REPORT

Tonkin+Taylor

Grey Lynn Tunnel Alternatives Assessment

Prepared for
Watercare Services Limited
Prepared by
Tonkin & Taylor Ltd
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Executive summary

Watercare proposes to construct the Grey Lynn Tunnel between Western Springs and Grey Lynn, connecting directly to the Central Interceptor tunnel. The proposed works will assist in reducing the volume and frequency of wet weather overflows (WWO) in the Cox's Bay catchment.

The Project Objectives are:

- To provide additional sewer network capacity for growth and development across the Auckland Isthmus;
- To reduce current wet weather wastewater overflow discharges, improving public health and environmental conditions;
- To enable future works to further improve fresh water quality for the Grey Lynn catchment.

The tunnel will connect to the Tawariki combined sewer and the Orakei Main Sewer and requires a shaft and connections in the vicinity of these existing sewers.

The proposed Grey Lynn tunnel forms one component of a package of solutions that will ultimately be required for addressing water quality issues in the Grey Lynn and Cox's Bay catchments. The Grey Lynn Tunnel will perform an enabling function for future works by providing conveyance and storage capacity to collect dry and wet weather wastewater volumes, through future works, from Grey Lynn and the waterfront catchments. The shaft at the Grey Lynn end of the tunnel will be future proofed to enable further collector sewer connections in due course.

The process of alternatives assessment has been led by Tonkin + Taylor (T+T). This report details the background to the Project and outlines the options and locations for the construction of the tunnel.

This report details the methodology for, and the results of, the Multi Criteria Analysis (MCA) applied to the shaft site options, which are as follows:

- Option 1 – St Paul's College;
- Option 2 – Moira Reserve;
- Option 3 – John Street;
- Option 4 – Hukanui Reserve;
- Option 5 – Tawariki Street.

The main purpose of the MCA process, and of this summary report, is to provide Watercare with information on potential effects (positive or negative) of each of the options under consideration. The results of the MCA are intended to inform Watercare's decision when selecting a preferred option. The MCA process has not recommended a preferred option.

The findings from the MCA process are summarised as follows:

- Option 4 (Hukanui Reserve) consistently scored the worst out of all the options. The raw score for this option is significantly lower than the other scores. On the basis of the MCA assessment, it is recommend that Option 4 not be progressed as a preferred option.
- The scoring for Option 1 (St Paul's College) and Option 2 (Moira Reserve) is close. These rank in the middle of the field (rank 3 and 4 respectively).
- The scoring for Option 3 (John Street) and Option 5 (Tawariki Street) is also close. These options rank first equal, with Option 5 ranking first when weighting is applied.

1 Introduction

Watercare proposes to construct the Grey Lynn Tunnel between Western Springs and Grey Lynn, connecting directly to the Central Interceptor tunnel. The proposed works will assist in reducing the volume and frequency of wet weather overflows (WWO) in the Cox's Bay catchment.

The Project Objectives are:

- To provide additional sewer network capacity for growth and development across the Auckland Isthmus;
- To reduce current wet weather wastewater overflow discharges, improving public health and environmental conditions;
- To enable future works to further improve fresh water quality for the Grey Lynn catchment.

The Grey Lynn Tunnel involves the construction of a 4.5 m diameter tunnel between Western Springs and Grey Lynn, in the order of 1.6 km long (depending on connection site location). The Tunnel will connect directly to the Central Interceptor main tunnel, at the downstream end, which is to be constructed between the Mangere Wastewater Treatment Plant and Western Springs.

The Grey Lynn Tunnel will connect to the existing Tawariki combined sewer and the Orakei Main Sewer. To make these connections, the Grey Lynn Tunnel requires a drop shaft and connection works in the vicinity of these existing sewers.

The process of alternatives assessment has been led by Tonkin + Taylor (T+T). This report details the background to the Project and outlines the options and locations for the construction of the tunnel.

This report details the methodology for, and the results of, the Multi Criteria Analysis (MCA) applied to the shaft site options, which are as follows:

- Option 1 – St Paul's College;
- Option 2 – Moira Reserve;
- Option 3 – John Street;
- Option 4 – Hukanui Reserve;
- Option 5 – Tawariki Street.

2 Background

The Grey Lynn Tunnel Project is a component of Watercare's wider regional wastewater strategy, which started development in 2004 and was published as the Three Waters Plan in 2008. The Central Interceptor was identified as a key part of implementing the Three Waters Plan. Several studies have considered options for addressing water quality issues in the Western Isthmus, including extending the Central Interceptor Tunnel. The construction of a tunnel from Western Springs to at least Tawariki Street (or vicinity) was identified as a key enabling project. Significant cost advantages were identified to procuring and constructing the Grey Lynn Tunnel in conjunction with the Central Interceptor construction contract. Work is continuing on investigating and developing options for further works to address water quality issues in the Western Isthmus.

The Grey Lynn Tunnel will perform an enabling function for future works by providing conveyance and storage capacity to collect dry and wet weather wastewater volumes, through future works, from Grey Lynn and the waterfront catchments. The shaft at the Grey Lynn end of the tunnel will be future proofed to enable further collector sewer connections in due course.

2.1 Options

The Grey Lynn Tunnel will be constructed using a tunnel boring machine (TBM) launched at the Western Springs construction site for the Central Interceptor tunnel. It will connect to the Tawariki combined sewer and the Orakei Main Sewer and requires a shaft and connections in the vicinity of these existing sewers.

Five options for the Grey Lynn shaft and connections were developed. These options have been assessed through an MCA process. The options were identified considering:

- The need for space for all required equipment and construction activities;
- The need to access the construction site, during construction and in the long term;
- The need to connect into the Orakei Main Sewer and Tawariki combined sewer;
- The need for permanent assets (shaft, plant room, control chambers, possible air treatment facility, grit chamber);
- The need to undertake a second stage of works to construct future connections.

The five options assessed through the MCA process and their key features are identified in Table 2.1 below. Drawings of each of the options and a summary of the key construction information for each option is contained in Appendix A.

Table 2.1: Overview of site options

Site Option	Site location/description	Key features
Option 1 – St Paul's College	Construction site on the school grounds, adjacent to the playing fields. Access through school grounds from Moira Street.	• Connections to existing sewers (trenchless) • Underground control chamber on Tawariki combined sewer • Underground control chamber on Orakei Main Sewer
Option 2 – Moira Reserve	Construction site on Moira Reserve, with connection to Tawariki local sewer in St Paul's College grounds. Access to Moira Street, partly through school grounds.	• Connections to existing sewers (trenchless) • Underground control chamber on Tawariki combined sewer • Underground control chamber on Orakei Main Sewer

Site Option	Site location/description	Key features
		• Underground grit trap
Option 3 – John Street	Construction site on currently vacant residential zoned site, with a small area extending into the St Paul's grounds. Access via John Street.	• Underground control chamber on Tawariki combined sewer and Orakei Main Sewer (combined) • Temporary diversion of Tawariki combined sewer (trenched)
Option 4 – Hukanui Reserve	Main construction site on Hukanui Reserve, with connections on Parawai Crescent (1 residential property and road reserve) and Tawariki Street (1 residential property and road reserve).	• Connections to existing sewers (trenchless and trenched) • Underground control chamber on Tawariki combined sewer • Underground control chamber on Orakei Main Sewer • Underground grit trap
Option 5 – Tawariki Street	Main construction site occupying three residential properties on Tawariki Street, with a small area of works extending into the road reserve and St Paul's College grounds.	• Connections to existing sewers (trenchless) • Underground control chamber on Tawariki combined sewer • Underground control chamber on Orakei Main Sewer
All sites		• Construction shafts (1 for Stage 1 and 1 for Stage 2 future connections) • Above ground plant and ventilation building

Table 2.2 below summarises key property and planning features of the sites, including the Auckland Unitary Plan (Operative in part) (AUP) zoning. There are no overlays applying to the sites[1].

Table 2.2 Planning and property features of the site options

Site	Address	Type of site	AUP zoning/relevant notations	Reserve status
Option 1 – St Paul's College	183 Richmond Road	School	Special Purpose – School Zone	N/A
Option 2 – Moira Reserve	14 Moira Street	Reserve	Open Space – Informal Recreation Zone	Recreation Reserve
	Connection and access works at St Paul's College, 183 Richmond Road	School	Special Purpose – School Zone	N/A
Option 3 – John Street	119-123 John St	Private	Residential – Mixed Housing Suburban Zone	N/A
	Part of future chamber – St Paul's College, 183 Richmond Road	School	Special Purpose – School Zone	N/A

[1] All sites are within the Macroinvertebrate Community Index (urban) Control in the AUP.

Site	Address	Type of site	AUP zoning/relevant notations	Reserve status
Option 4 – Hukanui Reserve	Hukanui Reserve – 44 West End Road	Reserve	Open Space – Informal Recreation Zone	Recreation Reserve
	16 Parawai Crescent	Housing New Zealand	Residential – Mixed Housing Urban Zone	N/A
	34 Tawariki Street	Housing New Zealand	Residential – Mixed Housing Urban Zone	N/A
	Richmond Road, Parawai Crescent, Tawariki Street - road	Road	Road	N/A
Option 5 – Tawariki Street	44, 46, 48 Tawariki Street	44-46: Housing New Zealand 48: Private	Residential – Mixed Housing Urban Zone	N/A
	Control chamber: Tawariki Street (road reserve)	Road	Road	N/A
	Control chamber and retaining of bank – St Paul's College, 183 Richmond Road	School	Special Purpose – School Zone	N/A

3 MCA methodology

3.1 Outline of methodology

The five options were examined as follows:

- **Development of assessment criteria and scoring methodology:** Assessment criteria and scoring methodology were developed by T+T planners (with input as appropriate from project team members and subject matter experts).
- **Brief specialists:** Relevant specialists were provided with a briefing pack containing information on the options to be assessed, the scoring methodology and expectations and assumptions (the briefing material is attached at Appendix A).
- **Assess options against criteria**: Specialists assessed each option against the criteria relevant to their area of expertise, provided an overall score and record reasons for the given score.
- **Workshop**: The specialists met at a half day workshop to discuss their assessments. They were given the opportunity to amend their scores in light of the discussion at the workshop, if appropriate. There was opportunity to discuss and clarify the nature of the proposed works at each site.
- **Finalise specialist reports**: The specialists produced their reports in the template provided with the briefing pack, explaining the matters considered in arriving at their scores, key reasons for the scores, and potential opportunities for enhancing outcomes.
- **Analysis**: Additional expert planning analysis was applied to the final scoring, including weighting/sensitivity analysis.
- **Reporting of MCA results**: The results of the MCA are reported in this report.

3.2 Assessment criteria

Fourteen assessment criteria were developed, with reference to key matters for consideration under the RMA and the project objectives. The options were scored against each of the criteria which were:

- Engineering constructability;
- Operations;
- Enabling network improvement opportunities;
- Heritage and archaeology;
- Ecology;
- Arboriculture;
- Noise;
- Vibration;
- Air quality;
- Construction traffic;
- Landscape and visual;
- Social;
- Recreation;
- Property.

A Mana Whenua or cultural criterion was not included. Watercare has an established process for consulting with Mana Whenua through its Kaitiaki Forum. The Grey Lynn Tunnel Project was

included in the project list provided to the Kaitiaki Forum in April 2018 to initiate the process of Mana Whenua engagement at an early stage.

3.3 Scoring methodology

The scoring methodology was as follows:

- Scores were based on the level of effects (adverse or positive) of each option for each criterion;
- All options were scored on a 9 point scoring scale, with a zero score being no change;
- At the workshop it was discussed that if any option presented what a specialist considered to be a fatal flaw, for example unacceptable adverse effects that could not be reasonably avoided, remedied or mitigated, this should be identified;
- A single score was given to each criterion. In some cases specialists broke their scores down into sub-criteria, but gave an overall single score for the criterion. The overall score was arrived at by the expert using their expertise, e.g. by averaging sub-criteria scores, applying weighting, or coming to an overall judgement taking into account the sub-criteria scores;
- The final score for each option assumes what the specialist considers to be standard/expected mitigation. Bespoke mitigation was not to be considered in the final score, but experts were encouraged to record the potential for further mitigation of identified effects where relevant.
- The scoring scale is set out in Table 3.1 below.

Table 3.1: Scoring scale

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

Specialists were given the opportunity at the scoring workshop to 'fatally flaw' an option if they felt that the effects were extreme.

3.4 Weighting

Three weightings were applied to the scores to consider different perspectives. The intention of the weightings was to apply three varying, but realistic perspectives to the relative importance of the various criteria. The intention was not to place artificially high or low weights on particular criteria, simply in order to arrive at different overall scores compared to the raw scores.

The three weightings applied were:

- An 'RMA' weighting. This was developed from analysis of the RMA and statutory documents and an eye to the RMA consenting process and the weight likely to be given to relevant statutory provisions. The weighting took particular account of the key matters reflected in the

provisions of Part 2 of the RMA, the relevant statutory provisions from the AUP, and also took into account the project objectives;

- An 'engineering' sensitivity analysis weighting, which prioritised those criteria that relate most directly to the technical aspects of constructing and operating the infrastructure;
- A 'community' sensitivity analysis weighting, which prioritised those criteria that relate most directly to issues that are likely to be of concern to the community.

Criterion	Weighting (RMA)	Weighting (engineering)	Weighting (community)	Notes on weighting
Engineering constructability	0.5	0.9	0.4	• A key factor for engineering
Operations	0.6	0.8	0.4	• An important factor for engineering/operations
Enabling network improvement opportunities	0.9	0.9	0.9	• Key project driver and positive effects – reduction in overflows to Cox's Creek (includes local benefits)
Heritage and archaeology	0.8	0.5	0.7	• Protection of historic heritage a s6 matter, but no historic heritage identified in AUP. Protection of Maori sites and waahi tapu (which may be recorded or unrecorded) a s6 matter.
Ecology	0.7	0.7	0.7	• Intrinsic values of ecosystems a s7 matter • No SEA overlays etc. in the AUP
Arboriculture	0.7	0.5	0.8	• Amenity values a s7 matter, • residential neighbourhood setting • No notable trees in AUP
Noise and vibration	0.9	0.7	0.9	• Amenity values a s7 matter • residential neighbourhood setting
Odour	0.9	0.7	0.9	• Amenity values a s7 matter • residential neighbourhood setting
Construction traffic	0.9	0.8	0.9	• Amenity values a s7 matter • residential neighbourhood setting
Landscape and visual	0.8	0.7	0.9	• Amenity values a s7 matter • residential neighbourhood setting
Recreation	0.8	0.6	0.9	• Amenity values a s7 matter • residential neighbourhood setting
Social	0.8	0.6	0.9	• Amenity values a s7 matter • residential neighbourhood setting
Property	0.5	0.5	0.5	

4 MCA workshop and results

The workshop was held on 7 August 2018. It was attended by the specialists responsible for carrying out the assessments and providing the scores for each criterion and members of the project team[2]. The discussion at the workshop was facilitated by Peter Roan.

The first part of the workshop provided an overview of the five options. The workshop attendees were able to ask questions in respect of each option to clarify or confirm the assessments they had carried out. The specialist responsible for each criterion then presented to the group, outlining their scoring and explaining the basis of their assessment. Other participants were able to pose questions to those experts. Where appropriate, in light of the discussion, the relevant specialist was entitled to alter the scores they had initially assigned.

The specialists reported their methodology, assumptions, scoring, and reasons for each score in a brief report. These reports are attached as Appendices C to P.

4.1 Raw scores

Results from the MCA are presented in Table 4.1 below. Table 4.1 provides the full set of raw scores for each option, with the sum total provided and the comparative rankings for raw scores for each option, based on the sum total of all the raw scores for each option.

No options were given a 'fatal flaw' score by any specialists during the scoring process.

Table 4.1: MCA raw scores

Criteria	Option 1 - St Paul's College	Option 2 – Moira Reserve	Option 3 – John Street	Option 4 – Hukanui Reserve	Option 5 – Tawariki Street
Engineering constructability	-2	-1	0	-3	3
Operations	-2	-3	1	-3	-3
Enabling network improvement opportunities	3	1	2	0	3
Heritage and archaeology	0	0	0	-2	0
Ecology	-1	-1	1	-2	-1
Arboriculture	-2	-1	0	-4	-2
Noise	-2	-3	-3	-4	-2
Vibration	-1	-2	-1	-2	-1
Air quality	-1	-2	-1	-2	-1
Construction traffic	-2	-1	-3	-4	-1
Landscape and visual	-1	-1	-1	-2	-1
Social	-2	-2	-2	-2	-2
Recreation	0	-2	0	-3	0

[2] Scoring of options against the Enabling network improvement opportunities, property, and operations criteria was not completed at the workshop on 7 August 2018. Scoring completed by these specialists was brought into the MCA analysis after the workshop.

Property	-2	0	-3	-1	-2
Total raw score	**-15**	**-18**	**-10**	**-34**	**-10**
Raw score rank	**3**	**4**	**1**	**5**	**1**

4.2 Weighted scores

After the MCA workshop, the scores were totalled for each option, and weightings applied as a sensitivity test in analysing option performance.

As explained in Section 3.4, three different weighting were applied to the raw scores. Table 4.2 below shows the relative rankings of each option when the raw scores from the workshop are applied, alongside the rankings when each of the three weightings are applied. The spreadsheet in Appendix B contains the actual scores for each option, including the scores as adjusted with the various weightings applied.

In all cases the ranking stayed the same for the third, fourth and fifth ranked options. With weightings applied Option 5 (Tawariki Street) was ranked first and Option 3 (John Street) second rather than the first equal ranking of the raw scores.

Table 4.2: Relative rankings and total MCA score of each option

	Option rank (and MCA total score)			
Option	**Raw score**	**RMA weighting**	**Engineering sensitivity**	**Community sensitivity**
Option 1 – St Paul's College	3 (-15)	3 (-10.4)	3 (-9.7)	3 (-10.3)
Option 2 – Moira Reserve	4 (-18)	4 (-14)	4 (-12.4)	4 (-13.9)
Option 3 – John Street	1 (-10)	2 (-8)	2 (-6)	2 (-8.5)
Option 4 – Hukanui Reserve	5 (-34)	5 (-26)	5 (-23.2)	5 (-26)
Option 5 – Tawariki Street	1 (-10)	1 (-7.6)	1 (-5.2)	1 (-7.8)

4.3 Scoring analysis

4.3.1 Overall summary

Based on the scores and ranking (both for raw scores and weighted scores) set out above:

- Option 4 (Hukanui Reserve) consistently scored the worst out of all the options. The raw score for this option is significantly lower than the other scores. This remains the case when weighting is applied.
- The scoring for Option 1 (St Paul's College) and Option 2 (Moira Reserve) is close. These rank in the middle of the field and this remains when weighting is applied.
- The scoring for Option 3 (John Street) and Option 5 (Tawariki Street) is also close. These options rank first equal, with Option 5 ranking first when weighting is applied.
- In relation to each criterion:

- Engineering constructability: Option 5 (Tawariki Street) was considered the easiest site in terms of constructability, with Option 4 (Hukanui Reserve) the most difficult, and the others in between.
- Operations: From an operations perspective Option 2 (Moira Reserve), Option 4 (Hukanui Reserve) and Option 5 (Tawariki Street) were scored the lowest due to their proximity to neighbours (increasing the requirements for stakeholder liaison and the risk of complaints during maintenance activities) and relatively constrained site areas. Option 3 (John Street) scored highest due to the greater distance to neighbours and available space.
- Enabling network improvement opportunities: All options would make the required connections to the Orakei Main Sewer and Tawariki combined sewer and enable future connections so all scored neutral or positive scores. Option 1 (St Paul's College) and Option 5 (Tawariki Street) scored the highest and Option 4 (Hukanui Reserve) scored lowest due to greater complexity in making the connections.
- Heritage and archaeology: Most options scored 0 as no archaeology or heritage features are expected. Option 4 (Hukanui Reserve) scored -2 due to the proximity to Cox's Creek and the potential to uncover unrecorded archaeological features.
- Ecology: Most options scored a -1, with the exception of Option 4 (Hukanui Reserve) which scored -2 due to the extent of native tree removal, and Option 3 (John Street) due to the potential for planting to improve the existing environment.
- Arboriculture: Scores ranged from 0 (at Option 3 – John Street where there are no existing trees) to -4 at Option 4 (Hukanui Reserve) where street trees and trees within the reserve would be impacted.
- Noise: Scores ranged from -2 (Option 1, St Paul's College and Option 5, Tawariki Street) to -4 (Option 4, Hukanui Reserve) which would result in the largest number of dwellings where the noise limits would be exceeded.
- Vibration: All sites scored either -1 or -2, largely driven by the proximity of receivers.
- Air quality: All sites scored either -1 or -2. Consideration was given to construction dust, construction odour (breaking into the Orakei Main Sewer), operational odour (grit trap), and operational odour (vent). Two sites (Option 2, Moira Reserve and Option 4, Hukanui Reserve) would require a new grit trap and these sites had lower scores.
- Construction traffic: Scores ranged from -1 for Option 2 (Moira Reserve) and Option 5 (Tawariki Street) to -3 for Option 3 (John Street) and -4 for Option 4 (Hukanui Reserve). Option 4 (Hukanui Reserve) would require significant works in the road reserve, including on the arterial Richmond Road. Option 3 (John Street) has constraints due to the narrow sections of road and its function as a 'rat-run'.
- Landscape and visual: Most options scored -1, with the exception of Option 4 (Hukanui Reserve) which scored -2.
- Social: All options scored -2. All sites either involve some impact on the school or some removal of dwellings, or both.
- Recreation: Three of the sites received 0 scores as they were not in or adjacent to reserves. Option 2 (Moira Reserve) scored -2 and Option 4 (Hukanui Reserve) scored -3. Hukanui Reserve contains a well-used walkway.
- Property: Option 3 (John Street) scored the lowest as it is expected to have the greatest cost and the most difficult acquisition process. Option 2 (Moira Reserve) and Option 4 (Hukanui Reserve) were expected to be the easiest and possibly lowest cost acquisition as they are Council owned and may not require purchase.

4.3.2 Option 1 – St Paul's College

This site scored in the middle of the field. Scores ranged between 3 (for enabling network improvement opportunities) and -2 (for social). Most criteria scored -1 or -2: Seven criteria scored -2 and four scored -1. The site would involve construction works adjacent to the St Paul's College playing fields so is further from residential receivers but would involve potential disruption to school activities and require management of the construction access from Moira Road through the school.

4.3.3 Option 2 – Moira Reserve

This site ranked fourth. Scores ranged between 1 (for enabling network improvement opportunities) and -3 (for operations and noise). Most (9) criteria scored -1 or -2. The proximity to dwellings means that the site scored relatively low in terms of noise and vibration and air quality. Its location within a reserve and infringing into the St Paul's School grounds (for access) means it also scored relatively low in terms of recreation and social criteria.

4.3.4 Option 3 – John Street

This site ranked first equal on raw scores and second when weighting was applied. There was a relatively wide range of scores at this site. Scores ranged between 2 (enabling network improvement opportunities) and -3. Noise, construction traffic and property criteria were all given scores of -3. This site received positive or neutral scores in a number of areas which offset the noise, traffic and property scores in the overall score. The site is relatively close to residential properties and located on a road with constraints that could require careful management. The availability of space on the site influenced positively in the scores for engineering constructability and operations.

4.3.5 Option 4 – Hukanui Reserve

Option 4 consistently ranks lowest out of the five options, in both the raw and weighted scores. Scores ranged between 0 (enabling network improvement opportunities) and -4 (noise). Three criteria received scores of -3 and three received scores of -4.

It is located within a reserve which is used as a popular walking track along Cox's Creek and links to Cox's Bay Reserve and would require the removal of mature and native vegetation. Due to the need to connect into the existing sewers, it also involves two additional construction sites occupying dwellings on Tawariki Street and Parawai Crescent, increasing the extent of effects. The connections would require a lot of work in the road reserve, including on Richmond Road, and therefore have significant traffic related effects. Due to the close proximity of dwellings, a number of receivers would be expected to experience noise levels exceeding the applicable noise standards during construction.

Due to the location near Cox's Creek, this is the only site that is considered to have the potential for the discovery of unrecorded archaeological remains.

4.3.6 Option 5 – Tawariki Street

This site ranked first equal on raw scores and first when weighting was applied. Scores ranged between 3 (engineering constructability and enabling network improvement opportunities) and -3 (operations). Most (9) criteria scored -1 or -2: five scored -1 and four scored -2. This site was favoured from an engineering constructability perspective as the location of the site and it being all in one location was judged to be beneficial in controlling the site and it had the best programme.

5 Conclusion

The main purpose of the MCA process, and of this summary report, is to provide Watercare with information on potential effects (positive or negative) of each of the options under consideration. MCA is essentially a decision support tool, and has been used to score each of the five options in a transparent and independent fashion against predetermined assessment criteria. The process assists in assessing the relative merits of options, making explicit the key considerations and the values attributed to them. The results of the MCA are intended to inform Watercare's decision when selecting a preferred option. The MCA process has not recommended a preferred option.

Of note, the MCA does not include consideration of cultural effects and we understand that Watercare has been separately seeking input from Mana Whenua and will take this into consideration in its decision making.

The findings from the MCA process are summarised as follows:

- Option 4 (Hukanui Reserve) consistently scored the worst out of all the options. The raw score for this option is significantly lower than the other scores. On the basis of the MCA assessment, it is recommend that Option 4 not be progressed as a preferred option.
- The scoring for Option 1 (St Paul's College) and Option 2 (Moira Reserve) is close. These rank in the middle of the field (rank 3 and 4 respectively).
- The scoring for Option 3 (John Street) and Option 5 (Tawariki Street) is also close. These options rank first equal, with Option 5 ranking first when weighting is applied.

6 Applicability

This report has been prepared for the exclusive use of our client Watercare Services Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
.....	.....
Alia Cederman	Peter Roan
Senior Planner	Project Director

Appendix A: Briefing pack

Tonkin+Taylor

Memo

To:	**All workshop attendees**	**Job No:**	**1007303**
From:	**Peter Roan/Alia Cederman**	**Date:**	**25 July 2018**
Subject:	**Specialist briefing for Grey Lynn tunnel multi-criteria analysis workshop**		

1 Introduction

This memorandum describes the shaft site options proposed by Watercare's engineering advisor Jacobs, along with an assessment approach for completing your evaluation of each site option for Watercare's Grey Lynn Tunnel Project. This information is presented ahead of the Multi-Criteria Analysis (MCA) workshop provisionally scheduled for **7 August 2018**.

2 MCA Workshop

The MCA workshop will take place on 7 August 2018. The purpose of the workshop is to test and confirm scoring for each shaft site option.

Prior to this workshop, specialists are expected to:

- Review this memorandum and the attached information.
- Advise Watercare (Bernice Chiam, copied to Alia Cederman) by 31 July 2018 if any additional information is required in order to score each option.
- Develop an understanding of each option from the attached.
- Review the MCA recording and scoring template.
- Visit each site.
- Score each site against your respective MCA scoring criteria and record reasons for scoring as per the report template.

You will need to be prepared to talk to your scoring at the workshop and then to provide your options assessment report (using the attached template), completed to sufficient detail to justify your assessment and scoring, following the workshop.

Draft reports are required to be provided by **17 August**. This is a critical deadline – if you think you will have any issues meeting it (or have any clarifications about reporting requirements), please advise Peter Roan / Alia Cederman immediately.

3 Information provided

The following documents are provided in this briefing document to inform technical specialists during the MCA shortlist workshop:

- Appendix A: Drawings of each option
- Appendix B: MCA criteria
- Appendix C: Options scoring sheet
- Appendix D: Reporting template

4 The Options

Drawings of each of the options for consideration and an overview of the works and construction method are contained in Appendix A. Each site includes a shaft (in black) and provision for a future shaft (in blue).

Table 1. Summary of options to be assessed

Site	Name	Address
1	St Paul's College	183 Richmond Road, Ponsonby
2	Moira Reserve	Moira Street
3	John Street	119-123 John Street
4	Hukanui Reserve	Parawai Crescent, Tawariki Street
5	Tawariki Street	44-48 Tawariki Street

5 Methodology for scoring

Thirteen criteria have been developed in total. These are engineering constructability, operations, enabling network improvement opportunities, heritage and archaeology, ecology, arboriculture, noise and vibration, odour, construction traffic, landscape and visual, recreation, social, and property.

These criteria, along with example/draft measures for scoring and the overall owner of each of the criteria are set out in the table attached in Appendix B.

Each site option is to be scored against your respective criteria.

The scoring and recording template are attached in Appendix C, and are also provided in Excel format.

Your scoring must take into account the following:

- Scores are based on the level of effects (adverse or positive) of each option for each specialist criteria.
- One score will be provided for every criterion.
- Reasons for scoring will be recorded, including if there are particular components of the option which have a significant influence on the scoring.
- The final score for each option should include standard/expected mitigation, e.g. mitigation in accordance with Council guidelines/recognised practice. Bespoke mitigation and offsetting should not be considered in the final score. However, if you identify potential for further mitigation / offsetting of identified effects, this should be recorded. Experts are instructed to record what mitigation they have factored into their scores (and what additional mitigation might be possible), to allow for those assumptions to be tested.
- All options should be scored on the 9-point scale set out in Table 2 below, along with reasons for the given score. This scoring scale has been adopted partly in order to provide greater scope for differentiation between options. However, experts are instructed to score each option by applying their expertise and against the description of the scores provided below. Scoring should be carried out on an absolute basis, rather than relative basis. In other words, experts should not seek to rank the site options and then allocate scores on a relative basis. Testing of the scores allocated will occur in the workshop.

Table 2: Scoring scale

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

5.1 Secondary assessment

As explained above, scores on the 9-point scale should be assigned on an absolute basis (i.e. you may score a number of options with the same score). If this occurs, experts should provide information as to the relative merits of those options that receive the same score. Experts should use their professional judgment as to how to provide that information, and tailor the information provided to the circumstances. That should then be set out in more detail in your report on the options.

6 Report

Each specialist is required to prepare a report outlining the scoring for their criterion and the reasons for that scoring. The reports will be compiled into an overall report which will explain the wider context. The report is due on **17 August**.

A template for the report is attached in Appendix D. As set out in the template, this report should include detail on:

- Assumptions applied when scoring; and
- Detailed scores and reasons for scoring.

The report should provide a level of detail which allows a layperson to pick up the report at a later stage in the project, and understand the methodology and reasoning behind the scoring given to each option.

7 Other matters and conclusion

It is important that information is shared effectively between the experts, and with the project team, through this process. In particular please:

- Proactively ask any questions you have in advance of the workshop; and
- Discuss your assessments ahead of the workshop with other experts as appropriate.

If you require any further information, please do not hesitate to contact me.

Peter Roan / Alia Cederman

24-Aug-18
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Appendix A: Option drawings and construction information

- **Overview of construction information**
- **Site Layout Plan - Alternative 1**
- **Site Layout Plan - Alternative 2**
- **Site Layout Plan - Alternative 3**
- **Site Layout Plan - Alternative 4**
- **Site Layout Plan - Alternative 5**

Alternative 1 – St Paul's College	
Construction site area	45 m x 60 m area occupied by school grounds and vegetated bank
Anticipated construction access	From Moira Rd, via the school grounds
Earthworks	20,000 – 25,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 35 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections – connections to Orakei Main Sewer and Tawariki Street CSO, including chamber. Likely trenchless methods.
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connections to Orakei Main Sewer and Tawariki CSO. • Underground chamber fitted with penstock • Above-ground plant room to house power supplies and controls for penstock (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.

Alternative 1 – St Paul's College	
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date;

Alternative 2 – Moira Reserve	
Construction site area	The whole of the reserve
Anticipated construction access	From Moira Rd, via an accessway formed along the existing walkway together with an easement across a strip of the school grounds
Earthworks	20,000 – 25,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 35 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections – connections to Orakei Main Sewer and Tawariki Street CSO, including chamber and grit trap. Construction by pipe jacking.
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Workshops • Electrical substation • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions.

Alternative 2 – Moira Reserve	
	• Connections to Orakei Main Sewer and Tawariki CSO. • Underground grit trap • Underground chamber fitted with penstock • Above-ground plant room to house power supplies and controls for penstock (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date;

Alternative 3 – John Street	
Construction site area	119-123 John St together with a 15 m x 30 m zone with the school grounds
Anticipated construction access	From John St
Earthworks	20,000 – 25,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 34 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections – connections to Orakei Main Sewer and Tawariki Street CSO combined into a single chamber, 15 m x 15 m x 18 m deep. Trenching required for temporary diversion of Tawariki CSO.
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Workshops • Compressor/generator

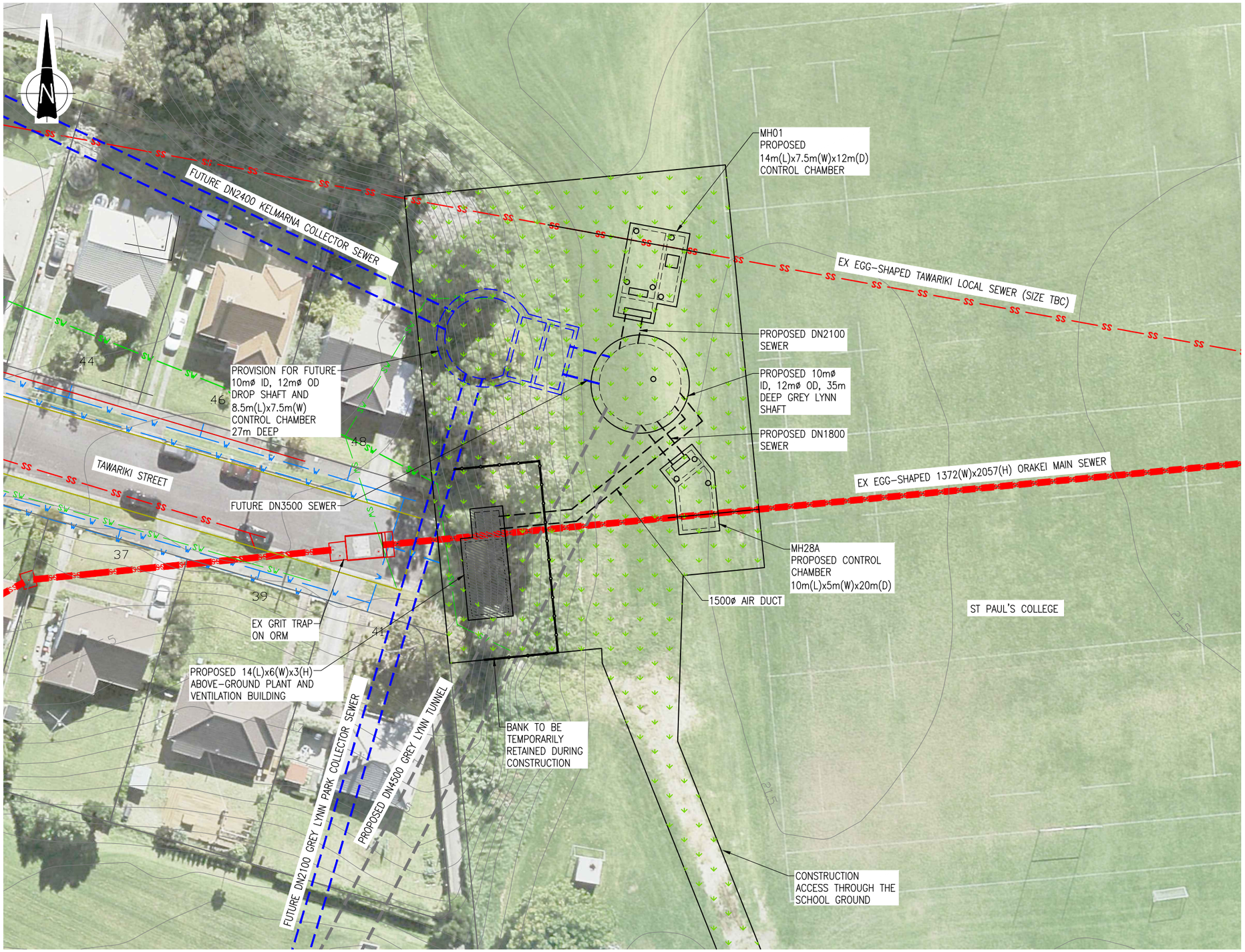
Alternative 3 – John Street	
	• Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes and hatches at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connections to Orakei Main Sewer and Tawariki CSO. • Underground chamber fitted with penstocks • Above-ground plant room to house power supplies and controls for penstocks (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date;

Alternative 4 – Hukanui Reserve	
Construction site area	30-40 m x 60 m area within the reserve, 16 Parawai Crecent, 34 Tawariki St, and various areas within Richmond Rd, Parawai Crescent and Tawariki St
Anticipated construction access	From Richmond Rd and Parawai Crescent.
Earthworks	10,000 – 15,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 20 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections: – 15 m deep connection to Orakei Main Sewer on Richmond Road (approx. 6-8 months); chambers and grit trap along Parawai Cresent (microtunneled, one or two 10-15 m deep chambers required); – Connection to Tawariki CSO, including connection chamber (open trenched).
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock

Alternative 4 – Hukanui Reserve	
	• One or more cranes • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Workshops • Electrical substation • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with asphalt in the roadways,; off-road reinstatement will utilise permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes and hatches at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connections to Orakei Main Sewer and Tawariki CSO - 15 m deep connection to Orakei Main Sewer on Richmond Road; connecting sewer, chambers and grit trap on Parawai Crescent. • Underground chambers fitted with penstocks • Two above-ground plant rooms to house power supplies and controls for penstock (14m x 6m, single storey). One will be in Hukanui Reserve and another possible one at 34 Tawariki Street. • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date; approx. 12-17 m diameter and 10-15 m deep.

Alternative 5 – Tawariki Street	
Construction site area	44-48 Tawariki St, 10-15m length of the end of the street about 10 m x 30 m strip of the school grounds. Access to the property at 41 Tawariki St would likely be cut-off for a period of several months.
Anticipated construction access	From Richmond Rd, via Mokau St and Moira St into Tawariki St.
Earthworks	10,000 – 15,000 m^3

Alternative 5 – Tawariki Street	
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 25 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections to Orakei Main Sewer and Tawariki CSO (likely trenchless methods)
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Blasting will not generally be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving (“Surepave” or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes and hatches at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connection to Orakei Main Sewer and Tawariki CSO. • Underground chambers fitted with penstocks • Above-ground plant room to house power supplies and controls for penstocks (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust ranging from a vent about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date; approx. 12-17 m diameter and 22 m deep.



PLAN
SCALE 1:250 (A1)

NOTES:

1. CO-ORDINATES ARE IN NZTM AND LEVELS ARE TO AUCKLAND L&S 1946 DATUM.
2. LOCATION OF EXISTING SERVICES HAVE BEEN EXTRACTED FROM AUCKLAND COUNCIL GIS AND UTILITIES PLANS AND ARE INDICATIVE.

SCALE 1:250 (A1) 0 5 10 15 20 25m

DRAFT

JACOBS AECOM McMILLEN JACOBS ASSOCIATES

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Plot Date: Jul 10, 2018 - 4:46pm

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DRAWN	PJG	06.18	
DWG. CHECKED	CW	06.18	
PROJECT LEADER	NK	06.18	
INFRAST'R APP'D			
	BY	DATE	

OPERATIONS

INFRASTRUCTURE

Watercare

GREY LYNN SHAFT SITE
SITE GENERAL
SITE LAYOUT PLAN – ALTERNATIVE 1

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REF. No. CI-CIVIL	ISSUE
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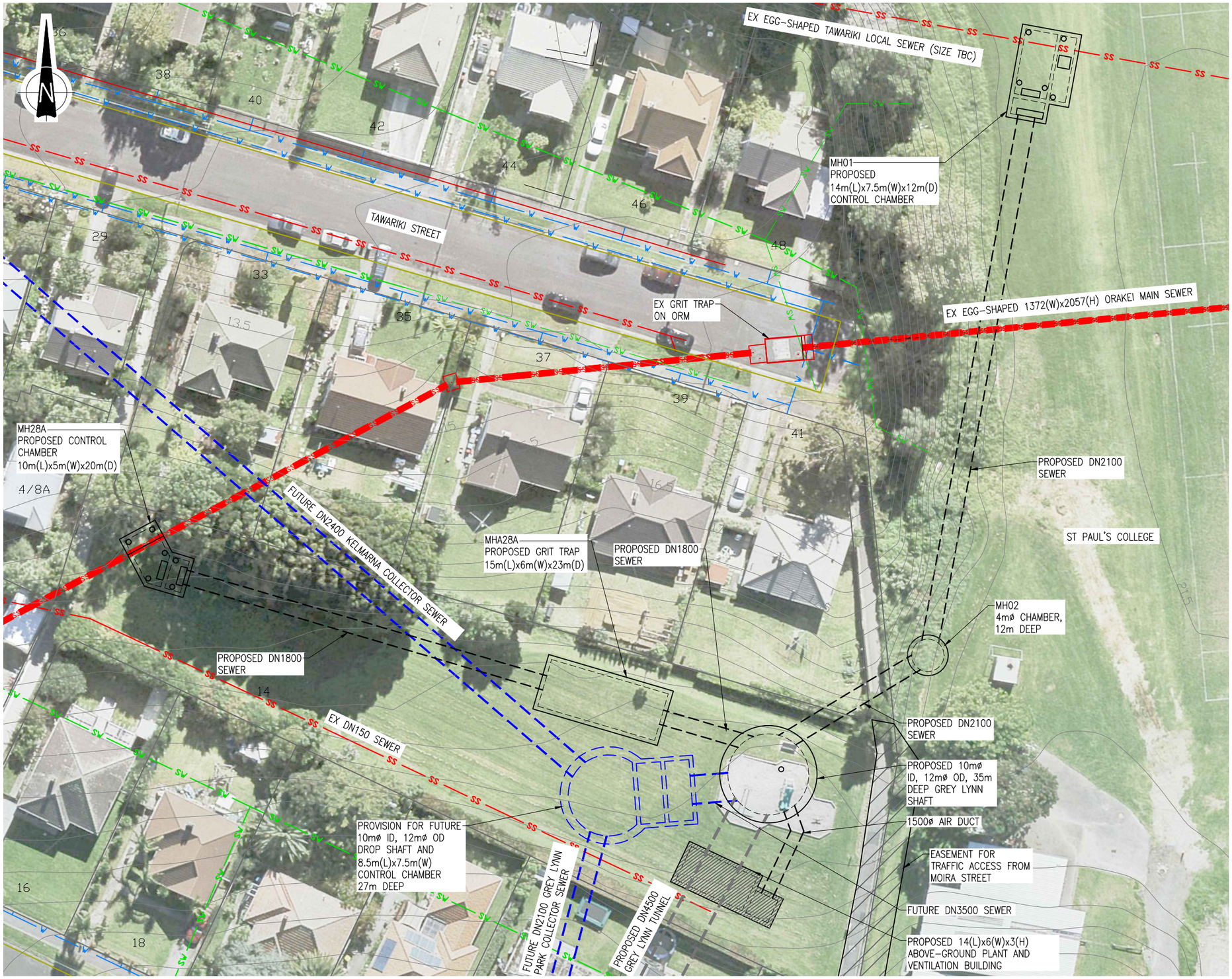

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SCALE 1:250 (A1) 0 5 10 15 20 25m

NOTES:

1. CO-ORDINATES ARE IN NZTM AND LEVELS ARE TO AUCKLAND L&S 1946 DATUM.
2. LOCATION OF EXISTING SERVICES HAVE BEEN EXTRACTED FROM AUCKLAND COUNCIL GIS AND UTILITIES PLANS AND ARE INDICATIVE.

DRAFT

JACOBS AECOM McMILLEN JACOBS

ISSUE	DATE	AMENDMENT	BY	APPD.
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DES. CHECKED	DS	06.18	
DRAWN	PJG	06.18	
DWG. CHECKED	CW	06.18	
PROJECT LEADER	NK	06.18	
INFRAST'R APP'D			

OPERATIONS

INFRASTRUCTURE

Watercare

GREY LYNN SHAFT SITE
SITE GENERAL
SITE LAYOUT PLAN – ALTERNATIVE 2

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NOTES:

1. CO-ORDINATES ARE IN NZTM AND LEVELS ARE TO AUCKLAND L&S 1946 DATUM.
2. LOCATION OF EXISTING SERVICES HAVE BEEN EXTRACTED FROM AUCKLAND COUNCIL GIS AND UTILITIES PLANS AND ARE INDICATIVE.

PLAN
SCALE 1:250 (A1)

SCALE 1:250 (A1) 0 5 10 15 20 25m

DRAFT

JACOBS AECOM McMILLEN JACOBS ASSOCIATES

ISSUE	DATE	AMENDMENT	BY	APPD.
1	06.18	DRAFT FOR DISCUSSION	PJG	

DESIGNED	CW	06.18
DES. CHECKED	DS	06.18
DRAWN	PJG	06.18
DWG. CHECKED	CW	06.18
PROJECT LEADER	NK	06.18
INFRAST'R APP'D		
	BY	DATE

OPERATIONS

INFRASTRUCTURE

Watercare

GREY LYNN SHAFT SITE
SITE GENERAL
SITE LAYOUT PLAN – ALTERNATIVE 3

CAD FILE 2012917.103	DATE 09.07.2018
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PLAN
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SCALE 1:250 (A1) 0 5 10 15 20 25m

NOTES:

1. CO-ORDINATES ARE IN NZTM AND LEVELS ARE TO AUCKLAND L&S 1946 DATUM.
2. LOCATION OF EXISTING SERVICES HAVE BEEN EXTRACTED FROM AUCKLAND COUNCIL GIS AND UTILITIES PLANS AND ARE INDICATIVE.

DRAFT

JACOBS AECOM McMILLEN JACOBS ASSOCIATES

ISSUE	DATE	AMENDMENT	BY	APPD.
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DRAWN	PJG	06.18
DWG. CHECKED	CW	06.18
PROJECT LEADER	NK	06.18
INFRAST'R APP'D		
	BY	DATE

OPERATIONS

INFRASTRUCTURE

Watercare

GREY LYNN SHAFT SITE
SITE GENERAL
OVERALL PLAN – ALTERNATIVE 4

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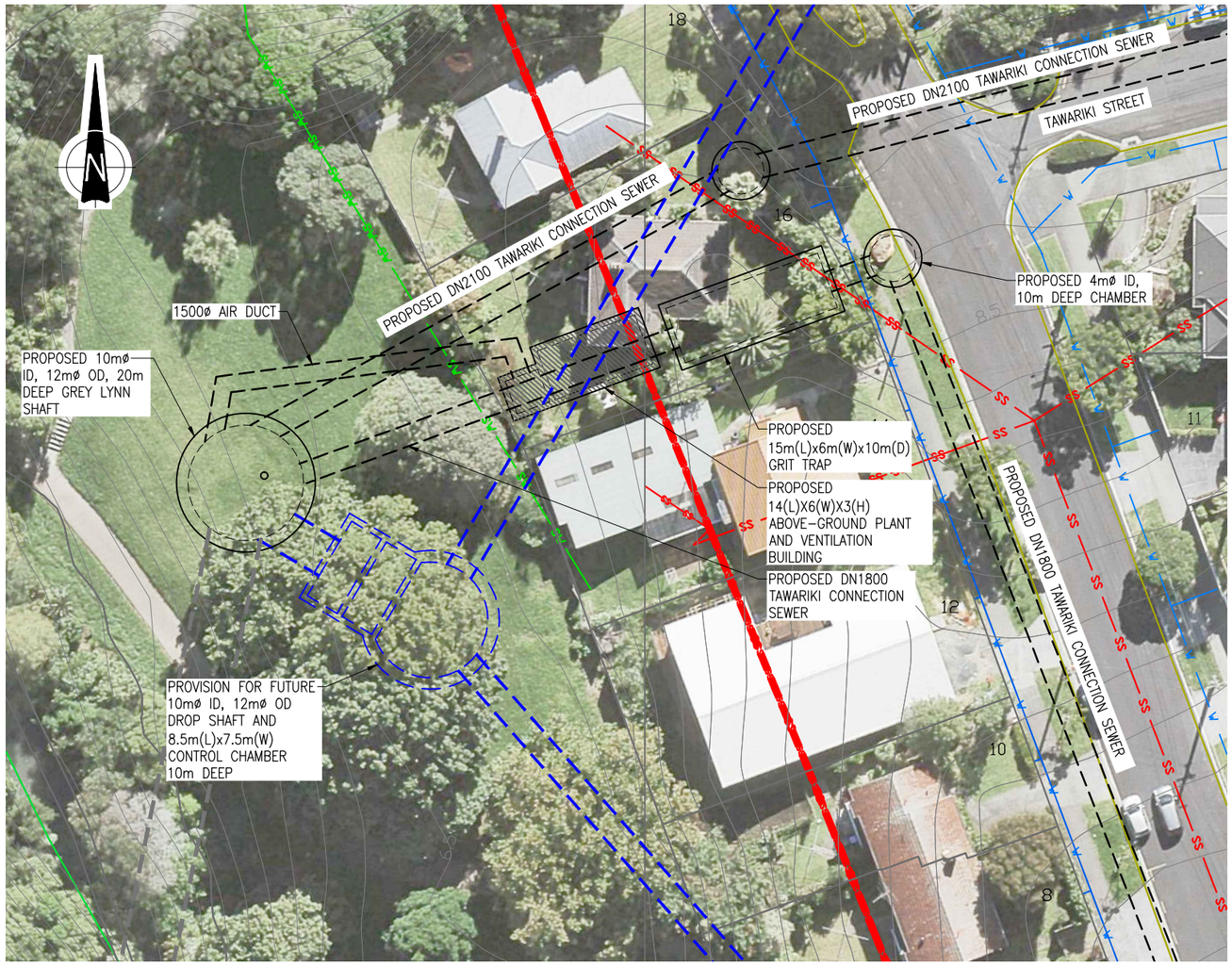

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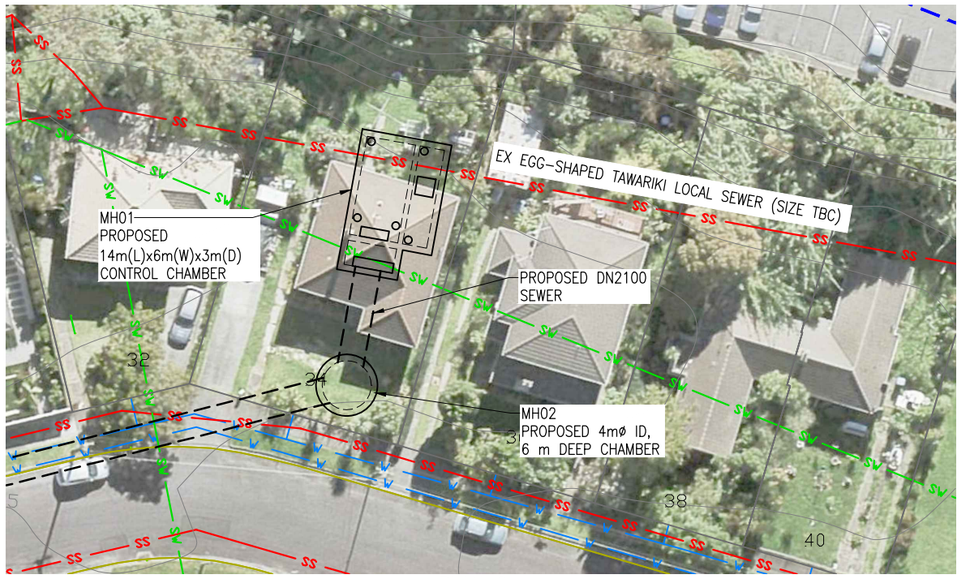

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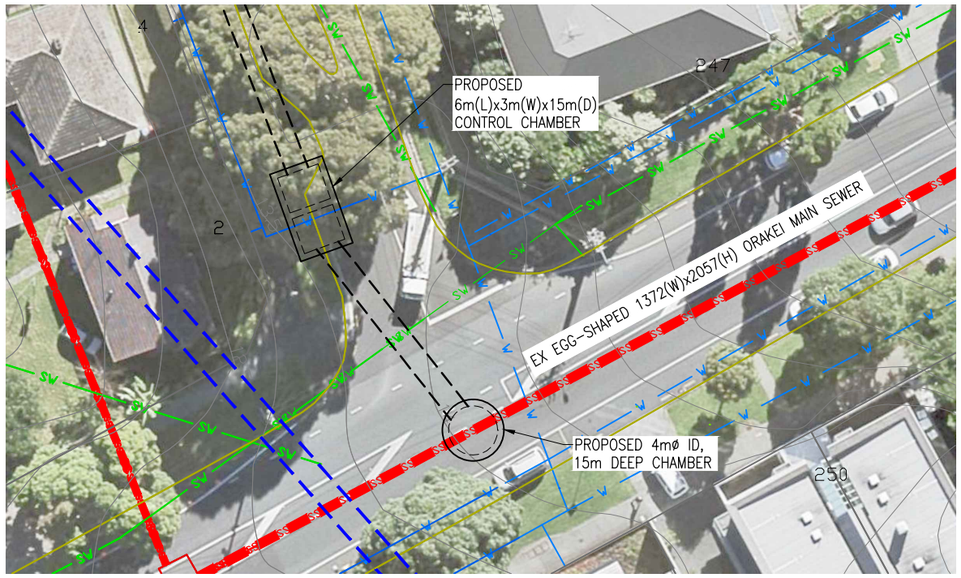

PLAN 3
SCALE 1:250 (A1)

NOTES:

1. CO-ORDINATES ARE IN NZTM AND LEVELS ARE TO AUCKLAND L&S 1946 DATUM.
2. LOCATION OF EXISTING SERVICES HAVE BEEN EXTRACTED FROM AUCKLAND COUNCIL GIS AND UTILITIES PLANS AND ARE INDICATIVE.

SCALE 1:250 (A1) 0 5 10 15 20 25m

DRAFT

JACOBS AECOM McJALLEN JACOBS

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INFRAST'R APP'D	BY	DATE

OPERATIONS

INFRASTRUCTURE

Watercare

GREY LYNN SHAFT SITE
SITE GENERAL
SITE LAYOUT PLAN – ALTERNATIVE 4

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SCALE 1:250 (A1) 0 5 10 15 20 25m (5 4 3 2 1)

NOTES:

1. CO-ORDINATES ARE IN NZTM AND LEVELS ARE TO AUCKLAND L&S 1946 DATUM.
2. LOCATION OF EXISTING SERVICES HAVE BEEN EXTRACTED FROM AUCKLAND COUNCIL GIS AND UTILITIES PLANS AND ARE INDICATIVE.

DRAFT

JACOBS AECOM McMILLEN JACOBS ASSOCIATES

ISSUE	DATE	AMENDMENT	BY	APPD.
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DRAWN	PJG	06.18
DWG. CHECKED	CW	06.18
PROJECT LEADER	NK	06.18
INFRAST'R APP'D		

OPERATIONS

INFRASTRUCTURE

Watercare

GREY LYNN SHAFT SITE
SITE GENERAL
SITE LAYOUT PLAN – ALTERNATIVE 5

CAD FILE 2012917.100	DATE 24.07.17
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Appendix B: MCA criteria

Criterion	Matters to be assessed	Specialist responsible
Engineering constructability	• Engineering team to determine. May consider: site physical constraints (e.g. topography, earthworks, flood hazard), laydown area, suitability for removal of TBM, programme etc. Access will be addressed as part of construction traffic criterion.	Jacobs
Operations	• Ease of maintenance	Watercare
Enabling network improvement opportunities	• Future opportunities for other projects/network connections	Watercare
Heritage and archaeology	• Potential for recorded archaeological or heritage sites to be impacted • Potential for unrecorded archaeological or heritage sites to be impacted	Kim Tatton, Archaeologist
Ecology	• Effects on terrestrial ecology • Effects on aquatic ecology	Chris Wedding, Ecologist
Arboriculture	• Extent of required tree works	Stacy Colyer, Arborist
Noise and vibration	• Number of properties where the AUP construction noise standard will be exceeded • Number of properties where the AUP construction vibration standard will be exceeded	Noise – Mat Cottle Vibration - Jacobs
Odour	• Potential for odour effects (proximity of neighbours, topography etc). • Feasibility of providing any necessary air treatment.	Andrew Curtis
Construction traffic	• Extent of required traffic management • Expected effects on wider traffic environment	Leo Hills, Traffic
Landscape and visual	• Landscape and visual effects • Effect on natural character and any outstanding features	John Goodwin, Landscape Architect
Recreation	• Effects on public/community open space	Alia Cederman, Peter Roan, Planners
Social	• Effects on community facilities/schools/businesses	Alia Cederman, Peter Roan, Planners
Property	• Number of properties to be acquired • Acquisition cost (high/medium/low) • Complexity of acquisition	Watercare

Appendix C: Options scoring sheet

Criteria	Scored by	Option 1			Option 2			Option 3			Option 4			Option 5		
		Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome

Appendix D: Reporting Template

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Criterion)

To:	**All workshop attendees**		**1007303**
From:	**Peter Roan/Alia Cederman**	**Date:**	**25 July 2018**

8 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the XX criterion and records the scores assigned for each option under that criterion.

9 Background

Brief (approx. half page) summary of context, e.g. landscape overlays, ecology overlays (as applicable)

10 Methodology

This section should be approximately 1-2 pages in total

10.1 Information used

Data and information relied on for this assessment includes:

- List information

10.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects

3	Moderate positive effects
4	Very high (significant) positive effects

We would prefer that a single score be determined, with no sub-criteria. However, we expect that various factors will be taken into consideration in arriving at a score and these should be identified here. We expect these will include the following:

Criterion	Matters to be assessed	Specialist responsible
Engineering constructability	• Engineering team to determine. May consider: site physical constraints (e.g. topography, earthworks, flood hazard), laydown area, suitability for removal of TBM, programme etc. Access will be addressed as part of construction traffic criterion.	Jacobs
Operations	• Ease of maintenance	Watercare
Enabling network improvement opportunities	• Future opportunities for other projects/network connections	Watercare
Heritage and archaeology	• Potential for recorded archaeological or heritage sites to be impacted • Potential for unrecorded archaeological or heritage sites to be impacted	Kim Tatton, Archaeologist
Ecology	• Effects on terrestrial ecology • Effects on aquatic ecology	Chris Wedding, Ecologist
Arboriculture	• Extent of required tree works	Stacy Colyer, Arborist
Noise and vibration	• Number of properties where the AUP construction noise standard will be exceeded • Number of properties where the AUP construction vibration standard will be exceeded	Noise – Mat Cottle Vibration - Jacobs
Odour	• Potential for odour effects (proximity of neighbours, topography etc). • Feasibility of providing any necessary air treatment.	Andrew Curtis
Construction traffic	• Extent of required traffic management • Expected effects on wider traffic environment	Leo Hills, Traffic
Landscape and visual	• Landscape and visual effects • Effect on natural character and any outstanding features	John Goodwin, Landscape Architect
Recreation	• Effects on public/community open space	Alia Cederman, Peter Roan, Planners
Social	• Effects on community facilities/schools/businesses	Alia Cederman, Peter Roan, Planners

Criterion	Matters to be assessed	Specialist responsible
Property	• Number of properties to be acquired • Acquisition cost (high/medium/low) • Complexity of acquisition	Watercare

In scoring the criterion we have considered:

- List matters considered

10.3 Key assumptions

Note any key assumptions.

Note any mitigation assumptions.

11 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Complete the table below. Include:

- *Option number, who undertook scoring and the score*
- *Key reasons for score, including the standard mitigation taken into account (if required)*
- *Any bespoke mitigation or design opportunities*

Scorer: (Name)	Option 1	Option 2	Option 3	Option 4	Option 5
Score					
Key reasons for score *e.g. would require removal of significant stand of trees*					
Potential opportunities to enhance outcome *e.g. avoidance of the group of trees could improve the score*					

Appendix B: MCA scoring results

Raw Scores					
Criteria	**Option 1 - St Paul's College**	**Option 2 – Moira Reserve**	**Option 3 – John Street**	**Option 4 – Hukanui Reserve**	**Option 5 – Tawariki Street**
Engineering constructability	-2	-1	0	-3	3
Operations	-2	-3	1	-3	-3
Enabling network improvement opportunities	3	1	2	0	3
Heritage and archaeology	0	0	0	-2	0
Ecology	-1	-1	1	-2	-1
Arboriculture	-2	-1	0	-4	-2
Noise	-2	-3	-3	-4	-2
Vibration	-1	-2	-1	-2	-1
Air quality	-1	-2	-1	-2	-1
Construction traffic	-2	-1	-3	-4	-1
Landscape and visual	-1	-1	-1	-2	-1
Social	-2	-2	-2	-2	-2
Recreation	0	-2	0	-3	0
Property	-2	0	-3	-1	-2
Total raw score	**-15**	**-18**	**-10**	**-34**	**-10**
Raw score rank	**3**	**4**	**1**	**5**	**1**

RMA Weighting						
Criteria	**Weighting**	**Option 1 - St Paul's College**	**Option 2 – Moira Reserve**	**Option 3 – John Street**	**Option 4 – Hukanui Reserve**	**Option 5 – Tawariki Street**
Engineering constructability	0.5	-1	-0.5	0	-1.5	1.5
Operations	0.6	-1.2	-1.8	0.6	-1.8	-1.8
Enabling network improvement opportunities	0.9	2.7	0.9	1.8	0	2.7
Heritage and archaeology	0.8	0	0	0	-1.6	0
Ecology	0.7	-0.7	-0.7	0.7	-1.4	-0.7
Arboriculture	0.7	-1.4	-0.7	0	-2.8	-1.4
Noise	0.9	-1.8	-2.7	-2.7	-3.6	-1.8
Vibration	0.9	-0.9	-1.8	-0.9	-1.8	-0.9
Air quality	0.9	-0.9	-1.8	-0.9	-1.8	-0.9
Construction traffic	0.9	-1.8	-0.9	-2.7	-3.6	-0.9
Landscape and visual	0.8	-0.8	-0.8	-0.8	-1.6	-0.8
Social	0.8	-1.6	-1.6	-1.6	-1.6	-1.6
Recreation	0.8	0	-1.6	0	-2.4	0
Property	0.5	-1	0	-1.5	-0.5	-1
Total weighted score		**-10.4**	**-14**	**-8**	**-26**	**-7.6**
Raw score rank		**3**	**4**	**2**	**5**	**1**

Engineering Sensitivity						
Criteria	**Weighting**	**Option 1 - St Paul's College**	**Option 2 – Moira Reserve**	**Option 3 – John Street**	**Option 4 – Hukanui Reserve**	**Option 5 – Tawariki Street**
Engineering constructability	0.9	-1.8	-0.9	0	-2.7	2.7
Operations	0.8	-1.6	-2.4	0.8	-2.4	-2.4
Enabling network improvement opportunities	0.9	2.7	0.9	1.8	0	2.7
Heritage and archaeology	0.5	0	0	0	-1	0
Ecology	0.7	-0.7	-0.7	0.7	-1.4	-0.7
Arboriculture	0.5	-1	-0.5	0	-2	-1
Noise	0.7	-1.4	-2.1	-2.1	-2.8	-1.4
Vibration	0.7	-0.7	-1.4	-0.7	-1.4	-0.7
Air quality	0.7	-0.7	-1.4	-0.7	-1.4	-0.7
Construction traffic	0.8	-1.6	-0.8	-2.4	-3.2	-0.8
Landscape and visual	0.7	-0.7	-0.7	-0.7	-1.4	-0.7
Social	0.6	-1.2	-1.2	-1.2	-1.2	-1.2
Recreation	0.6	0	-1.2	0	-1.8	0
Property	0.5	-1	0	-1.5	-0.5	-1
Total weighted score		**-9.7**	**-12.4**	**-6**	**-23.2**	**-5.2**
Raw score rank		**3**	**4**	**2**	**5**	**1**

Community Sensitivity						
Criteria	**Weighting**	**Option 1 - St Paul's College**	**Option 2 – Moira Reserve**	**Option 3 – John Street**	**Option 4 – Hukanui Reserve**	**Option 5 – Tawariki Street**
Engineering constructability	0.4	-0.8	-0.4	0	-1.2	1.2
Operations	0.4	-0.8	-1.2	0.4	-1.2	-1.2
Enabling network improvement opportunities	0.9	2.7	0.9	1.8	0	2.7
Heritage and archaeology	0.7	0	0	0	-1.4	0
Ecology	0.7	-0.7	-0.7	0.7	-1.4	-0.7
Arboriculture	0.8	-1.6	-0.8	0	-3.2	-1.6
Noise	0.9	-1.8	-2.7	-2.7	-3.6	-1.8
Vibration	0.9	-0.9	-1.8	-0.9	-1.8	-0.9
Air quality	0.9	-0.9	-1.8	-0.9	-1.8	-0.9
Construction traffic	0.9	-1.8	-0.9	-2.7	-3.6	-0.9
Landscape and visual	0.9	-0.9	-0.9	-0.9	-1.8	-0.9
Social	0.9	-1.8	-1.8	-1.8	-1.8	-1.8
Recreation	0.9	0	-1.8	0	-2.7	0
Property	0.5	-1	0	-1.5	-0.5	-1
Total weighted score		**-10.3**	**-13.9**	**-8.5**	**-26**	**-7.8**
Raw score rank		**3**	**4**	**2**	**5**	**1**

Appendix C: Engineering constructability

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Engineering Constructability)

To:	**Peter Roan/Alia Cederman**		
From:	**Kristian Nelson**	**Date:**	**22 August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the Engineering Constructability criterion and records the scores assigned for each option under that criterion.

2 Background

The Auckland City GiS (GEOMAPS) map of the area[1] shows all 5 key shaft sites and the impact flooding might have on them. Flooding of the tunnel works during construction is a major hazard, inundation in underground workings is a Principle Hazard that requires a specific management hazard plan under the Health and Safety in Employment (Mining Operations) Regulations 2013.

The maps (see Figure 1 below) show flood prone areas (hatched), flood plains (blue background) and overland flow paths (blue stream lines with thickness indicating intensity of flow).

I have developed construction method plans and temporary works for similar projects in the past. Using the proposed site layout plans and indicative required structures, I looked at the required size for both shaft sinking equipment and support cranes along with the transporter and crane requirements for TBM removal, disassembly and haulage from site.

Crane sizes for some of the deeper shafts will be 125 to 150 tonne crawler cranes (approximately 3-3.2m transport width on a low loader). The mobile crane likely required for the TBM removal would be 250-300 tonne with a 2.8 wide car body. Once set up this crane would require about a 9 x 9 platform for its outriggers.

[1] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

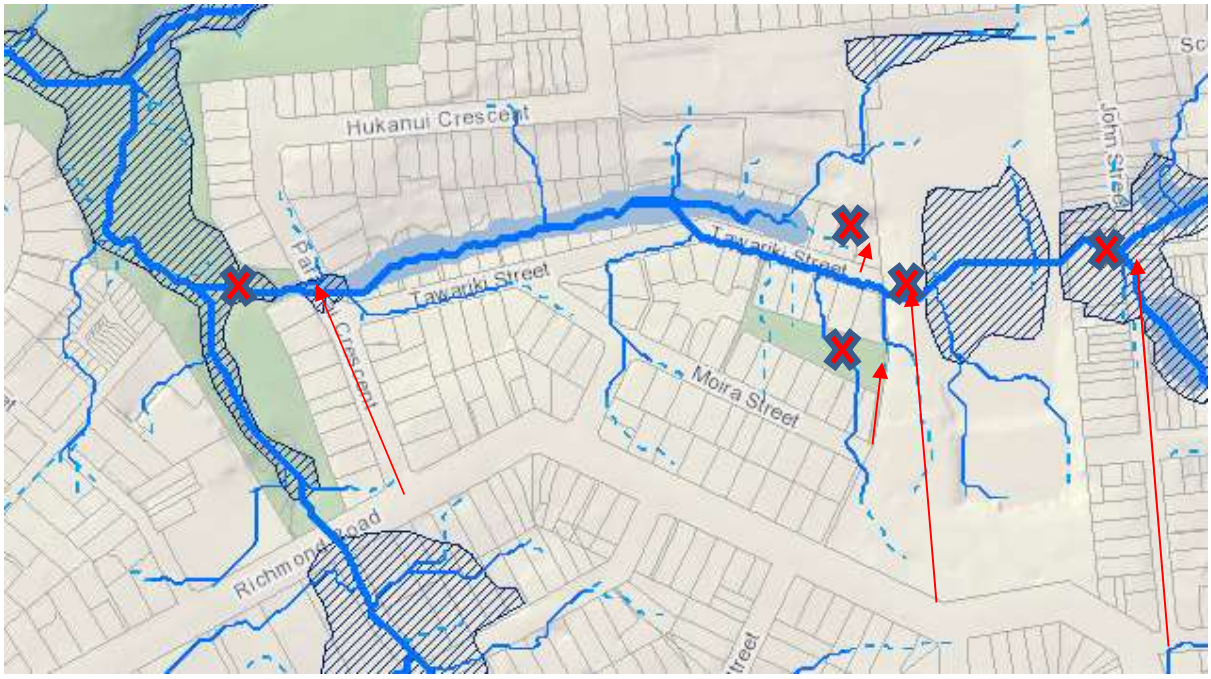


Figure 1: Auckland GIS Parcels, Roads & Flood Hazards

The volume of spoil produced is driven by the number of underground structures and their sizes. This also impacts both the size of the equipment required to excavate the depths and plan size of the chambers and the amount of transport trips to and from the site. Some sites have a higher likelihood of being in uncontrolled fill and having the potential for contaminated spoil.

The size and depth of the shafts and the underlying geological conditions will drive the cost of those works, which properties may be affected by dewatering and potential settlement, noise impacts and the size of the equipment required. The notes provided in the outlines of the options were used as a guide.

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

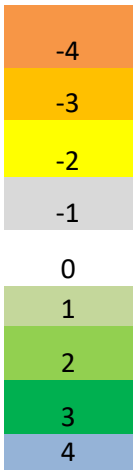
- Auckland Council GiS (GEOMAPS);
- Watercare Grey Lynn Shaft Site layout plans for five options;
- Specialist briefing memo from T+T, dated 25 July 2018;
- Previous knowledge of temporary works and the shaft structures required for the Central Interceptor (CI) project;
- Previous HAZOP/ Safety in Design sessions and outcome decisions undertaken on CI project for compliance with the new HSE Act & Mines Regulation;
- Site walkover and casual evaluation of the sites and immediate surrounds.

3.2 Scoring process

A scoring scale has been developed for all criteria. For constructability we developed a sub multi-criteria analysis as each of the options had some strengths and weaknesses. These were marked across an absolute scale with 4 as the best for project outcome in terms of constructability and -4

the worst for project outcome. This was then simply averaged with no weightings to particular categories.

The scoring scale is as follows:



Worst for project outcome

Best for project outcome

In scoring the criterion, based on experience of impact to constructability of a deep shaft, tunnel connection and TBM removal, we have considered:

- Flood hazard (a major risk to workers inside the tunnel);
- The layout of the site in terms of topography. This leads to outcomes for worker safety. Flat sites improve safety for equipment, positioning and handling of materials and worker ablution facilities;
- Management of sediment and stormwater runoff. Some of the sites are better than others in terms of controlling the onsite management of sediment and stormwater runoff. We looked at ease of containment and accessibility of discharge points;
- The depth of the shafts/extent of structures. This directly impacts the complexity and cost of both the temporary and permanent works. Some of the sites required far less in terms of structures which is a benefit;
- The complexity of the permanent above ground structures and Safety in Design issues for these;
- Programme. Reduced programme leads to reduced impact on stakeholder and typically lower cost and public safety hazard;
- The complexity of future tie-ins. This is important as these may be undertaken with remobilisations that would then have to work around the structures built under this work scope. Crossovers of existing assets is undesirable as there is exposure to existing conditions risk and disruption of service.

Please see appended spreadsheet for specific reasoning for scoring against each of the criteria.

3.3 Key assumptions

In general, the plans and description of works fairly outline the required works.

Reductions in programme, cost and complexity are benefits in terms of constructability.

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring. Please see appended detailed assessment of the sub-criteria scoring.

Scorer: (Name)	Option 1	Option 2	Option 3	Option 4	Option 5
Score	-2	-1	0	-3	3
Key reasons for score	Topography very poor; will require heavy equipment on top of the existing bank. Poor access past school and fill of an uncontrolled nature to a deep level.	Many deep structures and close proximity to neighbours. Poorest access, surrounded on all sides by housing.	Flood prone and open but very large excavations and complex future connections. Likely most spoil.	Highest flood risk at multiple locations, multiple sites very disruptive to locals. Impacts to Richmond Road from a construction & public safety point of view. Highest cost. Longest programme	Least Flood risk; Lowest cost; smallest/ shallowest structures; utilises existing assets; best access; simple future connection; easy to isolate from public; shortest programme.
Potential opportunities to enhance outcome	Caisson temporary support may be beneficial option	Option for mined connections to existing pipes may reduce impact but will increase risk	Redesign structures if possible to reduce size.	None	Procure more properties for space, return properties to green space

Criteria	Scored by	Option 1 - St Pauls			Option 2 - Moira Reserve			Option 3 - John St			Option 4			Option 5		
		Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome
Topography	K Nelson	-4	Top of bank - unbalance loading on shafts - equipment exclusion zones etc		2	Flat Site steeply sloping down at N Boundary		4	Flat open site		-3	top of bank - in soft ground - challengind at other shafts as well		3	Flat open site - bottom of slopes only	
Flood Hazard	K Nelson	0	School park flood prone & site located across overland flow path		1	Minor OLF path crossing reserve and along boundary		-3	Site is Flood Prone area and OLF runs through middle of site		-4	Flood plain, flood prone & OLF through middle of site & connecting shafts		4	no flood hazard indicators	
laydown area	K Nelson	-2	50% of indicated area on significant slope and will be useless without large volume earth works		0	Flat area but confined by housing		2	Would need more than indicated but open site to back and road at front		-4	small site & highly constrained - auxillary sites also will be difficult to provide space		3	sufficent for immediate work - more space required for future drop shaft unless lids trafficable by heavy plant	
Geotechncial Hazards	K Nelson	-4	St georges park is an uncontrolled fill zone Deep soil to rock		-2	Slope and unbalance loading expecially for deep retangular grit trap		-3	St georges park is an uncontrolled fill zone unknown depth soil to rock		-3	colluvial sediments and sloping ground		0	some original colluvium no slopes	
Earthworks	K Nelson	-3	Large volume to tip and potential for unknown material in fill		-4	volume is underestimated with additional chambers required - some excavation in the fill		-4	Volume underestimated given large square shaft - potential unknown material in fill		-2	underestimated with all the supplemental shafts and piep connections		2	least total volume inclusive of connections - all contained on one site	
Shaft Construction / Depth	K Nelson	-1	Additional depth on shaft and long upper zone may impace tighness and ground water control/ drawdown	Caisson - large and costly if required - would require significantly more room	-3	All deep shafts- long retangular shaft complex - draw down potential - Shafts in close proximity		-4	All deep shafts - large retangular shaft in made ground - future dron invert very close to tunnel crown		-3	large numbers - lots of colluvium - expensive support for so many excavations		3	Shallowest simple small connector shafts, no additional Grit trap required shallow surface soil	
Stormwater/ Sediment Control	K Nelson	-2	Open site but steep slope to W - access to SW flow to North		-2	okay for containment but no apparent location for disposal adjacent to site		2	flat site - available SW pipework nearby on street		-3	stormwater easy to control but many divers sites and more opportunity for realease		4	Flat site, natural barrier to 2 sides - access to nearby discharge locations	
TBM Removal	K Nelson	-3	need more space and long climb up access track to Richmond road next to school		-1	Space okay - very narrow access		3	good access and flat roads		-4	narrow poor access - traffic calming and powerlines		4	Good access right adjacent to road - wide streets and good corners up to richmond road	
Programme	K Nelson	-1	deeper shaft & deeper ancilliary structures - confined site		-3	many additional deep structures and closeness will mean they need to be done sequentially		-2	complex tie in and deep structures longer programme		-4	more excavations & locations and sites = longer and varied occupation		3	intermediat depth but single location - should be fastest programme give scope of other sites and separation of chambers	
Public Safety	K Nelson	-3	Close to school - heavy vehicle movements and deeper structures		1	well confined site easy to isolate - some slopes and narrow access		2	well confined site - open access but park activities and through road		-4	much more accessible, lots of other users - shafts in traffic		3	well controlled site - limited activities around	

Tie in to future services	K Nelson	-2	Future shaft to be constructed in slope - minimal shallow crossings of existing		-3	Crossing of Oreki main sewer (shallow trenched) - complex arrangement with additional manholes and grit trap required		-4	large connection chamber to 2 brick sewers - live tie ins		-4	Long pipejacks with little space - close proximity shafts and additional grit traps		2	no crossing of brick sewers - small tie ins - good set up to future drop structure and connections	
Permaent Structures	K Nelson	-2	building drawn over steep slope - uncertain if cut and significant retining wall required or some sort of pole house		0	good flat site maybe questional service provision - adjacent to homes		2	Good flat site, close to services but adjacent to homes		2	Good flat site, close to services but adjacent to homes		2	good flat site, tucked into corner away from adjacent occupied buildings	
Site access for equipment	K Nelson	-1	poor narrow access and constrainde site by slope. Reasonable drop from richmond road		-3	very narrow access indicated on accessway		2	good access - some traffic calming structures on roads		-4	most disruptive and dificult turns into site		2	good open access - TM easy - deadhead culdesac	
Score	K Nelson	-2.2			-1.3			-0.2			-3.1			2.7		

Appendix D: Operations

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Operations)

To:	**Peter Roan/Alia Cederman**		
From:	**Chris Harbour, Watercare**	**Date:**	**21 August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the 'operations' criterion and records the scores assigned for each option under that criterion.

2 Background

Watercare will need to undertake ongoing maintenance activities at the site for the lifetime of the infrastructure. Such activities would include routine planned preventative maintenance checks and minor maintenance of mechanical, electrical, & instrumentation equipment. These activities are likely to require site visits by maintenance personnel (fitter, electrician, or instrument technician in a van), on average, once every two months. The average duration of each visit is likely to be no longer than three hours. Cleaning and/or corrective maintenance to mechanical equipment (screens and gates) is likely to be required less frequently, depending on performance. These visits are likely to be no more frequent than annually but may require a larger work crew and either a vacuum suction truck or hiab crane unit to complete the work.

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

- Watercare Grey Lynn Shaft Site layout plans for five options;
- Specialist briefing memo from T+T, dated 25 July 2018;
- Existing knowledge of site location, topography, and access
- Twenty-five years' experience associated with the operation and maintenance of similar facilities in Watercare Services' Wastewater Transmission network

3.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- How easy or difficult it will be to maintain the infrastructure on an ongoing basis. This includes consideration of:
  - Available space on the site for access and manoeuvring of vehicles and equipment;
  - The likelihood of complaints from neighbours during maintenance activities and requirements for liaising with neighbours. This is influenced by proximity to neighbours and topography of the site.
- The fact that all options require the maintenance and operation of a facility in a residential environment. For this reason, the potential impact on site neighbours has resulted in most options receiving a negative score. The variability in scores reflects both site proximity and the potential number of residents likely to be affected.

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: Chris Harbour	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	-2	-3	1	-3	-3
Key reasons for score	Limitations on vehicular access due to slope Potential for odour and visual complaints due to topography and visibility	Potential for maintenance activity to cause nuisance to residential properties in close proximity (visual, odour, noise)	Adequate buffer (road and proximity to nearest properties) in considering potential for maintenance activity to cause nuisance to residential properties in close proximity.	Potential difficulties with vehicular access due to space constraints. Potential for maintenance activity to cause nuisance to reserve users and residential	Potential space constraints Potential for maintenance activity to cause nuisance to residential properties in close proximity (visual, odour, noise)

Scorer: Chris Harbour	Option 1	Option 2	Option 3	Option 4	Option 5
				properties in close proximity (visual, odour, noise) Multiple locations of structures	
Potential opportunities to enhance outcome	Measures to mitigate visual and odour effects (e.g. screen planting)		Measures to mitigate visual and odour effects (e.g. screen planting)	Measures to mitigate visual and odour effects (e.g. screen planting)	Measures to mitigate visual and odour effects (e.g. screen planting)

Appendix E: Enabling network improvement opportunities

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (enabling network improvement opportunities)

To:	**Peter Roan/Alia Cederman**		
From:	**Kristian Nelson**	**Date:**	**October 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the 'enabling network improvement opportunities' criterion and records the scores assigned for each option under that criterion.

2 Background

The Project Objectives for the Grey Lynn Tunnel Project are:

- To provide additional sewer network capacity for growth and development across the Auckland Isthmus;
- To reduce current wet weather wastewater overflow discharges, improving public health and environmental conditions;
- To enable future works to further improve fresh water quality for the Grey Lynn catchment.

As part of the initial Stage One works the proposed tunnel will connect to the Orakei Main Sewer (OMS) and the Tawariki combined sewer. At a later date it is expected that a second stage of works will take place to make further connections to two new collector sewers to be constructed to further improve fresh water quality (referred to as the Grey Lynn Park and Kelmarna CSO Collector Sewers). Each of the alternative site drawings therefore allow for a future shaft (shown in blue) to enable additional connections.

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

- Watercare Grey Lynn Shaft Site layout plans for five options;

- Specialist briefing memo from T+T, dated 25 July 2018;

3.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- The ability to make the required connections for stage 1 (OMS and Tawariki Combined Sewer) and for stage 2 (Grey Lynn Park and Kelmarna CSO Collector Sewers).
- The extent of the works/infrastructure required to make the required connections.

3.3 Key assumptions

In relation to the scoring for this criterion, 0/neutral means the connections can be made, a positive score means the connections can be made and the higher the score the better the site for making the connection. A negative score would mean that the required connections cannot be made. As all options will enable the required connections there are no negative scores.

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: Chris Harbour	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	3	1	2	0	3
Key reasons for score	• Connects into OMS and Tawariki Combined Sewer • Allows for future connection to Grey Lynn Park and Kelmarna CSO Collector Sewers	• Connects into OMS and Tawariki Combined Sewer • Allows for future connection to Grey Lynn Park and Kelmarna CSO	• Connects into OMS and Tawariki Combined Sewer • Allows for future connection to Grey Lynn Park and Kelmarna	• Connects into OMS and Tawariki Combined Sewer • Allows for future connection to Grey Lynn Park and Kelmarna	• Connects into OMS and Tawariki Combined Sewer • Allows for future connection to Grey Lynn Park and Kelmarna

Scorer: Chris Harbour	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	3	1	2	0	3
	• Two control chambers, one cascade chamber, ventilation building	Collector Sewers • Connection to Tawariki Local Sewer has an additional manhole and crosses the OMS • New grit trap required	CSO Collector Sewers • Has one control chamber for OMS and Tawariki Local Sewer connection (potential greater complexity for control of flows and to maintain isolation from each network)	CSO Collector Sewers • New grit trap required • Connection requires additional pipe work • Additional three chambers for connection to OMS	CSO Collector Sewers • Two control chambers, one cascade chamber, ventilation building

Appendix F: Heritage and archaeology

GREY LYNN SEWER TUNNEL SHAFT
SITE OPTIONS ASSESSMENT
(HERITAGE AND ARCHAEOLOGY)

Prepared for

Watercare Services Ltd

August 2018

By

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INTRODUCTION

Watercare Services Ltd (Watercare) is currently investigating alternative options to locate the shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

The alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018. The purpose of the workshop was to test and confirm scoring for each shaft site option.

This report summarises the evaluation of the options under the Historic Heritage and Archaeology criterion and records the scores assigned for each option under that criterion.

BACKGROUND

The five options identified to be assessed are shown in Table 1. :

Table 1. Options to be assessed

Site	Name	Address
1	St Paul's College	183 Richmond Road, Ponsonby
2	Moira Reserve	Moira Street
3	John Street	119-123 John Street
4	Hukanui Reserve	Parawai Crescent, Tawariki Street
5	Tawariki Street	44-48 Tawariki Street

Drawings of each of the five options for consideration and an overview of the works and construction method were provided (see Appendix 1 and 2). Each site included a shaft (in black) and provision for a future shaft (in blue).

Matters assessed under the Historic Heritage and Archaeology criterion were whether there are any recorded archaeological or other historic heritage sites on or near each of the site options and what is the potential for unrecorded sites being present.

Section 6 of the Resource Management Act 1991 (RMA) recognises as matters of national importance: 'the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga' (S6(e)); and 'the protection of historic heritage from inappropriate subdivision, use, and development' (S6(f)).

All persons exercising functions and powers under the RMA are required under Section 6 to recognise and provide for these matters of national importance when 'managing the use, development and protection of natural and physical resources'. There is a duty to avoid, remedy, or mitigate any adverse effects on the environment arising from an activity (S17), including historic heritage.

In addition to any requirements under the RMA, the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA) protects all archaeological sites whether recorded or not, and they may not be damaged or destroyed unless an Authority to modify an archaeological site has been issued by Heritage NZ (Section 42).

This report is an asssessment of archaeological and other historic heritage values at each of the site options and does not include an evaluation of Maori cultural values. Such assessments should only be made by the tangata whenua. Maori cultural concerns may encompass a wider range of values than those associated with archaeological sites.

METHODOLOGY

Information Used

Data and information relied on for this assessment includes:

- Option drawings and construction information provided;
- Background research of Maori and early European settlement of the Grey Lynn / Cox's Bay area;
- The New Zealand Archaeological Association's (NZAA) site record database (ArchSite), Auckland Council's Cultural Heritage Inventory (CHI), Auckland Unitary Plan Operative in Part (AUP) schedules and the Heritage New Zealand Pouhere Taonga (Heritage NZ) New Zealand Heritage List/Rārangi Kōrero were searched to determine whether any archaeological or other historic heritage sites had been recorded on or in the immediate vicinity of the five options;
- Literature and archaeological reports relevant to the area were consulted (see Bibliography);
- Early survey plans and aerial photographs were checked for information relating to past landuse at the five option locations.

A visual inspection of Options 2 Moira Reserve and Option 4 Hukanui Reserve was conducted on 1st August 2018, as these options are located within publically accessible reserves. Options 1, 3 and 5 are located on private property and access was restricted. During the visual inspections of Options 2 and 4 the ground surface was examined for evidence of former occupation (in the form of shell midden, depressions, terracing or other unusual formations within the landscape, or indications of 19th century European settlement remains). Exposed and disturbed soils were examined where encountered for evidence of earlier modification, and an understanding of the local stratigraphy. Subsurface testing with a probe and spade was carried out to determine whether buried archaeological deposits could be identified or establish the nature of possible archaeological features. Photographs were taken to record the topography and features of interest/the area and its immediate surrounds.

Scoring Process

A scoring scale has been developed for all criteria based on the level of effects (adverse and positive) of each option, including standard/expected mitigation. Scores are assigned on an absolute basis, meaning that a number of options may have the same score.

The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the Historic Heritage and Archaeology criterion I have considered:

- Whether there are any recorded archaeological or historic heritage sites on or in the vicinity of the options;
- Whether there is known or potential Maori or early European settlement in the area;
- What 20th century modification of the environment and land use occurred at the option sites;
- The proximity of the option sites to creeks and waterways;
- Whether any identified effects can be mitigated or offset.

Key Assumptions

That any archaeological remains relating to Maori or early European settlement could be dealt with through normal mitigation processes under the RMA and Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA).

That archaeological survey techniques (based on visual inspection and minor sub-surface testing) cannot necessarily identify all sub-surface archaeological features, or detect wahi tapu and other sites of traditional significance to Maori, especially where these have no physical remains.

In any area where archaeological sites have been recorded in the general vicinity it is possible that unrecorded subsurface remains may be exposed during development. Archaeological features and remains can take the form of burnt and fire cracked stones, charcoal, rubbish heaps including shell, bone and/or 19th century glass and crockery, ditches, banks, pits, old building foundations, artefacts of Maori and early European origin or human burials.

That archaeological sites beneath modern buildings and sealed surfaces in urban environments can rarely be identified prior to being exposed in the course of redevelopment work, and the approach to archaeological assessment is therefore to identify historically recorded activities on the site, and assess the potential for archaeological evidence to have survived on the basis of later modifications to the site.

SCORING

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: Kim Tatton	Option 1 St Paul's College	Option 2 Moira Reserve	Option 3 John Street	Option 4 Hukanui Reserve	Option 5 Tawariki Street
Score	0	0	0	-2	0
Key reasons for score	This option will not affect any known sites. Nil potential for unrecorded archaeological remains as the area is heavily modified - retained and filled gully for the creation of the St Paul's College sports fields in the 1950s	This option will not affect any known sites. Nil-low potential for unrecorded archaeological remains. Field inspection, including probing and test pits, did not identify any archaeological remains or other historic heritage features. It is a heavily modified area - the reserve has been levelled and filled to create a terrace post 1930s as part of the development of the Casey residential subdivision	This option will not affect any known sites. Nil-low potential for unrecorded archaeological remains. No residential development of the area but it has been levelled and modified - during the 1950s two large round barns were erected on the northern two-thirds of this area (removed approx 2006) and an access drive into the school grounds formed along its southern side	This option will not affect any known sites. Field inspection, including probing and test pits, did not identify any archaeological remains or other historic heritage features. There was evidence of fill in places across this area. This area has never been developed. It is located in the upper reaches of Cox's (Opou) Creek. A number of archaeological and other historic heritage sites relating to Maori occupation and early European industry are recorded around the original foreshore of Cox's Bay and creek to the north. The soil and north-facing slopes above Opou were cultivated by Maori for kumara. Two SPSMW within the AUP are recorded within Cox's Bay and Cox's Creek attributing to the significance of this area to Maori. Tukituki Muka Maori Heritage Area (UPID001) relates to the customary harvest and preparation of flax for the making of garments and lashings. Ōpoutūkeha or Opou (Cox's Bay) is also an ancient boundary line between Ngati Huarere	This option will not affect any known sites. Nil-low potential for unrecorded archaeological remains. This area has been modified by residential development. Nos 44-48 Tawariki Road were built in the late 1930s as part of a Department of Housing scheme – Casey Estate. No formal heritage recognition of these houses in the AUP

Scorer: Kim Tatton	Option 1 St Paul's College	Option 2 Moira Reserve	Option 3 John Street	Option 4 Hukanui Reserve	Option 5 Tawariki Street
				and Ngati Pou (Waahi whakahirahira) (UPID054) Option 4 is not located within these defined SPSMW. Previous archaeological survey of the Cox's Bay reserve (Foster April 2012, Oct 2012) did not identify any archaeological remains in the vicinity of option 4. The potential for unrecorded / buried archaeological remains is considered low and any effects are likely to be minor and can be dealt with under the RMA and HNZPTA	
Potential opportunities to enhance outcome	n/a	n/a	n/a	n/a	n/a

SPSMW – Sites and Places of Siginificance to Mana Whenua

AUP – Auckland Unitary Plan Operative in Part

BIBLIOGRAPHY

Auckland Council Cultural Heritage Inventory, accessed at http://maps.aucklandcouncil.govt.nz and https://chi.org.nz

Blair, N June 2013. Te Rimu Tahi. Ponsonby Road Masetrplan – Maori Heritage Report. For Auckland Council

Bush, G. W. A. 1971. Decently and in Order. The Government of the City of Auckland 1840-1971. Auckland: Collins.

Carlyon, J and D, Morrow2008. The Story of Ponsonby, Freemans Bay and St Mary's Bay – Urban Village. Random House New Zealand.

Foster, R. Jan 2012. Proposed Gravity Pipeline Replacment, Auckland Zoo, Westerm Springs, Auckland: Archaeological Assessment. Prepared for Auckland City.

Foster Oct 2012. Cox's Creek Footpath and Boardwalk Renewals: Stage 2. Archaeological Assessment. Prepared for Auckland Council.

Heritage NZ. 2006. Writing Archaeological Assessments. Archaeological Guidelines Series No. 2. New Zealand Historic Places Trust Pouhere Taonga (now Heritage NZ).

Heritage NZ. 2014. Investigation and Recording of Buildings and Standing Structures. Archaeological Guidelines Series No. 1. New Zealand Historic Places Trust Pouhere Taonga (now Heritage NZ).

Hiyama, K. 1991. High Hopes in Hard Times. A History of Grey Lynn and Westmere. Media Studies Trust.

Kelly, J. and J. Surridge. 1990. Map of the Tamaki Isthmus with Maori Place Names Redrawn from Tamaki Makau-Rau by Leslie Kelly. Department of Geography, Auckland University.

New Zealand Archaeological Association ArchSite Database, accessed at http://www.archsite.org.nz .

New Zealand Heritage List, accessed at http://www.historic.org.nz

McEvoy, M. 2015. The Grey Lynn Book. The Life and Times of New Zealand's Most Fascinating Suburb. Paul Little Books.

Murdoch, G.J. n.d. A History of the Water Supply of Metropolitan Auckland. Auckland Regional Authority.

Pearson Apr 2008. *The Beam Engine and Western Springs Pumping Station.* Auckland, Museum of Transport and Technology.

Shakles, R., S. Phear, S. Bickler and R. Clough Dec 2011.

Shakles, R., S. Phear, S. and R. Clough Mar 2012. Auckland Central Interceptor – CSO Collector Sewers: preliminary Archaeological Assessment. Report prepared for AECOM on behalf of Watercare Services Ltd.

Stone, R.C.J. 2001. *From Tamaki-makau-rau to Auckland*. Auckland University Press.

Tuhimata, E. (Te Iwi O Ngati Te Ata) and M. Paterson (Ngati Whatua Orakei) Nov 2012. Weona Walkway project: Archaeological and Cultural Assessment. Preliminary report for Auckland Council.

Waters, T. 2003. Confortare. A History of Sacred Heart College, Auckland 1903-2003. Sacred Heart College.

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APPENDIX 1: PLANS OF OPTIONS 1-5

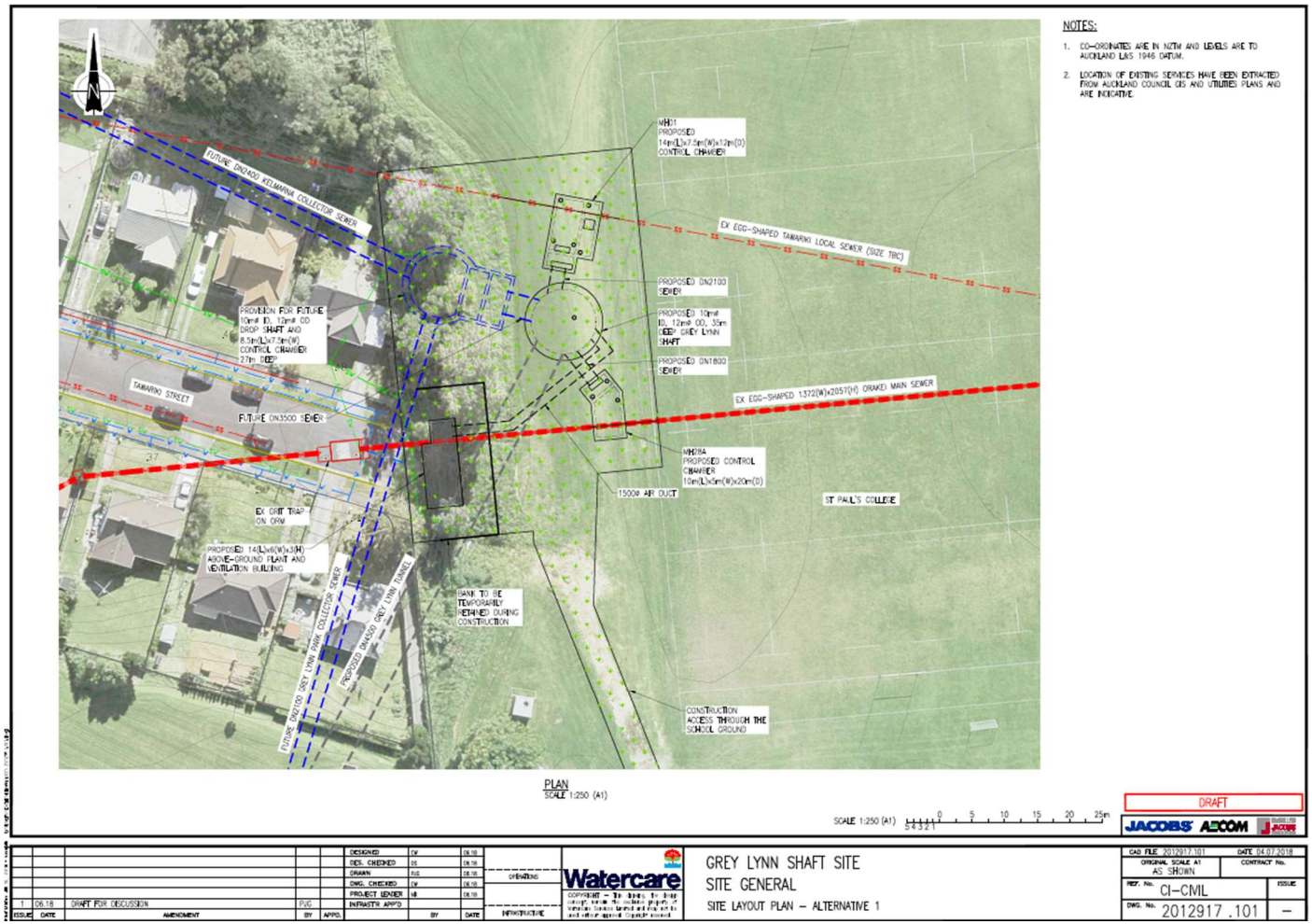

Figure 1. Option 1 – St Paul's College

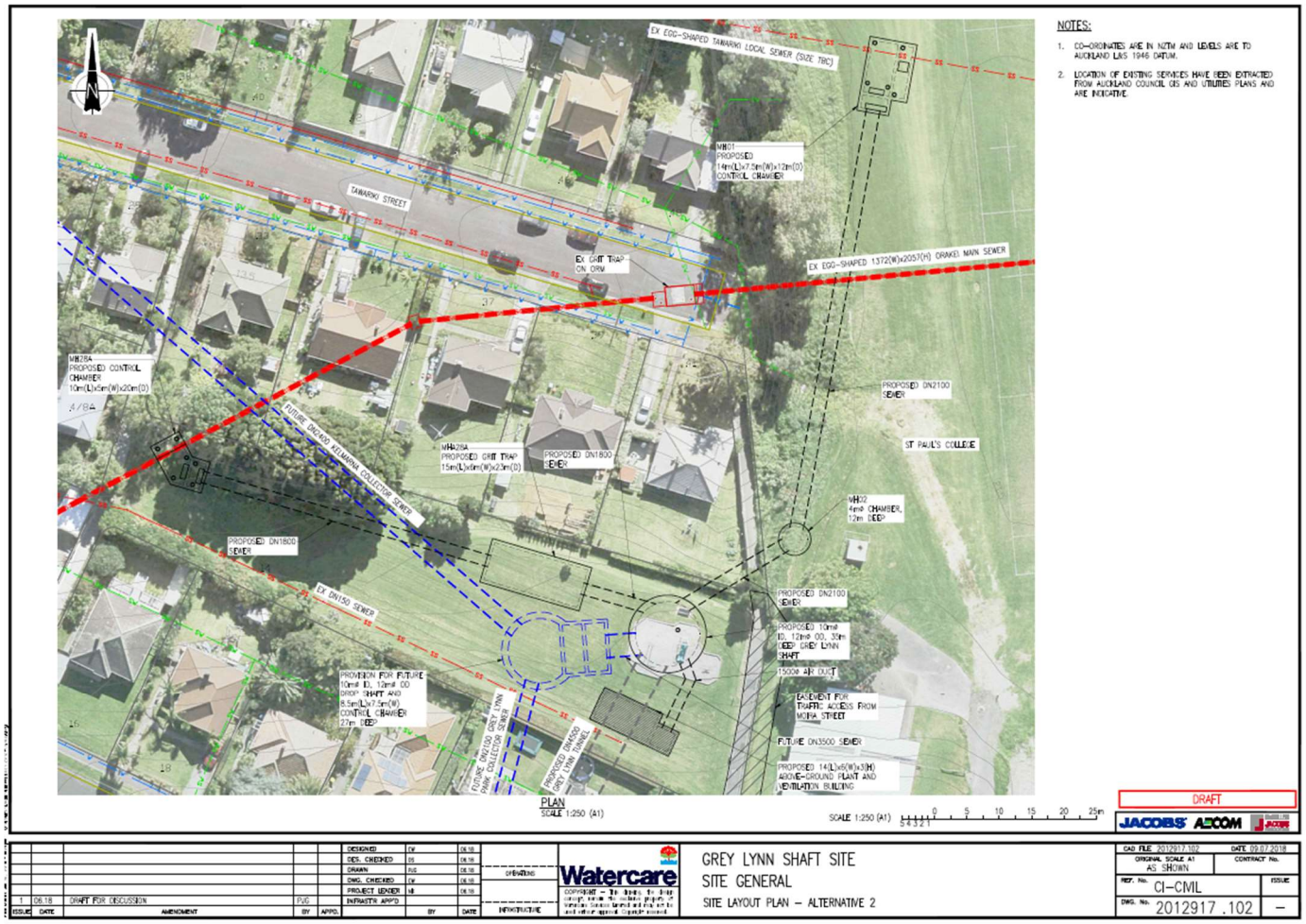

Figure 2. Option 2 – Moira Reserve

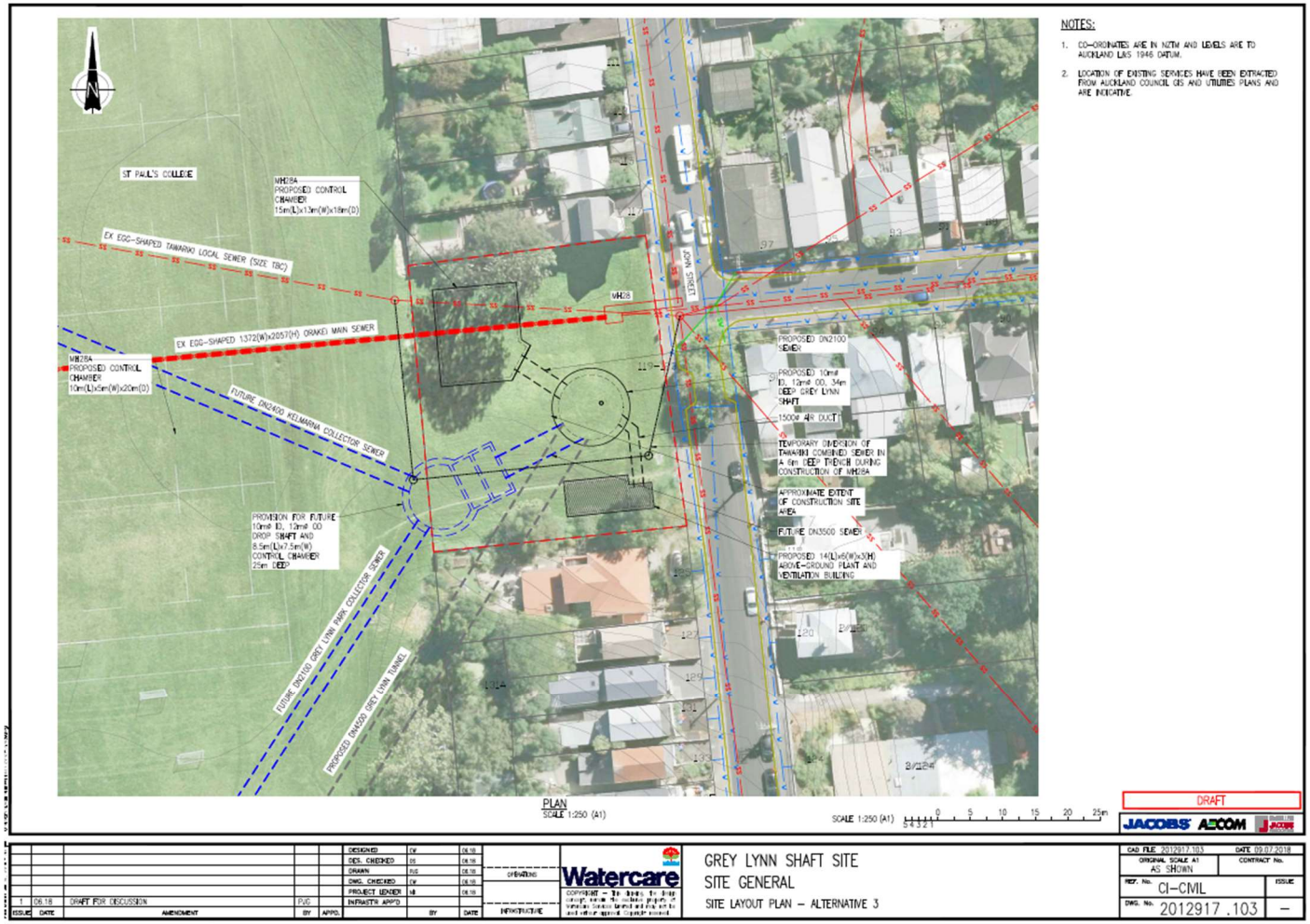

Figure 3. Option 3 – John Street

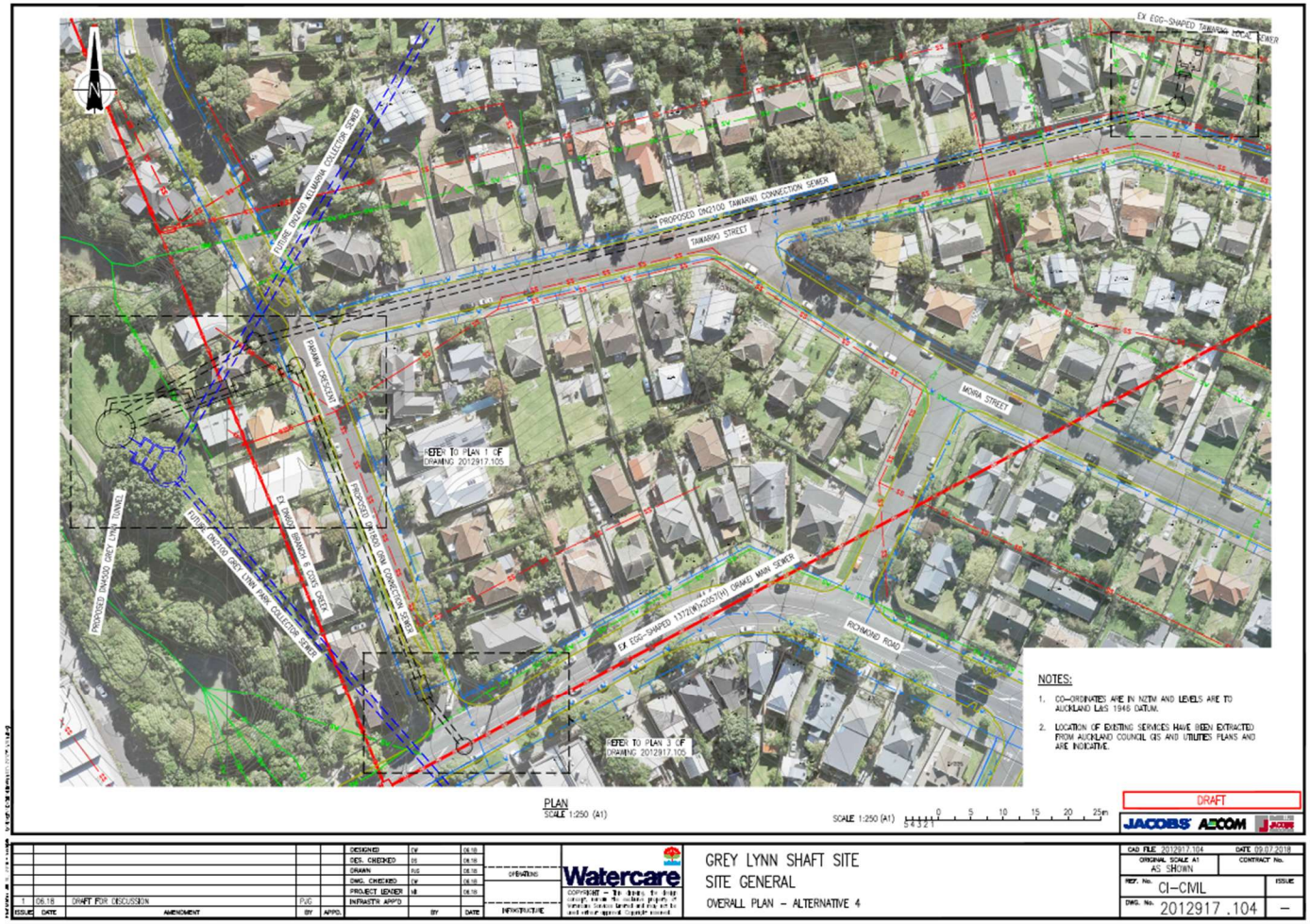

Figure 4. Option 4 – Hukanui Reserve

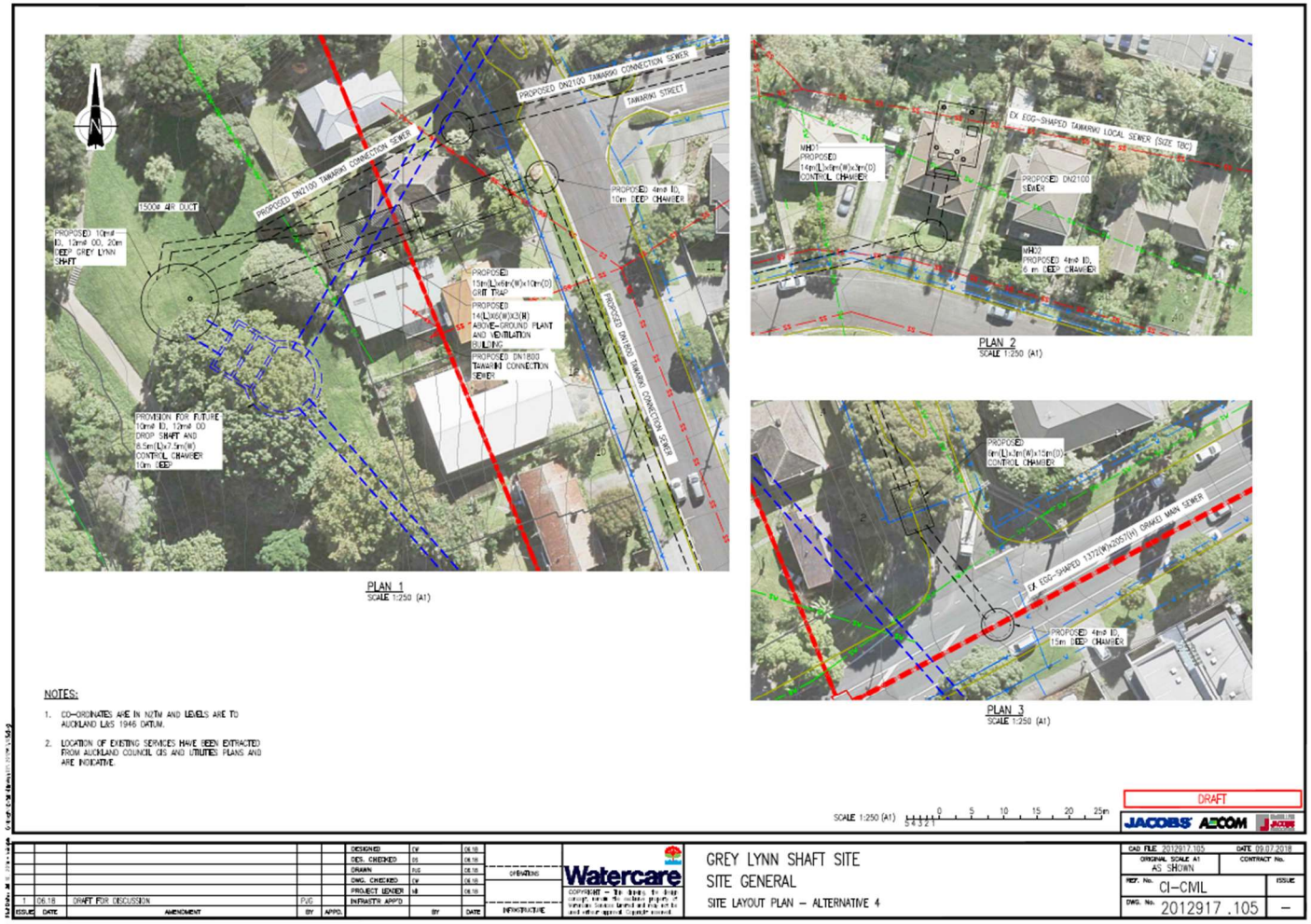

Figure 5. Option 4 – Hukanui Reserve (detail)

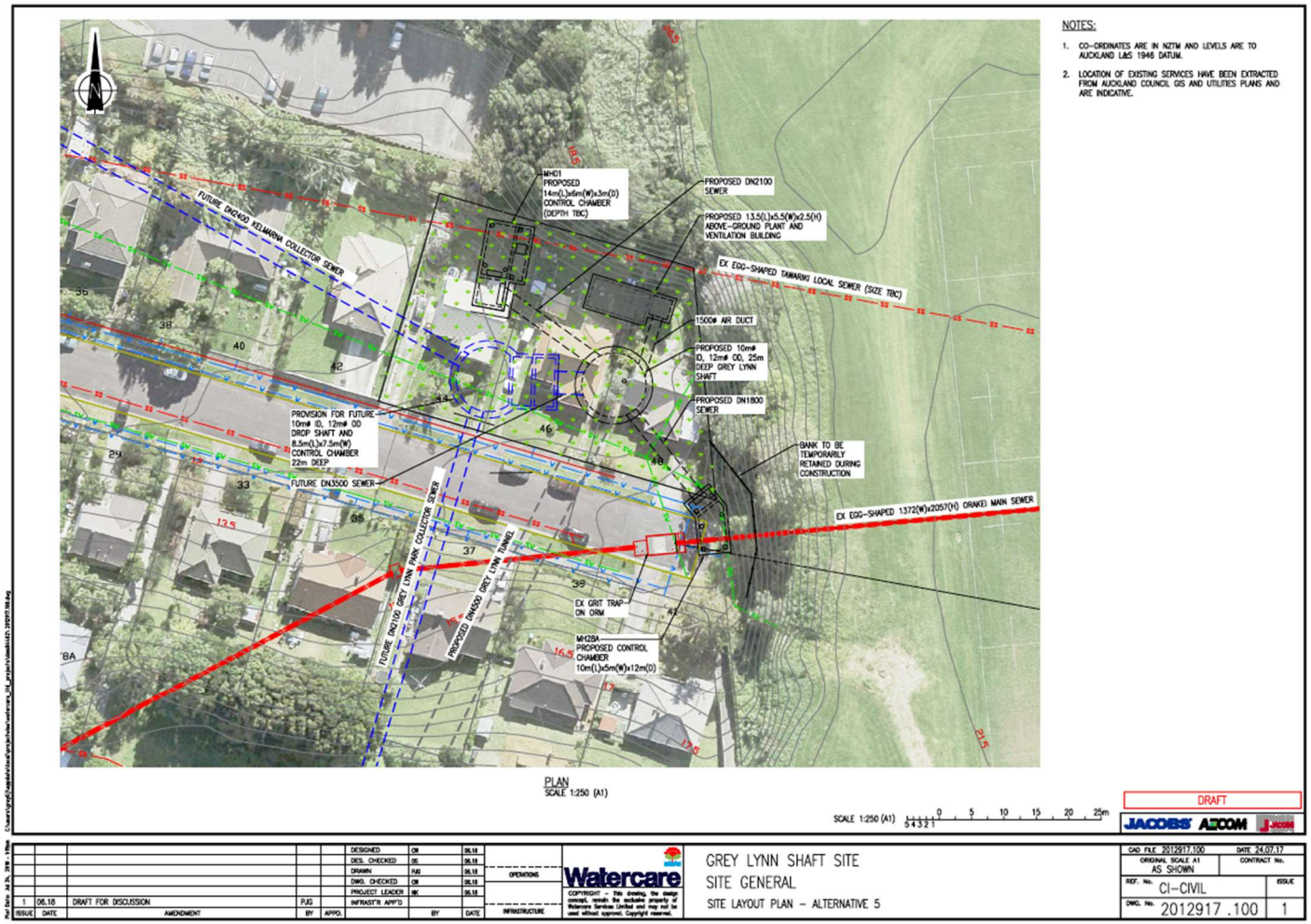

Figure 6. Option 5 – Tawariki Street

APPENDIX 2: CONSTRUCTION INFORMATION

Alternative 1 – St Paul's College	
Construction site area	45 m x 60 m area occupied by school grounds and vegetated bank
Anticipated construction access	From Moira Rd, via the school grounds
Earthworks	20,000 – 25,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 35 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections – connections to Orakei Main Sewer and Tawariki Street CSO, including chamber. Likely trenchless methods.
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connections to Orakei Main Sewer and Tawariki CSO. • Underground chamber fitted with penstock • Above-ground plant room to house power supplies and controls for penstock (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.

Alternative 1 – St Paul's College	
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date;

Alternative 2 – Moira Reserve	
Construction site area	The whole of the reserve
Anticipated construction access	From Moira Rd, via an accessway formed along the existing walkway together with an easement across a strip of the school grounds
Earthworks	20,000 – 25,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 35 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections – connections to Orakei Main Sewer and Tawariki Street CSO, including chamber and grit trap. Construction by pipe jacking.
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Workshops • Electrical substation • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions.

Alternative 2 – Moira Reserve	
	• Connections to Orakei Main Sewer and Tawariki CSO. • Underground grit trap • Underground chamber fitted with penstock • Above-ground plant room to house power supplies and controls for penstock (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date;

Alternative 3 – John Street	
Construction site area	119-123 John St together with a 15 m x 30 m zone with the school grounds
Anticipated construction access	From John St
Earthworks	20,000 – 25,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 34 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections – connections to Orakei Main Sewer and Tawariki Street CSO combined into a single chamber, 15 m x 15 m x 18 m deep. Trenching required for temporary diversion of Tawariki CSO.
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Workshops • Compressor/generator

Alternative 3 – John Street	
	• Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes and hatches at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connections to Orakei Main Sewer and Tawariki CSO. • Underground chamber fitted with penstocks • Above-ground plant room to house power supplies and controls for penstocks (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date;

Alternative 4 – Hukanui Reserve	
Construction site area	30-40 m x 60 m area within the reserve, 16 Parawai Crecent, 34 Tawariki St, and various areas within Richmond Rd, Parawai Crescent and Tawariki St
Anticipated construction access	From Richmond Rd and Parawai Crescent.
Earthworks	10,000 – 15,000 m^3
Duration of construction	Stage 1: 12-18 months Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 20 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections: – 15 m deep connection to Orakei Main Sewer on Richmond Road (approx. 6-8 months); chambers and grit trap along Parawai Cresent (microtunneled, one or two 10-15 m deep chambers required); – Connection to Tawariki CSO, including connection chamber (open trenched).
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock

Alternative 4 – Hukanui Reserve	
	• One or more cranes • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Workshops • Electrical substation • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with asphalt in the roadways,; off-road reinstatement will utilise permeable paving ("Surepave" or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes and hatches at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connections to Orakei Main Sewer and Tawariki CSO - 15 m deep connection to Orakei Main Sewer on Richmond Road; connecting sewer, chambers and grit trap on Parawai Crescent. • Underground chambers fitted with penstocks • Two above-ground plant rooms to house power supplies and controls for penstock (14m x 6m, single storey). One will be in Hukanui Reserve and another possible one at 34 Tawariki Street. • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust vent ranging from about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date; approx. 12-17 m diameter and 10-15 m deep.

Alternative 5 – Tawariki Street	
Construction site area	44-48 Tawariki St, 10-15m length of the end of the street about 10 m x 30 m strip of the school grounds. Access to the property at 41 Tawariki St would likely be cut-off for a period of several months.
Anticipated construction access	From Richmond Rd, via Mokau St and Moira St into Tawariki St.
Earthworks	10,000 – 15,000 m^3
Duration of construction	Stage 1: 12-18 months

Alternative 5 – Tawariki Street	
	Stage 2 (future collector sewer): 12-24 months
Principal temporary construction activities	• Shaft excavation and construction – 25 m deep shaft, 12m diameter • Shaft excavation support - either secant piles, sheet piles, ring beams with lagging, steel liner plate, precast segmental rings, caisson or similar • TBM retrieval • Excavations for underground permanent works • Blasting will not be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Construction of connections to Orakei Main Sewer and Tawariki CSO (likely trenchless methods)
Key features/equipment	• Shaft excavation with mechanical equipment e.g. CAT 330 medium hydraulics excavator or similar) through overburden soils and East Coast Bay Formation (ECBF) bedrock • One or more cranes • Blasting will not generally be used for construction of the shaft as basalt is not anticipated in the shaft excavation • Water treatment equipment • Storage areas for construction materials • Construction base, including: site access roading, security fencing, site offices • Wheel wash • Grout equipment • Materials storage area • Ventilation equipment • Compressor/generator • Site lighting
Permanent works	• Site to be reinstated upon completion of construction and surfaced with permeable paving (“Surepave” or similar) in the vicinity of shafts/chambers/accessways and grass for the remainder of the site. • The shaft roof slabs (i.e., lids) will be buried except for manholes and hatches at the ground surface which will be secured from public entry. At the completion of construction, the ground surface will be restored to the pre-existing conditions. • Connection to Orakei Main Sewer and Tawariki CSO. • Underground chambers fitted with penstocks • Above-ground plant room to house power supplies and controls for penstocks (14m x 6m, single storey) • Air vent –an underground 1.5 m diameter air duct from the shaft to an air intake/exhaust ranging from a vent about 3m high integrated with the plant room, to a 1.5 m diameter 10 m high stack.
Future works	• Collector sewer shaft (constructed adjacent to the tunnel shaft at a later date; approx. 12-17 m diameter and 22 m deep.

Appendix G: Ecology

Bioresearches
A Babbage Company

Grey Lynn Sewer Tunnel Shaft Site Options Ecological Assessment August 2018

Consulting Biologists – Established 1972
P.O. Box 2027, Auckland 1140. New Zealand
www.Bioresearches.co.nz

Grey Lynn Sewer Tunnel Shaft Site Options Ecological Assessment August 2018

DOCUMENT APPROVAL

Document title:	Grey Lynn Sewer Tunnel Shaft Site Options Ecological Assessment
Prepared for:	Babbage Consultants Ltd
Version:	Draft 1
Date:	13 August 2018
Document name:	Document1

Authors:	Jillana Robertson M.Sc. (Hons) Ecologist
Reviewer:	Alia Cederman
Approved for Release:	

Reference: Bioresearches (2018). Grey Lynn Sewer Tunnel Shaft Site Options Ecological Assessment. Report for Babbage Consultants Ltd. pp 7

Cover Illustration: Tawariki Road near Moira Reserve Entrance (Taken 21 June 2018)

CONTENTS

1. INTRODUCTION

1.1 Background

Watercare Services Limited (Watercare) is investigating options for the construction of a shaft for the new Grey Lynn Sewer Tunnel. Five options have been reviewed using a variety of criteria that were discussed at a workshop on 7 August 2018. Bioresearches was employed to review the 'shaft' options from an ecological perspective. A scoring process was developed ranking the effects as Very High (significant) adverse effects (-4) to Very High (significant) positive effects (+4).

1.2 Assumptions

Assumptions were made that all site options would receive plant pest management and native planting where possible. These enhancements are across the board and although further enhancements may be site specific, Bespoke mitigation has not been figured into the scoring of the sites.

1.3 Ecological Criteria

The primary criteria that were used to measure the effects of the shaft construction on the ecology of Options 1-5 were:

1. Are native trees present that will require removal? If there are native trees to be removed, then the option receives a more negative score.
2. Are there significant numbers of weeds present that will be removed (assumed)? If yes, then the option receives a more positive score.
3. Is the construction and/or removal of vegetation likely to impact native fauna, i.e. lizards & birds? If so, then the option receives a more negative score.
4. Are there any other factors, i.e. erosion, degradation of streams, that are likely to occur? If so, the option receives a more negative score.

Note: A score of zero would be indicative if no change is occurring to the site.

2. SCORING

The following table is the scoring for Options 1-5 and the key reasons for the scores.

Table 1: Scoring for Options 1-5. Scores are based on a scale of Significant adverse effects (-4) to Significant positive effects (+4). The 'Key reasons for score' row includes ++ or -- to indicate perceived positive or negative outcomes of an action.

Scorer: Jillana Robertson	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	-1	-1	+1	-2	-1
Key reasons for score	There are many exotic herbaceous and woody species that would be removed (++), however there is likely to be erosion from the exposed bank (-). Retaining wall option less desirable than keeping soil in place with vegetation.	There is not much native vegetation to disturb (+) and although the canopy trees present are exotic (+), the understory is native (-). Avian fauna both native and or non-native may be utilising the large trees for roosting (+/-).	There is nothing to destroy ecologically (++) as there is no vegetation to remove. Any native planting would only enhance the area (+).	There are a number of native trees and large exotics to remove (--), however there are a few smaller exotics for removal as well (+).	Although there are a lot of exotics (++), there are some mature silver ferns (*Cyathea dealbata*) that would be lost (--).
Potential opportunities to enhance outcome	Large specimen trees and other plantings could extend beyond the site which would dramatically improve the area.	Remove of all exotics from the area. Hedge screen with natives and other native specimen trees can be put on site if reserve is re-instated.		By removing all exotics in the surrounding areas and replacing with native plantings there is potential for an overall positive effect.	Enhancement would come in removing ALL exotics in the area and replanting with natives or doing something interesting like an arboretum or a community garden. Planting the adjacent bank would increase the benefit to the area.

3. CONCLUSIONS

Ecologically, Option 3 has the least negative impact and, in fact, could have an overall positive outcome for the area once planting has been done. Although the adverse effects of Option 4 would be minor, it would have the greatest negative impact and therefore received the lowest score.

The effects on ecology are one of the many factors to consider when choosing a site option. Providing the assumptions that weed eradication and native planting are implemented, the overall negative ecological effects should be minimal.

4. REFERENCES

Watercare Services Limited

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Criterion). 25 July 2018.

Appendix H: Arboriculture

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Criterion)

To:	**Peter Roan/Alia Cederman**		
From:	**Stacy Colyer - GreensceneNZ**	**Date:**	**August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the Arboriculture criterion and records the scores assigned for each option under that criterion.

2 Background

A request was received to review Watercare's five Grey Lynn Shaft alternative sites in relation to arboricultural matters. The context of the review was to consider the impact that proposed works within the various options would have on existing trees adjacent/within the alternative locations.

3 Methodology

Site plans of each alternative site were printed in A3 colour and taken to the various locations where a detailed walkover and consideration of the impact that the proposed works may have on the surrounding existing trees was undertaken.

The quality of the existing trees that may be affected by the proposed works on the various sites was visually assessed from ground level; in one case from outside the site. As is appropriate in projects of this nature, additional detailed assessment of existing trees will be undertaken post the site selection process.

Consideration in relation to the various works methodologies was also undertaken within the context of their effects on the surrounding existing trees. The ability to shift and/or re-orientate the locations of the proposed infrastructure was assessed, as was the viability of various installation methodologies within an overriding context that reconfiguration of the installation methodology/location of sizeable infrastructure such as those being assessed could have 'downstream' impacts.

3.1 Information used

Data and information relied on for this assessment includes:

- Watercare Grey Lynn Shaft Site layout plans for five options
- Auckland Unitary Plan Tree Rules
- Auckland Unitary Plan Notable Tree List and Overlay
- Visual Tree Assessment Methodology

3.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- Quality of surrounding existing trees
- Extent of required tree removal works
- Extent of required works within the dripline of trees that could be retained

4 Key Assumptions

When undertaking the scoring assessment, a key assumption made was that '-4 = Very High' reflected the highest impact that the proposed works could have on surrounding exiting trees; that being significant/scheduled tree removal.

Another key assumption as it relates to mitigation was the opportunity to relocate an existing watermain within the road reserve of a residential street so as to allow for additional mitigation planting to be undertaken.

5 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: Stacy Colyer	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	-2	-1	0	-4	-2
Key reasons for score	Reasonable number of trees (exotic, native, weed species and self-seeded specimens) to be removed	Based on assumption Orakei Main Control Chamber can be slightly relocated/ reoriented to southwest corner of reserve. Note that root impact may occur as trees on top of bank	No trees on site	Large tree removal (5 in reserve and 2 Gum street trees in traffic island – if directional drilling a possibility, score would reduce) + Melia street trees (if not installing asset via directional drilling) a requirement. Query on how Council will assess application if Option 4 was Watercare's desired option as there are alternatives	Reasonable number of trees (exotic, native, weed species and self-seeded specimens) to be removed
Potential opportunities to enhance outcome	Quality replacement planting will be a positive (long term) when compared with the quality of the existing trees	N/A as no trees being proposed to be removed so no mitigation required	N/A	Street tree planting options exist along a) Parawai = remove/upgrade Melia b) Tarawiki = move existing watermain and plant in berm	Quality replacement planting will be a positive (long term) when compared with the quality of the existing trees

Appendix I: Noise

MARSHALL DAY Acoustics

GREY LYNN WASTEWATER TUNNEL
ALTERNATIVE SHAFTS ASSESSMENT

Rp 001 20180726 | 9 August 2018

MARSHALL DAY Acoustics

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Attention: **Peter Roan/Alia Cederman**

Report No.: **Rp 001 20180726**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Draft	-	For client review	09/08/2018	S Wilkening	S Peakall/M Cottle

TABLE OF CONTENTS

1.0 INTRODUCTION

Watercare Services Limited (Watercare) is currently investigating options to locate a shaft for the construction of the Grey Lynn Wastewater Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the noise criterion and records the scores assigned for each against that criterion.

2.0 BACKGROUND

Five sites have been reviewed, for estimated compliance of construction noise levels with the relevant Auckland Unitary Plan Operative in Part (AUP) limits.

The sites are generally either on a special purpose (school), residential, or open space zone, or within the road reserve. The relevant criteria are the same, irrespective of the zoning.

3.0 METHODOLOGY

Generally, the permanent effects from a site are the focus of an MCA, such as operational noise. However, the shaft and associated equipment, once installed, would not generate any noise. Therefore, in this instance, the construction noise effects have been assessed in the MCA.

Construction noise, while extending over a significant period of 12 to 18 months, and up to 24 months for some options, is considered temporary and finite. Therefore, when weighting the MCA output, this should be considered for the final score for each option. If there had been permanent effects to assess, more weight should be given to these.

The noise criterion for the MCA was determined as follows:

1. The AUP contains construction noise performance standards, broadly similar to NZS 6803 requirements. The performance standards depend on the zone in which the works occur. However, for all sites assessed, the same rules apply, namely those in Table E25.6.27.1 of the AUP. As the works will be of 'long term' duration (i.e. more than 20 weeks), the values in the table are reduced by 5 decibels. In summary, this means that the daytime construction noise criteria are 70 dB L_{Aeq} and 85 dB L_{Amax}.
2. For each site, the construction locations and methodology were reviewed. Particular focus was on piling and excavation works as highest noise generating activities. There are several piling methodology options. Those range from vibratory piling and sheet piling, to secant and drilled piling. In order to obtain an outer envelope of effects, the assessment was based on vibratory piling methods, with secondary assessment of secant piling.
3. The number of dwellings, school buildings and businesses was counted for each location, where the AUP noise limit would likely be exceeded.
4. While common mitigation was included in the assessment (e.g. equipment is well maintained, unnecessary on-site noise is avoided), specific noise mitigation such as solid barriers or deliberate choice of low noise construction methods were initially excluded.
5. The scoring was determined by the overall number of buildings affected by non-compliant levels, the magnitude of exceedance and the practicability of implementing mitigation that would achieve effective reduction in noise level.

3.1 Information Used

Data and information relied on for this assessment includes:

- Specialist briefing memo from T&T, dated 25 July 2018

- Civil site layout plans from Jacobs and Aecom, dated July 2018
- Site visit on 5 August 2018
- Noise level information for equipment and construction methodologies, measured by MDA on comparative projects, and from BS5228-1:2009

3.2 Scoring Process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

Criterion	Matters to be assessed	Specialist responsible
Noise and vibration	Number of properties where the AUP construction noise standard are likely to be exceeded	Noise – Siiri Wilkening

In scoring the criterion MDA has considered:

- Potential construction methodologies
- Terrain, e.g. shielding provided
- Height of dwellings, e.g. single or double storey
- Potential for barriers to be used
- If works would occur simultaneously or staged

3.3 Key Assumptions

In order to be conservative, it has been assumed that piling will be undertaken using vibratory piling methods.

It has been assumed that all works will be undertaken Monday to Saturday, between 7am and 6pm. There will be no night-time, Sunday or public holiday works.

Mitigation options were limited to best practice on-site management, i.e. maintenance of equipment, no unnecessary noise such as using truck horns, tail gates securely fastened, no shouting or loud radios etc.

It has been assumed that standard site hoardings would be wire, and therefore not acoustically effective.

4.0 SCORING

The following table provides scores for each of the options and the key reasons for this scoring and includes:

- Key reasons for score, including the standard mitigation taken into account
- Any bespoke mitigation or design opportunities (noted, but not factored into score)

Scorer: Siiri Wilkening	Option 1 – St Paul's College
Score	-2
Key reasons for score	Exceedance of AUP limit from piling at 8 dwellings + 1 school building with noise levels up to 85 dB L_{Aeq} Exceedance of AUP limit from excavation and concreting at 4 dwellings with noise levels up to 75 dB L_{Aeq} Construction traffic, while unlikely to exceed limits, would occur on private land and affect 2 dwellings and 1 school building
Potential opportunities to enhance outcome	Use secant piling rather than sheet or vibratory piling: this reduces exceedance to 4 buildings, with levels up to 79 dB L_{Aeq} during retaining wall construction, and 74 dB L_{Aeq} during piling on the St Paul's fields Use min. 2.4m noise barriers along the property boundaries, and on top of the retaining wall, noise barrier towards the school fields to reduce impact on use of fields for coaching and training This would achieve compliance at all receivers during works after the retaining wall has been installed Special consideration (e.g. offer of temporary relocation during retaining wall piling works) for 48 Tawariki Street, which is within 3 metres of piling works Overall preferred option from a noise point of view

Scorer: Siiri Wilkening	Option 2 – Moira Reserve
Score	-3
Key reasons for score	Exceedance of AUP limit from piling at up to 45 dwellings + 4 school buildings with noise levels up to 93 dB L_{Aeq} Exceedance of AUP limit from excavation and concreting at up to 15 dwellings + 1 school building with noise levels up to 80 dB L_{Aeq} Construction traffic, while unlikely to exceed limits, would occur on private land and affect 2 dwellings and 1 school building
Potential opportunities to enhance outcome	Use secant piling rather than sheet or vibratory piling: this reduces exceedance to 20 dwellings and 1-2 school buildings, with levels up to 87 dB L_{Aeq} Use min. 2.4m noise barriers around the reserve Special consideration (e.g. offer of temporary relocation during highest noise works) for 4/8A Moira Street, which is within 8 metres of piling and excavation works

Scorer: Siiri Wilkening	Option 3 – John Street
Score	-3
Key reasons for score	Exceedance of AUP limit from piling at up to 40 dwellings (noise levels up to 93 dB L_{Aeq}) Exceedance of AUP limit from excavation and concreting at up to 10 dwellings with noise levels up to 82 dB L_{Aeq} Positive: Construction traffic off public road
Potential opportunities to enhance outcome	Use secant piling rather than sheet or vibratory piling: this reduces exceedance to 22 dwellings, with levels up to 89 dB L_{Aeq} Use min. 2.4m noise barriers around the reserve Special consideration (e.g. offer of temporary relocation during highest noise works) for 117 John Street, which is within 8 metres of piling and excavation works

Scorer: Siiri Wilkening	Option 4 – Hukanui Reserve
Score	-4
Key reasons for score	Three distinct areas which will be affected by construction works, with piling exceeding the AUP limit, with noise levels up to 100 dB L_{Aeq}: Parawai Crescent – 22 dwellings Tawariki Street – 28 dwellings and 4 school buildings Richmond Road – 18 dwellings and 3 businesses Positive: Construction traffic off public road
Potential opportunities to enhance outcome	Use secant piling rather than sheet or vibratory piling: this reduces exceedance to: Parawai Crescent – 7 dwellings Tawariki Street – 6 dwellings and 1 school buildings Richmond Road – 7 dwellings and 3 businesses Noise levels still up to 93 dB L_{Aeq} Use min. 2.4m noise barriers around work sites, but limited effect due to closeness of neighbouring dwellings and some double storey dwellings Special consideration (e.g. offer of temporary relocation during highest noise works) for 14 Parawai Crescent (3m), 36 Tawariki St (4m), 2 Richmond Road (8m) Least preferred option from a noise point of view

Scorer: Siiri Wilkening	Option 5 – Tawariki Street
Score	-2
Key reasons for score	Exceedance of AUP limit from piling at up to 15 dwellings (noise levels up to 93 dB L_{Aeq}) Exceedance of AUP limit from excavation and concreting at up to 10 houses with noise levels up to 82 dB L_{Aeq} Positive: Construction traffic off public road
Potential opportunities to enhance outcome	Use secant piling rather than sheet or vibratory piling: this reduces exceedance to 5 dwellings and 1 school building, with levels up to 85 dB L_{Aeq} Use min. 2.4m noise barriers around site. Higher may be required due to elevated dwellings across road Special consideration (e.g. offer of temporary relocation during highest noise works) for 42 John Street, which is within 10 metres of piling and excavation works Second most preferred option from a noise point of view.

APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A sound that is unwanted by, or distracting to, the receiver.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 μPa i.e. dB = 20 x log(P/Pr)
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\ (t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
NZS 6803	New Zealand Standard NZS 6803:1999 Acoustics – Construction Noise
BS 5228-1	British Standard BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise

Appendix J: Vibration

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Vibration)

To:	**Peter Roan/Alia Cederman**		
From:	**Kristian Nelson**	**Date:**	**22 August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the Vibration criterion and records the scores assigned for each option under that criterion.

2 Background

I have developed construction method plans and temporary works for similar projects in the past. The proposed site layout plans and indicative required structures were quite useful in this regard. I looked at the required size for both shaft sinking equipment and support cranes along with the transporter and crane requirements for TBM removal, disassembly and haulage from site.

The size and depth of the shafts and the underlying geological conditions will drive the size of the piling equipment which is likely to be the major source of ground borne vibration.

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

- Watercare Grey Lynn Shaft Site layout plans for five options;
- Specialist briefing memo from T+T, dated 25 July 2018;
- Previous knowledge of temporary works and the shaft structures required for the Central Interceptor (CI) project;
- Previous experience undertaking piling work, monitoring and mitigating ground borne vibration.

3.2 Scoring process

A scoring scale has been developed for all criteria.

The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- Number and proximity of receivers;
- Size and depth of structures. This influences the size of the machinery required to undertake the works. Other than Option 4 most of the options have been assessed relatively as if the type of ground support is similar – ie drilled piles as a mitigation.

3.3 Key assumptions

In general, the plans and description of works fairly outline the required works.

The more properties affected or the longer the duration or scope of the piling the more negative the impact.

Property effects or perceived vibration effects will always be viewed as negative.

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: (Name)	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	-1	-2	-1	-2	-1
Key reasons for score	Reasonably isolated from receivers	Many deep structures and proximity to many receivers; will need large equipment	One site, deep piles = larger rigs	Many receivers, multiple sites, may require driven sheet piling for road crossings	Limited receivers (1), simple construction
Potential opportunities to enhance outcome	Caisson temporary support may be beneficial option	Rationalise chambers out?	Redesign structures if possible to reduce size Drilling equipment instead of driven piles	Slide trenching system, modified frequency vibratory hammers	Procure more properties to eliminate receiver

Criteria	Scored by	Option 1 - St Pauls			Option 2 - Moira Reserve			Option 3 - John St			Option 4			Option 5		
		Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome	Score	Reasons for score	Opportunities to enhance outcome
Residential Recievers	K Nelson	0	Top of bank - decent distance to recievers		-3	close houses - many underground structures		0	2 sides only		-4	Many recievers at multiple sites		-1	one side only	
Depth of potential rock work	K Nelson	-1	soft upper ground but potential obstructions		-2	unknown depth to rock - potentilly shallow		-2	unknown depth to rock - potentilly shallow		0	various depth of structures - limited room.		-1	depth to rock known	
Equipment poterntial	K Nelson	-1	relatively simple construction - deep tunnels and shafts		-2	deeper structures requireing larger rigs		-2	Larger deeper shafts - larger drilling equipment		-3	may require sheets or driven piles due to limited site room		0	relatively simple construction - deep tunnels and shafts	

Appendix K: Air quality

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Air Quality)

To:	**Peter Roan/Alia Cederman**		
From:	**Andrew Curtis**	**Date:**	**10/8/18**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the air quality criterion and records the scores assigned for each option under that criterion.

2 Methodology

In this section I set out the methodology that I have used to undertake my assessment. As this is a high level assessment the methodology is qualitative and based on our experience with other similar projects.

2.1 Construction Effects

There are two main potential air quality effects associated with construction of a scheme like this, which are odour and dust. The dust can be generated by any activity that disturbs soil, together with the subsequent handling processes. These effects are generally well understood, and there are a range of standard mitigation measures which should be implemented, which will minimise as far as practical the potential for dust nuisance.

However even with these measures in place there is potential for there to be some dust nuisance effects close to the source, and in particular when sensitive receptors are within 50 m of the works. Therefore the rating for construction related dust considers the proximity of people to the works, and any terrain related factors which may increase risk, such as works being undertaken at a higher elevation than residences.

In terms of construction odour effects, this relates to odour associated with “breaking” into the existing Orakei Main Sewer, and to a lesser degree the local Tawariki sewer. As this risk exists for all alternatives the rating is based on the proximity of the tie in point to sensitive receptors and the duration of the works.

2.2 Odour Vent Stack

As AECOM was involved in assessing the odour effects for the Central Interceptor Project (CIP) as part of the detailed design process, AECOM has a good understanding of the potential for odour from the vent, and the frequency with which odour discharges are predicted to occur. Based on this the vent stack will only discharge odour in significant rain events when extraction and treatment of air from the Central Interceptor at the Mangere Pump Station and/or May Road is not possible. Consequently this means that in general any odours that are discharged will be relatively weak and relatively infrequent (once every five to 10 years). Therefore in order to assess the potential for effects I have considered factors such as:

- The proximity of the vent to sensitive receptors
- The elevation of the receptors in relation to the vent
- Typical wind directions in the area

I have also considered for each alternative whether it is practical to retrofit some form of odour mitigation, in the event that either odour strength or odour frequency are greater than predicted.

2.3 Odour Grit Traps

There are a range of normal operational activities than can give rise to odours. In this case I have identified cleaning the grit traps as being a suitable measure, as in AECOM's experience the odour associated with this process is invariably considered offensive by members of the public when they experience it.

Therefore in assessing this criteria, AECOM has considered:

- Whether a new grit chamber is proposed
- Where the chamber is in relation to sensitive receptors

At this stage there is no data available on how often the chambers might be cleaned out, therefore it has been assumed that it will occur at least annually.

2.4 Data relied on

Data and information relied on for this assessment includes:

- Grey Lynn Shaft site layout alternatives
- A site visit
- Overview of construction activities

2.5 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects

2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

As I have considered four different sub criteria, I have scored each of these criteria using the scale set out above, and then applied a weighting to them to assign a final score. The weighting factors and rationale are explained below.

Effects	Weighting	Rationale
Construction Dust	40%	Due to the proximity of the works to residences, and the duration of works, dust from construction has significant potential to result in nuisance effects to sensitive receptors around the works. Therefore a high weighting has been given to this potential effect.
Construction Odour	10%	Any odour from breaking into the existing sewers will occur in contained locations, generally a number of metres below ground level. This means that potential effects should be reasonably contained. In addition this potential effect should only occur for a short period of time. Therefore a low weighting has been given to this potential effect.
Vent Odour	10%	Given the infrequent nature of odour emissions from the vent stack a low weighting has been given to this effect.
Grit Trap Odour	40%	Given the regular requirement to clean out the grit traps, and the proximity of these to sensitive receptors, a high weighting has been given to this potential effect.

2.6 Key assumptions

The key assumptions that have been made in my assessment are as follows.

In terms of odour:

- Odours discharges from the vent stack will only occur in significant rain events when extraction and treatment of air is not possible at the Mangere Pump Station or May Road. Consequently the odours at Grey Lynn will be weak and only occur once every five to 10 years.
- Any odours discharged at the Grey Lynn shaft will be from a tall stack, designed to provide good dispersion.

In terms of dust:

- There will be no stockpiling of excavated materials, with all material loaded out directly into trucks.
- Where it is necessary to stockpile material for some reason, it will be contained in bunkers or covered.
- Standard construction dust control measures will be implemented.

3 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Construction Dust

Scorer: Andrew Curtis	Option 1	Option 2	Option 3	Option 4	Option 5
Score	-2	-2	-2	-2	-2
Key reasons for score	Construction will be elevated with respect to and very close to houses on Tawariki St which is downwind in prevailing conditions.	Construction will be very close to houses on Tawariki St and Moira St. Volumes of excavation will be greater than Option 1 due to additional tunnelling required.	Construction will be close to residences on John and Summer St.	While overall construction volumes are smaller, the length of open trench construction means that the potential for nuisance remains.	Construction will be close to houses on Tawariki St which are elevated and downwind in prevailing conditions.
Potential opportunities to enhance outcome	Construction of Shaft Activity could be undertaken enclosed/semi enclosed.	Construction of Shaft Activity could be undertaken enclosed/semi enclosed.	Construction of Shaft Activity could be undertaken enclosed/semi enclosed.	Micro tunnel the Tawariki connection and build enclosure around main shaft construction.	Construction of Shaft Activity could be undertaken enclosed/semi enclosed.

Construction Odour

Scorer: Andrew Curtis	Option 1	Option 2	Option 3	Option 4	Option 5
Score	-1	-2	-3	-2	-2
Key reasons for score	Breaking into Orakei main has the potential to generate odour, however there are a range of mitigation measures which can be incorporated into the process.	Breaking into the Orakei main has the potential to generate odour, however there are a range of mitigation measures which can be incorporated into the process.	Breaking into Orakei main and Tawariki collector has the potential to generate odour, however there are a range of mitigation measures which can be incorporated into the process	Breaking into the Orakei main has the potential to generate odour, however there are a range of mitigation measures which can be incorporated into the process	Breaking into Orakei main has the potential to generate odour, however there are a range of mitigation measures which can be incorporated into the process
Potential opportunities to enhance outcome					

Operational Odour (Vent)

Scorer: Andrew Curtis	Option 1	Option 2	Option 3	Option 4	Option 5
Score	-1	-1	-1	-1	-1
Key reasons for score	As long as odours are at the low level and frequency predicted, any odours discharged should be negligible.	As long as odours are at the low level and frequency predicted, any odours discharged should be negligible.	As long as odours are at the low level and frequency predicted, any odours discharged should be negligible. Adjacent houses are elevated with respect to the vent.	As long as odours are at the low level and frequency predicted, any odours discharged should be negligible.	As long as odours are at the low level and frequency predicted, any odours discharged should be negligible.
Potential opportunities to enhance outcome	There is potential to install additional odour control if odours are greater than predicted.	There is potential to install additional odour control if odours are greater than predicted.	There is potential to install additional odour control if odours are greater than predicted.	There is potential to install additional odour control if odours are greater than predicted.	There is potential to install additional odour control if odours are greater than predicted.

Operational Odour (Grit Trap)

Scorer: Andrew Curtis	Option 1	Option 2	Option 3	Option 4	Option 5
Score	0	-2	0	-2	0
Key reasons for score	No new grit chamber proposed	Due to proximity of proposed new grit trap to residences cleaning could result in regular off-site odours	No new grit chamber proposed	Due to proximity of proposed new grit trap to residences cleaning could result in regular off-site odours	No new grit chamber proposed
Potential opportunities to enhance outcome		Extraction system could be configured to draw air out and minimise effects		Extraction system could be configured to draw air out and minimise effects	

Overall Weighted Score

Scorer: Andrew Curtis	Option 1	Option 2	Option 3	Option 4	Option 5
Score	-1	-2	-1	-2	-1

Appendix L: Construction traffic

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Construction Traffic)

To:	**Peter Roan/Alia Cederman**		**1007303**
From:	**Leo Hills (Commute)**	**Date:**	**21 August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the construction traffic criterion and records the scores assigned for each option under that criterion.

2 Background

The five site alternatives are located in Grey Lynn / Ponsonby, in central Auckland. The sites are accessed from various local roads in the local transport network, which connect to Richmond Road to the south. The site alternatives are zoned Mixed Housing Urban, Special Purpose – School, and Open Space – Informal Recreation, as detailed in Figure 1 below.

All sites will feature construction traffic access from non-arterial roads (noting that one site has potential access via St Paul's College which does have frontage to Richmond Road which is an arterial), as detailed in the Auckland Unitary Plan – Operative in Part July 2018 (Unitary Plan).

Figure 1: Unitary Plan Zoning

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

- Unitary Plan Zoning Map
- Unitary Plan Controls and Overlays
- Auckland Transport (AT) Traffic Volume Data (where available)
  - Richmond Road
  - Parawai Crescent
  - Tawariki Street
  - Moira Street
  - Mokau Street
  - John Street
- Watercare Grey Lynn Shaft Site Plans (Alternatives 1 – 5)
- Vehicle Tracking Analysis prepared by Commute (attached Appendix A)
  - Low loader truck (25m long) with 150t crane throughout local road network
  - Figures 1-6 attached being vehicle tracking of the low-loader.
- On-site traffic and movement observations of the local road network (undertaken 3th August 2018)

3.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- Vehicle accessibility of the subject site with regard to:
  - Anticipated construction vehicles
  - Contractor vehicles
- Safety of construction workers and general public:
  - Construction vehicle users
  - On-site workers
  - Private vehicle users
  - Pedestrians
- Ability of the local road network to cater for construction:
  - Anticipated vehicle volumes and their effects on network operations
  - Form and alignment of local roads
- General loss of on-street parking associated with the construction
- Extent of traffic management required for each alternative.

3.3 Key assumptions

In scoring the criterion, we have assumed:

- All alternatives will incorporate standard safety mitigation (e.g safety fencing, vehicle / pedestrian separation), together with the ability to manage large low-loader trucks including reversing on local roads
- Any new roading / accessways required will be built to Auckland Council (Council) / AT engineering standards
- All alternatives will incorporate standard Traffic Management procedures
- Temporarary road closures may be required to enable plant to be delivered to / from the subject site
- Large plant will be removed from transport vehicles in the roadway where applicable

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: (Leo Hills)	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	-2	-1	-3	-4	-1
Key reasons for score *e.g. would require removal of significant stand of trees*	Access is proposed through a school and therefore an increase in safety risk exists. Assume access is through Moira Street and Mokau Streets. (albeit with some reversing of large low-loaders).	Access though Moira and Mokau Streets as this route is wider and has less constraints than Parawai Crescent. (albeit with some reversing of large low-loaders).	John Street very constrained especially at / near Richmond Road. Vehicle tracking shows intersection will need moderate modification to accommodate large low-loaders (eg removal of island and parking). John Street is also a busy rat-run route with almost 5,000 vehicles per day making it Collector Road levels.	Work in actual road corridor of Richmond Road, Parawai Crescent and Tawariki Street which are busy or are very constrained including narrow sections. Understood that Richmond Road would be reduced to one lane during parts of construction. Manoeuvring into and out of Parawai site difficult.	Access to some properties removed or limited (No 41). Assumes construction access via Tawariki / Moira and Mokau which are suitable for large trucks (albeit with some reversing of large low-loaders).
Potential opportunities to enhance outcome *e.g. avoidance of the group of trees could improve the score*	Look to completely separate construction vehicles from the school grounds.	Construction access via Moira and Mokau as these are the least constrained in terms of road width		Reduce construction area on Richmond Road to maintain two-lanes.	Construction access via Tawariki / Moira and Mokau as these are the least constrained in terms of road width

Revision notes:

Rev:	Date:	Notes:

Drawn by: JB

Client:

Project: Central Interceptor

Drawing Title: Vehicle Tracking low-loader + crane

Date: 9 August 2018

Scale @ A3: 1:500

Revision: A

commute TRANSPORTATION CONSULTANTS

Figure: 1

Revision notes:		
Rev:	Date:	Notes:

Drawn by: JB	Project: Central Interceptor	Date: 9 August 2018	commute TRANSPORTATION CONSULTANTS	Figure: 2
Client:	Drawing Title: Vehicle Tracking low-loader + crane	Scale @ A3: 1:500		
		Revision: A		

Revision notes:

Rev:	Date:	Notes:

Drawn by: JB

Client:

Project: Central Interceptor

Drawing Title: Vehicle Tracking low-loader + crane

Date: 9 August 2018

Scale @ A3: 1:500

Revision: A

commute TRANSPORTATION CONSULTANTS

Figure: 3

Revision notes:		
Rev:	Date:	Notes:

Drawn by: JB

Client:

Project: Central Interceptor

Drawing Title: Vehicle Tracking low-loader + crane

Date: 9 August 2018

Scale @ A3: 1:500

Revision: A

commute TRANSPORTATION CONSULTANTS

Figure: 4

Revision notes:		
Rev:	Date:	Notes:

Drawn by: JB	Project: Central Interceptor	Date: 9 August 2018	commute TRANSPORTATION CONSULTANTS	Figure: 5
Client:	Drawing Title: Vehicle Tracking low-loader + crane	Scale @ A3: 1:500		
		Revision: A		

Revision notes:		
Rev:	Date:	Notes:

Drawn by: JB	Project: Central Interceptor	Date: 9 August 2018	commute TRANSPORTATION CONSULTANTS	Figure: 6
Client:	Drawing Title: Vehicle Tracking low-loader + crane	Scale @ A3: 1:500		
		Revision: A		

Appendix M: Landscape and visual

Memorandum

Boffa Miskell
Level 3, IBM Centre, 82 Wyndham Street, Auckland
PO Box 91250, Auckland 1142
Telephone: +64 9 358 2526

Boffa Miskell

Attention:	Peter Roan / Alia Cederman
Company:	Tonkin + Taylor
Date:	13 August 2018
From:	John Goodwin
Message Ref:	Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Landscape and Visual Amenity)
Project No:	A08301E

1. Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the Landscape and Visual Amenity criterion and records the scores assigned for each option under that criterion.

2. Background and Context

The five subject sites are located within the residential suburbs of Ponsonby and Grey Lynn, 2 km to the west of the Auckland CBD. The area of subject sites is bounded by, the Marist Catholic School to the north and St Paul's College grounds to the east and Hukanui Reserve to the west. The arterial route of Richmond Road forms the notional southern boundary of the subject sites.

The wider context of the subject sites is the established residential character of Ponsonby/Grey Lynn suburbs with a predominance of traditional timber weatherboard villas and bungalows along with some more recent housing stock and infill development. Large mature trees are a feature both on the street and in front gardens, as most dwellings are set back from the street, creating a leafy residential character.

3. Methodology

The aim of the MCA for landscape and visual amenity is to identify and score the level of effects of the proposed Grey Lynn Sewer Tunnel construction and permanent elements, in relation to each of the subject sites. The assessment addresses:

a) Effects on the physical landscape and landscape character associated with changes to the landform, vegetation and the fabric, character and quality of the townscape and how it is experienced.

b) Effects on visual amenity relative to changes in views and viewers (communities/ people's) response to the character and quality of their outlook.

This high level assessment of landscape and visual amenity effects has been undertaken with cognisance taken of recognised best practice guidelines; including both the UK and the New Zealand Landscape Institute Guidelines for guidelines for landscape and visual impact assessment.

Assessing the significance of landscape and visual effect is a combination of both qualitative and quantitative processes and relies on reasoned professional judgement. The determination of the scale of potential

landscape and visual effects are not absolute and can only be defined in relation to individual developments and their locations.

The sensitivity of the landscape and viewers is derived from considering their susceptibility to change and the nature of the change associated with the proposed development together with the value of the landscape and/or view.

In order to provide a level of consistency within the assessment, the prediction of magnitude of change and assessment of the landscape and visual effects have been based on criterion, as provided below.

4. Information Used

Data and information relied on for this assessment includes:

- Baseline technical information (including both a site layout plan and details of the construction and permanent works) supplied by Watercare Services Limited (Watercare) relating to each of the alternative site options;
- Auckland Unitary Plan Operative in part (AUP OIP) including relevant planning maps;
- Auckland Council Geomaps;
- Aerial photography; and
- Site visit to the area to view the sites from adjacent land areas.

4.1 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

Each of the landscape and visual effects identified are evaluated in terms of their size or scale, the extent of the area influenced, and their duration and reversibility.

In scoring the criterion we have considered:

4.1.1 Landscape Considerations

The magnitude of effects arising from the proposed development in respect of landscape/ streetscape character is based on the interpretation of a combination of largely quantifiable parameters, as follows:

- The total extent / land-take associated with each phase of the development;
- The degree to which aesthetic or perceptual aspects of the landscape would be altered by removal of existing components or with the addition of new elements;

- The area over which the loss of landscape / streetscape elements will be perceived;
- The context in which the proposed development would be seen;
- The duration of the impact; and
- The reversibility of the impact.

4.1.2 Visual Amenity Considerations

The criteria utilised in ascribing magnitude of change in respect of visual amenity is as follows:

- The scale of change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the proposed development;
- The extent of the area over which the changes would be visible;
- The distance of the viewers from the proposed development;
- The nature of the view (whether views are direct and open, oblique or restricted) of the proposed development;
- The number of viewers affected; and
- The relative amount of time over which the view will be experienced.

4.2 Key Assumptions

4.2.1 Landscape / Streetscape Character

In landscape and visual amenity terms none of the sites are identified ONL / ONF and are not overlaid by any significant ridgeline notation in the AUP OIP. In addition, all the subject sites lie outside the Special Character Areas Overlay Residential and Business, which applies to most of the suburb of Ponsonby.

The sites lie outside the Residential – Single House Zone, within which most of the Ponsonby suburb extends and which is considered more sensitive than other Residential Zones. In landscape terms there is a general assumption that Conservation Zones (including public parks, playing fields) are more sensitive to the permanent effects (of the type of development proposed) than Residential Zones / areas or Special Purpose Areas. Therefore, the potential magnitude of change and the loss of landscape / streetscape features (including amenity trees) in terms of scoring each site option in relation to its zoning is regarded as a consideration for this assessment. The zonings for each site are:

Site 1 – Special Purpose – School Zone;

Site 2 - Open Space – Informal Recreation Zone;

Site 3 – Residential – Mixed Housing Suburban Zone;

Site 4 - Open Space – Informal Recreation Zone / Residential – Mixed Housing Urban Zone / Road Reserve; and

Site 5 - Residential – Mixed Housing Urban Zone/ Road Reserve.

4.2.2 Visual Amenity

Generally residential and recreational viewers are considered as a more sensitive viewing audience to the type of the development proposed, than transitory or temporary viewers. Therefore, the potential magnitude of change / the number of potentially affected viewers in terms of scoring each site option is regarded as a determining factor for this assessment.

4.2.3 Mitigation

The following standard/expected mitigation has been taken into account in the assessment of potential effects:

- 2-2.5m fencing to screen lower level activities during construction;
- Simple but appropriate design of plant room building using recessive materials and colours;
- Grounds / surface restoration;
- Replacement / compensation planting; and
- Planting to integrate building and retaining walls.

5. Scoring

The following table provides scores for each of the options, taking account the standard mitigation and the key reasons for this scoring.

Scorer: (JG)	Option 1-St Pauls College	Option 2-Moira Reserve	Option 3-John Street	Option 4-Hukanui Reserve	Option 5-Tawariki Street
Score:	-1	-1	-1	-2	-1
Key reasons for score:	Localised effects within an otherwise unaltered landscape/ streetscape or visual amenity context.	Localised effects within an otherwise unaltered landscape/ streetscape or visual amenity context.	Localised effects within an otherwise unaltered landscape/ streetscape or visual amenity context.	A partial / localised loss of key characteristics of the streetscape / reserve visual amenity.	Localised effects within an otherwise unaltered landscape/ streetscape or visual amenity context.
Landscape Effects	Low magnitude of change on landscape/ streetscape character: The perceived change will be caused by the removal of poplar trees and addition of the plant room building against the existing bank which forms a terminus at the end of Tawariki Street. However, the proposed building will be designed in scale and with materials to fit into the streetscape context. Construction effects on the grounds of the St Paul's College playing field can be sufficiently restored.	Low magnitude of change on landscape character: The perceived change will be caused by the addition of the plant room building on the south eastern corner of the Moira Reserve, against the fence/hedge which separates the rear gardens of the properties alongside the southern boundary of the Reserve. Although located within the open space which is in recreational use, the proposed building will be designed in scale and with materials to fit the context. Construction effects on the grounds of the Moira Reserve grounds can be sufficiently restored.	Low magnitude of change on landscape/ streetscape character: The perceived change will be caused by the addition of the plant room building next to the two-storey residential dwelling No 125 on John Street. However, the proposed building will be designed in scale and with materials to fit the streetscape context. Construction effects on the grounds in between residential dwellings No 117 and No 125 can be sufficiently restored.	Minor magnitude of change on landscape/ streetscape character: The perceived change will be caused by the removal of high amenity trees within Hukanui Reserve and in the road reserve in Parawai Crescent. Although mitigated by planting, the change will also be caused by the demolition of the house at No 32 or 34 Tawariki Street. The removal of house No 16 will not be so apparent due to it adjoining Hukanui Reserve. Apart from the removal of trees, the rest of the construction effects on the grounds can be sufficiently restored.	Low magnitude of change on landscape/ streetscape character: The perceived change will be caused by the removal of houses No 44-48 and by the addition of the plant room building on the northern boundary of the rear gardens of properties No 46 and 48. Due to the location of these dwellings at the end of the cul de sac street, sufficient mitigation by appropriate planting can be provided. Construction effects on the grounds can be sufficiently restored.
Visual Amenity effects	Low magnitude of change on visual amenity: Limited number of viewing audience will be affected. Apparent permanent effects will be caused by the plant room building located on the existing bank which forms a terminus at end of Wider visible effects would occur due to construction activities (use of machinery, such as cranes) on the elevated ground of the St Paul's College playing field, which is	Low magnitude of change on visual amenity: Limited number of viewing audience affected. Apparent permanent effects will be caused by the plant room building located in the park. However, these views are limited to playground users and footpath users, which extends to the east of the Reserve. Wider visible effects would occur due to construction activities (use of machinery, such as cranes) on the elevated grounds of Moira Reserve and St Paul's College playing field.	Low magnitude of change on visual amenity: Limited number of viewing audience affected. Apparent permanent effects will be caused by the plant room building located next to the two storey residential dwelling No 125 on John Street. However, the proposed building will be seen directly only from the properties No 125 and No 98. The proposed building will be located within the Residential Zone, where buildings are expected to be seen.	Minor magnitude of change on visual amenity: Although the removal of the dwellings will be mitigated by appropriate planting and will therefore not affect visual amenity of the nearby properties, the magnitude of change is regarded as being higher as a result of the dispersed development locations. Removal of high amenity trees in road reserve in Parawai Street is considered as a conspicuous change to the streetscape.	Low magnitude of change on visual amenity: Limited number of viewing audience will be affected. Apparent permanent effects will be caused by the removal of the dwellings at Nos 44-48. Due to their location at the end of the cul de sac street the change in views will be limited to adjacent site (No 42) and a number of properties across the street. Wider visible effects would occur due to construction activities (use of machinery, such as cranes) on the building site which is overlooked by elevated residential properties across the street.

	overlooked by a number of residential properties on Tawariki and Moira Streets and across the playing fields on John Street. However, low level views from the properties can be screened by fencing and many will be distant, filtered and temporary.	The latter is overlooked by a number of residential properties alongside John Street. However, these views from the rear gardens will be distant, filtered and temporary. Views of Moira Reserve are limited to the rear gardens of a few residential dwellings alongside its southern and northern boundary. A tall hedge lines parts of the perimeter of Moira Reserve, restricting views from many of these properties.	Wider, although temporary, visible effects would occur due to construction activities (use of machinery, such as cranes) on the plot between the St Paul's College playing field and John Street.	Wider, although temporary, visible effects would occur due to construction activities and use of machinery, such as cranes. Temporary disturbance to recreational users of the park (Hukanui Reserve) and houses backing on to Reserve.	Possible visual effects of crane from Marist School.
Potential opportunities to enhance outcome	Position of plant room building to avoid mature trees on the bank. Restoration of the bank landform and additional planting to integrate the building.	Position of control chamber flipped to the south of the block of trees, in order to avoid felling, and associated increased visibility of the proposed works. Restoration/ renovation of the Reserve with new/relocated playground and planting to integrate the ventilation building.	Appropriate design of ventilation building is regarded as sufficient mitigation in this case.	Provide enhanced access to reserve through No. 16 Parawai Crescent. Re-site infrastructure to avoid removal of high amenity trees.	Public access and appropriate landscape treatment of No 44-48 Tawariki Street could result in up to a minor positive effects i.e. local park outcome.

Grey Lynn Tunnel MCA Workshop – Landscape Effects

Options	Key Effects	Expected Mitigation	Score	Reasons	Potential Opportunities to enhance outcomes
1. St Paul's College	Landform modification due to construction earthworks for plant and ventilation building on bank. Removal of poplar trees on bank to accommodate ventilation building. Ventilation building as permanent element set within existing bank which forms a terminus at end of street. Temporary construction effects on existing open space character of sports fields Limited permanent effects due to surface elements manholes.	2-2.5m fencing to screen lower level activities during construction. Simple but appropriate building and air vent design using recessive materials and colours Restoration of sports field Restoration to bank landform and planting to integrate building and retaining walls.	-1	Temporary effects would be minor adverse (-2) during construction. Overall permanent effects would be less than minor (-1) following construction and restoration of site	Position of ventilation building to avoid group of trees on bank.
2. Moira Reserve	Removal of existing playground during construction Temporary effects on character of park/neighbourhood from construction elements Permanent plant and ventilation building within park.	Park to be fenced to 2-2.5m high to provide screening from adjacent residential properties Simple but appropriate building and air vent design using recessive materials and colours Restoration of park with new/relocated playground and planting to integrate building and vent	-1	Temporary effects would be minor adverse during (-2) construction Overall permanent effects would be less than minor adverse (-1) following construction and restoration of park and playground	Position of control chamber flipped to south to avoid mature trees on northern boundary. Enhancement of Moira Reserve could lead to overall minor positive effects (+2)

3. John Street	Ventilation building as permanent element set within existing residential street. Removal of trees resulting from control chamber works and possible removal for ventilation building. Temporary construction effects on existing open space character of sports fields and adjacent streetscape Limited permanent effects due to surface elements manholes.	2-2.5m fencing to screen lower level activities during construction. Simple but appropriate building and air vent design using recessive materials and colours Restoration of site	-1	Temporary effects would be minor adverse (-2) during construction. Overall permanent effects would be less than minor adverse (-1) following construction and restoration of site	
4. Hukanui Reserve	Removal of house on No. 32 Tawariki Street and replacement with (underground) control chamber. Possible new plant room at No. 34 Tawariki St. Removal of house on No. 16 Parawai Crescent and replacement with plant and ventilation building Removal of high amenity trees within Hukanui Reserve. Removal of high amenity trees in road reserve in Parawai Crescent Temporary effects on character of reserve/walkway/neighbourhood from construction elements.	2-2.5m fencing to screen lower level activities during construction from all locations (private properties and within reserve). Simple but appropriate building(s) and air vent design using recessive materials and colours Restoration of sites Replacement planting	-2	Effects would be at least moderate adverse (-3) during construction; and minor adverse (-2) permanently due to removal of mature and high amenity trees over a spread-out area.	Provide enhanced access to reserve through No. 16 Parawai Street Re-site infrastructure to avoid removal of high amenity trees A combination of above measures could reduce permanent adverse effects to less than minor (-1).

5. Tawariki Street	Landform modification/temporary retaining due to construction earthworks for control chamber set within toe of bank. Permanent removal of houses within Nos. 44-48 Tawariki Street Ventilation building as permanent element set back within Nos 46/48 Tawariki St. Limited permanent effects due to control chamber and surface elements/manholes Change to site f streetscape/urban character through removal of houses.	2-2.5m fencing to screen lower level activities during construction from private properties to the west and south across the street. Simple but appropriate building(s) and air vent design using recessive materials and colours Restoration of sites Removal of weed species and planting and landscaping,	-1	Effects would be up to moderate adverse (-3) during construction and less than minor adverse (-1) permanently.	Public access and appropriate landscape treatment of Nos. 44-48 Tawariki Street could result in up to minor positive (+2) effects i.e. local park outcome.

Note: Landscape Effects include physical effects to landscape elements (e.g. landform, vegetation and landscape character effects on streetscape / open space).

Options	Key Effects	Expected Mitigation	Score	Reasons	Potential Opportunities to enhance outcomes
1. St Paul's College	Earthworks for plant and ventilation building on bank. Ventilation building as permanent element set within existing bank which forms a terminus at end of street. Temporary construction effects (particularly due to crane used for shaft) on existing open space character of sports fields Limited permanent effects due to surface elements manholes	2-2.5m high fence to screen activities from school grounds and No 41 Tawariki Street and those at end of Moira Street Simple but appropriate building and air vent design using recessive materials and colours Restoration to bank landform and planting to integrate building and retaining wall.	-1	Temporary effects would be up to moderate adverse (-3) during construction for a limited no. of residents. Overall permanent effects would less than minor adverse (-1) following construction and restoration of site.	
2. Moira Reserve	Temporary adverse visual effects during construction (particularly due to crane used for shaft) on 37 – 41 Tawariki Street and 22-28 Moira Street. Permanent plant and ventilation building within park	2-2.5m high fence to screen activities from school grounds and affected residents in Tawariki Street/Moira Street. Simple but appropriate building and air vent design using recessive materials and colours	-1	Temporary effects would be moderate adverse (-3) during construction for residents in approx. 8 adjacent properties. Minor adverse effects (-2) from other more distant private properties and school. Overall permanent effects would be less than minor adverse (-1) following construction and restoration of park with suitable building and planting	Potential for positive minor effects (+2) with enhancement of reserve.

3. John Street	Ventilation building as permanent element set within existing sports fields. Temporary construction effects (particularly due to crane used for shaft) on existing open space character of sports fields Limited permanent effects due to surface elements manholes	2-2.5m high fence to screen activities from school grounds and adjoining and surrounding properties on John St. Simple but appropriate building and air vent design using recessive materials and colours	-1	Temporary effects would be up to moderate adverse (-3) during construction for a limited no. of residents adjoining and opposite site. Overall permanent effects would less than minor adverse (-1) following construction and restoration of site	
4. Hukanui Reserve	Views to construction activities at No. 32 Tawariki Street from adjacent properties, those opposite and from St Marys to the north which is elevated above site. Possible new plant room at No. 32 or 34 Tawariki St. Views of construction activities and replacement plant and ventilation building at No. 16 Parawai Street Removal of high amenity trees within Hukanui Reserve. Removal of high amenity trees in road reserve in Parawai Street.	2-2.5m fencing to screen lower level activities during construction from all locations (private properties and within reserve). Simple but appropriate building(s) and air vent design using recessive materials and colours Restoration of sites Replacement planting	-1	Effects would be up very high (-4) during construction and less than minor adverse (-1) permanently, once the replacement planting has time to mature – estimated to be 5-7 years.	Site future collector sewer and other structures to avoid removal of trees. Treatment of vacant sites for public open space could result in positive minor (+2) visual effects.

5. Tawariki Street	Landform modification due to construction earthworks for plant and ventilation building set within toe of bank. Removal of houses within Nos. 44-48 Tawariki Street. Construction activities (particularly crane elements) from 27-41 Tawariki/ 22-28 Moira Street/School Grounds and part of St Marys. Ventilation building as permanent element set back within Nos 46/48 Tawariki St. Limited visibility of other permanent effects due to control chamber and surface elements/manholes Change to character of streetscape/urban character through removal of houses.	2-2.5m fencing to screen lower level activities during construction from private properties to the west and south across the street. Simple but appropriate building(s) and air vent design using recessive materials and colours Restoration of sites Planting and landscaping	-1	Effects would be up to very high adverse (-4) during construction for the nearby elevated viewing audience opposite: and less than minor adverse (-1) permanently.	Potential for positive visual effects to a minor (+2) level with use of sites for public park with associated seating and planting.

Note: Visual amenity effects take into account duration of construction and permanent effects, likely type and proximity of viewing audience, and extent of visibility of key elements.

Appendix N: Social

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Social)

To: **Peter Roan**

From: **Alia Cederman** **Date:** **August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the "social" criterion and records the scores assigned for each option under that criterion.

2 Background

The table below summarises the existing environment with respect to community facilities, schools and businesses in the vicinity of each site.

Table 2.1 Summary of existing environment for each site

Site	Address	Type of site	Existing environment description and potential effects
Alternative 1 – St Paul's College	183 Richmond Road	School	The proposed area of works is located within the St Paul's College grounds, just to the west of the sports fields. The works will also require access through the school grounds from Moira Street.
Alternative 2 – Moira Reserve	14 Moira Street	Reserve	The proposed works will occupy a neighbourhood reserve and result in the removal of a children's playground. The site is surrounded by housing on three sides and borders St Paul's school to the east.
	Connection and access works at St Paul's College, 183 Richmond Road	School	Although the main area of works is proposed in the neighbouring Moira Reserve, works to connect to the existing sewer are located within the St Paul's College grounds, just to the west of the sports fields. Construction access would be from Moira Street, partly encroaching onto the school grounds.

Site	Address	Type of site	Existing environment description and potential effects
Alternative 3 – John Street	119-123 John Street	Private	The site is a currently vacant section zoned for residential uses. The site is surrounded by housing on three sides and borders St Paul's school to the west.
	Part of future chamber – St Paul's College, 183 Richmond Road	School	Although the main area of works is in the neighbouring site, part of the future (stage 2) shaft is located in within the St Paul's College grounds, just to the east of the sports fields.
Alternative 4 – Hukanui Reserve	Hukanui Reserve – 44 West End Road	Reserve	The proposed works will occupy a reserve and affect a walkway through the reserve that links Cox's Bay Reserve and Richmond Road. To the north the site is linked to a wider reserve network, to the east is single dwelling housing, to the west is higher density housing, and to the west and south are businesses (General Business, Business – Mixed Use zones). These include a supermarket and various retail stores.
	16 Parawai Crescent	Housing New Zealand	The site is occupied by a single dwelling owned by Housing New Zealand. The site is surrounded by other single dwellings to the north, east and south, and by Hukanui Reserve to the west.
	34 Tawariki Street	Housing New Zealand	The site is occupied by a single dwelling owned by Housing New Zealand. It is surrounded to the east, west and south by other single dwellings and by St Paul's College to the north.
	Richmond Road, Parawai Crescent, Tawariki Street	Road	These roads provide access to dwellings. Parawai Crescent provides access onto Richmond Road including to business uses.
Alternative 5 – Tawariki Street	44, 46, 48 Tawariki Street	44-46: Housing New Zealand 48: Private	These three sites are occupied by single dwellings, two owned by Housing New Zealand and one owned privately. They are surrounded by St Paul's School to the north and east and other single dwellings to the south and west.
	Control chamber: Tawariki Street (road reserve)	Road	This road provides access to dwellings.
	Control chamber and retaining of bank – St Paul's College, 183 Richmond Road	School	Although the main area of works is in the neighbouring site, part of the works (a control chamber) is located in within the St Paul's College grounds, just to the west of the sports fields.

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

- Auckland Unitary Plan Maps;
- GIS property information;
- Watercare Grey Lynn Shaft Site layout plans for five options;
- Specialist briefing memo from T+T, dated 25 July 2018;
- A site visit on 30 July 2018.

3.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- Community: The expected effects of the proposed works on community facilities/schools/businesses, including:
  - Temporary effects during construction;
  - Permanent effects in the long term.
- Dwellings: The number of dwellings directly impacted by the construction footprint.

We have identified sub-scores for community impacts (community facilities/schools/businesses) and on dwellings impacted. An overall score was derived using professional judgement.

3.3 Key assumptions

In scoring we have made the following assumptions:

- Effects on neighbouring dwellings are picked up by other criteria – e.g. noise, vibration, landscape and visual etc.

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: Alia Cederman	**Option 1 – St Paul's College**	**Option 2 – Moira Reserve**	**Option 3 – John Street**	**Option 4 – Hukanui Reserve**	**Option 5 – Tawariki Street**
Overall Score	-2	-2	-2	-2	-2
Sub-score: Community	-2	-2	-2	0	-1
Sub-score: Dwellings	0	0	0	-2	-2
Key reasons for score	• A construction site will occupy a portion of the St Paul's College grounds; • The construction area footprint sits outside the marked playing fields but could impact on their use; • Construction access will be via the school grounds (safety issues) • Works close to 48 Tawariki Street but don't cross boundary	• An ancillary works area (connection) is located on the St Paul's College grounds, outside the footprint of the playing area • Part of the construction access will be on the school grounds • No dwellings directly affected	• Part of the works area (future stage 2 shaft) is located on the school grounds, outside the footprint of the playing area • No existing dwellings directly affected	• Close to businesses on Richmond Road • Construction footprint occupies two dwellings	• A small area of works extends into the St Paul's College grounds, located in vegetated area away from the playing fields • Construction footprint occupies three dwellings
Potential opportunities to enhance outcome	Include measures to improve safety of the access through the school (e.g. complete separation) or consider other access options	Include measures to improve safety of the access through the school (e.g. complete separation)			

Appendix O: Recreation

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Recreation)

To:	**Peter Roan**		
From:	**Alia Cederman**	**Date:**	**August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the “recreation” criterion and records the scores assigned for each option under that criterion.

2 Background

Two of the sites involve construction works in reserves. These are Alternative 2 – Moira Reserve and Alternative 4 – Hukanui Reserve. Both these sites are zoned Open Space – Informal Recreation Zone in the Auckland Unitary Plan – Operative in Part and are classified as recreation reserves under the Reserves Act 1977.

Moira Reserve is located adjacent to housing and the St Paul’s College fields. Access is via Tawariki Street and Moira Street. There is a grassed area as well as a children’s playground containing play equipment located at the eastern end of the reserve. The play equipment is currently limited to a swing, slide and a spring rider.

Hukanui Reserve is located adjacent to housing and business uses. It is part of a complex of linked reserves comprising Hukanui Reserve, Kelmarna Gardens, Bayfield Park and Cox’s Bay Reserve. A watercourse (Cox’s Creek) runs through the site, with well vegetated riparian margins. A public walkway runs through the reserve alongside the Creek and connects Richmond Road in the south with Cox’s Bay Reserve in the north. The path branches off to provide access to Parawai Crescent. The proposed area of works is within an open grassed area, with some mature trees and a picnic table.

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

- Auckland Unitary Plan Maps;
- GIS property information;

- Watercare Grey Lynn Shaft Site layout plans for five options;
- Specialist briefing memo from T+T, dated 25 July 2018;
- A site visit on 30 July 2018.

3.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- The expected effects of the proposed works on public/community open space, including;
  - Temporary effects during construction;
  - Permanent effects in the long term.

3.3 Key assumptions

In scoring we have made the following assumptions:

- For Alternative 4, walking access would be maintained, either through shifting the walkway through Hukanui Reserve around the area of works during construction or diverting pedestrian traffic onto Parawai Crescent;
- For Alternative 2, at least one accessway between Tawariki and Moira St will remain open at any time;
- The sites would be reinstated on completion of the works. The visible changes following construction would be the area of the permanent structures covered in permeable paving and the plant and ventilation building. At Moira Reserve the playground would be reinstated and at Hukanui Reserve the walkway would be reinstated;
- We have not considered the benefits of the long term improvement to the water quality in Cox's Creek as this is an outcome of all the options.

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: Alia Cederman	Option 1 – St Paul's College	Option 2 – Moira Reserve	Option 3 – John Street	Option 4 – Hukanui Reserve	Option 5 – Tawariki Street
Score	0	-2	0	-3	0
Key reasons for score	• No works will occur on or neighbouring reserve land	• Removal of playground required • The entire reserve will be out of use for the duration of construction works (stage one and then later stage two) • The playground appears to have a very local catchment and is possibly currently underutilised (has minimal equipment) • At least one access will remain at any time between Moira and Tawariki St • There will be a permanent above ground plant and ventilation building	• No works will occur on or neighbouring reserve land	• A relatively high-use walkway with a key linkage to other reserves • Loss of picnic space • Loss of amenity (temporary and permanent) • Pedestrian diversions will be provided • There will be a permanent above ground plant and ventilation building but this will be at 16 Parawai Cres	• No works will occur on or neighbouring reserve land • At least one access will remain at any time between Moira and Tawariki St
Potential opportunities to enhance outcome	-	• Playground equipment upgraded upon reinstatement	-	• Following construction works, 16 Parawai Crescent could become part of the reserve	-

Appendix P: Property

Memo: Grey Lynn Sewer Tunnel Shaft Site Options Assessment (Property)

To:	**Peter Roan/Alia Cederman**		
From:	**Peter Nicoll, Watercare**	**Date:**	**23 August 2018**

1 Introduction

Watercare Services Limited (Watercare) is currently investigating alternative options to locate a shaft for the construction of the Grey Lynn Sewer Tunnel. In total, five options have been identified as part of the alternatives assessment process.

Alternative options were assessed via a multi-criteria analysis (MCA) process, including presentation of the experts' assessment for each criterion at a workshop on 7 August 2018.

This report summarises the evaluation of the options under the 'property' criterion and records the scores assigned for each option under that criterion.

2 Background

The property details and ownership of each of the sites is summarised in Table 2.1 below.

Table 2.1 Property details and ownership (as at August 2018)

Site	Address	Type of site	Legal description and title reference	Ownership
Alternative 1 – St Paul's College	183 Richmond Road	School	Lot 3 DP 17191 NA397/195	NZ Marist Brothers Trust Board
Alternative 2 – Moira Reserve	14 Moira Street	Reserve	Allot 56 Sec 8 SBRS OF Auckland NA19D/1109	Auckland Council
	Connection and access works at St Paul's College, 183 Richmond Road	School	Lot 3 DP 17191 NA397/195	NZ Marist Brothers Trust Board
Alternative 3 – John Street	119-123 John St	Private	Lot 1 DP 488567 707571	Alastair James Tilbrook, Anita Leanne Williams, Arthur William Young, Christopher John Bufton, Jennifer Jean Bufton, Simon John Bufton

Site	Address	Type of site	Legal description and title reference	Ownership
	Part of future chamber – St Paul's College, 183 Richmond Road	School	Lot 3 DP 17191 NA397/195	NZ Marist Brothers Trust Board
Alternative 4 – Hukanui Reserve	Hukanui Reserve – 44 West End Road	Reserve	Lot 20 DP 22408, Pt Allot 21 Sec 9 SBRS OF Auckland NA498/119	Auckland Council
	16 Parawai Crescent	Housing New Zealand	Lot 110 DP 38075 NA43A/608	Housing New Zealand Ltd
	34 Tawariki Street	Housing New Zealand	Lot 34 DP 38075 NA44C/1086	Housing New Zealand Ltd
	Richmond Road, Parawai Crescent, Tawariki Street - road	Road	N/A	Auckland Council
Alternative 5 – Tawariki Street	44, 46, 48 Tawariki Street	44-46: Housing New Zealand 48: Private	No. 44: Lot 38 DP 38075, NA44C/1089 No. 46: Lot 39 DP 38075, NA44C/1090 No. 48: Lot 40 DP 38075, NZ44C/1091	No. 44: Housing New Zealand Ltd No. 46: Housing New Zealand Ltd No. 48: Cheryl Faye Pagonis
	Control chamber: Tawariki Street (road reserve)	Road	N/A	Auckland Council
	Control chamber and retaining of bank – St Paul's College, 183 Richmond Road	School	Lot 3 DP 17191 NA397/195	NZ Marist Brothers Trust Board

3 Methodology

3.1 Information used

Data and information relied on for this assessment includes:

- GIS property information;
- CV and LV information, recent sales information from RPNZ;
- Watercare Grey Lynn Shaft Site layout plans for five options.

3.2 Scoring process

A scoring scale has been developed for all criteria. The scoring scale is as follows:

-4	Very High (significant) adverse effects
-3	Moderate (more than minor) adverse effects
-2	Minor adverse effects
-1	Low (less than minor) adverse effects
0	Neutral / no change
1	Low positive effects
2	Minor positive effects
3	Moderate positive effects
4	Very high (significant) positive effects

In scoring the criterion we have considered:

- The estimated approximate acquisition cost;
- The expected complexity of the acquisition process.

Key assumptions in relation to these matters are identified below.

3.3 Key assumptions

In relation to the expected complexity of acquisition, we have assumed:

- St Paul's College land: Dealing with the school board expected to be complex, time consuming and uncertain. Watercare would be expected to compensate for the loss of the value of the land and pay a temporary occupancy rental. The loss of value to the block of land is expected to be relatively high so compensation by Watercare is expected to be high.
- Where land is owned by Auckland Council: The process of applying for permission is relatively straightforward (including process under Reserves Act). Would likely need to go to Local Board for approval. Watercare would expect support given temporary occupation and opportunity for some offset betterment. Although straightforward, the process can still take some time. The costs to Watercare are expected to be low as permanent structures are minimal and the project will result in benefits to Cox's Creek/Cox's Bay.
- Where land is owned by Housing New Zealand: The process of acquisition from Housing New Zealand is expected to be relatively straightforward. Costs are expected to be market value for the properties (mainly land value).
- Where land is privately owned (owner/occupier): The process of acquisition is expected to be relatively straightforward and quick and Watercare can exercise statutory acquisition powers if necessary.
- Where land is privately owned by a developer: The process of acquisition may be more complex and compensation higher/harder to agree on where the developer is seeking to maximise return.

We have also assumed that, as there will be permanent structures and Watercare will need to have ongoing access for maintenance, Watercare will require some ongoing interest in the long term

(ownership or occupation). It will not be possible to build dwellings on top of the structures, but in some cases it may be possible to sell some land at the end of the project that is not required for permanent use, therefore offsetting some of the purchase price.

4 Scoring

The following table provides scores for each of the options and the key reasons for this scoring.

Scorer: Peter Nicoll	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Score	-2	0	-3	-1	-2
Key reasons for score (see also assumptions in Section 3.3)	• Property owned by NZ Marist Brothers Trust Board • Expect slow acquisition process • Cost to Watercare to obtain easement	• Main site owned by Auckland Council • Small area within the school (NZ Marist Brothers Trust Board) • Possibly low/no cost to obtain easement in reserve	• Main site in private ownership, expected to be developed for housing • Expect complex acquisition process • Small area within the school (NZ Marist Brothers Trust Board) (for future works) • Expect high cost	• Main site owned by Auckland Council • Two additional Housing New Zealand Properties, plus road reserve • Possibly low/no cost to obtain easement in reserve	• Two Housing New Zealand properties, relatively straightforward process. • One private property • Small area within the school (NZ Marist Brothers Trust Board)

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