AECOM Imagine it. Delivered.

AECOM New Zealand Limited
Level 2, 2 Hazeldean Road
Addington, Christchurch 8024
P O Box 710, Christchurch MC
Christchurch 8140
New Zealand
www.aecom.com

+64 3 966 6000 tel
+64 3 966 6001 fax

16 April 2018

Christchurch City Council
Program Delivery and Funding Team, CS -Asset Management Unit
Christchurch City Council
PO Box 73011
Christchurch 8154

Dear Prawindra Mukhia

Jeffreys Suction Tank Options Multi-Criteria Assessment Review

Thank you for the opportunity to assist Christchurch City Council (CCC) with the peer review of the multi-criteria analysis completed for the Jeffreys Reserve Suction Water Tank project. Our peer review has found that the assumptions and approach adopted by the CCC were sound, and the findings of the MCA can be considered a reasonable tool for the purpose of aiding decision making for the project.

Some initial findings and recommendations in our draft peer review dated 6 April 2018 have been considered and adopted by CCC. That resulted in a revised MCA Scoring Sheet and a revised Options Assessment Report being issued on 16 April 2018. This final report outlines those initial recommendations and conclusions reached based on the revised reporting and MCA Scoring Sheet.

The following report has been completed with the objective of undertaking the following:

- Review the content of each report;
- Check and provide comment on key assumptions and the methodology;
- Check key calculations, in particular relating to the multi-criteria analysis;
- Meet and discuss with the project team the background to the project; and
- Provide an independent and objective assessment of the findings and recommendations.

The reports that have been reviewed are:

- Jeffreys Suction Tank Options Assessment Report – CCC, March 2018
- Jeffreys Suction Tank Options Assessment Report – CCC, April 2018
- Jeffreys Reserve Suction Tank CPTED Review – CCC, March 2018
- Planning Assessment of Jeffreys Road Suction Tank Site Options_28 March 2018
- Jeffreys Road Suction Tank – Planning Assessment of Option 2 – Opus, March 2018
- Jeffreys replacement water tank location and design Option 1 submissions
- Jeffreys tank replacement location and design consultation – Consultation feedback – overview and project team response
- Jeffreys Suction Tank – Master MCA Scoring Sheet

1.0 Background

The existing CCC-owned Jeffreys Pump Station is located in the south-eastern corner of Jeffreys Reserve, situated at 18 Jeffreys Road, Fendalton. The reserve has frontage onto Jeffreys Road along the northern side boundary. The CCC's Fendalton Service Centre and Library is situated in the north-western corner of the reserve. A playground and tennis court with associated car parking also sit in this corner of the reserve. Wairarapa Stream runs along the reserve's southern boundary with a narrow pedestrian footbridge and footpath providing a connection to Waiwetu Street to the south. Residential properties extend the length of the eastern side boundary and across Wairarapa Stream to the south. The centre of the reserve contains a football field and rugby posts. The smaller Waiwetu Reserve adjoins the reserve in the south-eastern corner, and contains a smaller playground and many large mature trees. A pedestrian path links the two parks, providing a pedestrian connection to Thornycroft Street to the east.

An aerial photograph of the pump station location and the surrounding environment is shown in Figure 1 below.

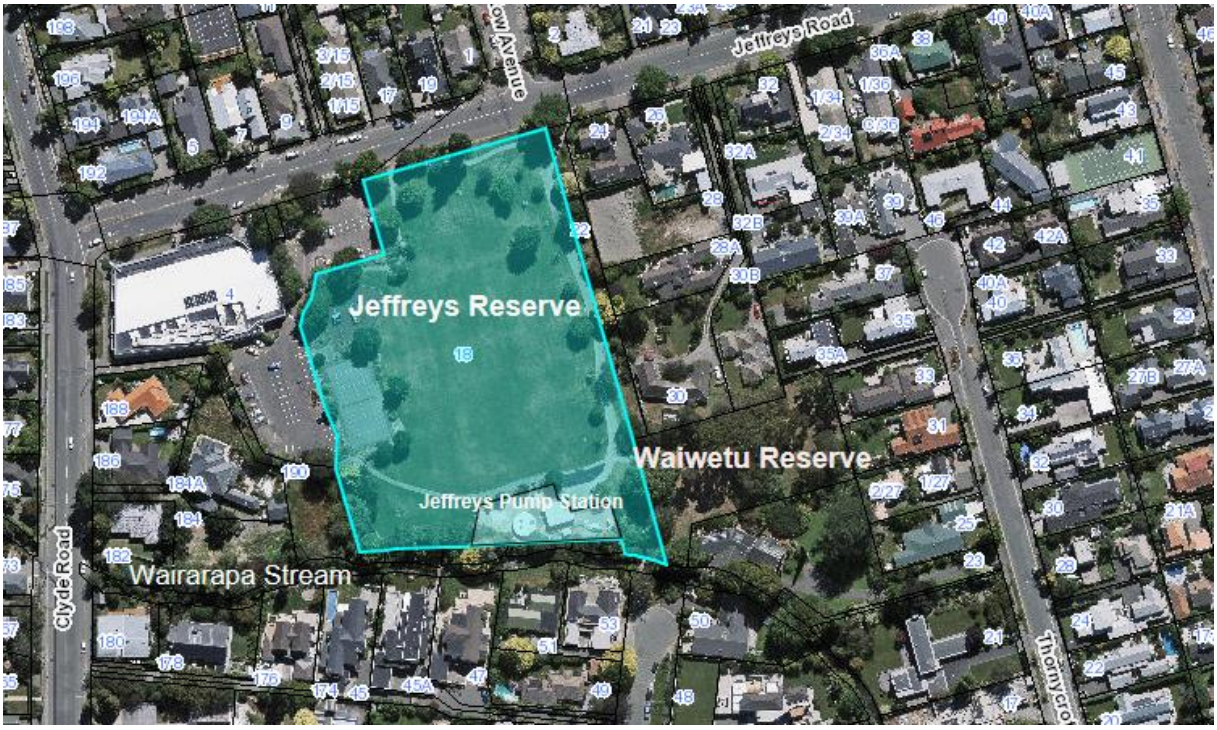

Figure 1 Aerial Photo of Jeffreys Reserve and surrounding built environment (Source: Canterbury Maps)

Figure 2 provides a summary of cadastral boundaries and ownership, and of interest is that properties on Waiwetu Street to the south have small strips of land that adjoin Jeffreys Reserve on the northern side of Wairarapa Stream.

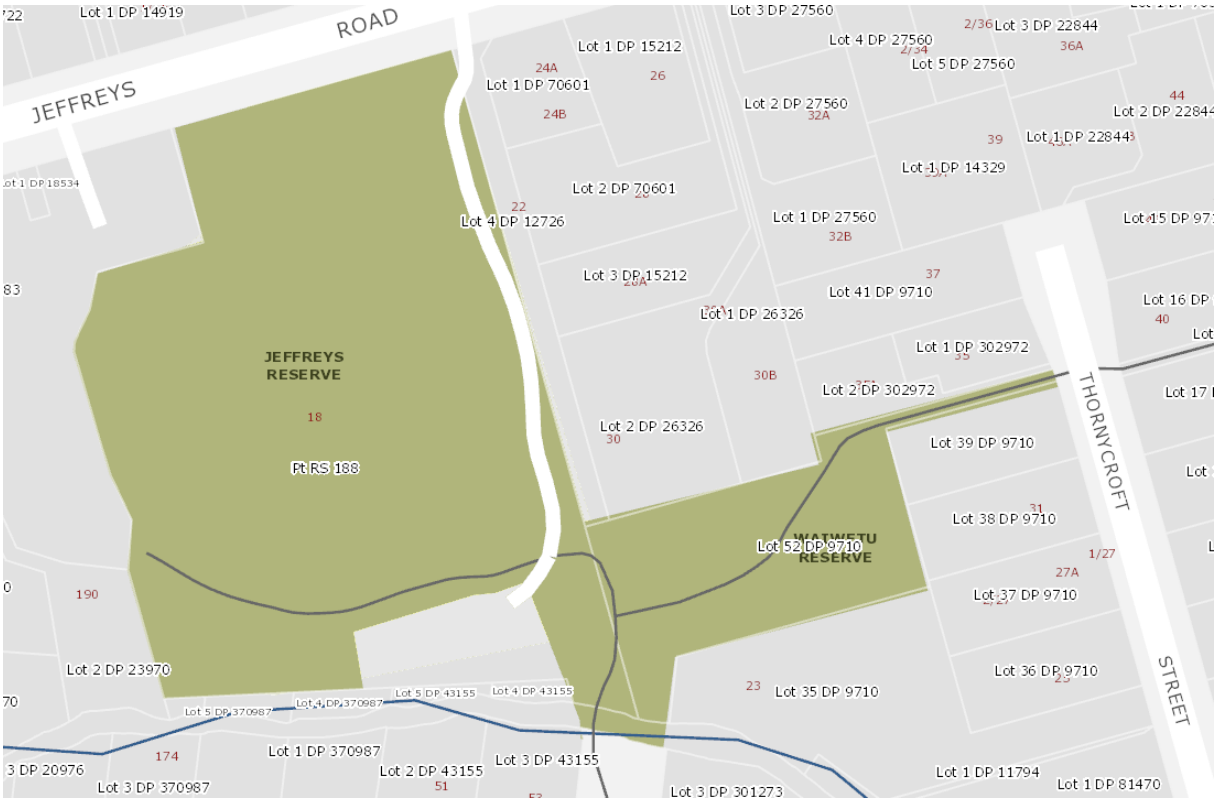

Figure 2 Cadastral boundaries and ownership summary (Source: CoreLogic eMap)

The Jeffreys Pump Station sits in the south-eastern corner of Jeffreys Reserve, adjacent to the Wairarapa Stream. It is 761 m^2 in area and is surrounded by a 2.2 m high wire mesh fence topped with barbed wire. The pump station consists of four wells and a 200 m^3 suction water tank, which forms part of CCC's North West Pressure Zone water supply network.

An assessment of the pump station and its various structures was completed following Canterbury's February 2011 earthquake. Two of the four artesian wells were shallow wells and these have since been upgraded to deeper wells. While parts of the infrastructure (e.g. the wells) have been restored or upgraded, the suction tank has been offline since that time, limiting its potential contribution (e.g. sand removal, flow buffering capabilities and storage) to the water supply network.

In March 2016, CCC staff completed an assessment of the pump station and suction tank to ascertain whether it was suitable to repair the existing infrastructure or replace the suction tank. It was determined by CCC that the cost to repair the existing tank was going to be considerable given the extent of the damage and the design/construction. While repair work would bring the suction tank back online, the result would not achieve CCC's overall objectives for the network. These objectives include provision of buffer storage, sand settlement and optimising the equalisation of flows from the four artesian wells on site. Furthermore, the repaired tank would still be susceptible to future earthquake damage as the foundation work and the structure of the tank were based on old construction methods. Thus, the long-term benefits of replacing the tank outweighed the immediate benefits from repairing the tank. A new tank based on the standard 250 m^3 capacity reservoir design was recommended and proposed in the project brief in April 2016. The CCC initiated the project to build the 250 m^3 suction tank and established a project team with Opus Consultants appointed as the project designer for the planning and investment phase.

After completing a cost benefit analysis assessment of the replacement tank, the project team reconsidered the size of the suction tank, increasing it from 250 m^3 to 500 m^3. The size of the tank had to take into account future proofing needs, potential flow capacities, future chlorination and fluoridation needs, future legislative requirements, and the Suction Tank Code of Practice. The main design parameter for sizing of the tank was to the 1 hour peak flow requirements.

Given the inadequacy of the existing tank site to accommodate a larger suction tank, the project team have initiated consultation with local residents in order to find the most suitable location for the new tank. The *Jeffreys Suction Tank Options Assessments* report (dated March 2018) prepared by Victor Mthamo on behalf of CCC sets out the consultation process followed, the multi-criteria analysis (MCA) assessment criteria utilised by CCC staff to determine the most favourable location, and the final recommendation to be put forward to CCC for sign-off.

2.0 Summary of Document

The *Jeffreys Suction Tank Options Assessments* report begins with an Executive Summary that explains the reasoning behind the CCC initiated project to replace the existing 200 m^3 water suction tank located within the existing Pump Station at the southern side of Jeffreys Reserve with a new 500 m^3 tank.

The report explains that the existing suction tank site is not large enough to accommodate the footprint of the proposed 500 m^3 tank. Thus, the CCC and the nominated consultants (Opus) decided on an alternative site (south of the tennis courts) within Jeffreys Reserve – herein called Option 1 (which was presented to the residents and the Community Board). The selection of the site was based on the following factors:

- Low capital costs.
- It had the least impact on the existing pump station site (low risk to the existing structures) and the existing facilities on the reserve (rugby field, tennis court, and playground).
- It was a site where all planning rules were complied with.
- There were no other services at the site that would need relocating.

During consultation with the local residents it became apparent that some residents were not in favour of the proposed location and by the end of the consultation period, a total of 35 submissions were received by CCC with 32 (91%) submissions directly or indirectly in opposition, one (3%) submission in support and two (6%) submissions supporting the proposed location subject to conditions.

Some of the reasons for the opposition to Option 1 are set out in the report. These include the following:

- Potential for criminal and undesirable activities in and around the tank area.
- Visual impacts on existing residents.
- Impact of the construction works on their properties.

A detailed list of the residents' concerns is provided in Section 2.2.4 of the report with copies of the submissions documents attached as Appendix A to the report.

As a result of the overwhelming majority of people opposing the location of the proposed tank and wanting other locations to be considered, the project team undertook a detailed assessment in October 2017 to formulate seven possible tank locations, including the original option. The seven options are as follows:

- Option 1 – original site option presented to the residents during the consultation phase.
- Option 2 – at the front of the existing pump station building and compound.
- Option 3 – within the Waiwetu Reserve and adjacent to 30 and 30A Jeffreys Road.
- Option 4 – adjacent to 28A and 30 Jeffreys Road but on the park side.
- Option 5 – next to the tennis court.
- Option 6 – on the existing playground near the library.
- Option 7 – between the rugby pitch and Jeffreys Road.

In order to assess each option for suitability the project team formulated a list of assessment criterion in which the pros and cons could be clearly defined. Each criterion was then grouped into four broad categories – 'Technical', 'Environmental', 'Social', and 'Financial'. The four categories had a combined weighting of 50% with a fifth category 'Social' covering impacts on the residents and crime prevention principles given the largest single weighting of 50%. The five assessment categories formulated the basis of the MCA to determine the best option.

Based on the MCA analysis, the order of preference was:

- Option 2 – at the existing pump station.
- Option 7 – next to Jeffreys Road.
- Option 5 – next to the tennis court.
- Option 6 – where the playground is located.
- Option 3 – in Waiwetu Reserve.
- Option 1 – the site option that was presented to the residents.
- Option 4 – adjacent to 28A and 30 Jeffreys Road.

The project team collated the seven options and the MCA results and put the documents out for consultation with the same local residents and the Community Board. Option 2 was widely accepted by the residents; however, residents of 53 Waiwetu Street were not satisfied with Option 2 and on 9 March 2018 suggested an additional option (Option 8) that would see the tank located on the southern side of the tennis court. The northern wall of the tank was to form back the southern wall of the tennis court.

The inclusion of Option 8 as an additional alternative led the project team to repeat the MCA analysis to ascertain whether Option 2 was still the preferred option. Based on the MCA analysis, the order of preference was:

- Option 2 – at the existing pump station.
- Option 7 – next to Jeffreys Road.
- Option 5 – next to the tennis court.
- Option 6 – where the playground is located.
- Option 8 – next to tennis court – new option suggested by residents.
- Option 1 – the site option that was presented to the residents.
- Option 4 – adjacent to 28A and 30 Jeffreys Road.
- Option 3 – in Waiwetu Reserve.

A sensitivity analysis was completed and this showed that Option 2 remained the most favourable option. The analysis involved increasing and decreasing the percentages allocated to the high weight sub-criteria (visual impacts on neighbours and financial) to determine whether the preferred option would change. The results demonstrated that the greatest impact on the outcome was the actual scores assigned by the individual respondents to the high weight value sub-criteria. All 8 options were taken to the Community Board, and Option 2 was identified as the preferred option.

2.1 Jeffreys Road Suction Tank – Planning Assessment of Option 2

Opus prepared a memo document that outlines the planning requirements under the Christchurch District Plan, Canterbury Regional Plans and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES) that needed to be considered as part of the replacement of Jeffreys Reserve water suction tank.

The planning section appears to have identified all relevant planning requirements for the construction and operation of the various options.

2.2 Jeffreys Reserve Suction Tank CPTED Review

Staff from CCC's Technical Services and Design Team completed a Crime Prevention Through Environmental Design (CPTED) review for the preferred Option 2 and the alternative Option 8 put forward by the owners of 53 Waiwetu Street. The CPTED review was requested by the Project Manager following the MCA assessment by the project team.

The CPTED report states that the Option 8 proposal will locate the tank directly adjacent to the southern fence line of the existing tennis courts. It also found that the siting of the tank would leave inadequate room to direct pedestrians safely between the tank and the reserve boundaries with the potential to create an unsafe movement predictor, and the new building would block sightlines in the area creating an unsafe escape route should conflict arise.

In addition to this, the report confirms that Option 8 would result in 40% of the car park depth not being accessible from the Reserve:

"*No access from Reserve would turn the southern part of the car park into a long dead-end location; with no secondary escape routes should a conflict arise. The project team have advised known historic CPTED issues in the existing west car park. Further restriction of the car park connections to the Reserve through locating a utility compound at the Option 8 location can only increase existing issues*" (page 11).

In terms of Option 2, the CPTED review acknowledges the proposal will alter the existing open space environment, and found that sightlines will be reduced, and the physical space connecting the two reserve areas will be reduced in width. It also found that this option would provide little opportunity for concealment or entrapment, and the site and its surroundings will remain a highly activated space. Option 2 was described in the CPTED review as "*consistent with CPTED principles of design and the scheme will enhance the amenity of the immediate area and will have little negative effect on the safety of the site and surrounding environment*" (page 12) if the recommendations put forward in the report are incorporated into the water tank design.

3.0 Discussion

AECOM have completed an assessment of the draft and final versions of the Options Assessment Report, as well as the MCA criteria and definitions, and the supporting technical documents that have been prepared by Opus and Council experts.

In our view the methodology for the MCA was generally sound. It set up measurement guidance on how each option would be scored against the sub-criteria and a definition for each. Our random selection for review of the scoring compared across the options for sub-criteria showed that there was a consistent approach taken and the differences were supported by the measurement guidance.

We note that the approach for the MCA sought to reduce the potential for bias in scoring and ranking by undertaking an independent assessment of each sub-criterion within each of the categories by five different assessors, and then averaging the totals from each. In our view that is a commendable approach, particularly since each could refer to the agreed measurement guidance and the definitions for each sub-criterion.

We also note that it was further agreed by the assessors that the Social category would be assigned a 50% weighting to maximise an outcome that is most likely to be acceptable to the community. Each assessor was then free to assign a weighting for the sub-criteria within each category and the overall weighting assigned to each of the three remaining categories. We understand that this was done to reduce the bias that could be introduced in selecting sub-criteria of greater importance than others and obtaining a broader view of what categories and sub-criteria were of greater importance. That does, however, introduce the potential for its own bias and the ability to further manipulate scoring. Since the results were assessed by five separate assessors and the results averaged from total scores, that concern is reduced somewhat, but not entirely. In our view, it is of prime importance that there is agreement on the weightings prior to undertaking the scoring to reduce the opportunity to influence the outcomes. Our preference is that this occurs prior to undertaking an MCA and that weightings are consistent and agreed upon in advance, but we recognise that there are different views on this approach. However, in this instance, the process of establishing an agreed percentage weight only occurred in relation to the Social category.

In our view, something to also consider and discuss prior to undertaking an MCA process is the number of criteria within each category and the weighting of each sub-criterion. Our recommendation would be to assign an equal weighting to each sub-criterion within the categories. There is a strong range of sub-criteria for assessment with the number of sub-criteria for each category as follows:

- Technical – 12 sub-criteria;
- Environmental – 2 sub-criteria;
- Social – 8 sub-criteria; and
- Financial – 1 sub-criterion.

In reviewing the sub-criteria there is, in our view, an opportunity for consolidation. For example, SF7 Landscaping Outcomes has potential for overlap with VA3 Impact on Community Enjoyment of the Park or Existing Facilities. Additionally, there could have been an Operational sub-criteria that addressed operational noise and this could have been combined with SF5 Ease of Site Access and SF Site Efficiency. However, since there is a wide range of sub-criteria, and the variation in weighting of each sub-criterion is averaged across each assessor as discussed above, we do not recommend a revision and reassessment.

Based on our review of the draft report, we made the following comments for consideration before the final document was released:

1. Financial Criteria

   Section 4.5 of the Options Assessment Report outlines all of the factors that will impact the costs associated with the designing, constructing, installing and monitoring a new 500 m^3 water suction tank. The capital cost estimates for each of the eight options have influenced the financial criteria utilised in the MCA assessment.

   There was the opportunity to consider whole of life costs and not just the immediate capital costs of the project. Each option could vary in this respect as a consequence of pumping water a greater distance and the costs of maintaining longer pipes for example. For that reason it is our view that an estimate of the costs of on-going management and maintenance for each option would further strengthen the MCA if it were included within the Financial category.

2. Stage 2 MCA Scoring Results

   Table 5.5 summarises the MCA score results for the eight Stage 2 options and provides a ranking of each of the eight options against the mean score derived by the five assessors involved in scoring each option against the relevant criterion.

   It is noted that there is no primary criteria assessment or total weighted score provided for Option 8 by Team Member D (MCA Assessor). Since the ranking is based on an averaging of total scores, with four remaining assessors, there is some small potential to skew the final MCA result and ranking of Option 8. However, we don't believe that is a fatal omission or that it presents a significant risk to the results.

   Similarly, we note that Team Member E (MCA Assessor) did not provide a score for EC1 sub-criterion for Option 8. That effectively means that the Environmental category for Option 8 is wholly related to EC2 Impact on the Waterway which does skew the results somewhat. Ideally that Assessor should provide a score. If Option 8 is ranked as for the other sites in Jeffreys Reserve, Option 8 would then rank above Option 6 for this Assessor.

3. Sensitivity Analysis

   Section 5.7 states that a "*sensitivity analysis was carried out by varying the average weights assigned (by all respondents) to the high percentage sub criteria (finance and visual impacts on neighbours)*". The conclusion was that Option 2 remained the preferred option.

   Whilst it is accepted that varying the average weights may not have had a major impact on the outcome of the MCA with regard to the ranking of the preferred option, this section of the report is unclear and incomplete; therefore, it is difficult to quantify the final result. The report does not provide an explanation of the adopted methodology for the sensitivity analysis nor is there any data available within the Master MCA Scoring Sheet demonstrating how varying the average weights impacts on the final outcome.

   The final report would benefit from a detailed explanation of the sensitivity analysis methodology and a table that demonstrates how a range of scenarios do not materially alter the ranking of each option.

Based on our review of the final report we make the following additional comments for consideration before the final document is released:

1. Financial Criteria

   The project team explained that the primary reason for not including the monitoring and maintenance costs within the MCA criteria was that these costs were going to be in the same ranking as the capital costs since both are related to the distance from the wells to the suction tank. In both cases Option 7 would be the most expensive and Option 1 being the most cost effective. Therefore, the project team stated that there was no merit in estimating the whole life costs and adding this to the MCA assessment. We are satisfied with this explanation and agree and that it is not required in this instance.

2. Stage 2 MCA Scoring Results

   In the final MCA Scoring Sheet results and the final report, the missing scores have been completed for Team Members D and E. Option 2 remains the preferred location, and Option 1 increased its ranking from sixth to fifth, and Option 8 has dropped from fifth to sixth. We are satisfied that the correct methodologies have been utilised and the final results accurately represent the preferred location for the proposed suction water tank.

3. Sensitivity Analysis

   In the final report the project team has updated the discussion of sensitivity analysis based on five scenarios in the accompanying MCA Scoring Sheet. We are satisfied that changes to the final report, including adding Tables ES4 and ES5, has satisfactorily addressed our comments on the draft report.

4.0 Conclusion

AECOM have been tasked with independently peer reviewing CCC's Jeffreys Suction Tank Assessment Report. The purpose of this review was to ascertain whether the assumptions and approach adopted by the CCC were sound, and the findings of the MCA can be considered a reasonable tool for the purpose of aiding decision making for this particular project.

Based on our review of the Jeffreys Suction Tank Assessment Report and associated MCA assessment, AECOM are of the opinion that the methodologies adopted by CCC are sound and the final recommendations set out in the report reflect the most desirable outcome.

Yours sincerely

Kylie Hall
Senior Planner
kylie.hall@aecom.com

Mobile: +64 21 195 7371
Direct Dial: +64 3 966 6045
Direct Fax: +64 3 966 6001