APPENDIX 2: ENGINEERING REPORT AND DRAWINGS
ENGINEERING REPORT

PINE HARBOUR MARINA - COMMERCIAL/RESIDENTIAL BUILDINGS

BEACHLANDS

Prepared for:
Pine Harbour Marina Ltd
July 2017
ENGINEERING REPORT

PINE HARBOUR MARINA - COMMERCIAL/RESIDENTIAL BUILDINGS

BEACHLANDS

Prepared for:
Pine Harbour Marina Ltd
July 2017

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### Document Quality Assurance Statement

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Appendices

Appendix A Preliminary Engineering Drawings
Appendix B Extracts from the ICMP
Appendix C HEC-RAS flood analysis
Appendix D Wastewater Calculations / Watercare Services
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1 Introduction

Crang Consulting Ltd has been commissioned by Pine Harbour Marina Ltd to assess the existing infrastructure and complete the civil engineering to service a proposed development of 7 commercial/residential buildings at Pine Harbour Marina.

The project will involve relocating services, installation of new services and works to the existing roads to increase car parking numbers and to provide better pedestrian facilities at Pine Harbour Marina.

The site is located to the south of Ranger House and beside the first three marina piers at Pine Harbour Marina. The land is flat and is sealed for car parking. An aerial photo of the site is shown below in Figure 1.

Figure 1. Existing Site

The key infrastructure issues associated with developing the land have been identified as follows:

- The extent of the flooding along the adjacent watercourse and whether any works are necessary to protect the proposed buildings.
The ability to relocate and provide adequate services for the development including stormwater and wastewater reticulation, water supply and utility services.

The construction of additional parking areas and road treatment for the development.

These issues are addressed in this report.

2 Earthworks

The construction site will first be cleared of all existing features. This will include relocating a power transformer, the demolition of a toilet block, removal of kerbs and seal. All the demolition material will be removed off site. Any trees within the area of works will also be removed and mulched. Some mulch will remain in site for respreads to future garden areas.

Some minor earthworks will then be necessary to prepare the site for the new buildings and to construct the additional parking areas. The work will excavations to new subgrades and foundation excavations. The volume is expected to be around 605m³ of cut and 270 m³ of fill (total of 975 m³ of earthworks) over an area of approximately 7,000m². The excess material from the excavations will be carted off site to a cleanfill.

Sediment controls will be installed prior to the works commencing. This will involve the installation of geotextile protection to existing cesspits and the construction of silt fences at low points where appropriate. Once subgrades have been excavated and inspected they will be metalled. This will minimize the time period that any land is left open.

3 Water Supply

3.1 Existing System

An existing private water supply system serves the marina and associated buildings. Water is supplied from a bore at the end of Tui Brae. It is treated to NZ drinking water standards prior to being reticulated around the marina. More information about the water is at the web site www.pineharbourwater.co.nz.

The water supply was recently upgraded to provide the capacity to service the new buildings at Pine Harbour and to also serve future developments in the wider catchment. The system has sufficient capacity and pressure to provide firefighting supplies.

3.2 Water Reticulation

Water will be supplied to the buildings from an existing 100 dia watermain along the north side of the property. Existing water supply for this site and the adjacent areas are included in Appendix A, Existing Services.
4  Wastewater

4.1  Existing Reticulation

Pine Harbour is well serviced with a wastewater reticulation network that discharges to a public pumping station. Watercare recently upgraded the Pump Station to allow for the development of Pine Harbour and the New Avenues catchment. Wastewater services available in the area from Watercare are included in Appendix D. All existing wastewater reticulation is included in Engineering Drawing C140 – C142.

4.2  Proposed Reticulation

New 150 mm dia sewers will be installed under the existing road to replace an existing sewer that is to be removed as part of the project as it is located under the line of the proposed buildings. New connections will be provided off the new line for each building.

Wastewater Design Flow calculations were conducted to account for a commercial building land use on the ground floor and residential use for levels 2 and 3. A total Peak Wet Weather flow was estimated at 7.15 L/s from this proposed site. The proposed 150 mm wastewater pipe at 1% min grade has a total capacity of 15.46 L/s. The reticulation network for this site and wastewater longsections are included in Appendix A Engineering Drawing C500, C501 and C505. Wastewater design flow calculations are included in Appendix D.

5  Stormwater

5.1  Existing Reticulation

Existing stormwater reticulation exists for the site that currently caters for the sealed parking areas. This reticulation discharges to the marina basin. The existing Stormwater infrastructure is shown on existing services drawings C140-C142.

5.2  Discharge Consent

A stormwater discharge consent was issued for the discharges occurring from the existing sealed areas. It was issued to Pine Harbour Marina (permit 38642 and 38643 – dated 2004) and has now been transferred to Auckland Council.

The consent allows for the discharges occurring from the current marina and proposed developments. For the catchment that the proposed development is located the requirements are as follows:

- Roof materials are to be constructed of inert materials
- Cesspits located on existing roads and sealed areas are to have smart sponge filter enviropods retrofitted to provide stormwater treatment.

The requirements of the discharge consent will be met as part of the development.
5.3 Proposed Reticulation

A new stormwater reticulation system will be installed that discharges to the same existing outlets. This will replace the existing system that would otherwise be located under the building. The upstream catchment will be connected to the system. The proposed reticulation network is included in Appendix A. New connection will be provided off this system for each building.

5.4 Coastal Inundation

The natural resources and hazards sections of the Auckland Unitary Plan (AUP) are now in effect. The AUP requires that habitable floors of buildings be 0.5m above the current coastal inundation level (RL 2.44) plus 1m to allow for sea level rise. This would set the minimum habitable floor levels at RL 3.94m.

The proposed buildings lower levels do not contain habitable floors. The proposed lower levels will be used for garage and commercial/retail space, and are proposed at RL=3.0m and RL=2.6m respectively. Residential levels are at RL 6.0m. A flood protection wall is proposed along the existing open drain channel that runs along the proposed building. This wall has been designed to provide 500 mm freeboard above the 100-year flood levels, as discussed in section 5.5.1 below.

The AUP does require that all new buildings in coastal inundation areas must be designed to ensure that structural integrity will be maintained during a 1% AEP storm tide event. This will be addressed at the building consent stage.

5.5 Stormwater Flooding

On the southern side of the proposed buildings is a formed open channel that has been rock lined. This channel has a significant upstream catchment that includes the residential developments of Beachlands New Avenues.

Beca on behalf of Auckland Council undertook significant flood modelling and option assessments to enable the completion of an integrated catchment management plan (ICMP) to enable a discharge consent to be lodged for the catchment. A copy of parts of the ICMP showing the flood levels and 100 yr ARI flows and maps is included in Appendix B. The report included an assessment of flood risks at Pine Harbour and proposals to mitigate those risks. Below in Figure 2 is a copy of the flood plain map showing a spill occurring through the Pine Harbour Marina according to the ICMP.

In order to mitigate the flood risk from the upstream catchment, Auckland Council proposed a bund along the stream edge to prevent the spill. This bund would prevent flooding and therefore minimise any risk to buildings and people. Final design of this bund was not undertaken by Auckland Council for the ICMP report, and it was required for this proposal that a final design of the wall be provided by surveying additional cross sections along the existing channel.

The proposed building floor levels are at RL 2.6 and RL 3.0 meters, part of the lower level will be below the adjacent flood level. The flood plain will however be modified by the proposed flood protection wall, so that the site is free from any inundation from the existing channel at the location where the proposed buildings will be erected, as shown in Engineering Drawing
The proposed location of the wall as well as top of wall elevation and sections are shown in Engineering Drawings C400 – C410 in Appendix A. The design of the height of this wall is discussed below.

Figure 2. Flood Plain through Pine Harbour Marina

Figure 3. Proposed Wall and Surveyed Channel Cross Sections

Figure 3 shows the location of the surveyed cross sections by Surveyworx that were used in HEC-RAS model by Crang Civil to better define the existing topography and levels next to the
location of the proposed buildings. Engineering Drawings C110 and C111 in the appendix show these sections in more detail.

5.5.1 HEC-RAS Model of Existing Channel for Flood Protection Wall Design

The proposal includes the construction of a concrete flood protection wall instead of an earth bund. This wall will achieve the same requirements as an earth bund while occupying less space. Crang Civil has prepared a new HEC-RAS model of the existing open channel that is located south of the proposed buildings, based on a report for Duckie Development by Watershed Engineering Ltd., Beachlands Model Stewardship: 110 Jack Lachlan Drive (26 Feb. 2015). This report updates the 100yr ARI design flows from BECA ICMP and it is included in the Appendix.

The reason for the update of the ICMP by Duckie Development was the removal of Formosa Dam, and adding a new stormwater pond as well as a designed channel with a larger cross section, which was re-routed around the new pond. These changes are now in place and constitute existing conditions for this proposal.

The HEC-RAS model by Crang Civil is based on these changes at Duckie Development already in place, and takes into account 100-yr ARI flows as resulted from Duckie’s model (shown in Table 1 below) without Formosa Dam, with a new pond and designed channel already built, and after the addition of a flood protection wall. The results of the updated HEC-RAS model by Crang Civil are included in Appendix C.

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Table 1 –Duckie Development 100yr flows, Beachlands Model Stewardship, 110 Jack Lachlan Drive (Watershed Engineering Ltd).

Results of the model indicate that during existing conditions the project site is partially subject to 100-yr ARI floods (between channel sections 95 to 220) spilling from the existing channel. Figure 3 and Engineering Drawings C110 and C111 show the location of the surveyed cross sections by Surveyworx that were used in HEC-RAS to properly represent the existing topography and levels next to the location of the proposed buildings, as well as the location of the proposed flood protection wall.

As can be observed in Figures 4 and 5 below, 100-yr ARI water levels would be contained by a proposed wall that is erected above 100 year floods. This resulted in a top of wall of RL 3.1m
at Ch. 50 and RL 4.1m at Ch 240 for the proposed wall, if using Duckie’s 40% impervious w/ climate change plus a safety freeboard. This freeboard will also allow for protection in the 75% impervious with climate change as modelled by Watershed Engineering Ltd.

Figure 4. HEC-RAS model with flood protection wall

Figure 5. Sections at Ch. 173 and Ch. 149 adjacent to proposed site, modelled with flood wall above 100yr ARI flows, 40% impervious with climate change

Tables 2 below shows the proposed 100yr ARI water surface elevations along the existing channel that will result after the construction of a flood protection wall. Since water will be contained within the channel by the wall, levels would rise during 100 yr floods that were previously spilling towards the proposed building location.

Although the lower levels of the proposed development do not contain habitable floors, as discussed in section 5.4 above, the proposed wall has been designed with a 300 mm freeboard above the 100-yr w/ CC, 40% impervious flows, which will also protect the buildings in the 100-yr w/ CC 75% impervious flows that resulted after Duckie Development. It must be noted that further development upstream along this catchment can impact these 100yr flood levels and the effectiveness of this wall if not mitigated in the future to the pre-development 100-yr
ARI flood events. Therefore, if development continues, the entire catchment will need to be reassessed in the future for impact on this flood protection wall and existing channel during 100 flood events.

Where the model indicated that 100-yr ARI floods would spill more critically (Ch. 140 to Ch 220) towards the proposed buildings, the wall height was increased to provide further protection for the buildings. These results and a long section of the proposed wall are included in Engineering Drawing C415 and in Appendix C.

### 6 Road Design

The existing right of way will be used for access to the new buildings. Some upgrading of that road will be undertaken including the following:

- Lowering the existing road long section to allow for proper drainage of the building lower (garage) level towards the road.
- Parallel and 90 degree parking on the southern side. This will involve widening the carriageway and providing stormwater controls.
- A footpath on the southern side to direct pedestrians to crossing points that flow through between buildings.
- Replacement of kerbs on the northern side with a dished channel to enable access to the building garages.

- Vehicle crossings using different textured materials on the northern side. Details of the road construction including typical sections, cross sections and a long section are shown in Engineering Drawings C300-315 in Appendix A.

7 Utility Services

Power by Vector and telecom by Chorus can be supplied to the buildings from the existing network. Appendix E and Engineering drawings C140 – 142 provide information of the location of existing Vector services and telecom lines. The work will also include for the relocation of any existing services within the building platform and the relocation of a transformer.

8 Conclusion

The civil engineering for the development of the commercial buildings at Pine Harbour can be summarized as follows:

- Minimal earthworks of approximately 605m³ of cut and 270 m³ of fill will be required for the preparation of building subgrades, car parking areas and foundations. Sediment controls will be installed and maintained to TP90 standard.

- Wastewater servicing can be provided for the development in compliance with Watercare’s engineering requirements and connected to an existing adequate system.

- New stormwater infrastructure can be provided and connected to the existing reticulation and outlets. Stormwater treatment will be provided in accordance with the discharge consent. Stormwater plans and long sections are included in Engineering Drawing C400-405 in Appendix A.

- Although the proposed buildings are located in an area subject to 100yr floods, the lower levels are not habitable floors, and flood protection for the entire development can be provided by a flood protection wall, which has been designed to convey post-development flood waters within the existing open channel, based on 100yr ARI flows modelled for Beachlands Model Stewardship: 110 Jack Lachlan Drive (by Watershed Engineering).

- Water can be supplied to the development from the existing 100 mm watermains at Pine Harbour. The water supply system provides for firefighting pressures.

- Road upgrading works are proposed to enable additional car parks to be constructed and to provide a safer environment for pedestrians. Lowering the existing road long section will be required to properly drain the building garage (lower level).

It is considered that there is adequate existing infrastructure in the immediate vicinity such that it does not restrict or constrain the proposed development. The effect of the proposed development on the existing infrastructure is considered to be less than minor.
APPENDIX A
PRELIMINARY ENGINEERING DRAWINGS
APPENDIX B

EXTRACT FROM THE ICMP AND DUCKIE DEVELOPMENT
BEACHLANDS MODEL BY WATERSHED ENGINEERING
APPENDIX C

HEC-RAS FLOOD ANALYSIS
APPENDIX E
POWER AND TELECOM SERVICES
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**LOCALITY PLAN**
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1. All stormwater areas shall be designed to accommodate flows of surface water from surrounding areas.

2. Existing stormwater drainage lines shall be maintained and inspected to ensure proper functioning.

3. All stormwater inlets shall be designed in accordance with the NZS 4296:1999 Standard, or equivalent, as specified by the local authority.

4. Open channels shall be designed to ensure adequate capacity for stormwater runoff.

5. All pipes located underground in the vicinity of proposed stormwater channels shall be adequately labeled.

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This document was prepared by Crang Consulting Engineers, Unit 4, 517 Mount Wellington Highway, Auckland PO Box 42-089, Orakei, Auckland 1745, NZ +64 09 320 3325 www.crangcivil.co.nz

Construction of the works shown in this plan shall be subject to the requirements of the Building Act 1991 and the Building Code of Practice. The plans are for design purposes only and do not constitute a contract for the supply of materials, labor, or services.

This plan is an indication of the proposed works only and does not represent a contract for the supply of materials, labor, or services. The plans are subject to change and are not intended to be used for construction purposes. The plans are prepared in accordance with the relevant codes and standards, and are subject to the requirements of the Building Act 1991 and the Building Code of Practice.

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PIPE DETAILS
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STORMWATER LONGSECTIONS

PINE HARBOUR MARINA DEVELOPMENT
PINE HARBOR COMMERCIAL/RESIDENTIAL BUILDINGS
STORMWATER LONGSECTIONS