



ENVELOPE ENGINEERING

LAND
STRUCTURE
MANAGE

SHELLY BAY INFRASTRUCTURE ASSESSMENT REPORT

THE WELLINGTON COMPANY LIMITED

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1.0 INTRODUCTION

Envelope Engineering Limited has been engaged to undertake an infrastructure assessment of the infrastructure requirements to service the proposed redevelopment of Shelly Bay.

In December 2015 the Shelly Bay site was announced as a Special Housing Area (SHA). For the Council to grant any resource consent under the Housing Accords and Special Housing Areas Act 2013 (the Act) the ability of the development site to be appropriately serviced needs to be considered. Details of the consideration required can be found in section 34 of the Act.

The Act refers to “sufficient and appropriate infrastructure” which has been determined to mean services (such as access, drainage and utilities) that could reasonably be expected to be provided in an urban situation, in a manner and to a standard that would generally be satisfactory to the general public.

To satisfy the Council that “sufficient and appropriate infrastructure” is available or achievable for the proposed development the following steps have been completed:

- Determining the scale and standard of services required
- Assessment of the existing infrastructure
- Considering and developing options for upgrade or replacement of services as required
- Confirming the feasibility and fit of the proposed services

Envelope has completed our assessment of the infrastructure requirements based on Envelopes own independent assessment of concept design and secondary information sources including 3 existing Infrastructure Assessments Reports prepared for Wellington City Council by GHD (May 2014); Calibre (June 2017); and Wellington Water (August 2017).

In addition we have consulted with Matt Aitchison of Wellington Water.

The assessment of these reports and our own concepts has confirmed that there is sufficient and adequate infrastructure in place, or can be reasonably provided, to support the proposed development.

2.0 PURPOSE

This report has been prepared in response to an Instruction document provided by Egmont Dixon Limited (Egmont Dixon), on behalf of The Wellington Company Limited (TWC) dated 7 February 2019. Verbal instructions have also been taken from Earl Hope-Pearson of Egmont Dixon. The purpose of the report is to confirm the ability of Shelly Bay development site to be appropriately serviced.

3.0 DOCUMENTS REFERRED TO

The following documents have been referred to in the preparation of this report:

- **GHD Infrastructure Assessment – Rev 2 dated May 2014.** This early briefing report was prepared for WCC around the time TWC first signalled interest in development of the Shelly Bay site and following their identification of this site to be designated as a Special Housing Area. The purpose of the report was to identify development options and infrastructure servicing requirements and costs for both Shelly Bay and Mt Crawford areas. Some of the findings of this early report have been the basis for the subsequent Calibre and Wellington Water reports listed below. (Refer Appendix 2).
- **Calibre Shelly Bay Servicing Feasibility Report, dated 1 September 2016.** This report was prepared for WCC and confirms the infrastructure servicing requirements for the proposed Shelly Bay development. (Refer Appendix 2)



- **Calibre Shelly Bay Public Infrastructure Briefing Report, dated 19 June 2017.** This report was prepared for WCC and provides updates and detail on servicing requirements and associated costs specifically for the Shelly Bay Development only. (Refer Appendix 2)
- **Wellington Water – Three Waters review memo, dated 14 August 2017.** This review memo was prepared for WCC. The purpose of the memo was to review the Calibre report listed above. The memo generally concurred with the servicing requirements identified and the costs estimated in the Calibre report, except that the authors additionally identify servicing requirements for the full/ future development potential of the area they term the ‘Miramar Peninsula’ which includes Shelly Bay, Mt Crawford and parts of Miramar. (Refer Appendix 2)
- **WCC Council briefing papers**
- **Envelope – Shelly Bay consented engineering plans and costing estimates.** These plans were completed on behalf of TWC as part of the final consented proposal for Shelly Bay. The plans included preliminary engineering design and specifications for the Shelly Bay development and cost estimates confirmed as part of TWC’s feasibility works.

4.0 PUBLIC REALM WORKS

4.1 ACCESS ROADING

According to Calibre’s infrastructure assessment, constructing Shelly Bay Road to a standard “collector” road is not feasible due to the site constraints (i.e. cliff face, sea walls etc). Upgrading the current carriageway to fully meet the guidelines of the Council’s Codes may have overall adverse effects. Primarily the route is for through traffic with adequate allowance for pedestrians / cycles. There is limited need for berm or other parking along the route.

To meet Council’s expectation for the level of service required by Shelly Bay Road to provide access to the developed site, the proposed carriageway width is 6.0m with two traffic lanes of 3m each. The total width of the road reserve will vary providing footpath and/or parking spaces. Footpath width varies along the route between 1.0m to 3.0m. Cyclist and pedestrian may be able to share the footpath. In general, it is expected that the existing road alignment can largely accommodate a 6.0m carriageway plus a footpath without significant structural works or creating large scale environmental impacts.

Envelope Engineering have carried out our own walkover inspection of Shelly Bay Road and agree with Calibre, in this respect, that a 6m carriageway with 1.5m wide footpath can be accommodated within the Shelly Bay Road alignment without significant sea wall or cliff retention works meaning that beach/ coastal areas and established bush along the route are largely unaffected.

The final design and specifics of the access road will however be confirmed as a result of the overall planning and detailed engineering design processes. The final design will need to be a balance between technical requirements and guidelines and retention of the existing natural character and amenity of the coastal route.

The Envelope Engineering Ltd engineering plans (refer Appendix 3) detail the proposed roading works to be provided to serve the development, in and around Shelly Bay itself.

The proposal will provide roading infrastructure that will adequately service the scale of the development proposed. While the finished result may not be fully compliant with standard Code of Practice requirements, it will be of a scale and standard that sufficiently and appropriately caters for the development proposal.

5.0 WASTEWATER

5.1 EXISTING WASTEWATER DRAINAGE

All previous reports referred to, along with available As-built/ GIS information are in agreement, that the Shelly Bay site is currently serviced by a private gravity wastewater main which discharges to a



pump station at the southern end of Shelly Bay. From the pump station, wastewater is pumped along a 100mm dia rising main to connect to the existing public gravity network at the Miramar cutting. The pump station and rising main had been thought to be public drainage and were previously shown as public on Council's GIS. We have recently been informed that the pump station and rising main are considered private drainage and are jointly owned and maintained by Shelly Bay Ltd and Council.

Figure 5.1.1 shows the main features of the existing wastewater network, including: the Shelly Bay pump station location; the sewer risingmain passing along Shelly Bay Rd; and the location where the risingmain connects to the gravity network at the Miramar Cutting.

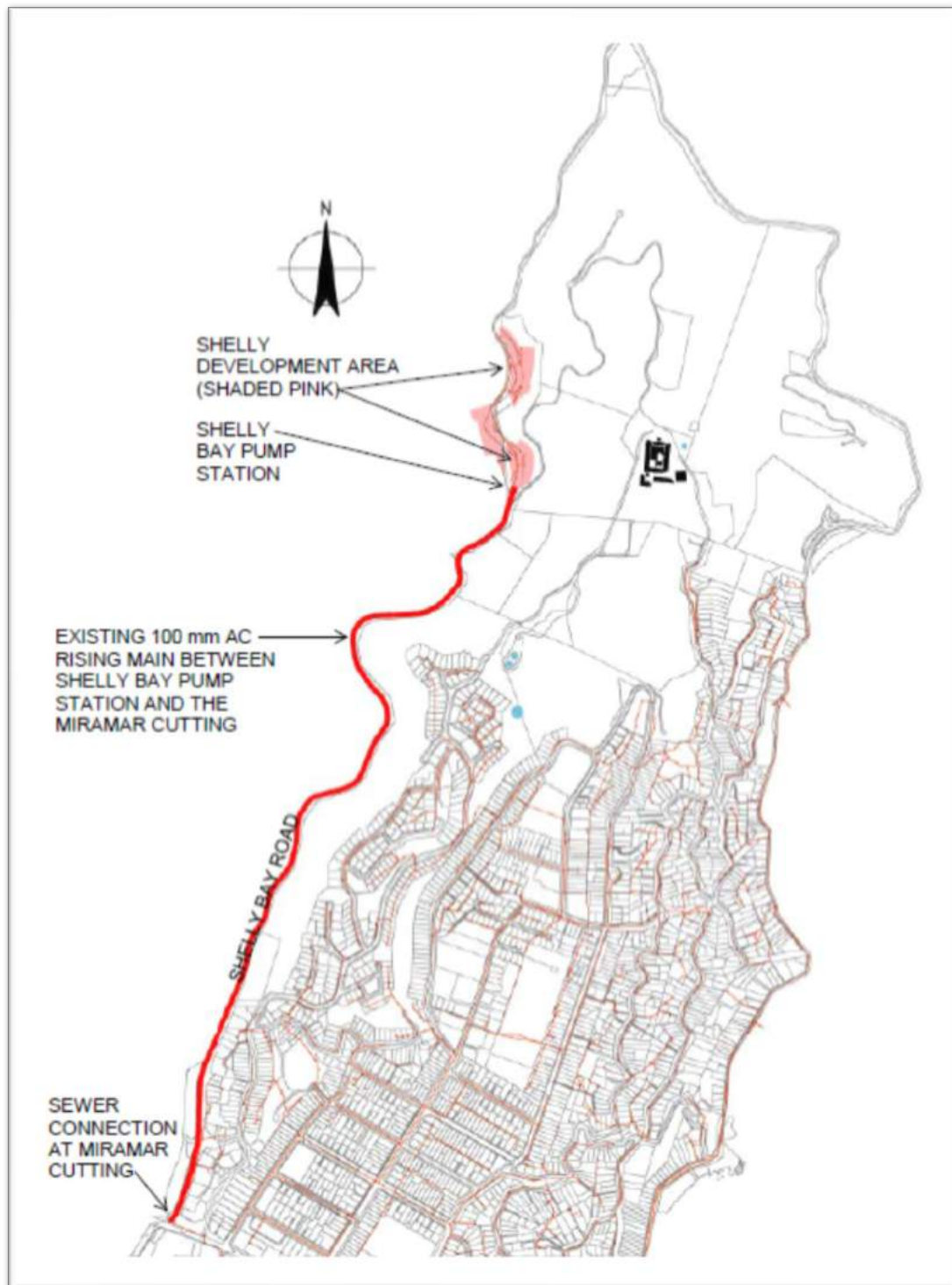


Fig 5.1.1 – The main features of the existing public sewers servicing Shelly Bay. (Source: GHD, May 2014)



It is accepted that the sewer pump station and rising main are in poor condition, with regular failures, leaks and overflows. The pump station and risingmain are also expected to be undersized to cater for the new development at Shelly Bay. Our preliminary calculations show that the rising main has about 2/3rds of the required capacity for theoretical peak wastewater flows for the consented development.

Within the Shelly Bay precinct there is existing private gravity wastewater sewer reticulation. This drainage is in poor condition and is affected by infiltration and seawater back-flow from the harbour through existing uncontrolled sewer overflow outlets.

5.2 PROPOSED WASTEWATER NETWORK

The Envelope Engineering Ltd drainage plans (refer Appendix 3) detail the proposed new gravity public wastewater sewer drainage to be provided to serve the development. The gravity lines vary between 150mm dia and 250mm dia. The gravity lines are currently proposed to discharge to a proposed new wastewater pump station and a proposed upsized 150mm dia rising main.

The Calibre infrastructure report identifies a peak wet weather flow (PWWF) of 18.1l/s, this is calculated in accordance with Wellington Water standards with a peak dry weather flow (ADWF) of 3.1 l/s. We agree with the calculations but note that, due to the relatively small catchment of the proposed development, this calculation includes a peaking factor of over 5 in addition to the 2.4 l/s allowed for wet weather flows. In our opinion it is feasible to attenuate the wastewater flow to reduce the peak flow rates. The existing rising main has a capacity of 11.8 l/s, which equates to an acceptable peaking factor of 3. Attenuation of the flow would require additional storage (in addition to the required emergency storage). Detailed modelling is required to confirm the additional storage requirements, at this stage we have made an allowance equating to an additional 4 hours ADWF (approximately 50m³ of additional storage).

For the purpose of this exercise, it is necessary to determine a baseline minimum requirement to serve the development. For wastewater this would involve:

- Upgrade the gravity wastewater network as detailed on the Envelope consent drawings in Appendix 3.
- Construct a new wastewater pump station including on-site storage to manage peaks and control discharge rate to a level able to be catered for within the existing 100mm dia rising main or within a new 100mm dia risingmain.
- Reline the existing 100mm dia risingmain up to the Miramar Cutting using CIPP methods, to provide 80yr life or construct a new 100mm dia risingmain replacing the existing substandard one.

The peak flows from the completed development will be controlled at the pump station. Accordingly, the baseline requirement described above does not include any allowance for upgrade works to the gravity network downstream of Miramar Cutting, based on discharge rate control provided by the on-site storage tanks.

The proposed infrastructure is considered to adequately meet or comply with the relevant standards for developments of this nature and will provide sufficient and appropriate wastewater drainage infrastructure for the proposal.

6.0 STORMWATER

6.1 DESCRIPTION OF WORKS

Stormwater from the Shelly Bay development area currently discharges through a number of undersized stormwater pipe and outfall structures passing under Shelly Bay and cascading into Shelly Bay.



The lines are in poor condition and don't work with the proposed development layout. It is intended that a proposed new network of public stormwater lines ranging in size from 225mm dia to 900mm dia will be installed, including 3 new/ upgraded outfall structures discharging to Shelly Bay.

The proposed gravity reticulation required to serve the Shelly Bay development is shown on the approved Envelope resource consent plans. (Refer Appendix 3).

In addition, we have also made some allowances for installation of rain gardens for runoff from proposed trafficked paved areas.

The required infrastructure will allow for the sufficient and appropriate drainage of stormwater into, within and through the site, along with the appropriate and controlled disposal into the harbour.

We understand that discharge consent applications for the site will be processed and approved by Wellington Water (as opposed to Greater Wellington Regional Council) under Wellington Water's open consent. However if this is not the case, then necessary consents for stormwater discharge will be sought from Greater Wellington Regional Council

7.0 WATER SUPPLY

7.1 EXISTING WATER SUPPLY TO SHELLY BAY

Currently all the water supplied to Shelly Bay is supplied out of the Mount Crawford Reservoir. There is an obsolete 150 mm steel water main laid in Shelly Bay Road between the Miramar Cutting and Shelly Bay which appears to be abandoned.

There is a single privately owned 150 mm NB steel water main that supplies the Shelly Bay (old NZDF buildings) land and the Shelly Bay Reservoir. This system has a limited life and will not be suitable for the proposed completed development.



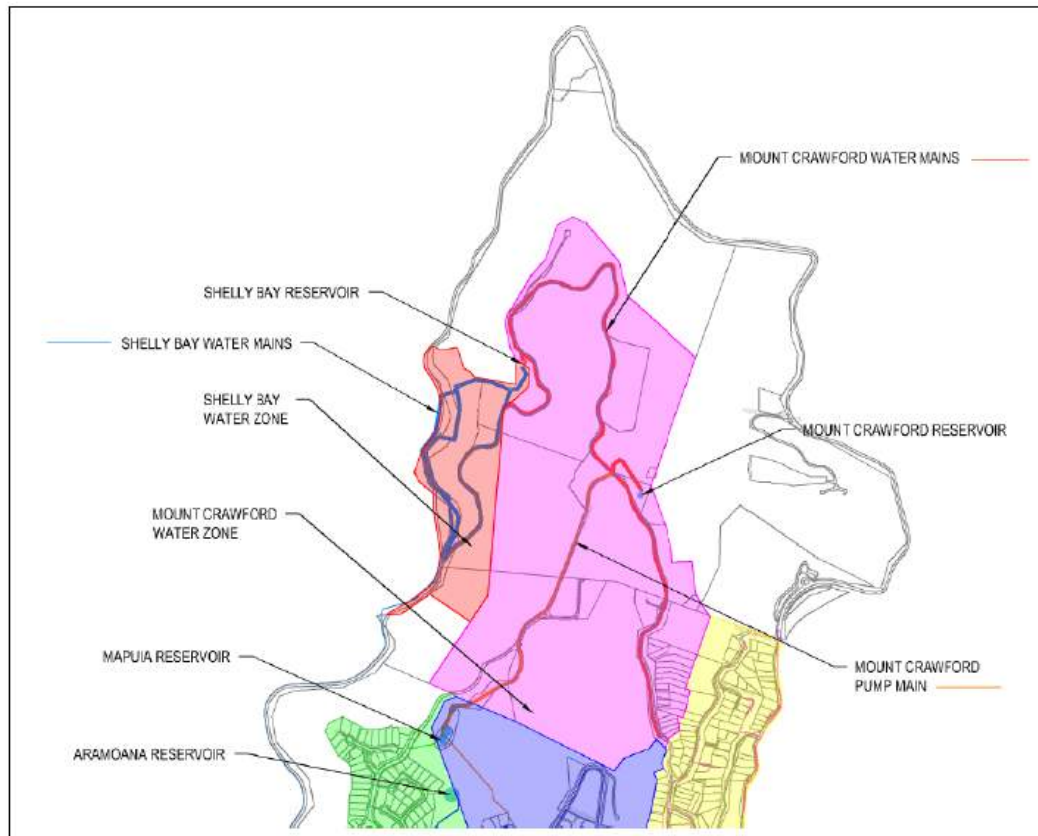


Figure 7.1.1 – Mount Crawford and Shelly Bay Water Zones, showing the main features of the existing public water supply network. (Source: GHD, May 2014)

7.2 DESCRIPTION OF WORKS

The Envelope Watermain Plans included within Appendix 3 detail the proposed water reticulation required to service the Shelly Bay development.

This includes:

- A new 1ML concrete Shelly Bay water reservoir, located in a similar location to the existing reservoir.
- A new 200mm dia watermain connecting from the existing Mt Crawford reservoir to the new Shelly Bay reservoir. This would follow the alignment of the existing access road.
- New public water reticulation from the new reservoir and within the Shelly Bay development area to cater for potable and firefighting supply.

The current infrastructure is in poor condition and undersized. Upgrade of the existing network is proposed. The proposed infrastructure will adequately meet or comply with the relevant standards and service the proposed development.

In addition to the baseline option for potable and fire fighting water supply required to serve the development, described above, Wellington Water have identified alternative plans to upgrade the capacity of the Mt Crawford reservoir and possibly the Mapuia reservoir along with bulk water reticulation between.

It is possible that the proposed baseline works for the development, described above, could be carried out in conjunction with wider water network upgrade projects (for the wider Miramar Peninsular). Carrying out water supply upgrade works jointly between Council and the project works would result in overall efficiencies. The water supply design for the proposed Shelly Bay development will be finalised at Detailed Design stage with Wellington Water and when Engineering Approvals are sought.



8.0 UTILITY SERVICES

The Calibre report outlined the responses and direct quotations from the utility services, which are summarised below.

8.1 POWER RETICULATION SERVICING

Wellington Electricity have confirmed that reinforcement requirements to get power services to the Shelly Bay Development area will require additional Transformer(s) and Switch gear and additional reticulated cabling.

8.2 TELECOMMUNICATIONS

Chorus has confirmed that they will be able to provide telephone and data reticulation for the proposed development. Chorus will undertake network design, supply of telecommunications specific materials and supervise installation.

Chorus did not raise any issues or concerns regarding their ability to appropriately service the development as proposed.

8.3 GAS SUPPLY

PowerCo has confirmed their requirements to service the proposal. This would include the installation of approximately 2.9km of 200NB PE gas pipe main from their existing service main in Shelly Bay Road.

Reticulated gas is not considered a core infrastructure requirement for new developments. If required PowerCo will be able to provide sufficient and appropriate service to the development.



9.0 LIMITATIONS

9.1 GENERAL

This report is for the use by The Wellington Company Limited and their agents, Egmont Dixon Limited, for the purposes of applying for resource consent under HASHA.

This report has been prepared for the particular project described to us and its extent is limited to the scope of work agreed between the client and Envelope Engineering Limited.



APPENDICES

APPENDIX 1
SHELLY BAY MASTERPLAN

1.3 Masterplan



fig. 1.3.1

Legend

Existing Buildings Remaining in Current Location

Relocated Buildings

New Buildings

--- HASHAA - Housing Accords and Special Housing Areas Act Boundary



APPENDIX 2
BACKGROUND REPORTS REFERRED TO. (WELLINGTON
WATER, CALIBRE & GHD)



Wellington City Council Shelly Bay Utilities Review of Infrastructure Utilities

May 2014 – Revision 2

Executive summary

The Royal New Zealand Air Force base at Shelly Bay was decommissioned by the defence department on the 30th June, 2005.

Adjacent to the Defence Force site is the Department of Corrections Mount Crawford Prison, which was also recently decommissioned.

The water infrastructure on these sites is variously owned by Wellington City Council (WCC) and private ownership.

Council is investigating theoretical development scenarios for both these sites and to inform these investigations, WCC require to know the condition and adequacy of the utility services servicing the sites.

Where the required infrastructure services do not exist, or the existing infrastructure has insufficient capacity or is in poor condition, the cost to construct new infrastructure shall be estimated for the Client.

The infrastructure investigated for the purposes of this report shall be limited to:

- potable water supply
- waste water
- storm water
- power
- telecom
- gas

Below is a table summarising the infrastructure assessed and the cost to install or upgrade as required.

Summary of Services to be Renewed and Estimated Cost

1. Mount Crawford Prison Site

| Infrastructure / Service | Site is Serviced? | Is Replacement Required? | Detail | Estimated Cost |
|--|---|---|--|--|
| Potable Water | No – water supply to old Prison building and Nevay Road only. | Yes - need to construct new water supply to prison site and Main Road. | New 150 mm water main laid in Main Road. New pump station to boost pressure at old Prison site. | \$ 333,200 \$ 123,300 |
| Wastewater | No – there is a single service from Prison that does not comply with Council requirements for a sewer main. | Yes. There are two options to service waste water to properties below Main Road: #1 collector main and pump to lift wastewater to Main road; # 2 collector main and pump to discharge waste water into Shelly Bay Road rising main. | New 150 mm sewer main in Main Road. Option # 1 – pump to Main Road, or Option # 2 – pump into Shelly Bay Road rising sewer | \$ 648,600 * \$ 430,475 * \$ 614,125 |
| Stormwater | No – stormwater currently by overland flow to natural drainage courses. | Yes – need to construct culverts to collect stormwater from developer's network and discharge into natural drainage courses. | Three new 675 mm culvert pipes under Main Road. | \$ 104,200 |
| Power | Yes. | Yes. Current capacity insufficient to supply proposed development. | Detail not supplied. | \$300,000 |
| Telecom and fibre optic | Yes. | No. Capacity is sufficient. | N/A | nil |
| Gas | Yes. | No. Capacity is sufficient. | N/A | nil |
| Total estimated cost to renew or provide services at the Mount Crawford Prison Development site | | | | \$ 1,509,300 |

* not included in total cost – recommend individual pumps at each house – see section Three

Shelly Bay Development Site

| Infrastructure / Service | Site is Serviced? | Is Replacement Required? | Detail | Estimated Cost |
|---|--|--|--|--|
| Potable Water | Yes. | Yes – condition of water main is poor and capacity of water main is too small to supply firefighting water supply. | New 200 mm CLDI water main in Defence Force property including new PRV installation to replace Shelly Bay Reservoir. | \$ 460,900 |
| Wastewater | Yes. Pump station and rising main pumps waste water back to Miramar along Shelly Bay Road. | Yes. Rising main is too small and requiring constant repair. Pump station will have to be replaced to match flows of new development. Recommend installing Council trunk main to reduce the depth of the pump station. | New 150 mm PE rising main in Shelly Bay Road. New Shelly Bay Pump Station. New trunk main to collect flows from network and discharge into pump station. | \$ 1,202,600 \$ 361,500 \$ 302,740 |
| Stormwater | Yes – there are stormwater networks and culverts that pipe streams to harbour. The network pipes will be developer assets. The culverts will be Council assets. | Yes. The culvert pipes are undersized and will receive greater flows due to development at the Prison site. | Replace identified culvert under existing buildings and retaining wall. Replace second culvert. | \$ 371,200 \$ 118,200 |
| Power | Yes. | Yes. Current capacity insufficient to supply proposed development. | High level cost estimate | \$3,500,000 |
| Telecom and fibre optic | Yes. | No. Capacity is sufficient | N/A | nil |
| Gas | No. | Yes – no existing supply to Shelly Bay | New 125 mm PE gas main. | \$ 1,100,000 |
| Total estimated cost to renew or provide services at the Shelly Bay Development site | | | | \$ 7,417,140 |

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Appendices

Appendix A – Water Supply to Miramar Peninsular

1. Introduction

The Royal New Zealand Air Force base at Shelly Bay was decommissioned by the defence department on the 30th June, 2005.

Adjacent to the Defence Force site is the Department of Corrections Mount Crawford Prison, which was also recently decommissioned.

The water infrastructure on these sites is variously owned by Wellington City Council (WCC) and private ownership.

It is proposed to develop these sites:

Shelly Bay Site – a mixture of

- residential apartments
- commercial premises such as retail, cafes and restaurants
- hotel accommodation

Mount Crawford Prison:

- residential housing

Before this can be undertaken WCC require to know the condition and adequacy of the utility services servicing the sites.

1.1 Purpose of this report

This report is to identify, as far as reasonably practical, the size and condition of the infrastructure servicing the sites, and determine if the existing infrastructure has sufficient capacity to service the proposed new development.

Where the required infrastructure services do not exist, or the existing infrastructure has insufficient capacity or is poor condition, the cost to construct new infrastructure shall be estimated for the Client.

1.2 Scope and limitations

Review of the existing infrastructure shall be by review of existing plans and asbuilt records. Where these are unclear, or incomplete, visual inspection onsite of the infrastructure shall be undertaken where possible.

Where visual inspection is not possible potholing of the service is excluded from the Brief, and no further investigation shall be undertaken.

The infrastructure investigated for the purposes of this report shall be limited to:

- potable water supply
- waste water
- storm water
- power
- telecom

This report: has been prepared by GHD for Wellington City Council and may only be used and relied on by Wellington City Council for the purpose agreed between GHD and the Wellington City Council as set out in all sections of this report.

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GHD has prepared the preliminary cost estimate set out in section 2 to 7 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD. Estimated costs are based on historical contracting rates over the previous 24 months and are in New Zealand dollars and exclude GST.

The Cost Estimate has been prepared for the purpose of informing WCC planning of the projected costs to replace or construct new utility services and must not be used for any other purpose.

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Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

2. Servicing of sites

Although the sites are in close proximity to each other the ability to service them from the same supply, or from separate supplies will vary according to the service.

2.1 Providing a potable water supply

Currently water is supplied to both sites from the Mount Crawford Reservoir.

This reservoir is adjacent to the prison grounds.

2.1.1 Alternate water supplies

There is no alternative water supply the Prison site.

Either maintaining, or renewing, the current water supply to the prison site is the only practical option to supply water to this site.

It is possible however to lay a new, alternate water supply to the Shelly Bay site. This would be laid from the Miramar Cutting along Shelly Bay Road to the Shelly Bay site. This option requires laying a much longer pipeline and would not be cost effective compared to supplying the Shelly Bay site out of Mount Crawford Reservoir.

2.1.2 Supply both sites out of Mount Crawford Reservoir

It is considered most practical and cost effective to supply both sites out of the Mount Crawford Reservoir.

2.2 Providing waste water services

In comparison to the water supply, both sites are serviced separately for waste water disposal.

The prison site has a private gravity main. This discharges into the WCC sewer connection at the intersection of Countess Close and Akaroa Drive.

The Shelly Bay site is virtually at sea level and sewage is pumped from the site along Shelly Bay Road and into the Council sewer system at the Miramar Cutting.

It would be impractical to combine the two waste water systems.

SECTION ONE

Water Supply at Mount Crawford Development Site

1. Water requirements of proposed Mount Crawford development site

There are three proposed development scenarios for the Mount Crawford Prison site. These are:

1. High density – 80 dwellings (stated in Brief to be 240 persons)
2. Medium density – 40 dwellings (stated in Brief to be 120 persons)
3. Low density – 20 dwellings (stated in Brief to be 60 persons)

1.1 Water demands for option 1 (high density)

1.1.1 Peak flow requirements

Applying the Regional Standard for Water Services the peak demand, on a maximum day, for this population is:

$$\begin{aligned} Q_{(\text{peak})} &= 0.0162 \times \text{population} \\ &= 0.0162 \times 240 \\ &= 4 \text{ L/sec} \end{aligned}$$

1.1.2 Daily water consumption

Typically peak Flow is approximately twice the average daily flow. Based on this the estimated daily water consumption of the development would be approximately 168 m³/day.

1.1.3 Firefighting flows

There is no commercial properties proposed as part of this development and the firefighting water supply is assessed to be FW2 (housing – includes single family dwellings, multiunit dwellings, but excludes multi story apartment blocks) in NZS 4509.

A FW2 firefighting water supply requires a flow of 25 L/sec.

1.1.4 Design Flows

The design flow required by the Regional Standard for Water Services is calculated as follows:

$$\begin{aligned} Q_{(\text{design})} &= 2/3 \text{ Peak Flow} + \text{Fire Flow} \\ &= 2/3 \text{ Peak} + 25 \\ &= 28 \text{ L/sec} \end{aligned}$$

1.2 Water demands for option 2 (medium density)

1.2.1 Peak flow requirements

The peak demand, on a maximum day, for this population is:

$$\begin{aligned} Q_{(\text{peak})} &= 0.0162 \times 120 \\ &= 2 \text{ L/sec} \end{aligned}$$

1.2.2 Daily water consumption

The estimated daily water consumption of the development would be approximately 84 m³/day.

1.2.3 Firefighting flows

There is no commercial properties proposed as part of this development and the firefighting water supply is assessed to be FW2 in NZS 4509.

A FW2 firefighting water supply requires a flow of 25 L/sec.

1.2.4 Design Flows

The design flow required by the Regional Standard for Water Services is calculated as follows:

$$\begin{aligned} Q_{(\text{design})} &= 2/3 \text{ Peak Flow} + \text{Fire Flow} \\ &= 26 \text{ L/sec} \end{aligned}$$

1.3 Water demands for option 3 (low density)

1.3.1 Peak flow requirements

The peak demand, on a maximum day, for this population is:

$$\begin{aligned} Q_{(\text{peak})} &= 0.0162 \times 60 \\ &= 1.0 \text{ L/sec} \end{aligned}$$

1.3.2 Daily water consumption

The estimated daily water consumption of the development would be approximately 42 m³/day.

1.3.3 Firefighting flows

There is no commercial properties proposed as part of this development and the firefighting water supply is assessed to be FW2 (housing – includes single family dwellings, multiunit dwellings, but excludes multi story apartment blocks) in NZS 4509.

A FW2 firefighting water supply requires a flow of 25 L/sec.

1.3.4 Design Flows

The design flow required by the Regional Standard for Water Services is calculated as follows:

$$\begin{aligned} Q_{(\text{design})} &= 2/3 \text{ Peak Flow} + \text{Fire Flow} \\ &= 25.6 \text{ L/sec} \end{aligned}$$

1.4 Minimum levels of service (flows and pressures)

Minimum pressure at point of supply: 25 m (head of water)

Maximum pressure at point of supply: 90 m

Minimum flow at point of supply: 25 L/min (0.4 L/sec)

2. Review of the existing Mount Crawford water supply

The water supply systems servicing both sites have been described in previous reports to Council.

We have visited site to confirm as previous estimations of the water supplies.

We note that it was not possible to gain access to the land still administered by the Defence Department during visits to site.

2.1 Water supply to Miramar Peninsular

Appended as Appendix A is a schematic view of the water supply zones in the Miramar Peninsular.

Water from the Carmichael Reservoir supplies lower Miramar and Aramoana Reservoir.

Water is pumped from the Aramoana water zone into the Mapuia Reservoir.

Finally water is pumped from the Mapuia Reservoir into the Mount Crawford Reservoir, which is the highest reservoir on the Miramar Peninsular.

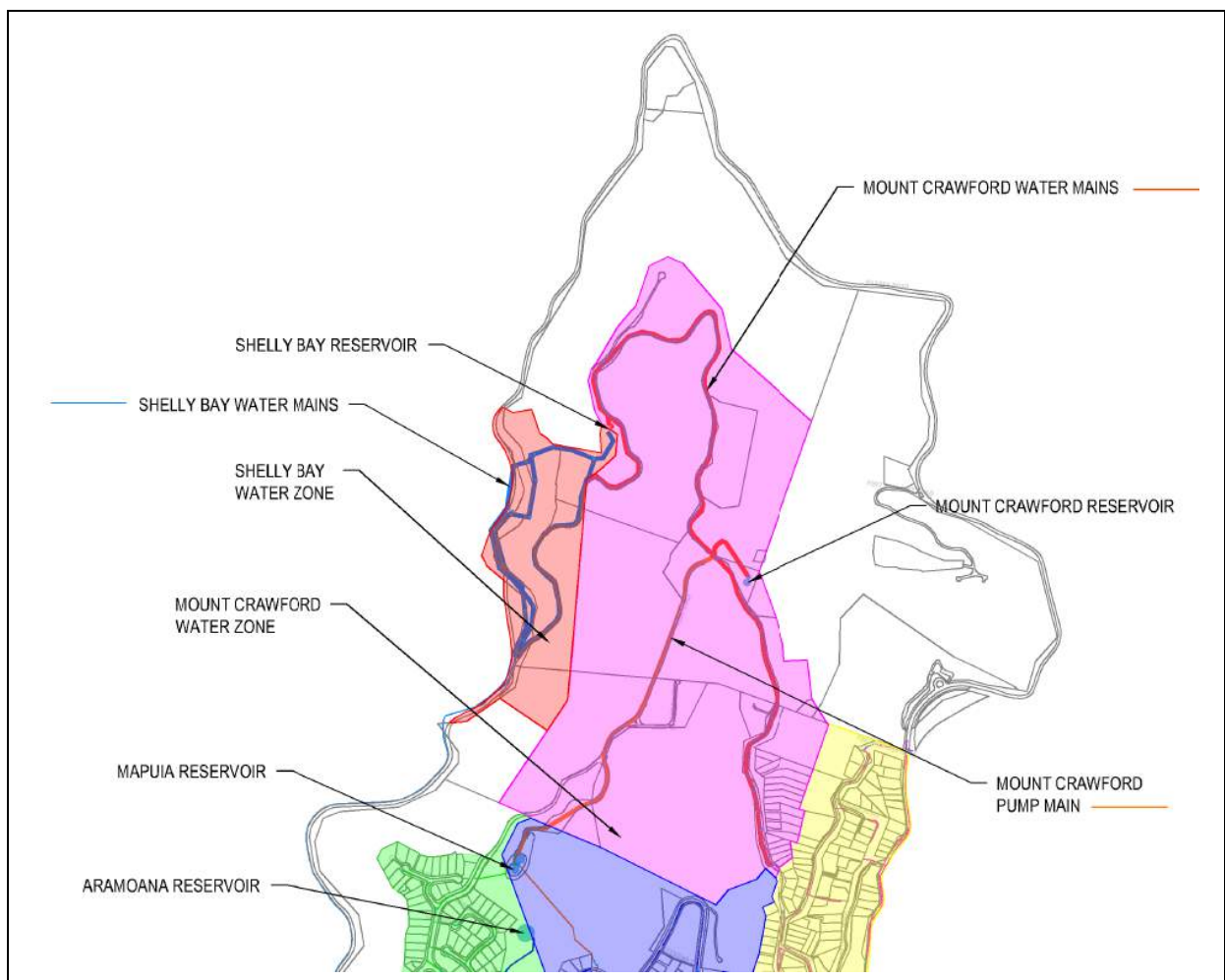
The Mount Crawford Reservoir supplies the Prison and prison grounds, the Defence Department grounds, Shelly Bay and high areas of Nevay Road.

A detailed view of the Mount Crawford and Shelly Bay water zones is also shown in Figure 1.

In supplying water to the proposed Mount Crawford development site the following considerations must be made:

1. Capacity of the existing pump main between Mapuia Reservoir and Mount Crawford Reservoir
2. Condition of the existing pump main between Mapuia Reservoir and Mount Crawford Reservoir
3. Capacity of the existing water reticulation mains in the Prison site
4. Condition of the existing water reticulation mains in the Prison site
5. Water pressure available at the prison site
6. The seismic resilience of the mains

Figure 1 Mount Crawford and Shelly Bay water zones

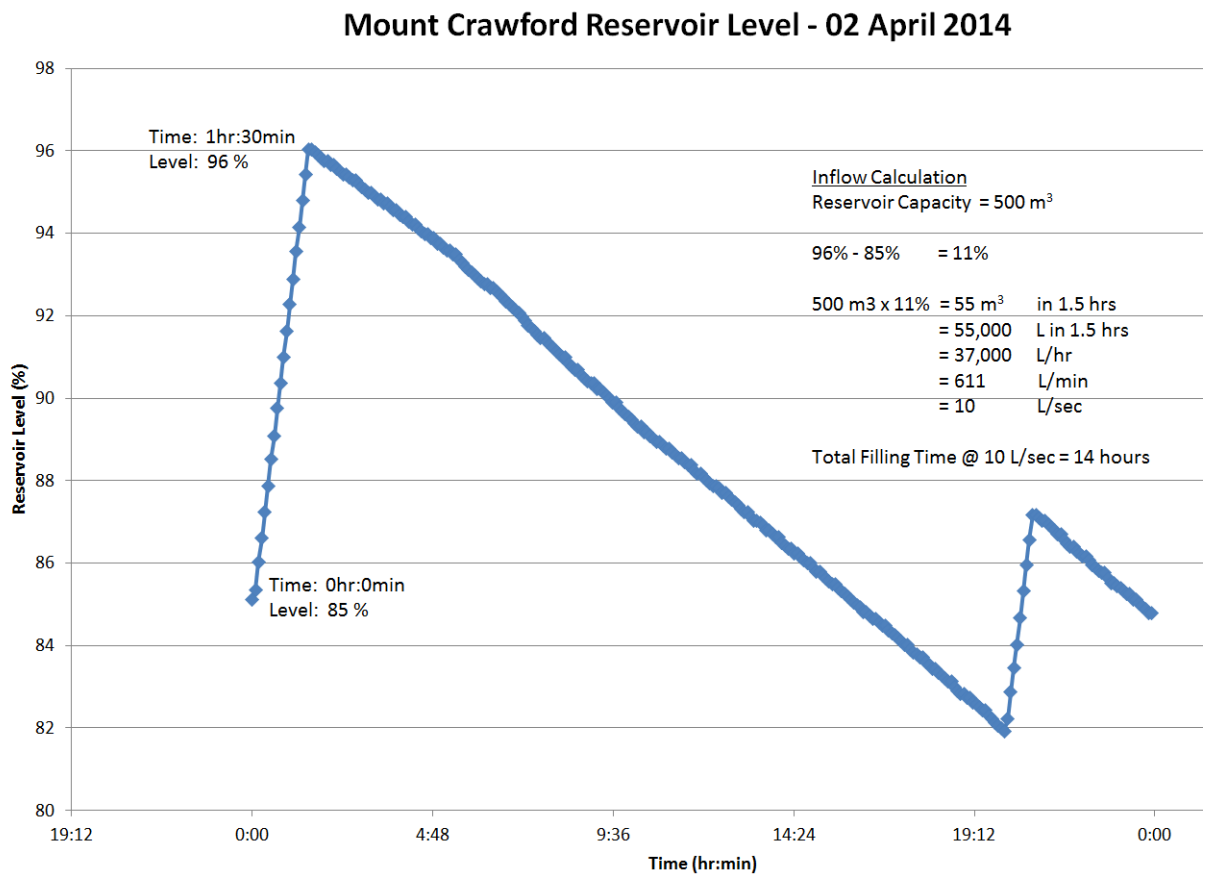


2.2 The existing pump main

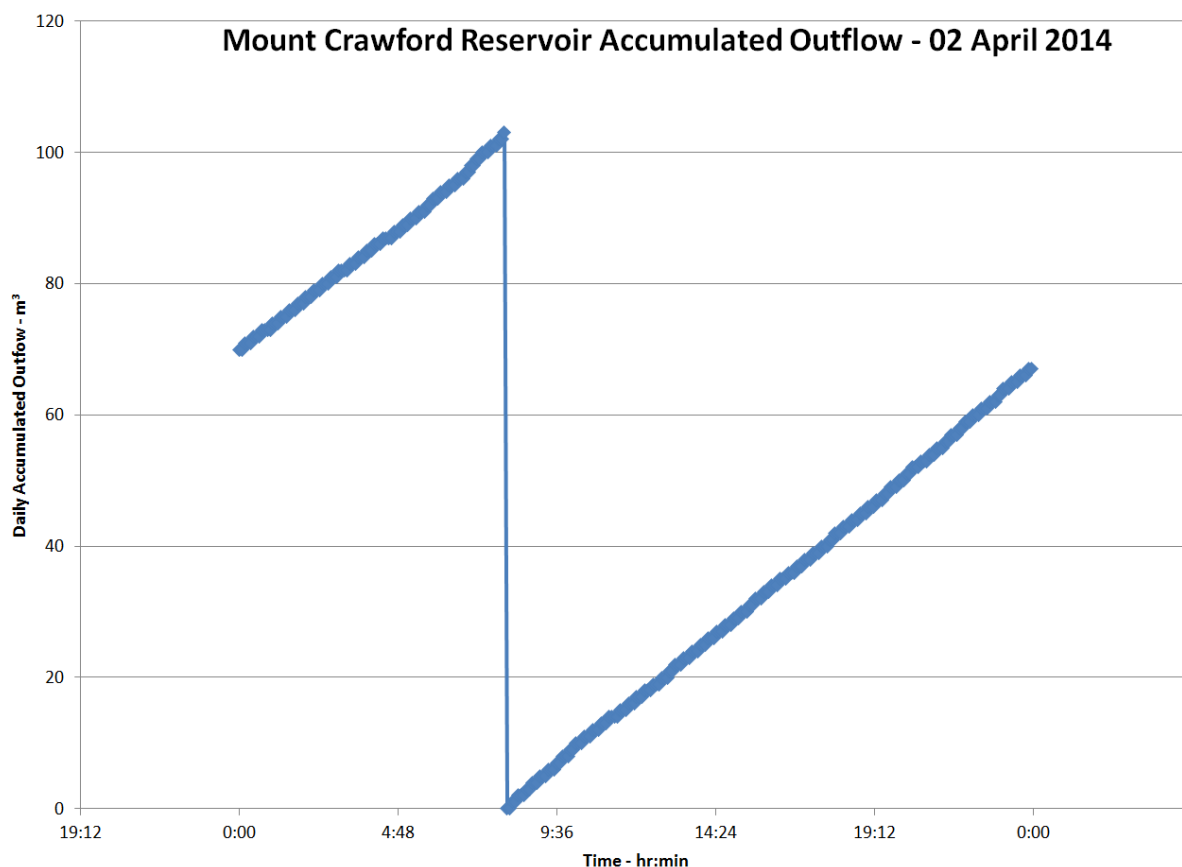
The existing pump main between Mapuia Reservoir and Mount Crawford Reservoir is a 150 mm nominal bore (NB) Asbestos Cement (AC) pipeline.

2.2.1 Pump main capacity

The pumping capacity of the Mapuia Pump Station and inlet is approximately 10 L/sec (37 m³/hr). This is calculated off the typical SCADA plot below, which is for Mount Crawford Reservoir level and was recorded on 2nd April 2014.



Currently the total outflow from the Mount Crawford Reservoir is approximately 100 m³ per day. This is calculated off the typical SCADA plot below, which is for Mount Crawford Reservoir daily accumulated flow and was recorded on 2nd April, 2014.



Following development of the Mount Crawford and Shelly Bay sites the total outflow from the reservoir is expected to increase to 263 m³ per day.

Currently the filling time of the Mount Crawford Reservoir 14 hours. The Regional Standard for Water Services states that filling times shall be less than 18 hours.

With the additional maximum demand of the new development the existing pump and pump main will operate for approximately 7 hours per day to maintain the reservoir level and they are deemed to have sufficient capacity to service the proposed development.

2.2.2 Pump Main Condition

The existing main is an AC pipeline. It was installed in 1985, and is now 29 years old. The pressure class of the pipeline is unknown, and assumed to be Class D (1,200 kPa, or 120 m).

Although AC pipelines do not suffer fatigue from the operation of the pump station, they lose strength from leaching of cement from the wall. This occurs both from the action of the water on the inside of the pipe and from the action of ground water surrounding the outside of the pipe.

It could not be determined from the site walk-over how advanced the loss of cement is from the pipe wall. However it has been our observation that in typical Wellington soils the pipe is weakened enough after 30 to 40 years that it is no longer serviceable.

We note that the pump main is likely to be approaching the end of its serviceable life and may require replacement in the near future. We suggest that this could be considered to be a part of the development costs for the Prison site.

2.2.3 Seismic resilience of the pump main

AC pipelines have very poor seismic resilience.

2.3 The existing reticulation mains out of Mount Crawford Reservoir

The existing reticulation mains out of Mount Crawford Reservoir are a variety of privately owned and Council owned water mains. Essentially the primary water mains are as follows.

Nevay Road

Council own and operate the main in Nevay Road. This main is a 150 mm NB AC pipeline of various manufacture and age.

Prison

There is a privately owned 150 mm NB AC water main which, presumably, serviced the Prison.

Defence Force and Shelly Bay Water Supply

There is a single privately owned 150 mm NB steel water main that supplies the Defence Department land and the Shelly Bay Reservoir (and Shelly Bay Air Force Base).

2.3.1 Capacity of existing water mains

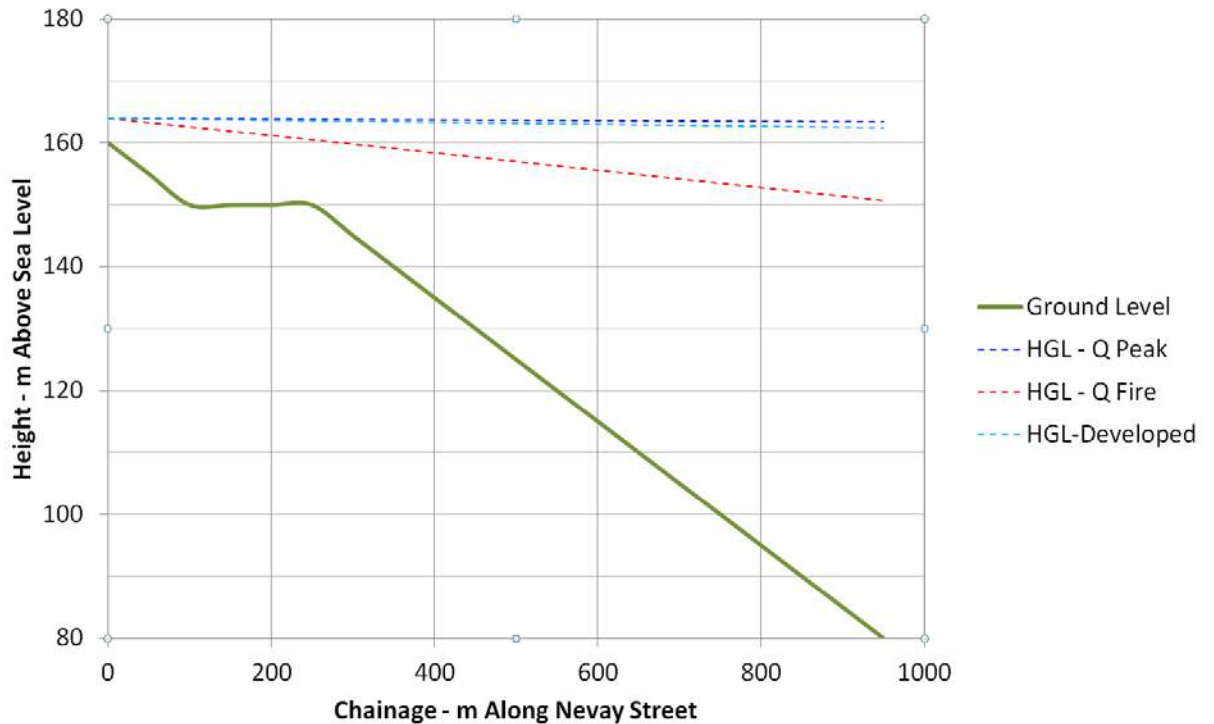
Nevay Road

There are approximately 20 properties in Nevay Road supplied out of Mount Crawford Reservoir.

Based on this and topographical data we have calculated the Hydraulic Grade Line (HGL) for Nevay Road. This is shown in Figure 2. This is calculated using conservative values for pipe ID, roughness and flow (150 mm for ID; and 0.1 mm for roughness; 6 L/sec for peak flow; 8 L/sec for peak flow with additional development; 26 L/sec for fire flow).

From this it can be seen that the capacity of the Nevay Road water main is sufficient for the current reticulation demands and there is sufficient residual capacity to supply some additional development in Nevay Road.

Figure 2 HGL Diagram for Nevay Raod



Prison

For the purpose of this report, the Prison is assumed to be demolished and replaced with housing as per the 3 development scenarios. Unless the Prison is retained substantially unchanged it is expected this water main will have to be replaced with a new water main that suits the layout of the re-developed Prison buildings.

If the prison is demolished, it is likely that this main would have to be replaced to better suit the layout of any new development.

Because of this we have not considered the capacity of this main further.

Defence Force and Shelly Bay Water Supply

This main is not in the area to be redeveloped.

2.3.2 Condition of existing mains

Nevay Road

We refer to the discussion regarding break down of AC pipelines in the pump main section.

This main is expected to be close to the end of its service life.

We would expect that this main would remain in service without any change as a result of the proposed development, as it is currently operated and maintained as part of the Wellington City reticulation.

Any additional demand on this main would not affect the condition of this main.

Prison

It is not possible to determine the condition of this water main. Like the pump main, the age of this main suggests it is close to the end of its serviceable life.

We imagine that the Prison will be demolished to make space available for development on the relatively level site around the Prison. This main would have to be replaced following demolition and no part of the main could be re-used.

Defence Force and Shelly Bay Water Supply

This main is not in the area to be redeveloped.

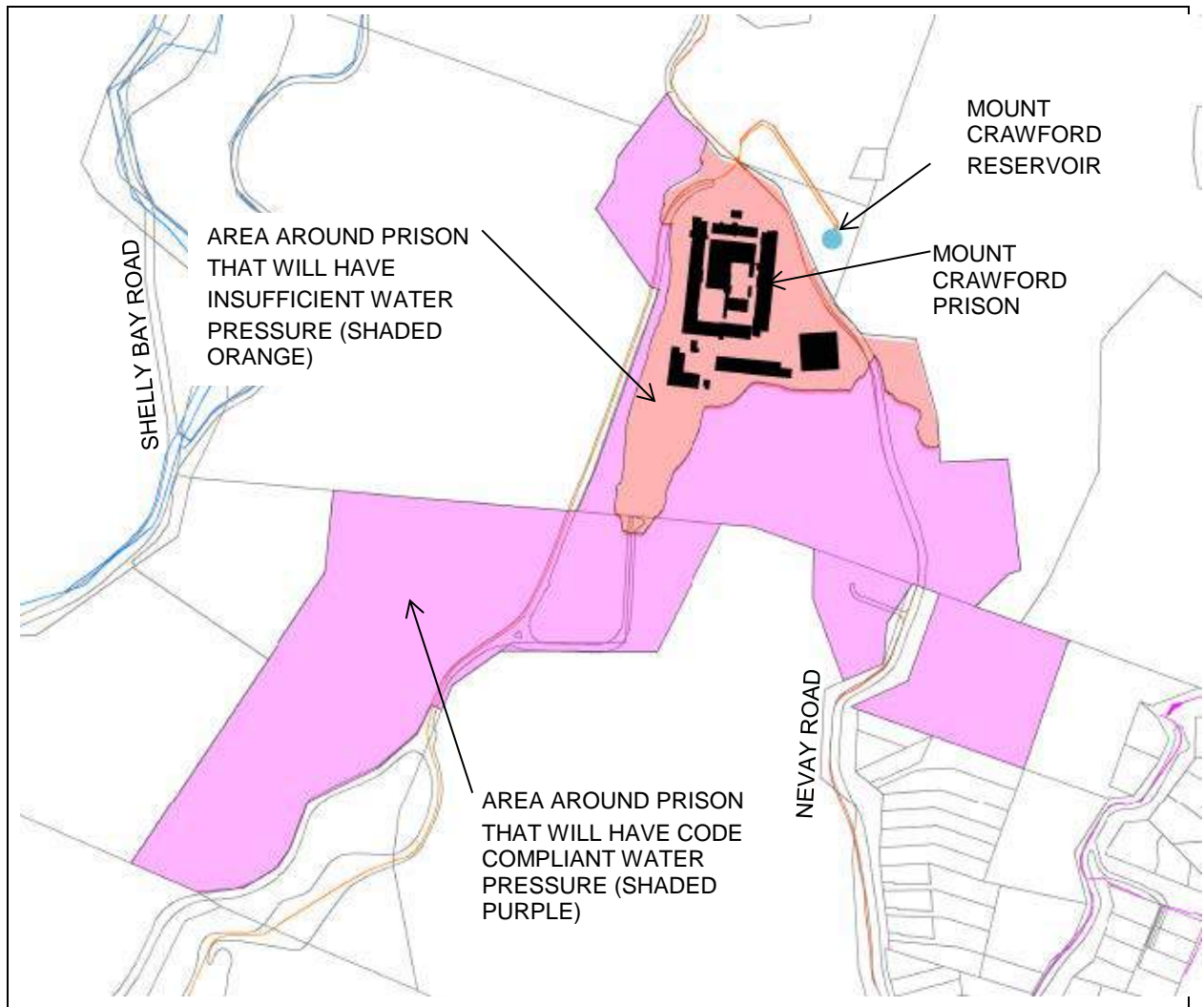
2.3.3 Water pressure available at the prison site

It should be noted that the ground level at the Prison is only 5 m to 10 m below the reservoir.

The available water pressure over a substantial part of the Prison site, that is available for redevelopment, would be less than the minimum level of service required by the Regional Standard for Water Services. This minimum level of service is 250 m head (or 250 kPa).

The shaded areas in Figure 3 are the areas that we understand are to be developed. The area shaded orange is the area that is likely to have insufficient water pressure to comply with the requirements of the Regional Standard for Water Services.

Figure 3 Development area around Prison where water pressure will be too low



The total area of the shaded area in Figure 3 is approximately 11 hectares. For the high density option comprised of lot sizes between 1,000 m² and 2,000 m² the entire area will be developed.

This will require the area shaded orange be made available for residential dwellings, and for this area of low water pressure we see two options as being practical:

- Tag the property title stating the property does not receive a water supply complying with Council standards – essentially each property would have to install a private pump to boost water pressure to the dwelling
- Construct a Council operated pump station to boost water pressure in this area

The construction of a pump station is technically difficult because a small number of houses draw a wide range of flows, and it is difficult to supply the variable flows and pressures required (pumps are best suited to pumping a single, optimum flow and pressure)

Also, because of the development is not likely to be completely finished and fully occupied at one time, some sort of interim pumping solution will have to be provided to supply water to a small number of initial houses. This adds to the complexity and cost of a pump station solution.

2.3.4 Seismic resilience of water mains at the Prison site

The existing water mains at the Prison site are all AC.

Their seismic resilience is expected to be poor.

3. Cost Estimates

3.1 Requirement and extent of new water mains

If all development was limited to Nevay Road little, or no, remedial work would be required on the Nevay Road water mains.

It is reasonable to assume that development will be undertaken over most of the area in the south-western area of Figure 3 because of the desirable views.

In this case a new water main will have to be laid between the reservoir and the development area because there are currently no water mains servicing this area. Figure 4 shows the possible extent of the new water.

3.2 Sizing of the new main in Main Road

We have assumed all 80 dwellings in the high density Scenario 1 are constructed on the Main Road. We have assumed the fire risk is FW2.

The water demand is calculated as follows.

3.2.1 Peak flow requirements

Applying the Regional Standard for Water Services the peak demand, on a maximum day, for this population is:

$$\begin{aligned} Q_{(\text{peak})} &= 0.0162 \times \text{population} \\ &= 0.0162 \times 80 \times 3 \\ &= 4 \text{ L/sec} \end{aligned}$$

3.2.2 Firefighting flows

There is no commercial properties proposed as part of this development and the firefighting water supply is assessed to be FW2 (housing – includes single family dwellings, multiunit dwellings, but excludes multi story apartment blocks) in NZS 4509.

A FW2 firefighting water supply requires a flow of 25 L/sec.

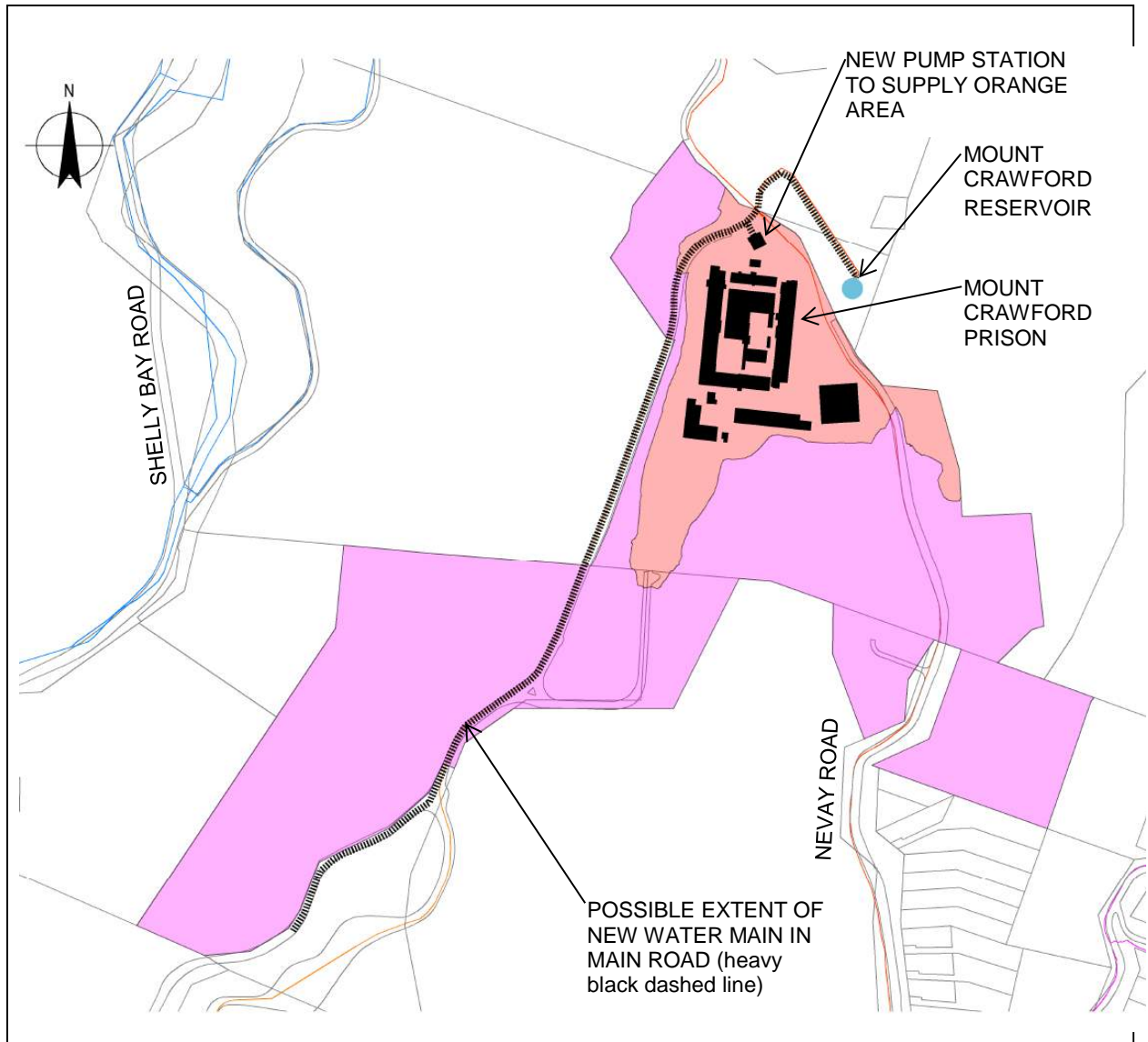
If multi-story dwellings are proposed, the fire water classification would be FW3 which would require a flow of 50 L/s if the maximum sized fire cell on each level is less than 600 m². For the purposes of this report, a FW2 classification has been used.

3.2.3 Design Flows

The design flow required by the Regional Standard for Water Services is calculated as follows:

$$\begin{aligned} Q_{(\text{design})} &= 2/3 \text{ Peak Flow} + \text{Fire Flow} \\ &= 2/3 \text{ Peak} + 25 \\ &= 28 \text{ L/sec} \end{aligned}$$

Figure 4 Possible extent of new water main in Main Road (Prison site)

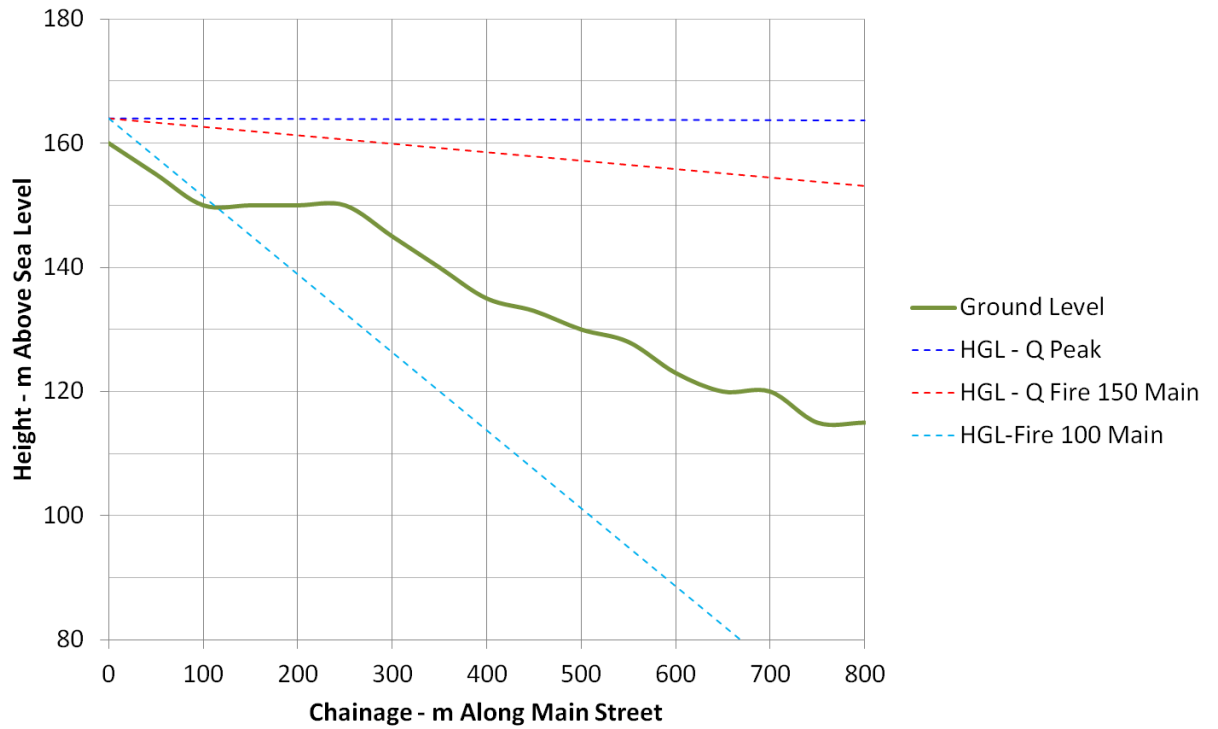


The total length of water main shown in Figure 4 is approximately 800 m. We have calculated the HGL for both a 100 mm mPVC water main and a 150 mm mPVC water main.

From the HGL in Figure 5 it can be seen that:

- either main has sufficient capacity to provide peak flow
- the 100 mm main has insufficient capacity to provide fire flow (the HGL falls below ground level – ie the pressure in the main is negative)
- the 150 mm main has sufficient capacity to provide fire flow

Figure 5 HGL Diagram for Main Raod



3.3 Cost estimate

Assuming the water main is a 150 mm NB mPVC pipeline laid in the carriageway (which is the WCC standard alignment, and there is no suitable berm area for much of the alignment) we estimate the cost for construction of the new pipeline is as follows.

Excluded from the cost estimate are network mains and rider mains required to provide a network supply to individual properties. These are assumed to be provided by the developer.

Table 1 Estimated cost of Main Road water main – Prison site

| Item | Quantity | Rate | Estimated Cost |
|-------------------------------------|----------|--------------|-------------------|
| 150 mm Water Main | | | |
| 150 mm NB mPVC pipe | 800 m | 45 \$/m | \$ 36,000 |
| Trench and lay pipe | 800 m | 220 \$/m | \$ 176,000 |
| Supply and install 150 mm valves | 4 each | 1,400 \$/ea | \$ 5,600 |
| Supply and install fire hydrants | 10 each | 1,800 \$/ea | \$ 18,000 |
| Reinstate carriageway | 800 m | 65 \$/m | \$ 52,000 |
| Commissioning | 1 each | 2,000 \$/ea | \$ 2,000 |
| Cut-in at reservoir | 1 each | 3,600 \$/ea | \$ 3,600 |
| 10% Contingency | 1 LS | | \$ 40,000 |
| Sub Total | | | \$ 333,200 |
| | | | |
| Pump Station | | | |
| Power supply | 1 each | 35,000 \$/ea | \$ 35,000 |
| Pump station cabinet | 1 each | 10,000 \$/ea | \$ 10,000 |
| Pump set (sized for ultimate flows) | 1 each | 22,000 \$/ea | \$ 22,000 |
| Switch board | 1 each | 9,000 \$/ea | \$ 9,000 |
| Valves and by-pass | 1 each | 5,800 \$/ea | \$ 5,800 |
| Ventilation | 1 each | 1,500 \$/ea | \$ 1,500 |
| SCADA control | 1 each | 5,000 \$/ea | \$ 5,000 |
| SCADA comms | 1 each | 3,500 \$/ea | \$ 3,500 |
| Mechanical installation | 1 each | 17,000 \$/ea | \$ 17,000 |
| Electrical installation | 1 each | 4,500 \$/ea | \$ 4,500 |
| 10% Contingency | 1 LS | | \$ 10,000 |
| Sub Total | | | \$ 123,300 |
| | | | |
| Total Estimated Cost | | | \$ 456,500 |

4. Summary and conclusions

4.1 Existing water mains

There are two primary water mains currently existing in the Mount Crawford Prison redevelopment area. These are:

- the existing 150 mm AC water main supplying properties in Nevay Road, and
- the existing 150 mm AC water main supplying the Prison complex

The Nevay Road water is a 150 mm AC water main with sufficient capacity to supply the current demand in Nevay Road and additional demand from some or all of the proposed development.

The existing water main in the Prison grounds is a 150 mm AC water main. Its capacity has not been checked because it will be replaced after demolition of the Prison.

4.2 Areas of low water pressure and pump station

It should be noted that a significant portion of the site around the Prison is at an elevation which is close to the elevation of the Mount Crawford Reservoir. Because of this the water pressure in this area would be insufficient to comply with Council requirements. If dwellings were to be constructed in this area a pump station will have to be built.

It is technically difficult to provide a pump station that would provide the wide range of flows drawn by the development.

4.3 Estimated costs

It is probable that development will be undertaken over most of the development area around the Prison. In this case a new 150 mm NB water main and pump will have to be constructed to supply water to the development sites. The estimated cost to construct this water main and pump station is \$478,900 plus GST. This estimate excludes local area network mains and includes mains to provide water to areas that are currently not reticulated with potable water.

4.3.1 Estimated costs for different development costs

The critical design flow for water supply is governed by the firefighting water supply required for the development. In the case of the Mount Crawford Prison area the firefighting water demand is the same regardless of whether the low density, or the high density, development option is constructed. Therefore there is no, or only minor differences in costs to provide water supply for all three development options.

SECTION TWO

Water Supply at Shelly Bay Site

1. Water requirements of proposed Shelly Bay development site

There are three proposed development scenarios for the Shelly Bay site. These are:

1. High density – 150 residential apartments (stated in Brief to be 300 persons); 1,200 m² retail development including cafes and restaurants; 24 bed boutique hotel; 300 m² visitor centre
2. Medium density – 100 residential apartments (stated in Brief to be 200 persons); 800 m² retail development including cafes and restaurants; 16 bed boutique hotel; 200 m² visitor centre
3. Low density – 50 residential apartments (stated in Brief to be 100 persons); 400 m² retail development including cafes and restaurants; 100 m² visitor centre

1.1 Water demands for option 1 (high density)

1.1.1 Peak flow requirements

Applying the Regional Standard for Water Services the peak demand, on a maximum day, for this population is:

$$\begin{aligned} Q_{(\text{peak})} &= 0.0162 \times 300 \\ &= 5 \text{ L/sec} \end{aligned}$$

In addition to this there is the water demand for the commercial development, hotel and visitor centre. Peak demand for these sites is typically low, but variable. It is very dependent on the size and density of restaurants and cafes, and we have allowed an additional 8 L/sec.

The total peak demand is therefore likely to be approximately 13 L/sec.

1.1.2 Daily water consumption

Typically peak Flow is approximately twice the average daily flow. Based on this the estimated daily water consumption of the development would be approximately 562 m³/day.

1.1.3 Firefighting flows

There are commercial properties proposed as part of this development.

The firefighting water supply will be governed by the building use and largest fire cell. For the purposes of determining the fire risk the following was considered:

- no detail is available on the commercial development
- hotels etc are defined as a category FHC1 fire risk
- restaurants etc are defined as a category FHC2 fire risk
- the largest fire cell is assumed to be the visitor centre, which is assumed to be a single fire cell of 300 m

Based on this the firefighting water supply is assessed to be FW4 (FHC2 fire risk and 300 m² fire cell) in NZS 4509.

A FW4 firefighting water supply requires a flow of 100 L/sec.

1.1.4 Design Flows

The design flow required by the Regional Standard for Water Services is calculated as follows:

$$\begin{aligned} Q_{(\text{design})} &= (2/3 \times 13) + 100 \\ &= 110 \text{ L/sec} \end{aligned}$$

1.2 Water demands for option 2 (medium density)

1.2.1 Peak flow requirements

The peak demand, on a maximum day, for this population is:

$$\begin{aligned} Q_{(\text{peak})} &= 0.0162 \times 200 \\ &= 3 \text{ L/sec} \end{aligned}$$

In addition to this there is the water demand for the commercial development, hotel and visitor centre. Peak demand for these sites is typically low, but variable. It is very dependent on the size and density of restaurants and cafes, and we have allowed an additional 6 L/sec.

The total peak demand is therefore likely to be approximately 9 L/sec.

1.2.2 Daily water consumption

The estimated daily water consumption of the development would be approximately 390 m³/day.

1.2.3 Firefighting flows

There are commercial properties proposed as part of this development.

The firefighting water supply will be governed by the building use and largest fire cell. For the purposes of determining the fire risk the following was considered:

- no detail is available on the commercial development
- hotels etc are still defined as a category FHC1 fire risk
- restaurants etc are still defined as a category FHC2 fire risk
- the largest fire cell is assumed to be the visitor centre, or an average restaurant eating area, which is assumed to be a single fire cell of 200 m

Based on this the firefighting water supply is assessed to be FW3 (FHC2 fire risk and 200 m² fire cell) in NZS 4509.

A FW3 firefighting water supply requires a flow of 50 L/sec.

1.2.4 Design Flows

The design flow required by the Regional Standard for Water Services is calculated as follows:

$$\begin{aligned} Q_{(\text{design})} &= (2/3 \times 9) + 50 \\ &= 56 \text{ L/sec} \end{aligned}$$

1.3 Water demands for option 3 (low density)

1.3.1 Peak flow requirements

The peak demand, on a maximum day, for this population is:

$$\begin{aligned} Q_{(\text{peak})} &= 0.0162 \times 100 \\ &= 1.6 \text{ L/sec} \end{aligned}$$

In addition to this there is the water demand for the commercial development, hotel and visitor centre. Peak demand for these sites is typically low, but variable. It is very dependent on the size and density of restaurants and cafes, and we have allowed an additional 5 L/sec.

The total peak demand is therefore likely to be approximately 7 L/sec.

1.3.2 Daily water consumption

The estimated daily water consumption of the development would be approximately 300 m³/day.

1.3.3 Firefighting flows

There are commercial properties proposed as part of this development.

The firefighting water supply will be governed by the building use and largest fire cell. For the purposes of determining the fire risk the following was considered:

- no detail is available on the commercial development
- restaurants etc are still defined as a category FHC2 fire risk
- the largest fire cell is assumed to be an average restaurant eating area, which is assumed to be a single fire cell of 200 m

Based on this the firefighting water supply is assessed to be FW3 (FHC2 fire risk and 200 m² fire cell) in NZS 4509.

A FW3 firefighting water supply requires a flow of 50 L/sec.

1.3.4 Design Flows

The design flow required by the Regional Standard for Water Services is calculated as follows:

$$\begin{aligned} Q_{(\text{design})} &= (2/3 \times 9) + 50 \\ &= 56 \text{ L/sec} \end{aligned}$$

1.4 Minimum levels of service (flows and pressures)

Minimum pressure at point of supply: 25 m (head of water)

Maximum pressure at point of supply: 90 m

Minimum flow at point of supply: 25 L/min (0.4 L/sec)

2. Review of the existing Shelly Bay water supply

The water supply systems servicing Shelly Bay have been described in previous reports to Council.

We have visited site to confirm as previous estimations of the water supplies.

We note that it was not possible to gain access to the land still administered by the Defence Department during visits to site.

2.1 Water supply to Shelly Bay

Currently all the water supplied to Shelly Bay is supplied out of the Mount Crawford Reservoir.

There is an old 150 mm steel water main laid in Shelly Bay Road between the Miramar Cutting and Shelly Bay.

The location of these mains are shown in Figure 6 on the following page.

2.2 The existing reticulation mains supplying the Shelly Bay Base

Water Supply Out of Mount Crawford Reservoir

There is a single privately owned 150 mm NB steel water main that supplies the Defence Department land and the Shelly Bay Reservoir (and Shelly Bay Air Force Base).

The condition of this main could not be assessed under the scope of this work. However this main has been previously identified as being corroded and in need of replacement.

Wellington soils are typically aggressive to metallic mains and, considering the probable age of the main (the Shelly Bay Air Force Base was constructed in 1942), it is likely that the main is affected by corrosion and is expected to be at the end of its serviceable life.

In addition to this if the main is unlined (which was common for steel mains of this age), it is likely to be tuberculated (where iron nodules grow on the inside of the pipe and reduce its effective diameter), which will reduce the capacity of the main.

Shelly Bay Reservoir

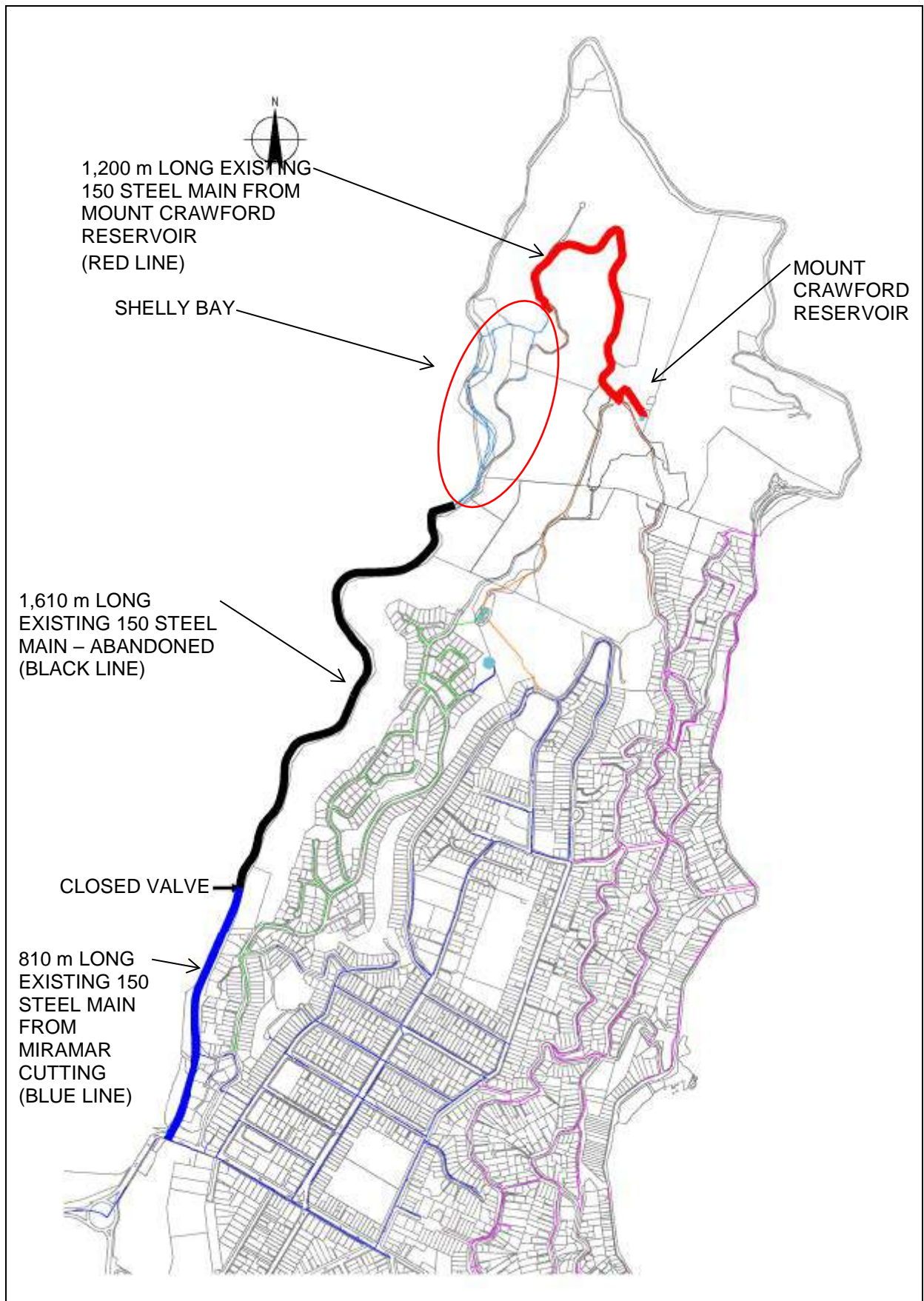
The Mount Crawford main discharges into the Shelly Bay Reservoir.

This is an underground cast in-situ reservoir above the old Shelly Bay Base, which acts as a break pressure tank.

The reservoir has previously been assessed as being in poor condition. It has a corrugated iron roof and does not comply with either Council requirements or the Drinking Water Standard's requirements.

This reservoir should be removed. We suggest that it could be replaced with a PRV installation.

Figure 6 Existing and abandoned water supplies to Shelly Bay development site



Water Supply Out of the Miramar Cutting

This main has been capped outside number 88 Shelly Bay and is abandoned between number 88 and the Shelly Bay Air Force Base.

Because of the close proximity to the tidal zone to this steel main, it is expected that this main is severely affected by corrosion and is not serviceable.

It is currently not in service and will require replacement if the water supply from the Miramar Cutting is to be reinstated.

The length of main to be replaced is approximately 1,600 m. This is 400 m longer than the length of main in the Mount Crawford water supply.

Because the Shelly Bay Road route is in the carriageway and the Mount Crawford water supply is in Defence Department tracks, it is expected it will be more cost effective to replace the from Mount Crawford water supply pipeline.

In addition to this the total length of main from the Miramar Cutting is over twice the length of main out of Mount Crawford Reservoir. Therefore hydraulic losses in the Shelly Bay Road route will be twice the hydraulic losses in the Mount Crawford water supply. Because of this it will be necessary to replace all of the main between the Miramar Cutting and Shelly Bay with a larger diameter pipeline. And it will be more cost effective to replace the existing Mount Crawford water supply, compared to replacing the existing pipeline in the Shelly Bay Road route.

2.2.1 Capacity of existing water mains

Mount Crawford Water Supply

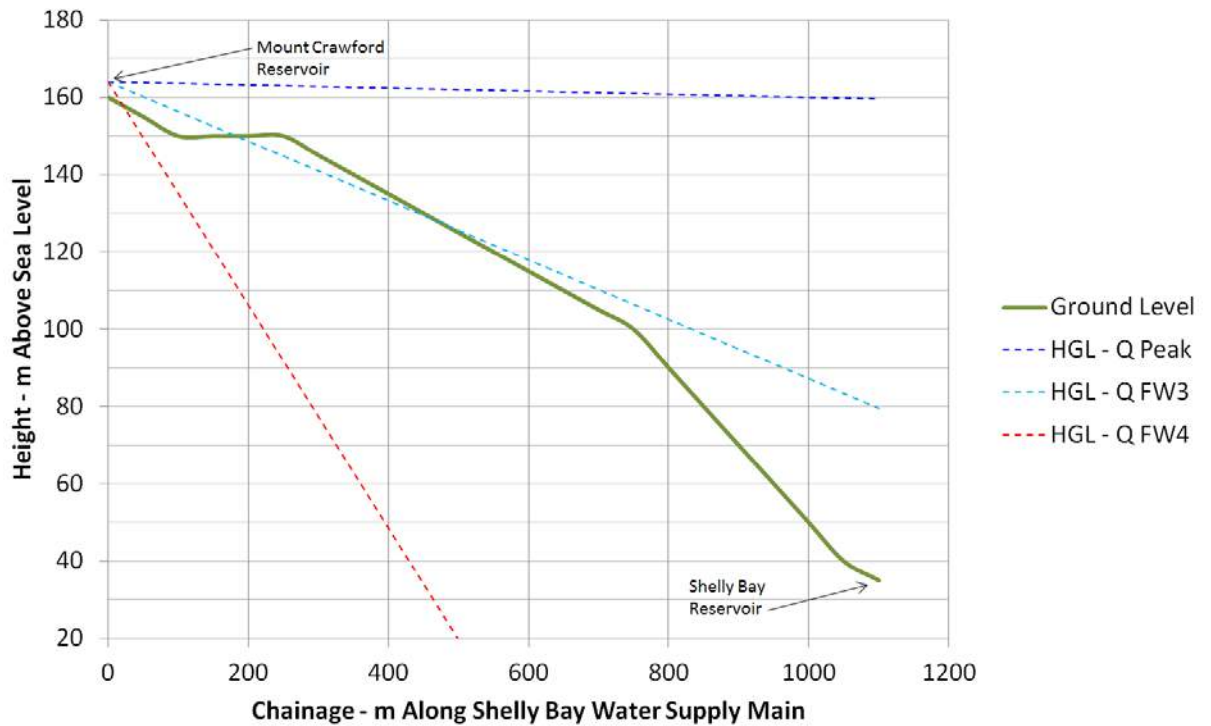
This main currently services the Defence Department land, the Massey Memorial site and all of the Shelly Bay development site.

Based on this and topographical data we have calculated the Hydraulic Grade Line (HGL) for this main based on the predicted water demands of the proposed development. This is shown in Figure 7.

This is calculated using conservative values for pipe ID, roughness and flow:

- 150 mm for ID
- 0.1 mm for roughness
- peak flow = 13 l/sec
- FW3 fire flow = 56 L/sec
- FW4 fire flow = 110 L/sec

Figure 7 HGL Diagram for existing 150 mm steel Shelly Bay water supply main



From Figure 7 it can be seen that the capacity of the existing Shelly Bay water main is sufficient to supply the expected reticulation demands. However it does not have sufficient capacity to supply a FW4 firefighting water supply and it has barely sufficient capacity to supply a FW3 firefighting water supply.

2.2.2 Condition of existing mains

Mount Crawford Water Supply

This main is expected to be affected by corrosion and be at the end of its serviceable life.

In addition to this this main is undersized and will have to be replaced with a larger diameter main to provide the projected fire flows.

Shelly Bay Road Water Main

This main has been abandoned – presumably because of maintenance issues.

It is expected to be severely corroded and require total replacement. Because of the length of the main and associated head loss issues replacement would have to include the section between the closed valve at number 88 Shelly Bay Road and the Miramar Cutting.

3. Capacity of Mount Crawford reservoir

It is noted that the final development in Shelly Bay may be an FW4 firefighting water supply classification. The final determination of the required firefighting water supply depends on the size of the largest fire cell, and with the information available at this stage it is not possible to rule out a FW4 classification.

SNZ 4509 requires 540 m³ of stored water for a FW4 classification (which is equivalent to a flow of 50 L/sec for a period of 180 minutes).

The volume of water stored in Mount Crawford Reservoir is 500 m³. Therefore the reservoir is undersized and during the development of Shelly Bay the developer will have to either:

- Construct a new, larger reservoir at Mount Crawford, or
- Construct an alternative, supplemental firefighting water supply at Shelly Bay, or
- Ensure all large fire cells or buildings at Shelly Bay are fitted with sprinklers to reduce the firefighting water classification

The cost to renew the reservoir at Mount Crawford is expected to exceed \$3,000,000, and would clearly not be cost effective.

An alternative, supplemental firefighting water supply may be achieved by constructing a second water supply main from another water source at the Miramar Cutting, or constructing a hard standing area for fire trucks to stand and suck water from the harbour. The option to lay a new main from the Miramar cutting would not be cost effective compared to the hard standing option.

The final option – ensuring all buildings are sprinklered is both cost effective and practical.

3.1 Liaison with Fire Brigade

The final solution should be addressed with the Fire Brigade during detailed planning of development.

It should be noted that the stored capacity in Mount Crawford Reservoir may be insufficient for the firefighting water supply classification of the final development.

4. Cost Estimates

4.1 Requirement and extent of new water mains

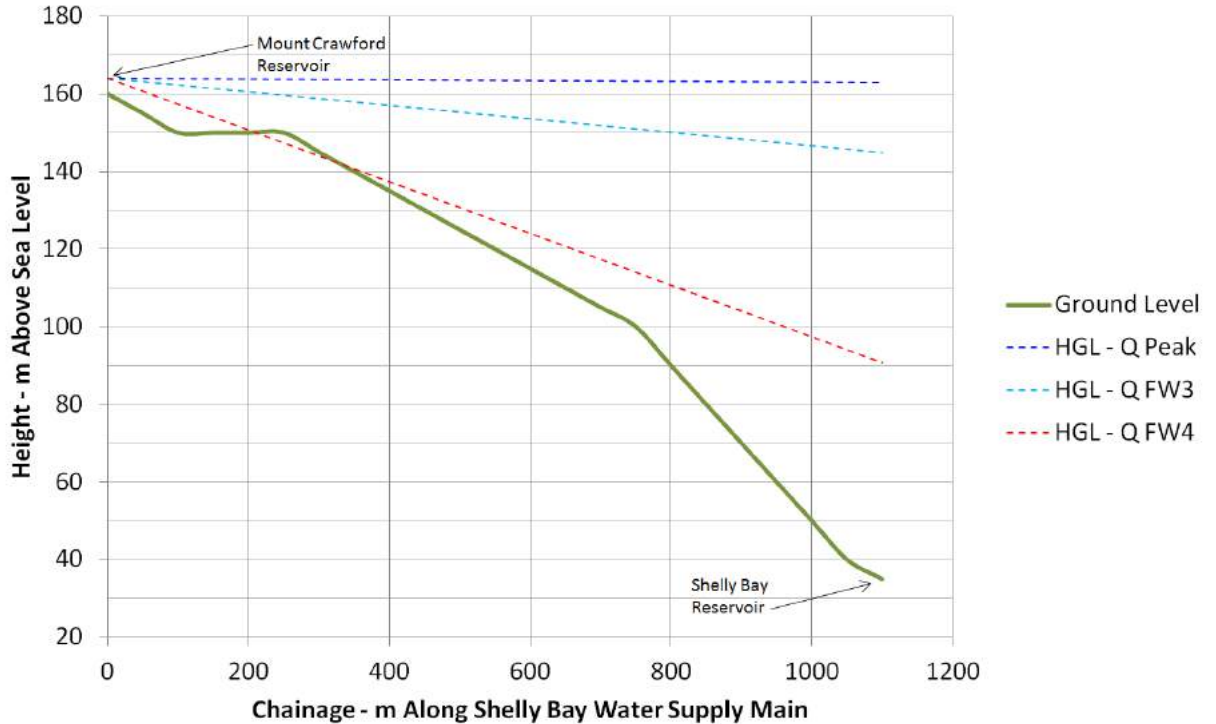
The entire existing water supply to Shelly Bay requires replacement.

The most cost effective replacement option is to replace the existing water supply out of the Mount Crawford Reservoir.

4.2 Sizing of new water mains

We have calculated the HGL for a replacement 200 mm concrete lined ductile iron (CLDI) main. This is shown in Figure 8.

Figure 8 HGL Diagram for new 200 mm CLDI Shelly Bay water supply main



From Figure 8 it can be seen that the capacity of a new 200 mm CLDI Shelly Bay water main is sufficient to provide the expected reticulation demands. It has sufficient capacity to supply a FW3 firefighting water supply and it has barely sufficient capacity to supply a FW4 firefighting water supply.

4.3 Cost estimate

Assuming the water main is a 200 mm NB CLDI pipeline laid in the Defence Force track we estimate the cost for construction of the new pipeline is as follows.

Assumptions

A CLDI pipeline has been selected to satisfy the water supply code requirements for pipelines laid on steep grades, pipelines that form principal mains and seismically resilience.

A 200 mm NB has been selected as it will provide sufficient capacity for a FW4 firefighting water supply. This will allow greater flexibility in the future development of the Shelly Bay site.

The main is constantly descending from Mount Crawford Reservoir, and is laid in essentially “green fields”. We have not allowed for hydrants except one near the top of the main, one near the bottom of the main and two line-hydrants to allow de-airing if there are any high points.

We have allowed for one 100 mm service connections to supply the Massey Memorial site. We have not allowed for any other service connections.

We have assumed the tracks in the Defence Force property are 30% sealed and 70% unsealed. We have allowed for standard AC reinstatement over 30% of the track and bound base course reinstatement over 70% of the track.

It may be possible to construct this main using welded PE pipe, however there will be areas where steel or ductile iron pipe will be required because of the steep grades along the alignment.

Table 2 Estimated cost of Main Road water main – Shelly Bay

| Item | Quantity | Rate | Estimated Cost |
|--|----------|-------------|-------------------|
| 200 mm CLDI pipe | 1,100 m | 95 \$/m | \$ 104,500 |
| Trench and lay pipe | 1,100 m | 220 \$/m | \$ 242,000 |
| Supply and install 200 mm valves | 2 each | 1,600 \$/ea | \$ 3,200 |
| Supply and install fire hydrants | 4 each | 1,800 \$/ea | \$ 7,200 |
| Supply and install service connections | nil | 2,500 \$/ea | \$ nil |
| Supply and install 100 mm service connection to Massey memorial site | 1 each | 3,800 \$/ea | \$ 3,800 |
| Reinstate sealed carriageway | 330 m | 60 \$/m | \$ 19,800 |
| Reinstate unsealed carriageway | 770 m | 30 \$/m | \$ 23,100 |
| Supply and install PRV chamber and lids | 1 each | 4,200 \$/ea | \$ 4,200 |
| Supply and install a PRV installation | 1 each | 7,500 \$/ea | \$ 7,500 |
| Commissioning | 1 each | 2,000 \$/ea | \$ 2,000 |
| Cut-in at reservoir | 1 each | 3,600 \$/ea | \$ 3,600 |
| 10% Contingency | 1 LS | | \$ 40,000 |
| Total Estimated Cost | | | \$ 460,900 |

5. Summary and conclusions

5.1 Existing water mains

There is currently a single 150 mm steel water main supply supplying the Shelly Bay area. This main is laid in Defence Force land between Mount Crawford Reservoir and Shelly Bay. This water main is expected to be affected by corrosion and at the end of its serviceable life.

There is also a second 150 mm steel water main laid in Shelly Bay Road. This main is currently capped and abandoned between number 88 Shelly Bay Road and Shelly Bay.

Either main could be renewed and used to supply water to Shelly Bay. It will be more cost effective to renew the main out of Mount Crawford Reservoir because the length of this main is less than half the length of the main laid in Shelly Bay Road.

5.2 Firefighting

Both water mains have insufficient capacity to supply a FW4 firefighting water supply to the Shelly Bay area, and it will be necessary to renew the mains using 200 mm NB pipe.

Because of steep grades in the main out of Mount Crawford we recommend the main be renewed using concrete lined ductile iron (CLDI) pipe.

5.3 Requirement for stored firefighting water at Mount Crawford reservoir

The volume of water stored at Mount Crawford reservoir is 500 m³. This is less than the 540 m³ volume of stored water required to supply a FW4 firefighting water supply.

It will not be cost effective to replace the reservoir with a larger reservoir, or construct an alternative water supply pipeline from the Miramar Cutting.

Options include ensuring buildings are sprinklered, or providing hard standing for fire trucks to stand while sucking additional water from the harbour.

At this time it is not known what the final firefighting water supply required for the development will be and this should be discussed with the Fire Brigade during detailed planning of the final development.

5.4 Cost Estimates

The estimated cost to construct a new 200 mm NB CLDI water main between Mount Crawford Reservoir and Shelly Bay is \$457,600 plus GST.

SECTION THREE

Waste Water System at Mount Crawford Prison Site

1. Sewer Mains requirements of the Mount Crawford development site

There are three proposed development scenarios for the Mount Crawford Prison site. These are:

1. High density – 80 dwellings (stated in Brief to be 240 persons)
2. Medium density – 40 dwellings (stated in Brief to be 120 persons)
3. Low density – 20 dwellings (stated in Brief to be 60 persons)

1.1 Waste water flows for option 1 (high density)

1.1.1 Average Dry Weather Flows (ADWF)

Applying the Regional Standard for Water Services the ADWF for this population is:

$$\begin{aligned} \text{ADWF} &= 0.0023 \times \text{population} \\ &= 0.0023 \times 240 \\ &= 0.6 \text{ L/sec} \end{aligned}$$

1.1.2 Peak Dry Weather Flow (PDWF)

Applying the Regional Standard for Water Services the PDWF for this population is:

$$\begin{aligned} \text{PDWF} &= \text{ADWF} \times \text{Peaking Factor} \\ &= 0.6 \times 6.2 \\ &= 3.4 \text{ L/sec} \end{aligned}$$

1.1.3 Peak Wet Weather Flow (PWWF)

Applying the Regional Standard for Water Services the PWWF for this population is:

$$\begin{aligned} \text{PWWF} &= \text{PDWF} + \text{PGWF} + \text{PRWF} \\ &= 3.42 + 0.13 + 1.01 \\ &= 4.6 \text{ L/sec} \end{aligned}$$

1.1.4 Design Flows

The peak flow for 80 dwellings is 4.6 L/sec.

1.2 Waste water flows for option 2 (medium density)

1.2.1 Average Dry Weather Flows (ADWF)

Applying the Regional Standard for Water Services the ADWF for this population is:

$$\begin{aligned} \text{ADWF} &= 0.0023 \times \text{population} \\ &= 0.0023 \times 120 \\ &= 0.3 \text{ L/sec} \end{aligned}$$

1.2.2 Peak Dry Weather Flow (PDWF)

Applying the Regional Standard for Water Services the PDWF for this population is:

$$\begin{aligned} \text{PDWF} &= \text{ADWF} \times \text{Peaking Factor} \\ &= 0.3 \times 7.0 \\ &= 1.93 \text{ L/sec} \end{aligned}$$

1.2.3 Peak Wet Weather Flow (PWWF)

Applying the Regional Standard for Water Services the PWWF for this population is:

$$\begin{aligned} \text{PWWF} &= \text{PDWF} + \text{PGWF} + \text{PRWF} \\ &= 1.93 + 0.13 + 1.01 \\ &= 3.1 \text{ L/sec} \end{aligned}$$

1.2.4 Design Flows

The peak flow for 40 dwellings is 3.1 L/sec.

1.3 Waste water flows for option 3 (low density)

1.3.1 Average Dry Weather Flows (ADWF)

Applying the Regional Standard for Water Services the ADWF for this population is:

$$\begin{aligned} \text{ADWF} &= 0.0023 \times \text{population} \\ &= 0.0023 \times 60 \\ &= 0.14 \text{ L/sec} \end{aligned}$$

1.3.2 Peak Dry Weather Flow (PDWF)

Applying the Regional Standard for Water Services the PDWF for this population is:

$$\begin{aligned}\text{PDWF} &= \text{ADWF} \times \text{Peaking Factor} \\ &= 0.14 \times 8.8 \\ &= 1.21 \text{ L/sec}\end{aligned}$$

1.3.3 Peak Wet Weather Flow (PWWF)

Applying the Regional Standard for Water Services the PWWF for this population is:

$$\begin{aligned}\text{PWWF} &= \text{PDWF} + \text{PGWF} + \text{PRWF} \\ &= 1.21 + 0.13 + 1.01 \\ &= 2.35 \text{ L/sec}\end{aligned}$$

1.3.4 Design Flows

The peak flow for 20 dwellings is 2.35 L/sec.

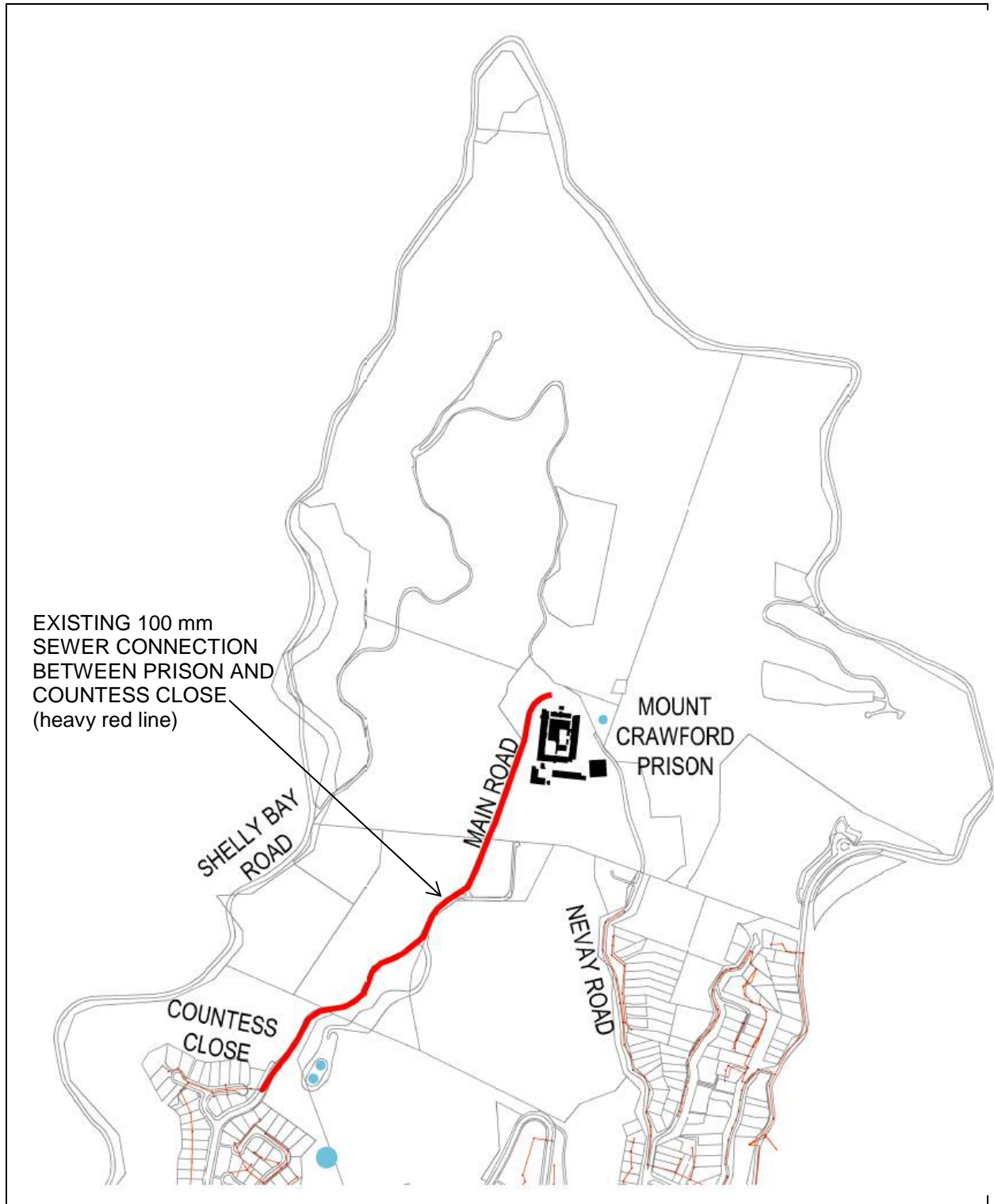
2. Existing Sewer network at the Prison site

Currently there is an existing Council owned sewer in Nevay Road. There is also an existing 100 mm sewer connection between the prison and the Council sewer network at Countess Close.

The existing sewers are shown in Figure 9.

The existing sewer connection to the Prison is 100 mm. This is permitted for a single, private connection. On development of the site this pipeline will change use from being a single connection for the Prison to being a Council owned waste water pipe. The Regional Standard for Water Services specifies the minimum size for a Council owned waste water pipe is 150 mm. Therefore this pipeline must be replaced when the site is developed.

Figure 9 Existing sewers in the prison development site



3. Options for a new waste water network at the Prison site

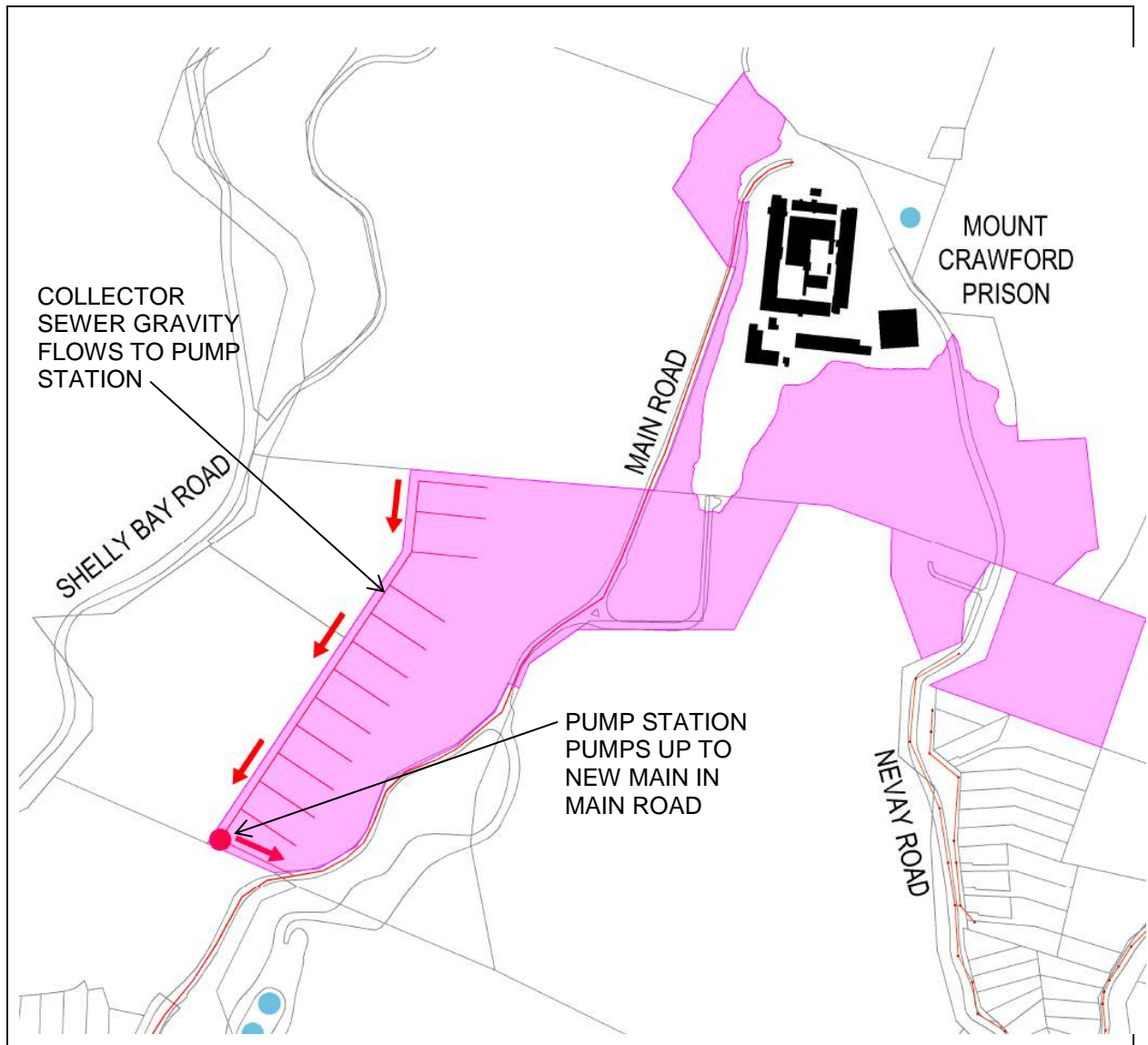
As outlined in Section Two it is expected it will be desirable to develop the areas overlooking Evans Bay. In addition to this there may be some development around the existing Prison site, if a water pump station was contracted.

We expect that dwellings around the existing Prison will be serviced by gravity flow into the new waste water main.

However new dwellings in the south-western area of Figure 3 will primarily be below the level of Main Road and will require pumping of waste water into a waste water main laid in Main Road.

Figures 10, 11, and 12 illustrate the three most practical options for servicing these properties for waste water.

Figure 10 Sewer option # 1



Sewer Option # 1

In this option conventional sewer laterals are laid between the dwellings and a Council owned and operated collector main that runs along contour mains below the houses (probably along the parcel boundary).

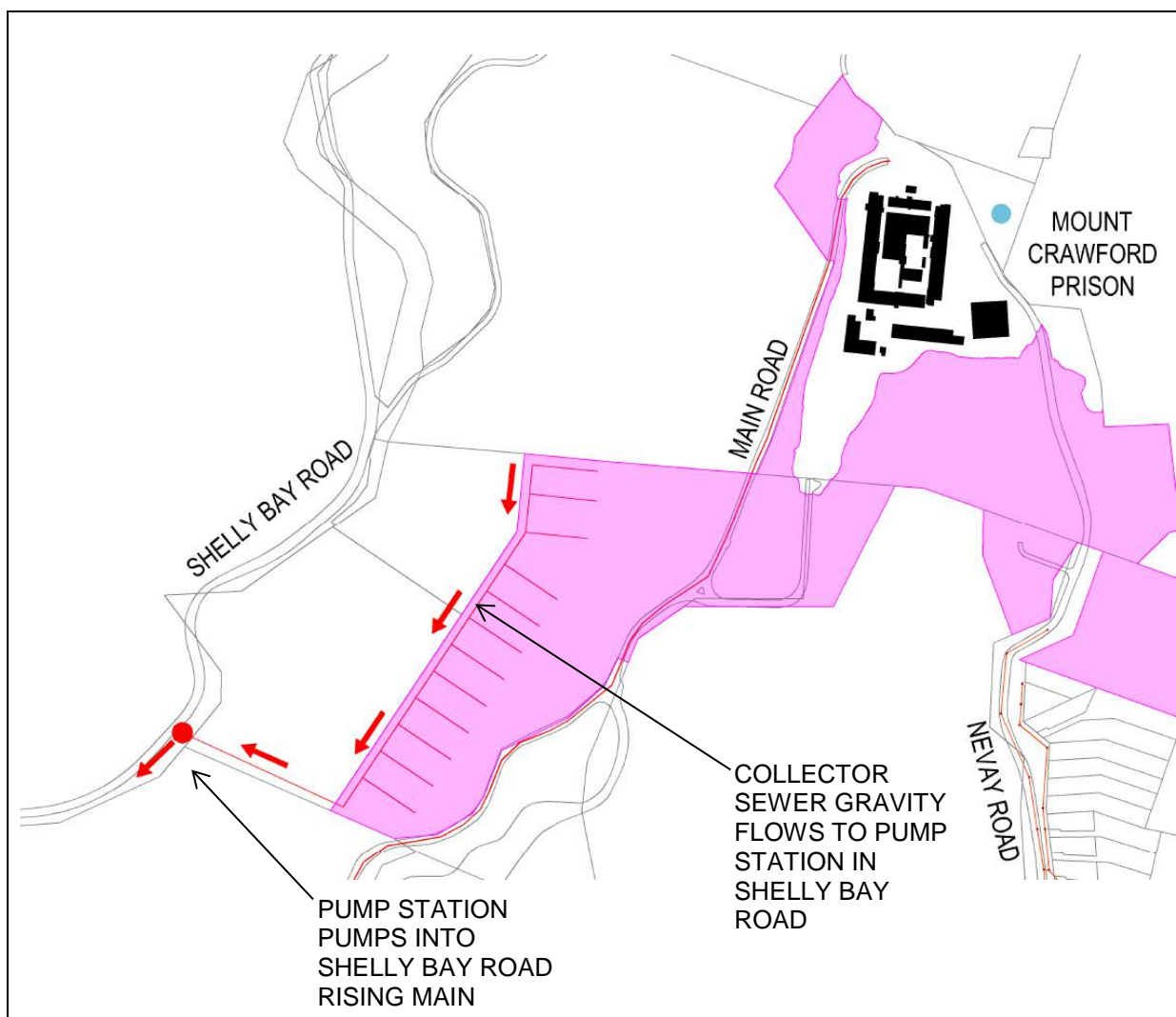
The collector main terminates at a Council owned and operated pump station that lifts sewage up to the gravity main in Main Road.

The benefit of this option is that it will suit most models of development.

The disadvantages of this option are:

- Council will have to register easements over the collector main, the pump station and the rising corridors
- Odour control will be necessary at the pump station site and possibly at the discharge into the Main Road sewer
- A power supply to the pump station will have to be installed

Figure 11 Sewer option # 2



Sewer Option # 2

In this option conventional sewer laterals are laid between the dwellings and a Council owned and operated collector main that runs along contour mains below the houses (probably along the parcel boundary).

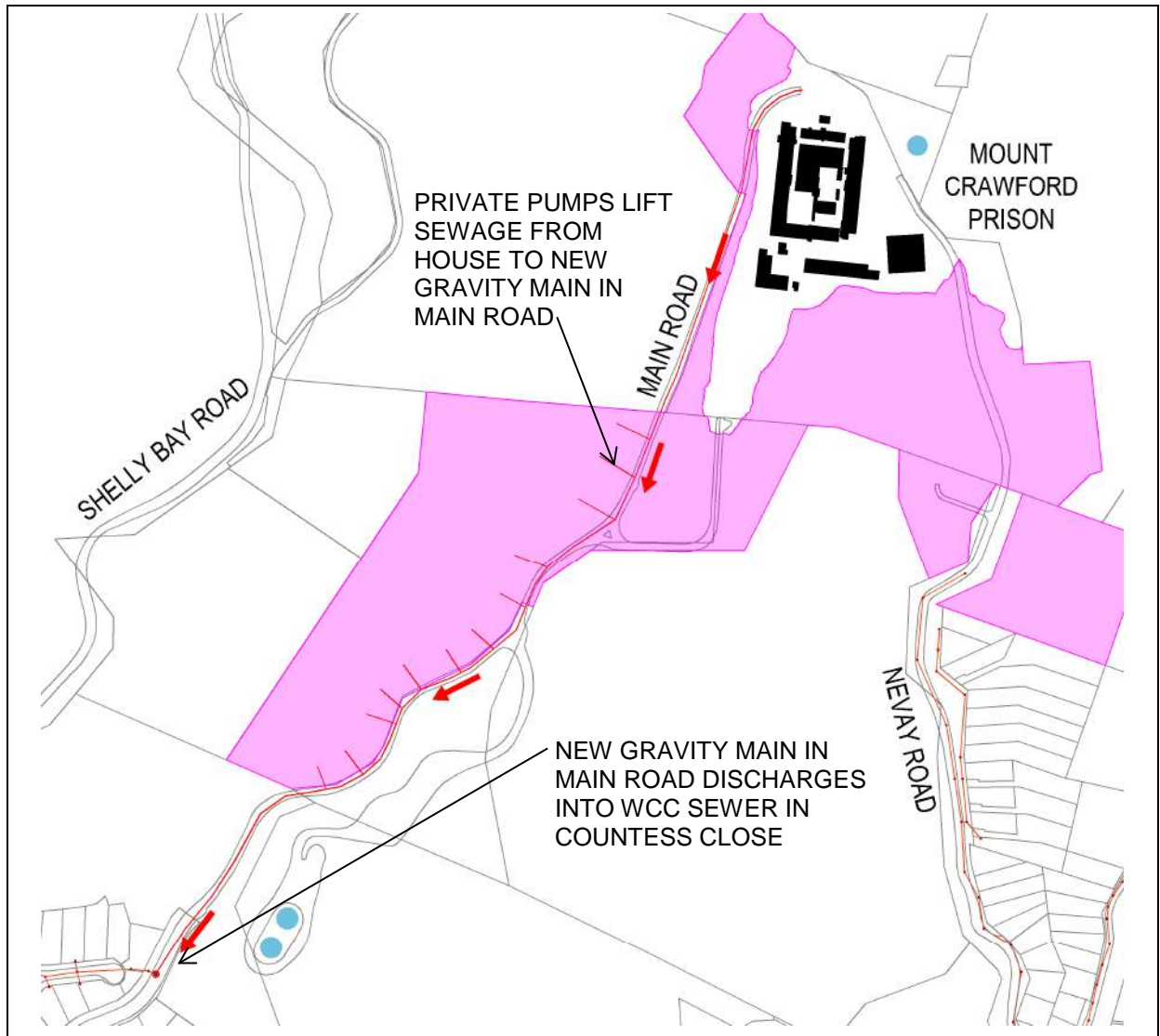
The collector main is laid down the steep slope to Shelly Bay Road and terminates at a Council owned and operated pump station that discharges sewage up to the rising main in Shelly Bay Road (this rising main takes the outflow from the Shelly Bay pump station).

The benefit of this option is that it will suit most models of development.

The disadvantages of this option are:

- Council will have to register easements over the collector main, the pump station and the rising corridors
- Council will have to buy a strip of land between the development site and Shelly Bay Road
- Odour control will be necessary at the pump station site and possibly at the discharge into the Main Road sewer
- A power supply to the pump station will have to be installed

Figure 12 Sewer option # 3



Sewer Option # 3

In this option each property must have a small, privately owned low pressure pump station that lifts sewage to the gravity main in Main Road.

These private pump stations are becoming more common as low pressure sewer systems are installed in places such as Christchurch (as part of the re-build following the earthquakes). They are reasonably reliable and typically provide approximately 24 hours storage when power supply is lost.

The benefits of this option is that it will suit most models of development, and Council does not have build or maintain infrastructure in private property. All pump stations become the property owner's responsibility for maintenance and replacement.

The disadvantage of this option is that some potential property buyers may be cautious of buying a property that requires a privately owned pump station. If the area lost power for an extended time there may be uncontrolled overflow of sewage.

4. Sizing of new sewer main in Main Road

The existing sewer main in Main Road is a 100 mm NB pipe. It is assumed to be an AC pipeline similar to the AC rising between the Shelly Bay pump station and the Miramar Cutting.

This main probably complies with current Council requirements because it can be considered a single sewer connection from the Prison.

This main would not satisfy Council requirements for a sewer main servicing more than one dwelling.

The minimum size for a sewer main is 150 mm NB. The Main Road main is 880 m long and the average grade is 1 in 19 (3.98%). To comply with the Regional Standard for Water Services the pipeline must:

- Have sufficient capacity to carry the maximum flows (with a maximum flow depth of 85 %)
- Achieve minimum self-cleansing velocities at minimum flows
- Not exceed a maximum velocity of 3 m/sec
- Must exceed the minimum grade

Table 3 shows the calculated flows and velocities for this main at a grade of 1 in 19 and if it complies with the requirements of the standard.

Table 3 Capacity of 150 mm sewer main at grade = 1 in 19

| Flow | Calculated Flow | Max. Pipe Capacity | Complies | Calculated Velocity | Required Minimum Velocity | Complies |
|------|-----------------|--------------------|----------|---------------------|---------------------------|----------|
| ADWF | 0.55 L/sec | 42 L/sec | Yes | 0.82 m/sec | 0.7 m/sec | Yes |
| PDWF | 3.42 L/sec | 42 L/sec | Yes | 1.41 m/sec | 0.7 m/sec | Yes |
| PWWF | 4.56 L/sec | 42 L/sec | Yes | 1.54 m/sec | 0.7 m/sec | Yes |

On this grade a 150 mm main complies with the Council requirements.

At the top of Main Road the grade flattens out and Table 4 shows the calculated flows and velocities for this main at an average grade of 1 in 40 and if it complies with the requirements of the standard.

Table 4 Capacity of 150 mm sewer main at grade = 1 in 19

| Flow | Calculated Flow | Max. Pipe Capacity | Complies | Calculated Velocity | Required Minimum Velocity | Complies |
|------|-----------------|--------------------|----------|---------------------|---------------------------|----------|
| ADWF | 0.55 L/sec | 29 L/sec | Yes | 0.65 m/sec | 0.7 m/sec | OK |
| PDWF | 3.42 L/sec | 29 L/sec | Yes | 1.09 m/sec | 0.7 m/sec | Yes |
| PWWF | 4.56 L/sec | 29 L/sec | Yes | 1.18 m/sec | 0.7 m/sec | Yes |

On this grade a 150 mm main complies with all Council requirements except minimum flow velocity at ADWF.

It is not possible to reduce the main size and it is concluded that the main has sufficient flow capacity.

5. Cost estimates

Following we have estimated the cost for:

- Constructing the new 150 mm Main Road sewer main
- Constructing Sewer Option # 1
- Constructing Sewer Option # 2

No allowance has made for the cost to construct the normal sewer network that will gravity flow waste water from dwellings on the old Prison site into the Main Road sewer main.

The cost of sewer option # 3 is the same as the cost to construct the Main Road sewer main only, because the property owners/developer supplies the pump and connects to the Main Road sewer main. The cost for sewer option # 3 has not been separately estimated.

Assumptions

The Main Road sewer main is constructed using 150 mm PVC SN16 pipe.

The Council owned collector sewer in Options 1 and 2 is 150 mm PVC SN16 pipe.

A strip of land must be purchased in which to lay the sewer main down to Shelly Bay Road in Option 2.

The estimated cost does not include sewer lateral connections, which will be paid for by the developer.

Table 5 Estimated cost of Main Road sewer main

| Item | Quantity | Rate | Estimated Cost |
|--|----------|-------------|-------------------|
| 150 mm NB SN16 PVC pipe | 880 m | 45 \$/m | \$ 39,600 |
| Trench and lay pipe | 880 m | 455 \$/m | \$ 400,400 |
| Supply and install manholes at change in direction | 18 each | 5,000 \$/ea | \$ 90,000 |
| Reinstate sealed carriageway | 880 m | 60 \$/m | \$ 52,800 |
| Commissioning | 1 each | 2,000 \$/ea | \$ 2,000 |
| Cut-in at Countess Close | 1 each | 3,800 \$/ea | \$ 3,800 |
| 10% Contingency | 1 LS | | \$ 60,000 |
| Total Estimated Cost | | | \$ 648,600 |

Table 6 Estimated cost of sewer option # 1

| Item | Quantity | Rate | Estimated Cost |
|---|----------|--------------|-------------------|
| 150 mm NB SN16 PVC pipe | 375 m | 45 \$/m | \$ 16,875 |
| Trench and lay pipe | 375 m | 600 \$/m | \$ 225,000 |
| Supply package pump station c/w detention storage | 1 each | 35,000 \$/ea | \$ 35,000 |
| Install package pump station | 1 each | 65,000 \$/ea | \$ 65,000 |
| Power supply (estimate 3 spans) | 1 each | 21,000 \$/ea | \$ 21,000 |
| Commissioning | 1 each | 2,000 \$/ea | \$ 2,000 |
| Cut-in Main Road sewer | 1 each | 5,600 \$/ea | \$ 5,600 |
| 10% Contingency | 1 LS | | \$ 40,000 |
| Total Estimated Cost | | | \$ 410,475 |

Table 7 Estimated cost of sewer option # 2

| Item | Quantity | Rate | Estimated Cost |
|---|----------|--------------|-------------------|
| 150 mm NB SN16 PVC pipe | 325 m | 45 \$/m | \$ 14,625 |
| Trench and lay PVC pipe | 325 m | 600 \$/m | \$ 195,000 |
| Supply package pump station c/w detention storage | 1 each | 35,000 \$/ea | \$ 55,000 |
| Install package pump station | 1 each | 21,000 \$/ea | \$ 65,000 |
| 150 mm NB CLS pipe down to Shelly Bay Road | 160 m | 200 \$/m | \$ 32,000 |
| Trench and lay CLS pipe (incl. trench stops etc) | 160 m | 900 \$/m | \$ 144,000 |
| Power supply (estimate 5 spans) | 1 each | 35,000 \$/ea | \$ 35,000 |
| Commissioning | 1 each | 2,000 \$/ea | \$ 2,000 |
| Cut-in Shelly Bay Road rising sewer | 1 each | 6,500 \$/ea | \$ 6,500 |
| 10% Contingency | 1 LS | | \$ 65,000 |
| Total Estimated Cost | | | \$ 614,125 |

6. Summary and conclusions

6.1 Existing sewer mains

There are no existing sewer mains in the Mount Crawford Prison site and new sewer mains have to be constructed to service the site.

6.2 Properties below Main Road

It is expected that most of the site will be developed. This will require building of dwellings below Main Road in the south-west of the site.

Waste water from these properties cannot be gravity fed into the Main Road sewer main and will have to be pumped-up to the Main Road sewer, or discharged downhill into the Shelly Bay Rising sewer.

All options require pumping solutions, and the most practical solutions are:

- Option # 1: A Council owned collector main and pump station below the houses that lifts waste water into the Main Road sewer main
- Option # 2: A Council owned collector main that gravity flows waste water downhill to Shelly Bay Road where it is pumped into the Shelly Bay Road rising sewer
- Option # 3: Privately owned individual pump stations that lift waste water from each house into the Main Road sewer main – these would be provided by the developer, or house owner

6.3 Cost Estimates

The estimated cost to construct a new 150 mm NB PVC sewer main in Main Road is \$648,600 plus GST.

In addition to this the estimated cost to construct Sewer Option # 1 to service houses below Main Road is \$329,875 plus GST.

Or the additional estimated cost to construct Sewer Option # 2 to service house below Main Road is \$456,625 plus GST.

SECTION FOUR

Waste Water System at Shelly Bay Site

1. Sewer mains requirements for the Shelly Bay development site

There are three proposed development scenarios for the Shelly Bay site. These are:

1. High density – 150 residential apartments (stated in Brief to be 300 persons); 1,200 m² retail development including cafes and restaurants; 24 bed boutique hotel; 300 m² visitor centre
2. Medium density – 100 residential apartments (stated in Brief to be 200 persons); 800 m² retail development including cafes and restaurants; 16 bed boutique hotel; 200 m² visitor centre
3. Low density – 50 residential apartments (stated in Brief to be 100 persons); 400 m² retail development including cafes and restaurants; 100 m² visitor centre

1.1 Waste water flows for option 1 (high density)

1.1.1 Average Dry Weather Flows (ADWF)

The population is assessed to be:

| | |
|--|-----|
| Residential apartments | 300 |
| 1,500 m ² retail and visitor centre (400 persons per ha of floor area) | 60 |
| 24 bed hotel (assume 2 persons per bed) | 48 |
| Total Population | 408 |

Applying the Regional Standard for Water Services the ADWF for this population is:

$$\begin{aligned} \text{ADWF} &= 0.0023 \times \text{population} \\ &= 0.0023 \times 408 \\ &= 0.94 \text{ L/sec} \end{aligned}$$

1.1.2 Peak Dry Weather Flow (PDWF)

Applying the Regional Standard for Water Services the PDWF for this population is:

$$\begin{aligned} \text{PDWF} &= \text{ADWF} \times \text{Peaking Factor} \\ &= 0.94 \times 5.8 \\ &= 5.5 \text{ L/sec} \end{aligned}$$

1.1.3 Peak Wet Weather Flow (PWWF)

Applying the Regional Standard for Water Services the PWWF for this population is:

$$\begin{aligned} \text{PWWF} &= \text{PDWF} + \text{PGWF} + \text{PRWF} \\ &= 5.44 + 1.06 + 0.98 \\ &= 7.5 \text{ L/sec} \end{aligned}$$

1.1.4 Design Flows

The peak flow for the high density option is 7.5 L/sec.

1.2 Waste water flows for option 2 (medium density)

1.2.1 Average Dry Weather Flows (ADWF)

The population is assessed to be:

| | |
|--|-----|
| Residential apartments | 200 |
| 1,000 m ² retail and visitor centre (400 persons per ha of floor area) | 40 |
| 24 bed hotel (assume 2 persons per bed) | 32 |
| Total Population | 272 |

Applying the Regional Standard for Water Services the ADWF for this population is:

$$\begin{aligned} \text{ADWF} &= 0.0023 \times \text{population} \\ &= 0.0023 \times 272 \\ &= 0.63 \text{ L/sec} \end{aligned}$$

1.2.2 Peak Dry Weather Flow (PDWF)

Applying the Regional Standard for Water Services the PDWF for this population is:

$$\begin{aligned} \text{PDWF} &= \text{ADWF} \times \text{Peaking Factor} \\ &= 0.63 \times 6.2 \\ &= 3.88 \text{ L/sec} \end{aligned}$$

1.2.3 Peak Wet Weather Flow (PWWF)

Applying the Regional Standard for Water Services the PWWF for this population is:

$$\begin{aligned} \text{PWWF} &= \text{PDWF} + \text{PGWF} + \text{PRWF} \\ &= 3.88 + 1.06 + 0.98 \\ &= 5.9 \text{ L/sec} \end{aligned}$$

1.2.4 Design Flows

The peak flow for the high density option is 5.9 L/sec.

1.3 Waste water flows for option 3 (low density)

1.3.1 Average Dry Weather Flows (ADWF)

The population is assessed to be:

| | |
|---|-----|
| Residential apartments | 100 |
| 500 m ² retail and visitor centre (400 persons per ha of floor area) | 20 |
| Total Population | 120 |

Applying the Regional Standard for Water Services the ADWF for this population is:

$$\begin{aligned} \text{ADWF} &= 0.0023 \times \text{population} \\ &= 0.0023 \times 120 \\ &= 0.3 \text{ L/sec} \end{aligned}$$

1.3.2 Peak Dry Weather Flow (PDWF)

Applying the Regional Standard for Water Services the PDWF for this population is:

$$\begin{aligned} \text{PDWF} &= \text{ADWF} \times \text{Peaking Factor} \\ &= 0.3 \times 7.0 \\ &= 1.9 \text{ L/sec} \end{aligned}$$

1.3.3 Peak Wet Weather Flow (PWWF)

Applying the Regional Standard for Water Services the PWWF for this population is:

$$\begin{aligned} \text{PWWF} &= \text{PDWF} + \text{PGWF} + \text{PRWF} \\ &= 1.9 + 1.06 + 0.98 \\ &= 3.97 \text{ L/sec} \end{aligned}$$

1.3.4 Design Flows

The peak flow for the high density option is 3.97 L/sec.

2. Existing sewer network at the Shelly Bay development site

Currently there is an existing Council owned and operates a sewer pump station at the south end of the Shelly Bay Base.

This pump station pumps waste water from the base through a Council owned and operated 100 mm AC rising main, which discharges into the Council sewer network at the Miramar Cutting.

There is a skeletal network of privately owned sewer mains that drain waste water from existing buildings into a 225 mm pipeline that discharges into the Shelly Bay Pump Station.

The existing sewer network is shown in Figure 13 and Figure 14.

The existing sewer network in the Shelly Bay Base is expected to be abandoned. It is flooded by sea water at high tide – presumably through uncontrolled overflow outlets to the harbour. The arrangement of the sewer pipes is not expected to suit the arrangement of the new development.

Figure 13 Existing sewers servicing the Shelly Bay development site

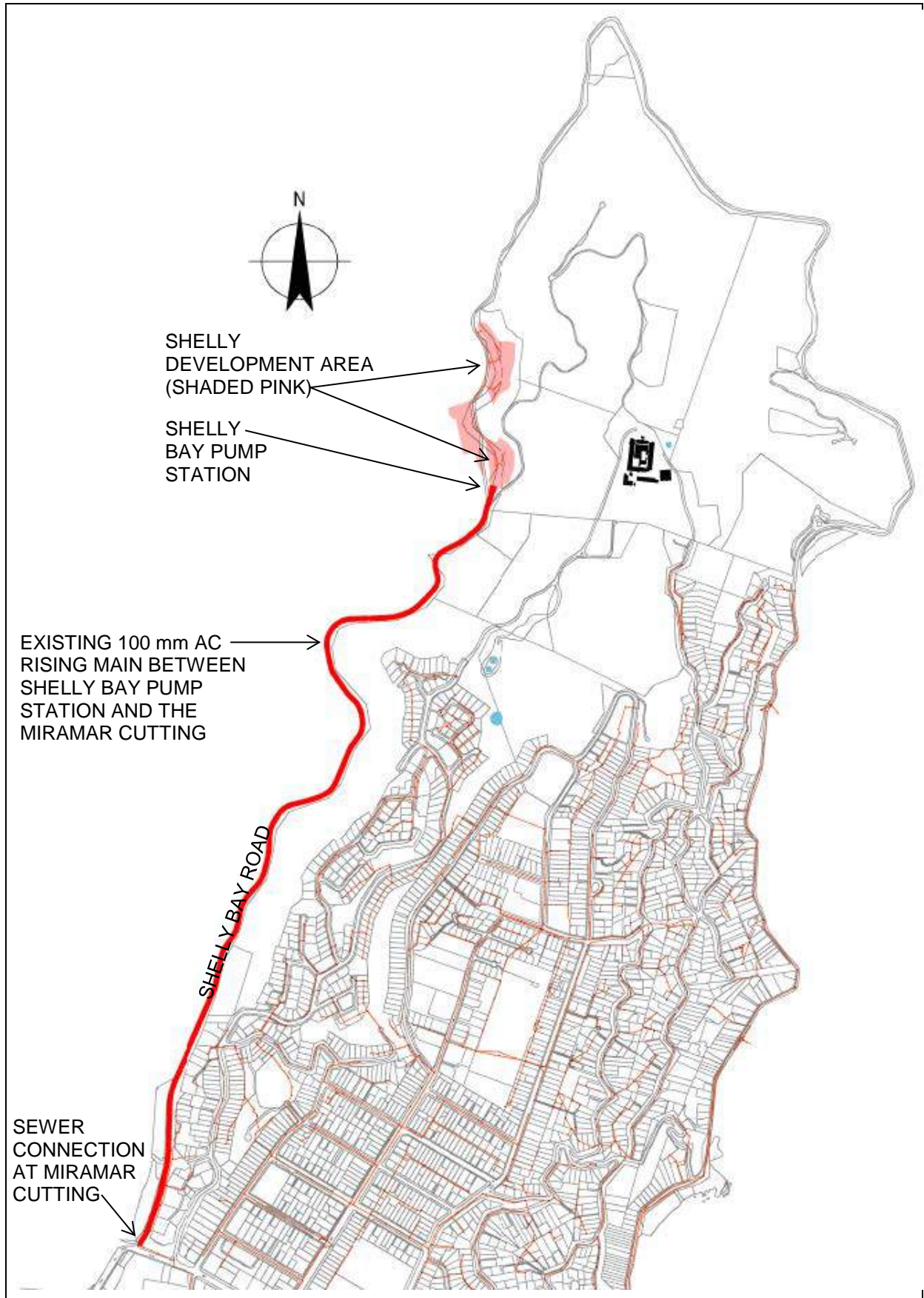
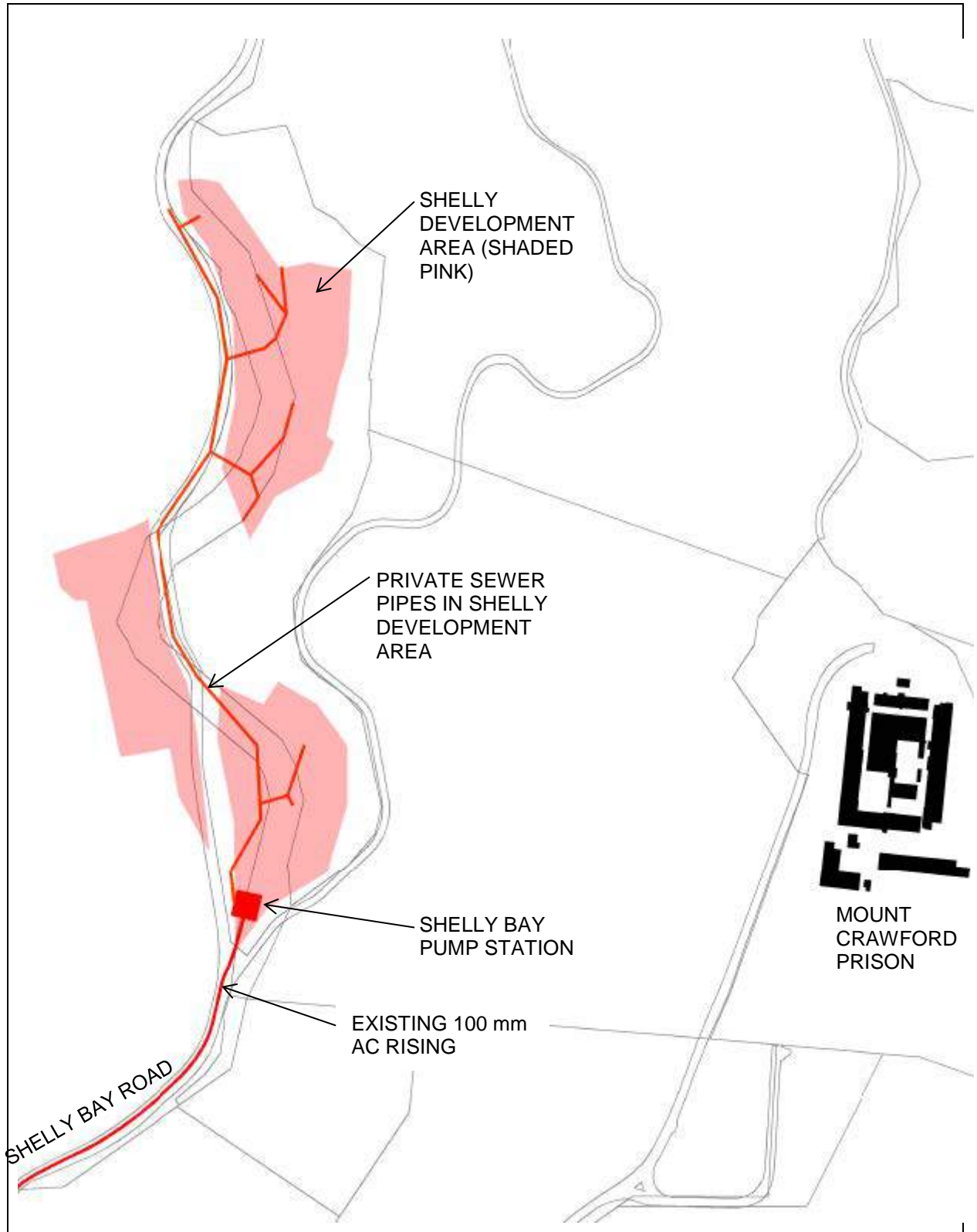


Figure 14 Detail - existing sewers servicing the Shelly Bay development site



The existing rising main will require replacement. It regularly blocks and/or bursts requiring ongoing maintenance. It does not have air relief valves, which are required to control water hammer.

The existing pump station appears to be in satisfactory condition.

3. Options for new waste water network at Shelly Bay

There is only one practical solution to servicing Shelly Bay for waste water. This is to replace the existing pump station and rising main.

The existing pump station has insufficient capacity for the new subdivision options, therefore a new pump station will be required to service the new development.

The only alternative to this is to investigate on-site treatment of waste water and discharge to the harbour. We suggest that Resource Consent for this option will be almost impossible to obtain.

3.1 Final pumping solution

The final pumping solution and rising main diameter cannot be determined at this time because the pumps must be sized to suit the waste water flows of the final development option adopted, and the size of the rising main must be matched to the pump curve of the pumps chosen.

It is however possible to give some guidance on the probably size of the rising main

The rising main is approximately 2,600 m long. It is important that:

- flow velocities are sufficient to ensure re-entrainment of solids which settle out of suspension when pumping stops
- waste water detention times in the rising main are as short as possible to reduce the effect of corrosion to the receiving sewer, and odour, due to the waste water becoming anaerobic (which occurs when the age of the waste water reaches approximately 8 hours)
- the diameter of the rising main is large enough that the head loss across the main does not exceed 60 m (sewer pumps pump around 35 m head and some can pump up to 70 m head)

3.2 Network sewer mains at Shelly Bay Base

We note that network mains are excluded from this brief and these will be the responsibility of the developer.

We suggest in Shelly Bay that a trunk main be constructed that collects flow from all the network mains and discharges this into the pump station. This would be a Council asset.

The installation of a trunk sewer allows for a larger pipe that can be laid at a flatter grade than smaller network pipelines. This results in a much flatter overall network, which in turn reduces the depth of the wet well at the pump station. For example if a small diameter (150 mm) pipe was laid, at minimum grade, from the extreme northern end of the site to the pump station it would require a 4.5 m fall. A larger 300 mm pipe laid at minimum grade over the same alignment would only require a 1.8 m fall.

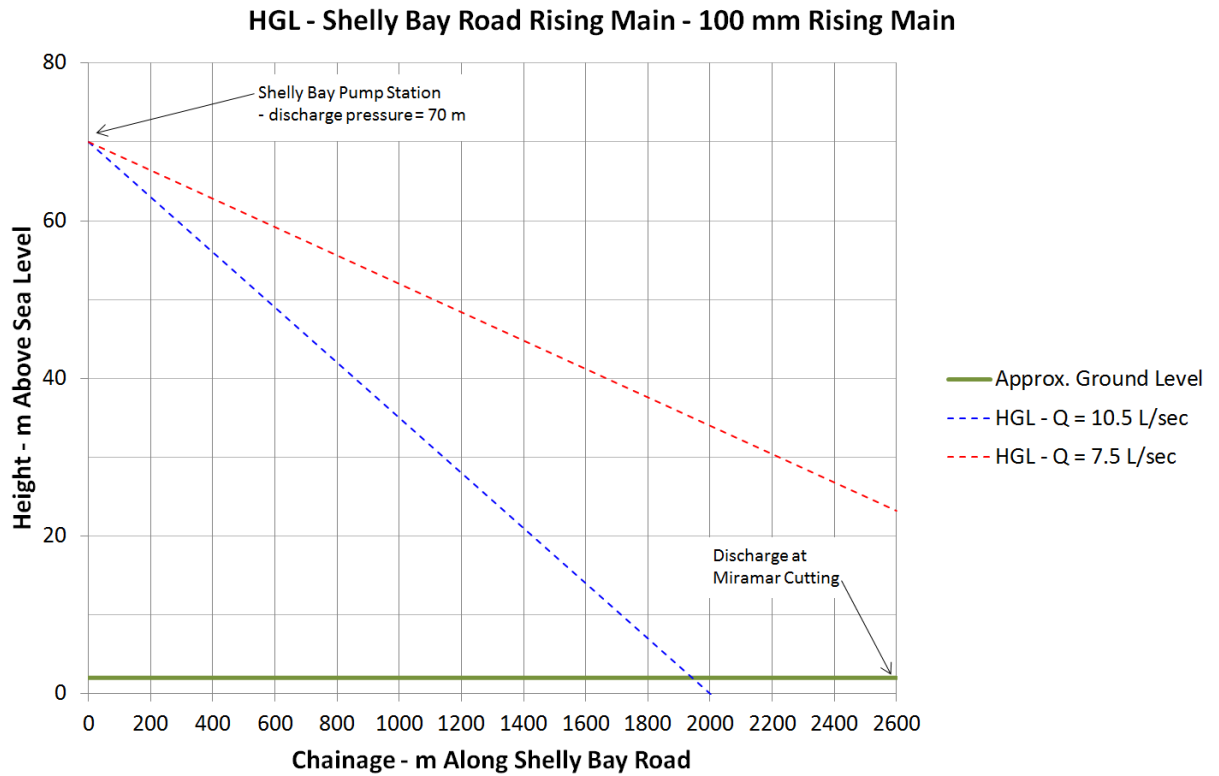
We have estimated the cost of a 225 mm main laid to grade along the length of the Shelly Bay base to collect flow from the future network.

3.3 Sizing of Rising Main

If we consider a design flow of 7.5 L/sec (PWWF) the pump flow must exceed this.

The HGL chart (below) for a 100 mm rising main shows that this pipeline does not have sufficient capacity.

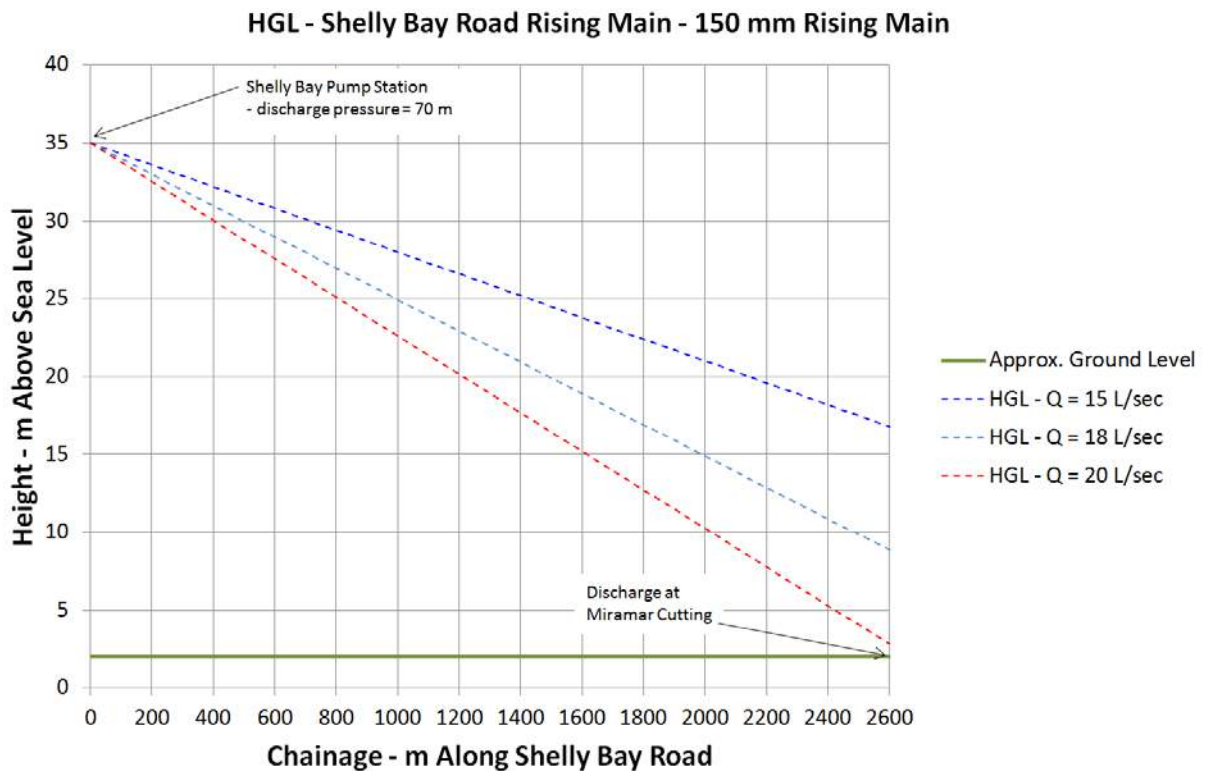
The Hydraulic Grade Line for a flow rate of 10.5 L/sec drops below the datum line.



The HGL chart (below) for a 150 mm rising main suggests a 150 mm pipeline will be suitable.

It should be noted that the flow velocity in a 150 pipeline is 1 m/sec, which is slightly too slow to achieve slime shear.

Until the final flows and wet well capacity is confirmed during detailed design, the age of the waste water at the discharge cannot be determined. We suspect water age may be a problem and odour control will be required at the discharge.



4. Cost estimates

We have estimated the cost for:

- Constructing the new Shelly Bay Road rising main
- Constructing a new Shelly Bay pump station
- Constructing a trunk sewer flowing into the pump station

No allowance has made for the cost to construct the normal sewer network that will gravity flow waste water into the trunk main.

Assumptions

The Shelly Bay Road rising main shall be a 180 mm (150 NB) PE100 SDR11 pipeline.

The Council owned collector sewer shall be a 225 mm PVC SN8 pipe.

The wet well capacity shall be 100 m³ to provide 4 hours PDWF emergency storage plus operating volume as required by the Regional Standard for Water Services. Maximum depth of wet well to be approximately 3 m.

We have assumed 6 air relief valves will be fitted to the rising sewer for water hammer control and to vent trapped air at high points.

Table 8 Estimated cost of Shelly Bay Road rising sewer

| Item | Quantity | Rate | Estimated Cost |
|--|----------|-------------|---------------------|
| 180 mm PE100 SDR11 pipe | 2,600 m | 35 \$/m | \$ 91,000 |
| PE welding and QA testing – assume 220 welds | 220 each | 180 \$/ea | \$ 39,600 |
| Trench and lay pipe (at depth sufficient for air valves) | 2,600 m | 290 \$/m | \$ 754,000 |
| Supply and install air valves | 6 each | 2,800 \$/ea | \$ 16,800 |
| Supply and install chambers for air valves (chambers to be drained) | 6 each | 3,500 \$/ea | \$21,000 |
| Reinstate sealed carriageway | 2,600 m | 60 \$/m | \$ 156,000 |
| Commissioning (split main into 4 sections for testing) | 4 each | 2,000 \$/ea | \$ 8,000 |
| Connection at pump station (assume pump station not operational yet) | 1 each | 2,400 \$/ea | \$ 2,400 |
| Cut-in at Miramar Cutting | 1 each | 3,800 \$/ea | \$ 3,800 |
| 10% Contingency | 1 LS | | \$ 110,000 |
| Total Estimated Cost | | | \$ 1,202,600 |

Table 9 Estimated cost of Shelly Bay pump station

| Item | Quantity | Rate | Estimated Cost |
|---|----------|--------------|-------------------|
| Wet well assume 8 m x 4 m x 3 m deep | LS | | \$ 120,000 |
| Pumps | 3 each | 36,000 \$/ea | \$ 108,000 |
| Pipework | LS | | \$ 8,000 |
| Mechanical install | LS | | \$ 20,000 |
| Switch board | 1 each | 32,000 \$/ea | \$ 32,000 |
| Switch board cabinet | 1 each | 8,000 \$/ea | \$ 8,000 |
| Electrical install | LS | | \$ 7,000 |
| Power supply connection (assume power is to site) | 1 each | 5,000 \$/ea | \$ 5,000 |
| Ventilation and odour control | LS | | \$ 8,000 |
| SCADA control | 1 each | 5,000 \$/ea | \$ 5,000 |
| SCADA comms | 1 each | 3,500 \$/ea | \$ 3,500 |
| Commissioning | 1 each | 2,000 \$/ea | \$ 2,000 |
| 10% Contingency | 1 LS | | \$ 35,000 |
| Total Estimated Cost | | | \$ 361,500 |

Table 10 Estimated cost of 225 trunk sewer

| Item | Quantity | Rate | Estimated Cost |
|--|----------|-------------|-------------------|
| 250 mm (225 NB) PE100 SDR11 pipe | 400 m | 45 \$/m | \$ 18,000 |
| PE welding and QA testing – assume 33 welds | 33 each | 180 \$/ea | \$ 5,940 |
| Trench and lay pipe 1 m to 1.5 m depth | 200 m | 400 \$/m | \$ 80,000 |
| Trench and lay pipe 1.5 m to 2.5 m depth | 200 m | 600 \$/m | \$ 120,000 |
| Supply and install manholes | 6 each | 3,500 \$/ea | \$ 21,000 |
| Reinstate sealed carriageway | 400 m | 60 \$/m | \$ 24,000 |
| Commissioning | 1 each | 2,000 \$/ea | \$ 2,000 |
| Connection at pump station (assume pump station not operational yet) | 1 each | 1,800 \$/ea | \$ 1,800 |
| 10% Contingency | 1 LS | | \$ 30,000 |
| Total Estimated Cost | | | \$ 302,740 |

5. Summary and conclusions

5.1 Existing sewer mains

It is expected that the existing sewer mains in the Shelly Bay site will be renewed as part of the development to suit the flows and locations of the buildings in the final development.

5.2 Existing pump station and rising main

The existing pump station will not have sufficient storage capacity to comply with the Regional Standard for Water Services and will require replacement.

The rising sewer is past the end of its serviceable life. It is being regularly repaired and maintained, and requires replacement. The final pumping solution for Shelly Bay will probably require a 150 mm NB rising main.

5.3 New trunk sewer

We have included as part of Council's infrastructure a 225 mm trunk sewer which will collect flows from all the network sewers and discharge these into the pump station.

We have assumed this trunk sewer runs the length of the development. By installing this trunk sewer we hope the overall network will be flatter, which will reduce the depth of the pump station wet well.

5.4 Cost Estimates

The estimated cost to construct a new 150 mm NB PE rising sewer main in Shelly Bay Road is \$1,202,600 plus GST.

The estimated cost to construct a new pump station at Shelly Bay is \$361,500 plus GST.

The estimated cost to construct a new 225 mm trunk main at Shelly Bay is \$291,940 plus GST.

SECTION FIVE

Stormwater at Mount Crawford Prison Site

1. Stormwater requirements for the Mount Crawford Prison site

1.1 Existing stormwater

Currently the Mount Crawford site has no, or very limited, stormwater infrastructure.

Prison flows appear to be discharged onto Main Road.

Surface flows from other areas are uncontrolled and flow into natural water courses which flow through the Shelly Bay site to the harbour.

Surface flows in upper Nevay Road are controlled by water tables and dish channels. Some of these discharge into the valley below the Prison and some presumably discharge into the Council stormwater further down Nevay Road.

Surface flows on Main Road are controlled by water tables and shallow dish channels, which discharge into the natural water courses which flow through the Shelly Bay site to the harbour.

There does not appear to be any underground stormwater pipelines, except for culvert pipes that cross Main Road and discharge to the environment.

1.2 Stormwater requirements

The majority of the site generally slopes to the south-west and most of the stormwater flows are expected to be carried down Main Road and from stormwater infrastructure below Main Road.

The Council stormwater in Akaroa Drive (which would receive flows from Main Road) has not been sized to carry the stormwater flows from the development site.

We suggest the only practical stormwater solution is to discharge stormwater into the natural drainage courses, already draining the site, which flow through the Shelly Bay site to the harbour.

We note some of these streams are piped through culverts at Shelly Bay and some of them are not. The development of the Prison site will increase the runoff coefficient, which will increase the peaking factor of the flow in the culverts, requiring these be up-sized.

2. Options for stormwater at Mount Crawford site

There is a single practical option to discharge stormwater flows to the harbour via the natural drainage courses. This is to construct culverts that run under Main Road that collect stormwater flows from the developed stormwater network and discharge into the head of the natural water courses flowing down to Shelly Bay.

There are three natural water courses below the development site and we have assumed that the stormwater flows can be reasonably evenly distributed across all these water courses so that any one water course is not overloaded.

We note that the final decision on what option is adopted depends on the outcome of the resource consent process. We have no control over this process and have provided cost estimates for both options.

3. Sizing of the stormwater system

The development site is relatively compact with a maximum length of flow path around 200 m. Therefore the time of concentration is going to be fairly short and we suggest it will be around 10 minutes.

An intensity of 59.4 mm/hr applies to a 10 year event.

The stormwater flows in each culvert (from the rational method) is approximately 0.5 m³/sec.

Assuming a grade of 1 in 200 across main road the culvert pipes are expected to be 675 mm.

4. Cost estimates

We have estimated the cost for constructing three new culverts across Main Road.

These culverts each collect approximately 1/3rd of the stormwater flows from entire development area.

Assumptions

Entrance to the culvert would be by manhole.

Discharge from the culvert would be by wing wall into a dish channel.

There would be a section of dish channel to direct flow into the stream bed.

Assume each culvert is approximately 20 m long.

Table 11 Estimated cost of stormwater culverts at Mount Crawford site

| Item | Quantity | Rate | Estimated Cost |
|---|----------|--------------|-------------------|
| 675 mm concrete pipe culverts (3 x 20 m long) | 60 m | 800 \$/m | \$ 48,000 |
| 1200 manhole entrance | 3 each | 10,000 \$/ea | \$ 30,000 |
| Wing wall on outlet | 3 each | 5,000 \$/ea | \$ 15,000 |
| Reinstate sealed carriageway | 20 m | 60 \$/m | \$ 1,200 |
| 10% Contingency | 1 LS | | \$ 10,000 |
| Total Estimated Cost | | | \$ 104,200 |

5. Summary and conclusions

5.1 Existing stormwater mains

There is no stormwater infrastructure at the Prison site.

Most of the infrastructure required will be network pipes installed by the developer.

5.2 Discharge of stormwater

The existing Council infrastructure below the Prison site has not been design to carry stormwater flows from the development site.

It will be necessary to discharge stormwater from the site directly into harbour, though Shelly Bay.

This will require constructing three culverts to channel flow from the stormwater network into the head of natural drainage courses that cross the Shelly Bay site.

5.3 Cost Estimates

The estimated cost to construct three 675 mm culverts across Main Road is \$104,200 plus GST.

SECTION SIX

Storm Water at Shelly Bay Site

1. Stormwater requirements at Shelly Bay

The Shelly Bay site borders the harbour and it is expected that any stormwater network constructed as part of the development will discharge directly into the harbour. There would be no cost to Council to construct this, as this work would reasonably be completed by the developer.

1.1 Existing culvert pipes at Shelly Bay

There is however at least two existing culvert pipes that collect flows from the streams coming down from the Prison site and pipe these flows under the existing Shelly Bay Base. These culverts discharge directly into the harbour.

Because of work done to develop the Prison site it is likely that the flows in these culverts will peak at a higher flow than is currently experienced.

The existing culverts are small (around 375 mm) and would comply with Councils current requirements.

At least one culvert pipe passes beneath existing buildings and a significant retaining wall. The cost to replace this culvert will be significant.

The final replacement option for this culvert will depend on whether the existing buildings over it will be retained, or if new buildings are planned to be built over it. The current Council requirements state that buildings must not be constructed over pipelines, and it may be more practical to renew this culvert on a new alignment.

2. Sizing the new stormwater culverts

There are records of the existing stormwater culverts. The outlet that we have identified on-site is a 375 mm pipe.

Until detailed hydrology is completed and a detailed plan is developed for the Prison site, re-sizing these culverts is difficult.

However for the purposes of estimating the cost to replace these culverts we have assumed that new pipe will be at least 750 mm.

3. Cost estimates

We have estimated the cost for constructing two new culverts crossing the Shelly Bay site.

Assumptions

Entrance to the culvert would be by new wing wall structure.

Discharge from the culvert would be through the sea wall.

The alignment of the culvert would be around existing or proposed buildings.

The straight line length is estimated to be 80 m and assume the culvert is approximately 100 m long.

The culvert size is 750 mm.

Changes in direction around buildings is by manhole. Assume 6 changes of direction.

Installation beneath retaining walls is by removing and reinstating the retaining wall. This may be amended following structural inspection of the retaining wall.

Table 12 Estimated cost of identified culvert at Shelly Bay

| Item | Quantity | Rate | Estimated Cost |
|---|----------|--------------|-------------------|
| 750 mm concrete pipe | 80 m | 1,200 \$/m | \$ 96,000 |
| 750 mm concrete pipe under retaining wall (deep descending section) | 20 m | 2,200 \$/m | \$ 44,000 |
| Support ground where wall removed | LS | | \$ 60,000 |
| Remove and reinstate retaining wall | LS | | \$ 60,000 |
| Manholes at change of direction (1,200 dia) | 6 | 10,000 \$/ea | \$ 60,000 |
| Wing wall entrance | 1 each | 10,000 \$/ea | \$ 10,000 |
| Outlet through sea wall | 1 each | 5,000 \$/ea | \$ 5,000 |
| Reinstate sealed carriageway | 20 m | 60 \$/m | \$ 1,200 |
| 10% Contingency | 1 LS | | \$ 35,000 |
| Total Estimated Cost | | | \$ 371,200 |

Table 13 Estimated cost of unidentified culvert at Shelly Bay

| Item | Quantity | Rate | Estimated Cost |
|---|----------|--------------|-------------------|
| 750 mm concrete pipe | 60 m | 1,200 \$/m | \$ 72,000 |
| Manholes at change of direction (1,200 dia) | 2 | 10,000 \$/ea | \$ 20,000 |
| Wing wall entrance | 1 each | 10,000 \$/ea | \$ 10,000 |
| Outlet through sea wall | 1 each | 5,000 \$/ea | \$ 5,000 |
| Reinstate sealed carriageway | 20 m | 60 \$/m | \$ 1,200 |
| 10% Contingency | 1 LS | | \$ 10,000 |
| Total Estimated Cost | | | \$ 118,200 |

4. Summary and conclusions

4.1 Existing stormwater mains

There is existing stormwater infrastructure currently servicing the existing buildings at the Shelly Bay site.

Any stormwater infrastructure required by the new development will be installed by the developer, as this will be stormwater network pipe and not Council infrastructure.

4.2 Existing culvert pipes

There is at least one culvert that pipes a stream through the Shelly Bay site.

It is suspected that there is another culvert that could not be identified on-site, or from records.

These culverts do not meet current Council requirements. The peak flow in these culverts will be increased by development work at the Prison site, and these culverts will require replacement.

The alignment of new culverts should not pass below buildings. It is expected that one culvert will still pass beneath a retaining wall.

4.3 Cost Estimates

The estimated cost to renew the culvert identified on site is \$371,200 plus GST.

The estimated cost to replace the second culvert not positively identified on site is \$118,200 plus GST. This assumed alignment of this culvert is shorter and simpler than the culvert identified on-site.

SECTION SEVEN

Other Services

1. Introduction

Gas (Powerco), telecommunications (Chorus) and electricity (Wellington Electricity) suppliers were contacted and the following information was requested from them:

- Current presence, capacity and condition of infrastructure including current usage level and spare capacity if any
- The estimated capacity of utilities required to accommodate the 3 theoretical development scenarios for each one of the two sites
- Estimated cost of upgrades required to serve 3 theoretical development scenarios for each one of the two sites.

The information we received from the suppliers varied in level of detail.

2. Gas

2.1 Shelly Bay

The proposed subdivision in Shelly Bay currently has no gas infrastructure and would require an approximate investment of \$1,100,000 to reticulate gas to the Shelly Bay development site.

All three scenarios would require approximately 2,940 metres of 100 mm NB PE80 gas main to be laid in the carriageway along Shelly Bay Road.

The pipeline route would traverse property requiring the creation of easements.

Powerco's alignment requires that the pipe be laid through a forested slope which would be high cost.

2.2 Former Mount Crawford Prison Site

The existing network is capable of supplying the three scenarios in this area including hot water to all houses.

However if the house numbers exceed the scenarios provided and more gas is required, then a more complex, network upgrade, solution would be required. This is due to the capacity of the existing 50 mm NB gas main in Seatoun.

2.3 House Connections

The cost for the homes to connect to natural gas is dependent on the uptake of gas and the design of the development.

For detached homes, Powerco offer a free service connection up to 40 metres from the main when installing hot water or central heating.

For an apartment type scenario Powerco will assist in the design and installation of gas reticulation and metering for the proposed apartment development. Powerco can supply a new service connection from the main to the building. The cost/if any of the connection is dependent on the level of uptake and demand required by the apartments.

3. Telecommunications

3.1 Shelly Bay

The proposed subdivision area has fibre availability. Therefore, any services required at this site would be available.

Chorus advise the rate to connect apartments, retail sites, cafés or hotel rooms to the existing fibre network is approximately \$900.00 excluding GST per connection.

This cost would be part of the developer's costs and we have not included these connection costs in our estimate.

3.2 Former Mount Crawford Prison Site

The proposed subdivision area has fibre availability. Therefore, any services required at this site would be available.

Chorus advise the rate to connect apartments, retail sites, cafés or hotel rooms to the existing fibre network is approximately \$900.00 excluding GST per connection.

This cost would be part of the developer's costs and we have not included these connection costs in our estimate.

4. Electricity

Wellington Electricity confirms that the existing network cannot support any of the scenarios for both Shelly Bay and the former Mount Crawford Prison site.

Wellington Electricity has provided high level cost information regarding the electricity requirements for the new subdivisions.

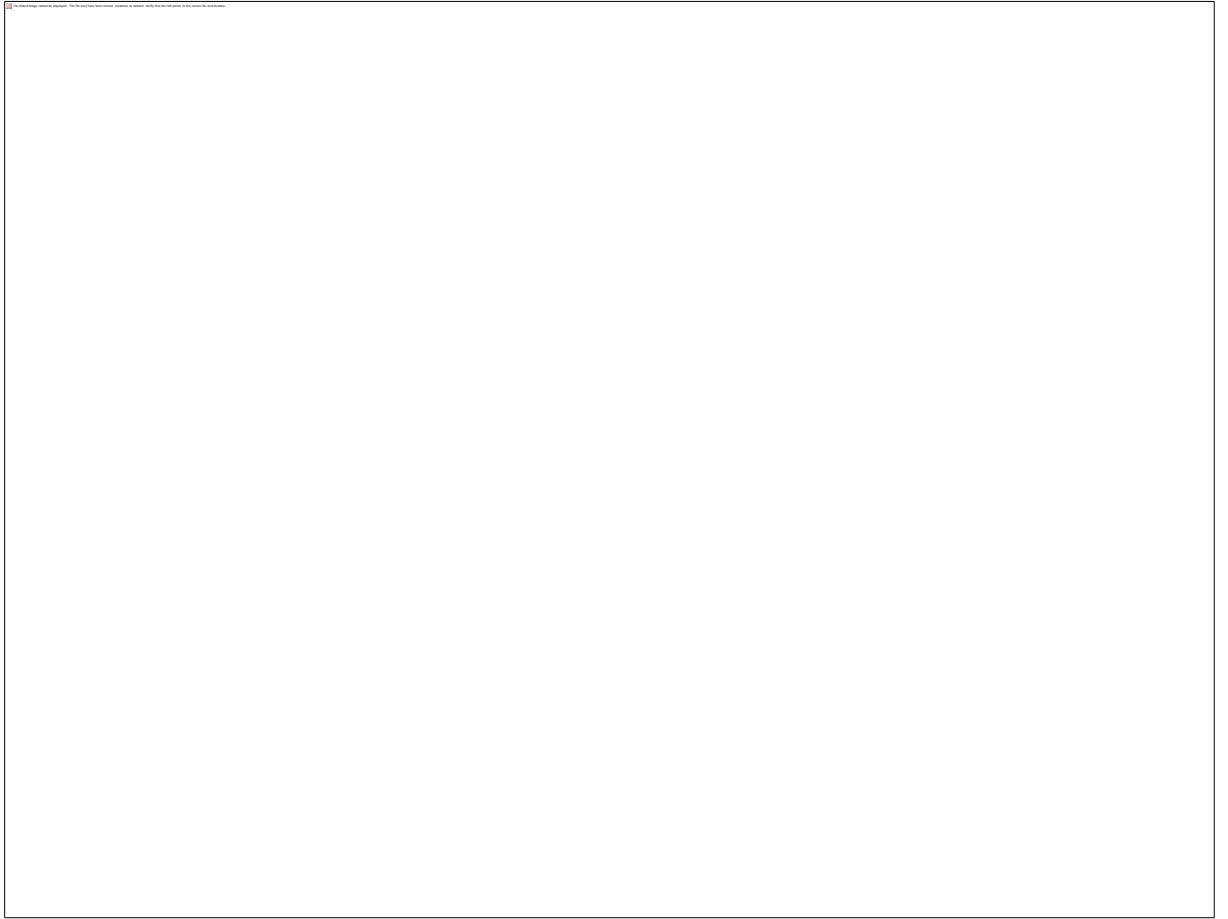
To provide a network that will support the proposed subdivision scenarios, new infrastructure will be required. New infrastructure required includes a new feeder, switchgear, canopy type substation and transformers.

The works required for the Shelly Bay site are considerably more extensive than the works required at Mt Crawford.

The approximate costs for each of the subdivision sites are:

- Shelly Bay - \$3,500,000
- Mt Crawford - \$300,000

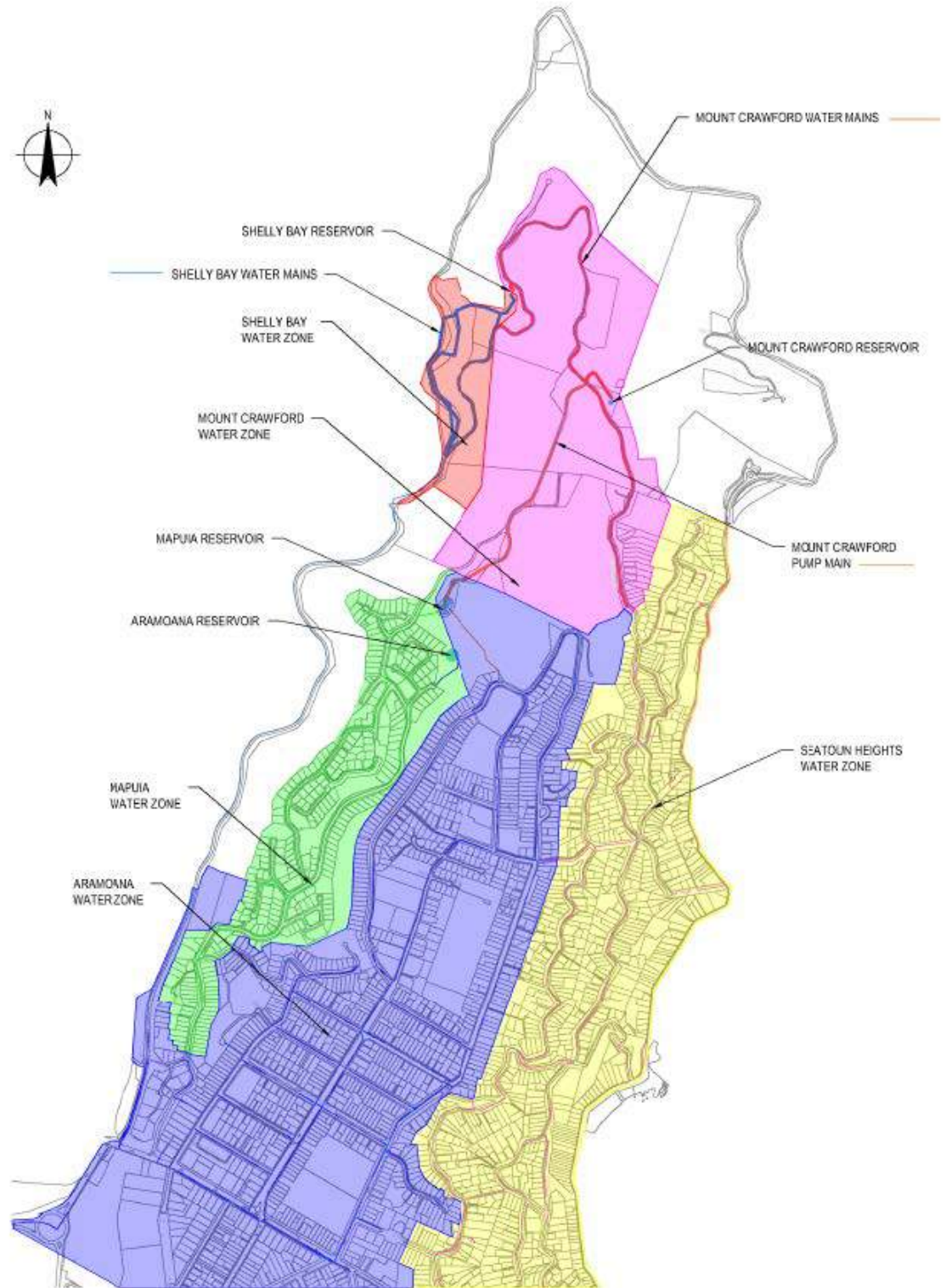
Wellington Electricity stress that these are high level cost estimates and if the development proceeds they will provide a more detailed design and cost estimate at that time.



Appendices

Appendix A – Water Supply to Miramar Peninsular

Schematic Drawing



EXISTING WATER ZONES IN MIRAMAR PENINSULAR



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Level One, 75 The Esplanade

Petone, Lower Hutt 5012

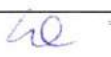

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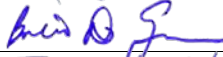

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QUALITY ASSURANCE STATEMENT

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DOCUMENT REVISIONS

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APPENDICES

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Declaration:

Much of the information contained in this report has been sourced from investigations completed by Calibre Consulting in assessing the costs of providing bulk infrastructure services to Shelly Bay. Those investigations form part of a separate report for Wellington City Council. Calibre Consulting has also been engaged by the developer to provide initial land surveying expertise to assist with the subdivisional aspects of the proposal.

1 PURPOSE

The purpose of this report is to confirm the ability of the Shelly Bay development site to be appropriately serviced.

2 BACKGROUND & METHODOLOGY

The Wellington Company is preparing a resource consent application for the proposed development of the Shelly Bay site. Schematic plans of the proposed development are attached as Appendix A.

In December 2015 the Shelly Bay site was announced as a Special Housing Area (SHA). For the Council to grant any resource consent under the Housing Accords and Special Housing Areas Act 2013 (the Act) the ability of the development site to be appropriately serviced needs to be considered. Details of the consideration required can be found in section 34 of the Act. An excerpt from the Act is included in Appendix B.

The Act refers to “sufficient and appropriate infrastructure” on several occasions. This phrase has been determined to mean services (such as access, drainage and utilities) that could reasonably be expected to be provided in an urban situation, in a manner and to a standard that would generally be satisfactory to the general public.

To satisfy the Council that “sufficient and appropriate infrastructure” is available or achievable for the proposed development the following steps have been completed:

- Determining the scale and standard of services required
- Assessment of the existing infrastructure
- Considering and developing options for upgrade or replacement of services as required
- Confirming the feasibility and fit of the proposed services

3 SUMMARY

Sufficient and appropriate infrastructure is in place, or can reasonably be provided, to support the proposed development of the Shelly Bay area.

The provision of suitable access, drainage and utility services can be achieved using standard civil engineering design and construction methodologies. Relevant authorities and service providers are satisfied that the development site can be adequately provided for. Fanciful, untested or cost-prohibitive solutions are not required to appropriately service the development.

4 INFRASTRUCTURE

4.1 ACCESS

Based on the proposed number of residential units, Shelly Bay Road would fall under the designation of Collector Road. In a normal “greenfield” situation this would require a carriageway width of 14m plus 8m of footpaths and berms, making 22m in total. Constructing a road to this standard is not feasible due to the cliff face along one side of the road and the sea wall and harbour on the other. Upgrading the current carriageway to fully meet the guidelines of the Council’s Codes would serve to urbanise the road and may have adverse effects overall.

The Council has indicated their expectations for the level of service required by Shelly Bay Road to provide access to the developed site. Calibre has also assessed the level of infrastructure considered necessary to service the proposal. The final design and specifics of the access road will however be confirmed as a result of the overall planning and detailed engineering design processes.

The proposed traffic lanes are consistent for the various options at a minimum carriageway width of 6.0m (two 3m moving lanes). The variations are predominantly around footpath/cycle lane provision and the extent of roadside parking.

The primary function of the route will be to “move”, so only needs to have traffic lanes and appropriately allow for pedestrian/cycle traffic. There is limited need for berm or other parking along the route. Parking on the harbour side of the carriageway is readily available in some places along the route, but will require substantial construction at other points.

A 1.0-1.5m wide pedestrian/cycle lane has been allowed for as a minimum requirement, with additional width the subject of potentially significant construction works. Preliminary investigations and some conceptual design work have been completed to assess the current layout’s ability to accommodate this allowance. In general it is expected that the existing road alignment can largely accommodate a 6.0m carriageway plus 1-1.5m pedestrian/cycle corridor, without need for significant structural works or creating large scale environmental impacts. Sketches indicating the ability of the alignment to accommodate this combined 7-7.5m width are attached in Appendix C.

The final design will need to be a balance between technical requirements and guidelines and retention of the existing natural character and amenity of the coastal route.

Notwithstanding the above the various options and alternatives will all provide roading infrastructure that will adequately service the scale of the development proposed. Whilst the finished result may not be fully compliant with standard Code of Practice requirements or 100 percent satisfactory to all parties, it will be of a scale and standard that sufficiently and appropriately caters for the development proposal.

4.2 WATER SUPPLY

Based on the expected population that will be generated by the development the water supply needs have been determined. The current infrastructure is considered to be in poor condition and grossly undersized. Consultation with Wellington Water Limited (WWL) confirmed that a new reservoir and related watermain infrastructure would be required to service this level of development. The major components of the capital works are a new reservoir (Shelly Bay), replacement of the pipeline between the Mt Crawford and Shelly Bay reservoirs, replacement of the pipeline from Shelly Bay reservoir and local reticulation.

There is considerable upgrading work needed to provide the level of service required for the proposal. The provision of a new reservoir and related pipelines is however fairly standard practice for a development at the scale of this proposal. The final details and specifications are yet to be determined, but in consultation with WWL the solutions comprise standard practice subdivisional engineering works, and are not considered unusually onerous or containing unexpected levels of risk.

The proposed infrastructure is considered to adequately meet or comply with the relevant standards for developments of this nature, and will provide sufficient and appropriate water supply infrastructure for the proposal.

4.3 WASTEWATER

The necessary wastewater drainage capacity was calculated using the Regional Standard for Water Service and the expected population generated by the development. The existing pipework was determined to be in such a condition as to be unable to cope with increased flows, and there were also issues with the size of the existing gravity feed to the existing pump station.

Consultation with WWL determined that a new wastewater pump station and rising main would be required to service the development. Due to uncertainty regarding the capacity of the existing downstream wastewater infrastructure it was determined that the new rising main would need to be extended so as to connect to the pump station in Salek Street, Kilbirnie. The major components of the capital works are a new wastewater pump station, a new rising main to the Salek Street pump station and local reticulation.

The Salek Street pump station is approximately 3.5km from the development site. Connection to this pump station will require construction of the new pipe alignment along busy roads (including SH1) and through or around large road intersections. Whilst these matters add complexity and cost to the requirements the actual logistics of the construction are within standard operating procedures for this manner of work.

The internal drainage network for the development site will also need to be designed. This will service the individual sites and connect to the public infrastructure or “mains”. The infrastructure design has allowed for the local reticulation. The design of any local reticulation is however subject to the details of the land use proposal and subsequent detailed engineering design.

The proposed infrastructure is considered to adequately meet or comply with the relevant standards for developments of this nature, and will provide sufficient and appropriate wastewater drainage infrastructure for the proposal.

4.4 STORMWATER

Current stormwater disposal for the site is via several discharge points directly feeding into Shelly Bay. Along the access to the site (Shelly Bay Road) there are several additional discharge points from the road directly to the harbour. Given the coastal nature of the site and the access road this is the logical arrangement. Current requirements for disposal, the protection of the coastal environment, discharge specifics and pollutant treatments are considered to be beyond the existing infrastructure.

The proposed development of the site and Shelly Bay Road will require upgrades and/or additions to the current discharge situation. New outfall structures have provisionally been allowed for to service the site and the upgraded Shelly Bay Road. Details of the locations and specifications for the outfalls will need to be confirmed and consented through both Wellington City and Regional Councils.

An internal stormwater network will also need to be designed for the development. This will service individual sites and allow rainfall and sub-surface runoff from above the site to be controlled through the site. The internal network design effectively comprises the positioning and sizing of appropriate catchment (sumps, raingardens etc) and distribution (pipework) networks. These are standard and expected matters for all land development proposals. The discharge points will be designed to allow for this internal network, in addition to the existing stormwater disposal.

The required infrastructure will allow for the sufficient and appropriate drainage of stormwater into, within and thorough the site, along with the appropriate and controlled disposal into the harbour.

4.5 POWER

Wellington Electricity is the infrastructure provider for power services in the Shelly Bay area. Wellington Electricity has assessed the proposal for their likely power servicing requirements. Based on the load proposed the required transformer capacity has been calculated. Upstream reinforcement work would be required to supply the development, and potentially three substations would be required. Wellington Electricity did not raise any issues or concerns regarding their ability to appropriately service the development as proposed.

4.6 TELECOMMUNICATIONS

Chorus Network Services (Chorus) is an infrastructure provider for telecommunication services in the Shelly Bay area. Chorus has confirmed that they will be able to provide telephone reticulation for the proposed development. Chorus' undertakings include the network design, supply of telecommunications specific materials and supervising installation. Chorus did not raise any issues or concerns regarding their ability to appropriately service the development as proposed.

4.7 GAS SUPPLY

PowerCo is an infrastructure provider for reticulated gas services in the Shelly Bay area. PowerCo has assessed the development proposal and determined their likely requirements. They have determined that the development would require the installation of approximately 2.9km of gas main in Shelly Bay Road. Depending on the uptake and investment required for the infrastructure the installation may utilise trenching from other services and be completed through a competitive tendering process.

Reticulated gas is not considered a core infrastructure requirement for new developments. If required for the Shelly Bay proposal PowerCo has indicated that supply to the development is feasible. Any reticulated gas supply would therefore be provided to sufficiently and appropriately service the development.

4.8 OTHER INFRASTRUCTURE

The Shelly Bay proposal also includes the potential for options such as a cable car and passenger ferry terminal. These options will potentially add to the amenity values of the area, but are not seen as key to supporting the feasibility of any development. The Act requires the consideration of “*sufficient and appropriate infrastructure*”, and matters such as cable cars and passenger ferries are considered outside of this definition.

5 PLANNING ASSESSMENT

The above details have been provided to allow the Council to appropriately assess the pending application for resource consents at Shelly Bay. Section 34 (2) of the Act states that the Council must not grant consent “*unless it is satisfied that sufficient and appropriate infrastructure will be provided to support the qualifying development*”. Section 34 (3) details the considerations that the Council must make.

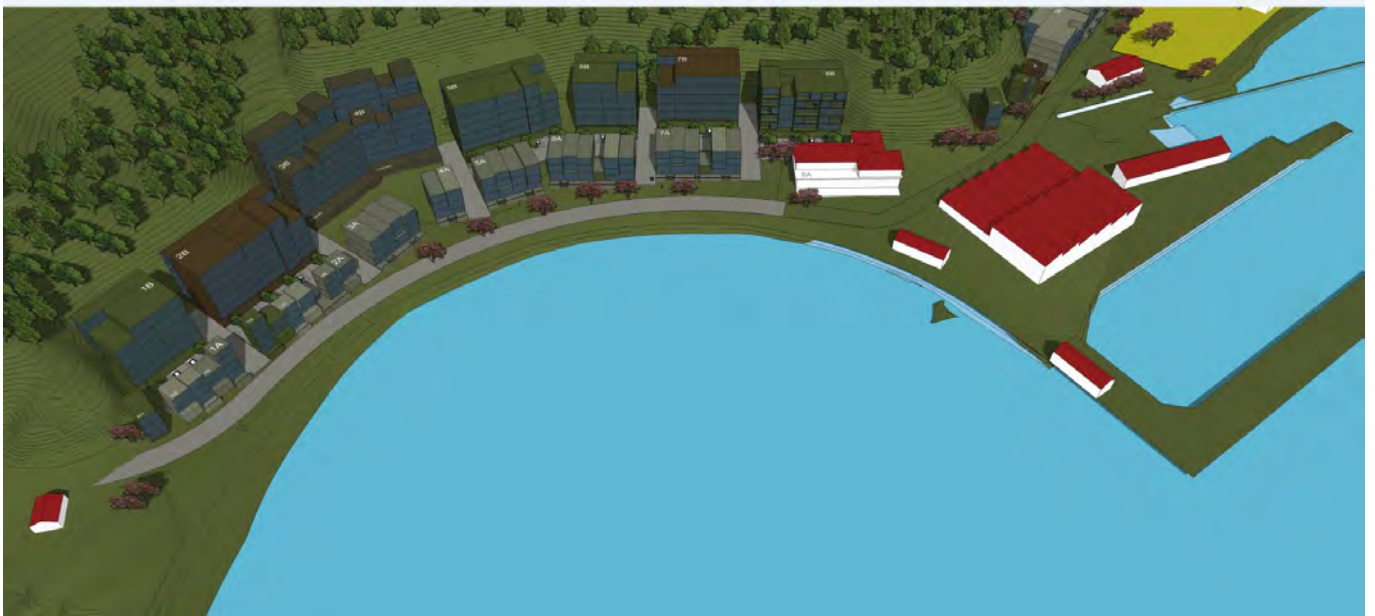
The proposed infrastructure will be designed and constructed so as to be fully compatible with the existing infrastructure - s34(3)(a). As part of the detailed design process the Council’s satisfaction as to the proposal’s compliance with the applicable Codes and Standards will be obtained – s34(3)(b). Downstream investigations have been undertaken to ensure that the capacity of the proposed and existing infrastructure is sufficient to support the development proposal – s34(3)(c).

APPENDICES

APPENDIX A SCHEMATIC PLANS OF THE PROPOSED DEVELOPMENT OF SHELLY BAY



AERIAL VIEW – SOUTH BAY



AERIAL VIEW – NORTH BAY

APPENDIX B EXCERPT FROM THE HOUSING ACCORDS AND SPECIAL HOUSING AREAS ACT 2013

Decisions on applications and commencement of resource consents

34 Consideration of applications

- (1) An authorised agency, when considering an application for a resource consent under this Act and any submissions received on that application, must have regard to the following matters, giving weight to them (greater to lesser) in the order listed:
- (a) the purpose of this Act;
 - (b) the matters in Part 2 of the Resource Management Act 1991;
 - (c) any relevant proposed plan;

24

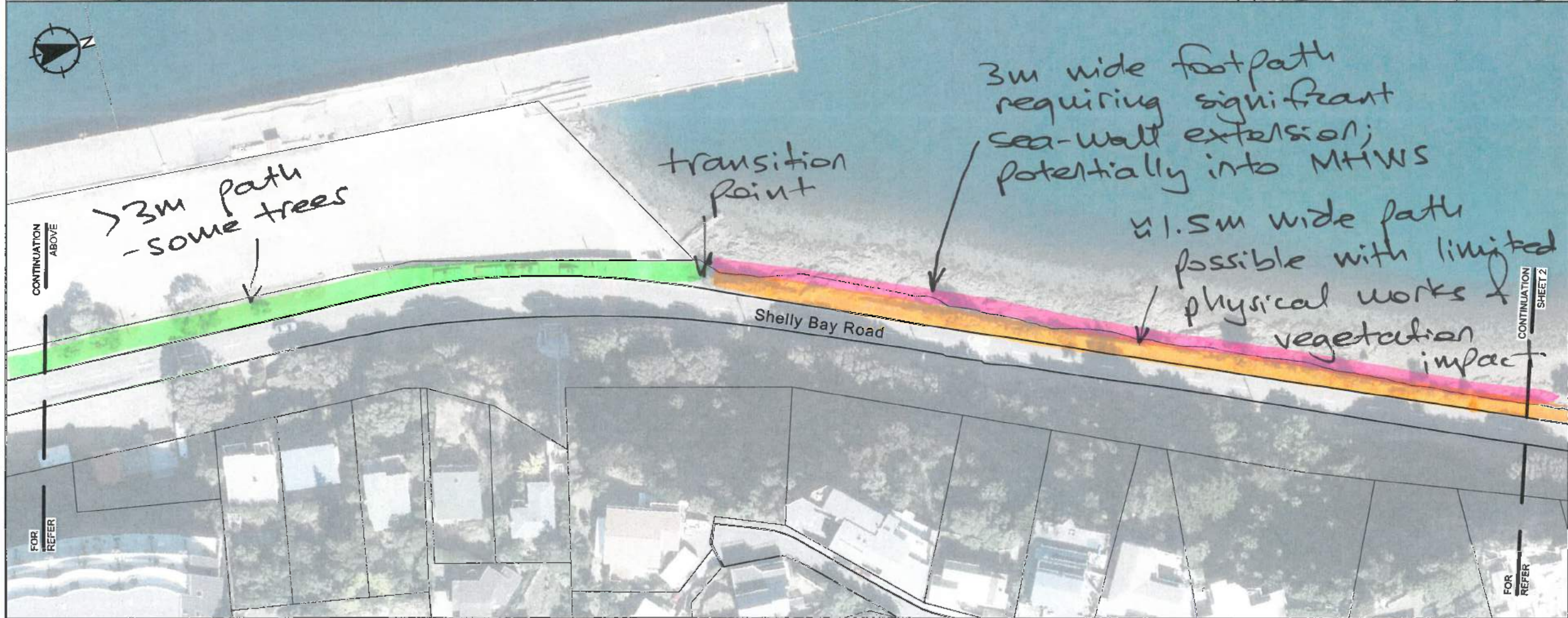
Reprinted as at
8 January 2015

Housing Accords and Special Housing Areas Act 2013

Part 2 s 34

- (d) the other matters that would arise for consideration under—
 - (i) sections 104 to 104F of the Resource Management Act 1991, were the application being assessed under that Act;
 - (ii) any other relevant enactment (such as the Waitakere Ranges Heritage Area Act 2008);
 - (e) the key urban design qualities expressed in the Ministry for the Environment's *New Zealand Urban Design Protocol (2005)* and any subsequent editions of that document.
- (2) An authorised agency must not grant a resource consent that relates to a qualifying development unless it is satisfied that sufficient and appropriate infrastructure will be provided to support the qualifying development.
- (3) For the purposes of subsection (2), in order to be satisfied that sufficient and appropriate infrastructure will be provided to support the qualifying development, the matters that the authorised agency must take into account, without limitation, are—
- (a) compatibility of infrastructure proposed as part of the qualifying development with existing infrastructure; and
 - (b) compliance of the proposed infrastructure with relevant standards for infrastructure published by relevant local authorities and infrastructure companies; and
 - (c) the capacity for the infrastructure proposed as part of the qualifying development and any existing infrastructure to support that development.
- (4) In considering an application for a resource consent under this section, the authorised agency—
- (a) may direct an affected infrastructure provider to provide any information that the authorised agency considers to be relevant in the circumstances to its consideration of the application; and
 - (b) if the authorised agency is the chief executive, may also direct any local authority to provide any information that the authorised agency considers to be relevant in the circumstances to its consideration of the application.
- (5) If an authorised agency makes a direction under subsection (4), the infrastructure provider or local authority must provide the information requested as soon as is reasonably practicable.
- (6) The Ministry must ensure that a copy of the document referred to in subsection (1)(e), or a link to that document, is on the Ministry's Internet site and that members of the public can easily access the document via that site, free of charge, at all reasonable times.

**APPENDIX C SCHEMATIC ACCESS LAYOUTS – CALIBRE 709360
SHEETS C11 – C14**



SHEET LAYOUTS

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| Surveyed | | |
| Designed SP | | 05/16 |
| Drawn JWM | | 05/16 |
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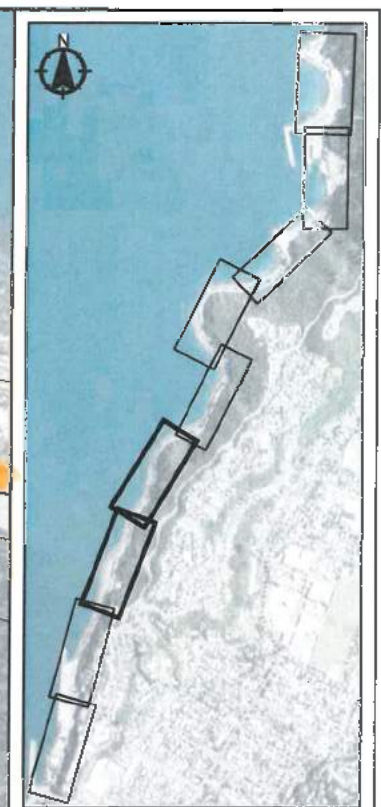
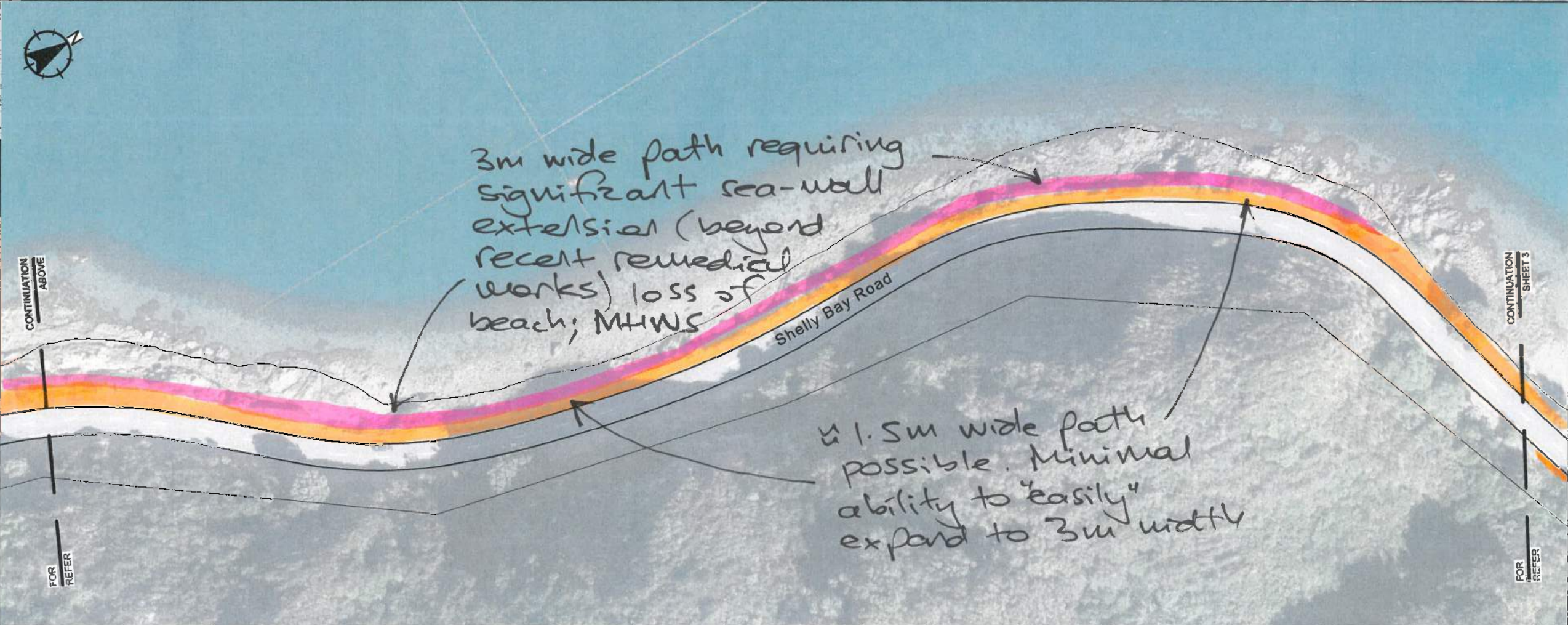
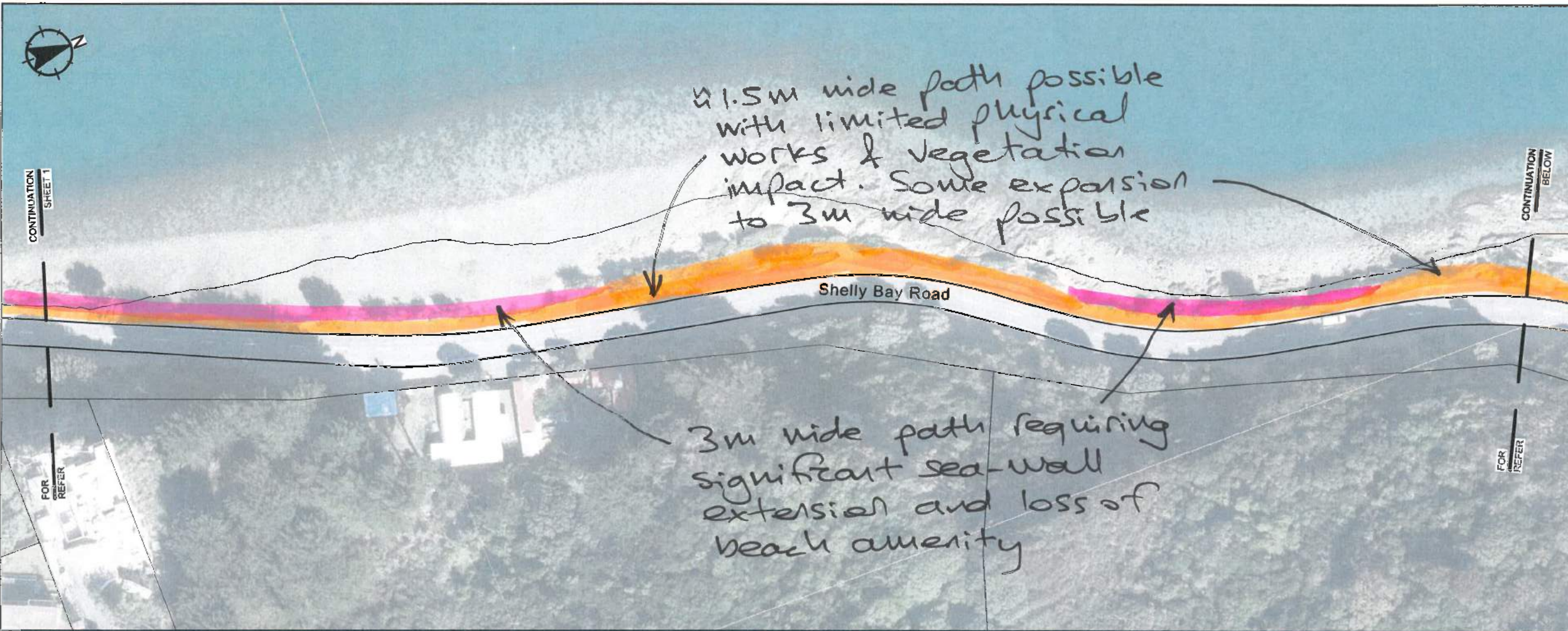
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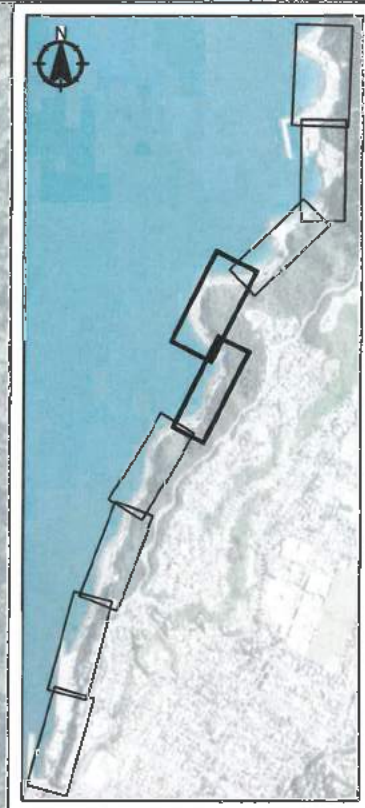
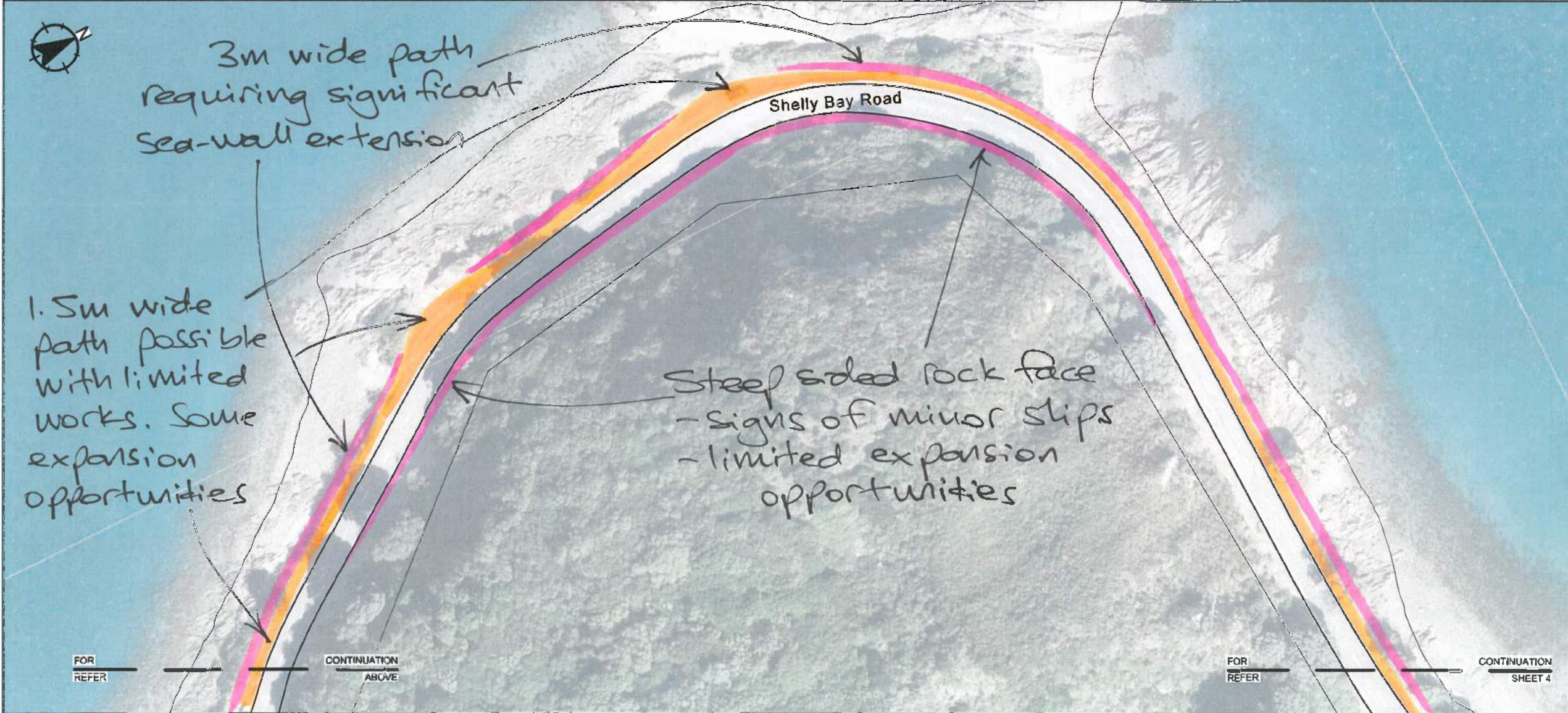
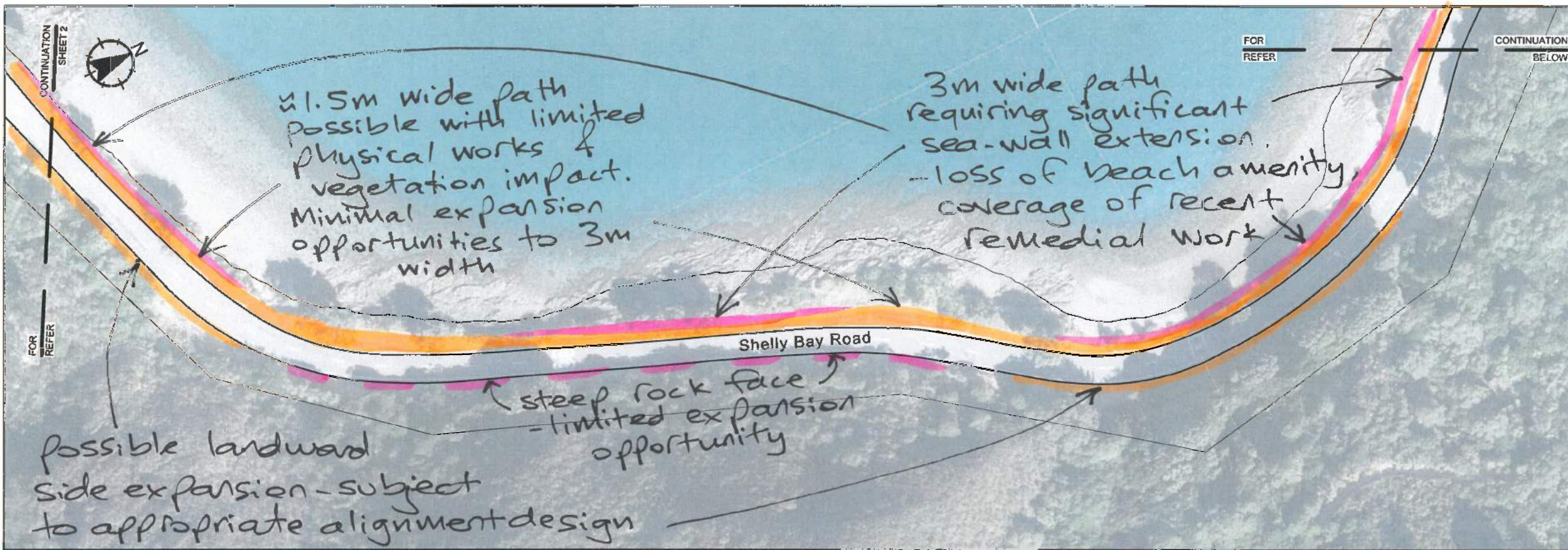
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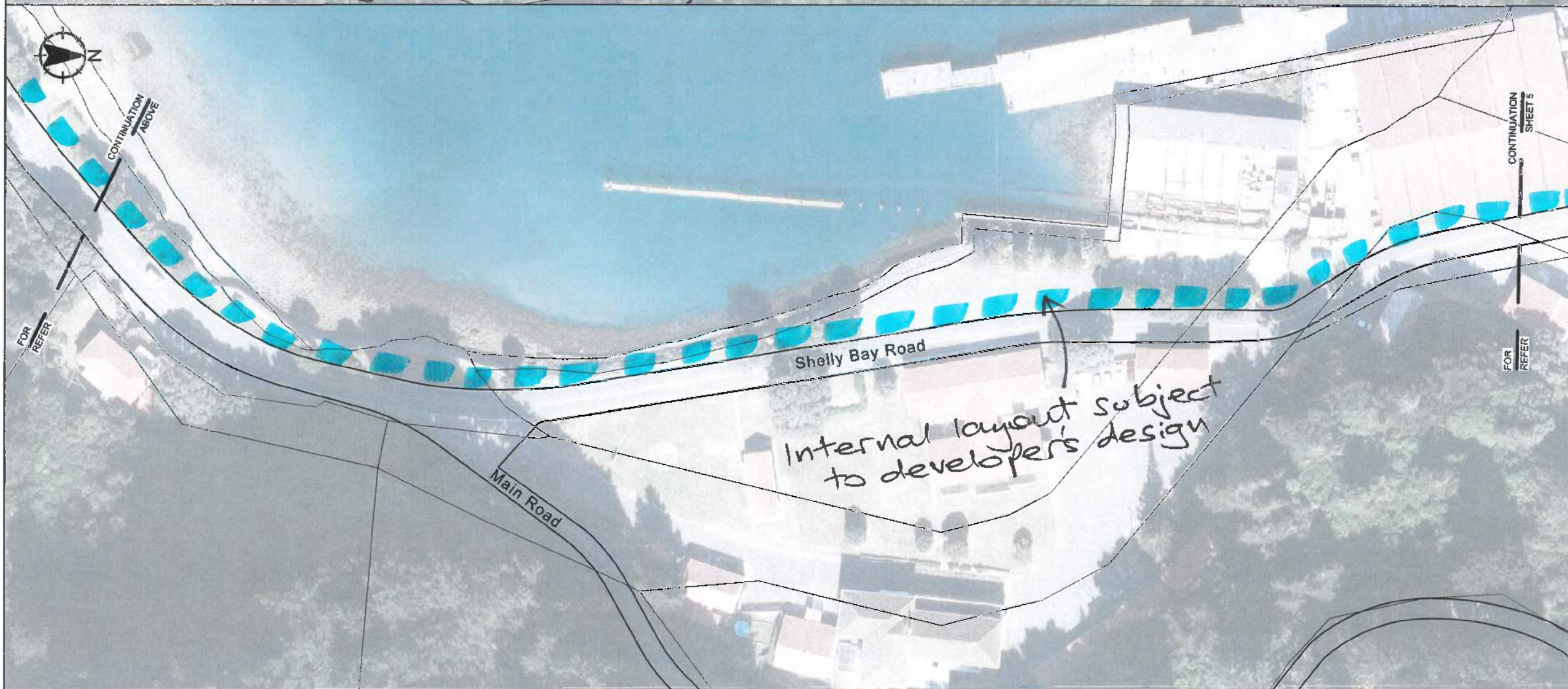
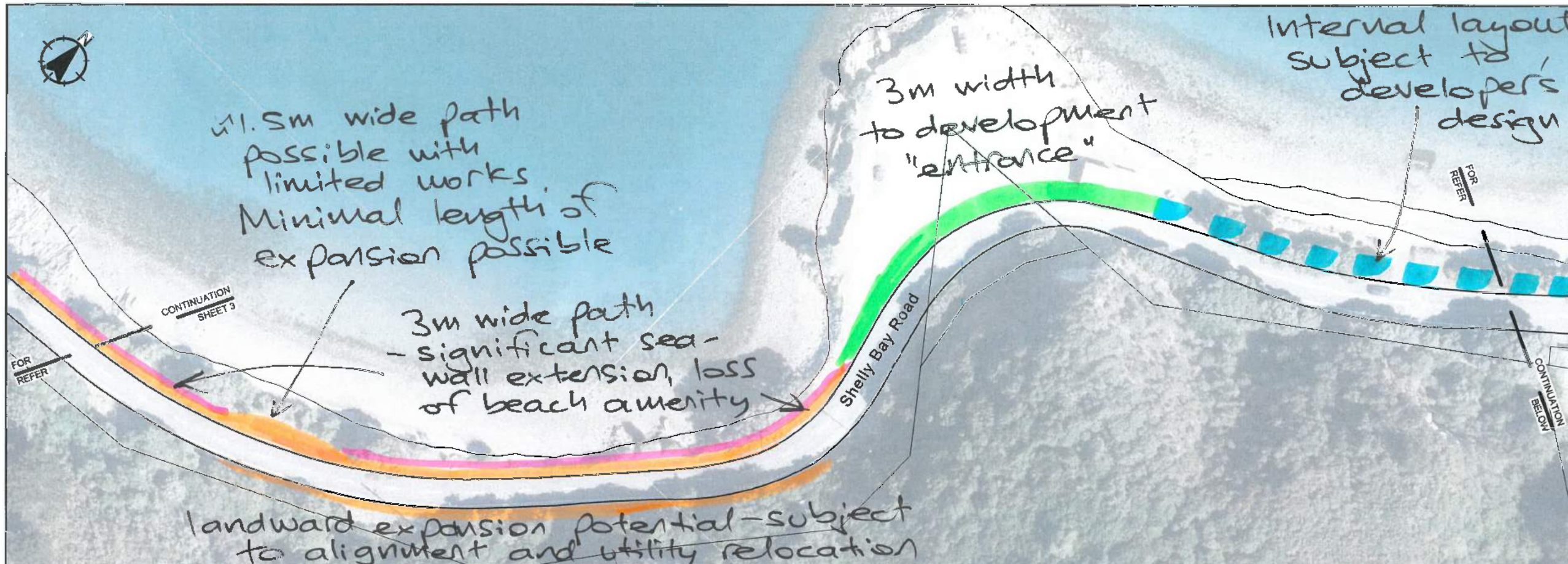
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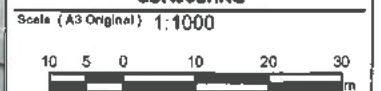
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19 JUNE 2017

**SHELLY BAY, WELLINGTON
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DOCUMENT REVISIONS

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1 INTRODUCTION

Port Nicholson Block Settlement Trust (PNBST) and The Wellington Company (TWC) (the partnership) are proposing a redevelopment of Shelly Bay on land previously owned by New Zealand Defence Force. Part of the development site is owned by Wellington City Council (WCC). A schematic diagram of the development is shown in Appendix B.

Calibre Consulting has previously responded to a number of requests from WCC to provide preliminary costs to upgrade bulk infrastructure to service the development site. The purpose of this report is to collate and summarise the issues and preliminary cost estimates to upgrade public infrastructure.

The development site itself is serviced by bulk infrastructure (roads, wastewater, water supply, power and communications) that is generally not of a sufficient standard to serve the proposed development.

This report does not cover any new infrastructure to provide road access or services to new sites or buildings within the development site itself.

It is important to note that no detail investigations on the current conditions of the infrastructure assets has been undertaken. Nor has any design been carried out for upgrades. The costs provided in this report are based on Calibre Consulting's generic knowledge of costs to carry out work of this nature. There could be variations to these estimates once detail investigations, design and construction tenders are carried out.

The costs are provided to assist with decision making in relation to selection of options and sharing of costs between various parties, or timing for upgrades.

Section 3 of this report provides a summary of the various cost estimates.

Sections 4 to 9 provide information on each of the infrastructure assets, their current condition and details of how the costs in the summary have been developed.

Section 10 sets out maintenance costs if no development proceeds, Section 11 discusses possible further development of Watts Peninsula.

2 SITE DESCRIPTION

The overall development site consists of approximately 7.3 hectares situated in Shelly Bay, on the west side of the Miramar Peninsular, east of the Wellington CBD. A location plan showing the site in relation to the city is attached in Appendix A. The site is the former home of the Shelly Bay Air Force Base and remains occupied by a number of diverse buildings from its former use as a military base. Several of the buildings are currently tenanted for a variety of uses including Propeller Studios, Blackmore & Best Gallery and Studio, and the Chocolate Fish Café.

The site comprises a flat, semi-built up area immediately adjoining the coast at Shelly Bay, along with an aging wharf and slipway structure and the surrounding steep hillside to Maupuia in the north of the Miramar Peninsula. The site is approximately 650m long in the north-south direction, with the flat area comprising two bays that extend up to 100m east of the coastline. Shelly Bay Road is generally positioned along the coastal boundary, except between the two bays where the flat area (housing Shed 8) is between the Road and the wharves.

Part of the land is owned by (WCC). Part of it is legal road and part of it is owned by Shelly Bay Ltd.

The legal description of the WCC land is Sections 3,4,5,6 SO Plan 339948. The legal description of the land owned by Shelly Bay Ltd is Section 1 SO Plan 37849, Section 9 SO Plan 339948, Part Section 20 Watts Peninsula District and Part Lot 3 DP 3020.

The proposed layout of the development in relation to the existing boundaries are shown on Calibre Scheme Plans 708977 V211 and V212. Attached in Appendix C.

3 COST ESTIMATE SUMMARY

The costs of providing bulk infrastructure services to Shelly Bay, relevant to the development proposed by TWC, are as follows:

| Item | Proposed Upgrade | Alternative Upgrade | Miramar Rd Intersection | Maintenance of Existing Assets Over 10 Years |
|-------------------------|---------------------|---------------------|-------------------------|--|
| Road Access | \$1,210,000 | \$10,000,000 | \$390,000 | \$250,000 ¹ |
| Water Supply | \$2,900,000 | - | - | \$25,000 |
| Stormwater Drainage | \$312,000 | - | - | \$62,000 |
| Wastewater Drainage | \$2,750,000 | - | - | \$55,000 |
| Seawall | \$858,000 | - | - | \$608,000 |
| Power Supply | \$690,000 | - | - | - |
| Telecommunications | \$292,000 | - | - | - |
| Gas | \$2,300,000 | - | - | - |
| Fees | \$1,200,000 | \$1,000,000 | Included elsewhere | - |
| Totals each item | \$12,512,000 | \$11,000,000 | \$390,000 | \$1,000,000 |
| Total Cost | | \$23,512,000 | \$23,902,000 | |

Total costs exclude GST and Escalation.

4 ROADING

4.1 CURRENT SITUATION

The development site has road access from the intersection of Cobham Drive and Miramar Avenue, along approximately 2.6 km of sealed coastal road. The eastern side generally is against the bottom of the Maupuia Peninsula escarpment and has approximately 1 metre informal water table edge. Evans Bay abuts the eastern side of the road with a grass or gravel berm varying between 1 and 4.5 metres.

Shelly Bay Road has a distinctive natural character. It is a coastal route with physical restrictions on both sides and has a current “Safer Speed Area” speed restriction of 40 kph.

The existing carriageway varies between 6 and 6.8 metres wide and the surface is chip seal in reasonable condition for the current traffic loadings. The carriageway is adequate for the current traffic that uses it.

4.2 PROPOSED ROAD UPGRADE

Appendix D provides details of the design criteria to develop options to upgrade Shelly Bay Road from Miramar Ave to the beginning of the development site. Based on the proposed level of development, Shelly Bay Road would fall under the designation of Collector Road. The standard configuration for a Collector Road is a carriageway width of 14m including roadside parking plus 8m of footpaths and berms, making 22m in total. However, no houses access most of this road so there is only a need for a footpath on one side of the road and roadside parking is not considered necessary along the majority of the road.

Further, as part of the coastal environment there will likely be limitations of development to maintain the character and public amenity of the area. Upgrading the current road environment to fully meet the guidelines would serve to urbanise

¹ Includes repairs to seawall along Shelly Bay Road.

the road and may have adverse overall effects. The route will effectively only have a “move” function, so only needs to have traffic lanes and allow for pedestrian/cycle traffic. There is limited need for berm or other parking along the route.

The proposed design maintains a minimum carriageway width of 6.0m (1 x 3 metre moving lanes), with the additional available width between the bank on the east and the sea on the west, being used for berm and footpath. This carriageway width has the capacity to carry the two-way peak hour traffic flows generated by the development. The footpath will be surfaced with crushed lime and will be a minimum of 1.5 metres wide.

The estimated cost to construct the proposed design is \$1,210,000 (\$1.21M). This includes \$332,000 of provisional items, such as resurfacing of approximately 20% of the existing road. Cost breakdowns and more detailed reporting are included in Appendix D.

4.3 ALTERNATIVE ROAD UPGRADE

An alternative proposal is a wider overall carriageway to accommodate the normal requirements for a collection road and better facilities for cyclists and pedestrians. It could accommodate the same vehicular traffic whilst providing a 3 metre wide two-way pedestrian and cycle corridor. This would require substantial physical works, particularly on the seaward side of the existing carriageway.

This option requires a combination of widening along the eastern (bank) side of the road costing approx. \$1.2M; extension of the existing seawall on the sea side of the road over a length of approximately 1,350 metres costing about \$7.3M, and providing a 3m wide concrete walking and cycling path costing approximately \$1.5M.

The total cost of this option would be approximately \$10M.

If the upgrade in section 4.2 above is completed as an interim measure, the cost to implement this alternative would still be \$10M as it is essentially a complete new upgrade.

Schematic plans and an analysis of this alternative proposal are detailed in Appendix E. Specifically it will include the loss of significant amounts of seaside vegetation along the route (Pohutakawas), potential impacts on the coastal environment, the loss of existing amenity in several of the beach areas along the route, uncertainties around the requirements and potential acceptance of the Regional Council. It will also result in the overall urbanisation of the existing coastal route.

4.4 MIRAMAR AVE/SHELLY BAY INTERSECTION UPGRADE

Predicted traffic flows indicate the current intersection layout where Shelly Bay Road meets Miramar Avenue needs to be upgraded. There are three options and the pros and cons of each are set out in the table below.

| Option | Advantages | Dis-advantages | Likely Cost Range |
|---------------------------------------|---|---|-----------------------|
| Roundabout | <ul style="list-style-type: none"> Allows good movement of traffic outside peak hours. | <ul style="list-style-type: none"> May require more land for widening. Proximity to existing intersection to east, and bend of Cobham drive to west, leading to safety and operational issues. Can provide a barrier to cyclist at the intersection, leading to crossing at “unsafe” points. | \$150,000 - \$260,000 |
| Improved Road Marking and Dual Laning | <ul style="list-style-type: none"> Improved version of existing layout, reducing uncertainty to drivers. Low cost option. | <ul style="list-style-type: none"> Doesn't allow traffic to flow freely from Shelly Bay Road, leading to queues in peak hours. Possibility improvements may be needed at a later stage. May require more land. | \$120,000 – \$235,000 |

| Option | Advantages | Dis-advantages | Likely Cost Range |
|-----------------|--|--|-----------------------|
| Traffic Signals | <ul style="list-style-type: none"> Allows movements for vehicles, cyclists and pedestrians. | <ul style="list-style-type: none"> More expensive option. May lead to queues on Miramar Avenue leading back to previous intersections during peak hours, depending on phasing of signals. Land take may still be needed, depending on final layout. | \$200,000 - \$390,000 |

The cost ranges are very broad at this stage, reflecting the very early information we have.

Traffic signals would fit best with the various proposals in the area including Shelly Bay Road traffic increasing and more cyclists using the new cycleway.

5 WATER SUPPLY

5.1 CURRENT SITUATION

Wellington Water Ltd (WWL) advises that there is currently a small privately owned reservoir above the site that is fed from Mt Crawford Reservoir feeding the existing uses on the development site. There is also the existing Maupuia reservoir that we believe has sufficient capacity to provide for the proposed development. This Maupuia reservoir provides water to the Mt Crawford Reservoir.

The existing Shelly Bay reservoir (near to the development site) and water-main serving it from the Mt Crawford reservoir (near the prison) are in poor condition and would be grossly undersized for the proposed development. Both need to be replaced to provide for the needs of the proposed development.

5.2 DEVELOPMENT SITE REQUIREMENTS

Based on the calculated population and the Regional Standard for Water Service, the required storage and water capacity are shown in the table below.

| Storage Requirements | Volume | Flow | L/s |
|----------------------|----------------------------|--------------|-------------|
| 650 L/person | 871 m ³ | Main flow | 21.7 |
| Firefighting FW3 | 180 m ³ | Firefighting | 25 |
| Required | 1,051 m³ | Peak | 39.5 |

The calculated storage volume including firefighting requirement is 1,051 m³ and the calculated peak flow is 39.5 L/s for the proposed development. Details for how these figures have been developed are attached in Appendix F.

5.3 ESTIMATED UPGRADE COST

We estimate the capital cost to provide water supply to the Shelly Bay Development in the table below. The estimates depend on the following assumptions:

- The existing pump station at Maupuia and the 150mm diameter rising main from Maupuia reservoir have capacity for the additional 39.5 L/s
- Assumed maximum water level in the new Shelly Bay reservoir is RL 90m
- There is no provision for a water supply pressure increasing station, which may be required if high rise buildings are proposed
- There is no provision for purchasing the land for the water reservoir if that is required
- The length of the water supply pipelines has been approximated from QuickMap

| Description | Unit | Quantity | Rate (\$) | Amount (\$) |
|--|----------------|----------|-----------|------------------|
| Water Supply | | | | |
| Water Supply Reservoir at the location of the existing Shelly Bay reservoir, estimated 90m RL, Volume 1,051 m ³ | m ³ | 1,051 | 600 | 630,600 |
| Replacement pipeline between Mt Crawford Reservoir and Shelly Bay Reservoir, 150 mm diameter pipe | m | 880 | 500 | 440,000 |
| Replacement pipeline from Shelly Bay Reservoir to the development site, 150 mm diameter pipe | m | 990 | 500 | 495,000 |
| Local reticulation, valves and fire hydrants | m | 800 | 1,100 | 880,000 |
| Contingencies: 25% | LS | 1 | 453,750 | 453,750 |
| Total Water Supply | | | | 2,899,350 |
| Margin of Error | | | | +/- 30% |

5.4 ALTERNATIVE OPTION

There is a possibility that more detail investigations may show there could be an adequate reservoir supply of water in the area without the need to construct a replacement for the existing Shelly Bay reservoir. The pipework would need to be upgraded. If a suitable route can be found a new pipe would need to be laid down the steep slope from the Maupuia Reservoir to Shelly Bay Road and then along Shelly Bay to the development site. It would be necessary to decommission the existing NZDF owned Shelly Bay Reservoir, install two pressure reduction valves and connect up pipework to maintain secondary flows from the Mt Crawford Reservoir. This option may cost less than the option in 5.3 as there would be no need for a new Shelly Bay Reservoir.

6 WASTEWATER

6.1 CURRENT SITUATION

The current buildings on the Shelly Bay Development site gravity feed to a collection point near the south end of the site. The sewage is then pumped south along Shelly Bay Road to a manhole at the north end of the Miramar wharves. There is anecdotal knowledge that this whole system is in poor condition and it is not clear as to whether this is a private or public pipe. It is maintained by CityCare under a contract with someone other than WWL but shows up as public in WWL's GIS layer currently.

WWL believe that the existing pipe network from the south end of Shelly Bay Road to the existing pump station in Salek Street (off Rongotai Road) is inadequately sized to manage the increased sewage flows from the proposed Shelly Bay Development.

6.2 DEVELOPMENT SITE REQUIREMENTS

Based on the Regional Standard for Water Service and the calculated population, required wastewater drainage capacity for the proposed development is in the table below:

| Flow | L/s |
|-------------------------------------|-------------|
| ADWF (Average Dry Weather Flow) | 3.1 |
| PDWF (Peak Dry Weather Flow) | 15.7 |
| PGWF (Peak Ground Water Flow) | 1.1 |
| PRWF (Peak Rain Water Flow) | 1.3 |
| PWWF (Peak Wet Weather Flow) | 18.1 |

The peak wastewater flow is 18.1L/s.

6.3 ESTIMATED UPGRADE REQUIREMENTS

After consultation with WWL, we believe the best solution would be to lay a new rising main from the site directly to the pump station in Salek Street.

The estimated capital cost to build this new system is \$2.75M. Details of how this figure has been arrived at are shown in the table below and depend on the following assumptions:

- The connection point for the wastewater outlet into the WCC network is the existing Salek Street pump station
- The length of the wastewater mains have been approximated from QuickMap
- There is no provision for purchasing the land for the wastewater pump station
- The existing system downstream of the Salek Street pump station has the capacity for the increased effluent from the Shelly Bay Development.

| Description | Unit | Quantity | Rate (\$) | Amount (\$) |
|---|------|----------|-----------|------------------|
| Wastewater | | | | |
| Local Reticulation, Gravity, including manholes, 150mm dia | m | 800 | 500 | 400,000 |
| Wastewater Pump Station, capacity 18.1 L/s, 50m head | LS | 1 | 400,000 | 400,000 |
| Wastewater Rising Main, 150mm dia, to Salek Street Pump Station, including crossing under two roundabouts, 150mm dia, Length = 3.5 km | m | 3,500 | 400 | 1,400,000 |
| Contingencies 25% | LS | 1 | 550,000 | 550,000 |
| Total Wastewater | | | | 2,750,000 |
| Margin of Error | | | | +/- 30% |

7 STORMWATER

Current storm-water disposal for the site is via several discharge points directly feeding into Shelly Bay.

Shelly Bay Road upgrades and the intensification of the development site will mean that the existing outfalls will likely be inadequate and new outfalls to the sea will be required.

Considering the proximity of the coastline the proposed development will continue to utilise stormwater discharge into the sea.

Calibre has recent experience that indicates the new outfall structure would cost approximately \$50,000 with five (5) outfalls/structures required, and contingency we estimate the cost to be \$310,000.

The following issues should be addressed in the final development design:

- Sea level rise and inundation within the proposed development
- Pollutant treatments prior to discharge into the sea from the proposed parking and residential/commercial areas.

8 UTILITIES

Calibre has contacted the utility authorities and their responses are attached in Appendix G.

The cost upgrade information for each of these utilities is outlined individually in the following paragraphs.

8.1 POWER

Wellington Electricity has assessed the proposal for their likely power servicing required. Transformer capacity has been assessed at 2,000 kVA, or 2MVA. Reinforcement work would be required to supply the development and potentially three substations would be required. Estimated costs for the cabling and substations total \$690,000.

8.2 TELECOMMUNICATIONS

Chorus Network Services (Chorus) has confirmed that they will be able to provide telephone and data reticulation for the proposed development. Chorus require a contribution for reticulating the development. Chorus' costs include the cost of network design, supply of telecommunications specific materials and supervising installation. The contribution is \$292,500 plus GST.

8.3 GAS SUPPLY

PowerCo has confirmed their requirements to service the proposal. This would include the installation of approximately 2.9km of 200NB PE gas pipe main from their existing service main in Shelly Bay Road. Their high-level investment cost for this work is \$2.3 million. Normally a contract of this size would be competitively tendered and there may be shared trenching possibilities that could significantly reduce this estimate.

9 MARITIME STRUCTURES

9.1 WHARF STRUCTURE

There is an existing wharf and slipway structure to the west of the Shed 8 building in the centre of the Shelly Bay area. Previous reports have determined that the wharf and slipway are in "very poor condition", and therefore unlikely to be able to service any form of proposal without significant structural repair or possibly complete demolition and rebuilding. Calibre have not carried out any investigations to determine what work or costs are involved in upgrading or replacing the wharves and slipway. Wellington City Council does not own and is not responsible for the maintenance of these structures.

The partnership's proposal indicates that the development will include a 100m² ferry terminal building and a 48 berth marina as part of the overall community. No designs or details for the proposed ferry terminal and marina have been included. The cost or value of such features cannot therefore be determined at this time.

9.2 SEAWALL

9.2.1 CURRENT SITUATION

The seawall in the vicinity of the development site appears to be a mass concrete wall which probably has no reinforcement. Some sections may be tied back in some places like the north and west sides of Shed 8. The seawall provides protection to the reclamation that has been formed behind the wall. The wall is most exposed to wave directions from the SSW to NNW with fetch distances of 1 to 4km depending on the direction.

Wave energy from these directions is concentrated in the bay due to the curved nature of the bay. A solid concrete wall does not provide any wave energy dissipation and results in reflected and refracted waves and very confused wave patterns. This can result in significant amplification of wave heights and increased wave velocities particularly at the transition between the gently sloping harbour bottom and the concrete wall, resulting in toe scour occurring.

In storm conditions waves will regularly overtop the wall, flooding the road behind. If the water that overtops the wall cannot flow directly back to the harbour (i.e. is blocked by a step in the wall, gaps behind the wall, potholes and permeable areas in the fill) it will result in scouring of the fines within the reclamation fill resulting in localised slumping.

Visually it can be seen that localised scouring of the wall toe has occurred which has resulted in some cracking in the wall and level variations of the top of the wall.

Slumping behind the wall has occurred in a number of locations.

9.2.2 SEAWALL UPGRADE RECOMMENDATIONS AND COST ESTIMATES

Areas of scour under the existing wall should be filled with pumped concrete. Areas of slumping behind the wall should be opened up and cavities filled with concrete block mix before restoring the subgrade and asphalt. Any gaps behind the wall and asphalt surfaces are to be sealed with a flexible membrane so water cannot migrate behind the wall.

Any cracks in the wall greater than 2mm in the wall should be repaired.

To mitigate further deterioration of the seawall and scour issues we would recommend that wave energy dissipation be installed in front of the existing wall in the form of a rock revetment. The revetment will also mitigate future toe scour of the concrete retaining walls.

Our rough order cost estimates for this work are:

| | | | |
|------------------------|-----------------|----|----------------|
| Revetment costs | 300m @\$1,600/m | \$ | 480,000 |
| Mass concrete filling | 20m3 @ \$300/m3 | \$ | 6,000 |
| Contingencies | 25% | \$ | 121,500 |
| Total indicative costs | Say | \$ | 608,000 |

This cost is based on the following assumptions:

- Any work required on the wall under Shed 8 will be part of any upgrade costs for Shed 8.
- Most of the above costs will be required in North Bay. South Bay is generally protected from significant waves by the wharf and slipway structures. The above costs assume those structures will stay or be replaced in some form. If the wharves are removed there could be a further \$250,000 cost to provide Revetment to the seawall in South Bay.
- The cost has no allowance for improvements or remediation of the seawalls on Shelly Bay Road south of the development site. Any costs associated with work that may be required along the road to the site will be covered in the upgrade cost for the road.

9.3 SEAWALL ADJACENT SHED 8

9.3.1 EXISTING STATUS

Calibre Consulting were asked by the Wellington City Council to provide options and rough order costs for the remediation of the seawall along the west side of Shed 8.

A number of reports have been commissioned to assess the condition of the retaining structures supporting the building foundations and fill below the building floor slabs. Calibre have reviewed these reports and provide a brief commentary here on our findings.

Shed 8 is supported on timber piles that are connected to reinforced concrete ground beams. The floor is concrete slab on the ground between the ground beams. The building is generally in a poor condition and is an earthquake prone building with a NBS of less than 33%. It is built on reclaimed ground of varying depths of marine silts making the land susceptible to liquefaction.

A number of the piles supporting the west side of the building are significantly compromised due to loss of section.

The ground under the building is held in place by a concrete retaining wall on the sea side. The bottom of this concrete wall is likely to be around one metre below low tide water level. Between the top of this wall and the foundation beam of the building there are vertical retaining timbers.

The concrete wall itself is generally in a reasonable condition but the reports indicate that there is undermining in some places along the wall with gaps of around 500mm below the wall.

The vertical retaining timbers on top of the concrete wall have failed over significant areas along the building foundation.

The concrete retaining wall – approximately 55 metres long - to the south of Shed 8, also requires similar remediation

The undermining of the concrete wall and the failure of the retaining timbers has caused subsidence of the fill under the western end of the building.

9.3.2 REMEDIATION WORK

We believe that the existing concrete retaining structure can be retained provided the areas of undermining are repaired using a rock revetment. The timber retainers need to be repaired and/replaced.

Once these remediation works are completed the ground behind the Seawall can be back filled to provide protection for the fill under the building.

Remediation requires the following work and rough order costs for each item:

| | |
|--|-------------------|
| Removal of the Shed 8 floor slab adjacent the sea wall | \$ 20,000 |
| Excavation of the fill behind the seawall where the bottom of the wall has been undermined | \$ 40,000 |
| Placement of rock revetment in the areas where the wall has been undermined | \$ 60,000 |
| Repairs to cracks in the concrete retaining wall | \$ 10,000 |
| Repairs to the vertical timber retainers | \$ 20,000 |
| Back filling and re-compaction of the ground behind the wall | \$ 50,000 |
| Contingency | \$ 50,000 |
| Total estimated cost | \$ 250,000 |

Comments

1. The above costs do not include any allowance for re-piling the Shed 8 building itself or replacement of its ground beams or floor slab.
2. The above costs assume the building remains in place and don't allow any cost of demolition of part or all of the existing building.

10 SHELLY BAY - 10 YEAR ASSET MANAGEMENT YEAR PLAN

This section of the report provides the costs of the likely/reasonably necessary works for the Shelly Bay public infrastructure over the next 10 years, assuming no substantive development occurs.

The analysis includes Shelly Bay Road (to and through the site), stability works for the road and other waterfront land, water supply, wastewater and stormwater.

The longer term maintenance and running costs of the Council's assets, including those at Shelly Bay, will have been allowed for in such areas as ongoing maintenance plans, annual budgets, long-term management plans or other asset management strategies.

The construction of new assets (in the case of the comprehensive development of Shelly Bay) will alter, but not extinguish, the maintenance requirements considered as part of the Council's asset management strategies. A new road will have different management requirements than a road overdue for sealing, but all will have some level of maintenance required over a 10 year period.

Notwithstanding the above, we have considered the existing assets and the likelihood of medium - large one-off costs over the desired 10 year period. These are more likely to be the result of significant failures within the assets rather than more typical ongoing maintenance and upkeep. How these events or failures would be managed is not certain, as there

would likely be some weighing up of the up-front costs versus the medium - long term benefit, especially if the Shelly Bay area remained largely undeveloped and not fully utilised.

Details of our assessment of these 10 year asset management costs are shown in Appendix H.

10.1 ROADING

A 500m section of Shelly Bay Road was resealed in 2014. The remainder was resealed in 2010. The lifespan of the seal in general terms is estimated at between 12 and 20 years, depending on traffic type, volume and speed and many other factors. The 10 year period takes us through to 2026, or 16 years since the last seal. The need for a resurfacing of the bulk of Shelly Bay Road within the 10 year period is therefore likely. Costs for this resealing, based on an estimated average road width and total length, and utilising current construction rates, are estimated at \$50,000.

Summarising the above estimates, provides a total cost of \$1,000,000 (\$1M) over the proposed 10 year period, as tabulated below.

10 Year Maintenance Costs Summary:

| | | |
|-------------------------------|-----------|------------------|
| Roading | \$ | 50,000 |
| Seawall to Shelly Bay Road | \$ | 200,000 |
| Shelly Bay Seawall and Shed 8 | \$ | 608,000 |
| Stormwater | \$ | 62,000 |
| Water Supply | \$ | 25,000 |
| Wastewater | \$ | 55,000 |
| Total | \$ | 1,000,000 |

11 FUTURE DEVELOPMENT POTENTIAL WATTS PENINSULA

This section sets out the possible future development potential on Watts Peninsula to assess what impact that might have on the provision of bulk infrastructure to the Shelly Bay Development site. This assessment was carried out in 2008 by Duffill Watts Group (a predecessor of Calibre Consulting) for New Zealand Defence Force.

A visual assessment of aerial photography and a site walkover was undertaken to identify all currently undeveloped land on the northern part of Watts Peninsula and its ownership.

The currently undeveloped land on Watts Peninsula is zoned in Wellington City District Plan as Open Space, Conservation and a small portion zoned Outer Residential.

In practice, there is only Open Space zoned land available for future development.

Within the Open Space zone any non-recreational activity, including residential and commercial development is a non-complying activity, and generally contrary to the objectives and policies of the District Plans. This means that a Plan Change would be required to enable residential or commercial development.

In addition, the majority of the land is also located within the Matakai-kai-poinga Landscape Feature Precinct identifying it as of significant importance to the Iwi and they would be considered as affected parties to any development within this area.

In the timeframe allowed for that report, it was not possible to come up with any form of development proposal for the peninsula. However, we made a broad assumption that it may be possible for a further 100 dwellings to be sensitively located in this area. They would be served by an upgraded road following the existing one that serves the magazine storage buildings and connects with the access road through to the Mt Crawford prison.

APPENDICES

APPENDIX A SITE LOCATION PLAN



DEVELOPMENT SITE

SELAK STREET

QuickMap
Custom Software Ltd



Any person wishing to rely on the information shown on this map must independently verify the information

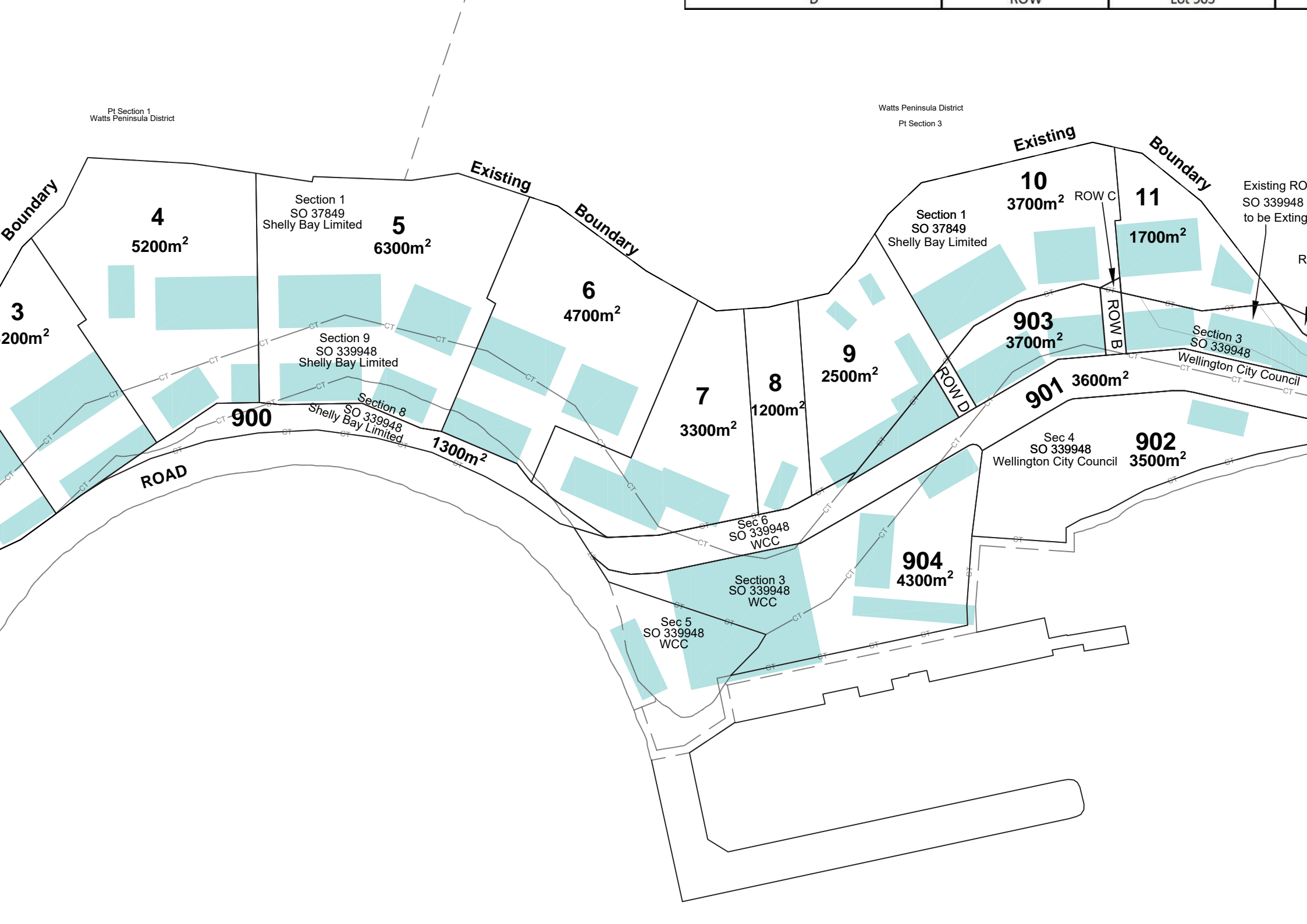
Scale 1:15000

Topographical and Cadastral map derived from LINZ data. Printed: 08-May-17 10:21.

APPENDIX B PROPOSED DEVELOPMENT SKETCH PLAN



APPENDIX C PROPOSED SCHEME PLAN WITH EXISTING LAND OWNERSHIP DETAILS



Pt Section 1
Watts Peninsula District

Watts Peninsula District
Pt Section 3

Existing RO
SO 339948
to be Exting

Boundary

Existing
Boundary

Boundary

Existing
Boundary

Boundary

4
5200m²

Section 1
SO 37849
Shelly Bay Limited

5
6300m²

6
4700m²

Section 9
SO 339948
Shelly Bay Limited

Section 1
SO 37849
Shelly Bay Limited

10
3700m²

11
1700m²

3
200m²

900

Section 8
SO 339948
Shelly Bay Limited

1300m²

7
3300m²

8
1200m²

9
2500m²

903
3700m²

901
3600m²

902
3500m²

Sec 4
SO 339948
Wellington City Council

Sec 6
SO 339948
WCC

Section 3
SO 339948
WCC

Sec 5
SO 339948
WCC

904
4300m²

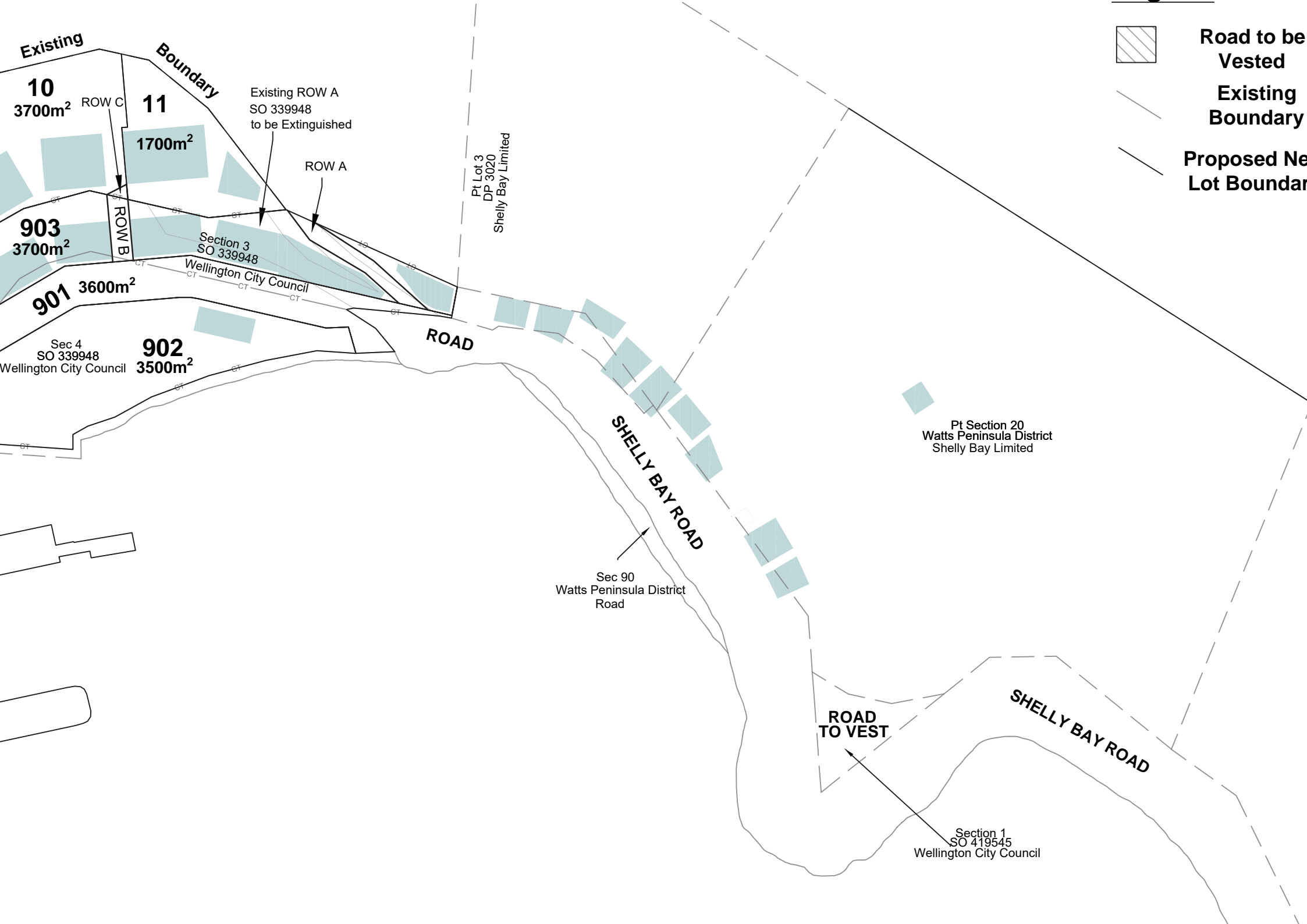
Section 3
SO 339948
Wellington City Council

ROAD

ROW D

ROW B

ROW C



APPENDIX D ROADING – PROPOSED UPGRADE

SHELLY BAY ROAD – ROADING INPUT

TRAFFIC FLOWS

An assessment has been carried out to confirm that the proposed road standards for Shelly Bay Road are suitable to cater for the new development. The development comprises:

- 311 residential units
- 1000m² GFA of retail activity
- 800m² GFA of hospitality activity
- Boutique hotel with 30 beds and 11 studios
- 500m² GFA of office activity
- 100m² GFA for a ferry terminal building
- Marina with 48 berths

Based on the proposed number of residential units, Shelly Bay Road would fall under the designation of Collector Road based on Table 1 of Wellington City Council's "Code of Practice for Land Development, Part C: Road Design and Construction" December 2012. This would require the following widths:

| No of units served | Traffic volumes (vph) | Road reserve width (m) | Minimum carriageway width (m) | | | | Footpath number and width (m) | Berm (m) |
|--------------------|-----------------------|------------------------|-------------------------------|---------|---------|-------|-------------------------------|----------|
| | | | Parking | Traffic | Cycles | Total | | |
| 150 - 500 | 1000 - 3000 | 22 | 2 x 2.0 | 2 x 3.5 | 2 x 1.5 | 14 | 2 x 2.0 | 4 x 1.0 |

However, constructing a road to this standard is not achievable, with the cliff face along one side of the road, and the sea wall and harbour to the other. As there are only a few properties that currently have frontage access, and these are all located at the Cobham Drive end of Shelly Bay Road, it can be assumed that roadside parking would not be required along the majority of the road.

Based on the existing typical cross-section, we initially considered a 1.0 - 1.5m crushed lime footpath, a 0.5m grass berm, two traffic lanes of 5.5m and a 1.0m unsurfaced water-table drain.

However, we believe that a better solution is that the east side water-table drain at the bottom of the cliff is replaced by a 0.6m wide concrete drainage channel, and the 0.5m grass berm is removed. This would give an additional width of 0.9m, which can be used to maintain a minimum road width of 6.0m, with any additional available road width divided between the footpath and road as required.

Given the land use of the proposed development above, we have predicted the likely peak hour flows for the development. For this, we have used Table 8.10 from NZTA Research Report 453 "Trips and parking related to land use November 2011" and assumed the following:

- Residential units taken to be medium density residential flats
- Retail activity taken to be equivalent to small shopping centre
- Hospitality taken to be an average of trip generation rates for restaurants (18/100m² GFA) and bars and taverns (15.6/100m² GFA)
- Hotel taken to be equivalent to motels
- Ferry terminal taken to be same as office activity
- Marina assumed to have most activity outside of peak hour flows
- Peak hours are taken as 8 - 9am and 5 - 6pm
- The larger traffic flows are assumed to be southbound during the AM peak, and northbound for the PM peak

With these assumptions, the two-way peak hour traffic flows generated by the development are likely to be as follows:

| Land Use | Peak hour rate (vph) | Quantity | Two-way peak hour flow (vph) |
|-------------------------|------------------------------|---------------------|------------------------------|
| Residential units | 0.8 / dwelling | 311 dwellings | 249 |
| Retail activity | 18.9 / 100m ² GFA | 1,000m ² | 189 |
| Hospitality activity | 16.8 / 100m ² GFA | 800m ² | 135 |
| Boutique hotel | 1.4 / unit | 41 units | 58 |
| Office activity | 2.5 / 100m ² GFA | 500m ² | 13 |
| Ferry terminal building | 2.5 / 100m ² GFA | 100m ² | 3 |
| Marina | - | - | 2 |
| Total | | | 649 |

Based on the available traffic flow data, from a count in March 2011, and assuming a 60/40 split to the development traffic flows to allow for the traffic direction above, this would give the following AM and PM peak flows:

| Time | Existing average peak flow (vph) | Additional development peak flow (vph) | Total peak flow (vph) |
|------------------------------|----------------------------------|--|-----------------------|
| AM Peak (8 - 9am) Northbound | 18 | 259 | 277 |
| AM Peak (8 - 9am) Southbound | 13 | 390 | 403 |
| PM Peak (5 - 6pm) Northbound | 46 | 390 | 336 |
| PM Peak (5 - 6pm) Southbound | 50 | 259 | 309 |

Reviewing the traffic figures for the area (provided by Wellington City Council), from the March 2011 counts, the peak traffic flows appear to be during the day, outside the assumed commuter peak times, with large hourly flows during the weekend. The traffic figures show weekday inter-peak flows between 40 and 70 vehicles per hour, and weekend flows up to 210 vehicles per hour. These flows can likely be attributed to the relocation of the Chocolate Fish café to the area, and the various small businesses that have opened up.

Based on the predicted peak hour flows above, and the proposed width of the road, the one way capacity of this level of road is between 750 – 900 vehicles per hour.

Therefore, we consider that the existing road will have sufficient capacity for the additional development traffic flows and would not require widening of the traffic lanes.

COSTS

To construct the road as proposed above – 1.5m crushed lime footpath, 2 x 3.0m traffic lanes, and 0.6m concrete drainage channel – we would estimate a cost of around \$1,210,000.

This does include \$330,000 of possible additional items, such as gateway features, stormwater drainage, installation of a nib kerb between road and footpath, and resurfacing of approximately 20% of the road (if required).

The full estimate is overleaf.

| Item | Description | Unit | Quantity | Rate (\$) | Amount (\$) |
|---------------------------------|---|----------------|----------|-----------|-------------------|
| 1 | Site Clearance | | | | |
| 1.1 | Remove existing trees and stumps and dispose to waste | LS | 1 | 9,900.00 | 9,900.00 |
| 1.2 | Cut back existing vegetation by an Arborist and dispose to waste | day | 2 | 1,200.00 | 2,400.00 |
| Total Carried to Summary | | | | | 12,300.00 |
| 2 | Earthworks and Landscaping | | | | |
| 2.1 | Excavate and dispose to waste to a depth of 150mm for footpath | m ³ | 470 | 9.20 | 4,324.00 |
| 2.2 | Excavate potholes by hand as directed by the Engineer to locate services, including backfilling and reinstatement | m ³ | 5 | 190.00 | 950.00 |
| Total Carried to Summary | | | | | 5,274.00 |
| 3 | Crushed Lime Footpath | | | | |
| 3.1 | Supply and place H4 150x50 timber edging including pegs at 2.5m spacing | m | 5000 | 20.00 | 100,000.00 |
| 3.2 | Supply, place and compact 100mm AP40 basecourse | m ² | 3125 | 8.00 | 25,000.00 |
| 3.3 | Construct crushed lime surface on footpath 50mm thick | m ² | 3125 | 17.00 | 53,125.00 |
| Total Carried to Summary | | | | | 178,125.00 |
| 4 | Surfacing and Kerbs | | | | |
| 4.1 | Construct 600mm wide concrete drainage channel on 150mm of compacted AP40 | m | 2500 | 105.00 | 262,500.00 |
| 4.2 | Excavate soft spots and replace with GAP65 subbase material (Provisional Item) | m ³ | 30 | 111.00 | 3,330.00 |
| Total Carried to Summary | | | | | 265,830.00 |
| 5 | Signs and Roadmarkings | | | | |
| 5.1 | Remove existing markings by waterblasting | m | 3750 | 20.00 | 75,000.00 |
| 5.2 | Paint 3m stripe 7m gap 100mm white centreline | m | 750 | 2.50 | 1,875.00 |
| 5.3 | Paint 100mm continuous white edge line | m | 5000 | 2.50 | 12,500.00 |
| 5.4 | Install white bi-directional RRPMS | ea | 250 | 20.00 | 5,000.00 |
| Total Carried to Summary | | | | | 94,375.00 |
| 6 | Speed Cushions | | | | |
| 6.1 | Construct speed cushions | ea | 10 | 8,000.00 | 80,000.00 |
| Total Carried to Summary | | | | | 80,000.00 |

| Item | Description | Unit | Quantity | Rate (\$) | Amount (\$) |
|---------------------------------|---|----------------|----------|-----------|-------------------|
| 7 | Possible Additional Items | | | | |
| 7.1 | Gateway feature | LS | 1 | 20,000.00 | 20,000.00 |
| 7.2 | Construct single sumps | ea | 3 | 3,500.00 | 10,500.00 |
| 7.3 | Supply and install 300mm Class 4 RCRRJ pipes | m | 100 | 147.00 | 14,700.00 |
| 7.4 | Construct 300mm diameter concrete bag outfall | ea | 3 | 320.00 | 960.00 |
| 7.5 | Mill out existing pavement, max depth 50mm | m ² | 3200 | 7.00 | 22,400.00 |
| 7.6 | Supply, place and compact AP40 basecourse in road, max depth 50mm | m ² | 3000 | 8.00 | 24,000.00 |
| 7.7 | Supply, place and compact Grade 3 + Grade 5 two coat chip seal | m ² | 3000 | 12.00 | 36,000.00 |
| 7.8 | Install edge marker posts | ea | 100 | 20.00 | 2,000.00 |
| 7.9 | Excavate and dispose to waste to a depth of 300mm for nib kerb | m ³ | 150 | 9.20 | 1,380.00 |
| 7.10 | Construct concrete nib kerb on 150mm of compacted AP40 | m | 2500 | 80.00 | 200,000.00 |
| Total Carried to Summary | | | | | 331,940.00 |

| Item | Description | Amount (\$) |
|------|------------------------------|---------------------|
| | Summary | |
| 1.0 | Site Clearance | 12,300.00 |
| 2.0 | Earthworks and Landscaping | 5,274.00 |
| 3.0 | Crushed Lime Footpath | 178,125.00 |
| 4.0 | Surfacing and Kerbs | 265,830.00 |
| 5.0 | Signs and Roadmarkings | 94,375.00 |
| 6.0 | Speed Cushions | 80,000.00 |
| 7.0 | Possible Additional Items | 331,940.00 |
| | Sub Total | 967,844.00 |
| | 25% Contingency | 241,961.00 |
| | Total (excluding GST) | 1,209,805.00 |

APPENDIX E ALTERNATIVE ROADING PROPOSAL – SCHEMATIC PLANS AND ANALYSIS

| | | | |
|---------------------|--|--------------------|------------------------|
| To | Ian Pike | Date | 30 May 2016 |
| From | Scot Plunkett | File No. | |
| Project Name | Shelly Bay – Bulk Infrastructure Costing | Project No. | 709360 |
| Subject | Subject | Reference | 709360 ME 20160530 S2P |

1. ADDITIONAL ROADING INVESTIGATIONS

As discussed we've looked into more detail at the current roading situation and the various requirements to upgrade this to either the proposed 6m carriageway plus 1.5-2m walk/cycle way or the wider 6m carriageway plus the full 3m walk/cycle way.

The following notes should be read in conjunction with the attached plans, reference 709360 ??? - ???.



Section A: Miramar Ave – 150m

6m carriageway plus 2m path beside low wall. Wall possibly 2m into legal road width.



Section B: 150m – 450

Formed channel, > 6m carriageway, 4m path including overhead power and Pohutakawas.



Section C: 450m – 700m

- Path tapers immediately at end of “urban” area
- < 1m path at times (including vegetation)
- overhead lines on landward side



Culverts at 700m and 1150m

- 6m carriageway plus 1.4 – 2.0m path
- Structural works into shore
- Steep slope on landward side
- Vegetation on seaward side
- Overhead lines until approximately 800m
- Corridor is literally between rocks and a hard place



Examples of sporadic reclamations and strengthening works



Minimal space between existing service structure and edge of carriageway. Addition of 3m walk/cycle path would effectively remove any beach or recreational area.



Corner example: steep slope on landward side, some reclamation/strengthening already in place on seaward side (1-2m).

2. OVERALL SITE STABILITY

You also raised the question of how stable the overall site was, in relation to what confidence the developer could have that the land is fit for purpose. In short, we don't know. The ability of the site to sustain the level of development proposed will be subject to detailed structural and geotechnical investigations and reporting, both of which are far beyond the scope of our agreement. On an *all care and no responsibility* level we note the following:

- The site is protected from the coastal environment by a sea wall in varying states of repair
- Previous resurfacing of the sea wall has occurred in the Northern extent of the North bay
- Additional resurfacing is considered to be needed in the Southern extent of the North bay
- The road alignment currently abuts the coastline in the Northern bay
- The sea wall in the South bay is of various materials and has had some previous treatments

- Areas of the South bay sea wall are in need of repair
- The coastal section of the South bay is likely to adjoin recreational amenities
- The sea wall is protecting the site from the effects of the sea, and is not known to be of any structural benefit to the site itself



The Northern bay showing recently treated sea wall area (foreground) and untreated sea wall area in distance



Damaged portion of untreated area of Northern bay sea wall



Southern bay showing various sea wall treatments



Damaged area of Southern bay

- The site has sustained buildings for approximately 130 years, including large multi-storied structures
- The buildings proposed for the site include multi-storied apartment buildings
- The proposed buildings are yet to be designed to a detailed level
- Structural and geotechnical analyses of the land upon which the buildings are proposed has yet to be undertaken
- There are signs of minor slips and frittering of the rock face within the site and the access along Shelly Bay Road

edge with
cycle lane
proposals

2m wide path
between low
wall & kerb

73m path
- some trees
& power poles

Shelly Bay Road

CONTINUATION
BELOW

FOR
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path
e trees

transition
point

3m wide footpath
requiring significant
sea-wall extension;
potentially into MTHWS

1.5m wide path
possible with limited
physical works &
vegetation
impact

Shelly Bay Road

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works & vegetation impact. Some expansion to 3m wide possible

Shelly Bay Road

3m wide path requiring significant sea-wall extension and loss of beach amenity

3m wide path requiring significant sea-wall extension (beyond recent remedial works) loss of beach; MHWs

Shelly Bay Road

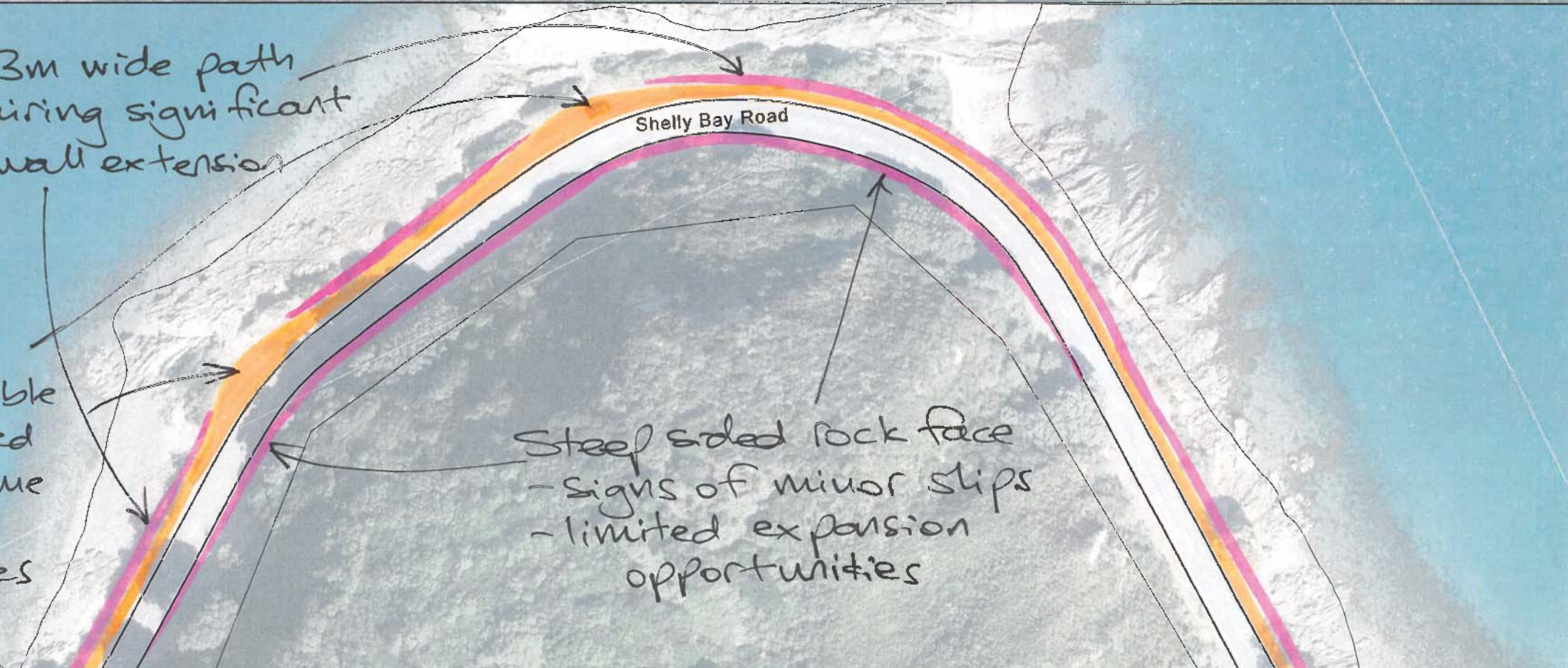
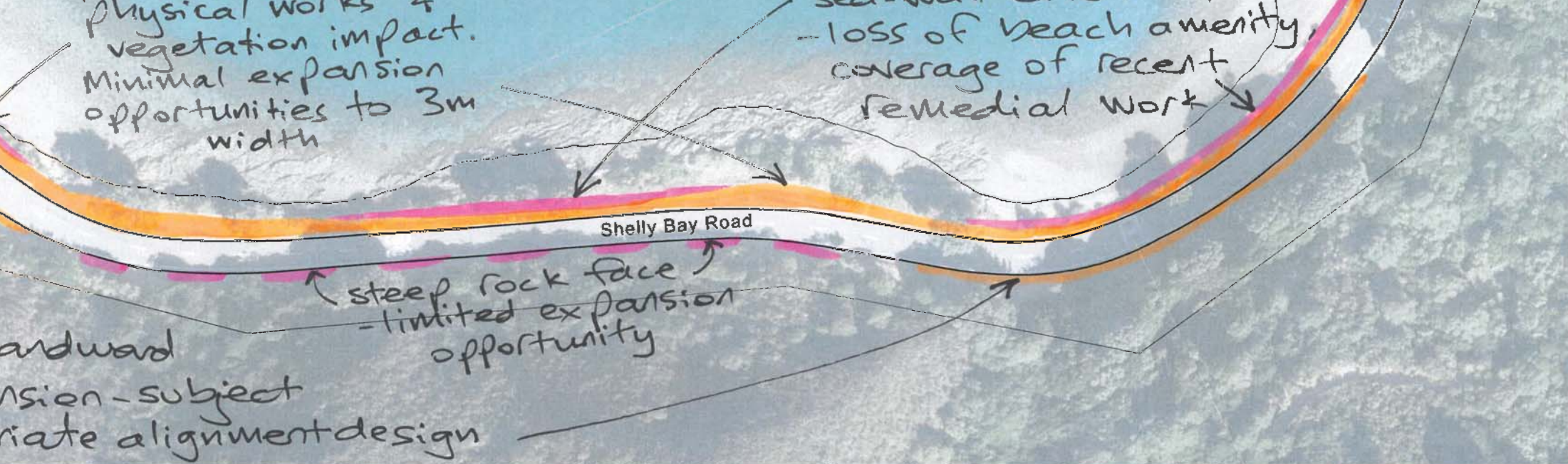
~ 1.5m wide path possible. Minimal

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possible with limited works. Minimal length of expansion possible

3m wide path - significant sea-wall extension, loss of beach amenity

landward expansion potential - subject to alignment and utility relocation

"entrance"

Shelly Bay Road

Shelly Bay Road

Main Road

Internal layout subject to developer's design

FOR REFER

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APPENDIX F WATER AND SEWAGE – DEVELOPMENT CRITERIA

This assessment of the requirements for wastewater, water supply and for the Shelly Bay Development is based on the following:

- 311 residential units
- 1,000m² of retail activity
- 800m² of hospitality activity
- Boutique hotel with 30 beds and 11 studios
- Commercial 500m² of office activity

To be able to calculate the required water supply needs and wastewater discharge, it was necessary to determine the population equivalents for the proposed development:

| Land Use | Area (ha) | Quantity | Population Equivalent |
|-------------------------------|-------------|------------------------|-----------------------|
| Residential units (dwellings) | 2.75 | 311 | 1,079 |
| Retail activity | 0.1 | 10 | 20 |
| Hospitality activity | 0.08 | 4 | 130 |
| Boutique hotel | 0.08 | 1 | 40 |
| Boutique hotel studios | 0.03 | 11 | 22 |
| Commercial | 0.05 | 1 | 50 |
| Total | 3.09 | | 1,341 |
| | | Margin of Error | +/-30% |

CHORUS

Chorus Network Services
PO Box 9405
Waikato Mail Centre Hamilton 3200
Telephone: 0800 782 386
Email: tsg@chorus.co.nz

16 May 2016

C/O Calibre Consulting
C/O Calibre Consulting

Attention: Scot Plunkett

Dear Sir / Madam

Fibre Reticulation Contract (ABF)

SUBDIVISION RETICULATION - MIR 300 SHELLY BAY ROAD, MAUPUIA, WELLINGTON, 325 UNITS MIXED COMMERCIAL & RESIDENTIAL

300 SHELLY BAY ROAD MAUPUIA

Thank you for your enquiry regarding the above subdivision.

Chorus is pleased to advise that, as at the date of this letter, we will be able to provide telephone reticulation for this subdivision. In order to complete this reticulation, we require a contribution from you to Chorus' total costs of reticulating the subdivision. Chorus' costs include the cost of network design, supply of telecommunications specific materials and supervising installation. In this instance, the Developer Contribution (as defined in the Subdivision Contract) is \$336,375.00 (including GST).

A copy of the Contract for the Supply and Installation of Telecommunications Infrastructure for the subdivision ("Subdivision Contract") is attached to this letter. If you decide to accept Chorus' offer and to proceed with reticulation of this subdivision, you will need to sign the Subdivision Contract and return it to us at: Chorus Network Services, PO Box 9405, Waikato Mail Centre, Hamilton 3200. The Subdivision Contract will govern our relationship with you in relation to reticulation of this subdivision.

You are also required to pay the Developer Contribution (see above) at the same time as you return the signed version of the Subdivision Contract to us. Clause 2.2 of the Special Terms of the Subdivision Contract explains your payment obligations in more detail.

If you do not sign the Subdivision Contract and return it to us within 90 days from the date of this letter, the offer made by Chorus to you under the Subdivision Contract is no longer valid and is automatically withdrawn. If you wish to proceed with reticulation of this subdivision in the future, we will need to issue a new agreement for you to sign at that time. We note that, if this occurs, the amount of the contribution required from you and other terms of the Subdivision Contract may change.

We draw your attention to the additional documentation included with this letter. It is very important that you read and understand this information as it relates to your obligations regarding reticulation of the subdivision.

If you have any queries, please do not hesitate to contact us.



Yours faithfully
Steve Gleadell
Network Services Coordinator

GAS SUPPLY

The following information has been supplied by Emma Gibson who is the Gas Account Manager at PowerCo.

To supply the development with a gas main to the northern most point, Powerco would need to install a new 200NB PE main approximately 2.9km from the existing 100NB PE main in Shelley Bay Road (gas main only – individual services have not been considered at this level of analysis).

A high level indication of cost to install this new gas main based on standard charges and rough order costs indicate an investment of approximately \$2.3 million dollars. This is a high level indication and normally a contract of this size would go through a competitive tender process and there could be possibilities to share trenching with other services etc. This high level indication is offered for feasibility and planning purposes only.

Powerco would be keen to engage with the developer to discuss options to make the investment feasible and provide reticulated gas to the development.

APPENDIX H 10 YEAR ASSET MANAGEMENT DETAIL

SEAWALL TO SHELLY BAY ROAD

The sporadic and variable nature of the seawall along Shelly Bay Road indicates a piecemeal reaction-based approach to maintenance. In the next 10 years, if no significant development of Shelly Bay is undertaken, this situation is unlikely to alter. It would appear that the catalyst for repairs and/or upgrades is spot-failures of the seawall or existing banks, possibly caused (at least in some way) by storm event erosion. Whilst a storm with a standard 10 year return is highly likely in the next 10 years, the impact that this would have (and therefore the remediation cost) is more difficult to determine. The "loss" of a 50m section of the seawall that requires significant remedial work to repair and secure against future events could cost between \$150,000 - \$250,000, but will largely depend on the nature of the failure and the level of remediation desired. Provisionally we suggest a budget of **\$200,000** is appropriate.

SHELLY BAY SEAWALL ON SITE

The costs outlined earlier in this report for repair, remediation and maintenance for the seawall in the development site are estimated at **\$608,000**. This figure is a useful indication of the likely costs for the upkeep of the Seawall within the development site in the next 10 years.

STORMWATER

The discharge points feeding directly to Shelly Bay appear to be fit for purpose for the current site arrangements. Without any significant changes in the use of the site over the next 10 years these are not considered likely to require substantial maintenance. If an additional outlet was required during this period, the estimated cost of the works would be in the order of **\$62,000**.

WATER SUPPLY

As noted earlier in the report, the current water supply to the site is in poor condition. We don't know whether any of the components of the system are likely to "fail" within the 10 year period or to merely require some ongoing maintenance. Failures could have significant implications for the buildings and related uses of the Shelly Bay area. For the purpose of this report we have assumed two sizeable "issues", will occur over the 10 year period, and each of these is estimated to require remedial/maintenance work of \$10,000 - \$15,000. On this basis, total estimated water supply maintenance costs would be **\$25,000**.

WASTEWATER

The existing rising main and gravity line that service the Shelly Bay area are anecdotally in poor condition. The current system requires careful and restricted use to ensure efficient service is not compromised, but it is hardly considered reliable. Without any significant development of the area there may be little priority given to upgrades of the service, beyond "patching up" what is there now. Depending on what "event" creates the need for specific maintenance the cost for this will vary considerably. A broad allowance for some reasonably significant work on a localised failure in the pipework is likely to generate costs of \$25,000 - \$30,000 per event. For the purpose of this report we have allowed for two such events giving a total estimated wastewater maintenance cost of **\$55,000**.



MEMO

TO: IAN PIKE

COPIED TO: JETESH BHULA, RYAN ROSE, MARK KINVIG, DAVID CHICK

FROM: BEN FOUNTAIN

DATE: 14-08-2017

SHELLY BAY: 3 WATERS INFRASTRUCTURE COST ESTIMATION REVIEW

Andrew and Ian,

Wellington Water Ltd has been asked to review the proposed 3 waters infrastructure and cost estimates in the document titled *Shelly Bay, Wellington, Public Infrastructure Briefing*, Calibre, 19 June 2017. This high level review has taken the following steps:

- A. Consider the 3 waters infrastructure needed to service the Miramar Peninsular in the long term. This includes the expected infill development, population changes and the likely major developments including those in Shelly Bay and Mount Crawford.
- B. Estimate the cost of the components of the long term Miramar infrastructure upgrade plans that will need to be constructed to enable the Shelly Bay Development.
- C. Calculate an appropriate contribution to the new infrastructure required that should be allocated to the Shelly Bay Development.
- D. Calculate an appropriate contribution to the upgrades required in the existing infrastructure that should be allocated to the Shelly Bay Development.
- E. Review the cost estimates for the proposed 3 waters infrastructure recommended by Calibre

Summary of Findings

A combination of new infrastructure as well as upgrades to the existing infrastructure is needed to provide wastewater and water supply infrastructure to service the Shelly Bay Development. The upgrades and new assets should be constructed with consideration given to the infrastructure needed to support all medium term growth on the Miramar Peninsular. There are significant overall cost savings if future developments, such as the Mount Crawford Development, are planned for in conjunction with the development in Shelly Bay.

Allocation of infrastructure costs has been made by proportioning the costs of the infrastructure based on required capacity needed for the Shelly Bay Development and the remaining life of the assets requiring upgrade. The results of this analysis are summarised in Table 1.

Table 1 Summary of the Cost Estimation

| Item | Description | Cost Estimate |
|-------------|---|----------------------|
| B | Total cost estimate of the components of the long term infrastructure upgrade plans for the Miramar Peninsular that will need to be constructed to enable the Shelly Bay development. | \$14.5M |
| C | A contribution to the required <u>new infrastructure</u> that should be allocated to the Shelly Bay Development. | \$6.6M |
| D | A contribution to the required upgrades of the <u>existing infrastructure</u> that should be allocated to the Shelly Bay Development. | \$2.3M |
| | Total contribution to the required wastewater and water supply infrastructure that should be allocated to the Shelly Bay Development (C+D). | \$8.9M |

The cost contribution that should be allocated to the Shelly Bay Development has been calculated to be \$8.9M out of the total \$14.5M worth of infrastructure upgrades required to support the development. The remaining \$5.6M worth of infrastructure costs includes the cost to provide additional capacity to support other future development on the Miramar Peninsular, this cost can be recovered as those developments are realised.

Please note that this analysis has excluded the costs of stormwater infrastructure at Shelly Bay as little detail has been provided in the Calibre report and the planned stormwater network services only the Shelly Bay Development.

Further detail of this assessment is included below.

Miramar Peninsular Long Term Infrastructure Plans

The Shelly Bay Development anticipates a mix of residential and commercial uses with a predicted equivalent population of just over 1300 people. Infill development in Miramar is expected to result in a population increase of around 1000 people in the next 30 years (Forcast.ID estimate). In addition to this there is the potential for considerable greenfield development on and around Mount Crawford. The existing 3 waters infrastructure in the Miramar Peninsular is at capacity in many parts of all three networks. Capacity increases in the existing network are needed to support future growth.

Wellington Water staff workshopped these considerations to identify the infrastructure upgrades required to support the Shelly Bay Development along with the other areas of growth potential on the Miramar Peninsular. Indicative plans of the required new and upgraded infrastructure identified in the workshop are shown in Figures 1 and 2 below.

In these Figures the new public infrastructure required to supply the Shelly Bay Development is indicated in yellow. The alignment of this new infrastructure is indicative only. The upgrades required to the existing infrastructure to provide the additional capacity needed for the development are shown in orange.

It is important to note that the infrastructure proposed by Wellington Water differs from that proposed in the Calibre Report especially for water supply. Wellington Water have focused on efficiently providing infrastructure to the foreseeable development on the peninsular whereas the Calibre report has focused on providing infrastructure to just serve Shelly Bay.

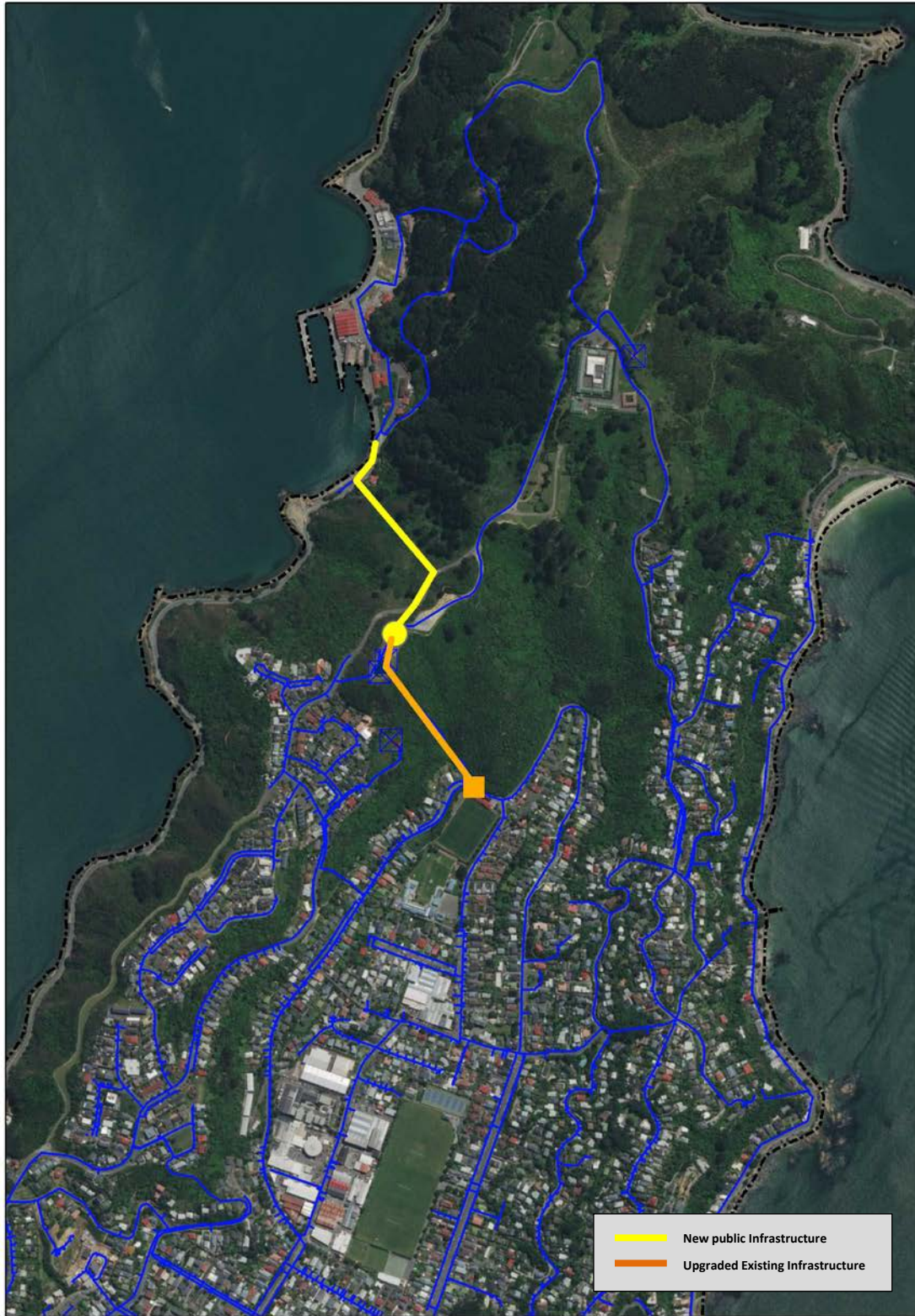


Figure 1: Water Supply network modifications required to support the Shelly Bay development



Figure 2: Wastewater network modifications required to support the Shelly Bay development

Water Supply

The existing twin Maupuia reservoirs, that supply much of the Miramar Peninsular, do not have spare capacity to support the proposed Shelly Bay Development. A new reservoir with sufficient capacity for Shelly Bay as well as increased storage for the existing area and capacity for the predicted infill development in Miramar is required at the Maupuia Reservoirs site. Filling the estimated 3 ML reservoir would require upgrades to the existing pump station and rising main that fills the existing Maupuia reservoirs. Connecting the reservoir with the development in Shelly Bay would require a new pipeline and fittings.

The high level costs of the new water supply infrastructure directly attributable to enabling the Shelly Bay Development is summarised in the table below (Table 2).

Table 2 High level estimate of costs of new water supply infrastructure to support the Shelly Bay Development

| Physical Works Element | Cost | Physical Work Total | Physical Work Incl. Uplifts (55% for design, consenting, supervision and risk) |
|--|--------------|---------------------|--|
| New water supply reservoir adjacent to existing Maupuia reservoirs | | | |
| Construct a new 3ML supply reservoir: above ground, reinforced concrete structure (Note: The full cost of the reservoir is \$3,609,000. This table includes 1/3 of the full cost as only 1/3 of the storage is directly needed for the proposed the Shelly Bay development, the remainder of the cost included in Table 3) | \$776,133.99 | \$776,134 | \$1,203,008 |
| Water supply main from new Water Supply Reservoir (Ref 1.2.1) to Shelly Bay Development | | | |
| supply and install 150mm internal diameter PN35 CLDI pipeline with tyton lok gaskets: installed at 1m cover on nominal grade, road | \$280,500.00 | | |
| supply and install 150mm internal diameter PN35 CLDI pipeline with tyton lok gaskets: installed at 1m cover, inclined on hillside | \$200,000.00 | | |
| bends and fittings along the alignment | \$48,050.00 | | |
| Break Pressure chamber or pressure reducing and pressure relief valve | \$200,000.00 | | |
| excavation in hard rock or concrete | \$1,000.00 | | |
| excavation in running sand | \$1,000.00 | | |
| concrete anchor Block at top and bottom of inclined section | \$5,000.00 | | |
| concrete water stop at each CLDI collar on inclined section | \$16,000.00 | | |
| reinstatement, trafficked highway | \$33,000.00 | | |
| reinstatement, greenfield | \$10,000.00 | | |
| make connection to existing reticulation | \$5,000.00 | \$799,550 | \$1,239,303 |
| Water supply local reticulation within the development | | | |
| Costs for reticulation, valves and fire hydrants taken directly from the Calibre report. | \$880,000 | \$880,000 | \$1,364,000 |
| Total Physical Work Incl. Uplifts (55%) | | | \$3,806,310 |

In addition to the new water supply infrastructure, to support the development there are also upgrades required to the existing water infrastructure. These upgrades will renew and add to the capacity of the existing system which benefits not just Shelly Bay but also the existing users as well as providing for future growth in the area. The required upgrades to these parts of the existing water supply network that are currently at capacity to allow for the development of Shelly Bay are summarised in the table below (Table 3).

Table 3 High level estimate of costs of upgrades to existing water supply infrastructure to support the development of Shelly Bay

| Physical Works Element | Cost | Physical Work Total | Physical Work Incl. Uplifts (55% for design, consenting, supervision and risk) |
|--|-------------|---------------------|--|
| Water supply reservoir adjacent to existing Maupuia reservoirs | | | |
| Construct a new 3ML supply reservoir: above ground, reinforced concrete structure (Note: The full cost of the reservoir is \$3,609,000. This table includes 2/3 of the full cost that supports the predicted infill development on the Miramar Peninsular) | \$1,552,268 | \$1,552,268 | \$2,406,015 |
| 45KW pump sets, switchgear and pipework | | | |
| Upgrade to existing reservoir pumps and rising main to fill the Maupuia reservoirs | \$299,995 | \$299,995 | \$465,000 |
| Physical Work Incl. Uplifts (55%) | | | \$2,871,015 |

The total high level cost estimate to provide the water supply infrastructure to support the Shelly Bay Development is just over \$6.7M with approximately \$3.8M of this related to new infrastructure to connect Shelly Bay with the existing public networks and the remainder being required for upgrades to the existing infrastructure.

Wastewater

To connect the proposed Shelly Bay development to the existing wastewater network a new pump station and rising main is required down Shelly Bay Road (this new infrastructure is shown in yellow in Figure 2). This infrastructure should be sized to also allow for future growth on Mount Crawford as the existing network in Miramar is already at capacity. An easement to secure a corridor for the Mount Crawford development’s infrastructure to connect to the wastewater pump station in Shelly Bay should also be included in the developments planning.

The high level costs of the new wastewater infrastructure directly attributable to enabling the Shelly Bay Development are summarised in the table below (Table 4).

Table 4 High level estimate of costs of new wastewater infrastructure to support the Shelly Bay Development

| Physical Works Element | Cost | Physical Work Total | Physical Work Incl. Uplifts (55% for design, consenting, supervision and risk) |
|--|--------------|---------------------|--|
| Wastewater PS for new development | | | |
| Construction of a wet well and dry well consisting of a 4 m wide x 5 m long x 3.5 m deep (internal dimensions) underground reinforced concrete chamber | \$375,000.00 | | |
| External pipework and inlet / outlet connections to pump station | \$2,500.00 | | |
| Internal pipework including sluice valves, non-return valves, rubber bellows, bends, tees and reducers | \$25,000.00 | | |
| wet well pipework including pipework through to dry well | \$2,500.00 | | |
| pumps, 15kW rated | \$20,000.00 | | |
| electrical works | \$50,000.00 | | |
| lighting | \$5,000.00 | | |
| power supply to site | \$7,000.00 | | |
| water supply to site plus internal plumbing | \$3,000.00 | | |
| miscellaneous site mechanical, electrical and control | \$24,000.00 | | |
| miscellaneous site civils | \$24,000.00 | \$538,000.00 | \$833,900.00 |
| Wastewater rising main from new development | | | |
| supply and install 250 OD SDR 17 PE 100 Rising Main (butt welded) | \$748,000.00 | | |
| bends and fittings along the alignment | \$74,800.00 | | |
| removal and disposal of existing main | \$110,000.00 | | |
| excavation in hard rock or concrete | \$6,000.00 | | |
| excavation in running sand | \$6,000.00 | | |
| reinstatement, trafficked highway | \$198,000.00 | | |
| make connection to existing network at existing chamber downstream | \$5,000.00 | \$1,147,800.00 | \$1,779,090.00 |
| Wastewater local reticulation within the development | | | |
| Costs for reticulation including manholes taken directly from the Calibre report. | \$400,000 | \$400,000 | \$620,000.00 |
| Total Physical Work Incl. Uplifts (55%) | | | \$3,232,990.00 |
| Total Physical Work Incl. Uplifts (55%) if Sized Just for Shelly Bay (reduced pump station and rising main size) | | | \$2,782,990.00 |

As with the water supply network, there are upgrades to the existing wastewater network that are also required to provide capacity for the Shelly Bay development. Currently much of the wastewater network in the low lying areas of Miramar is fully utilised. To cater for the growth expected on the Miramar Peninsular

upgrades are required. In Figure 2 the upgrades to the existing network required to support the Shelly Bay development have been shown in orange. Based on the age and condition of the existing infrastructure only a proportion of the cost of these upgrades should be assigned to the Shelly Bay Development. It should also be noted that these upgrades to the existing network are not currently planned in the LTP.

The required upgrades to the existing wastewater network that are currently at capacity to allow for the development of Shelly Bay are summarised in the table below (Table 5).

Table 5 High level estimate of costs of upgrades to existing wastewater infrastructure to support the development of Shelly Bay

| Physical Works Element | Cost | Physical Work Total | Physical Work Incl. Uplifts (55% for design, consenting, supervision and risk) |
|--|----------------|---------------------|--|
| Upgrade of existing gravity network | | | |
| supply and install 250 OD SDR 17 PE 100 Rising Main (butt welded) | \$8,580.00 | \$1,099,660.00 | \$1,704,473.00 |
| supply and install 355 OD SDR 17 PE 100 Rising Main (butt welded) | \$343,000.00 | | |
| supply and install 560 OD SDR 17 PE 100 Rising Main (butt welded) | \$255,500.00 | | |
| supply and install 630 OD SDR 17 PE 100 Rising Main (butt welded) | \$235,000.00 | | |
| reinstatement, trafficked highway (250 OD pipe) | \$1,980.00 | | |
| reinstatement, trafficked highway (355 OD pipe) | \$77,000.00 | | |
| reinstatement, trafficked highway (560 OD pipe) | \$45,500.00 | | |
| reinstatement, trafficked highway (630 OD pipe) | \$35,000.00 | | |
| removal and disposal of existing pipework | \$66,100.00 | | |
| Make connections to existing manholes | \$26,000.00 | | |
| excavation in hard rock or concrete | \$3,000.00 | | |
| excavation in running sand | \$3,000.00 | | |
| Upgrade of existing rising main | | | |
| supply and install 450 OD SDR 11 PE 100 Rising Main (butt welded) | \$1,045,000.00 | \$1,842,500.00 | \$2,855,875.00 |
| bends and fittings along the alignment | \$104,500.00 | | |
| removal and disposal of existing main | \$550,000.00 | | |
| excavation in hard rock or concrete | \$3,000.00 | | |
| excavation in running sand | \$3,000.00 | | |
| reinstatement, trafficked highway | \$132,000.00 | | |
| make connection to existing network at existing chamber downstream | \$5,000.00 | | |
| Total Physical Work Incl. Uplifts (55%) | | | \$4,560,348.00 |

The total high level cost estimate to provide the wastewater infrastructure to support the Shelly Bay development is \$7.8M with approximately \$3.2M of this related to new infrastructure to connect Shelly Bay with the existing public networks and \$4.6M related to upgrades of the existing network.

Stormwater

Little information has been provided on the provision of stormwater services for the site. The steep catchment behind the development can generate high flows in intense rainfall. There are historical records of surface flooding in Shelly Bay indicating there are possible flood risks that will need to be managed. Furthermore the stormwater infrastructure in Shelly Bay should be sized with consideration given to potential future development in the upper catchment. In addition to stormwater infrastructure it is recommended that the development includes easements that identify and protect the overland flow paths that pass through the site.

Contribution to the new infrastructure and upgrades that should be allocated to the Shelly Bay Development

The costs of the new infrastructure required to support the Shelly Bay Development (assets in yellow in Figure 1 and 2 and summarised in Table 2 and 4) should be allocated to the development. The total cost of this new infrastructure is estimated at just over \$6.6M. Please note that this includes only 1/3 of the cost of the new Maupuia water supply reservoir and does not include the cost of the additional wastewater capacity required for the Mount Crawford Developments.

The upgrades that are required to the existing public network to provide the additional capacity to support new development on the peninsula (assets in orange in Figure 1 and 2 and summarised in Table 3 and 5) will be undertaken on assets that have already delivered value to the city and in some cases are nearing the end of their service life. The methodology used to allocate the upgrade costs to the Shelly Bay Development is as follows:

1. Determine the like for like replacement costs for the upgrades of the existing assets.
2. Identify the average remaining life of the assets and proportion the like for like upgrade costs accordingly.
3. Determine the additional costs for the capacity upgrades required to support new development on the peninsula
4. Determine the proportion of the additional costs for the capacity upgrades required just to support the Shelly Bay Development
5. Calculate the total cost of the upgrades to be allocated to the Shelly Bay Development by adding the additional costs associated with the Shelly Bay capacity upgrades to the age proportioned costs of the like for like replacement.

The results of this analysis are shown in Table 6,7 and 8.

Table 6 High level estimate of the remaining value in the existing infrastructure requiring upgrade

| Item | Physical Works Element | Cost | Notes |
|------|--|--------|---|
| 1 | Like for like replacement cost of existing assets requiring upgrades | \$2.9M | Note that this excludes the 2/3 cost of the new Maupuia water supply reservoir (Table 3) which will service the existing community |
| 2 | Like for like replacement costs proportioned by the remaining average asset life (40%) | \$1.2M | Using the 100 year asset life that is anticipated from earthenware and HDPE wastewater pipes the average remaining life of the existing network that would need to be upgraded is 40 years. (40% of Item 1) |

Table 6 identifies the remaining value in the existing assets that will need to be replaced as \$1.2M.

Table 7 High level estimate of cost of increasing the capacity of the existing infrastructure

| Item | Physical Works Element | Cost | Notes |
|------|---|--------|--|
| | Total cost of the upgrades to the existing network to support new development on the peninsula. | \$5.0M | Sum of Table 3 and Table 5 provides the total cost of upgrades (excluding the reservoir costs) |
| 3 | Cost of providing the additional capacity in the existing infrastructure that is needed to support future development | \$2.1M | Total cost for upgrades less the like for like replacement costs |
| 4 | Additional cost for the capacity upgrades to support just the Shelly Bay Development | \$1.1M | It has been assumed that half of the foreseeable greenfield development on the peninsula will be associated with the Shelly Bay Development (half of Item 3) |

Table 7 identifies the cost of providing additional capacity for the Shelly Bay Development in the existing network as \$1.1M.

Table 8 High level estimate of costs of the upgrades to existing infrastructure to be allocated to the Shelly Bay Development

| Item | Physical Works Element | Cost | Notes |
|------|--|--------|---|
| 5 | Total cost of the existing network upgrades to be allocated to the Shelly Bay Development. | \$2.3M | Sum of proportion of the remaining asset life of the like for like replacement cost and the additional cost for the capacity upgrades required to service Shelly Bay. (Items 2+4) |

The contribution to the new infrastructure and upgrades to the existing infrastructure to be allocated to the Shelly Bay development is \$8.9M. This is made up of the full \$6.6M for the new infrastructure required and \$2.3M contribution towards the \$5.0M required for upgrades to the existing infrastructure. Note that this sum excludes 2/3s of the costs associated with the new Maupuia Reservoir which will service the existing community. It also excludes the costs of oversizing the new infrastructure to meet the predicted future needs of other-developments on the peninsula.

Assessment of the Calibre Cost Estimate

Wellington Water proposes that the infrastructure to support the Shelly Bay Development is implemented with consideration of the needs of the wider area including the potential for the Mount Crawford Developments. This differs from the infrastructure proposed in the Calibre report which is focused only on supporting the needs of the Shelly Bay Development. Using its database of current construction rates Wellington Water has also costed the proposed 3 waters infrastructure in the document titled *Shelly Bay, Wellington, Public Infrastructure Briefing*, Calibre, 19 June 2017. The Wellington Water cost estimates have been compared with those in the report.

The comparison found little difference in the base rates between the two cost estimates however the Calibre recommended uplift of 25% contingency is lower than the 55% Wellington Water would recommend for this high level assessment. The 55% uplift recommended by Wellington Water includes:

| | |
|---|------------|
| Preliminaries and Pre-construction Set-up | 10% |
| Risk and Contingency | 30% |
| Project and Contract Management | 5% |
| Consultancy Fees | 10% |
| TOTAL | 55% |

The comparison of the cost estimates associated with the new infrastructure in the Calibre report are shown in Table 9. Wellington Water has identified that these cost estimates should be increased by \$1.2M given the uncertainties of the high level assessment. However Wellington Water does not believe that some of this proposed infrastructure in the Calibre report is in the best long term interest of the peninsular as a whole.

Table 9 Comparison of the cost estimates of the infrastructure in the Calibre report

| Network | Calibre (+25%) | WWL (+55%) | Difference |
|--------------------|----------------|--------------|----------------------|
| Wastewater Network | \$ 2,750,000 | \$ 3,499,823 | -\$ 749,823 |
| Water Network | \$ 3,057,000 | \$ 3,502,239 | -\$ 445,239 |
| TOTAL | | | -\$ 1,195,062 |

Conclusions

The high level review of the costs to provide water supply and wastewater infrastructure to Shelly Bay has identified a total cost of \$14.5M. Of this total cost approximately half is new infrastructure and half is upgrades to the existing networks to create additional capacity for development. An \$8.9M contribution to the new infrastructure and upgrades should be allocated to the Shelly Bay Development.

The review identified that significant cost savings are available by considering the wider growth potential on the Miramar Peninsula and implementing infrastructure improvements in a coordinated and planned way rather than an ad-hoc site by site basis. Throughout the design and implementation of the 3 waters infrastructure for this development Wellington Water Ltd would want confidence that the infrastructure to support the Shelly Bay development is compatible with the wider renewal and growth plans for the Miramar Peninsula.

It is important to note that without site investigation, especially ground conditions, and detailed design there is considerable uncertainty around the costs of providing 3 waters infrastructure to Shelly Bay. It will be important to appropriately allocate and manage the financial risks when using these high level estimates.

A further suggestion is that a corridor is secured in the Shelly Bay development with an easement that allows new infrastructure from Mount Crawford to connect into the proposed wastewater pump station.

If you need additional information please contact me.

Ben Fountain
Modelling Manager
Wellington Water

Ph:021306239
Ben.fountain@wellingtonwater.co.nz

APPENDIX 3

**ENVELOPE ENGINEERING LTD ENGINEERING PLANS
DETAILING 'PUBLIC' WORKS**

ENVELOPE

LAND
STRUCTURE
MANAGE

CLIENT:
THE WELLINGTON COMPANY

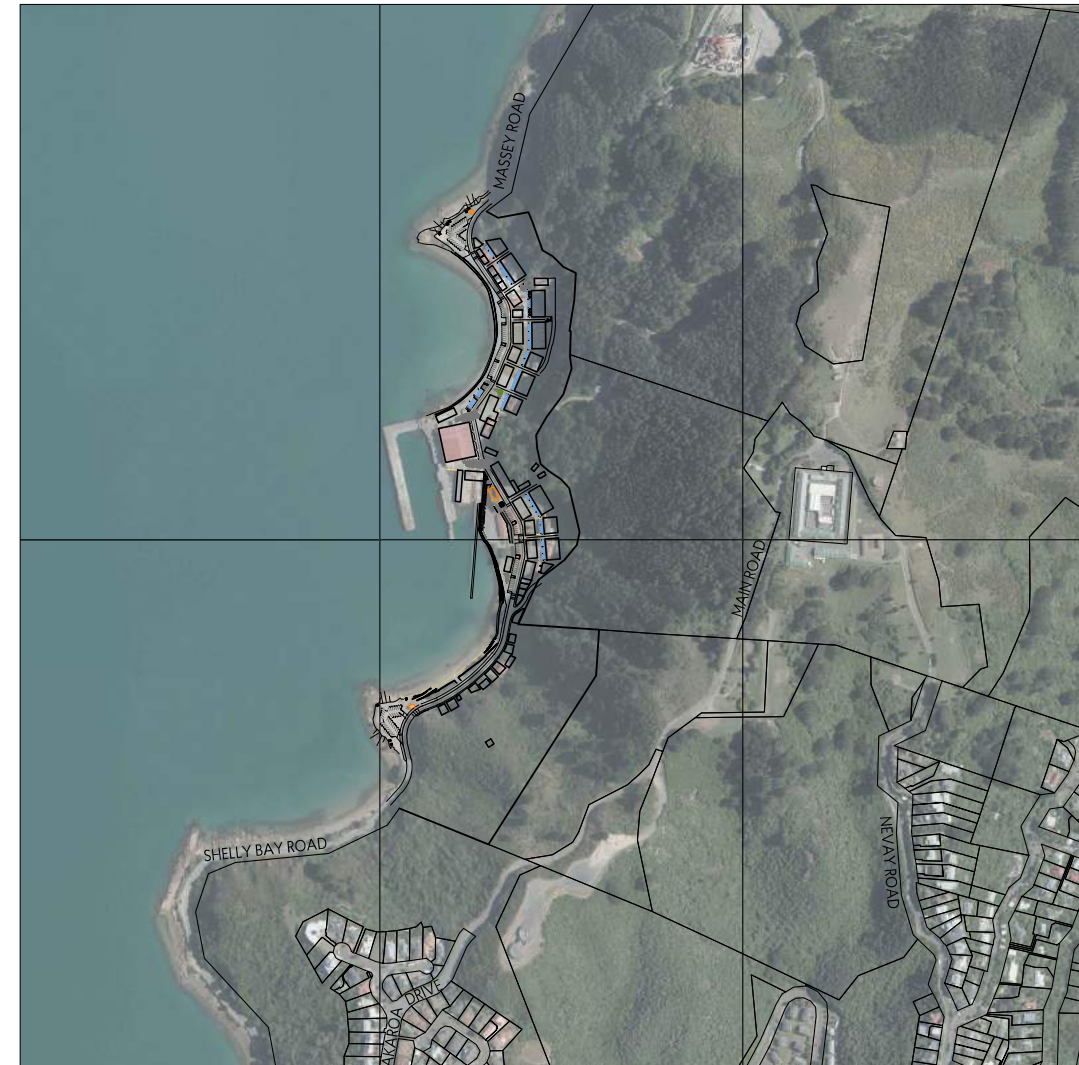
PROJECT:
SHELLY BAY
SHELLY BAY ROAD
WELLINGTON

PLAN SET:
CIVIL ENGINEERING DRAWINGS

ISSUE:
RESOURCE CONSENT

DATE:
14th SEPTEMBER 2016

REFERENCE:
1098-01



LOCATION PLAN
SCALE A1 - 1:5000, A3 - 1:10000

ENVELOPE

LAND
STRUCTURE
MANAGE

CLIENT:
THE WELLINGTON COMPANY

PROJECT:
SHELLY BAY
SHELLY BAY ROAD
WELLINGTON

PLAN SET:
CIVIL ENGINEERING DRAWINGS

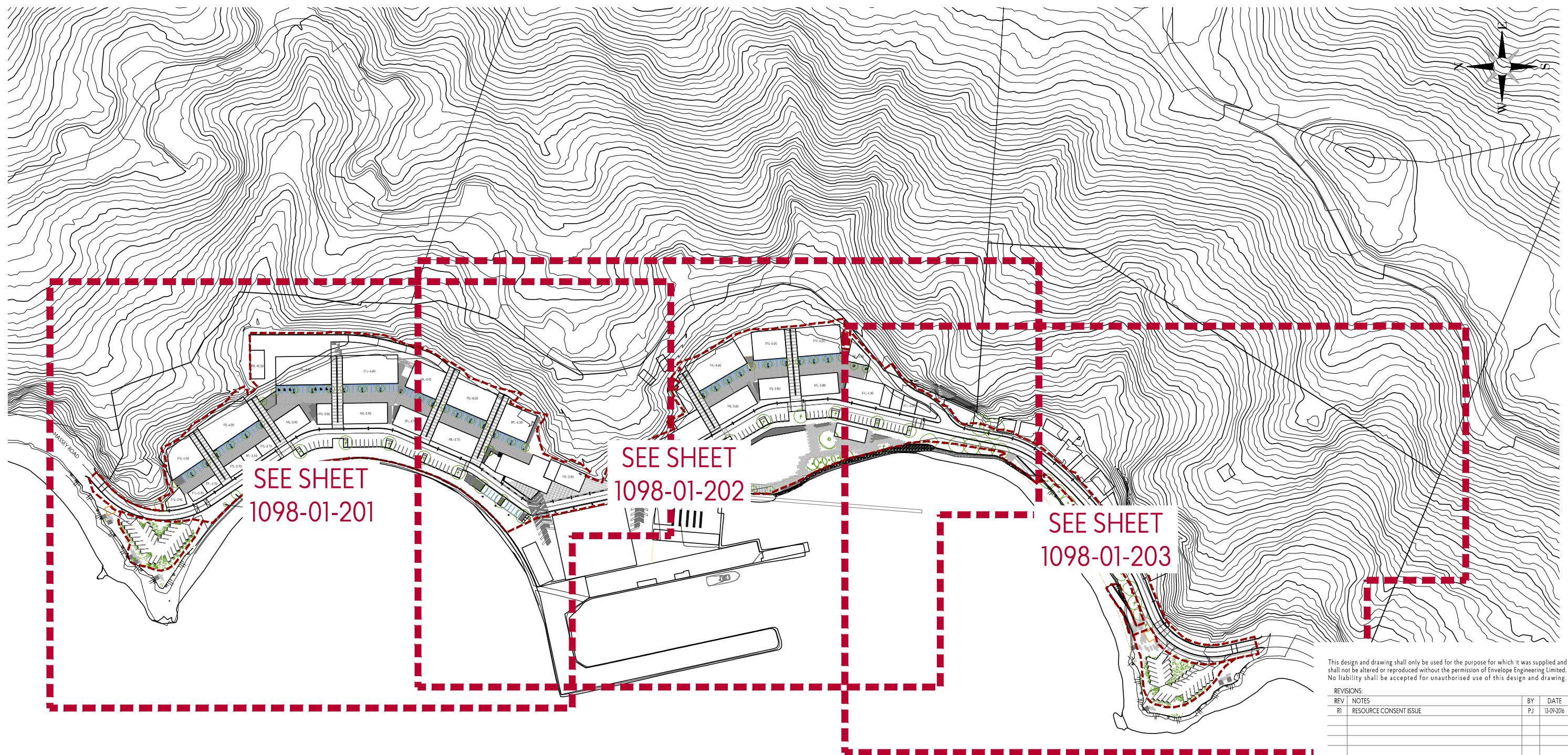
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RESOURCE CONSENT

DATE:
14th SEPTEMBER 2016

REFERENCE:
1098-01

| DRAWING INDEX | |
|---------------|---|
| DRAWING | NAME |
| 1098-01-200 | EXISTING CONTOUR PLAN - OVERALL LAYOUT |
| 1098-01-201 | EXISTING CONTOUR PLAN - SHEET 1 OF 3 |
| 1098-01-202 | EXISTING CONTOUR PLAN - SHEET 2 OF 3 |
| 1098-01-203 | EXISTING CONTOUR PLAN - SHEET 3 OF 3 |
| 1098-01-210 | PROPOSED CONTOUR PLAN - OVERALL LAYOUT |
| 1098-01-211 | PROPOSED CONTOUR PLAN - SHEET 1 OF 3 |
| 1098-01-212 | PROPOSED CONTOUR PLAN - SHEET 2 OF 3 |
| 1098-01-213 | PROPOSED CONTOUR PLAN - SHEET 3 OF 3 |
| 1098-01-220 | PROPOSED CUT/FILL PLAN - OVERALL LAYOUT |
| 1098-01-221 | PROPOSED CUT/FILL PLAN - SHEET 1 OF 3 |
| 1098-01-222 | PROPOSED CUT/FILL PLAN - SHEET 2 OF 3 |
| 1098-01-223 | PROPOSED CUT/FILL PLAN - SHEET 3 OF 3 |
| 1098-01-230 | PROPOSED EROSION AND SEDIMENT CONTROL PLAN - OVERALL |
| 1098-01-231 | PROPOSED EROSION AND SEDIMENT CONTROL PLAN - SHEET 1 OF 3 |
| 1098-01-232 | PROPOSED EROSION AND SEDIMENT CONTROL PLAN - SHEET 2 OF 3 |
| 1098-01-233 | PROPOSED EROSION AND SEDIMENT CONTROL PLAN - SHEET 3 OF 3 |
| 1098-01-235 | EROSION AND SEDIMENT CONTROL DETAILS - SHEET 1 OF 3 |
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| 1098-01-237 | EROSION AND SEDIMENT CONTROL DETAILS - SHEET 3 OF 3 |
| 1098-01-300 | PROPOSED ROAD LAYOUT - OVERALL LAYOUT |
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| 1098-01-302 | PROPOSED ROAD LAYOUT - SHEET 2 OF 6 |
| 1098-01-303 | PROPOSED ROAD LAYOUT - SHEET 3 OF 6 |
| 1098-01-304 | PROPOSED ROAD LAYOUT - SHEET 4 OF 6 |
| 1098-01-305 | PROPOSED ROAD LAYOUT - SHEET 5 OF 6 |
| 1098-01-306 | PROPOSED ROAD LAYOUT - SHEET 6 OF 6 |
| 1098-01-320 | PROPOSED ROAD LONG-SECTIONS - SHEET 1 OF 4 |
| 1098-01-321 | PROPOSED ROAD LONG-SECTIONS - SHEET 2 OF 4 |
| 1098-01-322 | PROPOSED ROAD LONG-SECTIONS - SHEET 3 OF 4 |
| 1098-01-323 | PROPOSED ROAD LONG-SECTIONS - SHEET 4 OF 4 |
| 1098-01-330 | PROPOSED ROAD TYPICAL CROSS-SECTIONS - SHEET 1 OF 2 |
| 1098-01-331 | PROPOSED ROAD TYPICAL CROSS-SECTIONS - SHEET 2 OF 2 |

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| 1098-01-400 | PROPOSED DRAINAGE LAYOUT PLAN - OVERALL LAYOUT |
| 1098-01-401 | PROPOSED DRAINAGE LAYOUT PLAN - SHEET 1 OF 6 |
| 1098-01-402 | PROPOSED DRAINAGE LAYOUT PLAN - SHEET 2 OF 6 |
| 1098-01-403 | PROPOSED DRAINAGE LAYOUT PLAN - SHEET 3 OF 6 |
| 1098-01-404 | PROPOSED DRAINAGE LAYOUT PLAN - SHEET 4 OF 6 |
| 1098-01-405 | PROPOSED DRAINAGE LAYOUT PLAN - SHEET 5 OF 6 |
| 1098-01-406 | PROPOSED DRAINAGE LAYOUT PLAN - SHEET 6 OF 6 |
| 1098-01-410 | STORMWATER CATCHMENT PLAN |
| 1098-01-420 | PROPOSED STORMWATER LONG-SECTIONS - SHEET 1 OF 5 |
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| 1098-01-423 | PROPOSED STORMWATER LONG-SECTIONS - SHEET 4 OF 5 |
| 1098-01-424 | PROPOSED STORMWATER LONG-SECTIONS - SHEET 5 OF 5 |
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| 1098-01-432 | PROPOSED WASTEWATER LONG-SECTIONS - SHEET 3 OF 5 |
| 1098-01-433 | PROPOSED WASTEWATER LONG-SECTIONS - SHEET 4 OF 5 |
| 1098-01-434 | PROPOSED WASTEWATER LONG-SECTIONS - SHEET 5 OF 5 |
| 1098-01-500 | PROPOSED WATER SUPPLY LAYOUT - OVERALL LAYOUT |
| 1098-01-501 | PROPOSED WATER SUPPLY LAYOUT - SHEET 1 OF 6 |
| 1098-01-502 | PROPOSED WATER SUPPLY LAYOUT - SHEET 2 OF 6 |
| 1098-01-503 | PROPOSED WATER SUPPLY LAYOUT - SHEET 3 OF 6 |
| 1098-01-504 | PROPOSED WATER SUPPLY LAYOUT - SHEET 4 OF 6 |
| 1098-01-505 | PROPOSED WATER SUPPLY LAYOUT - SHEET 5 OF 6 |
| 1098-01-506 | PROPOSED WATER SUPPLY LAYOUT - SHEET 6 OF 6 |





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PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
 EXISTING CONTOUR PLANS
 OVERALL LAYOUT

- LEGEND:**
-  INDICATES EXISTING CONTOURS SHOWN AT 2.0m INTERVALS
 -  INDICATES EXTENT OF PROPOSED BULK EARTHWORKS

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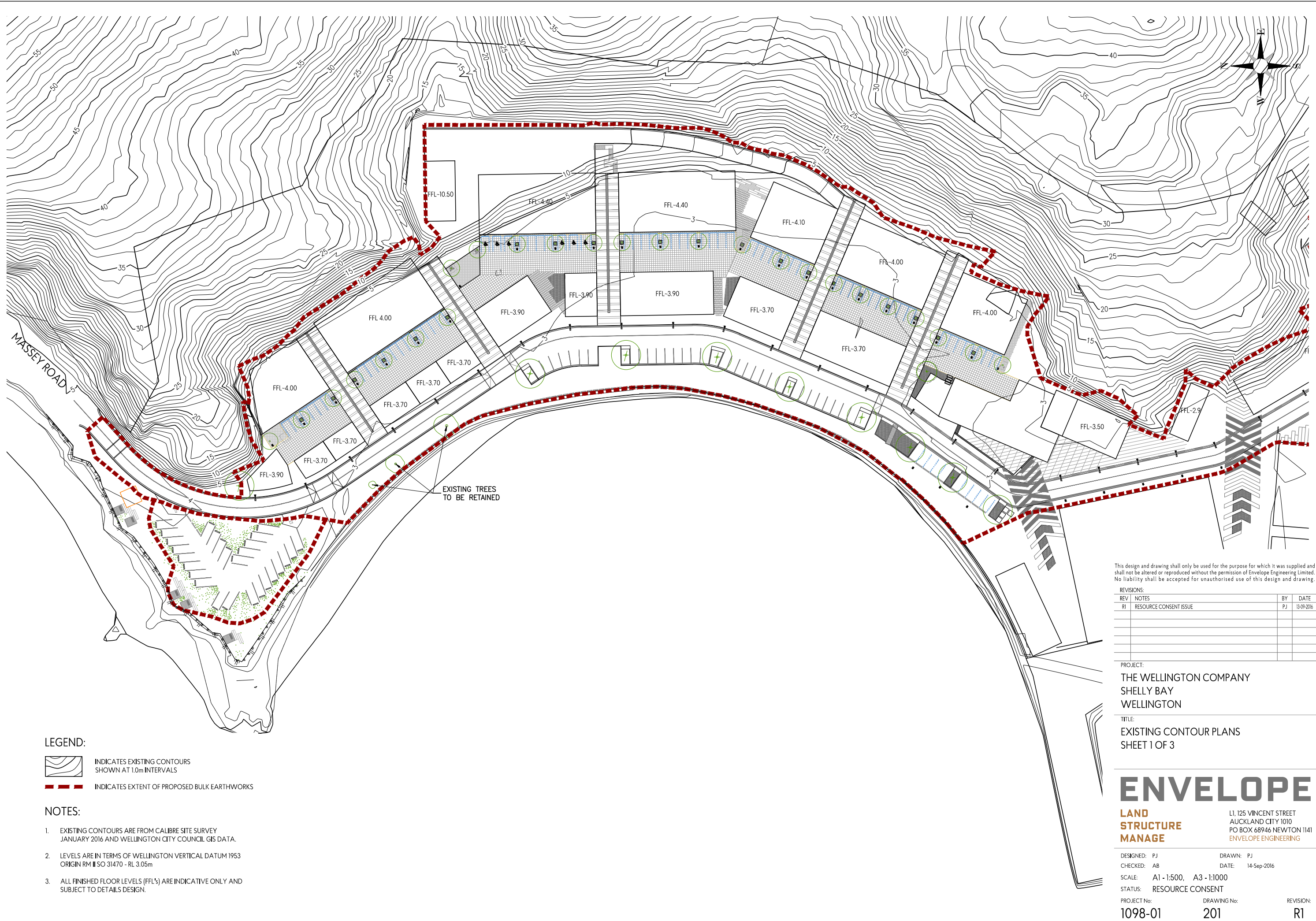
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PROJECT:
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 WELLINGTON

TITLE:
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 SHEET 1 OF 3

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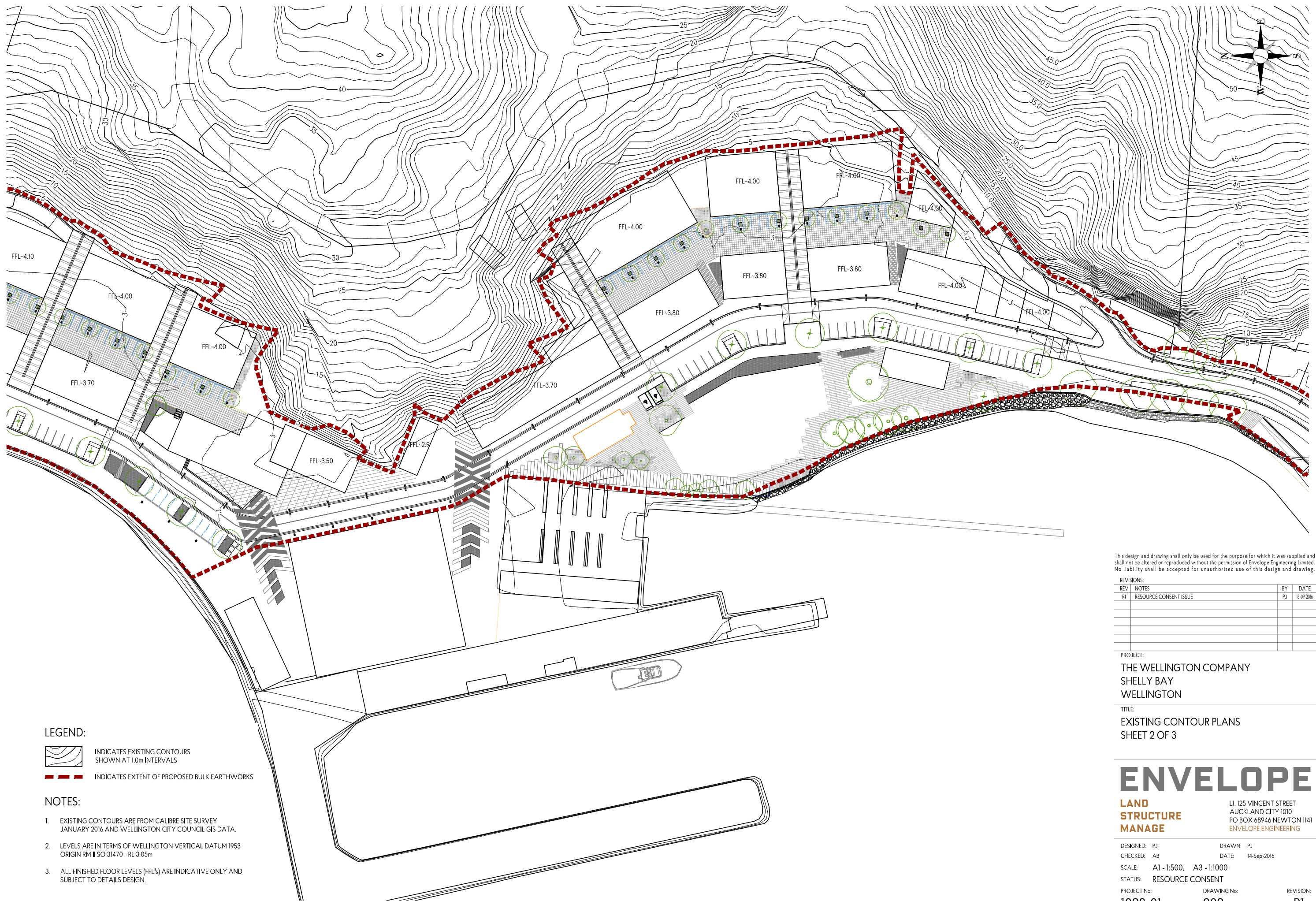
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

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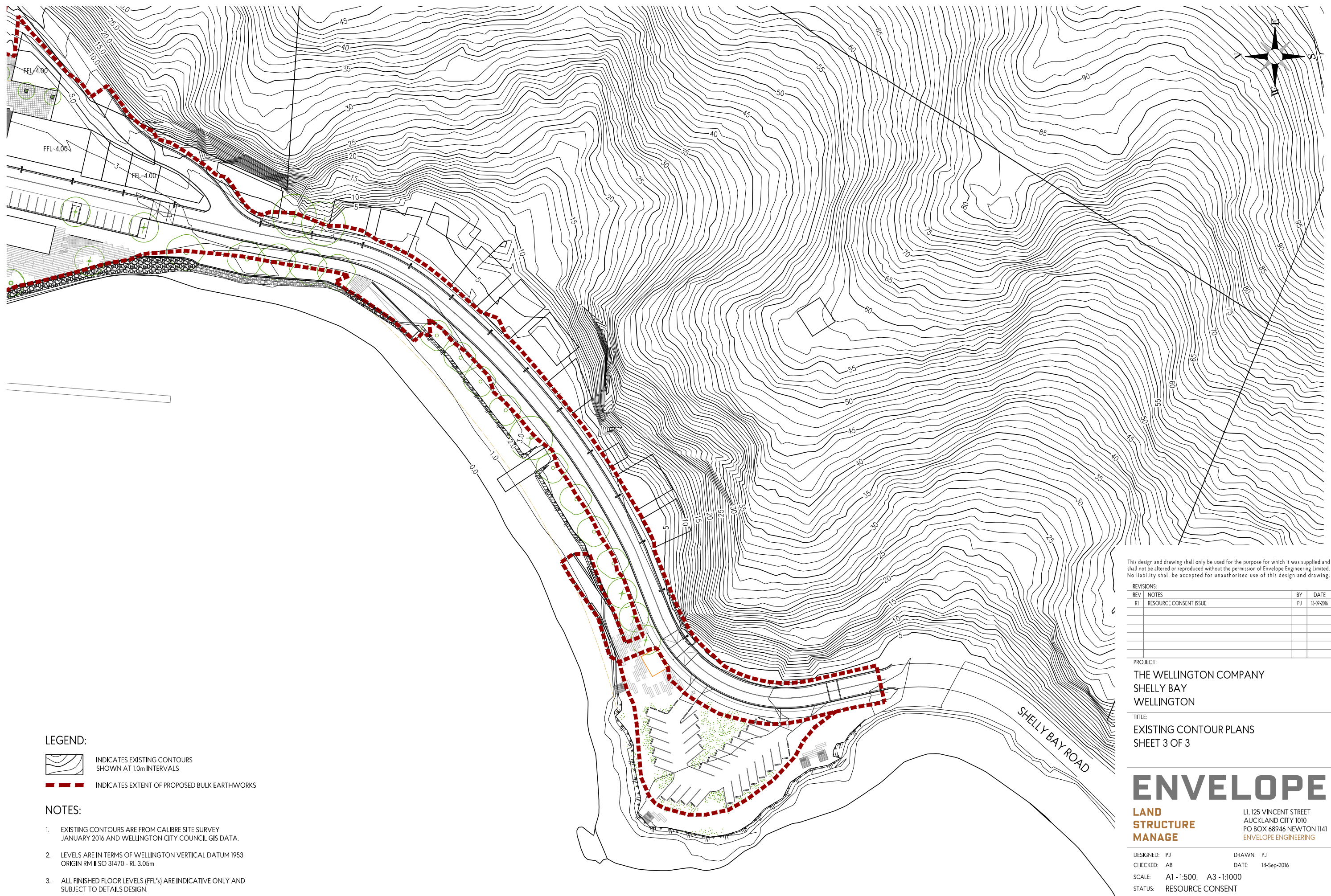
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ENVELOPE

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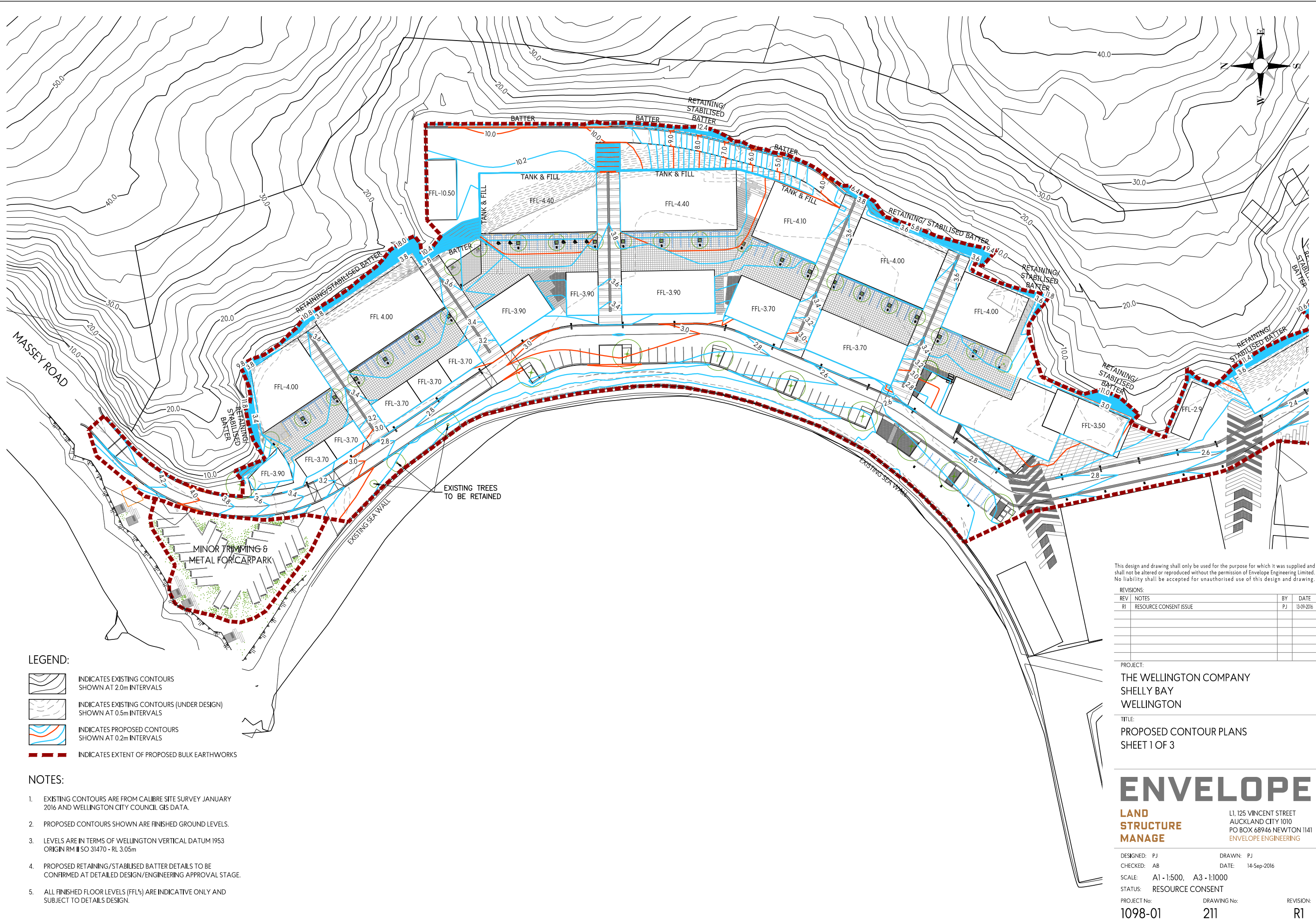
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

MASSEY ROAD

EXISTING TREES TO BE RETAINED

MINOR TRIMMING & METAL FOR CARPARK

EXISTING SEA WALL

EXISTING SEA WALL

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 -  INDICATES EXISTING CONTOURS (UNDER DESIGN) SHOWN AT 0.5m INTERVALS
 -  INDICATES PROPOSED CONTOURS SHOWN AT 0.2m INTERVALS
 -  INDICATES EXTENT OF PROPOSED BULK EARTHWORKS

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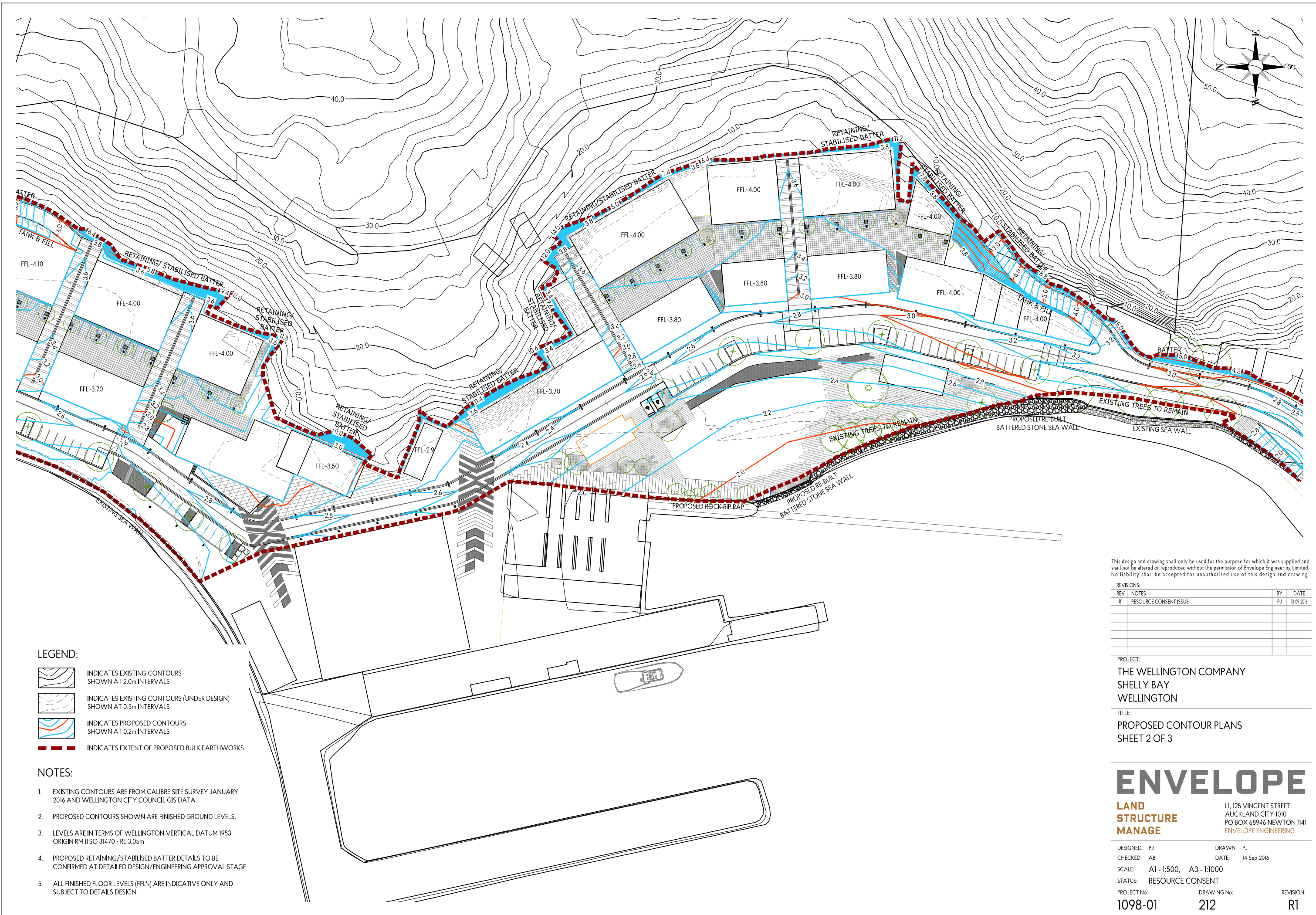
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 SHEET 1 OF 3

ENVELOPE

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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
PROPOSED CONTOUR PLANS
SHEET 2 OF 3

ENVELOPE
LAND
STRUCTURE
MANAGE

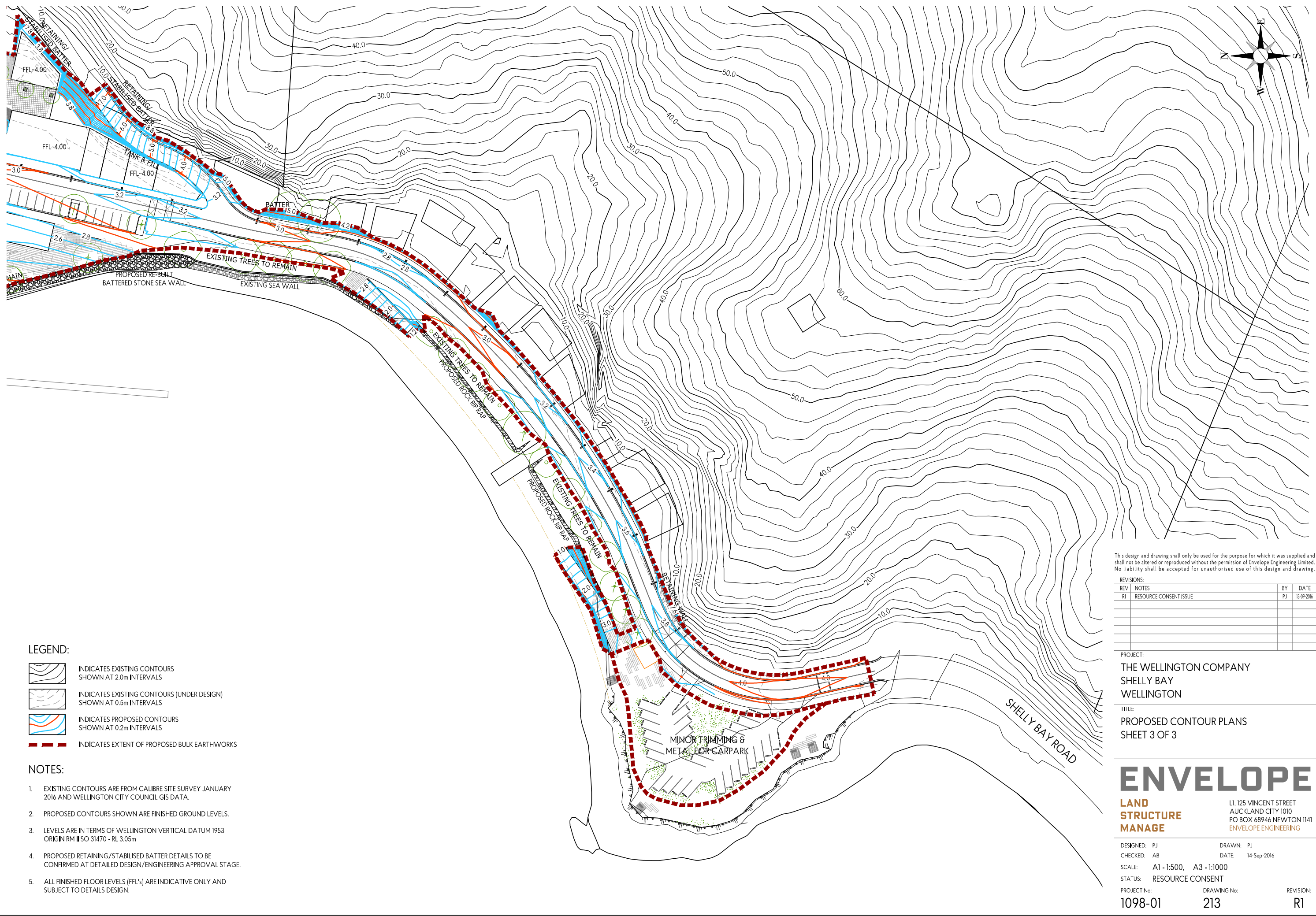
L1, 125 VINCENT STREET
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

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 PROJECT No: 1098-01
 DRAWING No: 212
 REVISION: R1

DRAWN: PJ
 DATE: 14-Sep-2016

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 - INDICATES PROPOSED CONTOURS SHOWN AT 0.2m INTERVALS
 - INDICATES EXTENT OF PROPOSED BULK EARTHWORKS

- NOTES:**
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 3. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m
 4. PROPOSED RETAINING/STABILISED BATTER DETAILS TO BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
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PROJECT:
THE WELLINGTON COMPANY
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TITLE:
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 SHEET 3 OF 3

ENVELOPE
LAND STRUCTURE MANAGE

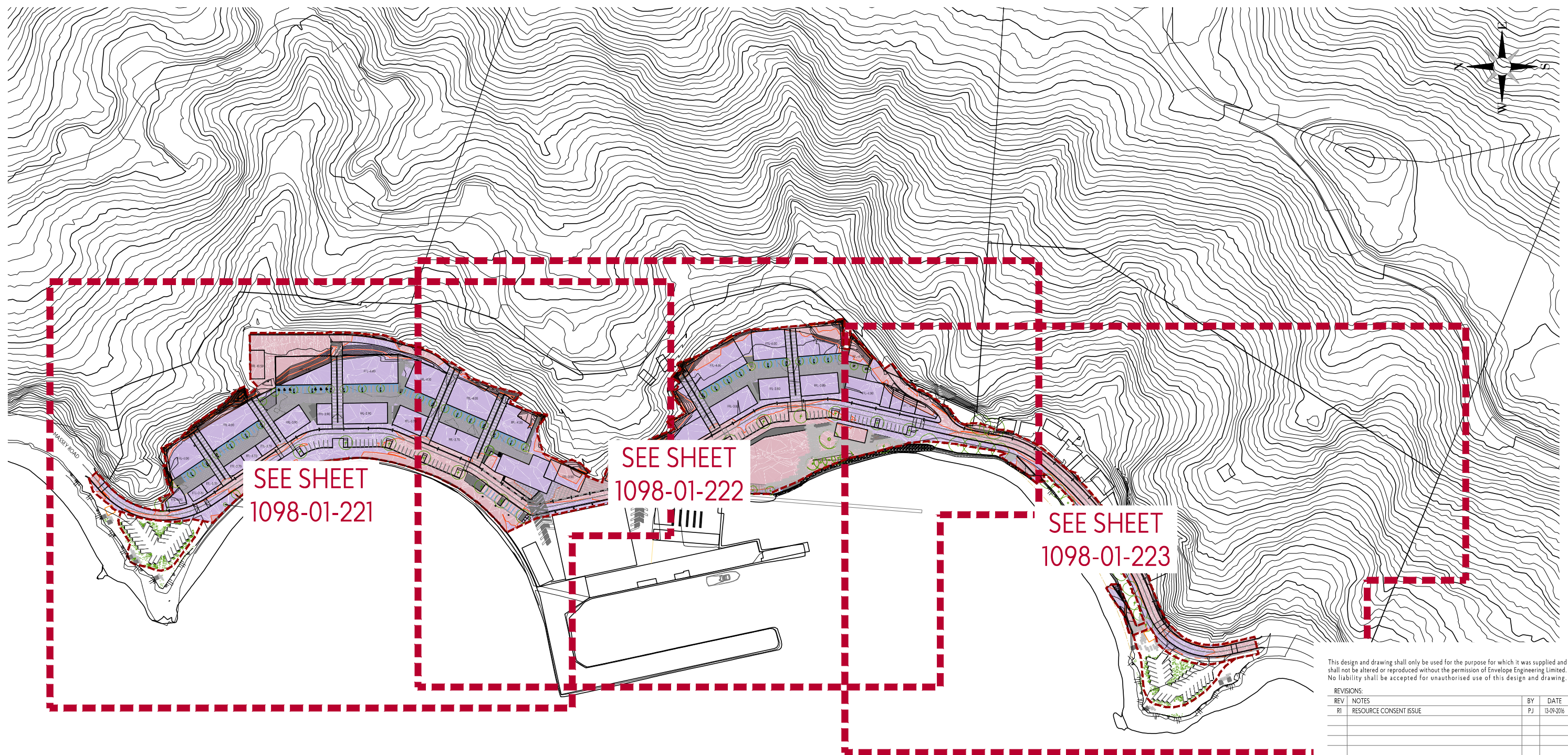
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


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 -  INDICATES FILL CONTOURS SHOWN AT 0.5m INTERVALS
 -  INDICATES EXTENT OF PROPOSED BULK EARTHWORKS

- NOTES:**
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 4. ALL FINISHED FLOOR LEVELS (F'L's) ARE INDICATIVE ONLY AND SUBJECT TO DETAILS DESIGN.

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**LAND
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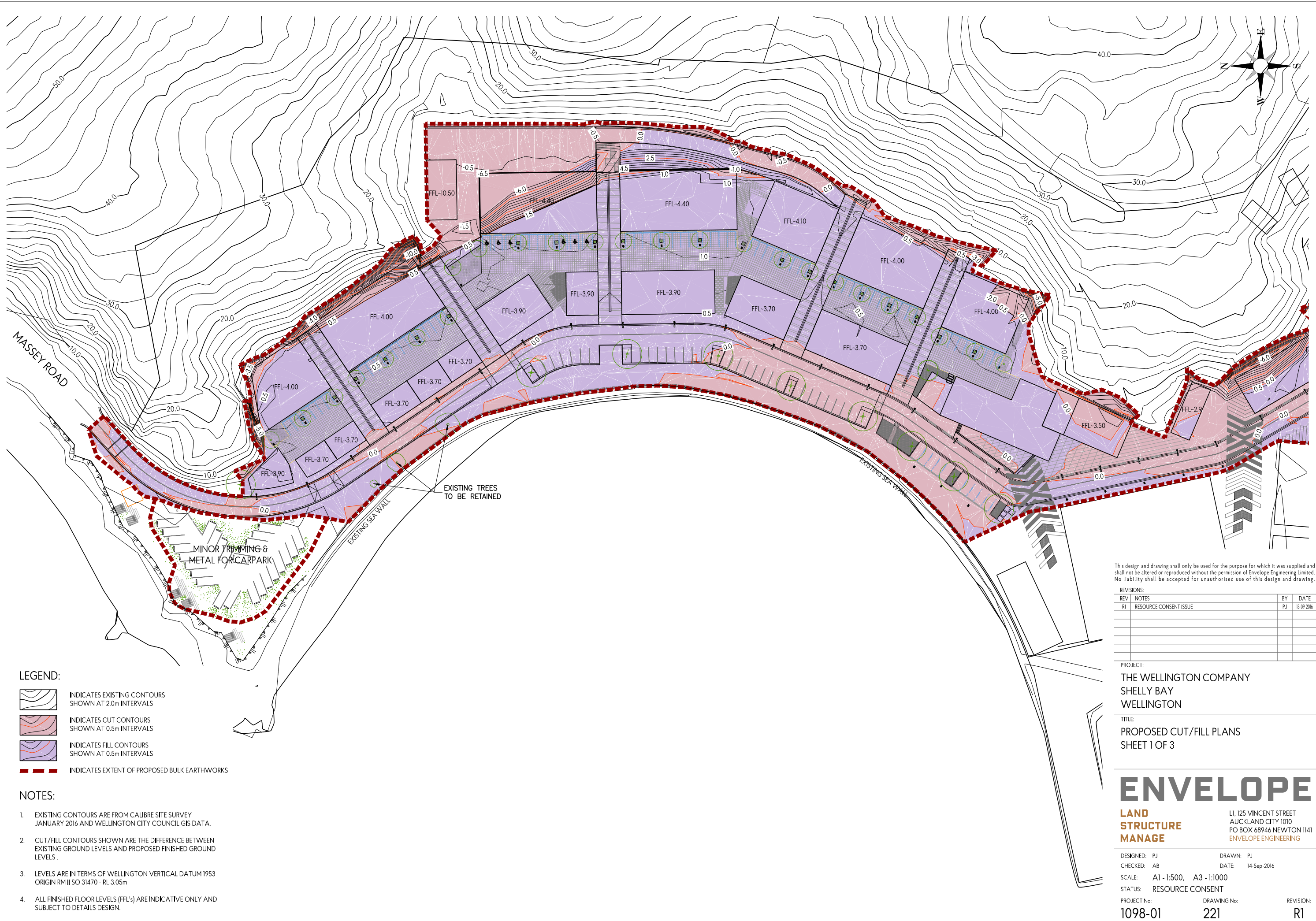
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


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1098-01 220 R1



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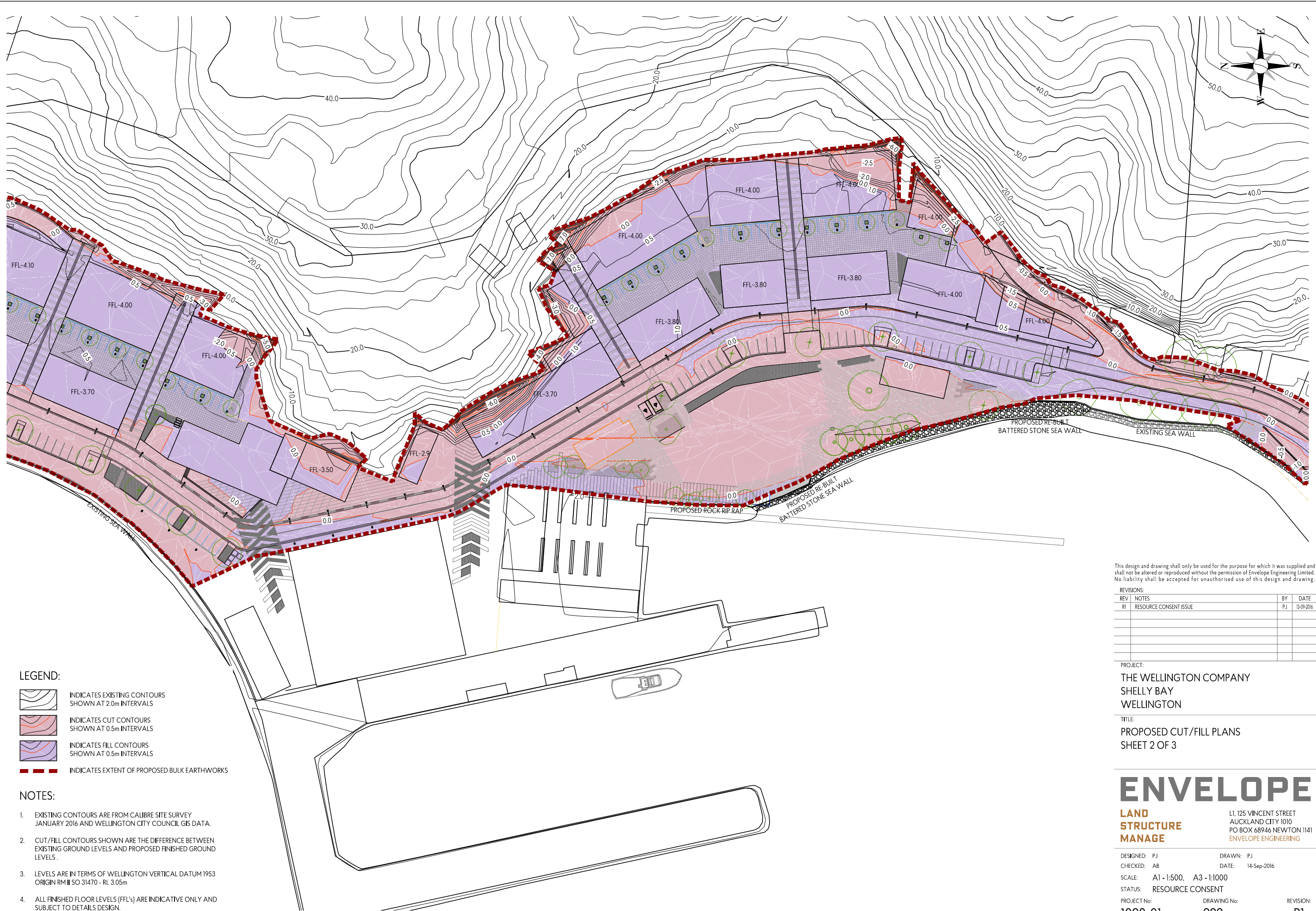
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 SHEET 1 OF 3





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 -  INDICATES FILL CONTOURS SHOWN AT 0.5m INTERVALS
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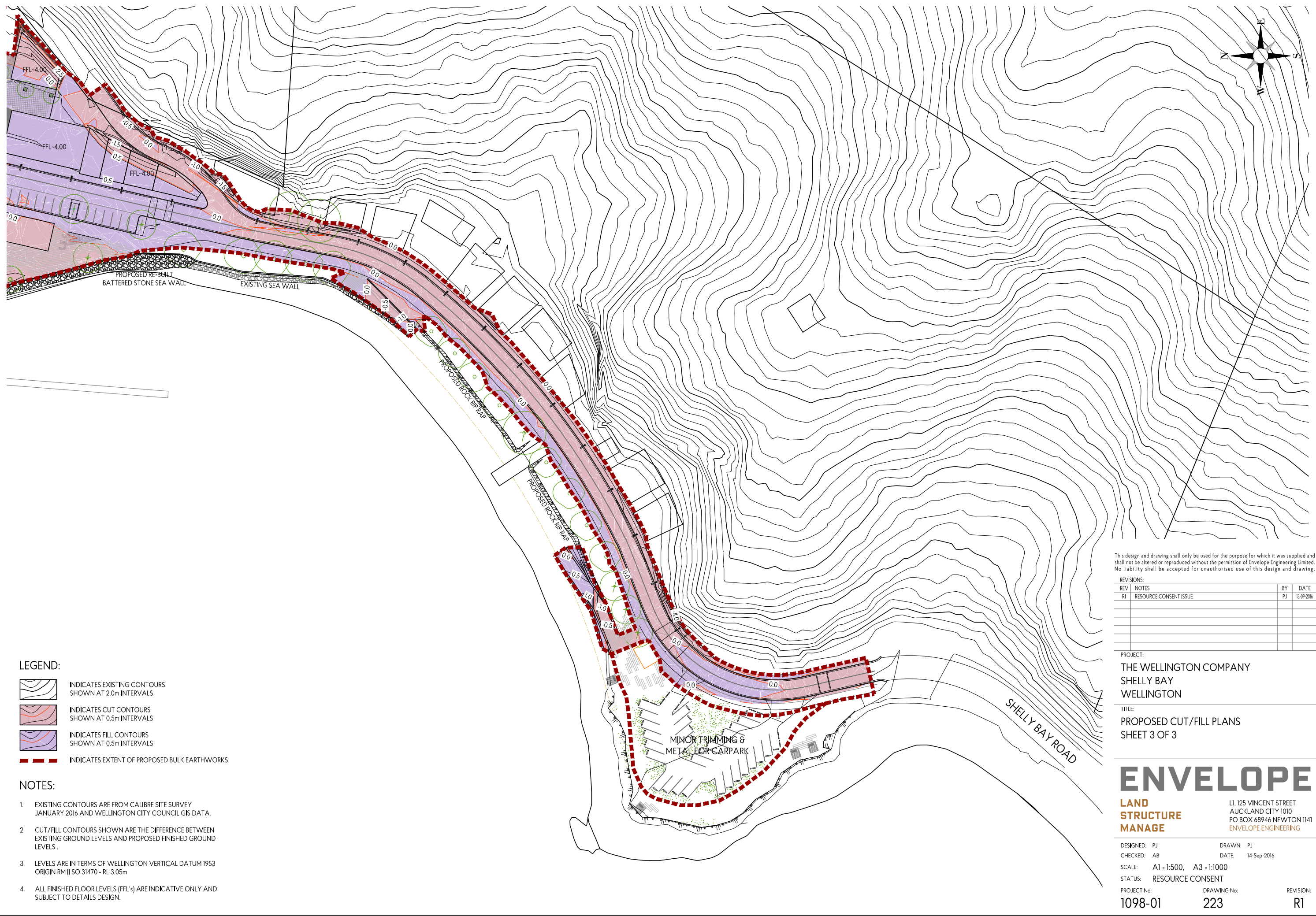
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 SHEET 2 OF 3





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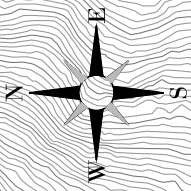
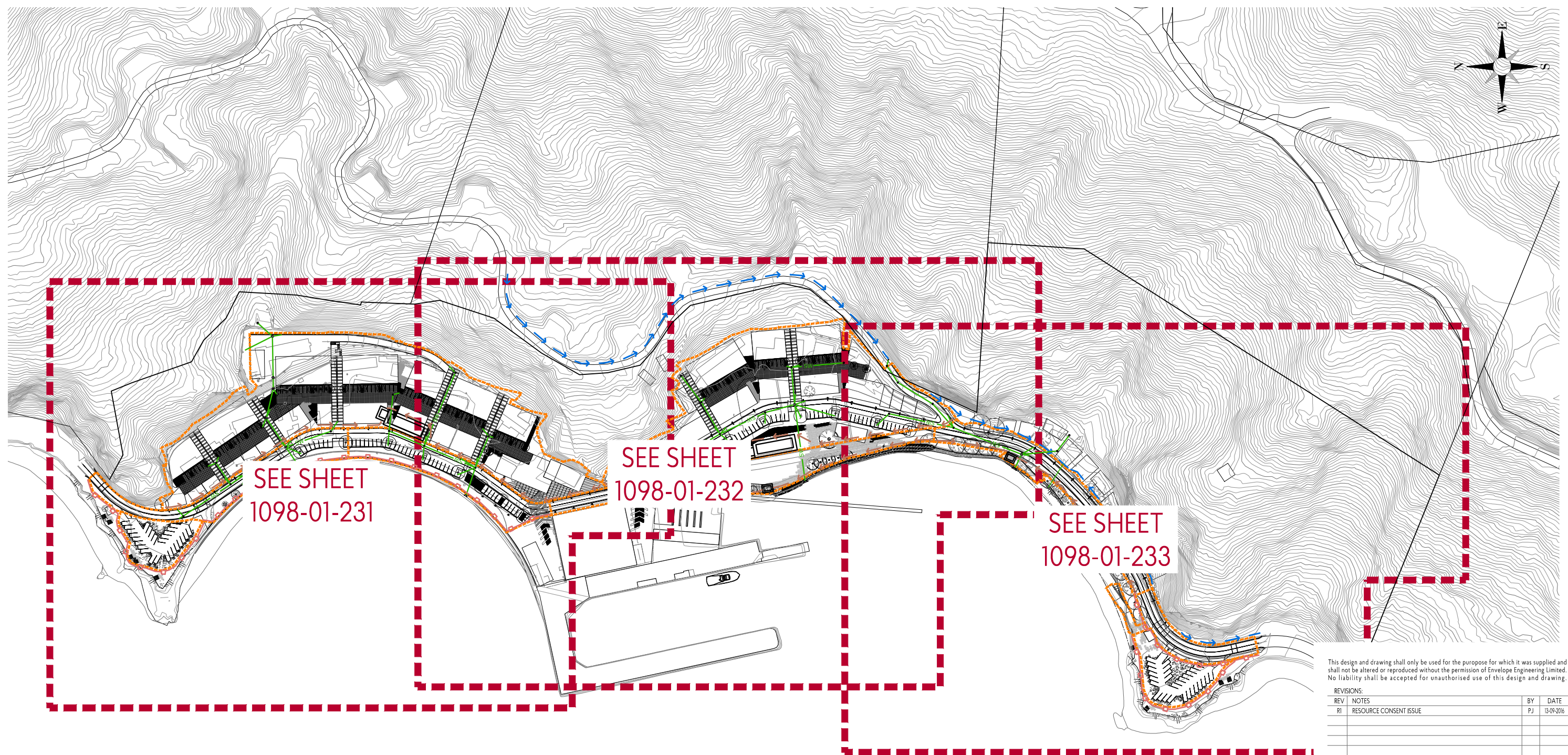
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PROPOSED CUT/FILL PLANS
 SHEET 3 OF 3

ENVELOPE
LAND STRUCTURE MANAGE

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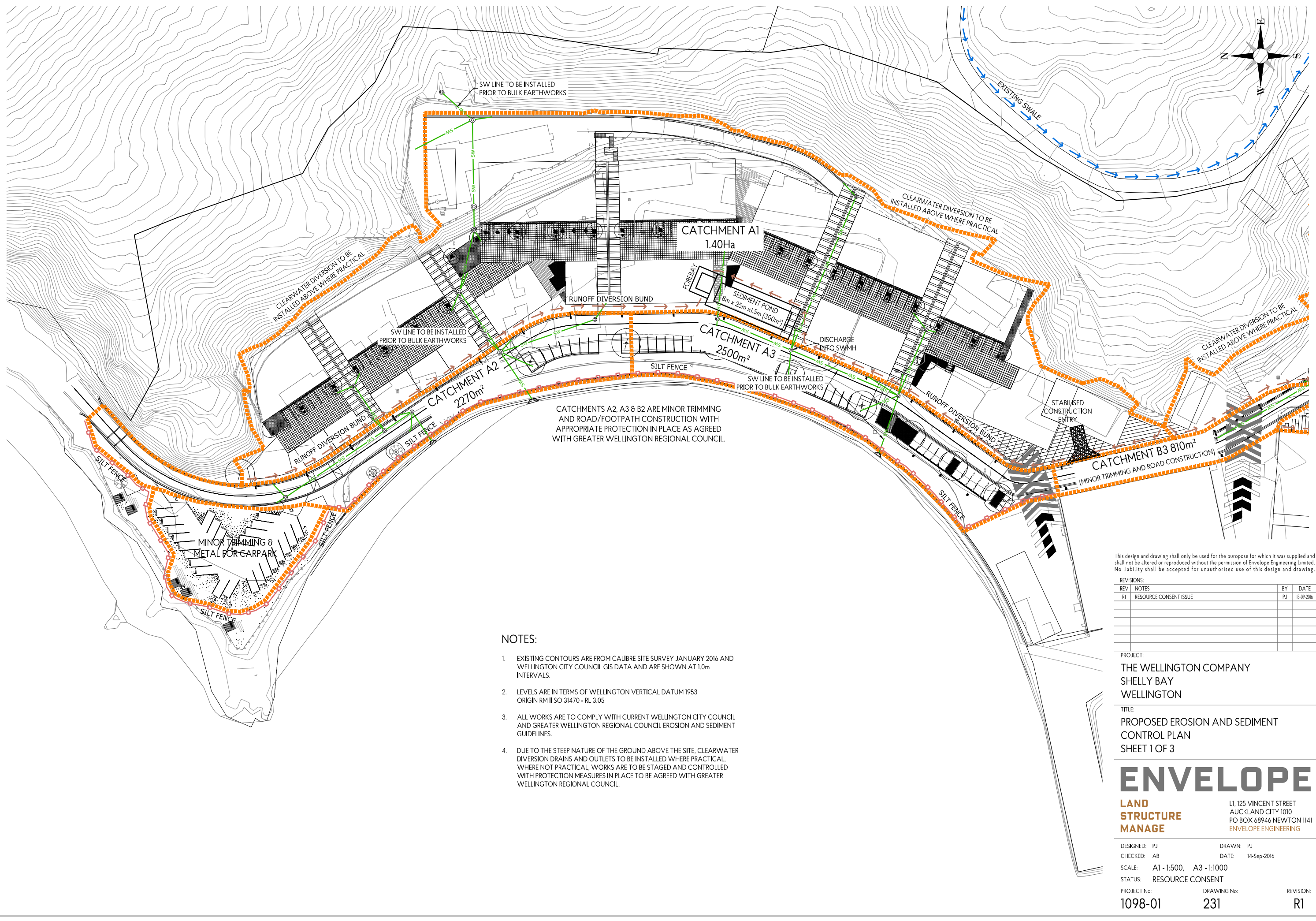
TITLE:
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1098-01 230 R1



CATCHMENTS A2, A3 & B2 ARE MINOR TRIMMING AND ROAD/FOOTPATH CONSTRUCTION WITH APPROPRIATE PROTECTION IN PLACE AS AGREED WITH GREATER WELLINGTON REGIONAL COUNCIL.

NOTES:

- EXISTING CONTOURS ARE FROM CALIBRE SITE SURVEY JANUARY 2016 AND WELLINGTON CITY COUNCIL GIS DATA AND ARE SHOWN AT 1.0m INTERVALS.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05
- ALL WORKS ARE TO COMPLY WITH CURRENT WELLINGTON CITY COUNCIL AND GREATER WELLINGTON REGIONAL COUNCIL EROSION AND SEDIMENT GUIDELINES.
- DUE TO THE STEEP NATURE OF THE GROUND ABOVE THE SITE, CLEARWATER DIVERSION DRAINS AND OUTLETS TO BE INSTALLED WHERE PRACTICAL, WHERE NOT PRACTICAL, WORKS ARE TO BE STAGED AND CONTROLLED WITH PROTECTION MEASURES IN PLACE TO BE AGREED WITH GREATER WELLINGTON REGIONAL COUNCIL.

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PROPOSED EROSION AND SEDIMENT CONTROL PLAN
SHEET 1 OF 3

ENVELOPE

LAND STRUCTURE MANAGE

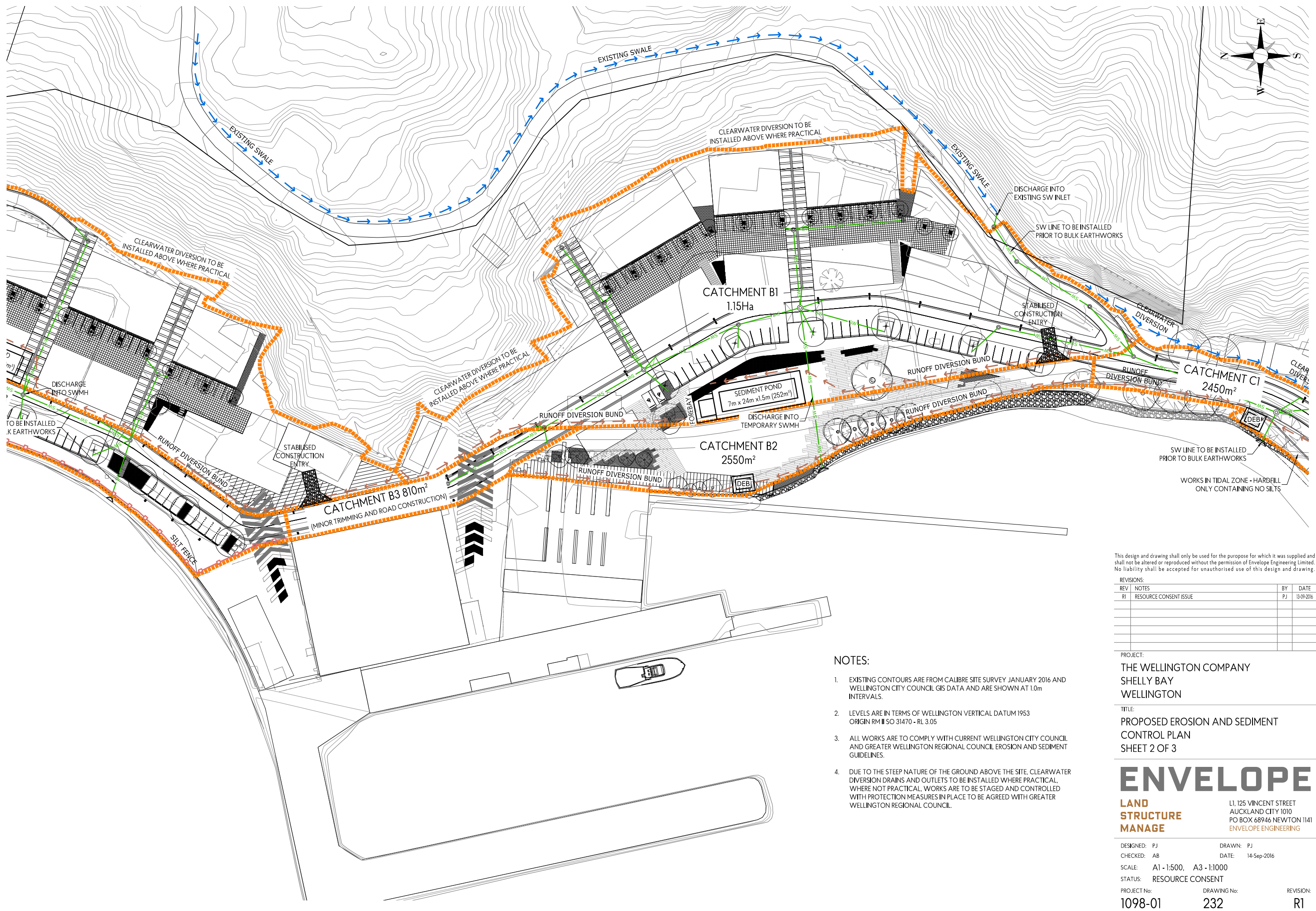
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SHEET 2 OF 3

ENVELOPE

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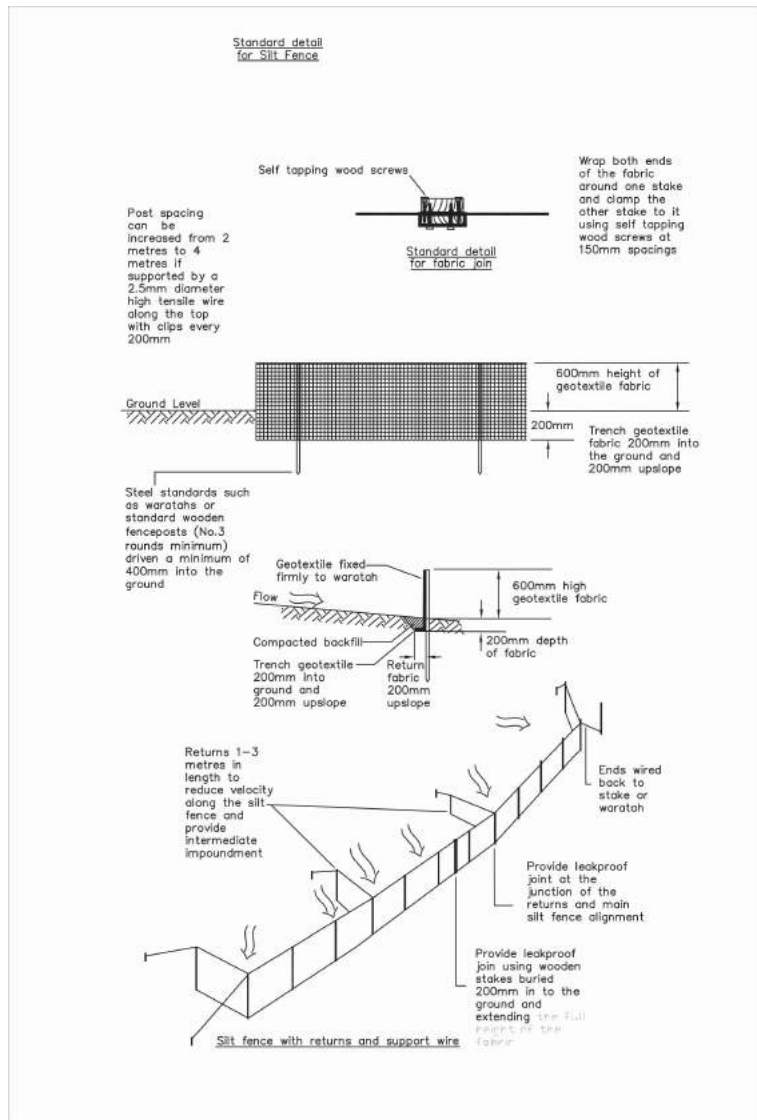
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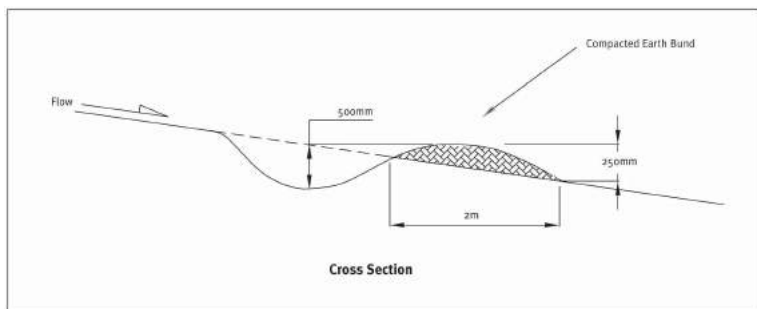
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SILT FENCE DETAIL



CUT OFF DRAIN DETAIL

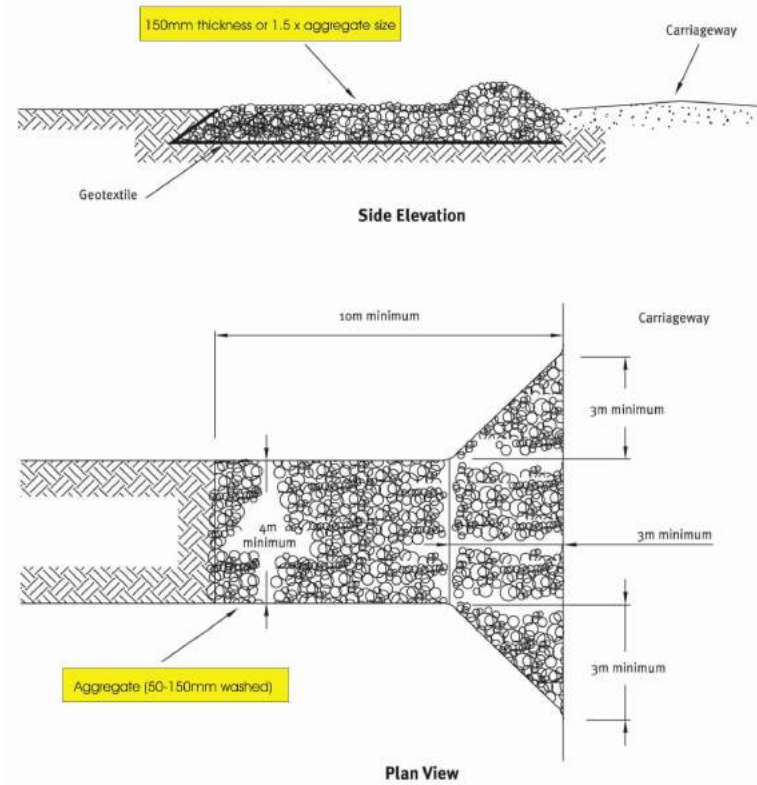


Figure 1.8 Stabilised Construction Entrance

STABILISED CONSTRUCTION ENTRANCE DETAIL

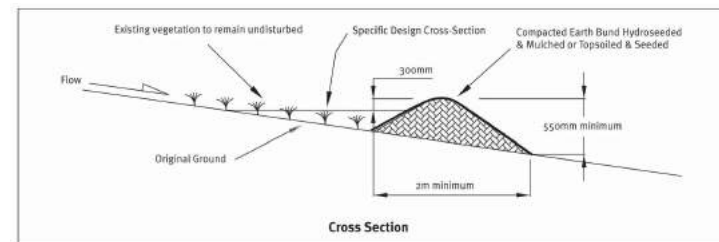


Figure 1.1.1 Clearwater Runoff Diversion Bund

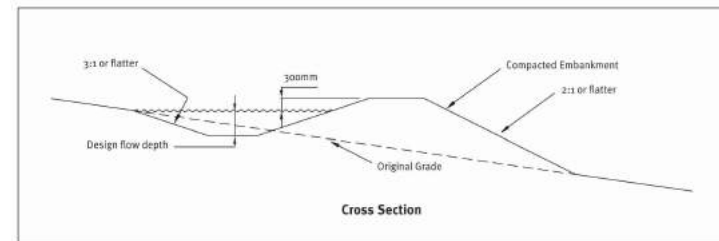
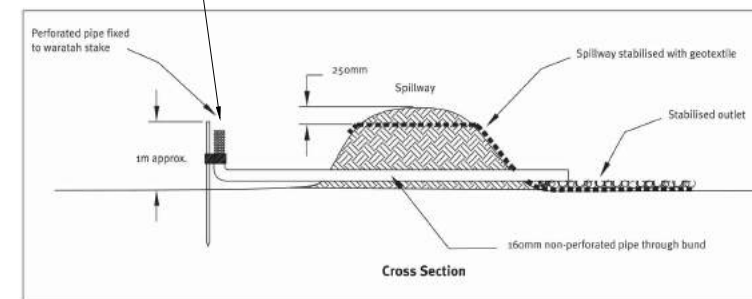


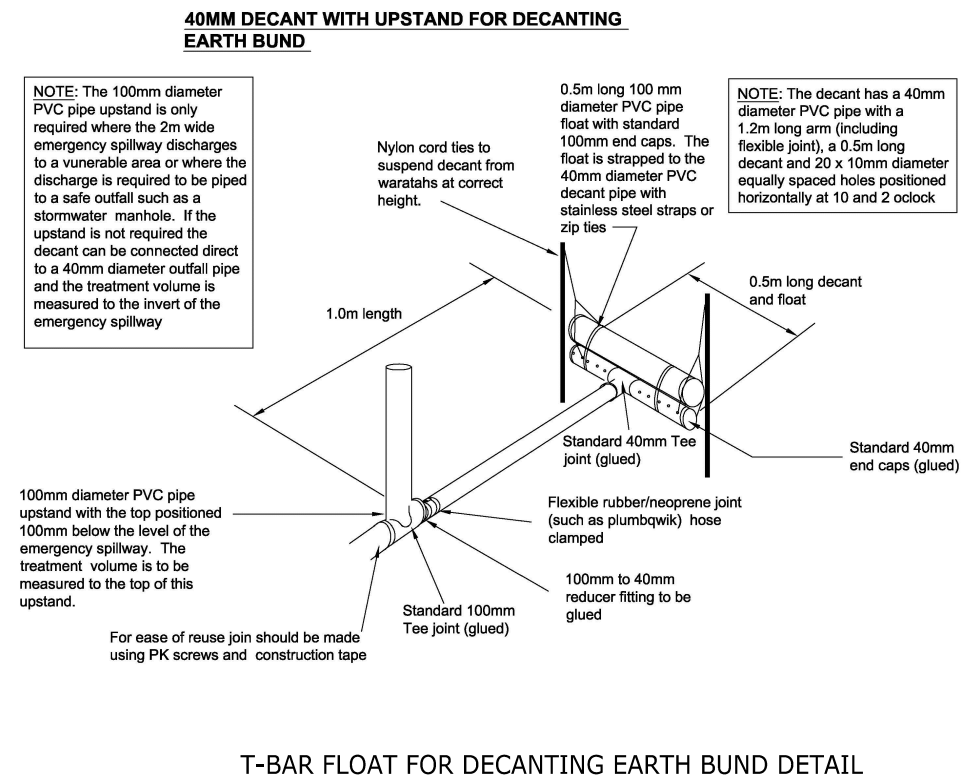
Figure 1.1.2 Runoff Diversion Channel

DIVERSION BUND DETAIL

T-BAR TO BE INSTALLED ON DECANTING EARTH BUND. REFER DETAIL.



DECANTING EARTH BUND DETAIL



T-BAR FLOAT FOR DECANTING EARTH BUND DETAIL

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Typical silt pond layout

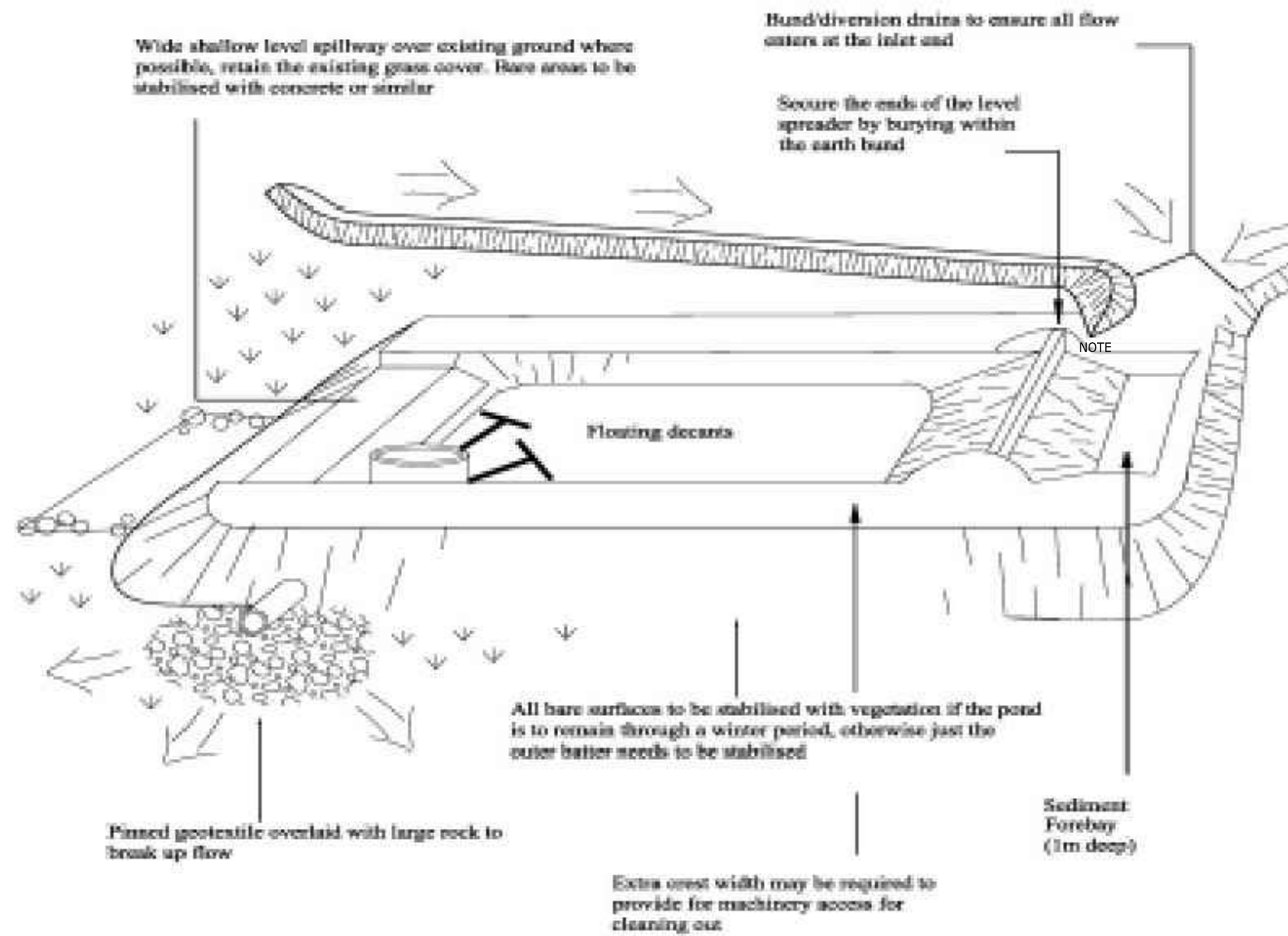


Figure 12: Sediment retention pond

SEDIMENT RETENTION POND

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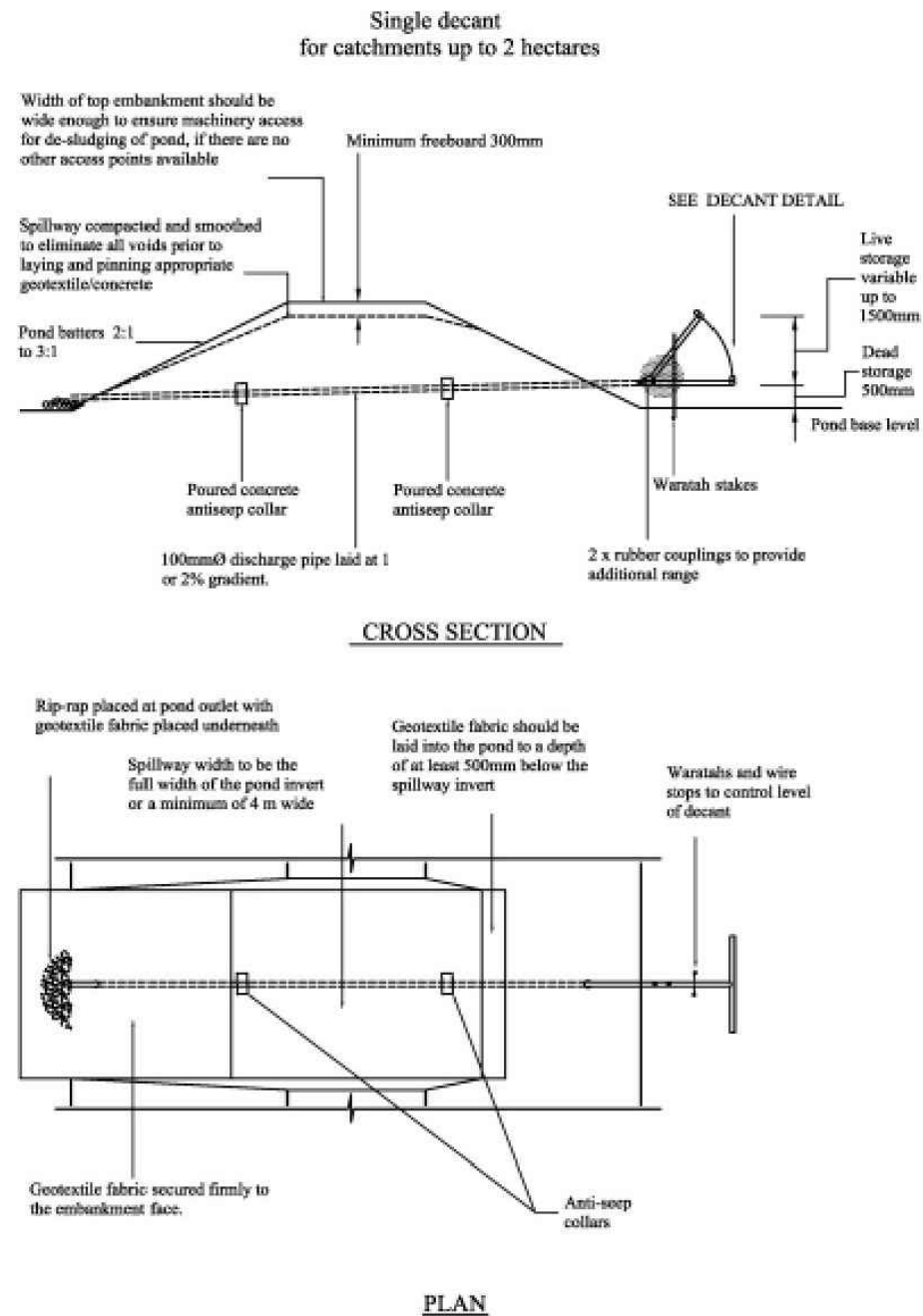


Figure 14: Sediment Retention Pond for Catchments up to 2 ha
SINGLE DECANT DEVICE (FOR CATCHMENTS UP TO 2 ha)

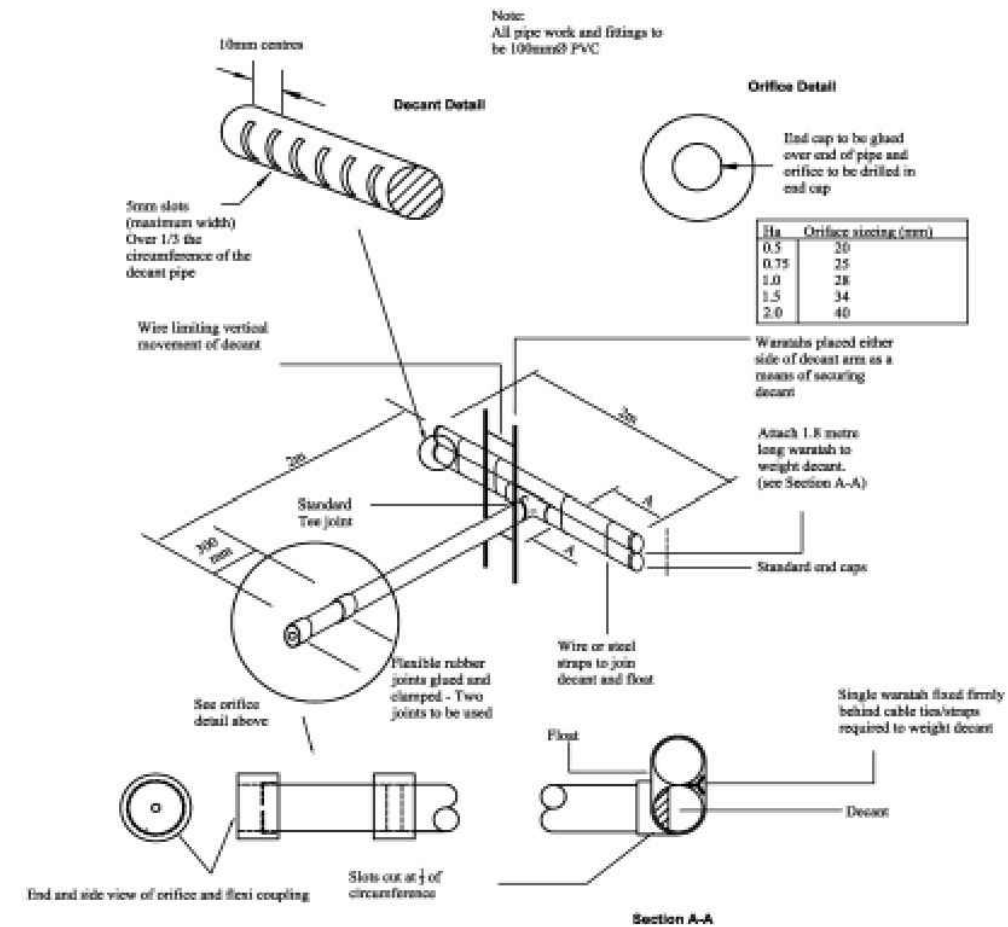


Figure 13: Sediment retention pond – decant details
DECANT DEVICE DETAILS

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SHEET 3 OF 3

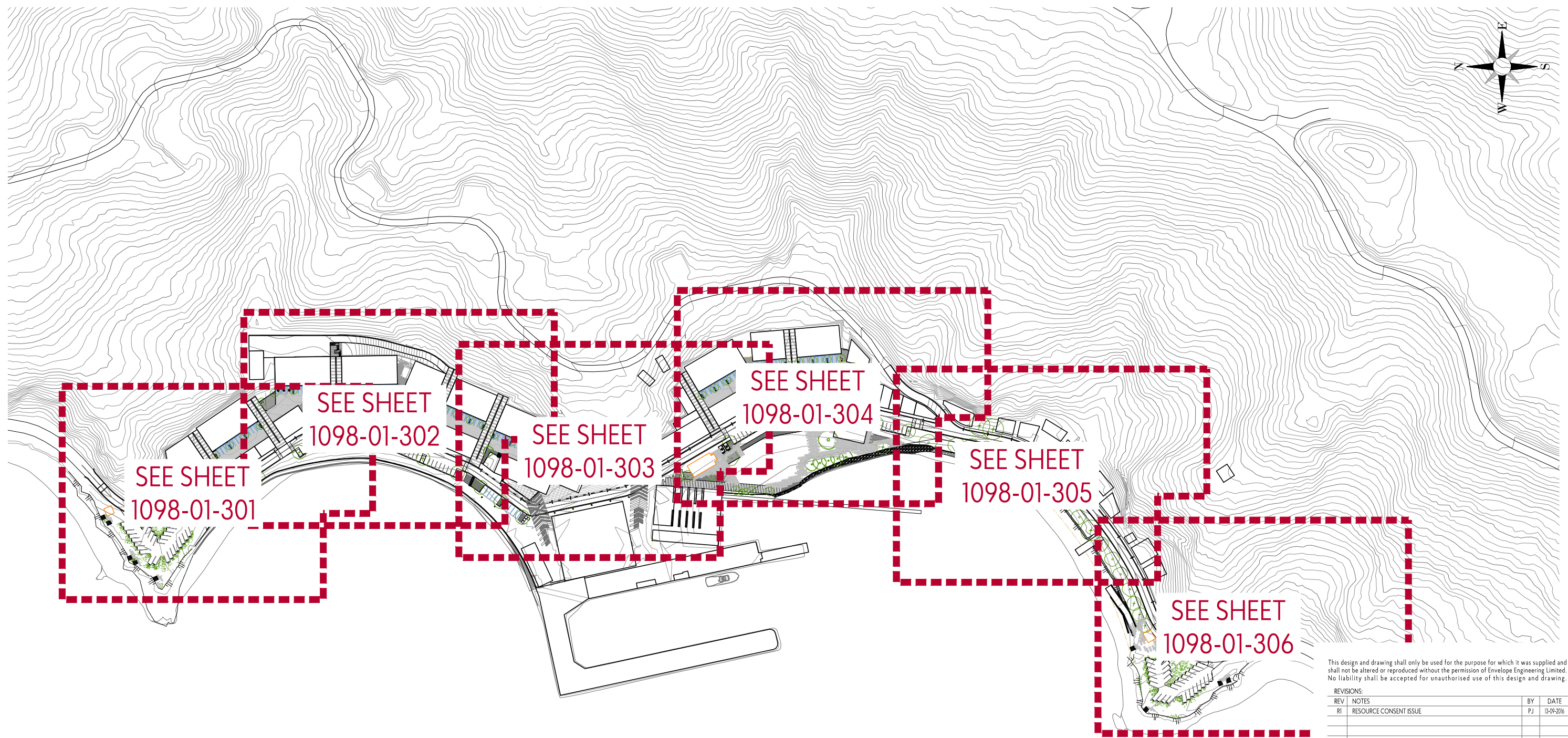
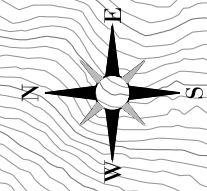
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SEE SHEET
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PROJECT:
 THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
 PROPOSED ROADING PLANS
 OVERALL LAYOUT

ENVELOPE

**LAND
 STRUCTURE
 MANAGE**

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016
 SCALE: A1 - 1:1250, A3 - 1:2500
 STATUS: RESOURCE CONSENT
 PROJECT No: DRAWING No: REVISION:
 1098-01 300 R1



- NOTES:**
1. CONTOURS SHOWN ARE FINISHED GROUND LEVELS AND ARE SHOWN AT 0.2m INTERVALS ON FLAT AREAS AND 2.0m INTERVALS ON STEEPER AREAS.
 2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m

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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
| | | | |
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| | | | |

PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
PROPOSED ROADING PLANS
 SHEET 1 OF 6

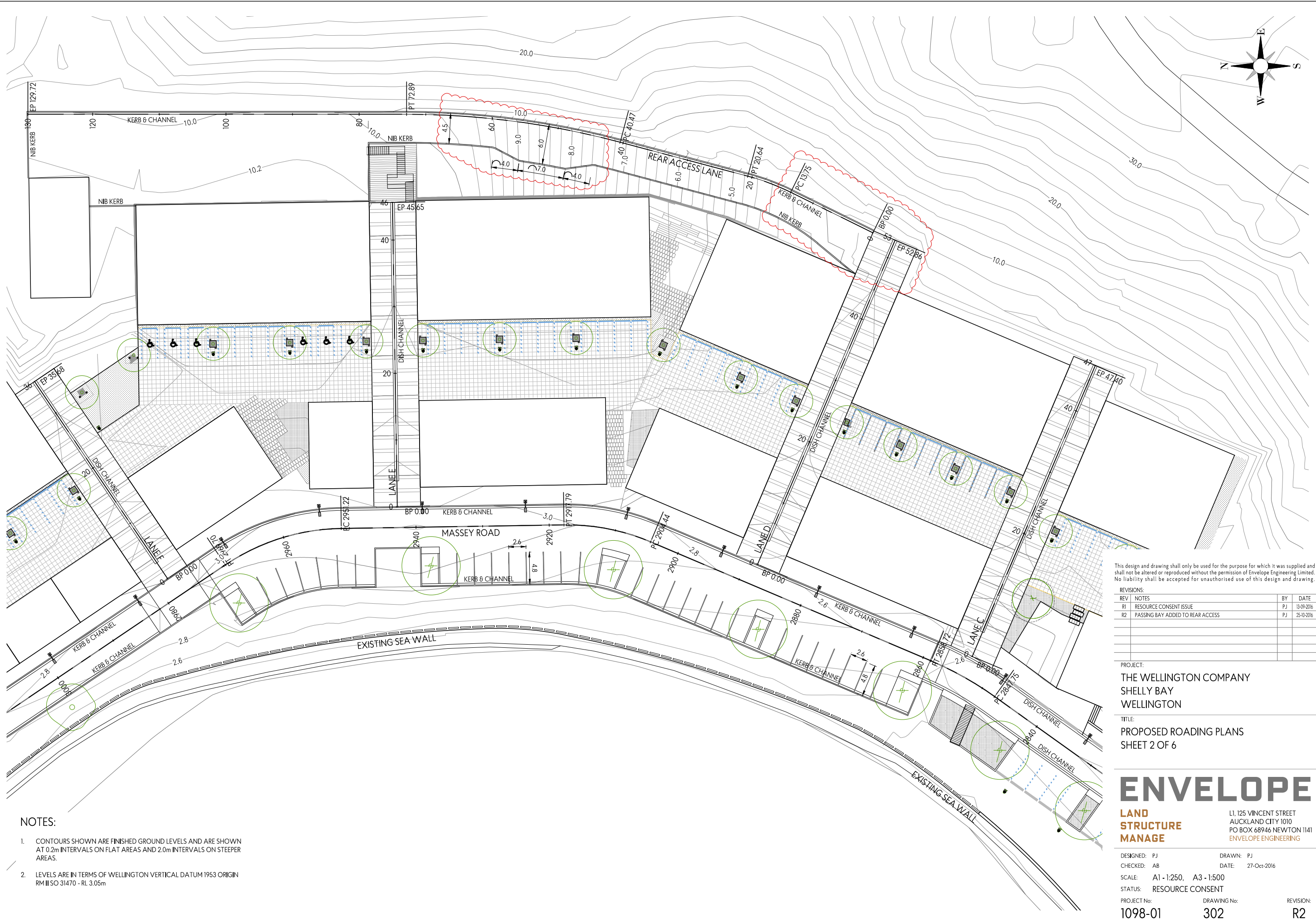
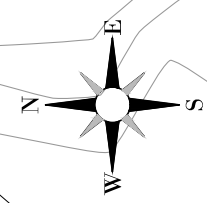
ENVELOPE
LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016

SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT

PROJECT No: 1098-01 DRAWING No: 301 REVISION: R1



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| REV | NOTES | BY | DATE |
|-----|----------------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
| R2 | PASSING BAY ADDED TO REAR ACCESS | PJ | 25-10-2016 |
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| | | | |

PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

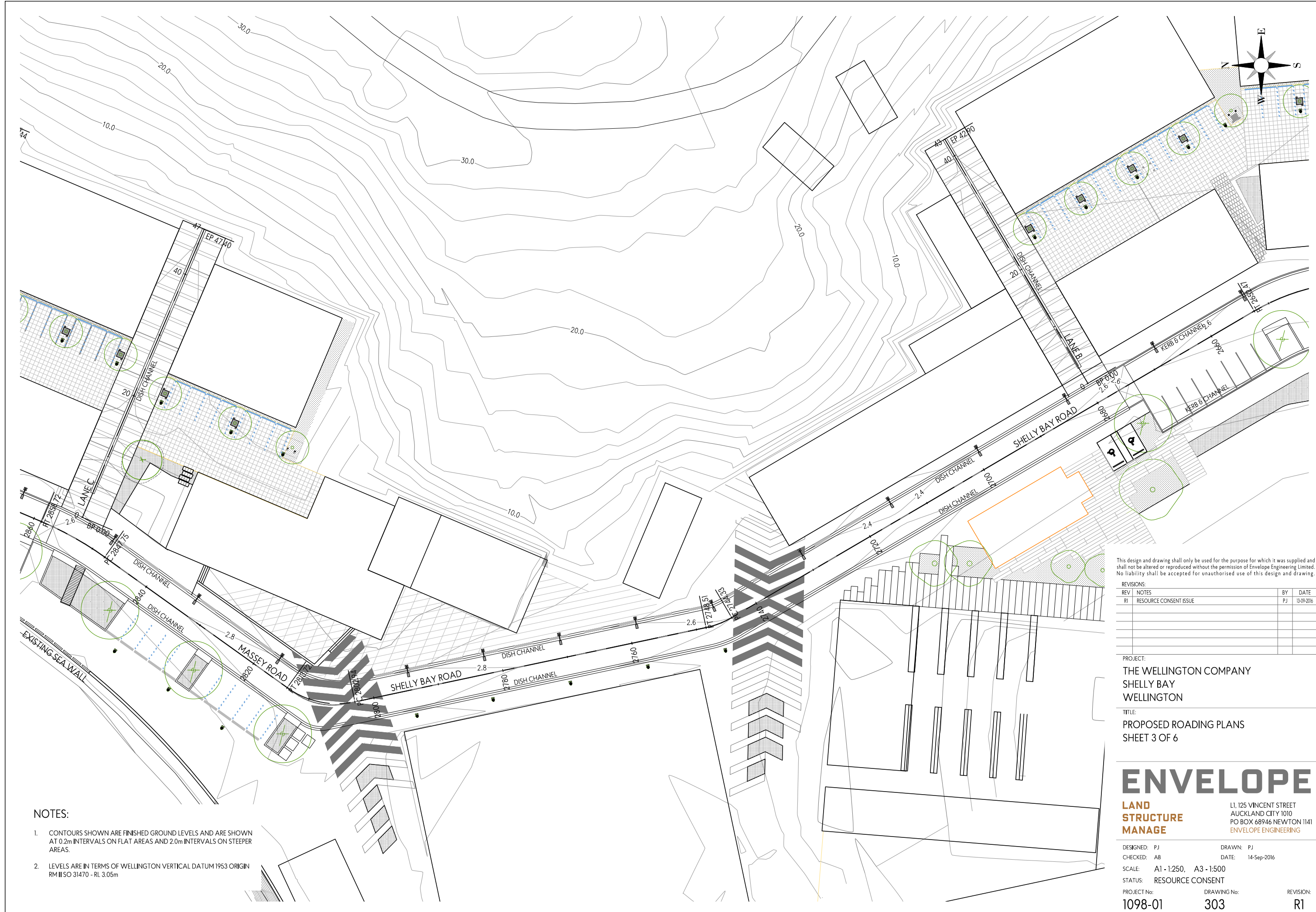
TITLE:
PROPOSED ROADING PLANS
SHEET 2 OF 6

ENVELOPE
LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

| | | |
|-------------------------------|--------------------------|-----------|
| DESIGNED: PJ | DRAWN: PJ | REVISION: |
| CHECKED: AB | DATE: 27-Oct-2016 | R2 |
| SCALE: A1 - 1:250, A3 - 1:500 | STATUS: RESOURCE CONSENT | |
| PROJECT No: 1098-01 | DRAWING No: 302 | |

- NOTES:**
- CONTOURS SHOWN ARE FINISHED GROUND LEVELS AND ARE SHOWN AT 0.2m INTERVALS ON FLAT AREAS AND 2.0m INTERVALS ON STEEPER AREAS.
 - LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m



- NOTES:**
1. CONTOURS SHOWN ARE FINISHED GROUND LEVELS AND ARE SHOWN AT 0.2m INTERVALS ON FLAT AREAS AND 2.0m INTERVALS ON STEEPER AREAS.
 2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m

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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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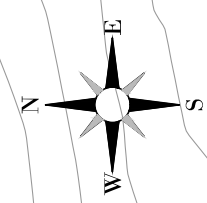
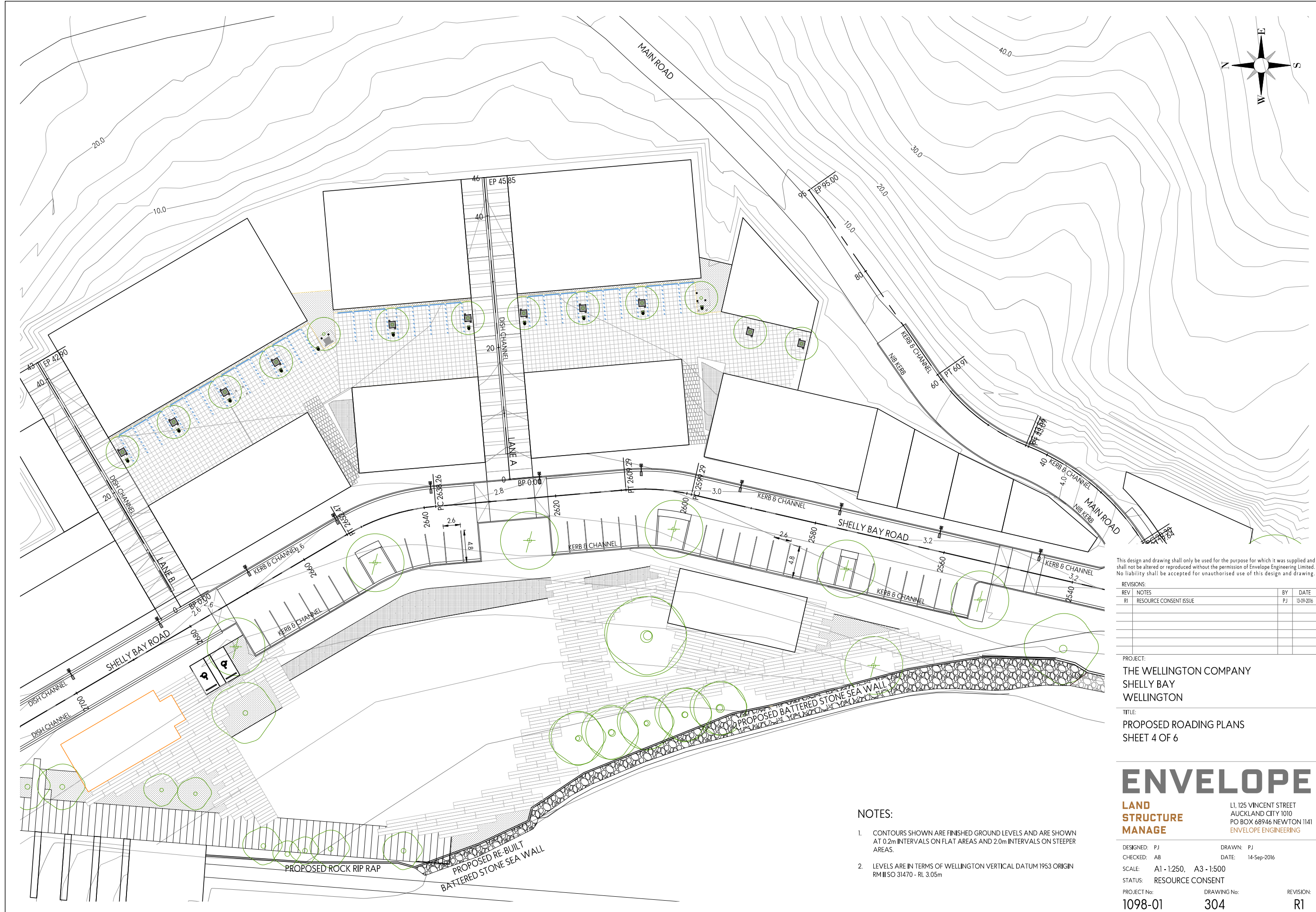
PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
PROPOSED ROADING PLANS
 SHEET 3 OF 6

ENVELOPE
 LAND
 STRUCTURE
 MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

| | | |
|-------------------------------|--------------------------|-----------|
| DESIGNED: PJ | DRAWN: PJ | REVISION: |
| CHECKED: AB | DATE: 14-Sep-2016 | R1 |
| SCALE: A1 - 1:250, A3 - 1:500 | STATUS: RESOURCE CONSENT | |
| PROJECT No: 1098-01 | DRAWING No: 303 | |



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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
 THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
 PROPOSED ROADING PLANS
 SHEET 4 OF 6

ENVELOPE
 LAND
 STRUCTURE
 MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 304
 REVISION: R1

DRAWN: PJ
 DATE: 14-Sep-2016

- NOTES:
- CONTOURS SHOWN ARE FINISHED GROUND LEVELS AND ARE SHOWN AT 0.2m INTERVALS ON FLAT AREAS AND 2.0m INTERVALS ON STEEPER AREAS.
 - LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m



- NOTES:**
- CONTOURS SHOWN ARE FINISHED GROUND LEVELS AND ARE SHOWN AT 0.2m INTERVALS ON FLAT AREAS AND 2.0m INTERVALS ON STEEPER AREAS.
 - LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II ISO 31470 - RL 3.05m

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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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| | | | |

PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
PROPOSED ROADING PLANS
 SHEET 5 OF 6

ENVELOPE
 LAND STRUCTURE MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

| | |
|-------------------------------|-------------------|
| DESIGNED: PJ | DRAWN: PJ |
| CHECKED: AB | DATE: 14-Sep-2016 |
| SCALE: A1 - 1:250, A3 - 1:500 | |
| STATUS: RESOURCE CONSENT | |
| PROJECT No: 1098-01 | DRAWING No: 305 |
| | REVISION: R1 |



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| REV | NOTES | BY | DATE |
|-----|--------------------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
| R2 | LANDSCAPE REDUCED FOR CARPARK ACCESS | PJ | 25-10-2016 |
| | | | |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
PROPOSED ROADING PLANS
SHEET 6 OF 6

ENVELOPE
LAND STRUCTURE MANAGE

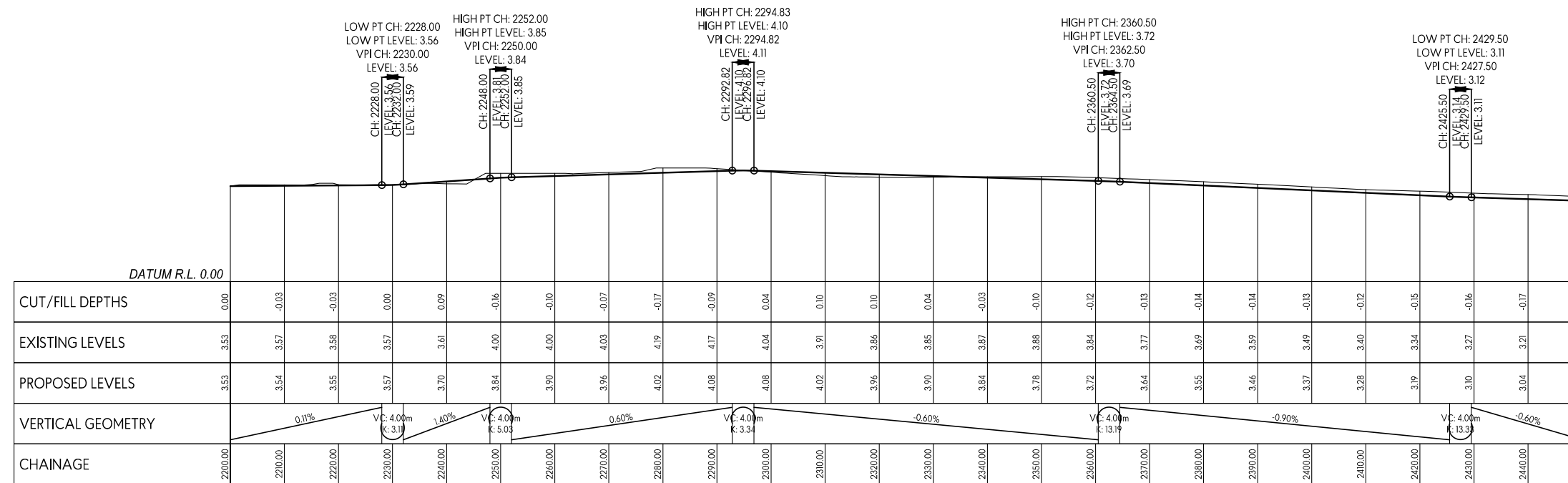
L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 306
 DRAWN: PJ
 DATE: 27-Oct-2016
 REVISION: R2

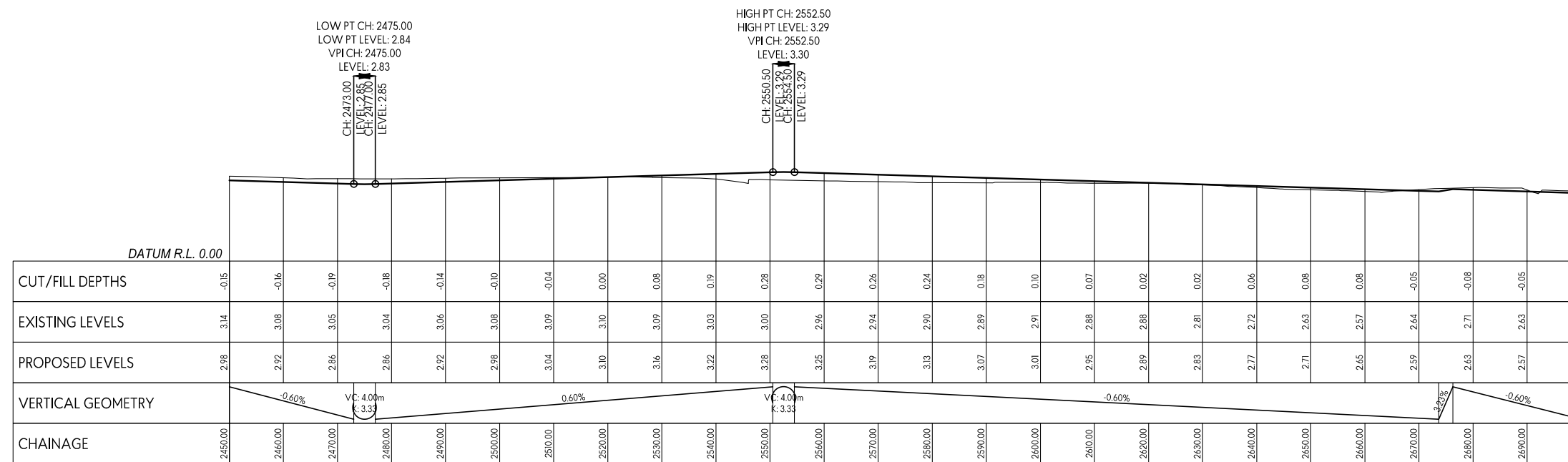
- NOTES:**
1. CONTOURS SHOWN ARE FINISHED GROUND LEVELS AND ARE SHOWN AT 0.2m INTERVALS ON FLAT AREAS AND 2.0m INTERVALS ON STEEPER AREAS.
 2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM IISO 31470 - RL 3.05m

NOTES:

- LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m



CL - ROAD-01 SHELLY BAY ROAD
LONGSECTION BETWEEN 2200.00 AND 2450.00



CL - ROAD-01 SHELLY BAY ROAD
LONGSECTION BETWEEN 2450.00 AND 2700.00

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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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| | | | |

PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
PROPOSED ROADING LONGSECTIONS
SHEET 1 OF 4

ENVELOPE
LAND
STRUCTURE
MANAGE

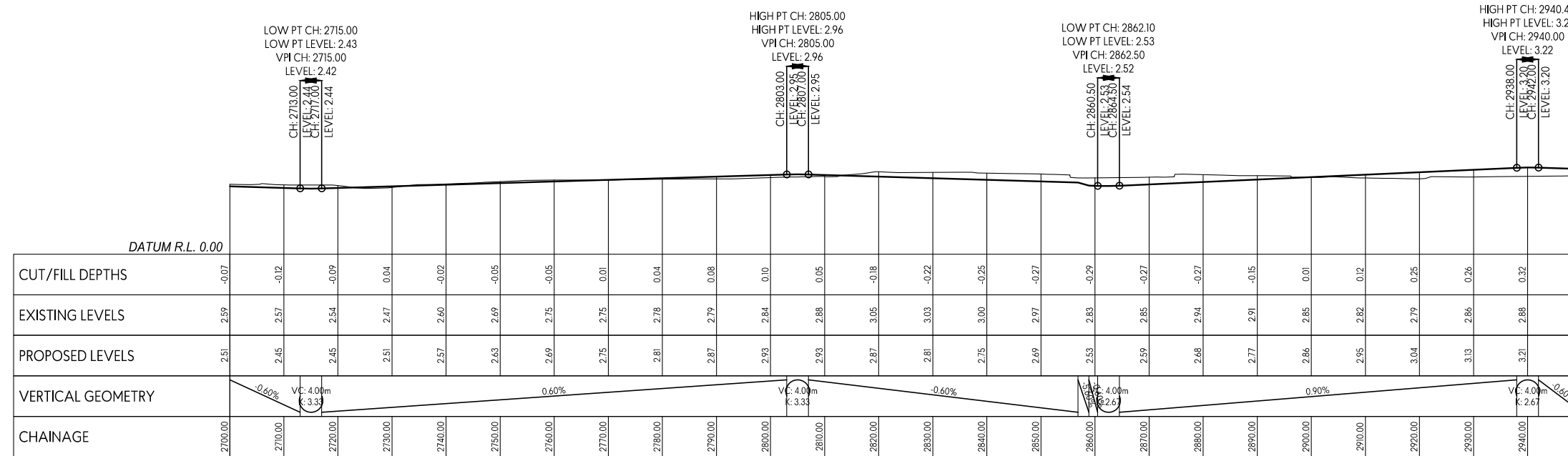
L1, 125 VINCENT STREET
AUCKLAND CITY 1010
PO BOX 68946 NEWTON 1141
ENVELOPE ENGINEERING

DESIGNED: PJ
CHECKED: AB
SCALE: A1 - 1:500 Horz, 1:100 Vert, A3 - 1:1000 Horz, 1:200 Vert
STATUS: RESOURCE CONSENT
PROJECT No: 1098-01
DRAWING No: 320
REVISION: R1

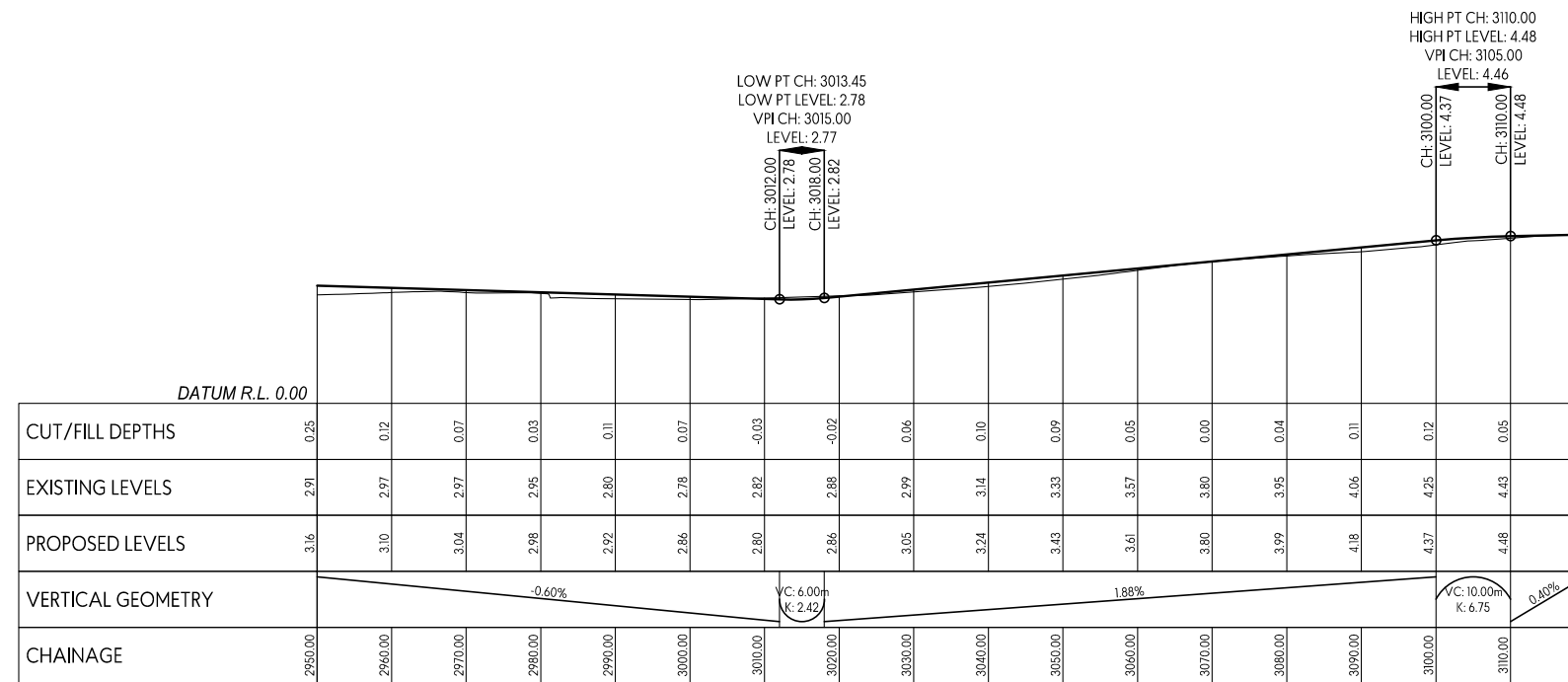
DRAWN: PJ
DATE: 14-Sep-2016

NOTES:

- LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN
RM II SO 31470 - RL 3.05m



CL - ROAD-01 SHELLY BAY ROAD
LONGSECTION BETWEEN 2700.00 AND 2950.00



CL - ROAD-01 SHELLY BAY ROAD
LONGSECTION BETWEEN 2950.00 AND 3120.00

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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
PROPOSED ROADING LONGSECTIONS
SHEET 2 OF 4

ENVELOPE
LAND
STRUCTURE
MANAGE

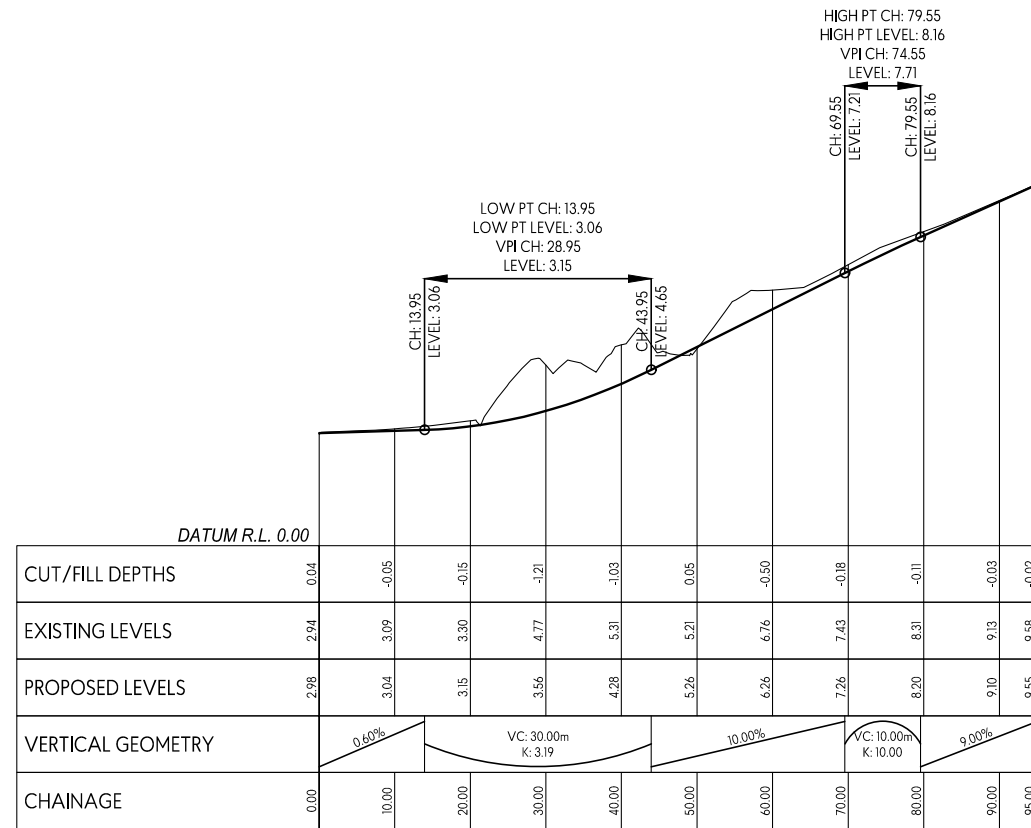
L1, 125 VINCENT STREET
AUCKLAND CITY 1010
PO BOX 68946 NEWTON 1141
ENVELOPE ENGINEERING

DESIGNED: PJ
CHECKED: AB
SCALE: A1 - 1:500 Horz, 1:100 Vert, A3 - 1:1000 Horz, 1:200 Vert
STATUS: RESOURCE CONSENT
PROJECT No: 1098-01
DRAWING No: 321
REVISION: R1

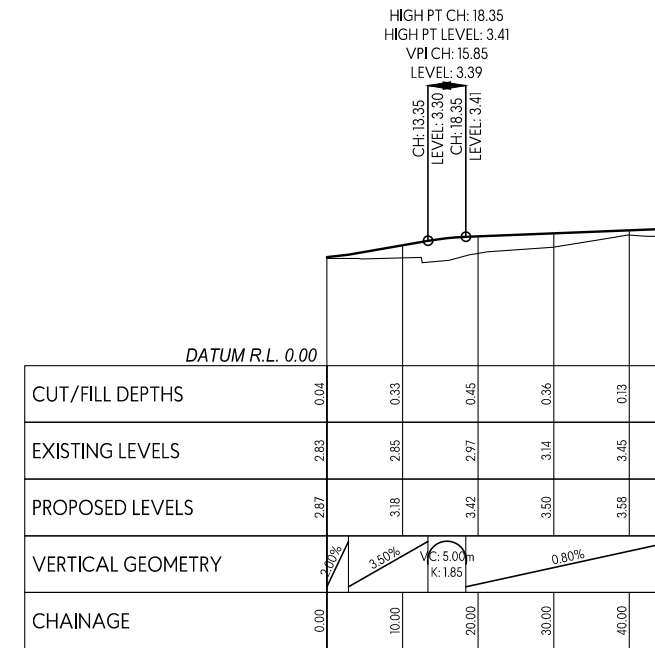
DRAWN: PJ
DATE: 14-Sep-2016

NOTES:

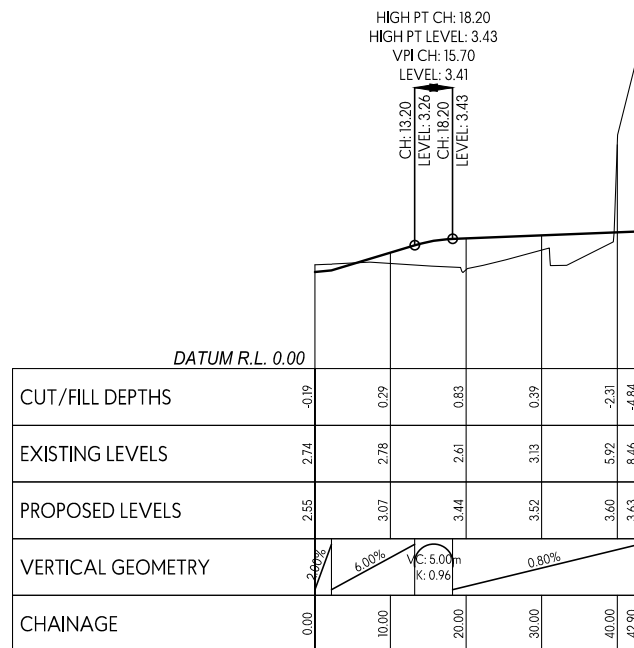
- LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN
RM II SO 31470 - RL 3.05m



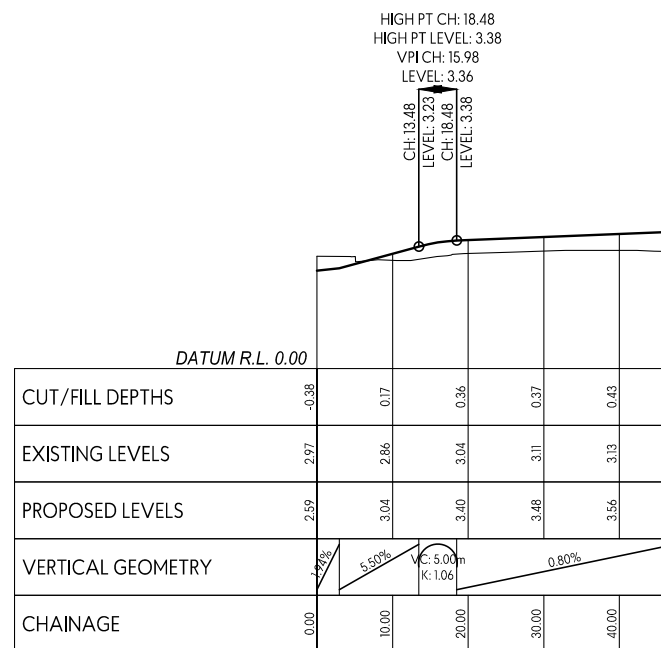
CL - ROAD-02 MAIN ROAD
LONGSECTION BETWEEN 0.00 AND 95.00



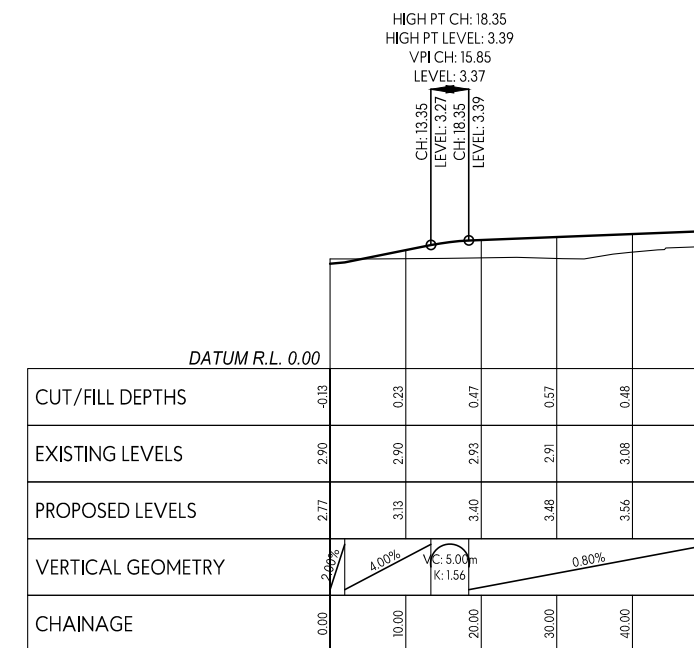
CL - LANE A
LONGSECTION BETWEEN 0.00 AND 45.85



CL - LANE B
LONGSECTION BETWEEN 0.00 AND 42.90



CL - LANE C
LONGSECTION BETWEEN 0.00 AND 47.40



CL - LANE D
LONGSECTION BETWEEN 0.00 AND 50.44

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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |

PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

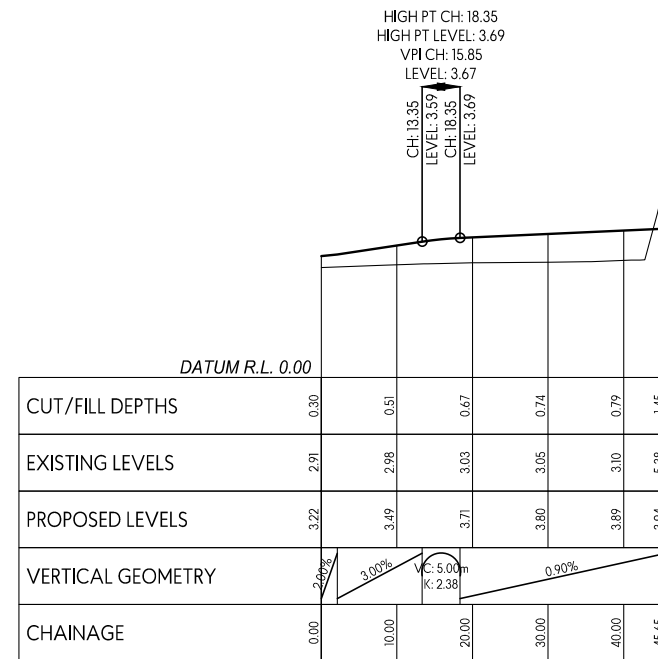
TITLE:
PROPOSED ROADING LONGSECTIONS
SHEET 3 OF 4

ENVELOPE
LAND
STRUCTURE
MANAGE
L1, 125 VINCENT STREET
AUCKLAND CITY 1010
PO BOX 68946 NEWTON 1141
ENVELOPE ENGINEERING

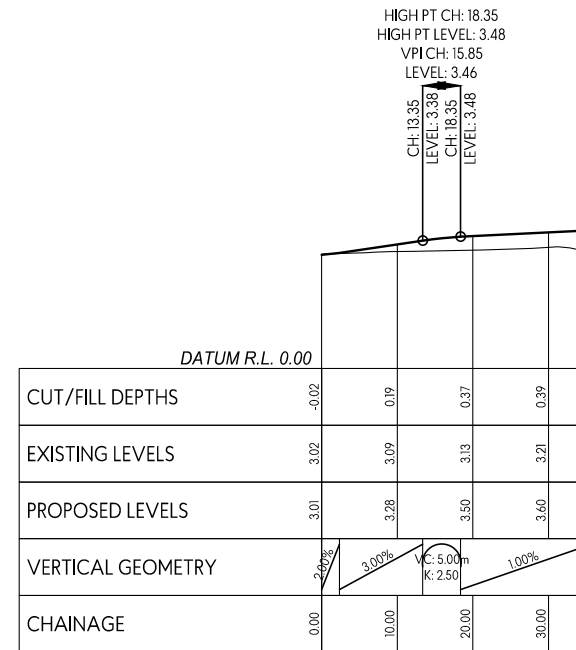
DESIGNED: PJ DRAWN: PJ
CHECKED: AB DATE: 14-Sep-2016
SCALE: A1 - 1:500 Horz, 1:100 Vert, A3 - 1:1000 Horz, 1:200 Vert
STATUS: RESOURCE CONSENT
PROJECT No: 1098-01 DRAWING No: 322 REVISION: R1

NOTES:

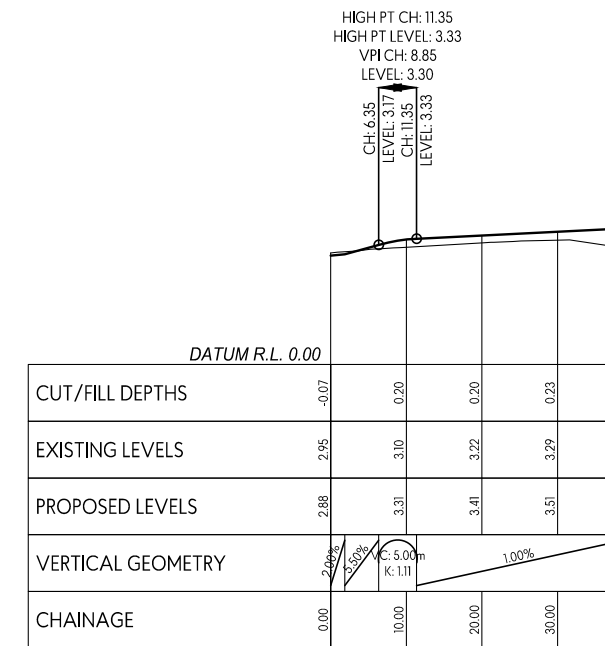
- LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN
RM II SO 31470 - RL 3.05m



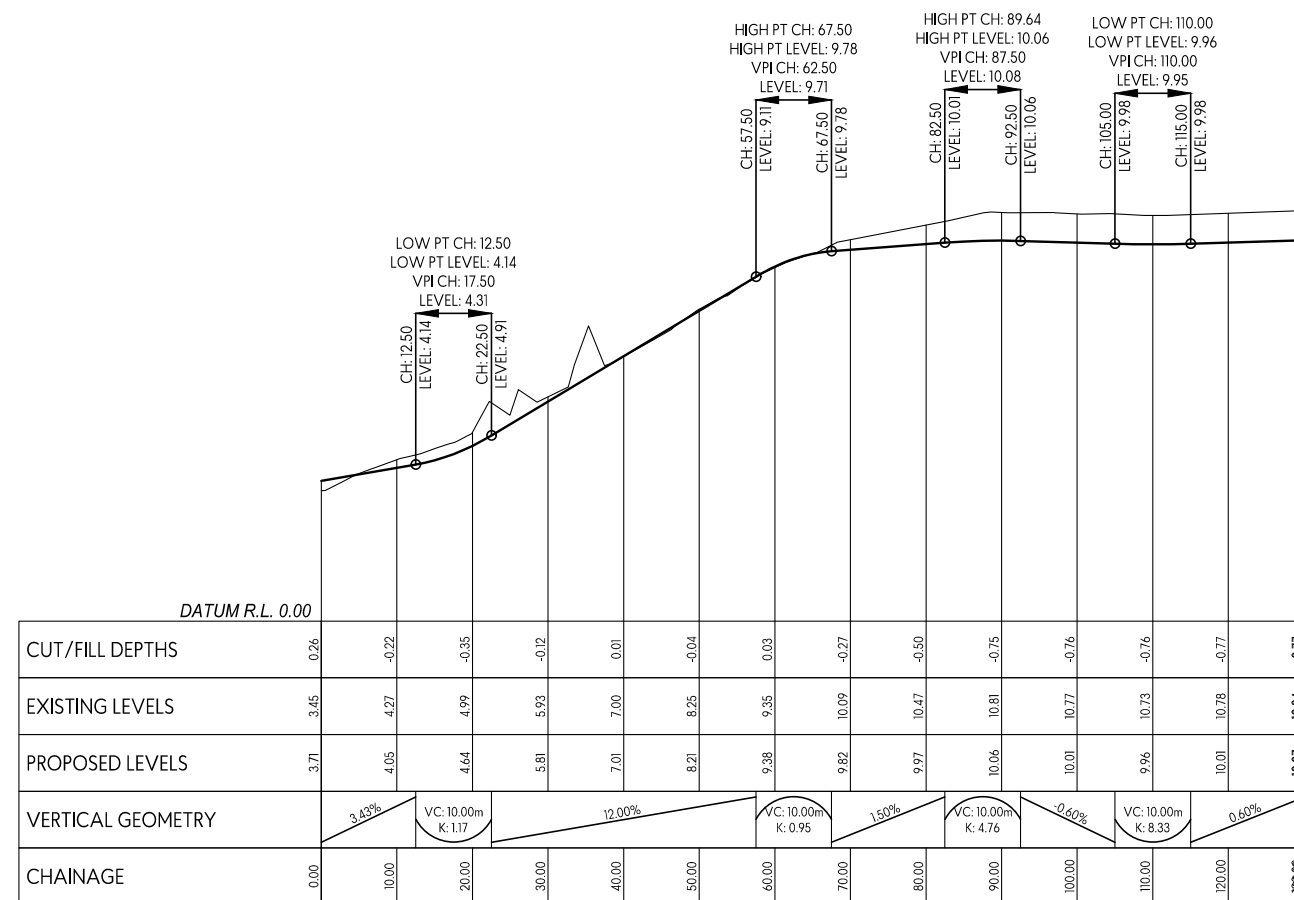
CL - LANE E
LONGSECTION BETWEEN 0.00 AND 45.65



CL - LANE F
LONGSECTION BETWEEN 0.00 AND 35.68



CL - LANE G
LONGSECTION BETWEEN 0.00 AND 38.82



CL - LANE REAR ACCESS
LONGSECTION BETWEEN 0.00 AND 130.12

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| REVISIONS: | | | |
|------------|------------------------|----|------------|
| REV | NOTES | BY | DATE |
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
PROPOSED ROADING LONGSECTIONS
SHEET 4 OF 4

ENVELOPE
LAND
STRUCTURE
MANAGE

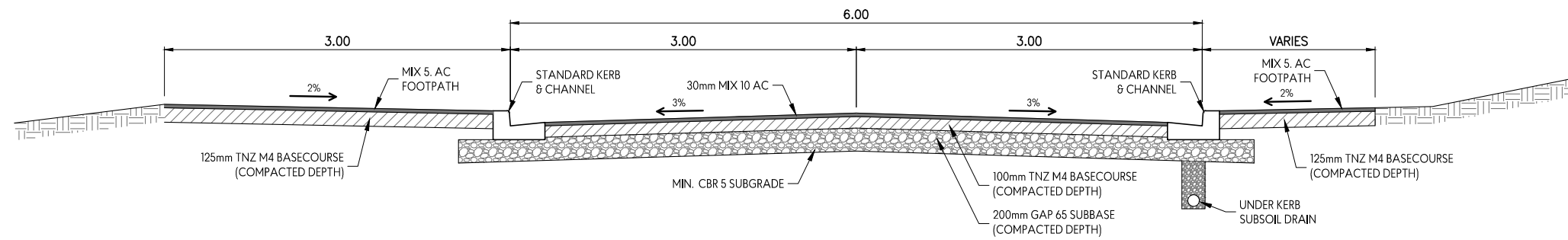
L1, 125 VINCENT STREET
AUCKLAND CITY 1010
PO BOX 68946 NEWTON 1141
ENVELOPE ENGINEERING

DESIGNED: PJ
CHECKED: AB
SCALE: A1 - 1:500 Horz, 1:100 Vert, A3 - 1:1000 Horz, 1:200 Vert
STATUS: RESOURCE CONSENT
PROJECT No: 1098-01
DRAWING No: 323
REVISION: R1

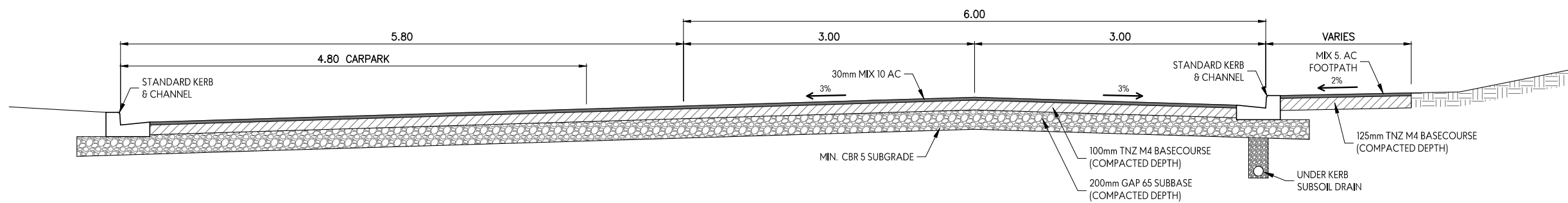
DRAWN: PJ
DATE: 14-Sep-2016

NOTES:

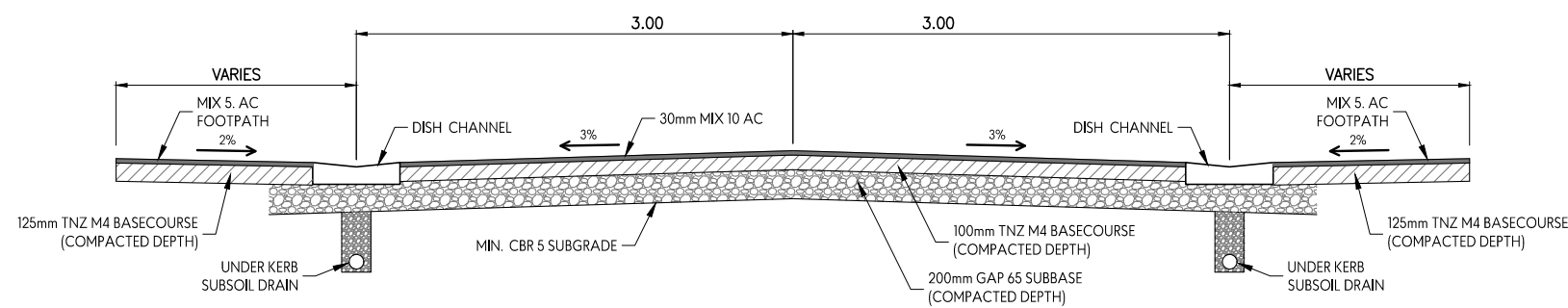
1. ALL METAL DEPTHS AND ROAD LAYERS TO BE CONFIRMED AT DETAIL DESIGN/ENGINEERING APPROVAL STAGE.



TYPICAL ROAD CROSS-SECTION
ROAD 1 - SHELLY BAY ROAD



TYPICAL ROAD CROSS-SECTION
ROAD 1 - SHELLY BAY ROAD
WITH CARPARKING



TYPICAL ROAD CROSS-SECTION
ROAD 1 - SHELLY BAY ROAD
CH 2676.3m to 2856.9m

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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
TYPICAL ROAD CROSS-SECTIONS
SHEET 1 OF 2

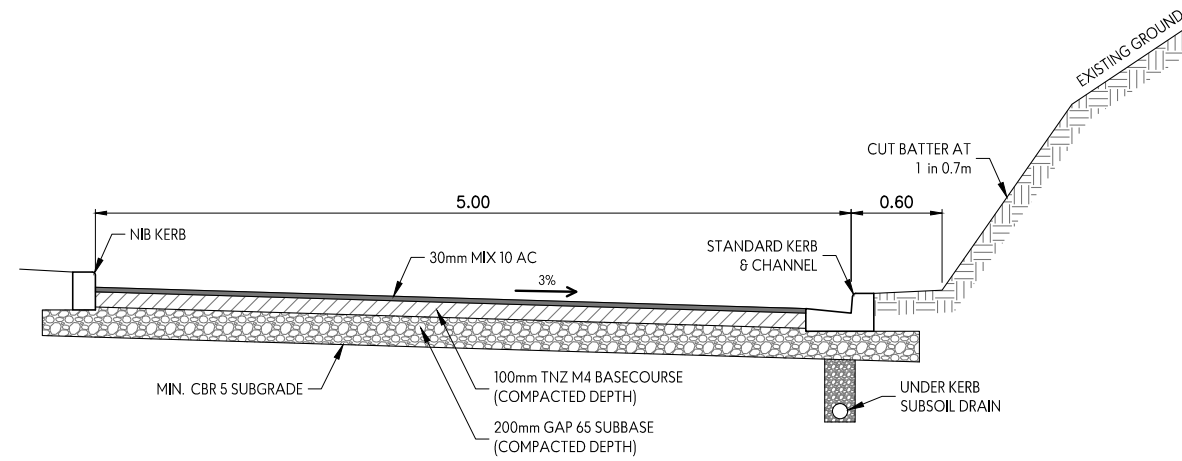
ENVELOPE
LAND
STRUCTURE
MANAGE
L1, 125 VINCENT STREET
AUCKLAND CITY 1010
PO BOX 68946 NEWTON 1141
ENVELOPE ENGINEERING

DESIGNED: PJ
CHECKED: AB
SCALE: A1 - 1:25, A3 - 1:50
STATUS: RESOURCE CONSENT
PROJECT No: 1098-01
DRAWING No: 330
REVISION: R1

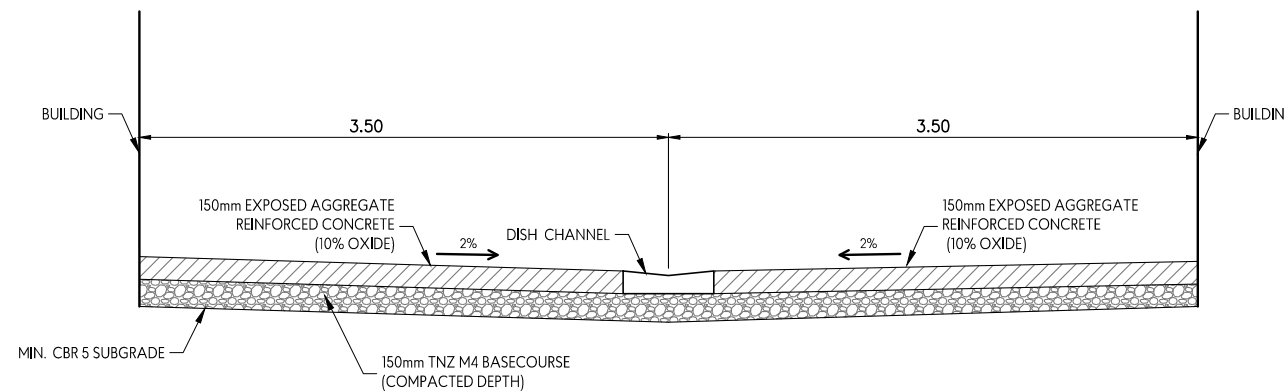
DRAWN: PJ
DATE: 14-Sep-2016
REVISION: R1

NOTES:

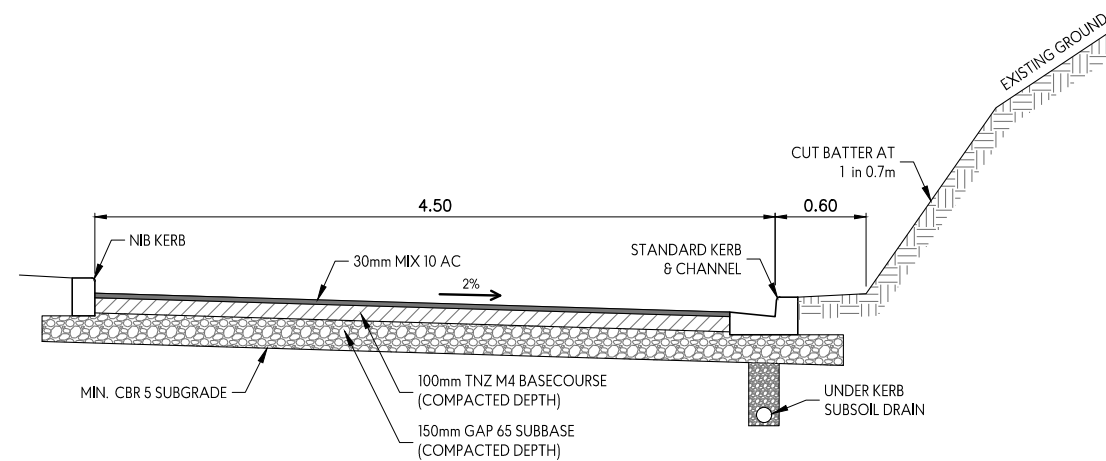
1. ALL METAL DEPTHS AND ROAD LAYERS TO BE CONFIRMED AT DETAIL DESIGN/ENGINEERING APPROVAL STAGE.



TYPICAL ROAD CROSS-SECTION
ROAD 2 - MAIN ROAD



TYPICAL ROAD CROSS-SECTION
SHARED LANES



TYPICAL ROAD CROSS-SECTION
REAR ACCESS LANE

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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
| | | | |
| | | | |
| | | | |

PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
TYPICAL ROAD CROSS-SECTIONS
SHEET 2 OF 2

ENVELOPE
LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
AUCKLAND CITY 1010
PO BOX 68946 NEWTON 1141
ENVELOPE ENGINEERING

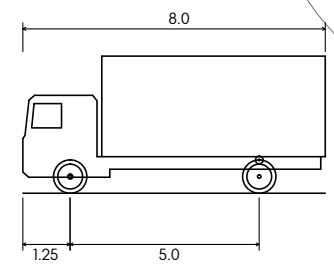
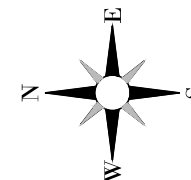
DESIGNED: PJ
CHECKED: AB

DRAWN: PJ
DATE: 14-Sep-2016

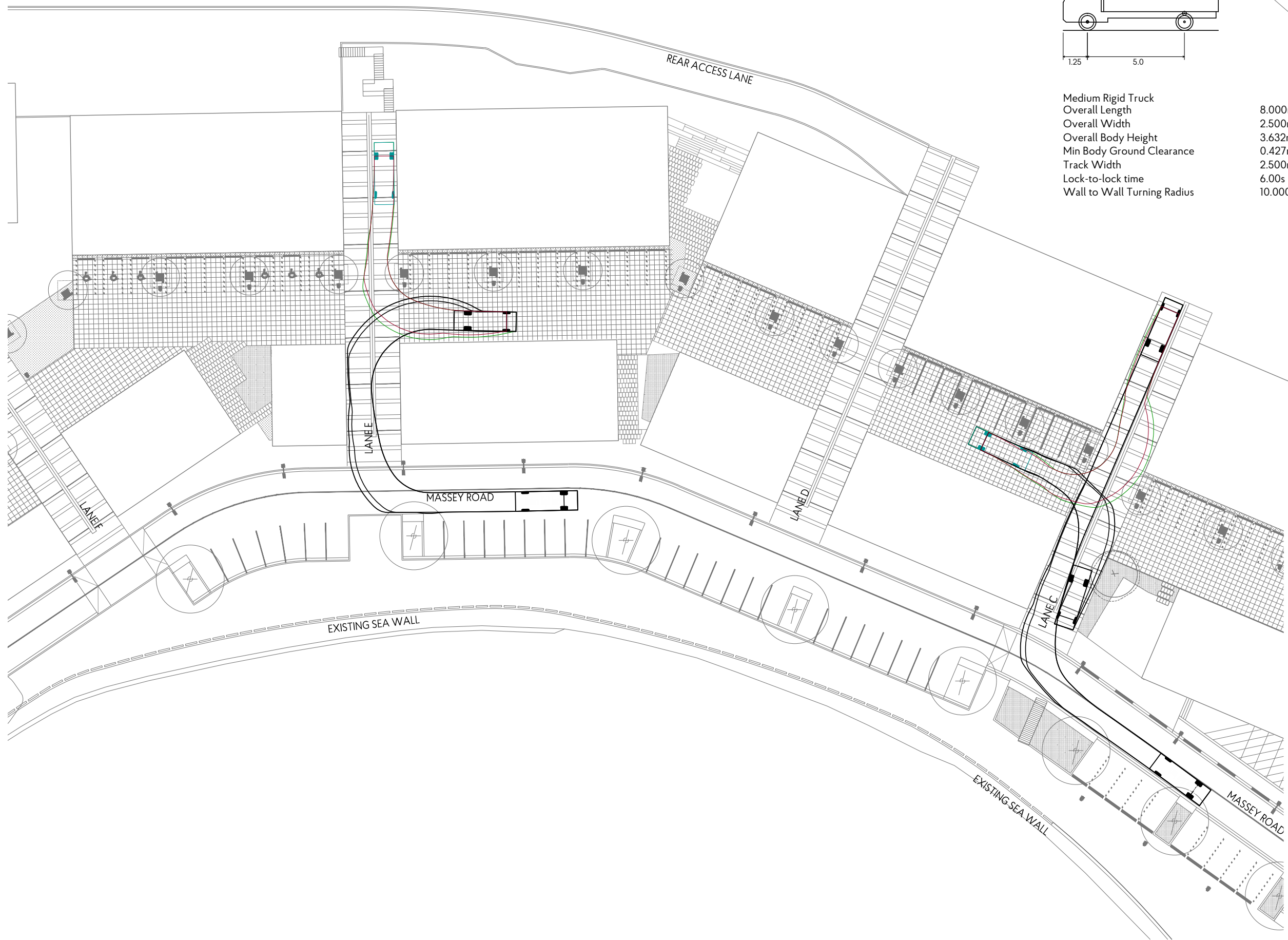
SCALE: A1 - 1:25, A3 - 1:50

STATUS: RESOURCE CONSENT

PROJECT No: 1098-01
DRAWING No: 331
REVISION: R1



Medium Rigid Truck
 Overall Length 8.000m
 Overall Width 2.500m
 Overall Body Height 3.632m
 Min Body Ground Clearance 0.427m
 Track Width 2.500m
 Lock-to-lock time 6.00s
 Wall to Wall Turning Radius 10.000m



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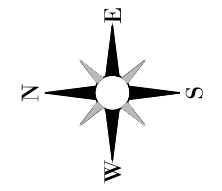
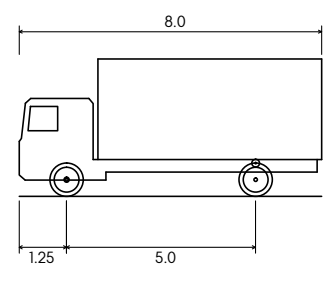
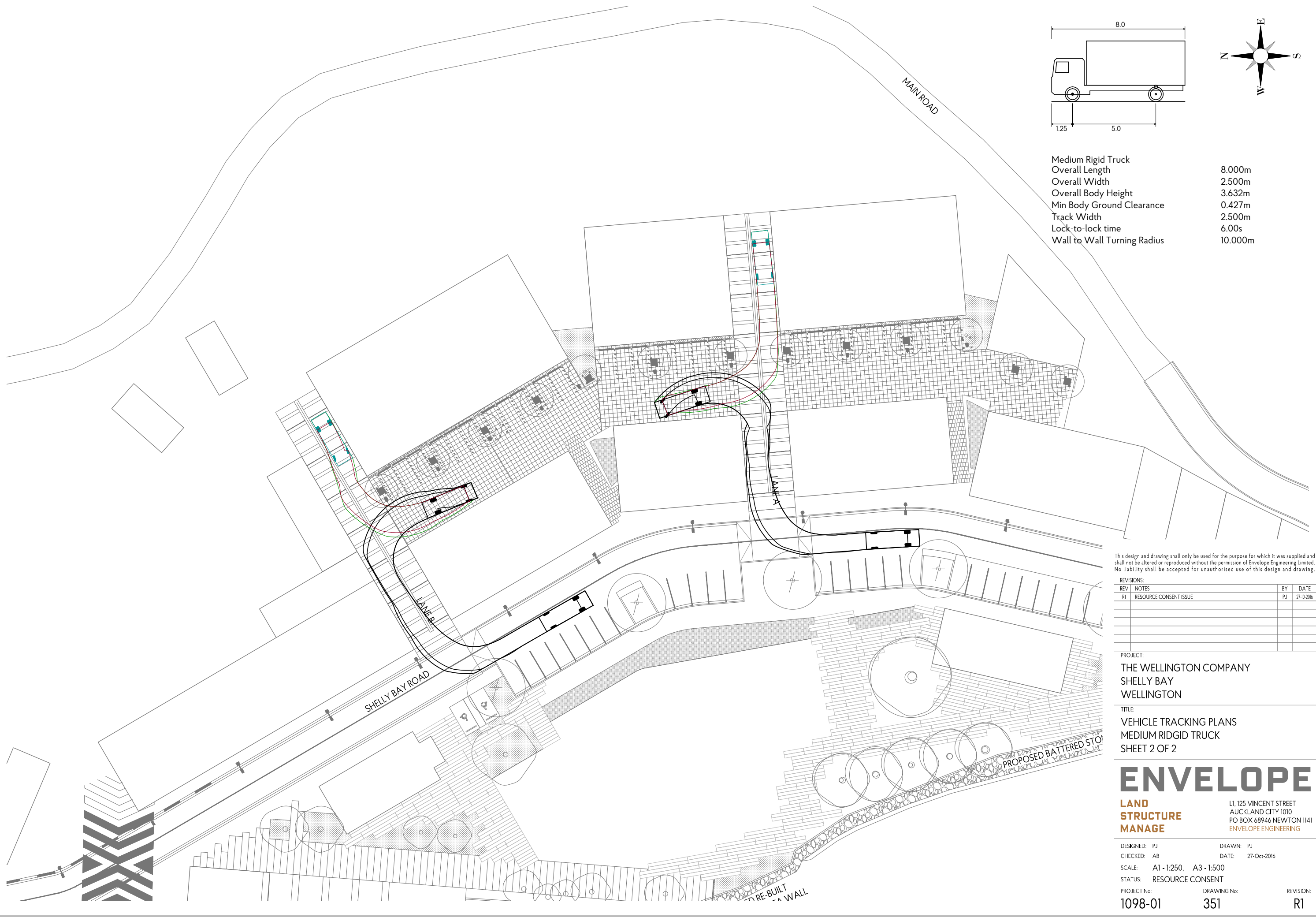
REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 27-10-2016 |
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PROJECT:
 THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON
 TITLE:
 VEHICLE TRACKING PLANS
 MEDIUM RIGID TRUCK
 SHEET 1 OF 2

ENVELOPE
 LAND
 STRUCTURE
 MANAGE
 L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 350
 DRAWN: PJ
 DATE: 27-Oct-2016
 REVISION: R1



| | |
|-----------------------------|---------|
| Medium Rigid Truck | |
| Overall Length | 8.000m |
| Overall Width | 2.500m |
| Overall Body Height | 3.632m |
| Min Body Ground Clearance | 0.427m |
| Track Width | 2.500m |
| Lock-to-lock time | 6.00s |
| Wall to Wall Turning Radius | 10.000m |

This design and drawing shall only be used for the purpose for which it was supplied and shall not be altered or reproduced without the permission of Envelope Engineering Limited. No liability shall be accepted for unauthorised use of this design and drawing.

REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 27-10-2016 |
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| | | | |

PROJECT:
 THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

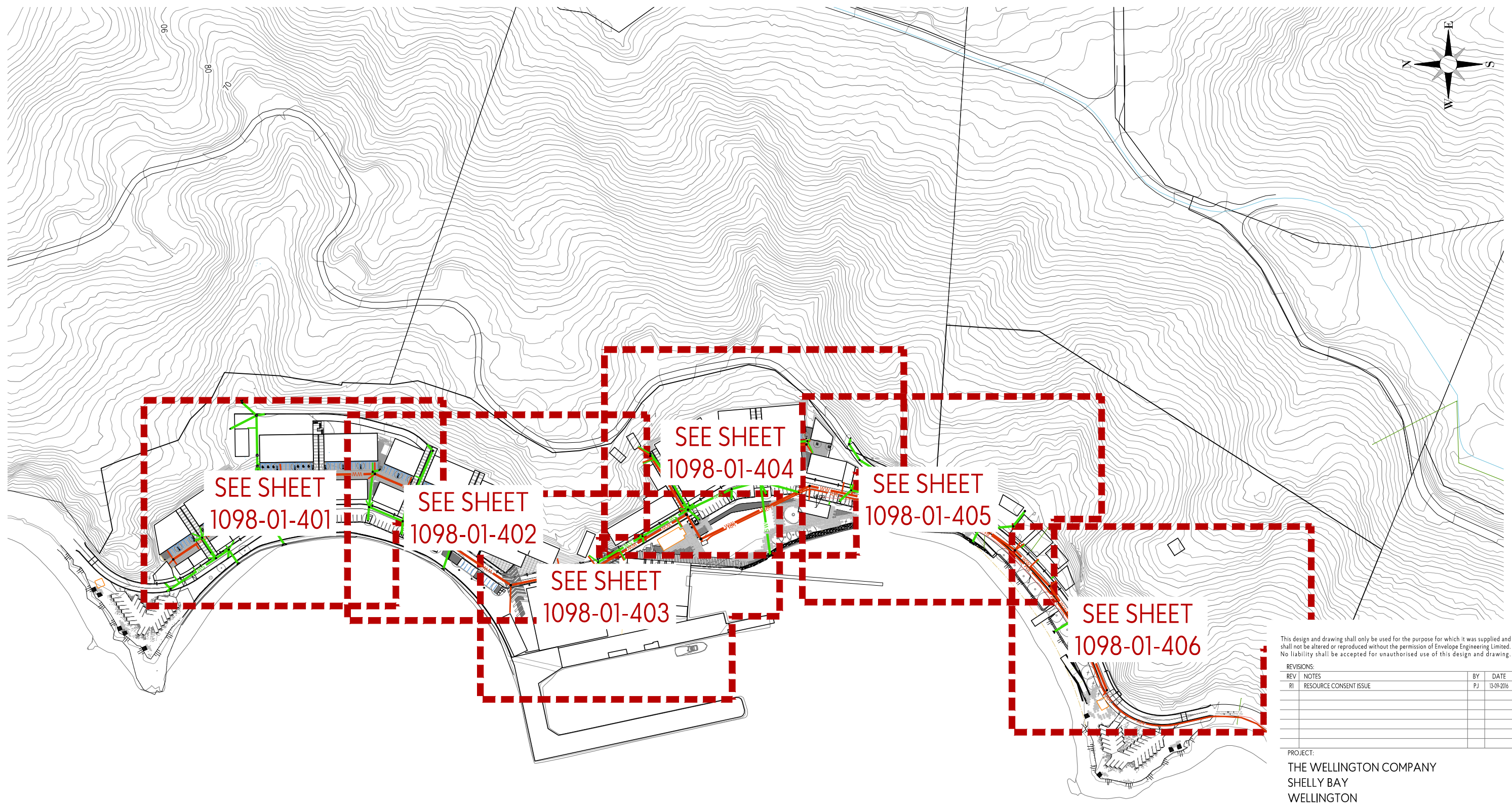
TITLE:
 VEHICLE TRACKING PLANS
 MEDIUM RIDGID TRUCK
 SHEET 2 OF 2

ENVELOPE

LAND
 STRUCTURE
 MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

| | |
|-------------------------------|-------------------|
| DESIGNED: PJ | DRAWN: PJ |
| CHECKED: AB | DATE: 27-Oct-2016 |
| SCALE: A1 - 1:250, A3 - 1:500 | |
| STATUS: RESOURCE CONSENT | |
| PROJECT No: 1098-01 | DRAWING No: 351 |
| | REVISION: R1 |



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REVISIONS:

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| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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| | | | |

PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

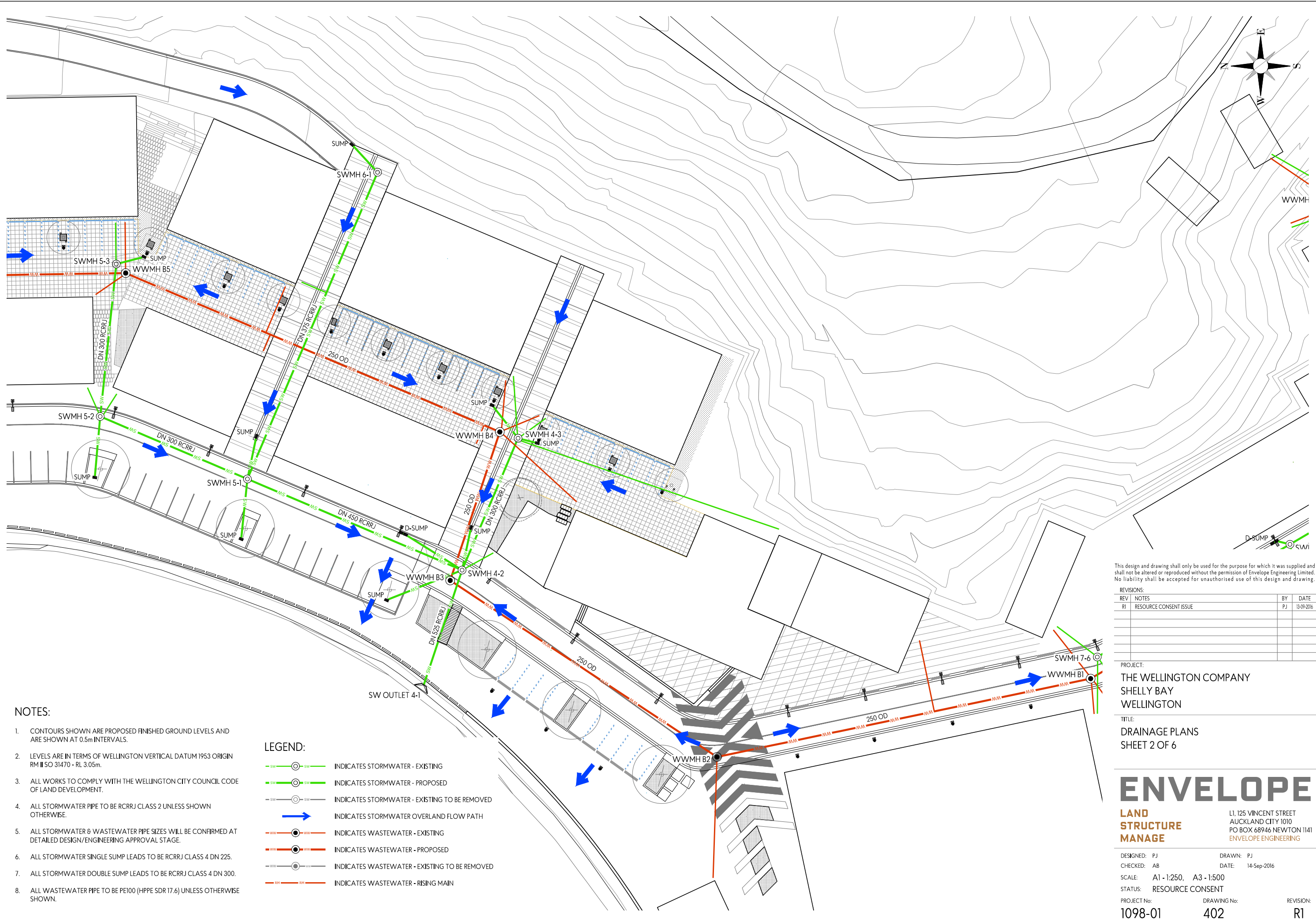
TITLE:
 DRAINAGE PLANS
 OVERALL LAYOUT

ENVELOPE

**LAND
 STRUCTURE
 MANAGE**

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:1250, A3 - 1:2500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 400
 DRAWN: PJ
 DATE: 14-Sep-2016
 REVISION: R1



NOTES:

1. CONTOURS SHOWN ARE PROPOSED FINISHED GROUND LEVELS AND ARE SHOWN AT 0.5m INTERVALS.
2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m.
3. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
4. ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
5. ALL STORMWATER & WASTEWATER PIPE SIZES WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
6. ALL STORMWATER SINGLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 225.
7. ALL STORMWATER DOUBLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 300.
8. ALL WASTEWATER PIPE TO BE PE100 (HPPE SDR 17.6) UNLESS OTHERWISE SHOWN.

LEGEND:

- INDICATES STORMWATER - EXISTING
- INDICATES STORMWATER - PROPOSED
- INDICATES STORMWATER - EXISTING TO BE REMOVED
- INDICATES STORMWATER OVERLAND FLOW PATH
- INDICATES WASTEWATER - EXISTING
- INDICATES WASTEWATER - PROPOSED
- INDICATES WASTEWATER - EXISTING TO BE REMOVED
- INDICATES WASTEWATER - RISING MAIN

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|------------|------------------------|----|------------|
| REV | NOTES | BY | DATE |
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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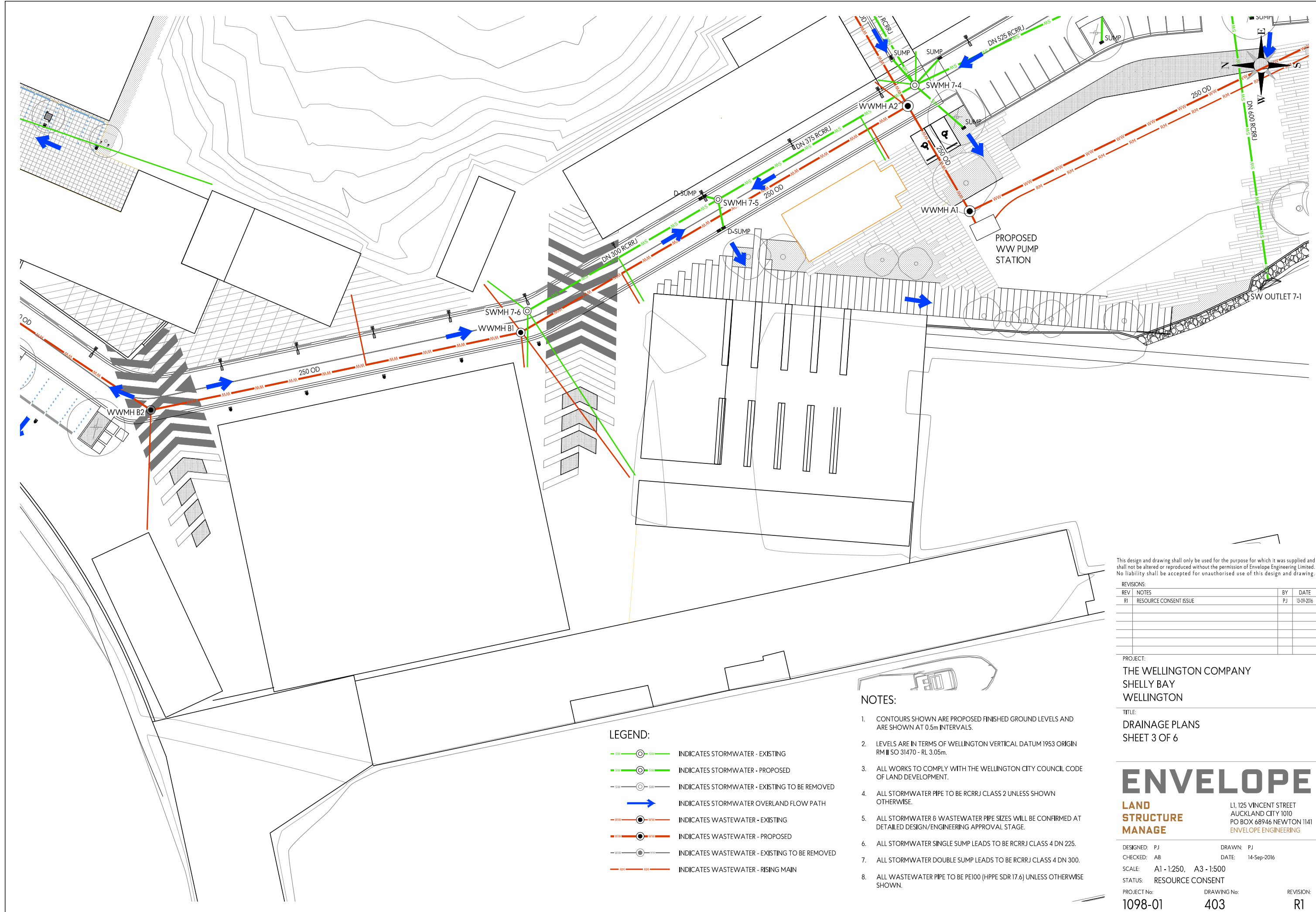
PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
DRAINAGE PLANS
 SHEET 2 OF 6

ENVELOPE
 LAND
 STRUCTURE
 MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

| | |
|-------------------------------|-------------------|
| DESIGNED: PJ | DRAWN: PJ |
| CHECKED: AB | DATE: 14-Sep-2016 |
| SCALE: A1 - 1:250, A3 - 1:500 | |
| STATUS: RESOURCE CONSENT | |
| PROJECT No: 1098-01 | DRAWING No: 402 |
| | REVISION: R1 |



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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
**THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON**

TITLE:
**DRAINAGE PLANS
 SHEET 3 OF 6**

ENVELOPE
**LAND
 STRUCTURE
 MANAGE**

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWN: PJ
 DATE: 14-Sep-2016
 DRAWING No: 403
 REVISION: R1








- LEGEND:**
- INDICATES STORMWATER - EXISTING
 - INDICATES STORMWATER - PROPOSED
 - INDICATES STORMWATER - EXISTING TO BE REMOVED
 - INDICATES STORMWATER OVERLAND FLOW PATH
 - INDICATES WASTEWATER - EXISTING
 - INDICATES WASTEWATER - PROPOSED
 - INDICATES WASTEWATER - EXISTING TO BE REMOVED
 - INDICATES WASTEWATER - RISING MAIN

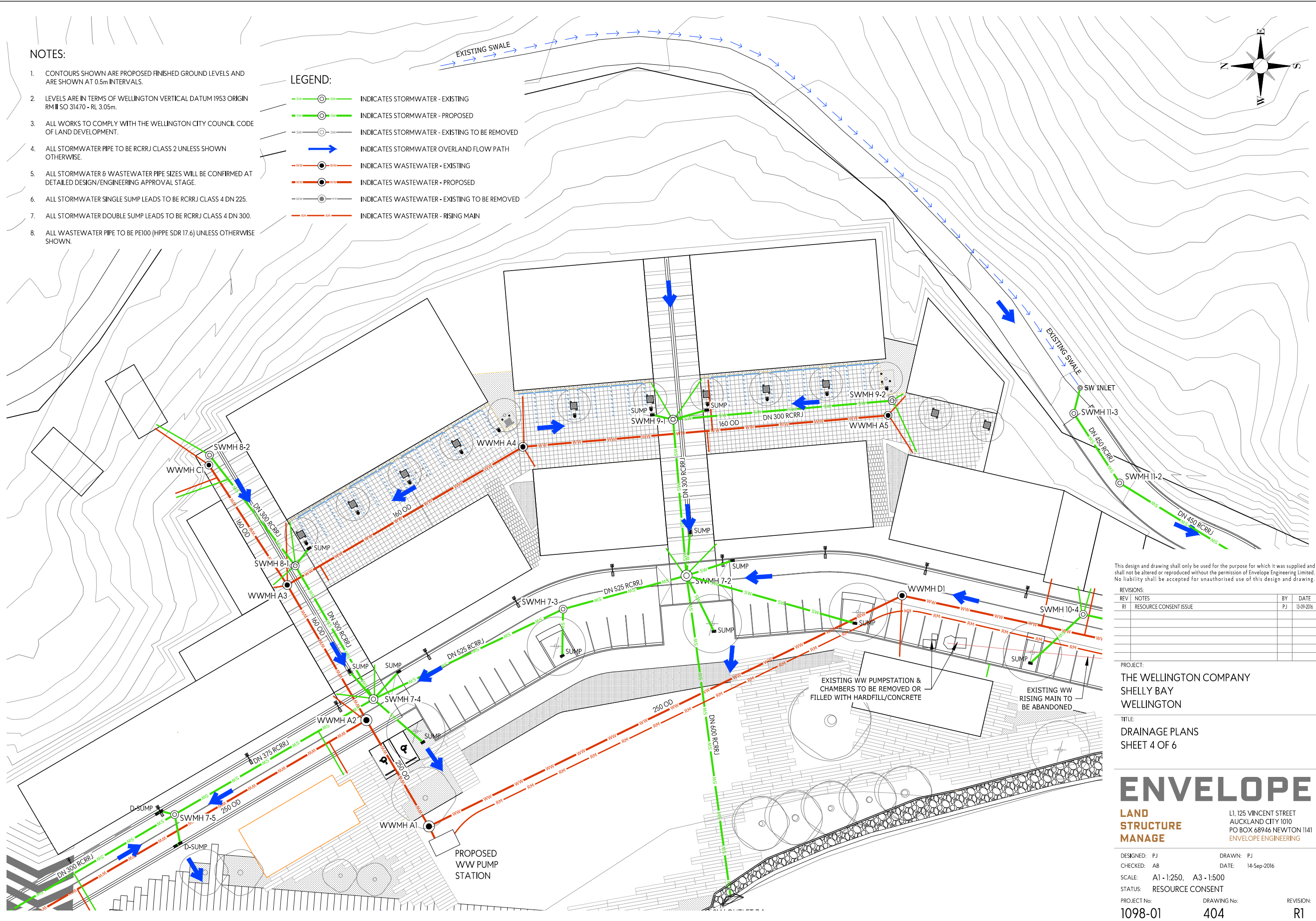
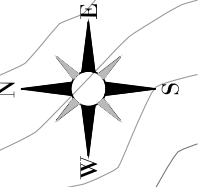
- NOTES:**
1. CONTOURS SHOWN ARE PROPOSED FINISHED GROUND LEVELS AND ARE SHOWN AT 0.5m INTERVALS.
 2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m.
 3. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
 4. ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
 5. ALL STORMWATER & WASTEWATER PIPE SIZES WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
 6. ALL STORMWATER SINGLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 225.
 7. ALL STORMWATER DOUBLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 300.
 8. ALL WASTEWATER PIPE TO BE PE100 (HPPE SDR 17.6) UNLESS OTHERWISE SHOWN.

NOTES:

1. CONTOURS SHOWN ARE PROPOSED FINISHED GROUND LEVELS AND ARE SHOWN AT 0.5m INTERVALS.
2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m.
3. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
4. ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
5. ALL STORMWATER & WASTEWATER PIPE SIZES WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
6. ALL STORMWATER SINGLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 225.
7. ALL STORMWATER DOUBLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 300.
8. ALL WASTEWATER PIPE TO BE PE100 (HPPE SDR 17.6) UNLESS OTHERWISE SHOWN.

LEGEND:

-  INDICATES STORMWATER - EXISTING
-  INDICATES STORMWATER - PROPOSED
-  INDICATES STORMWATER OVERLAND FLOW PATH
-  INDICATES WASTEWATER - EXISTING
-  INDICATES WASTEWATER - PROPOSED
-  INDICATES WASTEWATER - EXISTING TO BE REMOVED
-  INDICATES WASTEWATER - RISING MAIN



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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |

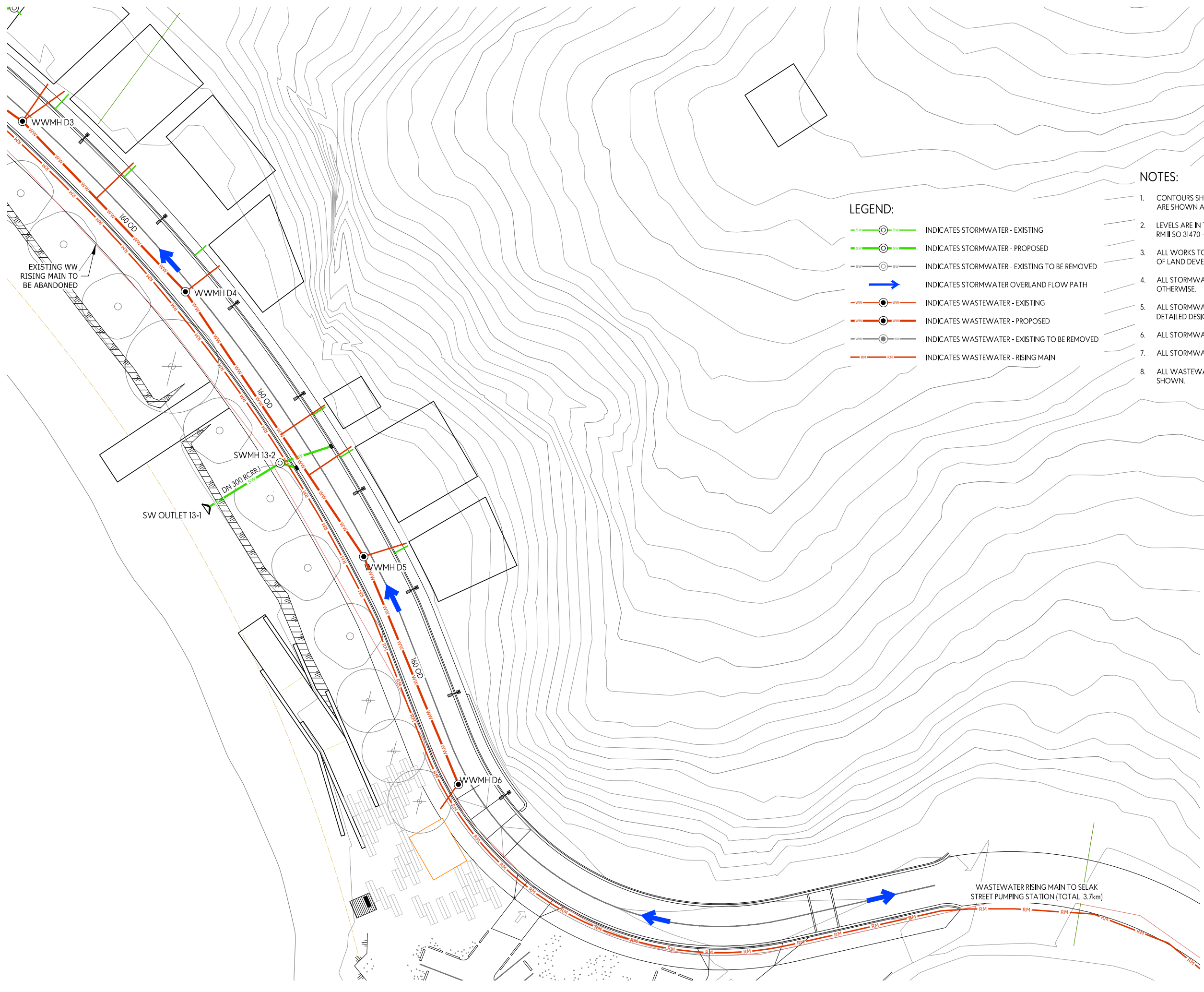
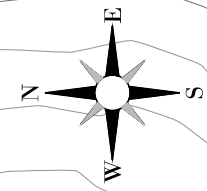
PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
DRAINAGE PLANS
SHEET 4 OF 6

ENVELOPE
LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

| | |
|-------------------------------|-------------------|
| DESIGNED: PJ | DRAWN: PJ |
| CHECKED: AB | DATE: 14-Sep-2016 |
| SCALE: A1 - 1:250, A3 - 1:500 | |
| STATUS: RESOURCE CONSENT | |
| PROJECT No: 1098-01 | DRAWING No: 404 |
| | REVISION: R1 |



LEGEND:

- INDICATES STORMWATER - EXISTING
- INDICATES STORMWATER - PROPOSED
- INDICATES STORMWATER - EXISTING TO BE REMOVED
- INDICATES STORMWATER OVERLAND FLOW PATH
- INDICATES WASTEWATER - EXISTING
- INDICATES WASTEWATER - PROPOSED
- INDICATES WASTEWATER - EXISTING TO BE REMOVED
- INDICATES WASTEWATER - RISING MAIN

NOTES:

1. CONTOURS SHOWN ARE PROPOSED FINISHED GROUND LEVELS AND ARE SHOWN AT 2.0m INTERVALS.
2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m.
3. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
4. ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
5. ALL STORMWATER & WASTEWATER PIPE SIZES WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
6. ALL STORMWATER SINGLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 225.
7. ALL STORMWATER DOUBLE SUMP LEADS TO BE RCRRJ CLASS 4 DN 300.
8. ALL WASTEWATER PIPE TO BE PE100 (HPPE SDR 17.6) UNLESS OTHERWISE SHOWN.

EXISTING WW RISING MAIN TO BE ABANDONED

SW OUTLET 13-1

WASTEWATER RISING MAIN TO SELAK STREET PUMPING STATION (TOTAL 3.7km)

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| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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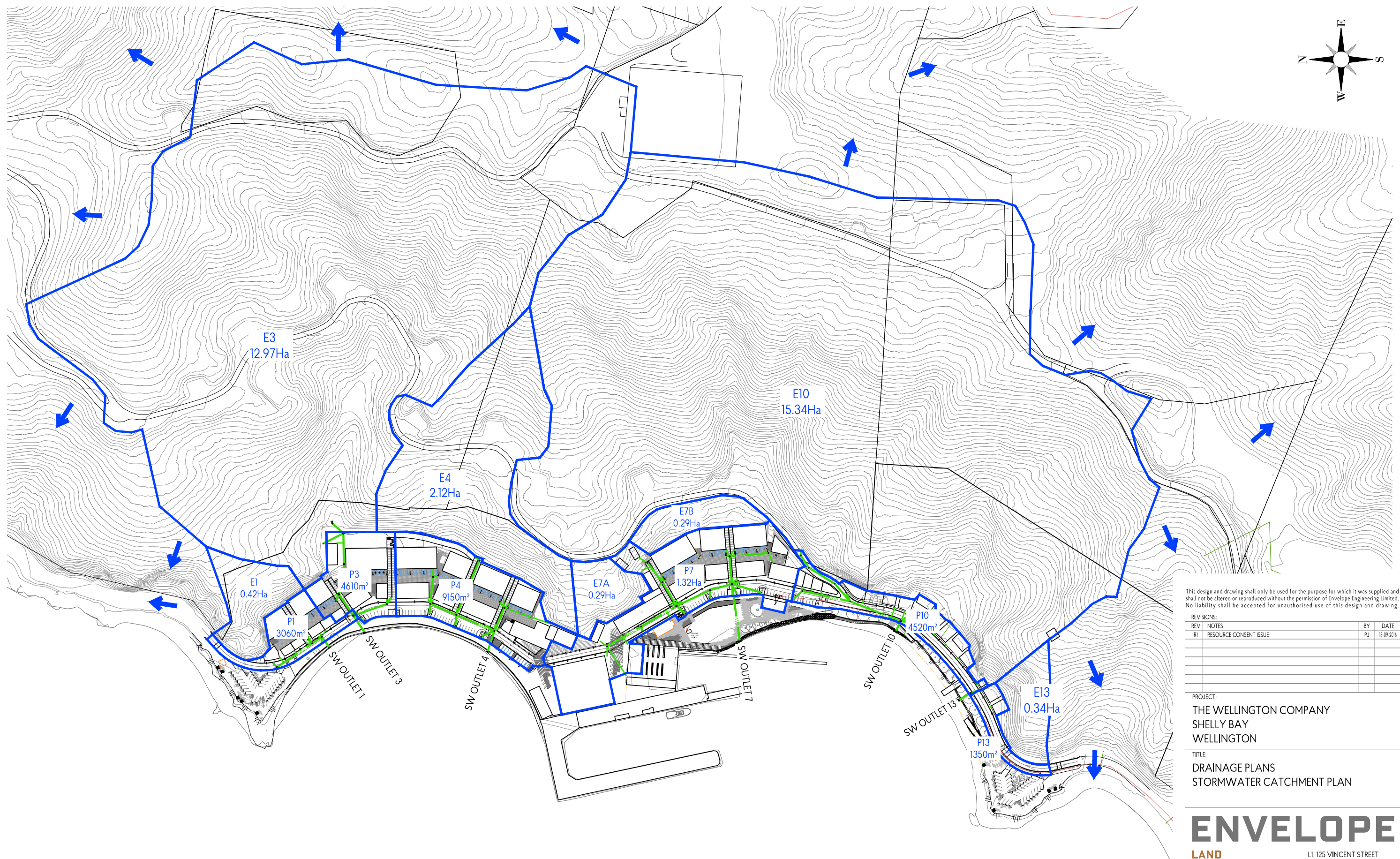
PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
DRAINAGE PLANS
 SHEET 6 OF 6

ENVELOPE
 LAND STRUCTURE MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWN: PJ
 DATE: 14-Sep-2016
 DRAWING No: 406
 REVISION: R1



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| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
 THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
 DRAINAGE PLANS
 STORMWATER CATCHMENT PLAN

ENVELOPE
 LAND
 STRUCTURE
 MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

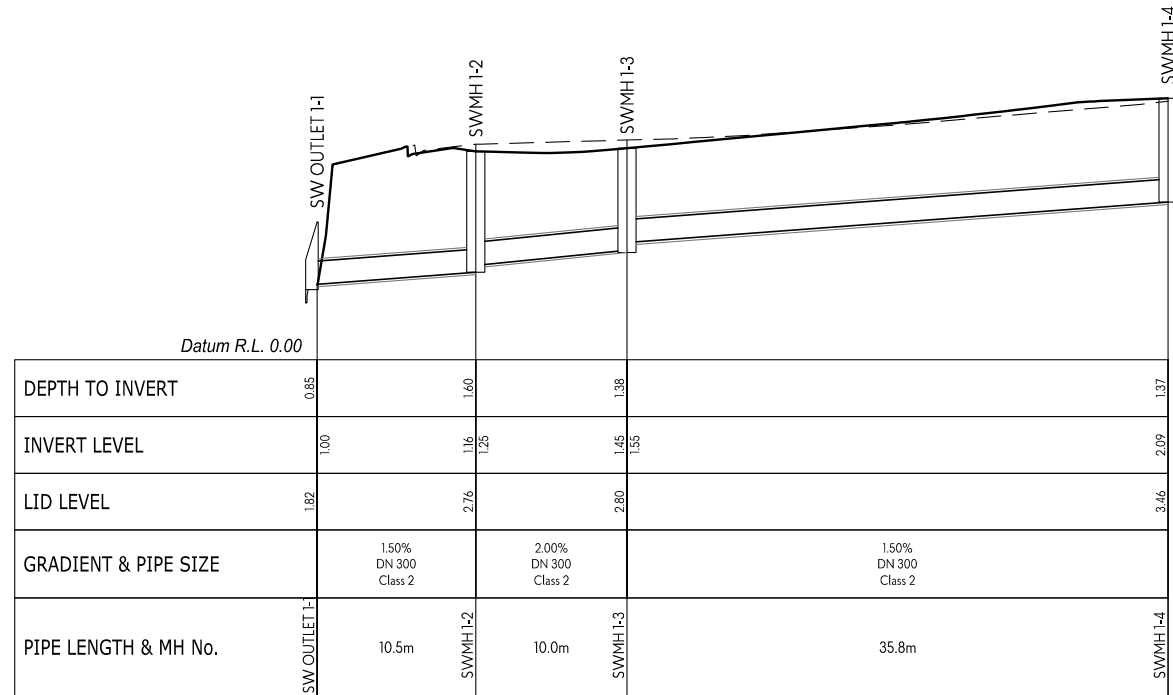
DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:1500, A3 - 1:3000
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01

DRAWN: PJ
 DATE: 14-Sep-2016
 DRAWING No: 410

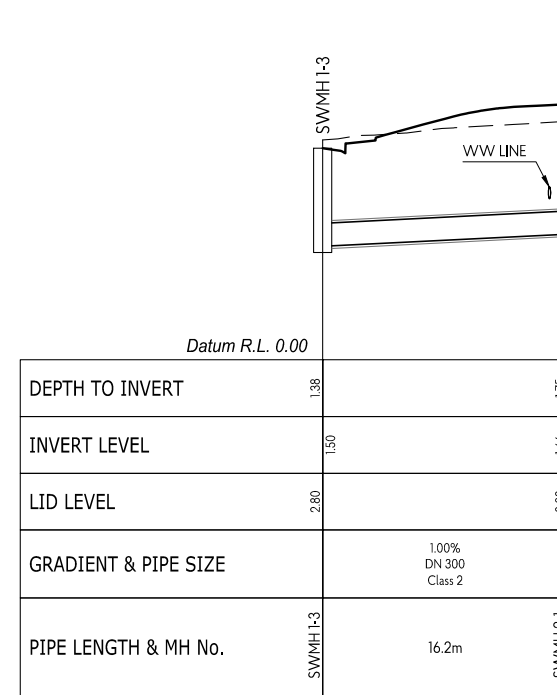
REVISION:
 R1

NOTES:

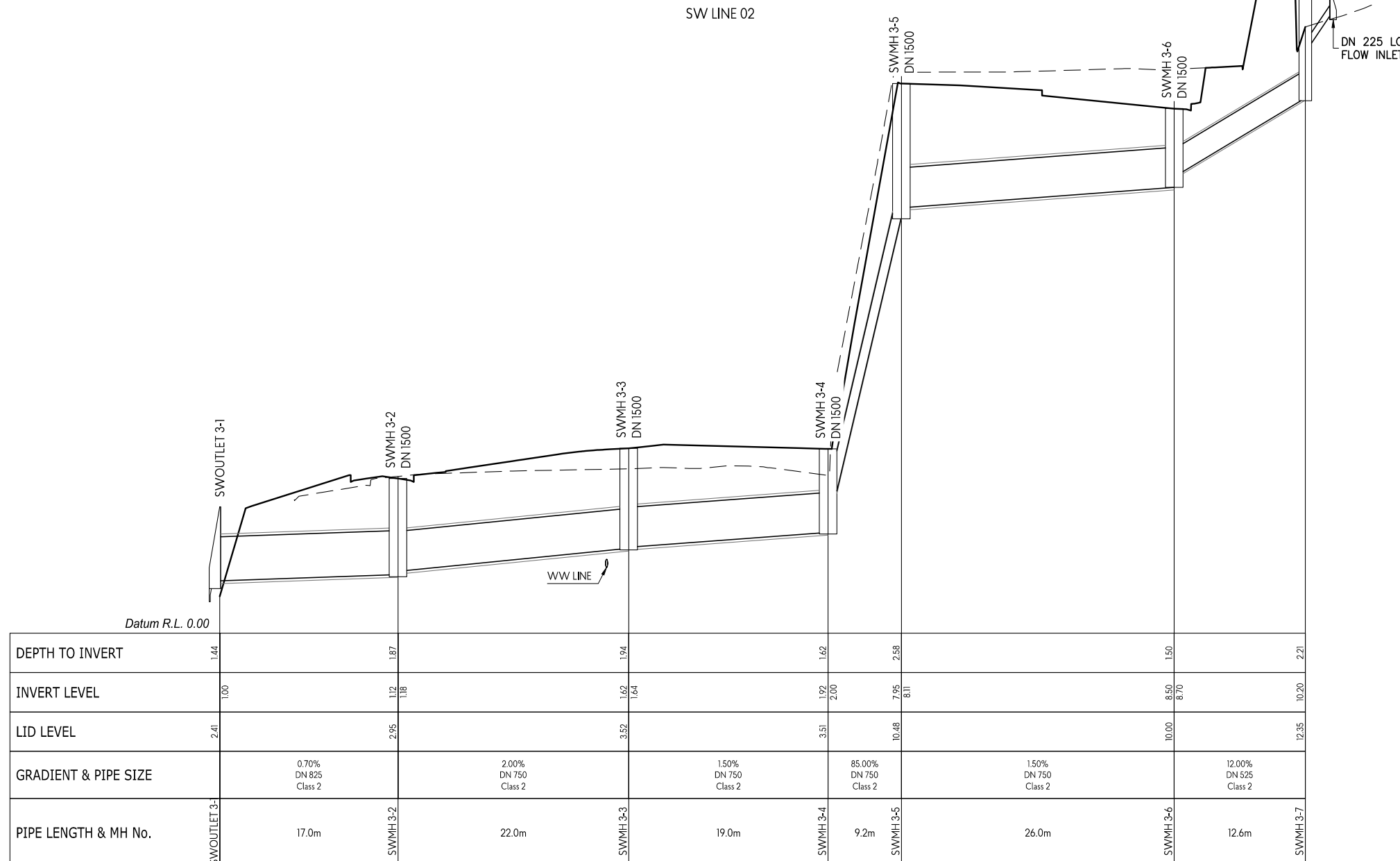
- INDICATES PROPOSED FINISHED GROUND LEVEL
- - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
- LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
- PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
- ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
- ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
- ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
- CONTRACTOR TO CHECK ALL INVERTS AGAINST PIPE CLASHES BEFORE LAYING. ADJUSTMENT OF ANY INVERT LEVELS IS AT THE CONTRACTORS OWN RISK DUE TO TIGHT TOLERANCES.
- PIPE LENGTH SHOWN IS THE LENGTH OF PIPE BETWEEN CENTRE OF MANHOLES.
- HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.



SW LINE 01



SW LINE 02



SW LINE 03

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| REV | NOTES | BY | DATE |
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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| | | | |
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PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
STORMWATER LONGSECTIONS
 SHEET 1 OF 5

ENVELOPE
LAND STRUCTURE MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016

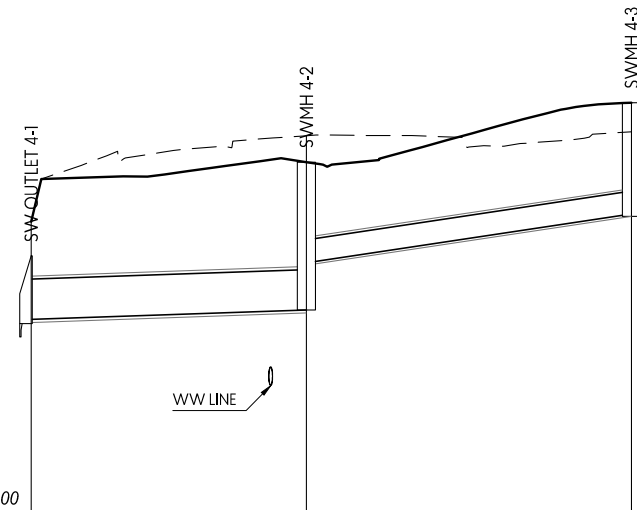
SCALE: A1 - 1:250 Horz, 1:50 Vert. A3 - 1:500 Horz, 1:100 Vert

STATUS: RESOURCE CONSENT

PROJECT No: 1098-01 DRAWING No: 420 REVISION: R1

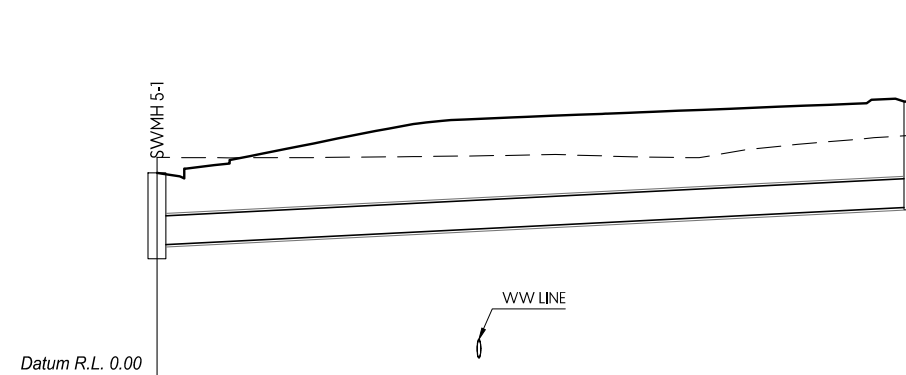
NOTES:

1. ——— INDICATES PROPOSED FINISHED GROUND LEVEL
2. - - - - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
3. LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
4. PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
5. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
6. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
7. ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
8. ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
9. CONTRACTOR TO CHECK ALL INVERTS AGAINST PIPE CLASHES BEFORE LAYING. ADJUSTMENT OF ANY INVERT LEVELS IS AT THE CONTRACTORS OWN RISK DUE TO TIGHT TOLERANCES.
10. PIPE LENGTH SHOWN IS THE LENGTH OF PIPE BETWEEN CENTRE OF MANHOLES.
11. HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.



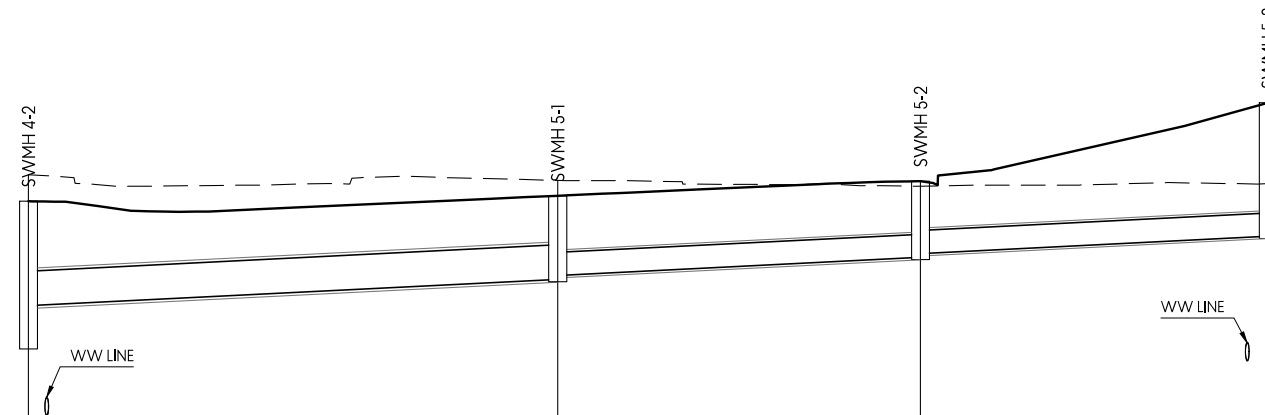
| Datum R.L. -2.00 | | | | |
|----------------------|----------------------------|-------------------|----------------------------|----------|
| DEPTH TO INVERT | 0.88 | 1.95 | 1.51 | |
| INVERT LEVEL | 0.55 | 0.68 | 1.30 | 1.95 |
| LID LEVEL | 1.39 | 2.63 | 3.42 | |
| GRADIENT & PIPE SIZE | 0.70% DN 525 Class 2 | | 3.00% DN 300 Class 2 | |
| PIPE LENGTH & MH No. | SW OUTLET 4-1 | 18.2m SWMH 4-2 | 21.5m | SWMH 4-3 |

SW LINE 04



| Datum R.L. 0.00 | | | | |
|----------------------|----------------------------|-------|--|----------|
| DEPTH TO INVERT | 1.14 | 1.43 | | |
| INVERT LEVEL | 1.75 | 2.25 | | |
| LID LEVEL | 2.70 | 3.65 | | |
| GRADIENT & PIPE SIZE | 1.00% DN 375 Class 2 | | | |
| PIPE LENGTH & MH No. | SWMH 5-1 | 50.0m | | SWMH 6-1 |

SW LINE 06



| Datum R.L. -2.00 | | | | |
|----------------------|----------------------------|-------------------|----------------------------|-------------------|
| DEPTH TO INVERT | 1.95 | 1.14 | 1.04 | 1.80 |
| INVERT LEVEL | 1.25 | 1.60 | 1.89 | 2.17 |
| LID LEVEL | 2.63 | 2.70 | 2.90 | 3.93 |
| GRADIENT & PIPE SIZE | 1.00% DN 450 Class 2 | | 1.00% DN 300 Class 2 | |
| PIPE LENGTH & MH No. | SWMH 4-2 | 35.0m SWMH 5-1 | 24.0m SWMH 5-2 | 23.0m SWMH 5-3 |

SW LINE 05

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| REV | NOTES | BY | DATE |
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

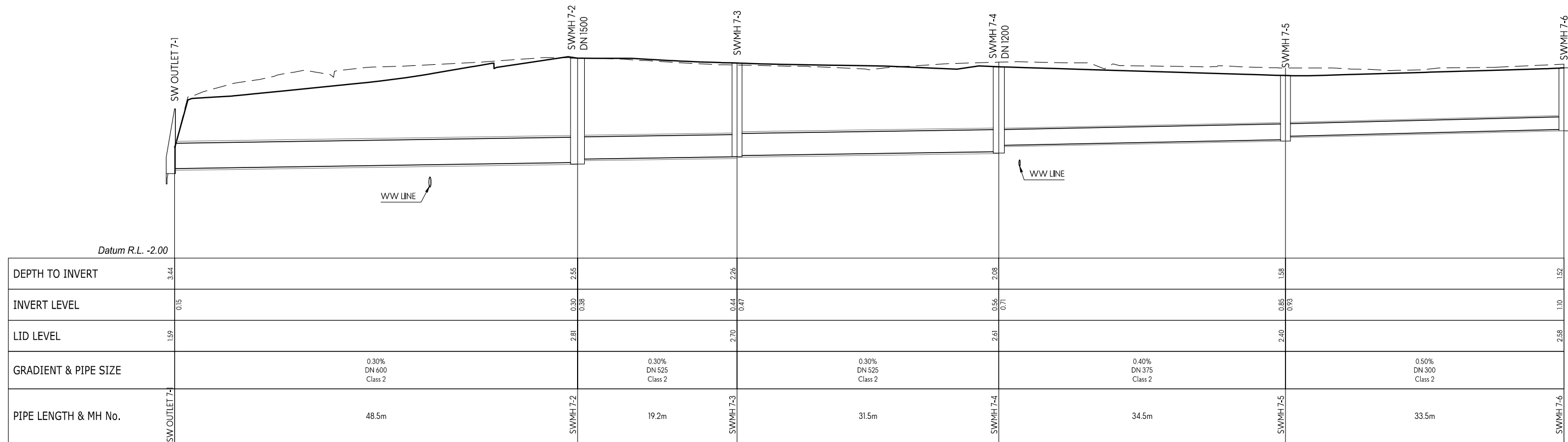
TITLE:
STORMWATER LONGSECTIONS
SHEET 2 OF 5

ENVELOPE
LAND
STRUCTURE
MANAGE

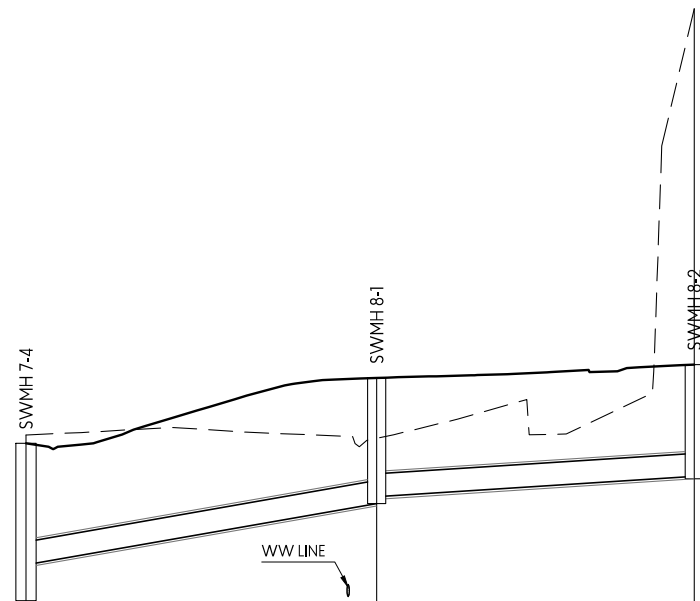
L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250 Horz, 1:50 Vert, A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 421
 REVISION: R1

DRAWN: PJ
 DATE: 14-Sep-2016



SW LINE 07



| | |
|----------------------|----------------------------|
| | 1.66 |
| INVERT LEVEL | 1.81 |
| LID LEVEL | 3.47 |
| GRADIENT & PIPE SIZE | 1.29% DN 300 Class 2 |
| PIPE LENGTH & MH No. | 21.0m |
| | SWMH 8-2 |

SW LINE 08

NOTES:

- INDICATES PROPOSED FINISHED GROUND LEVEL
- INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
- LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
- PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
- ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
- ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
- ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
- CONTRACTOR TO CHECK ALL INVERTS AGAINST PIPE CLASHES BEFORE LAYING. ADJUSTMENT OF ANY INVERT LEVELS IS AT THE CONTRACTORS OWN RISK DUE TO TIGHT TOLERANCES.
- PIPE LENGTH SHOWN IS THE LENGTH OF PIPE BETWEEN CENTRE OF MANHOLES.
- HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.

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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
STORMWATER LONGSECTIONS
SHEET 3 OF 5

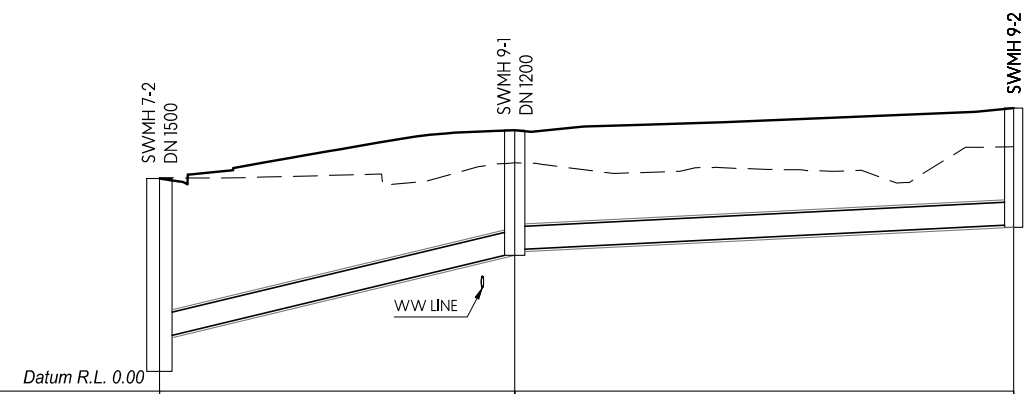
ENVELOPE
LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250 Horz, 1:50 Vert, A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 422
 REVISION: R1

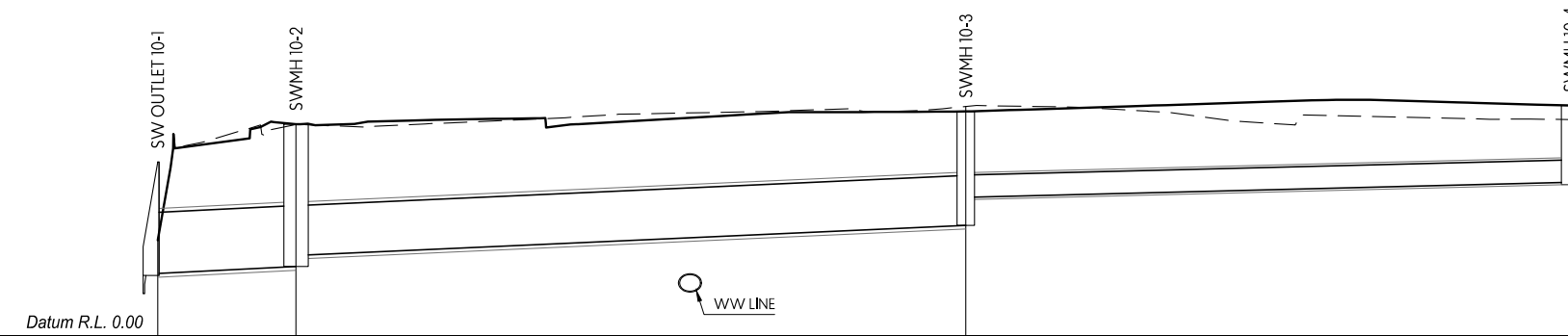
NOTES:

1. ——— INDICATES PROPOSED FINISHED GROUND LEVEL
2. - - - - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
3. LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
4. PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
5. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
6. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
7. ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
8. ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
9. CONTRACTOR TO CHECK ALL INVERTS AGAINST PIPE CLASHES BEFORE LAYING. ADJUSTMENT OF ANY INVERT LEVELS IS AT THE CONTRACTORS OWN RISK DUE TO TIGHT TOLERANCES.
10. PIPE LENGTH SHOWN IS THE LENGTH OF PIPE BETWEEN CENTRE OF MANHOLES.
11. HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.



| | | | |
|----------------------|----------|----------------------------|----------------------------|
| DEPTH TO INVERT | 2.55 | 1.66 | 1.58 |
| INVERT LEVEL | 0.70 | 1.83 1.87 | 2.20 |
| LID LEVEL | 2.81 | 3.45 | 3.75 |
| GRADIENT & PIPE SIZE | | 4.80% DN 300 Class 2 | 1.00% DN 300 Class 2 |
| PIPE LENGTH & MH No. | SWMH 7-2 | 23.5m SWMH 9-1 | 33.0m SWMH 9-2 |

SW LINE 09



| | | | | |
|----------------------|----------------|----------------------------|----------------------------|----------------------------|
| DEPTH TO INVERT | 1.58 | 1.95 | 1.57 | 1.09 |
| INVERT LEVEL | 0.85 | 0.95 1.10 | 1.51 1.90 | 2.11 |
| LID LEVEL | 2.39 | 2.90 | 3.08 | 3.16 |
| GRADIENT & PIPE SIZE | | 1.00% DN 825 Class 2 | 0.90% DN 675 Class 2 | 0.50% DN 300 Class 2 |
| PIPE LENGTH & MH No. | SW OUTLET 10-1 | 9.5m SWMH 10-2 | 46.0m SWMH 10-3 | 41.5m SWMH 10-4 |

SW LINE 10

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| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
| | | | |
| | | | |
| | | | |

PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
STORMWATER LONGSECTIONS
SHEET 4 OF 5

ENVELOPE
LAND
STRUCTURE
MANAGE

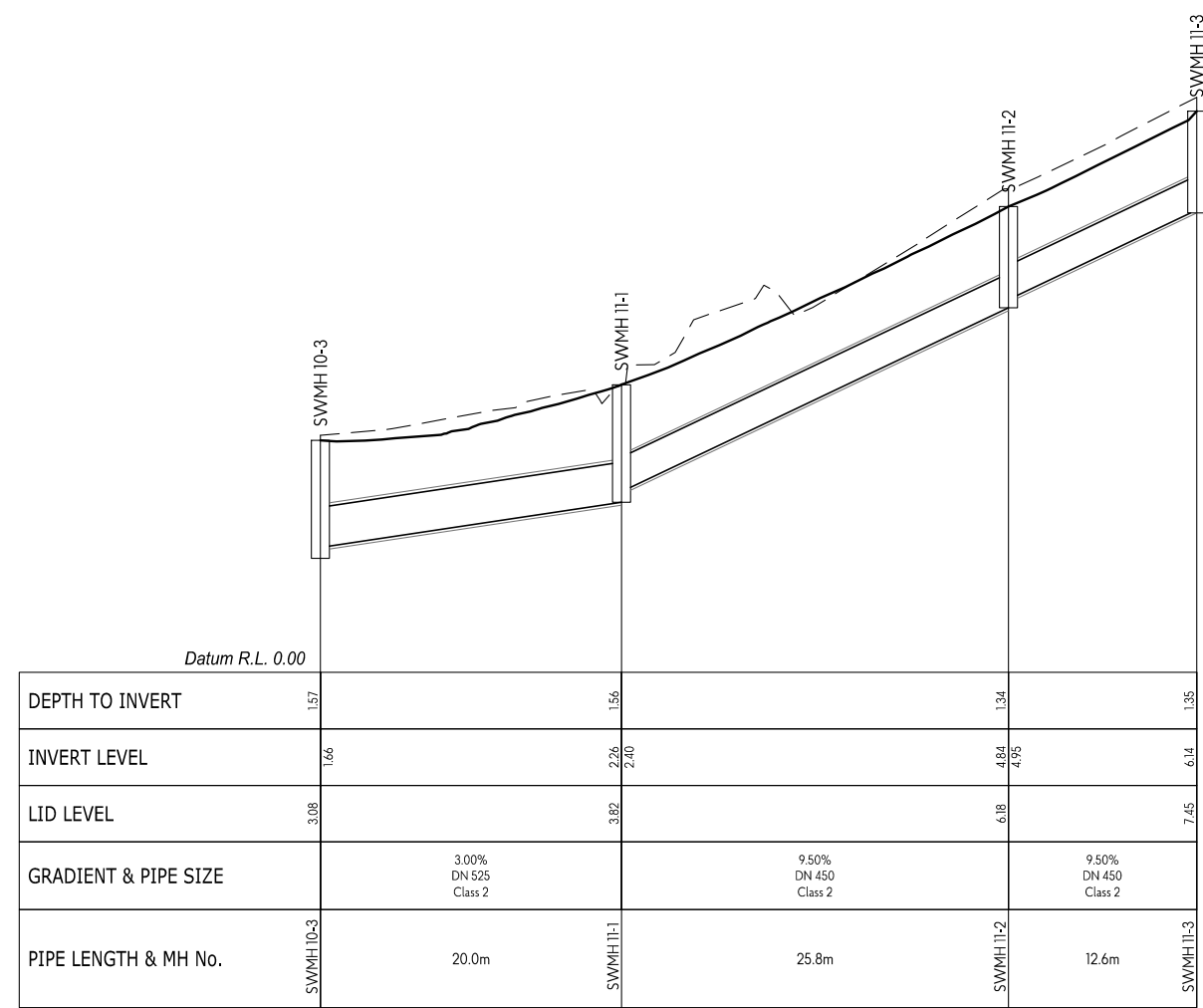
L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250 Horz, 1:50 Vert, A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 423
 REVISION: R1

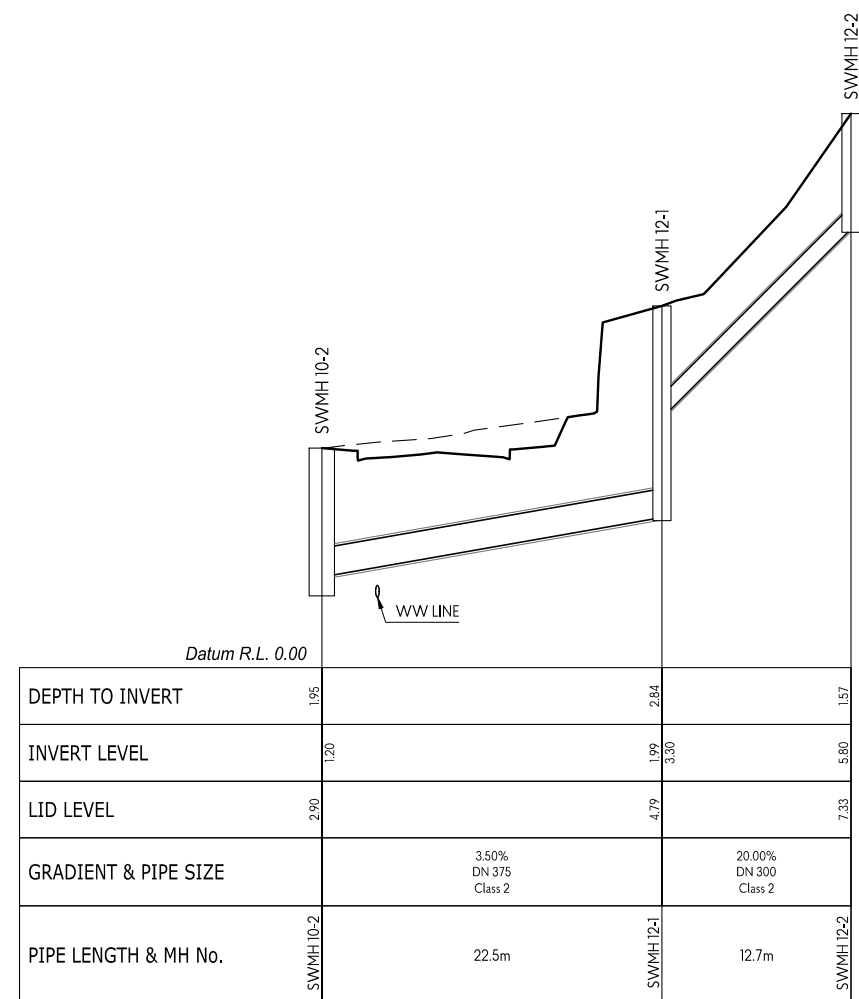
DRAWN: PJ
 DATE: 14-Sep-2016

NOTES:

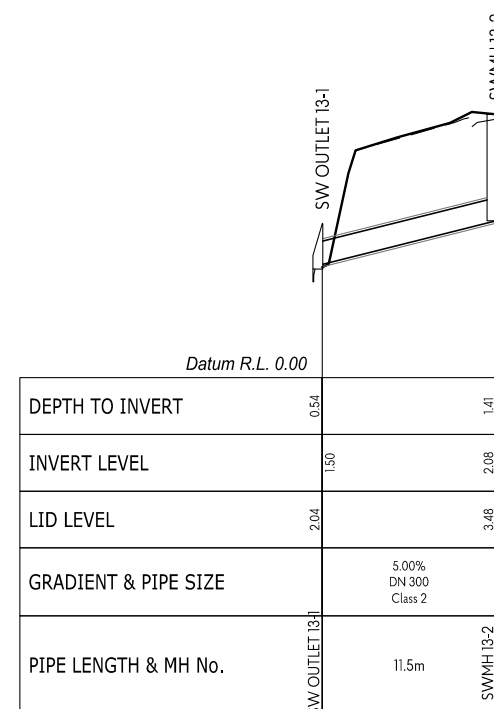
1. ——— INDICATES PROPOSED FINISHED GROUND LEVEL
2. - - - - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
3. LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
4. PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
5. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
6. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
7. ALL STORMWATER PIPE TO BE RCRRJ CLASS 2 UNLESS SHOWN OTHERWISE.
8. ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
9. CONTRACTOR TO CHECK ALL INVERTS AGAINST PIPE CLASHES BEFORE LAYING. ADJUSTMENT OF ANY INVERT LEVELS IS AT THE CONTRACTORS OWN RISK DUE TO TIGHT TOLERANCES.
10. PIPE LENGTH SHOWN IS THE LENGTH OF PIPE BETWEEN CENTRE OF MANHOLES.
11. HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.



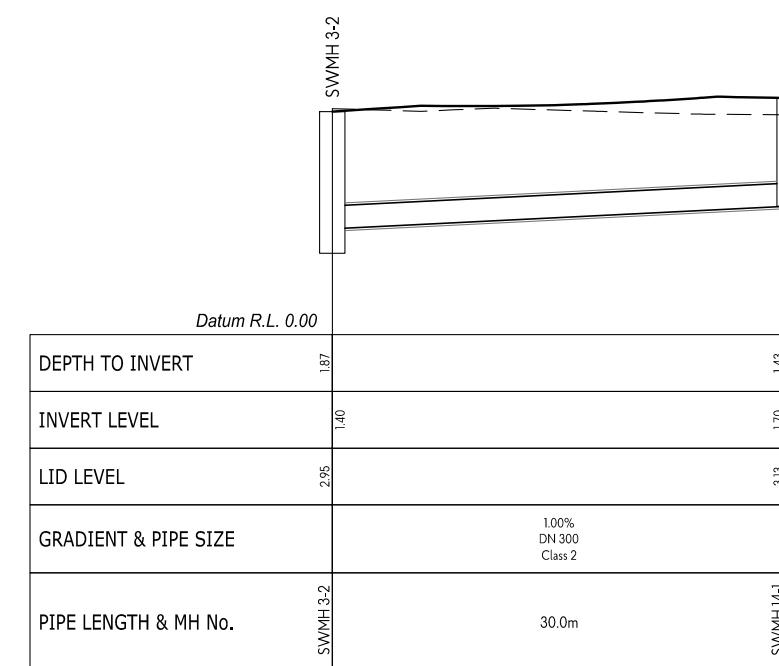
SW LINE 11



SW LINE 12



SW LINE 13



SW LINE 14

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| REVISIONS: | | | |
|------------|------------------------|----|------------|
| REV | NOTES | BY | DATE |
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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| | | | |
| | | | |

PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
STORMWATER LONGSECTIONS
SHEET 5 OF 5

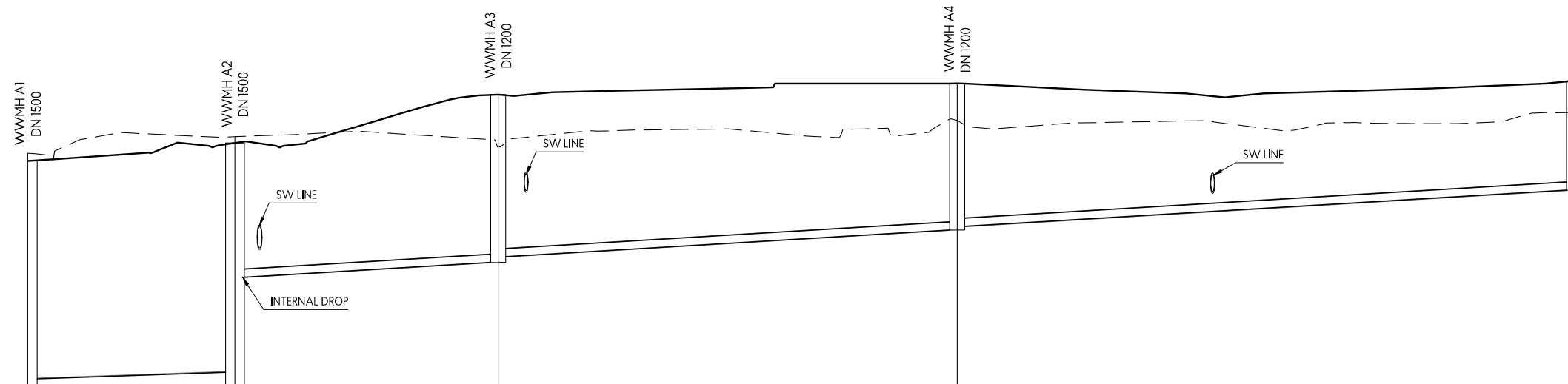
ENVELOPE
LAND STRUCTURE MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250 Horz, 1:50 Vert, A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 424
 REVISION: R1

NOTES:

1. ——— INDICATES PROPOSED FINISHED GROUND LEVEL
2. - - - - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
3. LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
4. PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
5. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
6. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
7. ALL WASTEWATER PIPE TO BE 160 OD PE100 (HPPE SDR 17.6) UNLESS SHOWN OTHERWISE.
8. ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
9. CONTRACTOR TO CHECK ALL INVERTS AGAINST PIPE CLASHES BEFORE LAYING. ADJUSTMENT OF ANY INVERT LEVELS IS AT THE CONTRACTORS OWN RISK DUE TO TIGHT TOLERANCES.
10. PIPE LENGTH SHOWN IS THE LENGTH OF PIPE BETWEEN CENTRE OF MANHOLES.
11. HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.



| | WWMH A1 | WWMH A2 | WWMH A3 | WWMH A4 | WWMH A5 |
|----------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| DEPTH TO INVERT | 4.13 | 4.33 | 3.00 | 2.62 | 1.96 |
| INVERT LEVEL | -1.85 | -1.72 0.19 | 0.47 0.56 | 1.05 1.10 | 1.76 |
| LID LEVEL | 2.28 | 2.60 | 3.46 | 3.66 | 3.71 |
| GRADIENT & PIPE SIZE | 0.70% 250 OD PE100 SDR 17 | 1.20% 160 OD PE100 SDR 17 | 1.20% 160 OD PE100 SDR 17 | 1.20% 160 OD PE100 SDR 17 | 1.20% 160 OD PE100 SDR 17 |
| PIPE LENGTH & MH No. | 18.5m | 23.5m | 41.0m | 55.0m | |

WW LINE A

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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
WASTEWATER LONGSECTIONS
SHEET 1 OF 5

ENVELOPE

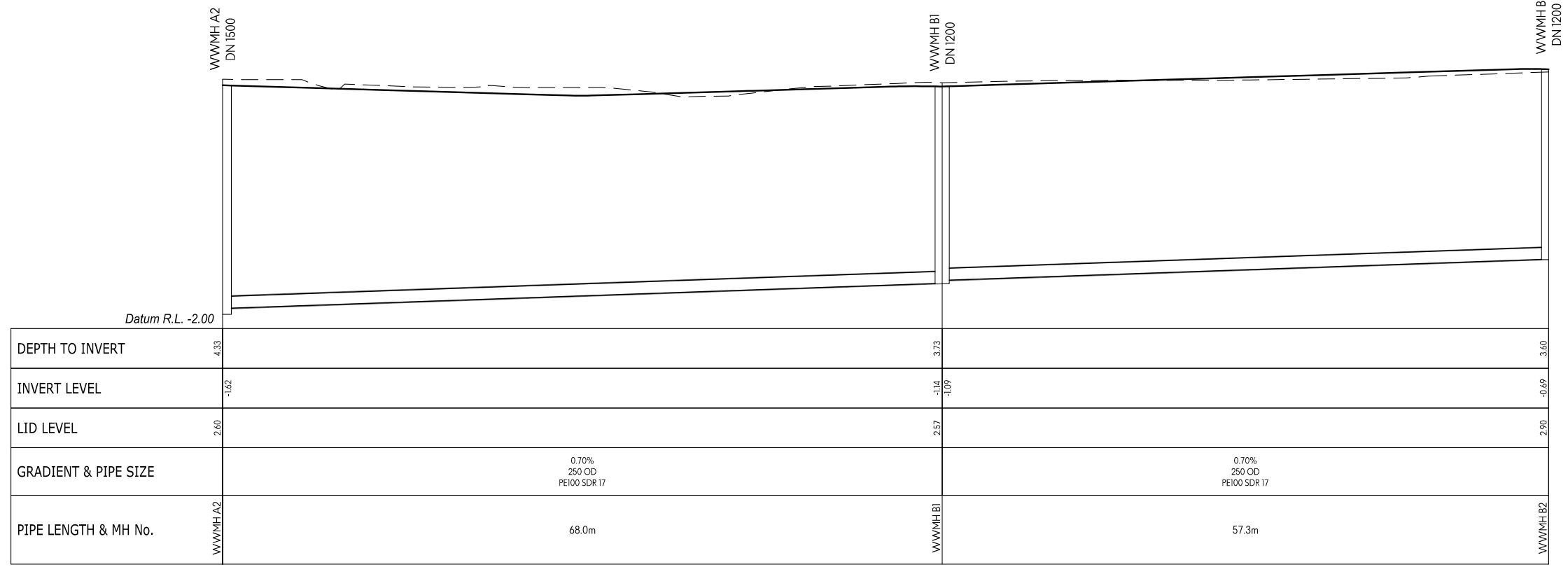
**LAND
STRUCTURE
MANAGE**

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

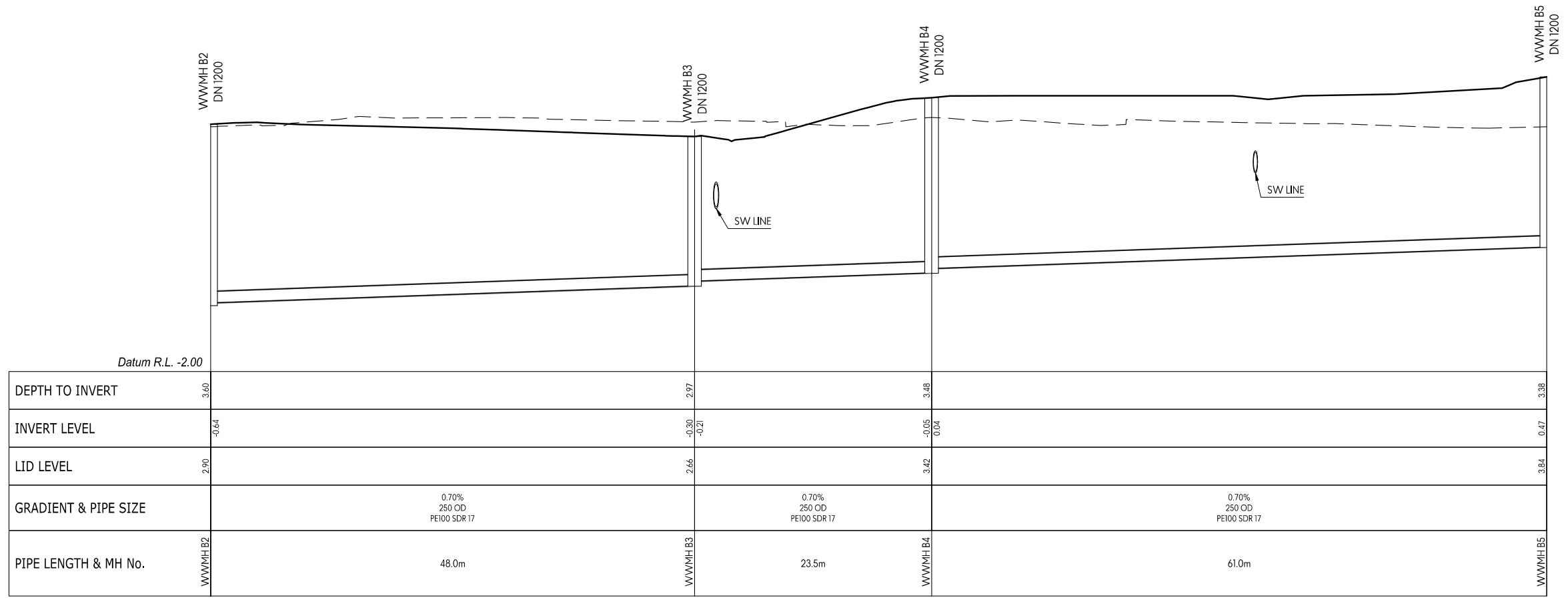
DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016
 SCALE: A1 - 1:250 Horz, 1:50 Vert. A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: DRAWING No: REVISION:
1098-01 430 R1

NOTES:

1. ——— INDICATES PROPOSED FINISHED GROUND LEVEL
2. - - - - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
3. LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
4. PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
5. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
6. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
7. ALL WASTEWATER PIPE TO BE 160 OD PE100 (HPPE SDR 17.6) UNLESS SHOWN OTHERWISE.
8. ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
9. CONTRACTOR TO CHECK ALL INVERTS AGAINST PIPE CLASHES BEFORE LAYING. ADJUSTMENT OF ANY INVERT LEVELS IS AT THE CONTRACTORS OWN RISK DUE TO TIGHT TOLERANCES.
10. PIPE LENGTH SHOWN IS THE LENGTH OF PIPE BETWEEN CENTRE OF MANHOLES.
11. HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.



WW LINE B



WW LINE B

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REVISIONS:

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| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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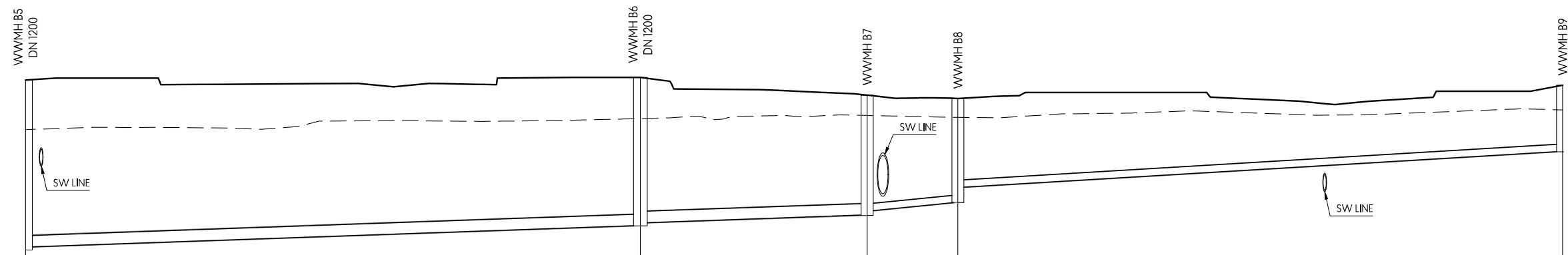
PROJECT:
THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

TITLE:
WASTEWATER LONGSECTIONS
 SHEET 2 OF 5

ENVELOPE
LAND STRUCTURE MANAGE

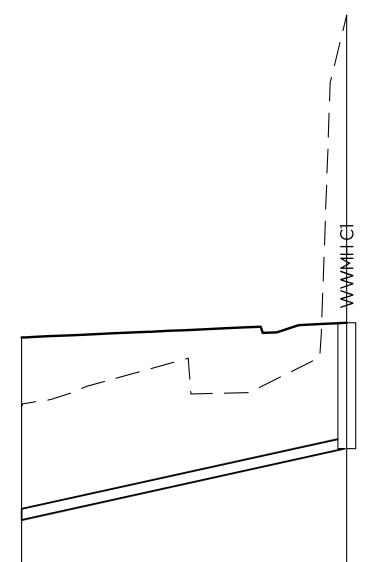
L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016
 SCALE: A1 - 1:250 Horz, 1:50 Vert. A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: DRAWING No: REVISION:
1098-01 431 R1



| Datum R.L. 0.00 | |
|----------------------|---------------------------------|
| DEPTH TO INVERT | 3.38 |
| INVERT LEVEL | 0.52 |
| LID LEVEL | 3.84 |
| GRADIENT & PIPE SIZE | 0.70% 250 OD PE100 SDR 17 |
| PIPE LENGTH & MH No. | WWWMH B5 61.0m |
| | WWWMH B6 |
| | 22.5m |
| | WWWMH B7 |
| | 9.0m |
| | WWWMH B8 |
| | 60.0m |
| | WWWMH B9 |

WW LINE B



| Datum R.L. 0.00 | |
|----------------------|---------------------------------|
| DEPTH TO INVERT | 1.67 |
| INVERT LEVEL | 1.05 |
| LID LEVEL | 3.66 |
| GRADIENT & PIPE SIZE | 4.42% 160 OD PE100 SDR 17 |
| PIPE LENGTH & MH No. | 21.5m WWWMH C1 |

WW LINE C

NOTES:

- INDICATES PROPOSED FINISHED GROUND LEVEL
- INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
- LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
- PIPE SIZES, INVERTS & GRADES AND MANHOLE DEPTHS ARE PRELIMINARY DESIGN AND WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.
- LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05.
- ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
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- ALL MANHOLES TO BE DN 1050 UNLESS SHOWN OTHERWISE.
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- HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.

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| REVISIONS: | | | |
|------------|------------------------|----|------------|
| REV | NOTES | BY | DATE |
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
WASTEWATER LONGSECTIONS
SHEET 3 OF 5

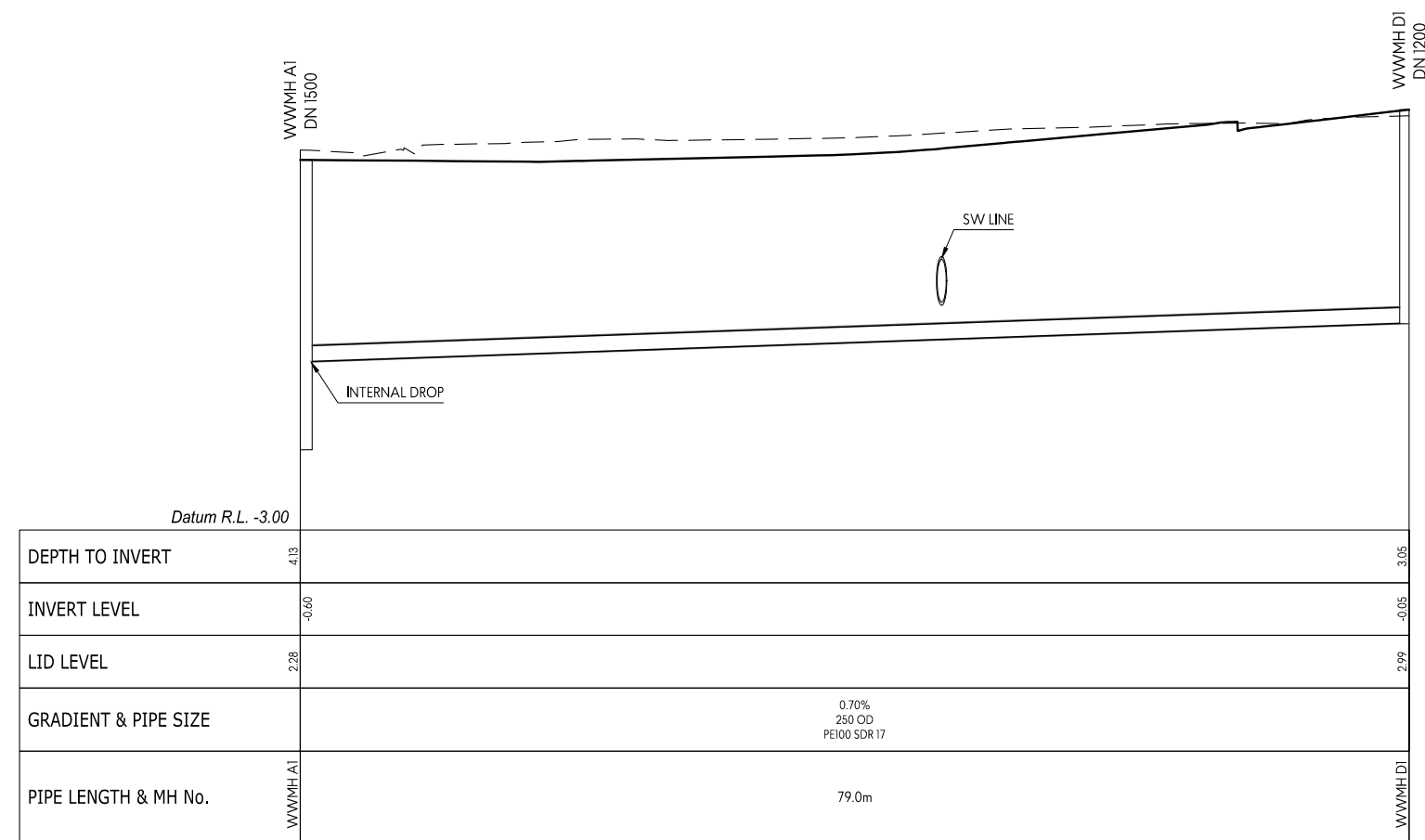
ENVELOPE
LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

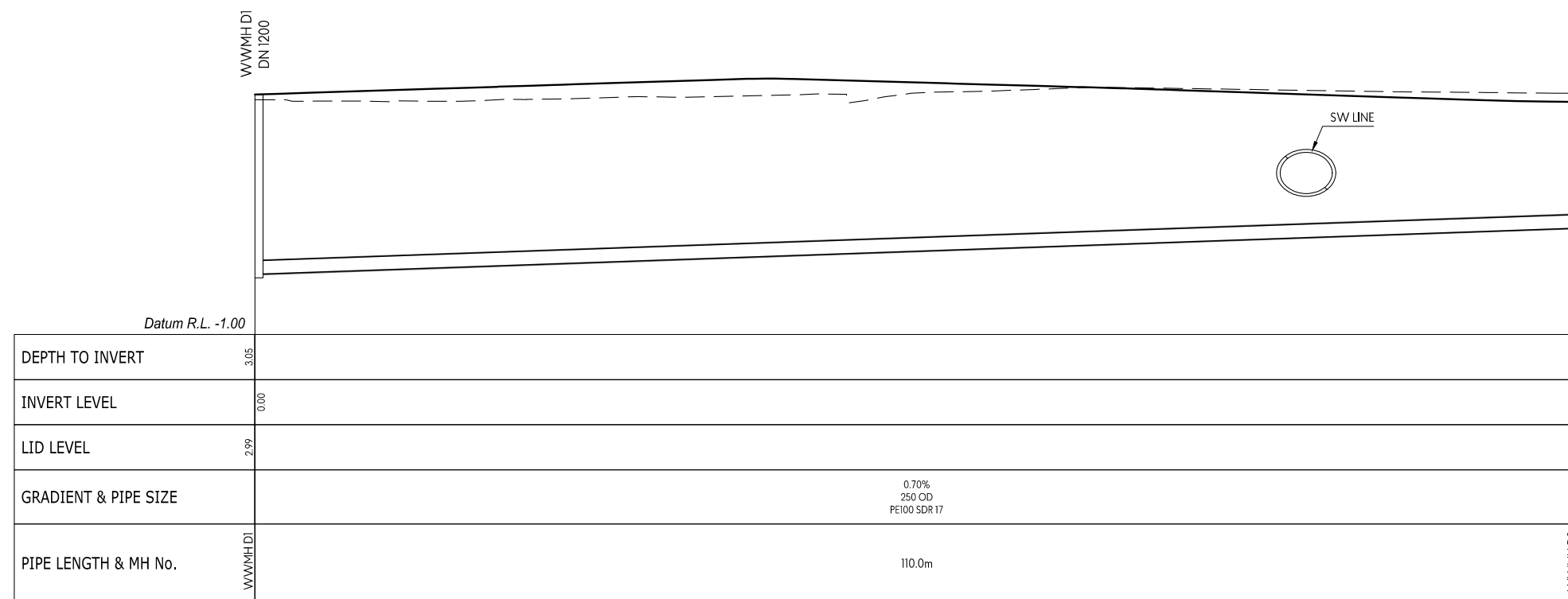
DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250 Horz, 1:50 Vert, A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 432
 REVISION: R1

NOTES:

1. ——— INDICATES PROPOSED FINISHED GROUND LEVEL
2. - - - - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
3. LONG-SECTIONS ARE SHOWN WITH A 5x VERTICAL EXAGGERATION.
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11. HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND 1m EITHER SIDE OF PIPE CROSSOVERS.



WW LINE D



WW LINE D

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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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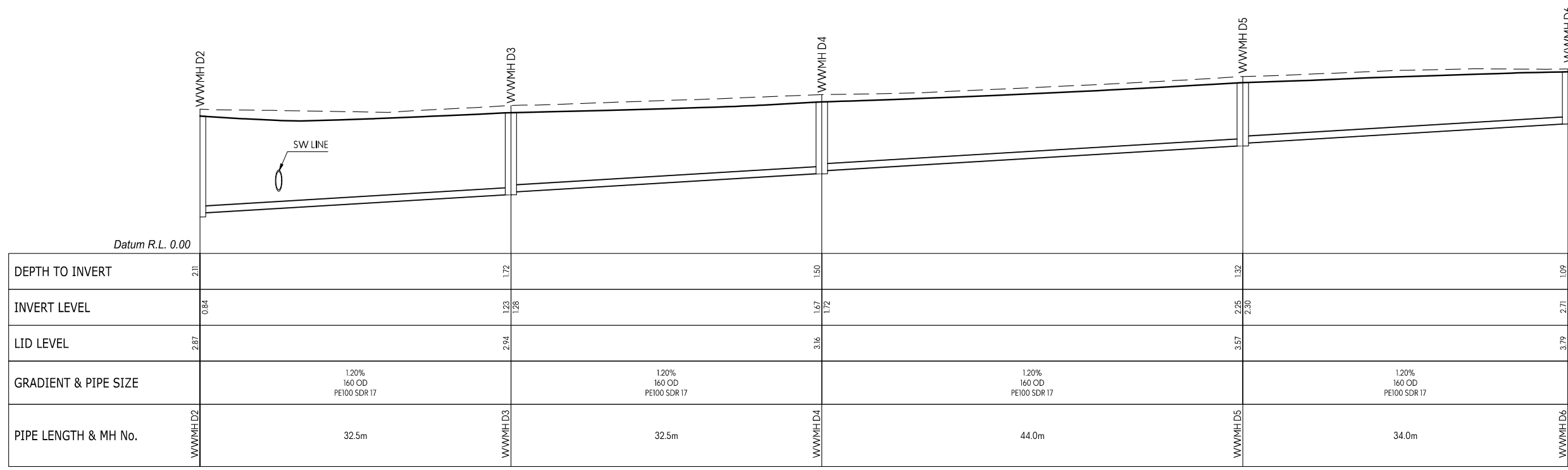
PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
WASTEWATER LONGSECTIONS
SHEET 4 OF 5

ENVELOPE
LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016
 SCALE: A1 - 1:250 Horz, 1:50 Vert. A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: DRAWING No: REVISION:
1098-01 433 R1



WW LINE D

NOTES:

- — — — — INDICATES PROPOSED FINISHED GROUND LEVEL
- - - - - INDICATES EXISTING GROUND LEVEL (PRE EARTHWORKS)
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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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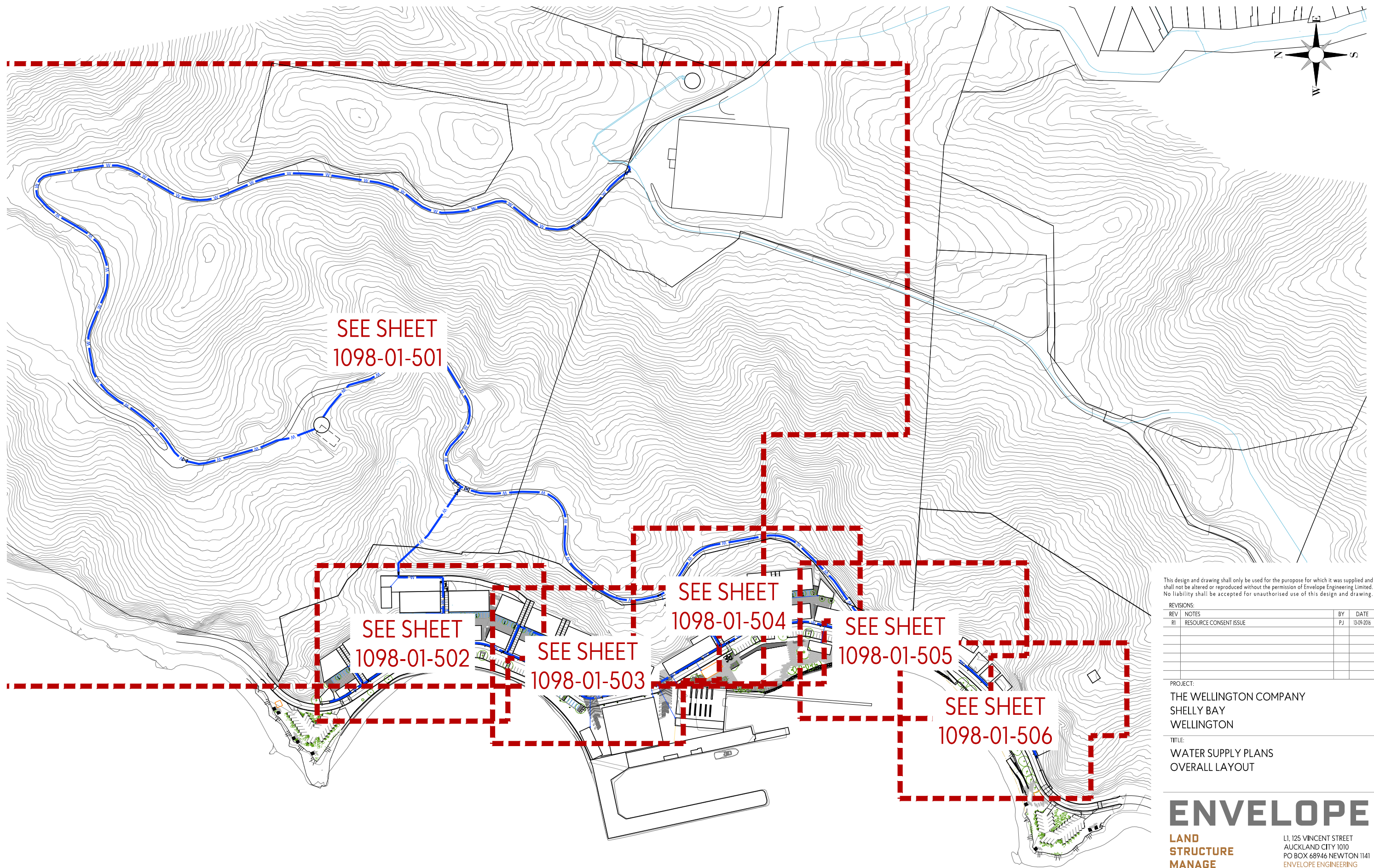
PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
WASTEWATER LONGSECTIONS
SHEET 5 OF 5

ENVELOPE
LAND STRUCTURE MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016
 SCALE: A1 - 1:250 Horz, 1:50 Vert. A3 - 1:500 Horz, 1:100 Vert
 STATUS: RESOURCE CONSENT
 PROJECT No: DRAWING No: REVISION:
1098-01 434 R1



SEE SHEET
1098-01-501

SEE SHEET
1098-01-502

SEE SHEET
1098-01-503

SEE SHEET
1098-01-504

SEE SHEET
1098-01-505

SEE SHEET
1098-01-506

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| REVISIONS: | | | |
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| REV | NOTES | BY | DATE |
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

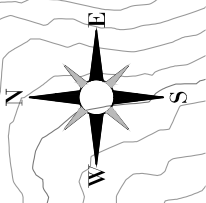
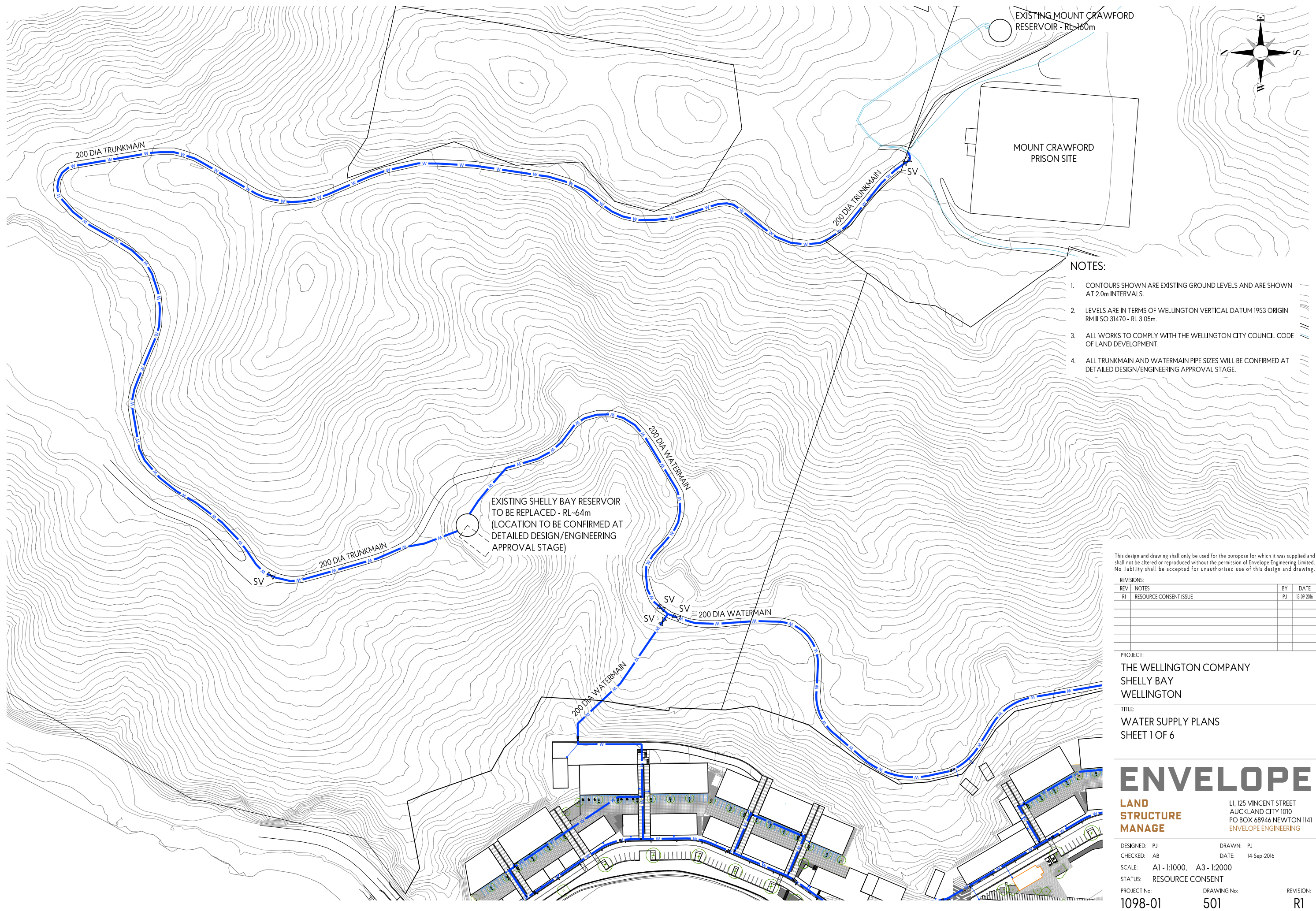
TITLE:
WATER SUPPLY PLANS
OVERALL LAYOUT

ENVELOPE

LAND
STRUCTURE
MANAGE

L1, 125 VINCENT STREET
AUCKLAND CITY 1010
PO BOX 68946 NEWTON 1141
ENVELOPE ENGINEERING

DESIGNED: PJ DRAWN: PJ
 CHECKED: AB DATE: 14-Sep-2016
 SCALE: A1 - 1:1500, A3 - 1:3000
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01 DRAWING No: 500 REVISION: R1



NOTES:

1. CONTOURS SHOWN ARE EXISTING GROUND LEVELS AND ARE SHOWN AT 2.0m INTERVALS.
2. LEVELS ARE IN TERMS OF WELLINGTON VERTICAL DATUM 1953 ORIGIN RM II SO 31470 - RL 3.05m.
3. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
4. ALL TRUNKMAIN AND WATERMAIN PIPE SIZES WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.

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REVISIONS:

| REV | NOTES | BY | DATE |
|-----|------------------------|----|------------|
| R1 | RESOURCE CONSENT ISSUE | PJ | 13-09-2016 |
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

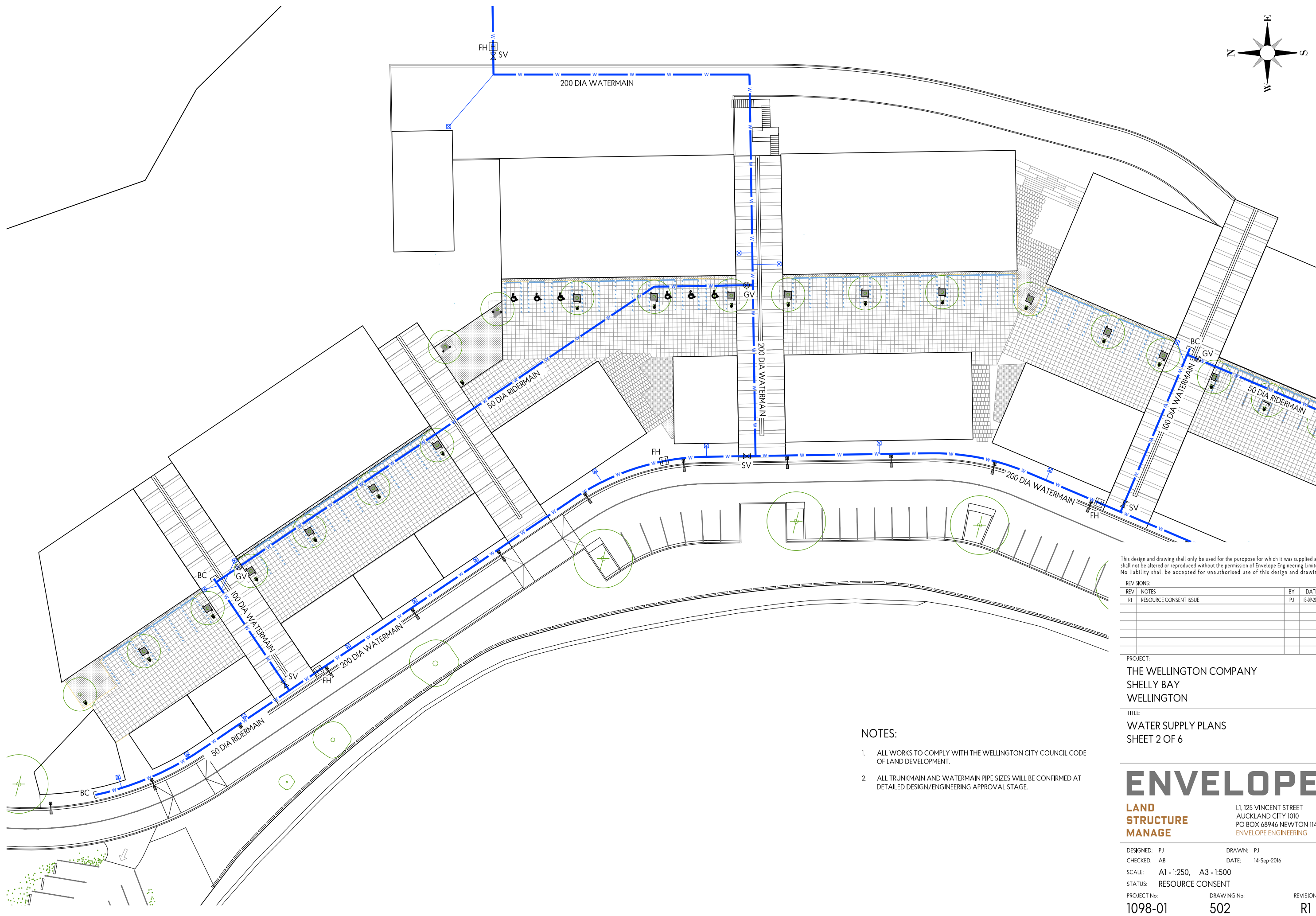
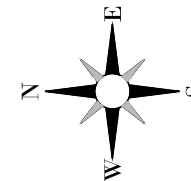
TITLE:
WATER SUPPLY PLANS
SHEET 1 OF 6

ENVELOPE

**LAND
STRUCTURE
MANAGE**

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:1000, A3 - 1:2000
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWN: PJ
 DATE: 14-Sep-2016
 DRAWING No: 501
 REVISION: R1



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PROJECT:
 THE WELLINGTON COMPANY
 SHELLY BAY
 WELLINGTON

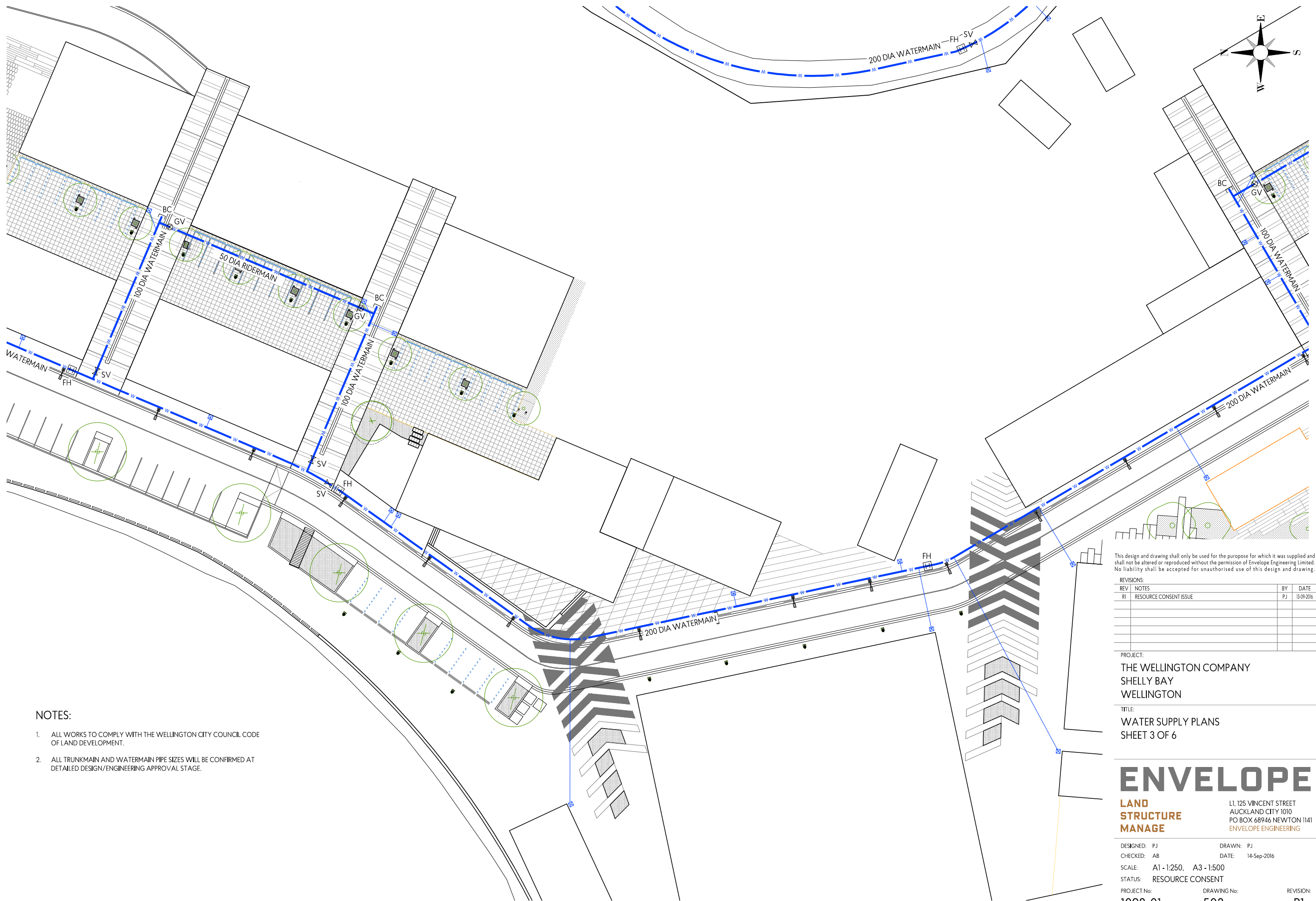
TITLE:
 WATER SUPPLY PLANS
 SHEET 2 OF 6

- NOTES:
1. ALL WORKS TO COMPLY WITH THE WELLINGTON CITY COUNCIL CODE OF LAND DEVELOPMENT.
 2. ALL TRUNKMAIN AND WATERMAIN PIPE SIZES WILL BE CONFIRMED AT DETAILED DESIGN/ENGINEERING APPROVAL STAGE.

ENVELOPE
 LAND
 STRUCTURE
 MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWN: PJ
 DATE: 14-Sep-2016
 DRAWING No: 502
 REVISION: R1



- NOTES:**
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PROJECT:
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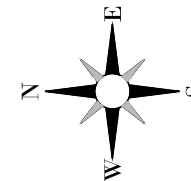
TITLE:
WATER SUPPLY PLANS
 SHEET 3 OF 6

ENVELOPE
 LAND
 STRUCTURE
 MANAGE

L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 503
 REVISION: R1

DRAWN: PJ
 DATE: 14-Sep-2016



NOTES:

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PROJECT:
THE WELLINGTON COMPANY
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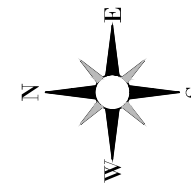
TITLE:
WATER SUPPLY PLANS
 SHEET 4 OF 6

ENVELOPE
 LAND
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L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
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 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01

DRAWN: PJ
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 DRAWING No: 504
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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
WATER SUPPLY PLANS
SHEET 5 OF 6

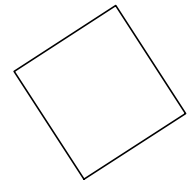
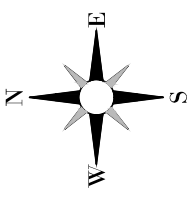
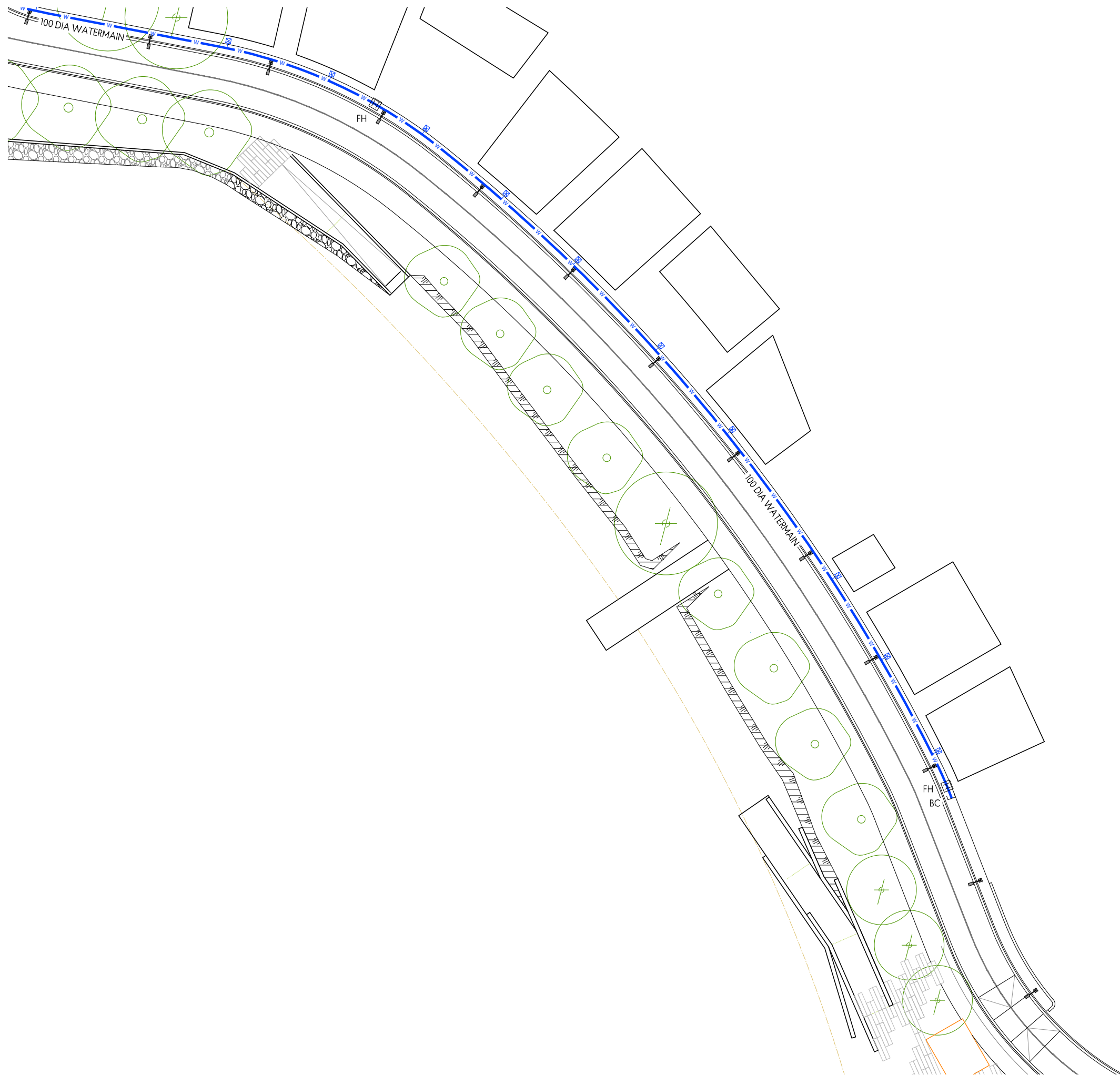
ENVELOPE
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L1, 125 VINCENT STREET
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DESIGNED: PJ
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 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01

DRAWN: PJ
 DATE: 14-Sep-2016
 DRAWING No: 505

REVISION: R1



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PROJECT:
THE WELLINGTON COMPANY
SHELLY BAY
WELLINGTON

TITLE:
WATER SUPPLY PLANS
SHEET 6 OF 6

ENVELOPE
LAND
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L1, 125 VINCENT STREET
 AUCKLAND CITY 1010
 PO BOX 68946 NEWTON 1141
 ENVELOPE ENGINEERING

DESIGNED: PJ
 CHECKED: AB
 SCALE: A1 - 1:250, A3 - 1:500
 STATUS: RESOURCE CONSENT
 PROJECT No: 1098-01
 DRAWING No: 506
 REVISION: R1

DRAWN: PJ
 DATE: 14-Sep-2016