Before the New Plymouth District Council

Independent Hearing Commissioners

PPC18/00048

Under	the Resource Management Act 1991 (**RMA**)
In the matter of	an application by Oākura Farm Park Limited to vary or cancel Condition 4 of Consent Notice Instrument No. 9696907.4 on Lot 29 DP 497629
And	
In the matter of	Proposed Private Plan Change 48 to the New Plymouth District Plan requested by Oākura Farm Park Limited for the proposed rezoning of land at Wairau Road, Oākura

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Statement of Evidence of Matthew Douglas Peacock

(Land Development & Subdivision Infrastructure Engineering)

on behalf of:

Matthew Peacock; Richard Shearer; Steven Looney; and Wayne Looker
25 June 2019

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1 INTRODUCTION

1.1 My name is Matthew Douglas Peacock

1.2 I am a consultant civil and structural engineer. This evidence is filed in support of my original submission and in the support of Messrs' Richard Shearer, Steven Looney and Wayne Looker and those submitter's supporting us (**Submitters**). This evidence covers land development and subdivision infrastructure engineering issues in relation to these matters.

2 QUALIFICATIONS AND EXPERIENCE

2.1 My professional qualifications are BE Civil from Canterbury University and a chartered member of Engineering New Zealand CMEngNZ.

2.2 I have worked as a civil and structural engineer in New Zealand for 15 years and for 12 years as a self-employed engineer for Set Engineering, where I'm the owner and director.

2.3 I have been involved with land development and infrastructure engineering for the past 15 years in the Taranaki Region, and gained the necessary experience required to provide the engineering for residential and commercial land development.

2.4 Recent land development projects I have been involved with for example include:

2.4.1 Fernbrook development, New Plymouth. 2011 – Present, 108 lots;

2.4.2 Pembroke Road development, Stratford. 2018 – Present, 33 lots;

2.4.3 Wills Road Development, Bell Block. 2011 – 2014, 47 lots;

2.4.4 Junction Street development New Plymouth. 2017 – 2018, 9 lots;

2.4.5 Cyrus Street development, New Plymouth. 2013 – 2018, 58 lots;

2.4.6 Armstrong Avenue development, Waitara. 2014 – 2019, 71 lots.

3 EXPERT WITNESS CODE OF CONDUCT

3.1 I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2014.

3.2 I have complied with the Code of Conduct in preparing my evidence and will continue to comply with it while giving oral evidence before the New Plymouth District Council (**Council**) independent hearing commissioners.

3.3 I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where I state I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from my expressed opinions.

4 ABBREVIATIONS

4.1 AFSE – Andrew Fraser Statement of Evidence

WES – Wairau Estate Subdivision proposal

PPC48 – Private Plan Change 48 Submitted by Oākura Farm Park Ltd

OFP – Oākura Farm Park Limited

NPDC – New Plymouth District Council

5 SCOPE OF EVIDENCE

5.1 My statement of evidence addresses the engineering matters which relate to the following key topics and issues:

5.2 Stormwater

5.2.1 I have undertaken a review of the OFP PPC48 application specifically the Red Jacket Feasibility report for stormwater on the Proposed Subdivision of Lot 29 DP 497629 Wairau Road Oākura, the statement of Evidence of Andrew Fraser on behalf of OFP and the stormwater management of the Wairau Stream and Wairau Stream Tributary which flow through Shearer Reserve in Oākura.

5.3 Potable Water and Firefighting water supply

5.3.1 I have undertaken a review of the OFP PPC48 application specifically the Red Jacket Feasibility report for drinking water and firefighting water supply on the Proposed Subdivision of Lot 29 DP 497629 Wairau Road Oākura, the statement of Evidence of Andrew Fraser on behalf of OFP, the drinking water and firefighting water supply network to the Oākura village and the NPDC Three Waters Technical Commentary summary for the PPC48 application.

5.4 Oākura Land Development Feasibility

5.4.1 I have undertaken a review of the OFP PPC48 application and the Oākura West FUD area land development potential to assess the general level of feasibility between the land areas to the south and north of state Highway 45 (SH45).

6 SUMMARY OF PPC48 APPLICATION AND OĀKURA VILLAGE

6.1 PPC48 and the ultimate proposed residential subdivision will potentially add 395 residential lots to the south western area of Oākura. This would increase the current number of lots in Oākura from approximately 660 to 1055 or 60% increase in lot number.

6.2 Stormwater catchment on the western side of Wairau Road includes the Kaitake Ranges National Park, developed residential land between Wairau Road and the Wairau Stream Tributary (including the Paddocks Subdivision), the land of PPC48, the western FUD area as indicated in the Oākura Structure Plan August 2006 map and the lower Wairau Stream area around Shearer Reserve.

6.3 Future Urban Development (FUD) land is identified in both the NPDC district plan and the Oākura Structure Plan August 2006. These areas have been ear marked for possible residential land development in a typical desk top assessment capacity. No entirely inclusive detailed design has been completed for the FUD areas and the existing Oākura area which would address the potential negative effects of stormwater flow, water supply and the difficulties involved with developing FUD land.

6.4 Oākura drinking water and firefighting water is supplied from a reservoir located at the top of Wairau Road close to the Kaitake Ranges in the National Park. The reservoir is filled from an underground bore located in the vicinity of the National Park. This is the only treated water supply to Oākura.

7 GENERAL LAND DEVELOPMENT ENGINEERING REPORTING

7.1 Red Jacket PPC48 application report page 18 reads '*it should be noted that this is a preliminary feasibility study and further assessment and engineering design will be required, as is usual practice in land development, throughout the development process.'*

7.2 The Red Jacket report acknowledges it is a preliminary feasibility study, and that detailed design has not been completed for the PPC48 or proposed land development. This engineering approach is typical of general Resource Consent applications for smaller land development projects in my experience.

8 STORMWATER

8.1 Our review of the PPC48 application stormwater feasibility study, AFSE report and general Oākura stormwater management is as follows:

8.2 The calculation in the AFSE report (Appendix III) for the proposed culvert to the Wairau stream tributary, under the WES entry road off Wairau Road, has been completed using a storm intensity ARI of 10 (1 in 10 year storm). Taranaki Regional Council (TRC) recommends that an ARI of 100 (1 in 100 year storm) should be completed for road culverts, because culverts are a primary stormwater system where no secondary flow path is available. Changing the ARI from 10 to 100 will increase the calculated stream design flow by approximately 167%. TRC culvert design recommendations are shown in **Appendix I.**

8.3 The proposed WES development along the western edge of the Wairau Stream Tributary will increase stormwater flow into the stream due to the land change of use from rural to residential. The addition of roads and less permeable ground coverings and surfaces will increase the ground surface runoff coefficients.

8.4 Detention ponds have been recommended by Red Jacket Engineers to capture and control the stormwater from part of the proposed WES development. Excavation within and bunding around the ponds appear to be required due to the natural sloping ground surface around the ponds, and the need to maximise detention pond depth and storage volume. AFSE report indicates that bunding up to 3 meters high above the existing ground surface will be required to the detention ponds.

8.5 Time of concentration (TOC) values, of 30 minutes, used in the PPC48 application stormwater report calculations for the detention Ponds appear too long for the mix of sealed and grassed surfaces within the proposed development. TOC of 10 to 20 minutes would be more appropriate considering detention ponds are located typically within 300 meters of the catchment area. Altering the TOC from 30 minutes to 20 minutes increases the rainfall intensity by approximately 26%.

8.6 AFSE report paragraph 23 indicates detention ponds have been designed for 20% AEP (1 in 5 year storm) for 22.6Ha of developed land area to achieve hydraulic neutrality (ie no change from the current undeveloped land stormwater runoff).

8.7 Detention Ponds are a primary source of stormwater control so no secondary flow path is available, and stormwater design should be completed for a 1% AEP (1 in 100 year storm). The 100 year storm information has been provided by Red Jacket in its PPC48 application report for stormwater, and the total required storage calculation for detention Ponds shows 5021m^3 is required, not the 2880m^3 stated in paragraph 23.

8.8 The increased storage volume and decreased TOC value will increase the required detention ponds size.

8.9 Stormwater design in the Red Jacket PPC48 application report only accounts for 23ha of the proposed 58ha development, see Appendix I. Considering the acknowledged historical flooding issues downstream in Shearer Reserve area, where the council owned waste water pump station is located, the remaining 35ha of stormwater catchment area should be accounted for. If this stormwater is left to flow uncontrolled into catchment streams it may have negative downstream effects, in particular at the Shearer Reserve area.

8.10 NZS4404 standard for Land Development and subdivision infrastructure states in section 4.3.5 that *'for larger catchments or where significant storage elements (such as ponds) are incorporated, surface water run-off should be determined using an appropriate hydrological or hydraulic model'*. A model is defined as a suitable computer analysis program used to analyse the stormwater systems hydraulic behaviour.

8.11 It appears that no hydraulic model has been completed for the PPC48 application stormwater report and according to NZS4404 one would be required, considering the use of ponds and the potential downstream flooding effects created by altering ground surface runoff coefficients.

8.12 The Wairau Stream Tributary along the eastern side of the proposed WES development flows under State Highway 45 in the north western corner of WES. The existing stream culvert under SH45 is reinforced concrete and has an internal diameter of 600mm. The house to the east of the Wairau Stream Tributary culvert, at 100 Wairau Road, has a basement floor level approximately 2.8 m above the top of the culvert pipe. The house basement is located below SH45 road level.

8.13 Inspection of the culvert pipe downstream end, northern side of SH45, showed that in low streamflow conditions two-thirds of the pipe is full of water. The culvert pipe is seated on the stream bed and the stream width is 1200 mm at the culvert exit point. See photos in Appendix I.

8.14 New Plymouth District Council PPC48 S42A planners report section 13.23 and our design analysis indicate the current culvert pipe under SH45 is undersized for the current stormwater flow rates. The culvert currently restricts or throttles the flow of stormwater down Wairau stream Tributary to the north of SH45.

8.15 The existing culvert pipe under SH45 does not meet the road culvert pipe design criteria specified by Taranaki Regional Council (TRC).

8.16 The property at 100 Wairau Road is at risk of flooding because the existing culvert pipe is undersized and unable to carry the existing stream stormwater flow.

8.17 A replacement culvert pipe is required to eliminate the flooding risk to the house at 100 Wairau Road and to adequately carry stormwater flow from the existing Wairau Stream Tributary catchment area, and any proposed additional land development upstream from the culvert, which includes the land of PPC48 application.

8.18 A replacement culvert pipe under SH45 is required to be designed in accordance with TRC standards, as indicated in Appendix I, for 100 year return period storm event by heading up to a maximum of 0.5 m below the adjacent house basement floor level, and water passage of the 10-year return flood without heading up.

8.19 Our preliminary design, in accordance with TRC guidelines, for the replacement culvert pipe under SH45 is a diameter 1500mm pipe on a slope of 1%.

8.20 The preliminary designed replacement culvert pipe under SH45 has a design flow rate of approximately 4.3 m^3/s and a design velocity of approximately 4.4 m/s. Our preliminary design indicates that in high intensity storm events the replacement culvert pipe will increase the stream stormwater flow by 3 – 4 times and stream stormwater velocity by 1.7 times from that of the existing throttled culvert pipe.

8.21 A replacement culvert pipe will increase downstream stormwater water flow volume and velocity which may impact on the current downstream channel stability and flooding in Shearer Reserve area, which has been identified in the AFSE report paragraph 20 and NPDC District plan.

8.22 Further detailed design analysis of the Wairau Stream tributary increased flow volume and velocity is required to ensure no negative effects are attributed to replacing the SH45 culvert.

8.23 The Oākura wastewater pump station is located within Shearer Reserve approximately 210 meters from Oākura beach high tide mark. Shearer Reserve is contained by the Wairau Stream which flows along its western boundary. Residential dwellings are located next to the eastern side of Wairau Stream.

8.24 It has been acknowledged by NPDC and in the AFSE report that the Wairau Stream through Shearer Reserve is prone to flooding in large storm events.

8.25 Surveyors have provided a survey level of the pump station floor level which is 7.70m in Taranaki 1970 datum. Taranaki datum is set above the mean sea level (MSL) which is 0.00m in Taranaki.

8.26 We have read the MWH report regarding Shearer Reserve Pump Station Flood Level Estimation dated 27 July 2007 (see Appendix I) and have taken this information to be factually correct. The MWH report covers the potential of the wastewater pump station being flooded by a 1 in 100 year storm event and is addressed to the New Plymouth District Council. The report does not indicate why the flooding potential was assessed, but we assume it was to determine the level of risk against the council owned pump station.

8.27 The MWH report concludes that the estimated flood ponding level adjacent to the pump station is 7.8m. We assume this is relative to the Taranaki 1970 Datum because the report also indicates the pump station finished floor level is 7.8m, which is close to our measured floor level of 7.7m.

8.28 We have assumed that the design calculations in the MWH report applied the 2007 rainfall intensity data provided by NPDC, which would be similar to the NPDC 2008 code of practice (COP) values. Recently NPDC discontinued using their rainfall data from the 2008 engineering COP and now adopt the more accurate NIWA – HIRD system to determine rainfall intensity.

8.29 Stormwater calculations are now required to use the NIWA – HIRDs data and account for future climate scenarios (relative concentration pathways or

RCP). A comparison of the 2008 NPDC COP rainfall intensity data and 2019 NIWA – HIRD data are shown in table 1 below for a 1 in 100 year storm for a duration of 1 hour. HIRD data shown in Appendix I.

	Rainfall intensity mm/hr
2008 NPDC (COP)	46.4
2019 HIRD RCP2.6	65.8

Table 1

8.30 **Table 1** above shows that the rainfall intensity data used in the 2007 MWH report is now 140% higher in today's current climate conditions.

8.31 The HIRD RCP2.6 data also shows that for the more frequent 1 in 20 year storm event, the rainfall intensity is 48.7mm/hr for a 1 hour storm duration. This is equivalent to the 2008 NPDC (COP) intensity of 46.4mm/hr for the 1 in 100 year storm event.

8.32 Our conclusion is that the wastewater pump station appears to be prone to flooding in a 1 in 20 year storm event based on the HWM calculations in the 2007 report, and using current rainfall intensity data from NIWA – HIRD system.

9 WATER SUPPLY

9.1 Our review of the PPC48 application water supply feasibility study, general Oākura water supply management and the NPDC Three Waters Technical Commentary is as follows:

9.2 Paragraph 46 of the AFSE report acknowledged that the Oākura Water Supply has areas of low pressure which do not provide the required firefighting supply for Council's FW 3 requirements.

9.3 The Three Waters Technical Commentary summary on page 8 concludes; *'We believe this plan change will increase the rate of growth in this town and result in infrastructure improvements being needed faster than currently budgeted for.'*

9.4 Paragraph 52 and the accompanying table of AFSE report indicate that the water supply numbers are additional residential lots in Oākura. This is incorrect as these numbers are actually the total number of residential households in Oākura, not the additional number of residential lots.

9.5 The NPDC PPC48 S42A planners report indicates that there are 660 existing lots in Oākura, of which not all lots currently contain a residential dwelling.

9.6 Fire water supply is required to meet the requirements of NSZ 4509 – K1 Water supply classifications – K1. 2 *General procedure for establishing classifications for water supply reticulations. The capacity of existing water supplies to store and deliver water for firefighting can be measured by undertaking comprehensive flow testing or estimated through computer modelling. Water supply authorities should undertake this work in partnership with the Fire Service. If necessary the WSA can establish water classification zones after consultation with the Fire Service, so that the minimum storage and flow requirements in the zones are clearly defined.*

9.7 The proposed WES is ultimately a large green field urban intensive development that has the potential to increase the existing number of residential lots in Oākura by 60%.

9.8 The only way to clearly establish firefighting capacity is to complete comprehensive flow testing of the entire Oākura water network, and combine this with computer modelling of the proposed 395 lot residential plan change development and the existing Oākura network.

9.9 Without providing this comprehensive analysis, and calculating the possible outcomes, any conclusions reached on the current Oākura piped water supply system capacity are merely opinions based on assumptions and a small amount of flow data provided by NPDC.

9.10 To the best of my knowledge the existing Oākura water supply consists of two bores; OAB-100 (also known as 'WTP-M' or the 'Wairau Bore') and OAB-200 ('WTP-IL') feeding a 2,500m^3 reservoir . It was discovered recently that bore OAB-200 is damaged; the casing has leaking welds, the screen is deformed, and biological growth has been detected. With the bore in its current condition, it is not 'secure' and therefore cannot be used to supply potable water to Oākura. The other bore, OAB-100, is being used currently to meet the demand for potable water (i.e. currently there is no redundancy in the water supply).

9.11 The current water reservoir capacity to the Oākura Township is 2,500m^3 with a daily water demand average of 743m^3 and a peak recorded demand of 1,497m^3. Should the only remaining bore fail the reservoir has sufficient capacity of between 1.7 – 3.4 days before running out.

10 OĀKURA LAND DEVELOPMENT FEASIBILITY

10.1 The Oākura Township is naturally bound along its eastern edge by the Oākura River, the northern boundary by the Tasman Sea, most of its western boundary by the Wairau Stream and Wairau Stream tributary and its southern boundary by the National Park.

10.2 The eastern and western natural boundary features of Oākura provide a containment of residential development due to the added expense of traversing these water features.

10.3 Access from any point along upper and lower Wairau Road across the Wairau Stream tributary is a significant undertaking involving earthworks, culverts and the formation of a 20 meter wide road corridor, just to traverse the stream and reach the development area. See photos **Appendix II**.

10.4 Any residential land development west of the Wairau Stream tributary will require a stormwater management system, which will involve significant earthworks, to adequately control the increased stormwater flow created by converting land from rural to residential. Such earthworks have been incorporated into the WES development plan with the use of detention ponds but these will come at a significant expense to the developer and the environment.

11 CONCLUSIONS

11.1 PPC48 has the potential to increase the number of residential lots in Oākura by 60%. This is a significant change within a relatively small community and when compared to other residential developments in the New Plymouth region it dwarfs them with respect to population percentage increase.

11.2 Proposed WES development PPC48 application contains a report by Red Jacket Engineers titled *'Feasibility Report on the proposed subdivision of lot 29 DP 497629 Wairau Road Oākura'.*

11.3 The report covers assessments of geotechnical, building platforms, water supply, stormwater, wastewater and roading; all of which have been assessed only for feasibility purposes.

11.4 The Red Jacket PPC48 report clearly states '*it should be noted that this is a preliminary feasibility study and further assessment and engineering design will be required, as is usual practice in land development, throughout the development process'.*

11.5 In my experience disclaimers like this are typical for small scale residential land development proposals where the impact on the surrounding landscape and population are relatively minor, and the preliminary investigations that are carried out are suitable for a Resource Consent application.

11.6 The existing stormwater network in areas through Oākura is not suitable to carry the current rainwater flow down to the sea during high intensity storm events and ponding occurs in various locations in Oākura.

11.7 The council owned wastewater pump station located in Shearer Reserve is within a flood zone. Stormwater has the potential to inundate the pump station in storm events of shorter return periods than originally considered. The flood return period for the pump station could be as low as 1 in 20 years.

11.8 The current water supply from the Wairau bore has no redundancy due to only one bore servicing the Oākura village. At present the water supply is unreliable and should problems arise with the single remaining bore Oākura would only have a water supply for between 1.7 – 3.4 days.

11.9 Increasing water supply demand on the Oākura bore, which has questionable supply reliability, is likely to increase the risk of further bore failures and its adequacy to supply water to Oākura.

11.10 Any land development in Oākura which is required to cross the Wairau Stream Tributary, control stormwater runoff and provide the necessary infrastructure will be a significant and costly undertaking. A significant amount of money will be invested in just getting from Wairau Road across the stream to the development area.

11.11 The land topography to the west of the Wairau Stream Tributary, to the north and south of SH45, is all relatively similar grass covered farm grazing land which is sloping and contains gullies and ridges. Soil conditions are also relatively similar to areas west of the Wairau Stream Tributary, to the north and south of SH45.

11.12 Due to the large scale residential land development proposal of PPC48 I consider a more rigorous detailed design based assessment for the engineering aspects of the project is required, to adequately understand the potential adverse effects on the environment, before any decision can be made on the PPC48 application.

11.13 Taking into account the size of the proposed development and the New Zealand standards NZS4404 and SNZ 4509 requirements I would expect detailed computer modelling combined with robust site testing and analysis to be completed for the current Oākura village area linked with the proposed PPC48 development, for:

11.13.1 Stormwater flows combined with ocean tidal effects, and

11.13.2 Potable water and firefighting water supply.

Matthew Douglas Peacock
25 June 2019

APPENDIX I STORMWATER

Date	17/03/2017	Job No.	2351
By	K Jansen	Page No.	
Doc No.	CAL-2351-01		

STORMWATER CALCULATION - 10% AEP

WAIRAU ESTATE - OAKURA

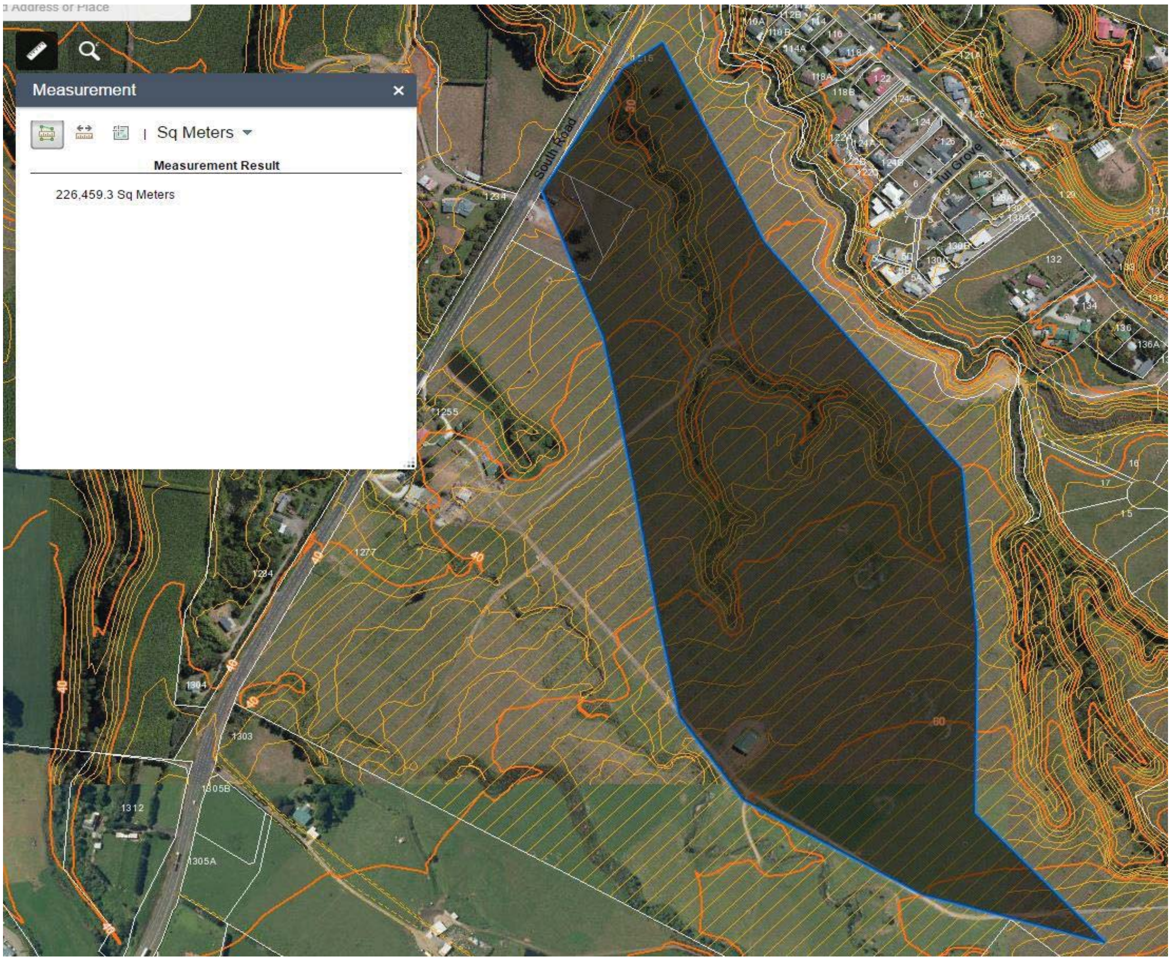
General Stream Characteristics

Stream Name: Un-named Tributary of Wairau

Catchment Area (A): 22.6 Ha

Runoff Coefficient: 0.45

Catchment Map



Source: TRC GIS Database

Document Set ID: 7649662
Version: 6, Version Date: 21/03/2018

Photo 1. Inlet end of the existing 600mm diameter culvert pipe for the Wairau Stream Tributary flowing under SH45. Low flow situation.

Photo 1. Outlet end of the existing 600mm diameter culvert pipe for the Wairau Stream Tributary flowing under SH45. Low flow situation.

Photo 3. Looking east over to the existing house at 100 Wairau Road.

Matt Peacock

Subject: FW: [BJSL 8714] Still consent application 10500

From: Daniel Harrison [mailto:Daniel.Harrison@trc.govt.nz]
Sent: Tuesday, 24 October 2017 4:13 p.m.
To: Colin Jackson <colin.jackson@bjsl.co.nz>
Cc: Anna Johnston <Anna.Johnston@trc.govt.nz>
Subject: Still consent application 10500

Hi Colin,

The hydrological analysis undertaken by Set Engineering to determine the culvert size required includes inputs that are either inaccurate or inappropriate.

1. The NPDC design charts used to derive rainfall are considered by TRC to be outdated and inaccurate. Rainfall derived from the NIWA Hirds v3 website includes all relevant up to date records including NPDC data, and would be an acceptable alternative. It should be noted that rainfall tables generated by the Hirds website should be adjusted by 2 degrees C, in accordance with MfE guidelines.
2. The table used to ascertain culvert size is appropriate for sizing piped systems, but is not appropriate for sizing culverts.
3. Culvert and bridge design standards acceptable to TRC are outlined in the BOPRC Hydrological and Hydraulic Guidelines (Guideline 2012/02). The appropriate standard for the subject culvert is the passage of the 100-year return period flood by heading up to a maximum 0.5m below road and adjacent house floor levels; and passage of the 10-year flood without heading up.

Please provide a revised hydrological analysis. Please also provide a revised culvert design that takes into account the revised hydrological analysis and the guidelines referred to above.

Kind regards,

Daniel Harrison
Rivers Manager

Taranaki Regional Council
47 Cloten Road | Private Bag 713 | Stratford 4352, New Zealand
P 06 765 7127 | F 06 765 5097 | www.trc.govt.nz
Working with people | caring for Taranaki

Appendix 6: Shearer Reserve Pump Station Flood Level Estimation, MWH New Zealand Ltd, 17 July 2007

MWH

26

MWH Ref: Z1554901

27 July 2007

New Plymouth District Council
Private Bag 2025
NEW PLYMOUTH 4342

Attention: **Michael Tarboton**
Senior Engineer

Dear Michael

Shearer Reserve Pump Station Flood Level Estimation

As requested we have checked the estimated flood level of the Wairau Stream adjacent to the proposed pump station in Shearer Reserve in a 1 in 100 year flood event.

The maximum ponding level shown on the SWMP plans indicates a maximum flood level during a 1% flood at the Tasman Parade Culvert of 5.60m. However, this does not correlate with the commentary in the SWMP which states that during the 1% flood, water would over top Tasman Parade (but not flood the Surf Club). Survey data from the long section drawings (WK-00259) states that the level of the centerline on Tasman Parade is 6.1m, i.e. higher than 5.60m. Therefore the flood ponding level quoted in the SWMP is unreliable.

The SWMP ponding level (5.60m) was also shown on the pre-tender issue drawings for the pump station (WK-00250) implying that this is the height of the flood water at the pump station location. This is unlikely as the pump station location is 150 m upstream (along channel centerline) of the Tasman Parade Culvert and the bed level of the stream (from contour levels) at this point is 5.0m. We therefore concluded that this is unlikely to be the true flood level at the pump station location.

Methodology

Our methodology included:

1. Determine the flood depth at the culvert restrictions at Tasman Parade. This was determined by calculating the discharge over the road and its corresponding depth.
2. Using an iterative process, determine the flow depth at the pump station. The height of water at Tasman Parade calculated above was used as the downstream height for the hydraulic grade. An initial estimate of flood depth was made at the pump station location (based upon the slope of the channel). This was then used as the upstream level for determining the slope of the hydraulic grade and the channel capacity recalculated. From the recalculated capacity a new flood level was determined which was then used to

LShearerReserveFloodLevels_b

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Delivering Innovative Projects and Solutions Worldwide recalculated the hydraulic grade. This process was repeated until the flood depth equaled the upstream height for the hydraulic grade.

3. Manning's Formula was used to determine flow capacity and depth in the open channel
4. The 1% AEP flow used was 51.16 m3/s. This was taken from the Stormwater Management Plan (Table Oak3).
5. A cross-section of the stream adjacent to the location of the pump station (approximately 150m upstream of the culvert under Tasman Parade) was created from the contour information contained on Map-TV. See attached plan showing the location of cross-section and cross-section sketch.
6. A Mannings n value of 0.045 was used to reflect the effect of the trees and other vegetation on the roughness of the channel during high flows.

Results (all heights rounded to nearest 100mm)

The estimated depth of flow over Tasman Parade during a 1% AEP flow is 400mm. This results in a flood ponding level at Tasman Parade of 6.5m.

Using the above height as the downstream hydraulic grade level, the estimated flood ponding level adjacent to the pump station is 7.8m.

Discussion

On the pre-tender issue drawings (refer to attached drawing WK-00259), ground level at the proposed pump station is 7.8m; the finished level for the slab over the pump station wet well is indicated to be flush with ground level, i.e. it is assumed this will have a finished level of 7.8m; and the specified finished level of the slab over the inlet screens is 8.05m.

Therefore based upon the flood levels estimated in this review there is no free board between the flood ponding level and the finished level of parts of the pump station. Given the level of accuracy of some of the inputs into this review (i.e. the cross-section levels where obtained from MapTV contours) this review indicates that it is possible that the pump station will be flooded during a 1% AEP event. If greater certainty is required regarding the flooding levels, a more detailed assessment will be necessary.

Comments

The design flow (51.16m3/s) taken from the SWMP was not checked. The following observations are made about the assessment contained in the SWMP:

- The commentary accompanying the plans mentions 3 culverts under SH45. However aerial photos and topographical maps indicate there is a fourth stream which crosses SH45. A brief site visit confirmed that this stream enters a culvert under SH45.
- The Table in the SWMP summarising the existing system data only refers to the first 600mm diameter culvert under SH45. No mention is made of the other culverts.

If you have any further questions, please contact the undersigned.

Yours faithfully
MWH New Zealand Limited

Mark Hall
Environmental Engineer

Encl.: Plan, Cross-section, Hardcopy Excel Spreadsheet Calculations

Flow Depth to Area Relationship

Flow Depth in Channel determined using Manning's formula 3.91

An iterative process has been used to determine the flow depth at the pump station. Firstly the flow depth at Tasman Parade was calculated. This fixes the downstream height for the hydraulic grade. An initial estimate of flood depth was made (based upon the S of the channel bottom). This was then used as the upstream level for the hydraulic grade. This process was repeated until the flood depth equaled the upstream height for the hydraulic grade.

Hydraulic Grade

S is hydraulic gradient between flood level and water level over Tasman Parade
Downstream water level in 1% AEP flow 6.54
Flood water level at PS site 7.772608
Distance of Channel 150 (centreline of channel distance, worst case as flow spreads out of channel)

Channel Section "D" Adjacent to PS Location

X is distance from centreline of channel.

A Mannings n of 0.045 has been used to allow for the effect of the trees that line the bank (these will be inundated during the 1% flow).

For 1% AEP Storm, Q= **51.16** m3/s (From NPDC SWMP)

RL	Depth Y (m)	X1	X2	A	P	A cum	P Cum	R	S	n	Q (m3/s)	Comments
5	0	1	1									
5.5	0.5	1.8	2.4	1.55	4.43	2	4	0.350	0.0082	0.045	1.55	Re calc grade
6	1	2.7	3.6	2.63	2.33	4	7	0.618	0.0082	0.045	6.11	
6.5	1.5	3.9	4.5	3.68	2.33	8	9	0.864	0.0082	0.045	14.36	
7	2	5.7	6	5.03	3.45	13	13	1.027	0.0082	0.045	26.44	
7.5	2.5	20.6	11	10.83	19.93	24	32	0.730	0.0082	0.045	38.76	
7.8	2.77	26.8	35.1	12.74	30.27	36	63	0.581	0.0082	0.045	**51.17**	X values interpolated
8	3	31.9	55.2	29.68	25.25	66	88	0.751	0.0082	0.045	110.23	
8.5	3.5											

Culvert Capcity Calculations

Flow determined by 3 different methods. Average depth/flow relationship used in subsequent calculations.

Inputs

Cd	0.75
Culvert Inlet invert	3.65
Outlet Invert	3.25
Culvert Area	7.955
wetted perimeter	16
Hydraulic Radius	0.4971875
manning n	0.015
culvert length	40
River Manning	0.04

Conversior 0.0419745

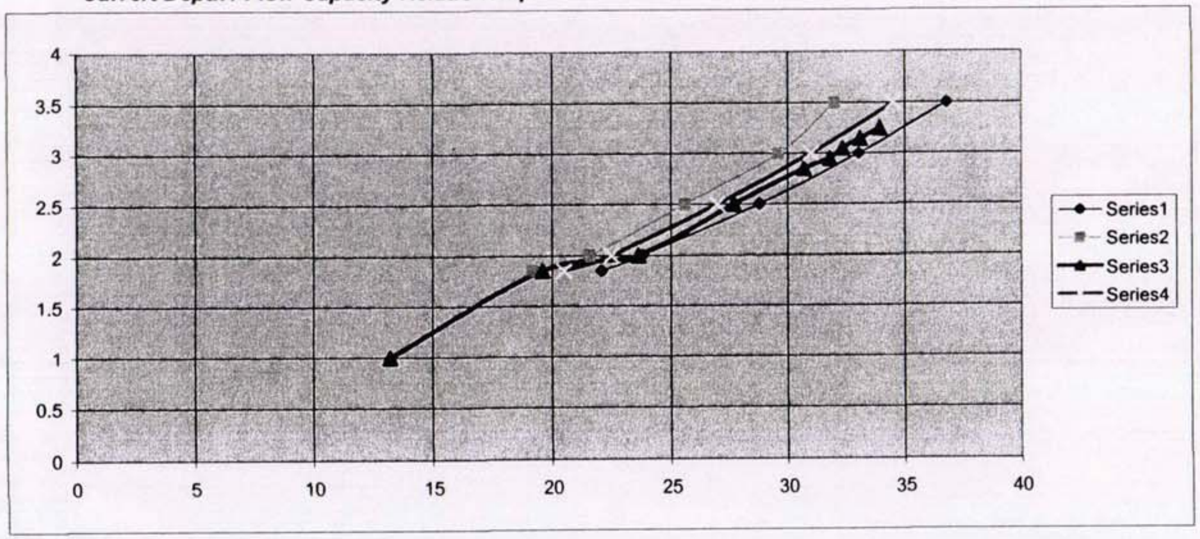
Determine tail water depth. Iterate until discharge approximately equals flow in culvert.

Upstream Depth	Water Level	Tail Water Depth	Series 3 Discharge	Area	Wetted	Radius	Flow in Culvert
1.00	4.7	0.75	13.2	3.225	7.3	0.441781	12.5
1.85	5.5	1.3	19.6	5.6	13.8	0.4	20.4
2.00	5.7	1.2	23.6	5.2	9.1	0.6	23.6
2.50	6.2	1.4	27.7	6.0	9.9	0.6	28.8
2.85	6.5	1.5	30.7	6.5	10.3	0.6	31.5
2.95	6.6	1.5	31.8	6.5	10.3	0.6	31.5
3.05	6.7	1.6	32.4	6.7	10.5	0.6	32.8
3.15	6.8	1.6	33.1	6.8	10.6	0.6	33.6
3.25	6.9	1.6	33.9	6.9	10.7	0.6	34.2

New Plymouth District Council
Shearer Reserve PS Flood Level Calculation

H/d	RL	Depth	Head	Area	Series 1 Discharge		Series 2 From Flow Chart		Series 4 Average Flow Adopted In Calculations
1	5.5	1.85	0.93	7.96	22.09001		19.2		20.5
1.08	5.65	2	1.08	7.96	23.8049		21.6		22.5
1.35	6.15	2.5	1.58	7.96	28.79274		25.6		27
1.62	6.65	3	2.08	7.96	33.0359		29.6		31
1.89	7.15	3.5	2.58	7.96	36.79292		32		34.5

Culvert Depth / Flow Capacity Relationship

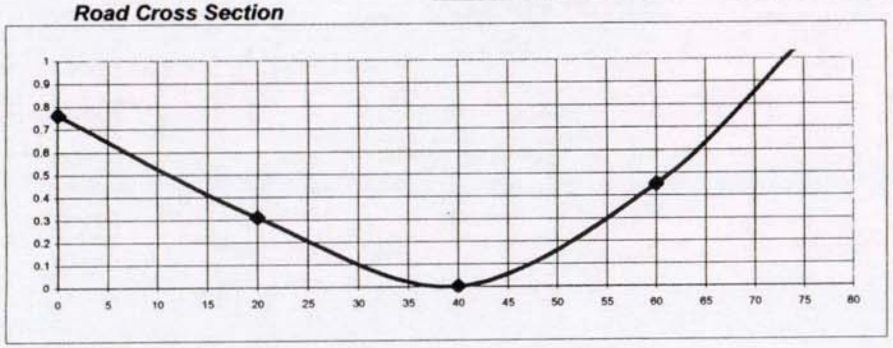


Spillage over Road

Chainage	Depth
0	0.76
20	0.31
40	0
60	0.45
75	1.08

Depth	Level	Length	Discharge (weir formula)	
0.1	6.2	17	1	1.1082
0.2	6.3	26	4	3.5649
0.3	6.4	35	9	8.9282
0.4	6.5	43	17	17.1981
0.5	6.6	50	28	28.3746
0.6	6.7	56	42	42.4577
0.7	6.8	64	60	59.4474

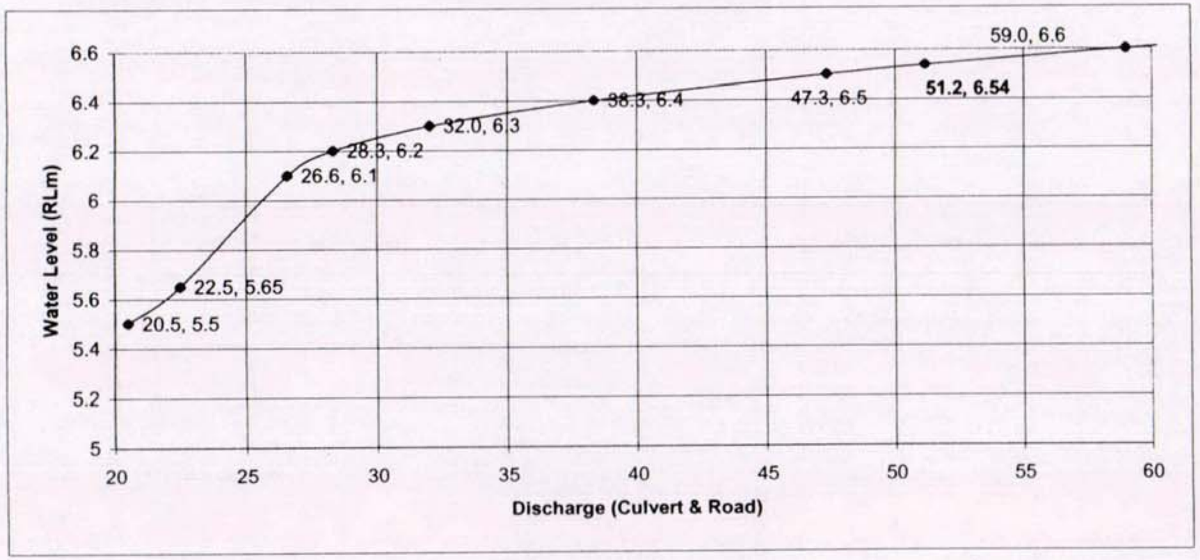
Road Cross Section



Depth/Flow Formula
y = 145.33x2 - 19.032x + 1.5581

Height - Discharge Relationship Flow in Culvert and Over Road

		Discharge m3/s		
RL	Depth	Culvert	Road	Total
5.5	1.85	20.5		20.5
5.65	2	22.5		22.5
6.1	2.45	26.6	0	26.6
6.2	2.55	27.4	1	28.3
6.3	2.65	28.3	4	32.0
6.4	2.75	29.1	9	38.3
6.5	2.85	29.9	17	47.3
6.54	**2.89**	30.2	21	**51.2**
6.6	2.95	30.7	28	59.0
6.7	3.05	31.4	42	73.1



y = 6E-06x3 - 0.0011x2 + 0.0704x + 4.9323

51.16 6.458304245

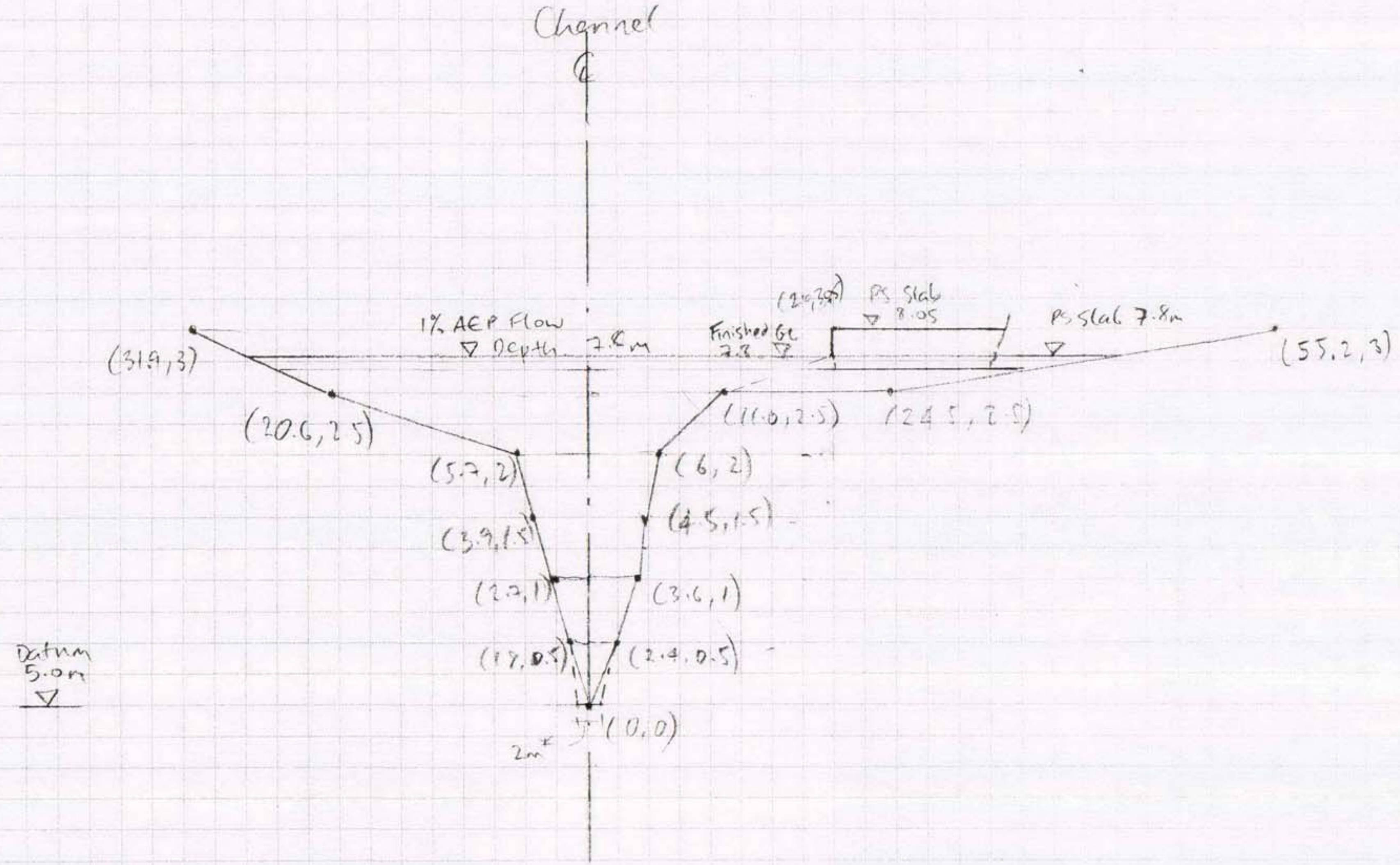
PROJECT ____ PROJECT No. ____

DESCRIPTION Section D (@ P.S.)

COMPUTED/PREPARED BY ____ DATE ____ 20 ____

REVIEWED/CHECKED BY ____ DATE ____ 20 ____

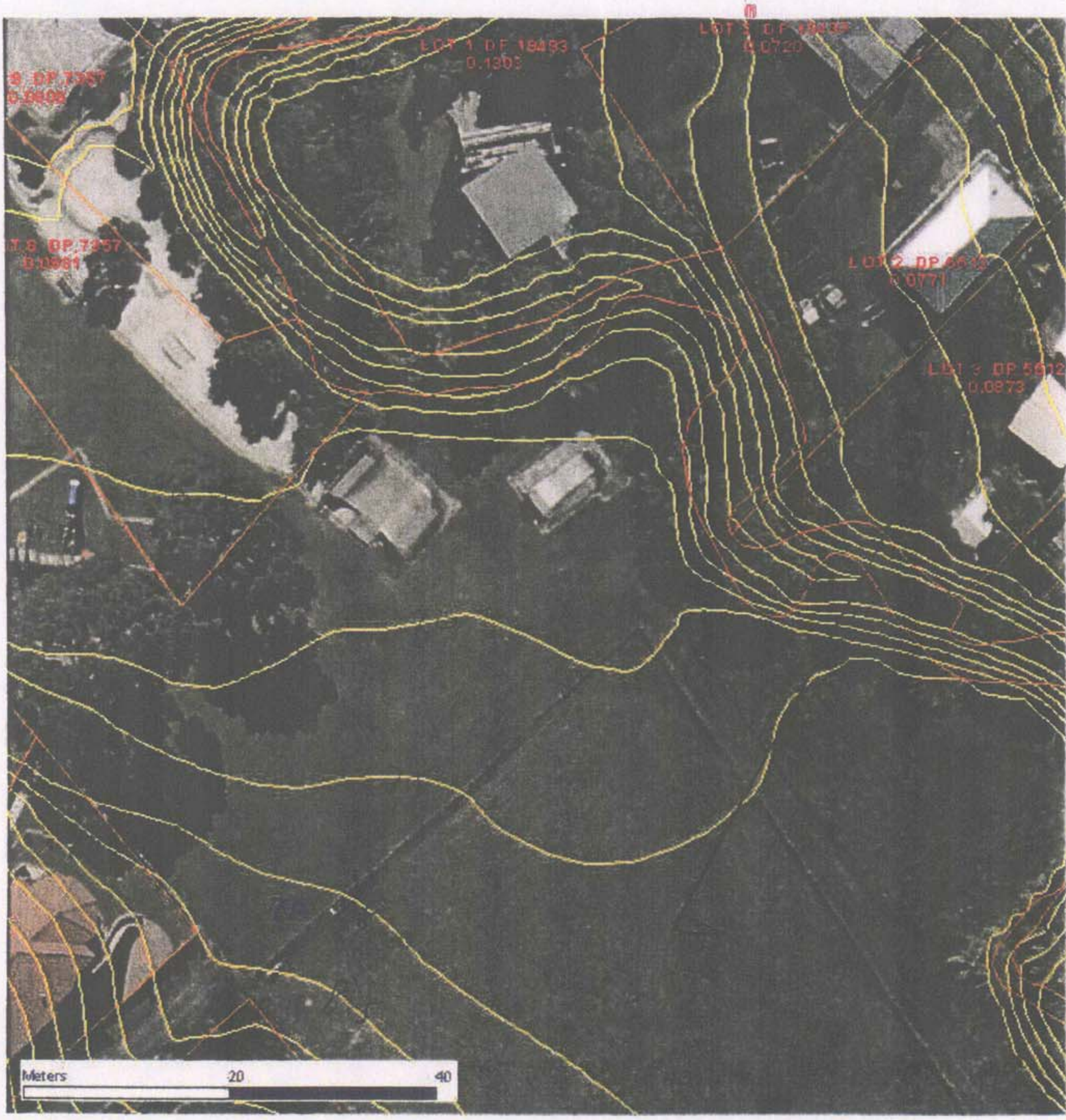
REF/DWGS ____ SHEET ____ OF ____



* Stream bed is flat + stoney + approximately 2m wide at this point

Scale Hor 1:500
Vert 1:50

MWH

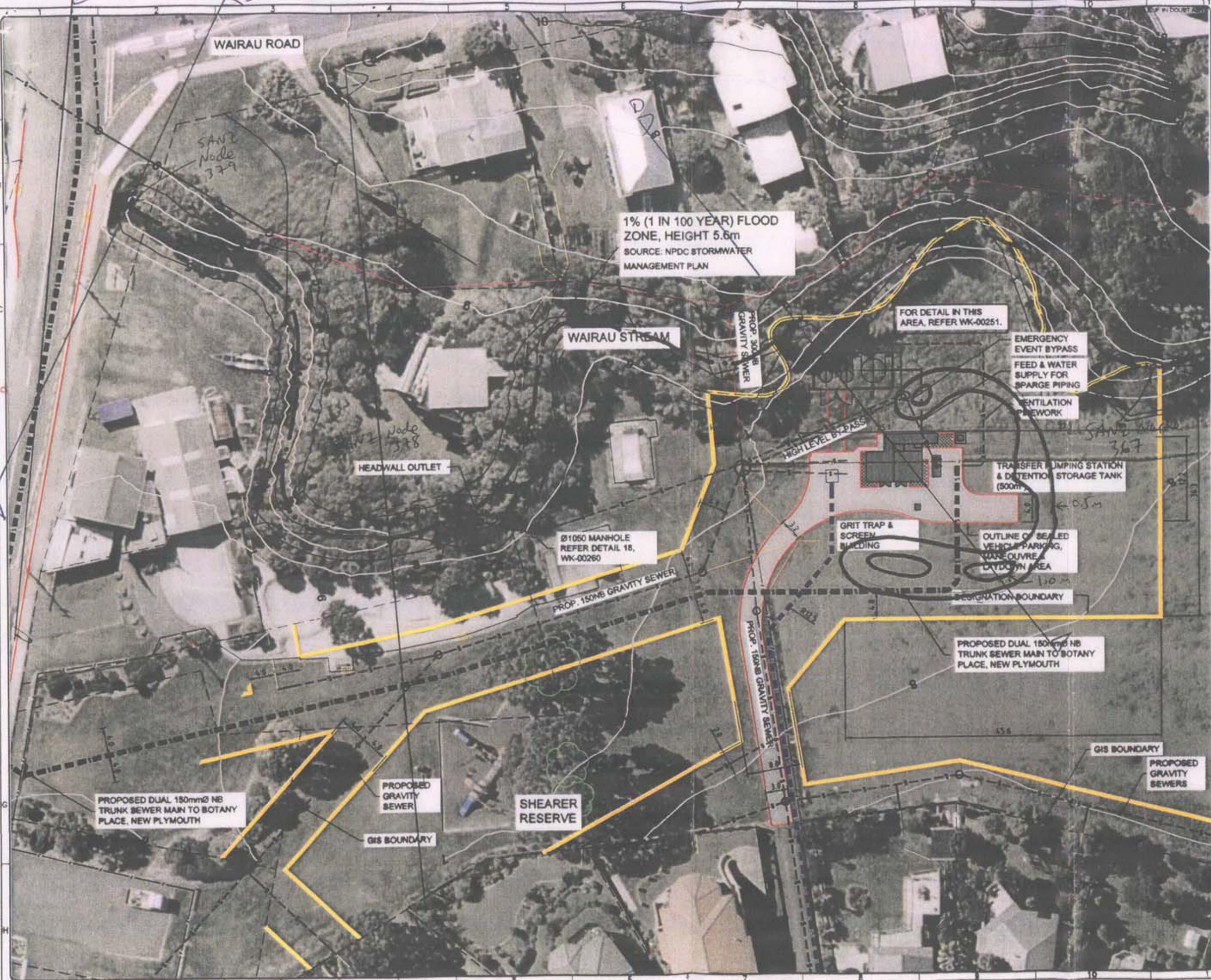


D.

Scale
67mm = 40m
~~km~~ 1:597
Datum = 5m.

RL	Y	X_1	X_2
5m	0	0 0	0 0
5.5	0.5	3.0 1.8	4 2.4
6.0m	1.0	4.5 2.7	6 3.6
6.5	1.5	6.5 3.9	7.5 4.5
7.0m	2.0	9.5 5.7	10 6.0
7.5	2.5	34.5 20.6	18.5 → 41.0 11.0 → 24.5
8.0m	3.0	53.5 31.9	92.5 55.2
8.5	3.5		

i.e flat @ 7.5m



NOTES
1. FOR LEGEND AND GENERAL NOTES PERTAINING TO THIS DRAWING, REFER WK-00251.

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

Modified by M Hall
10 July 07

—·—℄ Stream

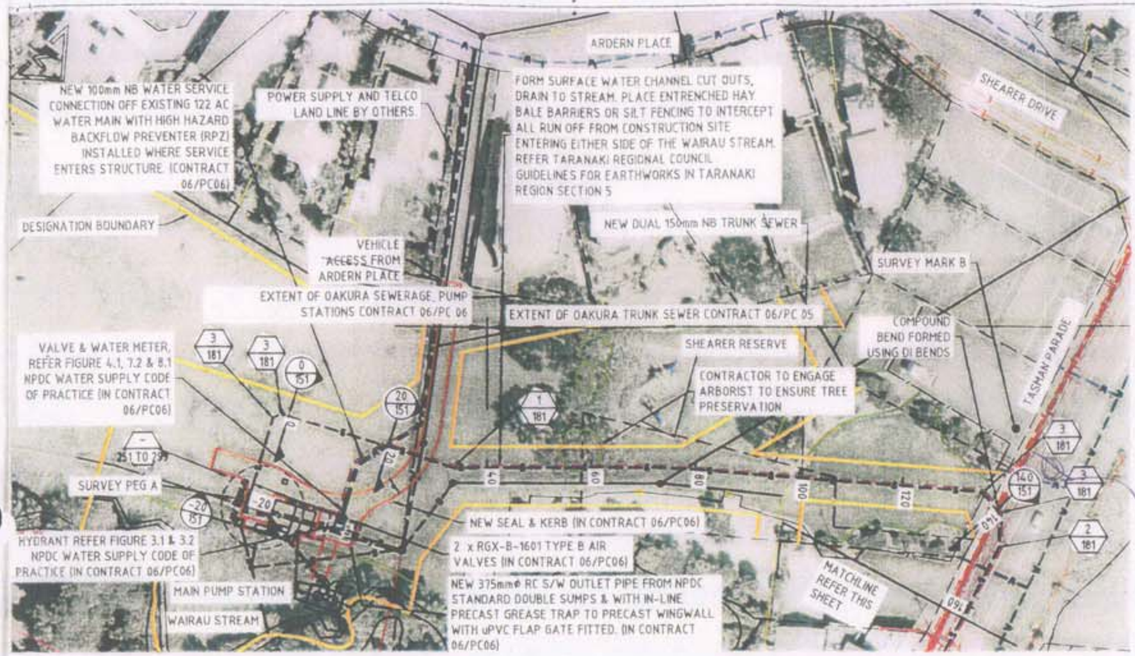
REV	REVISION DETAILS	APPD	DATE
B	PRE TENDER ISSUE FOR APPROVAL		06/07
A	PRELIM FOR CLIENT APPROVAL		05/07

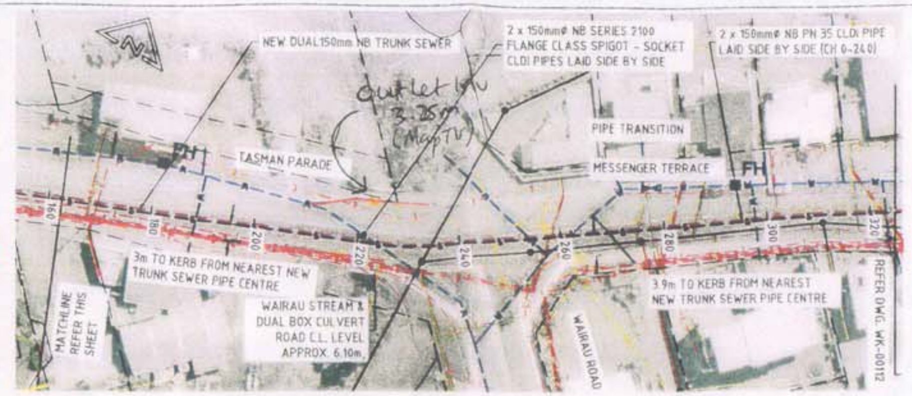
NEW PLYMOUTH DISTRICT COUNCIL
newplymouthnz.com

LOCATION/JOB
OAKURA SEWERAGE

DRAWING TITLE
MAIN PUMP STATION SITE LAYOUT PLAN

CONSULTANT:
JOB No. 51-22732
DATE 11/06
CLIENT:
JOB No.
CAD No. WK00250
FIELDWORK
DESIGNED C WELLING
DRAWN B MACDONALD
RECOMMENDED
APPROVED
DATE
ORIGINAL SCALES A1 1:250 A3 1:500
DRAWING No. WK-00250
SHEET 1 of 10
B





PLAN
SCALE: 500 (A1)

Approx High Pt in Road

LEGEND

TRUNK SEWER - PROPOSED
TRUNK SEWER VALVE - PROPOSED AV (TYPE) SC XO
-AIR = AV; -SCOUR = SC; CROSS OVER= XO
RISING SEWER MAINS-PROP. BY OTHERS
SEWER MAINS, GRAVITY - PROP.(BY OTHERS)
- OVER PRIVATE PROPERTY (BY OTHERS)
- PUMPING MAINS (BY OTHERS)
- HOUSE CONNECTIONS (BY OTHERS)
- COMMON HOUSE CONN. (BY OTHERS)
SEWER - EXISTING
ELECTRICITY - EXISTING
GAS - EXISTING
STORMWATER -EXISTING - PROP - SURFACE BOX
TELCO -EXISTING - PROP
WATER MAIN -EXISTING - PROP
BOREHOLE BH 1
TEST PIT TP 1
HAND AUGER HA 1
SCALA PENETROMETER SP 1 CPT

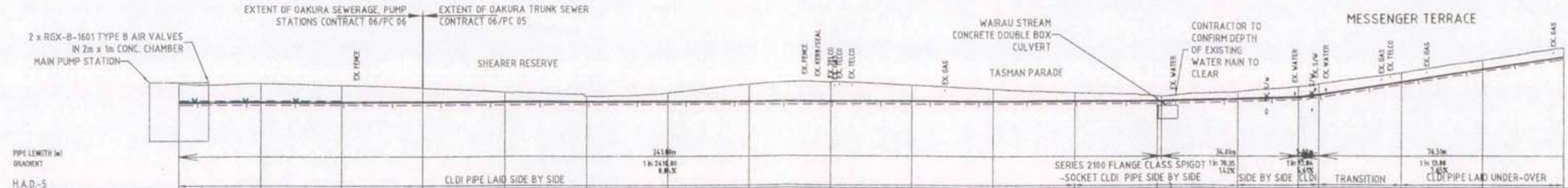
SURVEY MARKS
FENCE - EXISTING
KERB LINE - EXISTING -PROPOSED
SEAL EDGE - EXISTING
GIS BOUNDARY
LEGAL BOUNDARY-EXIST. -DESIGNATION
POWER POLE - EXISTING
LIGHT POLE - EXISTING
WATER VALVE -EXISTING -PROPOSED
FIRE HYDRANT -EXISTING FH -PROPOSED FH
WATER MAIN BLIND FLANGE -PROPOSED
WATER MAIN BACKFLOW PREVENTER -PROPOSED
SEWER MANHOLE -EXISTING -PROPOSED
STORMWATER MANHOLE -EXISTING - PROP.
DRAWING CROSS REFERENCES
-CROSS SECTION NUMBER
-DRAWING NUMBER: WK-00 (XXX)
DRAWING DETAIL REFERENCE
-DETAIL NUMBER
-DRAWING NUMBER: WK-00 (XXX)

NOTES

1. REFER TO DWG WK-00105 FOR GENERAL NOTES

SET OUT DATA

MARK	mE COORDINATE	mN COORDINATE	LEVEL
SURVEY PEG A	1681993.54	5669810.80	7.54
SURVEY MARK B	1681870.86	5669895.49	



H.A.D.-5

CUT TO INVERT (TOP PIPE)	INVERT LEVEL (TOP PIPE)	GROUND LEVEL	CHAINAGE
2.34	5.2	7.54	-20
2.36	5.21	7.57	0
2.14	5.22	7.36	20
1.8	5.22	7.03	40
1.27	5.23	6.5	60
0.75	5.24	5.99	80
1.14	5.25	6.39	100
2.19	5.26	7.45	120
2.38	5.27	7.65	140
2.04	5.27	7.32	160
1.57	5.28	6.86	180
1.12	5.29	6.41	200
0.7	5.3	6	220
0.66	5.3	5.96	221
0.98	5.57	6.55	240
1.4	5.78	7.18	255
1.4	6.06	7.46	260
1.23	7.59	8.82	280
1.21	9.12	10.33	300
1.18	10.65	11.83	320

VERTICAL 1:250 AT ORIGINAL SIZE
HORIZONTAL 1:500 AT ORIGINAL SIZE

LONGITUDINAL SECTION DUAL 150mm NB TRUNK SEWER

120m

FOR TENDER

No	Revision	Drawn	Checked	Approved	Date
A	FOR TENDER	BNM	CES		06-12-06

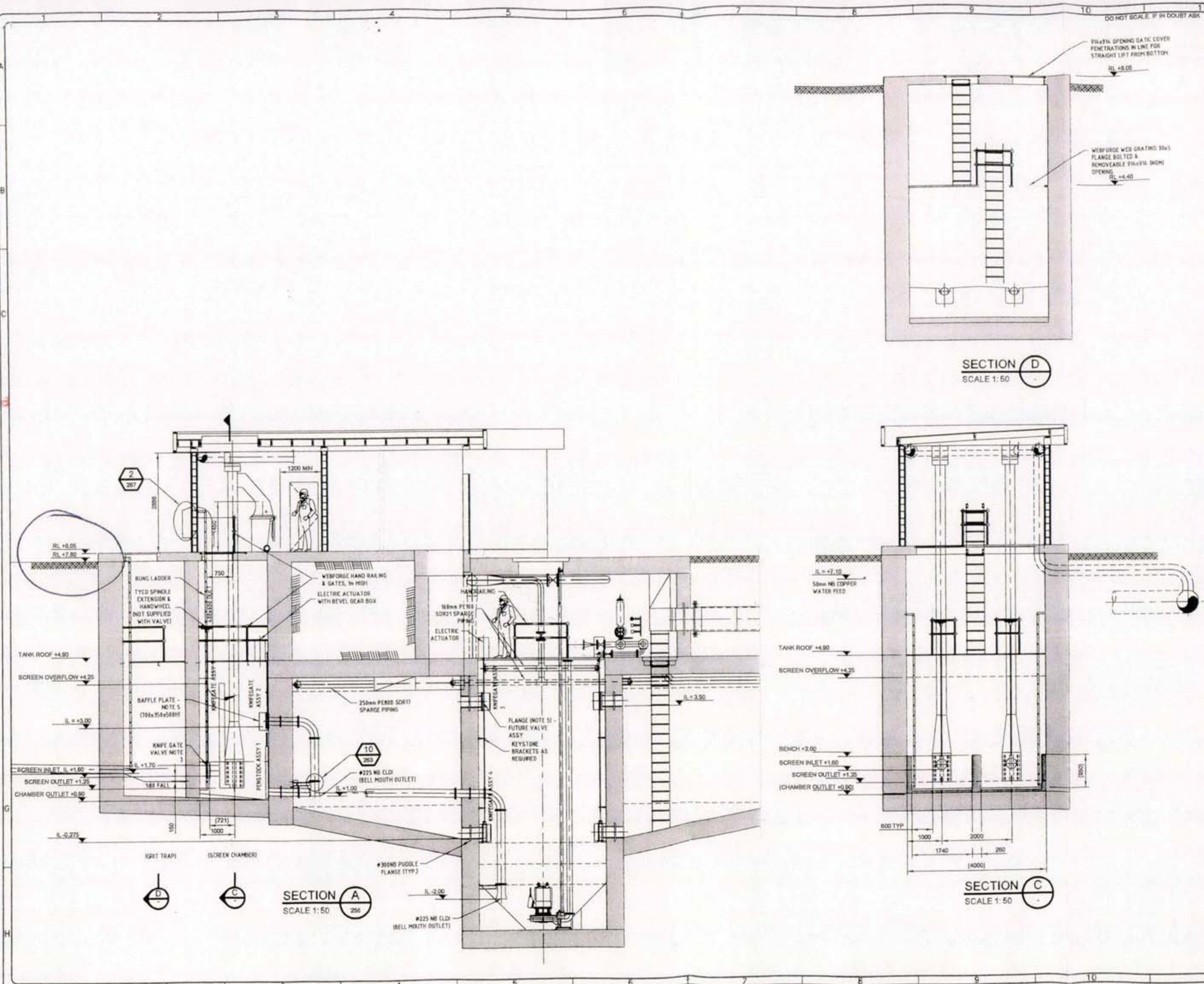
NEW PLYMOUTH DISTRICT COUNCIL newplymouthnz.com

Apex

GHD Limited
Level 11, Guardian Trust House, 15 Willeston Street, Wellington
T 64 4 472 0799 F 64 4 472 0833
E wgnmail@ghd.co.nz www.ghd.co.nz

Scale: AS SHOWN | DO NOT SCALE
Drawn: B MACDONALD | Designed: G. DICK
Drafting Check | Design Check
Approved
Date: 07-03-06
This Drawing must not be used for Construction unless signed as Approved

Client
Project: OAKURA SEWERAGE
Title: TRUNK SEWER 0 TO 320
Original Size: A1
Drawing No: WK-00111
Rev: 0



NOTES

1. INSIDE THE PUMP STATION ALL PIPEWORK FITTINGS, BOLTS, NUTS, AND WASHERS SHALL BE 316L STAINLESS STEEL.
2. INSIDE THE PUMP STATION ALL PIPEWORK SHALL BE SCHEDULE 40S 316L STAINLESS STEEL.
3. KNIFEGATE VALVE COMES AS PART OF HUBER ROK ASSEMBLY. HANDWHEEL AND SHAFT EXTENSION TO BE FITTED.
4. WEB FORGE GRATING TO HAVE REMOVEABLE (FLANGE BOLTED) PANELS FOR FITTING AND REMOVAL OF SCREENS & SCREENING DEVICE. HATCH OPENING SIZE AND LOCATION TO BE CONFIRMED.
5. FLANGED AND DRILLED WITH FUTURE PROVISION FOR KNIFE GATE VALVE.
6. KNIFE GATE VALVES AND PENSTOCKS WITH NON-RISING SPINDLES ARE TO BE OPERATED WITH A VALVE KEY.
7. KNIFE GATE WITH RISING SPINDLES ARE TO BE OPERATED WITH ROTARY MULTI-TURN ACTUATORS

KNIFEGATE ASSEMBLY 1 (Ø300NB)
MANUAL (HANDWHEEL) OPERATED, NON-RISING SPINDLE

KNIFEGATE ASSEMBLY 2 (Ø225NB)
ELECTRIC ROTARY ACTUATOR WITH RH GEARBOX, NON-RISING SPINDLE. VALVE NORMALLY OPEN

KNIFEGATE ASSEMBLY 3 (Ø300NB) FUTURE ASSY. IF REQUIRED)
ELECTRIC ROTARY ACTUATOR, NON-RISING SPINDLE

KNIFEGATE ASSEMBLY 4 (Ø300NB)
ELECTRIC ROTARY ACTUATOR, NON-RISING SPINDLE, BIDIRECTIONAL VALVE

PENSTOCK ASSEMBLY 1 (Ø225NB)
ELECTRIC ROTARY ACTUATOR WITH BEVEL GEARBOX, NON-RISING SPINDLE

0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

REV	REVISION DETAILS	APPD	DATE
B	PRE TENDER ISSUE FOR APPROVAL		06/07
A	PRELIM FOR CLIENT APPROVAL		05/07

NEW PLYMOUTH DISTRICT COUNCIL

LOCATION/JOB
OAKURA SEWERAGE

DRAWING TITLE
MAIN PUMP STATION ACCESS & VALVE ASSEMBLY DETAIL

CONSULTANT:	FIELDWORK
	DESIGNED C WELLING
JOB NO. 51-22732	DRAWN I WILSON
DATE 04/07	
CLIENT:	RECOMMENDED
JOB NO.	APPROVED
CAD NO. WK00259	DATE
ORIGINAL SCALES A1 1:50	A3 1:100
DRAWING No. WK-00259	SHEET B of

High Intensity Rainfall Design System V4 (/)

Location

Address search	Enter your address and press enter to search

Site Information

To generate a set of results, either click on an existing data point, or a new location and enter a site name, then press the Generate Report button.

Latitude	-39.12567848477632
Longitude	173.954933344157
Site Name	Custom Location
Site Id	

Output Table Format

- ○ Depth - Duration - Frequency
- ◉ Intensity - Duration - Frequency

Generate Report

Results Spreadsheet Download

Site Details | Historical Data | RCP2.6 Scenario | RCP4.5 Scenario | RCP6.0 Scenario | RCP8.5 Scenario

Rainfall intensities (mm/hr) :: RCP2.6 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	72.2	48.3	38.1	25.4	16.8	8.56	5.51	3.50	2.19	1.65	1.34	1.15
2	0.500	78.8	52.7	41.6	27.8	18.4	9.36	6.02	3.82	2.39	1.80	1.47	1.25
5	0.200	102	68.2	53.9	35.9	23.8	12.1	7.80	4.95	3.10	2.34	1.90	1.62
10	0.100	120	80.0	63.2	42.2	27.9	14.2	9.15	5.81	3.63	2.74	2.23	1.90
20	0.050	138	92.5	73.1	48.7	32.3	16.4	10.6	6.71	4.20	3.17	2.58	2.20
30	0.033	150	100	79.2	52.8	35.0	17.8	11.5	7.27	4.55	3.43	2.80	2.38
40	0.025	158	106	83.6	55.8	36.9	18.8	12.1	7.68	4.81	3.63	2.95	2.52
50	0.020	165	110	87.2	58.1	38.5	19.6	12.6	8.01	5.01	3.78	3.08	2.62
60	0.017	171	114	90.1	60.1	39.8	20.3	13.1	8.28	5.18	3.91	3.18	2.71
80	0.012	180	120	94.9	63.3	41.9	21.4	13.7	8.72	5.46	4.11	3.35	2.85
100	0.010	187	125	98.6	65.8	43.6	22.2	14.3	9.07	5.67	4.28	3.49	2.97
250	0.004	217	145	115	76.5	50.7	25.8	16.6	10.5	6.60	4.98	4.06	3.45

Rainfall intensities (mm/hr) :: RCP2.6 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	72.2	48.3	38.1	25.4	16.8	8.56	5.51	3.50	2.19	1.65	1.34	1.15
2	0.500	78.8	52.7	41.6	27.8	18.4	9.36	6.02	3.82	2.39	1.80	1.47	1.25
5	0.200	102	68.2	53.9	35.9	23.8	12.1	7.80	4.95	3.10	2.34	1.90	1.62
10	0.100	120	80.0	63.2	42.2	27.9	14.2	9.15	5.81	3.63	2.74	2.23	1.90
20	0.050	138	92.5	73.1	48.7	32.3	16.4	10.6	6.71	4.20	3.17	2.58	2.20
30	0.033	150	100	79.2	52.8	35.0	17.8	11.5	7.27	4.55	3.43	2.80	2.38
40	0.025	158	106	83.6	55.8	36.9	18.8	12.1	7.68	4.81	3.63	2.95	2.52
50	0.020	165	110	87.2	58.1	38.5	19.6	12.6	8.01	5.01	3.78	3.08	2.62
60	0.017	171	114	90.1	60.1	39.8	20.3	13.1	8.28	5.18	3.91	3.18	2.71

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
80	0.012	180	120	94.9	63.3	41.9	21.4	13.7	8.72	5.46	4.11	3.35	2.85
100	0.010	187	125	98.6	65.8	43.6	22.2	14.3	9.07	5.67	4.28	3.49	2.97
250	0.004	217	145	115	76.5	50.7	25.8	16.6	10.5	6.60	4.98	4.06	3.45

APPENDIX II OAKURA DEVELOPMENT FEASIBILITY

Photo 4. Wairau Stream Tributary gully at the point where the road into the proposed WES subdivision will cross. The new road will be 20 meters wide, maximum slope of 10% and will span approximately 80 meters between east and west banks.

Photo . Wairau Stream Tributary gully at the point where the road into the proposed west , unningham ane, will cross. The new road will be 20 meters wide, maximum slope of 10% and will span approximately 0 meters between east and west banks.