SERVICES ASSESSMENT REPORT

100WPS Trustees Limited
Proposed Building Platforms on Lot 100 DP 386580
Walter Peak, Queenstown
July 2020

CLARK FORTUNE MCDONALD & ASSOCIATES
REGISTERED LAND SURVEYORS, LAND DEVELOPMENT & PLANNING CONSULTANTS

CONTENTS

1 INTRODUCTION

Clark Fortune McDonald & Associates (CFM) has been engaged by 100WPS Trustee Limited to assess servicing options for proposed building platforms on Lot 100 DP 386580

The proposal seeks to create three new building platforms.

The site is legally described as Lot 100 DP 386580 (RT 346609) and has originally been consented under RM010111.

This report is preliminary and for the purposes of consent only. Further information and detailed engineering design will be required if development proceeds.

2 SCOPE OF WORK

The scope of work includes the examination of existing private and QLDC as-built records, confirmation of capacity of existing services to determine the adequacy of the existing infrastructure, and recommendation of infrastructure servicing options.

3 DESIGN STANDARDS & REPORTS

Site development standards include, but are not limited to, the following:

- QLDC Land Development and Subdivision Code of Practice adopted June 2018.
- NZS4404:2010
- NZS PAS 4509:2008, New Zealand Fire Service Fire-fighting Water Supplies Code of Practice.
- ASNZ 1547:2012 On site waste water

4 BACKGROUND

Lot 100 DP 386580 is part of the Walter Peak High Country Station development consented under RM010111. The site has been designed to contain a lodge and several accessory buildings.

Services to this lot have been provided via private infrastructure installed under RM010111.

5 ACCESS

The subject site being Lot 100 DP 386580 has legal access to Mount Nicholas Beach Bay Road via Mick O'Day Track. Mick O'Day Track crosses Lot 200 DP 386580. Lot 200 is a commonly owned lot in equal but undivided shares. Lot 100 DP 386580 owns a 1/9th share of Lot 200.

Mick O'Day Track has been consented and constructed under RM010111. The access is 3.5m wide and is formed to a metalled finish with 150mm compacted depth GAP40 aggregate. The maximum grade is 1 in 6.

The formation of Mick O'Day Track is generally in accordance with QLDC COP E1 standard table 3.2. Further, given its private rural context consideration has been given to section 3.3.16 of COP for passing bay locations.

It is also worth noting that the primary access to any buildings established within the building platforms on Lot 100 will be via Lake Wakatipu and the proposed new marina. It is expected that vehicles will use the access infrequently to visit the Walter Peak wharf or journey out via Mavora Lakes to Te Anau and beyond. It is noted that the rural roads that Mick O'Day connect to such as the Von Road are remote back country roads and are formed to a similar standard.

No upgrades are considered necessary to the formation of Mick O'Day Track as a result of this application.

6 WASTEWATER

Wastewater disposal from the proposed building platforms on Lot 100 DP 386580 is to be via the existing connection to the Hynds Foul Sewer Treatment Plant consented and constructed under RM010111 (variation RM061071).

Please refer to **Appendix A** for a copy of the as built plan showing the connection to Lot 100 and the foul sewer treatment plant.

Please refer to **Appendix B** for a copy of the design documents, the engineering approval from RM010111 and a copy of ORC consent 2006.446

The Hynds Foul Sewer Treatment Plant has been designed to cater for a maximum of 80 per day living on site with a flow per person per day of 300 litres.

There are 8 existing lots consented under RM010111 which are also connected to this system (Lot 1 – 8 DP 386580).

Under the QLDC Land Development and subdivision Code of Practice 2018 section 5.3.5.1 (a) there is to be an allowance for 3 people per dwelling with a dry weather flow of 250 litres per person per day.

Using the allowance of 3 people per dwelling the 8 existing lots will contribute 24 users to the existing system. This leaves capacity in the existing system for a further 56 users.

It is noted that the existing system was installed and commissioned in 2006/2007 but has not yet been in operation. It is recommended that a re-commissioning procedure be undertaken prior to use to confirm correct operation. It is possible that the existing ORC consent may need to be renewed.

It is recommended that a management entity be established which will be responsible for any maintenance, testing and on-going consenting requirements of the existing foul sewage treatment plant once operating.

7 STORMWATER

7.1 Existing Stormwater Infrastructure

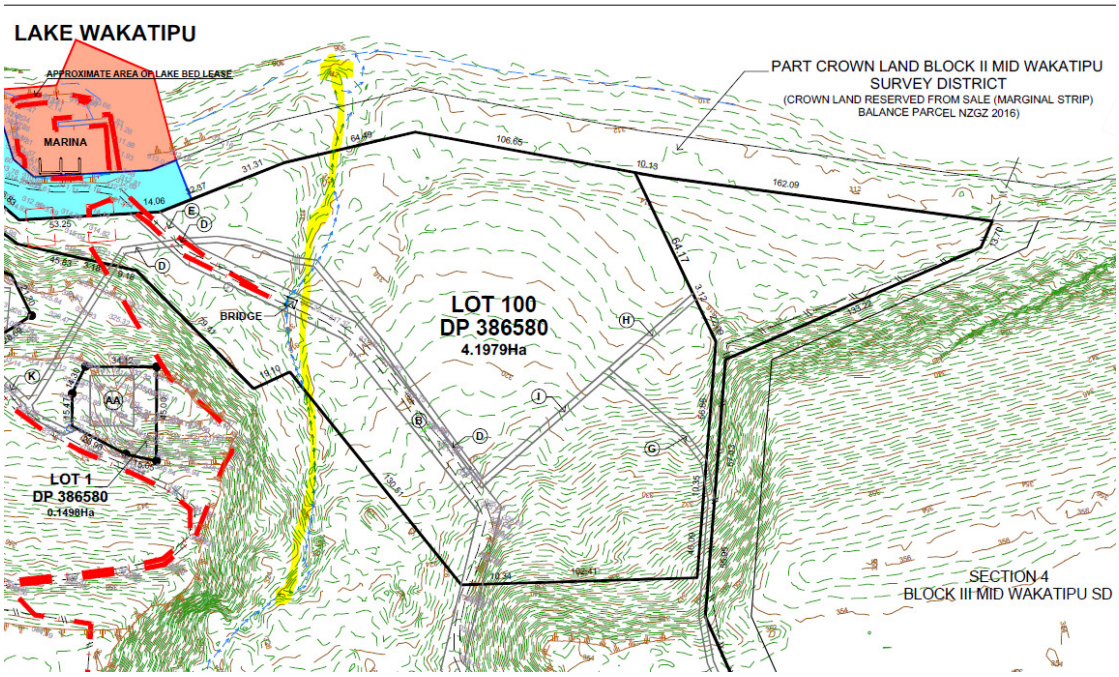
There is currently no reticulated stormwater infrastructure servicing the site. The subject site is currently undeveloped and consists of predominantly pasture grasses with shrubland and occasional rock outcrops.

7.2 Stormwater Catchments

The site covers a grassed terrace overlooking Lake Wakatipu.

Stormwater runoff from the mountains to the south of the subject site is channelled through Mick O'Day creek which runs to the western edge of Lot 100 before entering Lake Wakatipu.

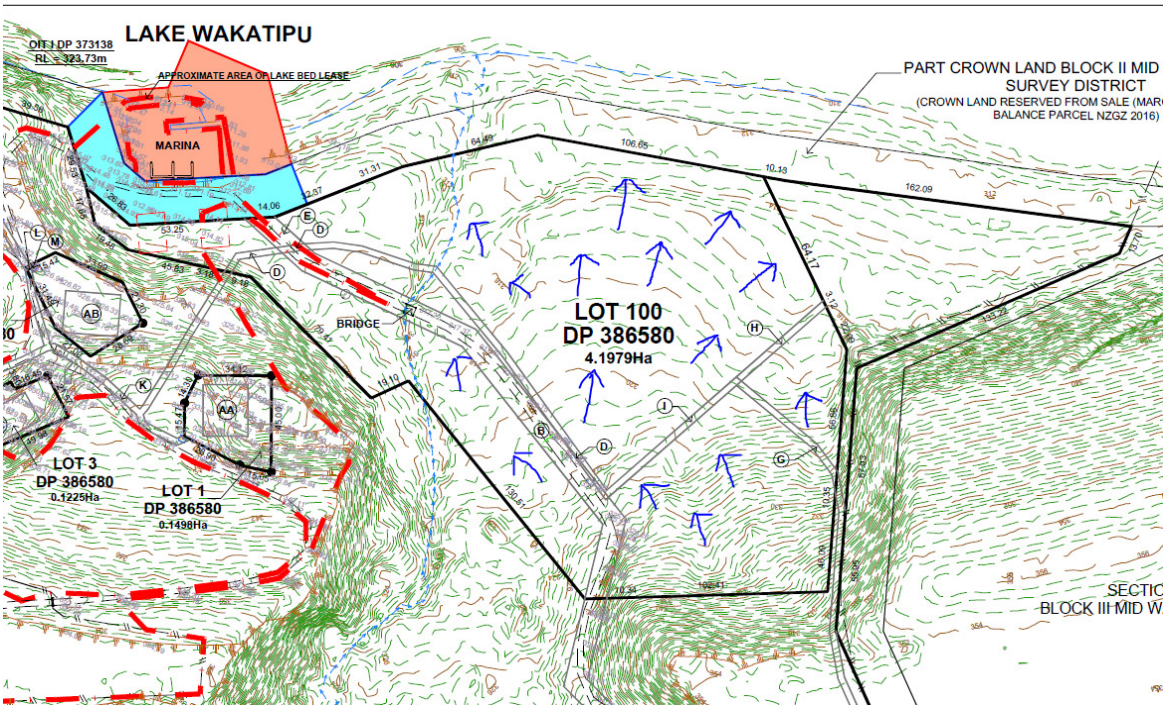
The proposed building platform locations are not situated near any significant seasonal drainage paths or flood prone areas. The proposed building platforms are to be located 3m – 4m above Mick O'Day creek.



4.3.5 Design criteria

Stormwater run-off from new impervious areas would be disposed to ground. The design shall be undertaken in accordance with Building Code Verified Method E1/VM1. This would take the form of a soak pit or similar on-site storage/soakage system. The site consists of relatively free draining gravels.

Overland flow from Lot 100 runs to the north where it crosses the adjoining marginal strip before entering Lake Wakatipu. There are no downstream properties that would be at risk from any increase in run-off.



Detailed design and confirmed permeabilities would be required to be supplied with the building consent documentation and shall be completed by a suitably qualified person.

8 WATER SUPPLY

8.1 Water supply

Water supply to the proposed building platforms on Lot 100 DP 386580 is to be via the existing connection established under RM010111.

Please refer to **Appendix C** which shows the existing design has allowed for 8 cottages with 2 occupants each and a lodge with 30 occupants on Lot 100. This allows for 46 occupants on Lot 100 in total with a daily consumption of 700 litres per occupant per day making a total consumption rate of 32,900 litres per day for Lot 100.

The 700 litres per occupant per day is in accordance with the QLDC Land Development and subdivision Code of Practice 2018 section 6.3.5.6 (a).

It is recommended to carry out on site flow tests to confirm that the design specifications have been achieved.

Please also refer to **Appendix C** for design of water treatment plant and water tests from 2007. It is recommended that new tests be conducted to confirm water quality is compliant with drinking water standards.

It is recommended that the same management entity responsible for the wastewater system also be for any maintenance, testing and on-going consenting requirements of the existing water supply system.

8.2 Fire fighting

As built records show that there are two fire hydrants installed near the boundary of Lot 100. (Refer **Appendix A**)

Firefighting flow requirements have been taken into consideration in the existing water supply calculations (Refer **Appendix C**).

It is recommended that site flow tests at the existing hydrants be undertaken to confirm that the design specifications have been achieved on site.

9 POWER AND TELECOMMUNICATIONS

An existing on-site electrical supply system has been installed as part of the subdivision consented under RM010111. Please refer to the attached as built plan **Appendix A** which shows the location of power transformer and reticulation to Lot 100.

Please also see Scorpion Engineering producer statement **Appendix D** which relates to the existing system.

It is anticipated that the existing electrical reticulation will be sufficient to supply electricity to the proposed building platforms on Lot 100. This will need to be confirmed by appropriately qualified professionals once he the electrical demand for the new buildings has been determined. This would occur as part of detailed design for building consent.

If it is found that the existing electrical supply requires upgrading several on site alternatives are available.

As built plans show a telecom connection from Mount Nicholas Beach Bay Road to Lot 100. Easements in gross in favour of Chorus New Zealand Ltd have also been created over this line.

It is expected that this will provide a telecommunications connection to Lot 100.

Please also note that Vodafone New Zealand show 3G mobile phone coverage over Lot 100.

10 CONCLUSION

The proposed building platforms on Lot 100 can be adequately serviced to QLDC current standards via existing infrastructure.

Given the existing infrastructure has been installed 13 – 14 years ago we would recommend that on site tests are carried out to confirm that the infrastructure is in working order.

We would also recommend that a management entity be established in order to maintain the existing private infrastructure in perpetuity.

Produced by:

Hayden Knight
BSurv, MCSNZ, MS+SNZ

Reviewed by:

Chris Hansen
BSurv, MCSNZ, MS+SNZ

LEGEND:

- Telecom Connection
- Power Connection
- Water Toby
- Foulsewer Connection
- Firehydrant
- Water Valve
- Power cable
- Power & water
- Power, water & foulsewer
- Telecom, water & foulsewer
- Power, water, foulsewer & telecom
- Peg
- Telecom dimension
- Power dimension
- Water dimension
- Foulsewer dimension

0 5 10 20 40m

N

Lake Wakatipu

Lot 100

Refer to Sheet 2383.15A.2A for connection details

Lot 1

Lot 2

Lot 3

Lot 4

Lot 5

Lot 6

Lot 7

Lot 8

Lot 200

Lot 1
LT373138
(37.7842ha)

P1 P2 P3 P4 P5 P6 P8 P10 P11 P12 P13 P14 P15 P16 P17

6.0 to P8
6.0 to P8
5.6 to P8
5.3 to P8

18.1 to P14
18.0 to P14
17.9 to P14
17.8 to P14
7.8 to P14
7.5 to P14
7.0 to P14
7.2 to P14

3.7 to P3
3.6 to P3
3.9 to P3
3.9 to P3
12.1 to P4
12.5 to P4
12.5 to P4
12.7 to P4

3.8 to P11
2.5 to P10
3.9 to P11
2.6 to P10
3.9 to P11
2.3 to P10
3.8 to P11
2.1 to P10

9.9 to P5
9.7 to P5
10.4 to P5
9.3 to P5
16.8 to P6
16.5 to P6
16.6 to P6
16.7 to P6

16.8 to P2
16.9 to P2
16.7 to P2
16.7 to P2
1.3 to P1
1.7 to P1
1.4 to P1
1.5 to P1

20.9 to P12
21.2 to P12
21.2 to P12
21.5 to P12
8.5 to P13
8.1 to P13
8.0 to P13
7.7 to P13

16.8 to P16
17.1 to P16
17.1 to P16
17.3 to P16
22.4 to P17
22.1 to P17
21.7 to P17
21.5 to P17

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER & WATER

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER & WATER

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER & WATER

COMMON TRENCH CONTAINS: TELECOM, FOULSEWER & WATER

COMMON TRENCH CONTAINS: POWER & WATER

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER & WATER

FIRE HYDRANT

FIRE HYDRANT

WATER VALVES (2)

POWER

POWER

POWER TRANSFORMER

POWER GENERATOR STATION

WATER PUMP STATION

POWER TO FEED PUMP STATION

WATERMAIN

WATERMAIN

WATER VALVE

WATER VALVES (3)

WATER TANKS (6) WITH VALVE (12)

Mackenzie Track

DATA QUALITY STATEMENTS

PROPERTY DATA

The property data has been sourced from land Information New Zealand (LINZ) and is current as at May 2006. The boundary data has been compiled from various existing surveys of different ages. Boundary lengths shown as calculated may vary from those shown on the Certificate of Title, and are subject to a legal redefinition survey. The accuracy of the boundary data is estimated to be within 30mm.

SURVEY DATA

Surveyed data has been captured using survey equipment, to a relative accuracy within approximately 30mm (horizontal and vertical).

SERVICES DATA

Where underground services have features visible on the surface, their positions have been measured by field survey. There may be services for which no records exist and not all services are shown on this plan. In all cases, if the location of a service is considered important, the relevant service provided should be consulted.

SURVEY DATUMS

Horizontal coordinates are in terms of NZMG.
Vertical elevations are in terms of Dunedin Vertical Datum (MSL).
The origin of levels is OIT1 DP373138 (R.L.=323.75)

ASBUILT PLAN

WALTER PEAK STATION
QUEENSTOWN

ISSUE DATE:	18 April 2007	PREPARED BY: Emily Dennison
ISSUE:	A – Original Issue	Scale 1:1000 Original Plan A3
		DRAWING & ISSUE No. 2383.15AB.1A

AURUM SURVEY CONSULTANTS LTD
PO Box 1493
Queenstown
Ph 03 442 3466
Fax 03 442 3469
Email admin@ascl.co.nz

LEGEND:

- Telecom Connection
- Power Connection
- Water Toby
- Foulsewer Connection
- Firehydrant
- Water Valve
- Power cable
- Power & water
- Power, water & foulsewer
- Telecom, water & foulsewer
- Power, water, foulsewer & telecom
- Peg
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0 5 10 20 40m

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N

Lake Wakatipu

Lot 100

Lot 200

Lot 2

Lot 1

unformed legal road

Mick O'Day Track

ROW easement

FOULSEWER DISPOSAL FIELD

FOULSEWER TREATMENT STATION

FOULSEWER PUMP SHED

FS MANHOLE 315.69 LID 314.60 INVERT

FS MANHOLE 319.03 LID 317.63 INVERT

FS MANHOLE 322.75 LID 320.70 INVERT

FS MANHOLE 324.32 LID 323.18 INVERT

FS LATERAL FOR COTTAGES

POWER TRANSFORMER
WATER VALVE

FIRE HYDRANT

FIRE HYDRANT
WATER VALVE

WATER VALVES (2)

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER & WATER

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER (150mmØ) & WATER

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER & WATER

COMMON TRENCH CONTAINS: TELECOM, POWER, FOULSEWER & WATER

TELECOM

P1 P2 P5 P6 P7

22.8 to P7
22.5 to P7
22.3 to P7

2.0 2.0 2.1

Refer to Sheet 2383.15A.1A for Lot 1-8 connection details

ASBUILT PLAN

WALTER PEAK STATION QUEENSTOWN

ISSUE DATE:	18 April 2007	*PREPARED BY:* Emily Dennison	
ISSUE:	A – Original Issue	*Scale* 1:1000 Original Plan A3	
		DRAWING & ISSUE No. 2383.15AB.2A	

AURUM SURVEY CONSULTANTS LTD
PO Box 1493
Queenstown
Ph 03 442 3466
Fax 03 442 3469
Email admin@ascl.co.nz

CivicCorp

File Ref: RM010111

Civic Corporation Limited
Private Bag 50077,
CivicCorp House, 74 Shotover Street
Queenstown, New Zealand
Tel 64-3-450 0300
Fax 64-3-442 4778
e-mail enquiries@civiccorp.co.nz
site http://www.civiccorp.co.nz

06 October 2006

Weber Consulting Engineers
P O Box 1587
Queenstown

Attention: **Mr Ben Jedrej**

Dear Ben

ENGINEERING APPROVAL

Re: RM 010111 FOUL SEWER TREATMENT PLANT – WALTER PEAK DEVELOPMENT

I refer to your application for engineering approval for **HYNDS FOUL SEWER TREATMENT PLANT** and provisions lodged for Resource Consent – RM 010111

Approval is given, subject to the following conditions:

1. That the engineering works be undertaken in accordance with the *Weber Consulting Drawings Cover 1107/302revB Hynds letter dated 15th September 2006 for foul sewer treatment proposal, Hynds Proposed Process Schematic drawing rev D, Lonmg section drawing rev 1, and Hynds Environmental treatment Plant Design and Specification* submitted for engineering approval and the conditions below.

2. **No work shall be undertaken** on Council's infrastructure until the applicant has completed an Application for Utility Service, paid associated fees and obtained approval, in writing, with respect to connecting to Council services.

3. CivicCorp Engineers are to be given at least 24 hours notice at each stage of development to enable all necessary inspections to be carried out.

4. Prior to commencement of Foul Sewer Treatment Plant and Effluent Field, copies of approval letters from ORC for such works are to be supplied to CiviCorp .

The proposed engineering works are in accordance with the Councils Code of Subdivision and have been checked and approved by CivicCorp.

If you have any enquires please contact Reg Fraser on phone direct dial 03-450 0302.

Prepared by
CIVICCORP

Reg Fraser
SUBDIVISION INSPECTOR

Reviewed and approved by
CIVIC CORP

Malika Rose
PRINCIPAL ENGINEER

CITATION
PROPERTY GROUP

September 18, 2006
Civic corp.
Private Bag
Queenstown

18 SEP 2006

Re RM 010111 – Walter Peak

Attention Alice Hill.

Dear Alice,

Attached for your attention are plans and specifications as designed by Hynds Environmental for the Foul Sewer Treatment plant for the above project. We submit these plans and specifications for Engineering approval in accordance with condition 8 (g) of RM 010111.

I note that Engineering approval has already been granted on Sept 1st for the Foul Sewer reticulation.

I wish to advise that Otago Regional Council are currently processing an application for the disposal field. This application is being processed under ORC number 2006.446. We expect approval to be granted within the next week. I will forward to you a copy of the approval as soon as it comes to hand.

The disposal field (by way of piped dripper field) is planned to be located in an area of established beech forest as per the attached site plan.

If you have any queries please contact me on 021 949 669 and address any correspondence to Walter Peak Developments ltd at the address below.

Regards

MALIKA

Simon Brackstone

Project Manager

SEP 2006

LEVEL 3, CNR EARL STREET & CHURCH LANE
PO BOX 672, QUEENSTOWN, NEW ZEALAND
TEL: 03 409 0022 FAX: 03 409 0006

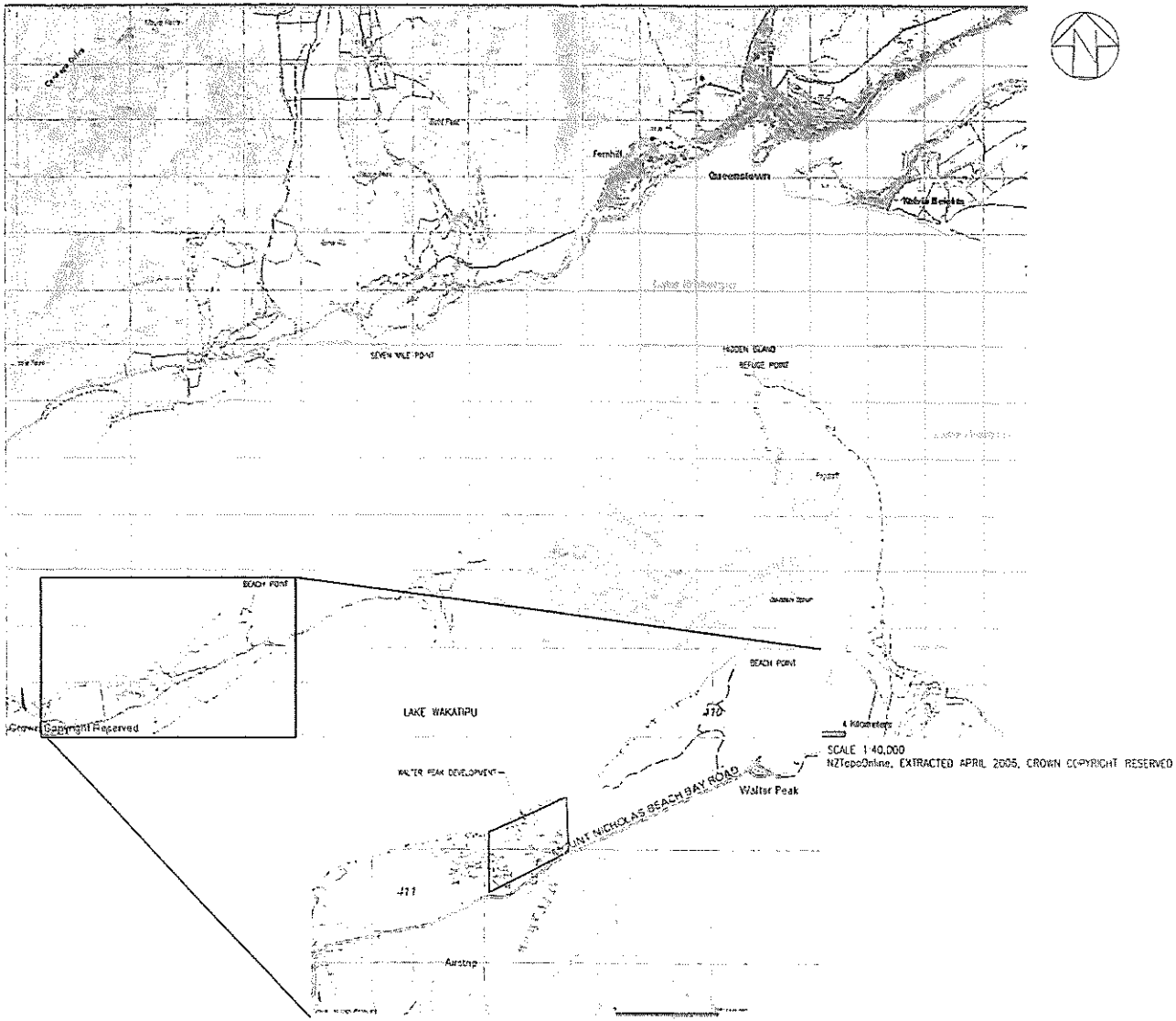


Figure 1: Site Location Plan

PRELIMINARY NFC	WALTER PEAK DEVELOPMENT	LOCATION PLAN	weber	Drawn by: BRJ	Designed by: BRJ	Scale @ A1: AS SHOWN
			Level 2, The Forge Athol Street, PO Box 1587, Queenstown T 03 442 7230 F 03 442 7232 E warrick@weberconsulting.co.nz	Drawing No: 1107/001	Revision: A

HYNDS ENVIRONMENTAL

Hynds Environmental Systems Limited
669 Great South Road, Penrose
PO Box 17388, Greenlane
Auckland, New Zealand
Telephone: +64 9 571 0090
Facsimile: +64 9 571 0091
Email: sales@hyndsenv.co.nz
www.hynds.co.nz

15th September 2006

CivicCorp
74 Shotover Street
QUEENSTOWN

Attention: Engineering Department

To Whom It May Concern:

RE: WALTER PEAK DEVELOPMENT – FOULSEWER TREATMENT

With respect to the above project and in accordance with Subdivision Condition 8(g) of Resource Consent RM 010111 and subsequent order of the Environment Court dated 25 January 2005 we have pleasure in submitting the Foulsewer Treatment design for engineering approval.

The following documents are attached for your consideration

- Design Report
- Producer Statement of design
- Indicative site layout plan

With specific regard to Condition 8(g) we comment as follows:

8 (g) Hynds Environmental's engineers whom have had over 12 years experience in designing wastewater treatment solutions have designed and specified this treatment plant using information supplied by Webber Consulting Engineers. This design is specific for this project and takes into consideration expected wastewater flow constituents and variability, expected temperature extremes at this site and relative remoteness of site.

The treatment plant specified is a centralized treatment plant catering for each individual lot at one location via a reticulated pipe network.

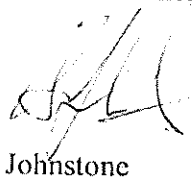
In addition to the supplied treatment plant, Hynds Environmental can supply a contracted maintenance service to undertake regular maintenance. Incorporated in this is a 24 hour monitoring service that will remotely highlight any faults that the treatment plant may have.

As part of the aforementioned maintenance contract, testing of effluent can be included as part of the maintenance, at the frequency specified.

The dripper field design is based on best practice and as Hynds Environmental understands, will be located no less than 50m to any watercourse or water supply bore.

We trust that the information supplied is sufficient for engineering approval. If you wish to discuss this further please contact the undersigned.

Best Regards
Hynds Environmental Systems Ltd

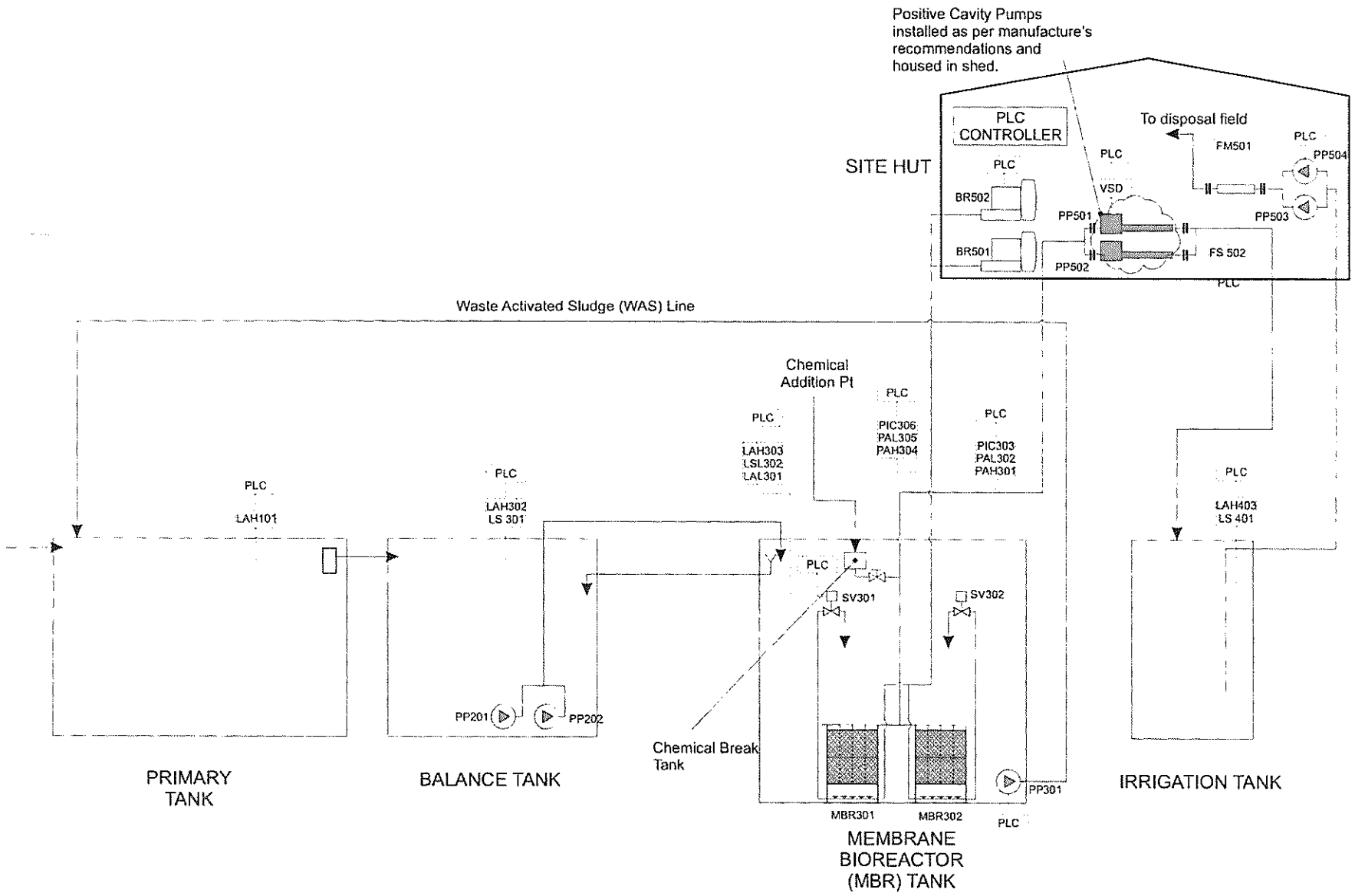


Niki Johnstone
Engineering Manager

QUEENSTOWN LAKES DISTRICT COUNCIL

APPROVED PLANS: RM .....

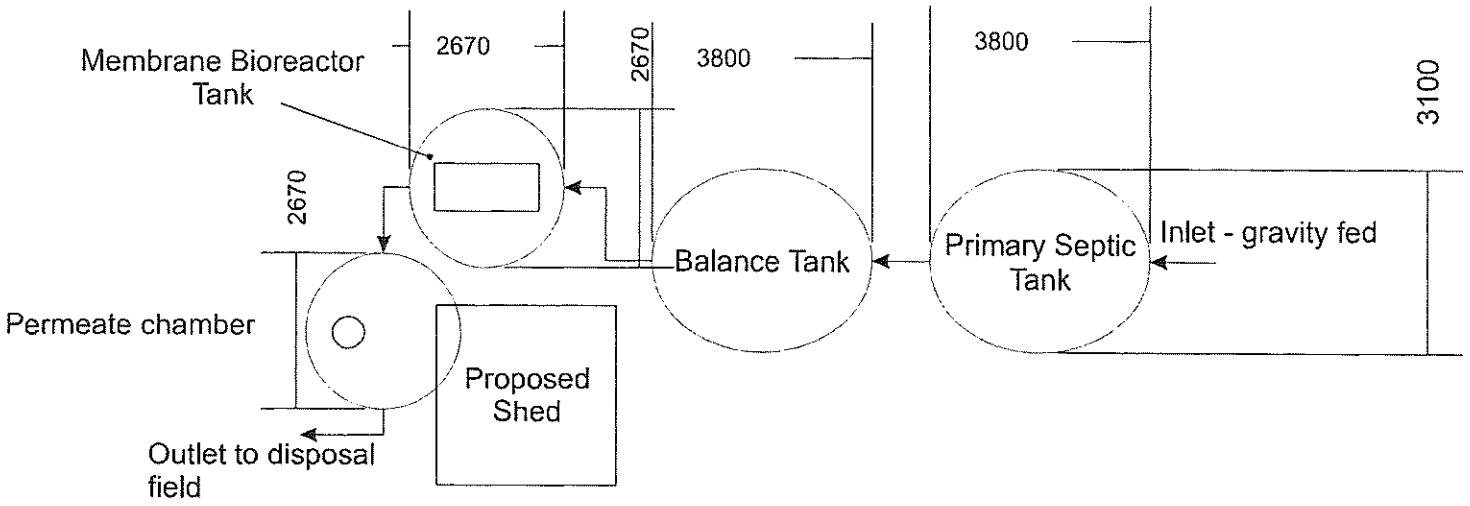
....
Date Initials



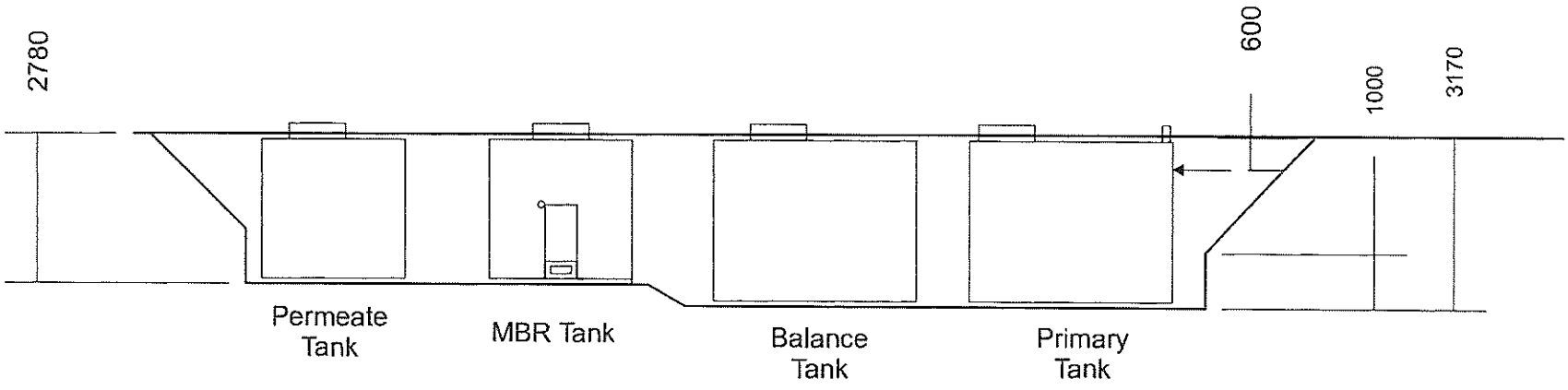
PROPOSED PROCESS SCHEMATIC

If dimension unknown, please ask.

TITLE: Walter Peak Development PFD	SCALE: N.T.S.	DATE DRWN: 06-04-06	DRWN by: N. Johnstone		
PROJECT: Walter Peak Development	DRWG#: ENV 1138	DATE CHKD:	CHKD by:		
CLIENT: Faulks Enterprises	SHEET:	CODE: MBR PFD	AMENDMENT	DATE	Revision No: 0
HYNDS ENVIRONMENTAL	SERIES:	STORAGE: DUAL			



Proposed Site Layout



Proposed Long Section

If dimension unknown, please ask.

TITLE: Proposed Site Layout		SCALE	1:120 (A4)	DATE DRWN	09/09/06	DRWN by	N. Johnstone
		DRWG#	ENV1138	DATE CHKD		CHKD by	
PROJECT: Walter Peak Station	HYNDS ENVIRONMENTAL	SHEET		CODE	LAYOUT	AMENDMENT / DATE	Revision no. 1
CLIENT: Faulks Enterprises	METRIC	SERIES		STORAGE	DUAL		

WALTER PEAK WASTEWATER TREATMENT PLANT DESIGN

Introduction

This report is to give the reader a guide on the design process undertaken to design the wastewater treatment plant in question. It will not disclose any calculations or other intellectual property however Hynds Environmental guarantees the performance of this plant based on the information supplied herewith.

Hynds Commercial Treatment System Design

The design flow was supplied by others. To Hynds Environmental's understanding the flow has been calculated as per the table below.

ITEM	Max No. of People	Flow per person per day (L)	Total Flow per day (L)
People living on site	80	300	24,000

Each critical component has a duty/standby facility. The advantage of this control is if a critical component fails (e.g. irrigation pump, blower etc), the other will automatically start while an alarm is raised thus guaranteeing continuous operation with no obvious system failure e.g. water overflow. It will also allow extra time for a replacement component to be installed. While both components are fault free, they operate alternatively.

Process Description

The attached schematic gives an indication of the process flow and control used for this plant.

The raw effluent enters the primary tank. The outlet of the primary tank has filters to prevent any large solids entering the downstream application. The primary tank provides some anaerobic treatment.

The primary treated effluent enters the balance tank through gravity. This tank includes two balance pumps on a timer to dose load the secondary treatment process therefore eliminating surge flows. Any peak flows are stored until periods of low flow when they are pumped through the treatment plant. The balance pumps transfer effluent to the membrane bioreactor (MBR) tank. This tank also allows for approximately 24 hours of emergency storage in peak flow conditions. During power outages the water usage will drop significantly and thus this will allow for significantly greater storage capabilities.

The MBR tank houses the MBR module and some fine bubble diffusers to aid in BOD reduction. A sludge return pump periodically returns nitrified sludge back to the primary tank. The permeate pump forces 'clean' water through the small pores of the MBR module and into the permeate tank.

The permeate tank stores the treated effluent and dose loads the irrigation field as the treated effluent volume allows.

A site hut will house the controller, blower and other components as deemed necessary.

Treatment Components

The standard treatment system will consist of the following:

MBR treatment system:

- 1 off $22m^3$ Primary Tanks with filter(s) on the outlet.
- 1 off, $22m^3$ Balance Tank with associated pumps and float switches to protect the system from surge flows.
- 1 off, $11m^3$ MBR Tank with associated blower(s), pump(s) and control system.
- 1 off, $11m^3$ Permeate Tank.
- 1 off, Site Shed to house control system and blower(s).
- 1 off, PLC - electronic controller complete with alarm identification.

Assumptions

It is assumed that the effluent will be of a domestic origin and have similar component load characteristics as the following table.

	BOD (mg/L)	TSS (mg/L)	TN (mg/L)	pH
Raw domestic effluent	<200	<200	<40	7.5 < x < 9

The balance tank used is not designed to be buried under more than 300mm of soil therefore, it is assumed that the invert into the balance tank is approximately 600mm below ground level.

It is assumed that a GSM signal is available at the location of the treatment plant to enable telemetry control.

Treatment Quality

The table below shows the expected median effluent quality. There will be testing after commissioning and after any cleaning of the membranes to ensure these levels are met. The periodic monitoring of the effluent quality is to be included in the Management Plan for this treatment plant.

	BOD (mg/L)	TSS (mg/L)	TN (mg/L)	Faecal Coliform
MBR treated effluent	<5	<5	<20-35	<1

Soil Analysis

The soil analysis is outside the scope of this design.

Upgrading

Based on the modular design, Hynds Environmental systems are easily and economical to upgrade if the need arises. Although this plant has not been designed with a future upgrade of wastewater treatment flows expected, it can be modified to accommodate any extra volume or concentration.

Maintenance

Hynds Environmental offers a comprehensive maintenance agreement that is based on the individual systems requirement, thus ensuring optimum performance. Our nationwide network of qualified installers and service technicians will ensure a prompt and appropriate response to any faults or issues that may arise. The advance process controller which this plant utilises includes a telemetry function that allows any faults to be alerted to Hynds Environmental's 24-hour call out service. On receiving such faults, Hynds Environmental organises the local agent to attend to the fault and repair it usually before the owner of the plant is aware of any problem.

Included in this maintenance program is the flushing of the irrigation field, pressure and flow readings to ensure the irrigation field has no leaks, blockages or other faults.

Disposal System

Disposal of the highly treated effluent is through pressure compensated dripline. The dripline is laid along the contours of the slope where possible. The dripline used does not allow fluid to escape the drippers with less than 20kPa back pressure. Therefore, for a single run of dripline, a difference in elevation of 1.5-2m is possible before any leaking from individual drippers occur.

It is the understanding of Hynds Environmental that the location of the irrigation field is such that no overland stormwater runoff will enter it.

Site Layout

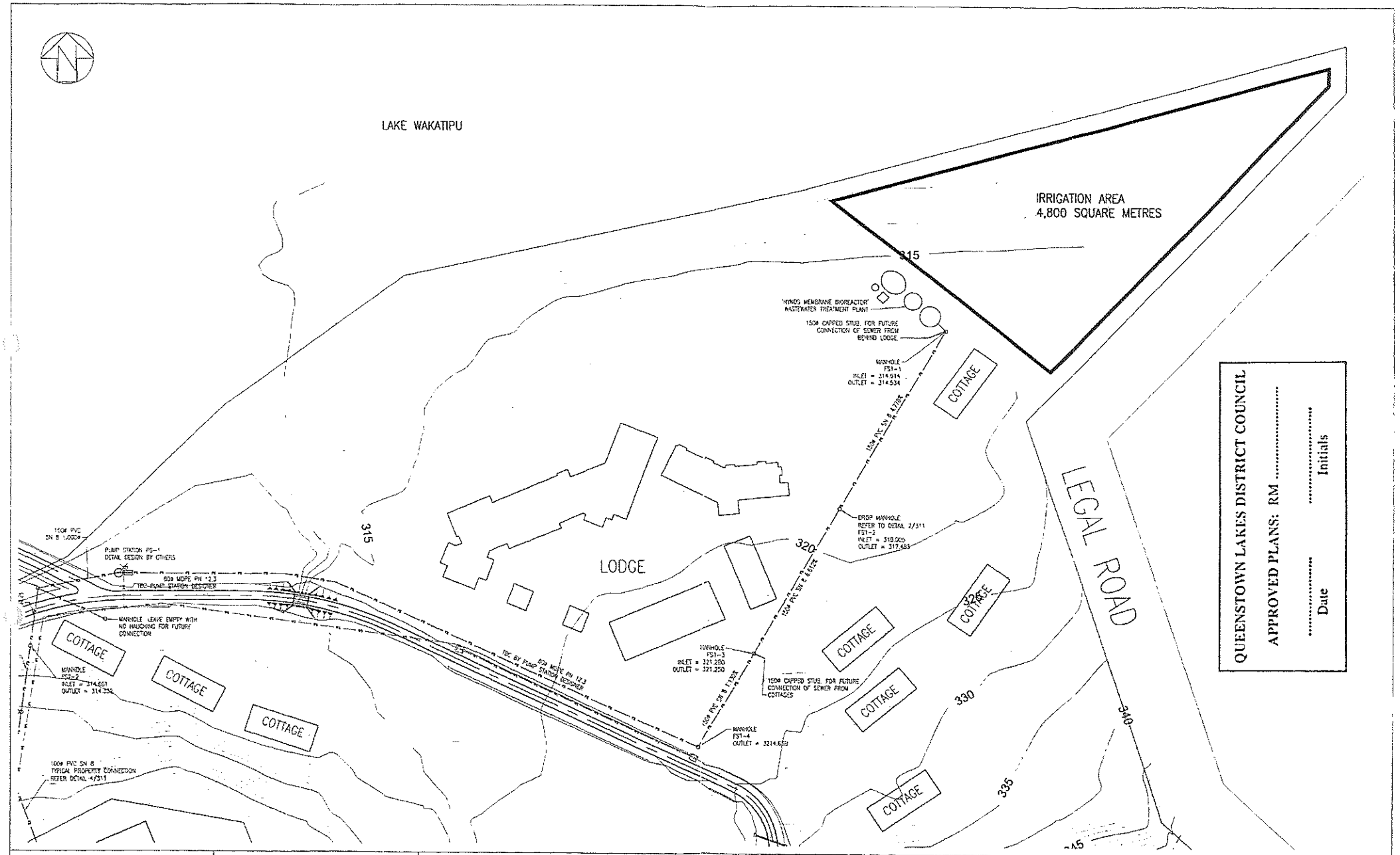
The attached drawing shows the proposed site layout. This may alter slightly to suit site characteristics however the general arrangement will remain the same.

HYNDS
ENVIRONMENTAL

Niki Johnstone *Engineering Manager*
B.E. Chem & Proc (Hons)

Hynds Environmental Systems Limited
Suite 2, 37 Wilkinson Rd, Ellerslie. PO Box 17388, Greenlane, Auckland, NZ
Ph: +64 9 571 0090 Mob: 0274 463 111 Fax: +64 9 571 0091
E-mail: nikij@hyndsenv.co.nz

www.hynds.co.nz



QUEENSTOWN LAKES DISTRICT COUNCIL
APPROVED PLANS: RM .....
..... Initials
..... Date

Rev.	Revision	By	Chk	Date
B	ENGINEERING APPROVAL	BRJ		10/1/16
A	ORC CONSENT	BRJ	BRJ	27/05/06

ENG. APPROVAL
For Construction signed off by: Date:
Refer to Revision for original signature

Job Title: WALTER PEAK

Drawing Title: FOUL SEWER LODGE AND COTTAGES LAYOUT

weber consulting engineers
Level 2, The Forge, Athol Street, PO Box 1587, Queenstown
T 03 442 7230 F 03 442 7232 E warrick@weberconsulting.co.nz

Drawn By	Designed By	Scale @ A1
BRJ	BRJ	1:500

Drawing No: 1107/302
Revision: B

HYNDS ENVIRONMENTAL

Our Ref. # : ENV1138
Resource Consent # : RM 010111

PRODUCER STATEMENT – DESIGN

To: **Citation Property Group**

Issued by: **Hynds Environmental Systems Ltd, 669 Great South Road, Penrose, Auckland**

For: **Walter Peak Development**

(Owner)

In respect of: **Hynds Membrane Bioreactor Wastewater Treatment System**

At: **Walter Peak Station, Central Otago, New Zealand**

Hynds Environmental Systems Ltd has contracted to Citation Property Group, to design a wastewater treatment plant to treat the human sewage waste from the aforementioned development. The design is based on previous correspondence in relation to the accepted quote and is invalid if the treatment system is subjected to adverse conditions as detailed, but not limited to, previous correspondence.

I, N.S. Johnstone, a duly authorized agent of **Hynds Environmental Systems Ltd,** believe on reasonable grounds that, as at today's date and following the successful commissioning and the ongoing maintenance of this system, and assuming the system is operated as per the original design, the median standards in the table below can be achieved. I also believe that the irrigation disposal field has been designed to best practice and will not cause any adverse affect to the local surrounds assuming the loading rate specified is a true reflection on the receiving soils properties.

	BOD (mg/L)	TSS (mg/L)	TN (mg/L)	Faecal Colform
Treatment Level	<5	<5	<20-35	<1

The above standards are in excess of the requirements stated in NZS/AS 1547:2000.

.....
(Signature of Duly Authorized Agent)

15 September, 2006
(Date)

on behalf of **Hynds Environmental Systems Ltd**

Note: This Producer Statement is limited to the design of the Hynds MBR Wastewater Treatment System and Effluent disposal field only and does not cover any geotechnical considerations for the site. All information should be read in conjunction with the site geotechnical report where available.

The maintenance of the system is to be completed by an authorized agent and will include the availability of 24 hour emergency callout coverage either directly or through a duly appointed agent.

Ken Higgie Ltd Trading as:-
Pearson & Higgie
Water Systems Consultants
P.O. Box 52,
Alexandra

Ken Higgie
Mobile 0274 716 411 Ph/fax 03 448 7673
email khiggie@es.co.nz

Thursday, 17 August 2006

Ben Jedrej,
Weber Consulting Ltd
PO Box 1587,
Queenstown
Via Email

Dear Ben,

Re :- Walter Peak Water Supply – Proposed System

1. Site data

Water source	Lake Wakatipu
Mean level	RL 309.956 (1962 – 2004)
Historical high	RL 312.78 (Nov 1999)
Lowest level	RL309.315 (1962 – 2004)
Existing GL level at pump site	RL315
Storage level	RL353 base of tank farm
Tank height	3.0m
Rising main length	370m

2. Water Requirement

Max. daily demand	55,000 litres per day (as advised)

3. Water Storage

Fire storage	90,000 litres
Total storage	Say 6 x 30,000 litre tanks = 180,000 litres = fire reserve plus 1.6 days domestic storage

4. Pumping System

Design flow	1.0 l/s
Domestic demand	15.3 hours pumping per day to provide 55,000 litres
Replenishment of fire reserve	25 hours pumping @ 1.0 l/s to replace 90,000 litres
Pumping arrangement	2 pumps – duty/standby

Rising Main	DN110PN12 connected to base of storage tanks to provide gravity flow for filter backwash
Intake pipe	1 x DN63PN12 pipe per pump
Pump station to intake	Approx. 100m
Approx. intake level	RL 299 (nominal 11m submergence)
Pump shed	3m x 3m internal dimension insulated with concrete floor
Floor level	RL314 (1m below existing GL)
Frost protection	Wall mounted fan heater with thermostat

5. Estimated Pumping Head at 1.0 l/s

Tank height	3.0 m
Static (353-310)	43.0 m
Friction Loss (370m DN110PN12 PE80)	0.2 m
Allowance plant losses	3.0 m
Suction losses (100m DN63PN12 PE80)	0.7 m
Total Head	49.9 m

6. Pumps

Make/model	Mono ASP420
Motor	2.2 kW 4 pole 400 VAC 3 phase
Capacity	1.0 l/s @ 50m at 1070 rpm
Speed/flow control	VSD controlled by flowmeter

7. Water Treatment

Plant providing Log 3 biological reduction for 1.0 l/s:-

- Pre filter in lake - 2.5mm slot SS screen
- Multi-media sand filter to 15 microns with auto backwash
- Cartridge filter to 5 microns
- UV sterilization (min. dose 40 mJ/cm^2)
- Tubidity meter

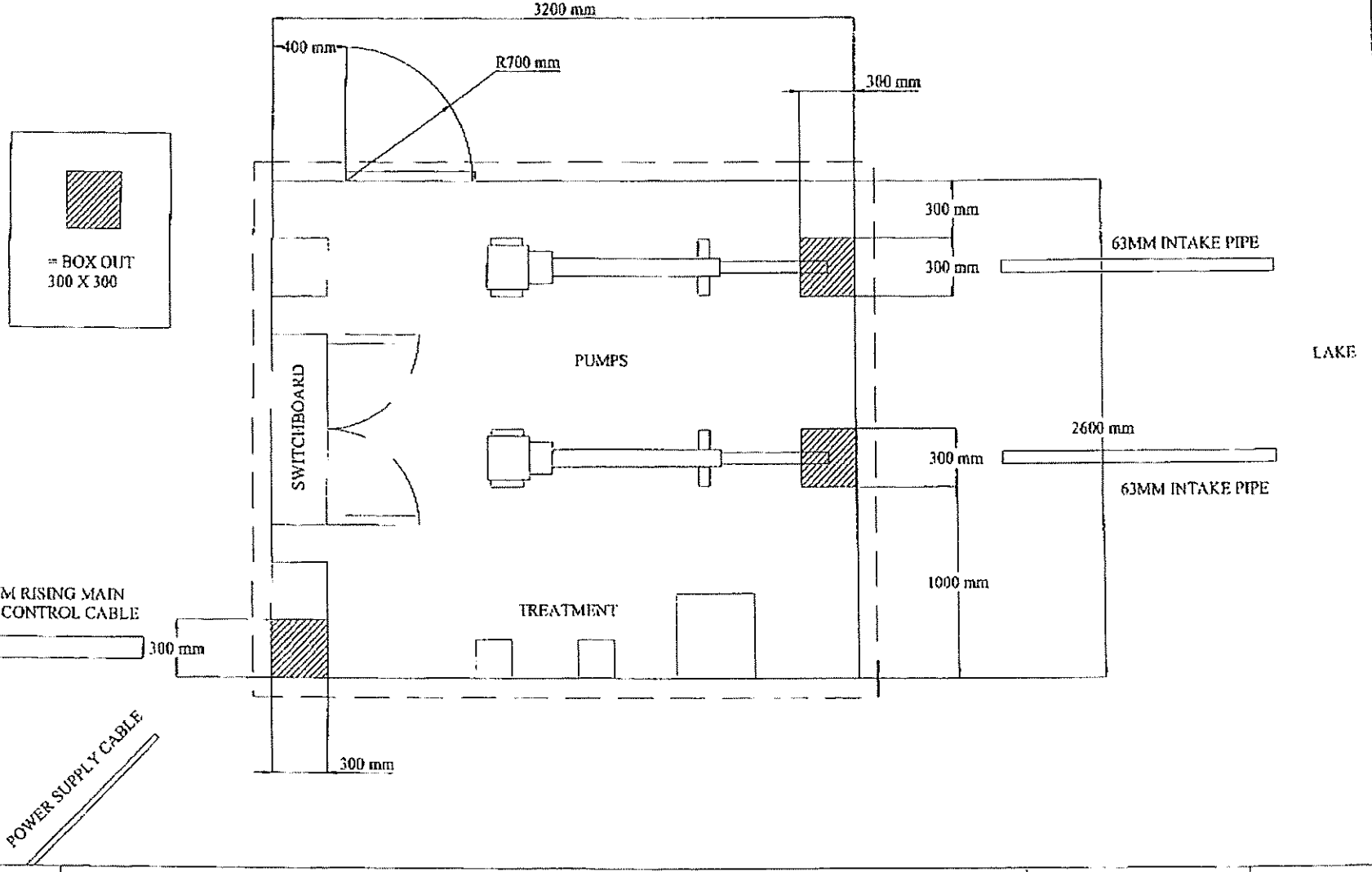
8. Controls

Refer attached

Yours faithfully,

K. J. Higgie

Ken Higgie



Ken Higgie Ltd,
Water Systems Consultant,
P.O. Box 52,
Alexandra
Phone/fax 03 4487673
Cell 0274 716411
Email khiggie@es.co.nz

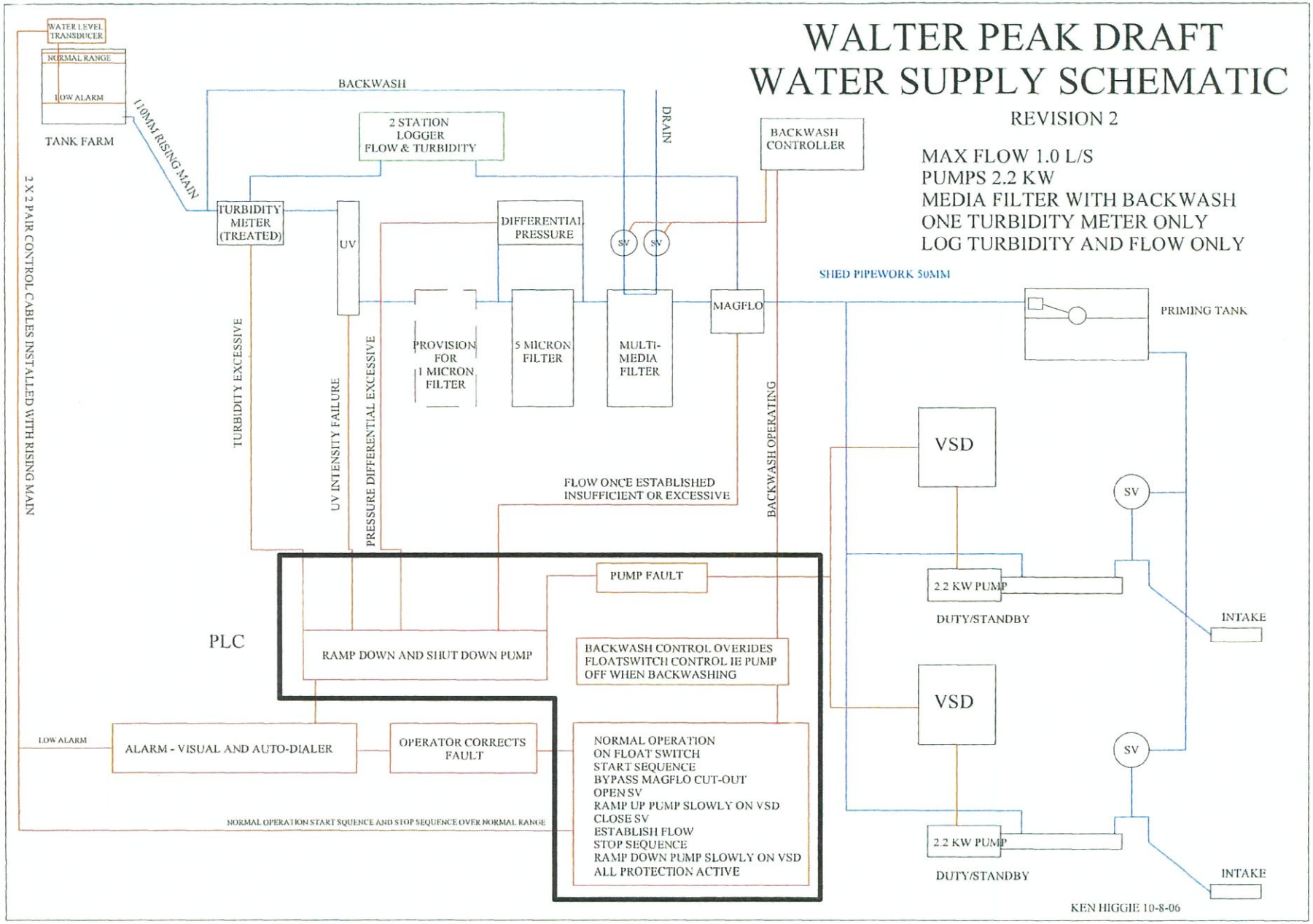
WALTER PEAK DEVELOPMENTS LTD
PUMP SHED LAYOUT

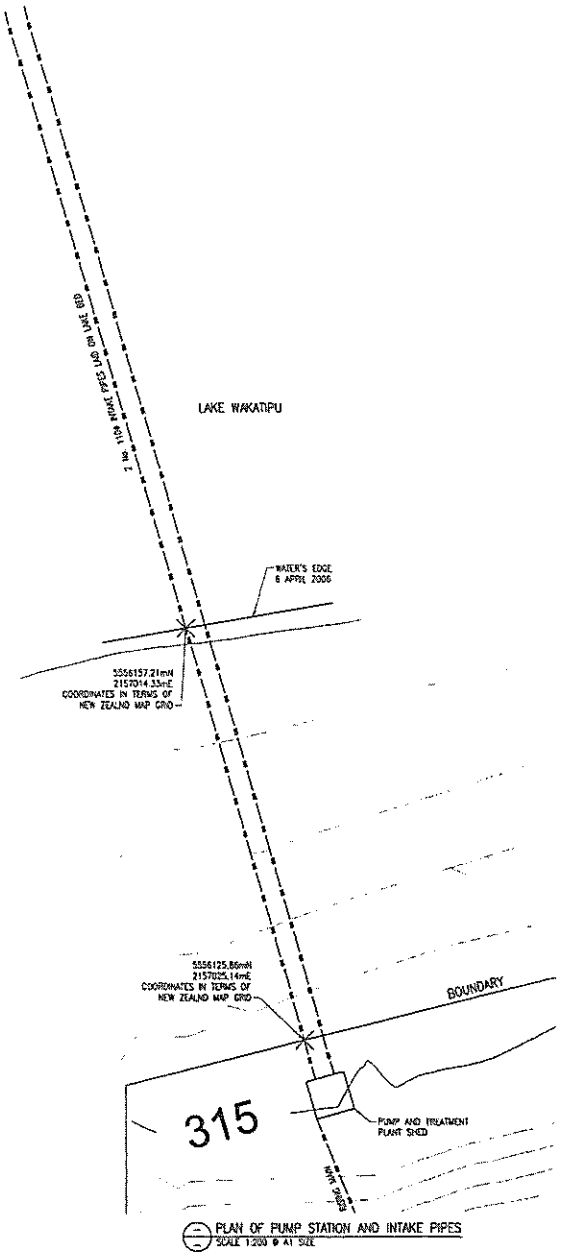
DRAWN - K. HIGGIE	REF - WP 1
DATE - 19/11/06	
SCALE - 1:30 (A4)	
FILE :- P&H\	

WALTER PEAK DRAFT
WATER SUPPLY SCHEMATIC

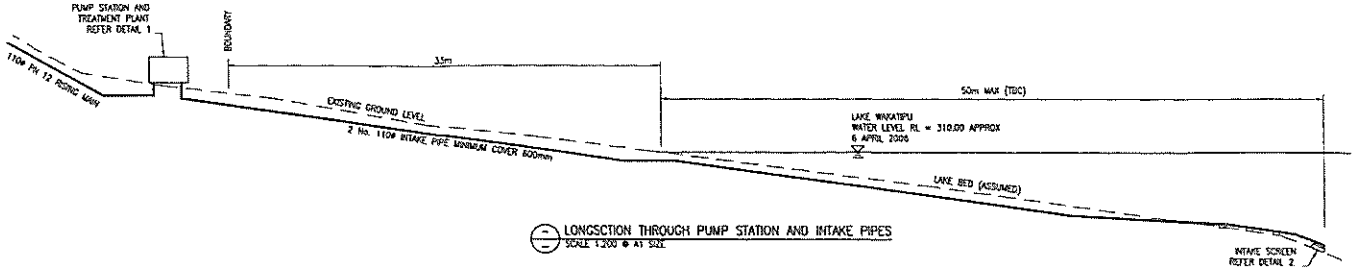
REVISION 2

MAX FLOW 1.0 L/S
PUMPS 2.2 KW
MEDIA FILTER WITH BACKWASH
ONE TURBIDITY METER ONLY
LOG TURBIDITY AND FLOW ONLY

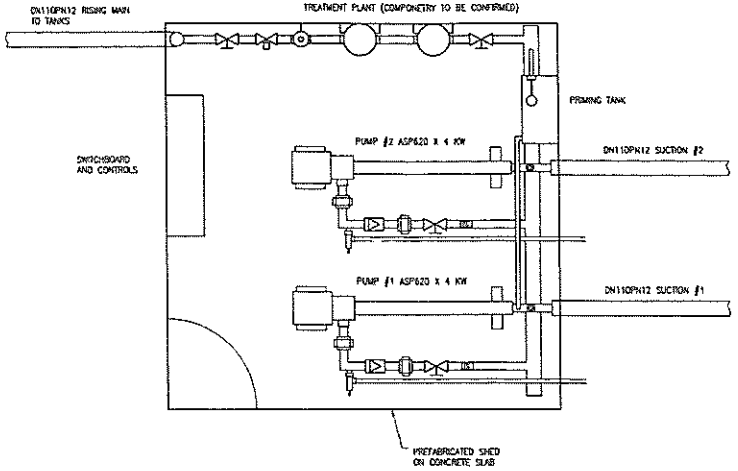




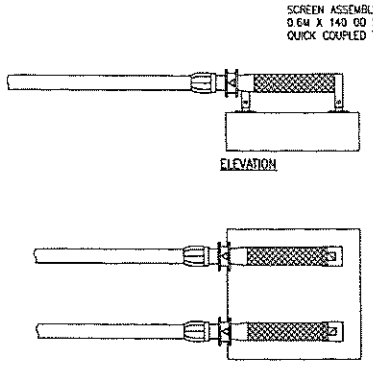
PLAN OF PUMP STATION AND INTAKE PIPES
SCALE 1:200 @ A1 SIZE



LONGSCTION THROUGH PUMP STATION AND INTAKE PIPES
SCALE 1:200 @ A1 SIZE



LAYOUT OF PUMPS AND TREATMENT PLANT
SCALE 1:20 @ A1 SIZE



2 INTAKE SCREENS
SCALE 1:20 @ A1 SIZE

Rev.	Revision	By	Date
D	FOR TENDER	BRJ	10.07.06
B	ENGINEERING APPROVAL	BRJ WK	10.07.06
A	DOC EASEMENT	BRJ WK	24.04.06

FOR TENDER

For Construction signed off by | Date

Refer to Revision 1 for original signature

Job Title: WALTER PEAK

Drawing Title: WATER SUPPLY
PUMP STATION &
INTAKE PIPES

weber consulting engineers
Level 2, The Forge, Athol Street, PO Box 1587, Queenstown
T 03 442 7230 F 03 442 7232 E warrick@weberconsulting.co.nz

Drawn by	Designed by	Scale @ A1
BRJ	BRJ	1:1000

Drawing No: 1107/201

Revision: 0

weber
consulting engineers
PO Box 1587, Queenstown

Title Walker Peak - Water Supply Daily Demand and Storage Page No. 1

Job No. 1107 Date 7 June 2006 Cals. by R. Jeckny.

Population

8 Residencial Lots

8 Cottages

Lodge equivalent to 10 Residences.

Invercargill Council Requirements

1000 l/day to each lot.

9 lots × 1000 = 9000 l/day which seems insufficient for council requirements.

8 Residencial Lots × 3 persons = 24 persons

8 Cottages × 2 persons = 16 persons

1 Lodge equiv to 10 residences × 3 persons = 30 persons

70 persons

QLDC Daily consumption = 700 l/person/day

∴ Daily consumption = 700 × 70 = 49,000 l/day

Allow for 3 days emergency storage

= 3 × 49,000 = 147,000 l

∴ 6 × 24750 litre tanks required.

Say install 4 then add 2 as demand requires.

4 tanks will satisfy the fighting demand of 45,000 l storage.

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Title Walter Peak - Pressures and Flow Check Page No. 1

Job No. 1107 Date 8-06-06 Cals. by B. Jedrej

Fire fighting Flows

Check that flows and pressure are compliant with the NZFS code of practice whilst maintaining minimum flow of 40 L/min to each lot.

Residential Lots

8 dwellings = 8 × 40 l/min = 5.3 l/s

Fire fighting W3 = 2 × 12.5 l/s = 25.0 l/s

30.3

Lodge + Cottages

8 Cottages = 8 × 40 L/min = 5.3 l/s

1 unit Lodge equivalent to 10 houses

∴ Demand = 10 × 40 l/min = 6.7 l/s

Fire fighting W3 = 2 × 12.5 l/s = 25.0 l/s

37.0 l/s

Fire fighting pressure @ T junction.

Fire to either residences or Lodge.

Flow = 42.3 l/s ✓

Pipe DN = 150 mm Colebrook. White, k = 0.15 mm

V = 2.4 m/s OK for Fire Fighting

H/L = 0.039 m/m

Head loss from tanks to T. junction

① Entry loss (entry inlet) $k = 0.5$

$$\text{Head loss} = 0.5 \times \frac{V^2}{2g}$$

$$= 0.5 \times \frac{2.4^2}{2g} = 0.15\ m$$

② Pipe friction loss

$$\text{Head loss} = 0.039 \times 170 = 6.63\ m$$

Total head loss = 6.78

Static Head @ junction = 353 − 337 = 16 m

Residual firefighting head = 16 − 6.78 = 9.22 m

Firefighting pressure @ 1st floor level

Flow = 42.3 − 12 = 30.3 l/s

Pipe DN = 150 mm Colebrook-White k = 0.15 mm

V = 1.7 m/s ✓

H/L = 0.021 m/m

Head Losses

① T-junction line to branch. k = 1.00

head loss = $1.00 \times \frac{1.7^2}{2g}$ = 0.15' ✓

② Gate valve k = 0.20

head loss = $0.20 \times \frac{1.7^2}{2g}$ = 0.03' ✓

③ Friction Loss

0.021 × 52	= 1.09
Total Head Loss	1.27

Residual Head @ FH1

= Residual Head @ T-junction − Total Head Loss + Static Head

= 922 − 1.27 + (737 − 330) = 14.95' m ✓

Fire fighting pressure @ 2nd Residential FH

Flow = 30.3 − 12.5' − 3 × 40 l/min = 15.8 l/s ✓

Pipe DN = 150 mm Colebrook-White k = 0.15 mm

V = 0.89 m/s

H/L = 0.0057 m/m

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PO Box 1587, Queenstown

Title ______________________ Page No. 4

Job No. ________ Date ________ Cals. by ________

Head Losses

Head loss due to junction

$0.0057 \times 121 = 0.69$

Residual Head @ FH2

= Residual Head @ FH1 − Head Loss + Static Head

$= 14.95 - 0.69 + (330 - 328) = \underline{\underline{16.26\ m}}$ ✓

For firefighting in residential areas a W? supply is achieved with a 150mm DN pipe. Residual pressure all > 10 m in 100 min. Velocities < 1.5 m/s.

———————————— // ————————————

Firefighting @ Lodge.

Flow from junction = 37.0 l/s ✓

Pipe DN = 150mm Colebrook-White k = 0.15 mm

$V = 2.1$ m/s

$H/L = 0.030$ m/m

Head losses.

Flow thro T junction $= 0.35 \times \frac{2.1^2}{2g} = 0.08$

Flow thro 2× 45° bend $2 \times 0.35 \times \frac{2.1^2}{2g} = 0.16$

Friction losses $= 219 \times 0.03 = \underline{6.57}$

6.81m

Title
Page No. 5

Job No. Date Cals. by

Residual Firefighting head @ FH3 =

= Residual Pressure at junction - Friction loss + static head

= 922 - 6.81 + (337 - 318) = 21.41 m ✓

Residual Firefighting head @ FH4

Flow = 37 - 12.5 - 2×60 L/min = 22.5 l/s ✓

Pipe DN = 150mm Colebrook roughness = 0.15 mm

V = 1.27 m/s

h_f/L = 0.012 m/m

Pipe friction loss = 0.012 × 75 = 0.9 m

Residual Pressure

= 21.41 - 0.9 + (318 - 323) = 15.5 m ✓

The minimum requirement for pressure and flow specified in the NZFS Code of Practice are met at all 4 fire hydrants. However the minimum pressure of 300 kPa required by the council will not be met. Explore solutions eg. booster pump to increase pressures or check valves to prevent contamination.

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PO Box 1587, Queenstown

Title _____ Page No. 6

Job No. _____ Date _____ Cals. by _____

Peak Daily Flows

Check that flows and pressures are compliant with Council requirements during anticipated peak daily flows.

Look at West Case Building Platform & - furthest away and Second Highest.

Peak flow per person.

Daily consumption = 700 l/per/day

Peak factor = 6.6 (Rest of Queenstown)

Peak flow per person = 0.053 l/per/s

From Tanks to T- junction.

Total Persons = 70

Total flow = 70 × 0.053 = 3.71 l/s

Pipe Ø = 90mm Colebrook - White = 0.15mm

V = 0.2

H/L = 0.00036

Residual pressure @ T- Junction

Exit/Entry Loss = $0.5 \times \frac{0.2^2}{2g} = 0.001$

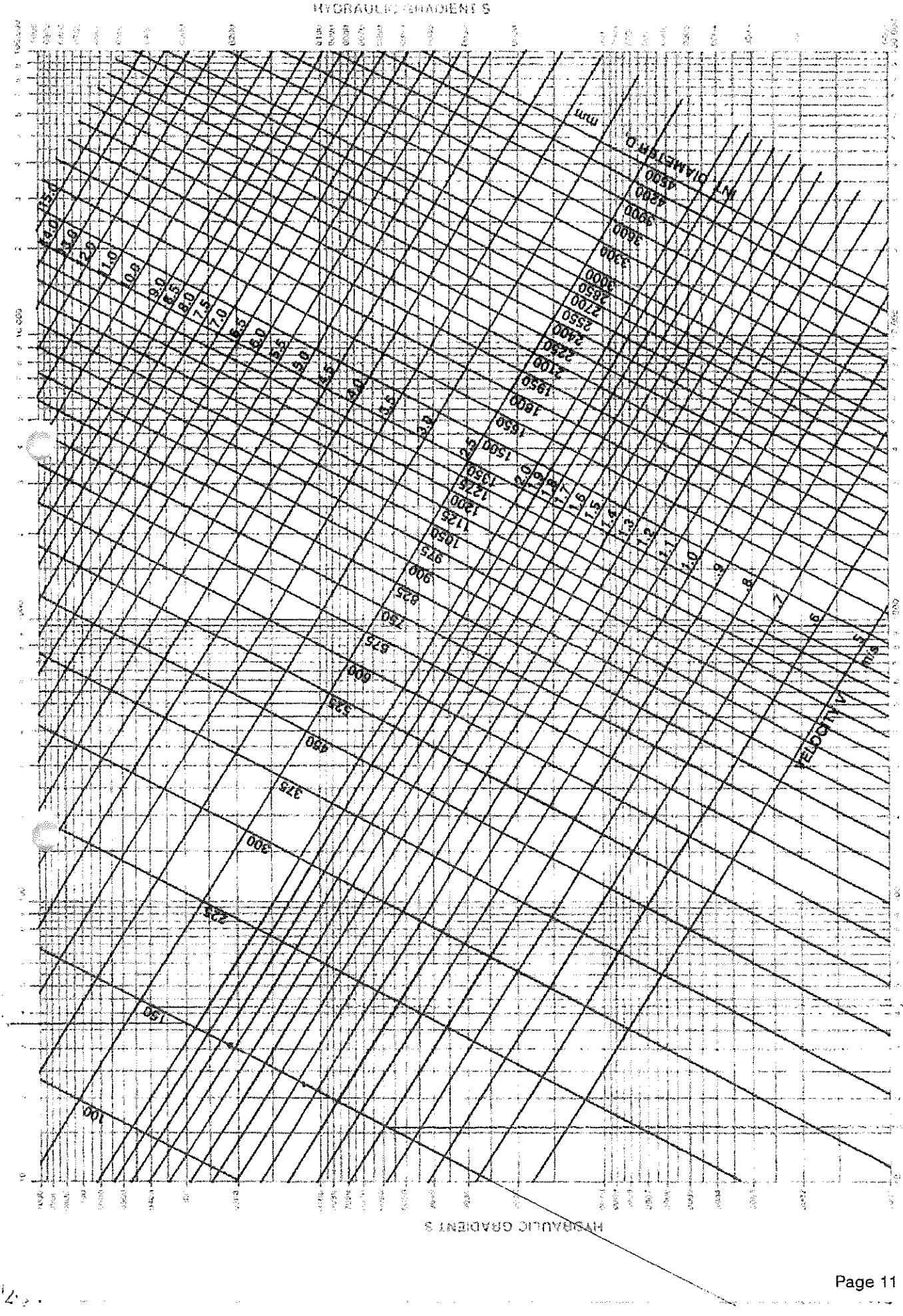
Friction Loss = 0.00036 × 170 = 0.0612

0.0622

By inspection max head loss due to major and minor losses in pipe is unlikely to be greater than 1m in the residential area and 2m for the Lodge and Cottages.

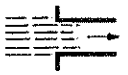
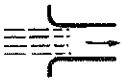
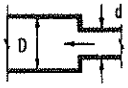
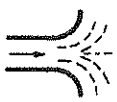
However there is insufficient static head to provide enough pressure for the Building Platforms to comply with the Council requirement for 30m. Worst case is platform 1 and 8 which will each have approximately 18m and 15m respectively.

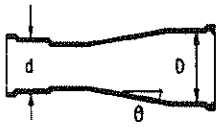
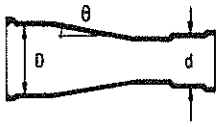
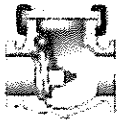
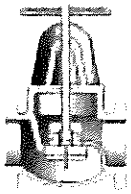
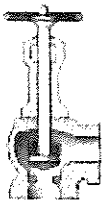
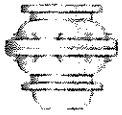
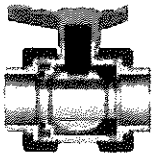
The Lodge, the 3 cottages to the west and the cottage to the east should comply but the four cottages located on the bank to the South east will not.



Design

RESISTANCE COEFFICIENTS FOR VALVES, FITTINGS AND CHANGES IN PIPE CROSS-SECTION.

TYPE OF FITTING		K
PIPE ENTRY LOSSES		
Square Inlet		0.50
Re-entrant Inlet		0.80
Slightly rounded Inlet		0.25
Bellmouth Inlet		0.05
PIPE INTERMEDIATE LOSSES		
Elbows: R/D < 0.6 e.g. uPVC		45° 0.35 90° 1.10
Long Radius Bends (R/D>2)		11¼° 0.05 22½° 0.10 45° 0.20 90° 0.50
TEES		
(a) Flow in line		0.35
(b) Line to branch flow		1.00
SUDDEN ENLARGEMENTS		
Ratio d/D		
0.9		0.04
0.8		0.13
0.7		0.26
0.6		0.41
0.5		0.56
0.4		0.71
0.3		0.83
0.2		0.92
<0.2		1.00
SUDDEN CONTRACTIONS		
Ratio d/D		
0.9		0.10
0.8		0.18
0.7		0.26
0.6		0.32
0.5		0.38
0.4		0.42
0.3		0.46
0.2		0.48
<0.2		0.50
PIPE EXIT LOSSES		
Square Outlet		1.00
Rounded Outlet		1.00

TYPE OF FITTING		K
GRADUAL ENLARGEMENTS		
Ratio d/D q = 10° typical		
0.9		0.02
0.7		0.13
0.5		0.29
0.3		0.42
GRADUAL CONTRACTIONS		
Ratio d/D q = 10° typical		
0.9		0.03
0.7		0.08
0.5		0.12
0.3		0.14
VALVES		
Gate Valve (fully open)		0.20
Reflux Valve		2.50
Globe Valve		4.00
Butterfly Valve (fully open)		0.20
Angle Valve		5.00
Foot Valve with strainer hinged disc valve unhinged (poppet) disc valve		15.00 10.00
Air Valves		zero
Ball Valve		0.10

weber
consulting engineers
PO Box 1587, Queenstown

Title Determination of Waste Water Flows. Page No. 1

Job No. 1107 Date 7 Jul 2006 Cals. by [illegible]

Population

8 Residential lots

=> 8 × 3.5 persons = 28 persons (QLDC commencement b 4404)

8 Cottages

=> 2 persons per cottage = 16 persons

Lodge equivalent to 10 residences

=> 10 × 3.5 = 35 persons

79 persons.

Wastewater

Average daily flows per persons from QLDC commencements b 4404 = 300 l/h/d

Average daily flow = 79 × 300 = 23,700 l/d

SIXTH SCHEDULE

FORM OF PRODUCER STATEMENT - CONSTRUCTION

ISSUED BY: ***Pearson and Higgie*** .....
(Contractor)

TO: .....***Faulks Enterprises Ltd*** .....
(Principal)

IN RESPECT OF: .....***Walter Peak Water Supply – Pumping and Water treatment Plant*** .....
(Description of Contract Works)

AT: .....***Walter Peak Developments, Walter Peak Station, Queenstown*** .....
(Address)

.....

.....***Pearson and Higgie***..... has contracted to..... ***Faulks Enterprises Ltd*** .....
(Contractor) *(Principal)*

to carry out and complete certain building works in accordance with a contract, titled ***Walter peak Development Water and Foul Sewer*** .....

..... (" the contract")
(Project)

I .....KEN HIGGIE..... a duly authorised representative of .....***Pearson and Higgie*** .....
(Duly Authorised Agent) *(Contractor)*

believe on reasonable grounds that .....***Pearson and Higgie*** ..... has carried out and completed *(Contractor)*

Part only as specified in the attached particulars of the building works in accordance with the contract.

K.J. Higgie ..... Date 8-5-07
(Signature of Authorised Agent on behalf of)

Pearson and Higgie .....
(Contractor)

Po Box 52 .....

Alexandra .....
(Address)

CITILAB, Box 781, Dunedin. Ph:03-4557938 Fax:03-4557940 Email: mail@citilab.co.nz

INTERIM REPORT ONLY

#30271

This emailed HTM or PDF report is "interim" - and should be followed by a full (signed) Laboratory Analysis Report by post.

Ken Higgie Ltd
(305 Dunstan Rd)
P.O. Box 52
ALEXANDRA

Friday, 11 May 2007

ATTENTION: Mr. Ken Higgie Order #:- 200014

LAB REF	Sample Taken:	Job Start:	Client Ref.	ANALYSIS	RESULT	Comments
42057	26/04/07 12:10:00	27/04/07 13:31:18	.... (Citilab to include explanatory notes with report) email results ASAP - Copy also to Simon Brackstone. Walter Peak Developments Ltd - Lake Wakitipu ~ Treated lake Water			
				Acidity	<5 g/m³ as CaCO3	Requires CO2
				Alkalinity to pH 4.5	25 g/m³ as CaCO3	
				Alkalinity to pH 8.3	<1 g/m³ as CaCO3	
				Bromide (IC)	<0.05 g/m³	
				Chloride (IC)	0.62 g/m³	
				Colour *	<0.5 C.P.U	
				Conductivity @ 25°C	5.9 mS/m	
				Fluoride (IC)	0.08 g/m³	
				Total Hardness	27.0 g/m³ as CaCO3	By Calculation
				pH	7.88 @ 20°C	
				Phosphate (IC) *	<0.4 g/m³	
				Phosphate-P (IC) *	<0.2 g/m³	
				Sulphate (IC)	4.4 g/m³	
				Turbidity - class 1	0.20 NTU	
			>>> Referral test: Hill Laboratories, Hamilt	Arsenic-Total	0.002 g/m³	Referral
			>>> Referral test: Hill Laboratories, Hamilt	Calcium-Total (ICP)	9.27 g/m³	ICP-MS (Referral)
			>>> Referral test: Hill Laboratories, Hamilt	Iron-Total (ICP)	<0.02 g/m³	ICP-MS (Referral)
			>>> Referral test: Hill Laboratories, Hamilt	Magnesium-Total (ICP)	0.92 g/m³	ICP-MS (Referral)
			>>> Referral test: Hill Laboratories, Hamilt	Manganese-Total (ICP)	0.330 g/m³	ICP-MS (Referral)
				E. coli (Quanti-Tray)	<1.0 MPN/100 mL	
				Nitrate (IC)	0.14 g/m³	
				Nitrate-N (IC)	0.03 g/m³	

These samples were collected by yourselves and analysed as received at the laboratory.

==========LAST PAGE OF REPORT==========

SCORPION
ENGINEERING LTD

O'Neills Lane Bruces Hill Alexandra PO Box 171 Phone/Fax +64 3 448 5421

Producer Statement

Date 23 May 2007
Certificate No. 0104

Issued To	Walter Peak
Issued By	Scorpion Engineering Limited
Designer	Peak Power Distribution, Scorpion Engineering Limited
Project Name	Walter Peak
Drawing Number	N/A
Design Serial Number	N/A

Peak Power Distribution Limited has confirmed that the design and installation of the high voltage and low voltage reticulation has been carried out in accordance with Aurora Energy network standards.

Scorpion Engineering has carried out the design of the high voltage earthing transformer and earth fault protection system in accordance with accepted electricity distribution standards. Peak Power Distribution Limited has confirmed that it has installed this transformer based on accepted installation procedures. The earthing transformer was tested according to standard practice.

The generator set was designed and supplied by others. This producer statement does not apply to the design or supply of the generator set. Peak Power Distribution Limited has confirmed that it has made the final connection to the generator, using accepted installation practices.

This certificate requires the following minor works to be carried out:

- Fitting of locks by the asset owner to all lockable electrical cabinets to prevent unauthorised access to dangerous voltages.

Santilal Parbhu
Chartered Professional Engineer (128102)

Santilal Parbhu
Mobile 0ONC65 599N
Email santilal@scorpioneng.co.nz
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patch

landscape ■ architecture ■ urban

Walter Peak Station - Landscape Assessment - Building Platforms

Document prepared by	Stephen Skelton
Document reviewed by	Felipe Braga
Client	WPS100
Status	Resource Consent
Issued	15 February 2021

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1. INTRODUCTION

1.1. This report provides an assessment of the landscape character and visual amenity effects of a proposed reconfiguration of an existing consent to construct a series of buildings for residential purposes near the foreshore of Lake Wakatipu. The following report includes:

- Assessment methodology
- A description of the site and surrounding landscape,
- A description of the proposal,
- A landscape assessment,
- Conclusion,
- Attachments.

2. ASSESSMENT METHODOLOGY

2.1. In undertaking this landscape assessment, Patch visited the site on several occasions and viewed the site from surrounding public places, including the surface of Lake Wakatipu. Photographs were taken using a digital SLR camera and these photographs are attached to this report (**Attachment A and Images**).

2.2. An assessment of the proposal's actual and potential effects on landscape character and visual amenity is undertaken in the frame of the relevant statutory considerations directed by the District Plan(s). This report uses the following definitions:

- Landscape character effects – These effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced. This may in turn affect the perceived value ascribed to the landscape.
- Visual effects – Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity.
- Landscape – Landscape is the cumulative expression of natural and cultural features, patterns and processes in a geographical area, including human perceptions and associations. [1]

[1] The Quality Planning Resource

Extent of Effect

2.3. In assessing the extent of effect, this report uses the following seven-point scale:

very high, high, moderate-high, moderate, moderate-low, low, very low.

2.4. An effects rating of moderate–low corresponds to a 'minor' adverse effects rating. An adverse effects rating of "low' or 'very low' corresponds to a 'less than minor' adverse effects rating.

3. DESCRIPTION OF THE SITE AND SURROUNDING LANDSCAPE

3.1. The site is large (approximately 40ha) rural property between the foot of Walter Peak and the surface of the Lake Wakatipu (**Attachment A**). It is approximately 2.17km west of the Walter Peak High Country Station, 7.42km southeast of Mt Nicholas Station and 4.3km south of Picnic Point (Pt 385) near Bobs Cove. The site is adjacent to and north of Mount Nicholas – Beach Bay Road which links Walter Peak High Country Station and Mt Nicholas Station with the Von Road which continues to the south across the high country to Mavora Lakes Road and SH94 in Southland.

3.2. The site is part of a rural, terrace landscape character unit wedged between the steeper, more densely vegetated mountain slopes to the south and Lake Wakatipu to the north. The landform has been shaped by a mix of glacial, lake and alluvial processes. Unlike much of the steeply sided lands adjacent to Lake Wakatipu's northern and southern arm, the southern shores of the lake's central arm are flatter. This is a result of the more recent process of erosion and deposition rather than the earlier process of the retreating and advancing Wakatipu Glacier which has sculpted the steeper sides of the lake. Between the Von River and Beach Bay the landform is characterized by a series of slightly sloped terraces segmented by scarps and incised by creeks and rivers. This terraced landform extends between the foot of the southern mountains to the shingle shores and rock headlands of Lake Wakatipu.

3.3. Pasture grass is the landscape's dominant land cover. The landscape also contains pockets of exotic and deciduous forest, riparian and wetland areas populated with indigenous grasses and sedges, swathes of mixed indigenous and exotic scrubland and areas of indigenous plantings. The site itself has been subject to robust ecological restoration planting and contains a large area of established and maturing indigenous vegetation.

3.4. This land is currently farmed and contains a few small farm services structures. It is part of a rural landscape which displays a character indicative of high country stations in Central Otago. Mick O'Day Creek passes through the site and flows into Lake Wakatipu, approximately 110m east of the marina site. This creek and its associated scarps, terraces, wetlands and vegetation are the dominant natural element of the site.

3.5. Between the site and the shores of the lake is a 20m wide marginal strip which is owned by the Crown and managed by the Department of Conservation. Within this marginal strip and the lake is an existing, 44m X 35m marina which was consented under RM021128. This marina contains a rock rip-rap around piles and berths. The entrance to the marina has been filled and closed due to the accumulation of long-shore drifted gravels. It is understood that entrance to the marina will often fill within weeks of excavation.

3.6. Land access to the site is by a gravel track which links the site to Mt Nicholas – Beach Bay Road.

3.7. For the purpose of this report, the site is broken into two areas; the marina area and the meadow area.

First Principles Assessment Under the Amended Pigeon Bay Criteria (EnvCrt C180/1999)

Natural Science Factors

3.8. While the topography of the Mt Nicholas - Walter Peak Lake Terrace area is dwarfed by the steep and craggy slopes and summits of the mountains which enclose Lake Wakatipu, the associations of the lake terraces to the lake and mountains are clearly presented in the land's series of terraces, scarps and incised water courses. The vegetation patterns of the landscape also highlight the landform as denser and larger stature vegetation is more prevalent on the site's slopes while the flatter terraces are mostly covered in pasture.

Aesthetic Values

3.9. The landscape's aesthetic values are intertwined with its diverse and distinct mix of natural and pastoral elements. The more modified landscape elements such as the pastoral units, roads, buildings and fences are interrupted by river and terrace scarps which cut through the

landscape. This mixed pattern of modified and natural elements conveys a patchwork which acts as an intermediary between the natural lake and mountain landscape. While the lake, foreshore and the surrounding mountains display a high degree of aesthetic qualities, the subject landscape increases the appreciation of these features by presenting a more tempered place between natural and outstanding features.

Expressiveness

3.10. The landscape's formative processes are not as obvious as the surrounding, glacially sculpted mountains, but the process of sedimentation and erosion, especially that expressed in the Von River delta is highly legible. The dynamic correlation of post glacial sculpting and environmental events which continue to shape the current landscape are expressed in the terraced and incised parts of the landscape.

Transient Values

3.11. The colours of the landscape vary through different times of the year and through changing land uses. This variance is typical of the pastoral land use which can change in colour between bright greens to tawny browns. The landscape's indigenous vegetation is generally consistent in colour throughout the year. The sporadic, exotic trees of the landscape can at times (autumn) create a high degree of contrast against the colours of the pastoral lands and native vegetation.

Shared and Recognized

3.12. While the human modification of the land has devalued the appreciation of its natural values, the pastoral elements have enhanced the shared and recognized appreciation of the classic 'high country' landscape. The appropriation of the land from its pre-human natural character to productive use is part of New Zealanders' cultural understanding of place. The pastoral layer in the landscape in many ways enhances the appreciation of the surrounding landscape as it presents a high degree of openness which can be viewed and understood through the lens of all cultural understandings.

Tangata Whenua

3.13. It is understood that these lands would have been frequented by Māori as they traversed the area's lands, lakes and rivers in search of Pounamu. The flatter lands of the landscape may

have provided safe refuge and the Von River may have provided access to the interior of the southern mountains and an overland link to the south.

Historical Associations

3.14. Pākehā historical associations with this landscape are most relevant to the settlements of Walter Peak Station and Mt Nicholas Station. The operational centres of these two large pastoral farms were historically sited at opposite ends of the landscape (Walter Peak to the east and Mt Nicholas to the west). The naturally occurring, pre-human vegetation of the wider landscape may have been burnt in favour of pasture and the terraces of the subject landscape are part of a mostly modified, pastoral character. The dwellings, structures and mature vegetation associated with the historical nodes of Walter Peak Station and Mt Nicholas Station are understood to be of high value to New Zealand's tourism industry. Both stations now run activities for visitors.

Landscape Classification

3.15. While the landscape category of the site is not indicated in the Queenstown Lakes District Councils (**QLDC**) Operative District Plan (**ODP**), the subject landscape is shown in the Proposed District Plan (**PDP**), Decisions Version map as being part of an Outstanding Natural Landscape (**ONL**). Following on from the above first principles assessment, it is determined that the whole of the Mount Nicholas - Walter Peak landscape character unit, which includes the flat lands between Walter Peak and Lake Wakatipu is part of the lake and mountain ONL.

Existing Baseline

3.16. The site's resource consent history is detailed in the Assessment of Environmental Effects attached to this application. In summary, the site has been subject to a series of resource consents which have resulted in the creation of eight residential lots with building platforms on the terrace above and south of the marina. The necessary infrastructure has been installed and earthworks undertaken to enable the council to issue 224c certification and enable the creation of these separate certificates of title, but no building platform has been built upon. To the east of the 8 lots is an approved lodge site and several other approved visitor accommodation buildings. Alongside this consent sits a suite of landscape and building conditions, including conditions requiring the implementation, management and monitoring

of extensive areas of indigenous plantings. Much of this planting has successfully established while none of the residential or visitor accommodation buildings have been constructed.

3.17. The overall anticipated character of the site is a landscape of high and increasing natural values harbouring residential development which will appear subservient to the natural character values and qualities of the landscape.

3.18. With regard to the marina area, three 162m^2 building areas are approved. These three building areas are permitted to each be 6m in height above existing ground level.

3.19. A visual interpretation of the approved built environment is attached to this report as **Image 14B**. It is also worth noting that while the site is within the Rural General Zone, the lands to the east of the site are part of a Rural Visitor Zone.

Statutory Considerations

3.20. The QLDC District Plan is currently under review. Much of the relevant landscape matters in the ODP are contained within Chapter 5 – Rural General. In terms of the PDP (Decisions Version), the landscape relevant matters are contained within Part 5 - *Tangata Whenua,* Part 6 - *Landscape and Rural Character* and Part 21 – *Rural.*

3.21. This assessment is undertaken in the frame of the relevant assessment matters with particular regard to:

ODP 5.4.2.2 (2) – Rural General, ONL District Wide;
PDP 21.21 – Rural, ONLs.

4. DESCRIPTION OF THE PROPOSAL

4.1. The complete details of the proposal are contained within the Assessment of Environmental Effects and the landscape plans which form part of this application.

4.2. In summary, this proposal seeks to reconfigure the existing consented development in the meadow and marina areas. The approved building areas would be amalgamated into four

separate building platforms with an overall permitted building coverage which will be 300m^2 less than to the consented building coverage.

4.3. On the meadow site, the groups of consented buildings will be consolidated into three building platforms. The proposed building platforms will be arranged near the centre of the meadow site with two 1000m^2 building platforms alongside one 830m^2 building platform. These building platforms will be no closer to the Lake Wakatipu foreshore than the existing approved building area.

4.4. To replace the three consented cottages near the marina, a proposed building platform will closely follow the boundary near the marina. There are proposed controls on this marina building platform which will see no more than 50% of the area covered in built development. This will be equal to the existing building area of the three consented cottages.

4.5. A visual interpretation of the proposed built environment is attached to this report as **Image 14C**.

4.6. A suite of design controls is also proposed (**Appendix A**). While many of these design controls are typical in ONL environment, there are specific design controls which will limit and control the visual effects with particular regard to glare and lighting. These design controls seek to present a built environment which is more sympathetic to and recessive than the consented development.

4.7. Some consented built development exists atop native planting areas, with particular regard to the three cottages nearest the marina. Similarly, the proposed building platform near the marina will take in parts of existing planting. It is proposed that if any planting shall be removed to accommodate future buildings that that planting shall be replaced in a similar density and composition on the slopes to the south of the meadow.

5. LANDSCAPE ASSESSMENT

Extent of Visibility

5.1. The following portion of this report will summarise the extent of visibility of the proposal from given locations. The assessment of visual and character effects will be addressed later under the provisions in the ODP and PDP.

5.2. The existing vegetation and landform of the site provide a high degree of visual screening. To the south of the site, a series of vegetated terrace risers associated with Mick O'Day Creek will screen the consented and proposed development area from southern views. West of the site, the terraces meet a rocky headland which screens much of the development area from western views. East of the site is a subtle terrace which screens the development area from more easterly, lake height views. Farther east is Von Hill (pt415) which encloses Beach Bay and screens the site from distant easterly views. The terrace riser south of the site screens the development area from any public places to the south while the rocky headland to the west of the marina will screen the proposed development from public places to the west. This landform creates a narrow window of theoretical visibility of the proposal. Similarly, the subtle, vegetated rise between the marina and the Mick O'Day Creek provides a level of screening, especially of the lower portions of the proposed development, as viewed from places to the south and east, but does not provide total screening of the development. Comprehensively, these vegetated landforms provide a textural and complex context in which well controlled and recessively clad and coloured buildings can be visually absorbed.

Visibility from the Glenorchy Road, walking tracks and other lands north of the site

5.3. Lake Wakatipu is in excess of 4.09km wide between the site and its southern shores. The proposal may theoretically be visible from parts of the Glenorchy Road between Rat Point (**Image 11**, 5.23km from the site) and Sunshine Bay (**Image 4**, 11.4km from the site). The proposal may also theoretically be visible from other private and public places near the northern shores of Lake Wakatipu including 7 Mile Reserve (**Image 5**), Wilson Bay (**Image 6**), and 12 Mile Delta (**Image 7**). Visual effects from these more distant places will be less in degree than those observed from the closest land-based view across the lake near Picnic Point (**Image 9**). From the bench at Picnic Point the site is not visible due to mature

vegetation. However, the southern loop track presents a few framed views of the site through vegetation (**Image 9**).

5.4. Generally, I consider well controlled recessively clad buildings in a vegetated context set against landforms to be reasonably difficult to see from distances between 2-3km. The level of development which is consented on the site will present built forms and patterns which are recognisably different from the ONL landscape. To the casual observer, the consented development will be well absorbed into the landscape such that there will be small change in visual effects. The more familiar observer may recognise a visual change in the landscape, as a result of giving effect to consented development, but I consider this change will not affect visual amenity from these distant places.

5.5. From lands north of the site, the proposal will result in no change in visual effect beyond what is consented and to an effect, will result in less potential visibility of development. This reduction is a result in a consolidation of built form and the introduction of glare and lighting controls which will reduce the effects of glare and lighting which may occur with the existing consented baseline.

Visibility from Private Places

5.6. There are several rural living areas on the mountain slopes north of Lake Wakatipu where the proposed development may potentially be visible. These areas include parts of the residential areas near Bobs Cove, Closeburn Station, the rural living areas near Wilson Bay, those on the knoll above the 7-Mile Reserve and some elevated properties on the southern shoulder of true Bobs Peak, near Alpine Retreat. The proposal will result in no change in views from these distant private places.

Visibility from the surface of Lake Wakatipu

5.7. From the surface of the lake, the proposed development will not be clearly visible until one approaches the vicinity of the site on the lake, within approximately 1km of the site (**Images 12 – 14**). From more distant locations on the lake the built development will be well absorbed within wider views of the broad and outstanding natural landscape. It is relevant to consider views from Southern Discoveries boat which transports tourists between Queenstown and

Mt Nicholas Station. As I understand this boat rarely comes within 1km of the site and I consider the proposal will result in no change in visual effects from what is consented as viewed from this boat and route.

5.8. As the observer approaches the site from the lake, the scale of the consented development will become increasingly apparent. The proposed development will be well absorbed visually within the landscape's natural elements (**Image 12**). The foreshore and associated vegetation will act as the foreground to views from the lake and the development will be set behind these features and set against a context of a vegetated terrace riser.

Visibility from Lake Wakatipu's southern foreshore

5.9. The 20m marginal strip is a public place and much of this strip is densely vegetated. The public is most likely to experience the site from the rocky foreshore, which is low in the landscape. The marina building platform may theoretically be visible when an observer is adjacent to the site. As discussed above, the site is well contained by landforms and vegetation. The meadow building platforms will be set back from the marginal strip and will not be visible from the foreshore. The marina building platform however may be visible when the observer is in the immediate area of the marina (**Image 14**). This visibility is limited to the immediate area around the marina.

ODP Assessment Matters 5.4.2.2 (2) Outstanding Natural Landscapes (District Wide)

(a) Potential of the landscape to absorb development

(i) whether, and to what extent, the proposed development is visible from public places;

(ii) whether the proposed development is likely to be visually prominent to the extent that it dominates or detracts from views otherwise characterised by natural landscapes;

5.10. The extent of the proposal's visibility is discussed above. It is considered the proposal will not increase any visual effects of the consented development and, to a small extent, will act to decrease the extent of visible built development. The proposal presents a more consolidated building area and reduces the spread of built development, especially on the more elevated

slopes above the proposed meadow building platforms. Similarly, the proposal introduces design controls which will act to render future buildings more visually recessive within the landscape than the consented development.

5.11. The proposal will not act to increase any visible built development and will not dominate or detract from views otherwise characterised by natural landscapes

(iii) whether any mitigation or earthworks and/or planting associated with the proposed development will detract from existing natural patterns and processes within the site and surrounding landscape or otherwise adversely affect the natural landscape character;

5.12. Significant planting has occurred within the site. While there may be some vegetation removed near the marina building platform, this vegetation will be replaced on the slopes above the meadow building platforms. It is relevant to note that the existing consented three cottages near the marina are also in places where revegetation planting has occurred and this vegetation would likely be removed to allow for the approved development. It is considered the existing revegetation planting has contributed to an increase in the natural landscape character and the proposal will continue and maintain this increasing natural character.

(iv) whether, with respect to subdivision, any new boundaries are likely to give rise to planting, fencing or other land use patterns which appear unrelated to the natural line and form of the landscape; wherever possible with allowance for practical considerations, boundaries should reflect underlying natural patterns such as topographical boundaries;

5.13. Subdivision does not form part of this proposal.

(v) whether the site includes any indigenous ecosystems, wildlife habitats, wetlands, significant geological or geomorphologic features or is otherwise an integral part of the same;

(vi) whether and to what extent the proposed activity will have an adverse effect on any of the ecosystems or features identified in (v);

5.14. As discussed above there may be some removal of recently planted revegetation, but any removed vegetation will be replanted or replaced above the meadow building platforms. The proposal will not result in adverse effects on ecosystems to a more than very low degree.

(vii) whether the proposed activity introduces exotic species with the potential to spread and naturalise.

5.15. No exotic species with the potential to spread and naturalise are proposed.

(b) Effects on openness of landscape.

(i) whether and the extent to which the proposed development will be within a broadly visible expanse of open landscape when viewed from any public road or public place and in the case of proposed development in the vicinity of unformed legal roads, the Council shall also consider present use and the practicalities and likelihood of potential use of unformed legal roads for vehicular and/or pedestrian, equestrian and other means of access; and

(ii) whether, and the extent to which, the proposed development is likely to adversely affect open space values with respect to the site and surrounding landscape;

5.16. The proposal will not act to increase any visibility of development as view from any public road or public place. It will act to consolidate built development into a smaller area than the consented development would allow. This will result in a very low positive effect on open space values as it will retain a larger part of the landscape in open space.

(iii) whether the proposed development is defined by natural elements such as topography and/or vegetation which may contain any adverse effects associated with the development.

5.17. The development area is contained by the terrace riser to the south, Von Hill to the east and the rocky headland west of the marina area. Similarly maturing vegetation around the site is increasing the containment values of these natural landforms.

(c) Cumulative Effects on Landscape Values

(i) whether, and to what extent, the proposed development will result in the introduction of elements which are inconsistent with the natural character of the site and surrounding landscape;

(ii) whether the elements identified in (i) above will further compromise the existing natural character of the landscape either visually or ecologically by exacerbating existing and potential adverse effects;

(iii) whether existing development and/or land use represents a threshold with respect to the site's ability to absorb further change;

(iv) where development has occurred or there is potential for development to occur (ie. existing resource consent or zoning), whether further development is likely to lead to further degradation of natural values or inappropriate domestication of the landscape or feature.

5.18. The proposal will not introduce any elements which would be inconsistent with the natural character of the surrounding landscape. As the proposal will result in less spread of built development across the site, it will not act to exacerbate any existing and potential adverse effects on the natural character of the surrounding landscape.

5.19. The proposal will not cross a threshold with respect to the landscape's ability to absorb further change. It is considered there is scope within the landscape for further appropriate

development to occur without unacceptably degrading the natural values of the landscape or leading to inappropriate domestication of the landscape.

(d) Positive Effects

(i) whether the proposed activity will protect, maintain or enhance any of the ecosystems or features identified in (a)(v) above;

(ii) whether the proposed activity provides for the retention and/or re-establishment of native vegetation and their appropriate management;

5.20. As discussed above there may be some removal of recently planted revegetation to accommodate development in the marina building platform. It is worth noting that the three consented cottage platforms near the marina are within approved and planted vegetation. The proposal will not exacerbate any adverse effects associated with the removal of vegetation and proposes to replace any vegetation removed to accommodate the marina building platform on the slopes above the meadow building platforms. All other existing vegetation will continue to be maintained and retained through the existing management regime.

(iii) whether the proposed development provides an opportunity to protect open space from further development which is inconsistent with preserving a natural open landscape;

(iv) whether the proposed development provides an opportunity to remedy or mitigate existing and potential (ie. structures or development anticipated by existing resource consents) adverse effects by modifying, including mitigation, or removing existing structures or developments; and/or surrendering any existing resource consents;

5.21. The proposal seeks to remove several consented building areas and replace them with one consolidated group of building platforms. This will have the effect of reducing the spread of built development across the site, with particular regard to the existing consented building

on the upper, southern meadow site. The proposal will result in a very low positive effect on open character and visual amenity.

(v) the ability to take esplanade reserves to protect the natural character and nature conservation values around the margins of any lake, river, wetland or stream within the subject site;

(vi) the use of restrictive covenants, easements, consent notices or other legal instruments otherwise necessary to realise those positive effects referred to in (i)- (v) above and/or to ensure that the potential for future effects, particularly cumulative effects, are avoided.

5.22. There are no new provisions for protection of natural character or nature conservation values on the lake margins. The existing provisions will be maintained. Similarly no new covenant, easements consent notices or other legal instruments are proposed.

PDP Assessment Matters 22.2.1 Outstanding Natural Features and Outstanding Natural Landscapes (ONF and ONL)

The assessment matters set out below are derived from Policies 3.3.30, 6.3.10 and 6.3.12 to 6.3.18 inclusive. Applications shall be considered with regard to the following assessment matters:

21.21.1.1 In applying the assessment matters, the Council will work from the presumption that in or on Outstanding Natural Features and Landscapes, the applicable activities are inappropriate in almost all locations and that successful applications will be exceptional cases where the landscape or feature can absorb the change and where the buildings and structures and associated roading and boundary changes are reasonably difficult to see from beyond the boundary of the site the subject of application.

5.23. The existing consent allows for a total of 3,333m^2 of buildable area. The proposal seeks to slightly reduce this allowable buildable area to 3,330m^2 and to consolidate built development into a more localised building area. This is an exceptional proposed which seeks to amend consented built development in a manner which will consolidate built development, reducing

the spread of buildings across the site and reducing visual effects through the implementation of design controls. The proposal will result in very low positive effects on the landscape.

21.21.1.2 Existing vegetation that:

a. was either planted after, or, self-seeded and less than 1 metre in height at 28 September 2002; and,

b. obstructs or substantially interferes with views of the proposed development from roads or other public places, shall not be considered:

i. as beneficial under any of the following assessment matters unless the Council considers the vegetation (or some of it) is appropriate for the location in the context of the proposed development; and

ii. as part of the permitted baseline.

5.24. All exiting vegetation on site is part of the existing baseline.

21.21.1.3 Effects on landscape quality and character

In considering whether the proposed development will maintain or enhance the quality and character of Outstanding Natural Features and Landscapes, the Council shall be satisfied of the extent to which the proposed development will affect landscape quality and character, taking into account the following elements:

a. physical attributes:

i. geological, topographical, geographic elements in the context of whether these formative processes have a profound influence on landscape character;

ii. vegetation (exotic and indigenous);

iii. the presence of waterbodies including lakes, rivers, streams,

b. visual attributes:

i. legibility or expressiveness – how obviously the feature or landscape demonstrates its formative processes;

ii. aesthetic values including memorability and naturalness;

iii. transient values including values at certain times of the day or year;

iv. human influence and management – settlements, land management patterns, buildings, roads.

c. Appreciation and cultural attributes:

i. Whether the elements identified in (a) and (b) are shared and recognised;

ii. Cultural and spiritual values for Tangata Whenua;

iii. Historical and heritage associations.

The Council acknowledges that Tangata Whenua beliefs and values for a specific location may not be known without input from iwi.

d. In the context of (a) to (c) above, the degree to which the proposed development will affect the existing landscape quality and character, including whether the proposed development accords with or degrades landscape quality and character, and to what degree.

5.25. I note that a first principles assessment of the landscape values is contained above in part 3.4 – 3.14 of this report. It is considered the proposal will result in no changes in the landscape's quality and character beyond what is anticipated by the consented baseline and to a very low degree will result in positive effects with regard to the visual and physical attributes of the landscape. This very low positive effect is attributed to the reduced spread of built development across the site,

e. any proposed new boundaries will not give rise to artificial or unnatural lines (such as planting and fencelines) or otherwise degrade the landscape character.

5.26. No new boundaries are proposed

21.21.1.4 Effects on visual amenity

In considering whether the potential visibility of the proposed development will maintain and enhance visual amenity, values the Council shall be satisfied that:

a. the extent to which the proposed development will not be visible or will be reasonably difficult to see when viewed from public roads and other public places. In the case of proposed development in the vicinity of unformed legal roads, the Council shall also consider present use and the practicalities and likelihood of potential use of unformed legal roads for vehicular and/or pedestrian, cycling, equestrian and other means of access;

b. the proposed development will not be visually prominent such that it detracts from public or private views of and within Outstanding Natural Features and Landscapes;

c. the proposal will be appropriately screened or hidden from view by elements that are in keeping with the character of the landscape;

d. the proposed development will not reduce the visual amenity values of the wider landscape (not just the immediate landscape);

e. structures will not be located where they will break the line and form of any ridges, hills and slopes;

f. any roads, access, lighting, earthworks and landscaping will not reduce the visual amenity of the landscape.

5.27. The extent of the proposal's visibility is discussed above. It is considered the proposal will not increase any visual effects of the consented development and, to a small extent, will act to decrease the extent of visible built development. The proposal presents a more consolidated building area, reducing the spread of built development, especially on the more elevated land around the meadow area. Similarly, the proposal introduces design controls which will act to render future buildings more visually recessive within the landscape than the consented development.

5.28. The proposal will not act to increase any visible built development and will not dominate or detract from views of the ONL. No building will be located where they may break the line and

form of any skyline, ridge or slope. No proposed roads, access, lighting, earthworks and landscaping will reduce the visual amenity of the landscape.

21.21.1.5 Design and Density of Development

In considering the appropriateness of the design and density of the proposed development, whether and to what extent:

a. opportunity has been taken to aggregate built development to utilise common access ways including roads, pedestrian linkages, services and open space (i.e. open space held in one title whether jointly or otherwise);

b. there is merit in clustering the proposed building(s) or building platform(s) within areas that are least sensitive to change;

c. development, including access, is located within the parts of the site where it would be least visible from public and private locations;

d. development, including access, is located in the parts of the site where it has the least impact on landscape character.

5.29. The proposal will use an existing access track and the proposed development will generally be located in an area where development is anticipated. This meadow and marina area are low in the landscape and well contained by existing vegetation and landform. The proposal sites development where it will be least visible in the landscape and in a part of the landscape which is least sensitive to change. The balance of the site will be unaffected by the proposal.

21.21.1.6 Cumulative effects of subdivision and development on the landscape

Taking into account whether and to what extent existing, consented or permitted development (including unimplemented but existing resource consent or zoning) may already have degraded:

a. the landscape quality or character; or,
b. the visual amenity values of the landscape.

The Council shall be satisfied the proposed development, in combination with these factors will not further adversely affect the landscape quality, character, or visual amenity values.

5.30. The proposal will not introduce any elements which would be inconsistent with the existing consented baseline or natural character of the surrounding landscape. As the proposal will result in less spread of built development across the site it will not act to exacerbate any existing and potential adverse effects on the landscape's quality, character or visual amenity values,

6. CONCLUSION

6.1. The proposal seeks to reconfigure an existing consent. This reconfiguration consolidates built development into four building platforms in the general area of approved building sites. The proposal also seeks to establish a suite of design controls which will guide the future external appearance of building within the proposed building platforms. Any planting which may be removed to accommodate development within the proposed marina building platform will be replaced on the slopes above the meadow building platforms.

6.2. Overall, the proposal will result in some very low positive effects by reducing the spread of built development across the site and introducing design controls, with particular regard to glare and lighting. It is considered the proposal will not act to any increase in effects anticipated by the approved development. The proposal will result in no adverse effects on landscape character or visual amenity.

Steve Skelton

Registered Landscape Architect

patch

landscape ■ architecture ■ planning

WALTER PEAK STATION

Design Controls – Meadow and Marina Building Platforms

External colours and materials of buildings

1. All external walls shall be coloured in the natural hues of green, brown or grey with a light reflectivity value of between 7% and 30%.

2. External wall claddings shall be limited to the following:
    a. Steel, zinc or aluminium (corrugated or tray),
    b. Plaster or textured concrete which meets the colour controls.
    c. Local schist or river stone,
    d. Timber weatherboards or board and batten.

3. All roofing material shall be finished in dark recessive tones of grey, green or brown with a light reflectivity value of between 7% and 20% and have a matt, or G10 low gloss finish.

4. The external roofing materials of all buildings shall be:
    a. Steel, zinc or aluminium (corrugated or tray),
    b. Slate,
    c. A living / green roof of a vegetation coverage consistent with the surrounding landscape,
    d. Membrane covered in local gravels,
    e. Shingles or cedar shakes.

5. All built elements upon the roof or the upper portion of a future building, including but not limited to chimney flues, satellite dishes and solar panels shall be of colours and materials in the natural hues of green, brown or grey with a light reflectivity value of between 7% and 20%, or be located so as not to be visible from beyond the site boundary.

6. Gutters, spouting, downpipes and all joinery are to match roof or wall colours and be of natural tones of grey, green or cool browns with a light reflectivity value of between 7% and 30%.

7. All ancillary structures (for example: garden sheds and garages) shall be clad and coloured to match the principal dwelling.

Glare and glazing

8. All external painted surfaces and roofs shall have a matt or G10 low gloss finish.

9. All glazing on the east, north and west elevations of any future building shall be anti-reflective glass (similar to GlareSheild) or an alternative product which will reduce the reflection of incident light to 8% or less.

Alternatively

10. Where antireflective glass is not used, buildings shall be constructed with eaves, overhangs or recessed windows of no less than 1.8m in depth over east, north and west elevations.

Building Form

11. Buildings shall be articulated in form and recessed or extruded to avoid monolithic, lineal built forms.

Lighting

12. All external lighting shall be directed at the ground and housed such that no filament will be visible from Lake Wakatipu. All external lighting shall be no higher than 1.2m above ground level. All external lighting shall not be used to highlight buildings or landscape features which may be visible from beyond the property boundary.

13. All internal lighting to be housed or recessed such that the filament is not visible from outside the boundaries of the site.

Landscape Controls

14. All water tanks to be partially or wholly buried. If partially buried, tanks shall be of dark recessive colouring which meets the building colour controls and/or visually screened by planting as to be not visible from beyond the site boundary.

15. Any entranceway structures from the property boundary shall be to a height of no more than 1.2m and shall be constructed of natural materials such as unpainted timber, steel or schist stone and consistent with traditional rural elements and farm gateways.

16. All boundary fences are to be standard rural character fence only, being post and wire or post and rail at a maximum height of 1.2m. Mesh fencing may be used for pest management purposes.

17. All earthworked/exposed areas shall be top-soiled and grassed/revegetated or otherwise permanently stabilised and vegetated to blend seamlessly into the natural landforms.

18. The surface of all access roads and driveways shall be a dark colour local stone chip or gravel, dark chip seal, a dark coloured and textured concrete or a dark coloured or vegetated impermeable surface.

19. No concrete kerb and channelling shall be used for the access road and driveway.

patch
landscape ■ architecture ■ urban

Landscape - Reference : PA20533 IS02
Scale 1:30.000 @ A1 - 1:60,000 @ A3

0 300 600 1500m
SCALE = 1:30,000 AT A1

Walter Peak Station
Visual Assessent Locations
9 February 2021

50mm - 5 March 2020 at 5:24 pm

50mm - 5 March 2020 at 5:14 pm

50mm - 5 March 2020 at 5:00 pm

50mm - 5 March 2020 at 4:50 pm

50mm - 5 March 2020 at 4:14 pm

50mm - 5 March 2020 at 4:04 pm

50mm - 5 March 2020 at 3:52 pm

50mm - 5 March 2020 at 3:20 pm

50mm - 20 December 2017 at 6:54 pm

50mm - 5 March 2020 at 2:41 pm

50mm - 5 March 2020 at 2:34 pm

50mm - 10 November 2020 at 9:51 am

50mm - 10 November 2020 at 10:01 am

50mm - 10 November 2020 at 10:05 am

50mm - 10 November 2020 at 10:05 am

50mm - 10 November 2020 at 10:05 am

Geotechnical Report for Resource Consent

Walter Peak Station building platforms,
Queenstown

Report prepared for:
100WPS Limited

Report prepared by:
GeoSolve Ltd

Distribution:
100WPS Limited
GeoSolve Limited (File)

February 2021
GeoSolve Ref: 180154

Revision	Issue Date	Purpose	Author	Reviewed
1	19/02/2021	Final	HS/SR	PGF

GEOTECHNICAL WATER RESOURCES PAVEMENTS

Table of Contents

1 Introduction

1.1 General

This report presents the results of a geotechnical investigation and assessment undertaken by GeoSolve Ltd to determine subsoil conditions and to provide geotechnical inputs for the proposed lodge, and building platforms south of the marina at Walter Peak Station, Queenstown.

An assessment of the alluvial fan, flooding, and liquefaction hazard with respect to the proposed development has been conducted. Geotechnical design parameters for foundation, earthworks and retaining wall design are also provided. This report is considered sufficient to confirm that development at the site is feasible from a geotechnical perspective and for consent applications with the local authority.

Photo 1. Site photo looking south east across site to the proposed lodge development, and building platforms south of the marina.

The geotechnical investigation was undertaken for 100WPS in accordance with GeoSolve Ltd proposal dated 30 July 2020, which outlines the scope of work and conditions of engagement.

1.2 Proposed Development

It is understood the proposed development involves 3 building platform areas on the eastern meadow area and a further building platform just south of the marina. Detailed development plans have not yet been provided. Building platform locations are shown on Figures 1c, Appendix A.

2 Site Description

2.1 General

The proposed development site is located at Walter Peak Station which is situated approximately 14 km southwest of central Queenstown on the opposite and southern side of Lake Wakatipu, as shown in Figure 2.1 below. The site is legally described as Lot 100, DP 386580.

Figure 2.1. Site location in relation to Queenstown. (Source- Google Earth- extracted 28/08/2020)

The site can be accessed by road from Mount Nicholas - Beach Bay Road or by boat. The development site is bounded by undeveloped sections and Lake Wakatipu.

The site is located at the toe of the Walter Peak mountain range slopes and adjacent to Lake Wakatipu.

2.2 Topography and Surface Drainage

2.2.1 General

The development site has been surveyed and the site topography is shown in Figure 1a, 1c & 1d, Appendix A. Geomorphological mapping of the site and immediate surrounding area is shown in Figure 1d, Appendix A.

The development area is located on a historic fan surface and the ground predominantly has a gentle inclination to the north towards Lake Wakatipu.

For the 3 meadow building platforms, the crest of a historic lake terrace slope, 3 m in height and approximately 30° is located approximately 25 m north of the proposed building platforms. This terrace slope extends around the western end of the meadow platforms, reducing in height and angle (15-20°).

The marina building platform is located at the toe of a terrace slope, which rises up immediately south of the building site for approximately 10-15 m at slope angles of approximately 30-40°.

Moderately sloping terrace slopes are located upslope of the subject sites, extending up to Nicholas-Beach Bay Road. Historic incision of the terrace slopes in this area has resulted in various current and historic overland flow paths, most of which are generally dry and inactive, as shown in Figure 1d.

The main channel draining the upper catchment and passing through the site is the Mick O'Day Creek. This creek is located 50 m west of the proposed meadow building platforms, and approximately 100 m east of the marina building platform. An active channel, named "Point 1673 Creek", converges with the Mick O'Day Creek immediately upslope of Mt Nicholas- Beach Bay Road, Photo 2 below.

No spring flows or seepages were observed within the vicinity of the proposed development area. All surface drainage is expected to flow in a northern direction into Lake Wakatipu.

Photo 2. Site photo looking south with convergence point of the Point 1673 Creek (blue) and Mick O'Day Creek (Red) indicated.

3 Geotechnical Investigations

An engineering geological site inspection has been undertaken with confirmatory subsurface investigations. The following geotechnical investigations were completed on site between the 2nd and 19th of August 2020 for the purposes of this report:

- 9 test pits (TP1-9) which were advanced to a maximum depth of 5.1 m below ground level (bgl);
- 2 machine boreholes which were advanced to a maximum depth of 21 m below ground level (bgl);
- Geomorphological mapping of the site and surrounding area was undertaken by an engineering geologist to assess the landforms and natural hazards at the subject site, and;
- Aerial photography analysis to assess the natural hazards at the subject site.

Test pit and machine borehole locations and logs are contained in Appendix A and B respectively.

4 Subsurface Conditions

4.1 Geological Setting

The site is located in the Wakatipu Basin, a feature formed predominantly by glacial advances. Published references indicate the last glacial event occurred in the region between 10,000 and 20,000 years ago. Glaciations have left deposits of glacial till, glacial outwash and lake sediment overlying ice–scoured schist bedrock. Post glacial times have been dominated by erosion of the bedrock and glacial sediments, with deposition of alluvial gravels by local watercourses and lacustrine sediments during periods of higher lake levels. Extensive post glacial fan complexes have also developed from range fronts to be deposited in the floor of the basin.

The nearest "potentially active[1]" fault is the Moonlight Fault located approximately 3 km to the west. This fault is assessed to have a re-occurrence interval of approximately 120,000 years and therefore does not pose a significant seismic risk to the development.

Significant seismic risk exists in this region from potentially strong ground shaking, associated with the rupture of the Alpine Fault, located 80 km northwest from Queenstown along the West Coast of the South Island. There is a high probability that an earthquake with an expected magnitude of over M_W 8 will occur along the Alpine Fault in the next 50 years.

4.2 Stratigraphy

The subsurface stratigraphy observed in test pits and a machine borehole around the proposed lodge development and typically comprises:

- 0.2 to 0.3 m of topsoil, overlying;
- 3.2 to 15.45 m of fan alluvium, overlying;
- Glacial till, overlying;
- Schist bedrock.

Topsoil (observed to between 0.2-0.3 m depth in all TP's and BH2) comprises dark brown, soft, organic SILT.

Beach Gravel, lake shore areas only, typically comprising a grey sandy GRAVEL.

Fan alluvium (observed to between 0.3-15.45 m depth in TP's and BH2) comprises grey/brownish grey medium dense to dense, sandy GRAVEL with occasional 100 mm thick GRAVEL lenses, silty SAND/sandy SILT, and interbedded SILT with minor sand and sandy GRAVEL with some silt.

Glacial Till and schist bedrock were not encountered within any of the test pits and BH2. However, nearby schist exposures and BH 1 completed approximately 200 m west of the proposed lodge development suggests these materials are present underlying the fan alluvium.

Geological cross-section models through the site can be found in Appendix A, Figures 2a-h.

[1] *General distribution and characteristics of active faults and folds in the Queenstown Lakes and Central Otago districts, Otago, GNS Science Consultancy Report 2018/207, March 2019.*

Full details of the observed subsurface stratigraphy can be found within the test pit and bore hole logs contained in Appendix B.

4.3 Groundwater

Groundwater was observed in several of the geotechnical investigation locations at depths coincident with the level of Lake Wakatipu, at approximately RL 309.6 m.

The groundwater table will be subject to seasonal variations in response to lake levels, heavy rainfall and snowmelt.

4.4 Slope Stability

No significant subsurface slope instability was observed within the immediate vicinity of the proposed development area during the site investigations and no known mapped slope stability risks are present on the Queenstown Lakes District Council (QLDC) GIS system.

Minor surficial fretting of existing steeply dipping soil slopes was observed in some locations. Debris flow hazard is discussed in Section 5 of this report.

5 Hazard Assessment

5.1 Alluvial Fan

5.1.1 General

QLDC hazard mapping indicates the subject site is located within an area identified as a recently active fan (ORC alluvial fan mapping), as shown on Figure 1d, Appendix A.

Site mapping and computer modelling has been undertaken to analyse the potential for debris flow activity affecting the site.

Topographical data for the study within the site vicinity was based on ground survey data, and in the wider catchment areas on the LINZ national 8 m DEM, which together provide a good level of accuracy and resolution for catchment and flow path analysis.

5.1.2 Geomorphic observations

The geomorphology of the catchment was closely examined on Google Earth images, aerial photographs and in the field as far as practicable. The development sites are located in relatively close proximity to Mick O'Day Creek, which is the main active flow draining the catchments above the site.

Point 1673 Creek converges with the Mick O'Day Creek immediately upslope of Mt Nicholas- Beach Bay Road, see Photo 2. Downslope of the Mount Nicholas - Beach Bay Road, the Mick O'Day Creek is contained in a deep channel formed by incision of the terrace slope. This channel opens out into a shallow valley as it approaches the development areas. The flow path heads north, passing west of the lodge and east of the marina building platform.

The crest of the Walter Peak range is located in the upper catchment of the Mick O'Day and Point 1673 Creeks (Photos 3 & 4 respectively). Steep relief and a high mountain environment can provide the conditions required to initiate debris flow events. Debris material within the channels and shallow seated landslides in the wider catchments were identified in the geomorphology assessment.

Both catchments transport debris to the toe of the Walter Peak range and a series of well-defined high to moderate angle fans have formed at the toe of these slopes. The fans become gently sloping, upslope of the Mt Nicholas-Beach Bay Road. In upper fan areas geomorphological observations indicate avulsion from the main channel has occurred, particularly for the Point 1673 creek. In lower fan areas Debris flow events are inferred from site observations to transition into fluvial flow (water flow only) and generally follow preferential and established flow paths across the existing fan surface.

Around the building platforms geomorphological evidence for recent alluvial fan activity was generally lacking. In general, significant topsoil development indicated a substantial passage of time since debris deposition in the area. This suggests the fan deposits identified in the assessment are historic and their accumulation is not a recently active process. No other recent deposits (bare ground), recent scouring, active flow channels, or other fan like feature were identified in the area of the proposed buildings. Active alluvial fan activity appeared to occurring upslope of Mt Nicholas-Beach Bay Road only.

A plan showing the main geomorphological observations, Figure 1d, is attached in Appendix A.

Photo 3. Site photo looking south into the upper catchment of the Mick O'Day Creek, shallow to moderate seated landslide potential possible within the upper slopes.

Photo 4. Site photo looking south into the upper catchment of the Point 1673 Creek, shallow to moderate seated landslide potential possible within the upper slopes and debris material located within the active channel. The main channel on the upper fan can be seen on the foreground.

5.1.3 Slope instability

Large areas of shallow to moderate seated slope instability are evident in the upper catchments of Mick O'Day and Point 1673 creeks, as shown in Photo 3 and 4 respectively. Landslide features are inferred to have the potential of generating debris material deposition into the relevant catchments of up to 50,000 m^3 & 100,000m^3 respectively.

Toe incision of the existing terrace slope has resulted in slope instability of the western side of the Mick O'Day Creek, as shown in Figure 1b. This instability is located approximately 200 m upslope of the development sites. Due to the shallow gradient downslope of the slip, and relatively low volumes, generation of a debris flow is not expected from this instability.

5.1.4 RAMMS Modelling

5.1.4.1 General

Due to the identified instability in the upper catchments, and well-defined fan features, RAMMS (Rapid Mass Movements Simulation) software was used to model potential debris flow paths and inundation extents in the Mick O'Day and Point 1673 flow paths. RAMMS is a numerical simulation model developed to calculate the motion of geophysical mass movements (debris flows) from initiation to runout in three-dimensional terrain.

The volume of debris likely to be mobilised is very difficult to explicitly estimate, with no generally accepted predictive methodology available. Therefore, debris flow events based on slope instability potential have been adopted to simulate a design event. The modelling comprised two debris flow scenarios with varying volume releases, including event:

a) A large landslide event in the upper eastern (Point 1673 Creek) catchment from a point release scenario of 50,000m^3 (shallow block release depth over a large area)
b) A larger landslide event in the upper western (Mick O'Day) catchment from a point release scenario of 100,000m^3 (deeper block release depth over a large area).

It is acknowledged that the modelling process has involved substantial assumptions and uncertainties, however the methodology is considered to be the best available and satisfactory for the purpose of assessing the rocky debris flow hazard. The modelling is also considered conservative.

5.1.4.2 Modelling Input

The release settings are shown below in Table 5.1

Table 5.1: RAMMS simulation release settings

Release	
DEM resolution (m)	0.8-2
Simulation Resolution (m)	0.8
Lambda	1
Constant density (kg/m3):	1700
Mu	0.20
Xi (m/s2)	200
Yield Stress	n/a
Erosion	n/a

Curvature	On
Stopping criteria (momentum threshold) (%):	5%
Simulation stopped due to;	LOW FLUX

5.1.4.3 Results

Modelling results indicate the site is not at risk from debris flow. Figure 5.1 and Figure 5.2 below show the modelled debris flow paths with maximum extents and depths indicated. The modelled events are generally confined to the area upslope of the Mount Nicholas - Beach Bay Road and this is agreement with site mapping and observations.

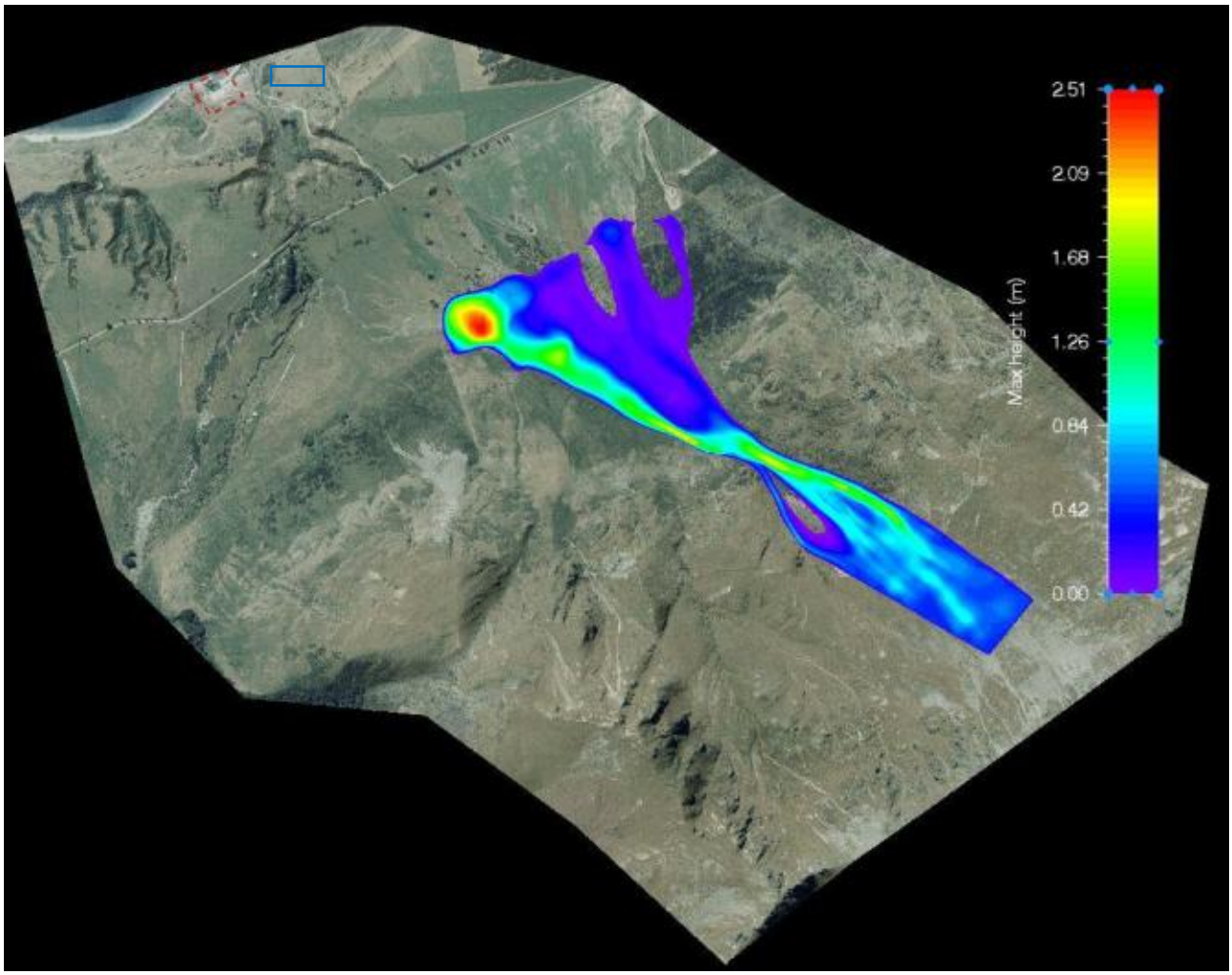


Figure 5.1: Modelled event (a)- A large landslide event in the upper eastern (Point 1673 Creek) catchment from a point release scenario of 50,000m3 - Site shown by blue rectangle & existing marina shown by red square

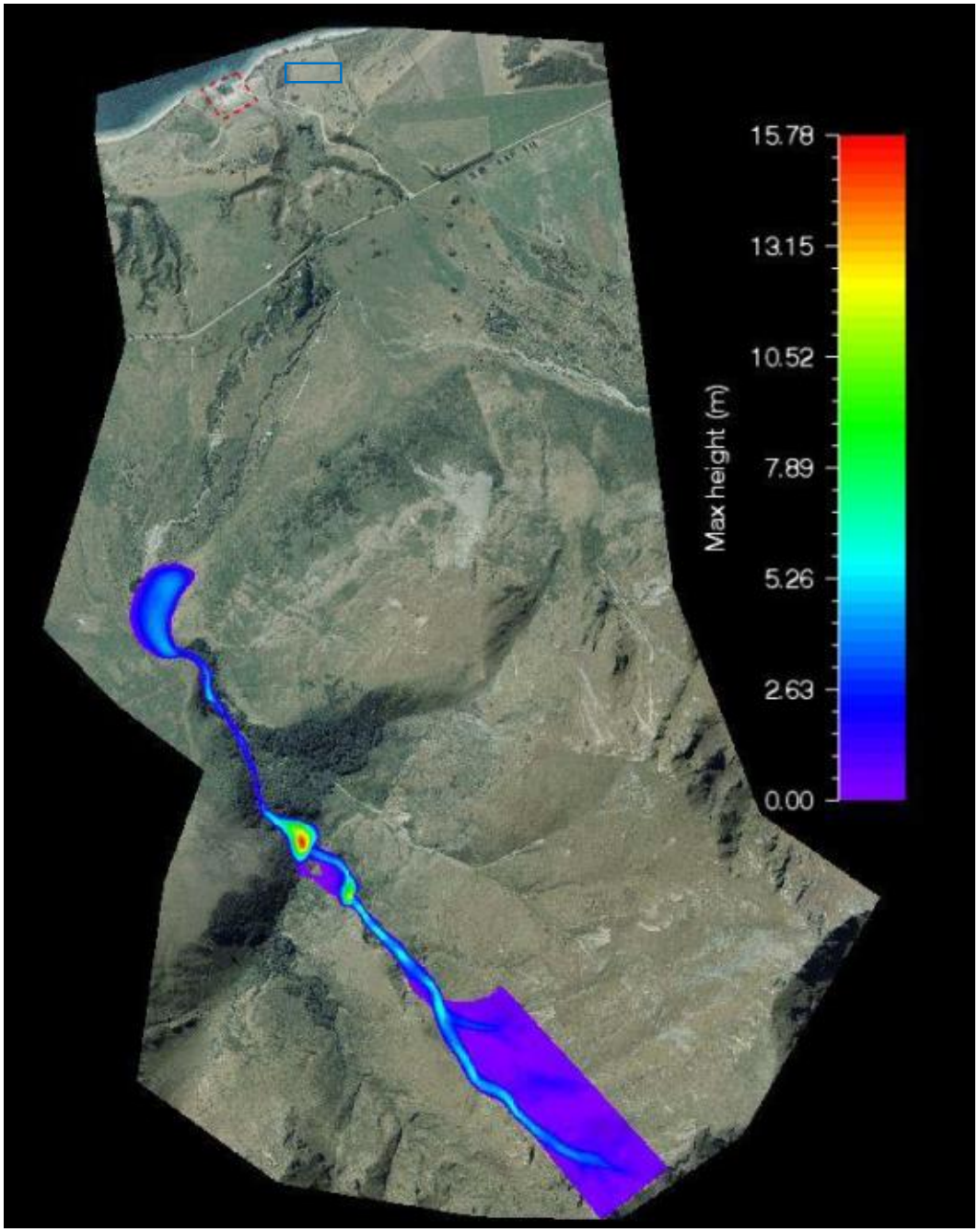


Figure 5.2: Modelled event (b)- A large landslide event in the upper western (Mick O'Day) catchment from a point release scenario of 100,000m3 - Site shown by blue rectangle & existing marina shown by red square

5.2 Fluvial Flooding

5.2.1 Lake Flooding

The proposed development area is above any credible lake flood level. Existing ground levels in the proposed lodge vary from approximately 315 to 320 m asl (above sea level) and are therefore significantly above maximum recorded flood levels for the lake of 312.78 m asl.

5.2.2 Stream Flooding

Potential stream flooding is shown in Figures 5.3 and 5.4 below, as predicted by hydrological analysis and hydraulic modelling of Mick O'Day stream which passes through the site.

Design flood for the development is taken as the 100-year ARI (return period) flow. The NIWA tool New Zealand River Flood Statistics was used to derive flood flow estimates by both the Rational Formula and the Henderson-Collins (2018) regional method. For the Rational Formula a runoff coefficient of 0.35 was applied, however the catchment area of 5.84 km^2 is somewhat larger than ideally suited to the Rational Formula. Therefore, a weighted average of the two results was calculated by applying weightings of 20% and 80% respectively to the Rational Formula and Henderson-Collins outputs. The resulting weighted average was then factored up by 20% to allow for potential future increase due to climate change, yielding a final estimate of 13.9 m^3/s for the 100-year ARI design flood flow.

Hydraulic modelling software HEC-RAS 2D was then used to estimate inundation extents and depths in the design flood event, based on a triangular hydrograph with peak flow of 14 m^3/s. Suitable terrain data was available from detailed site survey. For this scenario a high (but not extreme) lake level of 311 m was adopted as the downstream boundary condition. Flow calibration data was not available therefore conservative Manning's N roughness values of 0.55 for the somewhat overgrown main channel and 0.40 for the more open out-of-channel areas were applied. Also, it was conservatively assumed that the bridge that crosses the stream approximately 50 m to the west of the proposed lodge would be blocked by debris throughout the flood event. A blocked bridge is considered a possible but low likelihood event, and so the assessment is conservative.

Figure 5.3: Modelled flood depths for 100-year ARI stream flood. The meadow building platforms is shown by the red rectangles.

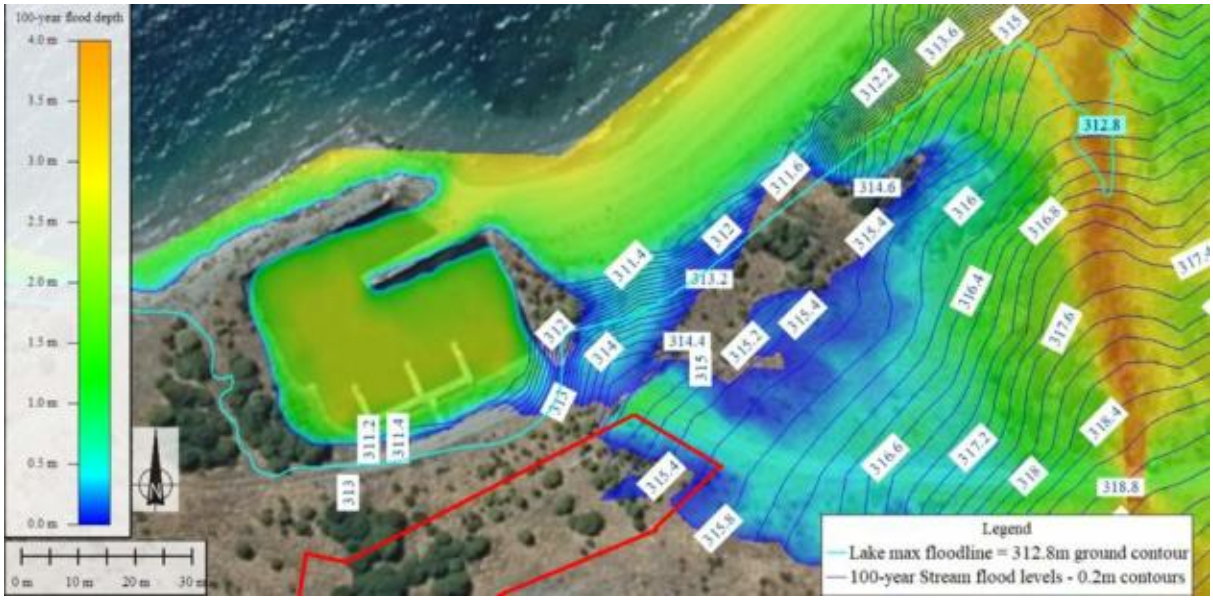


Figure 5.4: Modelled flood depths for 100-year ARI stream flood. The building platform is shown by the red rectangle.

5.2.3 Conclusions

Virtually all of the development areas are above the modelled 100-year ARI flood level, and therefore will be unaffected by flooding.

At the southwest corner of the meadow building platform area, and the eastern end of the marina building platform, may be marginally within the modelled 100-year flood plain, assuming a worst-case blocked bridge scenario. Development in the area is however considered achievable with simple precautions, such as, any habitable building elements located within this area (see Figure 4 above) should have floor levels elevated 600 mm above adjacent natural ground, avoidance of the area, or relatively minor landscaping.

5.3 Liquefaction

5.3.1 General

The site is identified as being in an area which is 'Possibly Susceptible' to liquefaction (Opus 2002 report). The Opus assessment is based on a broad scale review of the geology and geomorphology and is not based on a specific site assessment. The assessment assumes that subsurface conditions comprise loose boulders, gravel, sand, silt and clay with a shallow groundwater table.

A liquefaction risk review has been conducted for the purposes of this report, which includes one machine bore hole (BH2) drilled to a maximum depth of 15.45 m beneath the site.

The following comments are provided with respect to liquefaction for the proposed lodge development.

- The regional groundwater table underlies the site at approximately 7.5 m depth, coincident with the level of Lake Wakatipu.

- Medium dense, sandy GRAVEL and GRAVEL with some sand was identified in BH2 to a depth of 7.0 m. These materials have a very low liquefaction risk as drainage will dissipate any excess pore water pressure and they are above the regional water table.
- The medium dense gravel deposits are underlain by a 0.5 m thick layer of medium dense SAND with trace gravel to 7.5 m depth. It is believed that some liquefaction could occur within this sand layer, however the non-liquefiable crust of 7.0 m will limit surface damage and the regional water table is located beneath this 0.5 m thick SAND layer during typical lake levels.
- Data from the Canterbury earthquake sequence plus other historic earthquakes[2] has been collated and observed surface damage compared with crust thickness. This data indicates that surface damage is likely for crusts of less than about 3.5 m thickness. The subject site is there considered to be at low risk of surface damage due to it 7.0 m+ thick non-liquefiable crust.
- The medium dense, SAND layer is underlain by medium dense to dense, sandy GRAVEL and SAND with some gravel to the extent of BH 2 (15.45 m depth). These soils have a very low liquefaction risk due to their composition and density.
- Glacial till and schist bedrock were not encountered but are understood to underlie the site at depth which cannot liquefy.

Based on the above observations the risk of liquefaction is considered low at the lodge site due to a combination of the non-liquefiable crust of 7.0 m and the density and composition of the alluvial fan material.

For the marina building platform, glacial till and rock is expected to be present at relatively shallow depths and high levels of liquefaction is therefore not expected. Standard engineering such as TC 2, engineered fill rafts or pile foundations are expected to be suitable, if required, in this area.

[2] *Bowen, H.J. and Jacka, M.E. (2013). Liquefaction induced ground damage in the Canterbury Earthquake: Predictions versus reality. Proceedings of the 19th NZGS Geotechnical Symposium. Editor CY Chin. Queenstown, New Zealand.*

6 Engineering Considerations

6.1 General

The recommendations and opinions contained in this report are based upon ground investigation data and mapping obtained at discrete locations on site and historical information held on the GeoSolve database. The nature and continuity of subsoil conditions away from the investigation locations is inferred and cannot be guaranteed.

6.2 Geotechnical Parameters

Table 6.1 provides a summary of the recommended geotechnical design parameters for the soils expected to be encountered during construction of the proposed lodge development.

Table 6.1 – Recommended Geotechnical Design Parameters.

Unit	Thickness (m)	Bulk Density γ (kN/m^3)	Effective Cohesion c´ (kPa)	Effective Friction ϕ´ (deg)	Elastic Modulus **E** (kPa)	Poissons Ratio ν
Topsoil (soft, organic SILT)	0.2-0.3	16	To be removed from beneath building footprints and top of batter slopes			
Fan Alluvium (medium dense, gravelly SAND and sandy GRAVEL with trace to minor cobbles)	3.2-15.25	19	0	34	15,000	0.3

6.3 Site Preparation

During earthworks operations all topsoil, organic matter, and other unsuitable soils should be removed from the construction areas in accordance with the recommendations of NZS 4431:1989.

Robust, shallow graded sediment control measures should be instigated during construction where rainwater and drainage run-off across exposed soils is anticipated. If slope gradients in excess of 4% are proposed in erosive soils then the construction and lining of drainage channels is recommended, e.g. with geotextile and suitably graded rock, or similarly effective armouring.

Exposure to the elements should be limited for all soils and covering the soils with polythene sheeting will reduce degradation due to wind, rain and surface run-off. Excavations in soils should be left proud of the finished subgrade level by 200 to 300 mm if a delay prior to construction is expected. The final cut to grade should be performed immediately prior to foundation construction.

Water should not be allowed to pond or collect near or under a foundation slab. Positive grading of the subgrade should be undertaken to prevent water ingress or ponding.

All fill that is utilised as bearing for foundations should be placed and compacted in accordance with the recommendations of NZS 4431:1989 and certification provided to that effect.

We recommend topsoil stripping and subsequent earthworks be undertaken only when a suitable interval of fair weather is expected, or during the earthworks construction season.

6.4 Slope Stability

The crest of a small moderately sloping river terrace slope is located adjacent to the western edge of the proposed meadow building platform. A foundation assessment of any proposed building located adjacent to the crest of this slope should be undertaken during detailed design. Specific foundation design may be appropriate within this area to ensure adequate factors of safety are provided against slope failure. Several standard engineering options, or combination of options, are available to address this issue. Deepening foundations is expected to be the most practical solution.

6.5 Excavations

Excavations are expected to be undertaken within topsoil and fan alluvium.

Recommendations for temporary and permanent batter slope angles are described below in Table 3. Slopes that are required to be steeper than those described below should be structurally retained or subject to specific geotechnical design.

All slopes should be periodically monitored during construction for signs of instability and excessive erosion, and, where necessary, corrective measures should be implemented to the satisfaction of a suitably qualified Chartered Professional Engineer.

Batters excavated within wet soils should be cut as per the recommendations of Table 3, it is also recommended that a geotechnical engineer or engineering geologist should inspect any seepage, spring flow or under-runners where encountered during construction.

6.5.1 Cut Slopes in Soil Materials

Table 6.2 summarises the recommended batter angles for temporary and permanent slopes up to 4 m high, which are formed in the soil materials identified at the site and are not subject to significant surcharge loads.

Table 6.2 Recommended maximum batter angles for cut slopes up to 4 m high in site soils.

Material Type	Recommended Maximum Batter Angles for Temporary Cut Slopes Formed in Soil (horizontal to vertical)		Recommended Maximum Batter Angles for Permanent Cut Slopes Formed in Soil – dry ground only (horizontal to vertical)
	Dry Ground	Wet Ground	
Topsoil	2H: 1V	3H: 1V	3H: 1V
Fan Alluvium	1.5H: 1V	3H: 1V	2.5H: 1V

Permanent batter slopes in wet soils are provisional, if wet slopes are encountered, they should be inspected on a case by case basis by a geotechnical engineer/engineering geologist to confirm this recommendation is appropriate.

6.6 Engineered Fill and Engineered Fill Slopes

All fill should be placed and compacted in accordance with the recommendations of NZS4431: 1989 and Queenstown Lakes District Council Standards. All cut and fill earthworks should be inspected and tested as appropriate during construction and certified by a Chartered Professional Engineer.

All dry un-retained fill slopes which are less than 3 m high should be constructed with a batter slope angle of 2.0H: 1.0V (horizontal to vertical) or flatter and be benched into sloping ground.

Reinforced earth slopes or slope retention can be considered if batters need to be steeper than 2H:1V at detailed design.

6.7 Ground Retention

All retaining walls should be designed by a Chartered Professional Engineer using the geotechnical parameters recommended in Table 2 of this report. Due allowance should be made during the detailed design of all retaining walls for forces such as surcharge due to the sloping ground surface behind the retaining walls, groundwater, seismic and traffic loads.

All temporary slopes for retaining wall construction should be battered in accordance with the recommendations outlined in Table 2 of this report. Where these batter slopes cannot be achieved temporary retaining will be required.

To ensure potential water seepage or flows are properly controlled behind retaining walls, the following recommendations are provided:

- A minimum 0.3 m width of durable free draining granular material should be placed behind all retaining structures;
- A heavy duty non-woven geotextile cloth, such as Bidim A14, should be installed between the natural ground surface and the free draining granular material to prevent siltation and blockage of the drainage media;
- A heavy-duty (TNZ F/2 Class 500) perforated pipe should be installed within the drainage material at the base of all retaining structures to minimise the risk of excessive groundwater pressures developing. This drainage pipe should be connected to the permanent piped storm water system, and;
- Comprehensive waterproofing measures should be provided to the back face of all retaining walls.

It is recommended that the retaining wall excavation batters are inspected by a suitably qualified and experienced Geotechnical Engineer or Engineering Geologist.

6.8 Groundwater Issues

The regional groundwater table was observed in investigation and coincides with Lake Wakatipu. A groundwater model is shown on the cross sections presented in Appendix A, Figure 2a to 2h.

No significant groundwater issues are expected, however seepages may be encountered in excavations within permeable horizons in the soils and these are likely to be mitigated by standard drainage solutions.

All sources of slope saturation should be eliminated by cut-off drains, swale drains and bunds and redirected around building platforms.

6.9 Settlement and Foundations

6.9.1 General

Where shallow foundations are constructed, they should bear on fan alluvium or engineered fill. Topsoil will not be suitable for foundation bearing and should be removed from beneath foundation areas.

All unsuitable materials identified in foundation excavations, particularly those softened by exposure to water, should be undercut and replaced with engineered fill during construction.

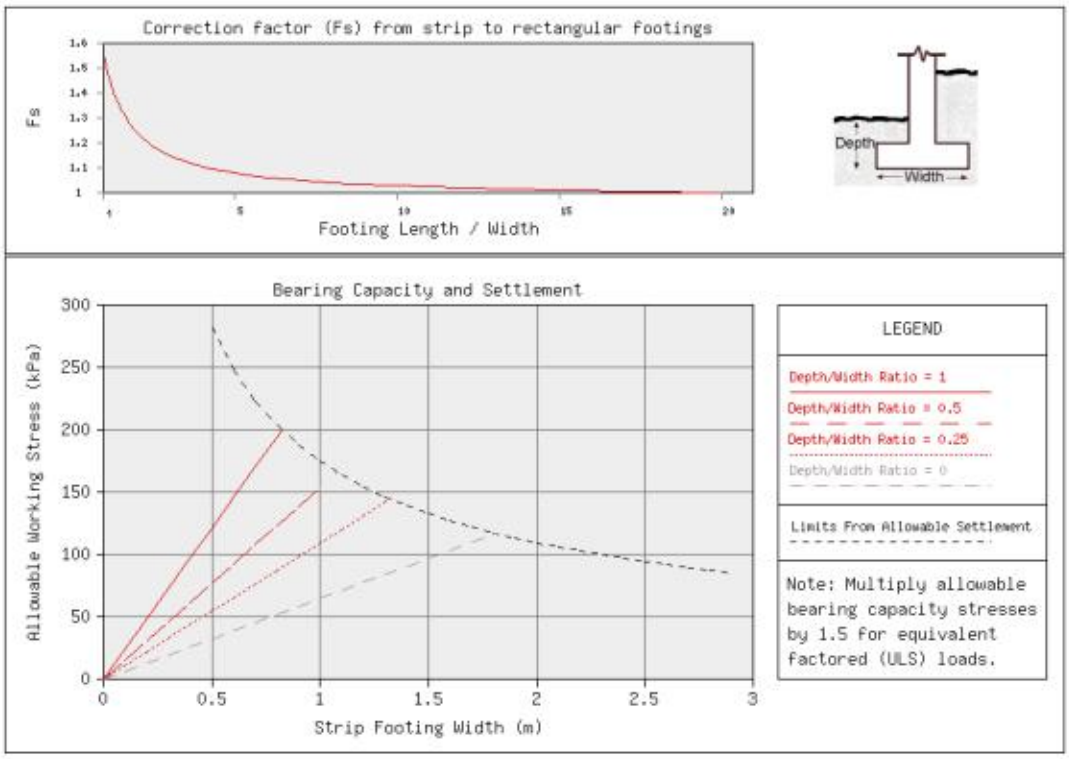
Any fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect.

It is recommended the foundation excavations be inspected and tested by a suitably qualified and experienced geotechnical specialist to confirm the conditions are in accordance with the assumptions and recommendations provided in this report.

6.9.2 Shallow Foundations

Figure 5 below summarises the recommended working stresses for shallow footings, which bear upon fan alluvium or granular engineered fill soils. It should be noted that foundation working stresses presented in Figure 5 are governed by bearing capacity in the case of narrow footings and settlement in the case of wide footings.

Figure 6.1. Recommended Bearing for Shallow Footings on Fan Alluvium or Engineered Fill Soils.



From Figure 5 it can be seen an allowable working stress of approximately 100 kPa is recommended for a 0.4 m wide by 0.4 m deep footing founded on fan alluvium or granular engineered fill soils This corresponds to a factored (ULS) bearing capacity of approximately 150 kPa and ultimate geotechnical bearing capacity of 300 kPa.

It should be noted that the bearing capacities presented above assume that the loads are vertical with no horizontal loads or moments applied to the foundations. Reduction factors to account for eccentric and/or horizontal loads can be provided during detailed design once loads are finalised.

6.10 Site Subsoil Category

For detailed design purposes it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations provided in NZS 1170.5:2004.

The site is expected to be Class C (Shallow soil site) in accordance with NZS 1170.5:2004 seismic provisions. For the lodge site, there is the possibility that Class D conditions are present, as this is the conservative option this is recommended for structural design.

7 Hazards/Neighbouring Structures

Natural Hazards: A risk of seismic activity has been identified for the region as a whole and appropriate allowance should be made for seismic loading during detailed design of the proposed building, foundations and associated earthworks.

Alluvial fan, flooding and liquefaction risk is discussed in Section 5.1, 5.2 and 5.3 above.

Distances to adjoining structures: No adverse geotechnical implications apply for neighbouring properties during construction of the proposed development provided the above excavation considerations are noted.

Aquifers: No aquifer resource will be adversely affected by the proposed development.

Erosion and Sediment Control: The site presents minor potential to generate silt runoff during heavy rainfall events and this would naturally drain downslope. Effective systems for erosion control are runoff diversion drains and contour drains, while for sediment control, options are earth bunds, silt fences, vegetation buffer strips and sediment ponds. Only the least amount of subsoil should be exposed at any stage and surfacing established as soon as practical. QLDC environment management plan requirements should be consulted for site management and dredging requirements.

Noise: Standard excavation and compaction plant will be required. The construction contractor should take appropriate measures to control the construction noise and ensure QLDC requirements are met in regard to this issue.

Dust: The soil materials at the site have potential to generate dust. Regular dampening of soil materials with sprinklers should be effective if required.

Vibration: No vibration induced settlement is expected in these soil types; however, any works that create vibrations should be subject to geotechnical advice.

8 Conclusions and Recommendations

- The site is considered suitable for the proposed developments from a geotechnical perspective. Natural hazards are considered to have a low likelihood of impacting the development. Should they occur, standard engineering solutions are available to address the geological conditions present.
- The stratigraphy at the site typically comprises topsoil overlying fan alluvium. Glacial till and schist bedrock are expected at depth;
- Groundwater was observed in the investigation locations at depths coincident with the level of Lake Wakatipu, at approximately RL 309.6 m.
- No significant subsurface slope instability was observed within the immediate vicinity of the proposed development area during site investigations and no known mapped slope stability risks are present on the Queenstown Lakes District Council (QLDC) GIS system.
- Alluvial fan, flooding and liquefaction risk is discussed in Section 5.1, 5.2 and 5.3 above.
- Geotechnical parameters are presented in Table 6.1 of this report.
- Recommendations for temporary and permanent batter slope angles are described in Table 6.2. Slopes that are required to be steeper than those described below should be structurally retained or subject to specific geotechnical design.
- All dry un-retained fill slopes which are less than 3 m high should be constructed with a batter slope angle of 2.0H: 1.0V (horizontal to vertical) or flatter and be benched into sloping ground.
- Reinforced earth slopes or slope retention can be considered if batters need to be steeper than 2H:1V at detailed design.
- All retaining walls should be designed by a Chartered Professional Engineer using the geotechnical parameters recommended in Table 6.1 of this report.
- Where shallow foundations are constructed, they should bear on fan alluvium or engineered fill. Topsoil will not be suitable for foundation bearing and should be removed from beneath foundation area.
- For foundations bearing on fan alluvium an allowable working stress of 100 kPa is recommended for a 400 mm wide by 400 mm deep footing. This corresponds to a factored (ULS) geotechnical bearing capacity of approximately 100 kPa and an ultimate geotechnical bearing capacity of 300 kPa.
- Any fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect.
- For detailed design purposes it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations provided in NZS 1170.5:2004. Further details are provided in Section 6.10 of this report.

- Inspections of the any earthworks batters, foundation sub-grade and engineered fills should be completed during construction by a suitably qualified Geotechnical Engineer or Engineering Geologist to confirm geotechnical conditions are in accordance with the recommendations of this report.
- It is recommended that geotechnical engineers review the completed foundation and retaining system at the detailed design stage to confirm they meet the design assumptions in this report.

9 Applicability

This report has been prepared for the benefit of 100 WPS Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

It is important that we be contacted if there is any variation in subsoil conditions from those described in this report.

Please do not hesitate to contact the undersigned if we can provide any further assistance with this project.

Report prepared by:

.....

Hank Stocker

Senior Engineer Water

Report prepared by:

.....

Simon Reeves

Senior Engineering Geologist

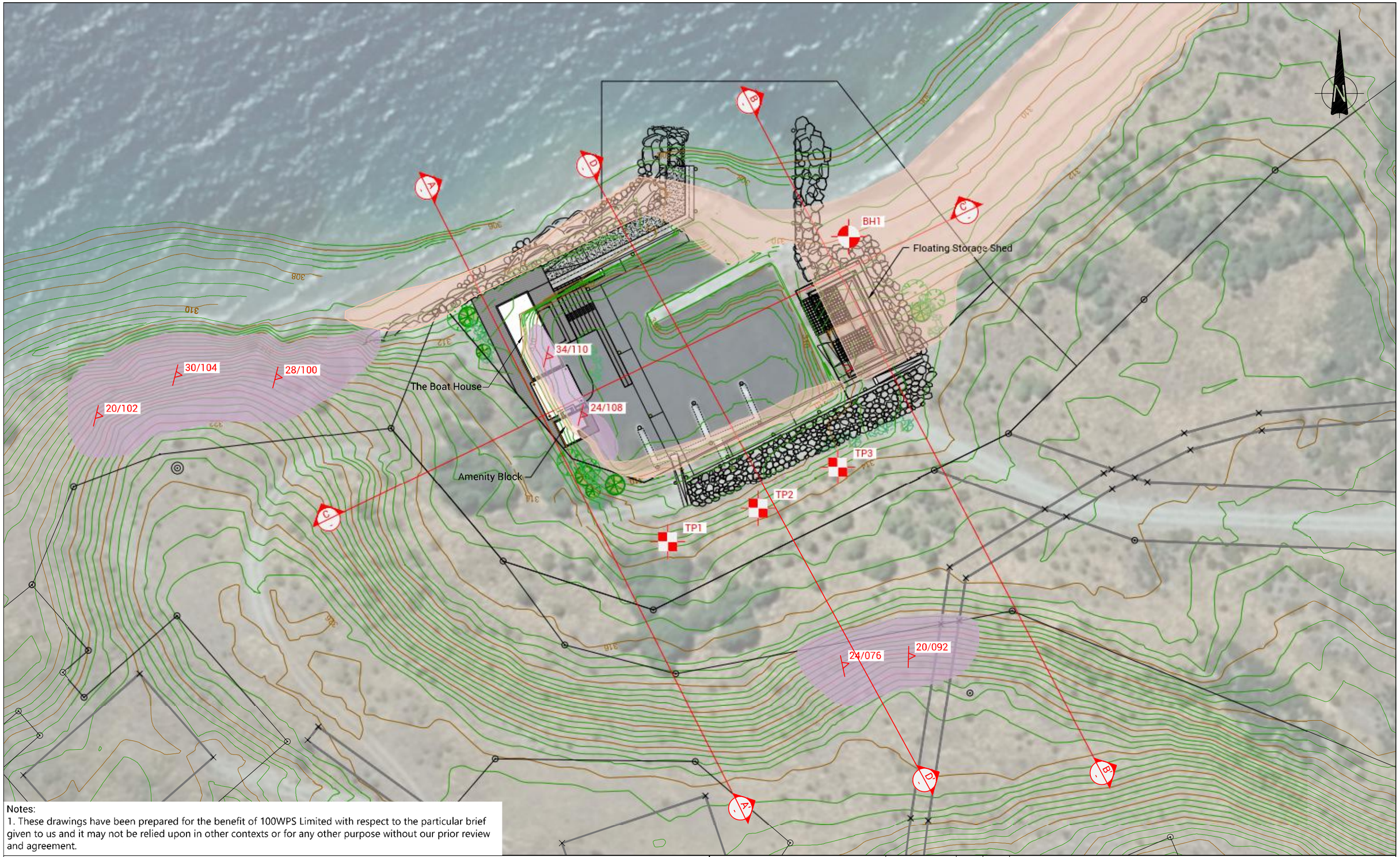
Reviewed for GeoSolve Ltd by:

.....

Paul Faulkner

Senior Engineering Geologist

Appendix A: Site Plans and Cross-Sections



Notes:
1. These drawings have been prepared for the benefit of 100WPS Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Legend:

- Test pit locations
- Borehole locations
- Cross section locations and facing
- Foliation measurements (dip/dip direction)
- Schist Bedrock exposures
- Beach Gravel exposures

SCALE 1:600

0 6 12 18 24 30 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
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DRAWN	JM	Sep.20
DRAFTING CHECKED	SAR	Sep.20
APPROVED	PGF	Sep.20

CADFILE: 180154.01.dwg

SCALES (AT A3 SIZE): 1:600

PROJECT No: 180154

100WPS Limited

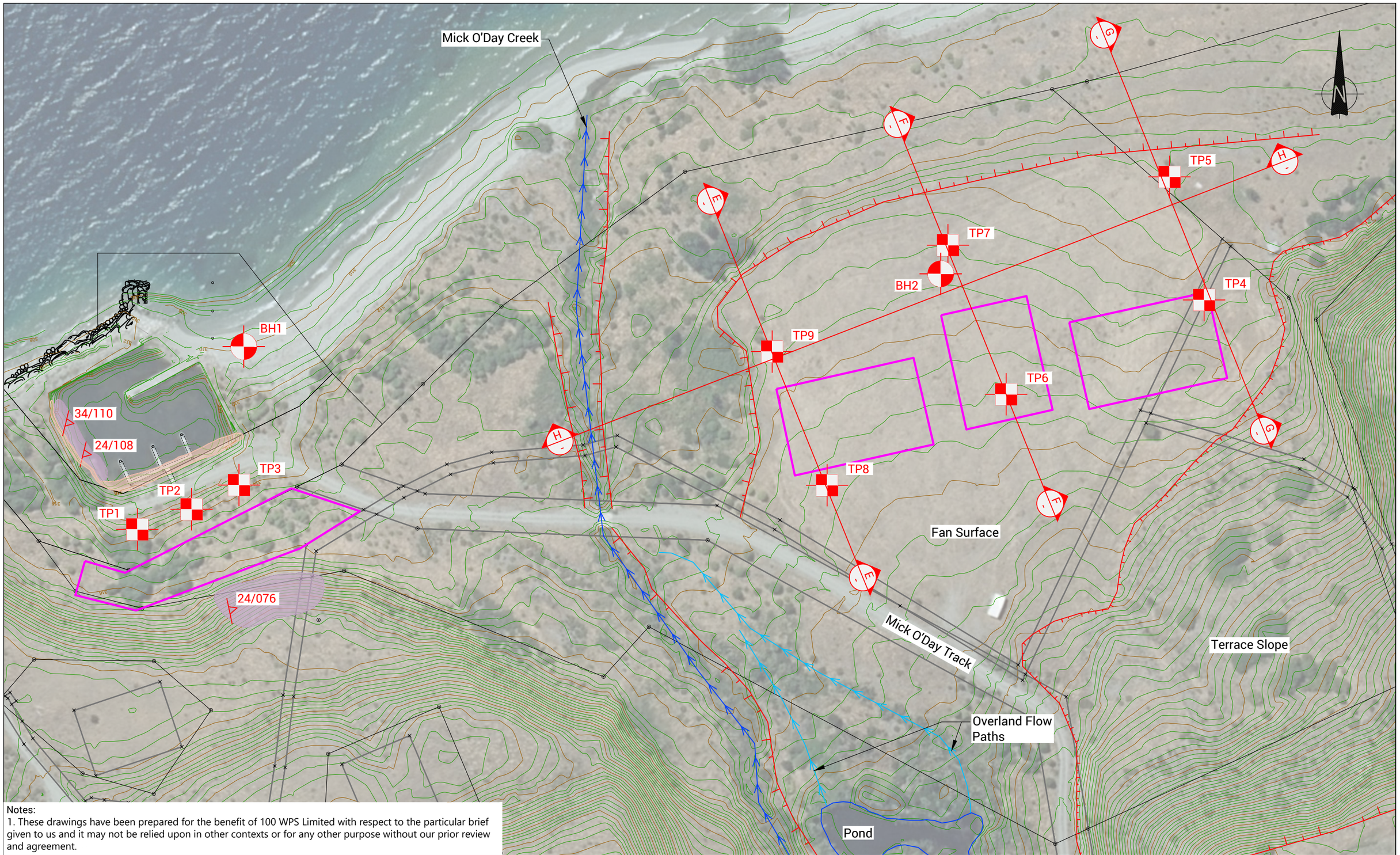
Walter Peak Subdivision

Geotechnical Inputs

Site Plan

FIG No: Figure 1a, Appendix A

REV. 0



Notes:
1. These drawings have been prepared for the benefit of 100 WPS Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Legend:

- Test pit locations
- Borehole locations
- Cross section locations and facing
- Channels
- Proposed building platforms

SCALE 1:1000

0 10 20 30 40 50 (m)

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CADFILE: 180154.01 Stage 2.dwg

SCALES (AT A3 SIZE): 1:1000

PROJECT No: 180154

FIG No: Figure 1c, Appendix A

REV. 0

100WPS Limited

Walter Peak Subdivision

Geotechnical Inputs

Stage 2 - Site Plan

Legend:
- ORC Mapped Alluvial Fan - Active Bed
- ORC Mapped Alluvial Fan - Recently Active
- ORC Mapped Alluvial Fan - Less Recently Active
- QLDC Mapped Concealed Inactive Fault - Location Approximate
- Overland Flow Path
- Main Channel

Box culvert 2m height, 4m width, 5m length
Moderately Incised Channel
Subject Site - Proposed Building
Subject Site - Proposed Lodge Development
Terrace Slope
Pond
Spur
Slip
Terrace Slope
Mick O'Day Track
Pipe-culvert 450mmØ
OFP - Low Flow
Deeply incised channel (Incised Fan Surface)
Pipe-culvert 1.2mØ
Eastern & Western Active Channel Convergence
Mt Nicholas-Reach Bay Road
Toe of Walter Peak Range Front Slopes
Western Debris Flow Source Area (1.5km upchannel)
Rockfall & Debris flow material
Fault
Eastern Debris Flow Source Area (1km upchannel)
Mick O'Day Creek (Western Active Channel)
Toe of Walter Peak Range Front Slopes
Steep Talus Slope
Point 1673 Creek (Eastern Active Channel)

Notes:
1. These drawings have been prepared for the benefit of John Edmonds and Associates Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

SCALE 1:5000
0 50 100 150 200 250 (m)

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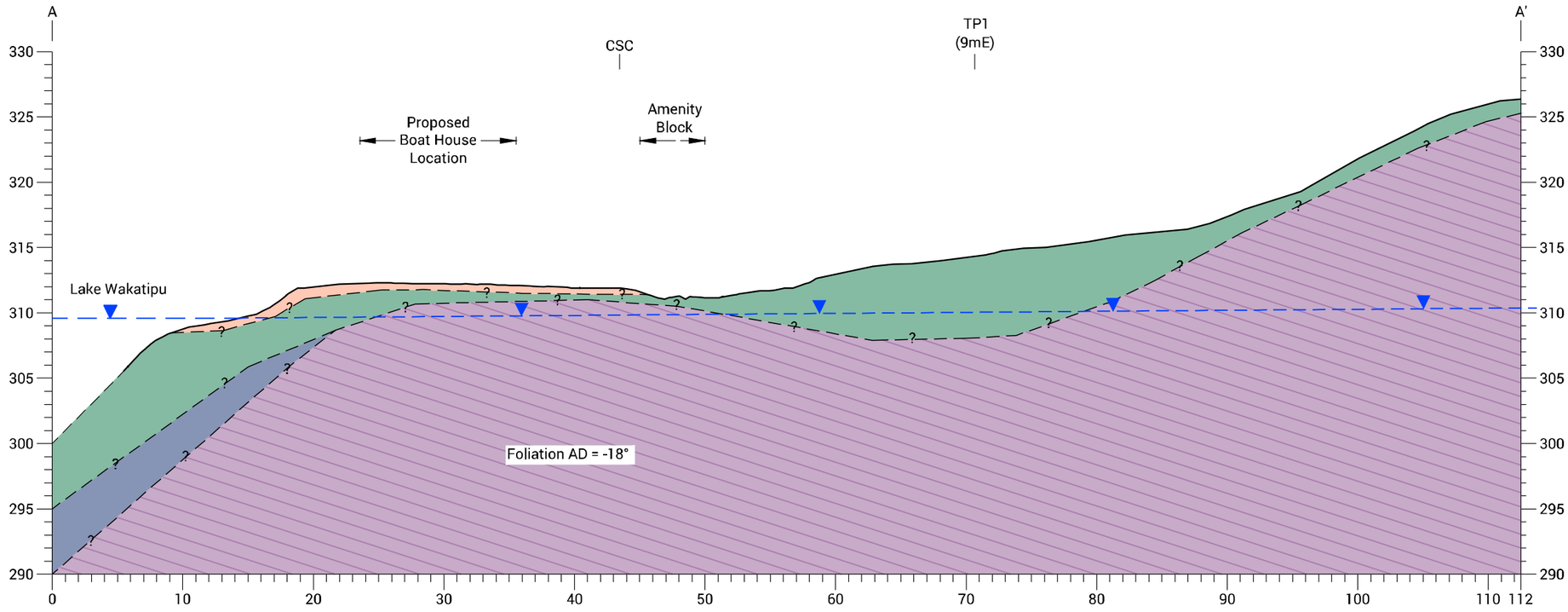
APPROVED		
CADFILE: 180154.dwg		
SCALES (AT A3 SIZE): 1:600		
PROJECT No: 180154	FIG No: Figure 1d	REV. 0

100WPS Limited
Walter Peak Subdivision
Geotechnical Inputs
Site Plan



Legend:

- Beach Gravel
- Fan Alluvium
- Glacial Till
- Schist Bedrock

SCALE 1:400

0 4 8 12 16 20 (m)

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SCALES (AT A3 SIZE): 1:400

PROJECT No: 180154

FIG No: Figure 2a

REV. 0

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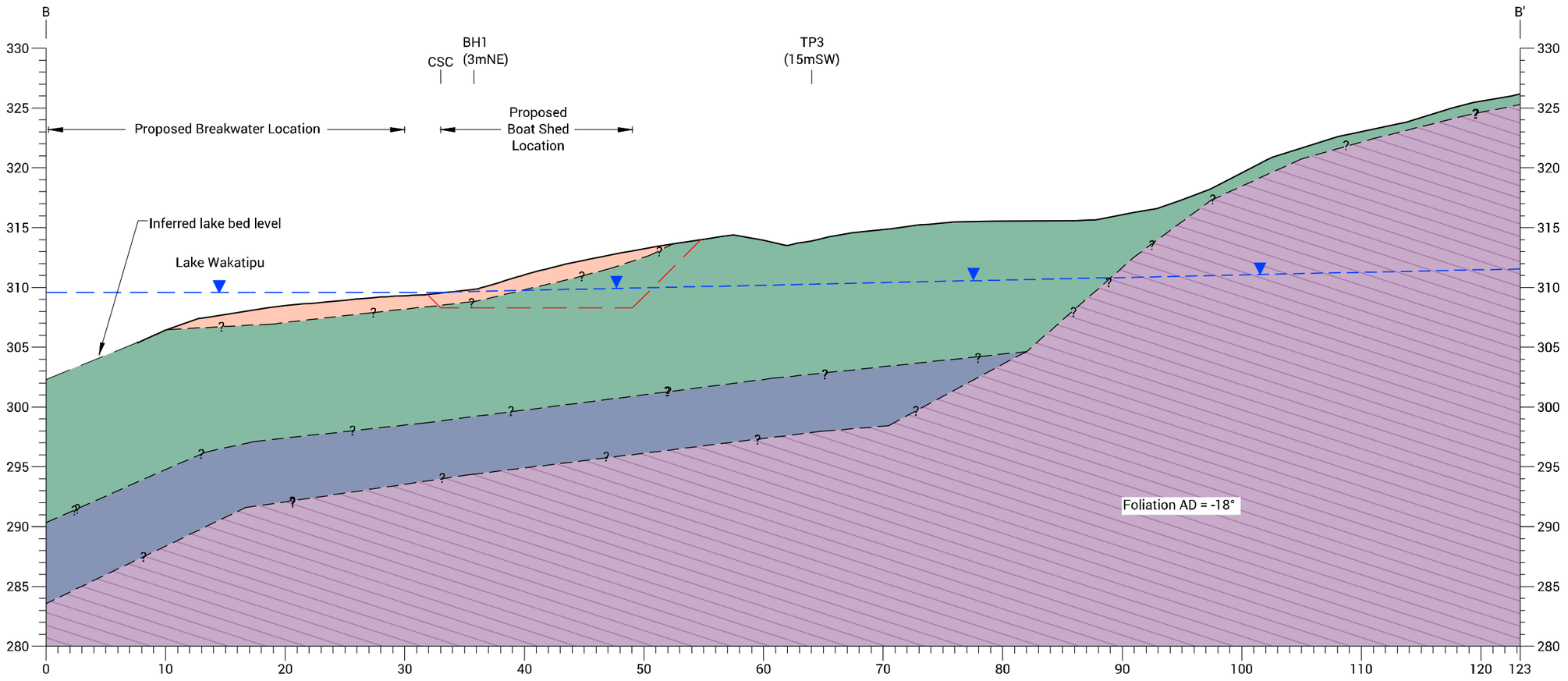
Walter Peak Subdivision

Geotechnical Inputs

Cross Section A



Legend:

- Beach Gravel
- Fan Alluvium
- Glacial Till
- Schist Bedrock

SCALE 1:400

0 4 8 12 16 20 (m)

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APPROVED	PGF	Sep.20

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SCALES (AT A3 SIZE): 1:400

PROJECT No: 180154

FIG No: Figure 2b

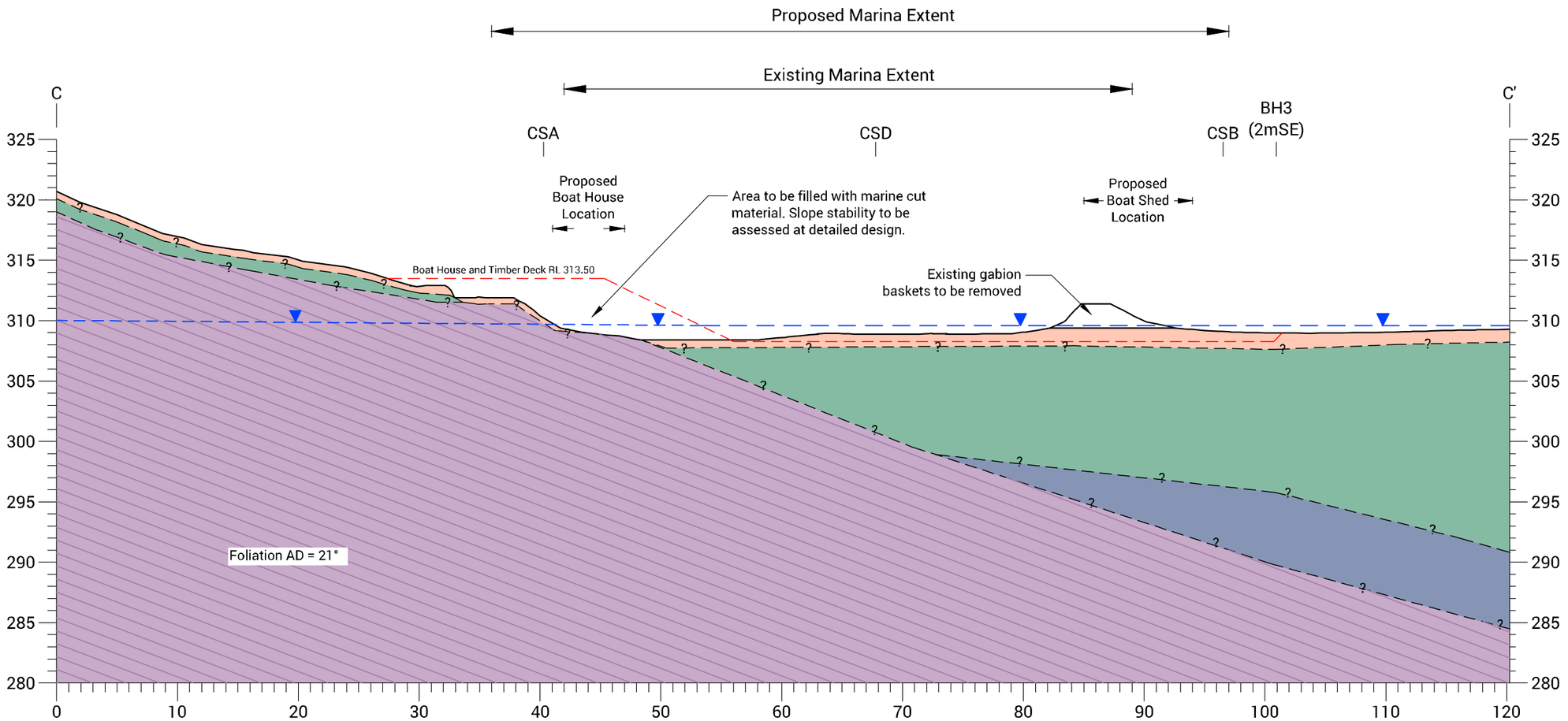
REV.: 0

100WPS Limited

Walter Peak Subdivision

Geotechnical Inputs

Cross Section B



Legend:

- Beach Gravel
- Fan Alluvium
- Glacial Till
- Schist Bedrock

SCALE 1:400

0 4 8 12 16 20 (m)

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CADFILE: 180154.01.dwg

SCALES (AT A3 SIZE): 1:400

PROJECT No: 180154

FIG No: Figure 2c

REV.: 0

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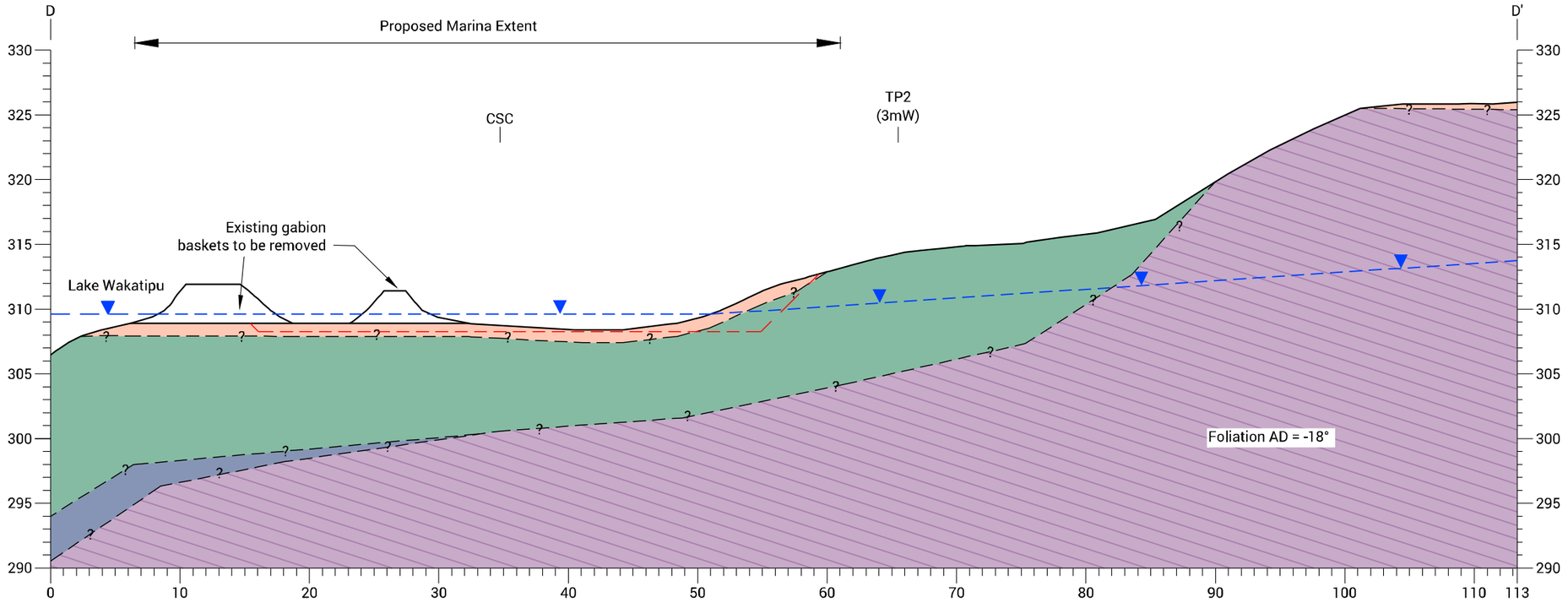
Walter Peak Subdivision

Geotechnical Inputs

Cross Section C



Legend:

- Beach Gravel
- Fan Alluvium
- Glacial Till
- Schist Bedrock

SCALE 1:400

0 4 8 12 16 20 (m)

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SCALES (AT A3 SIZE): 1:400

PROJECT No: 180154

FIG No: Figure 2d

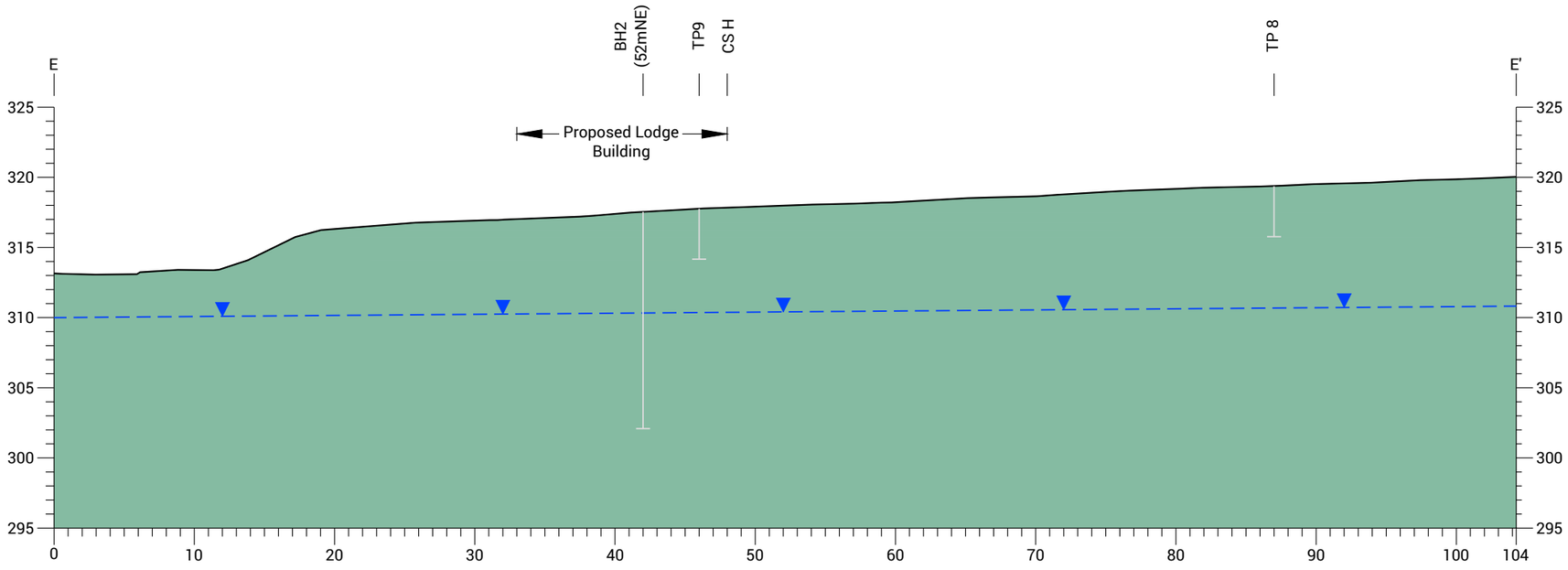
REV. 0

100WPS Limited

Walter Peak Subdivision

Geotechnical Inputs

Cross Section D



Legend:

- Fan Alluvium
- Water Table

SCALE 1:400

0 4 8 12 16 20 (m)

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CADFILE: 180154.01 Stage 2.dwg

SCALES (AT A3 SIZE): 1:400

PROJECT No: 180154

FIG No: Figure 2e

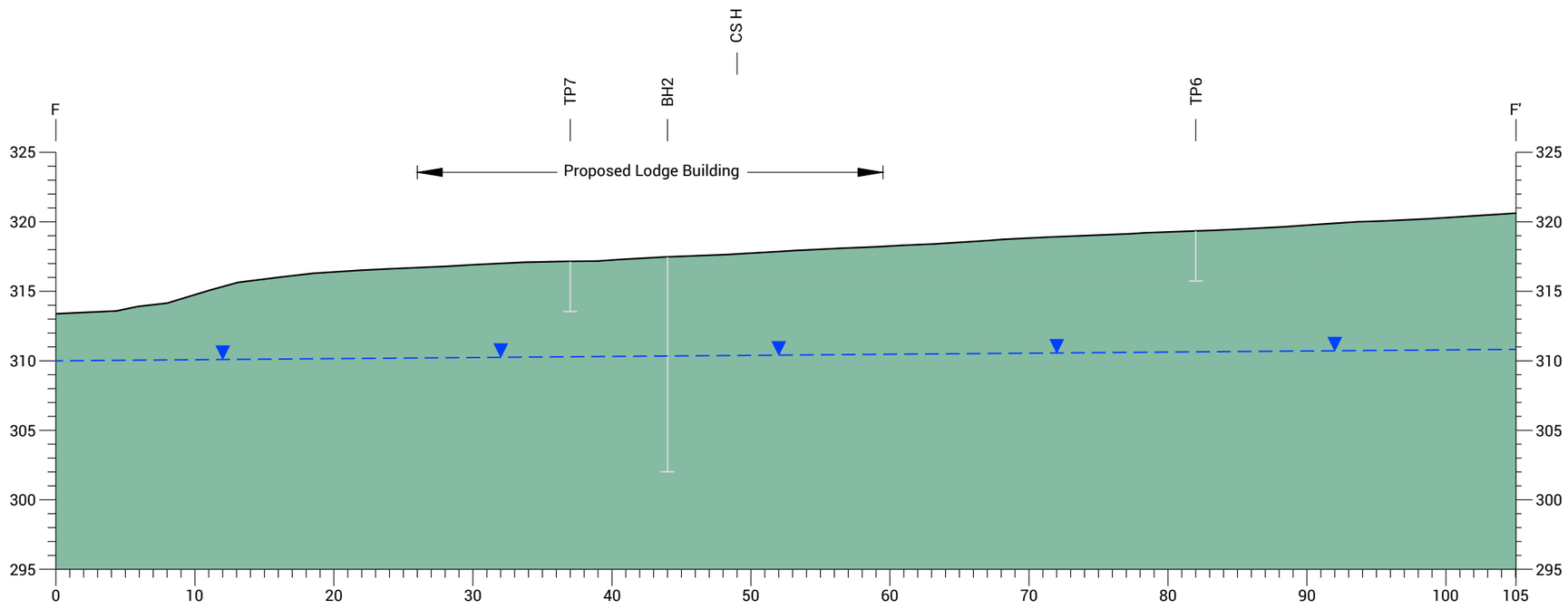
REV. 0

100WPS Limited

Walter Peak Subdivision

Geotechnical Inputs

Cross Section E



Legend:

- Fan Alluvium
- Water Table

SCALE 1:400

0 4 8 12 16 20 (m)

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CADFILE: 180154.01 Stage 2.dwg

SCALES (AT A3 SIZE): 1:400

PROJECT No: 180154

FIG No: Figure 2f

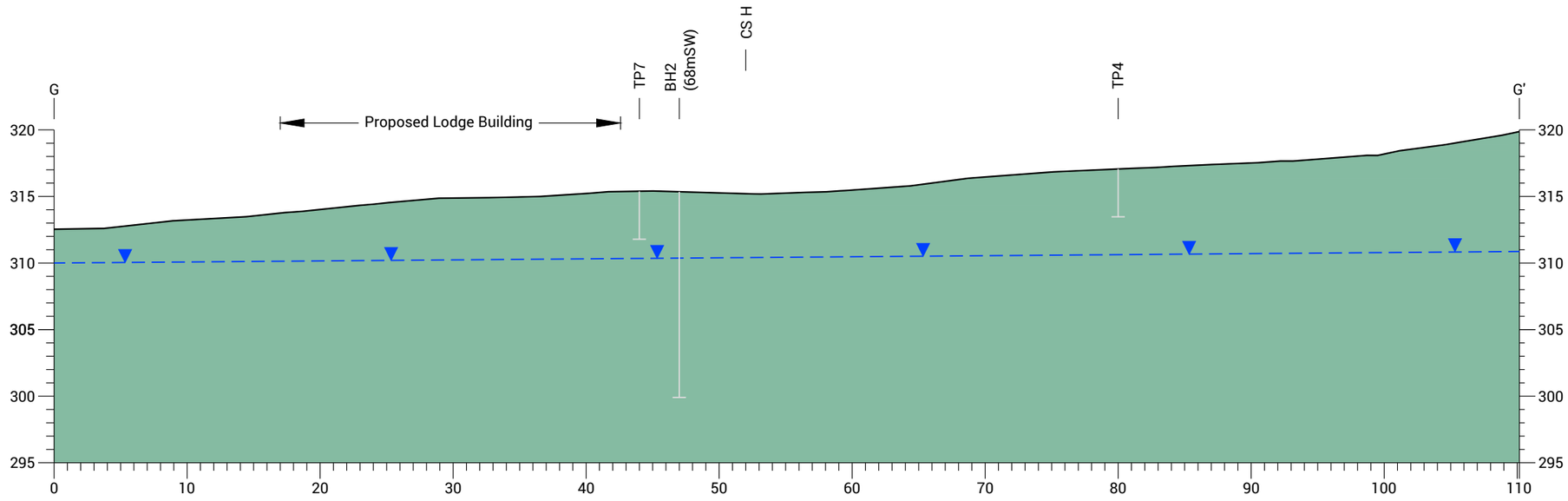
REV. 0

100WPS Limited

Walter Peak Subdivision

Geotechnical Inputs

Cross Section F



Legend:

- Fan Alluvium
- Water Table

SCALE 1:400

0 4 8 12 16 20 (m)

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CADFILE: 180154.01 Stage 2.dwg

SCALES (AT A3 SIZE): 1:400

PROJECT No: 180154

FIG No: Figure 2g

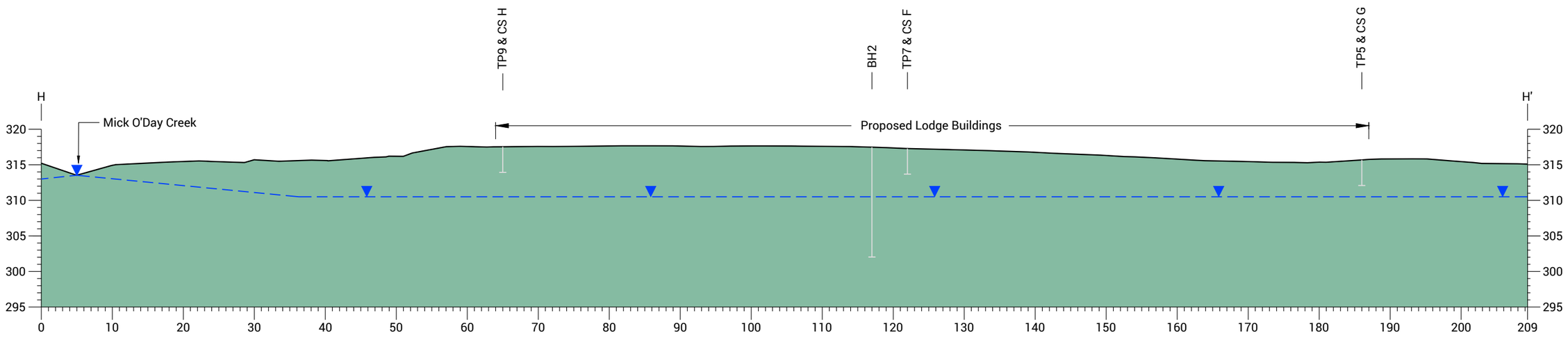
REV. 0

100WPS Limited

Walter Peak Subdivision

Geotechnical Inputs

Cross Section G



Legend:

- Fan Alluvium
- Water Table

SCALE 1:600

0 6 12 18 24 30 (m)

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DRAWN	JM	Feb.21
DRAFTING CHECKED	SAR	Sep.20
APPROVED	PGF	Sep.20

CADFILE: 180154.01 Stage 2.dwg

SCALES (AT A3 SIZE): 1:600

PROJECT No: 180154

FIG No: Figure 2h

REV. 0

100WPS Limited

Walter Peak Subdivision

Geotechnical Inputs

Cross Section H

Appendix B: Investigation Data

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 1**

PROJECT:	Walter Peak Station - Marina	JOB NUMBER:	180154

EASTING:		mE	EQUIPMENT:	13.5T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	19-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	19-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP
0.3	TOPSOIL		Dark brown, organic SILT with minor gravel. Soft. Moist.	
1.3	FAN ALLUVIUM		Brownish grey, sandy GRAVEL with with occasional 100 mm thick gravel lenses. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Gently inclined. Moist.	
3.5	FAN ALLUVIUM		Grey, silty SAND/sandy SILT. Sand is fine to medium. Sand becomes fine grained at 1.5 m. Loose. Bedded. Moist to wet.	
5.1	FAN ALLUVIUM		Blusih grey, Interbedded SILT with minor sand and sandy GRAVEL with some silt. Sand is fine (SILT). Sand is fine to coarse (GRAVEL). Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Wet.	

GROUNDWATER / SEEPAGE

Seepage @ 1.5 m

Regional groundwater table

SCALA PENETROMETER

Blows per 100mm

0 5 10 15

Total Depth = 5.1 m

COMMENT: Minor groundwater seepages (2L/min). Major slumping of test pit walls.

Logged By: JM

Checked Date:

Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 2**

PROJECT:	Walter Peak Station - Marina	JOB NUMBER:	180154

EASTING:		mE	EQUIPMENT:	13.5T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	19-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	19-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.3	TOPSOIL		Dark brown, organic SILT with minor gravel. Soft. Moist.			
4.0	FAN ALLUVIUM		Brownish grey, sandy GRAVEL with occasional 100 mm thick gravel lenses. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Gently inclined. Moist.		Regional groundwater table	

Total Depth = 4 m

COMMENT: Test pit walls collapsing at 4 m	Logged By: JM
	Checked Date:
	Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 3**

PROJECT:	Walter Peak Station - Marina	JOB NUMBER:	180154

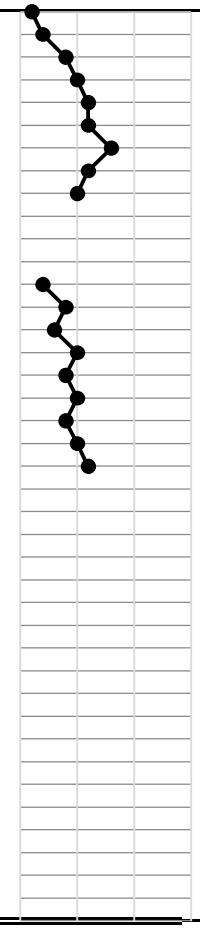
EASTING:		mE	EQUIPMENT:	13.5T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	19-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	19-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE
0.3	TOPSOIL		Dark brown, organic SILT. Soft. Moist.		
1.2	FAN ALLUVIUM		Brownish grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.		
1.9	FAN ALLUVIUM		Grey, GRAVEL with minor sand. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.		
2.2	FAN ALLUVIUM		Grey, SAND with minor gravel. Sand is fine to coarse. Gravel is fine to medium; subrounded to rounded. Medium dense. Bedded. Moist.		
4.0	FAN ALLUVIUM		Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.		Regional groundwater table

SCALA PENETROMETER

Blows per 100mm

0 5 10 15



Total Depth = 4 m

COMMENT: Test pit walls collapsing at 4 m

Logged By: JM

Checked Date:

Sheet: 1 of 1

GEOSOLVE

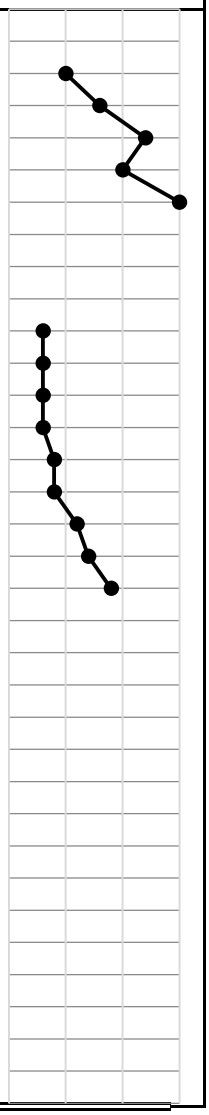
EXCAVATION LOG

EXCAVATION NUMBER: **TP 4**

PROJECT:	Walter Peak Station - Stage 2 Lodge	JOB NUMBER:	180154

EASTING:		mE	EQUIPMENT:	13T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	18-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	18-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.2	TOPSOIL		Dark brown, organic SILT with minor gravel. Soft. Moist.			
3.4	FAN ALLUVIUM		Light greyish brown, sandy GRAVEL with trace cobbles. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Cobbles up to 100 mm. Medium dense. Bedded. Moist.		NO SEEPAGE	



Total Depth = 3.4 m

COMMENT: Test pit dry. Minor slumping of side walls

Logged By: JM
Checked Date:
Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 5**

PROJECT:	Walter Peak Station - Stage 2 Lodge	JOB NUMBER:	180154

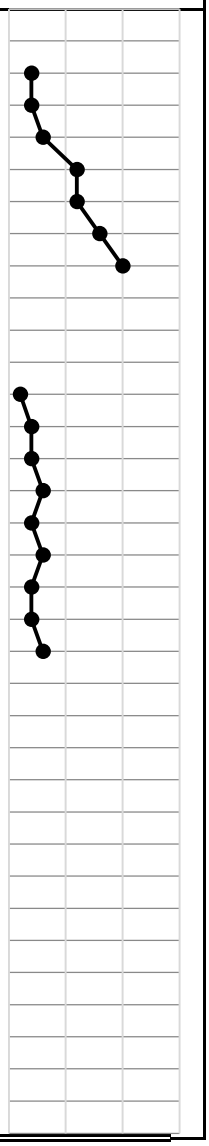
EASTING:		mE	EQUIPMENT:	13T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	18-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	18-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE
0.2	TOPSOIL		Dark brown, organic SILT with minor gravel. Soft. Moist.		
0.6	FAN ALLUVIUM		Grey, gravelly SAND. Sand is fine to coarse. Gravel is fine; subrounded to rounded. Medium dense. Bedded. Moist.		
0.8	FAN ALLUVIUM		Grey, SAND with minor gravel. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.		
1.1	FAN ALLUVIUM		Orangey brown, GRAVEL with minor sand. Sand is fine to medium. Gravel is medium to coarse; rounded. Medium dense. Bedded. Moist.		
2.0	FAN ALLUVIUM		Grey, Interbedded SAND with minor gravel and GRAVEL with minor sand. Sand is fine to coarse. Gravel is fine to coarse; rounded. Medium dense. Bedded. Moist.		
3.5	FAN ALLUVIUM		Grey, gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.		NO SEEPAGE

SCALA PENETROMETER

Blows per 100mm

0 5 10 15



Total Depth = 3.5 m

COMMENT: Test pit dry. Minor slumping of side walls

Logged By: JM

Checked Date:

Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 6**

PROJECT:	Walter Peak Station - Stage 2 Lodge	JOB NUMBER:	180154

EASTING:		mE	EQUIPMENT:	13T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	18-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	18-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.3	TOPSOIL		Dark brown, organic SILT with minor gravel. Soft. Moist.			
1.1	FAN ALLUVIUM		Orangey brown, sandy GRAVEL with trace cobbles. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.			
1.6	FAN ALLUVIUM		Grey, gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.			
3.6	FAN ALLUVIUM		Grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.		NO SEEPAGE	

Total Depth = 3.6 m

COMMENT: Test pit dry. Moderate slumping of side walls

Logged By: JM

Checked Date:

Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 7**

PROJECT:	Walter Peak Station - Stage 2 Lodge	JOB NUMBER:	180154

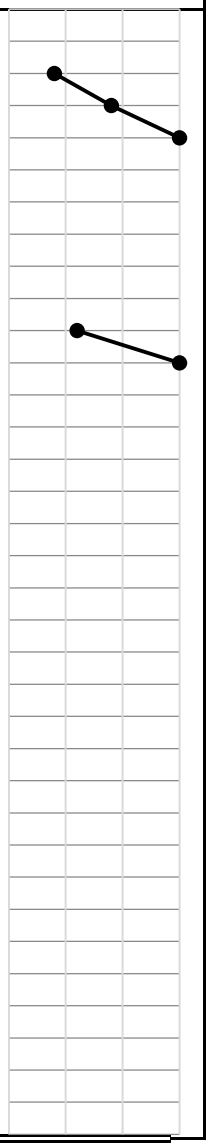
EASTING:		mE	EQUIPMENT:	13T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	18-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	18-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE
0.2	TOPSOIL		Dark brown, organic SILT with minor gravel. Soft. Moist.		
3.5	FAN ALLUVIUM		Brownish grey, sandy GRAVEL with trace cobbles. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Iron staining to 1.5 m. Medium dense. Bedded. Moist.		NO SEEPAGE

SCALA PENETROMETER

Blows per 100mm

0 5 10 15



Total Depth = 3.5 m

COMMENT: Test pit dry. Side walls stood well

Logged By: JM

Checked Date:

Sheet: 1 of 1

GEOSOLVE

EXCAVATION LOG

EXCAVATION NUMBER: **TP 8**

PROJECT:	Walter Peak Station - Stage 2 Lodge	JOB NUMBER:	180154

EASTING:		mE	EQUIPMENT:	13T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	18-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	18-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.3	TOPSOIL		Dark brown, organic SILT with trace gravel. Soft. Moist.			
2.1	FAN ALLUVIUM		Grey, sandy GRAVEL with trace cobbles. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.			
3.5	FAN ALLUVIUM		Grey, sandy GRAVEL with minor cobbles. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Medium dense. Bedded. Moist.		NO SEEPAGE	

Total Depth = 3.5 m

COMMENT: Test pit dry. Minor slumping of side walls	Logged By: JM
	Checked Date:
	Sheet: 1 of 1

GEOSOLVE

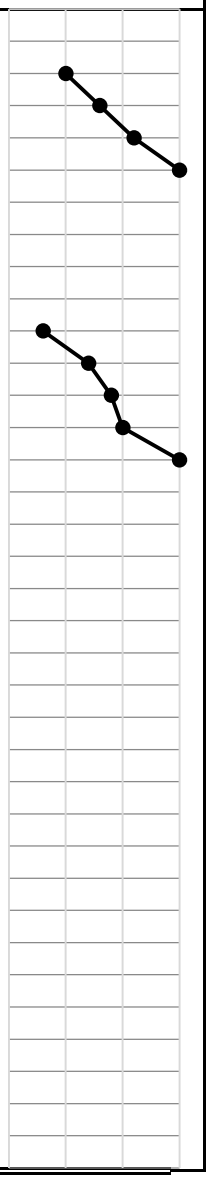
EXCAVATION LOG

EXCAVATION NUMBER: **TP 9**

PROJECT:	Walter Peak Station - Stage 2 Lodge	JOB NUMBER:	180154

EASTING:		mE	EQUIPMENT:	13T Excavator	OPERATOR:	Mat Burt
NORTHING:		mN	INFOMAP NO.		COMPANY:	MB Mechanical & Marine Limited
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	18-Aug-20
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	18-Aug-20

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm (0 5 10 15)
0.2	TOPSOIL		Dark brown, organic SILT with minor gravel. Soft. Moist.			
3.6	FAN ALLUVIUM		Grey, sandy GRAVEL with trace cobbles. Sand is fine to coarse. Gravel is fine to coarse; subrounded to rounded. Iron staining to 1.2 m. Medium dense. Bedded. Moist.		NO SEEPAGE	



Total Depth = 3.6 m

COMMENT: Test pit dry. Minor slumping of side walls

Logged By: JM

Checked Date:

Sheet: 1 of 1

GEOSOLVE

DRILLHOLE No: BH1

DRILLHOLE LOG

PROJECT: Walter Peak	JOB No: 180154	LOCATION: Walter Peak	HOLE LOCATION: See Site Plan
CO-ORDINATES -45.114948° 168.516604°		DRILL TYPE: Sonic	HOLE STARTED: 06/08/2020
		DATUM: Ground Level	HOLE FINISHED: 06/08/2020
DIRECTION: Vertical		R.L. 310 m	DRILLED BY: Jamie - Speight Drilling
ANGLE FROM HORIZ.: 90 °		R.L. COLLAR: m	LOGGED BY: MBS CHECKED: SR

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m) / Depth (m)	Graphic Log	Drillers Notes	TESTING Hammer Efficiency: 69.4% Borehole Diameter: Liner:	Water Loss (%) 25 50 75	Water Level	Installation	Core Box
BEACH GRAVELS	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded. - Sand is fine to medium from 0.3 m & gravel is subrounded to rounded. - Sand is fine to coarse from 0.5 m.	Sonic	65	Moist		1							
	Grey, sandy GRAVEL. Sand is medium to coarse. Gravel is fine to coarse, subrounded to rounded.												
	Dark grey, sandy GRAVEL with minor silt. Sand and gravel is fine to coarse, subrounded to rounded.												
	Core Loss 1.1 to 1.5 m								SPT @ 1.5 m 5, 5, 4, 5, 5, 6 N = 20				
FAN GRAVELS	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to medium, subrounded to rounded. - Gravel is fine to coarse, subrounded from 1.95 m. - Sand is fine to medium from 2.4 m. - Sand is fine to coarse from 2.6 m.	SPT Sonic	70 95		Medium dense	2					Groundwater @ 1.0 m depth		1
	Grey, GRAVEL with some sand and trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to rounded. - No silt from 3.45 m.	SPT Sonic	40 60		Medium dense	3			SPT @ 3 m 4, 5, 3, 4, 3, 3 N = 13				
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded.												
	Core Loss 4.0 to 4.5 m					4			SPT @ 4.5 m 4, 3, 1, 1, 1, 1 N = 4				
	Grey, SAND with minor gravel and trace of silt. Sand is fine to medium. Gravel is fine to medium, subrounded. Massive. - Gravel is fine to coarse from 5.0 m. - Trace of gravel, gravel is fine to medium from 5.2 m. - Gravel is fine from 5.4 m.	SPT Sonic	40 85	Wet	Loose	5							
	Grey, SAND with trace of silt. Sand is fine to medium. Massive.												
	Grey, sandy GRAVEL with trace of cobbles and silt. Sand is fine to coarse. Gravel is fine to coarse. Gravel and cobbles are subrounded to rounded.												
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. - Gravel is subrounded to subangular from 6.45 m.	SPT Sonic	40 50		Medium dense	6			SPT @ 6.0 m 2, 3, 4, 4, 3, 3 N = 14				2
	Core Loss 7.0 to 7.5 m.					7			SPT @ 7.5 m 5, 8, 6, 5, 5, 4 N = 20				
	Grey, SAND with some gravel and trace of silt. Sand is fine to medium. Gravel is fine to coarse, subangular.	SPT Sonic	55 40		Medium dense	8							
	Grey, GRAVEL with some sand. Sand is fine to coarse. Gravel is fine to coarse, subrounded.												
	Core Loss 8.5 to 9.0 m.					9			SPT @ 9.0 m 7, 8, 5, 6, 7, 6 N=24				3
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to medium, subrounded to subangular. - Gravel is fine to coarse from 9.45 m.	SPT Sonic	55 80		Medium dense								

COMMENTS:

Survey Method: Google Earth

Log Scale 1:50

DRILLHOLE No: BH1

DRILLHOLE LOG

PROJECT: Walter Peak	JOB No: 180154	LOCATION: Walter Peak	HOLE LOCATION: See Site Plan
CO-ORDINATES -45.115000° 168.516582°		DRILL TYPE: Sonic	HOLE STARTED: 06/08/2020
		DATUM: Ground Level	HOLE FINISHED: 06/08/2020
DIRECTION: Vertical		R.L.	DRILLED BY: Jamie - Speight Drilling
ANGLE FROM HORIZ.: 90 °		R.L. COLLAR: m	LOGGED BY: MBS CHECKED: SR

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m) Depth (m)	Graphic Log	Drillers Notes	TESTING Hammer Efficiency: 69.4% Borehole Diameter: Liner:	Water Loss (%) 25 50 75	Water Level	Installation	Core Box
GLACIAL TILL	Light grey, silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Massive	Sonic				10							
	Light grey, sandy gravelly SILT. Sand is fine to coarse. Gravel is fine coarse, subrounded to subangular. Massive. - Gravel is subangular from 10.95 m. - Gravel is subrounded to subangular from 11.2 m.	SPT	100		Very dense	11			SPT @10.5 m 5, 10, 14, 17, 19 N = 50 + over 370 mm				3
	Light grey, sandy GRAVEL with some silt. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular (schist). Massive.	Sonic	100			12			SPT @ 12.0 m 50 + Bouncing N = 50 + over 60 mm				4
	Light grey, silty sandy GRAVEL. Sand and gravel is fine to coarse, subangular. Massive.	SPT	100		Very dense								
	Light grey, sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular. Massive.	Sonic	100	Wet		13			SPT @ 13.5 m 50 + Bouncing				5
	- Sand is fine to medium from 13.45 m.	SPT	100		Very dense								
	- Sand is fine to coarse from 14.0 m. - Sand is fine to medium from 14.2 m.	Sonic	100			14			SPT @ 15m 50 + Bouncing				
		SPT	100		Very dense	15							
SCHIST BEDROCK	Grey, semi-pelitic SCHIST. Multiple drilling-induced fractures. Moderately strong.	Sonic	85			16							
	Grey, quartzofeldspathic schist. Multiple drilling-induced fractures. Moderately strong.					17							6
	Grey, semi-pelitic SCHIST. Multiple drilling-induced fractures. Moderately strong.		85			18							
			90			19							7
						20							

COMMENTS:

Survey Method: Google Earth

Log Scale 1:50

GEOSOLVE

DRILLHOLE LOG

DRILLHOLE No: BH1

PROJECT: Walter Peak	JOB No: 180154	LOCATION: Walter Peak	HOLE LOCATION: See Site Plan
CO-ORDINATES -45.114948° 168.516604°		DRILL TYPE: Sonic	HOLE STARTED: 06/08/2020
		DATUM: Ground Level	HOLE FINISHED: 06/08/2020
DIRECTION: Vertical		R.L. 310 m	DRILLED BY: Jamie - Speight Drilling
ANGLE FROM HORIZ.: 90 °		R.L. COLLAR: m	LOGGED BY: MBS CHECKED: SR

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m) Depth (m)	Graphic Log	Drillers Notes	TESTING Hammer Efficiency: 69.4% Borehole Diameter: Liner:	Water Loss (%) 25 50 75	Water Level	Installation	Core Box
SCHIST BEDROCK	Grey, semi-pelitic SCHIST. Multiple drilling-induced fractures. Moderately strong. - Light grey from 20.5 m.	Sonic	95										7
	End of Borehole @ 21.0 m												

COMMENTS:

Survey Method: Google Earth

Log Scale 1:50

GEOSOLVE

DRILLHOLE No: BH2

DRILLHOLE LOG

SHEET 1 OF 2

PROJECT: Walter Peak	JOB No: 180154.01	LOCATION: Walter Peak	HOLE LOCATION: See Site Plan
CO-ORDINATES -45.114907° 168.519054°		DRILL TYPE: Sonic	HOLE STARTED: 02/08/2020
		DATUM: Ground Level	HOLE FINISHED: 02/08/2020
DIRECTION: Vertical		R.L. 317.3 m	DRILLED BY: Jamie - Speight Drilling
ANGLE FROM HORIZ.: 90 °		R.L. COLLAR: m	LOGGED BY: MBS CHECKED: SR

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m) Depth (m)	Graphic Log	Drillers Notes	TESTING Hammer Efficiency: 69.4% Borehole Diameter: Liner:	Water Loss (%) 25 50 75	Water Level	Installation	Core Box
TOPSOIL	Dark brown, organic SILT with rootlets and grass. Moist.				Soft								
FAN ALLUVIUM	Grey brown, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. - Brown grey from 0.6 m. - Grey from 0.9 m.	Sonic	95	Moist									
	- Gravel is fine to medium from 1.45 m. - Gravel is fine to coarse from 1.6 m.	SPT	100		Medium dense				SPT @ 1.5 m 17, 33 N = 50+ for 130 mm				1
	- Trace of cobbles from 2.7 m.	Sonic	95										
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular.	SPT	55		Dense				SPT @ 3.0 m 13, 14, 11, 8, 10, 12 N = 41				
	- Gravel is fine to medium, subrounded from 5.0 m. - Sand is fine to medium from 5.3 m. - Sand is fine to coarse & trace of cobbles from 5.4 m. Cobbles are subrounded to subangular	Sonic	100										2
		SPT	35		Medium dense				SPT @ 4.5 m 9, 6, 6, 6, 6, 7 N = 25				
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular.	Sonic	95										
		SPT	45		Medium dense				SPT @ 6.0 m 4, 5, 4, 3, 3, 4 N = 14				3
	Grey, GRAVEL with some sand. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular.	Sonic	80										
	Grey, SAND with trace of gravel. Sand is fine to coarse. Gravel is fine to medium. Gravel is sub-rounded to sub-angular. Massive. - Trace of silt from 7.3 m.								SPT @ 7.5 m 7, 5, 4, 4, 3, 4 N = 15		▽ Groundwater @ 7.3 m depth		
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subangular. - Gravel is subrounded from 8.0 m.	SPT	30	Wet	Medium dense								
		Sonic	80										4
	Core Loss 9.0 to 9.45 m.	SPT	0		Medium dense				SPT @ 9.0 m 3, 4, 3, 3, 3, 4 N = 13				
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. - Brown grey from 9.9 to 1.0 m.		90										

COMMENTS:

Survey Method: Google Earth

Log Scale 1:50

DRILLHOLE No: BH2

DRILLHOLE LOG

PROJECT: Walter Peak	JOB No: 180154.01	LOCATION: Walter Peak	HOLE LOCATION: See Site Plan
CO-ORDINATES -45.114907° 168.519054°		DRILL TYPE: Sonic	HOLE STARTED: 02/08/20
		DATUM: Ground Level	HOLE FINISHED: 02/08/20
DIRECTION: Vertical		R.L. 317.3 m	DRILLED BY: Jamie - Speight Drilling
ANGLE FROM HORIZ.: 90 °		R.L. COLLAR: m	LOGGED BY: MBS CHECKED: SR

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity)	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m) Depth (m)	Graphic Log	Drillers Notes	TESTING (Hammer Efficiency: 69.4%, Borehole Diameter:, Liner:)	Water Loss (%)	Water Level	Installation	Core Box
FAN ALLUVIUM	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular.	SPT	90	Wet	Medium dense	11			SPT @ 10.5 m 8, 8, 6, 5, 5, 5 N = 21	25 50 75			4
	- Trace of cobbles from 11.2 m, cobbles are subrounded.	Sonic	100										
	Grey, sandy GRAVEL with trace of silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular.	SPT	50		Medium dense	12			SPT @ 12.0 m 6, 10, 6, 5, 4, 4 N = 19				5
		Sonic	100			13			SPT @ 13.5 m 13, 11, 10, 9, 7, 8 N = 34				
		SPT	55		Dense								6
		Sonic	95			14							
	Sandy GRAVEL with minor silt. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular.	SPT	65		Dense	15			SPT @ 15.0 m 9, 12, 10, 10, 11, 13 N = 44				
	End of Borehole @ 15.45 m					16							
						17							
						18							
						19							
						20							

COMMENTS:

Survey Method: Google Earth

Log Scale 1:50