pitt&sherry

Monitoring Report Q1 2024

Rosetta and Casuarina Landslip Areas

Prepared for
Glenorchy City Council

Client representative
Dan Egodawatte

Date
2 May 2024

Rev00

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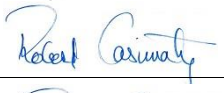
Prepared by — Megan Abbott		**Date —** 2 May 2024
Reviewed by — Robert Casimaty		**Date —** 2 May 2024
Authorised by — Robert Casimaty		**Date —** 2 May 2024

Revision History

Rev No.	Description	Prepared by	Reviewed by	Authorised by	Date
RevA	DRAFT	MA	RC	RC	22/04/2024

1. Introduction

At the request of Glenorchy City Council (GCC; the client) various aspects of the Rosetta Landslide and the Casuarina Landslide are being regularly reviewed (sites shown in Figure 1). Monitoring of the Rosetta site has been ongoing since 1990; Casuarina monitoring since 2015. Quarterly reviews of the monitoring data have been undertaken by Baynes Geologic over this time. This is the first quarterly review of monitoring data conducted by pitt&sherry, following a handover meeting with Fred Baynes of Baynes Geologic on 19th March 2024.

This report pertains to both landslip areas, for the monitoring period for Q1 (Jan 1st – 31st March) 2024. This report should be read in conjunction with the Rosetta and Casuarina Landslip Management Plan (Landslip Management Manual_Rev10.0), last revised by GCC in August 2020 in consultation with Baynes Geologic.

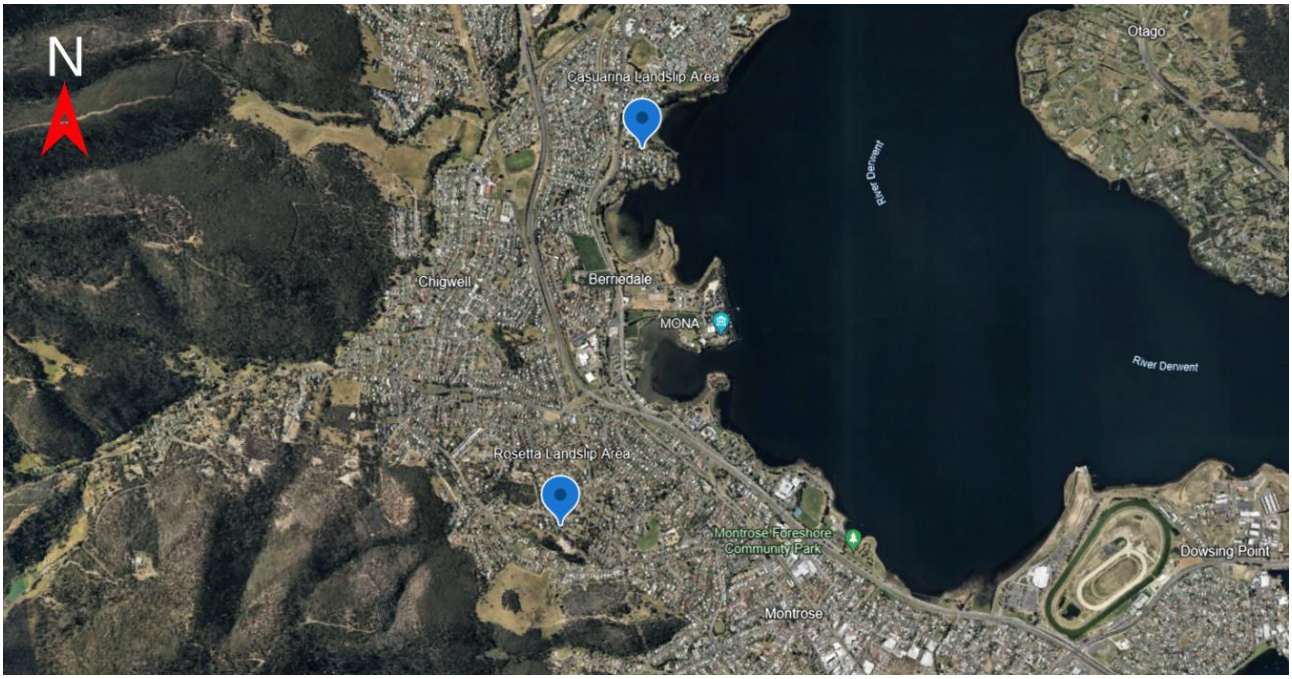


Figure 1: Satellite image of Glenorchy showing landslip investigation sites (image; Google Earth 2024)

This report concludes that small, localized movements of parts of the Rosetta landslide are continuing to show signs of minor development, but that mass landslide movements are unlikely at this time.

This report also concludes that there are small, localized movements of parts of the Casuarina landslide still occurring, but that mass landslide movements are stable at this time. Previously noted movement at the toe of the landslide appears to have been caused by cracking and leakage of a nearby sewer; it is understood that this has been repaired by TasWater.

2. Data Reviewed

The data reviewed in this report have been provided by GCC as of 10th of April 2024, and consist of the files listed below in Table 1.

Table 1: Summary of data files provided by client for review

File Type	Description
Excel spreadsheet (.xls)	Rosetta Landslip Surveys 1990 – MAR2024
Excel spreadsheet (.xls)	Casuarina Monitoring – JUL 2015 – JAN2024
PDF Manual (.pdf)	Landslip Management Manual_Rev10.0

2.1 Comments on Monitoring Data - Rosetta

Rosetta Landslip area is outlined below in Figure 2, and affects property along Crosby Rd, Officer St, and Hone Rd.

The most useful monitoring data to understand the behaviour of the landslide is provided by nine monitoring points and the water levels in three piezometers installed in boreholes and three boreholes in which pumps have been installed; the locations of these are shown in Figure 2.

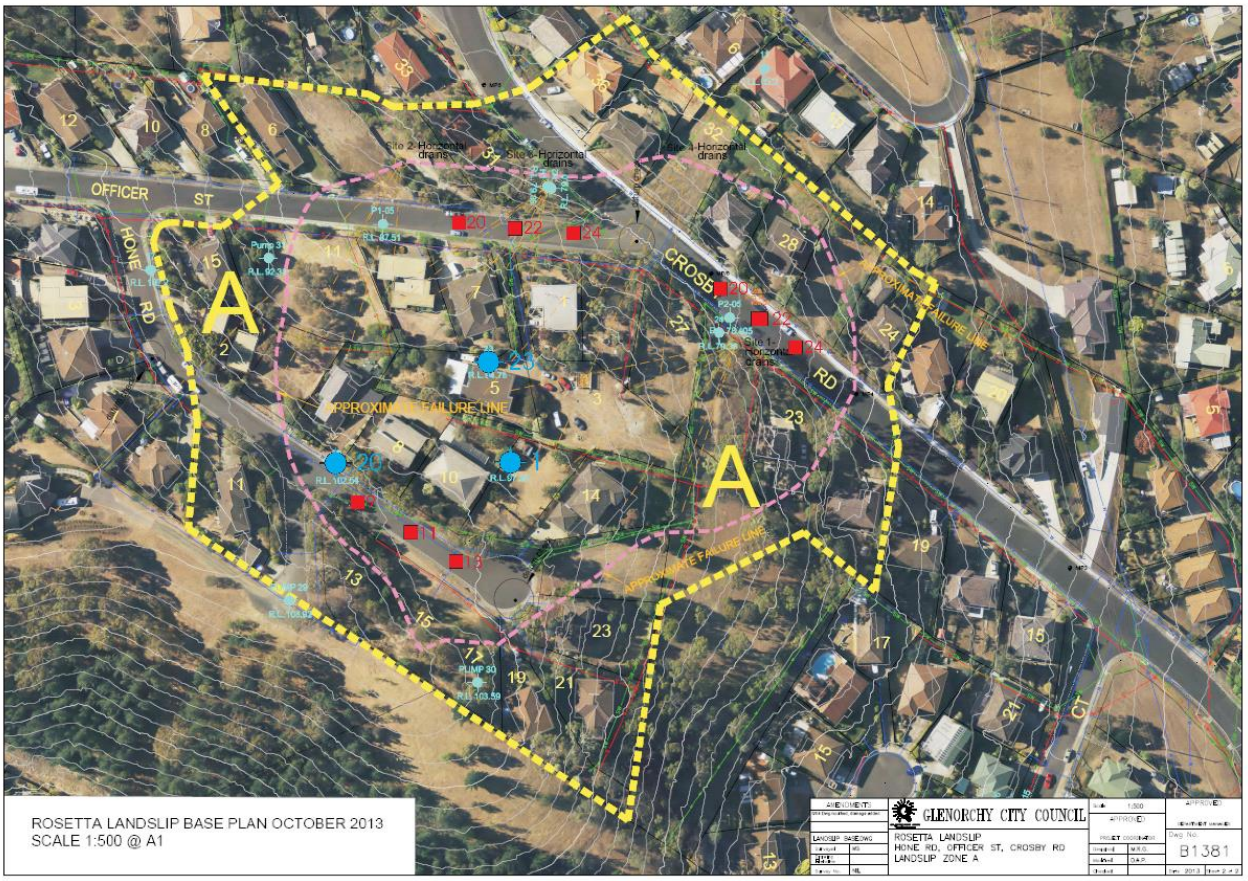


Figure 2: The Rosetta Landslip Area A (yellow outline). Critical survey monitoring points (red) and groundwater monitoring boreholes (blue).

The accuracy of the surveys is theoretically in the range of +/- 3 mm for the horizontal co-ordinates and +/- 1mm for the vertical co-ordinates (relative level). It is possible that variations associated with setting up the instrument, operator error or the stability of the base station could be greater than this error, as systematic variations in the precise position of the survey points of up to 5 to 10 mm appear to occur regularly. The effects of swelling and shrinkage of clay rich soils during wet and dry periods and settlement associate with the long-term consolidation of the landslide mass may also be contributing to minor variations in the measurements.

Although the individual movement vectors picked up in quarterly surveys often cannot be examined in isolation to detect landslide movements, trends in the long-term monitoring data provide greater insight into potential mass landslip movement.

2.1.1 Survey Points 9, 11 &13 – Hone Road

The last survey pickup was conducted by GCC in April 2024. There continues to appear to be a long-term trend of settlement or minor downwards movement of between 15 and 20 mm over the last 10 years in this area, with little in the way of lateral movements. This is consistent with the location of these monitoring points within the upper part of landslide, where downward movements would be anticipated. There is no significant mass-movement of the landslide suggested by data at this time.

2.1.2 Survey Points 20, 22 &24 – Officer Street

The last survey was conducted in March 2024. There appears to be a long-term trend of settlement and lateral displacement of between 10 and 15 mm over the last 10 years in this area with survey point 24 showing possibly 15 to 25 mm settlement over the same period, however local movement appears to have stabilised since 2018. No significant mass-movement of the landslide is suggested by data at this time.

2.1.3 Survey Points 20, 22 & 24 – Crosby Road

The last survey was conducted in February 2024. The three monitoring points appear to have settled by approximately 5-10mm over the last 10 years. There is no significant mass-movement of the landslide suggested at this time.

2.1.4 Boreholes 1, 20 & 23 – Piezometer monitoring

Groundwater levels in boreholes 1 and 20 continue to be below levels at which immediate actions are required, which indicates that the pumping and the gravity drainage is effectively maintaining groundwater levels. No landslide movements appear to be associated with a rise in groundwater levels and the previously noted temporary failure of pump 31 has been rectified. Following replacement, groundwater levels appear to have dropped below surface by 11m since December 2023.

2.1.5 Horizontal Drains

Four arrays of horizontal drains were installed in a fan pattern to drain and stabilize the landslide and have been continuously monitored since 2015, with the outfall connected to the mains stormwater system (Figure 3). Arrays 1, 2 and 3 are all dry with intermittent flows from two pipes in array 4. The most recent flow reading on array 4 has fallen to 0.05litre/minute since February 2024, following the replacement of pump 31 (Figure 4). Changes to the monitoring regime are not warranted at this stage.

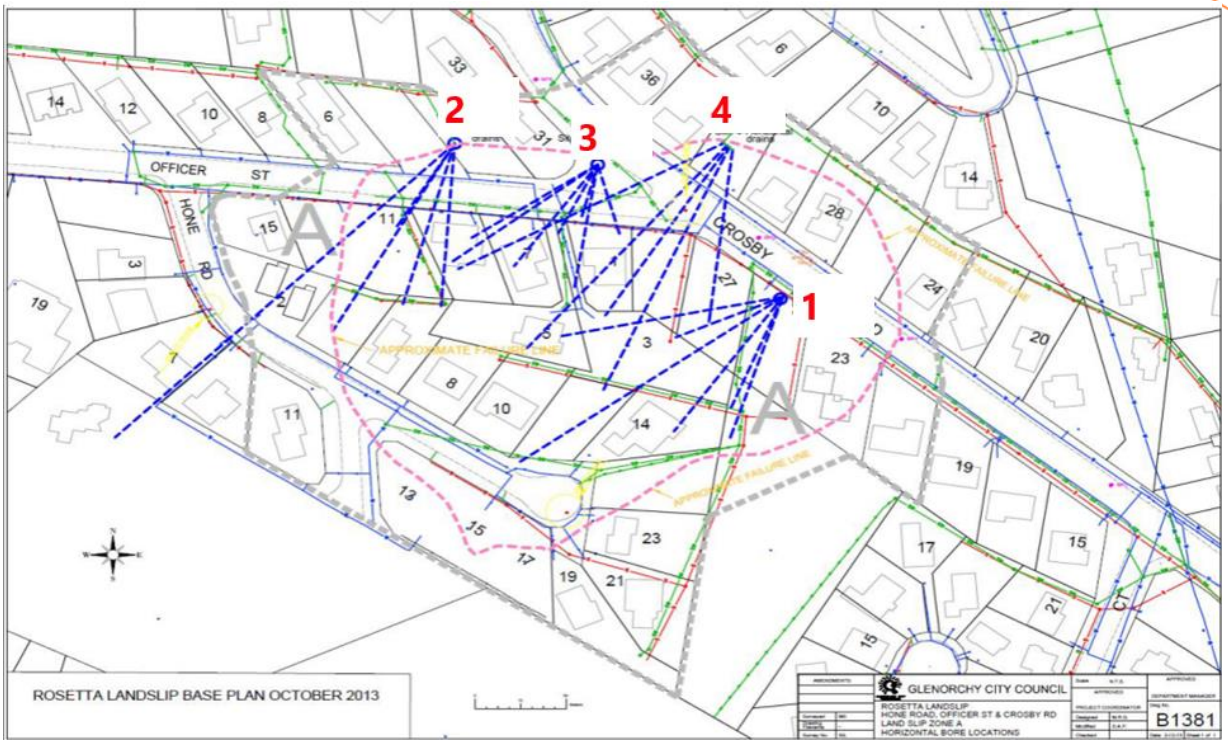


Figure 3: Installations of horizontal drains within the Rosetta Landslip A Zone

Figure 4: Array 4 outflow point of horizontal drains, minor flow only (image: pitt&sherry, 19th March 2024).

2.1.6 Water Usage

The reporting of average daily water usage is considered to be beneficial to understanding the stability of the Rosetta landslide. It is understood that GCC have identified a number of properties within the landslip footprint as having excessive water usage; it is understood TasWater have been advised and investigations are pending for leaks and defects at the time of writing.

A list of the properties is included in Appendix A.

2.1.7 Rainfall Data

Monthly rainfall data from the Bureau of Meteorology site 094025 at Glenorchy Reservoir from 1950 to date is summarised below.

Table 2: Monthly rainfall data from 094025 BOM station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	44.2	45.3	44.7	59.0	63.3	61.9	72.9	83.2	71.9	74.1	66.3	60.6	754.2
Lowest	0.8	4.0	4.6	5.2	10.5	8.0	8.8	16.4	15.4	19.5	4.4	2.1	486.2
Median	37.6	36.2	41.8	50.0	45.4	52.5	62.8	75.5	58.5	62.9	65.4	53.4	735.4
Highest	142.8	172.6	123.2	326.0	277.6	236.8	284.0	199.3	207.9	228.2	147.6	225.4	1200.7
2022	55.4	7.7	31.6	24.4	192.0	99.8	36.2	110.7	43.1	103.4	70.8	53.6	828.7
2023	7.8	51.0	42.3	23.4	43.8	74.6	60.2	27.6	55.5	69.4	30.8	35.2	521.6

From this data, the rainfall in 2022 was significantly above the mean, whereas in 2023 it was over 30% below the mean.

Monthly rainfall is also monitored by GCC directly via a station at Glenorchy Reserve. Apart from expected seasonal variations, no significant trends are observed in local rainfall (Figure 5).

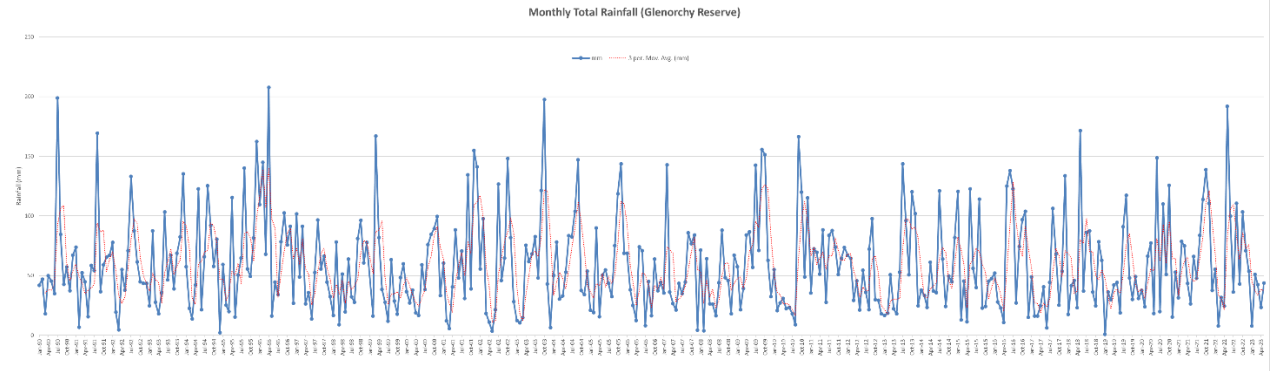


Figure 5: Monthly rainfall monitoring at Glenorchy Reserve

2.2 Comments on Monitoring Data - Casuarina

Casuarina Landslip area is located in the edge of Conneware Bay and is monitored with an array of 10 surface monitoring points along affected properties on Casuarina Crescent (Figure 6). Two piezometers are also installed to 5m and 10m respectively to monitor groundwater levels. Control points have been in place since 2015, and surveys are conducted monthly by GCC.

The last survey of Casuarina monitoring points was conducted by GCC in January 2024. There are movements of several millimetres both laterally and vertically, which probably reflect seasonal variations in moisture content of clay soils. Movement on the monitoring points shows minimal displacement in the order of 5-10mm over 5 years; with the exception of Control Point 2, which shows a displacement of ~35mm over the same period. Since March 2023, Control Point 2 appears to have stabilised but should remain under close observation.

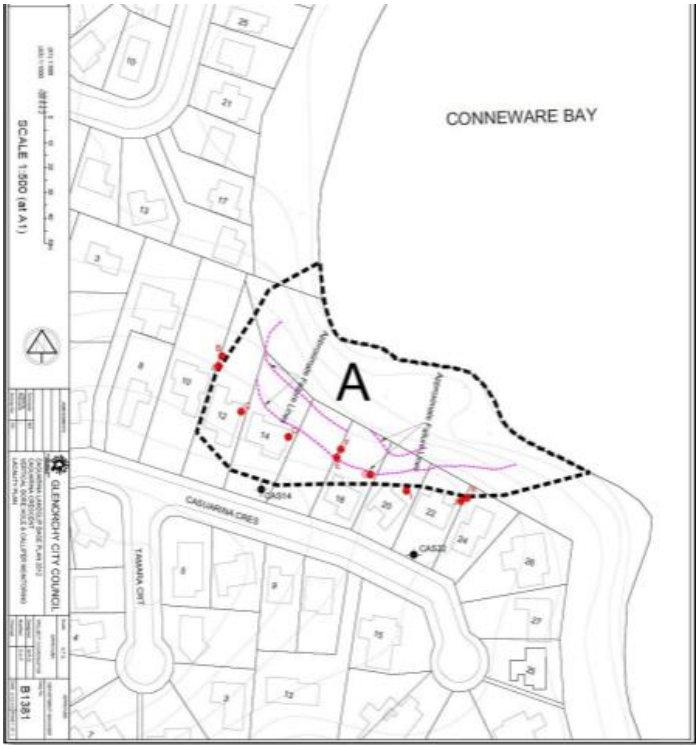


Figure 6: The Casuarina Landslip area (A), showing monitoring points (red).

Piezometer levels in two boreholes within the landslip footprint were last measured in December 2023, no significant changes were noted.

The stormwater outfall at Casuarina was observed to be damaged (Figure 7). It is understood that arrangements are being made to have this repaired.

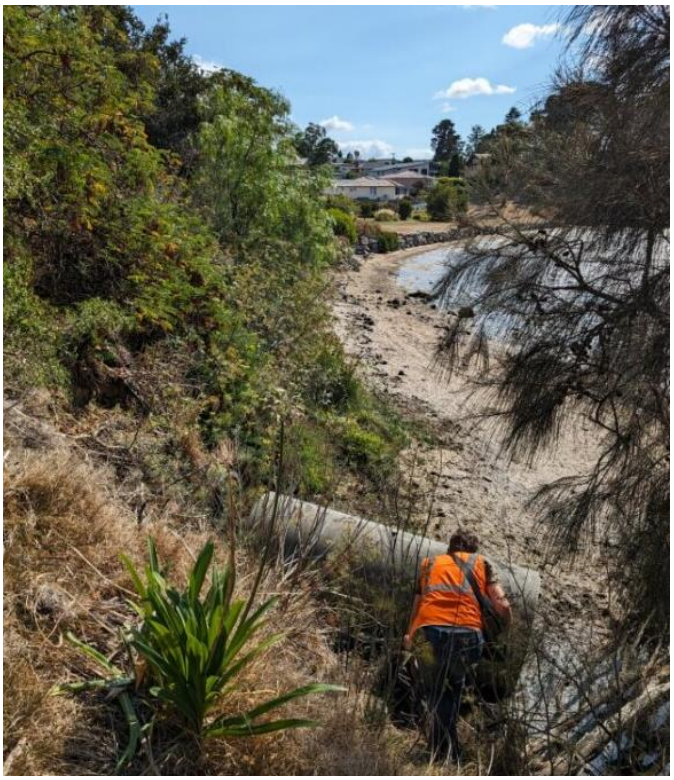


Figure 7: Disconnected stormwater outfall pipe; Casuarina landslip area

2.3 Conclusions and Recommendations

This report concludes that there are probably small, localized movements of parts of the Rosetta landslide that are continuing to develop, although mass landslide movements are unlikely to be occurring at this time.

This report concludes that that there are probably small, localized movements of parts of the Casuarina landslide occurring but that mass landslide movements are not occurring. Previously noted increased movement on Control Point 2 appears to be due to leakage from the sewer; it is understood this has been rectified.

Arrangements are being made to undertake repairs on the damaged stormwater outfall pipe at Casuarina.

3. References

Bureau of Meteorology, 2024, Monthly Rainfall – Glenorchy Reservoir 094025, electronic dataset, viewed 9th April 2024, <http://www.bom.gov.au/climate/data/>

DPIPWE, 2024, Land Information System Tasmania, electronic datasets, viewed 10th April 2024, <https://maps.thelist.tas.gov.au/listmap/>

DPIPWE, Latinovic. M, Forsyth. S, Matthews. W.L. (2012). Tasmanian Aquifer Framework Report. Groundwater Management Report Series, Report No. GW2012/02. Water and Marine Resources Division, Department of Primary Industries, Parks, Water and Environment, Hobart

Mazengarb, C. 2004: Map 1, Glenorchy – Landslide Inventory and Geomorphology. Tasmanian Landslide Hazard Series. Mineral Resources Tasmania, Department of Infrastructure Energy and Resources, Hobart.

Mazengarb, C. 2004: Map 3, Glenorchy − Potential Debris− Flow Hazard. Tasmanian Landslide Hazard Series. Mineral Resources Tasmania, Department of Infrastructure Energy and Resources, Hobart.

Mazengarb, C. 2004: Map 4, Glenorchy − Potential Rockfall Hazard. Tasmanian Landslide Hazard Series. Mineral Resources Tasmania, Department of Infrastructure Energy and Resources, Hobart.

Important information about your ground engineering report

These notes are additional to any limitations noted within the report. They have been provided by pitt&sherry to clarify the limitations of the report, and to clearly identify the individual responsibilities of all parties involved. It is important that all documents from pitt&sherry are read thoroughly, and that clarification is sought when necessary.

Specificity

Your report has been developed based on pitt&sherry's understanding of your project requirements and applies only to that project. If there are subsequent changes to the proposed project, pitt&sherry should be consulted to assess how the changes impact on the report's recommendations. If pitt&sherry are not consulted, they do not accept responsibility for issues that may occur due to project changes. No responsibility is accepted for the use of this report, in whole or in part, in other contexts or for any other purpose.

Report integrity

This report is presented as a whole; with conclusions and recommendations reliant upon data presented in other sections. Reading parts of the report in isolation may lead to misinterpretations, and as such the report should not be copied in part or altered in any way.

Where information contained within this report is to be used for tendering purposes it is recommended that the entire report be made available. In situations where this is not appropriate, pitt&sherry can assist in preparing a specially edited document to provide the information within an appropriate context.

Site variability

The results presented in this report represent the conditions at the specific sampling and testing locations. They also represent the conditions at the time that the work was carried out. Variations in conditions may occur between or beyond assessment locations, either due to natural variability or previous excavations.

It is recognised that conditions may change over time. This can be due to natural processes (landslides, water content change) or driven by human activities (cutting or filling in the vicinity).

The advice presented in this report is based on the data gathered during the investigation, and the accuracy may be impacted by undetected variations in ground conditions or later changes to the site. Retaining pitt&sherry throughout development stages can assist in reducing the impact of these issues by identifying variances, conducting additional testing if required, and recommending solutions to problems encountered on site.

Interpretation by others

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a ground engineering report. To help avoid these problems, pitt&sherry can work with other project design professionals to explain the findings in this report, and to review the adequacy of their plans and specifications with respect to these issues. pitt&sherry will not be responsible for interpretations of report findings by others involved in the design and construction process.

Third party and client supplied information

Data supplied by the client, or third parties is assumed to be correct, unless otherwise stated. While every care has been taken by pitt&sherry in producing the report, pitt&sherry has not checked or verified the accuracy of such information (unless specifically included in pitt&sherry's scope of services). Accordingly, no responsibility is accepted by pitt&sherry for incomplete or inaccurate data supplied by others.

Safety in design

This report does not contain information sufficient to constitute a safety report. Such a document would require inputs beyond pitt&sherry's current knowledge of the project and is beyond the scope of this investigation. pitt&sherry can assist in the risk assessment process required to produce such a document, if requested.

Geoenvironmental issues

Unless stated otherwise, your report does not make any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site. In the absence of such a statement, pitt&sherry take no responsibility for such issues. Since unanticipated environmental problems have led to numerous project failures it is pitt&sherry's recommendation that you obtain your own geoenvironmental information.

Water Meter Usage Data

Appendix A

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	30/08/2023	23/11/2023	26/02/2024		30/08/2023	23/11/2023	26/02/2024	
Address	**Average Daily Use [kL]**	**Average Daily Use [kL]**	**Average Daily Use [kL]**	**Difference**	**>0.7 Y/N**	**>0.7 Y/N**	**>0.7 Y/N**	**Trigger in 3 consecutive usage >0.7KL/D**
1-2/2 Hone Rd	0.881	0.931	0.749	-0.182	Y	Y	Y	Alert
3 Hone Rd	0.859	0.859	0.937	0.078	Y	Y	Y	Alert
6 Hone Rd	0.761	0.942	1.211	0.269	Y	Y	Y	Alert
14 Hone Rd	0.988	0.883	1.137	0.254	Y	Y	Y	Alert
5 Officer St	5.028	5.037	1.629	-3.408	Y	Y	Y	Alert
6 Officer St	-0.481	0.338	1.327	0.989	N	N	Y	Pass
7 Officer St	0.548	0.624	0.814	0.190	N	N	Y	Pass
8 Officer St	0.745	0.570	0.790	0.220	Y	N	Y	Pass
10 Officer St	0.399	0.617	1.071	0.454	N	N	Y	Pass
17 Officer St	1.120	0.765	1.011	0.246	Y	Y	Y	Alert
18 Officer St	0.440	0.478	1.071	0.593	N	N	Y	Pass
19 Officer St	1.085	1.194	2.454	1.260	Y	Y	Y	Alert
21 Officer St	1.848	0.965	3.590	2.625	Y	Y	Y	Alert
25 Officer St	0.739	1.201	1.327	0.126	Y	Y	Y	Alert
14 Casuarina Cres	1.040	0.916	2.600	1.684	Y	Y	Y	Alert
18 Casuarina Cres	1.640	0.909	0.808	-0.101	Y	Y	Y	Alert
20 Casuarina Cres	0.520	0.501	0.522	0.021	N	N	N	Pass
22 Casuarina Cres	0.402	0.101	0.398	0.297	N	N	N	Pass

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Rosetta and Casuarina Landslip Areas

Pitt & Sherry (Operations) Pty Ltd
ABN 67 140 184 309

Phone 1300 748 874
info@pittsh.com.au
pittsh.com.au

Located nationally —
Melbourne
Sydney
Brisbane
Hobart
Launceston
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Devonport