From: Philip Barrett
Sent: 16 Aug 2019 17:21:10 +1200
To: Cameron Aplin
Subject: Singleton Subdivision s92 reply
Attachments: G&S Singleton s92 reply letterV2.pdf, Final Report-August2019.pdf, Letter of Support - Singletons.pdf, G&S Singleton FINAL & Rev2 Geotechnical Investigation Report 150819.pdf, Singleton - FINAL Covenant Vegetative Area plan.pdf

See attached Cam.

Kind Regards

Philip Barrett
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OUR REF M13246

16 August 2019

Waikato District Council
CI- Cameron Aplin
BCD
PO Box 9421
Waikato Mail Centre,
Hamilton

ATTENTION: Cameron Aplin Email: camerona@bcdgroup.nz

Dear Cameron

635 WHATAWHATA ROAD: RMA SECTION 92 REPLY

Informal Further Information Request email dated 12 June 2019.

Access

Item 1: The applicant will not be seeking road to vest in Council. A public road will be an anathema to the design principles that drives this subdivision proposal. A road would reduce the site to the now defunct farm scenario that has more in common with urban areas. Rights of way are provided as per the lodged plan noting NZTA recommendation to enlarge insofar as to protect the SH 23 seal from stones. We note both the Operative and Proposed District Plans Table 4 and Table 14.12.5.15 respectively, do not require a road between 4 to 8 allotments. Lots 8 and 9 have an almost direct access off SH 23 so that practically only 8 allotments are proposed to be served by the ROW being Lots 1 - 7 and Lot 10. The proposed legal width of 10.0m and the metalled surface are supported by the design principles that seeks to avoid an urban effect. The proposed road width is sufficient to allow a carriageway enabling vehicles to pass safely in the context of the low speed private environment. The diminished width also supports the proposed power and communication self-sufficiency of future dwellings. There is no underground cabling that requires a standard road width. The narrow width results in residual Lot 10 retaining land that will be maintained within one allotment. These are matters to be considered in the context of the wider and noncomplying activity status application and not consideration of or dependent on specific rule dependent.

Stormwater

Item 2: We have not provided a stormwater report. The reasons for this being that:
The District Plan stormwater engineering standards require disposal systems to meet the following objectives:

(a) safeguard people from injury or illness from damage caused by surface water
(b) avoid adverse effects caused by surface water on other properties
(c) protect the environment from accelerated erosion or sedimentation
(d) protect the environment from the effects of heavy metals and other contaminants in stormwater discharges

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(e) protect the outfalls of drainage systems.
(ea) provide adequate drainage within each allotment

The Golovin addendum floodplain analysis shows zero effect on the building platforms of Lots 1 - 7 and 10 in compliance with (a) and (b). Any current flood event effect to the land west of the site is not increased given development will discharge stormwater at predevelopment rates to onsite existing ponds in compliance with (b). The CMW Geoscience report confirms all lot (flood safe) building platforms remain suitable for development in compliance with (c). A stormwater system can be designed at building consent stage to meet objective (d). In compliance with (e) and (ea), due to soil conditions (see CMW geoscience report) stormwater is proposed to be detained in tanks onsite and discharged at predevelopment rates to existing ponds, the details including outfall structures can be provided at building consent.

The two areas of access road subject to 100year flood (1%AEP) can be subject to a condition requiring specific engineering design to ensure the road surface is above the known flood level.

Geotechnical
Item 3: In order to better understand the request, I had a phone discussion with Malcom Brown who really wanted a discussion of potential flood effects should the 1.5m square culvert under the SH blocked. In the discussion Malcom suggested a 1%AEP and 100% blockage. However, this request is not supported by any rule in the plan or any standard in RITS. Speaking with stormwater engineers a 100% blockage scenario is not a standard calculation. We understand the need for a blockage scenario and have attached the Golovin floodplain analysis that contains an addendum. This addendum provides for a 1%AEP with 50% blockage. There is a zero flood effect on the building platform of Lots 1 - 7 and 10.

Attached is a revised CMW report with plans that show the possible location of WW and SW fields within each allotment. All of which are above the 1% AEP blockage flood event. No additional building restriction lines are required.

OTHER MATTERS
Iwi Consultation
Attached is a supportive reply from Ngaa Uri O Maahanga dated 7 August 2019.

Affected Party Approvals
Attached are two affected party approvals. One from Nigel Liddicott 14 Stonebridge Estate.

BOFFA MISKELL ASSESSMENT OF LANDSCAPE EFFECTS
RMA s104D Gateway Test
The conclusion of this report is that
With the inclusion of the recommendations set out in Section 6 and the retention of the design as it is presented the potential adverse landscape and visual effects will be low to moderate. This translates (as set out in Appendix 1) as being a minor adverse effect.
This means the application is compliant with RMA section 104D(1)(a) test.
RMA section 104D Particular restrictions for non-complying activities -
(1) Despite any decision made for the purpose of notification in relation to adverse effects, a consent authority may grant a resource consent for a non-complying activity only if it is satisfied that either—
(a)the adverse effects of the activity on the environment (other than any effect to which section 104(3)(a)(ii) applies) will be minor; or
(b)the application is for an activity that will not be contrary to the objectives and policies…

RMA s95A Notification and RMA s104 Consideration

The landscape assessment has not identified any affected parties where the recommendations of Section 6 of the report is acceptable to the applicant (see below). Notwithstanding, and with relevance to RMA S95D(e), the applicant has obtained the following approvals:

1. 14 Stonebridge Estate, Nigel Liddicott. While not an immediate adjacent neighbour, the dwelling directly overlooks the building platform of proposed Lot 4. Mr Liddicott acknowledged paragraph three of Visual Effects Assessment page 43 of the application report. This paragraph notes that the intervening ridgeline is already planted with Pittisporum and Redwoods to ensure mitigation in time. This ridgeline is also noted as a Covenant Vegetative Area shown on the McCracken Surveys Plan Proposed Covenant Vegetative Area (Visual Mitigation) 635 Whatawhata Road, Dinsdale. This plan is also subject to the landscape report Section 6 Recommendations.
2. 44 Wallace Road, Christopher and Melissa Gibbs. They are immediate farming neighbours to the east.

Landscape Assessment Report - visual effects

Visual Effects may be summarised as follows:

Section 5.2.1 Effects from public vantage points

Changes to SH23 vantage point is considered to be indiscernible. The report recommends that some of the existing tree planting north of Lot 1 are also protected to continue the existing visual integration and character of the site (see updated Covenant Vegetative Area plan).

Wallace Road: Considered low magnitude of change.

Section 5.2.2 Private effects from private viewpoints

SH23 – Low to very low degree of [less than minor] adverse visual effects.

Howden Road: Low [less than minor] in nature.

Taitua Road: Very low [less than minor].

Wallace Road: Very low [less than minor] in nature considering existing and covenant vegetative area mitigation.

Stonebridge Road: Most sensitive dwellings identified are14 and 23 Stonebridge Estate. Lot 2 and Lot 10 are visible with some available views to 15 to 21 Stonebridge Estate. However existing boundary planting provides substantial visual screening. Proposed additional planting was observed on site [i.e. recent boundary planting] however this planting was not shown on the Covenant Vegetative Area (now shown on updated Covenant vegetative Area plan).

Lot 6 magnitude of change is low to moderate (minor effect).

The magnitude of change varies for each of the [Stonebridge Estate] dwellings. The inclusion of subdivision will see a low to moderate level (minor) of adverse visual effect which can be suitably mitigated for Lots 1 - 5 and 10 with visual mitigation planting additional to that shown on the Covenant Vegetative Area Plan.

Report Summary of Landscape Effects

The direct landscape effects are stated to be that house platforms will requires minimal changes to the landform, the management of waterways have been enhanced with the inclusion of wetland areas and riparian planting. Although not stated in the report, these must be considered positive effects when responding to RMA s95 and s104 matters. The report summaries that due to the location of Lots 6 and 7 may result in low to moderate effects on the landscape rural character. The landscape effect is noted to specifically relate to 'potential spatial effects.

Report Summary of Visual Effects

Section 5.2.3 Summary of Visual Effects states that a low to moderate level of adverse visual effects can be suitably mitigated for Lots 1 - 10 with visual mitigation planting additional to that shown on the Covenant Vegetation Area plan. Attached is an updated Covenant Vegetation Plan that shows additional covenant areas suggested by Rebecca Ryder and agreed by the applicant.

The potential cumulative effects is considered to result in a low degree of adverse cumulative effects in the broader landscape character area. Low being less than minor effects. In this consideration Rebecca noted the overall density of development responds to the location, characteristics of the site and the surrounding landform and vegetation cover. Thus, the wider rural character formed part of this landscape assessment.
Section 5.2 Visual Effects last paragraph hints of the need for the type, height and objective of vegetation cover to be specifically notated on the plan. The point of the covenant plan is to show areas that are subject to covenant. Vegetative species type height and objective are better located within a landscape management plan. Such a plan is recommended in section 6 of the report.

Comment on Report Summaries and Conclusion
Paragraph one concludes that *The proposed subdivision has the potential to introduce low to moderate* [minor] *adverse landscape effects upon the wider rural character, which can be mitigated through the inclusion of design measures and reconfiguration of the southern lots 6 and 7.*

With regard to visual effects, these are concluded to be mitigated via the inclusion of the section 6 recommendations and landscape management plan and will result in minor landscape visual effects. Adverse effect can be eliminated or reduced by a countervailing factor, in this case additional planting covenant areas and [acceptance] of section 6 recommendations.

The landscape report evidence is that the minor rural character effect is based on one only rural character effect - spatial effect. This would be insufficient to warrant notification in the context of the entire application. It is noteworthy the land is not productive soils, is very unlikely to be reconverted to rural production, maintains a number of rural elements such as reasonable open space, tracts of improved wetlands, narrow carriageways and is a unique site.

Lots 6 and 7 spatial effect is based on house platforms sitting in a transition area between the site and its surrounding rolling hills and hence *spatially* these two house sites have the *potential* to introduce low to moderate adverse effects on the landscape character. Lots 6 and 7 spatial minor effect appears to hinge on a *balancing* perspective and that only these two lots somehow do not protect the rural character margins of the site from development. The lots are treated separately from lots 1-5 and building platform 10. The balance perspective applied to these two lots reasonably can only be proffered from an aerial view perspective or plan view. This perspective is evident only because of the existing cadastral boundaries that create a small wing effect to the south east and south west. Lots 6 and 7 from a ground perspective is not evident making the aerial perspective potentially academic. The practicable effect is no more than minor.

Notably the report states that lots 6 and 7 have the *potential* to have adverse effects not that they actually create spatial effects (there is no report discussion) or that the spatial effect is so significant to warrant notification. Only one rural character element is *potentially* infringed. Elements such as geology, landform, soils, vegetation are not so impinged, rather the proposal is very sensitive to these rural character elements in the whole.

Lots 6 and 7 sites are well chosen to provide space and separation, including visual separation, between onsite dwellings and provides more than compliant distances between boundaries and existing dwellings where they are adjacent. The minor visual effects are time sensitive, that is, the medium to long term existing and covenanted plantings will mitigate any current viewshafts that are already minor effects, to be less than minor as growth of planted vegetation happens. Notably, the landscape report notes at Section 5.3 cumulative effects, *the southern end (Lots 6 and 7) sleeving into the adjoining development and lowland plains area*. This is not a negative comment rather it supports the ability of these two lots to fit comfortably within the wider site maintaining rural character. It is the case that rural character and rural visibility may be academically assessed independently but they are otherwise largely indivisible, opposite

sides of the same coin so that one can positively influence or mitigate the other. In this case, the *potential spatial* effect is positively mitigated visually both internally and externally.

The wider and fuller RMA s104 assessment must also consider the permitted activity effects (baseline) at the site. Record of Title SA10B/683 contains 41.6194ha while also containing proposed lots 1 – 7 and 10 within its boundaries. Both the Proposed and Operative District Plans provide for up to two dwellings where the land title contains at least 40ha. It is entirely possible (not fanciful) that presently two residential dwellings can be constructed as a permitted activity within the locations of lots 6 and 7. The permitted baseline allows the consent authority to disregard adverse effects which are permitted by a rule in a district plan.

The landscape assessment has opted for minor visual and rural character effects. The visual effect is at worst experienced to a minor degree currently and will be less than minor upon future growth mid to long term and further mitigated by additional covenanted areas and upon the imposition of building design recommendations. The rural character minor effect hinges on a single rural character element that is proposed only to be potentially spatial. Recent case law notes that the statutory tests of 'minor', 'more than minor', and 'less than minor' can only be informed by context *One is dealing with degrees of smallness*. The court has considered that the term "less than minor" means an effect that in the overall context is insignificant and one which is so limited that it is objectively acceptable and reasonable in the receiving environment and to a potentially affected person. The weight of all information provided in the overall context of the application results in effects that are less than minor. The landscape assessment notes that *additional dwellings within the subdivision introduces a low [less than minor] degree of adverse cumulative effects when considering the broader landscape character of the area.*

Overall, the information provided supports effects that are less than minor and relieves the consent authority of its s 95E(1) obligation to notify.

Section 6 RecommendationsT
The draft building design management recommendations are acceptable to the applicant subject to the following amendments:

Fencing
Any fencing must be screen (vegetative) planted and not visible externally of the Record of Title boundary.

Buildings and Structures
Height: All buildings shall be single storey and a maximum height of 6.0m from the registered (finished) ground level.

It is understood the 5.0m height restriction in combination with the single storey requirement to limit a roof pitch within the context of the site but allow internal ceiling height. The preference for a 6.0m height restriction provides for existing shed structure on site as well as improved design criteria for single storey dwellings. Notable the District Plan provides for 10m maximum height. The reduction to 6.0m is therefore more restrictive.

Form
The applicant is not agreeable to a restriction of cantilevered building structures on slope. There are sites that are conducive to a cantilevered deck that would not detract from the internal rural character and that will provide a positive living environment.

Yours sincerely

PHILIP BARRETT
SENIOR PLANNER
Email: philipb@cheal.co.nz

Enclosures:

1. Golovin Floodplain Analysis
2. CMW Geotechnical Report
3. Iwi Consultative Reply

Copy to:
Company Name
Email Address

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GOLOVIN

FLOODPLAIN ANALYSIS

635 Whatawhata Road, Hamilton

August 2019

Graham and Sharon Singleton

Prepared by Dr Steven Joynes

Document Set ID: 2329579
Version: 1, Version Date: 19/08/2019

FLOOD LEVEL ANALYSIS

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Person assigned to manage the Project & Report

Name Dr Steven Joynes

Organisation **GOLOVIN**

Distribution List

Name	Project Designation	Organisation
Dr Steven Joynes	Modeller	Golovin
Philip Barrett	Senior planner	Cheal Consultants Ltd

Revisions

Version	Date	Comment
1	May 2017	Original
2	October 2018	Typographical amendments
3	This report	Addendum added concerning culvert blockage

Prepared by

Dr Steven Joynes

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1 INTRODUCTION

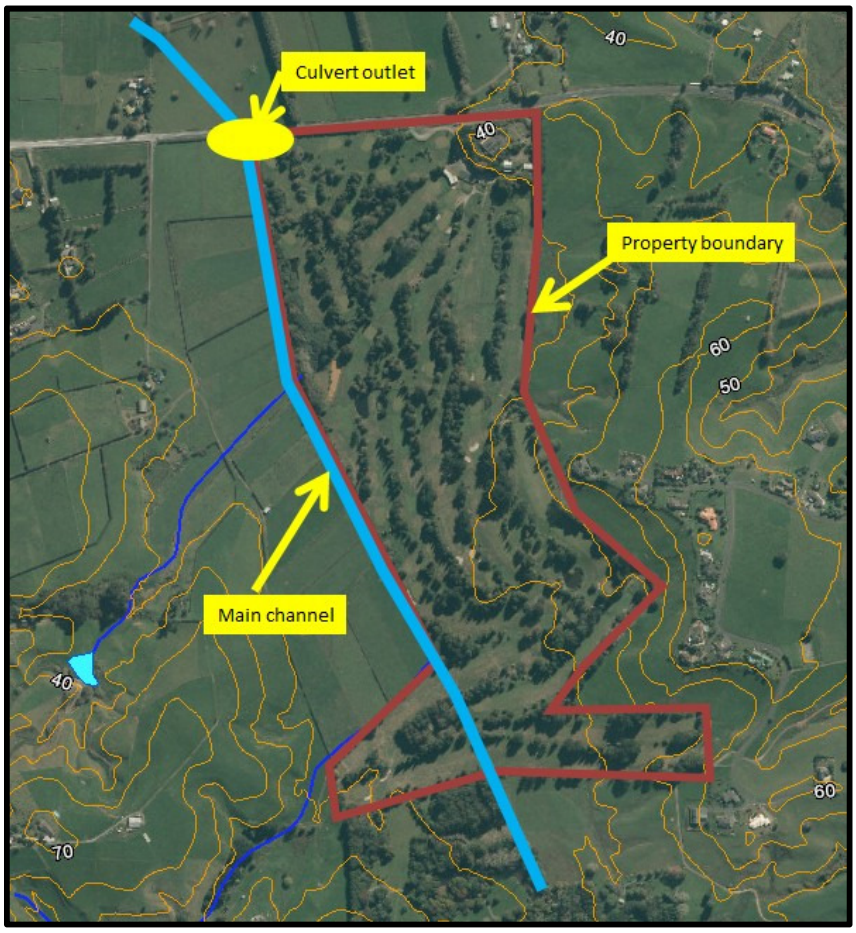
1.1 Statement of Issues

The client wishes build a number of dwellings on the former golf course. The land is prone to flooding due to its location and has a history of low-level ponding. The land is part of the catchment of Ohote Stream that is the eventual tributary of the Waipa River. It legal description is LOTS 1 2 DPS 12627 BLK I HAMILTON SD and measures just over 45 ha.

The flood levels need to be understood because the property has a number of potential house sites available. This report will determine minimum floor levels.

Figure 1.1 shows the property boundary. It also shows the main drainage route on the western boundary and the outlet location underneath the State Highway.

Figure 1.1 – Property location



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1.2 Proposed Strategy

The large catchment creates a reasonable sized floodplain. The hydrology will be calculated using the methodology required by Hamilton City Council. A hydraulic model will be used to calculate the floodplain levels based on LiDAR contours available and some site specific measurements. The 100-year storm will be analysed.

1.3 Target audience

The quality, quantity and tenure of the report should consider the following audience.

a) Waikato Regional Council engineering staff,
b) Waikato District Council engineering staff.

1.4 Previous Study

There is no known flood study of the catchment.

1.5 Previous flooding

The severe storm in April 2017 flooded the lower parts of the property at the culvert. Video evidence showed the peak flood level reached RL23m, about 1m above the invert of the culvert. The extent of flooding suggested no greater flood level than RL23.2m in the flooded area upstream of the culvert. The Waingaro rainfall gauge suggested a 20-year return period for a 12 hour storm. Therefore a 100-year flood level would be in the vicinity of RL24m and not overtop the road.

1.6 Sources of data

Table 1.1 – Source of Data

Attribute	**Organisation**
Catchment plans & contours	Waikato Regional Council Maps
Cross-section extraction	LiDAR plots from McCracken Surveys Ltd
Flow & WL data	none

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1.7 Reference Technical Documents

- Hamilton City Council Infrastructure Technical Specifications.

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2 HYDROLOGY

2.1 Methodology

The analysis is storage driven due to the impedance of the culvert at the outlet. Therefore it is important to do a dynamic analysis of the system, not a steady-state peak flow analysis. The analysis was done using the following steps:

1. Delineate the catchment.
2. Use HEC-HMS to generate flow hydrographs.
3. Model peak flood levels using HEC-RAS

2.2 Rainfall Data

The rainfall depth is prescribed in the HCC IFS. The 100-year development scenario is given in Table 4-9 of that manual. The total rain depth is 169.9mm.

2.3 Catchment Size

The catchment has been broken into four subcatchments which allows for the gradual input of flows. The areas are given in Figure 2.1.

Figure 2.1 – Catchment boundaries and areas

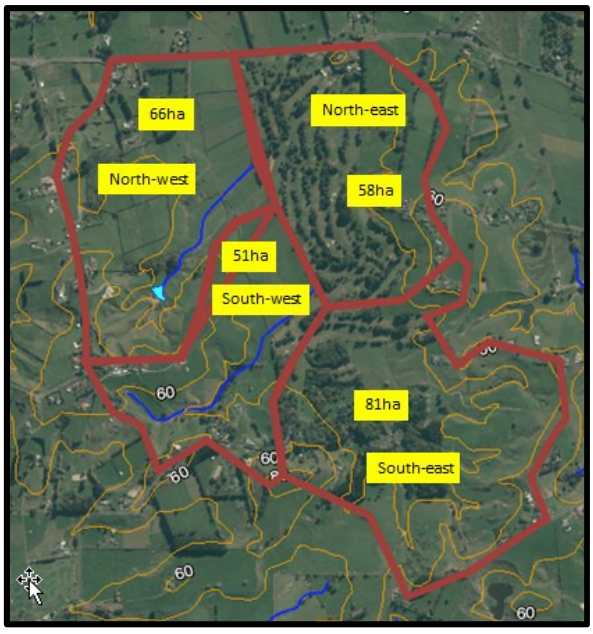

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Table 2.1 gives data and calculation of the subcatchment time of concentrations using the Ramser-Kirpich method. They were all rounded up to a minimum of 20 minutes.

Table 2.1 – Time of concentrations

	North-west	**North-east**	**South-west**	**South-east**
Length (m)	1343	832	1225	1080
H (m)	47	37	57	57
Slope %	3.5	4.4	4.7	5.3
Tc	**18**	**11**	**15**	**13**

2.4 HEC-HMS modelling

A HEC-HMS model was built to generate hydrographs. Figure 2.2 shows the simple layout and the rainfall hyetograph. Figure 2.3 shows the run-off hydrograph for the north-west subcatchment. Table 2.2 gives the peak flows.

Figure 2.2 – HEC-HMS Model

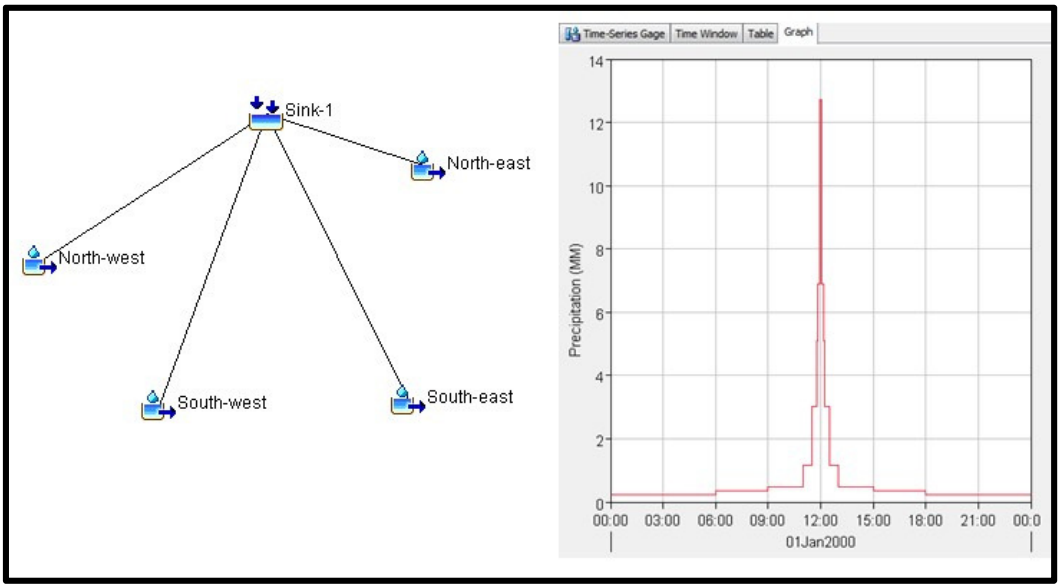

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Figure 2.3 – Flow hydrograph, 100-year storm for north-west subcatchment

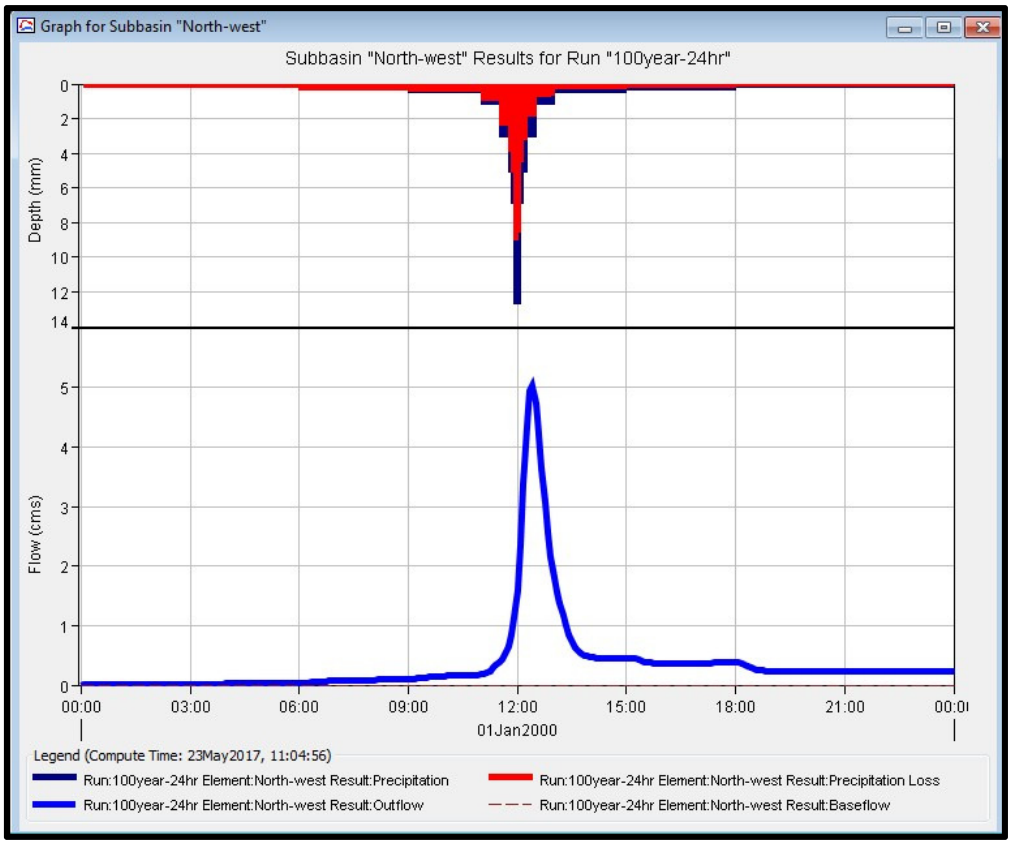

Table 2.2 – Peak flows for 24-hour, 100-year storm

	North-west	**North-east**	**South-west**	**South-east**
Q (m^3/s)	5.0	4.4	3.9	6.2

In theory, without impedance, the peak flow at the outlet will be about 19.5m^3/s. These four hydrographs can be applied to the hydraulic model.

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3 HYDRAULIC ANALYSIS

3.1 Model Layout

HEC-RAS software was used to generate flood levels. The setup is shown in Figure 3.1. The cross-sections have been extrapolated from the LiDAR 0.5m contours. The cross-sections were specific chosen to reflect restrictions in flows between contours and the structures. A 1m deep 1m wide drain was added for the whole length. The culvert under the State Highway is 1.5m square at an invert of RL22m. The floodplain bed roughness has been set to Manning's n = 0.05, a compromise between a good flowing main channel, shrubs on the edge of the stream and open grass paddocks.

Figure 3.1 – HEC-RAS model set up

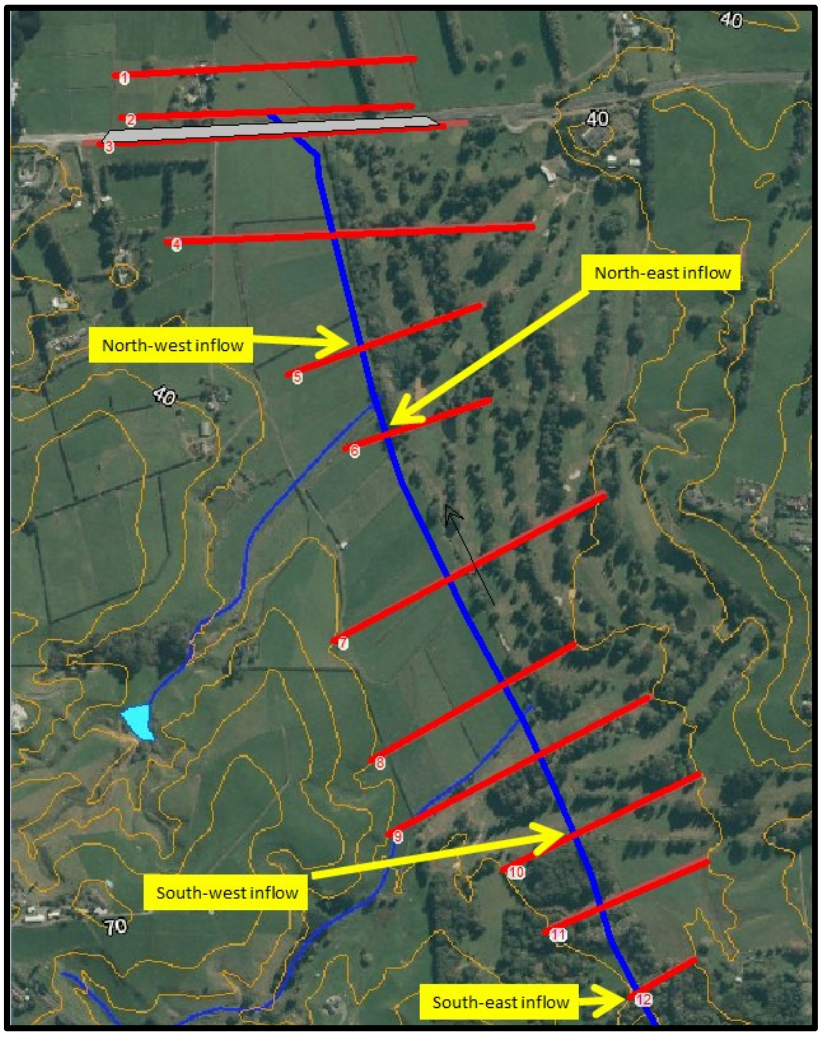

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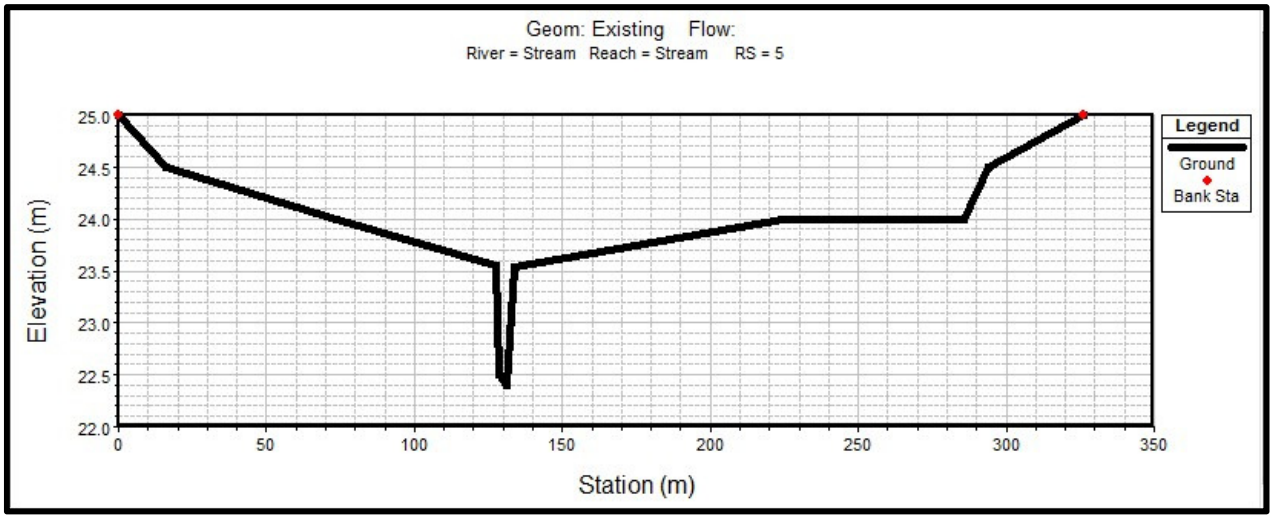
Figure 3.2 shows the cross-section at RS5 at the point of inflow for the north-west subcatchment.

Figure 3.2 – Cross-section RS5



3.2 Downstream boundary control

The downstream boundary is a wide open floodplain if relatively unrestricted flows. Instead of using a fixed boundary a normal flow boundary was used. This had a grade of 0.1%.

3.3 Floodplain profile

Figure 3.3 shows the hydraulic grade-line for the whole reach. There is a uniform flow until RS5 where the effect of the culvert creates a flat hydraulic grade. The peak level at the culvert is RL24.0m. This is close to that predicted based on the April 2017 storm.

Figure 3.4 shows the flow and water level hydrographs of RS5 and RS3. RS5 was chosen because it represents the highest flows where all subcatchments are contributing. RS3 is just upstream of the culvert. It is shown that the culvert reduces the floodplain flow (green-dashed line) from about 11m^3/s to 4m^3/s. The duration of the flows are affected as well with the culvert discharging over a good 12 hours compared to just 1-2 hours upstream. All this is expected due to the attenuation of the floodwaters.

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Figure 3.3 – Hydraulic grade-line for the 100- and 10-year flows

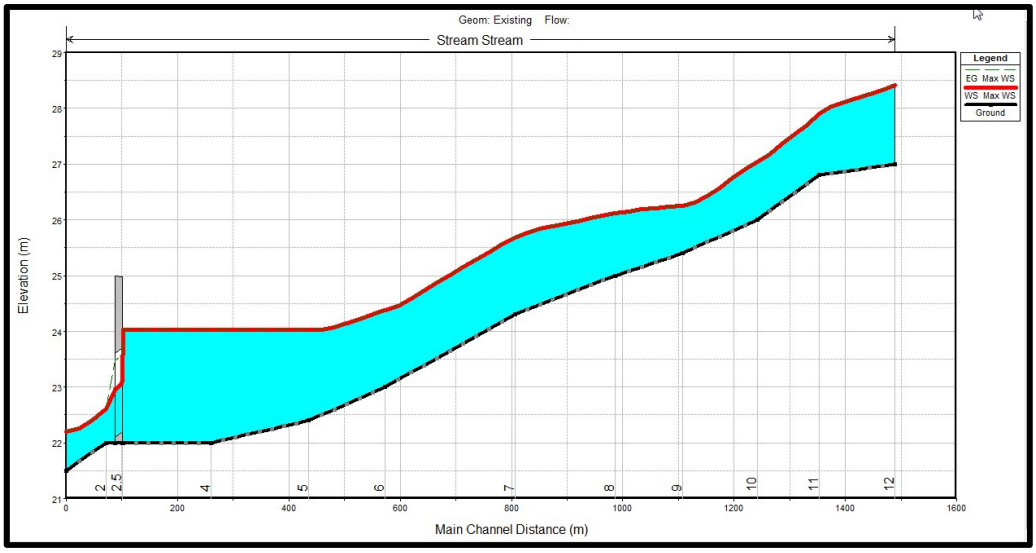
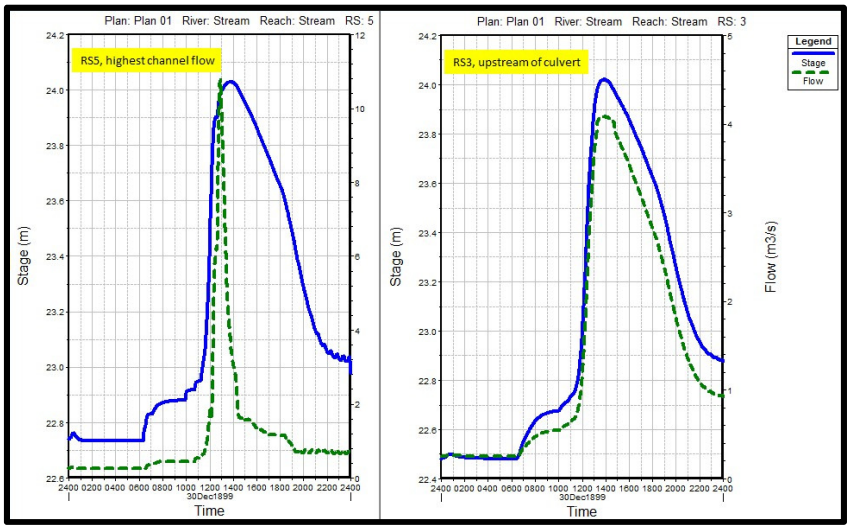


Figure 3.4 – Hydraulic grade-line for the 100- and 10-year flows



3.4 Floodplain and finished floor levels

Figure 3.5 overlays the estimated floodplain onto the aerial photograph. The 100-year flood level is given at each of the modelled cross-sections where a building site is proposed. Additionally the lettered orange labels show the approximate building site locations. *It should be noted the edge of the floodplain is indicative to create an impression only. It is only for the client's property. The proposed building sites are approximate based on a concept plan by Bernard Brown Associates.* Table 3.1 summarises the details required for the building sites. It is clear that sites A, C and G need to be surveyed in. The others appear to be well above floodplain.

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Figure 3.5 – Floodplain, flood levels and building site locations

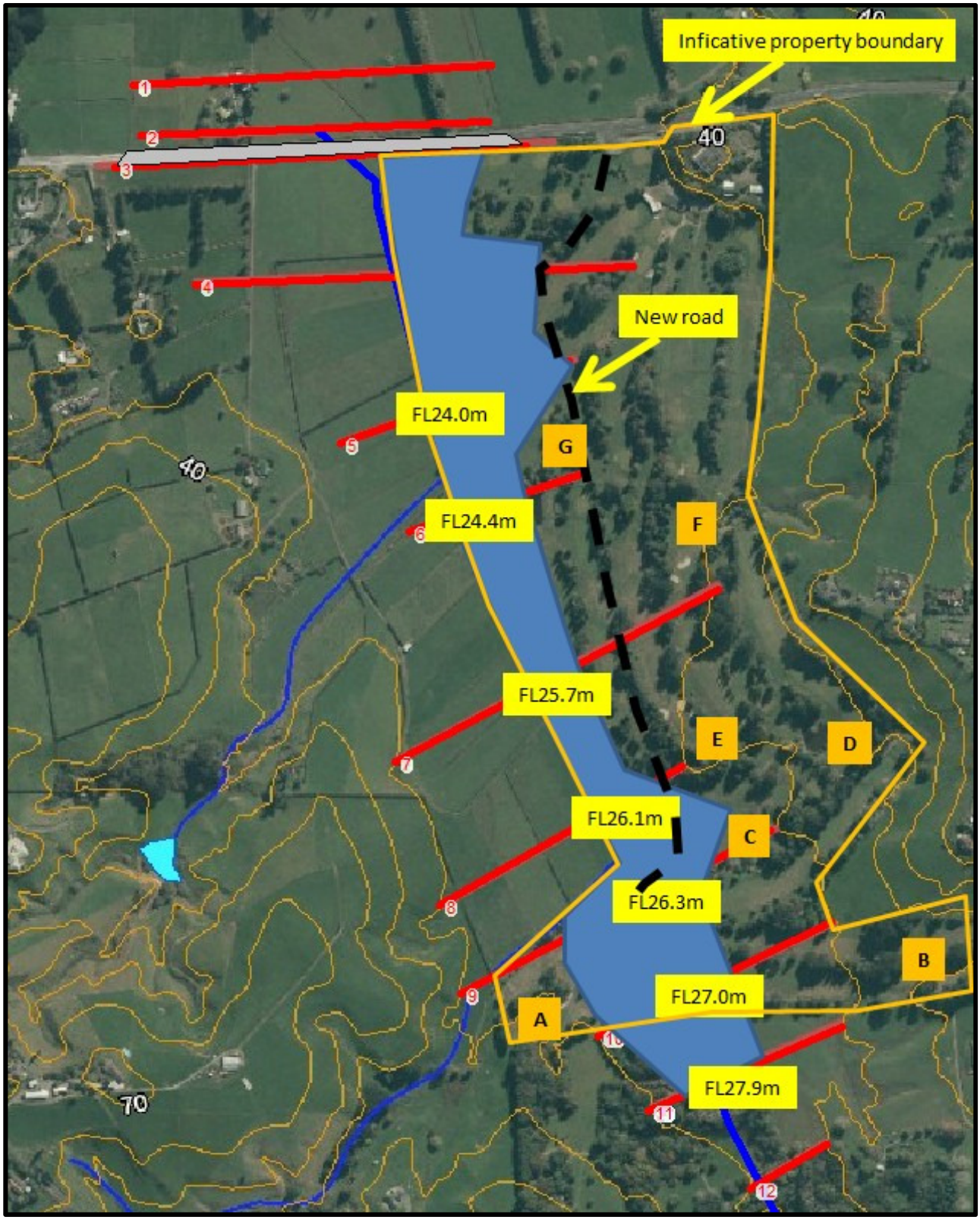

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Table 3.1 – Minimum finished floor levels

Site	Estimated flood level RL(m)	Minimum finished floor level RL(m)	Estimated ground level RL(m)	Comment
A	26.6	27.1	27.0	Survey check
B	27.5	28.0	34.0	Well away from floodplain
C	26.3	26.8	28.0	Survey check
D	26.2	26.7	35.0	Well away from floodplain
E	26.1	26.6	32.0	Well away from floodplain
F	25.0	25.5	29.0	Well away from floodplain
G	24.3	24.8	24.0	Survey check

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4 SUMMARY

Flood modelling has been undertaken to calculate the 100-year flood levels for the whole property along the drainage channel.

Utilising HEC-HMS, four hydrographs were generated and input into a hydraulic model. The model included the state highway culvert which attenuated the flows from 11m^3/s to 4m^3/s.

The ponded level at the culvert was close to that estimated based on the experience of the 20-year flood in April 2017.

Table 3.1 provides details of finished floor levels for each of the proposed building sites.

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5 ADDENDUM

This addendum was added. It based on a Section 32 request from Waikato District Council. It reads

Steven to consider
3(b) above - Specifically we need to understand the flooding effect of the culvert under the road being blocked, however unlikely, on the proposed building platforms. What would the wastewater field levels look like now and any change should the culvert block.

There are 3 items within this statement

1. Effect of culvert blockage
2. New building platforms and/or locations
3. The wastewater fields locations based on flood levels

5.1 Effect of culvert blockage

The Council have no criteria of blockage when examining flood risk. The two references to determine blockage are The Auckland Council's *COP for Land and Subdivision – Stormwater Chapter 4, Version 2.0*. It states

g) A secondary flow path shall be kept unobstructed at all times. The secondary flow path design shall assume the total blockage of the culvert in cases where it is less than 1500mm in diameter, and 50% blockage of the culvert where it is greater than or equal to 1500mm in diameter.

The Australian Rainfall and Run-off (ARR Project11 Stage3 Blockage guidelines February 2015) has a more detailed analysis based on a number of risk factors. The risk is Low based on a low-low-low criteria for

Debris Availability
Well maintained rural lands and paddocks with minimal outbuildings or stored materials in

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the source area.

1. Streams with moderate to flat slopes and stable bed and banks.
2. Arid areas where vegetation is deep rooted and soils are resistant to scour.
3. Urban areas that are well maintained with limited debris present in the source area

Debris Mobility

1. Low rainfall intensities and large, flat source areas.
2. Receiving streams infrequently overtops their banks.
3. Main debris source areas well away from streams

Debris Transportability

1. Flat bed slopes (< 1%).and/or low stream velocity (V<1m/sec)
2. Shallow depth relative to vertical debris dimension (D < 0.5L10)
3. Narrow stream relative to horizontal debris dimension (W<L10)
4. Stream meanders with frequent constrictions/snag points.
5. Low temporal variability in maximum stream flows

The analysis indicates that for a 100-year event the blockage for the inlet and sediment is 0%.

Therefore taking the worst-case of the two methods the 1.5m square culvert is an equivalent 1.7m barrel and the Auckland method might suggest 50% blockage.

The hydraulic model was re-run with the 100-year storm and the bottom 0.75m of the culvert blocked.

Figure 5.1 shows the hydraulic profiles along the reach comparing the non-blocked and 50% blocked. The 50% blockage effects cross-sections up to RS6. The increase in water level at the culvert is 0.2m. The flow is decreased from 4.1m^3/s to 1.6m^3/s.an almost 61% capacity loss.

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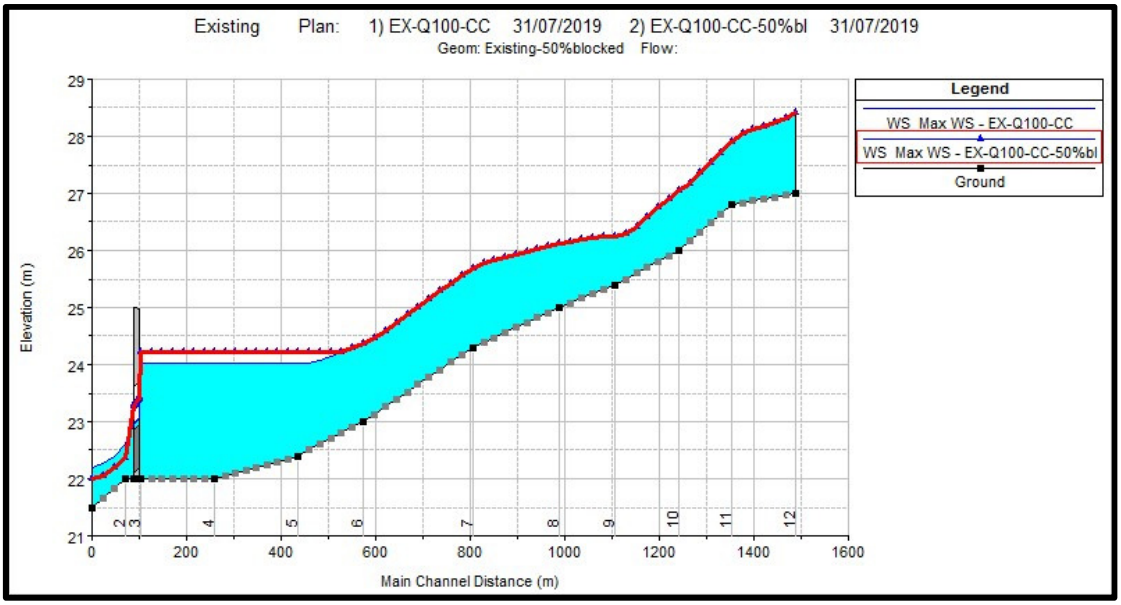
Figure 5.1 – Hydraulic grade-line comparing a 50% blockage



The expected increase in floodplain if the culvert is 50% blocked is shown in Figure 5.2 below. Essentially the flood width increases by about 25% at the immediate upstream cross-section and diminished to nothing at RS6. Figure 5.2 shows the area of the floodplain affected by the blockage.

Figure 5.2 – Change in floodplain width for 50% blockage near the culvert

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5.2 Minimum finished floor levels

Table 5.1 gives the minimum finished floor levels and have been adjusted when the culvert blockage impacts flood levels. Based on the estimated ground levels the new dwellings are above the freeboard requirement of 500mm even when the culvert is 50% blocked.

Table 5.1 – Minimum finished floor levels

Lot number	Former site number	Model RS	Estimated flood level RL(m)		Minimum finished floor level RL(m)	Estimated ground level RL(m)
			No blockage	50% blockage		
1	G	6	24.4	24.4	24.9	25.5
2	F	7	25.7	25.7	26.2	29.0
3	E	8	26.1	26.1	26.6	32.0
4	New	7	25.7	25.7	26.2	30.0
5	C	9	26.3	26.3	26.8	28.0
6	B	11	27.9	27.9	28.4	34.0
7	A	9	26.3	26.3	26.8	28.9
8	New	4	24.0	24.2	24.5	40.0
9	New	4	24.0	24.2	24.5	28.0
10	D	8 & 9	26.2	26.2	26.7	28.5

The expected increase in floodplain if the culvert is 50% blocked is shown in Figure 5.2 below. Essentially the flood width increase by about 25% for about

5.3 Addendum Summary

The 50% culvert blockage scenario was tested. The blockage caused the water level to rise by about 200mm up to 500m upstream. This does not affect the Lot designation. The minimum floor level designations were checked and re-tabulated with no change to the required finished floor levels due to the existing ground levels.

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NGAA URI O MAAHANGA
C/O – nuomtb@gmail.com

7 August 2019

Phillip Barrett

McCracken Surveys / Cheal

Email: PhillipB@cheal.co.nz

BY EMAIL ONLY

Tēnā koe Phillip,

RE: sub0165/19 – 635 State Highway 23, Whatawhata – G&S Singleton

1. Thank you for your correspondence with our Trustee, Ms. Heather Taruke Thomson on behalf of Ngaa Uri o Maahanga Trust Board regarding the above subject.
2. Our Board have discussed this matter in considerable depth.
3. Ms. Thomson has advised that she has visited the site in question and met with the owners.
4. Based on the site visit undertaken and the discussion with the owners, Ngaa Uri o Maahanga support the consent application.
5. Please accept this letter as an official letter of support.

Nāku iti noa, nā

Warren Williams
Chairman
Ngaa Uri o Maahanga Trust.

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15 August 2019 Document Ref: HAM2018-0112AB Rev 2

Singleton Heritage Trust
635 Whatawhata Road
RD 4
Hamilton

Dear Graham

RE: PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT FOR PROPOSED RESIDENTIAL DEVELOPMENT 635 WHATAWHATA ROAD, HAMILTON

1 INTRODUCTION AND SCOPE

CMW Geosciences (CMW) has been engaged by Singleton Heritage Trust to undertake a geotechnical assessment for the proposed rural residential subdivision development located at 635 Whatawhata Road, Hamilton legally described as Lots 1 & 2 DPS 12627.

In this report we present the results of our fieldwork and our assessment of the suitability of the land for residential development including assessment of liquefaction risk, slope stability, foundation suitability and on-site disposal of stormwater and wastewater.

This work has been carried out in accordance with Stage 1 of the geotechnical investigation as described in the CMW services proposal dated 21 September 2018 (ref. HAM2018-0112AB Rev0).

It is intended that this report will support the subdivision Resource Consent application to the Waikato District Council.

2 SITE DESCRIPTION

The site as presented in Appendix A is irregularly shaped with a plan area of approximately 45.6 Hectares, and is located at 635 Whatawhata Road. The site is predominantly in pasture with stands of large trees scattered around the site. The site has been previously used as a golf course.

The majority of the site is low-lying and gently slopes towards the north from approximately RL 27 to RL 23 metres. Along the eastern boundary moderately steep slopes rise to an elevation of approximately RL 42 metres.

There are multiple buildings located in current Lot 1 and another located centrally within Lot 2. These buildings are to remain and therefore are excluded from our scope.

The general site layout is presented on our Geotechnical Investigation Plan (Figure 01).

3 DEVELOPMENT PROPOSAL

Drawings provided by McCracken Surveyors (ref: 13246, Sheet 1 of 7, dated October 2018) indicate the proposed development involves the subdivision of the current Lots 1 and 2 into 10 lots with 7 new building

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platforms. Existing dwellings located in the current Lot 1 are proposed to occupy the proposed Lots 8 and 9 while the existing dwelling located centrally within the current Lot 2 is to occupy the proposed Lot 3.

The scope of our geotechnical assessment is limited to Lots 1, 2, 4, 5, 6, 7 and 10 as depicted on the attached plan (Figure 01).

We also investigated a potential building platform within the northern section of Lot 10, as shown on Figure 01.

Minor earthworks are expected in order to form level building platforms.

We have been advised by the client that each houses stormwater is to be collected in rain tanks while it is proposed to manage wastewater on site using an onsite disposal system for each new dwelling.

4 FIELD INVESTIGATION

Our field investigation was undertaken on 28th September, 1st October and 18th December 2018 and comprised:

- A site walkover by a CMW Engineering Geologist to assess the general landform and site conditions.
- Eight hand auger boreholes, denoted HA01 to HA08, carried out using a 50mm diameter auger to depth of up to 5.0 metres below existing ground level to visually observe the near surface soil profile in the locations of proposed house platforms. In-situ shear strength measurements were recorded in cohesive material at regular intervals using a hand-held shear vane apparatus during boring of the hand augers. Dynamic cone penetrometer (DCP) testing was carried out where sands were encountered to determine the relative density of the materials encountered.

Engineering logs of the hand auger boreholes are provided in Appendix B. Soils were logged by a CMW geotechnical engineer in general accordance with NZGS guidelines[1].

Boreholes were located using hand held GPS equipment and RL determined by interpolation from the McCracken Survey Plan ref: 13246, dated July 2018.

The approximate locations of the respective exploratory holes referred to above are shown on Figure 01.

5 GROUND MODEL

5.1 Geological Setting

The geological map of the area[2] indicates the low-lying portion of the site is underlain by Holocene aged swamps deposits (peats and silts) of the Piako Subgroup while the hills along the eastern boundary are shown to be underlain by Pleistocene aged fluvially reworked volcanic sourced material (silts, clays and sands) of the Walton Subgroup.

Elevated areas in the Hamilton area are typically mantled by several metres of volcanic ash comprising interbedded clays, silts and sands of the Hamilton Ash and the Kauroa Ashes.

5.2 Geomorphology

The site can be broadly classified into two main landform zones.

The first zone comprises low-lying alluvial flats which make up the majority of the site.

The flats gently grade from RL 27 metres at the southern boundary to RL 22 at the northern boundary. There are number of drains and ponds scattered across the low-lying areas indicating a shallow

[1] NZ Geotechnical Society, “Field Description of Soil and Rock” December 2005

[2] Edbrooke, S.W. (compiler) 2005: Geology of the Waikato area. Institute of Geological & Nuclear Sciences 1:250000 geological map 4.

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groundwater table. Water in the drains was approximately 1.0m below ground level at the time of our site visit.

The second landform zone comprises the elevated hills situated along the eastern boundary and in the south western corner of the site. Within the site the slopes grade towards the north and west at gradients generally between 3 to 25 degrees, with localised steepening within Lots 2 and 6.

Downslope gradients nearby the proposed building platform in Lot 6 are less than 11 degrees whilst maximum upslope gradients are approximately 23 degrees with overall slope heights of up to 6 metres.

Within Lot 2 downslope gradients of 25 to 45 degrees are present with a total slope height of up to 7 metres.

Beyond the eastern boundary of the site slopes steeply rise to elevations of up to RL 69.5m with numerous arcuate slip features.

The site has been previously used as a golf course therefore it is likely that some parts of the site have been modified to the current landform seen today.

5.3 Soil Stratigraphy

The boreholes generally confirmed the anticipated geology across the site.

All the boreholes encountered topsoil of between 100mm and 300mm thickness, except HA07 where no topsoil was encountered.

Uncontrolled fill consisting of stiff clayey silt associated with previous land use was encountered in borehole HA07 to a depth of 0.7 metres below ground level. The fill was underlain by a 100mm thick buried topsoil.

5.3.1 Low-Lying Zone

Borehole HA05 (potential northern platform Lot 10) encountered swamp deposits consisting soft to firm peat to a depth of 4.0 metres below ground level. The peat was found to be underlain by stiff to very stiff silt with a proven thickness of at least 1.0 metre.

Nearby, borehole HA06 (Lot 1) encountered soils of the Hinuera Formation which included stiff to very stiff sandy silt to a depth of 1.1 metres underlain by loose to medium dense silty sand becoming dense below 3.3 metres. Like borehole HA05 very stiff silt was encountered at a depth of 4.4 metres.

Within Lot 4, borehole HA08 encountered stiff silt to a depth of 1.2 metres underlain by medium dense to dense silty sand with a proven thickness of at least 1.4 metres where hole collapse due to saturated sand terminated the borehole.

5.3.2 Elevated Area

Within borehole HA02 (Lot 6) and HA07 (Lot 2) interbedded stiff to very stiff silts and clays (Hamilton and Kauroa ashes) were encountered to a depth of 1.5 and 1.7 metres respectively.

Beneath the ashes and from beneath the topsoil in HA01 (Lot 7), HA03 (Lot 5) and HA04 (Lot 10) stiff to very stiff clays and silts (Walton Subgroup) were encountered to the base of all boreholes. Shear vane readings in the cohesive materials ranged from 61 kPa to greater than 200 kPa (maximum value) with an average of 140 kPa.

Medium dense sand was encountered in HA04 at a depth of 2.3 metres.

Engineering logs of field investigations can be found in Appendix B and are summarised in Table 1 below.

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Table 1: Lot Summary Table					
Hand Auger Borehole No.	**Lot Number**	**Landform Zone**	**Approx. Building Platform RL (m)**	**Estimated Flood Level RL(m)***	**Soil Type**
HA01	7	Elevated	28.9	26.3	Stiff to very stiff Clay
HA02	6	Elevated	36.5	27.9	Stiff to very stiff Silt/Clay
HA03	5	Elevated	29.0	26.3	Stiff to very stiff Silt/Clay
HA04	10	Elevated	38.0	26.2	Stiff to very stiff Silt/Clay and medium dense Sand.
HA05	N/A	Low-Lying	24.0	28.0	Soft to firm Peat
HA06	1	Low-Lying	25.6	24.4	Stiff to very stiff sandy silt and loose to dense sand.
HA07	2	Elevated	36.0	25.7	Stiff clayey silt uncontrolled fill and very stiff clay/silt.
HA08	4	Low-Lying	28.0	25.7	Stiff Silt and Dense Sand.

*Note 1 – Flood levels include a 50% culvert block as defined in the Golovin Report titled "*Floodplain Analysis, 635 Whatawhata Road, Hamilton",* dated August 2019.

5.4 Groundwater

5.4.1 Low-Lying Areas

On the low-lying areas groundwater was encountered at approximately RL 23.2, 24.7 and 27.2 metres in boreholes HA05, HA06 and HA08 respectively. The elevation observed in these lower boreholes are similar to water levels observed in nearby drains and is thought to represent the local groundwater level.

5.4.2 Elevated Areas

In the elevated areas groundwater was only encountered in HA04 at a depth of 2.0 metres. We consider that this is likely to represent a perched groundwater table within the silty sand layer encountered in that borehole from a depth of 2.2 to 2.9 metres.

Due to the layered soil stratigraphy, there is potential for elevated pore water pressures to develop within higher permeability layers such as the silty sand present in HA04 during times of intense and prolonged rainfall.

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6 ENGINEERING EVALUATION AND RECOMMENDATIONS

6.1 Liquefaction Potential

6.1.1 Introduction

Liquefaction is a process in which loose saturated cohesionless soils are subject to temporary, but essentially full, loss of strength due to incremental pore pressure build up under reverse cyclic shear loading generated during an earthquake. As a consequence of this temporary strength loss, the liquefied soil can deform and settle. Case histories show that liquefaction is limited almost exclusively to geologically recent Holocene aged (<11.5 ka) saturated, fine to medium grained sands and low plasticity silts.

6.1.2 Low-Lying Floodplain

A detailed liquefaction assessment of the low-lying floodplain has not been carried out, although a shallow water table combined with loose to medium dense silty sand highlights the potential for liquefaction to occur within Lots 1 and 4.

Cone penetration testing (CPTs) of the saturated loose to medium dense silty sands close to the surface beneath the proposed house platforms within Lots 1 and 4 is required at the detailed design stage to confirm the liquefaction risk.

Potential construction methods for mitigating the effects of potential liquefaction may include piling of the house foundations or construction of a raft type foundation with or without ground improvement works. Foundation requirements are to be confirmed during detailed design of the house foundation.

Further assessment of liquefaction should be included as a condition of obtaining building consent.

6.1.3 Elevated Area

In the elevated area the groundwater table generally appears to be deeper than 3m beneath ground level except near the location of the southern building platform within Lot 10 where a possibly perched water table was encountered at a depth of 2 metres. The presence of saturated medium dense sand in this location indicates a potential for liquefaction therefore we recommend further assessment to be carried out at detailed design.

Investigations near building platform locations within Lots 2, 5, 6 and 7 indicate the presence of stiff to very stiff high plasticity clays and silts of the Walton Subgroup suggesting a substantial crust of non-liquefiable material may mantle these locations.

Work by Ishihara (1985)[3] with respect to assessing the contribution of a non-liquefiable crust and the risk of surface manifestation of liquefaction indicates that the risk of unacceptable liquefaction induced damage to buildings supported above a thick non-liquefiable crust is considered to be very low for a ULS seismic event and an Importance Level 2 (IL2) building.

6.2 Slope Stability

6.2.1 Lot 2

Slope gradients near the building platform within Lot 2 range between approximately 25 to 47 degrees with vertical heights of up to 7 metres, which are considered unlikely to meet the factor of safety for NZ building code.

For preliminary design in these soils types an upslope regression gradient of 1:2.5 (vertical to horizontal) projected from the toe of the slope provides a conservative design approach in the absence of detailed

[3] Ishihara, K., (1985) “Stability of Natural Deposits During Earthquakes,” Proc. Of the Eleventh International Conference on Soil Mechanics and Foundation Engineering, San Francisco, 12- 16th August 1985, Vol. 1, Theme Lectures Conferences, pp321- 376.

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slope stability analyses. This has been shown to offer an acceptable factor of safety with respect to deep seated slope instability.

6.2.2 Lots 1, 4, 5, 6, 7 & 10

Based on the shallow slope gradients observed surrounding all other building platforms and the suitable set back from over steepened slopes the building platforms within Lots 1, 4, 5, 6, 7 and 10 are considered to be at low risk of deep-seated instability.

6.3 Building Restriction Line

Figure 01 shows a building restriction line (BRL) within Lot 2 based upon a 1:2.5 (vertical to horizontal) regression line extended from the toe of the slope to the north of the building platform to identify an area of the site considered suitable for residential building development based upon the existing landform. This BRL has been extended to the western lot boundary above the crest of the steeper sloping land.

Unless supported by further geotechnical investigation and analysis by a suitably qualified engineer all building and earth fill construction should be located entirely on the upslope side of the BRL on account of land instability considerations.

Furthermore, any consented structures that may project over the BRL may be cantilevered from the land upslope of the BRL or have engineered design foundations (such as piles) that account for the presence of the steep slope.

The final location of this BRL must be confirmed once the final proposed landform is known.

6.4 Bearing Capacity for Shallow Foundations

6.4.1 Low-lying Areas

In Lot 1 the near surface soils predominantly consist of stiff to very stiff sandy silt and loose sands. In this location specific engineer designed foundations with a reduced bearing pressure, piled foundations or ground improvement works may be required subject to the findings of further analysis.

Due to the presence of stiff silt and dense sand the building platform within Lot 4 should be able to provide a geotechnical ultimate bearing pressure of 300kPa for shallow foundation systems (continuous and/or pad foundations) that are designed in accordance with NZS3604 subject to the findings of further analysis.

Based on the thick peat deposits encountered during our investigation the potential northern building platform within Lot 10 is considered unsuitable for shallow foundations and would require piled foundations or ground improvement works. Based on the presence of peat soils in the location of the potential northern building platform within Lot 10 has been not included in the subdivision.

6.4.2 Elevated Areas

At this stage building platform design levels are unknown although based on the findings of our investigation the soils across the elevated areas should be able to provide a geotechnical ultimate bearing pressure of 300kPa for shallow foundation systems (continuous and/or pad foundations) that are designed in accordance with NZS3604.

Stiffened raft type foundations (eg. RibRaft) are also considered suitable.

The uncontrolled fill (to a depth of 0.7 metres) and buried topsoil present near the building platform within Lot 2 is not considered suitable to support shallow foundations and should be undercut along with any other uncontrolled fill materials encountered and replaced with suitably compacted fill to achieve a 300 kPa ultimate bearing pressure.

Undercuts may be backfilled with onsite cut materials, imported sand or hardfill compacted to engineer certifiable standards.

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It will be necessary to re-assess bearing pressures at time of Building Consent once platform levels are known.

6.5 Static Settlement

The building platform within Lot 1 encountered loose sand which is potentially compressible indicating that there is potential for significant levels of settlement to occur under foundation loads. We believe that with further investigation and detailed design of the foundations this settlement risk can be mitigated using conventional methods.

Based on the presence of stiff to very stiff clays and silts and medium dense sands at the building platforms within Lots 2, 4, 5, 6, 7 and 10 we expect settlements to be within Building Code limits for foundations designed in accordance with NZS3604.

6.6 Stormwater Soakage

Site specific assessment of on-site soakage has not been carried out at this stage as exact building platform locations and levels have not been finalised.

In the elevated areas, based on the clays and silts encountered in our investigation, permeability is expected to be low and we do not recommend soakage to ground.

Due to the shallow groundwater encountered on the low-lying areas soakage to ground is expected to be limited.

We understand from discussions with the client that roof runoff is to be collected using on site storage tanks. These tanks should be designed with a low-flow orifice to enable attenuation of heavy rainfall events. Overflow structures are proposed to feed into existing ponds located near proposed building locations. It is our understanding that council have approved this methodology of stormwater disposal.

Detailed design of stormwater systems for each lot will be required at the time of Building Consent based on total impervious areas.

Possible locations of stormwater attenuation structures, above maximum flood level, are shown on ***Drawing 01***.

6.7 Wastewater

On-site wastewater disposal is required as there is no existing reticulated wastewater system.

Dwelling occupancy is unknown at this time therefore a wastewater design has not been carried out. Based on our investigation the low-lying areas due to the shallow water table may require advance aerated systems. On the elevated areas it is expected that either conventional shallow trenches or advanced aerated systems would be suitable.

The design of wastewater disposal measures should be carried out by a suitably qualified person prior to the Building Consent application.

Possible locations of wastewater soakage fields, above maximum flood level, are shown on ***Drawing 01***.

6.8 Earthworks

Based on the proposed building platform locations earthworks are expected to comprise minor cuts and fills of the order of 1 to 2 metres to form level building platforms and driveways. Batters are to be formed at suitable gradients following engineering assessment at detailed design stage.

The majority of cut material won from site is expected to consist of clays and silts of the volcanic ashes. These are typically close to optimum moisture contents during summer earthwork conditions and therefore are generally expected to be suitable for placement as engineered fill with appropriate conditioning to control moisture contents and enable compaction. Earthfill should be placed in accordance with NZS4404 and NZS4431 under the supervision of a suitably qualified engineer.

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As stated in Section 6.3, we recommend that any uncontrolled fill, soft soils or unsuitable material should be undercut prior to the placement of fill.

Cut to fill earthworks on the site are generally expected to be relatively straight forward using conventional earthworks equipment and techniques.

Earthworks recommendation are to be confirmed by the design engineer for each individual lot at the time of Building Consent.

7 SUMMARY

Based on our assessment and investigation we consider that the site is suitable for the proposed rural-residential subdivision development provided our recommendations are followed.

A geotechnical ultimate bearing capacity of 300 kPa is generally expected at shallow depth for elevated areas.

Further CPT investigation should be undertaken at Building Consent stage for building platforms within Lots 4 and 10 to assess liquefaction and allow detailed design of foundations if required.

Further CPT investigations should be undertaken at Building Consent stage for the building platform within Lot 1 to assess the potential for liquefaction, static settlement and allow detailed design of foundations. Local undercut and backfill with suitable approved compacted fill may be required in areas where uncontrolled fill or otherwise unsuitable soils are present or where soil strengths are variable.

Accordingly, a consideration of this report and further site-specific investigation of the ground conditions at each Lot should be carried out at Building Consent stage.

8 LIMITATIONS

This report has been prepared solely for the use of our client, Singleton Family Trust, their professional advisors and the Waikato District Council in relation to the specific project described herein. Liability for its use is limited to these parties and to the scope of work for which it was prepared as it may not contain sufficient information for other parties or for other purposes.

It should be noted that factual data for this report has been obtained from discrete locations using normal geotechnical investigation techniques. As such investigation methods by their nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site which have not been disclosed by the investigation and which have not been taken into account in the report. If variations in the subsoils occur from those described or assumed to exist then the matter should be referred back to CMW immediately.

For and on behalf of CMW Geosciences

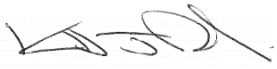
Prepared by:

Engineering Geologist

Reviewed by:

Associate Engineering Geologist

Authorised by:



Ken Read

Principal Geotechnical Engineer CMENZ

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Attachments: Figure 01 – Geotechnical Investigation Plan
Appendix A – Development Plans
Appendix B – Hand Auger Borehole Logs
Appendix C – Natural Hazards Risk Assessment

Distribution: 1 copy to Graham Singleton (electronic)
1 copy to Philip Barrett (McCracken Surveys)
Original held by CMW Geosciences

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Figures

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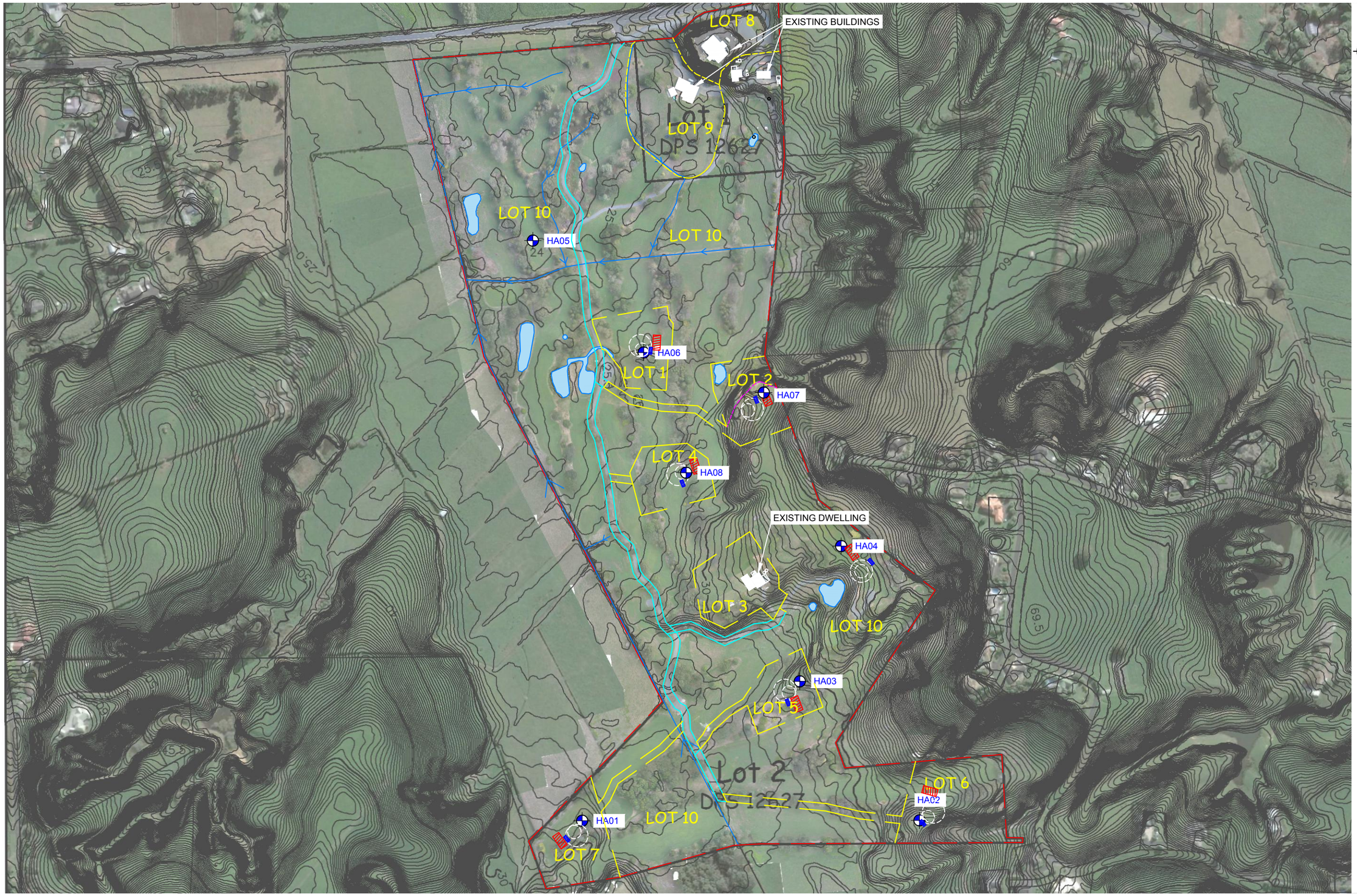

LEGEND:

- SITE BOUNDARY
- HA01 HAND AUGER (HA) LOCATION
- POND
- DRAINS
- POSSIBLE LOCATION OF STORMWATER ATTENUATION STRUCTURES
- PRELIM BUILDING RESTRICTION LINE (BRL)
- PROPOSED ACCESSWAY EASEMENT
- PROPOSED LOT BOUNDARY WITH INDICATIVE BUILDING PLATFORM
- POSSIBLE LOCATION OF WASTEWATER DISPOSAL FIELDS

NOTES:

1. BASE PLAN ADAPTED FROM McCRACKEN SURVEYS SCHEME PLAN REF: 13246, DATED JULY 2018.
2. CONTOURS ARE AS SHOWN ON McCRACKEN SURVEYS SCHEME PLAN AND ARE IN 0.5m INTERVALS.
3. SUBDIVISION LAYOUT PROVIDED BY McCRACKEN SURVEYS 20 DECEMBER 2018.
4. TEST LOCATIONS ARE APPROXIMATE ONLY.

1:5000 0 50 100 150 200 250 m

CMW Geosciences

CLIENT: SINGLETON HERITAGE TRUST		DRAWN: LYK	PROJECT: HAM2018-0112
PROJECT: 635 WHATAWHATA ROAD, HAMILTON		CHECKED: KAL	FIGURE: 01
		REVISION: 1	SCALE: 1:5000
TITLE: GEOTECHNICAL INVESTIGATION PLAN		DATE: 15/08/2018	SHEET: A3 L

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Appendix A
Development Plans

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13246

Contours - Waikato Regional LIDAR Service 2007 (WRLS 2007). LIDAR data sourced from Environment Waikato . COPYRIGHT RESERVED.

Contour Interval
Major Contour = 10m
Minor Contour = 0.5m

Aerial Photo is collected in February 2018.

Note: The Building Envelope within the land shown is all the land excluding the building setbacks specified in the Waikato District Plan.

Note: Areas & dimensions are subject to survey.

Zone:	Rural Zone & Hamilton Basin Ecological Management Area
Total Area:	45.6686 Ha.
Comprised in:	SA10B/683 & SA10B/682
Registered Owner(s):	G. L. & S. M. Singleton

I, David Vernon McCracken,
Registered Professional Surveyor, do hereby certify that this plan has been prepared by me for a Resource Consent under the provisions of the Resource Management Act 1991 and should not be used for any other purpose.

Registered Professional Surveyor _____ Date _____

Amendments

No	Activity	Date

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Plan of Lots 1 & 2 DPS 12627
635 Whatawhata Road, Dinsdale.

Prepared for: Singleton Family			Sheet
Drawn HC	Checked	Scales	Series of
Traced	Date July 2018	1:4000 A2	File Ref 13246

Document Set ID: 2329579
Version: 1, Version Date: 19/08/2019

13246

Proposed Easements

Purpose	Shown	Serv Ten.	Dom Ten.
Right of way & Right to convey Water, Electricity, Gas, Computer Media & Telecommunications & right to Drain Water & Sewage.	A	Lot 10 hereon	Lots 1 to 7 hereon
	B	Lot 10 hereon	Lots 3 to 7 hereon
	C	Lot 10 hereon	Lots 5 to 7 hereon
	D	Lot 10 hereon	Lot 6 hereon
	E	Lot 10 hereon	Lots 3 hereon
Right to convey Water	F	Lot 2 hereon	Lot 10 hereon

Min. finished Flood Level

Contours - Waikato Regional LIDAR Service 2007 (WRLS 2007). LIDAR data sourced from Environment Waikato . COPYRIGHT RESERVED.

Contour Interval
Major Contour = 5m
Minor Contour = 0.5m

Aerial Photo is collected in February 2018.

Note: The Building Envelope within the land shown is all the land excluding the building setbacks specified in the Waikato District Plan.

Note: Areas & dimensions are subject to survey.

Zone:	Rural Zone
Total Area:	45.6686 Ha.
Comprised in:	SA10B/683 & SA10B/682
Registered Owner(s):	G. & S. Singleton Heritage Ltd.

I, David Vernon McCracken,
Registered Professional Surveyor, do hereby certify that this plan has been prepared by me for a Resource Consent under the provisions of the Resource Management Act 1991 and should not be used for any other purpose.

Registered Professional Surveyor _____ Date _____

Amendments

No	Activity	Date

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Proposed Subdivision of Lots 1 & 2 DPS 12627
635 Whatawhata Road, Dinsdale.

Prepared for: G. & S. Singleton Heritage Ltd.			Sheet 1
Drawn HC	Checked	Scales	Series of 7
Traced	Date Oct. 2018	1:4000 A2	File Ref 13246

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Appendix B
Hand Auger Borehole Logs

Document Set ID: 2329579
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CMW Geosciences – SOIL (Field Logging Guide)

SEQUENCE OF TERMS:
Fine: Soil Symbol – Soil Type – Colour – Structure – (Consistency) – (Moisture) – Bedding – Plasticity – Sensitivity – Additional Comments – Origin/Geological Unit
Coarse: Soil Symbol – Soil Type – Colour – Structure – Grading – Particle shape – (Relative Density) – (Moisture) – Bedding – Additional Comments – Origin/Geological Unit

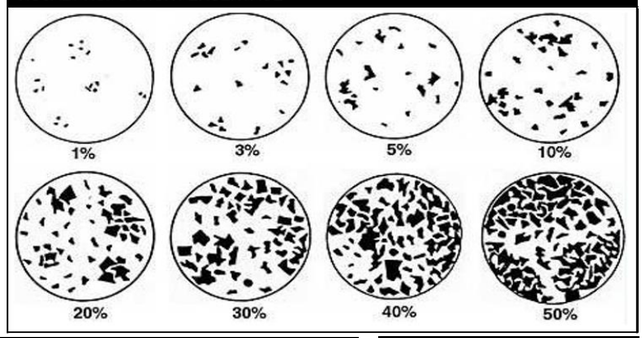
BEHAVIOURAL SOIL CLASSIFICATION SYSTEM

Major Divisions (behaviour based logging)			Soil Symbol	Soil Name
Coarse grained soils more than 65%>0.06mm	Gravel >50% of coarse fraction >2mm	Clean gravel <5% smaller 0.075mm	GW	Well graded gravel, fine to coarse gravel
			GP	Poorly graded gravel
		Gravel with >12% fines	GM	Silty gravel
			GC	Clayey gravel
	Sand ≥50% of coarse fraction <2mm	Clean sand	SW	Well-graded sand, fine to coarse sand
			SP	Poorly graded sand
		Sand with >12% fines	SM	Silty sand
			SC	Clayey sand
Fine grained soils 35% or more <0.06mm	Exhibits dilatant behaviour	inorganic	ML	Silt
			MH	Silt of high plasticity
		organic	OL	Organic silt
	No dilatant behaviour	inorganic	CL	Clay of low plasticity
			CH	Clay of high plasticity
		organic	OH	Organic clay
Highly Organic Soils			Pt	Peat

PROPORTIONAL TERMS DEFINITION

Fraction	Term	% of Soil Mass	Example
Major	(…) [UPPER CASE]	≥50 [major constituents]	GRAVEL
Subordinate	(…) [lower case]	20 – 50	Sandy
Minor	with some…	12 – 20	with some sand
	with minor…	5 – 12	with minor sand
	with trace of (or slightly)	< 5	with trace of sand (slightly sandy)

VISUAL PROPORTION PERCENTAGE



GRAIN SIZE CRITERIA

TYPE	Boulders	Cobbles	Gravel			Sand			Silt	Clay	Organic Soil
			coarse	medium	fine	coarse	medium	fine			
Size Range (mm)	200	60	20	6	2	0.6	0.2	0.06	0.002		
Graphic Symbol											

ADDITIONAL GRAPHIC LOG SYMBOLS

Term	Symbol
Topsoil	
Fill	
Bitumen	
Concrete	

ORGANIC SOILS / DESCRIPTORS

Term	Description
Topsoil	Surficial organic soil layer that may contain living matter. However, topsoil may occur at greater depth, having been buried by geological processes or man-made fill, and should be termed a buried topsoil.
Organic clay, silt or sand	Contains finely divided organic matter; may have distinctive smell; may stain; may oxidize rapidly. Describe as for inorganic soils.
Peat	Consists predominantly of plant remains. **Firm:** Fibres already compressed together **Spongy:** Very compressible and open structure **Plastic:** Can be moulded in hand and smears in fingers **Fibrous:** Plant remains recognisable and retain some strength **Amorphous:** No recognisable plant remains
Rootlets	Fine, partly decomposed roots, normally found in the upper part of a soil profile or in a redeposited soil (e.g. colluvium or fill)
Carbonaceous	Discrete particles of hardened (carbonised) plant material.

SHADE AND COLOUR

1	2	3
light dark mottled streaked	pinkish reddish yellowish brownish greenish bluish greyish	pink red orange yellow brown green blue white grey black

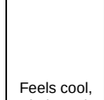
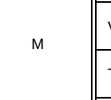
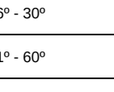
SOIL STRUCTURE

Term	Description
Homogeneous	The total lack of visible bedding and the same colour and appearance throughout
Bedded	The presence of layers
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Polished	Fracture planes are polished or glossy
Slickensided	Fracture planes are striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensoidal	Discontinuous pockets of a soil within a different soil mass

GRADING (GRAVELS & SANDS)

Term	Description	
Well Graded	Good representation of all particle size ranges from largest to smallest	
Poorly Graded	Limited representation of grain sizes – further divided into:	
	Uniformly graded	Most particles about the same size
	Gap graded	Absence of one or more intermediate sizes

ROUNDING/PARTICLE SHAPE

Rounded	Subrounded	Subangular	Angular
			

CONSISTENCY TERMS FOR FINE SOILS

Descriptive term	Undrained Shear Strength (kPa)	Diagnostic Features	Abbreviation
Very Soft	<12	Easily exudes between fingers when squeezed	VS
Soft	12-25	Easily indented by fingers	S
Firm	25-50	Indented by strong finger pressure and can be indented by thumb pressure	F
Stiff	50-100	Cannot be indented by thumb pressure	St
Very Stiff	100-200	Can be indented by thumb nail	VSt
Hard	200-500	Difficult to indent by thumb nail	H

DENSITY INDEX (RELATIVE DENSITY) TERMS FOR COARSE SOILS

Descriptive term	Density Index (RD)	SPT "N" value (blows/300mm)	Dynamic Cone (blows/100mm)	Abbreviation
Very Dense	> 85	> 50	> 17	VD
Dense	65 - 85	30 - 50	7 - 17	D
Medium dense	35 - 65	10 - 30	3 - 7	MD
Loose	15 - 35	4 - 10	1 - 3	L
Very loose	< 15	< 4	0 - 2	VL

Note:
- Where strength data cannot be confirmed Loosely Packed (LP) and Tightly Packed (TP) may be used.
- No correlation is implied between Standard Penetration Test (SPT) and Dynamic Cone Penetrometer (Scala) Test values.
- SPT "N" values are uncorrected.

MOISTURE CONDITION

Condition	Description	Coarse Soils	Fine Soils	Abbreviation
Dry	Looks and feels dry	Runs freely through hands	Hard, powdery or friable	D
Moist	Feels cool, darkened in colour	Tends to cohere	Weakened by moisture, but no free water on hands when remoulding	M
Wet			Weakened by moisture, free water forms on hands when handling	W
Saturated	Feels cool, darkened in colour and free water is present on the sample			S

BEDDING THICKNESS (Sedimentary)

Term	Bed Thickness
Thinly laminated	< 2mm
Laminated	2mm - 6mm
Very thin	6mm - 20mm
Thin	20mm - 60mm
Moderately thin	60mm - 200mm
Moderately thick	0.2m - 0.6m
Thick	0.6m - 2m
Very thick	> 2m

BEDDING INCLINATION

Term	Inclination (from horizontal)
Sub-horizontal	0º - 5º
Gently inclined	6º - 15º
Moderately inclined	16º - 30º
Steeply inclined	31º - 60º
Very steeply inclined	61º - 80º
Sub vertical	81º - 90º

PLASTICITY (CLAYS & SILTS)

Term	Description
High plasticity	Can be moulded or deformed over a wide range of moisture contents without cracking or showing any tendency to volume change
Low plasticity	When moulded can be crumbled in the fingers; may show quick or dilatant behaviour

SENSITIVITY OF SOIL

Descriptive Term	Shear Strength Ratio = $\frac{undisturbed}{remoulded}$
Insensitive, normal	< 2
Moderately sensitive	2 – 4
Sensitive	4 – 8
Extra sensitive	8 – 16
Quick	> 16

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Revision 3 April 2018

BOREHOLE LOG - HA01

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 28/09/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: NWB | Position: E.439423.4m N.697393.8m | Elevation: RL 28.30m | Hole Diameter: 50mm
Checked by: LYK | Survey Source: Hand Held GPS | Datum: Mount Eden 2000 | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.3	Peak = 195kPa Residual = 64kPa	28.3	0		OL: Organic SILT; dark brown. (Topsoil)					5 10 15	
				28.2			CH: CLAY; brownish orange. High plasticity, moderately sensitive. (Hamilton Ash)	D to M	VSt				
		0.6	Peak = >200kPa Residual = 81kPa	27.8			CH: CLAY; white mottled orange. High plasticity, moderately sensitive. (Walton Subgroup)						
		0.9	Peak = 160kPa Residual = 29kPa	27.5	1		Clayey SILT with trace medium sand; white mottled orange. High plasticity, moderately sensitive to sensitive. (Walton Subgroup)			100	HA		
		1.2	Peak = 73kPa Residual = 20kPa										
		1.5	Peak = 84kPa Residual = 23kPa										
		1.8	Peak = 122kPa Residual = 35kPa										
		2.1	Peak = 122kPa Residual = 35kPa		2			M	St to VSt				
		2.4	Peak = 119kPa Residual = 29kPa										
		2.7	Peak = 81kPa Residual = 23kPa										
		3.0	Peak = 116kPa Residual = 26kPa		3		Borehole terminated at 3.0 m						
					4								
					5								

Termination reason: Target depth.

Remarks: Groundwater not encountered. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

Document Set ID: 2329579
Version: 1, Version Date: 19/08/2019

BOREHOLE LOG - HA02

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 28/09/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: NWB | Position: E.439852.6m N.697394.2m | Elevation: RL 36.50m | Hole Diameter: 50mm
Checked by: LYK | Survey Source: Hand Held GPS | Datum: Mount Eden 2000 | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
				36.5			OL: Organic SILT; dark brown.						
				36.4			ML: SILT with some clay; brown. Low plasticity, sensitive. (Hamilton Ash)						
		0.3	Peak = 134kPa Residual = 29kPa						VSt				
		0.6	Peak = UTP	35.9			ML: Sandy SILT with minor clay; greyish brown. Sand, fine to medium. (Hamilton Ash)		H				
				35.8			CH: Silty CLAY with trace fine to coarse sand; brownish orange. High plasticity, moderately sensitive; sand, pumice, quartz. (Kauroa Ashes)						
		0.9	Peak = 175kPa Residual = 47kPa		1			D to M	St to VSt				
		1.2	Peak = 73kPa Residual = 21kPa										
		1.5	Peak = 166kPa Residual = 79kPa	35.0			CH: CLAY with trace fine to coarse sand; orange. High plasticity, moderately sensitive; sand, pumice, quartz; contains trace 20mm lenses of pumiceous sands. (Walton Subgroup)			100	HA		
		1.8	Peak = 172kPa Residual = 81kPa						VSt				
		2.1	Peak = 166kPa Residual = 58kPa		2								
				34.3			SW: Silty fine to coarse SAND with minor clay; light orange mottled orange. Well graded; pumiceous. (Walton Subgroup)						
		2.4	Peak = 111kPa Residual = 23kPa	34.2			ML: SILT with some fine to coarse sand and minor clay; white mottled brownish orange and mottled black. Low plasticity, sensitive. (Walton Subgroup)	M	St to VSt				
		2.7	Peak = 85kPa Residual = 15kPa										
		3.0	Peak = 61kPa Residual = 15kPa		3		Borehole terminated at 3.0 m						
					4								
					5								

Termination reason: Target depth

Remarks: Groundwater not encountered. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

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Version: 1, Version Date: 19/08/2019

BOREHOLE LOG - HA03

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 28/09/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: NWB | Position: E.439700.6m N.697597.1m | Elevation: RL 29.00m | Hole Diameter: 50mm
Checked by: LYK | Survey Source: Hand Held GPS | Datum: Mount Eden 2000 | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.3	Peak = 157kPa Residual = 52kPa	29.0	0		OL: Organic SILT; dark brown. (Topsoil)					5 10 15	
				28.9			GP: Sandy fine GRAVEL; greyish brown. Poorly graded; sand, medium to coarse. (Uncontrolled Fill)						
		0.6	Peak = 175kPa Residual = 73kPa	28.8			CH: CLAY with minor silt and trace fine sand; light orange mottled orange. High plasticity, moderately sensitive; quartz. (Walton Subgroup)	D to M	VSt to H				
		0.9	Peak = 145kPa Residual = 44kPa		1								
		1.2	Peak = >200kPa Residual = 47kPa	27.8			CH: Silty CLAY with trace fine to medium sand; light orange mottled white and orange. High plasticity, moderately sensitive to sensitive. (Walton Subgroup)			100	HA		
		1.5	Peak = 151kPa Residual = 44kPa										
		1.8	Peak = 61kPa Residual = 20kPa	27.3			MH: Clayey SILT with trace fine to coarse sand; white mottled orange. High plasticity, moderately sensitive to sensitive. (Walton Subgroup)						
		2.1	Peak = 108kPa Residual = 20kPa		2								
		2.4	Peak = 79kPa Residual = 26kPa	26.8			ML: SILT with some clay, minor fine to coarse sand, and trace fine to medium gravel; light grey mottled orange. Low plasticity, moderately sensitive to sensitive; sand, pumice, quartz. (Walton Subgroup)	M	St to VSt				
		2.7	Peak = 108kPa Residual = 20kPa										
		3.0	Peak = 88kPa Residual = 23kPa		3		Borehole terminated at 3.0 m						
					4								
					5								

Termination reason: Target depth.

Remarks: Groundwater not encountered. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

Document Set ID: 2329579
Version: 1, Version Date: 19/08/2019

BOREHOLE LOG - HA04

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 28/09/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: NWB | Position: E.439743.9m N.697769.8m | Elevation: RL 38.00m | Hole Diameter: 50mm
Checked by: LYK | Survey Source: Hand Held GPS | Datum: Mount Eden 2000 | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
				38.0			OL: Organic SILT; dark brown. (Topsoil)						
				37.9			CH: Silty CLAY; brown mottled orange. High plasticity, sensitive. (Walton Subgroup)						
		0.3	Peak = 105kPa Residual = 24kPa						VSt				
				37.5			CH: CLAY with minor silt and minor fine sand; light grey mottled orange brown. High plasticity, sensitive, contains minor 20-30mm inclusions of dark brown sandy silt and dark reddish brown pumiceous fine to coarse sand; quartz. (Walton Subgroup)						
		0.6	Peak = >200kPa Residual = 45kPa										
		0.9	Peak = >200kPa Residual = 111kPa		1			D to M	H				
		1.2	Peak = >200kPa Residual = 47kPa										
		1.5	Peak = UTP	36.5			CH: CLAY; light grey mottled orange brown. High plasticity, sensitive, contains minor 40-80mm inclusions of dark orange brown fine to coarse sand. (Walton Subgroup)			100	HA		
		1.8	Peak = 163kPa Residual = 21kPa					W	VSt				
	▼				2								
		2.1	Peak = 157kPa Residual = 20kPa										
				35.8			SW: Silty fine to coarse SAND; brown. Well graded. (Walton Subgroup)	S	L to MD			2 3 4 4 5 4 5	
				35.1									
		3.0	Peak = 143kPa Residual = 20kPa		3		ML: SILT with some fine to coarse sand; light brown. Low plasticity, sensitive. (Walton Subgroup)		VSt				
							Borehole terminated at 3.0 m						
					4								
					5								

Termination reason: Target depth.

Remarks: Groundwater encountered at 2.0m. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

Document Set ID: 2329579
Version: 1, Version Date: 19/08/2019

BOREHOLE LOG - HA05

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 01/10/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

1:25 Sheet 1 of 2

Logged by: NWB	Position: E.439345.6m N.698167.6m	Elevation: RL 24.00m	Hole Diameter: 50mm
Checked by: LYK	Survey Source: Hand Held GPS	Datum: Mount Eden 2000	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
				24.0			OL: Organic SILT; dark brown. (Topsoil)			100		5 10 15	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
				23.8			Pt: PEAT; dark brown. Some decomposed wood inclusions. (Recent Alluvium)	M					
		0.3	Peak = 29kPa Residual = 9kPa										
		0.6	Peak = 43kPa Residual = 6kPa					W					
	▼	0.9	Peak = 15kPa Residual = 6kPa		1								
		1.5	Peak = 17kPa Residual = 9kPa										
					2								
		2.1	Peak = 41kPa Residual = 20kPa						S to F	5			
							... from 2.20m to 2.30m, lens of grey medium to coarse sand				HA		
		3.0	Peak = 15kPa Residual = 7kPa		3			S					
		4.0	Peak = 143kPa Residual = 44kPa	20.0	4		ML: SILT; light blue. Low plasticity, moderately sensitive. (Hinuera Formation)						
		4.3	Peak = 52kPa Residual = 26kPa						St to VSt	30			
				19.1			ML: SILT; grey mottled blue. Low plasticity, moderately sensitive.		H	100			
		5.0	Peak = >200kPa Residual = 55kPa		5								

Termination reason: Target depth.

Remarks: Groundwater encountered at 0.8m. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

Document Set ID: 2329579
Version: 1, Version Date: 19/08/2019

BOREHOLE LOG - HA05

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 01/10/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

1:25 Sheet 2 of 2

Logged by: NWB	Position: E.439345.6m N.698167.6m	Elevation: RL 24.00m	Hole Diameter: 50mm
Checked by: LYK	Survey Source: Hand Held GPS	Datum: Mount Eden 2000	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
					6		(Hinuera Formation) Borehole terminated at 5.0 m					5 10 15	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
					7								
					8								
					9								
					10								

Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit)
Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)

Termination reason: Target depth.

Remarks: Groundwater encountered at 0.8m. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

Document Set ID: 2329579
Version: 1, Version Date: 19/08/2019

BOREHOLE LOG - HA06

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 01/10/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

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Logged by: NWB	Position: E.439516.5m N.698013.1m	Elevation: RL 25.50m	Hole Diameter: 50mm
Checked by: LYK	Survey Source: Hand Held GPS	Datum: Mount Eden 2000	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
				25.5			OL: Organic SILT; dark brown. (Topsoil)						
				25.4			SM: Sandy SILT; brown mottled orange. Low plasticity, sensitive; sand, fine to medium. (Hinuera Formation)						
		0.3	Peak = 116kPa Residual = 29kPa					M	St to VSt				
		0.6	Peak = 93kPa Residual = 20kPa										
	▼	0.9	Peak = 88kPa Residual = 29kPa		1								
				24.4			SM: Silty fine to coarse SAND with minor fine gravel; light brownish orange mottled orange. Well graded. (Hinuera Formation)					2	
												2	
												3	
												4	
												6	
												2	
												3	
									L			3	
												2	
					2							2	
				23.4			SM: Silty fine to medium SAND; bluish grey. Poorly graded. (Hinuera Formation)					2	
												3	
												2	
												3	
										100	HA	4	
												3	
												4	
												5	
								S	MD			4	
					3							4	
												5	
												8	
				22.2			SW: Fine to coarse SAND with some silt and trace fine gravel; bluish grey mottled dark brownish orange. Well graded. (Hinuera Formation)					11	
												10	
												14	
												13	
												13	
									D			11	3.9-4.0m: DCP data absent.
					4							7	
												7	
												9	
												12	
				21.1			ML: SILT; light grey mottled orange. Low plasticity, moderately sensitive. (Hinuera Formation)					6	
												8	
												9	
									VSt			10	
												9	
		5.0	Peak = 157kPa Residual = 55kPa		5		Borehole terminated at 5.0 m						

Termination reason: Target depth

Remarks: Groundwater encountered at 0.8m. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

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BOREHOLE LOG - HA07

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 01/10/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

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Logged by: NWB | Position: E.439641.4m N.697984.0m | Elevation: RL 36.00m | Hole Diameter: 50mm
Checked by: LYK | Survey Source: Hand Held GPS | Datum: Mount Eden 2000 | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.3	Peak = 76kPa Residual = 20kPa	36.0			ML: Clayey SILT with minor fine to medium subrounded gravel; brown mottled orange and black. Low plasticity, moderately sensitive to sensitive; gravel, pumiceous. (Uncontrolled Fill)	M	St				
		0.6	Peak = 76kPa Residual = 17kPa										
				35.3			OL: Organic SILT; dark brown. Low plasticity. (Topsoil)						
		0.9	Peak = 102kPa Residual = 23kPa	35.2	1		ML: SILT with minor clay; brownish orange. Low plasticity, sensitive. (Hamilton Ash)	D					
		1.2	Peak = 131kPa Residual = 23kPa										
				34.6			ML: SILT with minor fine gravel; light brown. Low plasticity, sensitive; gravel, orange, weathered pumice. (Hamilton Ash)			100	HA		
		1.5	Peak = 166kPa Residual = 35kPa										
				34.3			CH: CLAY; orange. High plasticity, moderately sensitive to insensitive. (Walton Subgroup)		VSt				
		1.8	Peak = 122kPa Residual = 44kPa		2								
		2.1	Peak = 189kPa Residual = 93kPa					M					
		2.4	Peak = 183kPa Residual = 84kPa										
				33.4			ML: SILT with minor clay; yellowish orange mottled orange. Low plasticity, sensitive. (Walton Subgroup)						
		2.7	Peak = 183kPa Residual = 29kPa										
		3.0	Peak = 169kPa Residual = 23kPa		3		Borehole terminated at 3.0 m						
					4								
					5								

Termination reason: Target depth.

Remarks: Groundwater not encountered. Shear vane no. 1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

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Version: 1, Version Date: 19/08/2019

BOREHOLE LOG - HA08

Client: Singleton Heritage Trust
Project: 635 Whatawhata Rd
Site Location: 635 Whatawhata Rd, Hamilton
Project No.: HAM2018-0112
Date: 18/12/2018
Borehole Location: Refer to Figure 01.

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: SMJ	Position: E.439548.0m N.697868.2m	Elevation: RL 32.00m	Hole Diameter: 50mm
Checked by: LYK	Survey Source: Hand Held GPS	Datum: Mount Eden 2000	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
	18-12-2018	0.4	Peak = 93kPa Residual = 23kPa	28.0	0	OL: Organic clayey SILT: Dark brown. Low plasticity; with trace of rootlets. (Topsoil)					2	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		0.8	Peak = 93kPa Residual = 29kPa	27.7		ML: SILT with some sand: Light blue. High plasticity, moderately sensitive to sensitive; sand, fine. (Hinuera Formation)	M	St			1 1 2 1 2 2 2 3	
		1.2	Peak = >200kPa	26.8	1	*... from 0.40m to 0.90m, Becoming orange mottled grey.* *... at 0.90m, Becoming light grey.* SM: Silty fine to coarse SAND: Orange. Well graded. (Hinuera Formation)	S	D		HA	4 5 7 7 7 9 9 10 8 9 8 10 10 11 10 17	
					2	*... at 1.80m, Becoming light brown.*						
						Borehole terminated at 2.6 m					12 11 10 9	
					3						8 10 9 10 9 9 8 10 11 10	
					4						10 10 10 14 13 13 12 12 13 15	
					5							

Termination reason: Terminated due to hole collapse.

Remarks: Groundwater encountered at 0.8m. Shear vane number #1911.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

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Appendix C

Natural Hazards Risk Assessment

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APPENDIX C

NATURAL HAZARDS RISK ASSESSMENT FOR LAND SUBDIVISION 635 WHATAWHATA ROAD, RD4, HAMILTON

A. CONTEXT

Section 106 of the Resource Management Act (RMA) requires an assessment of the risk from natural hazards to be carried out when considering the granting of a subdivision consent. S106 RMA specifically states that the assessment must consider the combined effect of the natural hazard likelihood and material damage to land or structures (consequence).

Section 2 of the RMA defines natural hazards as any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.

This appendix to CMW report reference HAM2018-0112AB Rev0 sets out the criteria for and presents the results of an assessment of the following geotechnical-related natural hazards associated with this proposed subdivision development:

(a) Earthquake,
(b) Erosion,
(c) Landslip,
(d) Subsidence,
(e) Sedimentation.

B. BASIS OF ASSESSMENT

B1. Risk Classification

The occurrence of natural hazards and their potential impacts on the proposed subdivision development is assessed in terms of risk significance, which is based on likelihood and consequence factors. A risk table is used to help assess the likelihood and consequence factors, the form of which used by CMW for this project is presented in Table B1.

Table B1: Natural Hazard Risk Classification

		Consequence				
		Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Likelihood	Almost Certain 5	Medium 5	High 10	Very high 15	Extreme 20	Extreme 25
	Likely 4	Low 4	Medium 8	High 12	Very high 16	Extreme 20
	Moderate 3	Low 3	Medium 6	Medium 9	High 12	Very high 15
	Unlikely 2	Very low 2	Low 4	Medium 6	Medium 8	High 10
	Rare 1	Very low 1	Very low 2	Low 3	Low 4	Medium 5

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B2. Likelihood

With respect to assessing the likelihood or chance of the risk occurring, the qualitative definitions used by CMW for this project are provided in Table B2 for each likelihood classification.

Table B2: Qualitative Natural Hazard Likelihood Definitions		
1	Rare	The natural hazard is not expected to occur during the design life of the project
2	Unlikely	The natural hazard is unlikely, but may occur during the design life
3	Moderate	The natural hazard will probably occur at some time during the life of the project
4	Likely	The natural hazard is expected to occur during the design life of the project
5	Almost Certain	The natural hazard will almost definitely occur during the design life of the project

B3. Consequence

In terms of determining the consequence or severity of the natural hazard occurring, the qualitative definitions used by CMW for this project are provided in Table B3 for each consequence classification.

Table B3: Qualitative Natural Hazard Consequence Definitions		
1	Insignificant	Very minor to no damage, not requiring any repair, no people at risk, no economic effect to landowners.
2	Minor	Minor damage to land only, any repairs can be considered normal property maintenance no people at risk, very minor economic effect.
3	Moderate	Some damage to land requiring repair to reinstate within few months, minor cosmetic damage to buildings being within relevant code tolerances, does not require immediate repair, no people at risk, minor economic effect.
4	Major	Significant damage to land requiring immediate repair, damage to buildings beyond serviceable limits requiring repair, no collapse of structures, perceptible effect to people, no risk to life, considerable economic effect.
5	Catastrophic	Major damage to land and buildings, possible structure collapse requiring replacement, risk to life, major economic effect or possible site abandonment.

B4. Risk Acceptance

It is recognised that the natural hazard risk assessment provided herein is qualitative and, due to the wide range of possible geohazards that could occur, is somewhat subjective. Other methods are available to quantitatively assess an acceptable level of geotechnical related natural hazard risk, such as defining an acceptable factor of safety with respect to slope stability or acceptable differential ground settlements with respect to recommended building code limits.

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Therefore, to give this qualitative natural hazard risk assessment some relevance to more commonly adopted numerical or quantitative geotechnical assessment techniques, a residual risk rating of very low to medium (risk value = 1 to 9 inclusive) is considered an acceptable result for the proposed subdivision development.

A risk rating of high to extreme (risk value ≥ 10) is considered an unacceptable result for the proposed subdivision development.

C. RISK ASSESSMENT

The natural hazards relevant to this proposed subdivision development have been assessed with respect to the criteria outlined above.

Assessment is based on pre and post development ground conditions. The latent risk was first assessed with the site in its current undeveloped state to consider the natural landform within and surrounding the proposed development. The specific geotechnical mitigation measures and engineering design solutions outlined in the CMW report, where relevant, were then considered to determine the natural hazard residual risk remaining after the proposed development works have been completed.

Results of this assessment are presented in Table C1 below.

Table C1: Natural Hazard Risk Assessment Results

RMA S2 Hazard	Description	Undeveloped Site Latent Risk			Comments and Geotechnical Control	Developed Site Residual Risk		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Earthquake	Fault Rupture	N/A No known active faults within or in close proximity to the site.						
	Liquefaction **(Lots 1,4, 10)**	4	3	High 12	Further investigation and foundation design confirmed at Building Consent.	2	3	Med 6
	Liquefaction **(Lots 2,5,6,7)**	1	4	Low 4	No remediation works required.			
	Lateral spread **(Lot 1, 4)**	3	4	High 12	Foundation Design confirmed at Building Consent.	1	4	Low 4
	Lateral Spread **(Lots 2,5,6,7,10)**	1	4	Low 4	No remediation works required			
Erosion	Cut & Fill batters	5	2	High 10	Batters (if required) to be formed at suitable slope angles confirmed at Building Consent stage.	2	2	Low 4

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	Coastal (cliff top)	N/A						
Landslip	Global stability **(Lot 2)**	3	4	High 12	Building restriction line at point projected at 1V:2.5H from toe of slope, retaining structure or regrade. Options and need to be confirmed at Building Consent stage.	1	4	Low 4
	Global Stability **(Lots 1,4,5,6,7,10)**	1	2	Low 4	No remedial works required.			
	Soil creep	N/A						
	Bearing Capacity Failure **(Lot 1)**	3	4	High 12	Detailed design of building foundations confirmed at Building Consent.	1	3	Low 3
	Bearing Capacity Failure **(Lots 2,4,5,6,7,10)**	1	4	Low 3	No remedial works required.			
	Cut & Fill batter stability	5	2	High 12	Batters to be formed at suitable gradients following engineering assessment at detailed design stage.	1	2	Very Low 2
Subsidence	Expansive soils	N/A						
	Sinkholes	N/A						
	Soft Soils **(Lots 2,4,5,6,7,10)**	2	3	Medium 6	Undercut unsuitable material where identified and replace with suitably compacted fill	1	3	Low 3
	Soft / compressible Soils **(Lot 1)**	3	3	Medium 9	Detailed design of building foundations confirmed at Building Consent.	1	3	Low 3

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Sedimentation	Rockfall, debris inundation	N/A
Inundation	Flood	See separate flood risk report.
Volcanic and Geothermal	N/A The site is not within a volcanic field or area of geothermal activity.	

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Key
P - Pond

100-year Flooding Level

Covenant Vegetative Area

Aerial Photo is collected in February 2018.

Note: The Building Envelope within the land shown is all the land excluding the building setbacks specified in the Waikato District Plan.

Note: Areas & dimensions are subject to survey.

Zone:	Rural Zone
Total Area:	45.6686 Ha.
Comprised in:	SA10B/683 & SA10B/682
Registered Owner(s):	G. & S. Singleton Heritage Ltd.

I, David Vernon McCracken,
Registered Professional Surveyor, do hereby certify that this plan has been prepared by me for a Resource Consent under the provisions of the Resource Management Act 1991 and should not be used for any other purpose.

Registered Professional Surveyor _____ Date _____

Amendments

No	Activity	Date

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Proposed Covenant Vegetative Area (Visual Mitigation)
635 Whatawhata Road, Dinsdale.

Prepared for: G. & S. Singleton Heritage Ltd.			Sheet 1
Drawn HC	Checked	Scales	Series of 1
Traced	Date July 2019	1:4000 A2	File Ref 13246

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