IN THE MATTER OF Plan Change 19 to the Operative Central Otago District Plan

AND

IN THE MATTER OF proposed Plan Change 19 (PC 19) to the Central Otago District Plan and to rezone the land at 2 Schoolhouse Road from Rural Resource Area to a Large Lot Residential zoning.

BEFORE THE CENTRAL OTAGO DISTRICT COUNCIL

IN THE MATTER OF Plan Change 19 to the Operative Central Otago District Plan

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STATEMENT OF EVIDENCE OF MARK CRUDEN

ON BEHALF OF ROWAN AND JOHN KLEVSTUL (SUBMITTER #163)

INFRASTRUCTURE

16 MAY 2023

INTRODUCTION

1.1 My full name is Mark Cruden. I have a Bachelor of Engineering degree (with honours) from the University of Glasgow, Scotland. I have 25 years' experience in civil and geotechnical engineering.

1.2 I am a member of Engineering New Zealand CMENGNZ, as a Chartered Professional Engineer (CPEng) in the practice areas of Civil and Geotechnical Engineering.

1.3 I hold the position of Director at Meyer Cruden Engineering Ltd. based in Wanaka. I have been in this position since March 2015. Within New Zealand, I was previously employed as a Civil Engineer with the Roading Company Limited from 2008 to 2015 and MWH (now known as Stantec) from 2003 to 2008.

1.4 Through the roles described above I have developed considerable experience in the planning, design and construction supervision of three waters infrastructure and natural hazard mitigation solutions in NZ. The majority of my experience has been developed in the Central Otago, Queenstown Lakes, Coastal Otago and Southland regions.

1.5 Although this is a Council hearing, I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

1.6 I have been asked by Rowan Klevstul to provide evidence on infrastructure requirements and any natural hazard considerations relating to the proposed zone change identified in their Submission #163

1.7 The key documents that I have used, or referred to, while preparing this brief of evidence are:

(a) Central Otago District Plan, Plan Change 19 – Residential Chapter Provisions, Appendix 5;

(b) NZS 4404:2004 Land Development and Subdivision Engineering;

(c) Central Otago District Council's Addendum to NZS4404, dated July 2008;

(d) Central Otago District Council's web based GIS mapping system;

(e) Otago Regional Council's web based "Otago Natural Hazards Portal";

(f) National Institute of Water and Atmospheric Research (NIWA) web based River Flood Statistics Portal.

1.8 I have prepared this evidence based on my:

(a) Expertise as a three waters land development Civil Engineer,

(b) Expertise as a land development Geotechnical Engineer;

(c) Familiarity with the application site and surrounding area, and

(d) Familiarity with the above-mentioned documents.

1.9 I have attached to this evidence the following:

(a) Appendix A – Concept plan for the development;

(b) Appendix B – CODC infrastructure boundaries;

(c) Appendix C – ORC Hazard Map

(d) Appendix D –NIWA NZ River Flood Statistics extract.

(e) Appendix E – New Zealand Geological Map extract

2. SCOPE OF EVIDENCE

2.1 My evidence addresses the following matters:

(a) Water supply

(b) Wastewater management

(c) Stormwater management

(d) Natural hazards – alluvial fan hazard

3. SUBMISSION

3.1 My client, Rowan Klevstul, has sought that approximately 7.37 ha of their site be rezoned from Rural Resource Area to Large Lot Residential under the proposed Plan Change 19 (PC19).

3.2 The client is considering a future development accommodating 35 residential Lots, ranging from 1000 to 2000m^2 in area, arranged a park like setting. A concept scheme plan in included in Appendix A.

4. EXISTING INFRASTRUCTURE

4.1 The site is located on the intersection of Schoolhouse Road and Bannockburn Road just beyond the southern extent of Bannockburn township and the proposed PC19 rezoning.

4.2 The site is located outside the Council's infrastructure scheme boundary. Appendix B includes a figure showing existing infrastructure and infrastructure scheme boundaries.

4.3 Currently the nearest wastewater manhole available for connection is CODC manhole #20040427085105 located 350m north of the site in Bannockburn Road. The manhole is approximately 20m above the lowest point of the site.

4.4 A private sewer line is located 60m west of the southwestern corner of the site and approximately 20m above the lowest point within the site. This connects to CODC sewer manhole #20080320092951 located 450m north west of the site in Lyn Lane. No information is available on CODC's GIS system regarding this private sewer, although it is assumed it is a low pressure sewer line.

4.5 There is an existing 50mm diameter water supply rider main located within the Schoolhouse and Bannockburn Road reserves where they adjoin the site. This watermain lies outside the infrastructure scheme boundaries and is available for connection at the sole discretion of CODC. The site currently has one connection to this water supply.

4.6 There is no reticulated stormwater network in proximity to the site. The nearest stormwater infrastructure is located further north on Bannockburn Road. Connection is not viable due to its elevation above the site.

5. NATURAL HAZARDS

5.1 A natural hazard map extract of the site obtained from Otago Regional Council's Natural Hazards Portal is included in Appendix C.

5.2 With reference to the Natural Hazards Portal a flood water dominated Alluvial Fan hazard is mapped in the southern portion of the site.

5.3 With reference to the Natural Hazards Portal the site is mapped as Domain A signifying an area with low to no liquefaction risk.

6. ASSUMPTIONS

6.1 From information provided by Klevstul I understand it is proposed to develop the site to accommodate 35 residential sites arranged in a park like formation. We understand it is proposed that these Lots will have a main residential dwelling and the potential to accommodate a second residential unit.

6.2 To assess any impacts of the rezoning and subsequent development on the existing wastewater and water supply network and surrounding environment, it is necessary to estimate the likely flow and demand generated by the proposed rezoning. In undertaking this assessment I have relied on the guidance within Sections 5 and 6 of NZS4404 Code of Practice for Subdivision and associated CODC 2008 amendments, along with NZS1547:2012 Onsite Domestic Wastewater Management.

6.3 To assess the impact of the development in terms of stormwater management, including the flood hazard associated with the mapped alluvial fan, I have referenced the guidance within Section 4 of NZS4404 and associated CODC 2008 amendments, along with the New Zealand Building Code Clause E1.

Wastewater

6.4 The wastewater supply design guidance within NZS4404 and the CODC addendum states under Section 5.3.5.1:-

(a) Residential flows

(i) Average dry weather flow of 180 to 250 litres per day per person

(ii) Dry weather diurnal PF of 2.5

(iii) Dilution/infiltration factor of 2 for wet weather

(iv) Number of people per dwelling 2.5 to 3.5.

Water Supply

6.5 The water supply design guidance within NZS4404 and the CODC addendum states the following under section 6.3.9 Hydraulic Design and 6.3.8 Fire Flow:

6.3.9.1 *General*

The diameter of the water main shall be selected to ensure that:

(a) The main has sufficient capacity to meet peak demands;

(b) All consumers connected to the main receive at all times an adequate water supply; and

(c) The appropriate fire demand is met.

6.3.8 *Fire flow*

The water reticulation system shall be designed to comply with SNZ PAS 4509.

6.6 CODC's 2008 addendum further states:-

6.3.9.6.1 Design pressure.

Add to Clause:
The maximum design pressure shall not exceed 800 kPa

6.3.9.8.2 Minimum allowable operating pressure.

Add to Clause:
The minimum operating pressure shall be not less than 300 kPa

Stormwater

6.7 Section 4 of NZS4404 provides guidance on stormwater management and disposal options relevant to the development of this site: NZS 4404 describes the key objectives of a stormwater system as follows:

> **4.2.1** *Objectives*
>
> The objective of a stormwater drainage system is to regulate storm surface run-off and groundwater levels to the extent that agreed levels of service are maintained and any adverse effects on the environment are not more than minor. To satisfy the latter, remedial or mitigation works will often need to be incorporated within the stormwater drainage system.
>
> Potential adverse effects include flood damage, surface and channel erosion and sedimentation, water pollution, and damage to aquatic ecosystems.

6.8 Key parameters to be considered in any stormwater management design include but are not limited to:-

(a) management of run off generated from events equivalent to 1 in 10 year, or 10% AEP, within a primary drainage system – sumps, pipes, manholes etc.

(b) management of runoff off generated from events of intensity beyond a 10% AEP up to a 1% AEP event within a secondary system – open channels, roadways, natural overland flowpaths etc.

(c) Limiting adverse effects on properties upstream or downstream of the development site.

(d) Suitable allowance for climate change in the derivation of peak rainfall intensities and subsequent run off flows.

Alluvial Fan

6.9 Section 4 of NZS4404 provides guidance on stormwater flood management and recommends that minimum floor levels be set with an appropriate freeboard allowance to protect against inundation from secondary flows:

6.10 4.3.2.5.2 of NZS4404:2004 recommends the following minimum freeboard heights:

Freeboard	**Minimum height**
Habitable building floors	0.5 m
Commercial and industrial buildings	0.3 m

7. INFRASTRUCTURE DEMAND & NATURAL HAZARD ASSESSMENT

7.1 Based on the assumptions I have outlined in the preceding paragraphs I have prepared water and wastewater demand / flow calculations for the proposed zoning.

(a) The estimated peak demand for water from a reticulated supply is driven by the firefighting demand, being FW2. This requires the provision of 12.5 l/s from within 135 m of each site and an additional 12.5 l/s within 270 m of each at 100 kPa minimum pressure.

(b) Alternatively a combined low flow and pressure potable supply could potentially be provided using the existing 50mm watermain in conjunction with adequate suitable storage for continuity of supply and firefighting purposes.

(c) Using the method described within NZS4404, the estimated wastewater design flow from the development is calculated at 2.17 Litres per second. This is based on the following assumptions:

(i) A combined total of 50 main and secondary dwelling units will be developed;

(ii) Allowance of 3 persons per unit;

(iii) Allowance of 250 litres per person per unit.

(d) The estimated daily wastewater flow for the sizing of an onsite treatment and disposal system has been estimated at $30m^3$ day when undertaken in accordance with NZS1547:2012, with the following assumptions:

(i) A combined total of 50 main and secondary dwelling units will be developed,

(ii) Allowance of 3 persons per unit,

(iii) Allowance of 200 litres per person per day as prescribed in NZS 1547:2012.

7.2 The stormwater runoff generated from the development can be determined at the time of development as it is dependent upon the area of impervious surfaces proposed. With reference to Table 1 of E1 of the New Zealand Building Code it is likely that the ratio of pervious to impervious areas resulting from development of the site will be 36% or less. This will result in moderately higher peak flow rates and volumes being generated following development than the current natural state.

7.3 The provisional estimate of run off onto the site from the associated alluvial fan hazard has been derived from NIWA's New Zealand River Flood Statistics web based portal which estimates a peak 1% flood flow at the bottom of the site of $2.79m^3$ per second. This has been derived from modelling completed in 2018

which was calibrated against nearby river and stream gauges. The NIWA site reports a standard error of 1.54 against this value. This information is included in Appendix C.

8. POTENTIAL SERVICING AND HAZARD MITIGATION SOLUTIONS

Water Supply

8.1 A reticulated water supply is one option to provide adequate flow and pressure to the site to meet Council's required level of service including, firefighting requirements. The existing 50mm dia main that adjoins the site in Bannockburn Road does not have sufficient capacity to achieve this. A minimum 100mm, possibly 150mm diameter main, could be extended from the existing 150mm diameter main, ID # 20040426110556, located 550m north of the site. Subject to confirmation by modelling this watermain should have adequate flow and pressure to service the site. If flow and pressure are not adequate then the developer could consider upgrading CODC's wider supply network to achieve the required flow and pressure. This could include the provision of booster pumps or other measures.

8.2 Alternatively a low flow, low pressure potable supply could potentially be established via the existing 50mm connection with onsite static storage provided for continuity of the potable supply and adequate firefighting supply for each Lot. Required storage would likely be in the region of $60m^3$ per Lot. This storage volume is predominantly driven by the volume required for firefighting. Table 2 of NZS4509 recommends a minimum static storage volume of $45m^3$ per dwelling for a development of this nature. This storage is typically provided as above ground or below ground tanks. A $30m^3$ tank is approximately 3.5m in diameter and 3m high.

Wastewater

8.3 The site lies 20m below the nearest CODC Sewer Manhole #20040427085105 located 350m north of the site in Bannockburn Road. If a connection is to be made to this manhole a pump station would be required to lift the wastewater from the site to this connection point via a rising main. A suitable rising main and pump station can be designed at the time of development of the site.

8.4 An alternative option would be to install onsite treatment and disposal system(s). With reference to NZS1547:2012 an onsite system would need to cater for approximately $30m^3$ of wastewater per day if the site were developed to create 50 residential dwellings with 3 persons per dwelling. This equates to $0.6m^3$ per day, per unit.

8.5 With reference to GNS's New Zealand Geology Web Map 1:250,000 the site is mapped as being underlain by "Quartz sand & gravel with lignite seams (Dunstan), overlain by interbedded clay, silt & minor sst (Bannockburn); sarsen stones". This underlying geology has the potential to practically accommodate treated effluent disposal to ground. Detailed site investigations would need to be completed to confirm this.

8.6 Proprietary treatment systems are available to cater for the level of demand discussed under item 8.3 above and are commonly used to service individual residences, small communities, campsites, ski areas etc. The treatment and disposal can be designed as a single large system or alternatively as individual systems on each Lot. Individual Lot systems would require approximately 100-150m^2 in area to house the treatment plant and disposal area.

8.7 There is also sufficient land available on site to accommodate a communal disposal area, which would need to be in the region of 2000 to 8000m^2 in size, depending upon the disposal method selected.

8.8 Both a single community treatment and disposal system or individual systems on each Lot are potentially viable. At 1000 to 2000m^2 the proposed Lot sizes have the potential to accommodate on site disposal areas.

8.9 At this early stage it is my view that a communal system would be the preferred engineering and environmental solution rather than individual onsite systems.

<u>Stormwater</u>

8.10 To manage the higher peak flow rates and volumes generated following development a combination of all, or some of the following components, will be required:-

(a) Sumps, pipes and manholes to convey primary flows and treat stormwater.

(b) Road, manmade swales and natural overland flowpaths to manage secondary flows and treat stormwater.

(c) Control measures to protect against scour and erosion.

(d) Attenuation systems such as tanks or ponds, and/or soakage devices to manage peak flows off site and further treat stormwater.

(e) The site in question has a well-defined flowpath through the southern portion running from west to east. This natural feature lends itself to incorporation into the overall stormwater management system for the site. I am of the view that the additional stormwater run off generated from the development can be more than adequately managed using the

range of features described above. This will ensure the objectives of section 4.2.1 of NZS4404 can be met.

8.11 The underlying geology has the potential to practically accommodate stormwater disposal to ground (soakage). This would need to be verified with onsite testing at the time of development.

Alluvial Fan Hazard

8.12 The current concept scheme plan has located the majority of residential dwellings on higher ground outside the natural overland flowpath on the southern side of the wider site. Some of the proposed Lots lie within the regional scale mapped hazard area. At the time of design of the development a detailed assessment of the peak flood flow associated with the upstream alluvial fan can be undertaken. This can be used to specify minimum setback and freeboards heights for residential dwellings in relation to the maximum flood flowpath and height. We note there is ample area to accommodate the proposed 35 Lots outside the current mapped alluvial fan hazard if necessary.

9. CONCLUSIONS

9.1 I consider that with the information available the proposed rezoning can be adequately serviced by way of existing infrastructure, and/or the installation of new infrastructure.

9.2 Wastewater can be managed by conveyance to the CODC's wastewater network via a pumping station and rising main if the wider system has capacity. Alternatively on site wastewater treatment and disposal at a single large treatment and disposal system, or individual Lot systems, is also viable.

9.3 Adequate provision of water for potable and firefighting supply can be provided by extending the existing 100/150mm diameter water main in Bannockburn Road. Alternatively a low flow, low pressure potable supply with supplementary on site storage can be designed.

9.4 Stormwater runoff generated from the impervious areas within the development can be adequately managed using the measures outlined within section 4 of NZS4404. This could potentially include a combination of soakage and attenuation to limit peak flows off the site to pre development levels.

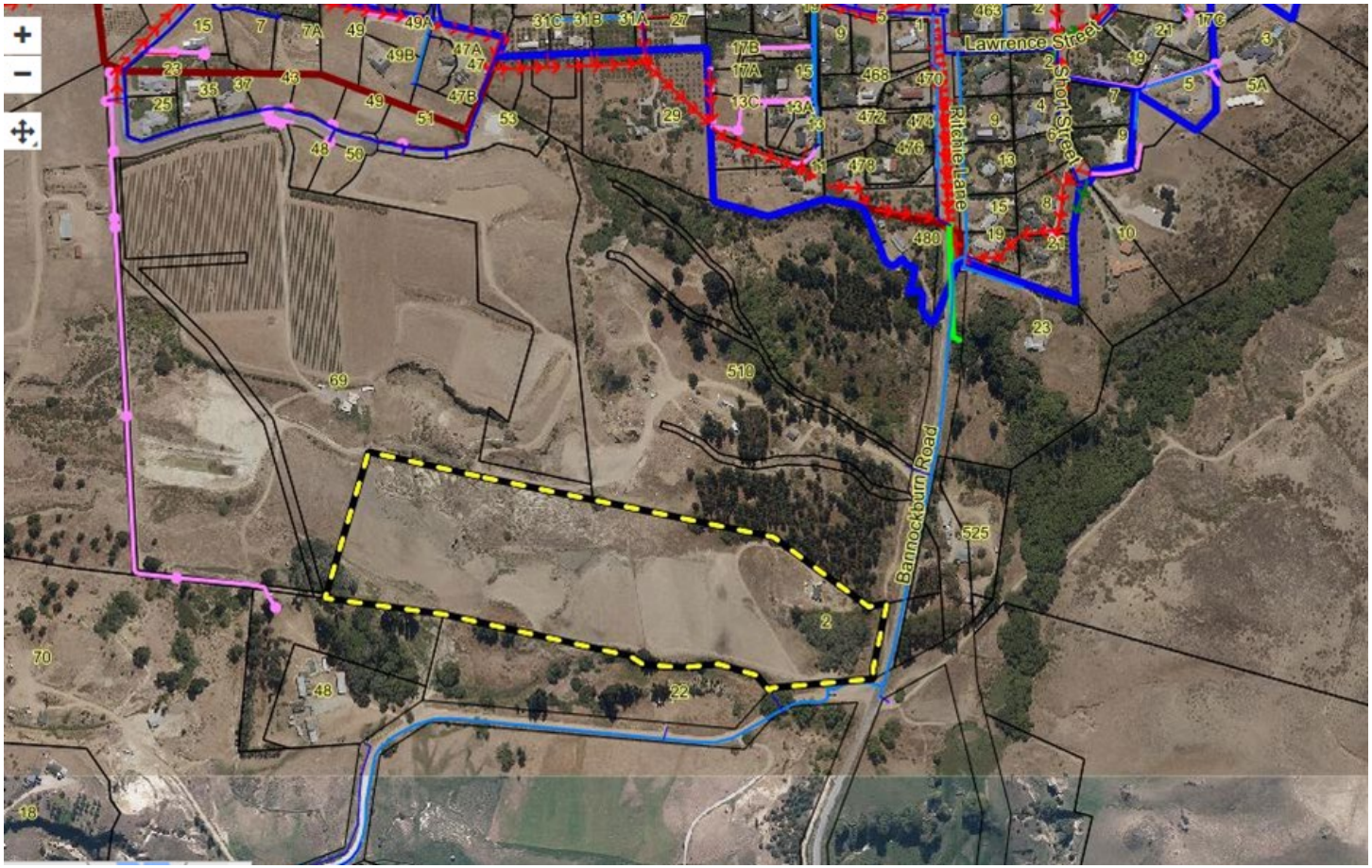
9.5 The floodwater dominated alluvial fan hazard mapped over the southern portion the site will need to be carefully considered in the final development plan, but does not prohibit development. Specifying minimum floor levels and setbacks

for residential development from estimated flood paths and heights will protect against inundation.

APPENDIX A –


commonground southern
client: klevstul family
0m
50m
100m
rev date details by
scale: size: ISO A1
Do not scale drawings. Verify all dimensions on site
drawn: CC checked: JL date 11/04/23
project
name
drawing
bannockburn rural hamlet
masterplan
project 2217
rev A

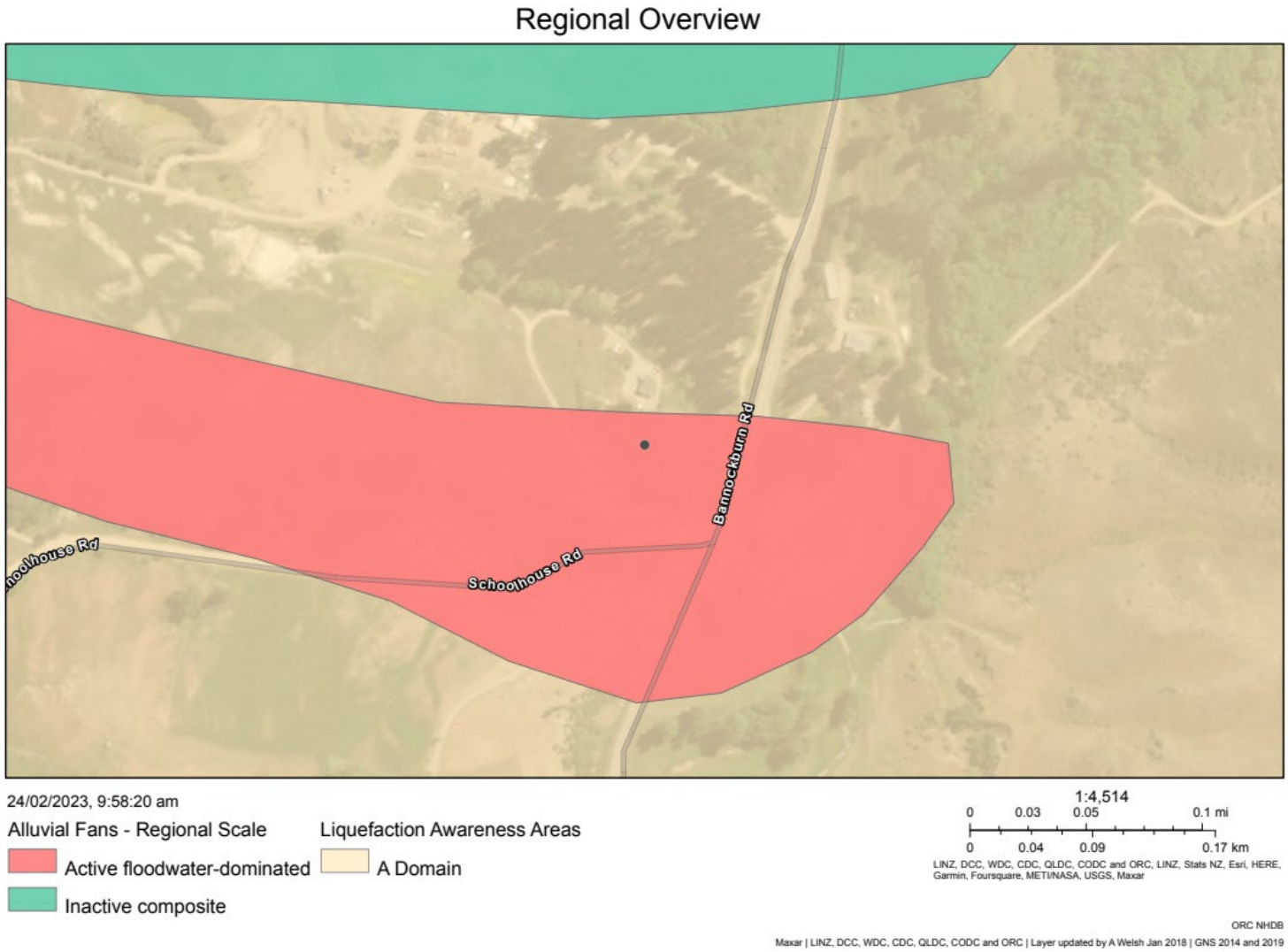
APPENDIX B – Existing Infrastructure and scheme boundaries



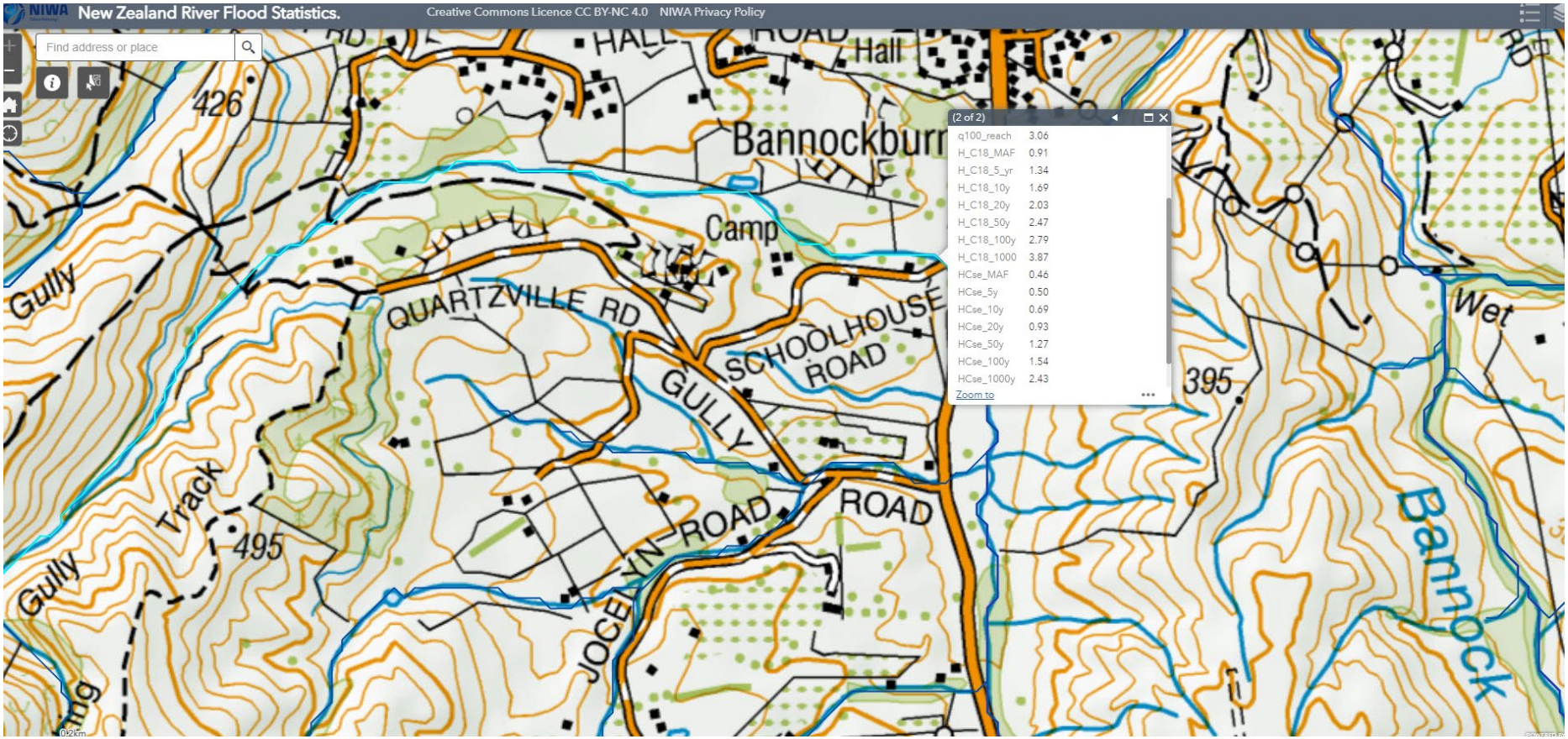
Notes

1. wastewater and water supply scheme boundaries denoted by thick blue and brown lines.
2. Site is denoted by black and yellow dashed lines.
3. Screenshot provided by CODC

APPENDIX C – Mapped Alluvial Fan Hazard



APPENDIX D – NIWA extract



Screen grab from NIWA River Flood Statistics Portal

https://niwa.maps.arcgis.com/apps/webappviewer/index.html?id=933e8f24fe9140f99dfb57173087f27d

APPENDIX E NZ GEOLOGICAL MAP FROM GNS WEBSITE, 1:250,000 Scale

https://data.gns.cri.nz/geology/