Akaroa Treated Wastewater Reuse Options Working Party

Date	1 March 2017	**Time**	6pm	**Venue**	Okuti Valley Hall 173 Okuti Valley Road Little River
Chairperson	Penny Carnaby			**Notes**	Amy Hart

Attendees	**Working Party Members:**	
	Penny Carnaby	- (Chairperson) Independent Appointee
	Christine Wilson	- Chair Banks Peninsula Community Board
	Janis Haley	- Banks Peninsula Community Board Member
	Pam Richardson	- Banks Peninsula Community Board Member
	Kevin Simcock	- Community Member, Takamatua
	Mark Wren	- Community Member, Takamatua
	Brent Martin	- Community Member, Robinsons Bay
	Suky Thompson	- Community Member, Robinsons Bay
	Andrew Dalglish	- Community Member, Akaroa
	Debbie Tikao	- Appointee, Onuku Rūnanga
	Alternates	
	Kathleen Reid	- Community Member, Robinsons Bay
	Kit Grigg	- Community Member, Akaroa
	Will Johns	- Landowner, Pompeys Pillar
	Staff & Consultants:	
	Bridget O'Brien	- Team Leader Asset Planning, CCC
	Penelope Goldstone	- Manager Community Governance – Rural, CCC
	Amy Hart	- Governance Support Officer, CCC
	Kirsty Huxford	- Senior Environment Adviser, Te Rūnanga o Ngāi Tahu
	Greg Offer	- Technical Director, Beca
	Richard Young	- Technical Director, Beca

1. Apologies

Apologies for absence were accepted from: Andrew Turner, Councillor Banks Peninsula Ward, John Davey, Community Member Akaroa, Liz Carter, Community Board Advisor CCC, Rik Tainui, Onuku Rūnanga, Manaia Cunningham, Koukourārata Rūnanga, Trevor Bedford, Community Member, Takamatua. Murray Johns, Landowner, Pompeys Pillar.

Apologies for lateness were accepted from: Kirsty Huxford and Debbie Tikao who arrived at 6.14pm.

2. Notes - Akaroa Treated Wastewater Reuse Options Working Party - 26 February 2017

2.1 The Working Party received the notes of its meeting on 26 February 2017. It was noted that the legal opinion provided is confidential to the Council and the working party.

3. Advice from Technical Experts Group on Alternative Options

3.1 Richard Young and Greg Offer on behalf of the Technical Experts Group (the Group) presented a preliminary geotechnical assessment of the Akaroa Wastewater Project – Land Disposal – Option 4 (**circulated separately** and TRIM 17/221887). This assessment does not investigate staging, distributed networks or smaller ponds due to time constraints. Refer to the attached presentation for more details on Items 3.2-3.7.

Action
The Working Party requested that possible staging of the irrigation scheme be investigated, and report back at the next meeting.

3.2 Groundwater Mounding
Question: Why doesn't a small application rate eliminate drainage to subsoils and groundwater mounding?
Answer: Application to trees typically occurs year-round. In winter vegetation cannot eliminate groundwater mounding even with a low application rate. Further work would need to be done to see if it is possible to eliminate groundwater mounding.

Action
The Working Party requested an assessment about whether eliminating drainage to subsoils and hence groundwater mounding is possible, and if so the application rate and area required.

3.3 Irrigation Effects on Slope Stability
Work done previously by Tonkin & Taylor on historical instability around Akaroa found that four out of five landslides were on slopes greater than 15 degrees. Landslides are triggered by extreme rainfall and earthquakes.

In geotechnical investigations undertaken in 2016 on Takamatua Headland found the soil moisture content ranged from 13 – 25%, with a five-fold reduction in strength at the higher moisture content.

Question: Would the range in soil strength change with irrigation?
Answer: Infiltration rates below the root zone are about 1 mm/day. The variation in the soil moisture content in the semi-saturated zone would change only a few percent as a result of irrigation.

Question: Could lime be applied to soil on steep downslopes to decrease infiltration and improve slope stability?
Answer: Typically lime is only applied to small areas to stabilise earthworks. It would be technically possible to apply to large areas but may be costly.

The Group noted that assessment of irrigation effects on slope stability is based on application to pasture rather than trees. Trees improve stability up to a depth of typically two metres (average depth of roots), but has no effect on bedrock landslides and deep loess landslides. The Group noted irrigation to pasture cannot occur in winter.

3.4 Land Stability Selection Criteria
The Group noted one of the criteria for land stability is that the irrigation area be less than 19 degrees and downslope to coastline be same 15 degrees or less. The criterion used to assess Option #4 was an irrigation area of less than 19 degrees, and for earlier screening of sites was 15 degrees. Slopes between 15 and 19 degrees can be irrigated if they are forested.

Action
The Working Party requested that the land stability of all sites be assessed based on the criterion that the application area be less than 19 degrees and downslope to coastline be 15 degrees or less.

3.5 Historical Instability and Slope Inclination
The Group noted mapping of historical instability is based on a 2008 Tonkin and Taylor study. White areas on the maps in the presentation were not assessed by Tonkin and Taylor and have not been assessed by Beca due to time constraints.

3.6 Preliminary Summary
The Group assessed the comparative instability of Option #4 sites to Options #1, #2 and #3 (Takamatua Valley, Robinsons Bay and Pompey Pillar sites).

The comparative likelihood and consequence of instability was assessed. All Option #4 sites have a greater likelihood of instability as all sites have downslopes greater than 19 degrees. Two Option #4 sites have a greater consequence (e.g. application area is above infrastructure) and five Option #4 sites have a neutral – greater consequence. The total comparative instability risk (likelihood x consequence) is greater for all Option #4 sites.

In summary, the Group's preliminary conclusion is that all Option #4 sites have a comparatively higher risk of instability than Options #1, #2 and #3 (Takamatua Valley, Robinsons Bay and Pompeys Pillar).

3.7 Effect of Trees and Lower Application Rate

Question: Could an irrigation scheme be established in existing native vegetation?
Answer: If geotechnically suitable site has existing vegetation then vegetation would remain and an irrigation scheme could be installed in it.

3.8 Re-Use of Treated Wastewater in Akaroa

It was noted that Option #4 included non-potable reuse in Akaroa as well as distributed irrigation areas and ponds. Could all treated wastewater be stored and re-used in Akaroa?

Action
The Working Party requested that staff circulate a link to the MWH 2008 report on re-use of treated wastewater in Akaroa.

Action
The Working Party requested an assessment of how much treated wastewater could be used for non-potable reuse in Akaroa.

3.9 General Comments and Questions

Question: Is Option #4 more expensive?
Answer: Reticulation costs would likely be more due to the much longer pipe lengths, but a cost estimate has not been prepared for Option #4.

3.10 Working Party Feedback on Option #4

The Chair asked that each Working Party member provide feedback on Option #4. There were a range of views, with some not supporting pursuing Option #4 further due to the higher risk and cost, and others wanting more time to consider Option #4 further. It was noted that the Council owns the Misty Peaks site, so the cost would be lower as land purchase would not be required.

Technical Experts Group Comment
The Group advised it is unsuitable to irrigate to land with a downslope greater than 15 degrees due to the risk of slope instability.

Council Staff Comment
Staff noted the Council is required to consider all technically feasible options. Staff will not recommend an option that is not technically feasible. Staff do not recommend Option #4 due to the increased risk of slope instability.

Working Party Comment
The Working Party requested that Option #4 continue to be investigated over the next week.

4. Timeframes

4.1 Upcoming Work

- 3 March – Mapping of Robinsons Bay alternative scheme (not Thacker land) complete
- 8 March – Survey of Pompeys Pillar site complete
- 24 March – Mapping of Pompey's Pillar, concept design and interpretation of evidence complete
- Timeframe unknown – The Council has requested a Cultural Impact Assessment of Pompey's Pillar
- Timeframe unknown – Updated Beca report "Akaroa Wastewater Investigation of Alternative Sites for Land Irrigation"

Question: Will the Council seek an extension from the Environment Court?

Answer: Not at this stage. An extension will be sought if work is unable to be completed within the current timeframe.

4.1 Agenda for 8 March Meeting

- Landscape and visual assessment of Pompeys Pillar site
- Responses to questions raised in these notes
- Draft Consultation Booklet

4.3 General Questions and Actions

Question: What work has been done on the Takamatua Valley site?
Answer: Beca is continuing to assess the suitability of the Takamatua Valley site. The suitable area is shrinking due to refined criteria and the area is unlikely to be enough for a standalone irrigation scheme, but the remaining areas could fit into a distributed irrigation scheme.

Nitrogen monitoring data in Takamatua Stream was provided by Pam Richardson and is **attached**.

Mark Wren has mapped the ephemeral streams in Takamatua Valley.

Action
Mark Wren to provide a map of ephemeral streams in Takamatua Valley to the staff who will forward to Beca.

Action
The Working Party requested additional pond locations be considered for Pompeys Pillar (e.g. along Long Bay Road) for non-potable re-use and fire-fighting ponds.

Action
The Working Party requested that staff provide a bibliography of all documents received by the Working Party.

Action
Staff to circulate the geotechnical investigation and infiltration testing reports on the Thacker land to the Working Party.

5. Consultation Booklet Input

5.1 **Action**
The Working Party requested that the following be included in the Consultation Booklet. Staff requested that the Working Party email any additional suggested input to staff by 3 March.

- Treatment process
- Quality of treated wastewater
- Advantages and disadvantages of options
- Irrigation to pasture cannot occur in winter
- Timeline / history of this project
- Identification of at-risk communities, and details of who is liable and what compensation would be provided
- Provide as much information as possible as succinctly as possible
- The **attached** suggestions were presented at the meeting.

Staff noted that if the Council chooses the harbour outfall option, it will go through the Environment Court mediation process. If the Council chooses a land-based option, it will apply for new resource consents.

The meeting adjourned at 8.07pm.
The meeting resumed at 8.18pm.

6. Consideration of Options 1-3

6.1 The Working Party brainstormed the advantages, disadvantages and efficiency of Options 1-3 (**attached**).

7. Joint Statements of Technical Experts Group

7.1 The Working Party noted the Joint Statements #1 and #2 of Technical Experts Group attached to the agenda (**attached**).

8. Communications

8.1 **Action**
The Working Party requested that the Chair let the community know that the Working Party is looking at different options and considering technically complex issues within a short timeframe.

9. Meeting Schedule

9.1 The following date and time is **confirmed**:

- Wednesday 8 March 6pm – 9pm, Okuti Valley Hall

Actions

- The Working Party requested that two additional meetings be scheduled from 9 March – 20 March.
- The Working Party requested that staff provide a revised timeline of critical dates.
- Working Party members to indicate to staff whether available after 20 March.

The meeting closed at 9.04pm.

Agenda for 8 March Meeting

- Option 4
- Landscape and visual assessment of Pompeys Pillar site
- Responses to questions raised in these notes
- Draft Consultation Booklet
- Joint Statements of Experts Group (Carried forward from 1 March meeting)

Akaroa Wastewater Project
Land Disposal – Option 4
Preliminary Geotechnical Assessment

Presentation to Working Party

Wednesday 1st March 2017

Alternative Proposal - Option 4

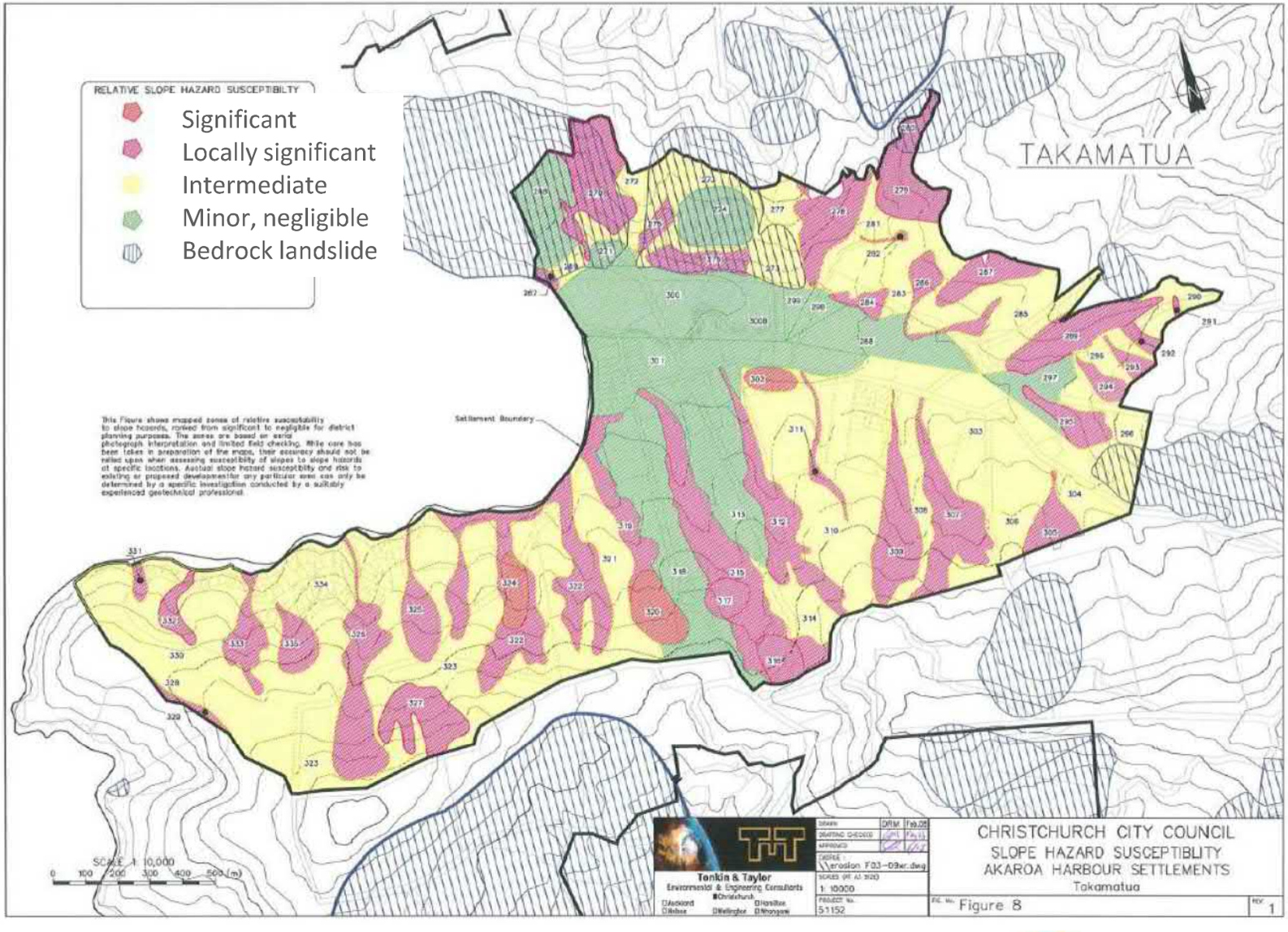
- Distributed tree irrigation scheme
- Over several smaller sites
- Small ponds instead of one large one
- Lower application rate applied to greater land area

- Preliminary evaluation of risks for this scheme

Background

- Desktop study identified historical areas of instability
- Concern that slope instability will be exacerbated by irrigation
- Preliminary geotechnical testing undertaken on Takamatua headland in September 2016
- A geotechnical assessment considered the stability of the land

Example of Slope Hazard Susceptibility



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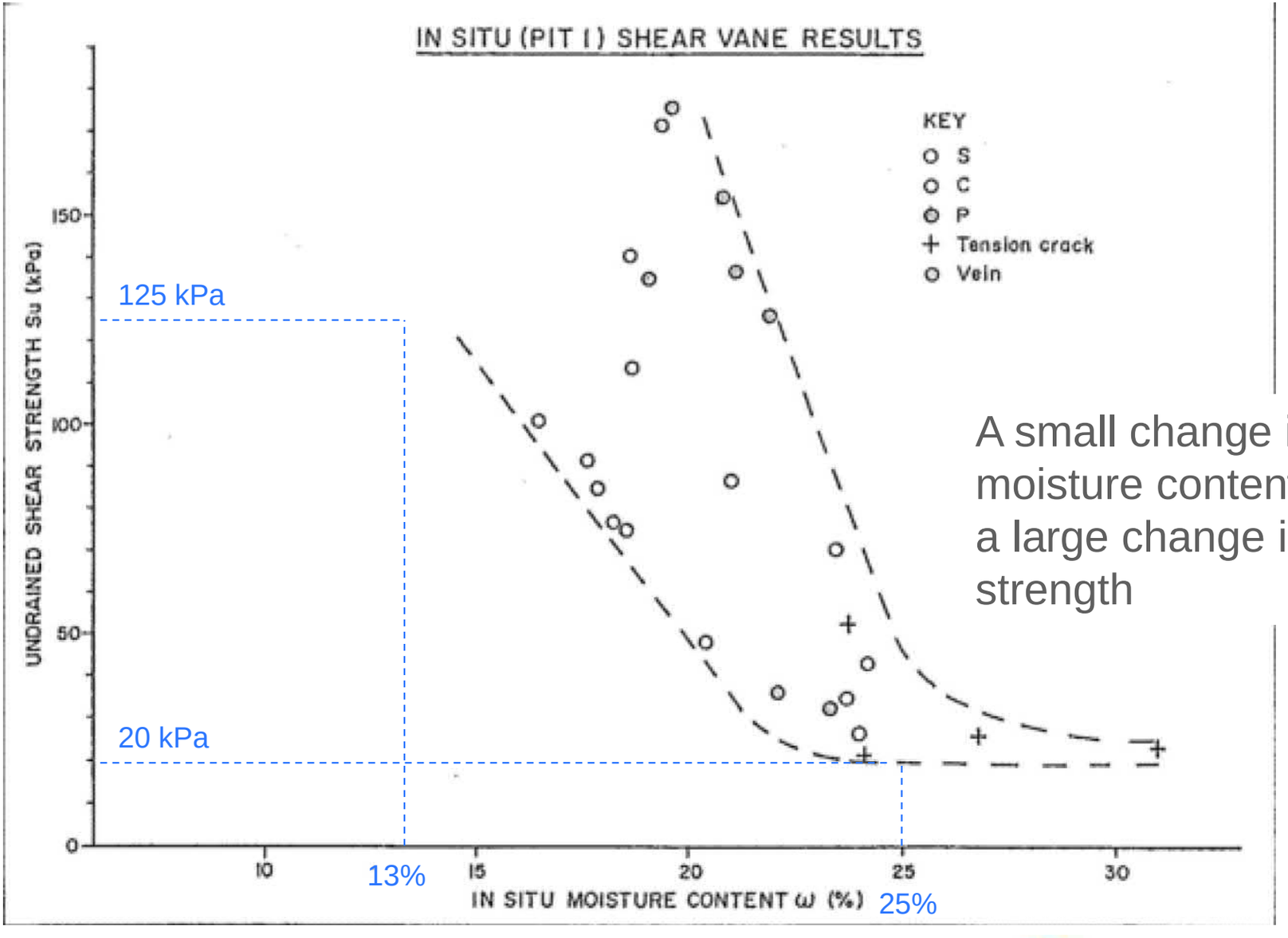
Generalised Ground Model

- Surficial Deposits
  - Loess (wind blown silt)
  - Colluvium (loess and bedrock moved down hill under gravity)
  - Alluvium (in valleys)
- Volcanic Bedrock
- Groundwater in bedrock at higher elevations and closer to ground level in valleys

Loess / Loess Colluvium Characteristics



A small change in moisture content leads to a large change in strength

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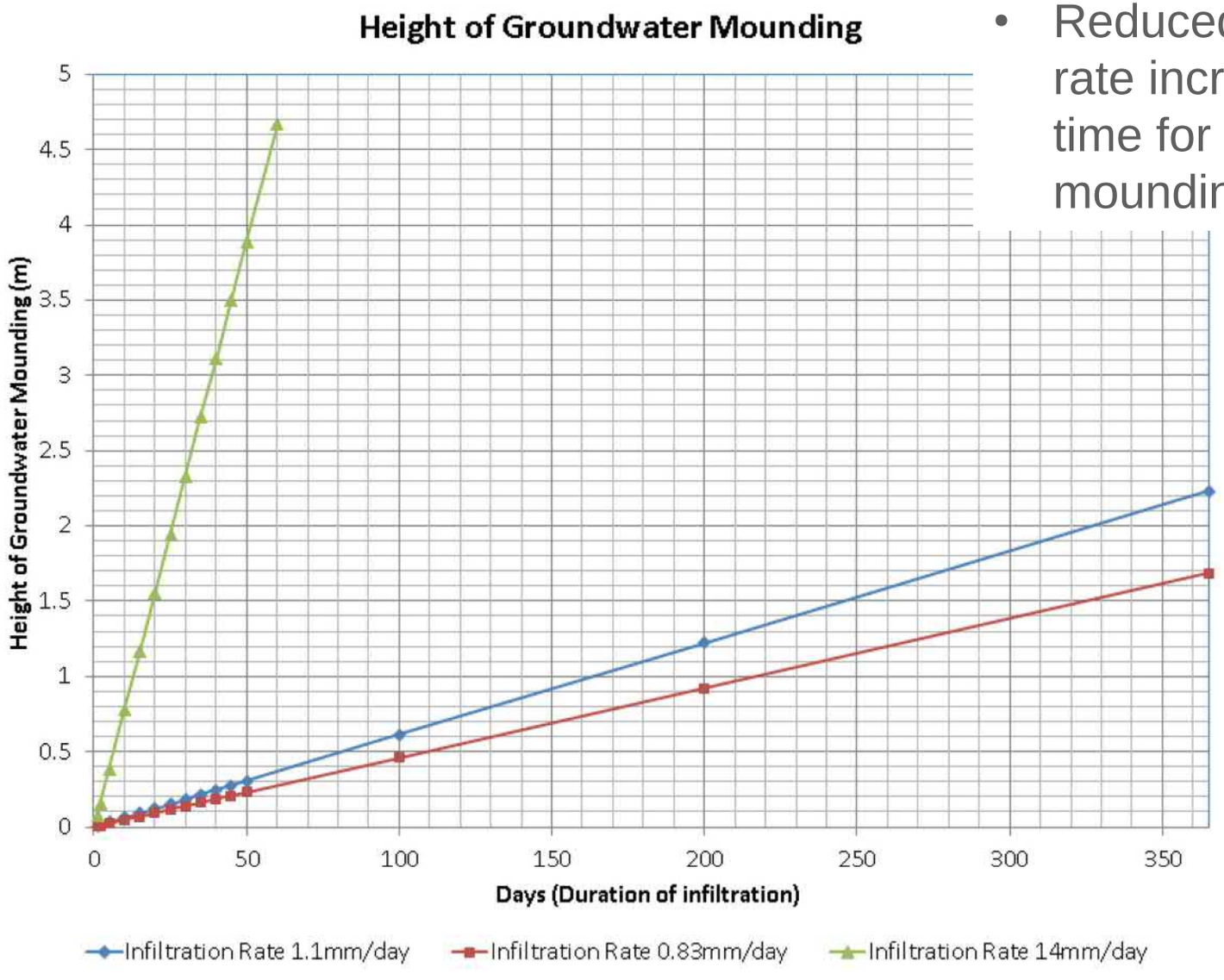
Groundwater Mounding



- Reduced application rate increases the time for groundwater mounding

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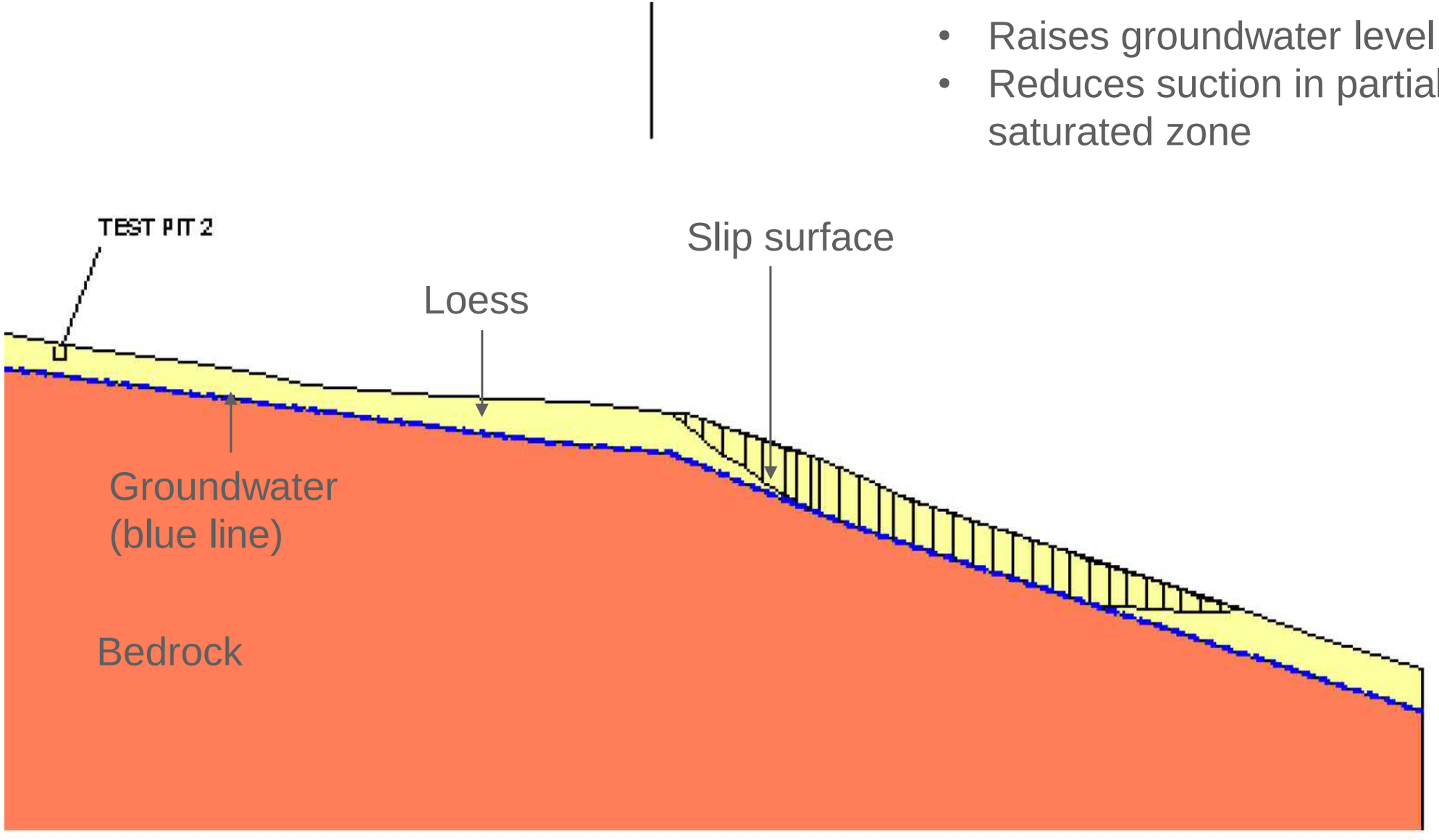
Irrigation Effects on Slope Stability

- Raises groundwater level
- Reduces suction in partial saturated zone



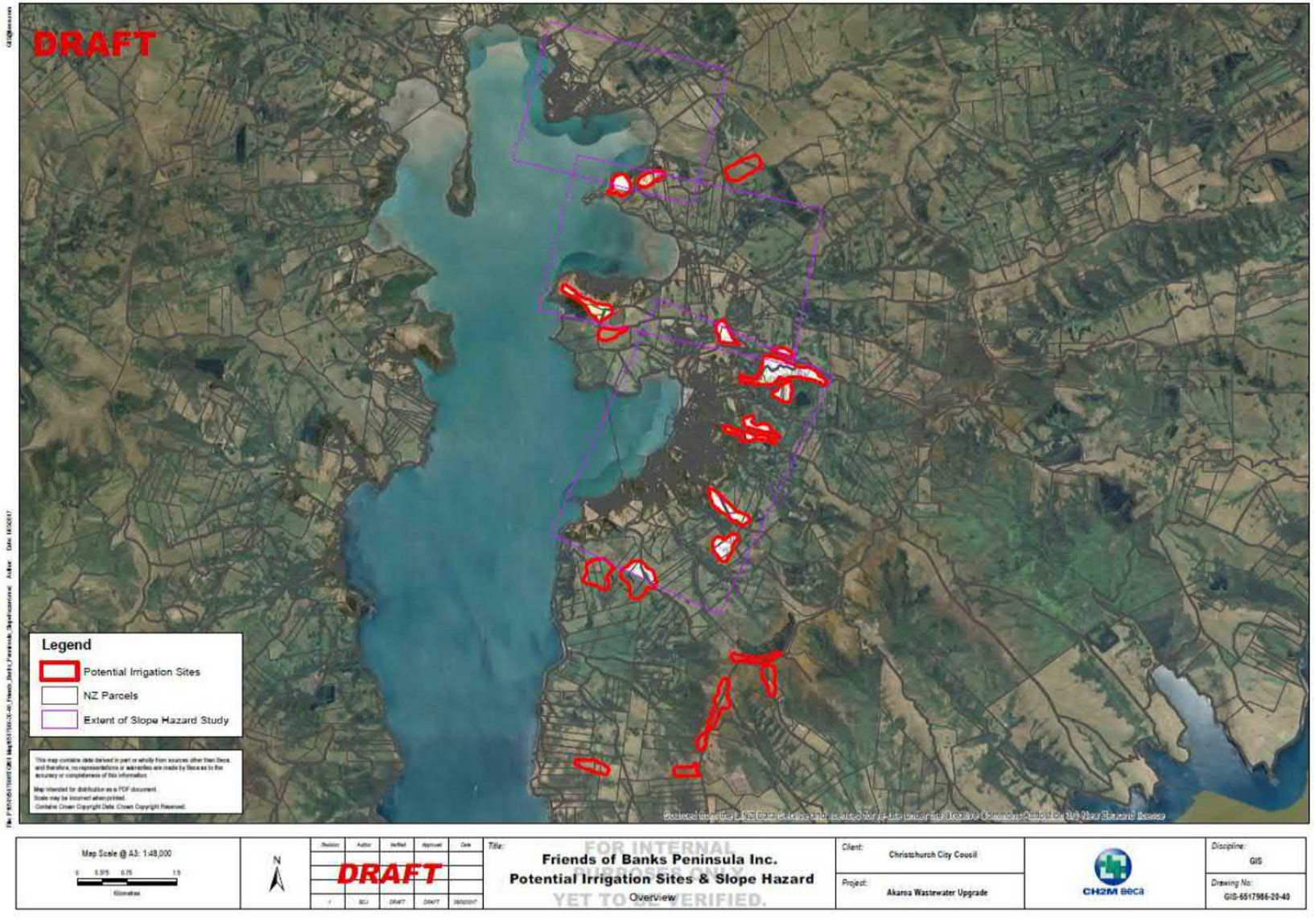
Slope Stability Summary

- Current likely Factor of Safety [of Slopes > 19°] is 1.1 – 1.3
- With irrigation
  - Extent of instability increases
  - Factor of Safety falls by 10% - 20%
  - For an earthquake the Factor of Safety falls by 30% - 40%
- With reduced application rate of irrigation
  - These aspects occur, but over a longer period as groundwater mounds
- Effect of wider distribution areas
  - As ground instability is a phenomenon that occurs over Banks Peninsula, widening the area is unlikely to reduce the risk

Land Stability Selection Criteria

Selection Aspect	Criteria Adopted
Land Stability	- Less than 15 to 19 degrees and downslope to coastline same grade or less - No identified instability below - Account for downslope residences, infrastructure and runout distance - Site aspect ratio (width to length)
Historical Instability Zones	Tonkin & Taylor 2008 erosion zones excluded

Working Party - Option 4 Distributed Network



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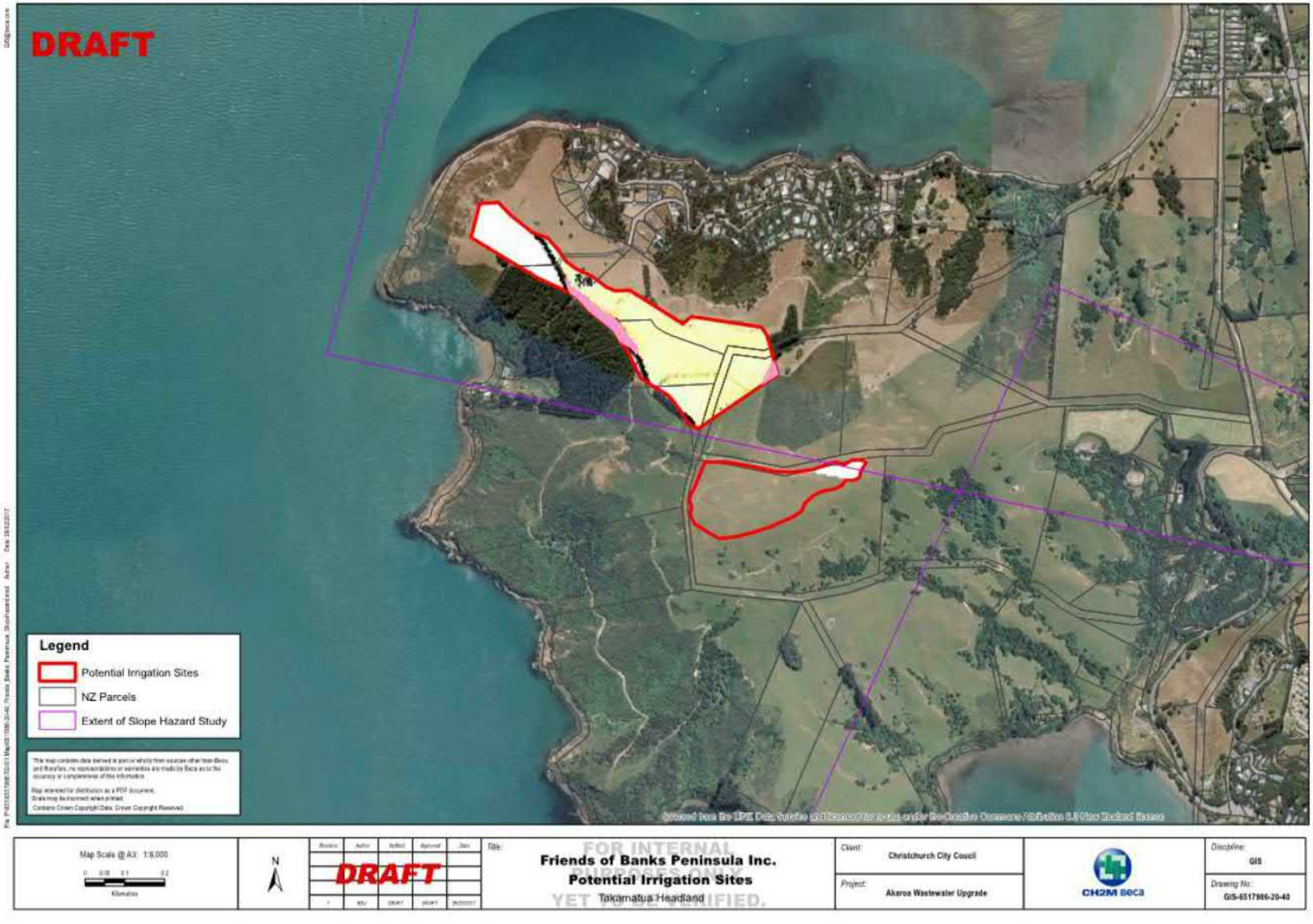
Historical Instability – Takamatua Headland (Sites 2 and 3)



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Slope Inclination - Takamatua Headland (Sites 2 and 3)

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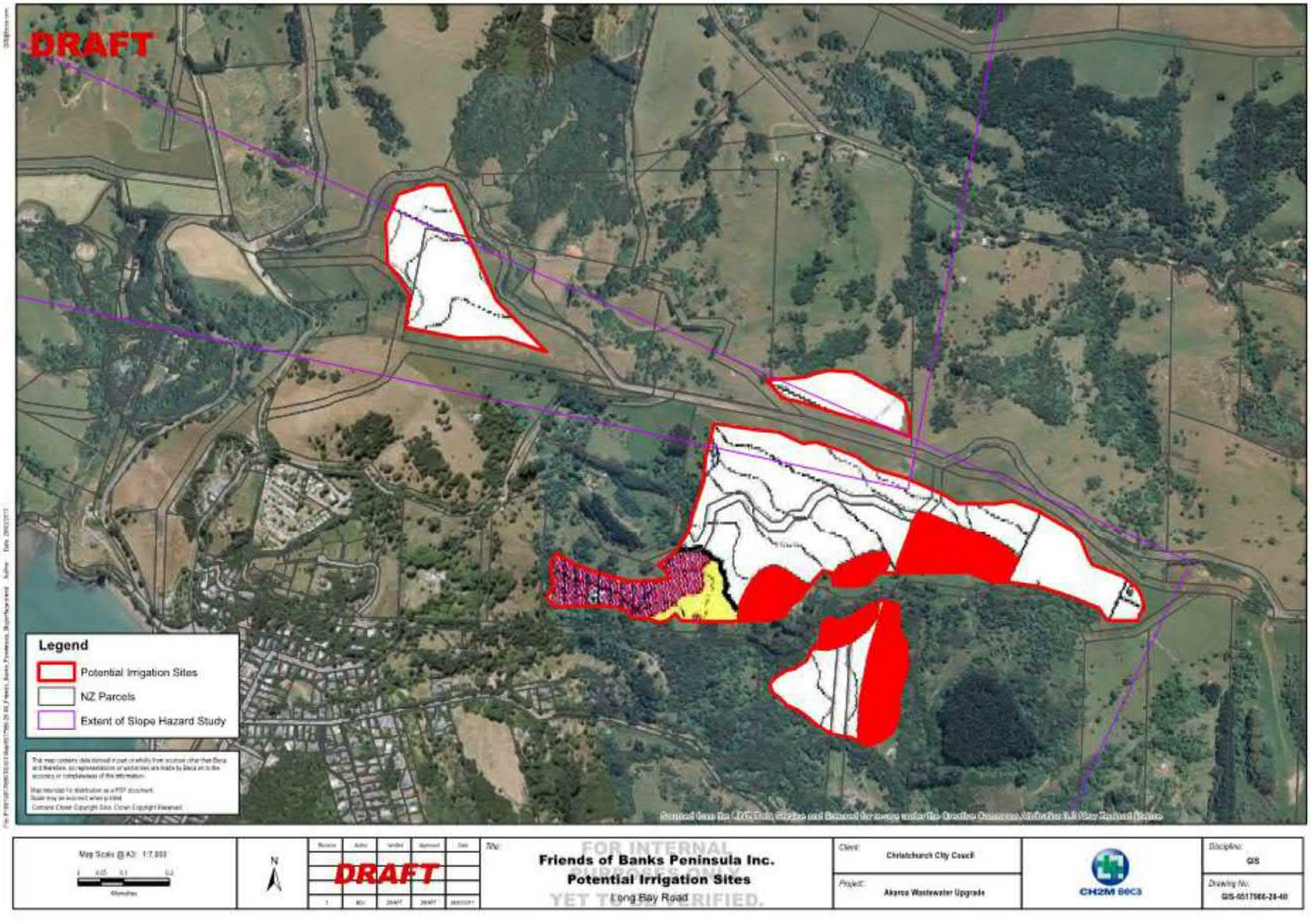
Historical Instability – Long Bay Road (Sites 4, 5, 6 and 7)



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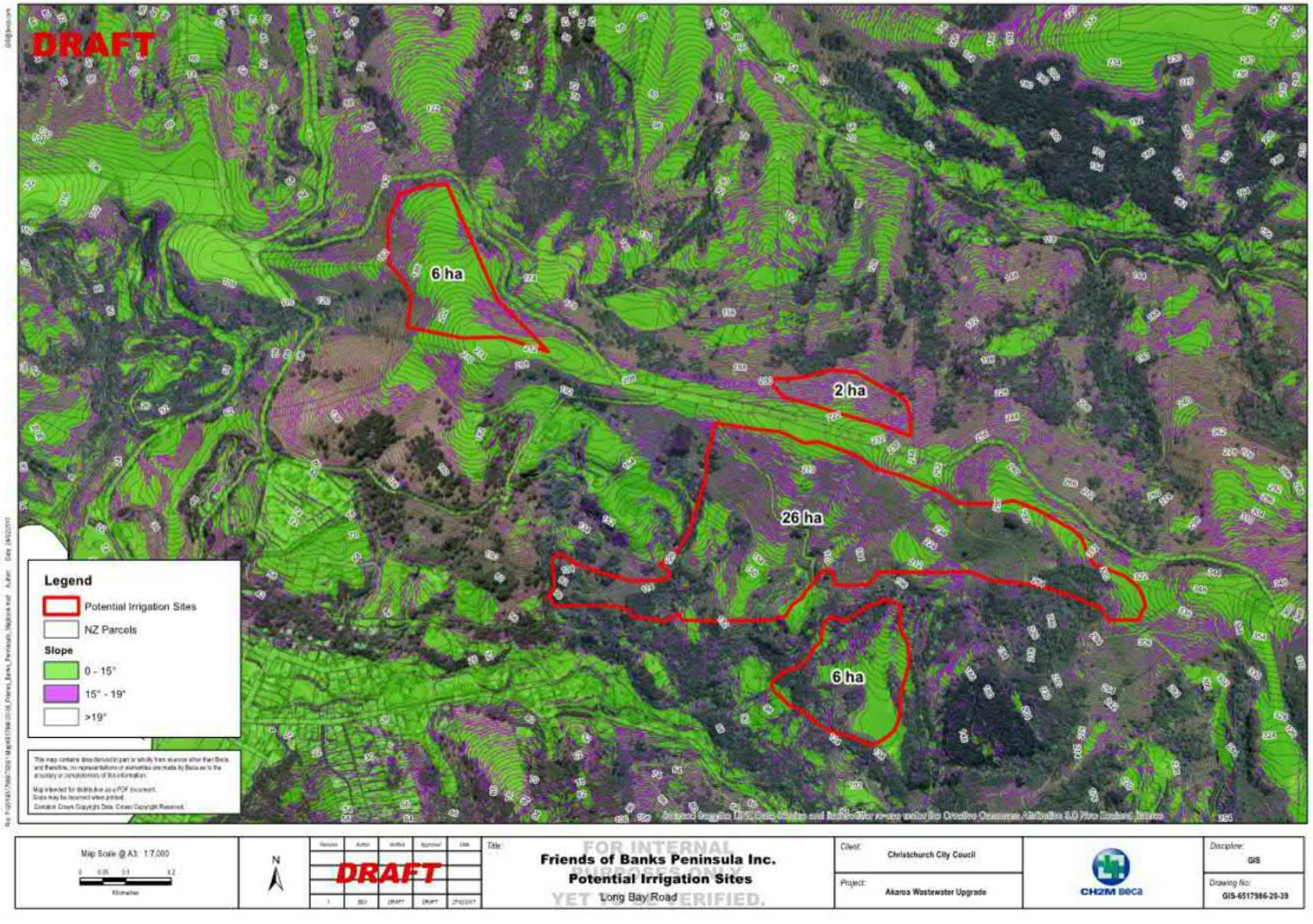
Slope Inclination - Long Bay Road (Sites 4, 5, 6 and 7)



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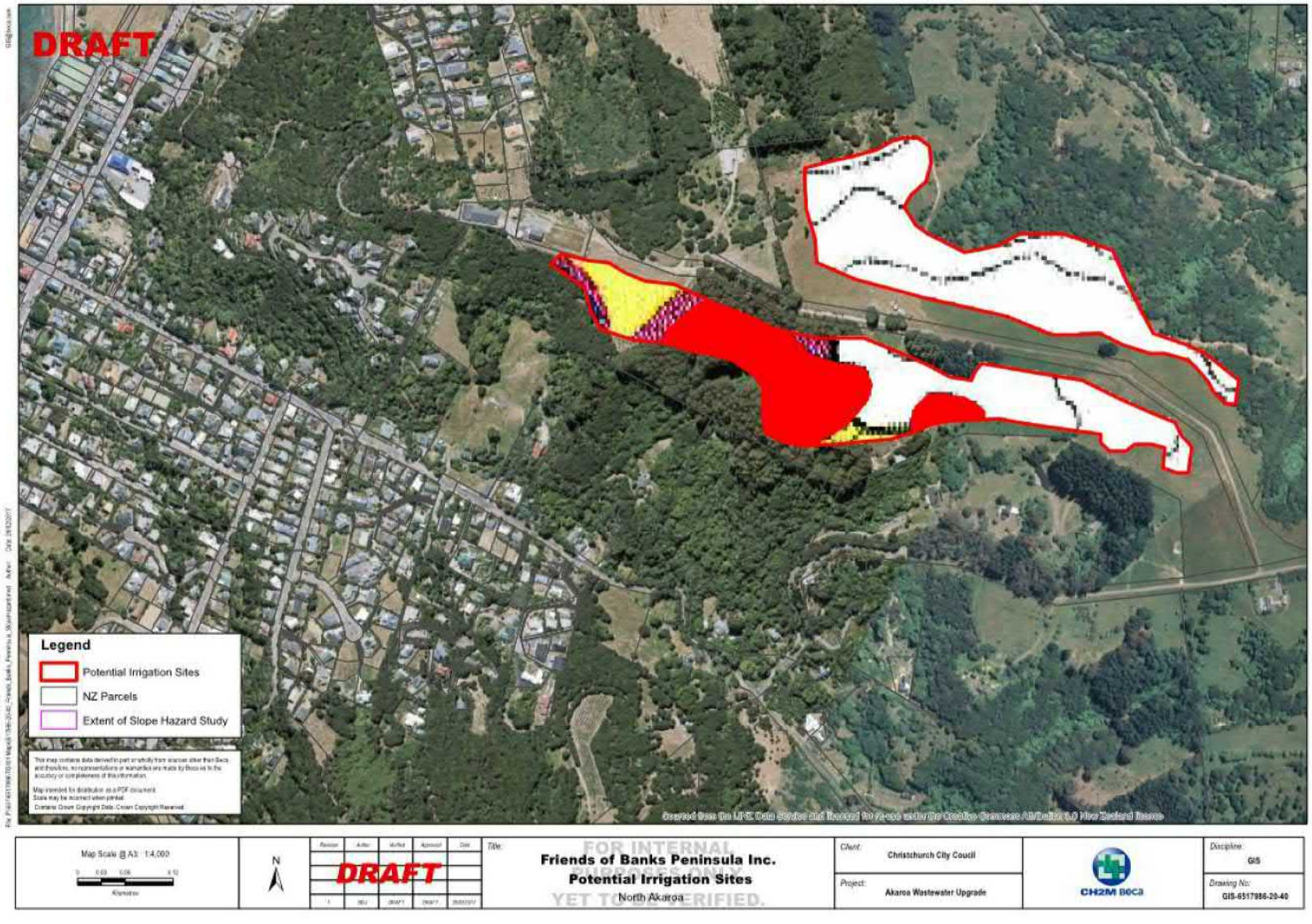
Historical Instability – East Akaroa (Sites 8 and 9)



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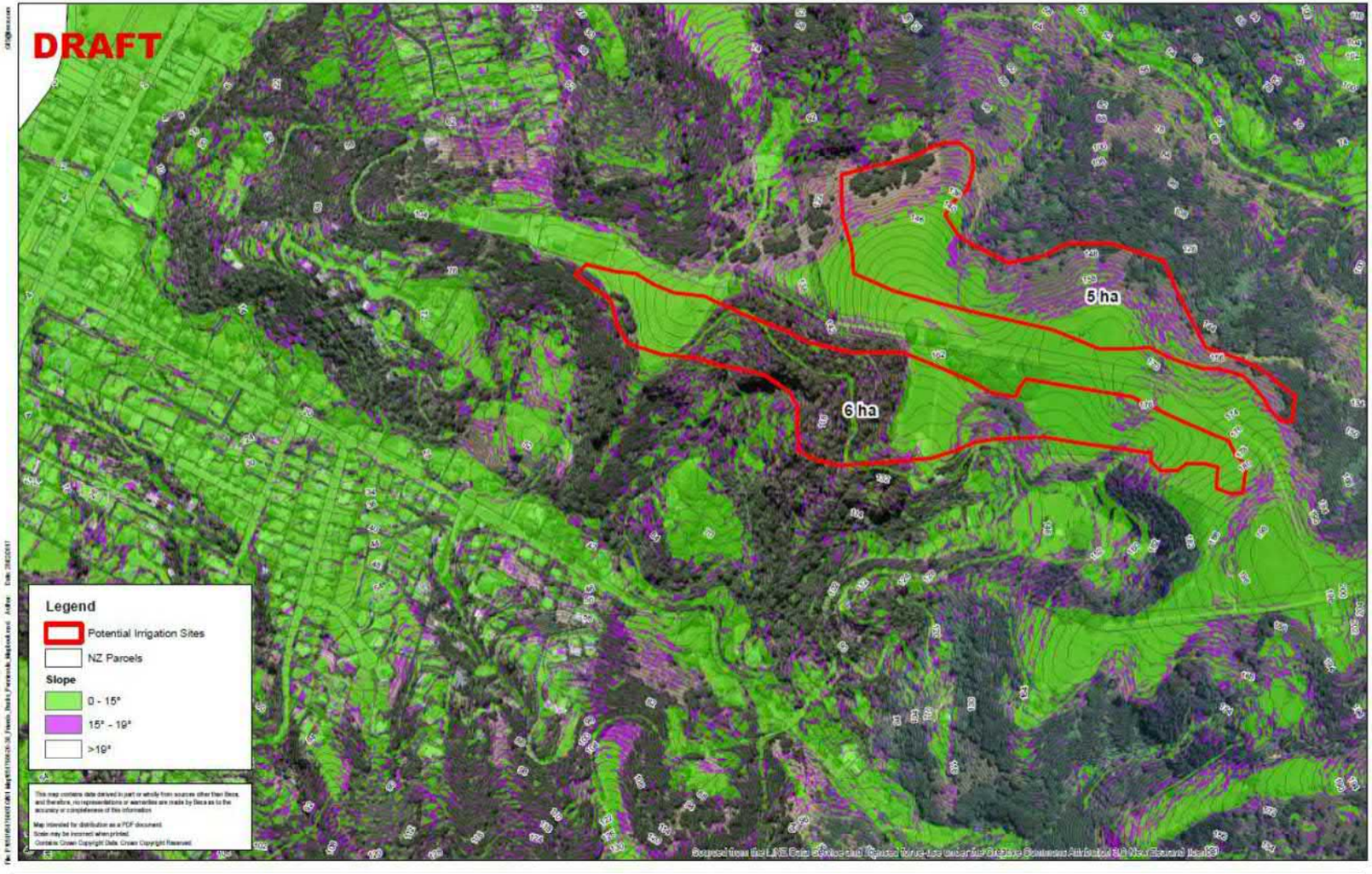
Slope Inclination - East Akaroa (Sites 8 and 9)



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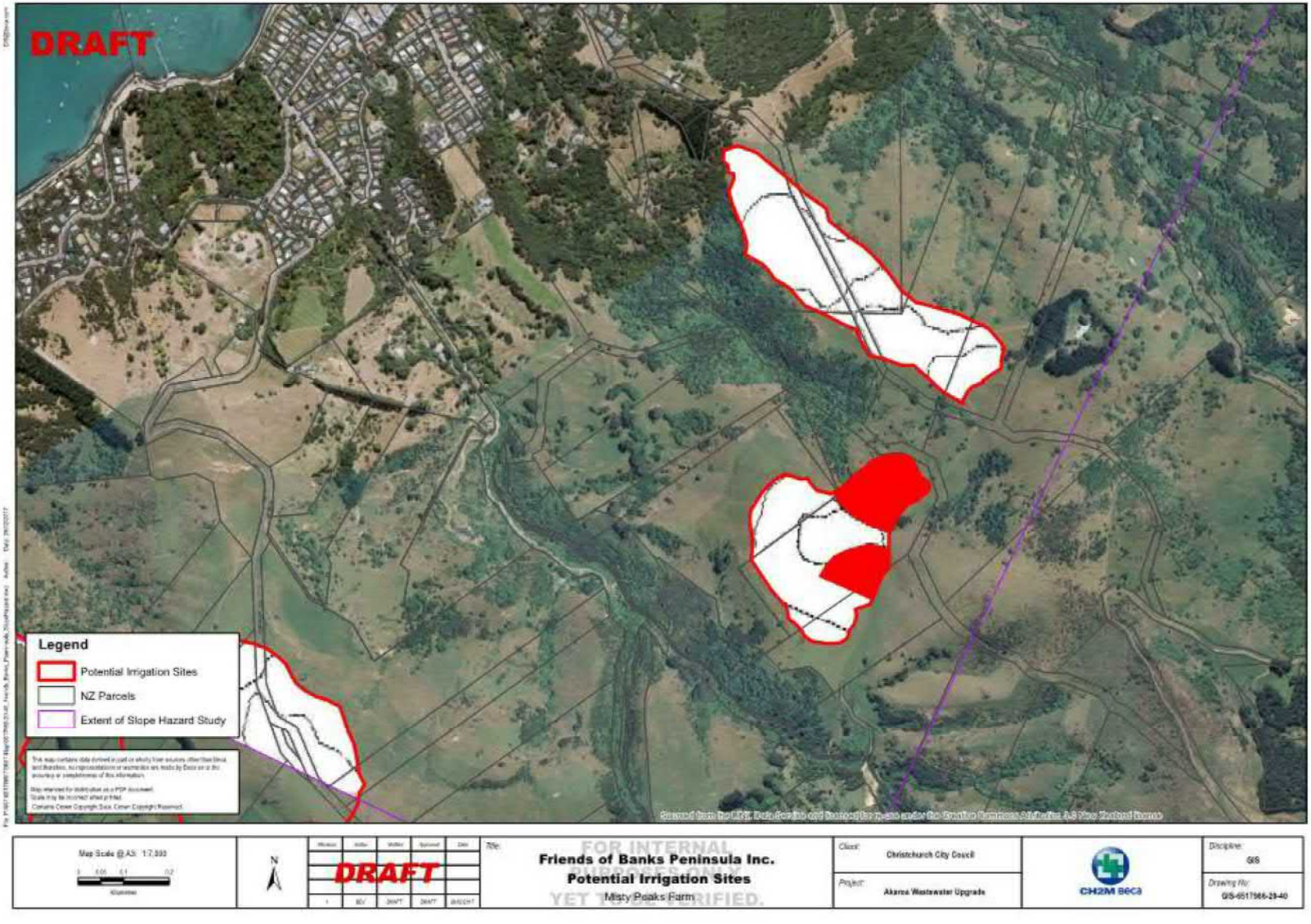
Historical Instability – Misty Peaks Farm (Sites 12 and 13)



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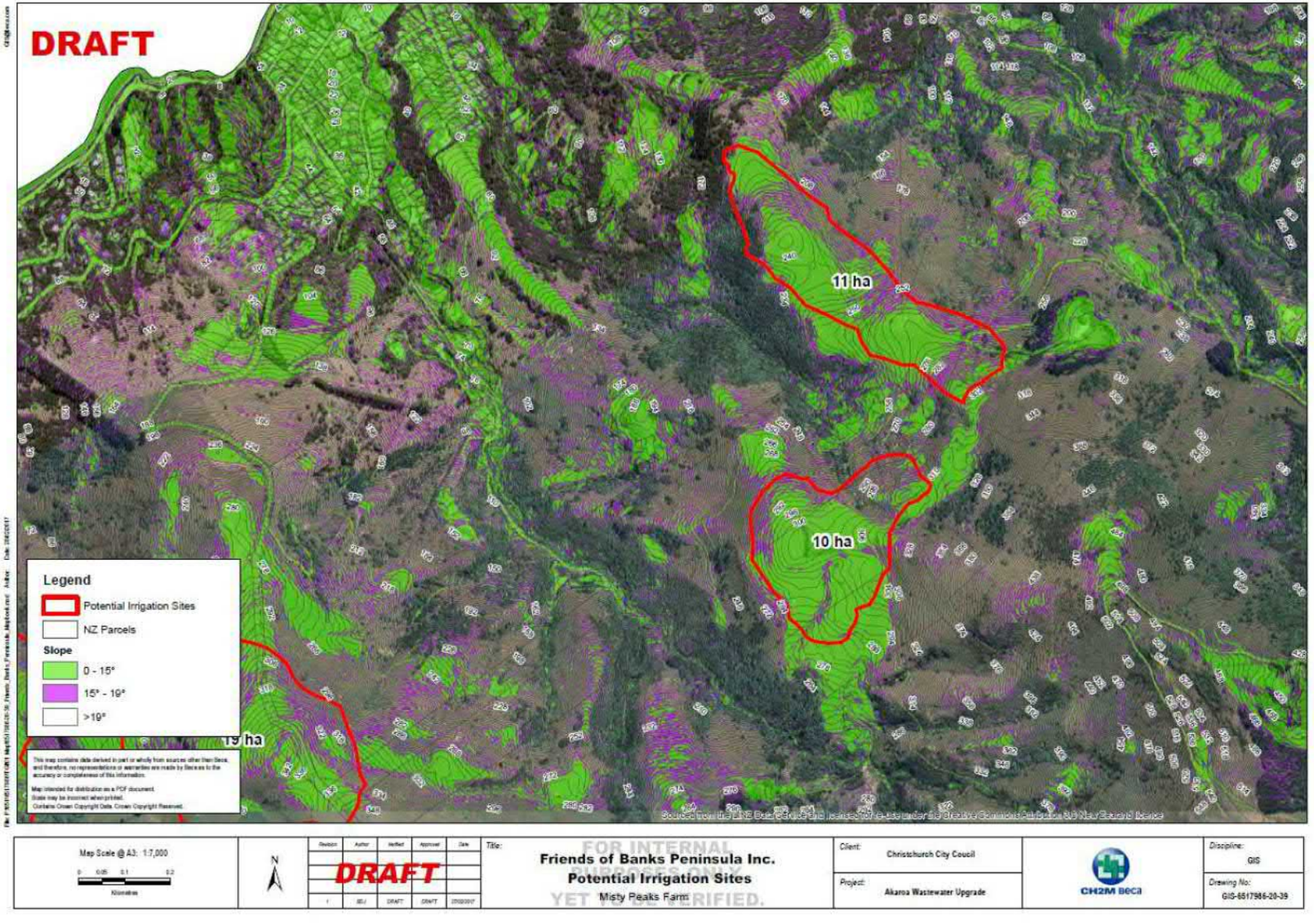

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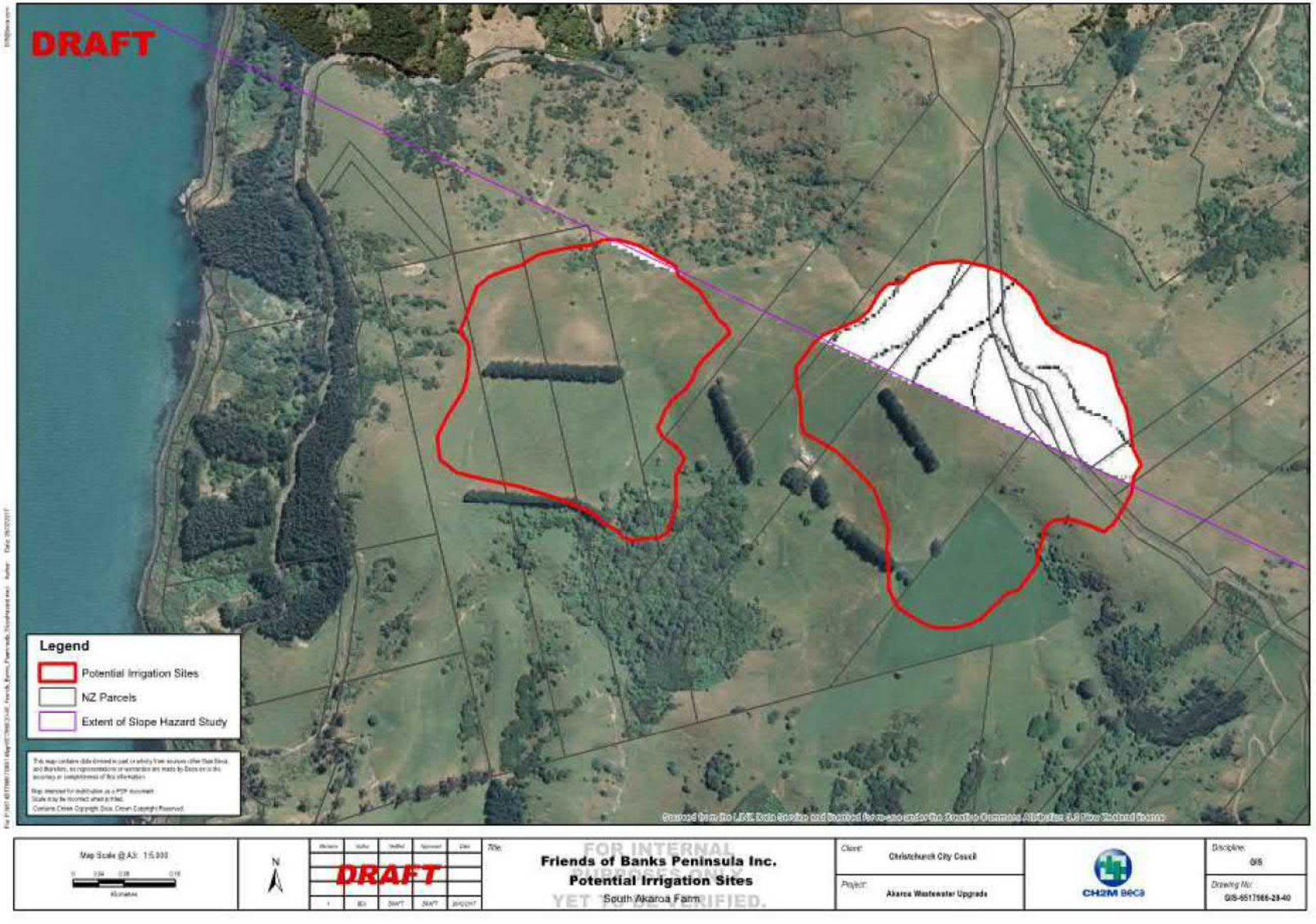
Historical Instability – South Akaroa Farm (Sites 14 and 15)



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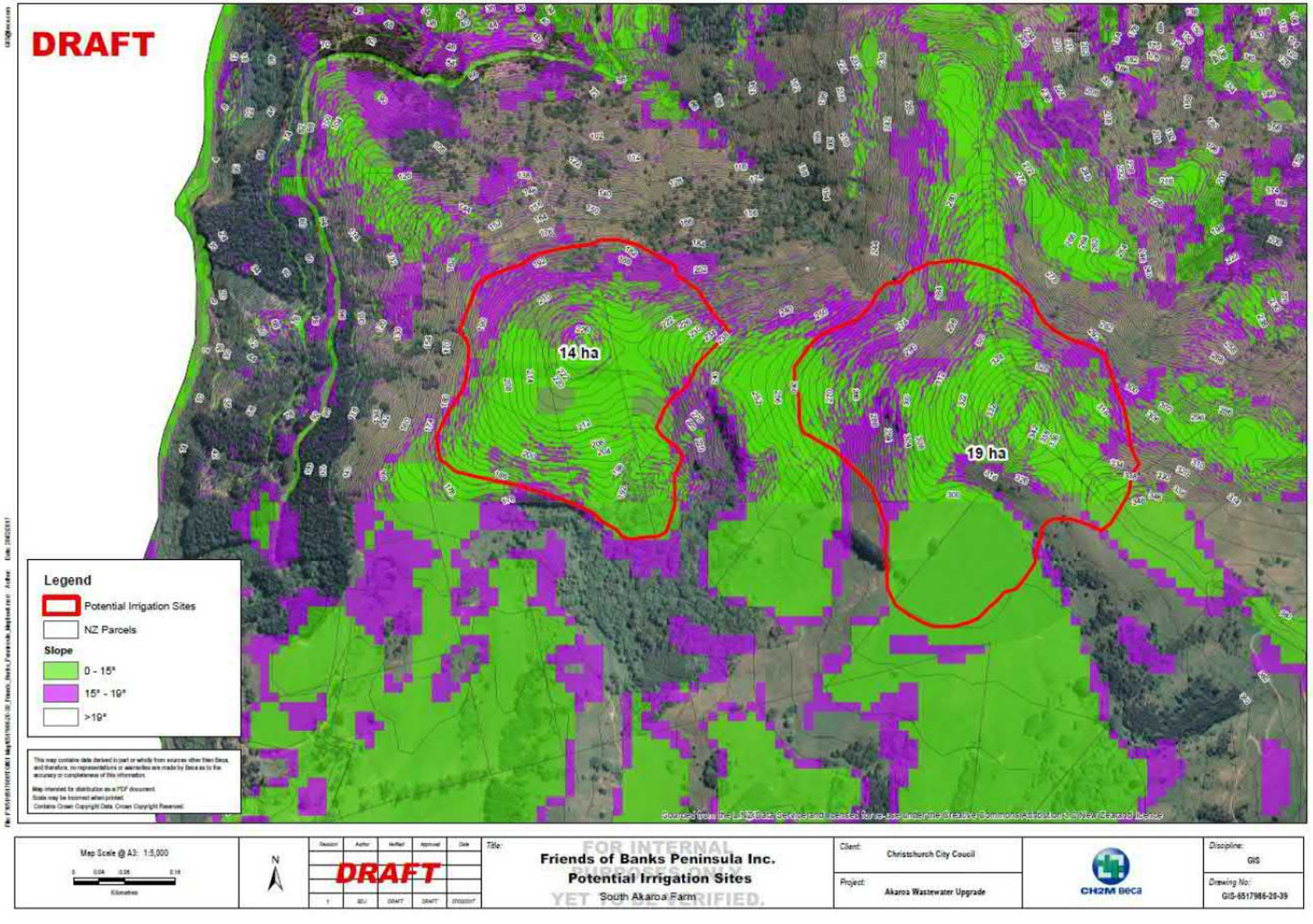
Slope Inclination - South Akaroa Farm (Sites 14 and 15)



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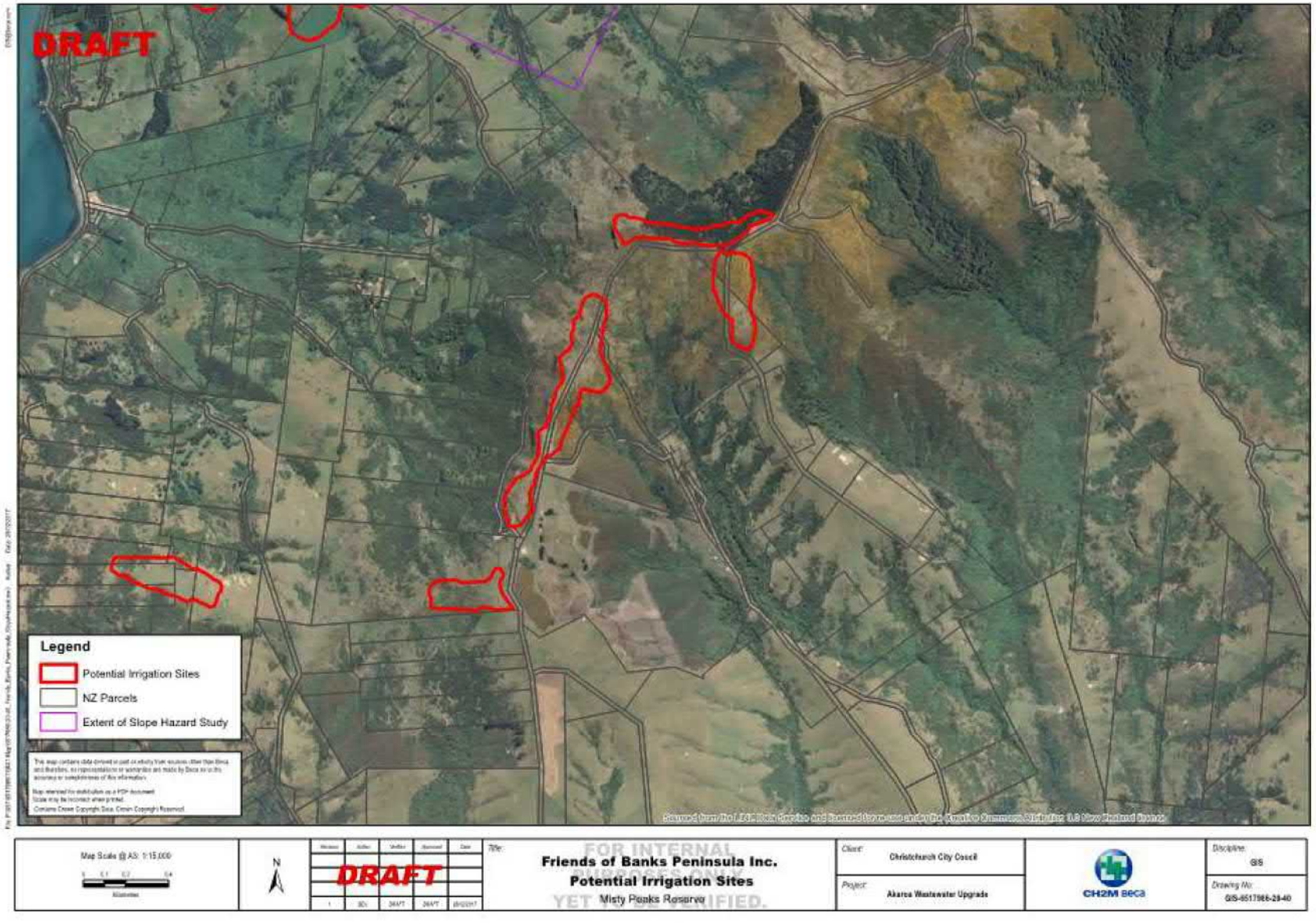
Historical Instability – Misty Peaks Reserve (Sites 16, 17, 18 and 19)



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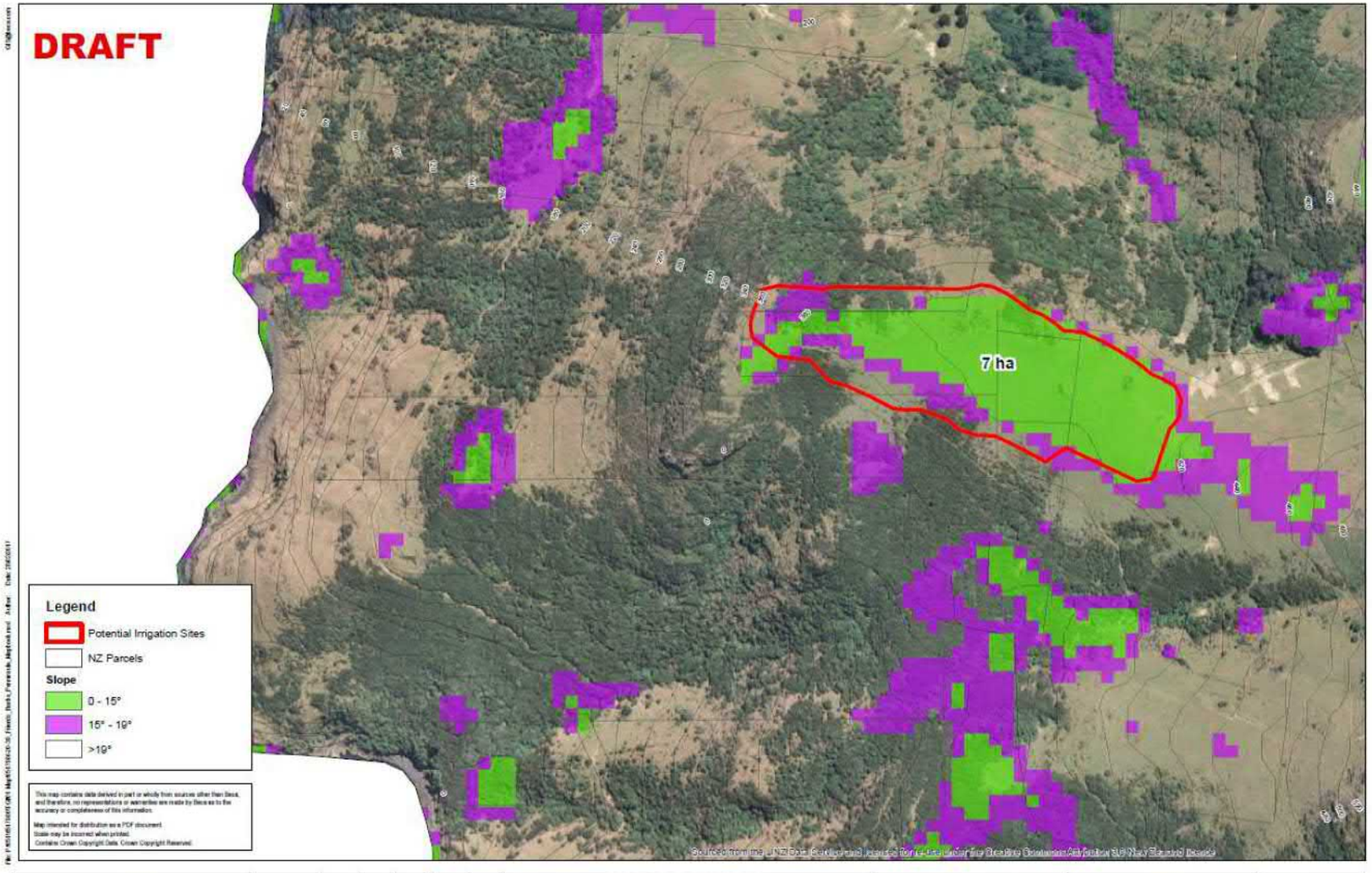
Slope Inclination - Misty Peaks Reserve (Site 16 - Hamiltons)



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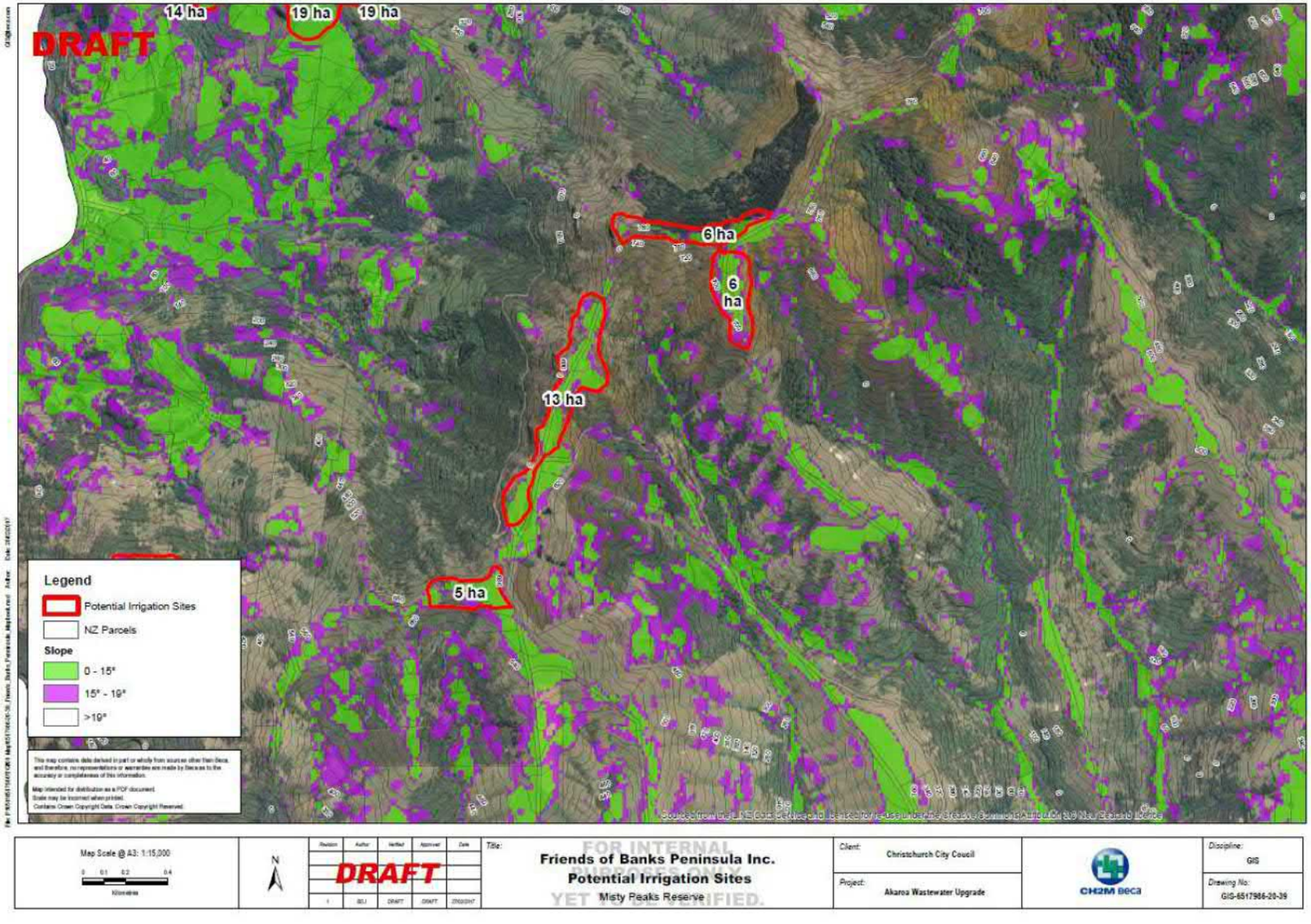
Slope Inclination - Misty Peaks Reserve (Sites 17, 18 and 19)



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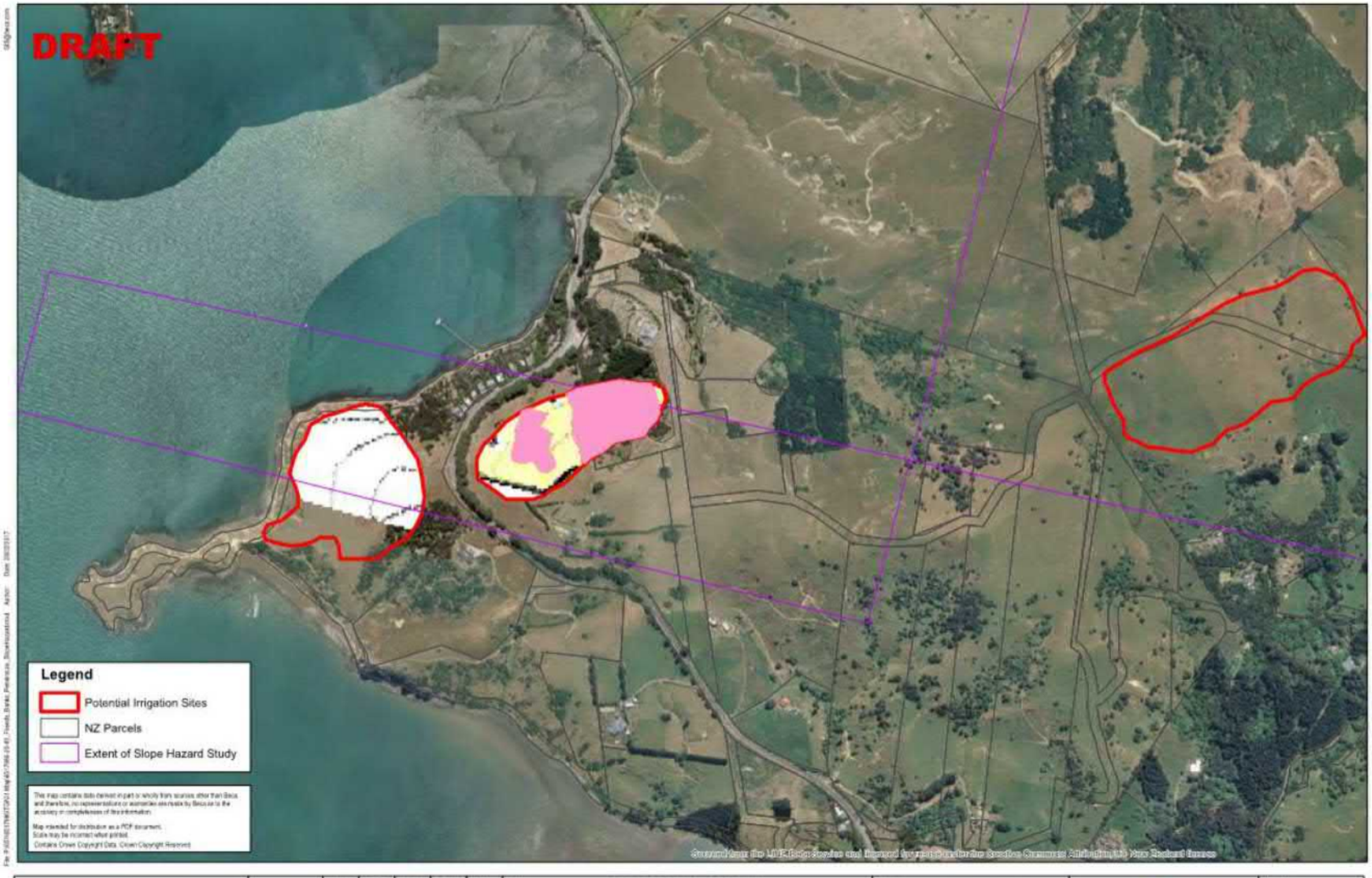
Historical Instability – Robinsons Bay Headland (Sites 24, 28 and 31)



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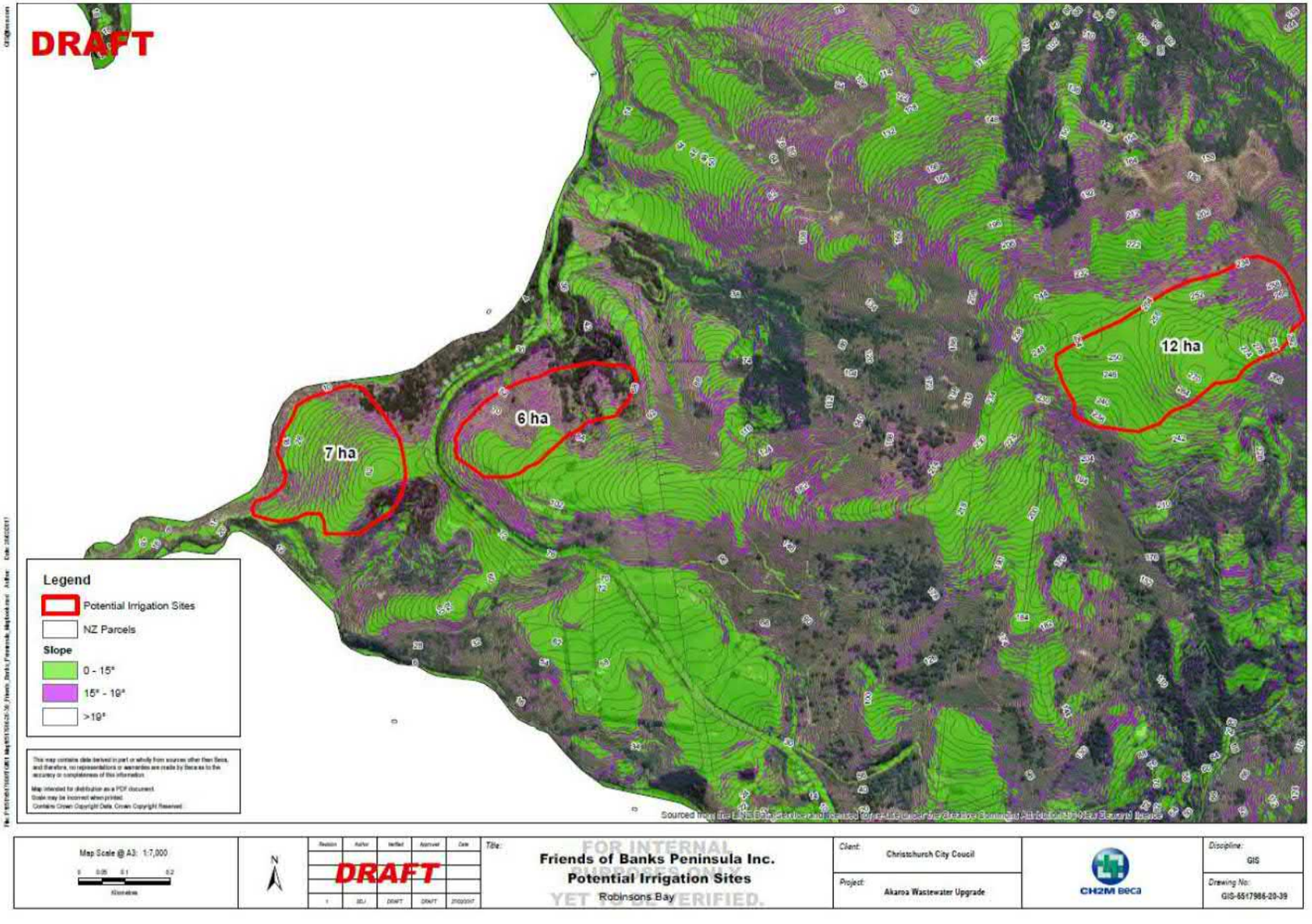
Slope Inclination – Robinsons Bay Headland (Sites 24, 28 and 31)



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Preliminary Summary

Site	Total Area (Hectares)	Approximate Percentage of Area > 19° (tbc)	Down Slope	Approx. % with T & T historical deep Instability (tbc)	Comparative* Instability Assessment	
					Likelihood	Consequence
Takamatua Headland	16	10 - 20%	> 19°	< 10%	Greater	Greater
Long Bay Road	40	60 – 70%	> 19°	20 – 30%	Greater	Neutral - Greater
East Akaroa	11	40 – 50%	> 19°	30 – 40%	Greater	Greater
Misty Peak Farm	21	10 – 20%	> 19°	10 – 20%	Greater	Neutral - Greater
South Akaroa Farm	33	10 – 20%	> 19°	Not mapped	Greater	Neutral - Greater
Misty Peaks Reserve	37	10 – 20%	> 19°	Not mapped	Greater	Neutral - Greater
Robinsons Bay Headland	25	20 – 30%	> 19°	10 – 20 % (Not all area mapped)	Greater	Neutral - Greater

* - Comparative to Takamatua Valley, Robinsons Bay Valley and Pompey Pillar sites

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Effect of Trees and Lower Application Rates

- Trees are beneficial in reducing shallow instability
  - Roots mechanically stabilise soil (upper ~2m)
  - Can induce suction in the partially saturated zone (particularly in summer)
  - Effect of established trees differs from saplings
- Lower Application Rates
  - Increases the time for groundwater to mound
  - Slows the incidence of instability, but doesn't eliminate it

Takamatua Stream Above Highway Bridge Site No:SQ35157			
Date Sampled	Ammonia Nitrogen mg/L	Nitrate + Nitrite Nitrogen mg/L	Total Nitrogen mg/L
27-Sep-07	0.011	0.34	0.33
19-Dec-07	0.021	0.1	0.75
6-Mar-08	0.015	0.055	0.09
26-Jun-08	<0.005	0.31	0.4
2-Jul-08	0.008	1	1.1
5-Aug-08	0.008	1.2	1.3
8-Sep-08	0.005	0.87	0.9
6-Oct-08	0.009	0.4	0.48
11-Nov-08	0.036	0.33	0.36
3-Dec-08	0.019	0.17	0.18
6-Jan-09	0.014	0.011	0.13
3-Feb-09	0.018	0.017	<0.08
4-Mar-09	0.017	0.14	0.15
3-Apr-09	0.021	0.078	0.09
18-May-09	0.009	0.35	0.43
3-Jun-09	0.011	0.6	0.6
2-Sep-09	0.018	0.42	0.44
2-Dec-09	0.011	0.16	0.22
23-Mar-10	0.018	0.014	<0.08
29-Jun-10	0.027	1.1	1.1
14-Sep-10	0.014	0.52	0.54
6-Dec-10	0.014	0.16	0.2
10-Mar-11	<0.010	0.022	0.17
16-Jun-11	0.013	0.16	0.18
5-Sep-11	0.015	0.32	0.4
6-Dec-11	0.02	0.11	0.14
6-Mar-12	0.005	0.065	<0.08
5-Jun-12	0.013	0.22	0.21
13-Sep-12	0.009	0.63	0.8
18-Dec-12	< 0.010	0.27	0.42
5-Mar-13	< 0.010	0.046	0.18
6-Jun-13	< 0.010	0.45	0.58
5-Sep-13	< 0.010	0.46	0.58
3-Dec-13	< 0.010	0.23	0.33
10-Mar-14	< 0.010	0.35	0.48
4-Jun-14	< 0.010	0.65	0.71
4-Sep-14	0.011	0.58	0.68
1-Dec-14	< 0.010	0.26	0.45
9-Mar-15	< 0.010	0.078	0.35
2-Jun-15	< 0.010	0.23	0.35
2-Sep-15	< 0.010	0.41	0.68
2-Dec-15	0.015	0.091	0.24

Takamatua Stream Above Highway Bridge Site No:SQ35157			
Date Sampled	Ammonia Nitrogen mg/L	Nitrate + Nitrite Nitrogen mg/L	Total Nitrogen mg/L
3-Mar-16	< 0.010	0.006	0.11
1-Jun-16	< 0.010	0.5	0.74
6-Sep-16	< 0.010	0.42	0.55
1-Dec-16	0.013	0.108	0.2

Easting 1597620.13290677
Northing 5152318.49230038

To: Bridget O'Brien

From: Working Party Representatives from Robinsons Bay on behalf of Friends of Banks Peninsula

Re: Suggested content for the GENERAL sections of the Akaroa wastewater consultation document

Date: 3 March 2017

Introduction

Members of the Community Board Akaroa Wastewater Working Party have been asked to submit ideas for the content of the next consultation document to be produced by Council. The following are submitted by the Friends of Banks Peninsula and is based on the understanding to date of the solutions currently proposed.

General

This section below identifies descriptions and information to go in the opening sections of the consultation document aimed at giving readers an overall understanding of the system proposed, and the issues it faces. We would then expect each option to detail how these issues are to be specifically handled in each of the options proposed.

Land Disposal Irrigation details

Described the overall intentions for land disposal and how it is to work explaining the following potential methods including:

- cut-and-carry, permanent native forest, or tree harvesting and their ongoing management implications such as mowing, weeding or harvesting activities
- Description of how the proposed solutions will be implemented (all at once, closed system or phased in with current harbour outfall abating over time), whether deep ripping or land contouring will be used and if trees, then how they would be managed during establishment (ie hand weeded or use of herbicide)
- Description of the types of irrigation proposed (spray, drip)
- Shelter belting and height to which this will grow and catering for wind, as applicable.
- How long the process of establishment is expected to take, and whether any irrigation would take place before the landscaping mitigation had taken place
- Buffer distances proposed and a clear explanation of how the Council has derived them including reference to similar schemes elsewhere and the actual distances between the irrigation and ponds and residential properties and houses.

- How shading effects on adjacent properties from either tree irrigation or shelter belts would be avoided

Treatment process

- There needs to be a clear explanation of the treatment process proposed including an explanation of the principal components of the treatment system in words and with clear accompanying diagrams detailing the steps including:
- How water from Akaroa sewer pipes is to reach the treatment plant
- Treatment plant location and what structures are consented at the plant
- Total capacity of the system and release points during network overload
- Bypass flows
- Wastewater storage ponds
- Irrigation areasThis needs to explain which elements of the Treatment plant are optional and could be included or omitted under different scenarios.

Wastewater quality standards

There needs to be a clear explanation of the proposed treatment level including:

- Water quality standards that would be used to establish consent conditions,
- Wet weather bypass flows – how they would be handled
- Where the wastewater or sewage will go if the irrigation pond/s fill up when irrigation can't proceed, and how such overflow is to be managed.
- What is left in the water after treatment, including bypass flows. List all nutrients and the various other components that have been identified such as protozoa, pharmaceuticals and viruses and what consent conditions are proposed for each.

Storage ponds

There needs to be a clear explanation of the purpose the storage ponds, their size and appearance.

For example

"Irrigating all of the treated wastewater to land will require storing the wastewater when it can't be irrigated. For irrigation to pasture this means storing all winter wastewater, in ponds of around 35,000m3 in volume, and taking up around 3 hectares (six football fields). For irrigation to trees around 17,000m3 of storage is needed, in ponds taking up around 1 hectare (two football fields). More than one pond may be constructed for each option. Because these ponds will store wastewater (which contains nutrients) for significant periods of time, they will grow algae, and there is some risk of midges and odour.

The ponds will be designed to [insert here what design and construction criteria the Council will follow, e.g. do they commit to the ponds being landscaped to look natural versus straight sides, etc]. Depending on the options chosen the pond(s) may be visible from public spaces

and private residences. In some cases the ponds will need to be built partly or wholly above ground (up to 3m high) depending on ground conditions."

The potential risks with such ponds needs to be identified including visual impact, and the probability of odour, midges or vermin.

Other infrastructure

There needs to be description of the other infrastructure involved with the wastewater disposal and how it will be implemented including:

- How the pipes will be laid – i.e. along formed public roads, could unformed public roads be used, could they cross private property that was not part of the irrigation field
- Where pumps would be located, both pumping to the storage pond/s and pumping to the irrigation fields
- How much noise and what type of noise pumps generate
- Frequency of servicing and whether any additional effects are generated such as odour or noise during servicing

Geography of Banks Peninsula

There needs to be an acknowledgment that the land disposal is not an easy thing to achieve on Banks Peninsula because it is a geographical area dominated by steep land, with low permeability soils that are slip-prone. It experiences ongoing earthquakes and intense localised rainstorm events. It is a coastal area and is likely to anticipate climate change effects including sea level rise and a related rise in groundwater levels over the period that it is consented for.

The document therefore needs to identify:

- Specific measures taken to ensure that the system will be resilient in the event of earthquakes, including if the Alpine fault ruptures or more severe localised earthquakes occur
- Specific measures taken to ensure that the system will be resilient in the event of intense localised rainstorms, including avoiding slips, flooding and flooding caused by slips
- Identify how downstream properties are to be protected from flooding should a pond breach
- Identify how the system would continue to operate if a single point of infrastructure was damaged – such as a pond, pipe , pump or electrical failure.
- Explanations of where redundancy is planned in the system to avoid single points of failure
- Identify capacity limitations and what plans Council has should a capacity limitation be reached. What would be the nature and duration of the impacts.
- The climate change parameters used in the design and how the impacts of sea level rise, including localised groundwater effects, increased storm events and rainfall changes are accommodated in the design

Acknowledgement of communities

There needs to be an acknowledgement that geographical constraints have meant that some of the areas selected for consideration include populated areas where the siting of storage ponds and irrigation will be close to communities and residences.

The document therefore needs to include:

- A clear statement as to whether the Council intends making a valuation of the financial impacts on neighbouring properties (capital and income potential), both in the short term during construction and long term, and if so whether it anticipates making compensation payments where adverse effects are likely, or will give owners the option of having the Council purchase their properties
- Liability if there is damage to private property and any expenses faced by those affected in the event of a natural disaster or other system failure
- Whether compensation will be payable to neighbours experiencing adverse effects if consent conditions are breached
- How the Council plans intends to provide benefits to such affected communities that would outweigh the disadvantages to them of having the wastewater from another community disposed of in their area, i.e. how the Council is going to ensure it behaves in a fair and responsible manner to all concerned in this project.
- If these potential impacts on neighbours or communities are not going to be addressed, then the document needs to clearly state this with a statement such as "receiving community and neighbouring properties cannot expect any compensation".

Sustainability

The document needs to acknowledge that finding a site for waste disposal is complex and difficult, and that will involve a substantial capital outlay. The solution chosen therefore needs to consider the long term impacts so that the process does not have to be repeated. It should look beyond its initial consent period and ensure that it is sustainable. How the following are considered and addressed needs to be stated:

- The potential for nutrients or other residues to build up in the soil over time and how this is to be dealt with
- The potential for nutrients to leach into fresh water including groundwater or streams, and how the system is designed to avoid this happening.
- The potential for nutrients to reach the sea, the potential impacts and the ability of different types coastal environments to cope with this

Re-use in Akaroa

Eventual re-use in Akaroa has been identified as a long term goal of the system. Explain how:

- The treatment quality is designed to facilitate this

- The infrastructure is sited to facilitate this
- Outline the implementation plan and time frame anticipated before all homes in Akaroa could access recycled water
- State whether or not the Council will include re-use in its public toilets or municipal watering as part of the scheme and if so when this is anticipated to occur

Day to day management

The community needs some idea of how the Council plans to manage land based disposal. The document should give some indication of:

- Who will be responsible for the daily management of the pipes, pumps, ponds and irrigation fields - Council employees, contractors or the actual land owners
- Will the people responsible for the daily management live nearby or will they be based in Christchurch
- What mechanism would be used by neighbours or communities to report faults. Whether a different process is anticipated from the Council's standard fault line?
- What response times will the Council aim to achieve for different types of faults

Robinsons Bay	
Advantages	**Disadvantages**
Close enough to plant	Close to residences - gardens
Gravity feed	Geotechnical problems – high water table & limited land available
Thacker land = easy solution	Drop in land/property values
Pond sites are available – good slopes	Nutrient leaching into streams
Grass – increased production	Stream bank instability
Aspirational land area public use	Increased flooding risk – impact on infrastructure
	Odour & insects
	Geese on ponds
	Akaroa involvement – none – no responsibility
	Multiple small parcels (non-Thacker site)
	Public opposition
	Tsunami risk close to sea / climate change impact
	Visual amenity decreased (visitors)
	Large ponds out of character
	Industrialisation – pumps, structures, traffic, activity, noise
	Increased fire risk
	Disruptive construction period
	Dam breach
	Increased shading near boundary
	Disconnected from Akaroa community – out of sight, out of mind
	Single point of failure with distribution point
	Unknown long term environmental effects – nitrogen
	Impact on historic buildings
	Additional insurance costs to residents
	Landscapes changes
	Increased vermin
	Wind impact
	Health risks
	Pond overflow
	Impact on farming activity
	Forest harvesting – amenity loss

Takamatua Valley	
Advantages	**Disadvantages**
Close enough to plant	Close to residences - gardens
Gravity feed	Geotechnical problems – high water table & limited land available
Increased biodiversity	Drop in land/property values
More trees to plant therefore increased stability?	Nutrient leaching into streams
Potential enhancement to landscape character	Stream bank instability
	Increased flooding risk – impact on infrastructure
	Odour & insects
	Geese on ponds
	Akaroa involvement – none – no responsibility
	Multiple small parcels
	Public opposition
	Tsunami risk close to sea / climate change impact
	Visual amenity decreased (visitors)
	Large ponds out of character
	Industrialisation – pumps, structures, traffic, activity, noise
	Increased fire risk
	Disruptive construction period
	Dam breach

Takamatua Valley	
Advantages	**Disadvantages**
	Increased shading near boundary
	Disconnected from Akaroa community – out of sight, out of mind
	Single point of failure with distribution point
	Unknown long term environmental effects – nitrogen
	Increased vermin

Pompey's Pillar	
Advantages	**Disadvantages**
Flat	Increased fire risk
Water wanted	Disruptive construction period
Firefighting	Increased cost
Non-residential	Farming effects unknown – Commercially viable? Sustainable? Future risk to stock?
Large land area	Distance from treatment plant
Less risk with dams	Compromises wildside concept (Hinewai)
Purple piping	Pasture application – only limited months to apply
Could purchase land	Road access
Potential to distribute wastewater to generate electricity	Disconnected from Akaroa community – out of sight, out of mind
Potential for ocean outfall as backup	More possible points of failure – length of pipes
Grass	Single point of failure with distribution point
Agri-products	Unknown long term environmental effects – nitrogen
Increased biodiversity	Increase vermin
	Wind impact
	Possibly culturally significant site to runanga

Efficiency
Treatment plant refinements to meet option, e.g. removal vs. use on farm
Decoupling ponds from location of plant
Cost efficiency including valuation of houses, maintenance, potential income
World class – fit for purpose
Number of ponds will affect efficiency
Tale away from Takapukeke
Consider tanks and ponds
Cost efficiency from Akaroa – charges on water use in Akaroa
Efficiency because food growing affected

Advantages Plus (aspirational)
Walkways
Recreation
Plantings (community)
Heritage areas protected
Enhanced
"Sell it to us"
Outstanding compensation for community
Community pride
Connected to reticulation system
Community involvement in solution

AKAROA WASTEWATER – IRRIGATION OF TREATED WASTEWATER TO LAND

CONFERENCE OF TECHNICAL EXPERTS 30/11/16

JOINT STATEMENT

1. This is the joint statement of technical experts from a meeting on 30th of November 2016 at the Beca Office in Sydenham, Christchurch. Attendees were Greg Offer (Notes) and Paul Horrey from Beca, Andrew Brough from Pattle Delamore Partners (PDP), Andrew Dakers from ecoEng, and David Painter from David Painter Consulting.

2. The agreed statement on the broad issues listed in the meeting agenda (received by email from Brent Pizzey, senior solicitor at Christchurch City Council, at 10:22 on 30/11) is set out below.

3. WATER BALANCE MODEL

3.1. The water balance model developed by PDP for pasture irrigation at Robinsons Bay Valley and Takamatua Valley should be reviewed by Andrew Dakers and Andrew Brough. In particular the model input parameters should be evaluated in detail and updated as appropriate taking into account any refinements and also incorporating Long Term Acceptance Rate (LTAR) data.

3.2. Once the modelling approach is agreed and the pasture option modelling rerun, the water balance model should be extended to consider wastewater irrigation to trees, at Robinsons Bay Valley, Takamatua Valley, and parts of Takamatua Headland not previously excluded due to land stability risk.

3.3. The Wainui wastewater irrigation to land scheme has been used as a basis for the Akaroa irrigation to trees concept design. The technical experts wish to conduct a visit to the Wainui scheme to inspect the operation and make observations about the performance. This should take place before the water balance model is rerun.

3.4. As part of the modelling revisions, soil infiltration assumptions used in the model and in the scheme assessment should be reviewed by a soil scientist knowledgeable on Banks Peninsula soils, with a focus on soil profile anomalies such as less permeable layers or pans. The person nominated to perform this task is Trevor Webb. Depending on the opinion of the soil scientist further physical sampling of soils may be required.

3.5. The modelling should consider and report on interflow and surface ponding risks.

3.6. Following the revised modelling, it is recommended that the geotechnical assessment of land stability risk is reviewed in light of any changes in water passage through soils. The geotechnical reassessment should take into account the differences between pasture and tree irrigation in terms of realistic groundwater mounding effects and the comparative impacts on land stability (due to the different root structures).

4. EFFECTS OF IRRIGATING TREATED WASTEWATER

4.1. The technical experts are not in a position to respond to questions on the effect of irrigating treated wastewater at this stage other than in a general sense.

4.2. It is recommended that further work is done to assess specific effects in more detail once a preferred option and location(s) have been selected by Christchurch City Council.

5. OPERATION AND MAINTENANCE OF IRRIGATION SYSTEM

5.1. The technical experts are not in a position to respond to questions on operation and maintenance of the irrigation system at this stage other than in a general sense.

5.2. It is recommended that specific operational and maintenance aspects are considered in more detail once a preferred option and location(s) have been selected by Christchurch City Council.

6. FURTHER COMMENTARY: ON SELECTION OF LAND FOR IRRIGATION AND STORAGE

6.1. The technical experts wish to draw attention to the possibility that irrigation areas may not necessarily be confined to one location. The general principles that should apply are set out below.

6.2. Irrigation areas should generally be co-located where sufficient land area with soils that are suitable for year round irrigation is available within a single area.

6.3. However, in the event that sufficient and suitable land is not available in a single area, then land for irrigation across a wider extent could be selected. Factors to take into account include the land suitability and availability, lack of soil anomalies, and proximity to the wastewater piping main (ie. typically running north along State Highway 75 from the treatment plant site).

6.4. The same principle applies to wastewater storage. The wastewater storage pond or ponds may be located together with the irrigation land area, or potentially elsewhere if suitable sites that are generally aligned with the wastewater pipeline can be identified.

6.5. The technical experts understand that the community has concerns about the impacts of wastewater storage ponds (including visual, odour, insects, resilience to natural hazards). These concerns can be addressed by design measures, by seeking a location that maximises the distance to private dwellings, and by locating the pond(s) such that viewpaths from public access areas including roads and reserves, and from private dwellings, are minimised.

6.6. In addition to mitigation by location, storage ponds should also be screened by use of boundary plantings and naturalised by planting the embankments.

7. ACTION PLAN AND TIMETABLE

7.1. Meeting between Andrew Dakers and Andrew Brough to discuss soil moisture balance modelling on 6th December.

7.2. Visit to the Wainui land irrigation scheme to take place preferably on the 7th or 8th of December.

7.3. Hydraulic modelling to be updated by PDP, date to be confirmed after meeting in item 7.1 above.

7.4. Geotechnical assessment to be revised by CH2M Beca and adjusted for trees vs pasture by 28th of January 2017.

Signed by ……

Date…….1/12/16…..

On behalf of;

The technical experts;

Greg Offer and Paul Horrey from Beca,

Andrew Brough from PDP,

Andrew Dakers from ecoEng,

David Painter from David Painter Consulting.

AKAROA WASTEWATER – IRRIGATION OF TREATED WASTEWATER TO LAND

JOINT STATEMENT OF TECHNICAL EXPERTS # 2

ISSUED ON 16/2/17

1.1. This is the second joint statement of technical experts in response to terms of reference set for the Akaroa Wastewater Scheme by Christchurch City Council (CCC) and agreed with Ngai Tahu on 6th of December 2016 (Terms of Reference document TOR Akaroa lex15247 2016-12-06). Several meetings have been held to discuss matters and to formulate this response. The technical expert group is composed of: Greg Offer (Notes) and Richard Young from Beca Limited, Andrew Brough from Pattle Delamore Partners Limited (PDP), Andrew Dakers from ecoEng, and David Painter from David Painter Consulting.

2. INSPECTION OF WAINUI WASTEWATER IRRIGATION SITE

2.1. A site visit to the Wainui land irrigation scheme was conducted on 8th of December 2016 by the technical experts. Assistance on site was provided by Kris Kaser from CityCare. The purpose of the visit was to allow the technical experts to review the scheme operation and performance.

2.2. The Wainui irrigation scheme has been constructed within an area of maturing Pinus radiata forest. It consists of four 1 ha forestry blocks with only one of the four blocks in use. The irrigation system is well built with the dripper lines pegged down and flush valves fitted at the end of each line. Some minor damage to dripper lines was observed including a line breakage caused by tree fall.

2.3. The Wainui scheme is operating at about 13% of design loads at present. Current connected population is 107 and the 2014 design population is 820. Flows and loads will increase when the Wainui Sewerage Scheme is expanded by Christchurch City Council in 2018-19.

2.4. Pine litter falling from the trees has covered the dripper lines up to 100mm thick in places. This is considered beneficial in terms of supporting biological processes in the wetted surface zone and in distributing the wastewater by surface wicking.

2.5. No adverse operational effects were observed on the day of the visit, from the application of wastewater to land. This includes no evidence of enhanced erosion in gullies, nor any recent ground movement, nor evidence of any surface runoff resulting from wastewater application even at the open end of the broken dripper line.

3. WATER BALANCE MODEL

3.1. The water balance model described in the PDP report including the methodology used and the outputs provided, are considered appropriate and provide a reasonable estimate of the soil moisture balance at this stage, given limitations in the current level of information. The Akaroa water balance model, unlike other similar models, does not allow for any water holding capacity in the soil moisture range between field capacity and saturation. As a result the model is considered to be conservative in terms of soil drainage. The model will be revised once physical data for a specific site has been obtained and should also be rerun for any specific scenarios based on irrigation to trees.

3.2. A particular aspect that requires checking is the Long Term Acceptance Rate (LTAR) of wastewater within the soil. LTAR is the terminal rate at which treated wastewater moves vertically downwards through sub-soils after a period of time (which could be months, or even years) once a stable soil ecology (usually referred to as biozone) has established in the soil due to residual wastewater components. It is usually expressed as mm/day, which is the same as L/m^2.day. The LTAR is used to inform the recommended rate at which treated

wastewater should be applied to land. Typically higher quality wastewater means that we can adopt a slightly higher value for the LTAR than for lower quality effluent. Data from field measurement of the rate at which clean water infiltrates through the local soil can be used as an indicator of the recommended value for LTAR. As an example, Van Cuyk et al. (2005)[1] recommends that the LTAR is in the range of no more than 3% to 5% of the saturated infiltration rate for clean water. The greater the LTAR value, the less land area required. A simplified explanation is that if the rate at which wastewater is applied to the land is greater than the LTAR and the evapotranspiration rate, then there is a high risk of the upper soils becoming saturated and possibly resulting in surface ponding and runoff. Clearly rainfall events will also have an impact on these risks. In summary, LTAR values depend not only on the quality of the treated effluent but also on soil texture, structure and soil profile anomalies such as less permeable soil layers (or "pans"). Rainfall patterns vary thoughout the year and for different locations, and evapotranspiration varies according to types of plants grown, and wind, sunlight, air temperature and humidity at the site. All these factors must be taken into consideration to assess the risks and performance of a wastewater land application field.

3.3. The wastewater flows used for the water balance model are considered appropriate and are likely to be conservative for winter dry weather flow as the assumed annual average daily flow is about 5 % higher than the design horizon flow estimated by Beca. Winter time is considered to be the constraining case. During peak summer wet weather events excess flows will go to the buffer storage.

3.4. It was agreed under Joint Statement # 1 item 3.4 that a soil scientist should review the soil infiltration assumptions in the model. If and when a preferred site has been selected, then a soil scientist should review assumptions about soil behaviour that affect the water balance model. Further soil testing may also be required at this stage.

4. EFFECTS OF IRRIGATING TREATED WASTEWATER

4.1. Potential risks to public health depend on the effluent quality, the type of irrigation, the separation distance to receptors, and other mitigations used (eg. boundary tree plantings). The buffer distances proposed for Akaroa are consistent with consented and operational land irrigation schemes while the microbiological quality proposed at Akaroa is significantly better than for most other operational schemes. Spray irrigation poses higher risks than dripper irrigation. This will be taken into account in developing the scheme design.

4.2. Food crops may, in certain situations, uptake contaminants from wastewater that could be potentially harmful to humans. The Akaroa proposal includes buffer separation from areas where people grow food crops. The intention of the design is to provide a sufficient buffer to prevent the risk of any cross-contamination of cropping or other sensitive land uses in proximity to the irrigation area.

4.3. Buffer distances to streams and residential properties, as currently proposed, are based on existing and operational municipal irrigation schemes. The appropriateness of buffers will be assessed for the site specific risks in due course.

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[1] Van Cuyk, S., R. L. Siegrist, K. Lowe, J. Drewes, J. Munakata-Marr, and L. Figueroa. 2005. Performance of Engineered Treatment Units and Their Effects on Biozone Formation in Soil and System Purification Efficiency. Project No. WU-HT-03-36. Prepared for the National Decentralized Water Resources Capacity Development Project, Washington University, St. Louis, MO, by the Colorado School of Mines, Golden, CO.

4.4. Stand down periods for stock have historically related to the cross contamination risk between humans and animals with key organisms (particularly the beef tapeworm, *Taenia saginata*). Stand down periods of up to 30 days have generally been adopted. Specific stand down periods would be developed for stock in any scheme involving irrigation to pasture, such that the risks from key organisms are appropriately managed.

4.5. The risk of wastewater runoff will be mitigated by careful management of the scheme, including monitoring of soil moisture such that irrigation will cease when soil moisture reaches a predetermined level. Irrigation of wastewater has the potential to generate nutrients in excess of the requirements of vegetation that is grown. The proposed scheme will be designed to manage this risk by adjusting the application rate to suit the ability of soils and vegetation to utilise nutrients (for example, more wastewater would be applied in summer and less in winter). Nutrient leaching to groundwater and/or surface water is most likely to occur over the winter when nutrient utilisation is lower. At this stage the movement of groundwater at the sites under consideration has not been fully investigated (although monitoring in some areas is underway). Further work will be required if and when a preferred site or sites are identified. This would include further groundwater level and quality monitoring to confirm the direction and rate of groundwater movement.

4.6. Flood risk will need to be taken into account in the scheme design. This will be assessed at selected sites and appropriate management procedures put in place. Note that for the assessment of the pasture and tree irrigation options to date it has been assumed that wastewater will not be applied to land during high rainfall events, or when soils are saturated, and including a specified period afterwards. These conditions are also times when flooding could occur.

4.7. Climate change has been included in the assessment to date and is detailed in PDP report (October, 2016) "Infiltration Testing Results For Akaroa Treated Wastewater Disposal Via Irrigation – Robinsons Bay And Pompeys Pillar". Climate change impacts on Banks Peninsula are difficult to predict accurately. For seasonal totals of precipitation, for Christchurch and Hanmer Springs [but not necessarily Banks Peninsula], forecast changes to year 2040 are not statistically significant[2]. But the forecast to year 2090 is for increased rainfall seasonal totals in Summer and decreased rainfall seasonal totals in Winter[2]. The forecast pattern of frequency of extreme daily rainfalls "is quite robust" and "shows a systematic increase in much of the South Island, with both time and increasing greenhouse gas concentration." [2] The design horizon for the Akaroa wastewater scheme is to year 2041. Within this time period forecast changes to seasonal totals are not statistically significant, based on best available information. If extreme rainfall events become more frequent in the long term this may result in more frequent use of the wastewater storage pond, or potentially require a larger storage pond. However this is somewhat speculative and a range of factors will influence long term future storage requirements including the impact of remediation to the Akaroa wastewater network to reduce inflow and infiltration. This remedial work is planned to be implemented over the next 5 years.

5. OPERATION AND MAINTENANCE OF IRRIGATION SYSTEM

5.1. Operation and maintenance issues are site specific. The following are general statements about operational and maintenance factors for irrigation schemes.

5.2. Drip irrigation systems can either be placed on the ground surface (surface drip irrigation) or placed below the ground surface (sub-surface drip irrigation). Generally for wastewater

[2] Climate Change Projections for New Zealand. Ministry for the Environment, 2016.

irrigation surface drip irrigation occurs in trees or on specially constructed mounds. For the Akaroa scheme surface irrigation would only occur as irrigation to trees. Surface irrigation to trees is common where there is an existing tree plantation that can be irrigated (e.g. Wainui, Blenheim). During normal operation damage may occur by wind fall of trees (damage by this method has been observed by the experts at Wainui) or by hares gnawing dripper lines. At Wainui the surface laid tubing has largely been covered by pine needle debris and this reduces the risk of damage from hares. Surface drip-irrigation is also at risk of damage if the trees are pruned. During harvesting it is common to roll up the irrigation lines prior to harvest.

5.3. Sub-surface drip irrigation is less susceptible to damage, although if not buried deep enough vehicle movements on the ground surface may cause compaction of the drip line. Modern sub-surface drip irrigation is less susceptible to root intrusion than in the past through careful design of the dripper and the inclusion of a herbicide impregnated into the dripper. Sub-surface drip irrigation of trees would still be at risk of damage if trees are felled by wind as the root ball may rip up the drip line.

5.4. Cut and carry systems need paddock sizes and land slopes that are safely and practically accessible by mowing and baling equipment. The presence of rocks and other obstacles on the land surface could prevent a cut and carry approach at some locations. The general method for cut and carry is to irrigate for a period of around 40 days then rest the area for several days prior to cutting. If a k-line irrigation system is employed the k-line would need to be removed prior to cutting. Various fixed sprinkler options are used in New Zealand. The management requires that paddocks are cut in rotation as irrigation cannot occur on a paddock while the cut grass is dried and made into the final product. Cut grass is removed from the paddock and stored in a suitable location before sale.

5.5. The monitoring of an irrigation scheme (whether sprinkler or drip irrigation) is likely to include monitoring of the wastewater quality, climate (rainfall, ET), soil moisture, depth of wastewater applied to each irrigation zone, calculation of the nutrient load (based on wastewater quality and depth of wastewater applied) and soil sampling for nutrient and other soil parameters. Operating pressure in the system would be monitored to identify blockages or build up of biofilm (especially for drip irrigation). Build up of biofilm is often checked by cutting a drip irrigation line to physically observe the condition. These cuts are easily repaired using standard joiners. Groundwater may be monitored if there is considered to be a risk to the environment. If spray irrigation is used wind monitoring may be used to prevent irrigation in certain conditions (eg. direction and speed). There would usually be a complaints register. All the data is normally recorded, analysed and prepared into an annual report and compared against consent conditions.

5.6. Servicing and maintenance of an irrigation scheme will depend on the system selected. When comparatively poor quality wastewater is spray irrigated then blockage of sprinklers may occur. Blockages can be identified during walkover of the site by the scheme operator. The proposed effluent quality for Akaroa is very good so blockage of sprinklers is considered unlikely. Repair of damage, often caused by stock and by equipment during harvesting of the grass in spray irrigation systems is a routine activity. For drip irrigation lines flushing will be required. The frequency will depend on the solids buildup that occurs (this is generally associated with the amount of nutrients and organic solids present in the wastewater) but is typically one to 4 times per year. Walkover of tree irrigation sites after high wind/rainfall will also be required to check for dripper line damage.

AKAROA WASTEWATER – IRRIGATION OF TREATED WASTEWATER TO LAND

JOINT STATEMENT OF TECHNICAL EXPERTS # 2

SIGNATURE SHEET

Signed by:...Andrew Dakers

Signature: Date: 16/2/17

Signed by:...David Painter

Signature: Date: 16/2/17

Signed by:...Andrew Brough

Signature: Date: 16/2/17

Signed by:...Greg Offer

Signature: Date: 16/2/17

Signed by:...Richard Young

Signature: Date: 16/2/17