

## **Christchurch City Council**

### **SUPPLEMENTARY AGENDA**

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#### **Notice of Meeting:**

An ordinary meeting of the Christchurch City Council will be held on:

**Date:** Thursday 25 January 2018  
**Time:** 9.30am  
**Venue:** Council Chambers, Civic Offices,  
53 Hereford Street, Christchurch

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#### **Membership**

Chairperson	Mayor Lianne Dalziel
Deputy Chairperson	Deputy Mayor Andrew Turner
Members	Councillor Vicki Buck
	Councillor Jimmy Chen
	Councillor Phil Clearwater
	Councillor Pauline Cotter
	Councillor Mike Davidson
	Councillor David East
	Councillor Anne Galloway
	Councillor Jamie Gough
	Councillor Yani Johanson
	Councillor Aaron Keown
	Councillor Glenn Livingstone
	Councillor Raf Manji
	Councillor Tim Scandrett
	Councillor Deon Swiggs
	Councillor Sara Templeton

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**24 January 2018**

**Principal Advisor**  
Dr Karleen Edwards  
Chief Executive  
Tel: 941 8554

Jo Daly  
Council Secretary  
941 8581  
jo.daly@ccc.govt.nz  
[www.ccc.govt.nz](http://www.ccc.govt.nz)

Note: The reports contained within this agenda are for consideration and should not be construed as Council policy unless and until adopted.  
If you require further information relating to any reports, please contact the person named on the report.

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## 16 Resolution to Include Supplementary Reports

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### 1. Background

- 1.1 Approval is sought to submit the following report to the Council meeting on 25 January 2018:
  - 17. Below Ground Well Heads and Drinking Water Supply Status Update
- 1.2 The reason, in terms of section 46A(7) of the Local Government Official Information and Meetings Act 1987, why the report was not included on the main agenda is that it was not available at the time the agenda was prepared.
- 1.3 It is appropriate that the Council receive the report at the current meeting.

### 2. Recommendation

- 2.1 That the report be received and considered at the Council meeting on 25 January 2018.
  - 17. Below Ground Well Heads and Drinking Water Supply Status Update



## 17. Below Ground Well Heads and Drinking Water Supply Status Update

Reference: 18/43326

Contact: Bridget O'Brien      bridget.obrien@ccc.govt.nz

941 8999

### 1. Purpose and Origin of Report

#### Purpose of Report

- 1.1 The purpose of this report is to update the Council on the status of Christchurch City's water supply; to provide advice on the measures required to reinstate secure water supply status; and to seek a decision from the Council whether to temporarily chlorinate the water supply in the meantime.

#### Origin of Report

- 1.2 This report is being provided to fulfil the Council Recess Committee Resolution CNRC/2018/00001:

*Receive the reports and request staff to prepare a new report for consideration at the next Council meeting, including:*

- a. Advice on how the Council engages the community on these issues.*
- b. Expediting the programme of improving the security of below ground well heads.*
- c. The installation of temporary chlorination measures.*
- d. Urgently investigating how to reinstate full secure status on a water supply zone by zone basis, in consultation with the Drinking Water Assessor.*

### 2. Significance

- 2.1 The decisions in this report are of high significance in relation to the Christchurch City Council's Significance and Engagement Policy.
- 2.2 The level of significance was determined following an assessment of the criteria in the Significance and Engagement Policy, in particular the level of community interest already apparent for the issue, proposal or decision and/or the potential to generate community interest. The community engagement outlined in this report reflects the assessment.

### 3. Staff Recommendations

That the Council:

1. Receive the information in the Below Ground Well Heads and Drinking Water Supply Status Update report.
2. Approve and accelerate the programme of improving the security of below ground well heads at a cost of \$840,000 made up of \$630,000 capital expenditure and \$210,000 operating expenditure.
3. Approve the installation of temporary chlorination at all 56 pump station sites within the Christchurch City Water and Brooklands/Kainga water supplies at a capital cost of \$600,000 and an operating cost of \$20,000 per month, until the Drinking Water Assessor and Medical Officer of Health agree that temporary chlorination can cease.
4. Note that staff will report back to the Infrastructure Transport and Environment (ITE) Committee:

- i. as soon as possible with an update on the cost of undertaking further improvements to all below ground well heads recommended by Beca to comply with the latest round of well head security assessments.
  - ii. monthly on progress with implementing the well head improvement works.
  - iii. with the draft Water Safety Plan for approval when completed.
5. Inform the community about the status of Christchurch's water supply and any decision on temporary chlorination. Coordinate with the Medical Officer of Health to ensure the community is suitably informed regarding the implications of any decision.
6. Note that the capital budget required can be found from savings elsewhere in the Three Waters & Waste Unit's capital programme and that Council staff will work to prioritise expenditure in order to seek to offset the additional unbudgeted operating costs required to implement the recommendations.

#### 4. Key Points

- 4.1 In accordance with the Drinking-water Standards for New Zealand (DWSNZ), the security of all water supply wells needs to be assessed by an expert in well head security assessments every five years. To comply with this, the Council has a rolling programme that assesses the security of approximately 20 percent of its wells each year. Previous assessments had found our wells to be secure.
- 4.2 Following the release of the Stage 1 Havelock North Drinking Water Inquiry in May 2017, Council staff asked its maintenance contractor, Citycare, to investigate the quality of below ground wellheads, as these were identified as a potential source of contamination by the Inquiry.
- 4.3 Citycare's investigation found that the well heads needed repairs and improvements to prevent contaminants entering them. In August 2017, Council staff instructed Citycare to proceed with the well head repair and improvement programme.
- 4.4 The latest round of well head security assessment reports, received in December 2017, found that those wells did not meet the security requirements of the DWSNZ.
- 4.5 As a result of the Havelock North Inquiry, the Director-General of Health issued a statement on 20 December 2017 to all drinking water suppliers and drinking water assessors that they must contribute to the protection of water supplies, should consider appropriate treatment without delay, and should reconsider their reliance on secure bore status.
- 4.6 On 22 December 2017, the Drinking Water Assessor advised the Council that the security status for the Christchurch and Brooklands/Kainga water supplies had been changed from provisionally secure to unsecure.
- 4.7 Staff have now assessed the Council's position and recommend accelerating the well head repair and improvement programme (which was started in August 2017) and also temporarily chlorinating the water supply to reduce the risks to the supply. Temporary chlorination would cease as soon as possible, when agreed by the Drinking Water Assessor and the Canterbury Medical Officer of Health.
- 4.8 It is important to note that the quality of our groundwater has not changed. While the likelihood of contamination is low, the consequences if there was contamination could be extreme.
- 4.9 This report supports the [Council's Long Term Plan \(2015 - 2025\)](#):
  - 4.9.1 Activity: Water Supply (combining water conservation)
    - Level of Service: 12.0.2 Ensure potable water is supplied in accordance with the Drinking Water Standards for New Zealand (microbiology)

4.10 The following feasible options have been considered:

- Option 1 - Accelerate measures to reinstate secure water supply status and temporarily chlorinate the water supply in the meantime (preferred)
- Option 2 – Accelerate measures to reinstate secure water supply status and do not temporarily chlorinate

4.11 Option Summary - Advantages and Disadvantages (Preferred Option)

3.1.1. The advantages of this option include:

- Improves the safety of the water supply as soon as possible, to protect the public from waterborne illness
- Complies with the requirements of the Health Act 1956 to take all practicable steps to comply with drinking water standards.

3.1.2. The disadvantages of this option include:

- Additional maintenance expenditure above current budget
- Some people may object to the taste of chlorine in the water supply
- Possibly seen by Health Authorities as not fully addressing all the risks.

## 5. Context/Background

5.1 Christchurch City Council owns and operates a large number of wells (also known as bores) across the city for the primary purpose of providing water to the city's residents. The Council is in a fortunate position that there is a high quality water source within the aquifers beneath the city, which provide a nearly pristine supply that has generally not required any further treatment. Very few cities in the world benefit from such a high quality water source.

5.2 Since the Canterbury earthquakes of 2010/11, Christchurch's water supply has had a 'provisionally secure' status. This has meant that the water supply complied with the DWSNZ without the need for treatment.

5.3 Under the DWSNZ, bore water security is demonstrated by meeting three criteria:

1. The aquifer from which bore water is abstracted must not be directly affected by surface or climatic influences (can be demonstrated by a verified hydrogeological model)
2. Bore head must provide satisfactory protection (as judged by a person recognised as an expert in the field)
3. E. coli must be absent from bore water.

5.4 In accordance with the DWSNZ, the security of all water supply wells needs to be assessed by an expert in well head security assessments every five years. To comply with this, the Council has a rolling programme to assess the security of approximately 20 percent of its wells each year. Previous assessments had found our wells to be secure.

5.5 The Council reports on its Water Safety Plan in July each year (for the previous financial year) to the Drinking Water Assessor to demonstrate compliance with the three criteria set out in 5.3 above. The Drinking Water Assessor then issues a compliance report to the Council. Any non-compliance during the year is reported immediately to the Drinking Water Assessor. The Council's Water Safety Plan is reviewed every five years. The most recent five-yearly review is underway. The Plan will be provided to the Infrastructure Transport and Environment (ITE) committee once it has been finalised.

- 5.6 There is a heightened awareness of water safety issues, assessment, and acceptability of risk as a result of the Havelock North water supply contamination event of August 2016.

#### Timeline

- 5.7 The Havelock North Drinking Water Inquiry Stage 1 report was released on 10 May 2017 and described the likely causes of the contamination event as well as other failings that could have caused the contamination. These failings included the poor condition of the below ground well heads, the potential for flood waters to have entered the well head, and the potential for contamination via poorly sealed cables that penetrated the well heads.
- 5.8 In light of the Stage 1 Inquiry report, and rather than waiting for the final Stage 2 inquiry report, staff proactively took steps to implement measures to improve the safety of Christchurch's water supply, including improving the security of Christchurch's well heads. In early June 2017, Citycare were instructed to assess, review and recommend repairs to all of the Council's below ground well heads. At a meeting with Citycare Water staff on 26 June 2017, it was agreed that they should continue this work with urgency. The Drinking Water Assessor was notified of this work and made a site visit on 3 October 2017.
- 5.9 On 21 August 2017 Citycare Water issued its report, *Christchurch City Council Below Ground Water Well Head Repair Recommendations* (see Attachment A), which summarised the typical defects that had been found through the investigations, and recommended a repair strategy with an estimated cost of \$840,000. It was expected that about half of the cost would be improvements (capital expenditure) and half would be maintenance (operational expenditure). Due to the urgency of the required work, approval was given for Citycare to proceed with the repairs.
- 5.10 On 22 August 2017, the annual compliance report was received from the Drinking Water Assessor confirming that the Christchurch water supply was compliant with the DWSNZ and commending the Council on having full bacterial compliance for all distribution zones.
- 5.11 The Three Waters & Waste Unit's 11 October 2017 report to the ITE Committee included the compliance report from the Drinking Water Assessor. It also included a brief summary of the work being undertaken to improve well heads as a result of the City Care report, and a comment in the financial section that an additional \$200,000 was being spent on essential maintenance and improvements to well heads.
- 5.12 The Stage 2 report from the Havelock North Drinking Water Inquiry was released on 6 December 2017. It was highly critical of the Ministry of Health particularly in the area of enforcement of the DWSNZ. There has not, as yet, been any Government response to the Stage 2 report.
- 5.13 A relevant recommendation from the Inquiry's Stage 2 report was that "[321] The Ministry, via the [Drinking Water Assessors] and Medical Officers of Health, should take urgent steps to administer and enforce the existing regulatory regime, having regard to the findings and recommendations in this Stage 2 Report."
- 5.14 On 20 December 2017, the Director-General of Health issued a statement under section 69ZZZC of the Health Act 1956 to bring the responsibilities under the Act and the DWSNZ to the attention of drinking water suppliers (Attachment B). While this was not a directive to drinking water suppliers, the advice needs to be considered with urgency. The advice from the Director-General was:
1. *Protection of drinking-water sources is of paramount importance and a founding principle of drinking-water safety;*
  2. *Every drinking-water supplier must contribute to the protection of drinking-water sources;*
  3. *The risk to the public is increased if drinking-water is untreated;*

4. *To provide adequate protection to public health, suppliers providing drinking-water to untreated networked supplies should consider implementing appropriate and effective treatment without delay; and*
  5. *They should reconsider their reliance on secure bore water status as a means of providing safe drinking-water.*
- 5.15 The latest round of well head security assessments was conducted in November 2017 by Beca Ltd. A total of 25 wells at nine pump stations were assessed (which accounted for all but one which could not be accessed for safety reasons). The findings of these assessments, contained in the draft reports, found that none of the below ground well heads inspected met the security criteria. Draft reports on each of the pump stations were provided to Council staff by Beca on 14 December 2017, which described the issues with each of the wells. The reports also recommended immediate actions to comply with the security criteria, as well as actions that should be undertaken within 12 months and in the longer term.
- 5.16 The findings of these assessments were discussed at meetings attended by the Drinking Water Assessor, the Canterbury Medical Officer of Health, the authors of the Beca report and Council technical staff on 14 and 19 December 2017.
- 5.17 After receiving the Director-General of Health's Statement on 20 December 2017, senior Council staff met with the Drinking Water Assessor and the Canterbury Medical Officer of Health on 22 December to discuss its implications. At this meeting the Drinking Water Assessor indicated that in light of the draft reports on the latest round of well head security assessments, the security status for the Christchurch and Brooklands/Kainga water supplies would be changed from 'provisionally secure' to 'unsecure'. The letter confirming the change was received by staff later that afternoon (Attachment C), and stated that this meant the Council no longer complies with the DWSNZ. The change of status also means that the Council may not meet its levels of service for water supply set out in its own Water Supply Activity Management Plan.
- 5.18 It is important to note that the quality of Christchurch's groundwater has not changed. Instead, since the Havelock North incident, there is clearly a different appreciation of the risks (both likelihood and consequences) of contaminated water supplies. This is manifest in the regulators bringing a sharper focus to compliance with the DWSNZ and consultants being much more diligent before "signing off" secure bores.
- 5.19 With the loss of secure status for Christchurch's water supply, the Council needs to decide how best to proceed.
- 5.20 Staff also note at the ITE Committee meeting on 13 December 2017, the following resolution was made:

*Oppose any government directive to compulsorily chlorinate the urban areas of Christchurch City secured water supply and write to the appropriate government minister to inform them of this position, advocating for exemption if required.*

This resolution is currently lying on the table.

#### **Additional documents**

- 5.21 A timeline of events since the Havelock North drinking water contamination in August 2016 is shown in Attachment D.
- 5.22 A map of the city's water supply zones and pump stations, showing which ones have below ground wells, is included as Attachment E.

### **Protection of drinking water sources**

- 5.23 Following the release of the Stage 1 report of the Havelock North Inquiry in May 2017, staff did investigate the critical control points in our water supply network. This found that there were

some improvements that should be made to below ground well heads that could be susceptible to surface water contamination under adverse conditions.

- 5.24 Council staff instructed Citycare to repair and improve all below ground well heads in August 2017. This work is due to be completed by December 2018, however it is possible that it could be accelerated. However, completion is unlikely to be any earlier than October 2018 because of the need for specialist sub-contractors to carry out water-proofing work.
- 5.25 The repairs to below ground well heads has been prioritised so that those at highest risk of contamination are repaired first. The report *Below Ground Wellheads Benchmark* (Citycare Water, December 2017) (Attachment F) describes the repair work done at Main Pump Station Well 2 and sets the benchmark for repairs to be done to the remaining wells.
- 5.26 This approach is being reviewed in light of Beca's well head security assessments, which recommend improvements in addition to those already being undertaken by Citycare. The need for these improvements will be discussed and agreed with the Drinking Water Assessor, and the improvements and repairs being undertaken by Citycare will be amended accordingly. As such, the additional cost of this work is not yet known.
- 5.27 It should be noted that Citycare is improving all Council's below ground well heads, not just those in the latest round of well head security assessments.

### Measures recommended to reinstate secure water supply status

- 5.28 Under the DWSNZ, bore water security is demonstrated by meeting three criteria:
  - 1. The aquifer from which bore water is abstracted must not be directly affected by surface or climatic influences (can be demonstrated by a verified hydrogeological model)
  - 2. Bore head must provide satisfactory protection (as judged by a person recognised as an expert in the field)
  - 3. E. coli must be absent from bore water
- 5.29 A verified groundwater model was used to demonstrate compliance with **Criterion 1** in 2012, but this needs to be updated every five years. It was agreed with the Drinking Water Assessor last year that this would be delayed until the well deepening programme in the North West zone was completed. However, this is not expected to be completed until June 2019 due to delays securing land for new wells for the Wrights water supply pump station.
- 5.30 It would be possible to update the groundwater model sooner based on the current wells, and to repeat this once the well deepening programme in the North West zone is complete. However, the additional cost of this is not yet known.
- 5.31 The consultants from Beca who undertook the well head security assessments late last year have confirmed that once the first priority recommendations in their report have been completed and a follow up inspection has been undertaken, they will confirm that those wells are secure (**Criterion 2**). A review is being done to make sure that the work being done by Citycare to repair and improve all below ground well heads will meet the well head security criteria.
- 5.32 The Council continues to be compliant with **Criterion 3**.
- 5.33 Councillors should note that one of the recommendations of the Havelock North Drinking Water Inquiry is that the secure groundwater classification should be abolished from the DWSNZ. The government has not yet made any decisions on this recommendation.



## Reinstating secure status on a water supply zone by zone basis

- 5.34 The Drinking Water Assessor has advised that it would be possible to reinstate secure status on a water supply zone by zone basis. This would involve undertaking repairs and improvements to all below ground wells in a water supply zone (to meet Criterion 2) and using a verified groundwater model (to meet Criterion 1).
- 5.35 Further work would be required to confirm the practicality of reinstating secure status on a water supply zone by zone basis.

## Measures recommended while water supply is unsecure

- 5.36 As the Council can no longer demonstrate compliance with Criterion 2 of the DWSNZ, it is recommended that the Council implements temporary chlorination without delay. Temporary chlorination would cease as soon as possible and when agreed by the Drinking Water Assessor and Medical Officer of Health.
- 5.37 A temporary chlorination site at each of the 56 water supply pump stations would be required, comprising a sodium hypochlorite tank and dosing pump. This is a quick solution to reduce the public health risk, but would not comply with the DWSNZ requirements (due to a lack of control and monitoring). It would take the same approach as was used after the earthquakes, when the city's water supply was chlorinated temporarily. The rough order capital cost estimate for this is \$600,000, with an annual operating cost of \$250,000 for chemical supply and maintenance.
- 5.38 The capital budget could be found within the existing water supply capital budget from savings on other projects. The additional operating costs required to implement the recommendations is unbudgeted. Council staff will work to prioritise expenditure in order to seek to offset the additional operating costs.
- 5.39 It is also recommended that the Council undertakes a comprehensive mains cleaning programme using either air scouring or flushing to remove biota that may have accumulated in the mains. The impact of not carrying out a cleaning programme presents the risk of chlorine reacting with the biota on the pipe walls, resulting in the production of undesirable chlorine by-products that produce unwanted taste and odours.
- 5.40 If temporary chlorination is not implemented, there is a risk that the Council would not comply with the requirement of Part 2A of the Health Act 1956 to take all practicable steps to comply with drinking water standards.
- 5.41 As the water supply is now unsecure, under the DWSNZ the Council is required to increase the frequency of E. coli monitoring from typically monthly to daily for Christchurch water supply zones and twice weekly or weekly for water supply zones with smaller populations (such as Lyttelton Harbour). While the monitoring frequency was already greater than the minimum required by DWSNZ, an even greater frequency of monitoring is required. As agreed with the Drinking Water Assessor, this will be implemented from 1 February 2018. The additional monitoring cost is \$60,000 per year.

## Financial Implications

- 5.42 The capital budget can be found from savings elsewhere in the Three Waters & Waste Unit's capital programme.
- 5.43 The additional operating costs required to implement the recommendations is unbudgeted. Council staff will work to prioritise expenditure in order to seek to offset the additional operating costs.

## Communication/Engagement with the Community

- 5.44 It is recognised that all matters relating to drinking water are of high interest to the community.

- 5.45 While this is an issue of high significance, if the Council considers it should make a decision urgently to address potential health and safety issues, then it can do so, considering what it knows about community views without consultation. It can then engage with (or inform) the community after a decision is made.
- 5.46 In addition, there are significant challenges in seeking community views on a temporary solution to a health and safety issue, where compliance is a deciding factor. There is considerable reputational risk in raising community expectations around how much of a say people can have on a compliance matter.
- 5.47 Our recommended approach would therefore be to engage at the 'inform' level, ensuring that residents have access to comprehensive, easy to understand information about the situation and how the Council is responding to it.
- 5.48 A communication/engagement plan has been developed to explain the Council's situation and what we are doing about it. It is important to be upfront about the situation, any decisions that may need to be made, and the implications. We have been working closely with the Canterbury Medical Officer of Health to communicate the situation and will ensure that information is clearly explained and easily accessible.
- 5.49 Staff and elected members will be informed about any decisions before any public statement is made.
- 5.50 Comprehensive information will be communicated through Newsline, on the Council website, social media, via a direct email to key stakeholders, briefings to media and newsletters (community board and other).
- 5.51 Staff have developed a list of frequently asked questions on a fact sheet to be published – for distribution in print and electronically. We have also prepared a video with Council staff and the Medical Officer of Health, which has been published on the Council's website and also social media platforms.
- 5.52 There will be specific communications with water supply users significantly affected by chlorination (e.g. dialysis patients, tropical fish owners, food manufacturing businesses).

## **6. Option 1 – Accelerate measures to reinstate secure water supply status and temporarily chlorinate the water supply in the meantime (preferred)**

### **Option Description**

- 6.1 Undertake measures to reinstate secure status for the Christchurch and Brooklands/Kainga water supplies. This involves undertaking repairs and improvements to all below ground well heads so that they are secure and creating a verified groundwater model. Temporarily chlorinate the Christchurch and Brooklands/Kainga water supplies until agreement to cease chlorinating has been reached with the Drinking Water Assessor and Medical Officer of Health. Undertake increased monitoring of the water supply until secure status is reinstated. Inform the public of the decision and the reasons for it.

### **Significance**

- 6.2 The level of significance of this option is high, consistent with section 2 of this report.
- 6.3 Engagement requirements for this level of significance vary depending on the circumstances, but the recommendation in this situation is to inform the public.

### **Impact on Mana Whenua**

- 6.4 This option does involve a significant decision in relation to ancestral land or a body of water or other elements of intrinsic value, therefore this decision does specifically impact Ngāi Tahu, their culture and traditions.



### Community Views and Preferences

- 6.5 All residents and most business in Christchurch and Lyttelton Harbour are specifically affected by this option as they consume drinking water from Christchurch. It can be expected some parts of the community will not be happy with a decision to temporarily chlorinate, but other parts of the community and the health sector will be satisfied that such a decision is necessary given that secure status has been withdrawn. It is also a decision that can be reversed.

### Alignment with Council Plans and Policies

- 6.6 This option is consistent with Council's Plans and Policies.

### Financial Implications

- 6.7 Cost of Implementation - \$1,230,000 made up of \$630,000 to improve well heads in accordance with Citycare's recommendations and \$600,000 to install temporary chlorination. Additional budget may be required for further improvements to well heads recommended in the latest well head security assessments. However, the additional cost of this is yet to be determined.
- 6.8 Maintenance / Ongoing Costs - \$520,000 made up of \$210,000 for well head maintenance, \$250,000 for temporary chlorination and \$60,000 for increased water quality monitoring.
- 6.9 Funding source – capital budget can be found from savings elsewhere in the Three Waters & Waste Unit's capital programme. The additional operating costs required to implement the recommendations is unbudgeted. Council staff will work to prioritise expenditure in order to seek to offset the additional operating costs.

### Legal Implications

- 6.10 There is a legal context, issue or implication relevant to this decision
- 6.11 This report has been reviewed and approved by the Legal Services Unit
- 6.12 The legal consideration is included as Attachment G.

### Risks and Mitigations

- 6.13 There is a risk of community opposition to temporary chlorination, related primarily to the taste of chlorine in the water. Some water supply users require an unchlorinated supply (e.g. for dialysis).
- 6.13.1 Residual risk rating: The residual rating of the risk after the below treatment is implemented will be high.
- 6.13.2 Planned treatment includes informing the public of the need for temporary chlorination. Special attention will be paid to users who require an unchlorinated supply.

### Implementation

- 6.14 Implementation dependencies - none
- 6.15 Implementation timeframe - the improvements to well heads is underway and is expected to be complete by December 2018 but could be accelerated to be completed by October 2018. The time to build a verified groundwater model is yet to be confirmed, but is expected to take several months.

### Option Summary - Advantages and Disadvantages

- 6.16 The advantages of this option include:
- Improving the safety of the water supply as soon as possible, to protect the public from waterborne illness
  - Complying with the requirements of the Health Act to 1956 to take all practicable steps to comply with drinking water standards.

6.17 The disadvantages of this option include:

- Additional maintenance expenditure above current budget
- Some people may be negatively affected by chlorine (e.g. dialysis patients, tropical fish owners, food manufacturing businesses) and would need to dechlorinate.
- Some people may object to the taste of chlorine in the water supply.

## **7. Option 2 - Accelerate measures to reinstate secure water supply status and do not temporarily chlorinate**

### **Option Description**

7.1 Undertake measures to reinstate secure status for the Christchurch and Brooklands/Kainga water supplies. This involves undertaking repairs and improvements to all below ground well heads so that they are secure and creating a verified groundwater model. Until secure status is reinstated, undertake increased monitoring of the water supply. Inform the public of the decision and the reasons for it.

### **Significance**

- 7.2 The level of significance of this option is high consistent with section 2 of this report.
- 7.3 Engagement requirements for this level of significance vary depending on the circumstances, but the recommendation in this situation is to inform the public.

### **Impact on Mana Whenua**

7.4 This option does involve a significant decision in relation to ancestral land or a body of water or other elements of intrinsic value, therefore this decision does specifically impact Ngāi Tahu, their culture and traditions.

### **Community Views and Preferences**

7.5 All residents and most business in Christchurch and Lyttelton Harbour are specifically affected by this option as they consume drinking water from Christchurch. It can be expected some parts of the community will be happy with a decision not to temporarily chlorinate, but other parts of the community and the health sector will be unhappy with such a decision due to safety concerns. It is likely that most people would be happy with the decision to improve well head security.

### **Alignment with Council Plans and Policies**

- 7.6 This option is inconsistent with Council's Plans and Policies
- 7.6.1 Inconsistency - does not comply with the Water Supply Activity Management Plan level of service "Ensure potable water is supplied in accordance with the Drinking Water Standards for New Zealand".
- 7.6.2 Reason for inconsistency - Christchurch's water supply is no longer secure and does not comply with the DWSNZ, as advised by the Drinking Water Assessor.
- 7.6.3 Amendment necessary - change in the performance target for the Ministry of Health risk grading for urban water supplies from Ba to Da.

### **Financial Implications**

7.7 Cost of Implementation - \$630,000 to improve well heads in accordance with Citycare recommendations. Additional budget may be required for further improvements to well heads recommended in the latest well head security assessments by Beca; the additional cost of this is yet to be determined.

- 7.9 Maintenance / Ongoing Costs - \$520,000 made up of \$210,000 for well head maintenance, \$250,000 for temporary chlorination and \$60,000 for increased water quality monitoring.

- 7.9 Funding source – capital budget can be found from savings elsewhere in the 3 Waters capital programme. The additional operating costs required to implement the recommendations is unbudgeted. Council staff will work to prioritise expenditure in order to seek to offset the additional operating costs.

### Legal Implications

- 7.10 There is a legal context, issue or implication relevant to this decision
- 7.11 This report has been reviewed and approved by the Legal Services Unit
- 7.12 The legal consideration is included as Attachment G.

### Risks and Mitigations

- 7.13 There is a risk of contamination of Christchurch's water supply caused by contaminated water entering unsecure wellheads or the water supply network. This may result in an outbreak of waterborne disease in Christchurch.

7.13.1 Residual risk rating: The residual rating of the risk will be high.

### Implementation

- 7.14 Implementation dependencies - not applicable
- 7.15 Implementation timeframe - the improvements to wellheads is underway and is expected to be completed by December 2018 but could be accelerated to be completed by October 2018. The time to build a verified groundwater model is yet to be confirmed but is expected to be several months.

### Option Summary - Advantages and Disadvantages

- 7.16 The advantages of this option include:
- Some further cost to Council (unless there is a disease outbreak in which case the cost could be significant).
- 7.17 The disadvantages of this option include:
- Risk of an outbreak of waterborne disease in Christchurch, which could have significant effects on the health and wellbeing of residents and visitors, on the ability of businesses to continue to function effectively, and on the economy of Christchurch. There would also be a significant cost to Council.
  - May not comply with the requirements of the Health Act 1956 to take all practicable steps to comply with drinking water standards.
  - The Canterbury Medical Officer of Health is likely to issue a compliance order under the Health Act 1956 requiring the Council to temporarily chlorinate if the Council decides not to implement temporary chlorination.

## Attachments

No.	Title	Page
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B <a href="#">↓</a>	Statement from Director-General of Health, 20 December 2017	31
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G	Legal considerations ( <i>Under Separate Cover</i> ) - <b>CONFIDENTIAL</b>	

ITEM NO.	GENERAL SUBJECT OF EACH MATTER TO BE CONSIDERED	SECTION	SUBCLAUSE AND REASON UNDER THE ACT	PLAIN ENGLISH REASON	WHEN REPORTS CAN BE RELEASED
17 Attachment G	LEGAL CONSIDERATIONS (Under separate cover)	S7(2)(g)	The withholding of the information is necessary to maintain legal professional privilege	Legal advice in relation to relevant issues affecting consideration of the report under the Local Government Act 2002 and the Health Act 1956.	Legal advice is not to be released.

## Confirmation of Statutory Compliance

Compliance with Statutory Decision-making Requirements (ss 76 - 81 Local Government Act 2002).

(a) This report contains:

- (i) sufficient information about all reasonably practicable options identified and assessed in terms of their advantages and disadvantages; and
- (ii) adequate consideration of the views and preferences of affected and interested persons bearing in mind any proposed or previous community engagement.

(b) The information reflects the level of significance of the matters covered by the report, as determined in accordance with the Council's significance and engagement policy.

## Signatories

<b>Authors</b>	Bridget O'Brien - Team Leader Asset Planning Judith Cheyne - Associate General Counsel Carolyn Gallagher - Programme Director – Strategic Support John Mackie - Head of Three Waters and Waste Peter Langbein - Finance Business Partner
<b>Approved By</b>	Karleen Edwards - Chief Executive

## Christchurch City Council Below Ground Water Well Head Repair Recommendations



*For: Christchurch City Council - Reticulation Manager [Robert Meek]*

*By: Citycare Group [Water] Christchurch*

*Date: 21 August 2017*

*Version: For Approval*

CitycareWater 

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## 1. Background

- 1.1 A meeting was held with Council staff<sup>1</sup> on 26 June 2017, with concern raised at the risk to contamination of the untreated drinking water supply via below ground well head assets. It was noted that this was not a new risk, though evidence from the Inquiry [Havelock North Water Contamination Event] identified the risk of contamination via this pathway was likely.
- 1.2 It was agreed that Citycare Water continue with urgency to assess, review and recommend repairs to below ground well heads. It was also noted by the Head of 3 Waters that this was an unacceptable risk to supply of clean safe to drink water and should be addressed urgently.
- 1.3 All well heads have been inspected, as below and Appendix One and Two:
- |                                      |     |
|--------------------------------------|-----|
| • # Station Sites Inspected          | 47  |
| • # Well heads Inspected at Stations | 108 |
- 1.4 As a result of several wet weather events [20/7/17 and 14/8/17], some well heads were inspected up to three times. This was considered appropriate as observation of wet well inundation (if any) provided direct evidence of shallow surface water and/or elevated groundwater level ingress.
- 1.5 This report provides the following information:
- i) The scope of works – inclusions/exclusions
  - ii) A risk profile, which sets the priority order in which well head repair works will be undertaken
  - iii) A general schematic describing typical well head works
  - iv) Cost estimates against the works

## 2. Timeline – Key Points

- 2.1 An interim report was tabled with the Councils Head of 3 Waters Manager and others<sup>2</sup> on 25 July 2017. At that time, site information from a limited number of wellheads had been reviewed due to the time required to inspect sites and wet weather events disrupting access. Further, Council staff had not yet provided feedback on the risk profile (priority ranking for repairs), and repair scope of works with cost estimates had not been completed.
- 2.2 At a meeting<sup>3</sup> on 17 August 2017, images of a set of common defects were tabled and typical repair scope of works outlined. Discussion occurred as to whether there was a requirement under the Drinking Water Standards for impermeable plinths to be installed around the below ground wellheads as a part solution to shedding some surface away from the chamber.
- 2.3 This report is tabled to support immediate commencement of physical works.

<sup>1</sup> 26/6 - Attendance by CCC [J. Mackie, J. Moore, M. Johnson, K. Winkles, R. Meek], CCG-W [H. Blake-Manson, C. Barron]

<sup>2</sup> 25/7 – Attendance by CCC [J. Mackie, J. Moore], CCG-W [H. Blake-Manson, B. Triplow]

<sup>3</sup> 17/8 – Attended by CCC [D. Muruges, R. Meek, K. Winkles, G. Wardman], CCG-W [H. Blake-Manson, C. Barron]



### 3. Repairs

#### 3.1 Minimum Requirements

- 3.1.1 The requirement for this work is driven by written and verbal statements Stage 1 and Stage 2 – Havelock North Inquiry; and the requirement to meet the Drinking Water Standards 2005 (amended 2008):

NB Bore head = well head

**Section 4.5.3.2** Bore water security criterion 2: bore head must provide satisfactory protection:

- a. The bore head must be judged to provide satisfactory protection by a person recognised as an expert in the field.
  - b. The bore head must be sealed at the surface to prevent the ingress of surface water and contaminants, and the casing must not allow ingress of shallow groundwater.
  - c. Animals must be excluded from within 5 m of the bore head.
  - d. The bore construction must comply with the environmental standard for drilling soil and rock (NZS 4411, Standards New Zealand (2001)), including providing an effective backflow prevention mechanism, unless agreed by the DWA.
  - e. The supply's water safety plan must address contaminant sources and contaminant migration pathways.
- 3.1.2 With respect to these requirements, it is the writers opinion based on site evidence, industry practice and general discussion with another industry experts that:
- i) A person recognised as an expert would not approve the current below ground bore head standard of work. **Outcome: Watershed plinths are required**
  - ii) Bore heads are not currently sealed at the surface – including air release valves, sample taps, infiltration, inflow **Outcome: Repair all chamber wall defects**
- 3.1.3 Citycare are not able to comment on items d. and e. as these are considered to be matters for the Council to respond to at present. Citycare do not hold or have access to this information at the time of this reports issue.

#### 3.2 Priority and Extent of Repair Works

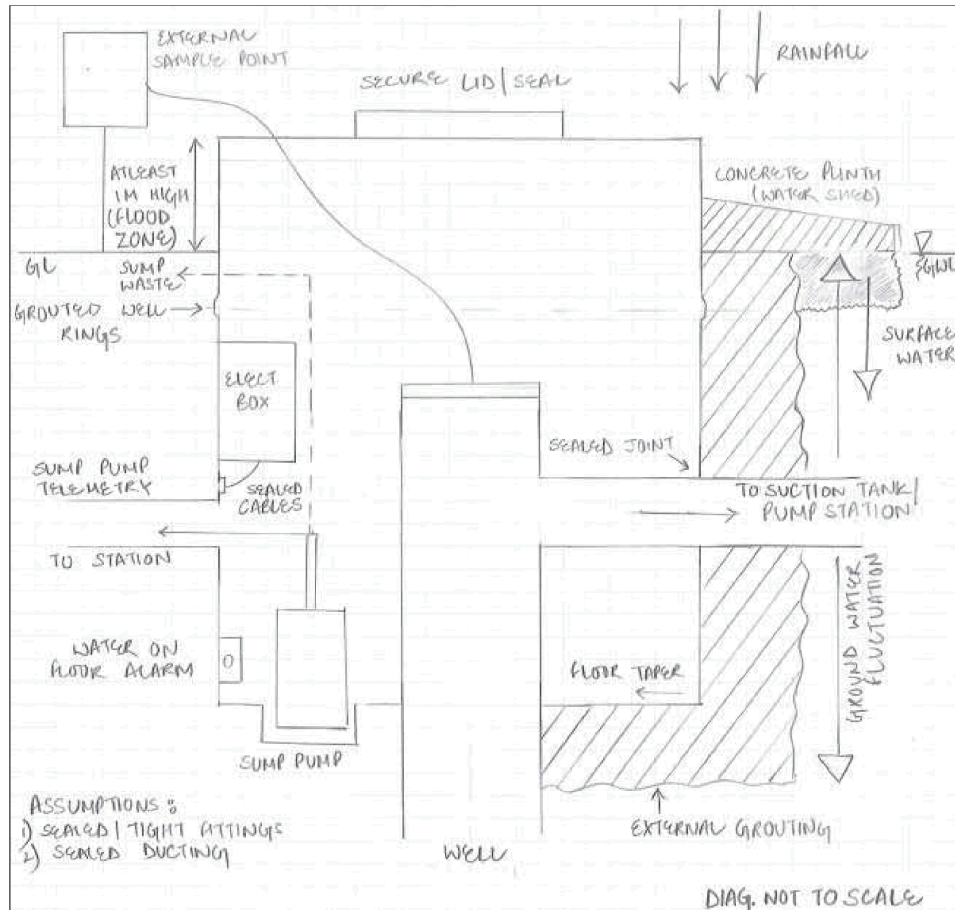
- 3.2.1 At the meeting of 25 July 2017, Citycare Group – Water were instructed to undertake repair works only. This therefore excludes raising well heads above ground and any barrier based treatment. It is noted that raising well heads is estimated to cost \$65,000 with associated exclusions.
- 3.2.2 At the meeting of 17 August 2017, it was also agreed that significant asset deterioration works would not be included e.g. Grade 4-5 external corrosion on well pipes and fittings
- 3.2.3 The extent of works would therefore include any of the following:
- i) Raised chamber, above any surface flood pathway. Includes rivers (1 in 200 year event 0.2% AEP).
  - ii) Watertight/vandal proof access hatch. Locked, with ability to remove entirely when servicing is required.
  - iii) Surface watershed plinth, approximately 2 sq.m. around access lid.
  - iv) External impermeable grouting around chamber perimeter, and under base to well riser pipe



- v) Internal mass major defect removal and grouting e.g. brick/timber packing, riser ring grouting
- vi) Sloped internal floor with sump pump and "water on floor" alarm
- vii) Removal of all water sampling taps and pipework to above ground secure boxes.
- viii) Removal of all air valves where possible, particularly where a suction tank is located downstream of the well head.

3.2.4 Please refer to Figure 2 for a schematic of a repaired below ground well head.

**Figure 1 - Schematic of A Repaired Below Ground Well Head**



- 3.2.5 Repairs at well heads will be undertaken against the following risk matrix - Table 1. That is works are well heads with highest overall scores will be undertaken first.

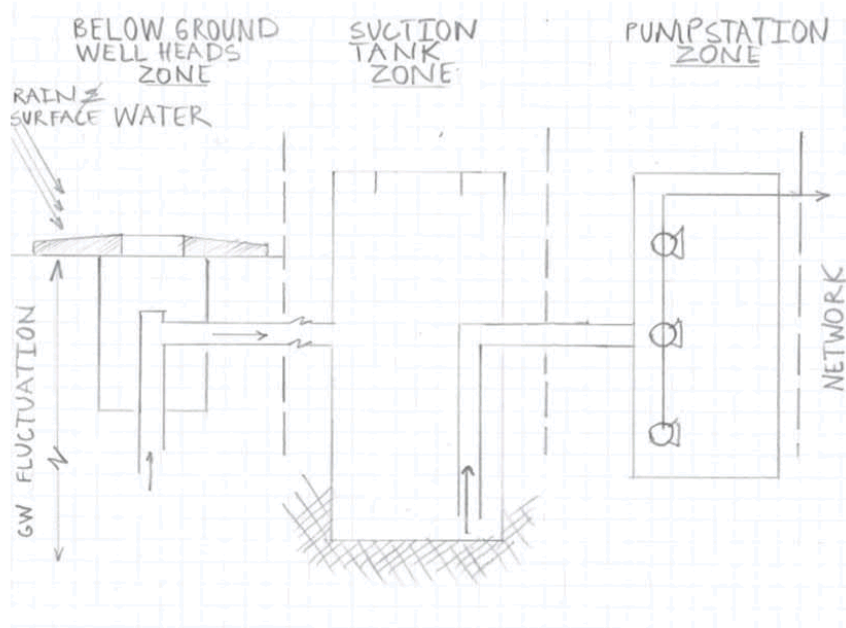
**Table 1 - Risk Profile Driving Site Order of Priority**

	Weighting Factor			
	2	1.5	1	
Risk Item	Scale			Comments
Surface Water Ingress	Monthly	Annually	>= Five Yearly	Risk of contaminants entering water supply increase as frequency of inundation increases
Shallow Ground Water Ingress	Always	Weekly	Annual	Risk of contaminants entering water supply increase as frequency of inundation increases
Well security designation (secure/unsecure)	Unsecure	-	Secure	Northwest zone wells are not in secure aquifers? Or there is a higher potential risk that contamination may occur from upstream sources
Well Water Supply Zone (CCC # connections)	>50K	49-10K	<10k	If contaminants enter the network, exposure increases with connected population
Chlorination/UV Treatment	None	CL2(g) or UV	Both CL2(g) & UV	This may only apply to BP
Well Depth to Screen (m)	0-49	50-119	Artesian and/or >120m	As well depth increases, there is an assumed greater protection with more "clean water" above the screen, and less mixing of any potential contaminants down inside/external wall of casing
PS Peak Abstraction Rate (l/s)	>120	119-50	<50	As PS abstraction increases, so does drawdown of potential contaminants

### 3.3 Residual Risk

- 3.3.1 During the rainfall event of 20-22 July 2017, river water inundated a number of well heads, contaminating them with sewage wastewater which had been washed in via surcharged sewerage networks/pump stations.
- 3.3.2 High groundwater (above chamber base) and rainfall seepage are also considered to present the highest risk and therefore drive the most extensive and intensive action
- 3.3.3 The repair works focus on minimising the ingress of surface water and very shallow unsecure groundwater (~2 m BGL) into the below ground well head chamber/pipework. The extent of works will not however eliminate the potential for pathogen ingress into the water supply via connected pipes eg between the suction tank, deep groundwater and other vectors - Figure 2.

Figure 2 - Focus Area for Repair Work – Below Ground Well Head Zone Only



- 3.3.4 The Council has not sought advice from, request or authorised Citycare to install a water treatment barrier e.g. ultra violet treatment. If pathogens (in particular viruses) are able to enter the groundwater source and migrate while still functional then contaminated water may enter the network. There is no regular testing for viruses to the writers knowledge.
- 3.3.5 The Council could consider pathogen monitoring, and the need for barriers.
- 3.3.6 The residual risks which will remain following completion of the repair works include:
- i) Chamber inundation through higher than design rainfall events (river/waterway flooding)
  - ii) Further chamber wall deterioration resulting in severe acute groundwater ingress
  - iii) No treatment barrier and monitoring in place for pathogen entry to the network via deep groundwater
  - iv) Contamination via other connected assets including well head pipes to suction tanks, suction tanks, pipes to pump station, pump casing and mainfolds to the network.

#### 4. Costs

- 4.1.1 Cost estimates by work item are provided in Table 2
- 4.1.2 Examples of site costs are provided in Figure 4. Total water supply station cost estimates against the number of well heads is provided in Figure 5.
- 4.1.3 A complete list of sites, works and costs is provided in Appendix Two.

*Table 2 Work Item Cost Estimate*

Work Item	ESTIMATED COST (per wellhead)
External Grouting	\$4,000
Internal Grouting of Well Rings	\$1,000
Sealing of Glands and Open Ducts	\$500
Construction of a 2 m Plinth Around Well Cover	\$3,500
Install Secure, Accessible Well Cover	\$3,000
Raise Wellhead Cover above Ground	\$5,000
Seal Tight Wellhead Cover with Well Wall	\$600
Sump Pump and Water On Floor Alarm	\$3,500
Fix Fittings Leaks	\$400
Reconstruct and Seal Wellhead Delivery Pipe In Wall	\$1,500
Move Internal sample Point to External Sample Point	\$1,500



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Figure 3 - Total Cost Estimate by Repair Work Type

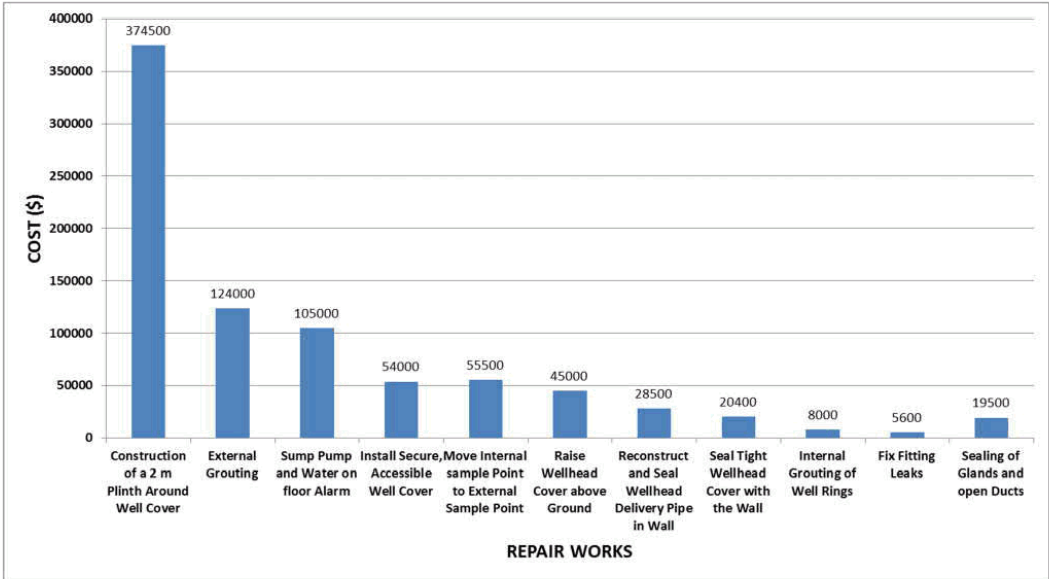
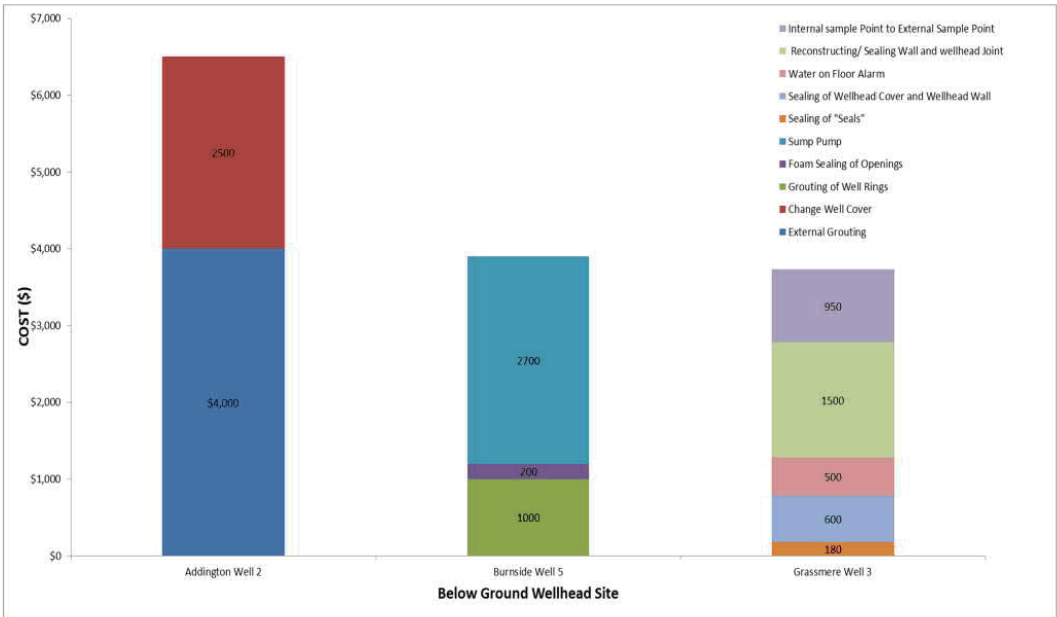
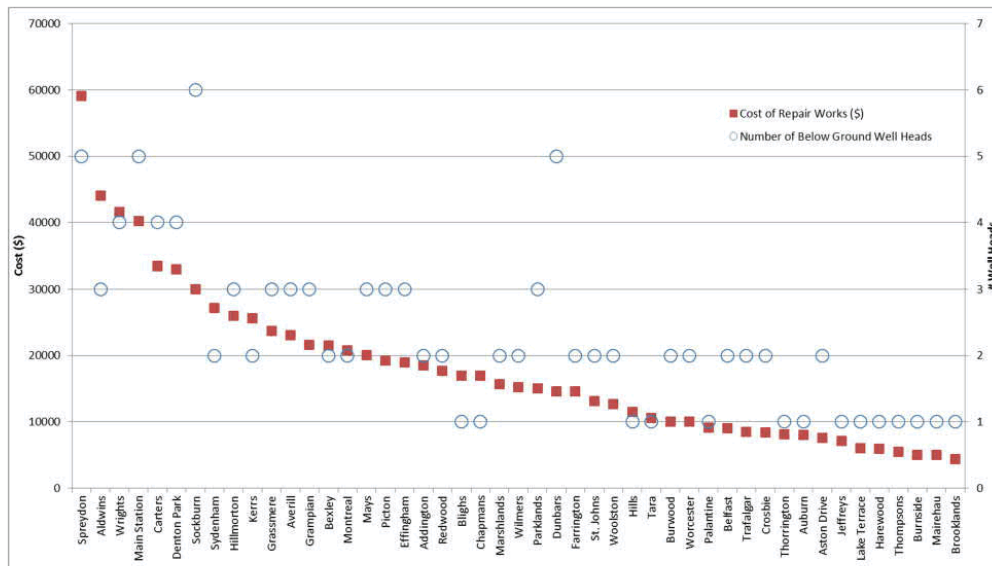


Figure 4 - Typical By Site Distribution of Costs



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Figure 5 - Station Cost Estimate / # Well Heads



## 5. Summary

- 5.1 Criteria for high risk sites have been developed to support determination of appropriate work and the order of prioritisation. Works should either result in minimisation or elimination of the risk of drinking water contamination – refer Risk Weighing Table 1.
- 5.2 Recommendations for risk reduction works at sites are estimated to cost \$840,000

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## 6. Quality Assurance

VERSION NO.	1 (For Approval)	DATE:	21 August 2017
APPROVED BY:	Bjorn Triplow	TITLE:	Southern Regional Manager
PREPARED BY:	Hugh Blake-Manson	TITLE:	Contract Manager CPeng, IntPE Nat. Dip. Drinking Water (Assessor) Nat. Dip. Infrastructure Asset Management
CERTIFIED BY:	Alan Gramstrup	TITLE:	Operations Manager
INPUT BY:	Neena Parul Sharma	TITLE:	Engineer
INPUT BY:	Chris Barron	TITLE:	Pumps and Storage Manager





## Appendix One – Below Ground Well Head Locations

Figure 4- Map Showing all Below Ground Well heads Inspected

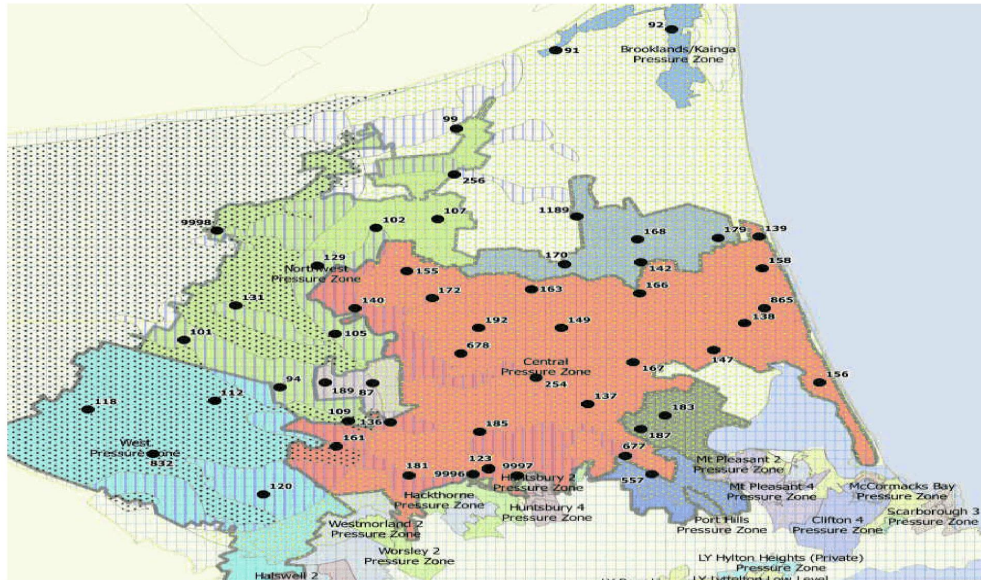
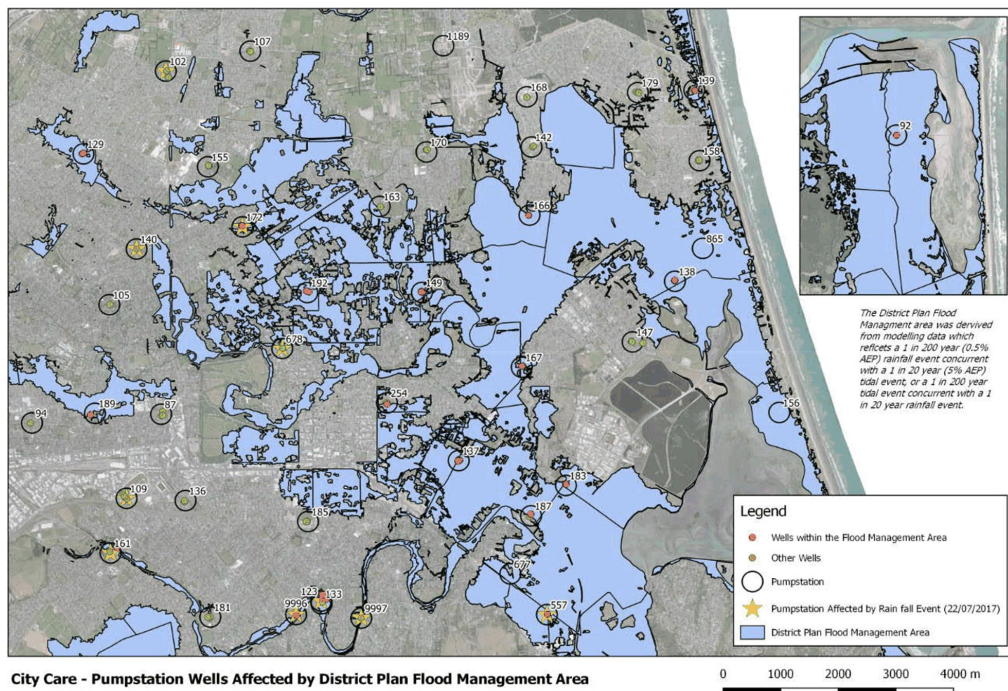


Figure 5- Map Showing Below Ground Wellheads Inspected After 20/07/17 Rainfall





## Appendix Two – Total Costs by Site

The following wellheads have been inspected to date:

Belowground Wellheads	Address	Number of belowground wellheads	Cost of Repair Works (\$)
Addington	479 Barrington St.	2	18500
Aldwins	54 Aldwins Road	3	44000
Aston Drive	67 Aston drive	2	7600
Auburn	29A Auburn Avenue	1	8000
Averill	57 Averill St.	3	23100
Belfast	38 Darroch St.	2	9000
Bexley	551 Pages Road	2	21500
Blighs	1 Blighs Road	1	17000
Brooklands	1001 Lower Styx Mill Road	1	4400
Burnside	Burnside Park	1	5000
Burwood	160 Burwood Road	2	10000
Carters	4 Carters Road	4	33500
Chapmans	Opposite LPG Tanks	1	17000
Crosbie	22A Woodbury St.	2	8400
Denton Park	58 Kathleen Cres	4	33000
Dunbars	CNR Halswell Road	5	14600
Effingham	72 Effingham St.	3	19000
Farrington	114 Farrington Avenue	2	14600
Grampian	62 Grampian St.	3	21600
Grassmere	21 Grassmere St.	3	23700
Harewood	8 Whitchurch Place	1	5900
Hillmorton	14 Halswell Road	3	26000
Hills	320 Hills Road	1	11500
Jeffreys	30 Jeffreys Road	1	7100
Kerrs	50 Kerrs Road	2	25600
Lake Terrace	5 lake Terrace Road	1	6000
Main Station	54 Colombo St.	5	40200
Mairehau	Burwood Hospital Grounds	1	5000
Marshlands	220 Marshlands Road	2	15700
Mays	107 Mays Road	3	20100
Montreal	447A Montreal St.	2	20800
Palantine	Opposite Number 24	1	9100

Parklands	8A Portnall Place	3	15000
Picton	61-69 Picton Avenue	3	19200
Redwood	54 Prestons Road	2	17700
Sockburn	Service Centre Yard	6	30000
Spreydon	83 Lyttelton St.	5	59100
St. Johns	120 St. Johns Street	2	13100
Sydenham	245 Milton street	2	27200
Tara	In Park	1	10600
Thompsons	Off Blakes Road	1	5500
Thorrington	24 Thorrington Road	1	8100
Trafalgar	Entrance Next to 41 Edgeware Road	2	8500
Wilmers	4 Wilmers Road	2	15200
Woolston	58 Glenroy Road	2	12700
Worcester	325 Worcester St.	2	10000
Wrights	Trotting Club Grounds	4	41600



**DIRECTOR-GENERAL STATEMENT**

**HEALTH ACT 1956 s 69ZZZC**

I, Chai Chuah, Director-General of Health, for the purposes of protecting public health and informing the public, issue the following statement.

In August 2016 an outbreak of campylobacteriosis arising from contamination of the Havelock North drinking-water supply affected around 5,500 people.

The Government Inquiry into the contamination event is now complete and the Stage Two report has provided important recommendations for the safe management of drinking-water supplies in New Zealand.

The Inquiry identified that the outbreak was caused by contamination of ground water that was provided to consumers as untreated drinking-water. The Inquiry identified that several parties with responsibility for the water supply system failed to adhere to the high levels of care and diligence necessary to avoid this occurring and to protect public health. Improvements to the drinking-water framework have been identified and need to be actioned.

I advise all drinking-water suppliers and drinking-water assessors that:

- Protection of drinking-water sources is of paramount importance and a founding principle of drinking-water safety;
- Every drinking-water supplier must contribute to the protection of drinking-water sources;
- The risk to the public is increased if drinking-water is untreated;
- To provide adequate protection to public health, suppliers providing drinking-water to untreated networked supplies should consider implementing appropriate and effective treatment without delay; and
- They should reconsider their reliance on secure bore water status as a means of providing safe drinking-water.

A blue ink signature of Chai Chuah, consisting of a large, stylized 'C' followed by a horizontal line.

Chai Chuah  
Director-General of Health

in Wellington this 20. day of December 2017.

# Canterbury

## District Health Board

Te Poari Hauora o Waitaha

File: CWS\_1\_CHR001+BRO012

22<sup>nd</sup> December 2017

Head of 3 Waters and Waste  
Christchurch City Council  
PO Box 73014  
CHRISTCHURCH 8154

Attention: John Mackie

Dear John

### **Removal of Provisional Security Status for Christchurch and Brooklands/Kainga sources (CHR001+BRO012)**

Following the Christchurch earthquakes in 2011 the security status for Christchurch (CHR001) and Brooklands Kainga (BRO012) was changed from 'Full' security to 'Provisional'. This was in recognition that a number of bores were damaged but none of the transgressions recorded in the period following the earthquakes were associated with the individual bores or pump stations.

This provisional status has continued as the remediation/new bore work programme has been rolled out.

Security criteria 2 (bore head security) is required “...to be judged by a person recognised as an expert in the field...” (Section 4.5.2.2) when initially established and then reviewed at least every five years as part of the requirements for ongoing demonstration of secure bore water. As such, in accordance with this requirement the Drinking Water Assessor (DWA) has been provided each year with reports for approximately one fifth of the bores, confirming that criteria two is continuing to be met.

The reports from the bores inspected recently this year show that some bore heads do not meet the security criteria and therefore the security status for Christchurch and Brooklands Kainga is removed. This means that the supplies now are not able to demonstrate the protozoa requirements of section 5 of the Drinking Water Standards for New Zealand (DWSNZ) through demonstrating secure sources.

It is acknowledged that while in some instances the bore heads may have deteriorated, the assessment and acceptance of risk are the more likely drivers that have meant that

Community & Public Health, 310 Manchester Street, Christchurch Telephone 03 364 1777 Facsimile 03 379 6125

◆Christchurch Office: PO Box 1475, Christchurch Telephone 03 364 1777 ◆Ashburton Office: PO Box 110, Ashburton Telephone 03 307 6902  
◆West Coast Office: PO Box 443, Greymouth Telephone 03 768 1160 ◆South Canterbury Office: PO Box 510, Timaru Telephone 03 687 2600

[www.cph.co.nz](http://www.cph.co.nz)

engineering experts are no longer willing to confirm the security of the bore head installations.

Christchurch City Council are also acknowledged for reacting swiftly as the findings from the Havelock North enquiry have emerged. This includes the programme for rehabilitation of below ground well heads and fast tracking of the new deep bores for Northwest Christchurch.

Yours sincerely



**Judy Williamson**  
**Drinking Water Assessor**  
**SIDWAU**  
Community & Public Health  
A division of Canterbury District Health Board



**Dr Ramon Pink**  
**Medical Officer of Health**

Community & Public Health, 310 Manchester Street, Christchurch Telephone 03 364 1777 Facsimile 03 379 6125

◆ Christchurch Office: PO Box 1475, Christchurch Telephone 03 364 1777 ◆ Ashburton Office: PO Box 110, Ashburton Telephone 03 307 6902  
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	August 2016				December 2017	
Havelock North Drinking Water Enquiry	August Havelock North incident	10 May Stage 1 Havelock North report released			6 December Stage 2 Havelock North report released	
Consultants				November Wellhead security assessments by Beca		
CCC/ITE Committee	1 September Report to ITE on drinking water quality	7 June Report to ITE on NW Compliance	6 July Report to Council on DRAFT CCC Submission on Havelock North Enquiry Stage 2  21 July CCC Submission on Havelock North Enquiry Stage 2 lodged	11 October ITE Committee Report on commencement of wellhead project and CDHB compliance letter to Council	13 December ITE resolution opposing any governmental direction to compulsory chlorination	
Contractor	22 September Report to ITE on NW Compliance with DWSNZ Christchurch		August CityCare Below Ground Wellhead report received and approval given to upgrade wellheads		14 December Wellhead Protection Plan - Approved	
Canterbury District Health Board, Drinking Water Assessor, Ministry of Health			August Letter from CDHB CCC Compliant with DWSNZ	3 October Wellhead work and reservoir roof sealing site visit CCC and CDHB	14 December Beca/CDHB/CCC Meeting on Secure Wellheads  19 December Wellhead Security Meeting DWA (CDHB)/ Beca/CCC  20 December Director General of Health statement received  20 December Email received from DWA re concerns about wellhead security  22 December DWA letter received re secure bore status removed	

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# Below Ground Wellheads Benchmark

22/12/2017



## 1. Summary

Works carried out at Main Pumps Station Well 2 as a part of the repairing of below ground wellhead project are:


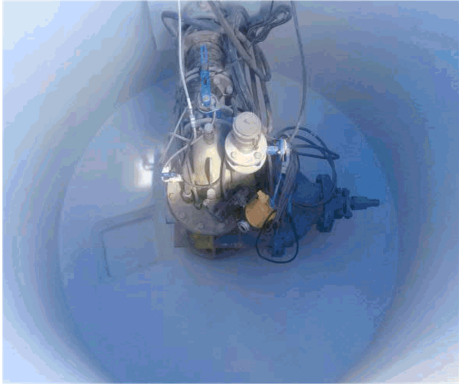


1. External grouting
2. Internal sealing and lining of the well
3. Sealing of glands and ducts
4. Cable relocation
5. Installation of a new sump pump
6. Floor regrading and sump deepening
7. Installation of a secure, accessible well cover
8. Construction of a 2m apron around well cover

The work undertaken on each component is considered to be the benchmark level required to minimise or eliminate water contamination from ground water and rainfall (or both).





Following are pictures of the finished works corresponding to the above list at Well 2 Main Pumps:

<p>1.External Grouting</p> 	<p>2/3.Internal Sealing and Lining of the Well</p> 
<p>5/6. Floor Regrading (in progress)</p> 	<p>7. Installation of Secure, Accessible Well cover</p> 



2. External Grouting

Ideal Well Picture (Main pumps Well 2)



### 3. Cable Relocation

Ideal Picture (Main Pumps Well 2)



## 5. Install Secure Accessible Well Cover

Ideal picture (Main Pumps Well 2)





## 6. Construction of 2m Apron around well cover

Ideal picture (Main Pumps Well 2)



Attachment E Item 17

## Timelines

The following high priority works will be completed by June 2018 – as these sites were assessed as having the highest potential risk of water contamination. There are 25 wells in this group. Of this, 16 wells require all eight (8) components of work to be undertaken. The remainder (nine) require lesser work in particular cable relocation.

In total 102 wells have been assessed, with the remainder (77) considered to be lower risk but still requiring remedial works. It is anticipated that this work will be completed by December 2018.

The table below identifies 25 wells, some with two work streams

Part 1: Cable Relocation where non External Grouting Require			
Part 2: All other works			
Site	Well Number	Estimated Start Date	Estimated Finish Date
Main Pumps Station	Well 1	26/10/2017	13/11/2017
	Well 2	12/09/2017	3/10/2017
	Well 4	7/11/2017	23/11/2017
	Well 5	15/01/2018	26/01/2018
	Well 6	29/01/2018	2/02/2018
Grampian	Well 5	5/02/2018	23/02/2018
Farrington (Part 1)	Well 4	17/11/2017	27/11/2017
Grassmere (Part 1)	Well 3	4/12/2018	15/12/2017
Farrington (Part 2)	Well 4	26/02/2018	9/03/2018
Palantine	Well 1	12/03/2018	30/03/2018
Thompsons (Part 1)	Well 2	15/01/2018	24/01/2018
Sydenham (Part 1)	Well 5	26/01/2018	2/02/2018
Sydenham (Part 2)	Well 5	2/04/2018	6/04/2018
	Well 6	20/04/2018	20/04/2018
Thompsons (Part 2)	Well 2	23/04/2018	27/04/2018
Burnside (Part 1)	Well 5	5/02/2018	14/02/2018
Belfast (Part 1)	Well 1	15/02/2018	22/02/2018
	Well 2	26/02/2018	6/03/2018
Grassmere (Part 1)	Well 2	12/03/2018	16/03/2018
Mays (Part 1)	Well 2	19/03/2018	27/03/2018
	Well 4	26/03/2018	3/04/2018
Redwood (Part 1)	Well 1	5/04/2018	12/04/2018
Burnside (Part 2)	Well 5	30/04/2018	9/05/2018
Belfast (Part 2)	Well 1	10/05/2018	18/05/2018
	Well 2	21/05/2018	29/05/2018
Blighs	Well 1	30/05/2018	13/06/2018
Grassmere (Part 2)	Well 1	14/06/2018	22/06/2018
	Well 2	25/06/2018	29/06/2018
	Well 3	2/06/2018	7/07/2018
Thorrington (Part 1)	Well 1	16/04/2018	24/04/2018
Bexley (Part 1)	Well 1	26/04/2018	2/05/2018
	Well 2	7/05/2018	15/05/2018
Brooklands (Part 1)	Well 1	16/05/2018	22/05/2018
Montreal (Part 1)	Well 1	23/05/2018	31/05/2018
	Well 2	4/06/2018	12/06/2018
St John (Part 1)	Well 1	14/06/2018	20/06/2018
Trafalgar (Part 1)	Well 1	21/06/2018	28/06/2018
	Well 2	29/06/2018	5/07/2018

