SOUTH WAIRARAPA DISTRICT COUNCIL

Kia Reretahi Tātau

Agenda

ORDER PAPER FOR AN EMERGENCY MEETING
TO BE HELD IN
The Supper Room, Waihinga Centre, Texas Street,
MARTINBOROUGH
ON
24 April 2019

MEMBERSHIP OF COUNCIL
HER WORSHIP THE MAYOR
Mrs Viv Napier

(Deputy Mayor Brian Jephson)

Cr L Carter
Cr P Colenso
Cr M Craig
Cr M Gray
Cr P Maynard
Cr C Olds
Cr C Wright
Cr R Vickery

RECOMMENDATIONS IN REPORTS ARE NOT TO BE CONSTRUED AS COUNCIL POLICY UNTIL ADOPTED BY COUNCIL

SOUTH WAIRARAPA DISTRICT COUNCIL EMERGENCY MEETING

AGENDA – 24 April 2019

Open Section

The meeting has been called as per schedule 7, section 22A of the Local Government Act and will be held in the Supper Room, Waihinga Centre, Texas Street, Martinborough and will commence at 9.00am. The meeting will be held in public (except for any items specifically noted in the agenda as being for public exclusion).

SWDC Affirmation

We pledge that we will faithfully and impartially use our skill, wisdom and judgement throughout discussions and deliberations ahead of us today in order to make responsible and appropriate decisions for the benefit of the South Wairarapa district at large.
We commit individually and as a Council to the principles of integrity and respect, and to upholding the vision and values we have adopted in our Long Term Plan strategic document in order to energise, unify and enrich our district.

A1. Karakia Timitanga

A2. Apologies

A3. Conflicts of interest

A4. Public participation

As per standing order 14.17 no debate or decisions will be made at the meeting on issues raised during the forum unless related to items already on the agenda.

A5. Actions from public participation

A6. Extraordinary business

B. Decision Reports from Chief Executive and Staff

B1. Martinborough Chlorination Pages 1-51

SOUTH WAIRARAPA DISTRICT COUNCIL

24 APRIL 2019

AGENDA ITEM B1

PROPOSAL TO TEMPORARILY CHLORINATE THE MARTINBOROUGH WATER SUPPLY

Purpose of Report

To seek approval to temporarily chlorinate the Martinborough water supply.

Recommendations

Officers recommend that the Council:

1. *Receive the proposal to temporarily chlorinate the Martinborough water supply.*
2. *Recommend that officers complete their investigation of the impact of chlorination on the vineyards and breweries in Martinborough and actions that need to be taken to ensure chlorination does not adversely impact the products from these businesses.*
3. *Recommend officers arrange temporary chlorination as soon as possible after recommendation two has been completed with a view to removing the boil water notice as soon as possible.*

1. Executive Summary

The Martinborough water supply (MWS) currently has only a single treatment barrier to contamination (UV treatment). It is the only water supply in the Wairarapa that is not chlorinated. Two recent incidents where *E.coli* has been detected in the MWS have led to boil water notices (BWNs) being required to protect the health of residents and visitors to Martinborough, as *E.Coli* indicates contamination of the water supply.

Officers have been working closely with Regional Public Health (RPH), water consultants Lutra and Wellington Water Limited's (WWL) potable water experts to find a solution to the water contamination and allow removal of the second BWN.

The advice from all experts and also the Havelock North Inquiry (HNI) is that a multiple barrier approach is required. The most effective and timely solution is for the MWS to be chlorinated.

This paper seeks approval to temporarily chlorinate the MWS to ensure the safety of residents and visitors and to enable the latest BWN to be removed.

2. Background

South Wairarapa District Council is committed to providing our communities with safe drinking water. The Council currently uses a combination of ultraviolet (UV) water treatment and chlorination for its water supplies. All supplies have Water Safety Plans which are approved by RPH.

Chlorination is currently used in the Greytown and Featherston water supply in conjunction with UV disinfection. The MWS is sourced from ground water bores adjacent to the Ruamahunga River and treated with ultraviolet (UV) disinfection before being distributed around Martinborough and to the reservoirs at the top of town near the golf course.

A diagram of the MWS is attached at Appendix 1.

The Martinborough UV treatment plant was installed in 2011. This plant treats the water just downstream of the water supply bores, however does not provide any protection from possible contamination of the water within the network.

Recently, there has been the need to put in place two Boil Water Notices (BWNs) due to routine tests confirming the presence of E.coli in the water. The presence of *E.coli* indicates that the water has been contaminated and is unsafe to drink. Those at highest risk of illness due to drinking the contaminated water are babies, the elderly, and people with compromised immune systems.

2.1 First Boil Water Notice

On 30 January 2019, SWDC received notification that *E.coli* had been detected in the MWS. In consultation with RPH, and following further positive *E.coli* tests, a BWN was issued on 2 February 2019. This remained in place until an investigation was completed; it was concluded that the probable cause of the water contamination was a malfunction of the UV at the water treatment plant (WTP) caused by a power cut.

Twenty one days after the BWN was put in place it was removed and Lutra water consultants were requested to complete a full report covering the probable cause of the contamination and any further work needed to avoid a recurrence. A copy of the Lutra report is included at Appendix 2.

Prior to the Lutra report being published, SWDC held a meeting with local business owners to obtain their feedback on the BWN and impacts on them. Subsequent to the Lutra report being published a public meeting was held on Monday 8th April 2019 in the MBA town hall with a panel of experts to answer queries about the probable cause of the water contamination and subsequent BWN.

At the public meeting the Mayor committed to working through the corrective actions in the Lutra report. (See page 22, Appendix 2).

2.2 Second Boil Water Notice

Less than 24 hours after this public meeting, on Tuesday 9th April 2019, officers once again received notice that *E.coli* had been detected in the

MWS. This indicated thatthe water was again contaminated, with positive test results returned from samples taken at the reservoirs and Shooting Butts Road areas. Officers immediately contacted RPH and it was agreed a BWN needed to be put in place and the source of the problem identified.

The positive results were obtained around 4pm and the BWN put in place around 6pm once elected officials had been notified. Officer's organised for the reservoirs to be chlorinated and the area where contamination was detected to be flushed.

Emails were sent to MBA residents and food and beverage providers, phone calls made to key people e.g. Chair of the MBA School Board of Trustees and Wharekaka rest home. A letter drop was completed by Council staff, some Councillors and the volunteer fire brigade who also made announcements on their loud hailer.

2.3 Incident Management Team

Subsequent to the second BWN being put in place an Incident Management team (IMT) was set up comprising WWL potable water experts, Lutra, Wairarapa DHB and SWDC personnel. RPH personnel also sit in on these calls, providing a liaison function. This group meets daily by teleconference to agree next steps and update on actions taken over the previous 24 hours.

The goal of the IMT has been to identify the source of the *E.coli* as quickly as possible and eliminate it to enable the BWN to be taken off. This team also ensures regular communications go out to the media, and through SWDC Facebook and website to keep the community informed.

2.4 Source of the *E.coli*

Investigations confirm that the bores and the WTP can be ruled out as the source of the contamination for the current contamination event. This is because the UV plant has been operating in compliance with drinking water standards requirements since the first incident.

Work to identify the source of the *E.coli* has focussed on potential sources of contamination within the water supply network, including the risk of backflow from private connections to the MWS. Contractors are systematically checking for issues but it is unlikely that this work will be able to definitively identify the source of the latest contamination incident to conclusively resolve the problem.

At about the same time as the *E.coli* was detected, sample results from within the MWS network showed a significant increase in the number of total coliform bacteria. Coliform bacteria are "indicator organisms" that may indicate a possible contamination pathway exists between a source of the bacteria (for example contaminated surface water) and the water supply. *E.coli* is a 'subset' of total coliforms that is most commonly associated with the bacteria existing within the gut of animals and humans.

As discussed above, investigations into the possible sources of the *E.coli* contamination or recent increase in total coliforms have not drawn any definitive conclusions. However, investigations have identified that there are

significant risks that cannot be eliminated or effectively managed if the supply of drinking water from the treatment plant continues without full treatment in place for the management of the waterborne pathogen risk.

Officers have considered different treatment options, including: temporary chlorination; permanent chlorination; ozone treatment; chloramination and ion exchange.

- Ozonation does not leave a lasting residual, so it doesn't provide ongoing protection to the water supply.
- Chloramination is no longer practiced in NZ as chloramines are hundreds of times less effective than chlorine.
- Ion exchange would be a method to remove manganese and would not add further protection to the network.

Any preferred option needs to:

- ensure that safe and healthy drinking water continues to be provided to SWDCs MBA customers (that is, those who currently receive unchlorinated drinking water),
- ensure ongoing compliance with the Drinking Water Standards of New Zealand 2005 (Revised 2018) and be cost efficient.

Accordingly, and after considering the different treatment options, Officers recommendation is to:

1. Implement temporary chlorination of the drinking water to be supplied from the treatment plant; and
2. That the water also continue to be treated with UV, as part of a multi-barrier approach in order to manage the waterborne pathogen risk.

This option is consistent with the independent experts' advice, as well as being in accordance with international best practice.

2.5 Chlorination

The quickest and safest way to be able to remove the BWN would be to chlorinate the water, thereby providing multiple treatment barriers for the MWS. This multi-barrier approach was recommended in the HNI report and the Lutra report.

All other water supplies in Wairarapa are chlorinated for this reason. The reason the MWS has not been chlorinated to date is the presence of manganese in the source water. The effect of adding chlorine to water with manganese is a discolouration of the water.

At the public meeting on 9 April 2019 the Mayor indicated that Council would consult before chlorinating the MBA water. However, this was prior to the second detection of *E.coli*. Since that meeting considerable time has been spent attempting to locate and eliminate the source of the latest contamination. As this has not been possible, the option to temporarily

chlorinate the water is the strong recommendation from the technical experts, and especially RPH, to protect the public from the risk of waterborne disease.

Due to the risk to the health of MBA citizens/visitors and the requests from the public, especially business owners, to remove the BWN, Officers recommend temporary chlorination at this time.

At a later date SWDC will consult with ratepayers regarding permanently chlorinating the water.

2.6 Manganese Extraction

After the first BWN in February, Council agreed to bring forward the installation of a manganese removal plant which had been provided for in the Long Term Plan (LTP) 2018/28 to enable chlorination if required for multi-barrier protection.

It was estimated this would be installed in the first quarter of the 2019/20 financial year (between July and September 2019). This would enable chlorination if needed in a situation such as the current one without the issue of discolouration of the water.

Since the second BWN was put in place and as the source of the contamination has not been able to be identified conclusively to date, RPH in particular have an expectation that chlorination be put in place as soon as possible to reduce the risk to public health in the MBA community.

Research has shown as time passes people become complacent about BWN and take more risks with using the water for everyday activities such as cleaning teeth. This means that the longer a BWN is on, the less effective it is and the greater the risk that someone will get ill as a result due to not following the BWN instructions.

Anecdotal information coming back to officers and elected members indicates that residents are already becoming less concerned about using the MWS water which is of real concern to all on the IMT.

For this reason we are recommending chlorination of the MWS as soon as possible to provide the multi-barrier approach and remove the risk of illness and waterborne disease from drinking contaminated water.

Lutra have tested the level of manganese in the bores and one of the bores has shown relatively low levels of manganese. This test result leads us to believe the discolouration of the water may not be as bad as first thought, and can be managed to minimise the impact to consumers.

If we are able to use this bore for the winter when demand is low, this will minimise the occurrence of discolouration and enable us to install the manganese removal plant in time for summer when demand increases again.

Based on historic water usage, officers believe it will be possible to operate on this one bore for the duration of the winter while the manganese plant is being installed.

2.7 Wineries and Breweries

One significant concern regarding chlorination is the potential impact on our wineries and breweries, some of whom use the MWS in their production. Information obtained by officers shows that chlorinated water has a negative effect on the wine production. The chlorine will react to produce a musty/mouldy/corked effect. This is known as TCA, a chemical that in minuscule levels is a taint in winemaking and may even cause the wine to be ineligible for export (see Appendix 3). Chlorine is an unacceptable element universally in winemaking across the world.

Officers are currently working with the wineries and breweries to establish the extent of this problem and how quickly it can be eliminated. For example, we are aware some vineyards use their own bores. Officers are in the process of establishing which wineries have access to bore water and what they use the town supply for.

Officers shared information regarding ways to offset the impact of chlorine on wine production with the wineries and will continue to engage with them to ensure there are solutions available and these are put in place. The most straight forward solutions are alternative water supplies or installation of carbon filters.

This same issue was encountered by winemakers in the Hawkes Bay as a result of chlorination there.

3. Significance Assessment

When making a decision in relation to the above recommendation, the Local Government Act 2002 (the **Act**) provides that Council must have regard to its Significance and Engagement Policy (the **Policy**).

In assessing the significance of this recommendation under the Policy, the Council must consider, amongst other factors, the level of community interest in the chlorination of water supplies. A great deal of attention has been given to this issue in recent years, and community interest is likely to be high. The community has not been consulted as part of the LTP process.

The Greytown and Featherston water supplies are currently chlorinated. The temporary or permanent chlorination of the MWS will likely attract further interest. Based on these and other factors, the Council may consider the significance of the recommendation to be high.

The Policy provides that, depending on the significance of the decision, the Council has a range of options available to it ranging from implementing the decision and informing the community of its decision, through to empowering the community by collaborating with it to make the decision.

It is proposed that the Council inform the MBA community of the need to temporarily chlorinate the MWS and engage with the community at a later date regarding chlorinating permanently.

3.1 The Havelock North Drinking Water Inquiry: Stage 2 Report

In August 2016, there was a major outbreak of campylobacteriosis in Havelock North. In September 2016, the Government established an enquiry to investigate and report on the outbreak. The HNI proceeded in two stages. The first stage focussed on identifying what happened, the cause of the outbreak, and an assessment of the conduct of those responsible for providing safe drinking water to Havelock North.

The key matters for consideration in Stage 2 were the improvement of the safety of drinking water in New Zealand, lessons to be learned from the Havelock North outbreak, and changes which should be made to achieve those goals

The HNI sets out in Part 24 of the report further changes needed to prevent recurrences of an outbreak of waterborne disease in water supplies throughout New Zealand. In relation to Chlorination, the HNI recommended Mandate Universal Treatment as follows:

(Recommendation 20) *Appropriate and effective treatment of drinking water should be mandated by law or through the DWSNZ for all supplies (networked and specified self-suppliers). This should include a residual disinfectant in the reticulation.*

(Recommendation 21) *Provision should be made for exemptions to mandatory treatment only in very limited circumstances. Any supplier seeking an exemption should have to discharge a heavy onus of satisfying an appropriately qualified and experienced body of the present, and ongoing, safety of the particular supply*.

We are awaiting a decision from the Government on the recommendations, though early indications are that the Department of Internal Affairs proposals to Central Government will include all water suppliers other than single households provide a residual disinfectant.

4. Options

4.1 Option Details – Advantages and Disadvantages

Option	tails	Advantage	Disadvantage
Status quo with increased testing for E.coli	Maintain the status quo	When consulted about water supply chlorination, the community may prefer not to. No impact on wineries.	Ignores the findings of the HNI and recommendations of RPH, and international best practice. Would need to retain BWN indefinitely which would not be acceptable to the public especially hospitality businesses. Council would be criticised as the water supply is unsafe. Risk of public getting ill and potential deaths as with Havelock North. Significant additional cost of testing and backflow prevention.
2. Adopt the recommended approach, including the option to temporarily chlorinate the MBA water supply (Option A)	Details as per recommendations to Council	Conservative approach (from a water supply safety perspective) which gives effect to the advice of the Director-General of Health and the HNI to provide adequate protection to public health.	The Council has not consulted with the MBA community regarding chlorination of the water supply. When consulted about water supply chlorination, some members of the community will prefer to not chlorinate. Council could potentially be criticised for not consulting further before taking this step. Need to put in place solutions to ensure wineries are not adversely affected.
3. Adopt the recommended approach but seek a further report from staff regarding the permanent chlorination of water supplies (Option B)	Details as per recommendations	Permanent chlorination is the option most in line with recommendations from the HNI and RPH.	Council needs to consider that the safety of the MWS is compromised. Although chlorination of the GTN and FTN water supplies has been in place since the 1970's, these water supplies do not the issue of manganese in the water. The Mayor has indicated that Council will consult prior to permanent chlorination. Need to put in place solutions to ensure wineries are not adversely affected.

5. Views of those Affected/Consultation

5.1 Views of those affected

The general public are expected to express their views in relation to permanent water supply chlorination as part of a future consultation process. The MBA community have not been consulted in relation to the chlorination of their water supplies to date.

5.2 Māori implications

The public notification and opportunity for submission on the subject of permanent chlorination will include input from the Māori Standing Committee. Their contribution to the decision making process in relation to water supply chlorination is considered important. Officers have commenced the discussions with the MSC regarding the proposed temporary chlorination of the MBA water supply.

6. Funding Implications

The cost to install temporary chlorination will be approximately $35,000. The chlorination equipment was available in case emergency chlorination was required. To commission the plant that had previously been installed required an additional $35,000 to be spent.

While the BWN is in place, additional sampling and testing is required which is currently costing Council $500 per day. This is equivalent to $182,500 p.a. Normal testing costs approximately $200 per week or $10,400 p.a.

In addition, once chlorination has been added, water consultants have advised Council should arrange for flushing of the MBA water supply network. This work will be carried out of the two to three weeks after the chlorination. The flushing will involve some residents being without water for several hours (as mains are progressively flushed) and communication will be made with residents to notify them of the timing of their water being unavailable.

This flushing will cost an estimated $**45,000**. The programmed flushing will be to minimise the discoloured water due to biofilm and accumulated manganese that may be bound.

SWDC have experienced black water previously following water main breaks so there is some manganese deposits present. The messaging will be that SWDC will do everything that is practicable to reduce the impact on the community. SWDC will air scour the network and will proactively flush the network. SWDC officers will also respond to any complaints and investigate.

7. Communication and Engagement

Officers have prepared a communications plan to help SWDC customers understand more about the water treatment processes undertaken at the treatment plant and the impact of chlorination. Officers are investigating options for the continued availability of unchlorinated UV treated water.

A media announcement will be prepared and distributed following Council's decision on the ongoing treatment.

These monitoring results indicated to officers that further investigation into the sources of the contamination, and appropriate water treatment responses needed to be put in place. In response, in April 2019 officers decided to recommend temporarily chlorinating the water as a precautionary measure. This recommendation is made in collaboration with Wellington Water, Regional Public Health and Lutra water consultants.

Engagement on the matters contained in this report aligns with the level of significance. Council officers have held two workshops with Councillors over recent weeks to discuss the proposed chlorination of the MWS and implications of doing so. RPH were in attendance at both workshops. Representatives from Wellington Water and Lutra were in attendance at the second workshop.

Officers have also met with winemakers to discuss the impact on their businesses and endeavour to establish plans together to eliminate the impact on their businesses.

A communication plan has been prepared to ensure residents and key stakeholders are kept informed of this decision and the implications for them. In addition, FAQs have been prepared and are included at Appendix 5.

8. Conclusion

The MWS is currently a non-chlorinated water supply treated by UV only, at the water treatment plant. The conclusions of the HNI were that drinking water standards needed to be improved to ensure the safety of residents and one of the key recommendations was a multi-barrier approach to treatment. Adding chlorination to the MWS would give this multi-barrier approach.

Whilst some members of the community will be against the idea of chlorination for a number of reasons, this is seen as the only feasible way to ensure the water supply is safe to drink and avoid further BWNs.

Objections from members of the community are likely to mirror those from other communities who have recently made this move e.g. Hutt City and Christchurch City.

The objections normally relate to taste and smell, a fear of having more chemicals in the water and a small percentage of the population (less than 1%) may get a skin reaction to chlorination. Some of these issues can be lessened either through installing filters or by storing the chlorinated water in containers in fridges, as the concentration and associated taste dissipates over time (see Appendix 4 for frequently asked questions and answers re chlorinated water).

MWS has the added complication of possible discolouration of the water due to the manganese content. Officers believe the impact of this can be minimised by using Bore 4 which has low levels of manganese.

It is acknowledged that early indications are that Central Government directives will require chlorination in the future. It is also possible that the outcome of the current RPH investigation into the first contamination event will be to require Council to chlorinate the MWS.

To support its investigations, SWDC sought independent expert advice on the results of its investigations. Both experts advised that they consider there are public health and safety risks associated with water that is sourced from aquifers that is not subsequently fully treated for waterborne pathogens. Both have ultimately recommended that the water supplied by the treatment plant be treated against waterborne pathogens through a combination of chlorine and ultra-violet (UV) processes.

Officers recommend that Council do not wait for potential regulator directives but act now to protect the safety of residents and visitors to MBA and follow expert advice received by Council

In summary, the need to temporarily chlorinate the MWS is due to:

- It being virtually impossible to conclusively determine the cause of the latest water contamination incident.
- The continued presence of total coliforms demonstrating that there may have been sources of contamination previously in the MWS.
- The ongoing risk posed by backflow - a residual disinfectant in the network reduces this risk significantly, and is a further management tool in addition to (but not a replacement for) an actively managed backflow prevention program.
- Chlorine and UV reflects international best practice for microbiological water treatment.
- Recommendations in part 24 of HNI report (see page 7) and Page 19 of the Lutra report (see Appendix 2).

9. Appendices

Appendix 1 – Diagram of Martinborough Water Supply

Appendix 2 – Lutra report

Appendix 3 – Implications of chlorination on winemaking

Appendix 4 – Frequently Asked Questions (FAQs) re chlorination

Contact Officer: Lawrence Stephenson, Assets and Operations Manager
Reviewed By: Jennie Mitchell, Acting CEO

Appendix 1 – Diagram of Martinborough Water Supply

Understanding Martinborough Water Supply

Mark Allingham, Infrastructure and Services Manager, SWDC (written for the March issue of the Martinborough Star)

During the Martinborough Boil water notice it came to our attention that many in the township were unaware of how the Martinborough water supply operated and why the system is not currently chlorinated.

Martinborough's system (Image 1) is different to most water systems in that groundwater is extracted from the bores next to the Rumahunga river to the west of town. It is then treated with Ultra Violet Radiation (sun lamps), PH corrected and pumped through the township to the reservoir tanks on the hill above the golf course. The gravity pressure from the tanks and the bore pumps keeps the pressure in the pipes that supply your homes.

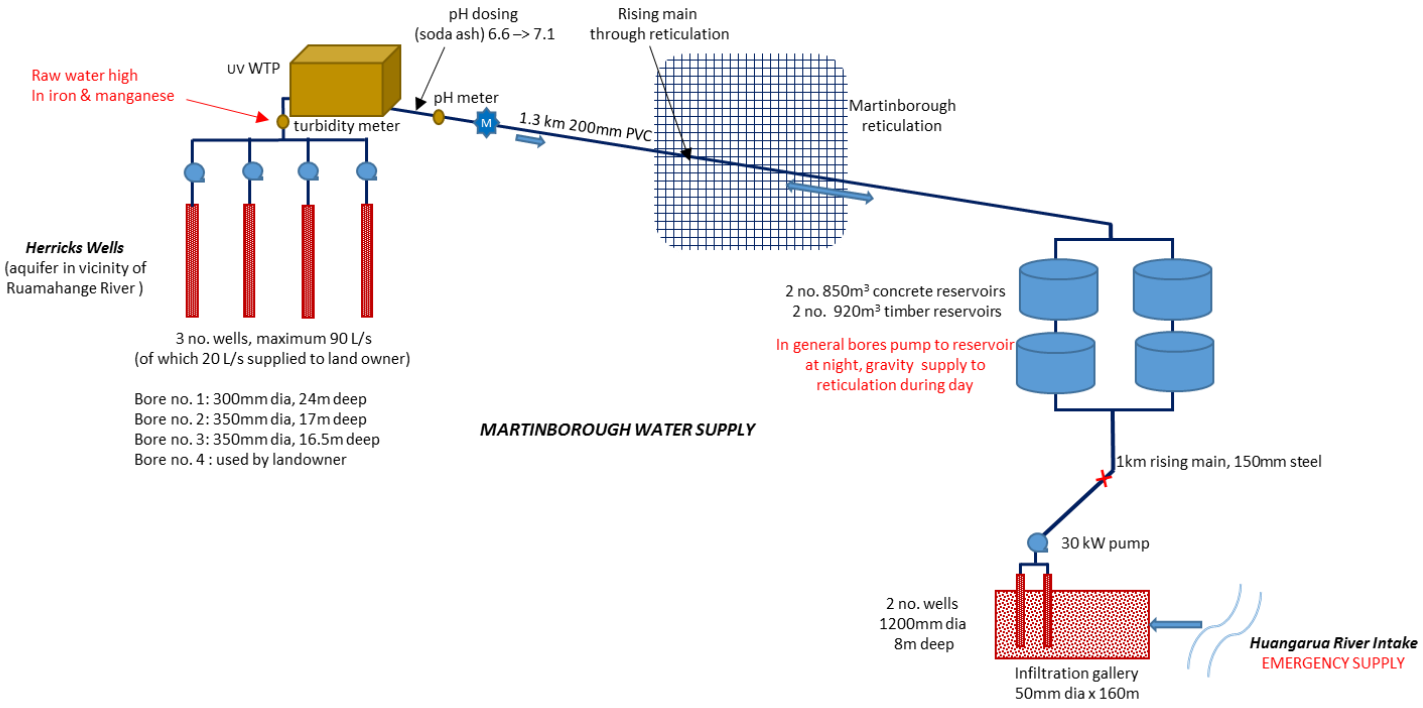

Image 1 – Martinborough Water Supply (uv WTP = UV water treatment plant)

Quarterly testing of the untreated groundwater, since 1990, has not shown any indication of bacterial contamination. The last of these routine tests was carried out in December 2018.

The UV disinfection system (Image 2) provides treats the water after it is extracted from the bores and at the point enters the system. The system relies on the premise that nothing else enters the system from anywhere. Backflow prevention mechanisms are fitted on connections throughout the system with the aim of preventing potential sources of contamination.

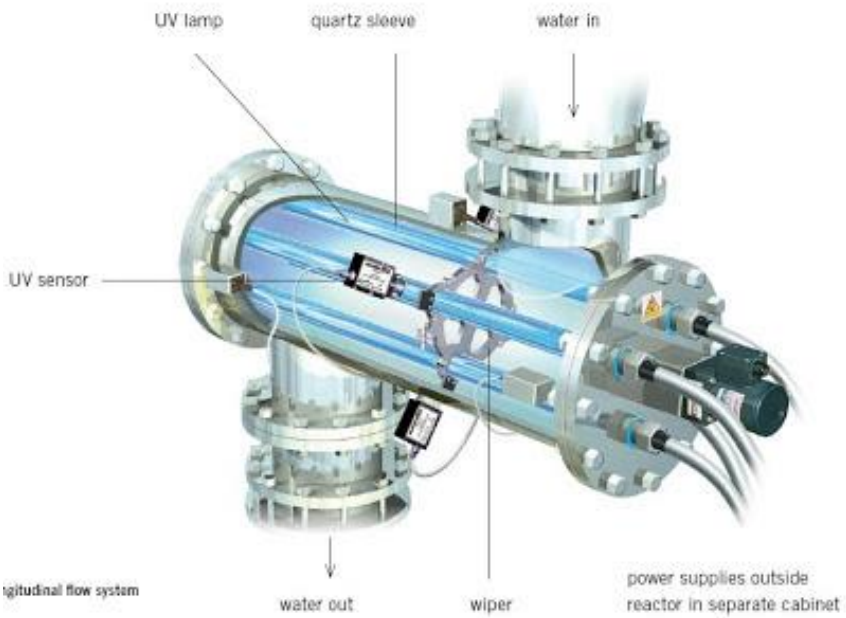

Image 2 – Diagram of UV disinfection system

The next three points are critical to understanding why there are issues associated with chlorinating Martinborough's water:

1. Inside the pipes is a biofilm (Image 3) that naturally accumulates on the pipe walls (like cholesterol in arteries).
2. The groundwater from the bores contains manganese, this when mixed with chlorine will discolour the water and while completely safe to drink, being blackish in colour is not palatable.
3. As the water is pumped through town to the tanks, the manganese settles on the bottom of the pipes, in the biofilm, and is suspended in the water.

Image 3 – Biofilm inside a pipe

So, if there is a broken pipe or major disturbance to the pipes this can cause either the dark manganese granules or biofilm containing the manganese to be released, this can enter people's water supply. Manganese is more of an issue in areas of the system where it settles in the biofilm, for example the bottom end of the system (New York St) and where the water travels frequently

backwards and forwards between the tanks and the bores; it's not so much of an issue at the top end of town.

Martinborough water is not chlorinated due to the presence of manganese. A manganese removal plant is planned for the future to enable chlorination. The additional of residual chlorine in the water protects it as it moves through the pipes and ensures the water is safe should anything enter the system. It will also destabilise the biofilm for a period of time.

Questions often asked are…

Q Why do people have discoloured water at times, is it chlorine?

A. It is not due to chlorination but rather unsettling of the biofilm.

Q. Is it true that Martinborough water can't be chlorinated?

A. The system can be chlorinated, but must have the manganese reduced/removed first to prevent discolouration.

Q When Martinborough Estate (East of Todds Rd) was chlorinated during the boil water notice period, the water didn't change, why?

A. The pipes in the Martinborough Estate are all newer than in other parts of town so there is very little biofilm. At the top end of the system there is also very little manganese.

Q. When flushing the top end of the system (East of Todds Rd), why did some houses have discoloured water at the bottom of the system?

A. Unrelated to the flushing, we unfortunately had a broken water pipe off the main at New York St West at the same time. This is what caused the discoloured water.

Q. If you replace water pipes why are there manganese and biofilm and issues?

A. We replace pipes on wear and criticality in sections over the whole network so no one area is new at any one time.

Q. Why don't the other towns have these issues?

A. The Featherston and Greytown water supply does not have Manganese and is chlorinated.

Any comments or questions, please contact Martinboroughwater@swdc.govt.nz

Appendix 2 – Lutra report

SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

Cover note from SWDC on the 'Technical Report: Martinborough Water Treatment Plant – Incident Review'

The attached 'Technical Report: Martinborough Water Treatment Plant – Incident Review' has been prepared by Lutra for the benefit of and use by South Wairarapa District Council (SWDC).

Lutra is an expert water consultancy. This is an independent report and, as such, SWDC, and other agencies involved in the incident, have not influenced its content other than to offer factual corrections to information such as dates, times etc.

Lutra was commissioned by SWDC to develop the Report based on the consultancy having the necessary expertise and knowledge to assess the Martinborough Water Treatment Plant. It should be noted that Lutra became involved in the response to remove the boil water notice, by providing services to fix and test the UV plant, at around Day 13 of the incident.

Despite this, the company was a fair and practical choice to prepare this Report. There are a limited number of companies in New Zealand that could have carried out this technical review, given the specialised nature of the subject matter and the tight timeline in which the Report needed to be completed.

This Report describes the incident, identifies potential intervention points that could have helped prevent the incident, and makes recommendations for the future to prevent a repeat incident.

As a technical report, SWDC acknowledges there will be terms used within the Report that may not be easily understood by a lay person. A glossary of terms will be made available to help address this.

SWDC considers this Report to be an important input to its overall post-incident review of the Martinborough water incident. Other key inputs to the review process include feedback from the Martinborough community, and business community, gathered via community meetings and email, and from other agencies involved in the response, gathered by an inter-agency debrief.

The full and final post-incident review will include this Technical Report, summaries of the feedback received from the community, and a plan of action to minimise the risk of a repeat incident and its impact on the community.

For questions or feedback on this report, please email martinboroughwater@swdc.govt.nz.

Jennie Mitchell
Acting Chief Executive

5 April 2019

Lutra.

Technical Report.

Martinborough Water Treatment Plant – Incident Review

Prepared for South Wairarapa District Council

SWDC-R01-11

April 2019

Document Details	
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Author	Jonathan Church	
Reviewer	Iain Rabbitts	
Approver	Dr Jason Colton	

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1 Introduction

E.Coli, an indicator of faecal contamination, was detected in the Martinborough water supply on the 30th of January 2019. A boil water notice was put in place on the 1st of February. The boil water notice remained in place until the 21st of February.

Lutra were engaged to provide an independent review of the contamination incident. South Wairarapa District Council (SWDC) had the following objectives for this incident review report:

- To describe the incident.
- To identify potential intervention points that could have helped prevent this incident happening.
- To recommend corrective actions that will prevent a repeat of the incident.

2 Background Information

2.1 Water Source

Water for the Martinborough supply is sourced from two bores – Herricks Bores 3 and 4 – located adjacent to the Ruamahanga River on a private dairy farm (Figure 1). The bores are classified as not secure (Morris and Mzila, 2019) and according to the Water Safety Plan (Graham, 2015) require 4 Log protozoa treatment. It is noted that *Cryptosporidium* testing undertaken between June 2016 and July 2017 (SWDC, 2019) showed no *Cryptosporidium* oocysts detected, indicating that the source is likely to require a maximum of 3 Log protozoal treatment. However, this sample data has not yet been assessed by the Drinking Water Assessor (DWA).

Figure 1 – Location of water source and water treatment plant.

Herricks Bore No.3 is 11.5m deep and Herricks Bore No.4 is 9.4m deep. The aquifer is unconfined and highly permeable (Morris and Mzila, 2019).

61 bore water samples have been taken since 2003 and no *E.Coli* have been detected (SWDC, 2003-2019). The most recent sample was taken in December 2018.

The bore water has a near neutral pH (lab data – average 6.9), low turbidity (online average of 0.037NTU), low organic carbon content (online average of 98.2% UVT), elevated dissolved manganese (lab data - average 0.049 mg/L) and dissolved iron (lab data - average 0.058 mg/L), and elevated hardness (lab data - average of 197mg/L).

There are no assigned P2 determinands.

2.2 Water Treatment Plant

The bore water was untreated until the installation of an ultraviolet (UV) disinfection process in 2011. This was designed as a protozoa barrier and applied a UV dose of 12mJ/cm^2. The UV models are Berson IL450+ configured in a duty/standby arrangement. The certificate of validation is based on the USEPA method. The UV plant is validated up to a flow of 26.1L/s with a UVT of 90% and a flow of up to 61.4 L/s with a UVT of ≥ 98% UVT. The UV

plant was upgraded in April 2018 when the target applied dose was increased to 40mJ/cm^2 to provide additional bacteriological disinfection.

The UV treated water is dosed with sodium carbonate to increase the pH of the treated water.

There is no chlorination process. The water is transferred to the reticulation system without any disinfectant residual.

The water treatment plant is operated by Citycare under contract to South Wairarapa District Council.

2.3 Supply Zone

Water is pumped directly from the bores, through the water treatment plant to the reticulation system. There are four reservoirs located at the far end of the system providing a total storage volume of approximately 4000 m^3 (Figure 2).

Figure 2 – Location of treated water storage reservoirs.

The Martinborough supply zone has a population of 1,505 (Environmental Science and Research, 2017).

3 Drinking Water Standards Compliance

The Drinking Water Standards for New Zealand 2005 (Revised 2018) (Ministry of Health, 2018), referred to simply as DWSNZ, define the minimum performance requirements for a water supply scheme. It is noted that recent changes to the DWSNZ did not come into effect until 1st March 2019 and therefore the previous version of the DWSNZ – The Drinking Water Standards for New Zealand 2005 (Revised 2008) were in effect at the time of the incident. The requirements of this version of the DWSNZ are defined in the following sections.

3.1 Water Source

The water source compliance requirements for the Martinborough water supply along with recent performance are summarised in Table 1. It is noted that the bores are classified as non-secure.

Table 1 – Water source DWSNZ compliance requirements and recent performance

Requirement	Compliance Achieved[1]	
	2017-2018	2018-2019 to date[2]
Radiological compliance [3]	Yes	Yes

Notes: [1] The compliance year runs from 1st July to 30th June. [2] Lutra assessment based on information available. [3] Radiological compliance requires testing against a range of radiological parameters. Testing must be undertaken once every 10 years. Sampling was completed in June 2016.

3.2 Water Treatment Plant

The water treatment compliance requirements for the Martinborough water supply along with recent performance are summarised in Table 2. It is noted that SWDC report against bacteriological compliance using Criterion 1 – *E.Coli* monitoring. Compliance against Criterion 5 – UV disinfection is shown in Table 2 for information only.

Table 2 – Water treatment plant DWSNZ compliance requirements and recent performance

Requirement	Compliance Achieved[1]	
	2017-2018	2018-2019 to date[2]
Protozoal compliance	No[3]	No[4]
Bacteriological compliance – Criterion 1	No	Not reviewed
Bacteriological compliance – Criterion 5	No[5]	No[6]
Chemical compliance	Yes	Not reviewed

Notes: [1] The compliance year runs from 1st July to 30th June. [2] Lutra assessment based on information available. [3] DWA annual review deemed Citycare staff not competent to calibrate instruments that ensure compliance is met. [4] Citycare staff failed DWA competency audit in November 2018 therefore still not competent to calibrate instruments to ensure compliance is met. No UV applied during Incident. [5] UV dose not sufficient to achieve Criterion 5. [6] UV dose not controlled correctly therefore not achieving correct UV dose in addition to no UV applied during incident and Citycare staff not being audited by DWA for competency to calibrate UV instruments (UVI and UVT) to ensure compliance is met.

The DWA identified in their annual review (July 1st 2017 – 30th June 2018) (Central North Island Drinking Water Assessment Unit, 2018) that Citycare operations staff were not competent to calibrate instruments that ensure compliance is met. The DWA undertook an audit of two Citycare staff members in November 2018 (Central North

Island Drinking Water Assessment Unit, 2018) and assessed their competency to calibrate pH meters, turbidity meters and free available chlorine analysers. Both operators failed this assessment and there were also non-conformances on record keeping. The two Citycare staff members were re-assessed on 27-28th March 2019 and found to be competent to calibrate pH meters, turbidity meters and free available chlorine analysers.

Lutra reviewed the compliance reporting spreadsheet (SWDC, 2018) used by South Wairarapa District Council to determine online protozoal and bacteriological compliance. Multiple cell reference and calculation errors were found, the net result of which was an under-reporting of non-compliance.

It was noted that in reviewing online data that the treatment plant was operational without UV (the most probable cause of the incident) on a prior occasion – 3rd April 2018 to 17th April 2018.

3.3 Supply Zone

The water supply zone compliance requirements for the Martinborough water supply zone along with recent performance are summarised in Table 3.

Table 3 – Supply zone DWSNZ compliance requirements and recent performance

Requirement	Compliance Achieved[1]	
	2017-2018	2018-2019 to date[2]
Bacteriological compliance	No[3]	No[4]

Notes: [1] The compliance year runs from 1st July to 30th June. [2] Lutra assessment based on information available. [3] Maximum interval between samples exceeded. No positive *E.coli* results from samples taken. [4] Positive *E.Coli* samples during incident.

3.4 Summary

At the time of the incident the plant was not compliant with the DWSNZ[1] and in fact had never been compliant with the DWSNZ. Sampling errors or omissions meant the supply zone was non-compliant with DWSNZ. Operators were assessed by the DWA and found not to be competent to calibrate instruments. Record keeping was assessed by the DWA as being non-conforming.

[1] As assessed by Lutra on information available.

4 Description of Incident

4.1 Incident Timeline

A timeline of the incident is presented in Table 4.

Table 4 – Incident Timeline

Time	Event	Comments
Wednesday 16th Jan 09:50	Sample taken at Martinborough school with following results[2]: • <1 MPN/100mL *E.Coli* • 19 MPN/100mL Total Coliforms • 750 cfu/mL HPC @ 35 degrees • 5700 cfu/mL HPC @ 22 degrees	Results received on 17th due to lab processing time. SWDC report that the sample point is on the school lateral and maintenance was undertaken around the time of this sample. No action taken.
Wednesday 23rd Jan 10:40	Sample taken at Martinborough water treatment plant (treated water) with following results: • <1 MPN/100mL total Coliforms • <1 cfu/mL HPC @ 35 degrees • 1 cfu/mL HPC @ 22 degrees	Results received on 24th due to lab processing time. *E.Coli* is not tested for at the plant. The next sample at the plant was taken on the 29th Jan.
Wednesday 23rd Jan 11:00	Sample taken at Martinborough school with following results: • <1 MPN/100mL *E.Coli* • <1 MPN/100mL total Coliforms • 1 cfu/mL HPC @ 35 degrees • 39 cfu/mL HPC @ 22 degrees	Results received on 24th due to lab processing time.
Wednesday 23rd Jan 18:08	Power cut occurs. UVT analyser fault at water treatment plant causes loss of UVT signal.	Power cut occurred from 18:08 to 21:00.
Wednesday 23rd Jan 18:08 to 23rd Jan 21:08	UVT analyser remains out of service. Bore water is pumped to supply without UV treatment.	

[2] *E.Coli* must be non-detectable. It is an immediate DWSNZ compliance failure if they are present. Total coliforms should be non-detectable but it is not a DWSNZ compliance failure if they are detected. Heterotrophic plate counts (HPC) are used as an indicator of change in a reticulation system. They are not included in DWSNZ. A non-chlorinated system should target less than 500 cfu/mL.

Wednesday 23rd Jan 21:08 to 23rd Jan 23:02	Plant stopped.	
Wednesday 23rd Jan 23:02 to Thursday 24th Jan 14:28	UVT analyser remains out of service. Bore water is pumped to supply without UV treatment.	
Thursday 24th Jan 15:00	The operations staff are reported to have entered a manual UVT of 95% into the UV controller to enable its operation.	
Tuesday 29th Jan 10:50	Sample taken at Martinborough water treatment plant (treated water) with following results: • <1 MPN/100mL *E.Coli* • <1 MPN/100mL total Coliforms • 3 cfu/mL HPC @ 35 degrees • 120 cfu/mL HPC @ 22 degrees	Results received on 30th due to lab processing time. Previous sample taken on 23rd Jan @ 10:30. No samples taken between 23rd and 29th.
Tuesday 29th Jan 11:15	Sample taken at Martinborough school with following results: • 2 MPN/100mL *E.Coli* • 5 MPN/100mL total Coliforms • 51 cfu/mL HPC @ 35 degrees • 220 cfu/mL HPC @ 22 degrees	Results received on 30th due to lab processing time.
Wednesday 30th Jan 16:17	SWDC receive notification of *E.Coli* detection in water supply.	
Wednesday 30th Jan 16:53	SWDC notify Regional Public Health (RPH) by email.	
Wednesday 30th Jan 17:00	Sample taken at Martinborough school with following results: • <1 MPN/100mL *E.Coli* • <1 MPN/100mL total Coliforms • 2500 cfu/mL HPC @ 35 degrees • 2000 cfu/mL HPC @ 22 degrees	Results received on 1st Feb 10:30 due to lab processing time.

Wednesday 30th Jan 17:15	Sample taken at SWDC offices with following results: • <1 MPN/100mL total Coliforms • 10 cfu/mL HPC @ 35 degrees • 43 cfu/mL HPC @ 22 degrees	Results received on 1st Feb 10:30 due to lab processing time. *E.Coli* is not tested for.
Thursday 31st Jan 09:00	Sample taken at Martinborough school with following results: • <1 MPN/100mL *E.Coli* • <1 MPN/100mL total Coliforms • 570 cfu/mL HPC @ 35 degrees • 620 cfu/mL HPC @ 22 degrees	Results received on 1st at 10:30 due to lab processing time.
Thursday 31st Jan 09:30	Sample taken at SWDC offices with following results: • <1 MPN/100mL total Coliforms • 22 cfu/mL HPC @ 35 degrees • 18 cfu/mL HPC @ 22 degrees	Results received on 1st at 10:30 due to lab processing time.
Thursday 31st Jan 10:30	RPH and SWDC phone discussion held on investigating source and confirming remedial action at school (alternative water source provided).	RPH sought confirmation alternative water source had been provided to the school.
Thursday 31st Jan 14:00	Sample taken at reservoir sample tap with following results: • 2 MPN/100mL *E.Coli* • 12 MPN/100mL total Coliforms • 7 cfu/mL HPC @ 35 degrees • 28 cfu/mL HPC @ 22 degrees	Results received on 1st at 13:36 due to lab processing time.
Friday 1st Feb 13:36	SWDC receive notification of *E.Coli* detection in reservoir sample tap sample taken on 31st. RPH and SWDC hold a phone discussion on further positive result and requirements for remedial action (Boil Water Notice).	
Friday 1st Feb 14:00	Boil Water Notice issued and source of alternative water supplies organised in consultation with RPH.	
Friday 1st Feb to Tuesday 5th Feb	Samples taken daily at multiple locations in the network. *E.Coli* was detected in each of the daily samples from the reservoir sample tap. Counts of 2,3,4 and 1 MPN/100mL. SWDC investigated potential contamination routes.	

Saturday 2nd Feb	Martinborough Country Fair. Tankers provided as alternative water source (filled with water from Masterton District Council).	
Sunday 3rd Feb	Wellington Water offers SWDC assistance with *E.Coli* response. Multiple Wellington Water emergency water bladders deployed.	
Saturday 2nd Feb 11:15 to Sunday 3rd Feb 08:00	UV plant operating at approx. half required UV dose.	No explanation provided by SWDC.
Monday 4th Feb	*E.Coli* detected at Martinborough golf course (1 MPN/100mL) and Fairway Drive (1 MPN/ 100mL).	Results received on 5th due to lab processing time.
Monday 4th Feb	Formal request for assistance from SWDC to Wellington Water	
Monday 4th Feb	Reservoirs sequentially chlorinated to 6mg/L of free available chlorine and limited area of the reticulation system in the vicinity of the reservoirs also chlorinated.	
Tuesday 5th Feb	SWDC, Wellington Water workshop. Plan put in place to review all potential contamination sources and eliminate or mitigate all identified risks. Possible sources of contamination identified by the group: • UV plant malfunction allowing untreated source water into supply; • Ingress in to reservoirs; • Backflow; • Air valves; • Loss of system pressure due to system shutdowns. Extensive sampling programme commenced. Boil Water Notice lifting plan development commenced.	
Tuesday 5th Feb	SWDC, RPH and Wellington Water teleconference.	Workshop discussion

Wednesday 6th Feb	SWDC, RPH and Wellington Water teleconference.	Progress and situation update.
Thursday 7th Feb	SWDC, RPH and Wellington Water teleconference.	Progress and situation update.
Thursday 7th Feb 17:00	Wellington Water received first UV plant performance data.	
Friday 8th Feb	Issues with UV plant performance identified in the data. Continued work on boil water notice lifting plan.	
Friday 8th Feb	SWDC, RPH and Wellington Water teleconference.	
Saturday 9th Feb	Reservoir cleaning continues.	
Sunday 10th Feb 10:30	SWDC, Wellington Water, RPH and Lutra teleconference.	
Sunday 10th Feb 21:50	UV plant performance data for February 2019 received.	
Monday 11th Feb 11:00	SWDC, Wellington Water and Lutra meeting at SWDC offices. RPH dialled in. Urgent review of UV plant performance & controls initiated. Lutra assistance commenced.	
Monday 11th Feb	Reservoirs 2 and 4 superchlorinated then fully drained.	10 mg/L of free available chlorine for not less than 12 hours.
Monday 11th Feb	SWDC, Wellington Water, RPH and Lutra teleconference.	Update on work completed, issues identified, plan to lift BWN
Tuesday 12th Feb	Reservoir cleaning continues.	
Wednesday 13th Feb	Reservoir 1 superchlorinated then fully drained.	10 mg/L of free available chlorine for not less than 12 hours.
Wednesday 13th Feb	Meeting to review plan to lift boil water notice. Regional Public Health, SWDC, Wellington Water and Lutra. Plan agreed.	
Wednesday 13th Feb	UV plant performance data received for 2018.	

Wednesday 13th Feb & Thursday 14th Feb	Lutra engineers attend site to perform initial checks on UV plant.	Large number of operational and control issues identified requiring software changes.
Wednesday 13th Feb	RPH, Lutra and Wellington Water meet in Wellington and agree plan to lift the boil water notice.	
Thursday 14th Feb	Reservoir 3 superchlorinated then fully drained.	10 mg/L of free available chlorine for not less than 12 hours.
Friday 15th Feb	Software changes made remotely by Qtech. Changes not validated or tested.	Collective agreement (SWDC, Wellington Water and Lutra) that the plant was producing DWSNZ compliant water and that flushing programme could start.
Friday 15th Feb & Saturday 16th Feb	Flushing of reticulation system during evening and in to the night by Citycare and Wellington Water staff. Flow management issues and water quality issues caused plant to shut down. Plant could not be restarted. Flushing ceased. A sample taken at Nelson Rd after the flushing had a positive *E.Coli* result (1 MPN/100mL).	Sample taken at Nelson Rd on 15th Feb at 23:05. Results received 17th Feb.
Saturday 16th Feb	Plant restarted manually. Abandonment of flushing programme.	
Sunday 17th Feb	Flushing of remaining reticulation system during evening and in to the night. 3 days of extensive *E.Coli* testing started after flushing completed. Nelson Rd was re-flushed, and three samples were taken on the 17th, 18th and 19th all of which were clear.	
Monday 18th Feb	Lutra engineers attend site and perform commissioning and UV plant validation checks. UVI reference sensor not available for UVI sensor check (DWSNZ monthly compliance requirement). One was borrowed from Carterton DC to allow the checks to be undertaken.	Unable to perform full checks due to unavailability of system control and data acquisition (SCADA) programmer. Collective agreement (SWDC, Wellington Water and Lutra) that the plant was producing DWSNZ compliant water at this stage.

Tuesday 19th Feb	Lutra engineers attend site with independent SCADA programmer, fix issues and perform remaining commissioning checks.	Collective agreement (SWDC, Wellington Water and Lutra) that the plant was producing DWSNZ compliant water at this stage.
Thursday 21st Feb	Boil water notice lifted in consultation with RPH after 3 days of clear *E.coli* samples.	

4.2 Probable Cause

The most probable cause of the contamination incident was the malfunction of the UV plant on the 23rd and 24th January 2019 allowing untreated water to enter the supply network and charge the storage reservoirs. However, it should be noted that the cause cannot be definitively identified. It is still possible that the contamination occurred within the network itself (e.g. backflow, air valves).

4.3 Water Treatment Plant Operation on 23rd and 24th January 2019

Given that the malfunction on the UV plant on the 23rd and 24th January was the most probable cause of the incident a more detailed review of the actions of the plant operator(s) was required. A timeline was developed from the operator's account of the power failure on the 23rd January 2019 (Citycare, 2019) and is presented in Table 5.

Table 5 – Operator notes on power cut

Time	Action (as noted by Operator)	Comments
23/1/19		
18:00	Power cuts in South Wairarapa and Masterton.	
18:09	Common Lamp Failure alarm at Ruamahanga Pump Station UV site.	
18:19	Ruamahanga Pump Station site battery Low alarm.	
18:40	Operator arrived at site.	
19:04	Operator contacts GVElectrical requesting assistance – he is told that someone will get back to him.	
19:11	Operator contacts second Operator for advice on the next course of action. Second Operator advised that the WTP would "probably resume normal production when the power came back on" and contacts the SWDC Assets and Operations Manager on how critical it was to get the power back on.	The lack of knowledge of how the plant would respond to power failure is concerning.
	GVE rang back saying he was available if required.	

19:33	Operator contacted SWDC Asset and Operations Manager and was advised that the reservoirs had 3 days storage and to “leave any remedial work to the next day”.	It is not clear whether the plant was left in a state where it would restart if the power came back on.
	Operator contacted second Operator again and relayed instructions received from the SWDC Asset and Operations Manager and locked up the WTP.	
20:30	GVE called again and was told that remedial work would be carried out the next day.	
21:08	Power was restored and UV common alarm received by the operator on his way home.	The operator interpreted this to be the “return alarm” that indicated that the UV was functional and no longer in an alarm state.
21:19	Pump 4 fault received by the operator indicating that the plant was now only running on bore 3.	
24/1/19		
07:30	Operator attends site and clears pump 4 fault and notices that UVT meter is not displaying the usual screen. Operator tries to reset the UVT meter several times without success. Operator checks the UV units and may have cleared a fault on UV One display.	
08:15	Operator arrives at SWDC and first discusses the UVT fault with second Operator.	
13:00	Operator meets second Operator on site, and they try to reset the UVT meter without success. Second Operator noticed that UV two is not dosing and tried stopping and starting the unit several times.	This is a considerable time lag between noticing a problem with a critical piece of equipment and the action
	They called the Berson agent (Davey). He told them how to put in a fixed UVT value into the UV system so it would dose “correctly”. The Berson agent made the comment that the UV should not have started without a UVT value.	Value of 95% entered. Record data was later shown to be inaccurate due to incorrect scaling of the UVT reading in the Datran control system.
	The Berson agent provided all the operating values that had been disrupted by the power outage. Two values were required from the manufacturer that were provided the following Monday to get the UV operational again.	PLCs and control systems should be protected during a power failure so that data is not lost.

5 Potential Intervention Points

In evaluating the events and actions before, during and after the incident, a benchmark was required. The public inquiry into the Havelock North contamination incident identified six principles for safe drinking water (Government Inquiry into Havelock North Drinking Water, 2017) which were used as that benchmark. These are repeated here for information:

Principle 1: A high standard of care must be embraced

Unsafe drinking water can cause illness, injury or death on a large-scale. All those involved in supplying drinking water (from operators to politically elected representatives) must therefore embrace a high standard of care akin to that applied in the fields of medicine and aviation where the consequences of a failure are similarly detrimental to public health and safety. Vigilance, diligence and competence are minimum requirements and complacency has no place.

Principle 2: Protection of source water is of paramount importance

Protection of the source of drinking water provides the first, and most significant, barrier against drinking water contamination and illness. It is of paramount importance that risks to sources of drinking water are understood, managed and addressed appropriately. However, as pathogenic microorganisms are found everywhere, complete protection is impossible and further barriers against contamination are vital.

Principle 3: Maintain multiple barriers against contamination

Any drinking water system must have, and continuously maintain, robust multiple barriers against contamination appropriate to the level of potential contamination. This is because no single barrier is effective against all sources of contamination and any barrier can fail at any time. Barriers with appropriate capabilities are needed at each of the following levels: source protection; effective treatment; secure distribution; effective monitoring; and effective responses to adverse signals. A "source to tap" approach is required.

Principle 4: Change precedes contamination

Contamination is almost always preceded by some kind of change and change must never be ignored. Sudden or extreme changes in water quality, flow or environmental conditions (for example, heavy rainfall, flooding, earthquakes) should arouse particular suspicion that drinking water might become contaminated. Change of any kind (for example, personnel, governance, equipment) should be monitored and responded to with due diligence.

Principle 5: Suppliers must own the safety of drinking water

Drinking water suppliers must maintain a personal sense of responsibility and dedication to providing consumers with safe water. Knowledgeable, experienced, committed and responsive personnel provide the best assurance of safe drinking water. The personnel, and drinking water supply system, must be able to respond quickly and effectively to adverse monitoring signals. This requires commitment from the highest level of the organisation and accountability by all those with responsibility for drinking water.

Principle 6: Apply a preventive risk management approach

A preventive risk management approach provides the best protection against waterborne illness. Once contamination is detected, contaminated water may already have been consumed and illness may already have occurred. Accordingly, the focus must always be on preventing contamination. This requires systematic assessment of risks throughout a drinking water supply from source to tap; identification of ways these risks can be managed; and control measures implemented to ensure that management is occurring properly. Adequate monitoring of the performance of each barrier is essential. Each supplier's risk management approach should be recorded in a living WSP which is utilised on a day to day basis.

Potential intervention points that may have prevented the incident occurring have been identified and are presented in Table 6.

Table 6 – Potential Intervention Points Prior to the Incident.

Potential Intervention Point	What should have been done?
Decision to not provide residual disinfection	Chlorination of the supply is essential to provide a robust multi-barrier treatment process and to protect against contamination of the reticulation system. If chlorination had been a part of the Martinborough WTP this incident would not have happened. Principle 3: maintain multiple barriers against contamination; Principle 5: Suppliers must own the safety of drinking water and Principle 6: Apply a preventative risk management approach.
Plant design	The design should have provided a means to demonstrate that flow was not by-passing UV treatment. Limit switches should have been installed on the UV reactor isolation valves and the plant by-pass should have been removed. Principle 5: Suppliers must own the safety of drinking water.
Plant construction record documents	A complete set of construction record documents should have been developed, including P&IDs, wiring diagrams and functional description. The standard of documentation was found to be very poor and made fault finding during the incident challenging. Principle 1: A high standard of care must be embraced
Plant labelling	Electrical and control cables should be clearly labelled. The plant cabling was found to be unlabelled and in a very untidy state making fault finding during the incident challenging. Principle 1: A high standard of care must be embraced
Plant programming and commissioning	A functional description should have been prepared. Factory acceptance test (FAT), site acceptance test (SAT) and full commissioning checks should have been completed and documented for the original UV installation and for the UV modifications in April 2018. Clearly none of these were performed since there was found to be a basic lack of understanding of the DWSNZ compliance requirements. A number had either not been programmed in at all or had been programmed incorrectly. Principle 1: A high standard of care must be embraced

Reliance on one person for plant control and SCADA programming	A SCADA maintenance and support system should have been set up without reliance on a single individual at the automation company. The vulnerability of the current arrangements became apparent during the incident when the sole person with knowledge of how the system operates was not available for critical testing. Principle 1: A high standard of care must be embraced and Principle 6: Apply a preventative risk management approach.
Operations and maintenance manuals.	An operations manual with clear description of how the plant operates, how it will respond to failures and with troubleshooting guides should have been prepared. Had this information been available, the operator may have been able to refer to the documents and provide a better response to the power failure and UVT instrument failure. Principle 1: A high standard of care must be embraced.
Lack of UVI reference sensor and training to carry out reference sensor checks	SWDC and Citycare should have UVI reference sensors available and staff should be trained in their use. UVI sensor reference checks are a monthly DWSNZ compliance requirement. Neither SWDC or Citycare had a UVI reference sensor at the time of the incident. Citycare staff did not appear to be trained in the UVI reference check process and records of previous checks were not available for review. Principle 1: A high standard of care must be embraced; and Principle 5: Suppliers must own the safety of drinking water.
No authorised staff available for calibrations and standardisations.	Operations staff should be assessed as competent to undertake all instrument calibrations and standardisations. This should cover turbidity, UVT and UVI sensor checks for UV plants. Citycare staff were assessed as not competent to carry out calibrations and standardisations by the DWA in accordance with the Drinking Water Standards in November 2018. It is noted that the DWA only audited the operators on turbidity, pH and FAC analysers since they do not cover competency for UVI sensor checks or for UVT calibrations. Principle 1: A high standard of care must be embraced.
Calibration and standardisation records missing	All calibration and standardisation activities should be recorded, performed and tracked according to a schedule. The DWA identified non-conformances with the frequency of calibration activities and with record keeping, noting problems with missing and incomplete records. Principle 1: A high standard of care must be embraced; and Principle 5: Suppliers must own the safety of drinking water.

DWSNZ compliance reporting spreadsheet incorrect	All compliance reporting should be based on a validated and quality-controlled procedure. The spreadsheet used by SWDC to report on compliance was found to contain multiple errors which under-reported non-compliance. Principle 1: A high standard of care must be embraced.

Potential intervention points during the incident have been identified and are presented in Table 7.

Table 7 – Potential Intervention Points During the Incident.

Potential Intervention Point	What should have been done?
First Detection of *E.coli*	A boil water notice should have been issued immediately[3]. The presence of *E.coli* means that faecal contamination of the water has occurred and any delay in issuing the boil water notice risks the health of the community. Principle 5: Suppliers must own the safety of drinking water.
Power cut causing plant shut down	Operators should know how the plant responds to power outages and what is required to protect public health. A more vigilant approach should have been taken with the plant being isolated until a detailed examination of the problems and remedial action could be undertaken. Principle 4: Change precedes contamination.
Operator notices fault with UVT instrument and fails to take immediate action.	This should have led to an immediate plant shutdown as a critical piece of equipment was not functioning correctly. Principle 5: Suppliers must own the safety of drinking water.

[3] Note this is a Lutra opinion. RPH states that for an *E.Coli* transgression in the distribution zone, the DWSNZ requires an investigation of cause and remedial actions. A boil water notice is one action to be considered based on initial assessment of cause.

6 Corrective Actions

The investigation of the contamination incident as documented in this report has highlighted a number of corrective actions which should be implemented. These are presented in Table 8 and are linked to the 6 principles of safe drinking water.

Table 8 – Corrective Actions

No.	Details
Principle 1: A high standard of care must be embraced	
1.1	SWDC should review the importance of drinking water supply within their organisation and those of their contractors specifically: a) Review the findings of the Havelock North Stage 1 and Stage 2 Reports. b) Ensure all staff and contractors involved with the supply of drinking water understand their personal responsibility for the health of the public. c) Ensure that the contracts with suppliers and contractors are set up for 24/7 support. d) Ensure that all staff are adequately trained to perform their duties including calibrations.
1.2	Ensure that the plant documentation is current and relevant, specifically: a) Ensure the process schematics (P&IDs) are available and current. b) Ensure the functional description describing plant operation is available and current. c) Provide a detailed operations manual that details the plant functionality, troubleshooting and standard operating procedures for the operators. d) Provide a schedule of maintenance checks, verifications and calibrations for the whole plant.
1.3	Ensure compliance data is analysed correctly (by a system that has been through adequate quality assurance) and presented in a way that is easily understood, specifically: a) Use an independent compliance reporting system to report compliance.
1.4	Replace existing outdated control system with a modern programmable logic controller (PLC) and SCADA system, specifically: a) Any failure will lead to a plant shutdown and the inability to deliver unsafe drinking water. b) Ensure that as-built documentation is accurate such that troubleshooting problems is not constrained because of lack of information.

1.5	Ensure that calibrations and verifications are carried out and recorded in accordance with the standards, specifically: a) Calibration and verifications are carried out by DWA approved personnel. b) Equipment required for calibrations and verifications is available. c) Calibration and verification records are available for inspection. d) Staff are competent and authorised to carry out calibrations.
Principle 2: Protection of the source water is of paramount importance	
2.1	SWDC should perform a catchment risk assessment and source protection zone study to develop a better understanding of the source risk.
Principle 3: Maintain multiple barriers against contamination	
3.1	Chlorination of the supply is essential to provide a robust multi-barrier treatment process and to protect against contamination of the reticulation system. It is noted that dissolved iron and manganese levels in the source water will cause aesthetic issues when chlorine is added to the water. To avoid these an iron and manganese removal process will need to be installed at the water treatment plant.
Principle 4: Change proceeds contamination	
4.1	Ensure operators, supervisors, and managers are sufficiently trained to understand the importance of change on a treatment plant, specifically: a) What constitutes a change. b) What action to take in the event of a change. c) Authority of operators to respond to a change. d) Understanding the change cannot compromise drinking water safety.
Principle 5: Suppliers must own the safety of drinking water	
5.1	Operators, supervisors and managers must understand their drinking water supply and understand the importance of each critical element, specifically: a) Understanding critical instruments and their function in the water supply. b) Understanding how the plant will respond to upset conditions (e.g. resumption of power after a power cut). c) Eliminate the ability to by-pass the UV treatment process. d) Understanding that a positive *E.coli* means the water is contaminated with faecal matter.
Principle 6: Apply a preventative risk management approach	
6.1	Undertake a systematic assessment of risks throughout the drinking water system, specifically: a) Identify source risks, treatment risks and reticulation risks. b) Identify mitigation measures for each risk. c) Monitor the performance of each barrier.

7 Conclusion

The seriousness of this incident cannot be overstated. It is a matter of luck that this was not another Havelock North[4] or a Walkerton[5]. *E.Coli* is an indicator organism. It indicates the presence of faecal material. It indicates the likely presence of pathogenic bacteria and some strains of *E.Coli* themselves can be deadly (*E.Coli* O157:H7).

E.Coli was present in the Martinborough system for **at least** three days before a boil water notice was put in place.

This incident has highlighted shortcomings in the design, operation and management of the Martinborough water supply system.

The incident response and management was largely reactive and unplanned until Wellington Water became involved and provided a risk based rationale to the decision making process.

It is understood that SWDC have a wish to improve their performance and that of their contractors. To this end they have committed to installing a manganese removal plant within the next 6-12 months, which will enable full time chlorination. In addition to this commitment, SWDC should adopt the six fundamental principles of drinking water safety for New Zealand and consider implementing the corrective actions presented in this report.

[4] The Havelock North incident occurred in August 2016. Campylobacter contamination caused approx. 5,500 (33% of the population) people to be violently ill and was linked to the deaths of three people.
[5] The Walkerton incident occurred in April 2000. *E.Coli* (O157:H7) and Campylobacter contamination caused 2,500 people (50% of the population) to get ill and seven people died.

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Appendix 3 – Implications of chlorination on winemaking

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FS-50-W

Commercial Winemaking Production Series

Chlorine Use in the Winery

Why not to use any chlorinated products anywhere in the winery

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Hypochlorite

Cleaning products that contain hypochlorite (OCl–) should not be used anywhere near the winery, especially the production and hospitality areas, specifically the tasting room.

Formation of 2,4,6-trichloroanisole

Presence of chlorine is one of the two major contributors to the production of 2,4,6-trichloroanisole (TCA), the compound that causes a moldy, musty cork taint. TCA's sensory threshold is one of the lowest in nature at around 1 to 5 nanograms per liter. The second requirement for TCA formation is the presence of molds. They are common even in watertight caves and cellars due to frequent rinsing of tanks and floors and the desirably high relative humidity (80 percent or more) in barrel rooms, which minimizes evaporative losses of wine. Chlorinated and mold-methylated phenolics from materials such as wood or cork bark are known as chloroanisoles, and their equally potent bromine analogues are bromoanisoles.

Airborne TCA

Dirty floor drains in particular can become a potential source for TCA formation in the winery as they combine chlorine residues from rinses with the rich microbial activity needed for its formation.

If TCA is subsequently present in the cellar air, it can be introduced into the wine when barrels or tanks are emptied and refilled. The tiny amount of TCA that it takes to spoil a wine lot corresponds to equally small residues of chlorine from sanitizing operations. TCA is also easily absorbed by corks stored in the bottling line hopper and by open bags of bentonite or filter pads, so proper and separated storage of all processing aids is crucial.

Chlorinated cleaning products

Unfortunately, it is not always easy to immediately recognize that a product contains hypochlorite. Look closely at the ingredient list in dishwasher detergents (for tasting glasses), kitchen and bathroom cleaners, disinfecting wipes, and anti-allergen and sanitizing sprays. You also should watch out for fabrics and textiles that were treated with proprietary coating techniques that bind hypochlorite and prolong the presence of chlorine bleach. Because it is easily inactivated on contact with organic matter, chlorine often bleaches the dirt without removing it, while leaving a "clean" (only by association) smell behind.

Water quality

In addition to eliminating hypochlorite-based cleaning products, wineries should not use chlorinated municipal water for

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processing grapes or wine, such as when rehydrating yeast or malolactic bacteria or when rinsing destemmer-crushers, tanks, or hoses, etc. If there are no other options, the water must be pretreated with high-capacity, in-line carbon filters that are maintained on a very regular basis and exchanged frequently.

Chlorine dioxide

In recent years, chlorine dioxide (ClO_2) has been introduced to sterilize containers in the food industry. So far, research has been unable to determine if the use of ClO_2 could contribute traces of hypochlorite that are sufficient to produce troubling amounts of TCA in the winery.

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Wineries and breweries use filters to combat chlorine

10 Nov, 2016 6:00am

3 minutes to rea

Hastings brewer Matt Smith, owner of Brave Brewing Co, with the carbon filter he has installed to extract the chlorine during beer production. PHOTO/WARREN BUCKLAND

Hawkes Bay Today

Chlorine in the water has left a bad taste in the mouths of Hawke's Bay brewers and winemakers.

Hastings-based Brave Brewing Co owner Matt Smith said chlorinated water did not make good beer.

"It has to be taken out so we had to put in a carbon filter. It cost about $1000 - I was not anticipating I would have to do it, as I was lucky enough when I started brewing to just take it from the water supply."

He said if you brewed with chlorinated water it came through in the flavour of the finished beer.

"It's called chlorophenol flavour - it's a harsh flavour and you don't want it in there."

He said there was no health issue, it was just a matter of protecting the premium beer flavour and brand.

Even if the Hastings District Council decided not to continue with chlorination, he said he would probably hold on to the filter, and put a bypass in so it could be used if necessary in the future.

"It was a pain for me, but not as much as for other businesses when they were tackling the water contamination."

He noted that in general food businesses were attracted to Hawke's Bay partly because of the water, and having chlorine in it didn't fit with that.

At Roosters Brewery, owner Chris Harrison said they had also put in a carbon filter, and it was a "bit of a scramble" at the time to install it once the chlorine was added to the water, but costs were kept down by installing it themselves.

Vidal Estate winemaker Hugh Crichton said they were checking the chlorine levels regularly, and had installed a filter they already had within the business.

"Chlorine in wine can have significant quality effects and we are very mindful of that - if the chlorine level is above what is acceptable we have to pass it through the carbon filter to strip it out.

"The downside of high levels of chlorine from a quality point of view could be significant in terms of aromatics and flavour, but the filter system is effective for this."

At Pask Winery, winemaker and co-owner Kate Radburnd said different filtration systems had been introduced on the bottling line as a result of the added chlorine.

"It's had an impact, we have been able to overcome it, but it's taken a bit of work."

Hastings mayor Lawrence Yule said he was aware of the filtering action that was required, and was keen to find a resolution to this that did not involve chlorine if possible.

"I can give businesses and the public an assurance they will be kept fully informed as we move into the longer term options following the Havelock North water contamination."

He said decisions around this would include the Ministry of Health and subsequently the Government inquiry findings.

"I want to support our pure water reputation and its use in food and beverages."

Hastings water services manager Brett Chapman said a number of businesses and major food processors did not access the Hastings supply for processing as they had their own bores and used the town water supply for service needs only.

Appendix 4 – Frequently Asked Questions (FAQs) re chlorination

Temporary Chlorination of the Martinborough water supply – FAQs

1. **Why are you planning to temporarily chlorinate?**

   The Martinborough water supply currently has UV treatment and is the only water supply in the Wairarapa that is not chlorinated. The two recent positive *E.coli* indicator tests, have led to Boil Water Notices and are a signal for further investigation to understand why this is happening.

   Community wellbeing is our number one priority, which means we have to temporarily chlorinate to protect the health of residents and visitors to Martinborough. This will be done in close collaboration with our wine and beer making industries.

2. **What do the health authorities say?**

   SWDC is working closely with Regional Public Health. Regional Public Health have advised that they will be satisfied with the multiple-barrier approach of UV treatment and temporarily chlorination in order for the Boil Water Notice (BWN) to be lifted. We have to temporarily chlorinate, otherwise a compliance order will be issued from Regional Public Health.

3. **What is the history of positive *E.coli* test results in the Martinborough water supply?**

   The UV treatment plant was installed in 2011 and has generally been effective. There had been precious positive *E.coli* results in 2012, 2014 and 2016. Follow up samples indicated a BWN was not required. Since 2016, there have been no positive *E.coli* results prior to the two recent incidents in February and April 2019.

   These recent positive results have not come from the water source but from the distribution network. Progress to date in identifying the source of the *E.coli* leads us to believe that part of the problem is back flow from private connections to the Martinborough water supply. Contractors are systematically checking connections, but it's unlikely that this exercise will completely eliminate the problem.

   Last three months:

   30 January 2019 – positive *E.coli* test result – probably cause due to UV malfunction, during a power cut. A Boil Water Notice was issued on 2 February 2019. The Boil Water Notice remained in place for 21 days.

   9 April 2019 – positive *E.coli* test result – this time from the reservoirs and Shooting Butts Road areas. 3 further tests were clear. The Boil Water Notice has been in place for 14 days to date (23 April 2019).

4. **How long will the Martinborough water be chlorinated for?**

   This depends on the results of SWDC's investigations. These investigations are expected to take a number of months to complete and the town water supply will remain chlorinated during this time.

5. **Why didn't you move to chlorinate the water supply the first time *E.coli* was found?**

   In 2016, the issues with manganese in the water reacting with chlorine was considered prohibitive, because of likely discolouration to the water. However, we are working towards installing a manganese removal plant, which will solve this problem. It's important that we can effectively chlorinate the water supply if we need to.

6. **So how will temporary chlorination work in the meantime without the manganese removal plant in place?**

   We're confident that during the winter months we can operate with a bore that has lower levels of manganese, which shouldn't affect the colour of the water too much.

7. **How likely is it that the Martinborough water supply will be permanently chlorinated?**

   A decision on the permanent chlorination of the Martinborough water supply has yet to be made. This decision depends on the result of SWDC's investigations and further discussions between Regional Public Health, Lutra water consultants, and Wellington Water.

8. **How will you keep us updated on the situation?**

   SWDC will be updating the website and Facebook pages on a regular basis.

9. **Is there any place in Martinborough to get access to unchlorinated water now?**

   No. If your water has a chlorine taste, try putting the water in a container or jug in the fridge (this helps the chlorine dissipate from the water). Boiling the water also helps take the chlorine taste out of the water.

10. **Is this issue similar to the water quality incident in Havelock North?**

    No. Havelock North had a number of unwell residents (that was traced to the water supply) while we have none.

11. **Who is responsible for the water network?**

    Each city council owns their respective reticulation network. Recently, SWDC voted to join Wellington Water (a Council Controlled Organisation). In the future, Wellington Water will manage the entire water network on behalf of SWDC as it does for its other five council owners (Greater Wellington Regional Council, Hutt City Council, Wellington City Council, Porirua City Council and Upper Hutt City Council).

12. **Is this just a ploy to permanently chlorinate the water because it's easier to do?**

    No. A decision on the permanent chlorination of the Martinborough town water supply water has yet to be made.

13. **What will be the impact of chlorine in the water?**

    SWDC will do everything possible to reduce the impact on the community. We will air scour the network and will proactively flush the network. Some people may experience a bit of discolouration initially, but it shouldn't be too bad. This short-term problem is part of having safe water while working towards a permanent solution.

14. **What about my pet fish?**

    If you have fish outside in ponds you will need to either turn down in-coming water to an absolute trickle (this dilutes the chlorine level to a safe amount for your fish), or fill up drums of water and let them stand for at least 24-hours before using (the UV of the sun evaporates chlorine). For fish tanks or bowls inside, fill up a container of water and let it sit for at least 24-hours and then only replace 1/3 of this water at a time with what is in the tank already. If you're still worried, de-chlorinating kits can be purchased from pet stores.