

CITY OF WHITE ROCK

City of White Rock

Emergency Response Plan White Rock Water Department

Updated March 28, 2018

Engineering and Municipal Operations

P: 604.541.2181 | F: 604.541.2190

877 Keil Street, White Rock BC, Canada V4B 4V6

City of White Rock

15322 Buena Vista Avenue, White Rock BC, Canada V4B 1Y6



www.whiterockcity.ca

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Emergency Response Plan – City of White Rock Water Utility (updated March 28, 2018). The following sections outline the City’s Emergency Response Plan for the Water Utility.

1. System Information

Table 1.1 System Information

System Name and Address	White Rock Water Distribution System
Basic Description and Location of System Facilities	76 km of distribution pipe, 7 wells, 344 fire hydrants, 4 storage reservoirs, 3 pressure reducing valve stations, 2 booster stations, 1150 valves, average daily consumption of 6 million litres.
Location/Town	City of White Rock
Population Served and Service Connections from Division of Drinking Water Records	21,000 people (including some areas of Surrey and Semiahmoo First Nation) 4,000 connections
System Owner	The City of White Rock
Name, Title, and Phone Number of Person Responsible for Maintaining, Updating and Implementing the Emergency Plan	Jim Gordon Director Engineering & Municipal Operations 604-541-2184

1.1. Chain of Command

The first response step in any type of emergency is to contact the person at the top of the list. The person at the top of the list should be the one who is responsible for managing emergencies and making key decisions.

Table 1-2: Chain of Command- Lines of Authority

	Name and Title
1	Dan Bottrill-CAO
2	Jim Gordon-Director
3	Dr. Saad Jasim- Manager, Utilities
4	Phil Lemire-Fire Chief
5	Dustin Abt-Operations Manager
6	Simon Pither-Lead Operator In his absence: Dean Brown

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If the person at the top of the list in Table 1-2 is unavailable during an emergency, protocol is to contact the next person in order on Table 1-2 and so on down the list.

Each person in Table 1-2 is aware of the components and their responsibilities and required actions in an emergency given that they may be the first to be notified.

1.2. Emergency Incidents

The events in table 1-3 are events that may cause water system emergencies. They are organized by highest risk rating to lowest risk rating. The risk ranking was evaluated by populating all of the possible scenarios that may have caused the emergency to occur and assigning a Likelihood and Consequence value to each, producing a Risk Score. Scores below 2 are considered Low risk, between 3-4 are Medium risk, and above 4 are High risk. Refer to the Appendices for the Risk Matrix and Scenarios for each Emergency Event in Table 1-3 below.

Table 1-3: Events That Cause Emergencies

Type of Event	Risk (High-Med-Low)	Comments
Bacteriological results exceeding the prescribed limits	High	
Loss of disinfectant	High	
Chemical results exceeding the prescribed limits	High	
Power failure	High	
Pressure loss	High	
Fire	Low to High	Water infrastructure and public buildings. Risk varies based on location, duration and size of fire.
Equipment breakdown	Medium	
Flood	Medium	
Distribution line break	Medium	
Turbidity exceeding the limits	Medium	
Alternate potable water supply	Medium	
Staffing	Medium	
Drought	Low	
Reduction or loss of water in well	Low	
Earthquake	Low	
Hazardous materials spill in vicinity of sources or system lines	Low	
Vandalism or terrorist attack	Low	
Cyber attack	Low	

1.3. Emergency Notification Procedures

Table 1-4: Emergency Contact Information

Emergency Notification List				
Organization/Department	Name/Title or Company	Telephone	Night or Cell Phone	E-mail
Local Law Enforcement	White Rock RCMP			
White Rock Fire Department	Phil Lemire (Fire Chief)			
BC Health Authority Fraser Health	Binny Sivia			
BC Health Authority-Environmental Health	Fraser Health Environmental Health Officer			
BC Health Authority-Medical	Fraser Health Medical Health Officer			
BC Health Authority After Hours	Fraser Health Public Health Answering System			
Health Emergency Management BC	Deidre McLachlan			
Water Supply	City of White Rock			
Emergency Coordinator	Phil Lemire			
Neighboring Water System				
City of Surrey	Manager of Utilities			
	Water Engineer			
	Water Works Department			
Drug and Poison Information Centre	BC DPIC			
BC Environment	BC Environment Ministry			
Kerr Wood Leidal	Kris Sundberg			
Whiteside Engineering	Neal Whiteside			
Stantec Consulting	Bartek Puchajda			
Wastewater Treatment Plant	Metro Vancouver Plant			
Priority Contact List				
Hospitals or Clinic(s)	Peace Arch Hospital			
Public or Private Schools	School District (Surrey)			
	Peace Arch Elementary			
	White Rock Elementary			
Semiahmoo First Nations	Joanne Charles			

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Service / Repair Notifications	
Utility-BC Hydro	
Electrician-Crescent Electric Ltd.	Ken Morrice
Gas-Fortis BC	
Water Testing-Exova Canada Inc	19575-55A Ave
Sewer-City of White Rock	Neil Koleszar
Telephone-Telus	
Plumber-Hilltop Plumbing	
Pumper-Dougness Holdings	
"Call Before You Dig"	BC One Call
Rental-Star Rentals	
Well Drilling-Precision Pumps Inc.	
Piper Supplier-Emco	
T&S Backhoe Services	
Traffic-Valley Traffic	
4Refuel	
Media Notifications	
Newspaper- Local	Peace Arch News
Newspaper-Regional Regional	Sun Newsroom
Radio	CBC
Radio	News 1130
Radio	CKNW
TV Station	Global News
TV Station	CTV
ReCollect Web App	Resident notification

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1.4. Health Advisory Procedures

A health advisory should be issued if the water quality and human health are in question. The health advisory must give advice or recommendations on how to protect water system customer's health when drinking water is considered unsafe. Health advisories usually take the form of water warnings or boil water advisories; these advisories should provide clear messages and be well communicated.

Table 1-5: Procedures for Issuing a Health Advisory

<p>Procedures</p> <p><i>Who is responsible:</i> <i>Chief Administrative Officer (CAO)</i> <i>or designate:</i> 1. <i>Director of Engineering & Municipal Operations (DEMO)</i> 2. <i>Emergency Coordinator (EC)</i> 3. <i>Utility Manager (UM)</i></p>	<p>Issue water quality advisory in consultation with Fraser Health</p> <ul style="list-style-type: none"> • Determine which water quality advisory to issue • Refer to Appendix B: Water Notice Samples <p>For any threats to the water system including emergencies or incidents that may result in a boil water notice or water quality advisory, contact the following:</p> <p>During office hours (8:30am-4:30pm, Monday to Friday):</p> <p>Binny Sivia Environmental Health officer (604-870-7902 or 604-870-7900) Medical Health Office– contact the MHO Line (604-870-7903)</p> <p>After hours: Public Health Answering service (604-527-4806)</p>
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<p>Notifications</p> <p><i>Who is responsible:</i> <i>Chief Administrative Officer (CAO)</i> <i>or designate:</i></p> <ol style="list-style-type: none"> 1. Director of Engineering & Municipal Operations (DEMO) 2. Emergency Coordinator (EC) 3. Utility Manager (UM) 	<p>Place notification letter on City website. Use Facebook, Twitter and Talk White Rock, etc.</p> <p>Contact media. Refer to section 1.4.</p> <p>Depending on area affected notify the following:</p> <ul style="list-style-type: none"> • All City facilities (City Hall, Operations Building, Centennial Arena, Kent Street Community Centre, White Rock Community Centre, Centre of Active Living, Water Operations, RCMP, Fire Hall, Library, City Washrooms and public fountains) • Peace Arch Hospital • White Rock Elementary school • Peace Arch Elementary School • Semiahmoo First Nations • City of Surrey (Some Surrey residents are serviced by White Rock water) • White Rock Business Improvement Association (BIA) • South Surrey White Rock Chamber of Commerce <p>If applicable place digital road signs at:</p> <ul style="list-style-type: none"> • Johnson Road and North Bluff Road • Marine Drive and Stayte Road • Stayte Road and North Bluff Road • Bergstrom Road and North Bluff Road <p>Placement of sandwich boards, if required</p> <ul style="list-style-type: none"> • Marine Drive and Bergstrom Road • Oxford Street and North Bluff Road • Stayte Road and Thrift Avenue • Stayte Road and Columbia Road
<p>Follow-up Actions</p> <p><i>Who is responsible:</i> <i>Chief Administrative Officer (CAO)</i> <i>or designate:</i></p> <ol style="list-style-type: none"> 1. Director of Engineering & Municipal Operations (DEMO) 2. Emergency Coordinator (EC) 3. Utility Manager (UM) 	<p>Boil advisories should be rescinded in a distribution area after it is confirmed that all upstream areas are free of contamination.</p> <ul style="list-style-type: none"> • Refer to Appendix B Water Notice Samples

1.5. Emergency Response Action Plans

In case of an emergency, follow these general steps:

1. Analyze the type and severity of the emergency;
2. Take any action needed to save lives;
3. Contact City emergency coordinator;
4. Take action to reduce system damage and injuries and reduce environmental and property damage;
5. According to priority demand, make appropriate repairs, and
6. Return the system to normal operation.

In the event of an emergency that is listed in Table 1-3, the following procedure shall be followed:

Table 1-6: Bacteriological Results Exceeding the Prescribed Limits

Description	<p>Water sampling has resulted in a bacteriological result higher than the allowed limit.</p> <ul style="list-style-type: none"> Refer to Table 1 in Appendix A for the associated risks Refer to the Canadian Guideline for Drinking Water Quality for regulatory limits
<p>Immediate Actions</p> <p><i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)</p>	<p>Notify Fraser Health of the exceedance.(UM)</p> <p>Conduct another water quality sample to ensure there was not a sampling or laboratory error.(LOWD)</p> <p>Initiate source-to-tap study to determine cause of contamination. (LOWD)</p> <p>Establish extent of contamination based on sampling program results. If contamination is at the supply; do not initiate any flushing of distribution system until supply is not contaminated. .(LOWD)</p> <p>Implement flushing program for affected zones; establish unidirectional flow throughout zone, increase chlorine residual as advised by Fraser health, flush main supply line from pump station to the reservoir, refill reservoir, flush major water mains. .(LOWD)</p>
<p>Notifications</p> <p><i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)</p>	<p>Fraser Health Authority (DEMO)</p> <ul style="list-style-type: none"> Issue Public Boil Water Advisory in consultation with Fraser Health(UM) Refer to Appendix B: Water Notice Samples(UM) Refer to Table 1-5: Procedure for issuing a health advisory(UM)

Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	Conduct water quality testing in each affected area and monitor results. <i>(LOWD)</i> Boil advisories should be rescinded in a distribution area after it is confirmed that all upstream areas are free of contamination. <i>(DEMO)</i> , <i>(UM)</i> <ul style="list-style-type: none">• Refer to Appendix B: Water Notice Samples
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Table 1-7: Loss of Chloramination Disinfection

Description	Water did not receive the correct chlorine/ammonia dosages at reservoir.
Immediate Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	Correct chloramine levels. (LOWD) Check Total and Free chlorine residuals in distribution system. (LOWD) If required, implement flushing program for affected zones; establish unidirectional flow throughout zone, increase disinfectant residual as advised by Fraser health, flush main supply line from pump station to the reservoir, refill reservoir, flush major water mains. (UM)
Follow-up Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	Drinking water advisories should be rescinded in a distribution area after it is confirmed that all upstream areas have been properly treated. (DEMO), (UM) <ul style="list-style-type: none"> • Refer to Table 1-5, Follow-up Actions (UM) • Refer to Appendix B: Water Notice Samples (UM)

Table 1-8: Chemical and Physical Parameter Exceeding the Prescribed Limits

Description	<p>Water sampling has found water is contaminated or overfed with chemicals.</p> <ul style="list-style-type: none"> Refer to Table 3 in Appendix A for the associated risks Refer to the Canadian Guideline for Drinking Water Quality for regulatory limits
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Identify the chemical or element that is over the limit and the source of exceedance. (LOWD)</p> <p>If the exceedance is in the well, compare values to distribution system laboratory data. (LOWD)</p> <p>Notify Fraser Health of the exceedance. (LOWD)</p> <p>Determine if a Water Quality Advisory is required. (LOWD)</p> <p>Conduct another water quality sample to ensure there was not a sampling or laboratory error. (LOWD)</p> <p>Check and adjust dosage going in to water distribution system, if it is a controlled chemical. (LOWD)</p> <p>Monitor chemical dosage of water until the correct chemical dosage is reached. (LOWD)</p> <p>If required, implement flushing program for affected zones; establish unidirectional flow throughout zone, increase chlorine residual as advised by Fraser health, flush main supply line from pump station to the reservoir, refill reservoir, flush major water mains. (UM)</p> <p>If required, make arrangements for alternate water supply delivery to high-risk customers (e.g. hospitals).</p> <ul style="list-style-type: none"> Refer to Table 1-16: Alternate potable water supply(UM)
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Fraser Health Authority (DEMO)</p> <p>Issue Water Quality Advisory in consultation with Fraser Health (UM)</p> <ul style="list-style-type: none"> Determine which water quality advisory to issue Refer to Appendix B: Water Notice Samples Refer to Table 1-5 and follow Notification procedure
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Conduct water quality testing in each affected area and monitor results. (LOWD)</p> <p>Water Quality advisories should be rescinded in a distribution area after it is confirmed that all upstream areas are free of contamination (DEMO),(UM)</p> <ul style="list-style-type: none"> Refer to Appendix B: Water Notice Samples

Table 1-9: Power Failure


Description	A widespread power outage. See Table 4 in Appendix A for the associated risks.
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	

Table 1-10: Pressure Loss

Description	<p>Pressure loss in the system due to leak in pipe, pipe burst, closed valve, high use due to fire fighting.</p> <ul style="list-style-type: none"> Refer to Table 5 in Appendix A for the associated risks
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Locate the source of the pressure loss. <i>(LOWD)</i></p> <p>Monitor the water system to ensure the reservoir levels, pressures are sufficient. If the reservoir is depleting, ensure all well pumps are on and pumping to fill the reservoirs. Call in additional staff, if required. <i>(LOWD)</i></p> <div style="background-color: #cccccc; text-align: center; padding: 50px; font-size: 100px; font-weight: bold;">Redacted</div> <p>Notify the City's Operation Department and advise if a road closure is required to make repairs. <i>(LOWD)</i></p> <p>Call BC One Call before you dig, if any excavation work is required. Replace or repair the pipe if source of the pressure loss is due to a main break. Follow AWWA procedures. <i>(LOWD)</i></p> <p>Take bacteriological samples for analysis to make sure the main has not been contaminated, per AWWA procedures. <i>(LOWD)</i></p> <p>If there is a loss of system pressure, a precautionary Water Advisory may need to be issued. Follow procedure in Table 1-5: Procedures for issuing a health advisory. <i>(LOWD)</i></p>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Notify the City's Operations Department who can update the City's website and other social media sources. <i>(UM)</i></p> <p>Notify the businesses and residences affected by the pressure loss. Include the hours that they will not have access to water services. <i>(UM)</i></p> <p>Notify Fraser Health for any water main break over 100 mm. If there is a significant loss of system pressure, a precautionary Water Advisory may need to be issued. Follow procedure in Table 1-5: Procedures for Issuing a Health Advisory. <i>(UM)</i></p>

Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Notify the City's Operations Department, business and residents affected by the pressure loss that the water is returned to regular service. <i>(UM)</i></p> <p>Conduct water quality testing in each affected area and monitor results. <i>(LOWD)</i></p> <p>Water Quality advisories should be rescinded in a distribution area after it is confirmed that all upstream areas are free of contamination. <i>(DEMO), (UM)</i></p> <ul style="list-style-type: none">• Refer to Appendix B: Water Notice Samples
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Table 1-11: Fire

Description	<p>A fire at one of the water facilities may interrupt the delivery of water to customers.</p> <p>A large fire at a large residential complex may deplete the reservoir levels faster than the well pumps can recharge the reservoirs.</p> <ul style="list-style-type: none"> Refer to Table 7 in Appendix A for associated risks
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Contact White Rock Fire Rescue if fire is at a water facility. <i>(LOWD)</i></p> <p>Determine which facilities are affected. Coordinate efforts with other City departments. <i>(LOWD)</i></p> <p>If fire is at public building, contact White Rock Fire to determine exact location of fire, size, and expected duration to extinguish fire. <i>(LOWD)</i></p> <p>Monitor the water system to ensure the reservoir levels, pressures are sufficient. Call in additional staff, if required. <i>(LOWD)</i></p> <p>Determine if fire pumps at Merklin Reservoir are required. Note: this will drain the reservoir more quickly. <i>(LOWD)</i></p> <div data-bbox="662 919 1511 1163" style="background-color: #cccccc; text-align: center; padding: 50px;"> <h1>Redacted</h1> </div> <p>Maintain communication with White Rock Fire and provide updates on water supply. <i>(LOWD)</i></p> <p>If there is a loss of system pressure, follow procedure in Table 1-10: Pressure Loss. <i>(LOWD)</i></p>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	<p>White Rock Fire Rescue City of Surrey Peace Arch Hospital Peace Arch Elementary Semiahmoo First Nations White Rock Elementary Fraser Health, if any type of advisory is issued.</p> <ul style="list-style-type: none"> Refer to Table 1-5: Procedures for issuing a health advisory <p>Health Emergency Management BC<i>(UM), (CO)</i></p>
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water (LOWD)</i>	<p>If an advisories was issued it should be rescinded after it is confirmed that the system is restored to normal operations. <i>(DEMO), (UM)</i></p> <ul style="list-style-type: none"> Refer to Table 1-5, Follow-up Actions

Table 1-12: Equipment Breakdown

Description	<p>Failure of a pump, or valve, etc. See Table 6 in Appendix A for the associated risks.</p>
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<div style="background-color: #cccccc; text-align: center; padding: 100px 0;"> <h1 style="margin: 0;">Redacted</h1> </div>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Notify people and businesses that may be affected by the repair or replacement. Inform them of the hours that water services will not be available. <i>(UM), (LOWD)</i></p> <p>If there is a possibility for contamination, a precautionary Water Advisory may need to be issued. Follow procedure in Table 1-5: Procedures for Issuing a Health Advisory. <i>(UM), (LOWD)</i></p>
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>A detailed record should be kept of every break, piece of equipment or leak that is repaired. Record the suspected cause of the break as well. <i>(LOWD)</i></p> <p>Drinking water advisories should be rescinded in a distribution area after it is confirmed that all upstream areas have been properly treated. <i>(DEMO), (UM)</i></p> <ul style="list-style-type: none"> • Refer to Table 1-5, Follow-up Actions • Refer to Appendix B: Water Notice Samples

Table 1-13: Flood

Description	White Rock is exposed to the ocean which could result in coastal flooding hazards. Flooding could potentially contaminate the drinking water. See Table 7 in Appendix A for the associated risks.
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	Redacted
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Contact Fire Department and exchange any relevant information. (LOWD), (LOWD)</p> <p>Fraser Health, if there is a possibility for contamination, a precautionary water advisory may need to be issued. Follow procedure in Table 1-5: Procedures for issuing a health advisory. (UM)</p>
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	Redacted

Table 1-14: Distribution Line Break

Description	<p>Break in water mains are usually reported from the public, fire department, large commercial user or the city staff. See Table 8 in Appendix A for the associated risks.</p>
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<div style="background-color: #cccccc; text-align: center; padding: 100px;"> <h1>Redacted</h1> </div>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Notify the City's Operations Department who can update the City's website and other social media sources. Advise if a road closure is required to make repairs. (UM)</p> <p>Notify people and businesses affected by distribution line break. (UM)</p> <p>Notify the Fire Department if any hydrants are put out of service and notify them when the hydrants are put back in to service. (LOWD)</p> <p>Notify the BC Environment Ministry if break had potential environmental effect on the receiving environment. (UM)</p> <p>Notify Fraser Health if break is over 100mm in diameter. (UM)</p>
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<p>Advise water operations when repair is complete. (LOWD)</p> <p>Monitor water quality data and determine if the event can be terminated. (LOWD), (UM)</p> <p>Notify Fraser Health of the results of the water quality tests after the repair. (UM)</p>

Table 1-15: Turbidity Exceeding the Limits

Description	<p>Water sampling has resulted in a turbidity result higher than the allowed limit.</p> <ul style="list-style-type: none"> • Refer to Table 1 in Appendix A for the associated risks • Refer to the Canadian Guideline for Drinking Water Quality for regulatory limits
Immediate Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	<p>Determine if there is an issue at the water supply. Make adjustments to operations as required to reduce turbidity. (LOWD)</p> <p>Determine the extent of the area affected, contact Fraser Health and determine if an advisory should be released. (LOWD), (UM)</p> <p>Resample water at sampling sites. (LOWD)</p> <p>Implement a flushing program, if required drain affected reservoirs if needed. (LOWD)</p> <p>If required, make arrangements for alternate potable water supply to high-risk customers (e.g. hospitals). (LOWD), (UM)</p> <ul style="list-style-type: none"> • Refer to Table 1-16
Notifications <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	<p>If there is a precautionary Water Advisory to be issued, follow procedure in Table 1-5: Procedures for Issuing a Health Advisory. (UM)</p>
Follow-up Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	<p>Conduct water quality testing in each affected area and monitor results. (LOWD)</p> <p>Boil advisories should be rescinded in a distribution area after it is confirmed that all upstream areas are free of contamination. (DEMO), (UM)</p> <ul style="list-style-type: none"> • Refer to Appendix B: Water Notice Samples

Table 1-16: Alternate Potable Water Supply

Description	Water distribution system is inoperable, potable water supply is needed from a secondary source. See Table 10 in Appendix A for the associated risks.
Immediate Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	Determine which of the following is the best solution for the given situation; water trucks, bottled water or open the emergency water supply connections to the City of Surrey. (DEMO), (UM)
Notifications <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD) Communications Officer (CO)	White Rock Fire Rescue(CO) Contact the City of Surrey and determine if they can supply White Rock water (CO) Peace Arch Hospital(CO) Peace Arch Elementary(CO) Semiahmoo First Nations(CO) White Rock Elementary(CO) Fraser Health, if any type of advisory is issued. (UM) Contact a vendor for a water truck or bottled water for delivery to residences. (UM) Make the appropriate public notifications and media releases. Refer to Table 1-5. (UM), (CO)
Follow-up Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD) Communications Officer (CO)	Continue to deliver a secondary source of potable water until the original system is repaired or back in service. (UM) Advise the public when the water system is back to normal operating parameters. (UM), (CO)

Table 1-17: Staffing

Description	Lack of staff during an emergency.
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	Contact City of White Rock staff: <i>(UM)</i> <ul style="list-style-type: none"> • Water Operations • Operations & Parks • Facilities • Fire Rescue • Recreation & Culture Contact designated contractors for staffing. <i>(UM)</i>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	If no staff is available, call surrounding districts such as the City of Surrey or Langley and ask for staffing aid. <i>(UM)</i>
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	Review the reasoning behind the lack of staff. Document any ideas to improve the situation for the future. <i>(UM)</i>

Table 1-18: Drought

Description	Water levels are decreasing in the wells due to excessive consumption during hot temperatures. See Table 11 in Appendix A for the associated risks.
Immediate Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Operations Manager (OM) Lead Operator-Water Department (LOWD)	Monitor the water system to ensure the reservoir levels, pressures are sufficient. If the reservoir is depleting, ensure all well pumps are on and pumping to fill the reservoirs. Call in additional staff, if required. (UM) Contact the City of Surrey to determine if Surrey can supply White Rock water through the emergency valves. (UM)
Notifications <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	Issue a water use restriction according to the severity of the drought. (UM) Notify the Fire Department of the water reservoir levels. (UM), (LOWD) Make appropriate public notifications and media releases. Refer to Table 1-5. (UM)
Follow-up Actions <i>Who is responsible:</i> Director of Engineering & Municipal Operations (DEMO) Utility Manager (UM) Lead Operator-Water Department (LOWD)	Monitor the levels of the wells and reservoirs. (LOWD) Rescind water use restrictions when water levels are back to normal. (UM)

Table 1-19: Reduction or Loss of Water in Well

Description	<p>Over pumping in a well has caused a well to run dry or have a significant loss of water. See Table 12 in Appendix A for the associated risks.</p>
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<div data-bbox="667 333 1507 495" data-label="Text"> <h1>Redacted</h1> </div>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	
	<p>Monitor levels of water in the wells. (LOWD)</p> <p>Remove the water use restriction once levels in the wells have been replenished. (UM)</p>

Table 1-20: Earthquake

Description	An Earthquake can potentially damage infrastructure or disrupt the water distribution system
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	Redacted

<p>Notifications</p> <p><i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i></p>	<p>Notify the City's Operations Department who can update the City's website and other social media sources. (UM)</p> <p>Notify the White Rock Fire Department. (UM)</p> <p>Notify the businesses and residences affected by any service loss. Including, Peace Arch Hospital, schools and Semiahmoo First Nations. (UM)</p> <p>Notify Fraser Health. (UM)</p> <p>If there is a significant loss of system pressure, a precautionary Water Advisory may need to be issued. Follow procedure in Table 1-5: Procedures for Issuing a Health Advisory. (UM)</p> <p>Issue a water use restriction if water system cannot supply adequate flow. (UM)</p> <p>Issue Water Quality Advisory in consultation with Fraser Health (UM)</p> <ul style="list-style-type: none"> • Determine which water quality advisory to issue • Refer to Appendix B: Water Notice Samples • Refer to Table 1-5 and follow notification procedures <p>Make appropriate public notifications and media releases. (UM), (CO)</p>
<p>Follow-up Actions</p> <p><i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i></p>	<p>Monitor water levels, conditions and perform water sampling. (LOWD)</p> <p>Conduct water quality testing in each affected area and monitor results. (LOWD)</p> <p>Water Quality advisories should be rescinded in a distribution area after it is confirmed that all upstream areas are free of contamination. (UM)</p> <ul style="list-style-type: none"> • Refer to Appendix B: Water Notice Samples

Table 1-21: Hazardous Materials Spill in Vicinity of Sources or System Lines

Description	Hazardous spill around well, reservoir, or near water mains.
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<div data-bbox="678 277 1507 436" data-label="Text"> <h1>Redacted</h1> </div>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	

Table 1-22: Vandalism or Terrorist Attack

Description	Any criminal act or threat that compromises the quality of water being distributed to the City of White Rock. See Table 13 in Appendix A for the associated risks.
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i>	<div data-bbox="669 333 1507 495" data-label="Text"> <h1>Redacted</h1> </div>

Notifications

Who is responsible:

*Director of Engineering & Municipal Operations
(DEMO)*

Utility Manager (UM)

Lead Operator-Water

Department (LOWD)

Communications Officer (CO)

Redacted

Follow-up Actions

Who is responsible:

*Director of Engineering & Municipal Operations
(DEMO)*

Utility Manager (UM)

Lead Operator-Water Department (LOWD)

Table 1-23: Cyber-Attack

Description	<h1>Redacted</h1>
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	

Table 1-24: Other

Description	Give a general description of the emergency.
Immediate Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	<div data-bbox="672 275 1503 436" data-label="Text"> <h1>Redacted</h1> </div>
Notifications <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	
Follow-up Actions <i>Who is responsible:</i> <i>Director of Engineering & Municipal Operations (DEMO)</i> <i>Utility Manager (UM)</i> <i>Lead Operator-Water Department (LOWD)</i> <i>Communications Officer (CO)</i>	

Communications

How Will White Rock Inform Residents of Water Quality Advisories

Communications plays a key role in how well we are able to respond during an emergency. We must be able to alert all the users on our system as soon as possible, especially if there is any possible risk to their health from drinking the water.

- Who will speak on behalf of the City:
 - o Table 1-2 Chain of Command-Lines of Authority: The person at the top of the list will be the one who is responsible for speaking on behalf of the City
 - o If the person at the top of the list in Table 1-2 is unavailable during an emergency, protocol is to contact the next person in order on Table 1-2 and so on down the list
- How will notices of advisories be disseminated to the public:
 - o When less than 100 homes are affected, City of White Rock staff will go house-to-house and leave door hangers. They will then return to notify residents in the same manner once the advisory is lifted.
- When a greater number of homes are affected, White Rock will take the following steps:
 - o a news release is issued to all media (Table 1-4 Emergency Contact Information, Media Notifications) which then quickly disseminate the information;
 - o an automated telephone call or email to everyone who has signed up for White Rock's ReCollect notification application;
 - o an alert on the City of White Rock's website;
 - o an RSS feed to everyone who is signed up for this kind of notice;
 - o an alert to everyone who is signed up on White Rock's Twitter and Facebook sites;
 - o If applicable place digital road signs at:
 - Johnson Road and North Bluff Road
 - Marine Drive and Stayte Road
 - Stayte Road and North Bluff Road
 - Bergstrom Road and North Bluff Road
 - o Placement of sandwich boards, if required
 - Marine Drive and Bergstrom Road
 - Oxford Street and North Bluff Road
 - Stayte Road and Thrift Avenue
 - Stayte Road and Columbia Road

Procedure for Notifying Owners of Public Buildings, Multi-Family Complexes, Schools, etc.

Notify the following facilities, if required (refer to Table 1-4 for Contact Information):

- All City facilities (City Hall, Operations Building, Centennial Arena, Kent Street Community Centre, White Rock Community Centre, Centre of

Active Living, Water Operations, RCMP, Fire Hall, Library, City Washrooms and public fountains)

- Peace Arch Hospital
- White Rock Elementary school
- Peace Arch Elementary School
- Semiahmoo First Nations
- City of Surrey (some Surrey residents are serviced by White Rock water)
- White Rock Business Improvement Association (BIA)
- South Surrey White Rock Chamber of Commerce

Public buildings, multi-family complexes, schools, businesses etc. are to be notified both verbally and with a written notice delivered by City of White Rock staff resources. If no verbal communication is available a written notice should be left in a conspicuous location (mail box or taped to door) advising that it is their responsibility to inform the public of water notice or advisory by posting signs at locations within the facility including:

- Inside and outside of every exit or entrance door
- Both sides of each door that accesses stair wells
- At the elevator buttons on each floor, inside each elevator car
- On the outside of each public washroom door
- Above all water fountains

Sample of form for recording the notification of public buildings, multi-family complexes, schools, etc.

	Building/Address/Telephone	Verbal Notification Name/Date/Time	Written Notice Mail box/taped/Date/Time
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
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Completed by _____

- Who will decide on the wording of the notices
 - Table 1-2 Chain of Command-Lines of Authority: The person at the top of the list will be the one who is decide on wording of the notices;
 - If the person at the top of the list in Table 1-2 is unavailable during an emergency, protocol is to contact the next person in order on Table 1-2 and so on down the list
- What the proposed key messages will be for each scenario
 - Refer to Appendix B – Water Notice Samples:
 - Water quality advisory
 - Boil water notice
 - Do not use water notice

-

Annual Review of the Emergency Response Plan for White Rock Water Department.

Being prepared for an emergency requires a regularly updated emergency response plan. The City will implement the plan as part of a continuous improvement model for emergency planning that includes: emergency management training, emergency exercises and program evaluation. Each procedure will be reviewed and, if possible, tested on a yearly basis and revisions made as necessary.

Appendix A- Risk Matrix and Risk Descriptions

		Risk Matrix		
		Consequence Descriptor		
		Low	Med	High
Likelihood Descriptor	High	3	6	9
	Med	2	4	6
	Low	1	2	3

Appendix A- Risk Descriptions

Table 1: Bacteriological

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Contamination of water in supply due to reduction in disinfectant levels resulting from long residence time of water in pipe caused by incorrectly sized/long service pipe.	Chemical contamination Microbiological contamination	Disinfectant decay due to long residence time of water in pipe due to long service pipe	Med	High	6
General Risks	Contamination of water in supply as a result of chloramine decay and production of nitrites	Chemical contamination Microbiological contamination	As a result of long residence time in network creating chloramine decay and formation of high levels of nitrite	Med	High	6
General Risks	Contamination of water in supply or pressure problems as a result of leaking service pipe	Microbiological contamination Loss of pressure	Due to ingress due to leaking service pipe	High	High	9
General Risks	Contamination of water in supply as a result of unsatisfactory or damaged new connections caused by inadequate installation procedures.	Chemical contamination Microbiological contamination	As a result of unsatisfactory or damaged new connections due to bad installation and failure to follow a suitable code of practice	Med	High	6
General Risks	Contamination of water in supply as a result of back siphonage caused by the lack of appropriate backflow protection	Chemical contamination Microbiological contamination	Resulting from back siphonage due to the lack of appropriate backflow protection, i.e. non-return valve.	Med	High	9
General Risks	Increased water temperature as a result of inadequate design of storage facility or internal pipework	Chemical contamination Microbiological contamination	Warm water due to on site storage above required temp due to inappropriate storage facility/lack of insulation	Med	High	6
General Risks	Contamination of water in supply as a result of loss of chlorine residual caused by increased temperature	Microbiological contamination	Resulting from loss of chlorine residual due to increase in temperature.	Med	High	6
General Risks	Contamination of water in supply as a result of inappropriate plumbing	Chemical contamination Microbiological contamination	Resulting from use of inappropriate plumbing materials	Low	High	3
General Risks	Contamination of water in supply as a result of open storage cistern with no lid.	Chemical contamination Microbiological contamination	Due to open storage tank due to inadequate plumbing work.	Low	High	3
General Risks	Contamination of water in supply as a result of the situation of the storage tank or lack of maintenance.	Microbiological contamination	Resulting from poor condition of on site storage tanks due to lack of inspection/maintenance.	Low	High	3
General Risks	Broken main as a result of PRV failure	Loss of supply Chemical contamination Microbiological contamination	As a result of a broken main due to high pressure due to failure of PRV.	Med	High	6

General Risks	Loss of supply and/or deterioration of water quality as a result of broken main	Loss of supply Chemical contamination Microbiological contamination	As a result of a broken main due to failure of pipe integrity.	Med	High	6
General Risks	Contamination of water as a result of cross-connection	Chemical contamination Microbiological contamination	As a result of connection with private supply due to customer having dual connection, no air gap	Low	High	3
General Risks	Contamination of water due to leaking air valves	Chemical contamination Microbiological contamination	Resulting from ingress of water due to faulty air valve surrounded by water.	Low	Med	2
General Risks	Contamination of water due to failure to follow proper hygiene practice when carrying out repairs.	Chemical contamination Microbiological contamination	Due to ingress of material from excavation and/or poor disinfection procedures.	Med	High	6
General Risks	Contamination of water in supply as a result of connection to mothballed or abandoned assets.	Chemical contamination microbiological contamination	As a result of connection to a main containing stagnant water.	Med	High	6
General Risks	Deterioration of water quality as a result of incorrect sequence of valve operations	Chemical contamination Microbiological contamination	As a result of flow reversal due to the need for rezoning due to the incorrect sequence of valve operations	Med	High	6
General Risks	Loss of supply or pressure or contamination of water in supply as a result of fire service tackling a fire	Loss of supply Loss of pressure Microbiological contamination Chemical contamination	Due to high flow rate or changes in flow patterns, or loss of disinfectant contact time or disturbance of sediment	Low	Med	2
General Risks	Microbiological growth in distribution system as a result of oversized mains	Microbiological contamination	Build up of biofilms in the network due to excessive dwell time as a result of incorrectly sized mains.	Low	High	3
General Risks	Microbiological growth in distribution system as a result of low disinfectant residual	Microbiological contamination	Build up of biofilms in the network due to inadequate residual disinfectant.	Med	High	6
Reservoir Risks	Contamination of water as a result of sediment deposition in reservoir	Chemical contamination Microbiological contamination.	Due to build up of sediment in bottom of reservoir as a result of inadequate maintenance.	Med	High	6
Reservoir Risks	Contamination of water due to ingress of water as a result of inadequate structure or maintenance.	Chemical contamination Microbiological contamination.	Due to lack of structural integrity of reservoir as a result of poor design or maintenance	Low	High	3
Reservoir Risks	Contamination of water due to ingress of organic debris as a result of inadequate	Chemical contamination Microbiological	Due to lack of structural integrity of reservoir as a result of poor design or maintenance	Low	High	3
Reservoir Risks	Contamination of water due to poor hygiene practice when doing planned inspection or maintenance.	Chemical contamination Microbiological contamination.	Due to poor hygiene practice or use of non-approved chemicals.	Med	High	6
Reservoir Risks	Contamination of water as a result of vandalism	Chemical contamination Microbiological contamination.	Due to vandalism, due to lack of secure fencing and structure.	Low	Med	2

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Reservoir Risks	Contamination of water due to access to reservoir by stock or wildlife	Microbiological contamination	Due to lack of secure fencing round reservoir.	Low	Med	2
Reservoir Risks	Contamination of water due vermin accessing reservoir	Microbiological contamination	Due to lack of mesh or flap valve on overflow from reservoir.	Low	High	3
Reservoir Risks	Deterioration of water quality due to thermal stratification	Chemical contamination Microbiological contamination.	Due to hot weather and reservoir being above ground and inadequately insulated and poor circulation	Med	High	6
Reservoir Risks	Deterioration of water quality due to excessive residence time of water in reservoir.	Chemical contamination Microbiological contamination.	Due to long storage time in reservoir and likely loss of disinfectant residual.	Med	High	6
General Risks	Deterioration of water quality due to birds roosting on reservoirs at night	Microbiological contamination	Due to bird roost due to large faecal loading	High	High	9
General Risks	Chemical contamination of raw water as a result of recreational activity within watershed	Microbiological contamination Hydrocarbons	Due to uncontrolled defecation or use of land or water vehicles within watershed	Low	Med	2
Well Risks	Contamination of well during construction	Microbiological contamination Metals Drilling fluids	Cross-contamination by drilling equipment or residual substances used in drilling e.g. Barium released from drilling.	Med	High	6
Well Risks	Contaminated water entering well from upper levels	Microbiological contamination Nutrients	Well casing does not extend above surface or is damaged or deteriorated.	Low	High	3
Well Risks	Contaminated water entering well from surface	Microbiological contamination Nutrients	Well head badly constructed, damaged, or badly maintained.	Low	Med	2
Well Risks	Contaminated water entering well from surface	Microbiological contamination Nutrients	Site prone to flooding due to poor siting and well head not sealed.	Low	Med	2
Well Risks	Contaminated water entering well from surface	Microbiological contamination Nutrients	Inadequate security around well head giving animals access.	Low	Med	2

Table 2: Chloramination Disinfection

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Contamination of water in supply due to reduction in disinfectant levels resulting from long residence time of water in pipe caused by incorrectly sized/long service pipe.	Chemical contamination Microbiological contamination	Disinfectant decay due to long residence time of water in pipe due to long service pipe	Med	High	6
General Risks	Contamination of water in supply as a result of chloramine decay and production of nitrites	Chemical contamination Microbiological contamination	As a result of long residence time in network creating disinfectant decay and formation of high levels of nitrite	Med	High	6
General Risks	Contamination of water in supply as a result of loss of disinfectant residual caused by increased temperature	Microbiological contamination	Resulting from loss of disinfectant residual due to increase in temperature.	Med	High	6
Reservoir Risks	Deterioration of water quality due to excessive residence time of water in reservoir.	Chemical contamination Microbiological	Due to long storage time in reservoir and likely loss of disinfectant residual.	Low	High	3

Table 3: Chemical

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Lead in water in supply picked up from the service pipes and other fittings	Chemical contamination	Resulting from dissolved lead from internal pipework or lead solder.	Low	High	3
General Risks	Contamination of water in supply due to reduction in disinfectant levels resulting from long residence time of water in pipe caused by incorrectly sized/long service pipe.	Chemical contamination Microbiological contamination	Disinfectant decay due to long residence time of water in pipe due to long service pipe	Med	High	6
General Risks	Contamination of water in supply as a result of chloramine decay and production of nitrites	Chemical contamination Microbiological contamination	As a result of long residence time in network creating chloramine decay and formation of high levels of nitrite	Med	High	6
General Risks	Contamination of water in supply as a result of unsatisfactory or damaged new connections caused by inadequate installation procedures.	Chemical contamination Microbiological contamination	As a result of unsatisfactory or damaged new connections due to bad installation and failure to follow a suitable code of practice	Med	High	6
General Risks	Contamination of water in supply as a result of back siphonage caused by the lack of appropriate backflow protection	Chemical contamination Microbiological contamination	Resulting from back siphonage due to the lack of appropriate backflow protection, i.e. non-return valve.	Med	High	6
General Risks	Increased water temperature as a result of inadequate design of storage facility or internal pipework	Chemical contamination Microbiological contamination	Warm water due to on site storage above required temp due to inappropriate storage facility/lack of insulation	Med	High	6
General Risks	Contamination of water in supply as a result of inappropriate plumbing	Chemical contamination Microbiological contamination	Resulting from use of inappropriate plumbing materials	Med	Med	4
General Risks	Contamination of water in supply as a result of open storage cistern with no lid.	Chemical contamination Microbiological contamination	Due to open storage tank due to inadequate plumbing work.	Low	High	3
General Risks	Broken main as a result of PRV failure	Loss of supply Chemical contamination Microbiological contamination	As a result of a broken main due to high pressure due to failure of PRV.	Med	High	6
General Risks	Loss of supply and/or deterioration of water quality as a result of broken main	Loss of supply Chemical contamination Microbiological contamination	As a result of a broken main due to failure of pipe integrity.	High	High	9
General Risks	Contamination of water as a result of cross-connection	Chemical contamination Microbiological contamination	As a result of connection with private supply due to customer having dual connection, no air gap	Med	High	6
General Risks	Contamination of water due to leaking air valves	Chemical contamination Microbiological contamination	Resulting from ingress of water due to faulty air valve surrounded by water.	Low	Low	1
General Risks	Contamination of water in supply as a result of the use of non-approved or inappropriate materials in the network	Chemical contamination	As a result of contact with inappropriate materials.	Low	High	3

General Risks	Contamination of water due to failure to follow proper hygiene practice when carrying out repairs.	Chemical contamination Microbiological contamination	Due to ingress of material from excavation and/or poor disinfection procedures.	Med	High	6
General Risks	Contamination of water in supply as a result of connection to mothballed or abandoned assets.	Chemical contamination microbiological contamination	As a result of connection to a main containing stagnant water.	Med	High	6
General Risks	Deterioration of water quality as a result of incorrect sequence of valve operations	Chemical contamination Microbiological contamination	As a result of flow reversal due to the need for rezoning due to the incorrect sequence of valve operations	Med	High	6
General Risks	Deterioration of water quality in supply as a result of unauthorised connection to the network.	Chemical contamination	As a result of unauthorised connection to the network due to incorrect use of hydrants and standpipes.	Med	High	6
General Risks	Deterioration of water quality due to change in normal flow pattern.	Chemical contamination	Due to mains sediment being disturbed by increased flow.	Med	Med	4
General Risks	Loss of supply or pressure or contamination of water in supply as a result of fire service tackling a fire	Loss of supply Loss of pressure Microbiological contamination Chemical contamination	Due to high flow rate or changes in flow patterns, or loss of disinfectant contact time or disturbance of sediment	Low	High	3
General Risks	Loss of supply or contamination of water in supply as a result of excessive demand in a short period of time	Loss of supply Chemical contamination builders	Lack of communication from external stakeholders, e.g. fire service	Med	High	6
General Risks	Migration of hydrocarbons and other contaminants through pipework as a result of inappropriate materials used in areas of contaminated land	Chemical contamination	Resulting from use of inappropriate materials in areas of contaminated land	Med	High	6
Reservoir Risks	Contamination of water as a result of sediment deposition in reservoir	Chemical contamination bottom Microbiological contamination.	Due to build up of sediment in of reservoir as a result of inadequate maintenance.	Med	High	6
Reservoir Risks	Contamination of water due to ingress of organic debris as a result of inadequate structure or maintenance.	Chemical contamination Microbiological contamination.	Due to lack of structural integrity of reservoir as a result of poor design or maintenance	Low	High	3
Reservoir Risks	Contamination of water due to poor hygiene practice when doing planned inspection or maintenance.	Chemical contamination Microbiological contamination.	Due to poor hygiene practice or use of non-approved chemicals.	Med	High	6
Reservoir Risks	Contamination of water due to reservoir running empty due to faulty or no telemetry.		Chemical contamination Due to disturbance of sediment on floor of reservoir due to low level as a result of lack of alarm.	Med	High	6
Reservoir Risks	Contamination of water as a result of vandalism	Chemical contamination Microbiological contamination.	Due to vandalism, due to lack of secure fencing and structure.	Low	Med	2

Reservoir Risks	Deterioration of water quality due to thermal stratification	Chemical contamination Microbiological contamination.	Due to hot weather and reservoir being above ground and inadequately insulated and poor circulation	Med	High	6
Reservoir Risks	Deterioration of water quality due to poor circulation in reservoir	Chemical contamination	Due to poor design of reservoir	Med	Med	4
Reservoir Risks	Deterioration of water quality due to excessive residence time of water in reservoir.	Chemical contamination reservoir Microbiological contamination.	Due to long storage time in and likely loss of disinfectant residual.	Med	High	6
General Risks	Chemical contamination of raw water as a result of proximity to transport corridor.	Chemical contamination Hydrocarbons	Due to chemical contamination in the source due to spillage from transport corridor (e.g. road or rail tanker) adjacent to source and no containment	Low	Medium	2
General Risks	Contamination of raw water with pesticides	Pesticides	Resulting from pesticides spraying in the watershed due to poor practice.	Med	High	6
General Risks	Changing raw water quality caused by environmental change	Manganese	Due to increase in manganese level resulting from changing weather patterns.	Med	Med	4
Well Risks	Contamination of well during construction	Microbiological contamination Metals Drilling fluids	Cross-contamination by drifting equipment or residual substances used in drilling (e.g. Barium) released from drilling mud	Low	High	3
Well Risks	Deterioration of water quality	Iron manganese	Due to over-production from aquifer, mixing with other zones or biofouling	Med	High	6
Well Risks	Deterioration of water quality	Fluoride Arsenic Uranium Other heavy metals	Due to naturally occurring minerals	Med	High	6
Well Risks	Contamination of aquifer	Hydrocarbons Nutrients	Pesticides Activities within recharge zone or vulnerable aquifer	Med	Med	4

Table 4: Power Failure

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
Pumping Station Risks	Failure of pump control panel resulting in power loss	Loss of supply	As a results of inability to operate pumps due to lack of power	High	High	9
Pumping Station Risks	Failure of pumps due to breakdown and no standby	Loss of supply	As a result of mechanical breakdown and lack of standby pump.	Med	High	6
Pumping Station Risks	Failure of pumps due to power surge at pump station.	Loss of supply	Due to pump failure due to electrical fault caused by power surge.	Med	High	6
Pumping Station Risks	Failure to meet demand as a result of loss of power supply	Loss of supply	Due to power failure and no standby generator.	High	High	9
Pumping Station Risks	Failure to meet demand due to insufficient pumping capacity	Loss of supply Low pressure	Due to pumps operating below rating or inadequately sized.	Med	High	6
Pumps & Mains Risks	Loss of power to pumps as a result of electrical fault.	Loss of capacity	Loss of power to pumps due to control panel fault resulting from insufficient maintenance.	Med	High	6

Table 5: Pressure

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Pressure problems as a result of leakage caused by corrosion	Loss of pressure	Resulting from leakage due to corrosion of copper pipework due to lack of protection or maintenance	High	Med	6
General Risks	Loss of pressure as a result of leakage	Loss of supply Loss of pressure	Due to leakage due to inadequate leakage control/poor maintenance.	Med	High	6
General Risks	Loss of supply or pressure or contamination of water in supply as a result of fire service tackling a fire	Loss of supply Loss of pressure Microbiological contamination Chemical contamination	Due to high flow rate or changes in flow patterns, or loss of disinfectant contact time or disturbance of sediment	Med	High	6
General Risks	Pressure problems caused by PRV failure	Loss of pressure High pressure	Pressure fluctuation due to the failure of PRV.	Med	High	6
Pumping Station Risks	Failure to meet demand due to insufficient pumping capacity	Loss of supply Low pressure	Due to pumps operating below rating or inadequately sized.	Low	High	3

Table 6: Fire

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
Pumping Station Risks	Failure of pump control panel due to fire	Loss of supply	As a results of inability to operate pumps due to fire	High	High	9
Pumping Station Risks	Failure of pumps due to fire	Loss of supply	As a result of fire.	Med	High	6
Pumping Station Risks	Failure to meet demand as a result of fire	Loss of supply	Due to fire.	High	High	9
Pumping Station Risks	Failure to meet demand due to fire	Loss of supply Low pressure	Due to fire.	Med	High	6
Pumping Station Risks	Failure to meet demand due to insufficient pumping capacity	Loss of supply Low pressure	Due to pumps operating below rating or inadequately sized.	Low	High	3
General Risks	Loss of supply or pressure or contamination of water in supply as a result of fire service tackling a fire	Loss of supply Loss of pressure Microbiological contamination Chemical contamination	Due to high flow rate or changes in flow patterns, or loss of disinfectant contact time or disturbance of sediment	Med	High	6

Table 7: Equipment Breakdown

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Contamination of water in supply as a result of the situation of the storage tank or lack of maintenance.	Microbiological contamination	Resulting from poor condition of on site storage tanks due to lack of	Low	High	3
General Risks	Contamination of water due to leaking air valves	Chemical contamination water Microbiological contamination	Resulting from ingress of due to faulty air valve surrounded by water.	Low	Med	2
General Risks	Contamination of water in supply as a result of the use of non-approved or inappropriate materials in the network	Chemical contamination	As a result of contact with inappropriate materials.	Low	High	3
General Risks	Deterioration of water quality as a result of incorrect sequence of valve operations	Chemical contamination Microbiological contamination	As a result of flow reversal due to the need for rezoning due to the incorrect sequence of valve operations	Low	Med	2
General Risks	Failure to meet demand due to inability to operate valves as required.	Loss of supply	Inability to operate valves when needed due to the lack of maintenance	Med	Med	4
General Risks	Failure to meet demand as a result of insufficient valves to isolate area affected by break		Loss of supply Due to high loss of water due lack of isolation of mains	Low	High	3
General Risks	Loss of pressure as a result of leakage	Loss of supply Loss of pressure	Due to leakage due to inadequate leakage control/poor maintenance.	Med	Med	4
Pumping Station Risks	Failure of pumps due to breakdown and no standby	Loss of supply	As a result of mechanical breakdown and lack of standby pump.	Med	Med	4
Pumping Station Risks	Failure to meet demand due to insufficient pumping capacity	Loss of supply Low pressure	Due to pumps operating below rating or inadequately sized.	Low	High	3
Pumps & Mains Risks	Failure of pumps at wells	Loss of supply	Resulting from pumps failure due to insufficient/no standby generation if electricity supply fails.	Med	Med	4

Table 8: Flood

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
Pumping Station Risks	Failure of pumps due to flooding	Loss of supply	Due to inadequate drainage or poor siting of pump house	Low	High	3
General Risks	Deterioration of raw water as a result of flooding or heavy rain	Turbidity	Due to inability to close intake when raw water has deteriorated.	Medium	Medium	4

Table 9: Distribution line break

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Contamination of water in supply or pressure problems as a result of leaking service pipe	Microbiological contamination Loss of pressure	Due to ingress due to leaking service pipe	Medium	Medium	4
General Risks	Loss of supply from regional supply line	Loss of supply	Failure of flow from regional supply	Low	High	3
General Risks	Build up of deposits in network as a result of inadequate flushing frequency and/or velocity	Discoloration taste & odour	Resulting from inadequate flushing of problem areas.	Medium	Medium	4
General Risks	Broken main as a result of PRV failure	Loss of supply Chemical contamination Microbiological contamination	As a result of a broken main due to high pressure due to failure of PRV.	Medium	Medium	4
General Risks	Loss of supply and/or deterioration of water quality as a result of broken main	Loss of supply Chemical contamination Microbiological contamination	As a result of a broken main due to failure of pipe integrity.	Medium	High	6
General Risks	Contamination of water as a result of cross-connection	Chemical contamination Microbiological contamination	As a result of connection with private supply due to customer having dual connection, no air gap	Low	High	3
General Risks	Contamination of water in supply as a result of the use of non-approved or inappropriate materials in the	Chemical contamination	As a result of contact with inappropriate materials.	Low	High	3
General Risks	Deterioration of water quality due to change in normal flow pattern.		Chemical contamination Due to mains sediment being disturbed by increased flow.	Medium	Medium	4
General Risks	Failure to meet demand as a result of failure to mend break in a reasonable time	Loss of supply	As a result of poor access.	Medium	High	6
General Risks	Failure to meet demand due to inability to operate valves as required.	Loss of supply	Inability to operate valves when needed due to the lack of maintenance	Medium	High	6
General Risks	Failure to meet demand as a result of insufficient valves to isolate area affected by break		Loss of supply Due to high loss of water due lack of isolation of mains	Low	High	3
General Risks	Failure to meet demand as a result of operating system above design pressure	Loss of supply	Due to broken mains as a result of operating mains above design pressure.	Medium	High	6
General Risks	Failure to meet demand as a result of breaks caused by age-related deterioration.	Loss of supply	Resulting from break due to deterioration of pipe condition due to age.	Medium	Medium	4
General Risks	Loss of pressure as a result of leakage	Loss of supply Loss of pressure	Due to leakage due to inadequate leakage control/poor maintenance.	Medium	Medium	4
General Risks	Loss of supply as a result of failure of critical main due to lack of alternative supply	Loss of supply	Due to break on a critical main such that no alternative means of supply is available	Medium	High	6

Table 10: Turbidity

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Deterioration of raw water as a result of flooding or heavy rain	Turbidity	Due to inability to close intake when raw water has deteriorated.	Med	Med	4

Table 11: Alternate potable water supply

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Loss of supply from regional supply line	Loss of supply	Failure of flow from regional supply	Low	High	3
General Risks	Failure to meet demand as a result of breaks caused by age- related deterioration.	Loss of supply	Resulting from break due to deterioration of pipe condition due to age.	Med	Med	4
General Risks	Loss of supply as a result of failure of critical main due to lack of alternative supply	Loss of supply	Due to break on a critical main such that no alternative means of supply is available	Low	High	4
Reservoir Risks	Failure to meet demand as a result of reservoir being undersized		Loss of supply Due to inability to allow sufficient throughput.	Low	High	3
Reservoir Risks	Failure to meet demand as a result of inability to access reservoir to correct fault	Loss of supply	Due to poor weather making access impossible.	Low	High	3
General Risks	Deterioration of water quality in supply as a result of unauthorised connection to the network.	Chemical contamination	As a result of unauthorised connection to the network due to incorrect use of hydrants and standpipes.	Low	High	3
General Risks	Loss of supply or contamination of water in supply as a result of excessive demand in a short period of time	Loss of supply Chemical contamination	Lack of communication from external stakeholders, e.g. builders, fire service	Low	High	3

Table 12: Drought

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
General Risks	Insufficient water available for abstraction	Low pressure Loss of supply	As a result of drought.	Low	Medium	2

Table 13: Reduction or loss of water in well

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
Well Risks	Contamination of well during Metals construction	Microbiological contamination Drilling fluids	Cross-contamination by drilling equipment or residual substances used in drilling e.g. Barium released from drilling	Low	High	3
Well Risks	Contaminated water entering well from upper levels	Microbiological contamination Nutrients	Well casing does not extend above surface or is damaged or deteriorated.	Low	Med	2
Well Risks	Contaminated water entering well from surface	Microbiological contamination Nutrients	Well head badly constructed, damaged, or badly maintained.	Low	Med	2
Well Risks	Contaminated water entering well from surface	Microbiological contamination Nutrients	Site prone to flooding due to poor siting and well head not sealed.	Low	Med	2
Well Risks	Contaminated water entering well from surface	Microbiological contamination Nutrients	Inadequate security around well head giving animals access.	Low	Med	2
Well Risks	Deterioration of water quality	Iron manganese	Due to over-production from aquifer, mixing with other zones or biofouling	Low	Med	2
Well Risks	Deterioration of water quality	Fluoride Arsenic Uranium Other heavy metals	Due to naturally occurring minerals	Low	High	3
Well Risks	Contamination of aquifer	Hydrocarbons Pesticides Nutrients	Activities within recharge zone or vulnerable aquifer	Low	Med	2

Table 14: Vandalism/Terror

	Risk Description	Hazard	Cause of Potential Failure	Likelihood	Consequence	Risk Score
Reservoir Risks	Contamination of water as a result of vandalism	Chemical contamination Microbiological contamination structure.	Due to vandalism, due to lack of secure fencing and	Low	Medium	2