2015 Annual Drinking Water Report

Resort Municipality of Whistler

Infrastructure Services

WHISTLER

The following is the 2015 Annual Water System Monitoring Report for the Resort Municipality of Whistler (RMOW).

This report summarizes the RMOW water system performance in 2015, and is prepared in accordance with a *Permit to Operate a Water Supply System* from the Vancouver Coastal Health Authority.

Executive Summary

The RMOW has the permission to operate two water supply systems in Whistler, as defined by the Vancouver Coastal Health Permit to Operate. One permit applies to the Emerald Estates Water System, and the other to the Whistler Community Water System. In 2015 the RMOW provided clean, safe drinking water to an estimated population equivalency of 29,820[1] residents. The total water consumption for the year was over 5.63 billion litres, 45% sourced from Twenty-One Mile Creek Intake surface water with the remainder from the 14 groundwater wells in Whistler. The RMOW uses two primary disinfection methods in its water systems to maintain clean, safe, and healthy drinking water; ultraviolet light and chlorination. Currently, Twenty-One Mile Creek is the only supply that uses an ultraviolet disinfection system in tandem with chlorination prior to the water entering the distribution system. The remaining water supply is derived from groundwater sources, which use chlorination for primary disinfection. In order to comply with both water supply systems' Permits to Operate, regular bacteriological sampling and monitoring is conducted.

There are several key water infrastructure projects that were conducted in 2015 contributing to the maintenance, improvement, and upgrade of the system. The Unidirectional Flushing Program had a good season flushing over 70 percent of Whistler's distribution system, a reduction from prior years due to the strong summer 2015 drought. The Hydrant Servicing Program serviced, maintained, and certified all 542 RMOW fire hydrants to ensure they were in good working order. The Groundwater Monitoring Program, Emerald Well Water Quality Study, Source Water Protection Plan, Water Loss Reduction Program, and the Corrosion Mitigation Program all operated to ensure optimal system operation.

The 2015 bi-weekly, quarterly, and annual water sampling measured each of the key water quality parameters used to maintain Whistler's clean and safe drinking water. The pH levels sampled in the distribution system fall well within prescribed safe and aesthetic objectives. Distribution system temperatures are measured to monitor for an aesthetic objective of less than or equal to 15° C, the average system temperature was 8.9° C. Turbidity is measured at both surface and ground water sources throughout the distribution system. Turbidity levels at the Twenty-One Mile Creek surface water source intake are triggered on an automated temporary shut down when turbidity is elevated over 1 NTU. Residual Chlorine concentrations throughout the distribution system were consistently within RMOW defined thresholds. These samples were neither too high nor too low throughout the system, rather, some locations experienced slightly higher or slightly lower chlorine residuals along with seasonal variation. Full disinfection of the system was achieved; as demonstrated by the microbiological parameters E. coli, Total Coliforms and Heterotrophic Plate Count returning zero positive results over 475 samples tested.

[1] Data sourced from Whistler Community Monitoring as the 2015 estimated daily population for Whistler, BC

Total Organic Content was always within RMOW guidelines (< 2.5mg/L). Iron levels were elevated in the Alpine Meadows and Function Junction wells on one occasion, Manganese was elevated in 10 out of 57 instances across the system. Both Iron and Manganese are currently solely aesthetic values identified as posing no hazard to public health. All disinfection by-products were within acceptable guidelines.

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1. RMOW Water Systems Overview

In 2015 the RMOW supplied potable drinking water to a permanent resident population of 10,361[1], and hosted approximately 2.7 million visitors[2] resulting in an estimated average daily population of 29,820[3]. In servicing the resident and tourism population of Whistler in 2015 the RMOW supplied 5,631,380m³ of potable drinking water.

In addition to the significant weekend and seasonal population fluctuations in Whistler there are a number of factors that affect both planning and how the municipal water distribution system is operated. For example, the water system has been designed to operate at maximum population (100% occupancy at build out); however, maximum daily population has been and will remain an estimate. In Whistler approximately 31% of the total assigned bed units are allocated to tourist accommodation and there are many residences that are used primarily as second homes, so they are often vacant.

Whistler's drinking water supply is sourced primarily from surface water derived from annual precipitation and snowmelt in the surrounding mountains. The surface water quality is excellent, with a neutral pH, low turbidity (cloudiness), good flavour, and low odour. Due to the superior quality of Whistler's source water only disinfection is required. There were several projects in 2015 that were conducted by the RMOW to improve and maintain Whistler's water supply and distribution system (Table 1.).

Table 1. RMOW Key Water Distribution System Accomplishments.

Key Projects	Description
Unidirectional Flushing Program (UDF)	Part of an ongoing effort to maintain mainline infrastructure, and integral to a multi-barrier approach to protect the quality and safety of Whistler's drinking water supply. The UDF program was suspended mid-summer 2015 due to concerns over drought conditions and supply levels. Significant catch-up was achieved in the fall, however some sections of the system were deferred to 2016.
Annual Maintenance Program	Developed to review the structural integrity of system assets, conduct leak checks, and provide regular service checks and preventative maintenance on equipment.
Hydrant Maintenance Program	All RMOW Whistler fire hydrants are annually inspected and maintained by an external contractor; additionally the utilities department completes weekly hydrant checks and inspections.
Groundwater Monitoring Program	As part of the Groundwater Resource Protection Plan the RMOW contracts a geotechnical and hydrogeological consultant to perform annual monitoring of the system. Water quality, water levels, well capture zones, aquifer capacity, and groundwater extraction levels are all checked and reported on.

[1] Data sourced from BC Statistics Municipal Population Estimate 2015 – Whistler, BC
[2] Data sourced from Tourism Whistler Stats and Facts estimated total number of visitors for Whistler, BC
[3] Data sourced from Whistler Community Monitoring as the 2015 estimated daily average population for Whistler, BC

Groundwater Resource Protection Plan	In an effort to maintain a healthy groundwater system the RMOW conducts enhanced monitoring of the quantity and quality of groundwater used within Whistler, including the identification of wellhead protection areas and groundwater pollution areas. The program also identifies areas of concern, weighing management options and proceeding accordingly; additionally, there are contingency and spill response plans in the event of a disaster.
Backflow Prevention Plan	In conjunction with Vancouver Coastal Health the RMOW implemented a Cross Connection Control Program in 2014. A hazard assessment on all ICI service connections in the Whistler distribution system were evaluated and rated on their potential hazard to the system. These results were presented to each ICI building owner along with required actions to comply with existing backflow prevention standards.
Source Water Protection Plan (SWPP) Twenty-One Mile Creek	In 2014 a Source Water Assessment was conducted by Urban Systems Ltd. to identify and evaluate the present and future hazards to drinking water quality and quantity in the watershed. The report was released in 2015 and made several recommendations for keeping the Twenty-One Mile Creek water quality as high as possible. To provide a forum to facilitate stakeholder involvement, a 21-Mile Creek Technical Advisory Committee (TAC) was formed to guide the development and implementation of the risk mitigation actions documented in the SWPP. The TAC consists of members from VCHA (Drinking Water Officer) MFLNRO (land jurisdiction), RMOW Parks (Rainbow Lake Trail maintenance), RMOW Parks Planning (resort experience), RMOW Environmental Stewardship (community forests) and RMOW Utilities Group (water supply). These parties met and held multiple collaborative discussions in 2015.

1.1 Water Sources

The RMOW uses both a surface water intake, and groundwater wells to provide domestic drinking water and fire protection supply for the municipality. The Twenty-One Mile Creek surface water intake comprised 45% of the water used in the distribution system in 2015, making it the single greatest source for the municipality. The Community water system, of which the Twenty-One Mile Creek intake is a part, supplied 95% of Whistler's potable water in 2015 with the remainder being supplied by the Emerald Estates water system.

Surface Water

- Twenty-One Mile Creek
- Blackcomb Creek (taken offline and locked out in 2012)

Groundwater

- Emerald Estates Wells (3), Community Wells (4), Alpine Meadows Wells (3), Twenty-One Mile Creek Aquifer Well (1), Function Junction Wells (2), Cheakamus Crossing Well (1)

1.2 Water Distribution System

The water distribution system maintained by the RMOW is a Class IV Water Distribution Facility, as classified by the Environmental Operators Certification Program (EOCP), the highest level of complexity in the EOCP classification system. In Whistler there are two private water distribution systems (Function Junction, and Whistler Blackcomb) and two municipal managed systems. The RMOW supplies

water to the private function Junction system, the Whistler Blackcomb system operates independently acquiring its water supply from 8 deep wells located on the mountain[4], and the two municipal systems are operated under separate Permits to Operate (Community and Emerald Estates); one operating surface water intake; 14 groundwater wells; 15 storage reservoirs; 34 individual pressure zones; 10 Pump stations; 37 pressure reducing valve stations; nine altitude valve stations; a real-time Supervisory Control and Data Acquisition (SCADA) monitoring system with process control; approximately 160 km of water main; approximately 3685 water service connections; 2,113 mainline valves; and 542 municipal fire hydrants, 398 private fire hydrants.

1.3 Operating Staff Qualifications

The Drinking Water Protection Regulation (DWPR) defines the qualification standards for persons operating water supply systems, this includes maintenance and repair of the systems. These qualification standards are established in British Columbia by the Environmental Operators Certification Program Society.

The RMOW Water Distribution Systems are classified by the Environmental Operators Certification Program (EOCP) as a WD-IV facility and currently meets the facility operator requirements. The following table (Table 2.) summarizes the current EOCP certification levels for each of the facility operators in the utilities department at the RMOW.

Table 2. Operations Staff EOCP Certifications 2015.

Certification	Number of Employees
WD - IV	3
WD - III	3
WD - II	3
WD - I	2
None	8

1.4 Disinfection System

The RMOW's source water quality is high enough that it does not require filtration treatment to achieve required quality levels, however, the RMOW does disinfect surface and groundwater by the following methods (Table 3.):

- Sodium Hypochlorite on-site generation,
- Calcium Hypochlorite and,

[4] Data sourced from Whistler Blackcomb Mountain Drinking Water system summary, 2016

- Ultraviolet Germicidal Irradiation (UVGI).

UVGI operates by inundating clear water with shortwave ultraviolet light, sufficiently incapacitating microorganism in the water. To ensure the water is fully disinfected residual chlorine is added after the UVGI process.

1.4.1 Chlorination

Table 3. Source water chlorination methods used by the RMOW.

Source Water	Chlorination Method	Contact Time (CT)
Twenty-One Mile Creek Intake – R231	*Sodium Hypochlorite on-site generation* Salt is dissolved in water to create a diluted brine solution which is then passed through an electrolytic cell using DC current from a rectifier which electrolyzes the diluted brine into a 0.8% solution of sodium hypochlorite.	For surface waters or well water deemed to be under the influence of surface water a *minimum* Log 4 reduction is calculated based on: minimum temperature, maximum pH, and minimum chlorine residual (0.20mg/L) in the distribution system. These calculations are used to determine the required CT for each injection site. Once the required CT is known the actual CT is achieved by measuring the minimum residual chlorine in the system and the time spent in pipe since source, which is a function of the measured water flow rate. Evidence the chlorine disinfection CT method working as intended can be seen in the weekly sampling results: there are no verified occurrences E. coli or Total Coliform found in the distribution system samples (Appendix A).
Rainbow Park – W218		
Cheakamus Crossing - W217	*Calcium Hypochlorite* Chlorination chemical that is a white, dry and solid product containing approximately 60-70% chlorine supplied in tablet form.	
Function Junction Junction - W2012-1, W212-2		
Emerald Estates - W201-1, W201-2, W201-3		
Alpine Meadows – W202, W210, W213		
Community – W205-1, W205-2, W205-3, W211		

1.4.2 Ultraviolet Germicidal Irradiation

The RMOW's UVGI system inundates clear water with shortwave ultraviolet light at sufficient amounts to incapacitate microorganisms in the water that may be harmful to humans. The UVGI unit manages the dosage of ultraviolet light by moderating the power intensity of the bulbs, increasing the power in order to reach the necessary transmissivity level. If the maximum safe power limit of the bulbs is reached prior to an effective transmissivity level being reached, then the UVGI will automatically shut the flow off preventing the water from contaminating the water distribution system. Once the UVGI system has shut off the flow, it requires a manual intervention by staff to bring it back online. This is a failsafe put in place to prevent any surface water from entering the distribution system that has not been irradiated.

2. Water Quantity Monitoring

In 2015 the RMOW water system supplied 5,631,380 m^3 of water to Whistler, 45% from the Twenty-One Mile Creek surface water source, and 55% from the 14 ground water source Wells (Table

4. and Figures 1 & 2.). Water consumption in 2015 was greater than 2014 by 273,431 m^3, this equates to an increase of 5.1% over 2014. The most likely reason for this gain can be seen in Appendix A – section 9.1 over the months of May and June, when an earlier than normal warm-and-dry spell occurred; the Monthly Water Consumption breakdown and trend sheets are located in Appendix A – Section 9.13.

Table 4. Source Water Consumption 2011 - 2015.

Year	2015	2014	2013	2012	2011
Total Volume (m^3)	5,631,380	5,357,949	5,308,459	5,243,423	5,269,489
Total Surface (m^3)	2,520,437	2,522,414	2,794,284	2,680,751	2,210,879
Total Ground (m^3)	3,110,943	2,835,535	2,514,175	2,562,672	3,058,610
% Surface	45%	47%	53%	51%	42%
% Ground	55%	53%	47%	49%	58%

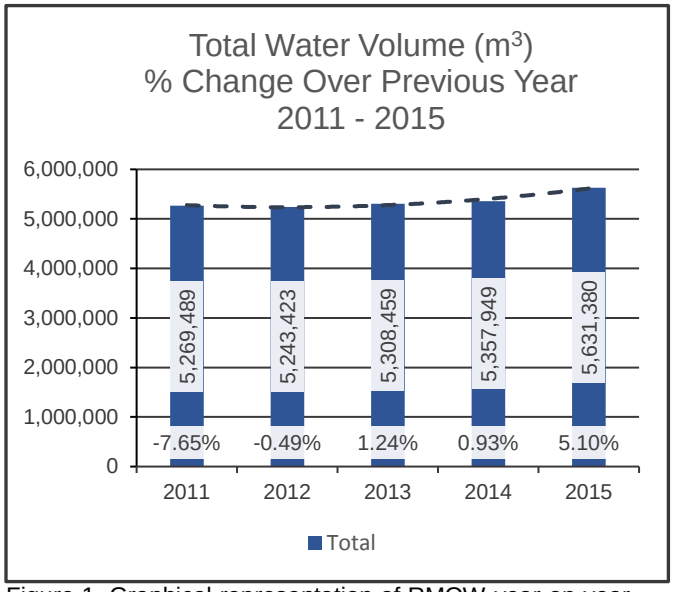


Figure 1. Graphical representation of RMOW year-on-year percentage difference in total water consumption by volume for the years 2011-2015 (Left).

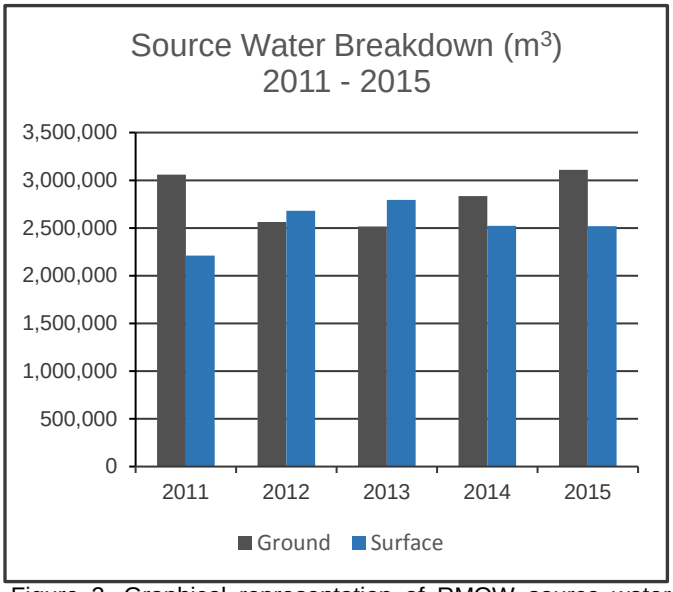


Figure 2. Graphical representation of RMOW source water breakdown, ground verse surface water by volume for the years 2011-2015 (Right).

3. Water Quality Monitoring

3.1 Sampling and Testing Program

The DWPR states that the water supplier (RMOW) must monitor its drinking water source and system at a frequency established by the regulations laid out in its operating permit. The RMOW is required to sample its distribution system 25 times per month for the Community Water System and 4 times per month for the Emerald Estates Water System. The RMOW has established a water quality sampling and testing program that samples the potable water supply quality at 35 locations throughout the municipality.

In 2015 the Utilities Department tested a total of 993 samples throughout the year, 802 bi-weekly samples from 35 sites, 161 quarterly samples from 40 sites, and 30 annual samples from 17 sites. These samples are tested for various water quality parameters as detailed in table below (Table 5.).

Table 5. RMOW Water Sampling Program

Sample Period	Testing Parameter
Two Weeks	pH, Temperature, Turbidity, Free CL2 (Residual Chlorine), E. Coli, Total Coliforms
Quarterly	Total Organic Carbon (TOC), Heterotrophic Plate Count (HPC), Trihalomethane (THM), Polycyclic Aromatic Hydrocarbons (PAH), Total and Dissolved Iron, Total Manganese
Annually	Water Chemistry

All samples required for the testing listed above are collected by the RMOW Utilities Department. All the bi-weekly water testing parameter analysis were carried out by the RMOW Utilities Department apart from the Coliform tests which require regulatory reporting. Testing for E. Coli and Total Coliforms were carried out by the British Columbia Centre for Disease Control; HPC, TOC, THM's and water chemistry testing were carried out by 3rd party testing facilities, Caro Analytical Services. All sample results data were uploaded and stored in the WaterTrax online data repository. Detailed summary reports of the weekly, quarterly and annual sample results are located in Appendix A – Section 9.4, 9.5, 0 of this report.

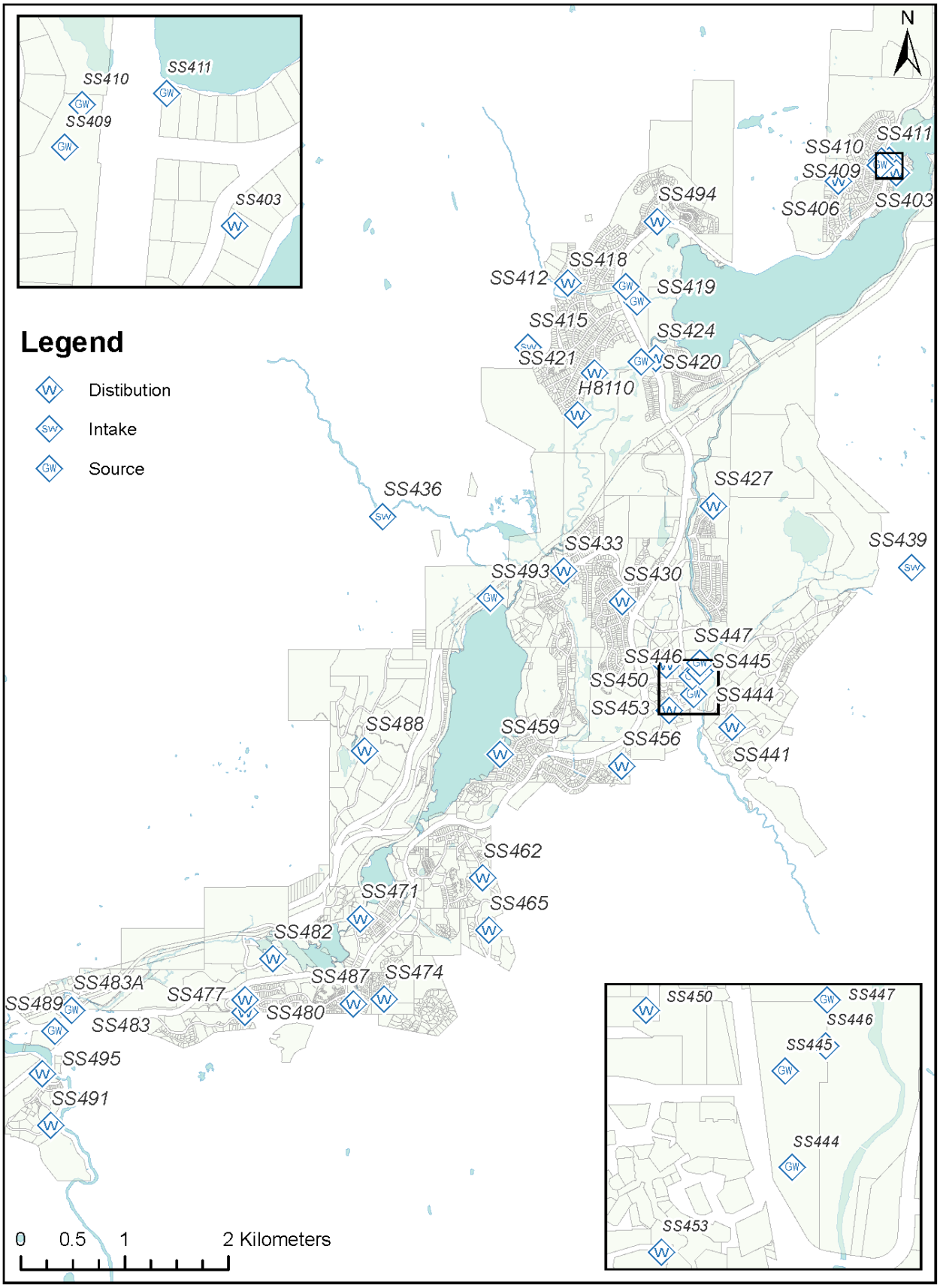
NOTE: The Total Iron results for W212-1 appear to have taken a significant jump; the data indicates this is the highest result we have had since beginning testing in December 2002. This is due to a lapse in following the procedure of allowing these wells to run for a minimum period of time prior to pulling a sample. The necessary procedural protocols have been reestablished.

3.2 Sampling Locations

There are 35 water stations sampled on a bi-weekly basis (Table 6.). These sampling stations are distributed across the municipality at various locations (Map 1).

Table 6. Bi-weekly sampled water stations

Week 1			Week 2		
SS – Station No.	*W – Well*	*P – Pump Station*	*S – Siphon Site*	*R - Reservoir*	
WTX #	**RMOW #**	**Description**	**WTX #**	**RMOW #**	**Description**
SS-409	W201-1	Emerald W1	SS-403	S131	Emerald SLS
SS-410	W201-2	Emerald W2	SS-406	R238	Emerald R
SS-411	W201-3	Emerald W3	SS-418	W202	Alpine Meadows W1
SS-412	P245	Mountain View PRV	SS-419	W210	Alpine Meadows W2
SS-424	P266/S123	Nicklaus North PRV	SS-420	W213	Alpine Meadows W3
SS-430		Snowflake S	SS-421	S101	Alpine Meadows SLS
SS-436	R231	Twenty-One Mile Creek Intake	SS-427	P267/S126	Spruce Grove PRV
SS-439	R232	Blackcomb Creek Intake	SS-444	W205-1	Community W1
SS-441	P256	Blackcomb PRV	SS-445	W205-2	Community W2
SS-453		Village S2	SS-446	W205-3	Community W3
SS-459	S104	Lakeside SLS	SS-447	W211	Village W1
SS-465	P270	Taluswood PRV	SS-450		Village S1
SS-480	P273/S132	Spring Creek PRV	SS-456	P265	Sunridge PRV
SS-482		Alta Lake S	SS-471	S106	Gondola SLS
SS-483	W212-1	Function Junction W1	SS-477	S121	Millers Pond SLS
SS-489	W217	Cheakamus W1	SS-488	P275	Stonebridge PRV
SS-491		Cheakamus S	SS-493	W218	Twenty-One Mile Creek Aquifer W1
			SS-494	S137	Rainbow SLS



Map 1. RMOW water sampling locations.

3.3 Sampling Parameters

The Guidelines for Canadian Drinking Water Quality (GCDWQ) are established by the Federal-Provincial-Territorial Committee on Drinking Water (CDW) and are published by Health Canada. Health Canada's guidelines for Canadian drinking water quality summary table can be found at: http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php. The RMOW tests several drinking water quality parameters using the GCDWQ limits under standard operating requirements.

The GCDWQ are set according to three primary criteria on contaminant considerations:

1. Could exposure to the contaminant lead to adverse health effects in humans?
2. Is the contaminant frequently detected, and therefore expected to be found in drinking water supplies?
3. Is the contaminant detected at levels that are of possible significance to human health?

3.3.1 Chemical and Physical

The chemical and physical parameter guidelines are set out by the GCDWQ and are measured using three tiers of consideration: (1) Maximum Acceptable Concentration (MAC) of a given contaminant based on health considerations, (2) Aesthetic Objective (AO), such as taste, odour, and colour, (3) Operational Guidance value (OG), which takes into consideration operational guidelines and requirements. The RMOW's chemical and physical sample parameters are detailed in the table below (Table 7.).

The GCDWQ do not set a safe level for chlorine (primary disinfectant used by the RMOW) due to its low toxicity at concentrations used in drinking water distribution systems. Free chlorine (Cl_2) concentrations in most Canadian drinking water distribution systems range from 0.04 to 2.00 mg/L; the RMOW maintains a range between 0.20 mg/L – 0.60 mg/L at all points throughout the distribution system, except for SS-406 R238 Emerald Reservoir where a Free Chlorine target range of 0.40 mg/L – 0.75 mg/L is applied. This exception is outlined in the Coast Garibaldi Health Permit to Operate. Chlorine injection and residual levels are monitored in real-time through an online monitoring and alarm system – SCADA – at strategic points throughout the system. The RMOW water treatment facilities subject the source water to chloride containing disinfectants, the active chlorine compounds react with natural organic matter in the water producing chlorinated disinfection by-products.

Table 7. Detailed chemical and physical parameters tested by the RMOW.

Inorganic Chemical Parameters	
Parameter: Free Chlorine (Cl_2) Units: Milligrams per Litre (mg/L) Source: Disinfectant Additive Tested: Bi-weekly	The amount of residual chlorine in the water distribution system is an indicator of the effectiveness of the disinfection process, therefore chlorine residual is measured at all sampling sites where bacteriological samples are collected. RMOW's water is treated at source with higher amounts of

	chlorine in order to provide adequate levels of residual chlorine throughout the distribution network.
Disinfection By-products	
Parameter: Trihalomethanes (THMs) Units: Milligrams per Litre (mg/L) MAC: 0.1 mg/L	Includes the total of chlorodibromomethane, chloroform, bromodichloromethane and bromoform in the water sample. It is important to make every effort to keep concentrations as low as reasonably achievable without compromising the effectiveness of disinfection.
Parameter: Haloacetic Acids (HAAs) Units: Milligrams per Litre (mg/L) MAC: 0.08 mg/L	Includes the total of monochloroacetic acid (MCA), dichloroacetic acid (DCA), trichloroacetic acid (TCA), monobromoacetic acid (MBA) and dibromoacetic acid (DBA) in the water sample. Several HAAs are probably carcinogenic to humans, which is why HAA levels are limited provided adequate disinfection is occurring.
Physical Parameters	
Parameter: Conductivity Units: Microsiemen per Centimetre (µs/cm) Tested: Annually	Conductivity can be used as a general measure of water quality, as it tends to be relatively constant. Once a baseline has been established comparisons can be made with the regular measurement. However, it is affected by the presence of inorganic dissolved solids such as, chloride, nitrate, sulfate, sodium, and magnesium. Temperature will also effect conductivity, therefore reporting is done at a standard 25 °C.
Parameter: pH Guideline: between 6.5 – 8.5 Tested: Bi-weekly	The normal range in pH for surface waters is 6.5 to 8.5, low pH (< 6.5) can be acidic, soft, and corrosive; high pH (> 8.5) can be alkaline, hard, and deposit scale on piping and fixtures.
Parameter: Temperature Units: Degrees Celsius (°C) AO: ≤ 15 °C Tested: Bi-weekly	High water temperatures can promote growth of microorganisms. This can cause problems with taste, odour, colour, and corrosion.
Parameter: Total Dissolved Solids Units: Milligrams per Litre (mg/L) AO: ≤ 500 mg/L Tested: Quarterly	“Dissolved Solids” refers to any minerals, salts, metals, cations or anions dissolved in water. Elevated levels of total dissolved solids in the drinking water supply can result in bitter or salty tasting water; incrustation, films, or precipitates on fixtures; corrosion, and reduced efficiency of water filtration equipment.
Parameter: True Colour Units: Color Unit AO: ≤ 15 Tested: Annually	True colour refers to the appearance of water after it has been filtered. It is often a result of decaying organic matter (producing a yellowish tea colour), but is a nontoxic characteristic and monitored as an aesthetic parameter affecting appearance and palatability.
Parameter: Total Hardness ($CaCO_3$) Units: Milligrams per Litre (mg/L) Tested: Annually	Elevated levels of total hardness in the water distribution system can cause scaly deposits in plumbing, appliances, and boilers. Ideally the water distribution system should not contain more than 80mg/L of total water hardness as $CaCO_3$.
Parameter: Total Organic Carbon (TOC) Units: Milligrams per Litre (mg/L) OG: ≤ 15 mg/L Tested: Quarterly	Detects the presence of all carbon-baring molecules, in turn identifying the presence of any organic contaminants. Used to provide a method of detecting organic contaminants that could pose a threat to public health.

3.3.2 Microbiological

It is the intent of the GCDWQ to provide guidelines focusing on the treatment and protection of domestic drinking water supplies. The highest priority is given to reducing the level of microbiological contaminants within a distribution system through proper treatment, maintenance, and disinfection practices (Table 8.).

Table 8. Detailed microbiological parameters tested by the RMOW.

Microbiological Parameters	
Parameter: *Escherichia coli (E. coli)* Guideline: MAC – none detectable per 100 mL Tested: Bi-weekly	The presence of E. coli indicates recent faecal contamination, and the potential for microorganisms capable of causing gastrointestinal illness.
Parameter: Heterotrophic Plate Count (HPC) Guideline: None Tested: Quarterly	HPC is naturally occurring and is not used as an indicator of drinking water safety, rather it is used to monitor the general bacteriological quality of the water.
Parameter: Total Coliforms Guideline: MAC – none detectable per 100 mL, at treatment plant exit; No consecutive positive samples or no more than 10% of samples should contain total coliforms < 10 CFU per 100 mL Tested: Bi-weekly	Coliform bacteria are generally non harmful, however, the total coliform test can be used as an indicator for the presence of other pathogenic bacteria.
Parameter: Turbidity Guideline: RMOW permit stipulates a Turbidity NTU requirement of < 1 in source water and < 5 within the distribution system Tested: Bi-weekly	Turbidity levels should be reduced to levels as low as reasonably achievable in an effort to have a treated water turbidity target of less than 0.1 NTU. Particles can harbour microorganisms protecting them from disinfection, it is therefore essential to keep turbidity levels low to ensure effectiveness of disinfection systems.

MAC – Maximum Acceptable Concentration, NTU – Nephelometric Turbidity Units

4. Drinking Water Protection Plans

4.1 Source Water Protection Plan (SWPP)

The primary objectives of the Source Water Protection Plan (SWPP) required by the Vancouver Coastal Health Authority (VCHA) operational permit are to ensure that exposure to unacceptable concentrations of contaminants in the source water are minimized, to implement procedures and policies that will support the long-term sustainability of the surface water resource, and to maintain public confidence in Whistler's drinking water quality.

The full scope of the plan includes: a long term sustainability plan beyond 2030, review of current water quality and future treatment recommendations, compliance with BC's Comprehensive Drinking

Water Source-to-Tap Assessment Guide, working closely with the Vancouver Coastal Health Authority, public consultation, and ultimately the implementation of a fully comprehensive action plan.

In an effort to facilitate stakeholder involvement, the 21-Mile Creek Technical Advisory Committee (TAC) was formed to guide the development and implement the risk mitigation actions documented in the SWPP. The TAC consists of members from VCHA (Drinking Water Officer) MFLNRO (crown land use), RMOW Parks (Rainbow Lake Trail maintenance), RMOW Parks Planning (resort experience), RMOW Environmental Stewardship (community forests) and RMOW Utilities Group (water supply). These parties met and held multiple collaborative discussions in 2015.

The RMOW has improved budget and planning measures to better mitigate impacts on the Twenty-One Mile Creek watershed. In 2014 the RMOW commissioned Urban Systems to: (1) identify and evaluate potential hazards to the drinking water supply quality and quantity, (2) characterize the risks, (3) propose several next step risk management strategies. The 2015 Twenty-One Mile Creek Source Water Assessment report made several recommendations to keeping the Twenty-One Mile Creek water quality as high as possible. The report identified five intrinsic risks, four anthropogenic risks, and strategies to address these risks (Table 9.).

Table 9. Twenty-One Mile Creek Source Water Assessment identified strategies to be addressed.

Intrinsic Risk Strategies		
Hazard (source)	**Contaminant**	**Preliminary Risk Managements Strategy**
Natural snowmelt and rainfall (peak flows)	Sedimentation, turbidity, coloration	Monitor water quality upstream of slumping to compare to quality at intake Install a second intake further upstream of the slumping Install an off-stream reservoir (storage) Install an off-stream settling basin
Slope instability Debris flows	Sedimentation, turbidity, coloration	Slope stabilization
Wildfire	Sedimentation, turbidity, coloration, organic content	Fuel thinning activities have been outcomes of the recent wildfire studies: consider expanding to Twenty-One Mile Creek watershed Update the wildfire protection plan to account for the Twenty-One Mile Creek watershed's natural infrastructure/assets
Wildlife	Bacteria, protozoa	Monitor fecal coliforms, including RNA or genomic analysis to identify source, to develop a baseline and better characterize the actual risks
Climate change	Impacts to water quantity, quality, wildfire risk	Conduct a climate change impact and response study that considers both natural and built assets and infrastructure, and anticipates potential (future) permitting constraints under the new Water Sustainability Act; e.g., environmental flow needs Address water demands through greater water conservation efforts
Anthropogenic Risk Strategies		

Hazard (source)	Contaminant	Preliminary Risk Managements Strategy
Non-motorized trail use Domestic pets	Sedimentation, turbidity, coloration Bacteria, protozoa	Expand MFLNRO's approach to monitoring/reporting snowmobile use to trail use and presence of dogs in the watershed Engage trail users in identifying responses to risks: Increase education efforts with trail users Seek input on enhanced signage to inform users of drinking water source (Community Watershed)
Snowmobiling	Petroleum products	Continue MFLNRO's approach to monitoring and reporting snowmobile use
Heli-skiing	Petroleum products	Do not permit flying directly over Rainbow Lake, Gin and Tonic Lakes, or Twenty-One Mile Creek Inform heli-skiing operators of the hazards posed by helicopters to the drinking water source
High user demands	Impacts water availability	Implement water use restrictions through bylaw Implement water conservation measures Inform users of importance of conservation

Twenty-One Mile Creek is a high quality and bountiful source of water, however the ability to use Twenty-One Mile Creek is occasionally limited by periods of high turbidity. Concerns have also been raised over the potential for increased periods of turbidity and/or the risk of contamination due to natural and/or anthropogenic activity in the watershed. For the Twenty-One Mile Creek source both intrinsic and anthropogenic hazards pose a risk to the water supply availability and the water supply quality, however relatively speaking, the intrinsic risks pose a greater threat to the availability, and the anthropogenic risks pose a greater threat to the quality, of the source water supply. While there are a number of other Hazards identified in the SWPP, the most complex component of the SWPP has been developing risk management strategies for the potential impacts on source water quality from the ongoing expansion of recreational activity. A thought model of acceptable risk was employed to facilitate that discussion. This document is still under review by VCHA, however the RMOW was given credit for its completion in September 2015.

There were several actions taken on maintaining the Twenty-One Mile Creek water source in 2015. There were significant trail and bridge improvements in the area, extensive signage changes with attention to placement in the area to better educate recreational users. Additionally a slope stability assessment was conducted on the upper portion of Twenty-One Mile Creek to evaluate potential remediation initiatives that could strengthen the slope. Specific plans for 2016 works were identified in the SWPP work-plan.

4.2 Groundwater Resource Protection Plan

In addition to a Source Water Protection Plan the RMOW is required to have a Groundwater Resource Protection Plan. Launched in 2008 the plan is comprised of several measures (Table 10.) designed to promote enhanced protection of the quantity and quality of groundwater used within Whistler. The primary objectives are: (1) to ensure exposure to unhealthy concentrations of contaminants in the drinking water is minimized, (2) to implement procedures and policies that support long-term sustainability of the groundwater resource.

Table 10. Groundwater resource protection plan framework.

Groundwater Resource Protection	
Wellhead Protection Area Initiative	Identifies areas that have a higher potential risk of contamination and targets these areas for enhanced management and protection of the long term water quality and sustainability of the groundwater supply.
Groundwater Pollution Areas of Concern	Identifies the potential groundwater pollution risk factors, providing an assessment of the areas of concern.
Management Options	Promotes public awareness, formulates appropriate well decommission procedures, and addresses legislative considerations, provincial regulations, bylaws, municipal policies, and community plans.
Contingency and Spill Response Plans	Groundwater monitoring plan in place is maintained by geotechnical and hydrological consultants. Emergency situation response to pollutant/contaminant spill and aquifer contamination are also incorporated.
Water Quality Monitoring	Regular sampling, review, and reporting procedures are in place to ensure safe and clean groundwater supply.

4.2.1 Groundwater Monitoring Program

The groundwater sources Function Junction, Twenty-One Mile Creek Aquifer and Community/Village are monitored annually by geotechnical & hydrogeological consultants (Piteau Associates) (Table 11.). The RMOWs Groundwater Resource Protection Plan requires annual analysis of groundwater from W212-1, W217, W218, W205-1, W205-2, W205-3, W211, and monitoring wells (MW) for potable water quality parameters and Potential Contaminants of Concern (PCOCs). The 2015 report by Piteau Associates concludes that concentrations of potential contaminants in groundwater collected from monitoring wells and water supply wells at Function Junction are in compliance with Guidelines for Canadian Drinking Water Quality and standards for the protection of groundwater used for drinking water, and drinking water standards from the BC Contaminated Sites Regulation. Minor water quality concerns include low pH (<6.5) at both W212-1 and W217. These are non-anthropogenic in origin.

Lower than average water levels measured in Function Junction over the summer of 2015 are attributed to an extremely low snowpack. Continued monitoring of groundwater levels and water quality

at Function Junction is recommended to assess aquifer performance and to reduce the contamination risk. A pesticide and herbicide scan is recommended for MW13-1 in 2016.

Water level data collected for Twenty-One Mile Creek Aquifer sites in 2015 shows that W218's capacity to sustain pumping was not affected by the reduced recharge during the summer and subsequent autumn recharge was sufficient to restore aquifer levels to within normal range. Monitoring results continue to indicate that the potential for groundwater from W218 to be under the direct influence of surface water is low.

Water levels in the aquifer supplying the Community/Village Well field are consistent with trends from the past four years.

Table 11. Groundwater Monitoring Program 2015 Summary.

Groundwater Monitoring	
Function Junction	The RMOW's Groundwater Resource Protection Plan requires annual analysis of groundwater from W212-1, W217, and monitoring wells throughout Function Junction, for the water quality parameters and Potential Contaminants of Concern (PCOCs). Data loggers have been recording water levels at hourly intervals at test well TW06-2 and at the pond to the west of the Wastewater Treatment Plant (the Pond) since September 2008 to provide information on long-term aquifer performance and response to pumping of W217. Monitoring well MW06-2S was irreparably damaged and decommissioned in 2012; it was replaced in July 2013 by MW13-1. Groundwater and surface water levels at TW06-2 and the Pond typically decrease gradually during summer months, and increase sharply in response to fall rains. However, the limited snowpack and early melt resulted in uncharacteristic sharp declines in April 2015, and from mid-April to August 2015 water levels were the lowest levels observed since 2008. Values of pH outside of (lower than) the recommended range (6.5 to 8.5) were recorded in W212-1 and W217 during 2015. Dissolved iron and manganese concentrations in samples collected from MW06-1D, MW06-2D, and MW07-1 in 2015 continued to exceed the GCDWQ AO. The analyses results for groundwater samples from MW09-1D and MW09-1S indicate no evidence that the groundwater near the monitoring wells is being affected by potential sewage-related contamination from the nearby wastewater treatment plant.
Twenty-One Mile Creek Aquifer Wells	Production well W218 at Rainbow Park (Fig. 4) went into service in 2009. A groundwater and surface water monitoring program has been underway at this location since 2005. This started with monitoring of water level and temperature in test well TW-1, and was augmented by continuous monitoring of a shallow monitoring well (MW-1) and a surface water station (SW-1) in 2007. Monitoring of turbidity, water level, groundwater temperature, and pumping rate at W218 (via RMOW's SCADA system) commenced in 2009. During 2013, extra water level monitoring was carried out at MW-1, SW-1 and TW-1 after new production well W219 was installed to ensure adequate groundwater levels were being maintained. The turbidity of W218 groundwater is monitored on an hourly basis. None of the 2015 readings exceeded the GCDWQ limit of 1 NTU.

	Water levels in TW-1 fluctuated within the previously observed range, indicating no evidence of a year-over-year decline, and confirming that there is sufficient recharge to the aquifer to meet the current demand. Between June and the end of August 2015 water levels were about 0.8m lower than during previous years. Water levels quickly returned to near the top of their seasonal range in September 2015 after heavy rains and a multi-day pump shutdown for well servicing, and remained within the seasonal range thereafter. Surface water levels at SW-1 dropped by slightly more than 0.3m between mid-June and early July in 2015. Though similar in magnitude to previous years, this occurred approximately one month sooner. The earlier than previously observed seasonal drop in water levels at TW-1, MW-1 and SW-1 in 2015 is attributed to an extremely low snowpack and resultant low freshet flows. W218's capacity to sustain pumping was not affected by the reduced recharge during the summer of 2015.
Community/Village	W205-1, W205-2, W205-3, and W211 are located in the day skier parking lots off Blackcomb Way and are screened in channel-fill sediments deposited by Fitzsimmons Creek. The capacity of this aquifer is limited by a near constant rate of recharge from the creek. A data logger was installed at TW04-2, and has been continuously recording water levels since June 2004. Water levels in 2015 exhibit a similar pattern and range as in previous few years, despite the low snowpack and dry summer. The absence of extremely low water levels in the late summer is attributed to the relatively constant leaky connection to Fitzsimmons Creek, and relatively light pumping of the village wells over the summer of 2015.

5. Water System Emergency Response Plan

The 2015 Water System Emergency Response Plan details the plan of action for staff in the event of an emergency situation, disruption in service, or threat to the health of people drawing from the distribution system. The plan provides staff with an understanding of the resources available to them, instructions on when to operate the Emergency Operations Center (EOC) and identifies external resources that can be called upon if required. The Water System Emergency Response Plan was updated in 2015 and supplied to all utilities staff and personnel who are required to act in the case of a water emergency. A sample version of the 2015 Emergency Response Plan is included as Appendix B.

If it is known that a contaminant has entered the water supply or it is suspected that one has, and it poses a potentially significant threat to public health, the Supervisor on duty/call must immediately notify the Drinking Water Officer and the public. If there is a suspicion of a potentially modest threat to the drinking water supply the Drinking Water Officer should also be notified and will advise on the appropriate public notification advisory.

5.1 Public Drinking Water Notifications Issued by the RMOW in 2015

1. Boil Water Advisory notices issued by the RMOW in 2015: **NONE**
2. Do Not Drink Water Advisory notices issued by the RMOW in 2015: **NONE**
3. Do Not Use Water Advisory notices issued by the RMOW in 2015: **NONE**
4. Maximum Water Use Restriction issued by the RMOW in 2015: **LEVEL 2**

5.2 Emergency Situations Occurring in the RMOW in 2015

1. Chemical or biological contamination events in 2015: **NONE**
2. Number of elevated turbidity level events in 2015: **6 Distribution & 14 Supply**
3. Number of water main breaks that occurred in 2015: **FOUR**
4. Number of flood events in 2015: **NONE**
5. Number of significant fire events in 2015: **FOUR**

5.3 Technical Systems Outage

1. Number of extended power failures in 2015: **NONE**
2. Number of SCADA system failures in 2015: **ONE – 4 DAYS**

6. Operations

6.1 Capital Water System Improvements

The RMOW is continually striving to effectively maintain, make improvements to, and upgrade the water systems infrastructure. There are several short and long term water systems capital projects underway at the RMOW, the following table details the progress in 2015 (Table 12.).

Table 12. Description of RMOW capital project progress in 2015.

Project	Description of Project Tasks
Water System Improvements	Twenty-One Mile Creek Aquifer Well 2 well pump installation was proposed in 2015 and is scheduled for 2016. Alpine Meadows reservoir control valve station and meter station design initiated in 2015 with construction planned for 2016. Unsupported MOSCAD RTU equipment replaced with current Motorola ACE hardware at R228, R237, R238, R240, W213, and P264. Annual water meter reading not conducted in 2015 due to lack of summer student resources, but is planned for 2016.
Drinking Water Corrosion	As a result of lessons learned from the sewer force main break in Spruce Grove a formal study was started in 2013 to evaluate the overall corrosion potential of each Whistler's many water sources. As a result, in 2014 the Cheakamus Crossing (CC) supply was identified as being the highest priority candidate for corrosion mitigation efforts. The consultant then undertook a study to identify and evaluate potential mitigation strategies. This study was completed in 2015, and identified four different possible mitigation strategies. In consultation with staff, chemical dosing at source was identified as the most effective and cost-effective candidate for mitigation. A design for a pilot dosing system was commissioned and completed in 2015. In light of the high costs identified to conduct such a dosing pilot, staff put any further work on hold pending a more thorough "real world" investigation into corrosion impacts in Cheakamus. As a result, staff initiated a monitoring program in 2015 in which copper and mild steel corrosion coupons were installed in the WWTP Admin building on a domestic hot water line, then evaluated for degree of corrosion over time. This study showed that copper was not significantly affected by Cheakamus water, in contradiction to the many green staining complaints from residents. Further investigation was planned for 2016.

Soil Corrosiveness Plan	A corrosion risk assessment report was started in 2014 and completed 2015. It provided support for establishing a municipal soil corrosion monitoring program. The report included training protocols for municipal staff to follow when collecting samples for analysis. Staff were trained and several samples were collected and analysed. These results will be used to develop a corrosive soil profile in areas of greater corrosion risk and support future policy decisions. Sample collection and analysis will be an ongoing program, so that over time staff will develop a comprehensive picture of the longevity of pipe and appurtenances in the various soil conditions which exist in Whistler's developed areas.
Alpine Meadows Water Main Replacement	In an effort to improve drinking water quality, improve water flow and pressure, improve water distribution infrastructure condition and longevity, reduce leakage and lower energy costs the Alpine Meadows neighbourhood received major water works upgrades in 2015. All unlined cast iron pipe and associated infrastructure are to be replaced with PVC pipe. Approximately 3000 linear meters of water main were replaced in 2015 including all valves, fittings, appurtenances, service connections, and hydrants. Further works on this system are planned for 2016.
Water Loss Reduction Program	The RMOW reviewed the possibility of reservoir draw down testing in the Village Zone in 2015, a complex zone that does not lend itself well to traditional leak detection methods. Once it was identified that remote data logging on new water meters and RF devices was possible the focus shifted to installing modern meters to a representative selection of property types in the Village Zone. Two (out of a possible six) replacement water meters and seven RF units were installed December 2015. Analysis of the flow data in 2016 will be used in leakage detection and additional meter installations.
Reservoir Upgrades	Reservoirs and clear wells are upgraded in an effort to improve water quality. A 2013 study suggested new level set points at various locations, and in 2014 mixers were installed in selected reservoirs. In 2015 a testing program began that will confirm chlorine decay rates at several locations in the water distribution system and these results will identify and prioritize future spending to improve reservoir water quality.
Olympic Reservoir Upgrade	Water system review in 2014 identified a high priority requirement to replace Olympic reservoir. Replacement planning for a new reservoir was conducted in 2015 with design and construction planned for 2016.
Fire Hydrant Maintenance	All 542 municipal fire hydrants were checked and serviced in 2015.
Reservoir Cleaning	RMOW reservoirs and clear wells are cleaned, inspected, and repaired if necessary in rotation each five years. In 2015 none of the reservoirs were cleaned due to the lack of availability of a contractor, and reservoirs due for cleaning have been rescheduled for 2016.
Groundwater Monitoring Program	The Groundwater Monitoring Program continued in 2015, annual sampling, analysis, and recommendations were provided by geotechnical & hydrogeological consultants Piteau Associates who reported on the water quality parameters and Potential Contaminants of Concern (PCOC's) through several monitoring wells throughout Function Junction, Rainbow Park, and Whistler Village (Section 4.2.1).

Source Water Protection Plan Twenty-One Mile Creek (SWPP)	The Vancouver Coastal Health Authority requires the RMOW to develop and maintain a Source Water Protection Plan for the Twenty-One Mile Creek watershed upstream of the Twenty-One Mile Creek Intake with the intention to implement procedures and policies that will support the long-term sustainability of the surface water resource, and maintain public confidence in Whistler's drinking water quality. In 2014 a Source Water Assessment was conducted by Urban Systems Ltd. to identify and evaluate the present and future hazards to drinking water quality and quantity in the watershed. The report was released in 2015 and made several recommendations for keeping the Twenty-One Mile Creek water quality as high as possible. The report identified five intrinsic risks, four anthropogenic risks, and strategies to address these risks (Section 4.1). Additionally in late 2015 a terrain stability/slope failure assessment was conducted by Urban Systems above the Twenty-One Mile Creek Intake to determine slope stability and potential remediation. A 21-Mile Creek Technical Advisory Committee (TAC) comprised of internal and provincial stakeholders was formed to guide the development of and implementation of risk mitigation actions documented in the SWPP. The TAC consists of members from VCHA (Drinking Water Officer) MFLNRO (land jurisdiction), RMOW Parks Operations (Rainbow Lake Trail maintenance), RMOW Parks Planning (resort experience), RMOW Environmental Stewardship (community forests) and RMOW Utilities Group (water supply). These parties met and held multiple collaborative discussions in 2015 cumulating in a VCHA accepted draft, in September 2015.
Emerald Well Water Quality	The drinking water officer requested study on pathogenic infection risk at two of the three Emerald wells in 2014, and Piteau Associates were contracted to sample the Emerald wells and conduct a microscopic particulate analysis. Continued microbiological testing by BCCDC was continued from December 2014 through to December 2015. Pump station improvements and UV addition project design are planned for 2016 with construction in 2017.
SCADA HMI Upgrade	The Utilities SCADA system was upgraded and merged onto the same platform as the waste water treatment plant and district energy system. This integration work will permit desired improvements to control reporting and alarming in 2016 and beyond.
SCADA System Audit	The SCADA Audit project stemmed out of lessons learned during the SCADA Utilities HMI Upgrade. The SCADA Audit project has some smaller components that can be achieved stand alone in 2016 (such as a radio path audit) however in 2017 the development of a SCADA Master Plan that captures all the objectives and long term operating goals of the SCADA systems will likely occur.

6.2 Unidirectional Flushing Program

Mainline flushing is one of the most effective tools available to maintain and improve water quality. The RMOW has implemented a Unidirectional Flushing Program, a procedure that removes more sediment, mineral, and biological deposits in the distribution lines than traditional flushing methods. This annual flushing program begins in May each year generally completing by the end of September. In 2015 71% of the Whistlers water distribution system water mains were flushed. Several pipe lines are not

flushed since they achieve the minimum flushing velocity required several times throughout the year and therefore are considered self-cleaning. There are also a few small sections of pipe that do not have the necessary connections/equipment required to be flushed. Additionally several sections of Alpine Meadows piping did not receive UDF in 2015 due to the water main replacement construction underway; also the UDF program ended earlier than usual because of the warm-and-dry climatic conditions putting higher than normal demand on the water system. Most of the remaining UDF for 2015 was completed in the fall, with a portion of the work scheduled for spring 2016.

6.3 Hydrant Servicing

In 2015, 542 RMOW hydrants were fully serviced and checked for operation. This is an annual program subcontracted in 2015 to Sea-to-Sky Fire Protection Ltd., and was completed on November 12, 2015. In addition to the check and service operation 16 hydrant work orders for maintenance and repair, many of which were identified through servicing, were completed by RMOW staff.

6.4 Reservoir Inspection

The RMOW currently contracts out the annual reservoir/clear-well inspection, cleaning and repair to Phoenix Marine Services Inc. Divers use cameras and specialized tools to clean and inspect the reservoirs, contact tanks and water wells. The RMOW conducts the cleaning and sanitization in this way to maintain fire suppression water levels throughout the process. In 2015 none of the RMOW reservoirs were cleaned due to the availability of divers. The reservoirs due for cleaning have been rescheduled for 2016 and alternative remote inspection methods are being explored.

6.5 Emerald Well Water Quality Study

The Emerald Well Water Quality Study was launched at the request of the Drinking Water Officer to determine the level of risk for pathogenic infection present at the three Emerald well sites. In 2014 Piteau Associates conducted a Microscopic Particulate Analysis (MPA) for the Emerald Wells. The findings presented in their report indicate a high risk of well W201-1 being under the influence of surface water contaminants, with wells W201-2 and W201-3 appearing to have lower risk. The report recommended consideration be given to enhancing the disinfection of groundwater for all three wells, and that the usage of well W201-1 be curtailed to the maximum extent possible until such time as disinfection can be enhanced at this location. These recommendations were been reviewed by the RMOW. In consultation with VCHA, in 2015 increased chlorination levels were implemented in combination with ongoing protozoa testing to ensure only safe, high quality water had entered the distribution system from these wells. Additionally Opus DaytonKnight was contracted to design

improvements to the Emerald pump station, including the addition of UV treatment to mitigate protozoa risk, with design and planning expected in 2016 and construction in 2017.

7. Performance

The RMOW uses a target response time of one hour in the event of a break in the system, the utilities staff works quickly to ensure all necessary repairs are completed and water service restored in a timely manner.

7.1 Incidents

1. Water Main Failure – Leak and/or Break: **FOUR**
2. Service Connection Failure – Leak and/or Break: **SEVEN**
3. Pump Failure – Break and/or Service Interruption: **ONE**

7.2 Complaints

For each and every water quality complaint received by the RMOW the Utilities Group staff will respond by assessing the initial complaint, and complete any necessary repair/service/maintenance work required to resolve the system cause. If the cause requires further investigation and/or intervention then a case file is opened. In 2015 the RMOW received 10 water quality complaints a brief description of each is located in the following table (Table 13.).

Table 13. Water Quality Complaints 2015

Date	Water Quality Complaint	Corrective Action Taken
11/6/2015	Water Quality	Investigated and resolved
2/23/2015	Dirty Water	Advised that it was likely due to the un-lined cast iron water main piping in the Alpine Meadows area and that pipes were scheduled to be replaced during 2015-2016
3/2/2015	Dirty Water	Called to let her know that her issues are very likely due to high iron in the water due to the un-lined cast-iron pipe in Alpine Meadows. I indicated that we have no reason to believe this is a health concern. I also informed her of the Alpine Meadows pipe replacement program 2015-2016
3/5/2015	Dirty Water	Advised to flush water until it runs clear. Issue related to Utilities shutting off the water to the Rimrock II site for a short time on 5th March around 12.30pm in response to a request from a plumber repairing a broken water main
3/5/2015	Dirty Water	Advised to flush water until it runs clear. Issue related to Utilities shutting off the water to the Rimrock II site for a short time on 5th March around 12.30pm in response to a request from a plumber repairing a broken water main
12/9/2015	Water Quality	Investigated and resolved
12/23/2015	Water Quality	Investigated and resolved
11/23/2015	Water Quality	Investigated and resolved

10/7/2015	Low Pressure	Water pressure tested at hydrant on street, pressure was adequate
2/2/2015	Taste	Water sample conducted – no anomalous results

8. Results

8.1 Chemical and Physical Parameters

8.1.1 pH

In 2015 there were 802 pH samples taken, 339 from source water sample sites and 463 from distribution system sample sites. The Canadian drinking water quality guidelines set an optimal target pH range of 6.5 to 8.5; the sampling process records all the pH values and flags any samples that fall outside this range. Of the 802 samples 216 individual samples were flagged, 107 from source water sample sites and 109 from the supply distribution sample sites. The average pH level in 2015 for the source water samples was 6.75 and 6.82 for the distribution system samples, which both fall within the recommended guidelines. As a single sample does not provide an adequate summary of the overall water condition, the system averages provide the best representation of the pH levels of the RMOW water distribution system. The pH levels in 2015 did not pose any hazard to human health.

8.1.2 Temperature

Temperature is primarily an aesthetic objective with a target of less than or equal to 15°C, according to the GCDWQ. Warmer water temperature within the distribution system has the potential to indirectly affect health through impacts on disinfection, corrosion control and formation of biofilms. Whistler overwhelmingly achieved this objective in 2015; of 786 temperature samples 12 were recorded outside this range (11 out of the 462 in the distribution system and 1 from the 324 source water sites).

8.1.3 Turbidity

The current GCDWQ states that the turbidity of water entering a distribution system should be < 1.0 NTU at all times, however the guideline is specifically for water supply systems that use filtration systems, which the RMOW distribution systems does not. As such the RMOW water supply permit allows for a turbidity of < 1 NTU in the source water and < 5 NTU throughout the distribution system.

Of the 804 turbidity samples taken 324 were from source water sampling stations and 464 from distribution sample sites. The distribution system samples tested below this threshold 98.7% of the time and the source water samples testing below the threshold 95.9% of the time. When the RMOW surface water intake (21-Mile Creek) exceeds the < 1 NTU threshold the intake automatically shuts down. Alpine Meadows groundwater wells W210 and W213 often display high turbidity upon start-up; turbidity at these

sites generally drops below 1 NTU after approximately 20 minutes of runtime. This start-up turbidity has had no effect on disinfection parameters.

8.1.4 Free Chlorine

The GCDWQ has no threshold set for chlorine concentrations in drinking water due to its low toxicity in amounts commonly used in the water supply disinfection process. The RMOW maintains a target range for Free Chlorine of between 0.20 mg/L – 0.60 mg/L at all points throughout the distribution system, except for SS-406 R238 Emerald Reservoir where a Free Chlorine target of 0.40 mg/L – 0.75 mg/L is applied. This exception is outlined in the Coast Garibaldi Health Permit to Operate. Sampling is conducted primarily post disinfection to monitor the residual chlorine in the distribution system, 462 samples were collected in 2015 meeting the RMOW target range 75.5% of the time. These samples provide the RMOW with the necessary information to regularly calibrate the amount of chlorine used to ensure effective disinfection.

8.2 Microbiological Parameters

Of the 773 weekly E. coli samples, 298 source water samples and 475 distribution system samples, two source water samples tested positive for bacteria pre-disinfection and none tested positive in the distribution system. Out of the 771 Total Coliform Count samples taken, of the 473 water distribution system samples none tested positive. Of the 298 source water samples (pre-disinfection) 2 tested positive with a Total Coliform Count greater than 10, above the maximum allowable count (MAC < 10 counts/100mL). The results above indicate that the RMOW disinfection system is operating as designed, effectively maintaining the required level of water quality. Quarterly testing detected zero Heterotrophic Plate Counts (HPC) in excess of the RMOW objective of < 200 colonies per millilitre, a significantly lower limit than the GCDWQ standard of < 500 colonies per millilitre.

8.2.1 Total Organic Carbon

Quarterly testing of Total Organic Carbon (TOC) at source water sample sites resulted in zero samples greater than the RMOW internal guideline of < 2.5 mg/L. The GCDWQ standards do not discuss TOC, and subsequently do not establish concentration guidelines for TOC levels in drinking water supply. The amount of TOC in the water does not directly represent a hazard to human health, however large quantities can contribute to an increase in disinfection by-products of epidemiological interest, such as trihalomethane (THM).

8.2.2 Disinfection Bi-Products

Quarterly testing showed that both trihalomethane (THM) and Haloacetic Acid (HAA) were within acceptable maximum concentrations as defined by the GCDWQ (MAC 100 µg/L).

8.2.3 Total Iron

Quarterly testing for Total Iron shows 2 sample results greater than the aesthetic objective of 0.3 mg/L, located in Alpine Meadows and W212-1 at Function Junction. As this is an aesthetic objective, the elevated results are not a public health concern.

8.2.4 Total Manganese

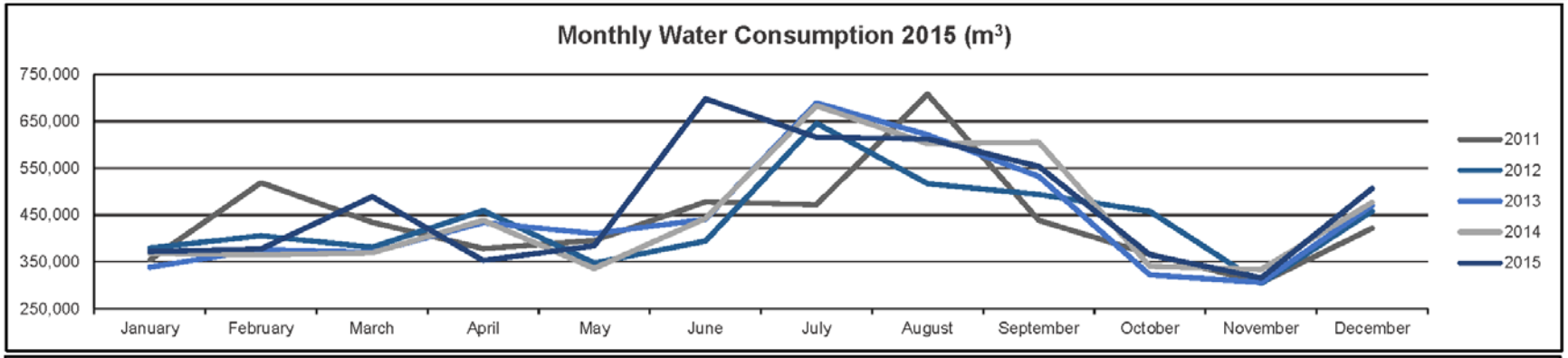
Quarterly testing for Total Manganese shows 10 sample results falling outside the aesthetic objective of 0.05 mg/L. High manganese levels are not considered a risk to public health, under current Canadian drinking water guidelines. Should manganese be assigned a MAC in the future capital works options are available to ensure manganese remains within the MAC.

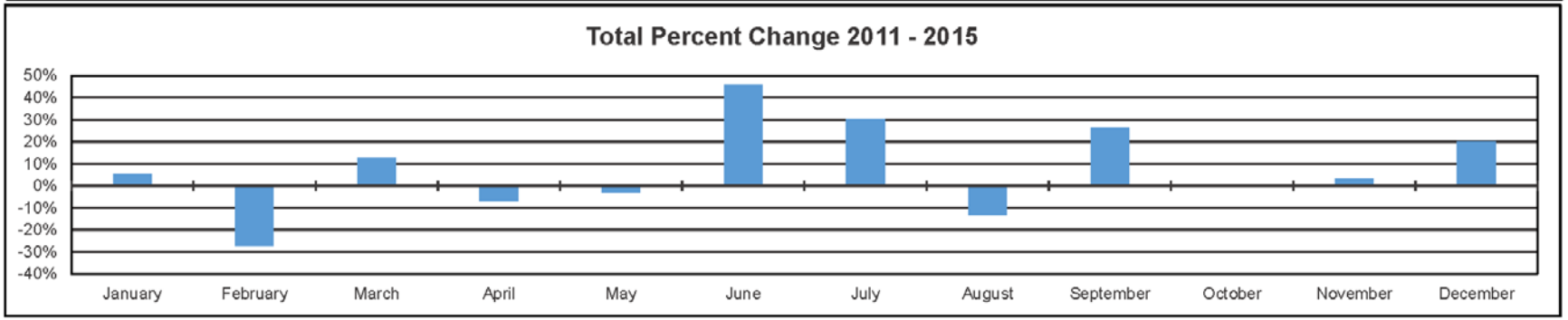
9. Appendix A – Water Consumption and Sampling Data

1. Monthly Water Consumption Summary 2015
2. Source Water Summary 2015
3. Monthly Water Consumption Summary 2015
4. Source Water Summary 2015
5. Monthly Water Consumption Reports January to December 2015
6. Standard Weekly Water Sampling Results 2015
7. Quarterly Water Sampling Results 2015Quarterly Water Sampling Results 2015
    a. Trihalomethanes and Haloacetic Acids
    b. Total Iron and Manganese
    c. Heterotrophic Plate Count and Total Organic Carbon
8. Annual Water Sampling Results 2015

9.1 Monthly Water Consumption Summary 2015

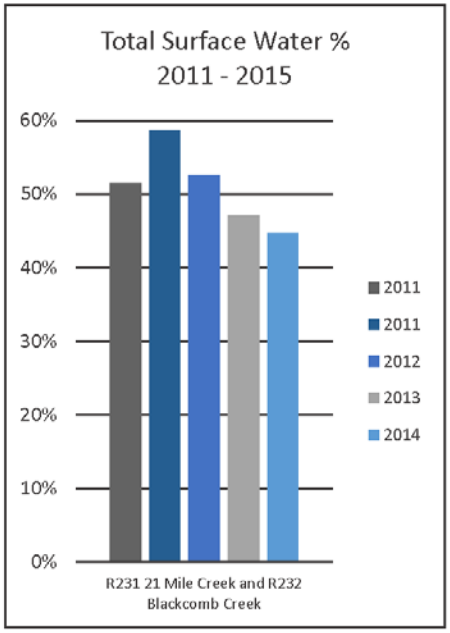
Monthly Water Consumption Percent Change 2015											
	2015	% Change	2014	% Change	2013	% Change	2012	% Change	2011	% Change	Total Percent Change
January	371,817	1%	368,414	9%	338,324	-11%	379,353	7%	353,656	-14%	5%
February	377,507	4%	364,722	-3%	376,055	-7%	405,506	-22%	518,862	14%	-27%
March	488,889	32%	369,247	0%	370,200	-3%	381,065	-12%	434,141	-33%	13%
April	353,026	-20%	438,730	1%	433,944	-6%	459,341	21%	378,461	-14%	-7%
May	384,361	14%	335,721	-18%	410,157	18%	347,627	-12%	395,377	-13%	-3%
June	697,981	58%	442,836	1%	440,513	12%	394,211	-17%	477,786	18%	46%
July	615,593	-10%	683,140	-1%	689,232	7%	645,777	37%	471,883	-22%	30%
August	612,770	2%	602,495	-3%	620,990	20%	516,917	-27%	707,794	-6%	-13%
September	553,712	-9%	605,319	14%	532,394	8%	494,041	13%	438,319	0%	26%
October	365,046	7%	340,677	6%	321,850	-30%	457,579	25%	365,972	13%	0%
November	315,323	-5%	333,660	9%	306,120	1%	303,577	-1%	305,501	-16%	3%
December	506,709	6%	476,836	1%	470,288	3%	458,429	9%	421,737	3%	20%
Total Water Consumption (m^3)	5,642,734	5%	5,361,797	1%	5,310,067	1%	5,243,423	0%	5,269,489	-8%	-1%

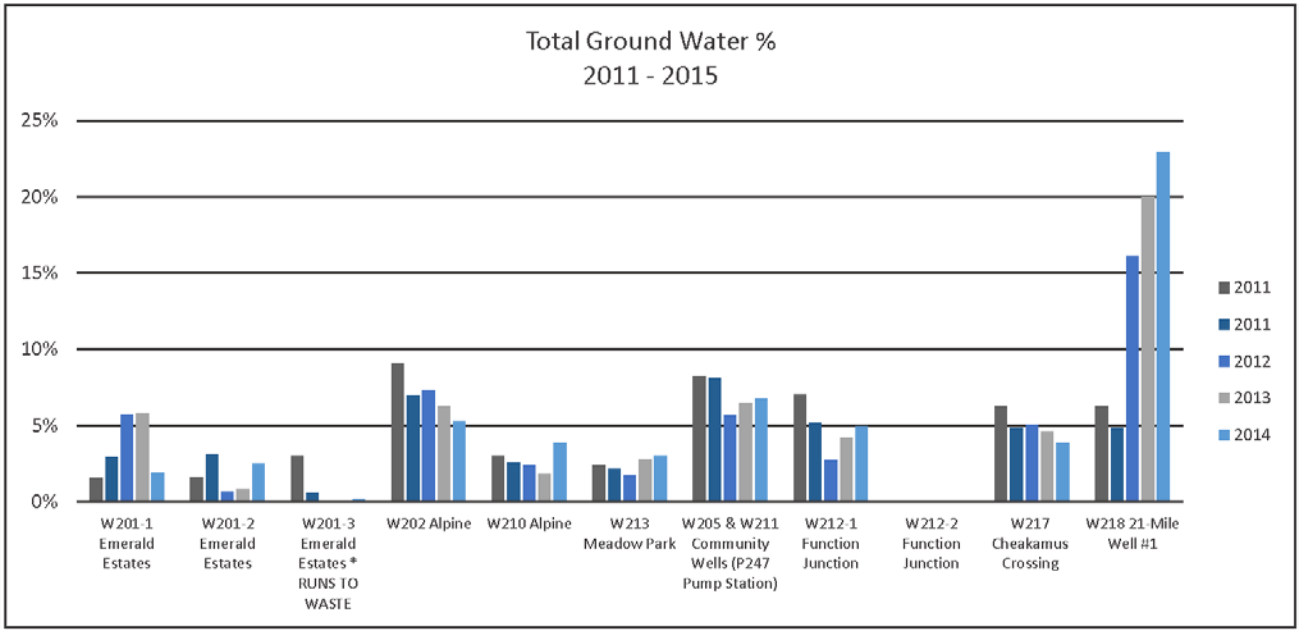




9.2 Source Water Summary 2015

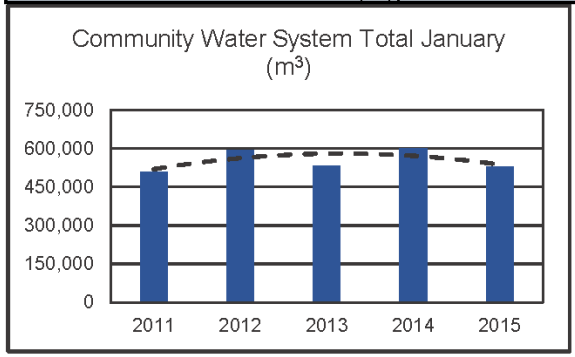
Source Water Sites	2015		2014		2013		2012		2011	
	m^3	%	m^3	%	m^3	%	m^3	%	m^3	%
R231 21 Mile Creek	2,520,437	45%	2,522,414	47%	2,794,284	53%	2,562,204	56%	2,112,143	49%
R232 Blackcomb Creek	-	-	-	-	-	-	118,547	3%	98,736	2%
Total Surface Water	2,520,437	45%	2,522,414	47%	2,794,284	53%	2,680,751	59%	2,210,879	51%
W201-1 Emerald Estates	105,350	2%	311,469	6%	304,014	6%	134,092	3%	67,758	2%
W201-2 Emerald Estates	142,423	3%	45,724	1%	35,562	1%	142,729	3%	70,639	2%
W201-3 Emerald Estates * RUNS TO WASTE	11,354	0%	3,552	0%	1,608	0%	29,121	1%	129,557	3%
W202 Alpine	298,432	5%	335,077	6%	387,681	7%	319,166	7%	391,111	9%
W210 Alpine	220,204	4%	99,707	2%	127,192	2%	116,951	3%	127,976	3%
W213 Meadow Park	168,999	3%	149,543	3%	90,657	2%	98,810	2%	102,781	2%
W205 & W211 Community Wells (P247 Pump Station)	380,922	7%	349,257	7%	300,409	6%	368,923	8%	355,472	8%
W212-1 Function Junction	279,604	5%	225,673	4%	143,678	3%	236,793	5%	303,263	7%
W212-2 Function Junction	0	0%	0	0%	0	0%	0	0%	0	0%
W217 Cheakamus Crossing	220,290	4%	247,466	5%	268,295	5%	221,489	5%	269,012	6%
W218 21-Mile Well #1	1,294,719	23%	1,071,915	20%	856,687	16%	221,489	5%	269,012	6%
W219 21-Mile Well #2	-	-	-	-	-	-	-	-	-	-
Total Ground Water	3,122,297	55%	2,839,383	53%	2,515,783	47%	1,889,563	41%	2,086,581	49%
Total Water	5,642,734	100%	5,361,797	100%	5,310,067	100%	4,570,314	100%	4,297,460	100%

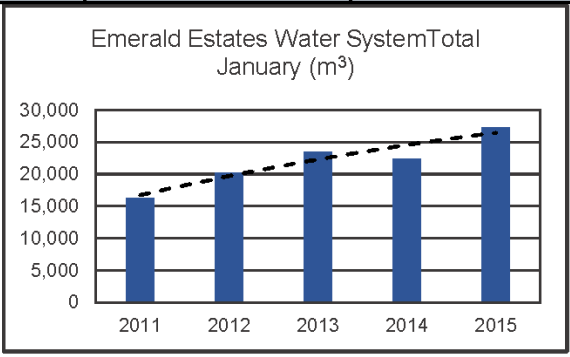


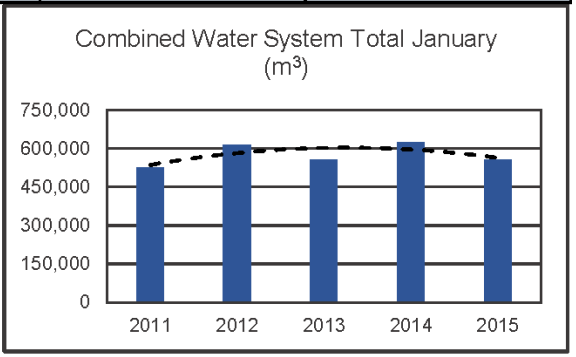


9.3 Monthly Water Consumption Reports January to December 2015

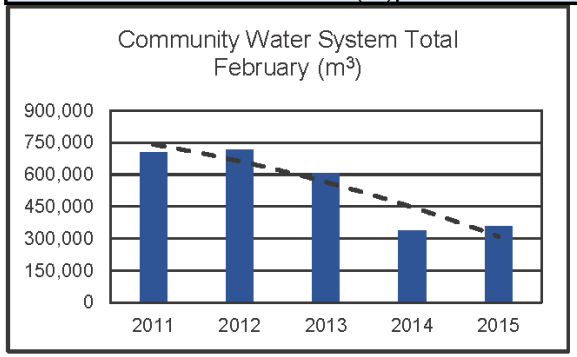
Resort Municipality of Whistler	January 2015 Water Consumption Report									
	Jan-15	YTD	Jan-14	YTD	Jan-13	YTD	Jan-12	YTD	Jan-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	185,831	185,831	254,791	254,791	218,471	218,471	211,858	211,858	160,672	160,672
R232 Blackcomb Creek	0	0	0	0	0	0	24,104	24,104	12,377	12,377
W202 Alpine	24,977	24,977	52	52	8,388	8,388	17,800	17,800	30,719	30,719
W210 Alpine	9,478	9,478	20,315	20,315	17,021	17,021	10,042	10,042	10,015	10,015
W213 Meadow Park	7,645	7,645	15,674	15,674	14,446	14,446	8,812	8,812	8,423	8,423
W205 & W211 Community Wells (P247 Pump Station)	22,100	22,100	4,951	4,951	6,377	6,377	20,589	20,589	13,689	13,689
W212-1 Function Junction	19,169	19,169	3,804	3,804	2,895	2,895	5,807	5,807	19,494	19,494
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	17,208	17,208	18,900	18,900	17,683	17,683	15,122	15,122	13,021	13,021
W218 Rainbow Well	58,101	58,101	27,483	27,483	29,630	29,630	44,924	44,924	69,018	69,018
Surface Water Total (m^3)	185,831	185,831	254,791	254,791	218,471	218,471	235,962	235,962	173,049	173,049
Ground Water Total (m^3)	344,509	344,509	345,970	345,970	314,911	314,911	359,058	359,058	337,428	337,428
Community Water System Total (m^3)	530,340	530,340	600,761	600,761	533,382	533,382	595,020	595,020	510,477	510,477
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	10,826	10,826	22,399	22,399	19,605	19,605	5,334	5,334	3,791	3,791
W201-2 Emerald Estates	15,018	15,018	18	18	3,737	3,737	5,575	5,575	3,950	3,950
W201-3 Emerald Estates * RUNS TO WASTE	1,464	1,464	27	27	71	71	9,386	9,386	8,487	8,487
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	27,308	27,308	22,444	22,444	23,413	23,413	20,295	20,295	16,228	16,228
Emerald Estates Water System Total (m^3)	27,308	27,308	22,444	22,444	23,413	23,413	20,295	20,295	16,228	16,228
Surface Water Total (m^3)	185,831	185,831	254,791	254,791	218,471	218,471	235,962	235,962	173,049	173,049
Ground Water Total (m^3)	371,817	371,817	368,414	368,414	338,324	338,324	379,353	379,353	353,656	353,656
Total Water (m^3)	557,648	557,648	623,205	623,205	556,795	556,795	615,315	615,315	526,705	526,705

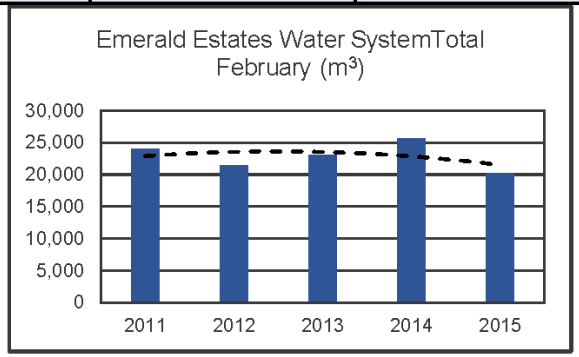


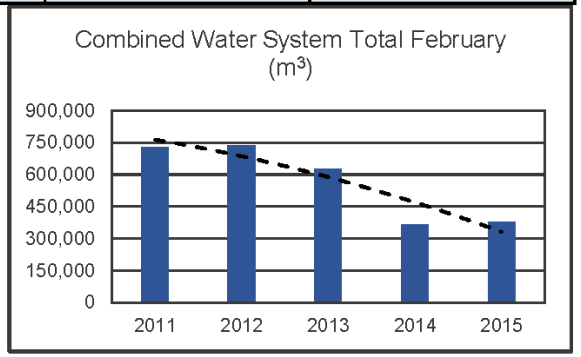




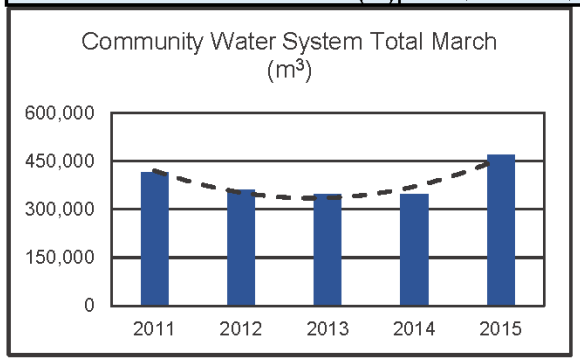
Resort Municipality of Whistler	February 2015 Water Consumption Report									
	Feb-15	YTD	Feb-14	YTD	Feb-13	YTD	Feb-12	YTD	Feb-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	142,720	328,551	257,377	512,168	251,446	469,917	280,610	492,468	190,187	350,859
R232 Blackcomb Creek	0	0	0	0	0	0	30,998	55,102	21,770	34,147
W202 Alpine	14,538	39,515	9,035	9,087	18,203	26,591	18,344	36,144	38,986	69,705
W210 Alpine	12,927	22,405	18,275	38,590	14,300	31,321	8,507	18,549	21,045	31,060
W213 Meadow Park	10,716	18,361	14,638	30,312	9,930	24,376	6,709	15,521	17,035	25,458
W205 & W211 Community Wells (P247 Pump Station)	31,160	53,260	2,651	7,602	3,516	9,893	5,057	25,646	51,984	65,673
W212-1 Function Junction	33,721	52,890	1,661	5,465	1,378	4,273	4,566	10,373	19,072	38,566
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	17,218	34,426	19,710	38,610	17,765	35,448	14,995	30,117	21,160	34,181
W218 Rainbow Well	94,296	152,397	15,767	43,250	36,482	66,112	36,482	81,406	113,614	182,632
Surface Water Total (m^3)	142,720	328,551	257,377	512,168	251,446	469,917	311,608	547,570	211,957	385,006
Ground Water Total (m^3)	214,576	559,085	81,737	427,707	353,020	667,931	406,268	765,326	494,853	832,281
Community Water System Total (m^3)	357,296	887,636	339,114	939,875	604,466	1,137,848	717,876	1,312,896	706,810	1,217,287
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	8,475	19,301	25,383	47,782	22,823	42,428	5,227	10,561	5,955	9,746
W201-2 Emerald Estates	11,046	26,064	50	68	79	3,816	5,428	11,003	6,204	10,154
W201-3 Emerald Estates * RUNS TO WASTE	690	2,154	175	202	133	204	10,808	20,194	11,850	20,337
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	20,211	47,519	25,608	48,052	23,035	46,448	21,463	41,758	24,009	40,237
Emerald Estates Water System Total (m^3)	20,211	47,519	25,608	48,052	23,035	46,448	21,463	41,758	24,009	40,237
Surface Water Total (m^3)	142,720	328,551	257,377	512,168	251,446	469,917	311,608	547,570	211,957	385,006
Ground Water Total (m^3)	234,787	606,604	107,345	475,759	376,055	714,379	427,731	807,084	518,862	872,518
Total Water (m^3)	377,507	935,155	364,722	987,927	627,501	1,184,296	739,339	1,354,654	730,819	1,257,524

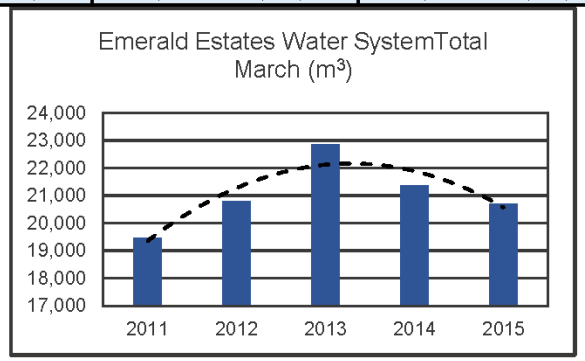


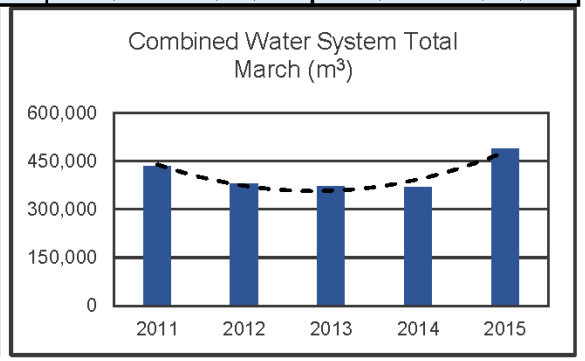




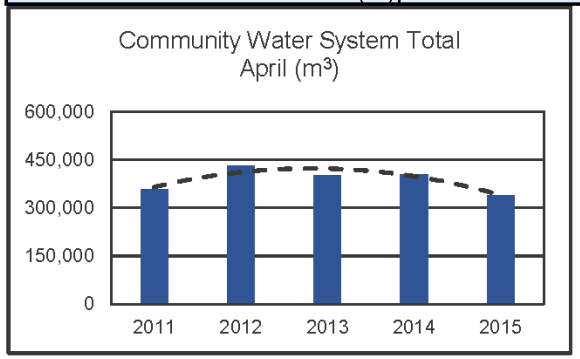
Resort Municipality of Whistler	March 2015 Water Consumption Report									
	Mar-15	YTD	Mar-14	YTD	Mar-13	YTD	Mar-12	YTD	Mar-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	234,712	563,263	246,784	758,952	208,007	677,924	213,156	705,624	205,672	556,531
R232 Blackcomb Creek	0	0	0	0	0	0	42,621	97,723	19,644	53,791
W202 Alpine	232	39,747	24,890	33,977	40,062	66,653	16,950	53,094	41,367	111,072
W210 Alpine	25,733	48,138	9,359	47,949	456	31,777	7,862	26,411	17,630	48,690
W213 Meadow Park	20,501	38,862	6,818	37,130	0	24,376	6,670	22,191	14,465	39,923
W205 & W211 Community Wells (P247 Pump Station)	36,180	89,440	9,244	16,846	16,201	26,094	15,004	40,650	13,140	78,813
W212-1 Function Junction	23,911	76,801	4,728	10,193	13,508	17,781	11,220	21,593	5,666	44,232
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	15,908	50,334	17,771	56,381	16,509	51,957	15,398	45,515	15,785	49,966
W218 Rainbow Well	111,007	263,404	28,277	71,527	52,593	118,705	31,391	112,797	81,311	263,943
Surface Water Total (m^3)	234,712	563,263	246,784	758,952	208,007	677,924	255,777	803,347	225,316	610,322
Ground Water Total (m^3)	233,472	792,557	101,087	528,794	139,329	807,260	104,495	869,821	189,364	1,021,645
Community Water System Total (m^3)	468,184	1,355,820	347,871	1,287,746	347,336	1,485,184	360,272	1,673,168	414,680	1,631,967
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	8,205	27,506	21,334	69,116	22,611	65,039	5,863	16,424	4,907	14,653
W201-2 Emerald Estates	10,843	36,907	17	85	78	3,894	6,215	17,218	5,113	15,267
W201-3 Emerald Estates * RUNS TO WASTE	1,657	3,811	25	227	175	379	8,715	28,909	9,441	29,778
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	20,705	68,224	21,376	69,428	22,864	69,312	20,793	62,551	19,461	59,698
Emerald Estates Water System Total (m^3)	20,705	68,224	21,376	69,428	22,864	69,312	20,793	62,551	19,461	59,698
Surface Water Total (m^3)	234,712	563,263	246,784	758,952	208,007	677,924	255,777	803,347	225,316	610,322
Ground Water Total (m^3)	254,177	860,781	122,463	598,222	162,193	876,572	125,288	932,372	208,825	1,081,343
Total Water (m^3)	488,889	1,424,044	369,247	1,357,174	370,200	1,554,496	381,065	1,735,719	434,141	1,691,665

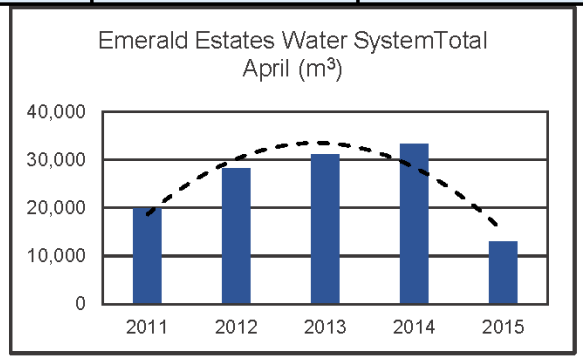


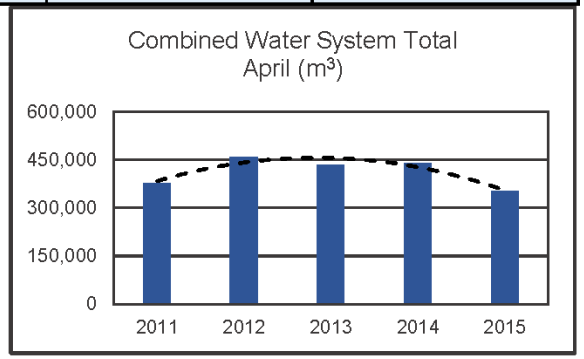




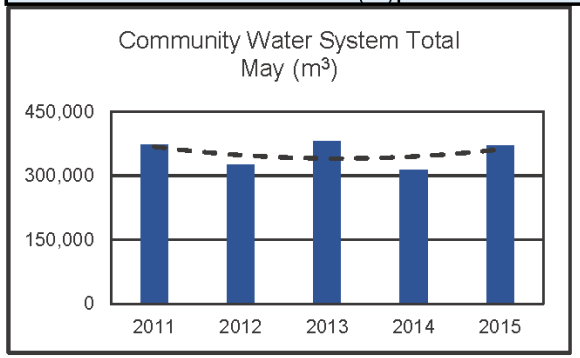
Resort Municipality of Whistler	April 2015 Water Consumption Report									
	Apr-15	YTD	Apr-14	YTD	Apr-13	YTD	Apr-12	YTD	Apr-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	231,423	794,686	101,575	860,527	211,072	888,996	170,725	876,349	72,915	629,446
R232 Blackcomb Creek	0	0	0	0	0	0	20,824	118,547	20,040	73,831
W202 Alpine	2,384	42,131	26,467	60,444	48,927	115,580	24,753	77,847	27,416	138,488
W210 Alpine	16,198	64,336	10,137	58,086	2,292	34,069	7,876	34,287	7,374	56,064
W213 Meadow Park	15,792	54,654	7,879	45,009	0	24,376	8,502	30,693	7,726	47,649
W205 & W211 Community Wells (P247 Pump Station)	7,391	96,831	42,686	59,532	27,904	53,998	39,499	80,149	28,010	106,823
W212-1 Function Junction	23,002	99,803	54,627	64,820	22,122	39,903	34,635	56,228	40,472	84,704
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	14,444	64,778	22,063	78,444	18,758	70,715	22,514	68,029	15,948	65,914
W218 Rainbow Well	29,343	292,747	139,991	211,518	71,715	190,420	101,695	214,492	138,692	402,635
Surface Water Total (m^3)	231,423	794,686	101,575	860,527	211,072	888,996	191,549	994,896	92,955	703,277
Ground Water Total (m^3)	108,554	901,111	303,850	832,644	191,718	998,978	239,474	1,109,295	265,638	1,287,283
Community Water System Total (m^3)	339,977	1,695,797	405,425	1,693,171	402,790	1,887,974	431,023	2,104,191	358,593	1,990,560
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	5,471	32,977	33,146	102,262	30,153	95,192	13,607	30,031	4,758	19,411
W201-2 Emerald Estates	7,114	44,021	43	128	776	4,670	14,499	31,717	4,950	20,217
W201-3 Emerald Estates * RUNS TO WASTE	464	4,275	116	343	225	604	212	29,121	10,160	39,938
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	13,049	81,273	33,305	102,733	31,154	100,466	28,318	90,869	19,868	79,566
Emerald Estates Water System Total (m^3)	13,049	81,273	33,305	102,733	31,154	100,466	28,318	90,869	19,868	79,566
Surface Water Total (m^3)	231,423	794,686	101,575	860,527	211,072	888,996	191,549	994,896	92,955	703,277
Ground Water Total (m^3)	121,603	982,384	337,155	935,377	222,872	1,099,444	267,792	1,200,164	285,506	1,366,849
Total Water (m^3)	353,026	1,777,070	438,730	1,795,904	433,944	1,988,440	459,341	2,195,060	378,461	2,070,126

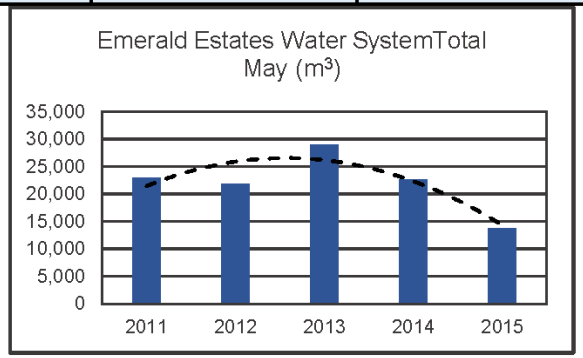


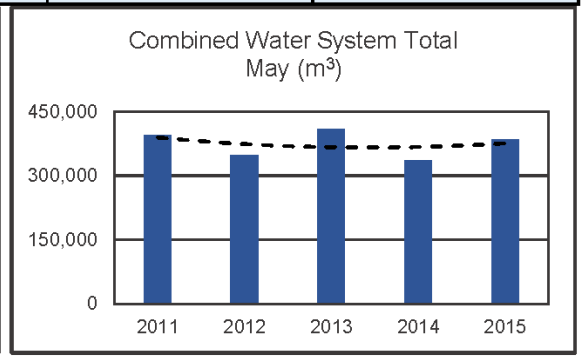




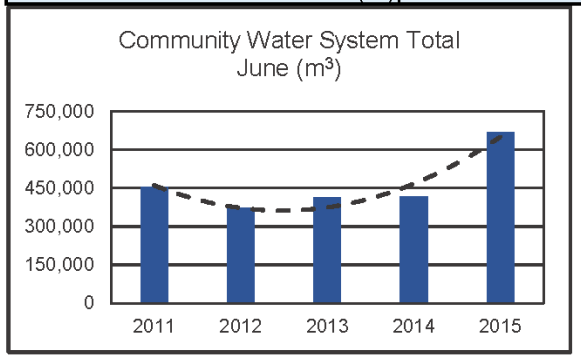
Resort Municipality of Whistler	May 2015 Water Consumption Report									
	May-15	YTD	May-14	YTD	May-13	YTD	May-12	YTD	May-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	253,562	1,048,248	66,011	926,538	141,534	1,030,530	28,305	904,654	1,440	630,886
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	5,689	79,520
W202 Alpine	24,850	66,981	34,493	94,937	47,788	163,368	25,363	103,210	23,785	162,273
W210 Alpine	12,052	76,388	2,215	60,301	3,889	37,958	9,470	43,757	9,294	65,358
W213 Meadow Park	9,390	64,044	1,533	46,542	0	24,376	7,899	38,592	8,004	55,653
W205 & W211 Community Wells (P247 Pump Station)	8,290	105,121	27,484	87,016	36,925	90,923	57,441	137,590	53,540	160,363
W212-1 Function Junction	7,771	107,574	39,702	104,522	36,511	76,414	53,902	110,130	58,605	143,309
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	17,237	82,015	16,707	95,151	18,832	89,547	16,446	84,475	11,935	77,849
W218 Rainbow Well	37,452	330,199	125,020	336,538	95,682	286,102	126,930	341,422	200,100	602,735
Surface Water Total (m^3)	253,562	1,048,248	66,011	926,538	141,534	1,030,530	28,305	1,023,201	7,129	710,406
Ground Water Total (m^3)	117,042	1,018,153	247,154	1,079,798	239,627	1,238,605	297,451	1,406,746	365,263	1,652,546
Community Water System Total (m^3)	370,604	2,066,401	313,165	2,006,336	381,161	2,269,135	325,756	2,429,947	372,392	2,362,952
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	4,923	37,900	22,412	124,674	28,659	123,851	10,713	40,744	5,350	24,761
W201-2 Emerald Estates	8,411	52,432	30	158	106	4,776	11,158	42,875	5,569	25,786
W201-3 Emerald Estates * RUNS TO WASTE	423	4,698	114	457	231	835	0	29,121	12,066	52,004
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	13,757	95,030	22,556	125,289	28,996	129,462	21,871	112,740	22,985	102,551
Emerald Estates Water System Total (m^3)	13,757	95,030	22,556	125,289	28,996	129,462	21,871	112,740	22,985	102,551
Surface Water Total (m^3)	253,562	1,048,248	66,011	926,538	141,534	1,030,530	28,305	1,023,201	7,129	710,406
Ground Water Total (m^3)	130,799	1,113,183	269,710	1,205,087	268,623	1,368,067	319,322	1,519,486	388,248	1,755,097
Total Water (m^3)	384,361	2,161,431	335,721	2,131,625	410,157	2,398,597	347,627	2,542,687	395,377	2,465,503

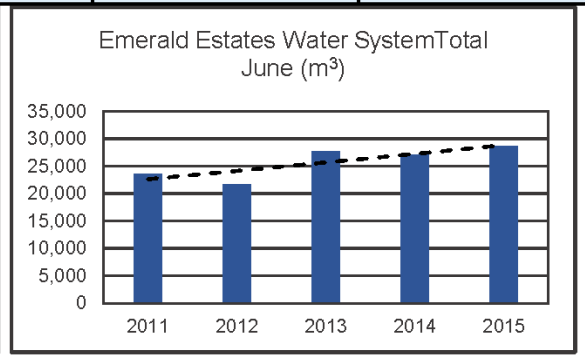


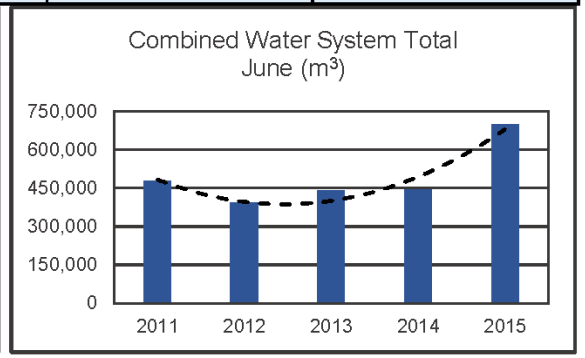




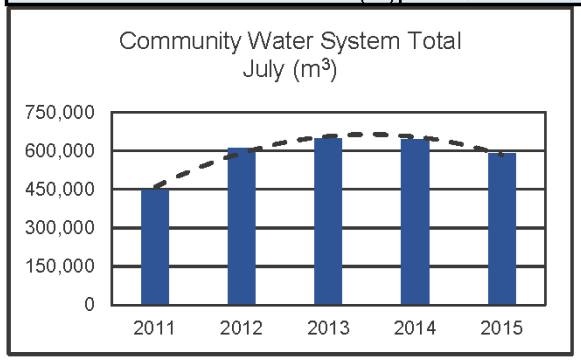
Resort Municipality of Whistler	June 2015 Water Consumption Report									
	Jun-15	YTD	Jun-14	YTD	Jun-13	YTD	Jun-12	YTD	Jun-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	337,006	1,385,254	218,112	1,144,650	259,134	1,289,664	153,307	1,057,961	133,105	763,991
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	0	79,520
W202 Alpine	38,842	105,823	40,777	135,714	48,923	212,291	27,826	131,036	35,989	198,262
W210 Alpine	24,136	100,524	1,941	62,242	3,233	41,191	6,715	50,472	9,779	75,137
W213 Meadow Park	21,043	85,087	8,440	54,982	373	24,749	5,224	43,816	5,317	60,970
W205 & W211 Community Wells (P247 Pump Station)	44,250	149,371	26,381	113,397	13,369	104,292	56,727	194,317	57,480	217,843
W212-1 Function Junction	10,599	118,173	9,924	114,446	8,815	85,229	25,398	135,528	48,130	191,439
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	28,670	110,685	23,353	118,504	22,201	111,748	17,310	101,785	50,449	128,298
W218 Rainbow Well	164,813	495,012	86,889	423,427	56,758	342,860	80,053	421,475	114,005	716,740
Surface Water Total (m^3)	337,006	1,385,254	218,112	1,144,650	259,134	1,289,664	153,307	1,176,508	133,105	843,511
Ground Water Total (m^3)	332,353	1,350,506	197,705	1,277,503	153,672	1,392,277	219,253	1,625,999	321,149	1,973,695
Community Water System Total (m^3)	669,359	2,735,760	415,817	2,422,153	412,806	2,681,941	372,560	2,802,507	454,254	2,817,206
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	11,583	49,483	26,810	151,484	27,707	151,558	10,479	51,223	6,174	30,935
W201-2 Emerald Estates	15,386	67,818	137	295	0	4,776	11,172	54,047	6,428	32,214
W201-3 Emerald Estates * RUNS TO WASTE	1,653	6,351	72	529	0	835	0	29,121	10,930	62,934
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	28,622	123,652	27,019	152,308	27,707	157,169	21,651	134,391	23,532	126,083
Emerald Estates Water System Total (m^3)	28,622	123,652	27,019	152,308	27,707	157,169	21,651	134,391	23,532	126,083
Surface Water Total (m^3)	337,006	1,385,254	218,112	1,144,650	259,134	1,289,664	153,307	1,176,508	133,105	843,511
Ground Water Total (m^3)	360,975	1,474,158	224,724	1,429,811	181,379	1,549,446	240,904	1,760,390	344,681	2,099,778
Total Water (m^3)	697,981	2,859,412	442,836	2,574,461	440,513	2,839,110	394,211	2,936,898	477,786	2,943,289

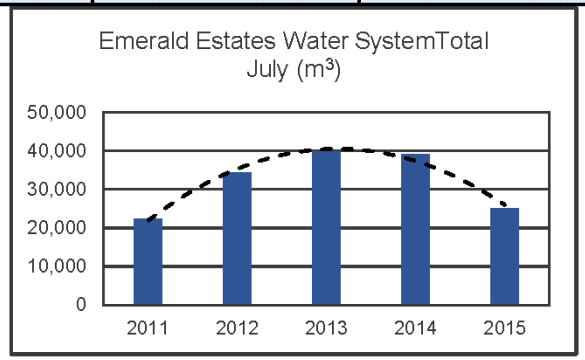


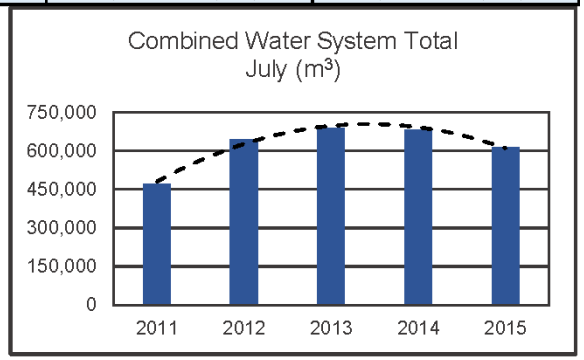




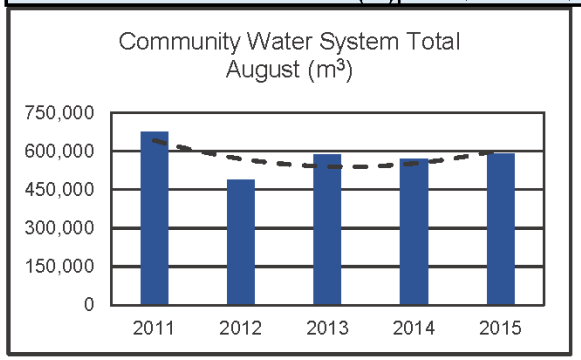
Resort Municipality of Whistler	July 2015 Water Consumption Report									
	Jul-15	YTD	Jul-14	YTD	Jul-13	YTD	Jul-12	YTD	Jul-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	271,618	1,656,872	320,771	1,465,421	348,414	1,638,078	310,894	1,368,855	217,108	981,099
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	0	79,520
W202 Alpine	31,210	137,033	49,421	185,135	48,904	261,195	33,862	164,898	23,409	221,671
W210 Alpine	22,442	122,966	266	62,508	21,479	62,670	16,801	67,273	7,893	83,030
W213 Meadow Park	17,826	102,913	32,036	87,018	16,811	41,560	14,279	58,095	5,739	66,709
W205 & W211 Community Wells (P247 Pump Station)	44,330	193,701	41,870	155,267	44,741	149,033	78,857	273,174	40,100	257,943
W212-1 Function Junction	9,096	127,269	21,477	135,923	10,631	95,860	23,418	158,946	11,874	203,313
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	20,822	131,507	30,195	148,699	37,494	149,242	28,728	130,513	40,195	168,493
W218 Rainbow Well	173,066	668,078	147,944	571,371	121,066	463,926	104,460	525,935	103,186	819,926
Surface Water Total (m^3)	271,618	1,656,872	320,771	1,465,421	348,414	1,638,078	310,894	1,487,402	217,108	1,060,619
Ground Water Total (m^3)	318,792	1,669,298	323,209	1,600,712	301,126	1,693,403	300,405	1,926,404	232,396	2,206,091
Community Water System Total (m^3)	590,410	3,326,170	643,980	3,066,133	649,540	3,331,481	611,299	3,413,806	449,504	3,266,710
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	10,525	60,008	28,779	180,263	36,176	187,734	16,654	67,877	4,880	35,815
W201-2 Emerald Estates	14,168	81,986	10,289	10,584	3,421	8,197	17,824	71,871	5,101	37,315
W201-3 Emerald Estates * RUNS TO WASTE	490	6,841	92	621	95	930	0	29,121	12,398	75,332
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	25,183	148,835	39,160	191,468	39,692	196,861	34,478	168,869	22,379	148,462
Emerald Estates Water System Total (m^3)	25,183	148,835	39,160	191,468	39,692	196,861	34,478	168,869	22,379	148,462
Surface Water Total (m^3)	271,618	1,656,872	320,771	1,465,421	348,414	1,638,078	310,894	1,487,402	217,108	1,060,619
Ground Water Total (m^3)	343,975	1,818,133	362,369	1,792,180	340,818	1,890,264	334,883	2,095,273	254,775	2,354,553
Total Water (m^3)	615,593	3,475,005	683,140	3,257,601	689,232	3,528,342	645,777	3,582,675	471,883	3,415,172

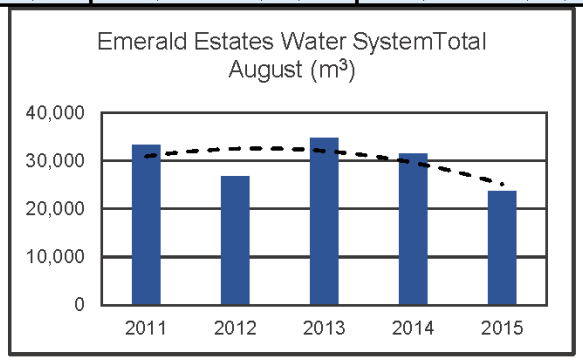


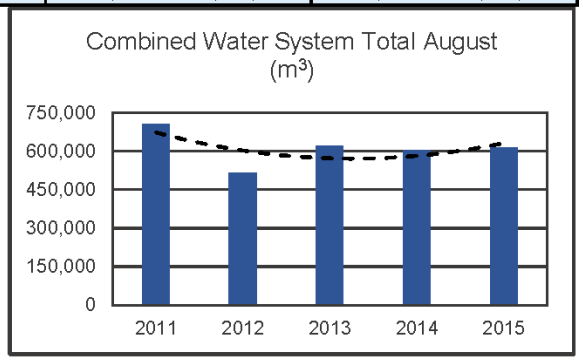




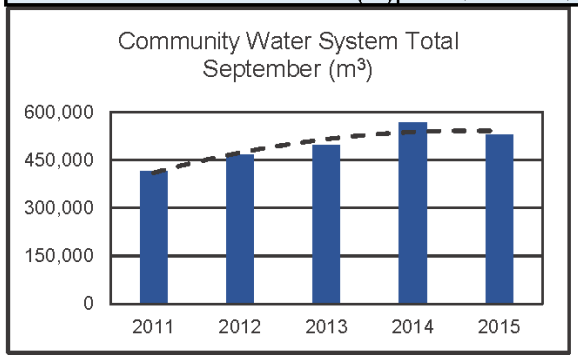
Resort Municipality of Whistler	August 2015 Water Consumption Report									
	Aug-15	YTD	Aug-14	YTD	Aug-13	YTD	Aug-12	YTD	Aug-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	273,554	1,930,426	315,323	1,780,744	300,190	1,938,268	241,946	1,610,801	380,732	1,361,831
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	0	79,520
W202 Alpine	36,965	173,998	36,679	221,814	41,270	302,465	23,943	188,841	41,910	263,581
W210 Alpine	24,712	147,678	0	62,508	12,508	75,178	12,324	79,597	16,537	99,567
W213 Meadow Park	21,651	124,564	21,280	108,298	10,670	52,230	9,057	67,152	13,454	80,163
W205 & W211 Community Wells (P247 Pump Station)	34,710	228,411	56,010	211,277	61,188	210,221	39,139	312,313	27,410	285,353
W212-1 Function Junction	2,771	130,040	22,407	158,330	3,161	99,021	13,752	172,698	3,040	206,353
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	19,215	150,722	27,069	175,768	28,095	177,337	24,317	154,830	34,114	202,607
W218 Rainbow Well	175,492	843,570	92,192	663,563	129,082	593,008	125,617	651,552	157,321	977,247
Surface Water Total (m^3)	273,554	1,930,426	315,323	1,780,744	300,190	1,938,268	241,946	1,729,348	380,732	1,441,351
Ground Water Total (m^3)	315,516	1,984,814	255,637	1,856,349	285,974	1,979,377	248,149	2,174,553	293,786	2,499,877
Community Water System Total (m^3)	589,070	3,915,240	570,960	3,637,093	586,164	3,917,645	490,095	3,903,901	674,518	3,941,228
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	9,745	69,753	29,102	209,365	19,309	207,043	12,977	80,854	9,166	44,981
W201-2 Emerald Estates	13,224	95,210	2,249	12,833	15,324	23,521	13,845	85,716	9,577	46,892
W201-3 Emerald Estates * RUNS TO WASTE	731	7,572	184	805	193	1,123	0	29,121	14,533	89,865
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	23,700	172,535	31,535	223,003	34,826	231,687	26,822	195,691	33,276	181,738
Emerald Estates Water System Total (m^3)	23,700	172,535	31,535	223,003	34,826	231,687	26,822	195,691	33,276	181,738
Surface Water Total (m^3)	273,554	1,930,426	315,323	1,780,744	300,190	1,938,268	241,946	1,729,348	380,732	1,441,351
Ground Water Total (m^3)	339,216	2,157,349	287,172	2,079,352	320,800	2,211,064	274,971	2,370,244	327,062	2,681,615
Total Water (m^3)	612,770	4,087,775	602,495	3,860,096	620,990	4,149,332	516,917	4,099,592	707,794	4,122,966

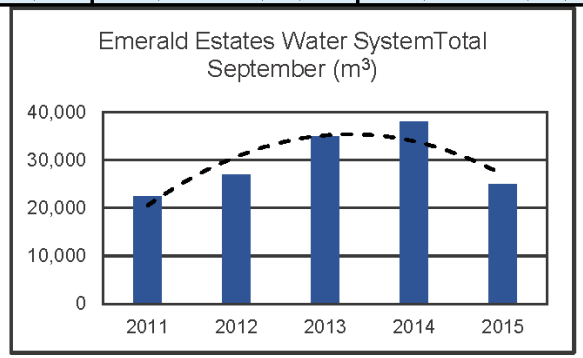


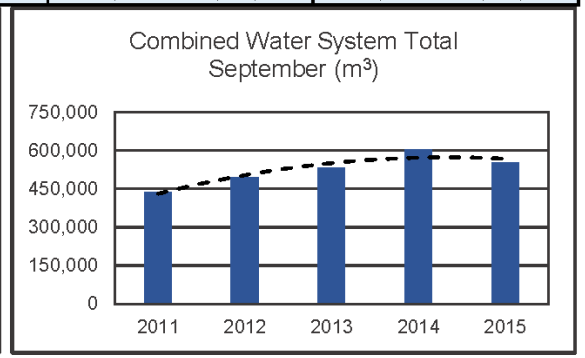




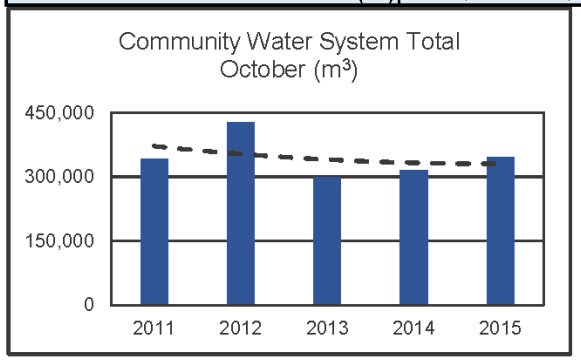
Resort Municipality of Whistler	September 2015 Water Consumption Report									
	Sep-15	YTD	Sep-14	YTD	Sep-13	YTD	Sep-12	YTD	Sep-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	233,126	2,163,552	357,508	2,138,252	246,974	2,185,242	297,910	1,908,711	227,348	1,589,179
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	0	79,520
W202 Alpine	43,974	217,972	36,418	258,232	35,021	337,486	33,608	222,449	40,975	304,556
W210 Alpine	29,612	177,290	9,869	72,377	13,793	88,971	11,366	90,963	6,434	106,001
W213 Meadow Park	20,683	145,247	18,770	127,068	11,131	63,361	9,550	76,702	7,540	87,703
W205 & W211 Community Wells (P247 Pump Station)	36,481	264,892	28,310	239,587	43,342	253,563	25,350	337,663	18,280	303,633
W212-1 Function Junction	14,265	144,305	37,533	195,863	12,679	111,700	3,504	176,202	9,085	215,438
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	19,781	170,503	22,351	198,119	27,731	205,068	22,401	177,231	17,949	220,556
W218 Rainbow Well	130,827	974,397	56,603	720,166	106,772	699,780	63,433	714,985	88,335	1,065,582
Surface Water Total (m^3)	233,126	2,163,552	357,508	2,138,252	246,974	2,185,242	297,910	2,027,258	227,348	1,668,699
Ground Water Total (m^3)	295,623	2,280,437	209,854	2,066,203	250,469	2,229,846	169,212	2,343,765	188,598	2,688,475
Community Water System Total (m^3)	528,749	4,443,989	567,362	4,204,455	497,443	4,415,088	467,122	4,371,023	415,946	4,357,174
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	10,355	80,108	37,761	247,126	24,196	231,239	13,020	93,874	6,047	51,028
W201-2 Emerald Estates	13,956	109,166	0	12,833	10,607	34,128	13,899	99,615	6,304	53,196
W201-3 Emerald Estates * RUNS TO WASTE	652	8,224	196	1,001	148	1,271	0	29,121	10,022	99,887
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	24,963	197,498	37,957	260,960	34,951	266,638	26,919	222,610	22,373	204,111
Emerald Estates Water System Total (m^3)	24,963	197,498	37,957	260,960	34,951	266,638	26,919	222,610	22,373	204,111
Surface Water Total (m^3)	233,126	2,163,552	357,508	2,138,252	246,974	2,185,242	297,910	2,027,258	227,348	1,668,699
Ground Water Total (m^3)	320,586	2,477,935	247,811	2,327,163	285,420	2,496,484	196,131	2,566,375	210,971	2,892,586
Total Water (m^3)	553,712	4,641,487	605,319	4,465,415	532,394	4,681,726	494,041	4,593,633	438,319	4,561,285

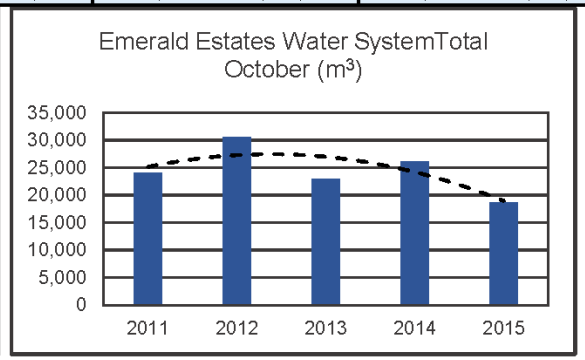


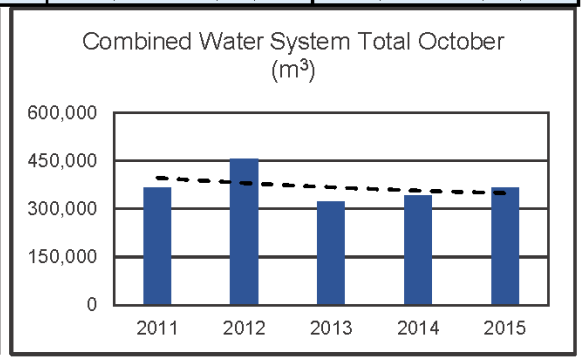




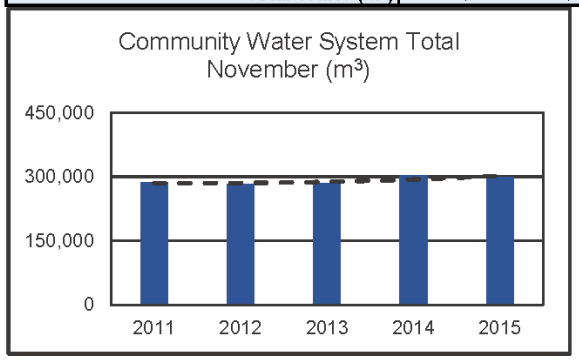
Resort Municipality of Whistler	October 2015 Water Consumption Report									
	Oct-15	YTD	Oct-14	YTD	Oct-13	YTD	Oct-12	YTD	Oct-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	41,430	2,204,982	140,558	2,278,810	135,819	2,321,061	288,521	2,197,232	127,298	1,716,477
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	0	79,520
W202 Alpine	30,485	248,457	22,326	280,558	20,500	357,986	41,744	264,193	44,337	348,893
W210 Alpine	17,230	194,520	8,374	80,751	9,077	98,048	8,914	99,877	5,590	111,591
W213 Meadow Park	3,618	148,865	6,825	133,893	6,543	69,904	7,478	84,180	1,095	88,798
W205 & W211 Community Wells (P247 Pump Station)	49,410	314,302	30,170	269,757	15,914	269,477	10,448	348,111	12,379	316,012
W212-1 Function Junction	51,449	195,754	1,706	197,569	22,829	134,529	7,016	183,218	35,389	250,827
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	14,948	185,451	13,994	212,113	18,540	223,608	10,427	187,658	15,076	235,632
W218 Rainbow Well	137,863	1,112,260	90,554	810,720	69,607	769,387	52,452	767,437	100,686	1,166,268
Surface Water Total (m^3)	41,430	2,204,982	140,558	2,278,810	135,819	2,321,061	288,521	2,315,779	127,298	1,795,997
Ground Water Total (m^3)	305,003	2,585,440	173,949	2,240,152	163,010	2,392,856	138,479	2,482,244	214,552	2,903,027
Community Water System Total (m^3)	346,433	4,790,422	314,507	4,518,962	298,829	4,713,917	427,000	4,798,023	341,850	4,699,024
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	7,465	87,573	26,049	273,175	22,162	253,401	14,762	108,636	6,137	57,165
W201-2 Emerald Estates	9,985	119,151	10	12,843	804	34,932	15,817	115,432	6,390	59,586
W201-3 Emerald Estates * RUNS TO WASTE	1,163	9,387	111	1,112	55	1,326	0	29,121	11,595	111,482
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	18,613	216,111	26,170	287,130	23,021	289,659	30,579	253,189	24,122	228,233
Emerald Estates Water System Total (m^3)	18,613	216,111	26,170	287,130	23,021	289,659	30,579	253,189	24,122	228,233
Surface Water Total (m^3)	41,430	2,204,982	140,558	2,278,810	135,819	2,321,061	288,521	2,315,779	127,298	1,795,997
Ground Water Total (m^3)	323,616	2,801,551	200,119	2,527,282	186,031	2,682,515	169,058	2,735,433	238,674	3,131,260
Total Water (m^3)	365,046	5,006,533	340,677	4,806,092	321,850	5,003,576	457,579	5,051,212	365,972	4,927,257

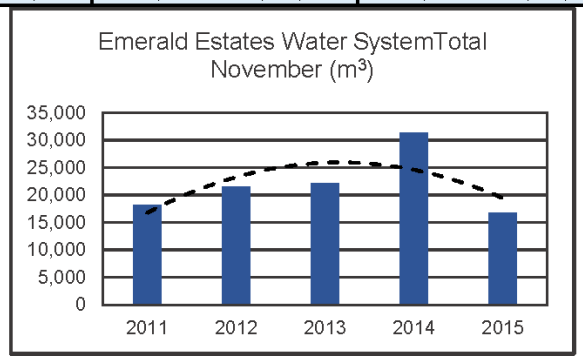


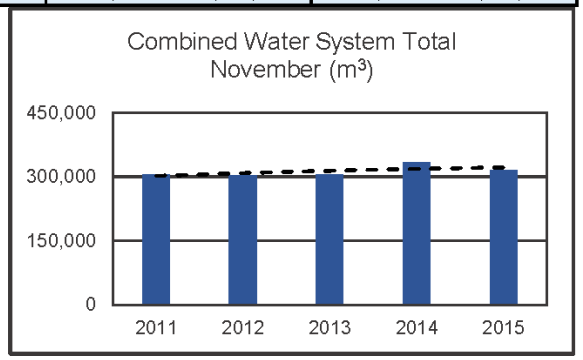




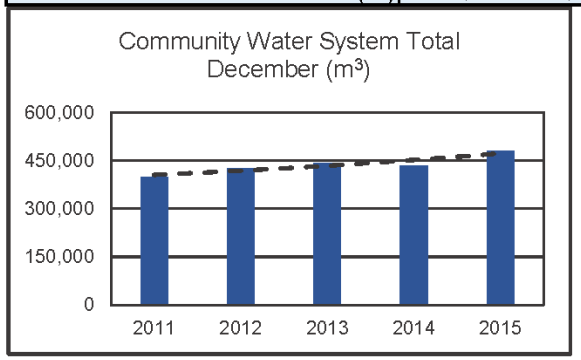
Resort Municipality of Whistler	November 2015 Water Consumption Report									
	Nov-15	YTD	Nov-14	YTD	Nov-13	YTD	Nov-12	YTD	Nov-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	47,160	2,252,142	54,013	2,332,823	178,276	2,499,337	53,144	2,250,376	137,244	1,853,721
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	6,722	86,242
W202 Alpine	17,934	266,391	33,296	313,854	21,357	379,343	21,316	285,509	16,303	365,196
W210 Alpine	12,326	206,846	6,335	87,086	8,364	106,412	7,286	107,163	4,960	116,551
W213 Meadow Park	9,523	158,388	5,000	138,893	4,143	74,047	6,724	90,904	4,315	93,113
W205 & W211 Community Wells (P247 Pump Station)	29,730	344,032	48,500	318,257	11,751	281,228	13,547	361,658	19,792	335,804
W212-1 Function Junction	54,483	250,237	7,702	205,271	3,446	137,975	44,767	227,985	41,453	292,280
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	14,174	199,625	15,191	227,304	18,890	242,498	13,392	201,050	14,942	250,574
W218 Rainbow Well	113,311	1,225,571	132,316	943,036	37,728	807,115	121,898	889,335	41,511	1,207,779
Surface Water Total (m^3)	47,160	2,252,142	54,013	2,332,823	178,276	2,499,337	53,144	2,368,923	143,966	1,939,963
Ground Water Total (m^3)	251,481	2,836,921	248,340	2,488,492	105,679	2,498,535	228,930	2,711,174	143,276	3,046,303
Community Water System Total (m^3)	298,641	5,089,063	302,353	4,821,315	283,955	4,997,872	282,074	5,080,097	287,242	4,986,266
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	6,861	94,434	21,183	294,358	21,943	275,344	10,381	119,017	4,751	61,916
W201-2 Emerald Estates	9,045	128,196	9,905	22,748	71	35,003	11,122	126,554	4,929	64,515
W201-3 Emerald Estates * RUNS TO WASTE	776	10,163	219	1,331	151	1,477	0	29,121	8,579	120,061
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	16,682	232,793	31,307	318,437	22,165	311,824	21,503	274,692	18,259	246,492
Emerald Estates Water System Total (m^3)	16,682	232,793	31,307	318,437	22,165	311,824	21,503	274,692	18,259	246,492
Surface Water Total (m^3)	47,160	2,252,142	54,013	2,332,823	178,276	2,499,337	53,144	2,368,923	143,966	1,939,963
Ground Water Total (m^3)	268,163	3,069,714	279,647	2,806,929	127,844	2,810,359	250,433	2,985,866	161,535	3,292,795
Total Water (m^3)	315,323	5,321,856	333,660	5,139,752	306,120	5,309,696	303,577	5,354,789	305,501	5,232,758

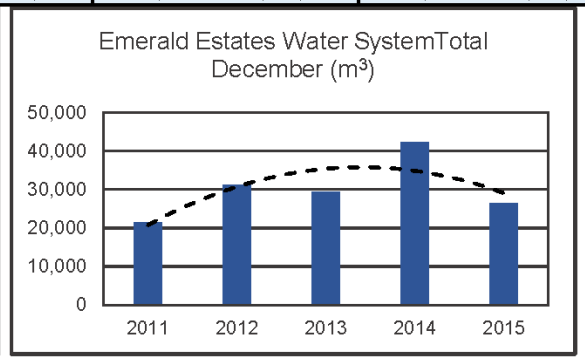


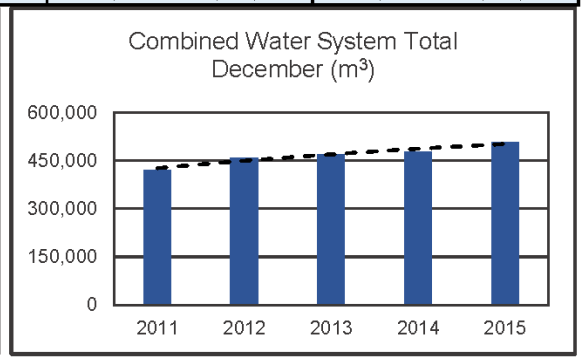




Resort Municipality of Whistler	December 2015 Water Consumption Report									
	Dec-15	YTD	Dec-14	YTD	Dec-13	YTD	Dec-12	YTD	Dec-11	YTD
RMOW Community Water System Ministry of Health Facility #1110299										
R231 21 Mile Creek	268,295	2,520,437	189,591	2,522,414	294,947	2,794,284	311,828	2,562,204	258,422	2,112,143
R232 Blackcomb Creek	0	0	0	0	0	0	0	118,547	12,494	98,736
W202 Alpine	32,041	298,432	21,223	335,077	8,338	387,681	33,657	319,166	25,915	391,111
W210 Alpine	13,358	220,204	12,621	99,707	20,780	127,192	9,788	116,951	11,425	127,976
W213 Meadow Park	10,611	168,999	10,650	149,543	16,610	90,657	7,906	98,810	9,668	102,781
W205 & W211 Community Wells (P247 Pump Station)	36,890	380,922	31,000	349,257	19,181	300,409	7,265	368,923	19,668	355,472
W212-1 Function Junction	29,367	279,604	20,402	225,673	5,703	143,678	8,808	236,793	10,983	303,263
W212-2 Function Junction	0	0	0	0	0	0	0	0	0	0
W217 Cheakamus Crossing	20,665	220,290	20,162	247,466	25,797	268,295	20,439	221,489	18,438	269,012
W218 Rainbow Well	69,148	1,294,719	128,879	1,071,915	49,572	856,687	27,488	916,823	33,262	1,241,041
Surface Water Total (m^3)	268,295	2,520,437	189,591	2,522,414	294,947	2,794,284	311,828	2,680,751	270,916	2,210,879
Ground Water Total (m^3)	212,080	3,049,001	244,937	2,733,429	145,981	2,644,516	115,351	2,826,525	129,359	3,175,662
Community Water System Total (m^3)	480,375	5,569,438	434,528	5,255,843	440,928	5,438,800	427,179	5,507,276	400,275	5,386,541
RMOW Emerald Estates Water System Ministry of Health Facility #11076										
W201-1 Emerald	10,916	105,350	17,111	311,469	28,670	304,014	15,075	134,092	5,842	67,758
W201-2 Emerald Estates	14,227	142,423	22,976	45,724	559	35,562	16,175	142,729	6,124	70,639
W201-3 Emerald Estates * RUNS TO WASTE	1,191	11,354	2,221	3,552	131	1,608	0	29,121	9,496	129,557
Surface Water Total (m^3)	0	0	0	0	0	0	0	0	0	0
Ground Water Total (m^3)	26,334	259,127	42,308	360,745	29,360	341,184	31,250	305,942	21,462	267,954
Emerald Estates Water System Total (m^3)	26,334	259,127	42,308	360,745	29,360	341,184	31,250	305,942	21,462	267,954
Surface Water Total (m^3)	268,295	2,520,437	189,591	2,522,414	294,947	2,794,284	311,828	2,680,751	270,916	2,210,879
Ground Water Total (m^3)	238,414	3,308,128	287,245	3,094,174	175,341	2,985,700	146,601	3,132,467	150,821	3,443,616
Total Water (m^3)	506,709	5,828,565	476,836	5,616,588	470,288	5,779,984	458,429	5,813,218	421,737	5,654,495







9.4 Standard Weekly Water Sampling Results 2015

2015 Source Water Sampling - Groundwater and Surface Water			pH Guidline pH 6.5 - 8.5						E. Coli (MPN/100mL) MAC 0 Counts/100mL						Free Cl_2 (mg/L) Guideline 0.2 - 0.6 mg/L						Turbidity (NTU) Guideline < 1 NTU (Source); < 5 NTU							Temperature (°C) AO ≤ 15°C						Total Coliforms (MPN/100mL) MAC < 10 Counts/100mL					
Week One Sample Sites			S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F>1	F%	F>5	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%
SS-409	W201-1	Emerald W1	20	7.6	6.5	6.7	0	0%	24	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	20	0.6	0	0	0	0%	0	20	12	7	9	0	0%	24	0	0	0	0	0%
SS-410	W201-2	Emerald W2	21	7.6	6.7	6.9	0	0%	24	1	0	0	1	4%	n/a	n/a	n/a	n/a	n/a	n/a	21	0.5	0	0	0	0%	0	21	12	6	9	0	0%	24	3	0	0	0	0%
SS-411	W201-3	Emerald W3	20	7.6	6.7	7.0	0	0%	21	1	0	0	1	5%	n/a	n/a	n/a	n/a	n/a	n/a	20	0.6	0	0	0	0%	0	20	11	6	8	0	0%	21	12	0	1	1	5%
SS-436	*R231*	*21 Mile Creek*	*22*	*8.8*	*6.4*	*7.3*	*2*	*9%*	n/a	n/a	n/a	n/a	n/a	n/a	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*23*	4	0	0	*1*	*4%*	*0*	21	16	1	7	1	5%	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
SS-439	*R232*	*Blackcomb Creek*	*18*	*9.2*	*6.8*	*7.5*	*1*	*6%*	n/a	n/a	n/a	n/a	n/a	n/a	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*18*	20	0	3	*12*	*67%*	*3*	18	10	1	5	0	0%	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
SS-483	W212-1	Function W1	25	7.2	6.0	6.3	22	88%	23	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	25	2	0	0	1	4%	0	23	13	5	10	0	0%	23	0	0	0	0	0%
SS-489	W217	Cheakamus W1	26	6.8	6.1	6.3	23	88%	22	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	26	0.3	0	0	0	0%	0	25	13	8	10	0	0%	22	0	0	0	0	0%

2015 Source Water Sampling - Groundwater and Surface Water			pH Guidline pH 6.5 - 8.5						E. Coli (MPN/100mL) MAC 0 Counts/100mL						Free Cl_2 (mg/L) Guideline 0.2 - 0.6 mg/L						Turbidity (NTU) Guideline < 1 NTU (Source); < 5 NTU							Temperature (°C) AO ≤ 15°C						Total Coliforms (MPN/100mL) MAC < 10 Counts/100mL					
Week Two Sample Sites			S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F>1	F%	F>5	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%
SS-418	W202	Alpine W1	24	7.5	6.4	6.7	3	13%	23	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	24	0.4	0	0	0	0%	0	23	12	6	9	0	0%	23	0	0	0	0	0%
SS-419	W210	Alpine W2	24	7.4	6.8	7.1	0	0%	23	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	24	0.8	0	0	0	0%	0	23	14	6	8	0	0%	23	0	0	0	0	0%
SS-420	W213	Alpine W3	23	7.4	6.5	6.8	0	0%	23	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	23	0.6	0	0	0	0%	0	22	10	0	7	0	0%	23	0	0	0	0	0%
SS-444	W205-1	Community W1	23	7.1	6.2	6.4	16	70%	23	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	23	0.5	0	0	0	0%	0	22	9	1	8	0	0%	23	0	0	0	0	0%
SS-445	W205-2	Community W2	24	7.3	6.3	6.6	9	38%	24	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	24	0.5	0	0	0	0%	0	23	8	7	8	0	0%	24	31	0	1	1	4%
SS-446	W205-3	Community W3	24	7.2	6.3	6.6	11	46%	23	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	24	0.5	0	0	0	0%	0	22	9	7	8	0	0%	23	0	0	0	0	0%
SS-447	W211	Village W1	21	7.2	6.1	6.4	15	71%	22	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	21	0.4	0	0	0	0%	0	19	9	7	8	0	0%	22	0	0	0	0	0%
SS-493	W218	Village W2	24	7.6	6.3	6.7	5	21%	23	0	0	0	0	0%	n/a	n/a	n/a	n/a	n/a	n/a	24	0.8	0	0	0	0%	0	22	11	7	8	0	0%	23	0	0	0	0	0%

2015 Drinking Water Distribution System Sampling			pH Guidline pH 6.5 - 8.5						E. Coli (MPN/100mL) MAC 0 Counts/100mL						Free Cl_2 (mg/L) Guideline 0.2 - 0.6 mg/L						Turbidity (NTU) Guideline < 1 NTU (Source); < 5 NTU							Temperature (°C) AO ≤ 15°C						Total Coliforms (MPN/100mL) MAC < 10 Counts/100mL					
Week One Sample Sites			S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F>1	F%	F>5	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%
SS-412	P245	MountainView PRV	24	7.7	6.5	6.9	0	0%	23	0	0	0	0	0%	24	0.36	0.05	0.18	18	75%	24	1	0	1	0	0%	0	24	14	6	10	0	0%	23	0	0	0	0	0%
SS-424	P266	Nicklaus North PRV	24	7.9	6.4	7.0	2	8%	23	0	0	0	0	0%	24	0.64	0.05	0.34	7	29%	24	0.8	0	0	0	0%	0	24	14	5	10	0	0%	23	0	0	0	0	0%
SS-430	S. Park	Snowflake S	24	7.4	6.4	6.9	2	8%	23	0	0	0	0	0%	24	0.57	0.12	0.35	4	17%	24	0.8	0	0	0	0%	0	24	14	5	10	0	0%	23	0	0	0	0	0%
SS-441	P256	Blackcomb PRV	23	7.5	6.5	6.9	0	0%	22	0	0	0	0	0%	23	0.57	0.11	0.34	2	9%	23	0.5	0	0	0	0%	0	23	15	6	10	0	0%	22	0	0	0	0	0%
SS-453	Mtn Sq.	Village S2	24	8.3	6.4	7.0	4	17%	23	0	0	0	0	0%	24	0.60	0.10	0.36	5	21%	24	0.9	0	0	0	0%	0	24	15	5	10	0	0%	23	0	0	0	0	0%
SS-459	S104	Lakeside SLS	22	8.2	6.3	6.9	7	32%	20	0	0	0	0	0%	22	0.58	0.21	0.40	0	0%	22	0.4	0	0	0	0%	0	22	17	5	10	1	5%	20	0	0	0	0	0%
SS-465	P270	Taluswood PRV	24	7.6	6.4	6.9	4	17%	24	0	0	0	0	0%	24	0.60	0.10	0.38	3	13%	24	0.6	0	0	0	0%	0	24	16	7	10	1	4%	24	0	0	0	0	0%
SS-480	P273	Spring Creek PRV	23	7.5	6.0	6.6	14	61%	24	0	0	0	0	0%	23	0.60	0.12	0.37	4	17%	23	0.6	0	0	0	0%	0	23	11	5	9	0	0%	24	0	0	0	0	0%
SS-482	Alta Lk.	Alta Lake S	24	7.4	6.1	6.6	13	54%	24	0	0	0	0	0%	24	0.50	0.08	0.28	7	29%	24	0.4	0	0	0	0%	0	24	18	6	10	1	4%	24	0	0	0	0	0%
SS-491	Mt. Fee	Cheakamus S	24	6.6	6.2	6.4	18	75%	24	0	0	0	0	0%	24	0.60	0.24	0.35	1	4%	24	0.4	0	0	0	0%	0	24	16	0	10	3	13%	24	0	0	0	0	0%

2015 Drinking Water Distribution System Sampling			pH Guidline pH 6.5 - 8.5						E. Coli (MPN/100mL) MAC 0 Counts/100mL						Free Cl_2 (mg/L) Guideline 0.2 - 0.6 mg/L						Turbidity (NTU) Guideline < 1 NTU (Source); < 5 NTU							Temperature (°C) AO ≤ 15°C						Total Coliforms (MPN/100mL) MAC < 10 Counts/100mL					
Week Two Sample Sites			S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F>1	F%	F>5	S	Max	Min	Avg	F	F%	S	Max	Min	Avg	F	F%
SS-403	S131	Emerald SLS	20	7.3	6.7	6.9	0	0%	24	0	0	0	0	0%	20	0.74	0.37	0.52	3	15%	20	0.5	0	0	0	0%	0	20	15	6	11	0	0%	24	0	0	0	0	0%
SS-406	R238	Emerald R	19	7.0	6.7	6.9	0	0%	24	0	0	0	0	0%	19	0.73	0.51	0.60	0	0%	19	0.3	0	0	0	0%	0	19	12	6	9	0	0%	22	0	0	0	0	0%
SS-421	S101	Alpine SLS	23	7.6	6.4	6.8	1	4%	24	0	0	0	0	0%	23	0.72	0.01	0.46	6	26%	23	3	0	0	1	4%	0	23	13	6	9	0	0%	24	0	0	0	0	0%
SS-427	P267	Spruce Grove PRV	25	7.6	6.4	7.1	2	8%	23	0	0	0	0	0%	24	0.72	0.27	0.49	6	25%	25	0.8	0	0	0	0%	0	24	16	1	8	2	8%	23	0	0	0	0	0%
SS-450	Main St.	Village S1	23	7.6	6.4	7.0	2	9%	25	0	0	0	0	0%	23	0.59	0.20	0.44	1	4%	23	0.8	0	0	0	0%	0	23	15	2	9	2	9%	25	0	0	0	0	0%
SS-456	P265	Sunridge PRV	23	7.5	6.4	7.0	1	4%	27	0	0	0	0	0%	23	0.62	0.01	0.26	12	52%	23	0.5	0	0	0	0%	0	23	15	4	9	1	4%	27	1	0	0	0	0%
SS-471	S106	Gondola SLS	23	7.5	6.1	6.6	14	61%	24	0	0	0	0	0%	23	0.60	0.20	0.38	3	13%	23	0.7	0	0	0	0%	0	23	13	5	9	0	0%	24	1	0	0	0	0%
SS-477	S121	Millars Pond SLS	25	7.5	6.1	6.5	13	52%	26	0	0	0	0	0%	24	0.47	0.12	0.31	5	21%	25	0.6	0	0	0	0%	0	24	13	5	9	0	0%	26	0	0	0	0	0%
SS-488	P275	Stonebridge PRV	23	7.4	6.4	6.7	8	35%	25	0	0	0	0	0%	24	0.61	0.03	0.28	11	46%	24	0.4	0	0	0	0%	0	24	14	6	10	0	0%	25	0	0	0	0	0%
SS-494	S137	Rainbow SLS	23	7.3	6.4	6.7	4	17%	23	0	0	0	0	0%	23	0.34	0.01	0.17	15	65%	23	4	0	1	5	22%	0	23	14	6	10	0	0%	23	0	0	0	0	0%

Total Number of Samples						
Sample Source	pH	E. Coli	Cl2	Turb.	Temp.	T. Coli.
Source Water	339	298	0	340	324	298
Distribution	463	475	462	464	462	473
Total	802	773	462	804	786	771

Notes:

1. Results are based on limited manual samples and are not indicative of the true duration of failure.
2. Sample station SS-436 R231 is the 21 Mile Creek surface water intake, as such these samples are ***raw*** water measures and are ***pre***-disinfection.
3. Sample station SS-439 R232 is the Blackcomb Creek surface water intake and has been removed from production in the drinking water distribution system.
4. Blue highlighted samples are distribution system (potable water) samples, non-highlighted samples are groundwater source wells and surface water intakes.
5. pH fail and fail % values are primarily "low" failures ie. The water is slightly more acidic than the aesthetic objective, this common occurance throughout the coastal mountain region.
6. Sample station SS-406 R238 has a unique target guidleine range for Free Cl2 of **0.4 - 0.75 mg/L** under Coast Garibaldi Health requirements.
7. See detailed Free Cl2 disscussion in Section 8.1.4

9.5 Quarterly Water Sampling Results 2015

9.5.1 Trihalomethanes and Haloacetic Acids

2015 Quarterly Water Quality Sampling - Trihalomethanes & Haloacetic Acids (MAC 100 µg/L)

Water System	*Sample Site*			*Collection Date*	*Dibromoacetic acid (micro g/L)*	*Dichloroacetic acid (micro g/L)*	*Haloacetic acids 5 / HAA5 (micro g/L)*	*Monochloroacetic acid (micro g/L)*	*Total Trihalomethanes / TTHM (micro g/L)*	*Trichloroacetic acid (micro g/L)*
Emerald Estates	SS-403	S131	Emerald SLS	01/06/2015	< 2	4	7	< 2	9	2
Emerald Estates	SS-403	S131	Emerald SLS	04/10/2015	< 2	5	10	< 2	10	5
Emerald Estates	SS-403	S131	Emerald SLS	07/28/2015	< 2	3	3	< 2	7	< 2
Emerald Estates	SS-403	S131	Emerald SLS	11/03/2015	< 2	3	8	3	6	2
Community	SS-427	P267/S126	Spruce Grove PRV	01/08/2015	< 2	18	29	< 2	25	10
Community	SS-427	P267/S126	Spruce Grove PRV	03/26/2015	< 2	< 2	< 2	< 2	< 4	< 2
Community	SS-427	P267/S126	Spruce Grove PRV	07/22/2015	< 2	6	17	7	8	3
Community	SS-427	P267/S126	Spruce Grove PRV	11/03/2015	< 2	< 2	2	2	< 4	< 2
Community	SS-427	P267/S126	Spruce Grove PRV	12/22/2015	< 2	21	48	5	25	22
Community	SS-441	P256	Blackcomb PRV	02/12/2015	< 2	13	31	< 2	20	18
Community	SS-441	P256	Blackcomb PRV	03/26/2015	< 2	24	53	< 2	37	29
Community	SS-441	P256	Blackcomb PRV	07/22/2015	< 2	10	26	6	16	10
Community	SS-441	P256	Blackcomb PRV	11/03/2015	< 2	7	17	2	14	7
Community	SS-450		Village S1	02/12/2015	< 2	< 2	< 2	< 2	< 4	< 2
Community	SS-450		Village S1	07/10/2015	< 2	8	8	< 2	11	< 2
Community	SS-450		Village S1	11/06/2015	< 2	< 2	< 2	< 2	< 4	< 2
Community	SS-462	P264	Nordic PRV	02/05/2015	< 2	8	14	< 2	14	6
Community	SS-462	P264	Nordic PRV	03/05/2015	< 2	8	15	< 2	13	7
Community	SS-462	P264	Nordic PRV	07/10/2015	< 2	< 2	< 2	< 2	< 4	< 2
Community	SS-462	P264	Nordic PRV	11/12/2015	< 2	< 2	< 2	< 2	< 4	< 2
Community	SS-462	P264	Nordic PRV	12/10/2015	< 2	3	7	3	< 4	< 2
Community	SS-491		Cheakamus S	02/05/2015	< 2	2	2	< 2	5	< 2
Community	SS-491		Cheakamus S	03/27/2015	< 2	3	3	< 2	4	< 2
Community	SS-491		Cheakamus S	07/09/2015	< 2	< 2	< 2	< 2	< 4	< 2
Community	SS-491		Cheakamus S	10/29/2015	< 2	< 2	6	6	4	< 2

9.5.2 Total Iron and Manganese

2015 Quarterly Water Quality Sampling - Total Iron & Manganese (AO < 0.3 mg/L & AO < 0.05mg/L)						
Water System	*Sample Site*			*Collection Date*	*Iron (mg/L)*	*Manganese (mg/L)*
Emerald Estates	SS-409	W-201-1	Emerald W1	11/18/2015	< 0.10	< 0.002
Emerald Estates	SS-410	W-201-2	Emerald W2	11/18/2015	< 0.10	< 0.002
Emerald Estates	SS-411	W-201-3	Emerald W3	11/18/2015	< 0.10	< 0.002
Community	SS-412	P245	Mountainview PRV	02/06/2015	0.22	
Community	SS-412	P245	Mountainview PRV	03/27/2015	0.12	
Community	SS-412	P245	Mountainview PRV	07/24/2015	0.17	
Community	SS-412	P245	Mountainview PRV	11/06/2015	0.24	
Community	SS-418	W202	Apline W1	02/06/2015	< 0.10	
Community	SS-418	W202	Apline W1	03/27/2015	< 0.10	
Community	SS-418	W202	Apline W1	07/16/2015	< 0.10	
Community	SS-418	W202	Apline W1	11/06/2015	< 0.10	
Community	SS-418	W202	Apline W1	11/26/2015	< 0.10	< 0.002
Community	SS-419	W210	Alpine W2	02/06/2015	< 0.10	
Community	SS-419	W210	Alpine W2	03/27/2015	< 0.10	
Community	SS-419	W210	Alpine W2	07/16/2015	< 0.10	
Community	SS-419	W210	Alpine W2	11/06/2015	< 0.10	
Community	SS-419	W210	Alpine W2	11/26/2015	< 0.10	< 0.002
Community	SS-420	W213	Alpine W3	02/06/2015	< 0.10	
Community	SS-420	W213	Alpine W3	03/27/2015	< 0.10	
Community	SS-420	W213	Alpine W3	07/16/2015	< 0.10	
Community	SS-420	W213	Alpine W3	11/06/2015	< 0.10	
Community	SS-420	W213	Alpine W3	11/26/2015	< 0.10	< 0.002
Community	SS-421	S101	Alpine SLS	02/06/2015	< 0.10	
Community	SS-421	S101	Alpine SLS	03/27/2015	< 0.10	
Community	SS-421	S101	Alpine SLS	07/24/2015	< 0.10	
Community	SS-421	S101	Alpine SLS	11/06/2015	0.14	
Community	SS-427	P267/S126	Spruce Grove PRV	01/08/2015	< 0.10	< 0.002
Community	SS-436	R231	21 Mile Creek	11/27/2015	< 0.10	< 0.002
Community	SS-439	R232	Blackcomb Creek	11/16/2015	< 0.10	< 0.002
Community	SS-444	W205-1	Community W1	11/30/2015	< 0.10	< 0.002
Community	SS-445	W205-2	Community W2	11/30/2015	< 0.10	< 0.002
Community	SS-446	W205-3	Community W3	11/30/2015	< 0.10	< 0.002
Community	SS-447	W211	Village W1	11/30/2015	< 0.10	< 0.002
Community	SS-453		Village S2	11/18/2015	0.12	0.003
Community	SS-474	R228	Baxter R	01/08/2015	< 0.10	0.015
Community	SS-474	R228	Baxter R	11/27/2015	< 0.10	**0.101**
Community	SS-477	S121	Millars Pond SLS	11/12/2015	< 0.10	**0.078**
Community	SS-483	W212-1	Function W1	01/09/2015	0.18	**0.052**
Community	SS-483	**W212-1	Function W1	05/07/2015	**3.29**	**0.093**
Community	SS-483	W212-1	Function W1	07/16/2015	< 0.10	**0.081**
Community	SS-483	W212-1	Function W1	11/06/2015	< 0.10	**0.1455**
Community	SS-483A	W212-2	Function W2	01/09/2015	< 0.10	**1.33**
Community	SS-483A	W212-2	Function W2	05/07/2015	< 0.10	**1.81**
Community	SS-483A	W212-2	Function W2	07/16/2015	0.16	**1.93**
Community	SS-483A	W212-2	Function W2	11/06/2015	0.13	**1.805**
Community	SS-489	W217	Cheakamus W1	11/12/2015	< 0.10	< 0.002
Community	SS-493	W218	Village W2	01/15/2015	< 0.10	< 0.002
Community	SS-493	W218	Village W2	11/12/2015	< 0.10	< 0.002
Community	SS-494	S137	Rainbow SLS	02/06/2015	0.26	

2015 Quarterly Water Quality Sampling - Total Iron & Manganese (AO < 0.3 mg/L & AO < 0.05mg/L)						
Water System	*Sample Site*			*Collection Date*	*Iron (mg/L)*	*Manganese (mg/L)*
Community	SS-494	S137	Rainbow SLS	04/24/2015	0.22	
Community	SS-494	S137	Rainbow SLS	07/22/2015	< 0.10	
Community	SS-494	S137	Rainbow SLS	11/06/2015	0.13	
Community		P278	Cheakamus PRV	01/08/2015	< 0.10	< 0.002
Community		H8110	Alpine H1	02/06/2015	**1.09**	
Community		H8110	Alpine H1	03/27/2015	0.13	
Community		H8110	Alpine H1	07/24/2015	< 0.10	
Community		H8110	Alpine H1	11/06/2015	< 0.10	

**NOTE: The total Iron results for W212-1 appear to have taken a significant jump in recent sample results; the data indicates this is the highest result we have had since beginning testing - December 2002. This is due to a lapse in the procedure of allowing these wells to run for a minimum period of time prior to pulling a sample. The necessary procedural protocols have been reestablish.

9.5.3 Heterotrophic Plate Count and Total Organic Carbon

2015 Quarterly Water Quality Sampling - HPC & TOC (RMOW < 200 colonies per million & RMOW < 2.5 mg/L)						
Water System	*Sample Site*			*Collection Date*	*HPC (CFU/mL)*	*TOC (mg/L)*
Emerald Estates	SS-403	S131	Emerald SLS	01/06/2015	< 1	
Emerald Estates	SS-403	S131	Emerald SLS	04/10/2015	< 1	
Emerald Estates	SS-403	S131	Emerald SLS	07/13/2015	< 1	
Emerald Estates	SS-403	S131	Emerald SLS	10/27/2015	< 1	
Emerald Estates	SS-406	R238	Emerald R	01/06/2015	< 1	
Emerald Estates	SS-406	R238	Emerald R	04/10/2015	< 1	
Emerald Estates	SS-406	R238	Emerald R	07/13/2015	< 1	
Emerald Estates	SS-406	R238	Emerald R	10/27/2015	< 1	
Emerald Estates	SS-409	W201-1	Emerald W1	02/23/2015	< 1	0.5
Emerald Estates	SS-409	W201-1	Emerald W1	03/09/2015	< 1	1
Emerald Estates	SS-409	W201-1	Emerald W1	07/28/2015	< 1	< 0.5
Emerald Estates	SS-409	W201-1	Emerald W1	10/29/2015	< 1	0.7
Emerald Estates	SS-409	W201-1	Emerald W1	12/16/2015	< 1	0.7
Emerald Estates	SS-410	W201-2	Emerald W2	02/23/2015	< 1	0.5
Emerald Estates	SS-410	W201-2	Emerald W2	03/09/2015	< 1	1.2
Emerald Estates	SS-410	W201-2	Emerald W2	07/28/2015	< 1	< 0.5
Emerald Estates	SS-410	W201-2	Emerald W2	10/29/2015	< 1	< 0.5
Emerald Estates	SS-410	W201-2	Emerald W2	12/16/2015	< 1	< 0.5
Emerald Estates	SS-411	W201-3	Emerald W3	02/23/2015	< 1	0.5
Emerald Estates	SS-411	W201-3	Emerald W3	03/09/2015	< 1	1.3
Emerald Estates	SS-411	W201-3	Emerald W3	07/28/2015	< 1	< 0.5
Emerald Estates	SS-411	W201-3	Emerald W3	11/04/2015	< 1	0.8
Emerald Estates	SS-411	W201-3	Emerald W3	12/16/2015	2	0.6
Community	SS-412	P245	Mountainview PRV	02/19/2015	< 1	
Community	SS-412	P245	Mountainview PRV	04/24/2015	< 1	
Community	SS-412	P245	Mountainview PRV	07/15/2015	< 1	
Community	SS-412	P245	Mountainview PRV	11/03/2015	< 1	
Community	SS-418	W202	Alpine W1	02/19/2015	< 1	< 0.5
Community	SS-418	W202	Alpine W1	04/30/2015	< 1	< 0.5
Community	SS-418	W202	Alpine W1	07/15/2015	< 1	< 0.5
Community	SS-418	W202	Alpine W1	10/28/2015	< 1	0.7
Community	SS-419	W210	Alpine W2	02/19/2015	< 1	< 0.5
Community	SS-419	W210	Alpine W2	04/24/2015	< 1	< 0.5
Community	SS-419	W210	Alpine W2	04/30/2015	< 1	< 0.5
Community	SS-419	W210	Alpine W2	07/15/2015	< 1	< 0.5
Community	SS-419	W210	Alpine W2	10/28/2015	< 1	< 0.5
Community	SS-420	W213	Alpine W3	02/19/2015	< 1	< 0.5
Community	SS-420	W213	Alpine W3	04/30/2015	< 1	< 0.5
Community	SS-420	W213	Alpine W3	07/15/2015	< 1	< 0.5
Community	SS-420	W213	Alpine W3	10/28/2015	< 1	< 0.5
Community	SS-421	S101	Alpine SLS	02/19/2015	< 1	
Community	SS-421	S101	Alpine SLS	04/24/2015	< 1	
Community	SS-421	S101	Alpine SLS	07/15/2015	< 1	
Community	SS-421	S101	Alpine SLS	10/28/2015	< 1	
Community	SS-424	P266/S123	Nicklaus North PRV	02/12/2015	< 1	
Community	SS-424	P266/S123	Nicklaus North PRV	04/10/2015	< 1	
Community	SS-424	P266/S123	Nicklaus North PRV	07/09/2015	< 1	
Community	SS-424	P266/S123	Nicklaus North PRV	11/03/2015	< 1	
Community	SS-424	P266/S123	Nicklaus North PRV	12/22/2015	< 1	

2015 Quarterly Water Quality Sampling - HPC & TOC (RMOW < 200 colonies per million & RMOW < 2.5 mg/L)						
Water System	*Sample Site*			*Collection Date*	*HPC (CFU/ml)*	*TOC (mg/L)*
Community	SS-427	P267/S126	Spruce Grove PRV	01/08/2015	< 1	
Community	SS-427	P267/S126	Spruce Grove PRV	03/26/2015	< 1	
Community	SS-427	P267/S126	Spruce Grove PRV	07/09/2015	< 1	
Community	SS-427	P267/S126	Spruce Grove PRV	10/28/2015	< 1	
Community	SS-427	P267/S126	Spruce Grove PRV	12/22/2015	1	
Community	SS-430		Snowflake S	02/12/2015	< 1	
Community	SS-430		Snowflake S	03/05/2015	< 1	
Community	SS-430		Snowflake S	07/22/2015	< 1	
Community	SS-430		Snowflake S	11/04/2015	< 1	
Community	SS-433	S103	Crabapple SLS	02/05/2015	< 1	
Community	SS-433	S103	Crabapple SLS	03/05/2015	< 1	
Community	SS-433	S103	Crabapple SLS	07/22/2015	< 1	
Community	SS-433	S103	Crabapple SLS	11/12/2015	< 1	
Community	SS-433	S103	Crabapple SLS	12/10/2015	< 1	
Community	SS-436	R231	21 Mile Creek	02/19/2015	< 1	1
Community	SS-436	R231	21 Mile Creek	04/09/2015	< 1	1.1
Community	SS-436	R231	21 Mile Creek	07/09/2015	< 1	< 0.5
Community	SS-436	R231	21 Mile Creek	11/04/2015	< 1	1.7
Community	SS-439	R232	Blackcomb Creek	03/05/2015	< 1	0.6
Community	SS-439	R232	Blackcomb Creek	07/22/2015	< 1	< 0.5
Community	SS-439	R232	Blackcomb Creek	11/03/2015	< 1	1.5
Community	SS-441	P256	Blackcomb PRV	02/12/2015	< 1	
Community	SS-441	P256	Blackcomb PRV	03/26/2015	< 1	
Community	SS-441	P256	Blackcomb PRV	07/22/2015	< 1	
Community	SS-441	P256	Blackcomb PRV	11/03/2015	< 1	
Community	SS-444	W205-1	Community W1	04/30/2015	< 1	< 0.5
Community	SS-444	W205-1	Community W1	07/08/2015	< 1	< 0.5
Community	SS-444	W205-1	Community W1	11/05/2015	< 1	< 0.5
Community	SS-445	W205-2	Community W2	04/30/2015	< 1	< 0.5
Community	SS-445	W205-2	Community W2	07/08/2015	2	< 0.5
Community	SS-445	W205-2	Community W2	11/05/2015	< 1	< 0.5
Community	SS-446	W205-3	Community W3	04/30/2015	< 1	< 0.5
Community	SS-446	W205-3	Community W3	07/08/2015	< 1	< 0.5
Community	SS-446	W205-3	Community W3	11/05/2015	< 1	< 0.5
Community	SS-447	W211	Village W1	04/30/2015	< 1	< 0.5
Community	SS-447	W211	Village W1	07/08/2015	< 1	< 0.5
Community	SS-447	W211	Village W1	11/05/2015	< 1	< 0.5
Community	SS-450		Village S1	02/12/2015	< 1	
Community	SS-450		Village S1	07/08/2015	< 1	
Community	SS-450		Village S1	10/28/2015	< 1	
Community	SS-453		Village S2	02/12/2015	< 1	
Community	SS-453		Village S2	04/10/2015	< 1	
Community	SS-453		Village S2	07/08/2015	< 1	
Community	SS-453		Village S2	11/03/2015	< 1	
Community	SS-456	P265	Sunridge PRV	02/12/2015	< 1	
Community	SS-456	P265	Sunridge PRV	04/09/2015	< 1	
Community	SS-456	P265	Sunridge PRV	07/09/2015	< 1	
Community	SS-456	P265	Sunridge PRV	10/27/2015	< 1	
Community	SS-456	P265	Sunridge PRV	12/22/2015	< 1	

2015 Quarterly Water Quality Sampling - HPC & TOC (RMOW < 200 colonies per million & RMOW < 2.5 mg/L)						
Water System	*Sample Site*			*Collection Date*	*HPC (CFU/ml)*	*TOC (mg/L)*
Community	SS-459	S104	Lakeside SLS	02/12/2015	< 1	
Community	SS-459	S104	Lakeside SLS	04/09/2015	< 1	
Community	SS-459	S104	Lakeside SLS	07/08/2015	< 1	
Community	SS-459	S104	Lakeside SLS	11/03/2015	< 1	
Community	SS-462	P264	Nordic PRV	02/05/2015	< 1	
Community	SS-462	P264	Nordic PRV	03/05/2015	< 1	
Community	SS-462	P264	Nordic PRV	07/08/2015	< 1	
Community	SS-462	P264	Nordic PRV	11/12/2015	< 1	
Community	SS-462	P264	Nordic PRV	12/10/2015	< 1	
Community	SS-465	P270	Taluswood PRV	02/05/2015	< 1	
Community	SS-465	P270	Taluswood PRV	03/05/2015	< 1	
Community	SS-465	P270	Taluswood PRV	07/09/2015	< 1	
Community	SS-465	P270	Taluswood PRV	10/29/2015	< 1	
Community	SS-465	P270	Taluswood PRV	12/10/2015	< 1	
Community	SS-471	S106	Gondola SLS	02/05/2015	< 1	
Community	SS-471	S106	Gondola SLS	04/09/2015	< 1	
Community	SS-471	S106	Gondola SLS	07/08/2015	< 1	
Community	SS-471	S106	Gondola SLS	10/27/2015	< 1	
Community	SS-471	S106	Gondola SLS	12/10/2015	< 1	
Community	SS-474	R228	Baxter R	01/08/2015	< 1	
Community	SS-474	R228	Baxter R	04/09/2015	< 1	
Community	SS-474	R228	Baxter R	10/29/2015	< 1	
Community	SS-477	S121	Millers Pond SLS	02/12/2015	< 1	
Community	SS-477	S121	Millers Pond SLS	04/09/2015	< 1	
Community	SS-477	S121	Millers Pond SLS	07/08/2015	< 1	
Community	SS-477	S121	Millers Pond SLS	10/27/2015	< 1	
Community	SS-480	P273/S132	Spring Creek PRV	02/12/2015	< 1	
Community	SS-480	P273/S132	Spring Creek PRV	04/09/2015	< 1	
Community	SS-480	P273/S132	Spring Creek PRV	07/28/2015	< 1	
Community	SS-480	P273/S132	Spring Creek PRV	10/29/2015	< 1	
Community	SS-480	P273/S132	Spring Creek PRV	12/22/2015	< 1	
Community	SS-482		Alta Lake S	02/12/2015	< 1	
Community	SS-482		Alta Lake S	04/09/2015	< 1	
Community	SS-482		Alta Lake S	07/08/2015	< 1	
Community	SS-482		Alta Lake S	10/29/2015	< 1	
Community	SS-483	W212-1	Function W1	01/09/2015	< 1	
Community	SS-483	W212-1	Function W1	03/27/2015	< 5	< 0.5
Community	SS-483	W212-1	Function W1	07/16/2015	3	< 0.5
Community	SS-483	W212-1	Function W1	09/24/2015	< 1	< 0.5
Community	SS-483A	W212-2	Function W2	01/09/2015	< 1	
Community	SS-483A	W212-2	Function W2	05/07/2015	< 1	< 0.5
Community	SS-483A	W212-2	Function W2	07/16/2015	< 1	< 0.5
Community	SS-483A	W212-2	Function W2	11/06/2015	< 1	< 0.5
Community	SS-488	P275	Stonebridge PRV	01/06/2015	< 1	
Community	SS-488	P275	Stonebridge PRV	04/09/2015	< 1	
Community	SS-488	P275	Stonebridge PRV	07/22/2015	< 1	
Community	SS-488	P275	Stonebridge PRV	10/27/2015	< 1	
Community	SS-489	W217	Cheakamus W1	03/27/2015	< 5	< 0.5
Community	SS-489	W217	Cheakamus W1	07/09/2015	< 1	< 0.5

2015 Quarterly Water Quality Sampling - HPC & TOC (RMOW < 200 colonies per million & RMOW < 2.5 mg/L)						
Water System	*Sample Site*			*Collection Date*	*HPC (CFU/ml)*	*TOC (mg/L)*
Community	SS-489	W217	Cheakamus W1	09/24/2015	< 1	< 0.5
Community	SS-491		Cheakamus S	02/05/2015	< 1	
Community	SS-491		Cheakamus S	03/27/2015	< 5	
Community	SS-491		Cheakamus S	07/09/2015	< 1	
Community	SS-491		Cheakamus S	10/29/2015	< 1	
Community	SS-493	W218	Village W2	01/06/2015	< 1	< 0.5
Community	SS-493	W218	Village W2	03/26/2015	< 1	< 0.5
Community	SS-493	W218	Village W2	07/09/2015	< 1	< 0.5
Community	SS-493	W218	Village W2	07/22/2015	< 1	
Community	SS-493	W218	Village W2	10/27/2015	60	< 0.5
Community	SS-494	S137	Rainbow SLS	01/06/2015	< 1	
Community	SS-494	S137	Rainbow SLS	04/24/2015	< 1	
Community	SS-494	S137	Rainbow SLS	07/22/2015	< 1	
Community	SS-494	S137	Rainbow SLS	10/28/2015	< 1	

9.6 Annual Water Sampling Results 2015

2015 Annual Water Chemistry Sampling Results			SS-409 W201-1 Emerald W1	SS-410 W201-2 Emerald W2	SS-411 W-201-3 Emerald W3	SS-418 W-202 Alpine W1	SS-419 W-210 Alpine W2	SS-420 W213 Alpine W3	SS-436 R231 21 Mile Creek	SS-439 R232 Blackcomb Creek	SS-444 W205-1 Community W1	SS-445 W205-2 Community W2	SS-446 W205-3 Community W3	SS-447 W211 Village W1	SS-474 R228 Baxter R	SS-483 W212-1 Function W1	SS-483A W212-2 Function W2	SS-489 W217 Cheakamus W1	SS-493 W218 Village W2
Test Parameter	**GCDWQ Standard**	**Units**	18-Nov-15	18-Nov-15	18-Nov-15	26-Nov-15	26-Nov-15	26-Nov-15	27-Nov-15	16-Nov-15	30-Nov-15	30-Nov-15	30-Nov-15	30-Nov-15	27-Nov-15	6-Nov-15	6-Nov-15	12-Nov-15	12-Nov-15
Aluminum	-	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Antimony	0.006	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Arsenic	0.01	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Barium	1	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05
Boron	5	mg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Cadmium	0.005	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0001	< 0.0001	< 0.0001
Calcium	-	mg/L	22.1	19.4	15.8	34.1	09.3	35.1	05.3	09.9	51.4	73.3	17.3	25.8	15.6	16.7	14.7	14.5	13.8
Chloride	250	mg/L	15.6	05.2	05.1	18.6	0.35	09.1	0.29	0.24	29.6	29.8	01.9	05.3	56.9	60.0	87.1	05.5	01.8
Chromium	0.05	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cobalt	-	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Colour	15	TCU	< 5	< 5	< 5	< 5	< 5	< 5	7	6	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Conductivity	-	µS/cm	209	147	139	237	60	220	36	58	352	485	125	182	269	282	362	105	100
Copper	1	mg/L	0.088	0.059	0.043	0.014	< 0.002	0.006	< 0.002	< 0.002	0.023	0.006	0.014	0.007	0.023	0.003	0.005	< 0.002	< 0.002
Fluoride	1.5	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Hardness (CaCO3)	-	mg/L	59.4	51.4	42.1	90.2	24.8	91.8	14.4	25.9	134.0	188.0	44.5	66.9	48.0	52.0	48.3	40.1	38.0
Iron	0.3	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.13	< 0.10	< 0.10
Lead	0.01	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001
Magnesium	-	mg/L	1.0	0.8	0.6	1.2	0.4	1.0	0.3	0.3	1.3	1.1	0.3	0.6	2.2	2.5	2.8	0.9	0.8
Manganese	0.05	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	**0.101**	**0.146**	**1.805**	< 0.002	< 0.002
Mercury	1	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Nitrate	10	mg/L	0.253	0.070	0.041	0.331	0.021	0.175	0.020	0.031	0.135	0.112	0.036	0.075	0.104	0.116	0.068	0.102	0.028
Nitrite	1	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
pH	6.5-8.5	-	7.03	7.19	7.24	7.27	7.31	7.36	7.19	7.51	7.12	7.28	7.23	7.15	7.08	6.85	7.00	6.80	6.83
Potassium	-	mg/L	0.8	0.5	0.3	1.1	0.6	1.3	0.4	0.4	0.9	0.5	< 0.2	0.7	3.1	2.5	3.8	0.8	0.7
Selenium	0.01	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Sodium	200	mg/L	16.7	07.8	11.7	09.2	00.8	04.6	00.8	00.7	19.0	18.6	05.2	07.7	35.7	39.0	59.8	03.8	01.7
Sulphate	500	mg/L	17.6	15.1	14.7	38.5	08.6	52.8	03.7	04.3	74.6	128.0	21.8	39.4	12.7	24.7	08.6	14.0	26.6
Turbidity	1	NTU	< 0.1	0.1	0.1	< 0.1	0.2	< 0.1	0.2	0.7	0.1	0.1	0.1	< 0.1	0.1	0.3	0.3	< 0.1	< 0.1
Uranium	0.02	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Zinc	5	mg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04

10. Appendix B – Water Emergency Response Plan 2015

10.1 Public Notifications

There are numerous emergency situations that could trigger the RMOW to advise the public to limit their water use. For example the flooding of a well, a backflow incident, or reservoir contamination could result in a Boil Water Advisory or possible a Do Not Use Advisory. In some cases boiling the water may render it safe, and in other cases the public may be advised to not use the water at all. In a situation where public health is at risk from a contaminated water supply the responsibility falls to the Drinking Water Officer, who will assist the RMOW and provide recommendations on the steps required to mitigate the threat and restore the municipal water system to a safe level.

NOTE: *The information stated here are guidelines only, the Drinking Water Officer has the authority to undertake actions at variance with the guidelines where necessary.*

10.1.1 Boil Water Advisory

The RMOW will administer a Boil Water Advisory when there is a significant enough public health threat posed by the water quality in the distribution system that can effectively be mitigated through sufficient water boiling. Precautionary boil water advisories are issued routinely to buildings affected by any water system maintenance work that has the potential to contaminate the water.

If it is suspected that the water supply is contaminated with pathogenic micro-organisms or volatile chemicals (that can be safely evaporated), then the RMOW will notify and consult with the Drinking Water Officer to issue a Boil Water Advisory. It is possible to make water contaminated by microbiological contaminants safe by bringing the water up to a rolling boil **and** maintaining a rolling boil for **at least** two minutes. While a boil water advisory is in effect the water may safely be used for laundry, and for bathing or showering as long as no water is swallowed. The water should **not** be used for cooking, food preparation, or brushing teeth without first being boiled.

10.1.2 Do Not Drink Water Advisory

The RMOW will administer a Do Not Drink Advisory when there is a significant public health threat posed by ingesting contaminated water from the drinking water supply, and the nature of the threat is one that cannot be effectively mitigated by a Boil Water Advisory. The RMOW will notify the Drinking Water Officer and issue a Do Not Drink Water Advisory as soon as possible after discovering the threat.

Residents are instructed not to drink water or use it for cooking, food preparation, brushing teeth, or bathing. In this situation bottled/trucked water will be provided to residents.

10.1.3 Do Not Use Water Advisory

The RMOW will administer a Do Not Drink Advisory when a significant public health threat exists in relation to the water supply system and the threat cannot be adequately addressed by a Do Not Drink Advisory or a Boil Water Advisory. If this threat level is reached the RMOW will notify the Drinking Water Officer and issue a Do Not Use Water Advisory to notify the public to not drink the water or use it for any domestic purpose. Under these conditions bottled/trucked water is provided to residents by the RMOW.

If the contaminant is unknown, confirmed, or suspected to be a toxic chemical or mineral, then boiling is not recommended as it may have a concentrating effect on the substance rather than making the water safe. Chemical contaminants may have various negative health effects including skin irritation and respiratory problems, and should be avoided as much as possible. Under a Do Not Use Water Advisory distribution water should not be used for drinking, cooking, food preparation, bathing or brushing teeth.

10.1.4 Water Use Restriction

At any time of the year it may be necessary to implement a general Water Use Restriction on the drinking water supply as circumstances may dictate that water use be restricted until the system returns to normal operating capacity. However, for at least June 1st through September 30th each year water use restrictions are in affect (Bylaw No. 1538, 2001 as amended). It is at the discretion of the General Manager to issue a Water Use Restriction Order. Water use restriction orders may be necessary under circumstances where a water source or reservoir needs to be isolated for cleaning or maintenance, a pump or water source has failed, or demands are being placed on the system that exceed capacity (e.g. drought circumstances where consumption is greater than available supply).

10.1.5 Public Premises Notice

Due to its unique nature as a resort municipality, the RMOW has numerous restaurants, hotels, and other public establishments. The locations of these public facilities are documented by the RMOW as part of the Drinking Water Protection Regulation, but it is the responsibility of the owner of the public premises to notify the public of any drinking water advisories either verbally and/or by posting a sign at every sink and drinking water source accessible to the public.

It is important to ensure that public premises such as hotels, inns, restaurants, bars, convention centres and sports facilities are made aware of current advisories that effect the water quality so signage can be posted and appropriate action taken. It is the responsibility of the RMOW to post easily visible signs/notices at public water fountains located within municipal owned public facilities.

10.2 Emergency Situations

10.2.1 Chemical and/or Biological Contamination

If Utility staff identify a contamination event that may threaten the drinking water supply:

- Utility personnel must immediately inform all supervisory personnel up to, and including the general manager
- Contact the Drinking Water Officer and Environmental Health Officer
- Contact Spill Reporting Centre if necessary
- Isolate the contaminated zone area
- Activate the Emergency Operations Centre (EOC) if required
- Issue a Do Not Drink Water Advisory for the affected part of the system and arrange for trucked/bottled water if necessary
- If the spill enters or is near a fish-bearing stream, contact the Department of Fisheries and Oceans
- Identify the contaminant and determine the level of contamination through water testing and sampling
- If spill is near well, have monitoring wells installed to monitor contaminant plume and take action to mitigate impacts of spill on aquifer. Contact a hydro-geologist for assistance. Review well head protection plan
- Confirm water quality is acceptable to Drinking Water Officer before removing public notices

If a sample analyzed by the British Columbia Centre for Disease Control tests positive for E. coli:

- Utilities personnel and Drinking Water Officer will be notified via an alert from the laboratory
- All outstanding samples will be examined immediately
- Repeat samples will be collected immediately
- The chlorine residual for the sample will be reviewed to determine if a localized loss of disinfectant residual has occurred
- Utilities staff will determine if an interruption of source water disinfection occurred
- Utilities staff will determine if localized flushing and/or temporary increase in disinfectant residual dosage is warranted
- Turbidity, pH, and temperature values for the affected sample will be reviewed to determine other possible factors which may have contributed to the event
- The need for a Boil Water Advisory will be evaluated, and if deemed necessary the RMOW will carry out various means to inform the public
- The municipality will coordinate with the Drinking Water Officer on the extent of the Boil Water Advisory

10.2.2 Elevated Turbidity Levels

Turbidity is not a persistent problem in the RMOW's water supply although, on occasion elevated levels can be experienced. The Drinking Water Officer has set a Turbidity NTU guideline of < 1 NTU in source water and < 5 NTU within the distribution system. The following actions are taken when increased turbidity occurs in source waters and/or the distribution system:

- During turbidity events of ≥ 1 NTU at surface water supply sites, the intakes automatically shut down and alternative source waters are drawn upon

- During turbidity events of > 1 NTU at groundwater supply sites, the chlorine residual for the high turbidity sample will be reviewed to determine if elevated turbidity has caused a localized loss of disinfectant residual; as well historical raw water microbiology and turbidity data for the groundwater source in question will be reviewed to determine if further action is warranted
- The RMOW will take into consideration the effectiveness of increased chlorine dosage, chlorine contact time and the source of the turbidity in its response to minimizing the amount of turbidity entering the distribution system
- During turbidity levels of > 5 NTU within the distribution system, the utilities staff will carry out an examination of other events that may have taken place to cause the increased turbidity, for example water main or service repairs, construction activity, unidirectional flushing program, etc. Further sampling for chlorine residual and/or microbiological activity will be conducted to assist in determining the extent of the response required
- During turbidity levels of > 5 NTU within the distribution system a public notification may be issued in consultation with the Drinking Water Officer
- Two consecutive days of turbidity of < 1 NTU shall pass before lowering chlorine dosage to pre-event levels

10.2.3 Water Main Break

In the event of a reported water main break:

- Staff inspect the area to determine the extent and scope of the break, response time for leaks is one hour
- The leak/break will be isolated to prevent any safety hazards and mitigate further property or infrastructure damage
- If possible a small flow will be maintained to ensure positive pressure is sustained in the water line, this prevents backflow or back siphoning which could allow contaminated water back into the main
- The area affected by the leak/break will be assessed, repair requirements are determined and critical customers are notified (e.g. Health Clinic, businesses, residents etc.)
- The need for an alternate water supply to critical customers or residents will be determined
- Repairs are planned taking the following into consideration:
    - The excavation safety requirements and traffic safety plan
    - Equipment requirements
    - Operator labour requirements
    - Parts availability
- Repairs are performed ensuring that the water contact surface of all replacement parts and adjacent existing piping are disinfected by spraying or swabbing with a strong chlorine solution
- If any contamination is suspected, flushing and sampling is carried out and, if necessary, a water main disinfection procedure would be initiated

10.2.4 Building Fire

Do not try to put out the fire in the following circumstances:

- If the fire is spreading beyond the spot where it started
- If there is a potential for explosion
- If the fire could block your escape
- If the fire extinguisher prove to be in effective

In the event of an internal or external fire in any RMOW building or outbuilding:

- Initiate emergency meeting with the critical management team
- Contact the fire department
- Advise of any chlorine or other chemicals that may be stored at the location
- Ensure all personnel are clear of the building
- Complete a post incident report

10.2.5 Vandalism and/or Security Concerns

There is potential for vandalism and/or security concerns for any RMOW facility. When there is a report of vandalism to a utilities structure, facilities, and/or if deliberate contamination is suspected:

- Contact the RMOW and the RCMP
- Contact the utilities manager and the Drinking Water Officer/Environmental Health Officer
- When there is a threat to drinking water quality, issue Boil Water Advisory for suspected microbiological contamination or Do Not Drink the Water Advisory for suspected chemical or unknown contamination
- Ensure that staff is implementing appropriate measures for cleaning/decontaminating facilities
- Do not remove the public advisories until instructed by the Drinking Water Officer

NOTE: Notify the Drinking Water Officer or Environmental Health Officer of any vandalism or deliberate acts of contamination to any part of the water system. The new Drinking Water Protection Act prohibits any person from introducing anything into a domestic water source, a well recharge zone, or an area adjacent to a drinking water source that could in any way result in a health hazard related to the drinking water supply. The Act also prohibits any person from destroying, damaging, or tampering with any part of a domestic water system that would limit the use of the water system on the basis that there may be a public health risk.

10.2.6 Flood Event

Floods may affect water sources by depositing debris and silt in the water or by contaminating wells with surface water. In addition, facilities and equipment may be damaged or rendered inoperable by flood waters. Staff may not be able to gain access to some facilities due to high water. In the event of a major flood:

- Confirm which facilities are functional and accessible
- If a well is reported flooded, assume it has been contaminated by untreated surface water and issue a Boil Water Advisory. If chemical storage or application occurred in the vicinity, issue a Do Not Drink Water Advisory
- If a facility(s) becomes damaged and there is a concern of a lack of water, issue a Water Restriction Notice
- Once flood waters have receded, have affected facilities checked for structural integrity and contact a structural engineer for assistance
- Have the water quality in affected wells tested and do not remove public notices until instructed by the Drinking Water Officer
- Consider flood proofing affected facilities and ensure all wells are sealed and flood proofed
- Contact Provincial Emergency Program to apply for funding

10.2.7 Forest Fire

Local forest fires can cause serious damage to water infrastructure, such as reservoirs, pump stations, and building facilities. In the event of a serious forest fire there will likely be an increased demand on the system, disrupting normal operations. There is also the concern of fire suppression chemicals entering the water courses and distribution system. The hydrology of a watershed is altered after a forest fire, leading to increased turbidity, colour, and modified stream flow. In the event of a local forest fire:

- Contact the Fire Department and BC Forest Service
- Contact staff and determine if any facilities are potential danger
- If possible, isolate threatened facilities and switch to backup sources to maintain system pressure and supply
- If fire suppression activities occur, contact BC Forest Service and Fire Department to determine nature of suppressants used
- If surface waters are affected by fire suppressants, issue a Do Not Drink Water Advisory, or apply appropriate treatment approved by the Drinking Water Officer to render the water safe to drink
- Once danger of fire has passed, have facilities checked and ensure that necessary repairs are completed
- Do not remove any public notices until instructed by the Drinking Water Officer
- Contact Provincial Emergency Program to apply for funding
- If long-term impacts to surface waters occur, consider alternate sources or installation of treatment system

10.2.8 Earthquake

Earthquakes can be particularly destructive to both above ground and underground infrastructure. Pipes and well casings can be bent, twisted, or sheared off completely. Reservoirs or storage tanks can be damaged, soils with high water content can liquefy and damage buildings and underground pipes, other soil types can compact causing similar damage. Unstable slopes may slide, sending debris into source waters and blocking access roads. Fires will likely occur from ruptured gas mains and downed power lines, increasing demand on the water system to provide adequate fire suppression. In the event of an earthquake:

- Consult with utilities team to determine which facilities are accessible, and which may be damaged as it relates specifically to maintaining safe drinking water
- If necessary, issue public alerts and supple bottled/trucked water
- Contact a structural engineer for assistance in assessing the damage to the water facilities
- If surface sources are degraded by landslides, switch to alternate sources (wells)
- If wells are destroyed, switch to backup sources and investigate locations for new wells
- Have damaged equipment and facilities replaced or repaired
- Contact the Provincial Emergency Program for funding

10.3 Technical Systems Outage

10.3.1 Extended Loss of BC Hydro Supply

In the event there is an extended loss of BC hydro supply to the municipal drinking water supply infrastructure system standby power/generators will activate to provide enough power for the water system to function. In an extended loss of power situation:

- Utilities supervisor will notify the utilities group manager and the critical management team as required
- Contact BC Hydro and notify them of the situation
- Ensure that the generators are running properly and can maintain minimum functionality to the water system infrastructure
- Maintain the working order of the generators for the duration of the power loss
- Once BC Hydro is back and running shut down generators and restore them to a ready state

10.3.2 Failure of SCADA System

The RMOW's SCADA system continuously monitors chlorination and UV disinfection within the distribution system and automatically alerts personnel of any failures. The surface water UV disinfection control system operates independently of the RMOW SCADA system. Any failure of the surface water UV system triggers an automatic shutdown of the surface water supply at the intake. The following actions are to be taken in the event of an interruption to the disinfection system within the drinking water distribution system:

- Utility personnel immediately carry out any repairs to equipment and if necessary manual disinfection is established
- Chlorine residual samples are taken at various points in the distribution system to ensure adequate free chlorine residual is present
- In cases where chlorine residual levels are < 0.2 mg/mL utility crews will flush the affected area until an acceptable level is achieved
- Monitoring will continue until disinfection is resumed and adequate levels have been reached in the distribution system