



Nick Fish, Commissioner
David G. Shaff, Administrator

1120 SW 5th Avenue, Room 600
Portland, Oregon 97204-1926
Information: 503-823-7404
www.portlandoregon.gov/water



December 15, 2014

WQ 0.10.12

Carrie Gentry
Oregon Health Authority
Drinking Water Services
PO Box 14450
Portland, OR 97293-0450

Subject: Annual Watershed Control Program Report for Water Year 2014

Dear Carrie:

As required by the Surface Water Treatment Rule and Section 333-61-0032 (2)(c)(B) of the Oregon Administrative Rule, the Portland Water Bureau herewith submits its Water Year 2014 Watershed Control Program Report for the Bull Run water supply system. The watershed control program for the Bull Run system continues to be an effective barrier for minimizing the potential for microbial contamination.

The OHA watershed and disinfection system survey for Water Year 2014 was conducted on July 29, 2014. OHA sent its annual on-site watershed control program inspection report on November 17, 2014.

Please note that the annual Bull Run Treatment Variance Watershed Report for Water Year 2014, required by OHA's 2012 *Cryptosporidium* treatment variance Final Order, is being submitted separately.

If you have any questions about the enclosed report, please feel free to contact me at (503) 823-7648.

Sincerely,

Yone Akagi, P.E.
Water Quality Compliance Manager

Enclosure

Cc: Edward Campbell
Ann Richter
Chris Wanner
Jessica Letteney

Portland Water Bureau

Annual Watershed Control Program Report for Water Year 2014

December 2014



**Submitted to Oregon Health Authority
Public Health Division Drinking Water Services**



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Annual Watershed Control Program Report for Water Year 2014

1. Introduction

For unfiltered water systems, the federal Surface Water Treatment Rule and the Oregon Administrative Rules (OARs) require annual reporting of the control programs in place for these systems' watersheds "identifying any special concerns about the watershed, the procedures used to resolve the concern, current activities affecting water quality, and projections of future adverse impacts or activities and the means to address them" [OAR 333-061-0032 (2)(c)(B)]. This Annual Watershed Control Program Report for Water Year 2014 is submitted to the Oregon Health Authority (OHA) in fulfillment of requirements for unfiltered systems. Water Year 2014 started on October 1, 2013, and ended on September 30, 2014.

This report covers the Bull Run water supply drainage, referred to hereafter as the Bull Run Watershed. The Bull Run Watershed encompasses 102 square miles of land upstream of the intake for the Portland Water Bureau (PWB) drinking water supply and is within the Bull Run Watershed Management Unit (BRWMU). The BRWMU is the legal boundary defined by federal law (Public Law 95-200 and amended by the Oregon Resources Conservation Act of 1996 and the Little Sandy Act of 2001) for 147 square miles of land (see Figure 1). An additional 1.3 square miles of City-owned land on the

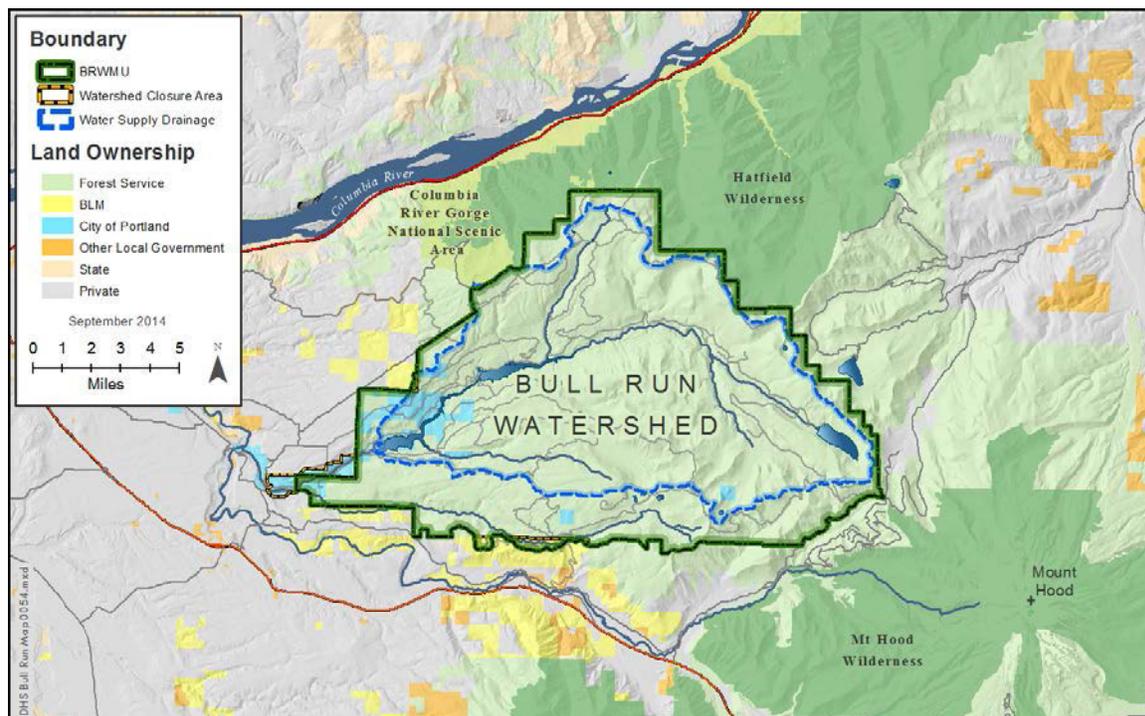


Figure 1. Bull Run Water Supply Drainage, Bull Run Watershed Management Unit, and Closure Area Boundaries^a

^aEffective November 8, 2014, the Watershed Closure Area was extended to include lands within the management unit administered by the Bureau of Land Management, per Portland City Council Ordinance 186839. The revised boundary will be shown on this map in the report for Water Year 2015.

western edge of the unit, closed by a 2010 City of Portland Code amendment, adds to the protected area and forms what is known as the Bull Run Watershed Closure Area.

A separate report, the Bull Run Treatment Variance Watershed Report for Water Year 2014, describes inspections and monitoring conducted in the Bull Run Watershed in fulfillment of conditions in OHA's Final Order in the Matter of Portland Water Bureau's Request for Variance Under 42 USC § 300g-4(a)(1)(B). The Final Order provides PWB with a method of alternative compliance to the Environmental Protection Agency's (EPA) Long Term 2 Enhanced Surface Water Treatment Rule. The variance report documents the results of field inspections and environmental monitoring conducted during each water year.¹

2. Land Ownership and Management

About 95 percent of the BRWMU is federal land administered by the U.S. Forest Service (Forest Service); 4 percent is owned by the City of Portland; and 1 percent is federal land administered by the U.S. Bureau of Land Management (BLM). The land in the Bull Run Watershed is protected through a variety of federal, state, and local legal controls, listed below.

Federal Controls

- Bull Run Management Act (PL 95-200 (1977), as amended by PL 104-208 (1996) and PL 107-30 (2001); 16 U.S. Code, Section 482b Notes)
- 1990 Mt. Hood National Forest Land and Resource Management Plan (pages 4-295 through 4-317)
- 1994 Northwest Forest Plan
- 1995 Bureau of Land Management, Salem District, Record of Decision and Resource Management Plan
- 2012 Mt. Hood National Forest Closure Order for the Bull Run Watershed Management Unit—Closure Order MH-2012-05 [pursuant to 36 Code of Federal Regulations (CFR) 261.50(a) and (b), 36 CFR 261.52(a), 36 CFR 261.53(e), 36 CFR 261.54(e), and 36 CFR 261.55(a)]
- 2011 BLM Permanent Closure Order for the Bull Run Watershed Management Unit (pursuant to 43 U.S.C. 1733(a), 43 CFR 8360.0-7, and 43 CFR 8364.1)
- 2007 Bull Run Watershed Management Unit Agreement between the U.S. Department of Agriculture (USDA) Forest Service, Mt. Hood National Forest and the City of Portland

¹ The Bull Run Treatment Variance Watershed Report is available on the Portland Water Bureau website at www.portlandoregon.gov/water/treatmentvariance.

State Controls

- Oregon Revised Statute (ORS) 448.295 to ORS 448.325
- State of Oregon Department of Forestry Regulated Closure Proclamations (for the Bull Run Regulated Use Area during fire season, pursuant to ORS 477.35 to 477.550)
- Bull Run Treatment Variance Final Order, March 14, 2012

Local Controls

- Portland City Code Chapter 21.36, Bull Run Watershed Protection
- Section 00203, Bull Run Watershed Closure Area, of Portland Water Bureau contract specifications for construction projects in the Bull Run Watershed Closure Area²
- Section 00202, Security, of Portland Water Bureau contract specifications for construction projects in the Bull Run Watershed Closure Area²

PWB and the Forest Service are pursuing a land exchange that involves approximately 5,400 acres. The land exchange will create a better alignment of land ownership responsibilities with the respective missions of the agencies while reducing administrative burdens for both agencies. The exchange will consolidate City holdings to lands surrounding reservoirs and associated infrastructure. The two agencies signed a formal agreement, referred to as the Agreement to Initiate (ATI), in February 2010. The ATI outlined the estimated costs, agency responsibilities, and schedule for the land exchange project. The ATI is a non-binding agreement whereby the parties agree to further evaluate the exchange through steps such as appraisals and completion of an environmental assessment. In 2014, the Forest Service continued work on a transportation analysis of roads affected by the land exchange. Forest Service and Portland Water Bureau personnel continue to work on refining information for the National Environmental Policy Act (NEPA) analysis and the land appraisal. The exchange is currently expected to be completed in 2016.

In April 2009, PWB implemented a standard operating protocol to prevent the introduction and establishment of aquatic invasive and nuisance animals, plants, and diseases. The bureau's Bull Run Watershed and Sandy River Basin Aquatic Invasive and Nuisance Species Standard Operating Protocol, effective in May of 2009, was revised March 7, 2012. The Invasive Plant Standard Operating Protocol for the Bull Run Watershed Management Unit was approved in 2013. This protocol establishes a set of practices designed to ensure PWB staff and contractors are actively minimizing the risk of introducing or transporting invasive terrestrial plant species within the BRWMU through bureau-related activities. The protocols and procedures of the Invasive Species

² Available at www.portlandoregon.gov/water/47998.

Program are consistent with standards in place on federal lands and are intended to reduce the risks to water quality from invasive species in the watershed.

3. Security and Trespass

Security measures and trespass restrictions are in place to protect the ecological features that make the Bull Run a source of high-quality water. PWB Security and Forest Service law enforcement officers patrol the watershed regularly. PWB controls watershed access through policies that limit entry privileges to approved staff and contractors; procedures that control electronic CyberKeys, access badges, and keys; and surveillance at the main watershed gate including a camera and the monitoring of CyberKey entry data. The limited-entry policy³ includes a requirement for entry permits. Law enforcement and emergency response personnel are allowed to enter the BRWMU when necessary to perform their duties. Domesticated animals are expressly prohibited from entering the BRWMU. The Forest Service has similar policies and practices limiting access.

Forest Service lands in the BRWMU are closed through a combination of policy in the federal Bull Run Act (Public Law [PL] 95-200, as amended in 1996 and 2001) and an administrative closure order that was most recently updated by the Mt. Hood Forest Supervisor in October 2012. The BLM is the other federal agency that administers land in the BRWMU. In December 2011, the BLM issued a permanent administrative closure of the lands that the agency manages within the BRWMU.

In addition to the Forest Service and BLM closure regulations, the City of Portland has enacted City Code changes to further strengthen the protections for the BRWMU. In February 2010, the Portland City Council approved adoption of City Code (Chapter 21.36) that prohibits entry into Forest Service lands within the BRWMU and adjacent City of Portland-owned lands to the west of the unit. The 2010 code provides the City with additional enforcement capabilities to deal with trespassers.

In 2011, PWB and the Forest Service took several actions to reduce the risk of trespass in the portion of the BRWMU along Lolo Pass Road. PWB installed road signs along Lolo Pass Road that alerted motorists that the area west of the road was within the BRWMU and closed to public entry. Lockable steel barriers were installed on all spur roads used by the Bonneville Power Administration (BPA) crews for transmission line maintenance. The Forest Service completed the decommissioning of Road 1800210 and blocked access to an area that had been the site of illegal dumping and campfires.

In 2014, PWB conducted a targeted outreach campaign to approximately 200 landowners that own land and/or reside within one-quarter of a mile of the BRWMU. The campaign enlists the aid of neighbors in reporting any observed or suspected trespass, fire, or

³ Portland Water Bureau. Bull Run Watershed Security Access Policies and Procedures (S.02), Final Revision. 2012. Portland, Oregon.

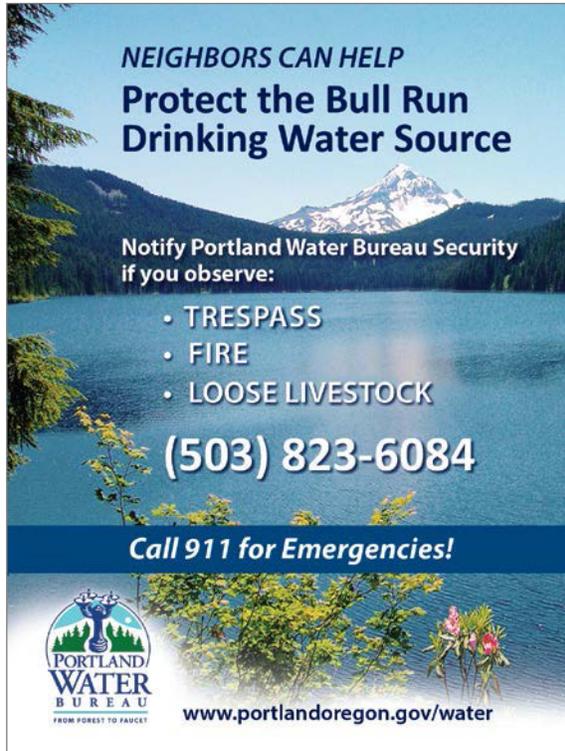


Figure 2. Refrigerator Magnet Accompanying Brochure Sent to Neighbors of the BRWMU

three-mile buffer around the drainage present a risk of livestock intrusion into the Bull Run Watershed. The Escaped Livestock Plan describes protocols for removing livestock from the watershed and evaluating the risk of contamination in the case of any future intrusion.

In October 2014, the Portland City Council approved adoption of amendments to Chapter 21.36 of the City Code that includes BLM as a managing partner for enforcing restricted access to the Bull Run Watershed Closure Area, updates enforcement provisions, and extends the Closure Area boundary to include all BLM lands within the BRWMU. These changes became effective November 8, 2014, and will be described in detail in this report for Water Year 2015.

The security and access measures implemented by PWB, the Forest Service, and BLM support the legal direction to manage the watershed in a way that protects the ecological features of the water source. PWB and the Forest Service coordinate access policies and security efforts. A list of specific access, entry, and security control measures follows.

Access and Entry

- All roads leading into the Bull Run Watershed are gated.
- With few exceptions, all gates are locked with an electronic programmable

livestock intrusions around the unit. Campaign materials included a brochure and a magnet. The brochure, titled Neighbors Can Help Protect the Bull Run Drinking Water Source, provided context and actions that landowners can take to address the three most likely risks to watershed security: trespass, fire and livestock intrusion. The materials include the Water Bureau Security telephone number as well as a reminder to call 911 for emergencies. The brochures and magnets were distributed to properties within the targeted area and given to residents at a community meeting during the spring and summer of 2014.

In addition to the community outreach effort, PWB conducted a geographic information systems (GIS) analysis and created a plan for escaped livestock. The GIS analysis of surrounding areas evaluated the likelihood that properties within a

CyberKey that records information—such as the badge number, time, and date—every time the gate is opened.⁴

- The main watershed gate can also be opened by authorized access card holders. The access card reader records the time and date of entry every time the access card is used.
- Access cards, CyberKeys, or physical keys are issued through a security control process and only to employees, agencies, and contractors with a demonstrated need for watershed access.
- In addition to the access controls, PWB and the Forest Service issue vehicle permits to contractors to authorize the use of contractors' vehicles in the Bull Run.
- Most PWB contractors receive an electronic programmable CyberKey for the automated main gate only. The electronic CyberKeys are disabled and returned after the authorized use period expires.
- All authorized public access into the watershed is through public tours or escorted access by PWB, Forest Service, or BLM staff.
- Recreational trail access inside the BRWMU is prohibited except for a 1.0-mile segment of the Oneonta Creek trail to the north and an 8.3-mile segment of the Pacific Crest Trail (PCT) and the Huckleberry Trail, to the east. The PCT and Huckleberry Trail are located outside the Bull Run water supply drainage, except for 1.2 miles.
- The segment of the PCT and Oneonta Creek trails within the BRWMU are well signed with Bull Run "No Trespassing" signs instructing hikers not to trespass on the drainage side of the trail.
- The BLM Sandy Ridge bike trail system abuts the southern border of the BRWMU, but is located approximately 2 miles from the water supply drainage boundary. The steep terrain in this area provides a natural deterrent for human incursion into the BRWMU.

Security

- In 2006, PWB acquired a private property at the main gate and converted the dwelling into an office and residence for one of the lead Rangers who conduct security patrols for trespassers in the Bull Run Watershed.
- The main gate surveillance camera is monitored by PWB's security staff.
- Security staff have access to all electronic CyberKey transaction data.
- PWB Rangers conduct patrols to check for evidence of trespass and confirm the condition of boundary signage.

⁴ The few gates with conventional padlocks are not primary gates and do not provide direct access to the BRWMU.

- PWB previously hired additional seasonal rangers to patrol the watershed during the peak hiking season. In 2015, PWB will be hiring a second permanent, full-time Ranger for additional coverage.
- Security patrols are also provided by the Forest Service law enforcement officer assigned to Zigzag Ranger District of the Mt. Hood National Forest. The Multnomah and Clackamas County Sheriff's Offices are available to assist with incidents as well.
- PWB monitors surveillance cameras on Dam 1 and Dam 2—the live video feed is monitored by Headworks operators who staff the facility 24 hours a day, 7 days a week, 365 days a year. PWB's Security Dispatch Center and Water Control Center staff also have the capacity to monitor the video.
- Motion-activated cameras provide surveillance at several undisclosed locations. PWB Security staff collect digital image files from these cameras as part of regular surveillance and patrols.
- During Water Year 2014, PWB conducted a total of six trail patrols: two on the Oneonta Creek trail to the north, two on the Pacific Crest Trail to the east, and two on the BLM Sandy Ridge bike trails to the south.

Human Incursion

PWB rangers reported a total of 9 trespass incidents at the boundary or in the BRWMU for Water Year 2014. Of the 9 trespass incidents, 1 was inside the water supply drainage boundary. Based on the evaluation of the circumstances around the trespass events, there were no concerns for contamination that required further investigation.

Domesticated Animal Incursion

PWB Rangers reported three incidents of domesticated animal incursion. In February and again in September 2014, two different pairs of dogs were found inside the BRWMU (but not inside the watershed boundary). In each case, PWB Rangers located the owners, advised the owners to secure the dogs and warned that consequences would be elevated if the incidents were repeated. In July 2014, trail cameras showed two human trespassers on horseback entering the BRWMU through a gate, then exiting 20 minutes later. The equestrians most likely did not travel inside the watershed boundary. The Bull Run Ranger investigated and reported the incident to the Forest Service law enforcement officer for issuance of applicable citations.

4. Wildlife

The potential sources of microbial contamination are mammalian species common to the Bull Run (such as deer, black bear, and rodents) and Canada geese. As part of the Bull Run Treatment Variance, PWB monitors wildlife in the watershed. The monitoring includes the following:

- Wildlife inspections of areas that are in close proximity to the reservoirs and water intake structures
- Scat sampling throughout the watershed to test for the presence of *Cryptosporidium* and *Giardia*

PWB conducts wildlife studies to better understand the risk of microbial contamination posed by wildlife, particularly with regards to *Cryptosporidium*. The Bull Run Treatment Variance Watershed Report for Water Year 2014 contains detailed information on the scat monitoring and wildlife inspection programs as well as any separate wildlife studies initiated by PWB.

5. Weather, Turbidity, and Erosion

Water Year 2014 was, overall, somewhat drier than average in the Bull Run Watershed. A total of 74.2 inches of precipitation was recorded at Headworks during the water year. The long-term average annual precipitation for this location is slightly less than 80 inches. A comparison of monthly total precipitation levels at Headworks is shown in Figure 3. The months of October 2013 through January 2014 were considerably drier than the historical median; February–April were considerably wetter than the median; May–July continued to be slightly wetter than the median; August and September were drier than their respective medians.

Figure 4 shows mean daily flows at the Bull Run main stem key station, located upstream of Reservoir 1. A flow of 5,000 cubic feet per second (cfs) at this station typically heightens the concern that a turbidity event that approaches or exceeds 5 nephelometric turbidity units (NTU) may occur.⁵ The maximum mean daily flow recorded at this site during Water Year 2014 was 3,740 cfs on March 9, 2014, and was not associated with a turbidity event.

A landslide on the South Fork Bull Run tributary to Reservoir 2 occurred in January 2012. The landslide caused two turbidity spikes at the raw water intake resulting in one shutdown in January 2012 and reducing conduit flows in February 2012. The landslide was inspected twice from the air in Water Year 2014—once in October 2013 and once in August 2014. Both inspections showed that there were no signs of further large-scale sediment movement toward the stream.

⁵ The source-water criteria for unfiltered systems include maintaining turbidity levels at less than 5 nephelometric turbidity units (NTU) for source water.

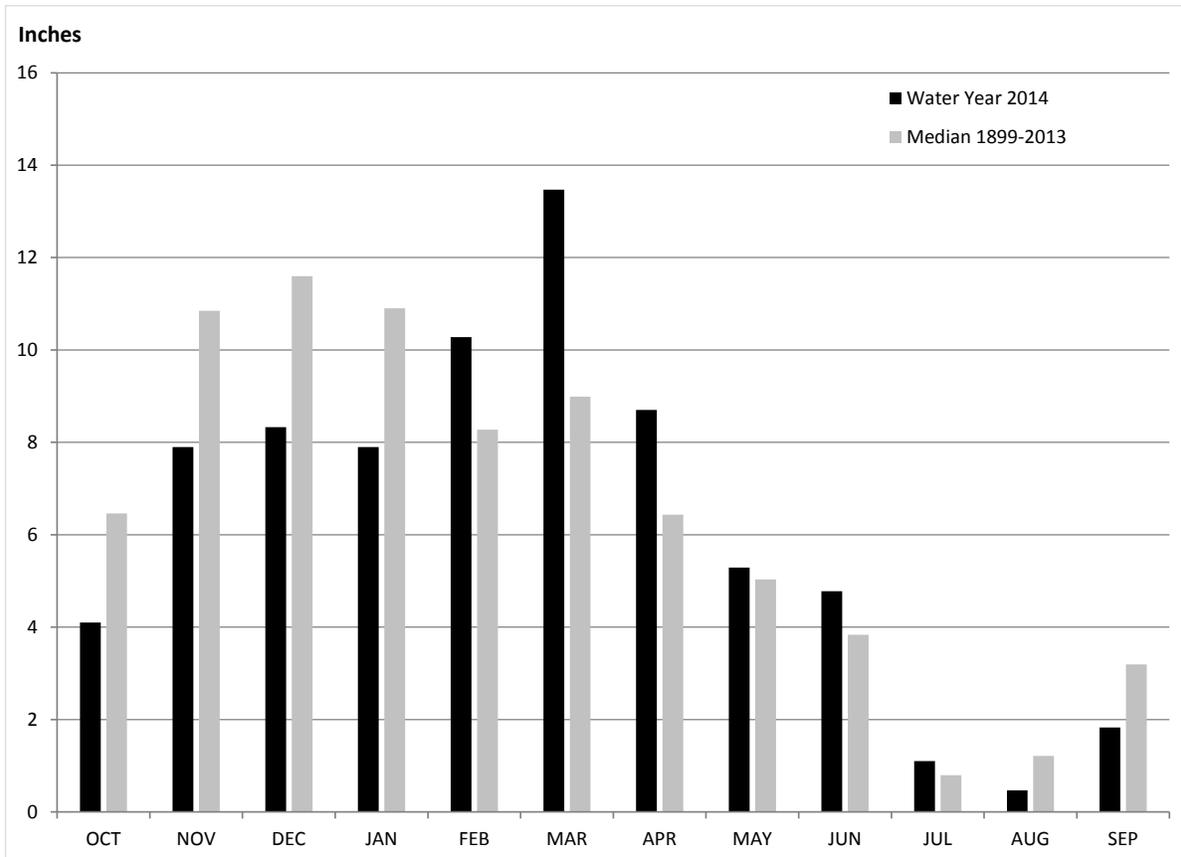


Figure 3. Monthly Precipitation at Headworks, Bull Run, Oregon, Median and Water Year 2014 Results

During Water Year 2014, PWB used pairs of HF Scientific MicroTOL 3 process online turbidimeters at each raw water intake location—the Primary Intake Structure and Screenhouse 3—for compliance with the Surface Water Treatment Rule. All four online turbidimeters were set up to read turbidity in the range of 0–20 NTU. Bureau staff performed a three-point calibration of these turbidimeters with ProCal® (a styrene divinylbenzene co-polymer) monthly at minimum, and verified them twice weekly using the high and low secondary standards. In addition, an HF Scientific Micro 1000 laboratory bench-top turbidimeter was used for routine measurement of grab samples. This bench-top turbidimeter uses the same technology as the online turbidimeters.

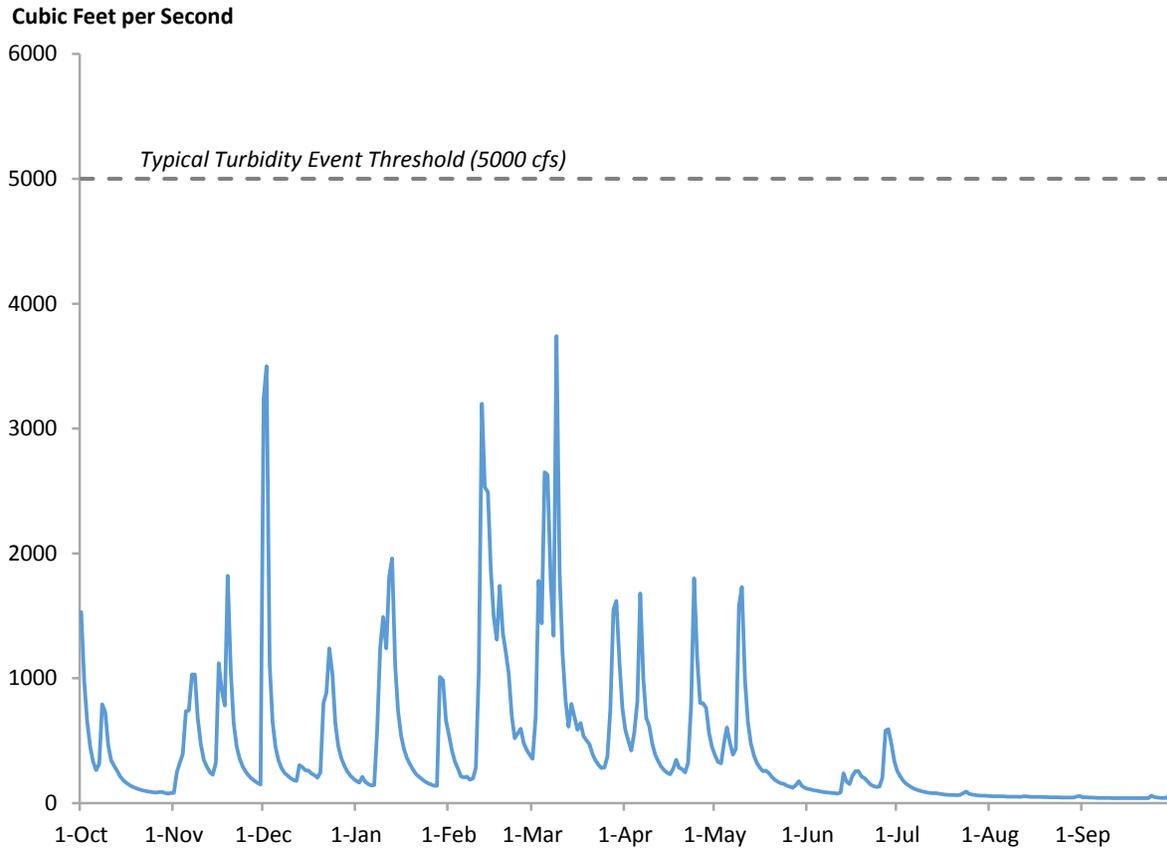


Figure 4. Stream Flow in the Main Stem Bull Run River Measured at Key Station 18 above Reservoir 1, Water Year 2014

6. Fire Protection

Fire-protection responsibilities for the Bull Run are shared among the Forest Service, the Oregon Department of Forestry (ODF), and PWB. In July 2006, staff from the Forest Service, ODF, and PWB prepared an update to the Bull Run Fire Management Plan. The plan identifies fire-suppression resources available to respond to fires in the Bull Run, defines policies on the use of aerial resources, and defines the roles and responsibilities of the three agencies.

The Forest Service’s Closure Order for the BRWMU was updated in October 2012 to prohibit hikers from building and using a fire, campfire, or fire stove (except for a pressurized liquid or gas stove) on trails located within the unit. (See Section 3, Security and Trespass, for more information about trails located within the unit.)

No wildland fires occurred in the BRWMU during Water Year 2014 and no significant fires burned in areas bordering the watershed. Three incidents of small fires were observed or reported during the water year:

- PWB Rangers found evidence of a small fire started with a road flare just outside of the BRWMU. The fire had been extinguished and no subjects were found.
- A small (less than 1 acre) isolated fire occurred in remote forest land approximately one mile outside the BRWMU boundary in August 2014 and was extinguished by Forest Service personnel within 48 hours of the initial report.
- A vehicle trailer was set on fire and abandoned outside a watershed gate (outside the Closure Area) in September 2014. The Sandy Fire Department and the Clackamas County Sheriff's Office responded and extinguished the fire.

Fire Suppression Resources

The Forest Service has the primary responsibility for initial attack on Forest Service lands and ODF has primary responsibility for initial attack on City and BLM land. However, those two parties operate under the “closest forces” incident command policy, whereby the agency that arrives at the fire earliest assumes the role of incident commander until authority is transferred to the primary agency.

The Sandy Fire Department has responsibility for protection of structures in the Bull Run Watershed because the wildland fire protection agencies are not trained to participate in extinguishing structure fires. Portland Fire & Rescue plays a secondary role and would respond to a structure fire or vehicle fire in the watershed if the Sandy Fire Department deemed that it needed additional resources.

PWB crews and contractors comply with the Industrial Fire Precaution Level guidelines on projects and maintenance activities that involve use of heavy equipment, power saws, and other spark-emitting equipment during fire season. PWB provides funding to the Forest Service to staff a fire lookout on Hickman Butte, located on the southern boundary of the Bull Run Watershed, from early July through mid-to-late September. Aerial surveillance of the watershed from fixed-wing aircraft is routinely conducted after lightning storms.

7. Project Planning and Construction

Road Maintenance

In December 2007, the Portland Water Bureau (PWB) and the U.S. Forest Service entered into a 20-year intergovernmental agreement called the Bull Run Watershed Management Unit Agreement. The agreement identifies the roles and responsibilities for the two agencies and formally assigns responsibility for roads maintenance to PWB. PWB has assumed responsibility for the maintenance, repair, and upgrades of nearly all roads in the Bull Run necessary for long-term access. Routine maintenance includes activities such as trimming vegetation and cleaning ditches and culverts. The technical details of the roads maintenance program are described in the 2009 Bull Run

Transportation System Maintenance Plan. Major repairs and upgrades are implemented as capital road construction projects. In addition to major road projects, the Water Bureau conducts annual culvert condition assessment surveys for a subset of the large- and small-diameter culverts.

Two major road projects in the BRWMU began in Water Year 2014. In the summer of 2014, the entire 3.5 miles of Road 1008—the preferred secondary access road to Headworks and other critical water supply infrastructure—was repaved. Routine ditch cleaning was also performed as part of the project. A second project along a 1.2-mile section of Road 10—the primary access road to Headworks and other critical water supply infrastructure—began in September 2014. This segment is downriver of the primary water supply intake at Dam 2. It is expected to be completed in the spring of 2015. This project includes repaving the 1.2-mile section; improving ditch lines; and widening and reconstructing the road surface as needed to improve drainage and pavement condition, meet safety standards, and address road surface slumping. The bureau's erosion-control, invasive species, and portable sanitation requirements are part of PWB's standard contract for road projects. PWB inspectors check for conformance to these requirements as part of standard construction project inspections.

Dam 2 Tower Project

The Dam 2 Tower Improvements Project, completed in February 2014, provided modifications to the north tower inlet to allow selective-depth withdrawal from Bull Run Reservoir 2. The project was implemented to help regulate temperatures for flows released to the lower Bull Run River for the benefit of anadromous fish species and to improve water quality by providing flexibility during turbidity events. The modified tower has been operating since the spring of 2014.

On November 5, 2013, PWB staff observed an oil sheen on a small area inside the spill containment boom around the Dam 2 Tower project work area in Reservoir 2. The North Tower was not active at the time. The source of the sheen was unknown. PWB staff collected water samples at the site of the sheen, just outside of the boom in the direction of the active South Tower, and at the active raw water intake (Screenhouse 3). The samples were tested for diesel, oil hydrocarbons, and BTEX. BTEX is the term used for benzene, toluene, ethylbenzene, and xylene – volatile organic compounds typically found in petroleum products, such as gasoline and diesel fuel. Analytical results from the three sampling locations indicated that these substances were not detectable at the Method Reporting Limit (MRL). The MRL is the smallest measured concentration of a substance that can be reliably measured using a given analytical method.

8. Hazardous Materials Spills

Hazardous materials spills are handled in accordance with the PWB's Emergency Operations Plan. The bureau also takes measures to prevent spills. For any project, a detailed plan is required to address potential problems—for example, machine operators are required to use absorbent spill pads. PWB personnel conduct on-site inspections for all projects with the potential to affect water quality.

In May 2012 a diesel fuel spill was discovered near the Portland Hydroelectric Project (PHP) Powerhouse 2, which is maintained and operated by Portland General Electric (PGE). PGE initiated cleanup, remediation, and a three-year follow-up water quality monitoring plan for groundwater contamination around the remediation site.⁶

As part of the remediation plan, follow-up groundwater quality monitoring at PHP Powerhouse 2 was again conducted by the PGE contractor in Water Year 2014. Samples from three groundwater monitoring wells were tested for diesel contaminants. None of the samples contained contaminant levels above the Method Reporting Limit (MRL), which is the smallest concentration of a substance that can be reliably measured using a given analytical method. The next round of groundwater monitoring will occur during Water Year 2015 and will be reported in the 2015 Annual Watershed Control Program Report.

In addition to the groundwater monitoring, PWB conducted raw water quality testing to monitor for any impacts from the diesel spill on the water supply.⁷ The monitoring was conducted at five different sites upstream and downstream of the raw water intake before, during, and after the site remediation. In all, PWB took 20 different raw water samples on four different dates. Although there were some detections of polycyclic aromatic hydrocarbons (PAH) contaminants associated with the combustion of fuels and organic materials, the concentrations were very low—near the Method Reporting Limit of 0.00002 milligrams per liter—and below any established health effect level.⁸ In addition, these same contaminants were not present above the MRL in the groundwater samples. The raw water monitoring indicates that there were no impacts from the diesel fuel spill to the water supply.⁹ No further raw water monitoring related to the May 2012 diesel fuel discovery is planned.

⁶ The Annual Watershed Control Program Report for Water Year 2012 provides a detailed description of the cleanup, the water sampling, and PGE's remediation plan. The Annual Watershed Control Program Report for Water Year 2013 provides results for PGE monitoring conducted during that water year.

⁷ The Annual Watershed Control Program Report for Water Year 2013 includes a detailed description of PWB's monitoring and the results as of Water Year 2013.

⁸ A health effect level is established as a Health Reference Level, which is part of the basis for establishing a drinking water Maximum Contaminant Level for a given chemical.

⁹ Portland Water Bureau. 2014. Technical Memorandum: Diesel Spill Near Headworks Diversion Pool—PWB Monitoring Results.

9. Tours

The bureau typically conducts public tours of the Bull Run Watershed from May through October. The purpose of public tours is to provide the public with access to the otherwise closed watershed to educate the participants about the history, natural resources, and function of the watershed within Portland's drinking water system.

All public tours are conducted with an emphasis on protecting water quality. PWB staff inspect tour vehicles for fuel and other possible automotive leaks before entering the watershed. At the beginning of the tour, educators inform all participants of the watershed rules, which include requirements that participants use only the provided sanitary facilities as restrooms and that they avoid contact with Bull Run raw water. To prevent the spread of invasive species, educators also require all tour participants to use a boot brush to clean shoes prior to boarding the tour vehicle.

From October 1, 2013 to September 30, 2014, PWB conducted 69 tours, with a total of approximately 1,700 participants.

10. Compliance with Unfiltered Criteria

The criteria for unfiltered systems include source-water and site-specific criteria. The source-water criteria include source-water bacteriological quality and turbidity requirements. These are reviewed in the Annual On-Site Watershed Control Program Inspection Report prepared by OHA staff. The site-specific conditions include the following:

- Meet disinfection requirements:
 - (a) Three-log inactivation of *Giardia* cysts and four-log inactivation of viruses
 - (b) Redundant disinfection components or automatic shutoff of delivery of water to the distribution system when the chlorine residual is below 0.2 milligrams per liter (mg/L)
 - (c) The residual disinfection concentration at the entry point cannot be less than 0.2 mg/L for more than four hours
 - (d) Disinfectant residuals in distribution system cannot be undetectable in more than 5% of the samples each month for any two consecutive months
- Maintain a watershed control program and submit an annual watershed control program report
- Be subject to an annual on-site inspection of the watershed control program and the disinfection treatment by OHA
- Not be identified by OHA as a source of waterborne disease outbreak

- Comply with total coliform requirements for 11 of the previous 12 months
- Comply with requirements for total trihalomethanes, haloacetic acids, bromate, chlorine, chloramines, and chlorine dioxide

PWB has met all of these criteria during Water Year 2014.

11. Results of OHA 2014 Annual On-Site Watershed Inspection

The watershed and disinfection system inspection for Water Year 2014 was conducted on July 29, 2014. OHA transmitted its annual on-site watershed control program inspection report to PWB on November 17, 2014. OHA's overview of the site visit states the following:

Overall, the watershed is well protected and the treatment facilities have redundant disinfection options with auxiliary power. The Portland Water Bureau continues to do an excellent job maintaining the water quality from Bull Run and being proactive with the watershed control program.

No significant deficiencies were noted and the report concludes with the following:

The Portland Water Bureau continues to meet all of the criteria for the exemption from filtration, and can therefore remain using an unfiltered surface water source as allowed in the Surface Water Treatment Rule.

2014 Annual On-site Watershed Inspection
For Systems with an Exemption to Filtration
OHA-Drinking Water Services

System: Portland Water Bureau (PWB) **ID#: 4100657**
Reviewed by: Carrie Gentry
Date: July 29, 2014

1. Watershed Control Program Effectiveness

The following documents establish and describe the watershed control program (no changes from 2013):

- 1990 Mt. Hood National Forest Land and Resource Management Plan (pages 4-295 through 4-317)
- Northwest Forest Plan (April, 1994)
- 1995 Bureau of Land Management (BLM), Salem District, Record of Decision and Resource Management Plan
- Bull Run Management Act (PL 95-200, November 23, 1977; PL 104-208, September 30, 1996; PL 107-30, August 20, 2001)
- 2012 Mt. Hood National Forest Closure Order for the Bull Run Watershed Management Unit—Closure Order MH-2012-05 (pursuant to 36 Code of Federal Regulations (CFR) 261.50(a) and (b), 36 CFR 261.52(a), 36 CFR 261.53(e), 36 CFR 261.54(e), and 36 CFR 261.55(a))
- BLM Permanent Closure Order for the Bull Run Watershed Management Unit (pursuant to 43 U.S.C. 1733(a)), 43 CFR 8360.0-7, and 43 CFR 8364.1)
- Oregon Revised Statute (ORS) 448.295 to ORS 448.325
- State of Oregon Department of Forestry Regulated Closure Proclamations (for the Bull Run Regulated Use Area during fire season, pursuant to ORS 477.35 to 477.550)
- Water Quality Standards for Bull Run Watershed Management Unit (1984, Rev. 1991)
- Portland City Council Resolution No. 35203
- Portland City Council Resolution No. 35981
- Source Water Assessment Report – Bull Run Water Supply (June, 2003)
- Bull Run Agreement 2007 (Portland Water Bureau and USFS)
- City Ordinance 183540, February 2010. Add Code Chapter 21.36 and amend Code Chapter 21.24
- Bull Run Treatment Variance Final Order, March 14, 2012 (Oregon Health Authority)

- a. *Have any changes been made that affect the effectiveness of the program?*

In 2012, the Oregon Health Authority issued a final order granting a treatment variance. This variance has conditions that address, among other items, watershed protection.

- b. *Has the Annual Watershed Issues and Activity report been submitted by PWB?*

PWB submits a Watershed Control Program Report and a Variance Report annually.

- c. *Are there any other management practices that have been incorporated since August 2013?*

Under the treatment variance, Portland has taken proactive steps to protect the watershed. These include removing portable sanitary facilities at headworks and creating standard operating procedures for remaining portable sanitary facilities. Minor changes to the watershed inspection and monitoring plan were made in 2014.

2. Physical Condition and Level of Protection of the Source Intake

- a. *Location of the Source Intake:*

Water travels from the Bull Run watershed into Reservoir #1, which holds about 10 billion gallons, then into Reservoir #2, which holds about 7 billion gallons of water. The combined useable total is 9.9 billion gallons. The source intake (collectively known as “Headworks”) consists of two intake towers (the “North” and “South” Towers) located within Reservoir #2, about 200 feet upstream of Dam #2. Both towers (completed in 1961) are approximately 140 feet tall and are mostly submerged below the normal reservoir elevation of 860 feet, with the actual intakes about 80 feet below the water surface. The North Tower Intake is equipped with trash racks, while the South Tower Intake is equipped with smaller diameter fish screens. Multi-level intakes on the North Tower, with temperature and turbidity probes, were constructed in 2013 for added flexibility for municipal supply and releases to the lower Bull Run River. Additional piping improvements at the downstream end of the South Tower Intake were in progress during the 2014 inspection.

Water from the North tower can be conveyed through either the Howell-Bunger valves or the Powerhouse to the Diversion Pool, then through either the Primary Intake Structure (PIS), or Screenhouse #3 (currently through PIS). From the South tower, water can flow through another Howell-Bunger valve to the Diversion Pool, then to either intake, or directly into Screenhouse #3 through a Pressure Reducing Valve (PRV). Piping configuration will change if Ultraviolet light (UV) treatment is installed in the future, and Screenhouse #3 will be removed from service. A chain-link fence was installed around the entire diversion pool sometime in the early 1990s to prevent beavers or other animals from entering the diversion pool. The fence is inspected daily.

b. Have any improvements been made to the source intake since August 2013?

Bureau staff installed new ultrasonic flow meters in 2014. The Bureau may consider new chlorinators that can allow auto flow-pacing, which is currently manual.

c. General Condition:

Overall, the intake structure and level of protection of the intake are excellent.

3. Equipment and Maintenance of the Disinfection Facilities.

a. Location of Injection Points:

Free chlorine is added at Headworks. There are 2 sets of chlorine injection points (“primary” and “secondary”) for each conduit, for each intake. Each has its own carrier-water line, which is gravity-fed. The Hudson and Larson interties can be used to mix water between conduits if there is a problem. CT’s are met in each of the 3 transmission lines on their way to the Lusted Hill treatment facility.

Ammonia is added to each conduit at the Lusted Hill facility approximately 10 miles downstream.

b. Type of Disinfectant Used:

The primary chlorination system can run on the Equa-Draw vacuum system, with 2 cylinders on liquid chlorine with an evaporator in case of peak demand (vacuum system can handle up to 200 MGD, or 225 MGD with the liquid), or a gas system, using 6 cylinders. The secondary chlorination system provides chlorine gas with an Equa-Draw vacuum system. Free chlorine is used for CT’s, and chloramination is used to maintain a residual, as described above. Chlorine gas or liquid is added at

Headworks to provide a free chlorine concentration of up to 3.9 ppm, which results in a free chlorine concentration seasonally adjusted from 1.8 ppm to 3.0 ppm entering Lusted Hill. A minimum target ratio of CT available/CT required is set at > 1.4 . Conduit 3 can be sampled directly at Lusted, whereas sampling from Conduits 2 or 4 require driving out to the sampling point, which is done daily. Chlorinators are from 1956. Currently chlorine dosing is not automatically flow-proportioned. Water flows and chlorine dosage are both adjusted manually.

c. *Extent of Redundancy of Disinfection:*

There are several layers of redundancy built in to the chlorination system. At Headworks, chlorine is injected via the carrier-water line into each conduit from two chlorination systems (called primary and secondary). Although each system is capable of delivering a sufficient dose of chlorine, both normally operate, adding just over one-half of the applied dose each. If one were to fail, CT's would sufficiently be met with just one of the two systems operating. One-ton chlorine cylinders are used, and 12 are ready at any given time with 12 one-ton cylinders typically in stand-by with automatic switch-over. In addition, there is a spare chlorinator in the primary system that can be used to back up any of the chlorinators in the primary system. There are multiple low level alarms and low vacuum alarms. There are also extra chlorine cylinders available for a typical 3-week supply. The same chlorination systems and carrier-water lines are used regardless of which intake is in use. The valves for switching from one carrier-water line to the other are manual, but normally both are used simultaneously. Chlorination can continue in the event of a power failure since the carrier water supply is gravity-fed.

At the Lusted Hill facility, two 7,000-gallon aqueous ammonia tanks (containing about a 19% solution) can supply three injection points (one for each conduit). Feed pumps were replaced in early 2006. An extra feed pump is also available for each conduit and there is one additional spare. The need for new corrosion control treatment is being discussed. Once the open reservoirs are off-line, further studies may be conducted on the best approach for corrosion control.

Backup generators are available at both the Headworks and the Lusted Hill facilities and are tested on a weekly basis and load tested annually. Systems automatically switch to the generators in the event of a power failure. Note that chlorine can still be injected without power, since the carrier water is gravity flow. There is an emergency response procedure in place in case of a chlorine leak.

d. *Maintenance of disinfection equipment.*

PWB has an aggressive maintenance program. A maintenance tracking system is used with the intent to be proactive and preventative. Components are replaced frequently; chlorinators and injectors are rebuilt annually. The chemical feed pumps (ammonia) are calibrated twice per week. CPVC piping related to the ammoniation system was replaced with PVC piping in early 2004. Piping, valves, manifolds, and evaporators in the primary chlorine control room at Headworks have been replaced. The Equa-Draw vacuum system was installed in 2008. There are no signs of physical deterioration beyond expected wear and tear.

4. Watershed / Headworks Operating Procedures.

a. *Description of the System's Operating Procedures for:*

1) *Watershed Monitoring*

Raw water turbidity is measured continuously at Headworks and sent to the main control in town. Turbidimeters are primary-calibrated monthly. Secondary verification is completed twice per week. Regardless of the turbidity levels, raw water coliform samples are taken 7 days per week. Therefore, if the turbidity is greater than 1.49 NTU, an additional coliform sample is not taken, since one is already taken daily (See Section 5d). Water from Bull Run is usually shut off if turbidity reaches around 3.5 NTU, depending on trending. Under the treatment variance, PWB must sample 50 liters for *Cryptosporidium* when the turbidity is greater 2.0 and less than 5.5 NTU.

The Bureau has their own certified lab to analyze raw water coliforms. Normally, fecal coliforms are measured for compliance using the membrane filtration method. For operational purposes, total coliform is also analyzed using the QuantiTray method. If by chance the fecal sample is invalidated, and they may not get the required 5 fecal samples for the week, the total coliform sample will be used for compliance for that day. Samples are also collected from the reservoir to be analyzed for turbidity, temperature, and pH on a biweekly basis. Nutrients are monitored monthly. Source water turbidity ranges from 0 to 25 NTU.

The facilities in the watershed are monitored for security via remote cameras. Security cameras are equipped with recording devices and footage is kept for 30 days. Access to the watershed is limited and monitored both at the electronic gates and with cyber keys at more remote gates. It is known that a small number of

people enter and occasionally establish campsites. There are 4 hidden portable cameras placed at various locations in the watershed that record a photo when they detect movement. Approximately 2-3 miles of the Pacific Crest and Oneonta Trails are in the watershed. Security for Lusted Hill, Headworks, the Groundwater Pump Station, and Bull Run Watershed has been enhanced with locked gates, more security cameras, increased staffing during night shifts and routine patrols.

Annual load bank testing is performed on all generators to ensure mechanical integrity.

2) *Disinfection Monitoring*

Monitoring for chlorine residual is done continuously at the Headworks and at the Lusted Hill facility. Daily chlorine readings are taken throughout the distribution system. Target dosage varies seasonally and can be as high as 3.9 ppm. The first user typically sees chlorine residual values that range between 1.8 and 3.0 ppm. This often allows more than double the required CT.

Ammonia injection amounts are calculated automatically based on the ratio of chlorine to ammonia-nitrogen (~ 4.85:1 ratio) and pumps are calibrated twice a week. Ammonia is generally adjusted to the point just before free Ammonia-Nitrogen is detected. Testing for Ammonia-Nitrogen is done using grab samples taken once every 2 weeks.

Although a 3-log removal for giardia is required, the target allows for a factor of safety of 1.4 (e.g. a log removal of about 4.2 or greater is the current target).

b. Have there been any changes in the monitoring or protection program since August 2013? If so, identify:

PWB continues to conduct monitoring for *Cryptosporidium* as required under their treatment variance. This monitoring includes weekly monitoring of at least 100 liters. The treatment variance also requires semi-annual field inspections and environmental sampling at key stations in the watershed. Slight changes were made to the watershed monitoring program in 2014.

5. Data Records for Turbidity, Raw Water & Distribution Coliform Tests, Disinfection By-products, and "CT" Compliance Data.

a. *Does system keep records on site/in office?*

Records are kept on a computer database as well as paper copies at Lusted.

b. *How many months showed an exceedence of the following:*

- * Raw Total coliform concentrations > 100/100 ml
- 1 Raw Fecal coliform concentrations > 20/100 ml
- * As of December 2007, PWB is reporting Fecal coliform counts only.

For the period of August 2013 to August 2014:

<u>Month/Year</u>	<u>Max FC (Source)</u>
10/2013	27

c. *Which months (if any) showed a turbidity over 1.49 NTU (less than 5)?*

For the period of August 2013 to August 2014:

<u>Month/Year</u>	<u># days > 1.49 NTU</u>
09/2013	3
12/2013	20
02/2014	1
06/2014	1

d. *Were coliform tests done in raw water on days of the exceedences?*

Regardless of the turbidity levels, raw water coliform samples were taken 7 times per week between August 2013 and August 2014. Therefore, if the turbidity is greater than 1.49 NTU, an additional coliform sample is not taken, since one is already taken daily. Only 5 per week are required, but 2 extra are taken in case of invalidation, bad weather, or other problems.

e. *Were CT values met every day?*

Yes.

f. Is system in compliance with TTHM and HAA5 sampling?

Yes. Under the Stage 2 DBP rule, Portland is currently under routine monitoring, sampling at 12 sites quarterly. Portland was on reduced monitoring until the end of 2013.

6. Note any Improvements that are needed in any of the above areas.

None noted.

7. Compliance plans for the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2):

As noted above (1a), Portland received a variance from this treatment requirement. Portland continues to meet the conditions of the variance.

Summary:

1. General Overview of Site Visit.

Overall, the watershed is well protected and the treatment facilities have redundant disinfection options with auxiliary power. The Portland Water Bureau continues to do an excellent job maintaining the water quality from Bull Run and being proactive with the watershed control program.

2. Compliance with all Criteria for an Exemption to Filtration.

- Source water quality
- 3-log disinfection with redundancy
- Watershed control program
- On-site inspection
- Has not been the source of a waterborne disease outbreak
- Compliance with Total Coliform Rule 11 of 12 previous months
- Trihalomethanes and HAA5

Conclusion: The Portland Water Bureau continues to meet all of the criteria for the exemption from filtration, and can therefore remain using an unfiltered surface water source as allowed in the Surface Water Treatment Rule.