

**OREGON HEALTH AUTHORITY
PUBLIC HEALTH DIVISION
OFFICE OF ENVIRONMENTAL PUBLIC HEALTH
DRINKING WATER PROGRAM**

In the Matter of: Portland Water Bureau's Request for Variance Under 42 USC § 300g-4(a)(1)(B)	Intent to Grant Variance
---	---------------------------------

I. INTRODUCTION

Statutory and Regulatory Background

1. In 2006, the US Environmental Protection Agency (EPA) finalized its Long-Term 2 Enhanced Surface Water Treatment rule (LT2). This regulation requires unfiltered water systems subject to federal regulation that have no current treatment for *Cryptosporidium*, to: 1) treat its source water for *Cryptosporidium*; and 2) use at least two disinfectants.¹

2. Under its drinking water regulations, EPA has established programs and requirements that form a multiple barrier approach for public water systems to reliably supply safe drinking water for consumers. Multiple barriers include protection of source water, treatment of source water, and properly trained and certified water system operators.²

3. The Safe Drinking Water Act (SDWA), Section 1415(a)(1)(B), (42 USC § 300g-4(a)(1)(B)), permits a State that has primary enforcement responsibility to grant a variance from a specified treatment technique *if the water system “demonstrates to the satisfaction of the State that such treatment technique is not necessary to protect the health of persons because of the nature of the raw water source of such system.”* *Id.* (Emphasis added)

4. The State of Oregon, Oregon Health Authority (OHA), Office of Environmental Public Health, Drinking Water Program submitted its primacy application to EPA on July 8, 2009. EPA granted Oregon interim primacy upon receipt of its application. OHA thus has the authority to consider and rule on a variance submitted pursuant to 42 USC § 300g-4(a)(1)(B).

5. Primacy requires that OHA requirements are no less stringent than EPA requirements.³ The federal Safe Drinking Water Act (SDWA) provides for a variance from a treatment technique if the enforcing entity is satisfied the treatment technique is not necessary to protect human health due to the nature of the raw water source.⁴ OHA has a statute that is no less stringent than EPA in this regard. Under ORS 448.135:

¹ 40 CFR § 141.712.

² EPA publication 816-K-06-005.

³ 42 USC § 300g-2.

⁴ 42 USC § 300g-4(a)(1)(B).

(2) The authority may grant variances from standards requiring the use of a specified water treatment technique if the authority:

(a) Determines that the use of a specified water treatment technique is not necessary to protect the public health based on the nature of the raw water source for a public water system;

(b) Has conditioned the variance as required by the federal Safe Drinking Water Act, 42 U.S.C. 300g-4;

(c) Has announced its intent to grant a variance and has either:

(A) Held a public hearing in the area prior to granting the variance; or

(B) Served notice of intent to grant the variance either personally, or by registered or certified mail to all customers connected to the water system, or by publication in a newspaper in general circulation in the area. If no hearing is requested within 10 days of the date that notice is given, the authority may grant the variance; and

(d) Promptly notifies the administrator of the United States Environmental Protection Agency of any variance granted, as required by the federal Safe Drinking Water Act, 42 U.S.C. 300g-4.

(Emphasis added).

6. Oregon Administrative Rules (OAR) address the variance more specifically. OAR 333-061-0045(13) as it applies to treatment requirements, provides:

[OHA] may grant variances from the standards specified in OAR 333-061-0032(3)(e) through (g)⁵ requiring the use of a specified water treatment technique

⁵ OAR 333-061-0032(3)(e) - (g) are set out below for the reader's convenience:

(3) Disinfection requirements for systems utilizing surface water or GWUDI sources without filtration. Each public water system that does not provide filtration treatment must provide disinfection treatment as follows:

* * *

(e) Unfiltered water systems must provide the level of *Cryptosporidium* inactivation specified in this subsection, based on their mean *Cryptosporidium* levels, and determined in accordance with subsection (2)(d) of this rule and according to the schedule in subsection (1)(a) of this rule.

(A) Unfiltered systems with a mean *Cryptosporidium* level of 0.01 oocysts/L or less must provide at least 2-log *Cryptosporidium* inactivation.

(B) Unfiltered systems with a mean *Cryptosporidium* level of greater than 0.01 oocysts/L must provide at least 3-log *Cryptosporidium* inactivation.

(f) Inactivation treatment technology requirements. Unfiltered systems must use chlorine dioxide, ozone, or UV as prescribed by 333-061-0036(5)(c) of these rules to meet the *Cryptosporidium* inactivation requirements of this section.

(A) Systems that use chlorine dioxide or ozone and fail to achieve the *Cryptosporidium* inactivation required in subsection (3)(e) of this rule on more than one day in the calendar month are in violation of the treatment technique requirement.

(B) Systems that use UV light and fail to achieve the *Cryptosporidium* inactivation required in subsection (3)(e) of this rule are in violation of the treatment technique requirement.

if the Authority determines that the use of a specified water treatment technique *is not necessary to protect public health based on the nature of the raw water source for a public water system*. A variance granted under this section shall be conditioned on such monitoring and other requirements as the Administrator of the U.S. Environmental Protection Agency or the Director of the [OHA] may prescribe.

(Emphasis added).

Portland Water Bureau Water System and the Bull Run Watershed

7. The Portland Water Bureau (PWB) operates a public water system as that term is defined by OAR 333-061-0020(157). PWB directly provides water to 180,100 connections, serving an estimated population of 539,200 people. Portland also provides wholesale water year-round to 16 other public water systems serving an additional 426,000 people in Multnomah, Washington, and Clackamas counties.⁶ Many additional people who work in or visit the Portland area regularly consume this water.

8. The PWB uses the Bull Run watershed as its primary source of water, supplying a total of 36 billion gallons of water in 2010. The PWB maintains an additional source of supply of 31 groundwater wells along the south shore of the Columbia River, which provide on average four percent of the water system's demand, as well as 6 additional emergency wells.⁷

9. The Bull Run watershed is located 26 miles east of Portland. The drainage area for the PWB intake is 102 square miles. The legal boundaries for the Bull Run Watershed Management Unit (Unit) are slightly larger than the drainage area to provide a buffer around the drainage area boundary. Approximately 95 percent of the Unit is federal land administered by the U.S. Forest Service (USFS); four percent is owned by the City of Portland, and one percent is federal land administered by the Bureau of Land Management (BLM).⁸

10. The Bull Run watershed drinking water supply is permitted to be unfiltered because it meets the requirements outlined in OAR 333-061-0032(2). PWB compliance with the criteria in this rule is confirmed in a watershed survey and inspection OHA conducts each year.

11. Water from the Bull Run watershed is treated with chlorine, with sufficient contact time available to achieve at least 99.9 percent inactivation of *Giardia lamblia*, now called *Giardia intestinalis*. Water is also treated with ammonia for disinfection residual maintenance,

(g) Use of two disinfectants. Unfiltered water systems must meet the combined *Cryptosporidium* inactivation requirements of subsection (3)(e) of this rule, and the *Giardia lamblia* and virus inactivation requirements of subsection (3)(a) of this rule using a minimum of two disinfectants. Each of the two disinfectants must achieve by itself, the total inactivation required for at least one of the following pathogens: *Cryptosporidium*, *Giardia lamblia*, or viruses.

⁶ Drinking Water Data Online (Data Online), <http://170.104.63.9/inventory.php?pwsno=00657>.

⁷ Data Online, <http://170.104.63.9/inventory.php?pwsno=00657>; OHA's PWB file

⁸ PWB Variance request, Section 2.

and caustic soda for pH and corrosion control. PWB is not currently treating for *Cryptosporidium*.⁹

The PWB's request for a Variance

12. On June 7, 2011, OHA received a variance request from the PWB under section 1415(a)(1)(B) of the SDWA, (42 USC § 300g-4(a)(1)(B)). Specifically, the PWB requests a variance from the *Cryptosporidium* treatment requirements in OAR 333-061-0032(3)(e) through (g). Under that rule a water system using unfiltered surface water must provide at least 2-log (99%) *Cryptosporidium* inactivation. A minimum of two disinfectants must also be used. Granting a variance to the *Cryptosporidium* treatment provision necessarily requires granting a variance to the requirement to provide two disinfectants as well.

13. The PWB asserts that because of the nature of the Bull Run watershed, its raw water source, treatment for *Cryptosporidium* is unnecessary.

14. Specifically, the PWB asserts that the following characteristics of the watershed contribute to the low prevalence of *Cryptosporidium* in the Bull Run watershed:

- Limited human access to the watershed;
- No grazing of domesticated livestock;
- Low wildlife densities and infection prevalence;
- Good soil infiltration and limited runoff;
- Raw water storage reservoirs upstream of the drinking water intake dilute and attenuate the concentration of pathogens.¹⁰

15. In support of its variance request, the PWB conducted monitoring at the raw water intake for *Cryptosporidium*. Fifty liter samples were collected four times per week from December 2009 to December 2010. In total, 10,271 liters of raw water were analyzed in 449 samples. No *Cryptosporidium* was detected.¹¹

16. The PWB collected additional samples at upstream locations thought to have higher risk for wildlife fecal contamination. A total of 3,384 liters in 315 samples were collected over time. Four locations were routinely sampled weekly, in addition to storm event-triggered monitoring at those and other locations. No *Cryptosporidium* was detected.¹²

17. The PWB adapted the Pathogen Catchment Budget model as recommended by EPA to determine the fate and transport of *Cryptosporidium* in the watershed. As part of this effort, PWB collected and analyzed 307 fecal samples from 11 species of wildlife. Two *Cryptosporidium* oocysts were found in one sample from a coyote. Since the application was

⁹ Data Online, <http://170.104.63.9/inventory.php?pwsno=00657>; OHA's PWB file.

¹⁰ PWB Variance Request, Section 2, Section 4.

¹¹ PWB Variance Request, Section 3.

¹² PWB Variance Request, Section 3.

submitted, on-going sampling detected one *Cryptosporidium* oocyst from fecal material of a bobcat.¹³

18. The PWB proposes an on-going monitoring program and other operational approaches to be set as conditions, should a variance be granted.

II. FINDING OF FACTS

Regulatory Scheme

1. The PWB operates a public water system that is subject to the federal SDWA, ORS 448.115 *et seq.* and OAR 333, Division 61.

2. Under its drinking water regulations, EPA has established programs and requirements that form a multiple barrier approach for public water systems to reliably supply safe drinking water for consumers. Multiple barriers include protection of source water, treatment of source water, and properly trained and certified water system operators.¹⁴

3. EPA has established an annual risk of infection of 1 in 10,000 as a reasonable goal for drinking water supplies.¹⁵ EPA designed LT2 to lower the level of infectious *Cryptosporidium* in finished drinking water to less than one oocyst per 10,000 liters.¹⁶

4. LT2 regulates the genus *Cryptosporidium*, and does not differentiate between species.

5. Unless OHA grants PWB a variance under 42 USC § 300g-4(a)(1)(B) and ORS 448.135, the PWB will be required to treat its source water to inactivate 99% of *Cryptosporidium* and use a minimum of two disinfectants no later than April 1, 2014.

Cryptosporidium Biology and Human Health Risks

6. *Cryptosporidium* is a genus of related protozoan parasites. Over 20 species of *Cryptosporidium* are now recognized. Several of these species or their subtypes are known to infect humans frequently; others infrequently, and many not at all.¹⁷

7. The human illness associated with *Cryptosporidium* is called cryptosporidiosis. Most documented cryptosporidiosis outbreaks to date have been linked to the species *C. parvum* or *C. hominis* of the *Cryptosporidium* genus.

¹³ PWB Variance Request, Section 4.2.2.

¹⁴ EPA publication 816-K-06-005.

¹⁵ 54 Fed Reg 27486, June 29, 1989.

¹⁶ EPA 71 Fed.Reg. 658. Jan.5, 2006.

¹⁷ Xiao L. Molecular epidemiology of cryptosporidiosis: an update. *Exp Parasitol* 2009;124:80-9; Xiao L, Cama V. *Cryptosporidium*. in *Manual of Clinical Microbiology*, 10th ed. Versalovic J, ed. Washington DC: ASM Press. 2011: pp. 2180–89.

8. *C. parvum* can be carried by humans and several non-human species, principally cattle and sheep especially the young animals of those species.¹⁸ Humans are the only significant reservoir of *C. hominis*.

9. The potential for human epidemic disease caused by other *Cryptosporidium* species is less certain,¹⁹ although many are clearly potentially pathogenic for humans.²⁰ At least one outbreak, in the United Kingdom, has been caused by one of these other species (*C. cuniculus*).²¹

10. The infective stage of the *Cryptosporidium* parasite, the oocyst, is shed in the feces of infected hosts. Oocysts are resistant to environmental degradation and can survive for weeks or months under some conditions; oocysts are also highly resistant to disinfection with chlorine products.

11. Cryptosporidiosis is transmitted by the fecal-oral route. Most recognized outbreaks to date have been waterborne or from direct animal contact. Well-documented exposure pathways include: contact with fecally contaminated recreational water (e.g., swimming pools, water slides, fountains); consumption of fecally contaminated drinking water; person-to-person spread by direct/indirect contact (e.g., in daycare centers); consumption of unpasteurized milk or cider; and contact with infected livestock or their environments. Recreational water may be the most common route of exposure in the U.S. today.²²

12. Infected animals and people can excrete as many as 10⁷ oocysts per gram of stool.²³ Studies with human volunteers have demonstrated that a low dose of *C. parvum* (e.g., 10 oocysts) is sufficient to cause infection in healthy adults, although some strains are more infectious than others.²⁴

13. *Cryptosporidium* infections are often asymptomatic. Illness, when it occurs, is characterized by mild to severe diarrhea, sometimes watery, usually accompanied by moderate to severe abdominal cramps. Nausea, vomiting, and low-grade fever may also occur. Illness can be intermittent and prolonged, lasting days to several weeks in most persons, and occasionally even a month or longer.

¹⁸ Jiang J, Alderisio KA, Xiao L. Distribution of *Cryptosporidium* genotypes in storm event water samples from three watersheds in New York. *Appl Environ Microbiol* 2005;71:4446-54.

¹⁹ Xiao L. Molecular epidemiology of cryptosporidiosis: an update. *Exp Parasitol* 2009;124:80-9.

²⁰ Chappell CL, Okhuysen PC, Langer-Curry RC, Akiyoshi DE, Widmer G, Tzipori S. *Cryptosporidium meleagridis*: infectivity in healthy adult volunteers. *Am J Trop Med Hyg* 2011;85:238-42; Xiao L. Molecular epidemiology of cryptosporidiosis: an update. *Exp Parasitol* 2009;124:80-9.

²¹ Chalmers RM, Robinson G, Elwin K, Hadfield SJ, Xiao L, Ryan U, et al. *Cryptosporidium* sp. rabbit genotype, a newly identified human pathogen. *Emerg Infect Dis*. 2009 May;15(5):829-30; . Xiao L, Cama V. *Cryptosporidium*. in *Manual of Clinical Microbiology*, 10th ed. Versalovic J, ed. Washington DC: ASM Press. 2011: pp. 2180–89.

²² Yoder JS, Harral C, Beach MJ. Cryptosporidiosis surveillance—United States, 2006–2008. *MMWR Surveill Summ* 2010;59:1-14.

²³ Chappell CL, Okhuysen PC, Langer-Curry R, et al. *Cryptosporidium hominis*: experimental challenge of healthy adults. *Am J Trop Med Hyg* 2006;75:851-7; DuPont HL, Chappell CL, Sterling CR, Okhuysen PC, Rose JB, Jakubowski W. The infectivity of *Cryptosporidium parvum* in healthy volunteers. *N Engl J Med* 1995;332:855-9.

²⁴ EPA 71 Fed.Reg. 658. Jan.5, 2006.

14. Severely immunocompromised persons (e.g., AIDS patients; solid organ transplant patients on immunosuppressive therapies; certain cancer patients on certain therapies) may suffer prolonged and potentially intractable diarrhea from *Cryptosporidium* infection. Such fulminant cryptosporidiosis was common among AIDS patients before the advent of effective antiretroviral therapy, and remains a risk if CD4 cell counts drop below approximately 100 cells/microliter.²⁵

15. For many years there was no effective specific therapy for cryptosporidiosis. In 2005, nitazoxanide was licensed for treatment in immunocompetent hosts; clinical trials demonstrated significant reductions in the duration of diarrhea. The effectiveness of nitazoxanide therapy has not been demonstrated among immunocompromised patients.

Cryptosporidiosis Surveillance and Outbreak Data

16. Cryptosporidiosis has been officially reportable in Oregon since 1995, although some reports were made as early as 1988. Prior to 2007, local health departments were not expected to follow-up on individual case reports absent some indication of an outbreak or other unexplained increase in incidence. Reporting and follow-up procedures in Multnomah County are typical for Oregon counties.

17. Public health surveillance data are an amalgam of reports that mostly originate from private laboratories. Laboratory confirmation of cryptosporidiosis can be difficult; both false positive and false negative results are common. One recent study found that only 56 percent of positive results from these tests were likely true positives.²⁶ Untrustworthy laboratory data further compromise the ability of a public health authority to recognize and investigate outbreaks.

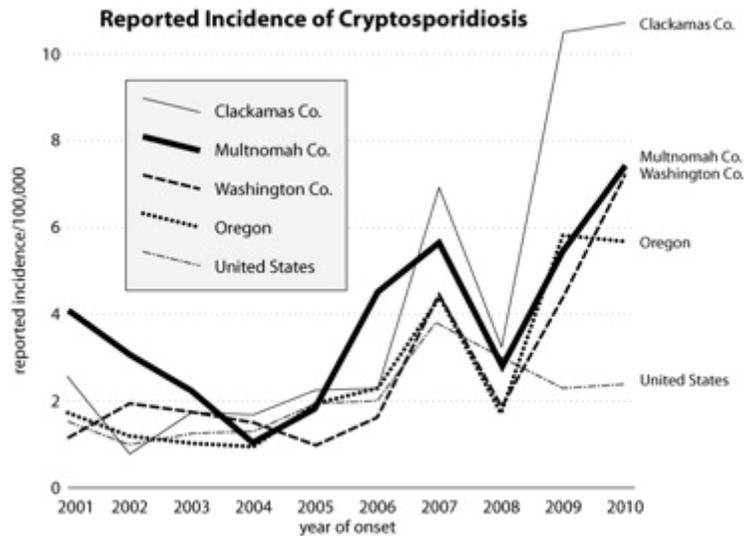
18. If multiple cryptosporidiosis cases report shared exposures (e.g., swimming in the same pool) or the number of cases increases above historical norms, a cluster investigation may ensue. Unlike bacterial pathogens such as *Salmonella* or *Escherichia coli* O157, *Cryptosporidium* cannot be readily subtyped in a private laboratory or at the Oregon State Public Health Laboratory (OSPHL), which means that it is relatively difficult to identify outbreaks and outbreak-associated cases. Diagnostic material (e.g., stool) is not forwarded to OSPHL. For all practical purposes, this means that clustered cases are only recognized as such if the spike is self-apparent to the reporter or the public health epidemiologist (e.g., normally a certain county only sees 0–2 cases/month, and suddenly they get 10 reports in 1 week).

19. Long-term trends in the incidence of cryptosporidiosis in Multnomah County, Oregon, or the United States as a whole are difficult to interpret (see figure below). Over the past decade, Multnomah County rates tend to be higher than the Oregon and U.S. rates, although these rates generally track together. This co-linearity suggests that the apparent changes are

²⁵ Kaplan JE, Hanson D, Dworkin MS, et al. Epidemiology of human immunodeficiency virus-associated opportunistic infections in the United States in the era of highly active antiretroviral therapy. Clin Infect Dis 2000;30 Suppl 1:S5-14.

²⁶ Robinson TJ, Cebelinski EA, Taylor C, Smith KE. Evaluation of the positive predictive value of rapid assays used by clinical laboratories in Minnesota for the diagnosis of cryptosporidiosis. Clin Infect Dis 2010;50:e53-5.

largely driven by broader trends in diagnostic practices (e.g., changes in testing frequencies and test modalities) rather than changes in disease incidence per se. During this period, 119 (12%) of 995 cases reported statewide were outbreak-associated; among Multnomah County residents that proportion was 8 (3%) of 271.



20. Twelve outbreaks of cryptosporidiosis have been recognized and investigated in Oregon since 1990, including one large outbreak (5,000–15,000 cases in Jackson County, 1992) linked to municipal drinking water. Other outbreaks have been linked to recreational water contact (swimming pools and water parks), veterinary exposure to calves, and person-to-person transmission in hospital settings. No outbreaks of cryptosporidiosis have been linked to the Portland water supply.

21. In 1992, an outbreak of cryptosporidiosis linked to drinking water was recognized and investigated in Jackson County, Oregon. Telephone surveys indicated that thousands of people became sick. Surface water from the city of Talent’s poorly functioning filtration plant was confirmed to be a source, but whether surface-influenced spring water feeding the separate Medford water supply was also part of the problem was never resolved. The Talent water source was of poor quality, including both run-off from agricultural lands and effluent from the Ashland sewage treatment plant.²⁷

22. Dozens of other drinking water-associated cryptosporidiosis outbreaks have been reported in the U.S., Canada, Europe, Australia, and elsewhere. A massive outbreak in 1992 affected an estimated 400,000 persons in Milwaukee, Wisconsin.²⁸ Many of these outbreaks involved surface water sources from areas with heavy livestock and human presence that were overwhelmed by anomalous circumstances, such as exceptional rainfall events or treatment failures. However, outbreaks have occurred in filtered systems with high-quality water sources

²⁷ Leland D, McAnulty J, Keene W, Stevens G. A cryptosporidiosis outbreak in a filtered water supply. JAWWA 1993;85(6):34-42.

²⁸ MacKenzie WR, Hoxie NJ, Proctor ME, et al. A massive outbreak in Milwaukee of *Cryptosporidium* infection transmitted through the public water supply. New Engl J Med 1994;331:161-7.

(e.g., Las Vegas, Nevada).²⁹ No cryptosporidiosis outbreaks linked to community surface water supplies have been identified in the U.S. since 1993.³⁰

Bull Run Water Monitoring and Laboratory Results

23. EPA has indicated that an unfiltered water system that could show a *Cryptosporidium* level at or below 0.075 oocysts per 1000 liters would have demonstrated that no treatment for *Cryptosporidium* is necessary.³¹ Prior to applying for the variance, the PWB consulted with EPA about the level of monitoring that would be acceptable to show that the Bull Run source water *Cryptosporidium* concentration is below 0.075 oocysts per 1000 liters. EPA calculated that PWB would need to analyze at least 10,250 liters of intake water with zero oocysts detected in order to make such a showing.³²

24. During one year (December 14, 2009 to December 6, 2010) of monitoring and analyzing 449 samples of Bull Run source water totaling 10,271 liters, no *Cryptosporidium* oocysts were detected. Three hundred and fifteen samples were also collected from upstream locations to identify any *Cryptosporidium* entering the Reservoir, and no oocysts were detected.³³

25. All of the PWB's *Cryptosporidium* testing was performed by Analytical Services, Inc., a laboratory approved under the EPA's Laboratory Quality Assurance Evaluation Program for Analysis of *Cryptosporidium* in Water, using Method 1623. Modifications to this method were accepted by OHA and EPA and were intended to improve the *Cryptosporidium* recovery rate.

26. Matrix Spike Recovery, a quality control verification process, was employed no less frequently than every 20 samples. The purpose of this verification process was to assure that if *Cryptosporidium* oocysts were present in water samples, the laboratory would be able to detect them despite any possible interference by the contents of the Bull Run water itself. Over the one-year monitoring period *Cryptosporidium* oocyst recovery was 28.8 percent. In other words, for every 100 oocysts purposely added to the sample, the laboratory detected an average of 28.8. The average recovery for the upstream location sampling was 48.8 percent. These recovery rates are within the acceptable range of 13 to 111 percent for Method 1623.³⁴

27. The distribution of matrix spike data from the Information Collection Rule Supplemental Study is presented in Table 5 of EPA Method 1623, 430 water samples were collected from 87 water sources and distributed to different laboratories using EPA approved analytical methods. Among these laboratories, matrix spike recoveries for *Cryptosporidium* oocysts were 40 percent or higher in about 60 percent of the water samples, and about 28 percent

²⁹ Goldstein ST, Juranek DD, Ravenholt O, et al. Cryptosporidiosis: an outbreak associated with drinking water despite state-of-the-art water treatment. *Ann Intern Med* 1996;124:459-68.

³⁰ Yoder JS, Harral C, Beach MJ. Cryptosporidiosis surveillance—United States, 2006-2008. *MMWR Surveill Summ* 2010;59:1-14.

³¹ EPA 71 Fed.Reg. 658. Jan.5, 2006.

³² PWB Variance Request, Appendix I-87.

³³ PWB Variance Request, Section 3 and Section 4.

³⁴ EPA Method 1623, Table 3.

of samples had matrix spike recoveries less than 30 percent.³⁵ Therefore, the recovery performance of the samples for the PWB's variance application is at the lower end of the recovery rates found in this study.

28. Independent of the PWB variance request, a separate study of *Cryptosporidium* in the Bull Run reservoir was conducted from June 1999 to May 2000. Out of 97 water samples collected using Method 1623, nine samples showed a combined total of 14 oocysts, and matrix spike recovery averaged 73.7 percent. Using the cell culture-PCR method, two of 87 samples were found to have a presence of infectious *C. parvum*.³⁶

29. Prior to the compliance monitoring or sampling done for the variance request, PWB sampled for *Cryptosporidium* at the Bull Run intake monthly from September 2000 to November 2002, for a total of 28 samples. Analysis using Method 1622 and 1623 detected five *Cryptosporidium* oocysts. Recovery rates were not reported to OHA.

30. The PWB collected 26 samples at the intake from Bull Run between December 2002 and November 2004. Analysis using Method 1622 and 1623 did not detect any *Cryptosporidium* oocysts. EPA accepted these as grandparented data for the initial compliance round as required in LT2.³⁷ Recovery rates were not reported to OHA.

31. Oregon drinking water rules require the PWB to sample and test five days per week for total coliforms or fecal coliforms.³⁸ Water samples collected at the Bull Run intake and tested for fecal or total coliforms have, since the PWB began testing, been below the maximum allowable level. This sampling data has allowed the PWB to meet the criteria required to remain unfiltered.

32. The 449 samples mentioned in paragraph 22 above were also analyzed for *Giardia* and a total of 58 cysts were detected.

33. Total and fecal coliforms and *Giardia* are all bacterial indicators of fecal contamination in water. PWB's fecal and total coliform monitoring data and the *Giardia* data correlate with PWB's *Cryptosporidium* sampling data and indicate that Bull Run water is from a low-contamination environment.

Wildlife Scat Sampling

34. There is no EPA-approved standard method to analyze wildlife fecal samples for *Cryptosporidium* oocysts, although there are standard methods to analyze human fecal samples for *Cryptosporidium*. The PWB's laboratory analyzed wildlife fecal samples for *Cryptosporidium* oocysts using a different method - a combination of immunomagnetic separation to capture and concentrate the oocysts and immunofluorescence microscopy to

³⁵ EPA Method 1623, Table 5.

³⁶ LeChevallier et.al., Comparison of Method 1623 and Cell Culture-PCR for Detection of *Cryptosporidium* spp. in Source Waters.

³⁷ Per OHA file: EPA letter to PWB, July 2, 2007; 40 CFR § 141.712.

³⁸ OAR 333-061-0036(6)(b).

visualize and identify them. Modifications to validate the method included spiking feces with oocysts and tracking the efficiency of recovery. Recovery data were not provided to OHA.

35. Between August 31, 2009 and April 21, 2011, the PWB collected and analyzed 307 fecal samples from 11 species of wildlife. Two *Cryptosporidium* oocysts were found in one sample from a coyote. Since the variance application was submitted, on-going sampling detected one *Cryptosporidium* oocyst from fecal material of a bobcat.³⁹

Legal Protections for the Bull Run Watershed

36. The legal boundaries for the Bull Run Watershed Management Unit (Unit) are slightly larger than the drainage area; this difference in physical size provides a geographic buffer around the drainage area boundary. Approximately 95 percent of the Unit is federal land administered by the USFS; four percent is owned by the City of Portland, and one percent is federal land administered by the BLM.⁴⁰

37. In 1892, a presidential proclamation declared the Bull Run area as a national Forest Reserve.⁴¹

38. In 1904, Congress passed the Bull Run Trespass Act that prohibits domestic animals from grazing in the Bull Run Forest Reserve and limits access into the area to certain federal, state and city employees.⁴²

39. In 1977, Congress passed the Bull Run Act that prohibits the cutting of trees on federal land in the Unit.⁴³ The Act also specifies that the Unit be managed to ensure "pure clear raw potable water" for persons in the Portland metropolitan area.⁴⁴

40. In 1996, Congress passed the Oregon Resources Conservation Act of 1996, which prohibits "the cutting of trees in that part of the Unit consisting of the hydrographic boundary of the Bull Run River Drainage, including certain lands within the unit and located below the headworks of the City of Portland, Oregon's water storage and delivery project, as depicted in a map dated July 22, 1996 and entitled 'Bull Run River Drainage'."⁴⁵

41. In 1995, the BLM Salem District issued a Record of Decision and Resource Management Plan consisting of management objectives, land use allocations, and management direction on BLM-administered lands, including protecting and enhancing water quality within the Unit.

³⁹ PWB response to OHA's questions, 9/11/11, page 3.

⁴⁰ See Appendix A, Map.

⁴¹ Proclamation 332 (June 17, 1892).

⁴² 33 Stat. 526, Chapter 1774 (April 28, 1904).

⁴³ Public Law 95-200, Sec. 2(b)(November 23, 1977).

⁴⁴ *Id.*, Preamble.

⁴⁵ S. 1662, 104th Congress (1995 - 1996)

42. In 2001, Congress passed the Little Sandy Protection Act, increasing the square miles of the Unit and prohibiting timber cutting in this area.⁴⁶

43. In July 2007, the USFS, Mt. Hood National Forest and the PWB signed the Bull Run Watershed Management Unit Agreement specifying how the parties intend to jointly manage the Unit, consistent with federal law. The agreement is effective for 20 years with a review every five years.

44. In 2010, the City of Portland passed an ordinance, City Code 21.36.050, prohibiting tree cutting on City-owned land within the Unit.

45. Both the USFS and the BLM have issued closure orders, closing the Unit to unauthorized access.⁴⁷

Bull Run Watershed Characteristics

46. Topography in the Bull Run watershed is characterized by streams cutting through historic lava flows. Approximately 12 percent of the watershed has slope angles greater than 50 percent due to the down-cutting streams. The Bull Run watershed is heavily vegetated, covered by approximately 55 percent mature and old growth (large conifers) and another 41 percent in various stages of re-growth and reforestation (medium conifers and broadleaf). Wildlife found in the watershed includes deer, elk, cougar, coyote, black bear, hare, and rodents.⁴⁸

47. The soils in the forested areas of the watershed are complex organic ground cover. The soil characteristics of high infiltration capacities and being well-drained are favorable for filtering *Cryptosporidium* oocysts before transport to surface waters in the watershed. Areas that are open or have limited shrub cover are considered more vulnerable to erosion. Approximately four percent of the Bull Run watershed is in this category. Exposed rocks and soils in the watershed include some volcanic soils, with mostly gravelly-silt loams that have high infiltration capacity. Overall, the combination of mature forest cover and high infiltration capacity of soils results in low potential for soil erosion in the Bull Run watershed.⁴⁹

48. A total of 222 miles of roads have been constructed within the Unit. As of 2010, 112 miles of these roads have been decommissioned. Through both active and passive processes, reforestation and rehabilitation have been initiated on the decommissioned roads. These projects are collaborations between the USFS and the PWB.⁵⁰

⁴⁶ Public Law 107-30 (August 20, 2001).

⁴⁷ Forest Service Order No. M-H-2007-1; BLM Temporary Closure Order 1610 (November 24, 2009); BLM Permanent Closure Order 4310-33, effective December 2, 2011; See Appendix B for complete list of documents that control activities within the Unit.

⁴⁸ PWB Variance Request. Land use percentages from figure 2.3 in section 2.1. Old growth defined as the sum of giant conifer and large conifer land use percentage and re-growth and reforestation is the remainder of the forest types, Pages 2-1 to 2-4.

⁴⁹ PWB Variance Request Section 2.2, pages 2-4 to 2-5.

⁵⁰ PWB response to OHA's questions, 9/11/11. Section 2.7.3. Page 2-12.

49. Characteristics of the watershed that would increase the risk of the PWB water source being contaminated with *Cryptosporidium* are primarily large wildlife populations, poor soil infiltration, and large areas vulnerable to erosion. Potential changes in the climate, especially changes in precipitation type from snow to rain and changes in storm patterns from low-intensity/long-duration to high-intensity/short-duration, could increase the potential for soil erosion.

Potential Human Impact

50. While access to the Unit is generally closed to the public, there are segments of popular recreational trails within the Unit, including 8.3 miles of the Pacific Crest Trail, 1.3 miles of the Huckleberry Trail, and 1.4 miles of the Oneonta Creek Trail. Approximately 2-3 total miles of the Pacific Crest and Oneonta Creek Trails are within the water supply drainage itself. The USFS estimates usage to be in the range of 2-12 hikers per day when the trails are accessible. Pack animals on these trails are reported to be very rare.⁵¹

51. Sanitary facilities exist within and adjacent to the water supply drainage. Within the drainage, two seasonal portable toilets are near the northwest edge of Bull Run Lake, and two portable toilets and a toilet with a closed holding tank are located at the southwest end of Bull Run Reservoir #1. All four portable toilets are traded out on a regular schedule and the closed holding tank is emptied regularly. Outside of the water supply drainage at the southwest end of the Bull Run Reservoir #2, the headworks facility has sanitary facilities, including a septic system and two portable toilets. A pit toilet is also located near Hickman Butte, just outside the water supply drainage.⁵²

52. The BLM recently constructed a network of mountain biking trails on land adjacent to the Unit's southern boundary. The Sandy Ridge mountain bike trail system is within 2 miles of the water supply drainage; BLM estimated 20,000 to 25,000 riders will use these trails in 2011.⁵³

53. Most of the land adjacent to the boundary of the Unit consists of public and private forest, designated wilderness, and national scenic area. Less than 2% of land adjoining the Unit is in agriculture or livestock use. The closest private land is less than a half mile from the water supply drainage.⁵⁴

III. CONCLUSION OF LAW

1. An unfiltered water system such as that operated by the PWB is required to treat its water for *Cryptosporidium*, and use a minimum of two disinfectants no later than April 1, 2014.⁵⁵

⁵¹ PWB response to OHA's questions, 9/11/11, Page 4-5 and Map 1A-1.

⁵² PWB response to OHA's questions, 9/11/11, Page 3-4 and Map 1A-1.

⁵³ PWB response to OHA's questions, 9/11/11, Page 5 and Map 1A-1.

⁵⁴ PWB response to OHA's questions, 9/11/11, Pages 2, 4-5 and Map 1A-1.

⁵⁵ 40 CFR § 141.712; OAR 333-061-0032(3)(e) to (g).

2. The PWB can be granted a variance from the *Cryptosporidium* raw water treatment requirement if the OHA is satisfied that, due to the nature of the raw water source, treatment is not necessary to protect the public's health.⁵⁶

3. The PWB has shown that:

(a) The Bull Run water source legal protections effectively limit people and exclude livestock, the primary hosts for two species of *Cryptosporidium* from the watershed;

(b) There appears to be a low occurrence of *Cryptosporidium* found in wildlife scat in the watershed;

(c) The soil in the watershed has high infiltration capacity; and

(d) No *Cryptosporidium* was detected in the water samples collected and analyzed for this variance request.

4. The PWB has demonstrated to the satisfaction of OHA that because of the nature of the raw water source, treatment for *Cryptosporidium* at the Bull Run watershed intake is not necessary to protect public health. This Finding is subject to specific conditions identified below.

IV. PROPOSED ORDER

It is therefore proposed to be ordered that:

1. The PWB's variance request IS GRANTED, subject to the following conditions:

(a) Watershed control and stewardship

A. All current protections for the Bull Run Management Unit must remain in place.

B. The PWB must inspect the locations of possible human intrusion at least annually and must make all reasonable efforts to eliminate potential unauthorized entry.

C. Any human sewage (e.g., portable toilets) must be contained and must be kept at least 200 feet from any water body.

D. The PWB must inspect the fence around the diversion pool at least annually, and the fence must be kept intact.

E. The PWB must document the results of these inspections in its Annual Watershed Report submitted to OHA each year.

(b) On-going monitoring

A. The PWB must conduct routine monitoring for *Cryptosporidium*. The monitoring must consist of collecting at least two 50L samples each week,

⁵⁶ 42 USC § 300g-4(a)(1)(B); ORS 448.135(2); OAR 333-061-0045(13).

and analyzing the samples for *Cryptosporidium* using method 1623 from a laboratory approved by the EPA to utilize this method.

B. If any one sample detects a presence of *Cryptosporidium*, the monitoring frequency must be increased.

C. Increased monitoring must consist of collecting at least four 50 liter samples weekly. Analysis of the samples for *Cryptosporidium* using method 1623 must be done by a laboratory approved by the EPA to utilize this method.

D. If, while on increased monitoring, another sample detects a presence of *Cryptosporidium*, OHA may revoke the variance. Revocation of the variance will include a schedule for the PWB to install treatment required by LT2.

E. The PWB must continue increased monitoring until the running annual average drops below 0.000075 oocysts/L. When this average is below 0.000075 oocysts/L, the PWB may resume routine monitoring.

(c) The PWB must allow OHA or its designee, upon request, access to the watershed, laboratory results and pertinent documents, in order to determine compliance with these conditions or for special studies.

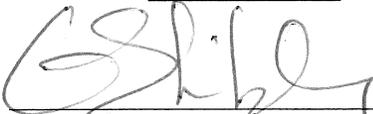
(d) The PWB must timely notify OHA, Environmental Public Health, Drinking Water Program of any circumstances that may impact any of the above conditions, including but not limited to land management decisions, environmental events or structural changes within or adjacent to the Unit.

(e) The PWB must notify OHA, Environmental Public Health, Drinking Water Program within 24 hours of any laboratory results that include any *Cryptosporidium* detections.

2. This variance is valid for a period of ten (10) years, beginning on the date the Final Order is issued.

3. Notwithstanding any other provision of this Order, OHA may revoke this variance at any time if 1) the PWB does not comply with the above conditions; 2) OHA reasonably believes that the lack of *Cryptosporidium* treatment is posing a threat to the public's health; or 3) conditions in the watershed change to such a degree that the facts supporting the variance no longer support the basis for OHA granting the variance.

Dated this 29th day of November, 2011

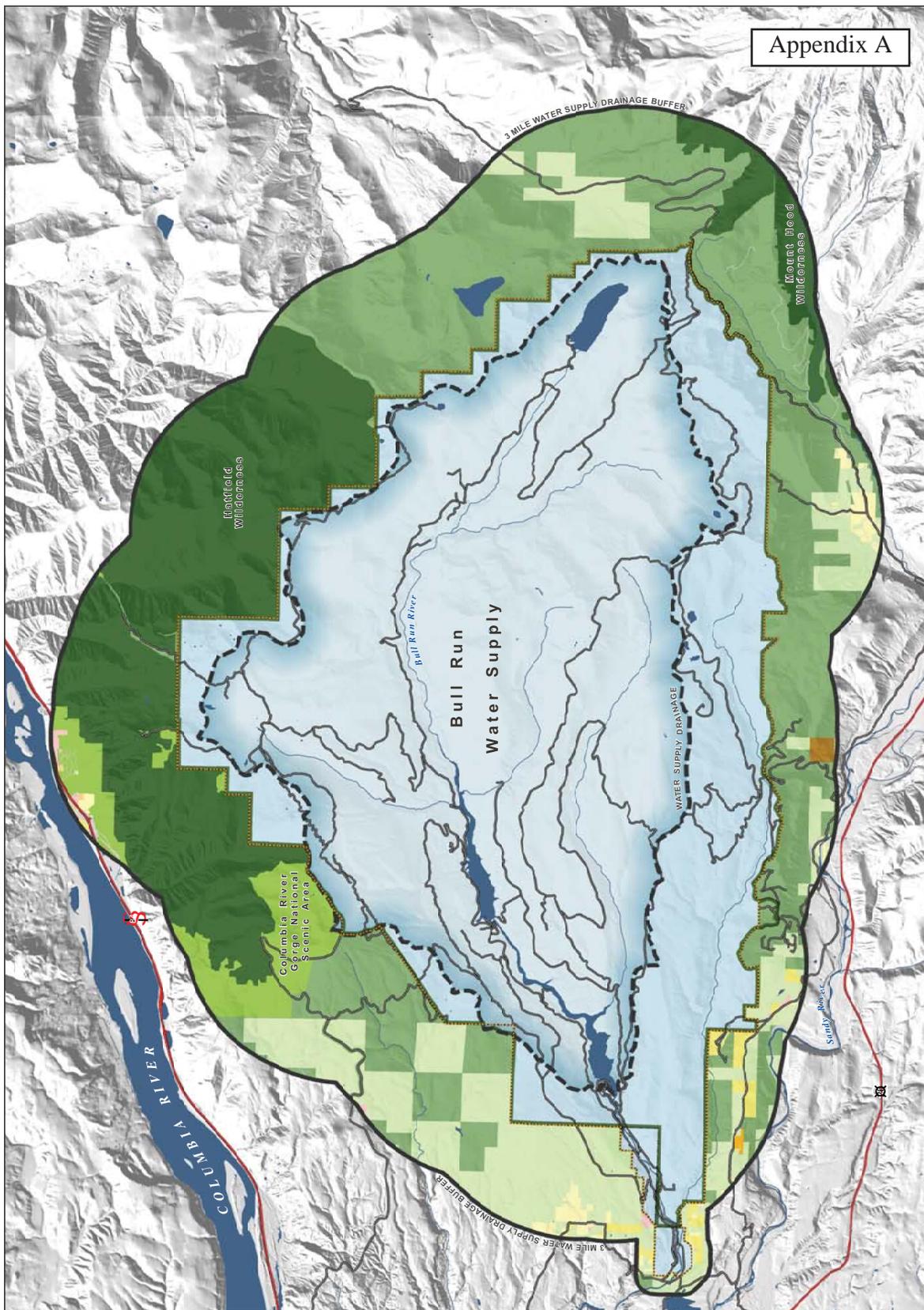


Gail R. Shibley, JD, Administrator
Office of Environmental Public Health
Public Health Division, Oregon Health Authority

NOTICE OF PUBLIC HEARING:

A public hearing shall be held to take public comment on OHA's intent to grant the PWB's variance request. The hearing will be held on December 14, 2011, from 5:00 p.m. to 7:00 p.m., at 800 NE Oregon Street, Portland, Oregon, Room 1B.

OHA shall consider all comments received at the public hearing and during the public comment period. Any interested person may submit comments during the public hearing, or at any time beginning immediately and ending at 5 o'clock pm January 3, 2012. Comments may be submitted electronically by emailing pwb.treatment-variance@state.or.us, or by U.S. Mail to OHA, OEPH, Drinking Water Program, 800 N.E. Oregon Street, Suite 640, Portland, OR 97232.



**1A-2
LAND USE IN AND ADJACENT
TO THE
BULL RUN WATER SUPPLY**

Land Use	Cover (%)
Watershed Protection Land	54.6
Designated Wilderness	14.7
National Scenic Area	2.5
Forested (Local, Federal)	18.6
Forested (Private)	8.1
Rural	0.5
Residential	0.1
Commercial	<0.1
Agriculture	0.5
Livestock	<0.1
Mining	0.1
Road	0.3

- Boundary**
- Water Supply Drainage
 - 3 Mile Water Supply Drainage Buffer
 - Public Closure
 - Bull Run Watershed Management

- Roads**
- Freeway / Highway
 - Primary Road







Oregon Watershed Assessment
 Bureau of Land Management
 Oregon Department of Water
 1100 SW 26th Ave
 Med. Center
 Med. Center
 (503) 853-5788

Appendix B: Legal Protections and Controls of Bull Run

Federal:

- The Bull Run Management Act signed by Congress on November 23, 1977 established a special resources management unit for the purpose of the continued protection of Bull Run.
- The 1990 Mt. Hood National Forest Land and Resource Management Plan was prepared by the US Department of Agriculture. It guides natural resource management activities and establishes management standards and guidelines for the Mt. Hood National Forest, which includes the Bull Run Watershed Management Unit.
- The 1994 Northwest Forest Plan Record of Decision was prepared by the US Departments of Agriculture and Interior and jointly amended the planning documents of 19 national forests and 7 BLM districts. It guides the management of habitat within the range of the Northern Spotted Owl.
- The 1995 BLM Salem District Record of Decision and Resource Management Plan consists of management objectives, land use allocations, and management direction on BLM-administered lands, including protecting and enhancing water quality within the Bull Run Management Unit.
- The 2007 Mt. Hood National Forest Closure Order for the Bull Run Watershed Management Unit, signed February 6, 2007 by the Forest Supervisor of the Mt. Hood National Forest, prohibits unauthorized access to the Bull Run Watershed Management Unit.
- The BLM Temporary Closure Order for the Bull Run Watershed Management Unit, issued November 24, 2009, temporarily closes the public lands to unauthorized personnel from December 1, 2009 to December 1, 2011.
- The BLM Permanent Closure Order for the Bull Run Watershed Management Unit permanently closes the public lands to unauthorized personnel from December 2, 2011 until further notice.
- The July 2007 Bull Run Watershed Management Unit Agreement between the US Forest Service, Mt. Hood National Forest and the Portland Water Bureau expresses the intentions on how best to jointly manage the Bull Run Watershed Management Unit. The agreement is effective for 20 years with a review every five years.

State:

- Sections 448.295 through ORS 448.325 provide jurisdiction to Cities to protect water supplies.
- The State of Oregon Department of Forestry Regulated Closure Proclamation Number 14, signed August 16, 2011, provides restrictions in the regulated use area of Bull Run during fire season to help prevent fires.

Local:

- The Portland City Code Chapter 21.36 Bull Run Watershed Protection contains the Bull Run Watershed Protection Policy and designates the closure area, prohibits entry without permit and prohibits actions within the closure area. Enforcement provisions are also detailed.
- Section 00203 of the Portland Water Bureau Contract Specifications contains contract specifications for construction projects in the Bull Run Watershed Closure Area.
- Section 00202 of the Portland Water Bureau Contract Specifications contains contract specifications for security requirements for construction projects.