Oregon Health Authority
Drinking Water Services

Water System Survey Reference Manual

May 2026

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Scope

Water system surveys, called sanitary surveys by the Environmental Protection Agency (EPA), are defined in Oregon Administrative Rule (OAR) 333-061-0020. Water system surveys are an onsite review of the water system source, treatment, storage, distribution facilities, operations, management, and compliance with regulations to determine if any deficiencies exist that could result in unsafe drinking water. Additional information related to surveys, significant deficiencies and requirements for corrective action are specified in OAR 333-061-0076. Significant deficiencies and unmet rule requirements listed on the survey forms will be referenced as "deficiencies" in this manual.

1. Required frequencies of water system surveys:
    a. Every 3 years for Community water systems (C), regardless of source, unless determined to meet "Outstanding Performer" criteria.
    b. Every 5 years for Non-Community systems (NTNC and TNC), and "Outstanding Performer" Community water systems.

2. A hyperlink to the Water System Surveys due each year is in the Information by County section of Drinking Water Data Online.

3. Water system survey information and additional resources can be found on the Drinking Water Services webpage for County and Dept. of Agriculture partners.
    a. Water system survey form templates
    b. Water system survey procedure
    c. Water system survey deficiency follow-up

4. Water system survey resources for operators:
    a. Preparing for a water system survey
    b. Preparing for a water treatment plant inspection

Checklist for Water System Survey Packets

The water system survey forms are provided in 3 packets – one packet for Community and NTNC (C / NTNC) groundwater systems, one packet for Community and NTNC (C / NTNC) surface water systems, and one packet for Transient Non-Community (TNC) water systems. The forms are included in packets so that the water system name, ID number, and survey date appear as a header at the top of every page and the page numbering is done automatically. The form packets are also designed to allow you to add or subtract as many pages as necessary to accommodate systems with more than 6 wells or to include more than just one page of schematics, maps, or pictures. Systems that purchase surface water and do not have their own surface water source can use packet 1 or 2 and delete any unnecessary pages.

The following form pages are included in each of the 3 packets:

Survey Page	Packet 1 C / NTNC GW	Packet 2 C / NTNC SW	Packet 3 TNC
Significant Deficiency & Unmet Rule Requirement Summary	X	X	X
Inventory and Narrative	X	X	X
Water System Schematic	X	X	X
Source Information	X	X	X
Well Information	X	X	X
Spring/Other Source	X	X	
Conventional and Direct Treatment Plant Inspection		X	
Alternative Technology Treatment Plant Inspection		X	
Membrane Filtration Treatment Plant Inspection		X	
Disinfection	X	X	X
Treatment	X	X	X
Finished Water Storage & Pressure Tanks	X	X	X
Distribution System Information	X	X	
Water Quality Monitoring	X	X	
Management & Operations	X	X	
Transient (TNC)			X

C - Community water system
NTNC - Non-transient non-community water system
TNC - Transient non-community water system
GW - Groundwater
SW - Surface water

Recommended List of Equipment
For County/Ag Drinking Water Services

1. **Chlorine Test Kit**
    - DPD type, both free and total chlorine reagents
    - DWS uses HACH CN-66F or HACH Pocket Colorimeter
    - Make sure reagents have not expired!
    - No pool kits or test strips!

2. **pH meter**
    - For systems with corrosion control or related problems, or surface water sources
    - Digital, temperature compensating and calibratable for accuracy. Meters need to meet the EPA Method 150.1/150.3 for pH.

3. **Calibration chemicals / standards**
    - As required by manufacturer
    - DWS has standards for the 2100P turbidimeter if you want to bring it in periodically for calibration.

4. **Updated USGS maps, 7.5 minutes quads or** http://maps.google.com
    - For surveys, to locate water system for a person unfamiliar with the area
    - Using Google Maps, you can right click on the map and select “What’s Here?” to get the latitude and longitude in decimal degrees.

5. **Camera**
    - For water system surveys, to put photos in the file and imbed images in the survey forms.

6. **Flashlight**
    - To see in unlit areas, behind pressure tanks, into a reservoir, etc.

7. **Mirror**
    - To see underneath a down-turned elbow or reservoir vent

Useful Water-Related Websites & Phone Numbers

OHA – Drinking Water Services: 971-673-0405**,** After Hours Emergencies (on-call DWS manager): 503-704-1174

OHA-DWS Drinking Water Data Online

Oregon Department of Emergency Management

Oregon Emergency Response System (OERS): After Hours Emergencies: 800-452-0311

Oregon Water Agency Response Network (ORWARN): info@orwarn.org

Oregon Association of Water Utilities (OAWU): 503-837-1212, Emergency Contact: 503-580-4445

Drinking Water Services Circuit Rider Program: Civil West Engineering Services, Inc. 541-266-8601, mgochnour@civilwest.net

Local Public Health Authority Directory

Oregon Department of Agriculture

Oregon Water Resources Department

- **Well Report Query** – Search for a Well Report
- **Water Rights Information Query** – looking up water rights

National Sanitation Foundation (NSF) – to see if a certain product is certified

Environmental Protection Agency – Groundwater and Drinking Water: **EPA Safe Drinking Water Hotline** 1-800-426-4791 (water-related info for government and the public)

American Water Works Association

Center for Disease Control

Oregon Department of Environmental Quality (DEQ): Water Quality and Source Water Protection

New Sources on Existing Systems

New sources (or newly discovered sources) need to be added to the DWS inventory of public water systems.

- If you do a water system survey of the system before activating the new source or you've discovered it in the field, fill out the survey form as usual, including the new source. Make a comment where applicable that this is a new source and needs to be put on the inventory. Make sure all the information is correct, as this is what we will enter in the inventory. If the new source is a well, use the Water Resources Department's Well Report Query to find the well log (see useful websites and phone numbers on page 8). Always, before leaving for a survey, make sure you know how many and which sources are in the inventory for the system. Be sure the system knows that they need to go through the plan review process. We cannot accept new sources without making sure the construction standards are met.

- When a new source goes through the plan review process, the state reviews the information to make sure it meets construction standards. DWS sends copies of all correspondence and essential drawings to the County Health Departments and/or the Dept. of Agriculture. The source should be added to the inventory at this time by the responsible state or county/Ag staff. If you activate the source before completing a survey, use the separate forms: Water System Information, Entry Structure Diagram, and Source Info. Again, be sure the information is complete and correct, as this will go into the inventory.

  For new systems or sources, follow the steps below:
  - Add to survey.
  - For new sources, write in – UNAPPROVED after source name.
  - Inform system of need for plan review.
  - Be sure to list "major modifications (plan review)" as an unmet rule requirement.
  - DWS will send letter and track.

Significant Deficiency and Unmet Rule Requirement Summary

Significant Deficiency and Unmet Rule Requirement Summary

Surveyor(s): _____

Date Corrective Action Plan is due: _____ **County:** _____

Yes	No	N/A	Significant Deficiencies and Unmet Rule Requirements:	Unaddressed in past survey(s)? Yes No	Date to be corrected	Date corrected
☐	☐	☐	**Source**			
			Well construction:	☐ ☐		
				☐ ☐		
			Spring/other source:	☐ ☐		
				☐ ☐		
☐	☐	☐	**Treatment**			
			Surface water treatment:	☐ ☐		
				☐ ☐		
			Disinfection:	☐ ☐		
				☐ ☐		
			Other treatment:	☐ ☐		
				☐ ☐		
☐	☐	☐	**Finished Water Storage**			
				☐ ☐		
				☐ ☐		
☐	☐	☐	**Distribution**			
				☐ ☐		
				☐ ☐		
			Booster Pumps:	☐ ☐		
☐	☐		**Monitoring**			
				☐ ☐		
				☐ ☐		
☐	☐		**Management & Operations**			
				☐ ☐		
				☐ ☐		
			Operator Certification:	☐ ☐		
				☐ ☐		
☐	☐		**Other**			
				☐ ☐		

Database Updates: ☐ None ☐ Inventory ☐ Treatment ☐ Monitoring ☐ Page:

Survey report sent on: mm/dd/yy ☐ Email ☐ Hardcopy through USPS ☐ Both

Comments:

Significant Deficiencies and Unmet Rule Requirements

● Significant deficiency per OAR 333-061-0076 ○ Unmet Rule Requirement per OAR 333-061-XXX

☐ **Source**

Well Construction:

☐ ● Sanitary seal and casing not watertight
☐ ● Unscreened well vent

Spring/Other Source:

☐ ● Spring box construction does not exclude surface water
☐ ● Spring box not impervious durable material
☐ ● Spring box hatch/entry not watertight
☐ ● Spring box access hatch not secured
☐ ● No screened overflow

☐ **Treatment**

Surface Water Treatment:

☐ ● Turbidity standards not met
☐ ○ Turbidimeters not calibrated per manufacturer or at least quarterly - *0036(5)(d)(A)(i)*
☐ ● Incorrect location for turbidity monitoring
☐ ○ Conventional filtration: Settled water not measured daily - *0036(5)(b)(A)(iii)*
☐ ○ Conventional or direct filtration: Turbidity profile not conducted on individual filters at least quarterly - *0036(5)(b)(A)(iv)*
☐ ● Cartridge filtration: Filters not changed according to mfg. rec. pressure differential
☐ ● Membrane filtration: Direct integrity testing does not meet requirements

Disinfection:

☐ ● Unable to demonstrate minimum CTs are met (including no tracer study)
☐ ○ Free chlorine residual not maintained - *0036(5)(C)*
☐ ○ DPD/EPA approved method not used - *0036(9)(e)*
☐ ○ Chlorine not measured & recorded - *0036(9)(f)*
☐ ○ No means to adequately determine flow rate on contact chamber effluent line - *0036(5)(a)*
☐ ○ Failure to calculate CT values correctly - *0032(3)*
☐ ○ pH, temperature, and chlorine residual not measured daily at first user - *0036(5)(b)(B)*
☐ ○ If serving > 3,300 people no alarm or auto plant shut off for low chlorine residual - *0036(5)(a)(E)*
☐ ● UV Disinfection: No intensity sensor with alarm or shut-off *0036(5)(c)(D)(ii)*

Other Treatment:

☐ ○ Non-NSF approved chemicals - *0087(5)*
☐ ○ Corrosion control parameters not met – *0034(1)*
☐ ● Bypass: no physical separation between treated and untreated water

☐ **Finished Water Storage**

☐ ● Roof and access hatch not watertight or adequately secured
☐ ● No flap valve, screen, or equivalent on overflow or drain
☐ ● No screened vent

☐ **Distribution System**

☐ ● 20 psi not maintained at all service connections at all times

Booster Pumps:

☐ ● Pump drawing from distribution main not equipped to maintain at least 20 psi on suction side

Cross Connection - 0070:

☐ ○ No ordinance or enabling authority (CWS)
☐ ○ Annual Summary Report not issued (CWS)
☐ ○ Testing records not current (CWS, NTNC, TNC)
☐ ○ No Cross Connection Control Specialist (CWS ≥ 300 connections)

☐ **Monitoring**

☐ ○ Monitoring not current - *0025(1)*
☐ ● Unaddressed MCL violations
☐ ○ Unaddressed LCR AL exceedances - *0030*
☐ ○ No Coliform Sampling Plan - *0036(6)(a)(I)*

☐ **Management & Operations**

☐ ○ No operations and maintenance manual - *0065(4)*
☐ ○ Emergency response plan not completed (CWS, NTNC) - *0064*
☐ ○ Major modifications not approved (plan review) - *0050*
☐ ○ Master plan not current (≥ 300 connections) – *0060(5)*
☐ ○ Annual CCR not distributed (CWS) – *0043*
☐ ● Overdue on compliance schedule
☐ ○ Public notice not issued as required - *0042*

Operator Certification:

☐ ● No DRC at required certification level
☐ ○ No protocol for under certified operator – *0225(2)*

☐ **Other**

☐ ● Other situations presenting an immediate public health risk, as determined by the Authority (requires manager approval)

Rev. 5/20/26 C-NTNC Groundwater

Significant Deficiency and Unmet Rule Requirement Summary

This page lists a summary of all significant deficiencies (as defined in OAR 333-061-0076) and significant unmet rule requirements identified elsewhere on the survey form pages. It is categorized into the eight (8) elements of the survey. Any significant deficiencies (identified by a small black dot) and unmet rule requirements (identified as a small open dot) cited on the survey form pages next to the question should be carried forward to the Significant Deficiency and Unmet Rule Requirement Summary page and the "Yes" box checked next to the element. If there are no significant deficiencies or unmet rule requirements identified for an element, then check the "No" box.

All significant deficiencies and unmet rule requirements must be corrected in a specified time. Surface water or GWUDI systems **have 45 days from the date of the survey letter** to respond in writing with how and when the deficiency is or will be corrected. Groundwater systems have **30 days to respond and 120 days** to either correct the deficiency or be on approved schedule to correct the deficiency.

On the back of the Deficiency Summary page is a list of all the current significant deficiencies/unmet rule requirements. Make sure and fill it out (check the box next to any significant deficiencies or unmet rule requirements that were cited and make sure the deficiencies match those listed on the Significant Deficiency and Unmet Rule Requirement Summary page and in the cover letter).

You may notice a problem with the system or operation but one that is not considered a significant deficiency. These issues should be noted as recommendations or comments and detailed separately in the cover letter that accompanies the completed survey (but not listed on the Significant Deficiency and Unmet Rule Requirement Summary page).

If a Community water system does not have any significant deficiencies, they may qualify for the Outstanding Performer designation, reducing their survey frequency from once every 3 years to once every 5 years. See Appendix 12 for Outstanding Performer criteria.

Inventory & Narrative

Inventory and Narrative

☐ Outstanding Performer					
Type:		**Status**	**Size**	**Season:** ☐ All year ☐ Seasonal	
☐ Community (C) ☐ Non-Transient Non-Community (NTNC) ☐ Transient Non-Community (TNC) ☐ Oregon Very Small (OVS)		Population:		Begins: (mm/dd)	/
		Connections:		Ends: (mm/dd)	/
License:	☐ Not Lic ☐ Health Dept. ☐ Ag	**Service Area Characteristics:**			
Responsible Agency:	☐ State ☐ County ☐ Ag	**Owner Type:**			
Minimum WS Certification Requirements:	WD: WT: ☐ FE ☐ Small WS ☐ N/A				

For changes in operations staff, contact Operator Certification: dws.opcert@odhsoha.oregon.gov

Primary Administrative Contact (mailing address):			
Contact Name:		Phone:	
Title:		Cell:	Texting OK ☐
Street Address:		Emergency:	
City/State/Zip:		Email:	
Is this system signed up for the DWS newsletter (ePipeline)? ☐ Yes ☐ No			
System Physical Address (optional/not entered in SDWIS):			
Contact Name:		Phone:	
Title:		Cell:	
Street Address:		Email:	
City/State/Zip:			
Legal/Owner/Secondary Contact (optional):			
Name & Title:		Phone:	
Street Address		City/State/Zip:	
Water system and regulatory staff present during survey:			
Narrative:			

Service Area Characteristics and Owner Type Codes

Service Area Characteristics		
Primary	Secondary	CODE
Residential	City or Town	MU
	Mobile Home Park	MP
	Subdivision	SU
	Rural	RA
	Other	OR
Transient	Recreation (parks, campground, beaches, ski areas, marinas)	PA
	Service Station	SS
	Summer Camp	SK
	Restaurant/Store	RS
	Highway Rest Area	HR
	Hotel/Motel, B&B	HM
	Other (visitor ctr, church)	OT
Non-Transient Non-Community	School	SC
	Institution	IN
	Medical Facility	MF
	Industrial/Agricultural	IA
	Day Care Center	DC
	Other	OA
	Interstate Carrier	IC
Other	Wholesaler (sells water)	WH
	Other Area	OT

Determining System Type				
Population/ Daily Use	Number of Connections	>25 Same Daily Users	≥25 Year-Round Residents	System Type
<10	<4	No	No	Not a System
10 – 24	4-14	_	_	Oregon Very Small
25+	_	No	No	Transient Non-Community
25+	_	Yes	No	Non-Transient Non-Community
25+	15+	Yes	Yes	Community

Coliform Bacteria Sampling			
Community systems	Monthly samples based on population*		
Non-Transient, Transient, Oregon Very Small Systems	Groundwater population served		Surface water
	≤1000 1 per quarter	>1000 Monthly based on population*	Monthly sampling based on population*
Non-Community systems operating seasonally	Monthly samples based on population*		

Owner Type	Code
Federal Government	1
Private	2
State Government	3
Local Government	4
Mixed Public/Private	5

* Population	Samples per month
Up to 1,000	1
1,001 to 2,500	2
2,501 to 3,300	3
etc.	See rules or call DWS

Inventory & Narrative

Type: Based on the number of connections, population, transient or year-round residents. Refer to the back of the form page for explanations of system types.

License: If the system is licensed by the Health Division or County check the box for Health Department. If it is licensed by the Department of Agriculture, check the box for Dept. of Ag. Examples of licensed facilities include restaurants, markets that serve food, food processors, RV parks, and recreational camps.

Responsible agency: Check the appropriate box for the agency that is responsible for contact, surveys, etc. Refer to the master inventory list if you are unsure.

Service area characteristics: Choose the designation that best aligns with the service population of the water system. Refer to the back of the form page for service characteristics codes.

Owner type: Choose the ownership type of the water system. Refer to the back of the form page for ownership codes.

Minimum WS certification requirements: Indicate the operator certification level required for the water system (WD: 1-4; WT: 1-4; FE required; Small Water System certification). Check the N/A box for TNC systems.

Primary administrative contact (mailing address): Use the name of the operator, contact person, person in direct responsible charge, etc. It should be the person who will receive correspondence and phone calls from the DWS.

System physical address (optional/not entered in SDWIS): The actual physical address or a description of the location if located in a remote site or to indicate the location of a treatment plant.

Legal/owner/secondary contact (optional/not entered in SDWIS): This should be the owner of the system, if privately held, or an alternate contact such as an officer in a homeowner's association. The owners name and address are essential for enforcement action via certified mail.

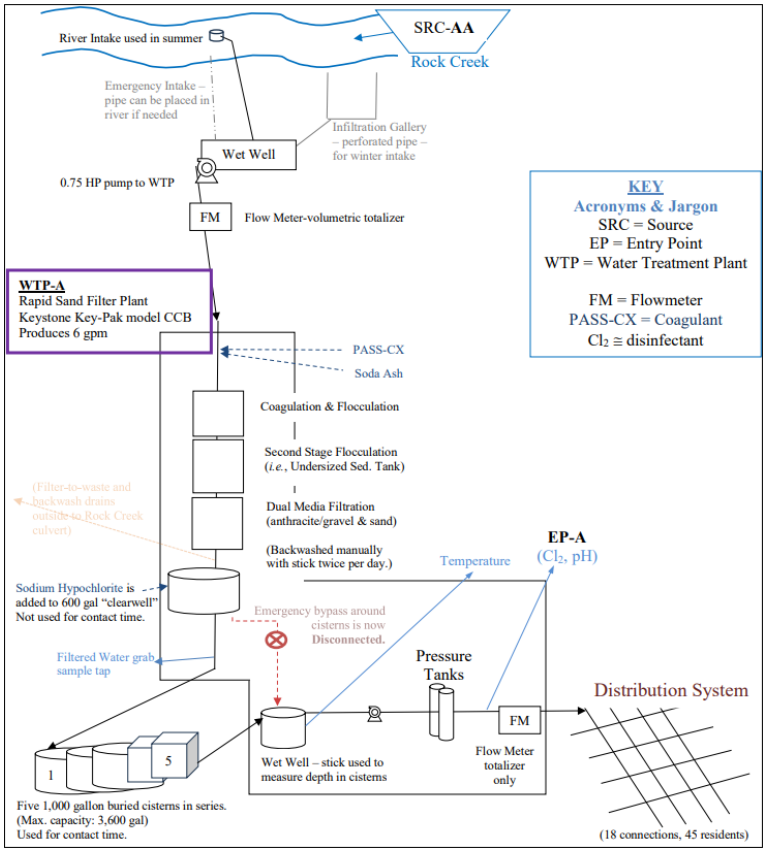
Narrative: Briefly describe the system components (sources, treatment, storage, etc.), modifications made since the last survey, and other pertinent information. This is often used by people who have not visited the system but need a quick understanding of the system.

Water System Schematic

Schematics should illustrate the "flow" of water from source to the distribution system and should include all sources (showing each entry point), reservoirs, points of treatment and disinfection, distribution system, and interties. For common shapes, use the "Symbols for Schematics and Sample Water System Schematics" document found online at: http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Partners/Pages/surveys.aspx. See Appendix 1 for treatment code configuration examples.

Considerations for creating a schematic:

- Create a general direction of flow: sources begin at the top of the page and flow down to distribution at the bottom of the page.
- Use DWS terms such as SRC-XX (Facility ID), EP (entry point), and Distribution to identify key points in a schematic.
- Consider creating a key/legend to define labels in the schematic such as FM (flow meter), Cl_2 (chlorine), NTU (turbidimeter), IFE (individual filter effluent), or CFE (combined filter effluent).
- Minimizing clutter such as turbidimeter model names, or WTP package plant names to increase readability. These details can be added to the Treatment section of the survey.
- Consider different colors or dashed arrows to distinguish chemical additions and monitoring points.
- If inactive, abandoned or optional details such as sources or treatment processes are added to the schematic, consider grey dashed lines or text.



Source Information

Source Information

ID	Entry Points (Location where water enters distribution and is sampled)	Source Type (Ground, Surface, GWUDI, Purchased ground, Purchased surface)	Availability (Permanent, Seasonal*, Emergency) *If seasonal, indicate begin and end dates	Begin (M/D)		End (M/D)	
A							

ID	Sources (used or contributing to Entry Point, including interties, or hauled water)	Land Use*	Capacity (GPM)	Source Type (Ground, Surface, GWUDI, Purchased Ground, Purchased Surface)	Availability (Permanent, Seasonal, Emergency, Abandoned, Disconnected)
AA					

*Land Use Codes: (A) Pristine Forest (B) Irrigated Crops (C) Non-Irrigated Crops (D) Pasture (E) Light Industry (F) Heavy Industry (G) Urban-Sewered Area (H) Rural On-Site Sewage Disposal (I) Urban On-Site Sewage Disposal (J) Rangeland (K) Managed Forest (L) Commercial (M) Recreational Use

	Yes	No	N/A
Has the system implemented strategies to protect their drinking water source? ☐ Providing residents with information about maintaining their septic systems or abandoning unused well ☐ Posting source area signs ☐ Notifying residents of hazardous waste collection events ☐ Other activities:	☐	☐	☐
Are emergency sources readily available to use during an emergency? Comments:	☐	☐	☐
Is water supply adequate to meet system demand without curtailment? Average daily demand: Peak demand: Comments:	☐	☐	☐
Is the system interested in protecting their sources or need source water information for their CCR or ERP? If yes, refer system to regional geologist at 971-673-0405 or info.drinkingwater@odhsoha.oregon.gov.	☐	☐	☐

Comments:

Source Information

ID: Identify the entry point ID from Data Online (or new ID for entry point), and type in the ID section.

Entry Points (location where water enters distribution and is sampled)**:** Enter the name of the entry point for the appropriate water sources. The entry point is the point where water enters the distribution system. For systems with only one source, it should use the following convention: EP for Well #1, EP for North Spring, EP for Columbia River, etc. Facilities at water systems with a single source must use the same facility ID (A, B, C, etc.). Water systems with multiple sources may have multiple entry points or a single entry point depending upon the system's configuration. Well identification must not be included in the facility name. This information is stored in a separate database displayed online.

Never re-name sources or give them new identification from what exists in DATA ONLINE. If a new source is added later, follow the directions to add a new source. If you believe there is a mistake in DATA ONLINE, and a source or entry point ID needs to be changed, discuss the changes with DWS tech services staff first.

If more than one source enters distribution through the same EP, but the sources are never used at the same time, the sources will require separate sampling schedules (unless they mix in a reservoir first).

Source type: Identify the type of source for the corresponding entry point (options are in the header).

Availability: Identify if the source is used year-round or seasonally. Year-round sources are identified as permanent, and backup sources are identified as seasonal. Identify the operating season in the Begins and Ends boxes if they are seasonal sources, which are usually sources used during periods of high demand during the warmer months. If the source is an emergency source, check that box as these are only used in an emergency and not to regularly supplement the system. Be aware of the previous designations, and if there is a change, verify that it is correct.

Sources (used or contributing to entry point, including interties, or hauled water): Enter the corresponding name from the Entry Point line. The first letter in the ID column identifies the Entry Point while second letter identifies the detail of the source. If the system has an intertie/connection with another public water system, list all the providing water system names and PWS ID numbers. Hauled water, or "alternative water" can be purchased from another existing PWS. If the purchased water is not from an existing PWS, that water source will need to be approved prior to use. This is particularly important for multiple source and entry point systems. Each water source will have a 2 letter ID to distinguish it from any other source.

Land use: Individual sources may have different land use activities, capacities, source types, availability and treatment. Choose the land use that identifies use activities that occur in the vicinity of the source.

Capacity (GPM): This is the known capacity of each source obtained from flow tests, well reports, water rights, etc.

Source type: Identify the corresponding source type (options are in the header).

Availability: Identify the availability of the source (options are in the header). Abandoned indicates if the source is permanently abandoned as opposed to physically disconnected, which means that it could be reconnected and used at a later data.

Drinking water source protection strategies: Has the system implemented strategies to protect their drinking water source? Examples include posting source-area signs, distributing fact sheets to residents about maintaining their septic systems and/or lawns, notifying residents of Household Hazardous Waste Collection events, properly abandoning unused wells, etc. If the water system has implemented protection strategies, please recommend that they complete the following survey: https://yourwater.oregon.gov/dwsp-form.php. For additional management strategies, visit the DEQ Drinking Water Protection web page: https://www.oregon.gov/deq/wq/programs/Pages/dwp.aspx

Availability of emergency sources or interties: Ask if all emergency sources or interties are connected to the existing infrastructure or are readily available to use during an emergency. Does the system need to install pumps to use the emergency source? Identify if the intertie flows both ways, or one way.

Water supply and customer demand: Identify the average daily demand and peak demand in gpm. Ask if the current water supply can adequately meet customer demand without curtailment measures in place.

Interest in source water protection: Ask if the water system is interested in receiving technical assistance on source water protection strategies, or if they need source water information for their Consumer Confidence Report (CCR) or Emergency Response Plan (ERP). If interested, give them the option of having the Regional Hydrogeologist contact them or they can call the Regional Hydrogeologist. If there is interest, call DWS Phone Duty (971-673-0405) to get contact information for the Regional Hydrogeologist.

Comments: Describe the operation of multiple sources here. For example, what are the pumping cycles? Are the sources controlled by pressure differential? Do multiple sources operate at the same time, or do they alternate and for how long? For single sources describe the plant operation or how long a source produces water each day.

Well Information

Well Information

Source (SRC) ID (e.g., AA, BA, AC):						
Source Name:						
Well log available? *	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
Well log ID (e.g., COLU123, L12345):						
	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Well active?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Pitless adaptor?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
● Sanitary seal & casing watertight?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Raw water sample tap?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Treated water sample tap? ☐ N/A	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
● If vented, properly screened?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Wellhead protected from flooding?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Concrete slab around casing?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Casing height ≥12 in. above slab/grade?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Flowmeter?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Pressure gauge?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Pump to waste piping?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Well meets setbacks from hazards?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
If no, identify hazard(s) within the setback and the distance to the hazard:						
Hazard:						
Distance (ft.):						
Protective housing?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
If yes, does it have:						
Heat?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Light?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Floor drain?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Well pump removal provision?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Pump type (vertical turbine, submersible, centrifugal, shallow jet, deep jet):						
Bearing lubrication (oil or water):						
Pumping capacity (gpm):						

*If no well log is available, record all known information regarding depth of well, depth of grout seal, year of installation, and casing diameter in the comments section below.

Comments:

Potential Sanitary Hazards

(From OAR 333-061-0050(2)(a)(E))

The following sanitary hazards are not allowed within 100 feet of a well or spring:

- Any existing or proposed pit privy
- Subsurface sewage disposal drain field
- Cesspool
- Solid Waste disposal site
- Pressure sewer line
- Buried fuel storage tank
- Animal yard, feedlot, or animal waste storage
- Untreated storm water or gray water disposal
- Chemical (including solvent, pesticides, and fertilizers)storage, usage, or application)
- Fuel transfer or storage
- Mineral resource extraction
- Vehicle or machinery maintenance or long term storage
- Junk / auto / scrap yard
- Cemetery
- Unapproved well
- Well that has not been properly abandoned or of unknown or suspect construction
- Source of pathogenic organisms
- Any other similar public health hazards

The following are not allowed within 50 feet of a well or spring:

- Gravity sewer line
- Septic Tank

Exemptions to these setbacks must be listed and documented within the plan approval letter and in an approved construction waiver standard.

If a surface water source is located within 500 feet of a well or spring, please note the water body name and the distance to the well or spring. All groundwater sources within 500 feet to a surface water source should be considered for potential surface water influence. Check the file for correspondence. If a review has been done indicate results in comment section. If not, contact DWS at 971-673-0405.

Well Information

For additional information on wells, see Appendix 2 — About Wells.

Source ID#, name, and well log ID: Use the appropriate 2-letter Source ID from the Source Information page in the boxes above each column. Also write in the actual well name or number above the source ID, and the Well Log ID (e.g., “L12345” or “COLU123”). If the system has more than 6 wells, copy and insert as many Well Information pages as necessary.

Well log available? Indicate whether there is a well log for the well. See the section in this manual “New Sources on Existing Systems” for directions on looking up well logs.

Well active? Is the well an active source used by the water system to provide water to the community. Seasonal sources should be identified as active and included in water quality monitoring to ensure the delivery of safe water. Emergency sources are those that are not normally used and typically are inactive.

Pitless adapter? These units are installed on some wells, usually in areas where freezing temperatures are common for long periods in the winter. A well fitted with a pitless adapter does not require a concrete slab around the casing or a wellhouse. The screened vent on these units is usually on the underside of the cap near the electrical conduit entry point.

Sanitary seal & casing watertight? Visually inspect the sanitary seal and casing to determine if any openings are present. Slide a small knife or thin coin around the seal to see if the rubber seal is in place. Welded plates are an acceptable type of sanitary seal as long as all openings are properly sealed.

Raw water sample tap? A sample tap must be installed at or near the well head. For systems that disinfect, it must be installed prior to the chlorine injection point. This allows for source water sampling to help determine if contamination is source related. Systems may choose to use a sample tap further from the well (for example, after a pressure tank) but should be aware that if a sample collected from that location is positive for coliform or E.coli, the system will have to live with the results (that is, they cannot blame the contamination on the pressure tank).

Treated water sample tap? If treatment is applied, a sample tap must be installed after the treatment process and preferably before storage.

If vented, properly screened? Most wells have a screened vent. The vents are usually in the top of the casing in the sanitary seal; however, some wells have vents welded in the side of the casing, which is acceptable. If there is a vent, it needs to be screened so that insects and small animals cannot crawl into the well.

Wellhead protected from flooding? If the well is in a flood plain, the top of the casing must extend at least 2 feet above the anticipated 100-year (1%) flood plain. Wells that are in surface drainage areas must have diversion ditches constructed around them to divert surface runoff away from the well head.

Concrete slab around casing? The well casing must have a concrete slab around it unless fitted with a pitless adapter. The slab must extend at minimum of 12 inches in all directions from the casing and be at least 3 inches thick.

Casing height > 12 inches above slab/grade? The top of the casing must extend above the ground surface or slab. The current construction standards require at least a height of 12 inches above grade or slab or 24 inches above the 100-yr flood plain, whichever is greater. This height is preferred; however, in some instances a casing terminating less than 12 inches above grade is acceptable. The determining factor is the location of the well head.

Flowmeter? A flow meter or some other method of determining total well output should be installed.

Pressure gauge? These are usually installed near the well head to measure system pressure and can control booster pump operation.

Pump to waste piping? Some means of piping arrangement must be installed at the well head to allow the total flow of the well to be dumped to waste. A hose bib sample tap is insufficient in most cases.

Well meets setbacks from hazards? Certain hazards must be kept at least 100 feet from the well (see back of the Well Info form for a list). Indicate the type and distance of the nearest hazard in the space provided to the right of the question or in the comments section at the bottom of the page. See DWS procedure titled "*Waivers and Setback Issues for Groundwater Sources*" for details on how to handle setback deficiencies.

Aboveground fuel tanks for emergency pumping equipment can be located within the 100-ft. setback if secondary containment is provided that exceeds the volume of the tank. Propane tanks are ok within the 100-ft. setback. Note in the comments section if either of these are present.

Protective housing? In most cases, a housing must be constructed around the well head, however, the rules do not specifically require it. There does need to be some means of protecting pump controls and other aboveground appurtenances at the well head. This may be decided on a case-by-case basis.

> **Heated/lighted**: It is preferable that all well houses be heated, and larger structures have lighting.

Floor drain: The building should have a floor drain that allows adequate discharge to daylight. Some building codes do not allow for floor drains unless tied to a wastewater system.

Well pump removal provision: The well house or control building should be constructed to allow for easy access and removal of the pump.

Pump type: Choose from the types listed below that section. See appendix 2 for more information about pumps.

Bearing lubrication: Submersible pumps for drinking water wells should be water lubricated. Vertical turbine (VT) pump line shaft bearings must be water-lubricated unless it is not feasible due to depth to the water. In that case, oil-lubricated bearings are allowed for VTs as long as food-grade (FG) lubricant is used. Check that they are using food-grade oil (for example, NSF Nonfood Compounds Program Listed H1). VTs with oil-lubricated line shaft bearings will have a container attached to the side of the pump that holds the oil. There should be a valve to adjust the drip rate and tubing that allows the oil to flow down into the line shaft bearings. There may also be a small glass window that allows you to see the individual drops falling when adjusting the oil feed rate. Note: the oil in the VT pump motor is not required to be food-grade and is not considered a setback issue since the pump motor is sealed into the casing (the oil itself should not be stored within the 100’ setback area).

Pumping capacity: Indicate the pumping capacity of the well pump.

Spring/Other Source

Spring or Other Source

Source ID#: SRC-												
Source Name:												
Source Classification Type: (Spring, Infiltration Gallery/Radial (e.g., Ranney) Well, Dug Well, Other)												
Springs	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Collection box? ☐ N/A	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Source construction material:												
● Is collection box constructed of impervious durable material?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Does collection box have a hatch?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● Access hatch secured?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● Access hatch watertight?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● Is surface water excluded from entering collection pipe or spring box?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Raw water sample tap?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● Overflow screened? ☐ N/A	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bottom drain and shut-off valve?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Intercepting ditch above source?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fencing around collection area?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Is the spring collection area clear of woody vegetation?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Meets setback from hazards?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
If no, identify the hazard(s) within the setback:												
Distance (ft.):												

Attach drawings/photos of source construction showing details of access hatch, drain, overflow, description of collection piping, diversion ditch, placement of perforated pipe, etc.

	Yes	No
If SW is within 500 ft uphill, has source been evaluated by DWS for direct influence of surface water? Year:	☐	☐
Does water quality vary seasonally? Explain:	☐	☐
Is source considered groundwater (G), surface water (S), or groundwater under the direct influence (I)?		

Additional information specific to:

Infiltration Gallery/Radial (e.g., Ranney) Well	Dug Well
Number of laterals:	Depth of well (ft.):
Average depth (ft.):	Construction material:
Is turbidity measured daily? Yes ☐ No ☐	

Comments:

Spring / Other Source

This page is meant for one or more springs. If there are multiple infiltration galleries, or dug wells, each should have a separate page unless the construction plans show that these sources are similar to each other, as is often the case. These sources are in a separate category since it depends on several factors whether they are groundwater (GW), surface water (SW), or groundwater under the direct influence of surface water (GU). See data online for current source type designation.

Prior to conducting a survey at a spring, infiltration gallery, dug or other types of sources consider consulting with your regional hydrogeologist for historical information on the source such as construction issues or prior GWUDI or MPA results (if there is a surface water source uphill). The regional hydrogeologist,
(see https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/Documents/gw/geologist-map.pdf)

Source ID: Entry Point letter and Source letter

Source name: List the name of the source

Source type: Choose the type of the source (options are in the header). If the regional hydrogeologist has not previously conducted a site visit and you have questions or concerns about the source, request that the hydrogeologist conduct a site visit or attend the water system survey.

> **Spring**: In nature, a spring is a naturally occurring discharge of flowing water at the ground surface, or into surface water where the flow of water is the result of gravity or artesian pressure. They usually erupt from hillsides. A groundwater spring for a public water system must be collected below ground surface, before it is exposed to the atmosphere or flowing over ground. There are two main types of aquifers feeding springs, gravity/unconfined springs and artesian/confined springs (most in Oregon are gravity). The methods on how water is collected from a spring also varies depending on the spring types. Common types of springs include, but are not limited to;
>
> 1. A scoop and fill type spring which has perforated pipe lateral(s) or collection pipes that collects water then flows into the collection box;
> 2. A collection box with either a permeable side or base that allows water to enter the spring collection box (no collection pipe); or
> 3. A pipe driven into the formation without a collection box. See Appendix 3 for a few examples on how springs are designed to collect water.
>
> **Infiltration Gallery**: A system of perforated pipes laid along the banks or under the bed of a stream or lake installed for the purpose of collecting water from the formation on its way to or beneath the stream or lake. Infiltration galleries are often

at risk of being surface water influenced due to the proximity to surface water, depending on distance and pumping rates.

Radial Horizontal Collector (e.g. Ranney) Well: A series of perforated pipes extending radially from a collection caisson. Often located in the flood plain and designed to collect groundwater that flowing towards or under a river. The collector wells can also be referred by their brand name which is Ranney Collector Well.

Dug Well: Dug wells are holes in the ground dug by shovel or backhoe. Historically, a dug well was excavated below the groundwater table until incoming water exceeded the digger's bailing rate. The well was then lined (cased) with stones, brick, tile, concrete rings, corrugated steel or other material to prevent collapse. The opening to the dug well is typically covered with a cap of wood, metal, stone, or concrete. Since it is so difficult to dig beneath the ground water table, dug wells are not very deep. Typically, they are only 10 to 30 feet deep. Dug wells have a high risk of becoming contaminated due to their shallow nature. Scoop and fill type springs are essentially a type of horizontal dug well (see Appendix 3).

Other: If the type of source is unclear. Describe the source in sufficient detail with photos. Ask the water system for additional source construction information. If needed, consult with your DWS technical services person and regional hydrogeologist since they may have accesses historical records with information on the spring construction.

Drawings of source collection devices are included in Appendix 2 and Appendix 3.

Collection box: Identify if there is a collection box. A collection box is a water-tight box/tank made of concrete, fiberglass, galvanized steel, or other material approved to be in contact with potable water. The collection box is designed to collect spring water below ground surface or as water erupts from the hillside. The collection box in some cases may be sealed and buried, but normally the box/tank extends above ground surface. The collection boxes located above ground surface shall have access for inspection and cleaning/disinfection. Water from the spring flows into the collection box from lateral collector pipes or from a permeable bottom.

Source construction material: List the type of material the source is constructed from (if applicable).

Collection box constructed of impervious durable material? Identify if the collection box is made of an impervious material such as concrete, fiberglass, galvanized steel, or other material approved to be in contact with potable water.

The surveyor should inspect for cracks or holes in the visible portions of the collection box that would allow surface water or snow melt to enter the collection box. If surface water or snowmelt can enter the collection box, then the source

could be considered surface water and should be immediately corrected. (**see Appendix 4**). Consult with your technical services contact to determine whether a surface water designation or boil advisory is needed.

Collection box access hatch: Does the collection box have an access hatch for cleaning and inspection/maintenance? If spring is not constructed with a hatch, explain how the spring is constructed and the reason for no hatch. If the hatch is buried or inaccessible, contact your regional hydrogeologist.

Access hatch secured? The collection box should have a lockable watertight overlapping lid. It can be considered adequately secured if there is a fence or is in a very remote area that is difficult to access.

Access hatch watertight? Identify if the access hatch is constructed such that water cannot enter the collection box. Typically, access hatches are equipped with a shoebox overlapping lid. The inside of the overlapping lid shall be lined with gasket material to ensure water or melting snow does not flow up an over the curbing into the collection box. The collection box should be marked as a significant deficiency if not equipped with a watertight access hatch.

Is surface water excluded from entering the collection pipe or spring box? Visually inspect the spring box, the collection pipe and area directly upgradient for any evidence of surface water entering the collection pipe or spring box. If there is surface water entering the collection pipe(s) or collection box, mark it as a significant deficiency, and please consult with the regional hydrogeologist and technical services contact regarding reclassifying the source as surface water and if a boil water notice is necessary.

The collection piping for a spring, infiltration gallery, radial horizontal collector or dug well must be buried below ground surface and not be exposed to the atmosphere. Any perforated collection piping that is exposed to the atmosphere is not excluding surface water and should be noted as a significant deficiency.
Consult with your state regulator or the regional hydrogeologist regarding reclassifying the source as surface water and whether a boil water notice may be necessary.

If there is standing water on top of the collection piping, ask the operator if they have construction plans or are aware of an impermeable layer between the ground and collection piping. It may or may not be known. If possible, they should grade the area so that water drains away from the spring. Take photos and discuss with your state contact or hydrogeologist.

Raw water sample tap? Identify if there is a tap to collect a raw water sample from the source. If there is no raw water sample tap, ask the water system how an

uncontaminated raw water sample can be collected from the source. Recommend a raw sample tap be installed if possible.

Overflow screened? A true spring is typically equipped with an overflow since water does not stop flowing. If the spring collection box is not equipped with an overflow, the source may be classified as a dug well or infiltration gallery so please consult with your regional hydrologist. If there is an overflow, the outlet should be equipped with a non-corrodible screen to exclude small animals, insects and contamination from entering. If the overflow is equipped with a flapper valve, the overflow must also have a screen. The screen provides additional protection in case debris, ice or snow props open the flap valve.

Bottom drain & shutoff valve? Identify if the collection box has these components for cleaning.

Intercepting ditch above source? Identify whether a ditch is present to intercept water runoff or uncaptured seeps away from the collection box. If no intercepting ditch is located above the source, recommend they construct one. If water is standing or continuously flowing in the intercepting ditch, it's important that an impermeable layer be present between the surface and where the spring is captured. If it is known that there isn't one, the source may be at risk for the influence of surface water. Consult with your regional hydrogeologist to determine if the source has or should be evaluated for GWUDI. If the system is not able to construct or maintain a diversion ditch, note in the comments section the reason for no ditch.

Fencing around collection area? Identify if there is a fence or means to protect the spring area from access by animals and unauthorized persons. If the fence is down or in poor condition and unable to prevent access by animals and unauthorized persons, then the question should be marked no and counted as a rule requirement.

Is the spring collection area clear of woody vegetation? The roots of trees or shrubs can not only clog the spring collection pipe flow but also create a pathway for contaminants to enter the collection box. Recommend removal of trees or shrubs around the spring area that can plug up or lead to contamination of the spring.

Meets setback from hazards? Certain hazards must be kept at least 100 feet from the spring (see back of the Well Info form for a list) according to our construction standards. Indicate the type and distance of the nearest hazard in the space provided to the right of the question or in the comments section at the bottom of the page.

Attach drawings/photos of source construction: Be as detailed as possible, showing all important components of the source, including but not limited to, access hatch, drain,

overflow, diversion ditch, description of collection piping, placement of perforated pipe, and area surrounding source. Take photos of any surface water that has the potential to flow into or around the collection box. Also, collect photos of any standing water in the spring collection area or upgradient from the spring collection area. The technical services contact, or regional hydrogeologist will request to view the photos prior to conducting a site visit.

If SW within 500 ft uphill, has source been evaluated by DWS for direct influence of water? This question applies if there is a surface water body 500 ft upgradient from the spring. DWS provides copies of any correspondence, including that regarding GWUDI, to the county or Ag. Some sources that were determined to be groundwater sources (infiltration gallery, Ranney wells, dug wells), are required to conduct daily raw water turbidity monitoring, if the raw turbidity value ever goes above 5 NTU, a re-evaluation for GWUDI using MPA testing) is required. If source is determined to not exclude surface water, continue to use this page and mark the source as GW. Do not switch source type to SW, DWS has a procedure for this.

Does water quality vary seasonally? Ask the operator if they notice any seasonal differences such as changes in temperature, pH, flow, or turbidity. If the water quality does vary seasonally or after a precipitation event (rain or snowmelt), consult with your regional hydrogeologist to determine if the source needs to be evaluated for GWUDI.

Is source considered groundwater, surface water, or groundwater under the influence of surface water GU/GWUDI? Check data online for current source designation. If the surveyor feels an incorrect designation has been made based on information collected during the water system survey, contact technical services person for your area and regional hydrogeologist. In general, anything with an intake open to the atmosphere (sees the light of day) or any construction deficiency that will allow surface water to enter the source is considered surface water (SW), and everything else is groundwater (GW), except for what DWS determines to be GWUDI when there is a surface water body nearby and is noted on data online as GU.

Infiltration Gallery/Radial (e.g., Ranney) Well: Identify the number of collection laterals, that is the number of perforated pipes in the ground adjacent to or underneath the water source. The average depth of laterals from ground surface may be found in the engineered plans or drawings (if recent), or the operator may know.

Dug Well: Identify the depth of the well and the construction material of the well.

Disinfection

Disinfection

Number	Disinfection Method (Chlorine Gas, Sodium Hypochlorite, On-site Generated Sodium Hypochlorite, Calcium Hypochlorite, Chloramines, Ozone, UV, Mixed Oxidants, Other)	Location	Disinfection Source Water	Residual Maintenance	Other Purpose	Proportional to Flow	Dosage Recorded
			☐	☐		☐	☐
			☐	☐		☐	☐
			☐	☐		☐	☐

Chlorine Residuals	Yes	No	N/A
▫ Is a DPD or other EPA approved method used?	☐	☐	☐
▫ NSF 60/61 certified (or equivalent)?	☐	☐	☐
▫ Are entry point residuals recorded at least once per day (SWTR, GWR 4-log)?	☐	☐	☐
▫ Is entry point residual monitoring continuous if population > 3,300 (SWTR, GWR 4-log)?	☐	☐	☐
▫ Are distribution residuals recorded at least twice weekly?	☐	☐	☐
Are on-line chlorine analyzers verified weekly with DPD type or EPA approved test kit?	☐	☐	☐

Chlorine gas ☐ N/A	Yes	No		Yes	No
Separate room for gas storage and feeder?	☐	☐	Gas cylinders properly secured?	☐	☐
Fan with on/off switch outside?	☐	☐	Door that opens out?	☐	☐
Vent located next to the floor?	☐	☐	Self-contained breathing apparatus?	☐	☐
Door with a window?	☐	☐	Air scrubber system?	☐	☐

UV ☐ N/A ☐ Required treatment ☐ Not required treatment	Yes	No		Yes	No
● Does all water contact UV (no bypass for req'd treatment)?	☐	☐	Is lamp replaced per manufacturer?	☐	☐
● Intensity sensor with alarm or shut-off?	☐	☐	Is lamp sleeve cleaned?	☐	☐

CT evaluation for disinfection (SW or GWR 4-log only) ☐ N/A		
Disinfection Requirement:		
☐ (SW) 0.5 log inactivation Giardia	☐ (SW) 1.0 log inactivation Giardia	☐ (GW) 4.0 log inactivation viruses
☐ (SW) log inactivation Crypto:	☐ (GW) Minimum chlorine residual: mg/l	

	Yes	No
▫ Does the contact chamber have effluent flow meter or adequate alternative?	☐	☐
If no, how is peak flow determined for CT calculations?		
● (SW only) Has a tracer study been conducted or adequate alternative?	☐	☐
Tracer Study Date: Demand flow (gpm):		
Baffling factor (%): Volume used (gal): Results (min):		
Adequate alternate method for contact time? Describe:	☐	☐
▫ (SW only) Are CT values calculated correctly (describe how contact time is determined, below)?	☐	☐
▫ (SW only) Is peak hourly demand flow within 10% of approved tracer study parameters?	☐	☐
▫ (SW only) Is lowest operating volume within 10% of approved tracer study parameters?	☐	☐
▫ (SW only) Are pH, temp, and chlorine residual measured daily before or at the first user?	☐	☐
▫ Is compliance reporting location prior to 1st user or equivalent? If no, explain:	☐	☐
● Able to demonstrate CT values are met at all times?	☐	☐
▫ Are minimum residuals met at all times?	☐	☐

Comments:

Disinfection

Disinfection method: Choose the appropriate method from the options in the header.

Location: Identify the location where the disinfectant is injected into the system. Examples of this would be the wellhead or source, pre-chlorination at the front end of the treatment plant, post-chlorination at the clearwell of the treatment plant, or inlet to the contact chamber. You can also choose to use the treatment plant code in Data Online (e.g., WTP-A).

Disinfection source water: Check this box if the system uses a disinfectant for source water microbiological contamination (this should be checked for all surface water systems and groundwater systems doing 4-log disinfection). Ask the operator why they disinfect. If it is "just to be safe" do not check this box.

Residual maintenance: Check this box if the system adds a disinfectant only for keeping a residual in the distribution system to help prevent microbial regrowth or biofilms or if one source has coliform and the other is disinfected just to match residual. If the disinfectant is completely removed such that a residual is not maintained in the distribution system (for example carbon filter after chlorination), leave the Residual Maintenance blank. In either case, residuals must still be recorded even if the chlorine is removed prior to entering the distribution system, and raw water samples must still be taken as required.

Other purpose: This column should be filled in if the disinfectant is used to treat the source for a secondary contaminant, such as iron and manganese or taste and odor. Indicate the purpose in the blank below.

Proportional to flow: The disinfectant must be injected proportional to flow or in other words it is added to the source water as it is pumped out of the well or flowing through a treatment plant. Adding a disinfectant by hand to a storage tank (sometimes called "batch chlorinating") is unacceptable. Erosion chlorinators are acceptable if no other alternative is feasible, and the operator can control the dosage.

Dosage recorded: Does the operator record the disinfectant dosage daily? This is the amount of disinfectant added and is usually recorded in mg/l. An optional method is pounds per day, which can be converted to mg/l. based on gallons per day of water produced.

Chlorine Residuals:

Is a DPD type test kit or other EPA-approved method used? An approved method (for example, DPD color wheel or colorimeter, or SenSafe™ Free Chlorine Water Check test strips manufactured by Industrial Test Systems, Inc. (ITS Method D99–003)) to test chlorine residuals must be in use by the water system. Using an OTO oxidizing reagent or swimming pool test kit is not approved. The DPD packets are labeled "Free" and "Total". If free available chlorine is all that needs to be

measured, that packet is used. If the system uses chloramines or purchases from a system that uses chloramines, then total chlorine must be measured. Chloramines have a far less disinfectant potential than free chlorine but are nevertheless able to kill pathogenic organisms in water.

NSF 60/61 certified (or equivalent)? Verify that the chlorine used as a disinfectant is National Sanitation Foundation (NSF) 60/61 certified or equivalent. Typically, there will be a printed certification logo on the container (but not always). For chlorine received in bulk, the system may have to track down paperwork showing the product is NSF.

Are entry point residuals recorded as least once per day (SWTR, GWR 4-log)? For surface water and groundwater 4-log systems, verify that entry point chlorine residual measurements are recorded at least once per day. There should be clear documentation of daily chlorine residual levels.

Is entry point residual monitoring continuous if population >3,300 (SWTR, GWR 4-log)? For systems with populations over 3,300, residual monitoring must be measured on a continuous basis**.** Check N/A if your system is below the 3,300 population.

Are distribution residuals recorded at least twice weekly? They should have written records to show this is being done.

Are on-line chlorine analyzers verified weekly with DPD type or EPA-approved test kits? Surface water systems that use a continuous chlorine analyzer for compliance with the Surface Water Treatment Rule and ground water systems that use a continuous chlorine analyzer for compliance with the Groundwater Rule (4-log disinfection) must check them at least weekly against a handheld test kit to verify accuracy.

Chlorine Gas: If gas chlorination is used, fill out the boxes pertaining to gas chlorine, otherwise mark it as N/A. Note any comments in the comments section.

UV: If ultraviolet radiation (UV) is used, fill out the boxes pertaining to UV, otherwise mark it as N/A. Note any comments in the comments section.

Does All Water Contact UV (no bypass for required treatment)? Verify that all water comes into contact with UV and that no bypass exists for required treatment.

Intensity Sensor with Alarm or Shut off? Inspect to determine if there is a sensor to measure lamp intensity and a shut-off alarm when intensity is below required level to disinfect.

Is Lamp Replaced per Manufacturer? Ensure that the lamp is replaced per the manufacturer guidance and is not operated past its useful life.

Is Lamp Sleeve Cleaned? Verify that the lamp sleeve is cleaned on a regularly scheduled and documented basis.

CT evaluation for disinfection (SW or GWR 4-log only): Fill out this section for surface water and groundwater systems required to do 4-log disinfection, otherwise mark it as N/A.

Disinfection requirement: For surface water sources, indicate the required log inactivation from disinfection. For groundwater required to do 4-log disinfection, indicate the minimum chlorine residual required.

Does the contact chamber have effluent flow meter or adequate alternative? Inspect to see if there is a flow meter on the effluent side of the clearwell or contact chamber (required for surface water systems). If not, ask how the system calculates peak flow for CT calculations.

Has a tracer study been conducted or adequate alternative? The method of choice for determining chlorine contact time is by a tracer study (required for surface water systems). Tracer study information can be found in the system's file. This requires the system to increase the amount of disinfectant introduced into the system and recording the time it takes to get to the first user. The system must be operating at maximum flow to conduct a tracer study to determine the lowest amount of contact time available. Alternate tracer materials are acceptable such as calcium chloride and fluoride. Record tracer study information in this section as a reference. If a tracer study or adequate alternative has not been completed, this would be the significant deficiency marked "unable to demonstrate minimum CTs are met."

Adequate alternative method for contact time? If the time is determined by an adequate alternative (e.g. plug flow calculations for pipelines or pumping rates out of a clearwell), indicate this on the line.

Are CT values calculated correctly? Assess the CT tables and verify the calculation process with the operator to determine if the CT values are being calculated correctly. If the system is using an Excel spreadsheet that contains formulas that make calculations automatically, verify that those formulas are valid.

Is peak hourly demand flow within 10% of approved tracer study parameters? Compare this to the flow used during the tracer study. The current PHD flow should not exceed more than 10% of the tracer study flow. If it does, the tracer study needs to be redone. *Note these changes in the comments and consult your DWS tech services contact as this may need to be cited as a significant deficiency.*

Is lowest operating volume within 10% of approved tracer study parameters? Compare this to the volume used during the tracer study. The current lowest operating volume should not be less than the volume used during the tracer study. If it is, the tracer study needs to be redone. *Note these changes in the comments and consult your DWS tech services contact as this may need to be cited as a significant deficiency.*

Are pH, temp, and chlorine residuals measured daily before or at the first user? For surface water systems, verify that pH, temperature, and chlorine residuals are measured and recorded daily at or before the first user for purposes of calculating chlorine contact time or CT.

Is compliance reporting location prior to 1st user or equivalent? Ensure the water system is using the 1st user location for compliance reporting.

Are CT values met at all times? Check the daily SWTR records for surface source and groundwater 4-log systems and indicate the appropriate answer.

Are minimum residuals met at all times? For surface water and groundwater systems doing 4-log disinfection, check the daily chlorine residual records to verify that the minimum required entry point residual is being met.

Treatment

Treatment

Process Used*	Chemical Added**	Purpose	Location in System	Code***

*See "Treatment Plant Inspection" page for details on filtration. **See "Disinfection" page for details on disinfection equipment.
***See Treatment Codes on back.

	Yes	No	N/A
Is treatment the same as last survey? (if no, explain in comments)	☐	☐	
Is lab equipment for on-site analysis appropriate?	☐	☐	
Is equipment maintained properly?	☐	☐	
Is redundant equipment available?	☐	☐	
○ Are chemicals NSF Standard 60 certified or equivalent? (N/A = no chemicals are used)	☐	☐	☐
For required treatment, is there a physical separation between treated and untreated water? ☐ No bypass ☐ Bypass with spool ☐ ● Bypass with valve ☐ Other – describe:	☐	☐	
Does system practice corrosion control?	☐	☐	
○ Is corrosion control operated within parameters set by DWS?	☐	☐	☐
Describe method of corrosion control (if applicable):			

Residual (waste streams, byproducts, sludges, etc.) disposal methods (for WTP classification):		
☐ N/A	☐ Discharge to raw water	☐ On-site disposal
☐ Discharge to lagoons	☐ Disposal to sanitary sewer	☐ Land application
☐ Discharge to lagoons then raw water source	☐ Mechanical dewatering	☐ Solids composting

Comments:

Treatment Codes:

Disinfection By-products Control

B121 Activated Carbon, Granular
B125 Activated Carbon, Powdered
B200 Chloramines
B220 Chlorine Dioxide
B240 Coagulation
B344 Filtration, Pressure Sand
B500 Lime-Soda Ash Addition
B600 Rapid Mix
B742 pH Adjustment, Pre
EP240 Enhanced Coagulation (BEP240)
ES240 Enhanced Softening (BES240)

Disinfection for Surface Water/GWUDI

D200 Chloramines
D220 Chlorine Dioxide
D401 Gaseous Chlorination, Post
D403 Gaseous Chlorination, Pre
D421 Hypochlorination, Post
D423 Hypochlorination, Pre
D455 Iodine
D541 Ozonation, Post
D543 Ozonation, Pre
D720 Validated Ultraviolet Radiation
D800 Mixed Oxidants, Post
D802 Mixed Oxidants, Pre

Disinfection or Residual Maintenance/Other for Groundwater (ZX200, ZX401, etc.)

D361 GWR 4-log Virus Compliance Mon
Z361 Interim 4-log Virus Compliance Mon
X200 Residual Maintenance, Chloramines
X401 Residual Maintenance, Gas Chlorination
X421 Residual Maintenance, Hypochlorination
X455 Residual Maintenance, Iodine
X541 Residual Maintenance, Ozonation
X800 Residual Maintenance, Mixed Oxidants
X720 NSF-55 Class A Ultraviolet Radiation

Dechlorination

E121 Activated Carbon, Granular
E627 Reducing Agent, Sulfur Dioxide

Corrosion Control

C143 Aeration, Diffused
C145 Aeration, Packed Tower
C441 Inhibitor, Bimetallic Phosphate
C443 Inhibitor, Hexametaphosphate
C445 Inhibitor, Orthophosphate
C447 Inhibitor, Ortho-Polyphosphate Blend
C449 Inhibitor, Silicate
C501 pH/Alkalinity Adjustment-Lime
C502 pH/Alkalinity Adjustment-Soda Ash
C503 pH/Alkalinity Adjustment-Caustic Soda
C504 pH/Alkalinity Adjustment-Sodium Bicarb.
C505 pH/Alkalinity Adjustment, Calcite Contactor
C506 Calcium Carbonate Precipitation
C507 pH/Alkalinity Adjustment-CO2
C550 Plumbing Replacement
CBLEND Blending for Dilution

Inorganics Removal (excluding As/Mn/Fe)

I344 Filtration, Pressure Sand
I460 Ion Exchange
I640 Reverse Osmosis
I999 Blending for Dilution

Arsenic (As) Removal

A100 Activated Alumina
A240 Coagulation
A320 Electrodialysis
A343 Filtration, Greensand
A344 Pyrolusite Filter
A347 Membrane Filtration
A423 Hypochlorination - arsenic
A460 Ion Exchange
A500 Lime Softening
A640 Reverse Osmosis
A742 PH Adjustment Pre - arsenic
A900 Granular Ferric Hydroxide
A902 Ferric Chloride Coagulation - arsenic
ABLND Blend for dilution of arsenic

Iron (Fe) Removal

F143 Aeration, Diffused
F240 Coagulation
F341 Filtration, Cartridge
F343 Filtration, Greensand
F344 Filtration, Pressure Sand
F345 Filtration, Rapid Sand
F403 Gaseous Chlorination, Pre
F421 Hypochlorination, Post
F423 Hypochlorination, Pre
F460 Ion Exchange
F506 Calcium Carbonate Precipitation
F543 Ozonation, Pre
F560 Permanganate
F640 Reverse Osmosis
F660 Sedimentation
F680 Sequestration
F740 pH Adjustment

Manganese (Mn) Removal

M343 Filtration, Greensand
M403 Gaseous Chlorination, Pre
M423 Hypochlorination, Pre
M560 Permanganate
M680 Sequestration

Radionuclides

R147 Aeration, Slat Tray

Other

Z200 Chloramines
Z380 Fluoridation
Z551 Public Education for L/C
Z580 Peroxide
Z720 Other Ultraviolet Radiation
ZC125 Pwd. Act. Carbon (PAC) for Cyanotoxins
ZN520 Groundwater Filter/Strainer

"Non-Treatment" (ZN000, etc.)

N000 No Treatment / Not Applicable
N349 Unfiltered, Avoiding Filtration
N350 Unfiltered, Must Install Filter
N996 Treatment Applied by Seller

Organics Removal

O121 Activated Carbon, Granular
O145 Aeration, Packed Tower
O160 Algae Control
O423 Hypochlorination, Pre
O560 Permanganate
O640 Reverse Osmosis
O742 pH Adjustment, Pre
O999 Blending for Dilution

Filtration for SW or GWUDI

P240 Coagulation
P341 Filtration, Cartridge
P342 Filtration, Diatomaceous Earth
P344 Filtration, Pressure Sand
P345 Filtration, Rapid Sand
P346 Filtration, Slow Sand
P347 Filtration, Ultrafiltration
P349 Filtration, Microfiltration
P360 Flocculation
P520 Microscreening
P600 Rapid Mix
P660 Sedimentation
P700 Sludge Treatment
P742 Ph Adjustment, Pre
PP349 Natural Filtration

Softening (Hardness Removal)

S240 Coagulation
S344 Filtration, Pressure Sand
S360 Flocculation
S460 Ion Exchange
S500 Lime – Soda Ash Addition
S640 Reverse Osmosis
S680 Sequestration

Taste/Odor Control

T121 Activated Carbon, Granular
T125 Activated Carbon, Powdered
T141 Aeration, Cascade
T143 Aeration, Diffused
T149 Aeration, Spray
T160 Algae Control
T343 Filtration, Greensand
T403 Gaseous Chlorination, Pre
T421 Hypochlorination, Post
T423 Hypochlorination, Pre
T506 Calcium Carbonate Precip.
D541 Ozonation, Post
D543 Ozonation, Pre
T560 Permanganate
T580 Peroxide
T720 Ultraviolet Radiation

Treatment

Process used: The process used is listed next to each code on the back of the Treatment page. For example, the process for treatment code P345 is “Filtration, Rapid Sand”.

Chemical added: Include all chemicals (coagulants, polymers, filter aids, corrosion control chemicals, inhibitors, oxidants, etc.) used in all the processes. If no chemical is used (i.e., for sedimentation), leave blank or write “N/A”.

Purpose: List the purpose of the treatment. The purpose for each treatment code is the bold underlined heading for each group of codes on the back of the Treatment page. For example, the purpose of P345 Filtration, Rapid Sand is “Particulate Removal”.

Location in system: Note the location of the process in the treatment system. For example, disinfection is applied either pre- or post-filtration, or both. You can also choose to use the treatment plant code in DATA ONLINE (for example, WTP-A).

Code: Refer to the back of the Treatment page for a list of treatment codes. If treatment has not changed, these codes should be the same as what is showing Data Online (see below for changes in treatment).

Questions about Treatment:
Is treatment the same as last survey? Inquire if treatment has changed since the last survey and if treatment reflects what is displayed online and is necessary for the system. In general, treatment should not be removed or added without consulting the regulatory agency. If treatment has been added since the last survey, check DATA ONLINE to make sure it went through plan review with DWS; if not, cite it as an unmet rule requirement on the Management & Operations page (mark “No” for “Have all major modifications been approved by DWS?”).

Are on-site analyses done using EPA approved methods? Determine if the onsite lab equipment is appropriate for the treatment provided and tests required by the system. Ensure that lab equipment is intended for drinking water, reagents are not expired, and sufficient quantity is on hand.

Is equipment maintained properly? Inspect the equipment to determine what condition it is in and discuss with the operator the maintenance schedules that are established.

Is redundant equipment available? Redundant equipment such as dosage pumps should be available as well as a good supply of spare parts.

Are chemicals NSF Standard 60 certified or equivalent? All chemicals added to drinking water must meet NSF Standard 60 requirements or equivalent. Check labels and

containers for this approval stamp. The operator should also be aware of OSHA requirements for storage, handling and containment for chemicals. For chemicals received in bulk, the system may have to track down paperwork showing the product is NSF certified.

Fore required treatment, is there a physical separation between treated and untreated water? Bypasses are not allowed around the following:

- Filtration or any of the unit processes (coagulation, flocculation, sedimentation or filtration) or alternate treatment for surface water or groundwater under the direct influence of surface water (GWUDI)
- Ultraviolet light for pathogen inactivation
- Disinfection contact time chambers (clearwell or pipeline), if using for disinfection CT (Chlorine residual x contact Time), for any of the following:
    - All surface water or GWUDI sources
    - Confirmed *E. coli*-positive groundwater sources (wells or springs) requiring 4-log treatment or inactivation of viruses
- Treatment for maximum contaminant level exceedances for any of the following primary health-based contaminants:
    - Nitrate
    - Arsenic
    - Inorganic compounds
    - Synthetic organic compounds
    - Volatile organic compounds
    - Radionuclides

A treatment bypass is a cross connection between non-potable, nontreated water and potable, treated water. Valves can leak without obvious signs. If a water system wants the ability to bypass the treatment plant, there must be a physical separation in the bypass line (e.g., a cut and capped pipe with a removable pipe spool) to prevent non-potable water from being served to customers. Closed valves or double block and bleed valves are not an acceptable form of physical separation and are not allowed for treatment plant bypasses.

If an improper bypass is observed, cite as a significant deficiency on the survey cover page and the deficiency checklist on the back of the page. Example language that can be used in the survey cover letter is “Bypass around [enter process being bypassed] is a potential pathway for untreated water to enter the distribution system and is considered an unprotected cross connection by OAR 333-061-0020(34) and OAR 333-061-0070(3).”

Does the system practice corrosion control? Identify through Data Online if the system practices corrosion control and confirm with the onsite visit.

Is corrosion control operated within parameters set by DWS? If the system practices corrosion control, check the system records to determine if it is operating within the parameters established by DWS. Approximately one year after the installation of corrosion control treatment, the regulator will establish minimum operating parameters (usually pH

and sometimes alkalinity) at the entry point and in the distribution system. The entry point parameter must be monitored at least every two weeks and a report submitted to DWS monthly. The distribution system parameter must be monitored twice during the monitoring period when lead and copper tap samples are collected and reported to DWS as well. Entry point and distribution minimums that have been set and a record of whether the system is reporting as required can be found in Data Online for the system. *Note: pH must be measured with a calibratable, temperature-compensating, electrode-type pH meter (not a phenol red color comparison swimming pool type kit)*.

Other notes about treatment:

- There is no need to enter treatment codes for non-health-related treatment like softeners, small pre-filters, sand traps, etc. The only exception are filters installed to remove iron or manganese.

- Regarding disinfection codes, codes that begin with a "D" are used with surface water only, *EXCEPT* for D361 which is used for groundwater systems that provide 4-log disinfection. Groundwater systems chlorinating but not required to provide 4-log disinfection should use the codes that begin with "X" (residual maintenance).

- If the system has fluoride treatment, indicate the type of fluoride used (sodium fluoride, sodium fluorosilicate, or fluorosilicic acid). Systems must record daily 1) the amount of fluoride added, 2) the quantity of water treated, and 3) the fluoride levels of the treated water. These records must be submitted to DWS monthly. The system must also submit split samples to DWS quarterly.

- D800 Mixed Oxidants treatment code is only used for MIOX brand, not onsite generated chlorine (use D421 or D423). MIOX is the only known mixed oxidant treatment at this time.

- Blending is an acceptable method to address nearly any contaminant. Although not common, you may inspect systems that blend sources with higher levels of Nitrate — for example, with sources that have little or no Nitrate. Blending can also be used to mitigate a low pH source for corrosion control.

Residual (waste streams, byproducts, sludges, etc.) disposal methods (for WTP classification): check the method the WTP uses to dispose of waste from any treatment processes. Treatment plants are classified by assigning points for each unit process and is used to determine operator certification classification.

Finished Water Storage and Pressure Tanks

Finished Water Storage and Pressure Tanks

Number	Name	Tank Type (G)round, (E)levated, (P)ressure	Tank Material (Concrete, Steel, Redwood, Plastic, Other)	Year Built	Volume (gal.)
				Total Volume:	

Reservoirs Name or Number:										
Features	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Fence/gate?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● Hatch secured (e.g. locked, bolted, etc.)?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● All tank access points watertight?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● Screened vent?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Overflow?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
● Overflow protected (screen/flap/valve)?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Drain to daylight?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Water level gauge?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bypass piping? (● if used for contact time)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Alarm for high or low levels?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Separate inlet/outlet?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Approved interior coating?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
If redwood tank, continuously disinfected?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Exterior in good condition?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Interior inspection schedule?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Is interior cleaning schedule based on inspection?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Pressure Tanks Name or Number:										
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Accessible for maintenance?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bypass piping?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Drain?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pressure relief device?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Air bladder/diaphragm?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Valve for adding air?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments:

Finished Water Storage & Pressure Tanks

Surveyors are not advised to climb storage tanks due to safety and potential liability. Notify the water system operator at least two weeks prior to survey to request photos documenting the condition of the following storage tank features:

1. Access hatch, with lid or door open and closed/locked. Request a photo of internal gutter system if applicable.
2. Vents are completely screened (multiple photos may be required), and
3. Other openings into tank interior (e.g., telemetry ports, cathodic protection).

If the water system cannot obtain photos prior to survey, surveyor can request photos during site visit. If photos cannot be obtained at time of survey, system can be given 2-3 weeks to provide photo documentation. If documentation is not received or if photos are inadequate, significant deficiencies can be applied. If the system's maintenance log of visual/tank integrity inspections is recent and satisfactory, or professional inspection report is available, photos may not be necessary.

There is room for documenting the features of five storage and five pressure tanks on this form. For systems with more than five tanks, copy and insert as many pages as necessary.

Number: Identify each tank with a number beginning with 1, then 2 and so on until all tanks are numbered.

Name: Identify each tank with a name that is used by the water system.

Tank type: Use (G) for all non-pressure tanks that are sited on (or partially below) a natural ground surface. Use (E) for all tanks that are constructed on stilt type supports that elevate the tank to provide adequate pressure. Use (P) for all pressure-type tanks.

Tank material: Choose the type of material used in the tank construction.

Year built: Type in the year the tank was put into service. If it is unknown get an estimation from the operator.

Volume: The total volume of the tank in gallons. If the tank is never used at its full capacity indicate the maximum volume it holds based on information provided by the operator.

Total volume: Add the total volume of all the reservoirs.

Reservoir features: These features are all evaluated and then answered in the yes/no boxes in the columns under each reservoir number. Many of these features are significant deficiencies.

Reservoir number: The number used in the column should correspond with the appropriate number identified above.

Fence/gate? A fence or other method of vandal deterrence should be provided around distribution storage tanks.

Hatch secured? A lock must be on the hatch, or the tank must be in a locked building. Check to be sure it is watertight and that very small animals and rodents cannot enter the tank in this area. A shoebox type lid is the preferred type of hatch access.

All tank access points watertight? Inspect that all access points into the reservoir are watertight and do not allow contaminants to enter the tank. Examples of access points that are not watertight include hatch seals that are not tight, gaps around telemetry cables that enter the tank, loose fitting or missing cover plates over cathodic protection (sacrificial rods that hang down from steel tank roofs), exterior water level gauges that have been removed but the tube where the cable used to enter the tank has not been plugged. Non-overlapping hatches or doors with gutters should be checked to ensure that drainage gutters are clear of contamination and free to drain, otherwise they could overflow into the tank (note: these types of hatches are no longer allowed but existing ones are grandfathered in).

Screened vent? Visually inspect the reservoir vents to ensure that they are screened to prohibit the passage of pests and organic material into the reservoir. The mesh on the screen should be small enough to only allow air to pass through.

Overflow? Indicate if the tank has an overflow outlet. Sometimes the drain line and overflow are connected but not always.

Overflow protected? Locate overflow outlets and check for the presence of flap valves or heavy-duty screens. Flap valves sometimes get stuck in the open position so check that they are in the fully closed position.

Drain to daylight? Storage tanks that do not have a drain to daylight must have a cleaning plan in place that adequately addresses cleaning and confined space entry procedures.

Water level gauge? Does the tank have a water level gauge, check the area where the cable for the water level gauge enters the tank for unsealed openings where small animals can enter.

Bypass piping? This piping allows the tank to be taken offline for maintenance and still allow water to enter the system. Tanks that cannot be bypassed typically have to be cleaned and inspected by divers. *Bypasses are not allowed around tanks*

used for disinfection contact time (cite as a significant deficiency if encountered during a survey).

Alarm for high and low levels? Determine if the reservoir equipped with an alarm for high or low water levels.

Separate inlet/outlet? Determine if there is a separate inlet and outlet for the reservoir.

Approved interior coating? All interior coatings, typically on steel tanks, must be NSF Standard 61 or equivalent approved. Older tanks with coatings may have had FDA approved coatings at the time of construction and these are allowed. Any recent coatings, however, must have the NSF approval. Check the system's records for manufacturer and type of coating. NSF updates approved coatings periodically on their website at www.nsf.org.

If redwood tank, continuously disinfected? Determine if the reservoir is continually disinfected. This is a significant deficiency for post-1981 redwood tanks.

Exterior in good condition? The exterior of tank should be painted or coated if it is steel and in good condition with little or no rust. Concrete tanks typically spall or flake on the roof and crack in the corners and this is an indication of deterioration. Repairs should be recommended.

Interior inspection schedule? Ask if storage tank is scheduled for inspection and if so, how often, and whether it's done in-house by water staff or contracted to professional divers to not take tank offline.

Is interior cleaning schedule based on inspection? Based on the exterior conditions, water quality, and findings from the last interior inspection. Cleaning frequency depends on source water quality and tank condition.

Pressure Tanks: These features are to be evaluated during the survey and then answered in the yes/no boxes.

Accessible for maintenance? There should be a way to easily access each pressure tank for routine maintenance or replace a tank that fails.

Bypass piping? This piping allows the tank to be taken offline for maintenance and still allow water to enter the system. Most larger tanks >1000 gallons have an access port for internal inspection.

Drain? The drain may not be attached to the tank itself so check around in the outlet piping arrangement for a drain or hose bib, etc. that would allow the tank to be drained.

Pressure relief device? This is usually on the top of the tank and provides an escape outlet for excessive pressure buildup. It may also be located on the side of the tank. The air blow-off valve, if installed, is usually installed in the piping prior to the tank.

Air bladder/diaphragm? Most of the smaller and newer pressure tanks have a bladder or diaphragm that physically separates the air and water inside the tank.

Valve for adding air? There should be a valve in the tank for adding air to recharge it.

Distribution System Information

Distribution System Information

Service Area and Facility Map	Yes	No
Does the system have a service area and facility map? Describe features:	☐	☐
Does DWS have an accurate service area boundary for this system? ☐ Yes – system verified no changes ☐ No – updated boundary attached ☐ Data not available ☐ No – system will submit boundary ☞ **Review boundary map online and confirm whether information is current** ☜ ☞ **Submit file to DMCE with survey form or provide system with link to submit their own file** ☜ ☞ **If system does not provide boundary, add this as a recommendation to the survey letter** ☜	☐	☐

Distribution Data	Yes	No	Comments
● 20 psi maintained at all service connections?	☐	☐	
Water system leakage <10%?	☐	☐	
Hydrants or blowoffs on all dead ends? ☐ N/A	☐	☐	
Routine flushing? (How often)	☐	☐	
Adequate valving?	☐	☐	
Routine valve turning? (How often)	☐	☐	
Distribution system free of asbestos cement (AC) pipe?	☐	☐	
If no, verify asbestos sampling is completed on Water Quality Monitoring Page (CWS, NTNC).			

Booster Pumps ☐ N/A	Yes	No	Comments
Are pumps in good working condition?	☐	☐	
Are pumps protected and secured?	☐	☐	
● If pump draws from distribution main, is there a cutoff switch or SCADA control if upstream pressure drops below 20 psi? ☐ N/A	☐	☐	
Is there redundancy of pumps?	☐	☐	
Can system maintain 20 psi if any pump out of service?	☐	☐	

Service Line Inventory	Yes	No
○ Service line inventory submitted?	☐	☐
Are service lines all non-lead? ☐ N/A If no: ☐ Galvanized requiring replacement (GRR) ☐ Unknown If there are unknown service lines, what is the progress on categorizing these lines? Describe:	☐	☐

Cross Connection Control	Yes	No	N/A	Comments
○ Assemblies tested annually? (CWS, NTNC, TNC)	☐	☐	☐	
○ Ordinance or enabling authority? (CWS)	☐	☐	☐	
○ Annual Summary Report submitted? (CWS)	☐	☐	☐	
○ Certified Cross Connection Control Specialist? (CWS ≥ 300 connections)	☐	☐	☐	
○ Written Cross Connection Control Program? (CWS ≥ 300 connections)	☐	☐	☐	

Comments:

Distribution System Information

Does the system have a service area and facility map? The system should have some kind of map of its service area. List the features on the map. It may be a large map on the wall or contained within a Master Plan document.

Does DWS have an accurate service area boundary for this system? Check data online before the survey. A link to the map can be found on Data Online web forms by clicking on the "PWS Service Area Boundaries" button on the main menu. The map includes tools to search boundaries and to create a pdf map to share with the operator. The page also has a link that regulators can provide to systems so they can submit their own boundary information.

If the system has already submitted a verified service area boundary and there are no updates, a new map is not needed. If DWS does not have a boundary for a given system, or if the system has boundary updates, they should submit the information to their regulator or submit via the Data Online link provided by the regulator. If the system submits information to the regulator, it should be included when submitting the survey, or if it is received later the regulator can send it to compliance.dw@odhsoha.oregon.gov. Accepted data formats include GIS files (shapefile, KML/KMZ), digital maps (.pdf, .jpeg, etc.), paper maps, or a list of addresses. If the system does not provide boundary information, add this as a recommendation to the survey letter.

Distribution Data: Evaluate all seven questions and answer appropriately.

20 psi maintained at all service connections? The system must always maintain at least 20 psi at all service connections.

Water system leakage <10%? Obtain leakage information from the system's records. Leakage is determined by comparing total production with the system usage obtained from meter readings or other known accurate usage. 10 to 15 percent loss is considered average.

Hydrants or blowoffs on all dead ends? All dead-end lines must have a hydrant or blow off. The diameter of the blow off must be at least one half the diameter of the distribution line. Generally, the maximum size of a hydrant or blow off is six (6) inches in diameter.

Routine flushing (how often)? The system must have a routine flushing schedule established. Schedules can range from twice a year to once every four or five years for large systems with many miles of pipe.

Adequate valving and routine valve turning: A system should have adequate valving that minimizes the number of connections without water service during

repairs. The valves should be exercised periodically to prevent them from freezing in one position.

Distribution system free of asbestos cement (AC) pipe? Does the system have asbestos cement type present anywhere in the system? If they do, they must be placed on an asbestos monitoring schedule to monitor the amount of asbestos entering the drinking water.

Booster Pumps: Surveyors are not required to inspect all booster pumps at the water system, use your best professional judgement.

Are pumps in good working condition? Look for excessive vibration (evidence if misaligned shaft or motor imbalance) or deep swishing noise coming from the pump casing (possible cavitation).

Are pumps protected and secured? Is the pump housed in a secured location and with durable materials? Evidence of tampering or unauthorized access? Inadequate structural support for pumps? Is the pump house free of obvious electrical or mechanical hazards?

If pump draws from distribution main, is there a cutoff switch or SCADA control if upstream pressure drops below 20 psi? If the booster pump draws from the mainline, is there a shutoff valve or SCADA control that stops the pump if the upstream pressure drops below 20 psi?

Is there redundancy of pumps? If a booster pump fails, the system will quickly depressurize unless it has another pump ready to operate or elevated atmospheric storage. If the answer is no, recommend a redundancy of pumps or backup power.

Can system maintain 20 psi if any pump out of service? Adequate pressure is no less than 20 psi at each service connection during periods of peak demand, and positive pressure throughout the system during fire flow events. Can the system maintain adequate pressure if any pumps are out of service?

Service Line Inventory: Check Data Online prior to the survey to verify if the service line inventory has been submitted. If the initial inventory has been submitted, check if the water system is required to submit a baseline inventory. If the baseline inventory has not been submitted as required, this should be marked as an unmet rule requirement.

Are service lines all non-lead? Systems that have identified lead, GRR, or unknown service lines will need to update their service line inventories in the future and remove and replace lead service lines. Additional Service Line Inventory requirements and resources can be found here:

https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/RULES/Pages/LCRR.aspx.

Cross Connection Control: Check Data Online prior to the survey to verify if an enabling authority or ordinance has been submitted to DWS. Verify with the system that the one submitted is current.

Assemblies tested annually (C, NTNC, TNC)? All backflow assemblies must be tested annually by a certified Backflow Assembly Tester. Spot check some backflow assemblies in the field and verify that they are approved.

Ordinance or enabling authority (C): Confirm that the water system has an ordinance or enabling authority to carry out and enforce a cross-connection control program.

Annual Summary Report submitted (C): Verify on Data Online that the cross connection annual summary report was submitted for the previous years since the past survey. Answer this question based on the most recent year of data available. The Annual Summary Report is due each year before the last business day of March for the previous year's reporting period of January 1 to December 31. If the system has a spotty history in Data Online of submitting the report but has done it for the most recent year, then mention it in the comments but do not cite it as a significant deficiency.

Certified Cross Connection Control Specialist (C)? Community systems with more than 300 connections shall make provision for at least one person certified in cross connection control to carry out the cross-connection control program (a Certified Cross Connection Specialist).

Written Cross Connection Control Program (C)? Community systems with more than 300 connections must have a written program plan that includes a master list of facilities and premises that are subject to inspection and the degree of hazard for each; a current list of cross connection control personnel and responsibilities; and a provision and schedule of initial inspection, installation and annual inspection of each assembly, and a periodic re-inspection of each assembly.

Water Quality Monitoring

Water Quality Monitoring

Contaminant — Entry Point Sampling	N/A	Number & Frequency	Next Tests Due
Arsenic	☐		
Inorganic Chemicals (Including Nitrite) (sw)	☐		
Inorganic Chemicals (Including Nitrite) (gw)	☐		
Nitrate	☐		
Radionuclides (Community Water Systems Only):			
Gross Alpha	☐		
Radium 226/228	☐		
Uranium	☐		
SOCs	☐		
VOCs (sw)	☐		
VOCs (gw)	☐		
Are Entry Point (EP) samples taken at the correct location? ☐ Yes ☐ No			

Distribution System Sampling	N/A	Number & Frequency	Sampled at Correct Location? Yes	No	Next Test Due
Coliform Bacteria	☐		☐	☐	
Asbestos (for AC pipe/asbestos geologic areas)	☐		☐	☐	
TTHMs and HAA5s	☐		☐	☐	
Lead and Copper # sites:	☐		☐	☐	
Other Sampling	**N/A**	**Number & Frequency**	**Yes**	**No**	**Next Test**
TOC	☐		☐	☐	
Source Water Coliform	☐		☐	☐	
Other (specify)	☐		☐	☐	

☞ **Discuss proper way to collect representative samples at all locations** ☜

☞ **Discuss possible sample reductions** ☜

	Yes	No	N/A
○ Is all required monitoring current?	☐	☐	
● Have all MCL violations been addressed? Comments:	☐	☐	☐
○ Have all LCR AL exceedances been addressed? Comments:	☐	☐	☐
○ If chlorinating, does the system report chlorine residual with routine coliform samples?	☐	☐	☐
○ Does the system have a written coliform sampling plan?	☐	☐	
Is the coliform sampling plan followed? Yes ☐ No ☐ — Does the plan include:	☐	☐	
☐ Sample collection protocol — Yes ☐ No ☐ Rotation schedule			
☐ Distribution map — Yes ☐ No ☐ Repeat locations			
☐ Sample site locations			
☐ Protocol for labeling sample types (triggered, repeat, specials, routine)			
☐ Are routine samples representative of distribution system water quality?			

Comments:

Water Quality Monitoring

Contaminant/number & frequency/next tests due: Prior to conducting the survey, print out the latest monitoring history from Data Online (https://yourwater.oregon.gov/) and review it with the operator. Fill in the frequency for each contaminant that is required to be monitored by the system and provide the next due dates for these tests. If a particular contaminant is not required to be monitored, check the N/A box.

It is important that this page be filled out accurately and completely as it is an essential responsibility of the water system to conduct water quality monitoring properly. The operator should post this page to keep track of when their next monitoring is due.

Are samples collected at the correct locations in the system? Discuss correct sampling locations for all sampling:

- **Source** samples must be collected directly from the source prior to any treatment.
- **Entry point** samples must be collected after all treatment and prior to the first customer and any storage.
- **Distribution** samples must be collected out in the distribution system at designated locations:
    - coliform samples at sites described in the coliform sampling plan,
    - TTHM & HAA5 sites at locations of highest DBP levels and according to DBP sampling plan. Check Data Online for this information and discuss with operator if samples are not being collected at the correct locations or correct months of the year,
    - asbestos downstream of A/C pipe, and
    - lead and copper at tap samples selected using the tier system.

Discuss proper way to collect representative samples at all locations:

- Discuss proper coliform sampling technique (should be part of their coliform sampling plan).
- Discuss proper lead and copper sampling technique and location (sites based on tier system, first draw cold water kitchen or bathroom tap sitting at least 6 hours).

Discuss possible sample reductions (see section on next page for details on monitoring reductions):

- Review all monitoring schedules for possible monitoring reductions and discuss any changes with the operator. Record the reduced schedule on the survey form and mention it in the comments at the bottom of the form; DWS will update the monitoring schedule in Data Online when the survey is submitted to the state.

Is all required monitoring current?

Verify that all the required monitoring has been conducted and is current. The DWS Data Online printout should be compared with the system's records for accuracy. If DWS does not have the results of any test that creates a monitoring violation, get copies from the

water system and forward them to DWS. Explain in the comments section any monitoring violations.

Have all MCL violations been addressed? Review the “violations” tab in Data Online for any MCL violations and verify they have been addressed.

Have all LCR AL exceedances been addressed? Review the “Lead & Copper” tab in Data Online for any lead or copper action level exceedances and verify that they have been addressed.

If chlorinating, does the system report chlorine residual with routine coliform samples? Systems adding disinfection for residual maintenance are required to report chlorine residuals throughout the distribution system while conducting routine coliform sampling.

Does the system have a written coliform sampling plan? Review the coliform sampling plan and determine if it is adequate and sites sampled represent the entire distribution system. The plan must be written and include the items listed under this question on the form. A general rule of thumb is for the system to have two or three routine sites identified for each routine sample collected each month or quarter. If there are recent +TC samples on data online, check that the site address is on the sampling plan. If applicable, make sure the plan includes source water sampling for a system subject to triggered source monitoring under the Groundwater Rule.

Monitoring Reductions

Check sampling history in Data Online to determine eligibility for monitoring reductions. Also verify that systems are still eligible for any monitoring reductions they currently have.

Inorganics (IOCs): Testing may be reduced to 1 sample every 9 years if 3 rounds of sampling are completed and there are no MCL violations.

Nitrates (NO3): Groundwater sources must be tested every year (no reductions). A surface water source must be tested quarterly for nitrate for at least one year, after which the water system can submit a written request for a reduction to annual sampling.

Lead and Copper (Pb/Cu): Lead and Copper sampling can be reduced in the following manner: After 2 initial consecutive 6-month rounds, they need to do 3 annual rounds at the reduced number of sites, then every 3 years. If the results of the two consecutive 6-month rounds are such that the 90th percentile for lead is < 0.005 mg/l and the 90th percentile for copper is < 0.65 mg/l (1/2 the copper Action Level), then the system can go directly to a 3-year frequency (skipping the 3 annual rounds). If the lead and copper 90th percentile results are greater than these amounts but less than the Action Levels, three years of annual monitoring is needed.

Volatile and Synthetic Organic Compounds (VOC / SOCs):

Monitoring of certain compounds can be reduced to once every 6 or 9 years if they have a state-certified Drinking Water Protection Program. A Use and Susceptibility Waiver is also available, but the degree of work involved is similar to the DWPP and is not as proactive, so we recommend the DWPP.

Dioxin: Only required if DWS determines that the source is susceptible.

Asbestos (Community and Non-Transient Non-Community systems): If system has Asbestos-Cement (A-C) piping, sample at a tap served by the A-C piping every 9 years. If the source is in an identified geographical area with the potential for source water asbestos, sample at the Entry Point every 9 years. Identified geographical areas are in parts of Curry, Josephine, Coos, Douglas, Jackson, Grant, Baker, and Malheur County (see Asbestos Maps or contact your Regional Hydrogeologist).

Radionuclides (Community water systems only): Monitoring can be reduced to once every 6 or 9 years (from the normal 3-year schedule), depending upon the results. For new Community water systems or existing systems with a new source, 4 consecutive quarters of radionuclides are required, however, the last two quarters can be waived if the results of the first 2 quarters are non-detect (ND). Future monitoring is based upon the results of the initial quarterly sampling and may be on a frequency of every 3, 6 or 9 years for any or all of the three radionuclides (gross alpha, uranium, and radium 226/228).

Arsenic: Groundwater systems may have arsenic reduced to every 9 years after conducting a minimum of 3 rounds of monitoring with detection limits below 0.010 mg/l. Eligible sampling must have occurred after 1/23/06 (samples taken prior to this time often had a higher detection limit than the current MCL). Systems may request monitoring reductions in writing at any time.

Water System Operations

Water System Operations

O&M Manual	Yes	No
○ Does system have an operation and maintenance manual? Year last updated:	☐	☐
☐ Description of water system facilities or infrastructure ☐ List of routine operational tasks		
☐ Procedures for source and intake facilities ☐ Procedures for treatment facilities		
☐ Procedures for storage tank and reservoir facilities ☐ Procedures for distribution system		
☐ Procedures for standard operating calculations		
Are BMPs followed during repairs or no pressure events? If not, describe:	☐	☐

Resiliency	Yes	No	N/A
Has system completed a risk and resiliency assessment (○ CWS > 3300 people)?	☐	☐	
Is the assessment updated at least every 5 years?	☐	☐	☐
Does system have an emergency response plan (○ CWS, NTNC)? Year last updated:	☐	☐	
Has the system coordinated emergency response exercises, or discussed emergency response or resource needs with their local emergency management agency? Describe:	☐	☐	
Are there mutual aid agreements in place for emergency assistance (such as ORWARN)? Describe:	☐	☐	
Does the system have response procedures for spills, high risk contaminant sources, or events that could affect source water quality (○ CWS > 3300 people with a source water assessment)?	☐	☐	☐
Does the system have water shortage procedures? Describe:	☐	☐	
Does the system have an updated emergency contact list? *Recommend at least annually*	☐	☐	
Does the system have a procedure for issuing advisories or public notices to customers (○ CWS, NTNC)?	☐	☐	
Do any system components have auxiliary power? Describe:	☐	☐	
How many power outages impacting operations has the system experienced in the last 5 years?			
Can staff operate the system manually if telemetry/SCADA communication is lost?	☐	☐	☐

Supervisory control and data acquisition (SCADA) use for water operations (for WTP classification)	
☐ None	☐ SCADA systems provide data w/ partial process control
☐ SCADA systems provide data w/ no process control	☐ SCADA systems provide data w/ complete process control

Comments:

Water System Operations

Operation and Maintenance Manual (O&M):

Does the system have an O&M manual? Ask to see all operation and maintenance manuals the system uses. These procedures must be documented and not just verbally passed on to new operators. If the systems needs guidance on creating or updating their O&M manual, see https://www.oregon.gov/oha/ph/healthyenvironments/drinkingwater/operations/documents/creatingsystem.pdf.

Are best management practices (BMPs) followed during repairs or no pressure events in the distribution system? OHA-DWS has guidelines describing best practices on water system operations in the event there are repairs or if there is a loss of pressure event in the distribution system. It is highly recommended that water systems have a copy of the BMPs in their O&M manual for reference.

Resiliency:

The resiliency questions below will allow DWS and other state agencies to assess a system's capacity to respond effectively to water system emergencies.

Has the system completed a risk and resiliency assessment? CWSs serving over 3,300 people are required to complete a risk and resilience assessment and update the assessment at least every 5 years.

Does the system have an emergency response plan (ERP)? The ERP should be kept current (must be updated at least every 5 years), particularly individual and agency phone numbers. As of January 1, 2022, TNC systems are no longer required to have a written ERP, though it is highly encouraged. If the system needs resources or templates to develop an ERP, see DWS's Emergency Response and Planning website.

Has the system discussed emergency response or resource needs with their local emergency management agency? Water systems should discuss with their local or county emergency managers on their capacity to respond to drinking water emergencies and resources needs during an emergency.

Are there mutual aid agreements in place for emergency assistance? This can be mutual aid agreements with nearby water systems or being a member of the Oregon Water/Wastewater Agency Response Network (ORWARN).

Does the system have response procedures for spill, high risk contaminant sources, or events that could affect source water quality? CWSs serving over 3,300 people must have response procedures for events involving high-risk contaminant sources/activities identified in the DEQ Source Water Assessment for the following areas:

- One-year time-of-travel for wells or zone 1 in springs for groundwater sources with delineated drinking water source area.
- Within 500 ft radius of a groundwater well, spring, infiltration gallery without a delineated drinking water source area.
- Eight-hour time-of-travel (or area within eight-hour time-of-travel) that captures high-risk sources based on sensitive area info for surface water sources

Does the system have water shortage procedures? Does the system have procedures for responding to low source water supply? This can include operational changes or implementing a water conservation program.

Does the system have an updated emergency contact list? Has the contact list been updated within the past year? Ensure the proper regulatory contacts are on the list.

Does the system have a procedure for issuing advisories or public notices to customers? Does the plan describe templates to use and how the customers will be notified of advisories or public notices?

Do any system components have auxiliary power? Indicate if auxiliary power (portable or onsite generators) is available to power any part of the system in an emergency. If so, describe in the space provided.

How many power outages impacting operations has the system experienced in the last 5 years? Power outages can lead to an increase in responding to events that lead to a loss of adequate distribution system pressure.

Can staff operate the system manually if telemetry/SCADA communication is lost? Supervisory Control and Data Acquisition (SCADA) allows operators to remotely monitor and control water treatment and distribution processes. If telemetry or SCADA communications are lost, can the water system switch to manual controls?

Supervisory control and data acquisition (SCADA) use for water operations (for WTP classification): check the SCADA capabilities at the water system for process control and data acquisition. Treatment plants are classified by assigning points for each unit process and is used to determine operator certification classification.

Water System Management

Water System Management

Operator Certification	Yes	No	N/A
● Is the DRC identified and certified at the appropriate level?	☐	☐	☐
If the DRC is a contract operator, how do they work with the system?	☐	☐	☐
○ Does system have written protocols for under-certified operators?	☐	☐	☐
Is a backup operator assigned when the regular operator is unavailable?	☐	☐	☐
☛ **Review the list of certified operators on Data Online** ☚			

Plan Review/Master Plan	Yes	No	N/A
○ Have all major modifications in use received final plan review approval?	☐	☐	☐
Has conditional approval been granted?	☐	☐	☐
Comments:			
☛ **Review current plan review information and status on Data Online** ☚			
For watermain extension projects, has a plan review exemption been granted?	☐	☐	☐
If not, has a waiver application been sent to plan review engineers?	☐	☐	☐
○ Does the system have a current (<20 yr. old) master plan? (Not required if < 300 connections)	☐	☐	☐
What year was the plan completed?			

Compliance Status	Yes	No	N/A
● Milestones in compliance schedule met?	☐	☐	☐
○ Does the system issue public notice as required?	☐	☐	☐
○ Was the CCR sent to customers by July 1/December 31? (CWSs only)	☐	☐	☐
○ Was a copy of the CCR and Certification Form sent to DWS by July 10/January 10? (CWSs only)	☐	☐	☐

Comments:

Water System Management

Operator Certification

Is the DRC identified and certified at the appropriate level? All Community and Non-Transient Non-Community water systems must be under the supervision of a certified operator. One operator must be designated as the individual in direct responsible charge (DRC). Check Data Online to verify that a DRC is identified and is certified to the level required by the system. If a DRC is not identified, the water system needs to fill out the Water System Operation Designation DRC Form and send it to DWS. The system must have an operator certified at the same level as the water system and that individual must be maintaining CEUs.

If the DRC is a contract operator, how do they work with the system? Contracting with a certified operator is an acceptable way to comply with requirements to have a certified operator. A copy of the contract signed by both the operator and the water system must be sent to DWS within 30 days of hire (see DWS website for a contract template systems can use). Indicate in the space provided how the operator works with the system.

Does the system have written protocols for under-certified operators? All under-certified operators (that is, those operators not certified to the minimum levels required by the water system) must have written protocols outlining what activities they can and cannot do without consulting the DRC. The protocols must be signed by both the DRC and the operator.

Is a backup operator assigned when the regular operator is unavailable?

Plan Review/Master Plan:

Have all major modifications in use received final plan approval? Determine if any major modifications have been completed since the last survey without plan review. If so, then the system must complete the plan review process with DWS. Major modifications include new well/water source, storage tanks, reservoirs, treatment units to remove or inactivate regulated contaminants, and extensions to distribution lines to add customers. Review the file or check the “Plan Review” link on the Data Online page for the water system prior to the survey to verify plan review activity initiated or completed with DWS. Ask the water system operator/owner about any of the listed plans that do not have a date in the “Final Approval” column. Plan review resources can be found online (http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/PlanReview/Pages/index.aspx).

Systems that have an engineer on staff can apply to DWS for a plan review exemption for water main extensions. The exemption applies only to water mains and is renewed annually by DWS; the list is available upon request.

For watermain extension projects, has a plan review exemption been granted? If the system has extended their watermains, ensure plan review exemption has been granted. More information can be found here: https://www.oregon.gov/oha/ph/healthyenvironments/drinkingwater/planreview/pages/exemption.aspx.

Does the system have a current (<20 yr. old) master plan? Systems with more than 300 connections must have a current master plan approved by DWS. If the plan is approaching its 20-year life span, remind the operator that it should be updated. Obtain the date of the plan from DWS or the system, which should have a copy of it in their records.

What year was the plan completed? Indicate the date of the most recent master plan on record with DWS.

Compliance Status:

Milestones in compliance met? Review the system's files and the Data Online website (https://yourwater.oregon.gov/) to determine if the system is under an enforcement (informal, bilateral compliance agreement, administrative order) or is a priority non-complier (PNC) and evaluate if any progress is being made to comply with it.

> ***Special note on licensed facilities:*** Facilities licensed by the County (via OHA) or the Department of Agriculture that are **also themselves water systems** must be in compliance with all drinking water rules as a condition of the license. Prior to an inspection or license renewal of a licensed facility, check Data Online to see if all monitoring is current and if any enforcement issues are outstanding. Any issues identified need to be cited during the licensed facility inspection and enforced by the licensing agency (formal enforcement of these facilities is not done by DWS) per the PE 50.

Does the system issue public notice as required? Check violations, alerts, and the public notice (PN) sections on Data Online to determine if the system issues public notices as required. The emphasis should be on notices issued for water quality MCL violations. If the system was supposed to issue a PN and didn't earlier in the year but the violation has since been resolved, cite it as a significant deficiency but then note on the cover letter that the violation has returned to compliance, so the significant deficiency is considered corrected.

Was the CCR sent to customers by July 1/December 31? All Community water systems must distribute consumer confidence reports (CCRs) to users annually. Community water systems serving 10,000 people or more must send a CCR to customers

by July 1 and another by December 31 annually. Community water systems serving less than 10,000 people must distribute a CCR by July 1 annually.

Systems that sell water to another PWS must provide a copy of their CCR to all purchasing systems by April 1 each year or on a date mutually agreed upon by both parties. This is so the purchasing system can include the info in their own CCR and meet the July 1 deadline for distributing it to users.

Was a copy of the CCR and Certification Form sent to DWS by July 10/January 10?
Community water systems must submit a copy of the CCR and certification form describing the methods used to distribute the CCR and when it was distributed to DWS.

Community water systems serving 10,000 people or more must submit a copy of the CCR and certification form to DWS by July 10 and January 10 annually. Community water systems serving less than 10,000 people must submit a copy of the CCR and certification form by July 10 annually.

Look on Data Online at (https://yourwater.oregon.gov/) to determine CCR compliance status. Ask the operator how these are distributed to the users and if DWS was sent a copy. If you are finishing a survey just after one of those due dates and it does not show up as received by DWS yet, ask the system to show you a copy of the CCR and confirm they have sent it to DWS. If the system has a spotty history in Data Online of submitting the CCR but has done it for the most recent year, then mention it in the comments but do not cite it as a significant deficiency.

Transient (TNC) Water Systems

Transient (TNC) Water Systems

	Yes	No	N/A
Well Construction & Protection Attach Well Information page if more than one well			☐
Well log available?	☐	☐	
Pitless adaptor?	☐	☐	
● Sanitary seal & casing watertight?	☐	☐	
Meets setbacks from hazards? ft.:	☐	☐	
Wellhead protected from flooding?	☐	☐	
Raw water sample tap?	☐	☐	
Treated water sample tap? (N/A=no treatment)	☐	☐	☐
● If vented, properly screened? (N/A=not vented)	☐	☐	☐
Concrete slab around casing?	☐	☐	
Casing height ≥ 12-in. above slab/grade?	☐	☐	
Pump to waste piping?	☐	☐	
Protective housing?	☐	☐	
Spring/Other Source Construction			☐
● Does spring box exclude surface water?	☐	☐	
● Impervious durable material?	☐	☐	
Does the collection box have a hatch?	☐	☐	
● Access hatch secured?	☐	☐	
● Access hatch watertight?	☐	☐	
● Screened overflow?	☐	☐	☐
Raw water sample tap?	☐	☐	
Meets setbacks from hazards? ft.:	☐	☐	
Treated water sample tap? (N/A=no treatment)	☐	☐	☐
Bottom drain and shutoff valve?	☐	☐	
Intercepting ditch above source?	☐	☐	
Chlorination and UV Attach Disinfection page			☐
Treatment Attach Treatment page			☐

	Yes	No	N/A
Pressure Tanks Attach Storage Tank page for reservoirs			☐
Accessible for maintenance?	☐	☐	
Bypass piping?	☐	☐	
Drain?	☐	☐	
Pressure relief device?	☐	☐	
Air bladder/diaphragm?	☐	☐	
Distribution			☐
○ Required backflow assemblies tested annually?	☐	☐	☐
● 20 psi maintained at all service connections?	☐	☐	☐
Monitoring			
● All MCL violations addressed?	☐	☐	☐
○ Coliform sampling plan?	☐	☐	
○ Previous 12 months of routine coliform sampling up to date?	☐	☐	
○ Source sampling up to date?	☐	☐	☐
○ Nitrate sampling up to date?	☐	☐	
○ Initial arsenic test done?	☐	☐	
Management			
○ Major mods approved? (plan review)	☐	☐	☐
○ If new PWS, PR approval?	☐	☐	☐
○ Operations and maintenance manual?	☐	☐	
● Milestones in compliance schedule met?	☐	☐	☐
○ Public notice issued as req.?	☐	☐	☐
Has operator taken Essentials of SW training? (SW system only)	☐	☐	☐

Comments:

Transient (TNC) Water Systems

This form will be used for all Transient Non-Community systems. As throughout the rest of the survey form, black dots after the check boxes are used to denote a significant deficiency and open dots are used to denote an unmet rule requirement. If a box with a dot is marked “No” that item must be transferred to the front page under “Significant Deficiency or Unmet Rule Requirement Summary” and corrected within a certain time frame or being on an approved schedule for correction.

In addition to this form, **at a minimum**, the following forms must accompany this form to be a complete sanitary survey:

- Deficiency Summary
- Inventory and Narrative
- Schematic
- Source Information
- Disinfection (if the system has disinfection including UV or chlorination for residual maintenance, iron, taste and odor, etc.)

Additional form pages must be included with the survey if they are needed to document that particular information. For example, if the system has more than one well or storage tank, then the Well Information and Storage Tank pages must be filled out. When in doubt, fill out the long version of the page.

The TNC survey page is explained briefly below. *However, the details of each category can be found in the text of the manual under that heading.*

Well Construction & Protection: We have selected items from the lengthier list on the Well Information page that we considered to be the highest priority.

Spring/Other Source Construction: For a spring, check the appropriate boxes listed. If the source is an infiltration gallery or dug well that doesn’t fit the same criteria as a spring, use the long page (Spring/Other) from the C/NTNC survey packet.

Chlorination and UV: If the system uses chlorination or UV for disinfection, complete and attach the disinfection page from the C/NTNC survey packet.

Treatment: See the Treatment section of this manual for guidance on answering the treatment questions.

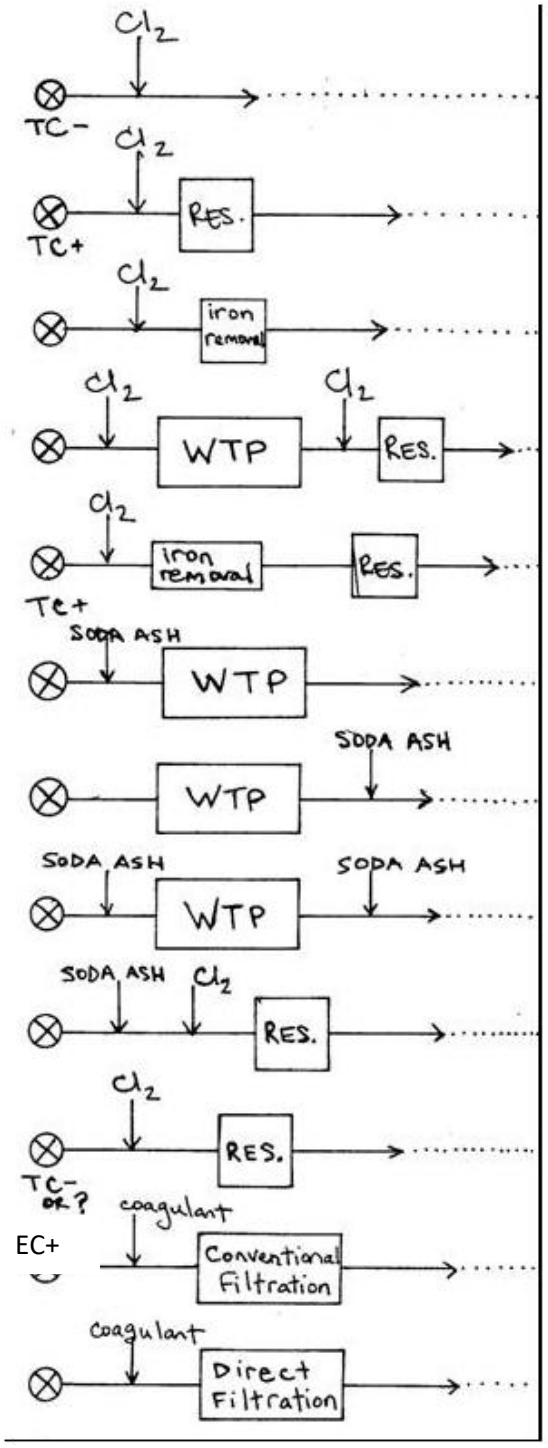
Pressure Tanks: In the past we have not focused much attention on pressure tanks. However, there are also some sanitary defects that could potentially cause a bacterial contamination problem. Since small systems frequently just have pressure tanks, we did not list items for a full-scale storage reservoir. If they have one, the long page must be used. If the system has reservoirs, include the “Storage and Pressure Tank” form.

Distribution: Inquire to determine if backflow assemblies are tested annually. The system must always maintain at least 20 psi at all service connections.

Monitoring: The answers to these questions can be researched ahead of time from Data Online, except the coliform sampling plan (CSP). We have found that the CSP is very important in preventing violations, especially for a very small system. Procedures of how to take a sample, what to do if one is positive, where to take the sample, etc. should be written and posted in an accessible location. If they have a lab do their sampling, a written CSP must still be developed, just in case.

Management: See the Management and Operations section of this manual for guidance on answering the management questions. If the water system is new, determine if the system has gone through plan review and been approved. If the water system is new and has not received final plan review, the “major modifications approved (plan review)” unmet rule requirement should be marked on the survey form.

Appendix 1. Treatment Code Configuration



Residual Maintenance:
X421

Disinfection, Hypochlorination, Post:
D421

Iron Removal, Hypo-, Pre:
F423

Disinfection, Hypo-, Pre and Post:
D423 & D421

Disinfection, Hypo, Pre:
D423 (Iron Removal is Secondary*)

pH adjustment, Pre:
P742 (never Corrosion Control if Pre)

Corrosion Control, pH adj, soda ash:
C502

Both P742 & C502

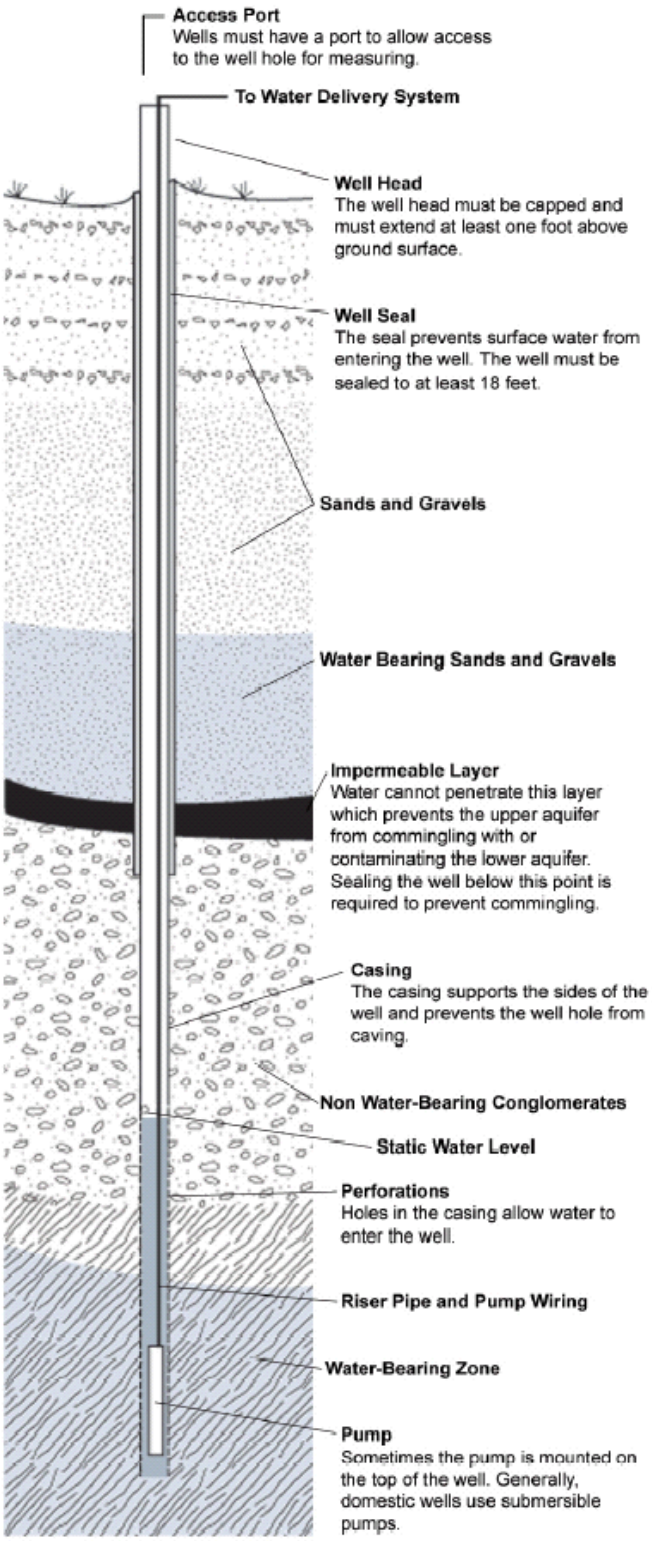
Corrosion Control and Disinfection, Post: C502 & D421

4-log Disinfection, Post:
D361

Conventional Filtration:
P240, P360, P660, P345

Direct Filtration:
P240, P360, P345

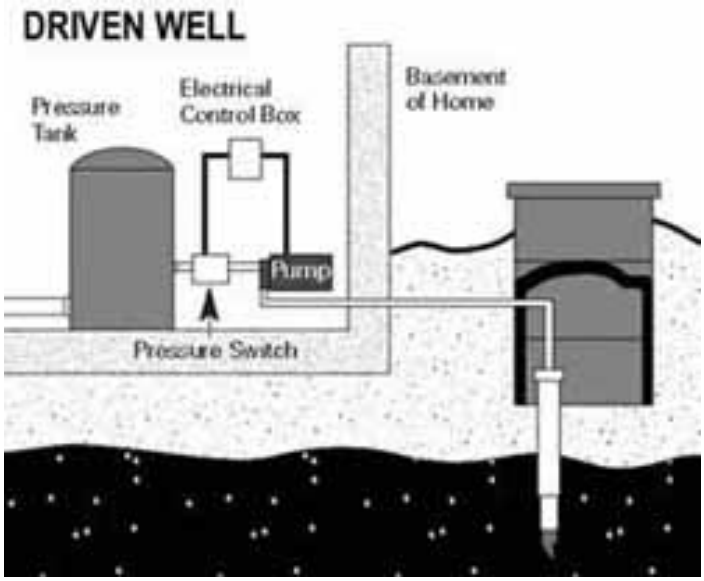
Appendix 2. About Wells



Driven Wells

Like dug wells, driven wells pull water from the water-saturated zone above the bedrock. Driven wells can be deeper than dug wells. They are typically 30 to 50 feet deep and are usually located in areas with thick sand and gravel deposits where the ground water table is within 15 feet of the ground's surface. In the proper geologic setting, driven wells can be easy and relatively inexpensive to install.

Although deeper than dug wells, driven wells are still relatively shallow and have a moderate-to-high risk of contamination from nearby land activities.



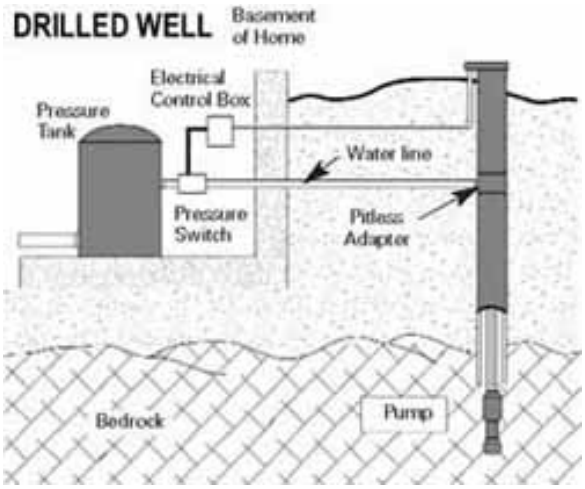
Driven Well Construction Features

- Assembled lengths of two inches to three inches diameter metal pipes are driven into the ground. A screened "well point" located at the end of the pipe helps drive the pipe through the sand and gravel. The screen allows water to enter the well and filters out sediment.
- The pump for the well is in one of two places: on top of the well or in the house. An access pit is usually dug around the well down to the frost line and a water discharge pipe to the house is joined to the well pipe with a fitting.
- The well and pit are capped with the same kind of large-diameter concrete tile used for a dug well. The access pit may be cased with pre-cast concrete.

To minimize the risk of contamination, the well cover should be a tight-fitting concrete curb and cap with no cracks and should sit about a foot above the ground. Slope the ground away from the well so that surface water will not pond around the well. If there's a pit above the well, either to hold the pump or to access the fitting, you may also be able to pour a grout sealant along the outside of the well pipe. Protecting the water quality requires that you maintain proper well construction and monitor your activities around the well. It is also important to follow the same land use precautions around the driven well as described under dug wells.

Drilled Wells

Drilled wells penetrate about 100-400 feet into the bedrock. Where you find bedrock at the surface, it is commonly called ledge. To serve as a water supply, a drilled well must intersect bedrock fractures containing ground water.

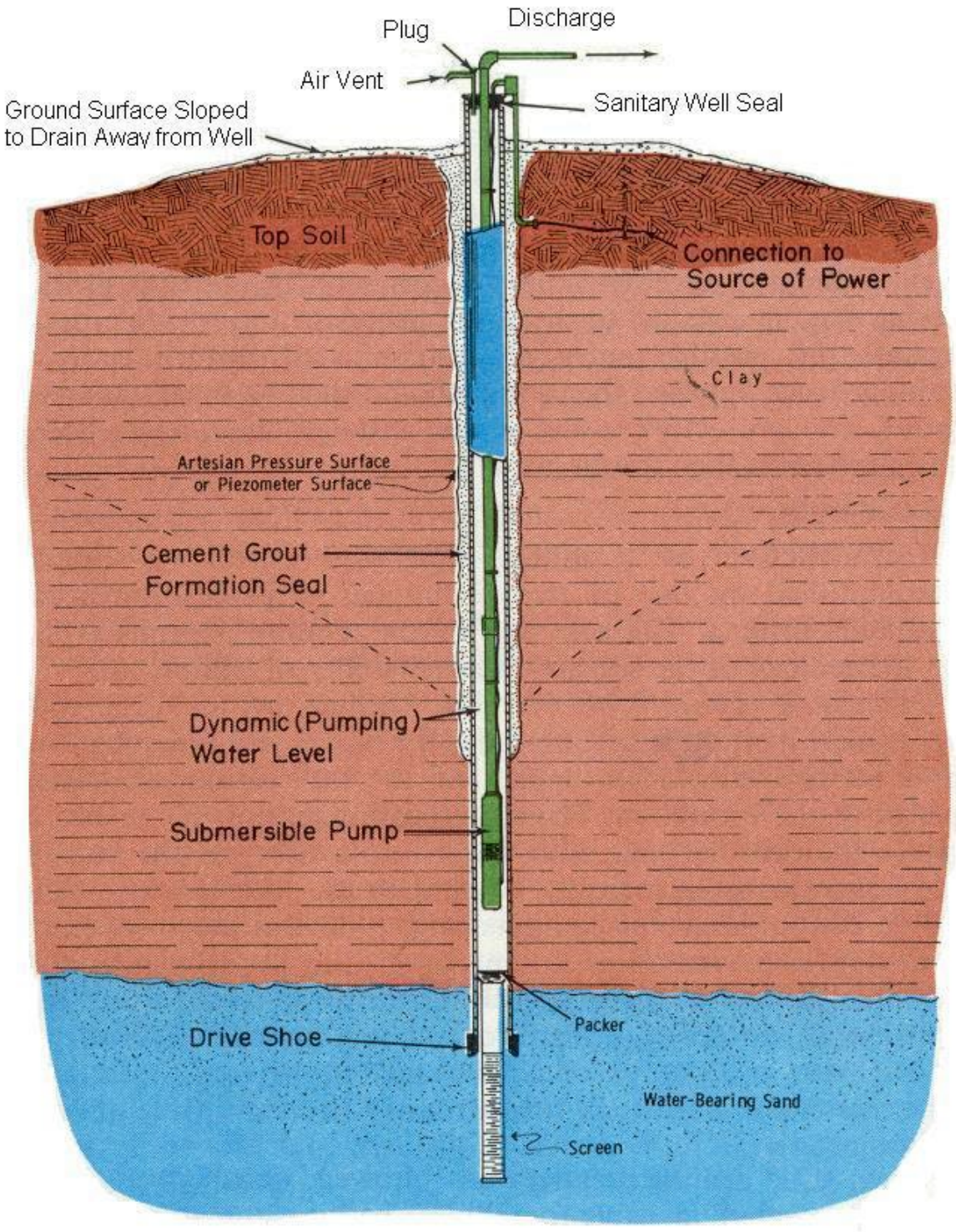


Drilled Well Construction Features

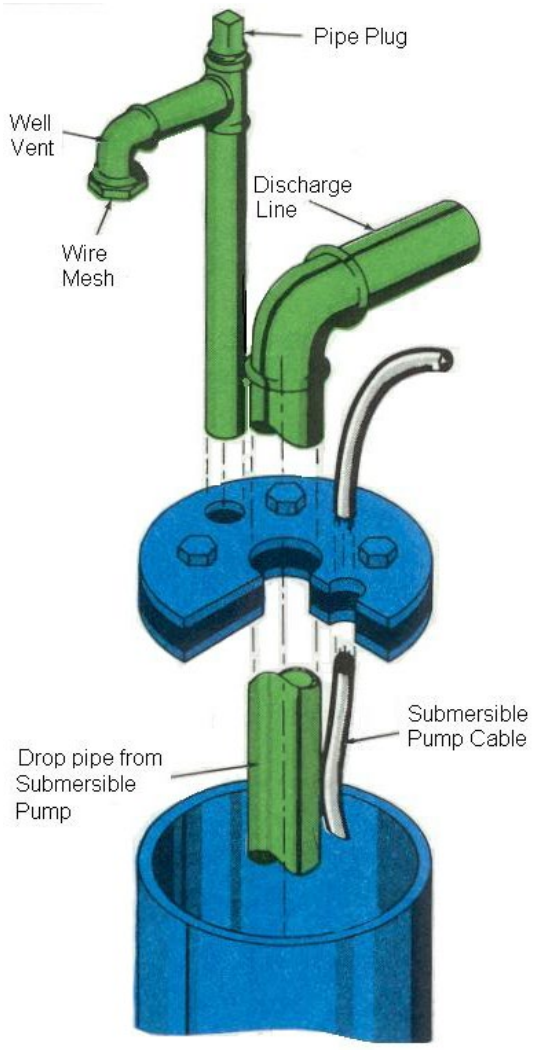
- The casing is usually metal or plastic pipe, six inches in diameter, that extends into the bedrock to prevent shallow ground water from entering the well. By law, the casing has to extend at least 18 feet into the ground, with at least five feet extending into the bedrock. The casing should also extend a foot or two above the ground's surface. A sealant, such as cement grout or bentonite clay, should be poured along the outside of the casing to the top of the well. The well is capped to prevent surface water from entering the well.
- Submersible pumps, located near the bottom of the well, are most commonly used in drilled wells. Wells with a shallow water table may feature a jet pump located inside the home. Pumps require special wiring and electrical service. Well pumps should be installed and serviced by a qualified professional registered with your state.
- Most modern drilled wells incorporate a pitless adapter designed to provide a sanitary seal at the point where the discharge water line leaves the well to enter your home. The device attaches directly to the casing below the frost line and provides a watertight subsurface connection, protecting the well from frost and contamination.
- Older drilled wells may lack some of these sanitary features. The well pipe used was often 8-, 10- or 12- inches in diameter, and covered with a concrete well cap either at or below the ground's surface. This outmoded type of construction does not provide the same degree of protection from surface contamination. Also, older wells may not have a pitless adapter to provide a seal at the point of discharge from the well.

Hydrofracting A Drilled Well

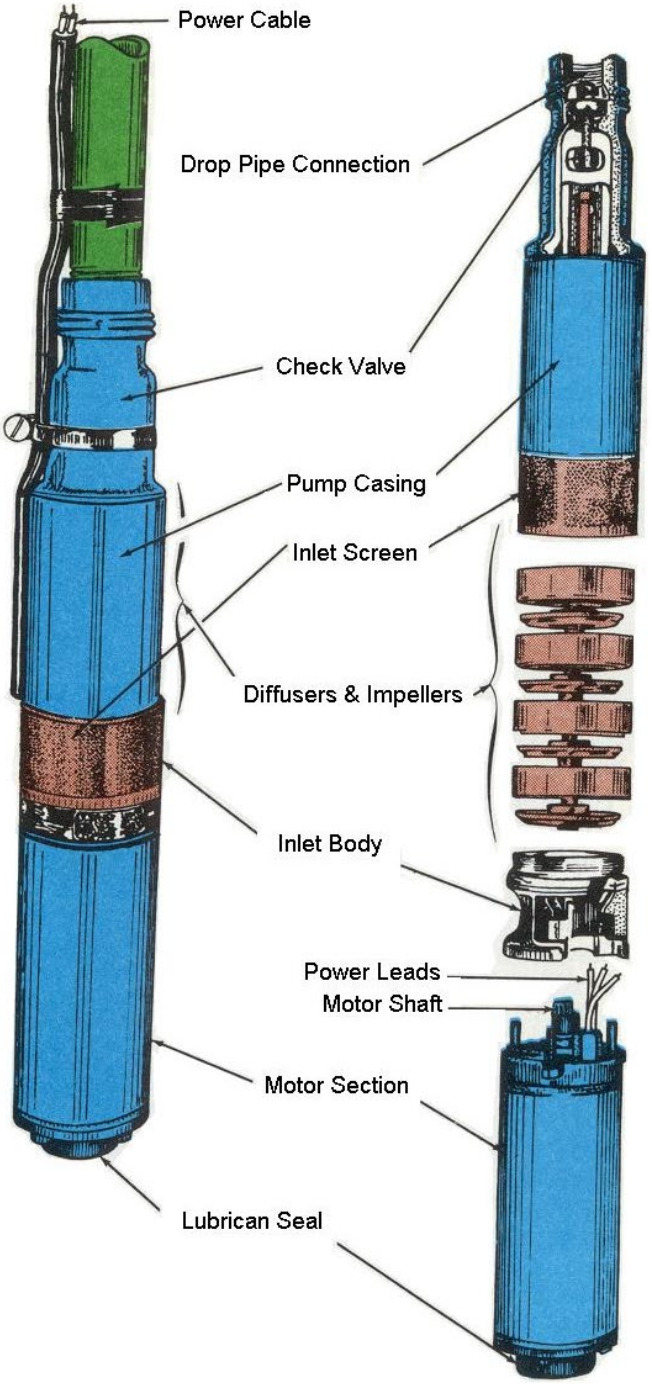
Hydrofracting or hydraulic fracturing is a process that applies water or air under pressure into the well to open up existing fractures near the well; it can even create new ones. Hydrofracting can often increase the yield of the well. This process can be applied to new wells with insufficient yield and to older wells to improve the yield quantity.



Drilled well with submersible pump

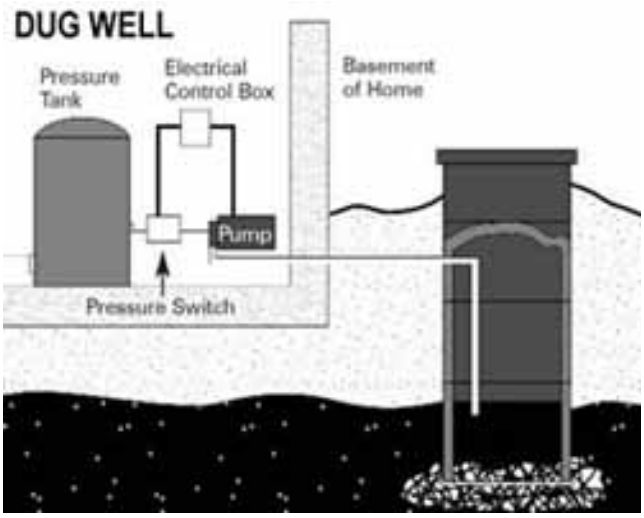


Well seal for submersible pump



Exploded view of submersible pump

Dug Wells

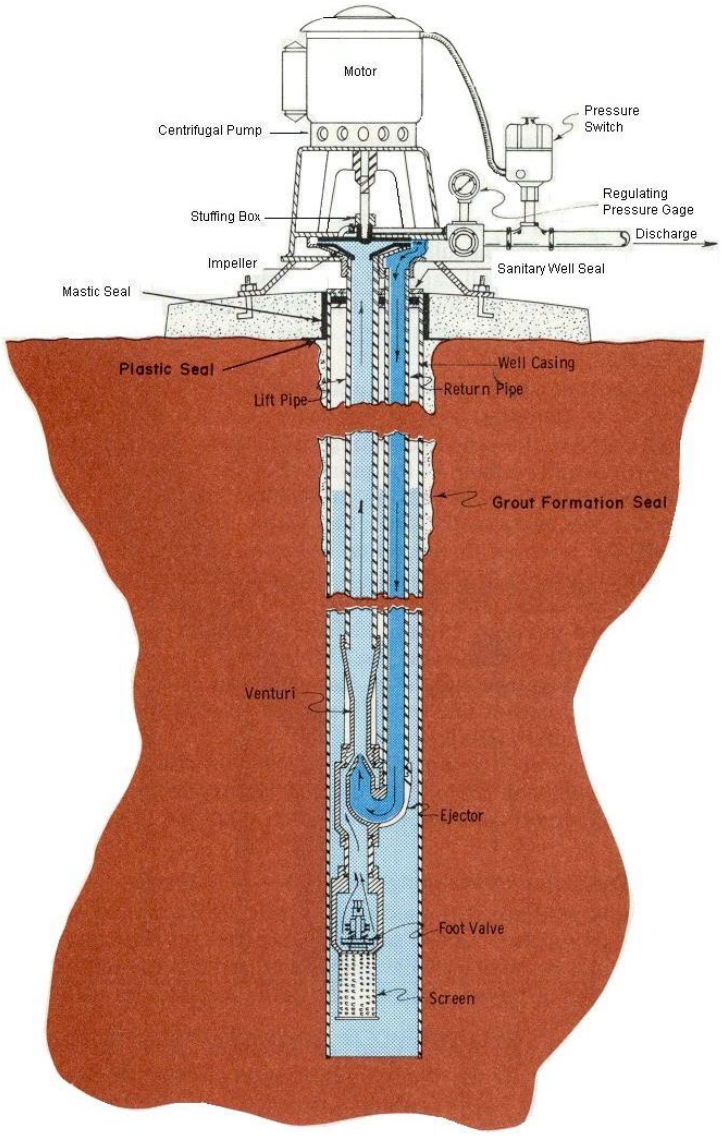


Dug wells are holes in the ground dug by shovel or backhoe. Historically, a dug well was excavated below the groundwater table until incoming water exceeded the digger's bailing rate. The well was then lined (cased) with stones, brick, tile, or other material to prevent collapse. It was covered with a cap of wood, stone, or concrete. Since it is so difficult to dig beneath the ground water table, dug wells are not very deep. Typically, they are only 10 to 30 feet deep. Being so shallow, dug wells have the highest risk of becoming contaminated. To minimize the likelihood of contamination, your dug well should have certain features. These features help to prevent contaminants from traveling along the outside of the casing or through the casing and into the well.

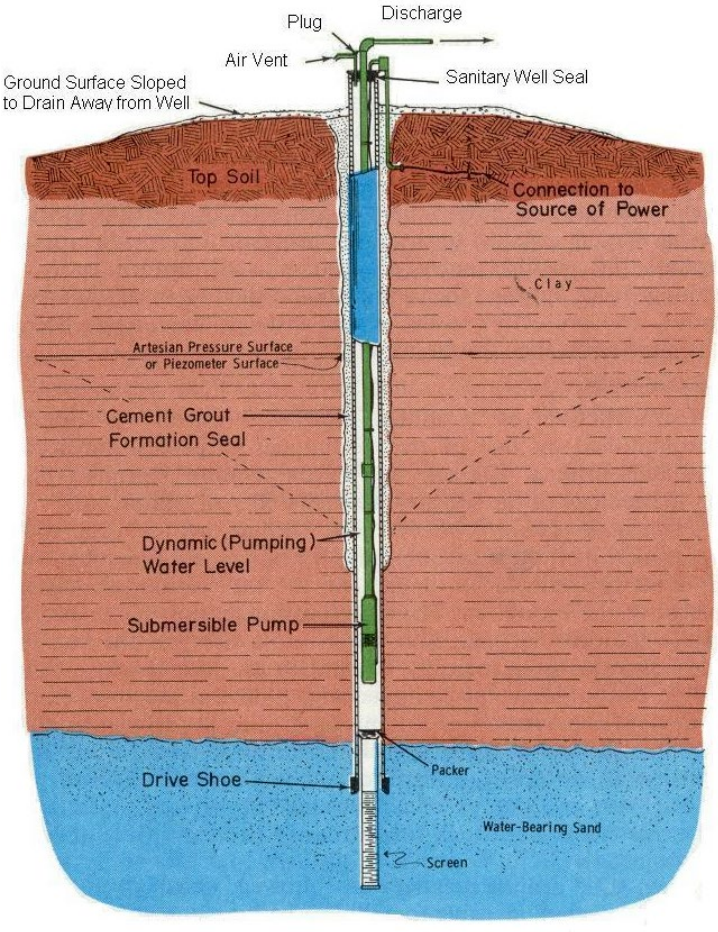
Dug Well Construction Features

- The well should be cased with a watertight material (for example, tongue-and groove pre-cast concrete) and a cement grout or bentonite clay sealant poured along the outside of the casing to the top of the well.
- The well should be covered by a concrete curb and cap that stands about a foot above the ground.
- The land surface around the well should be mounded so that surface water runs away from the well and is not allowed to pond around the outside of the wellhead.
- Ideally, the pump for the well should be inside the home or in a separate pump house, rather than in a pit next to the well.

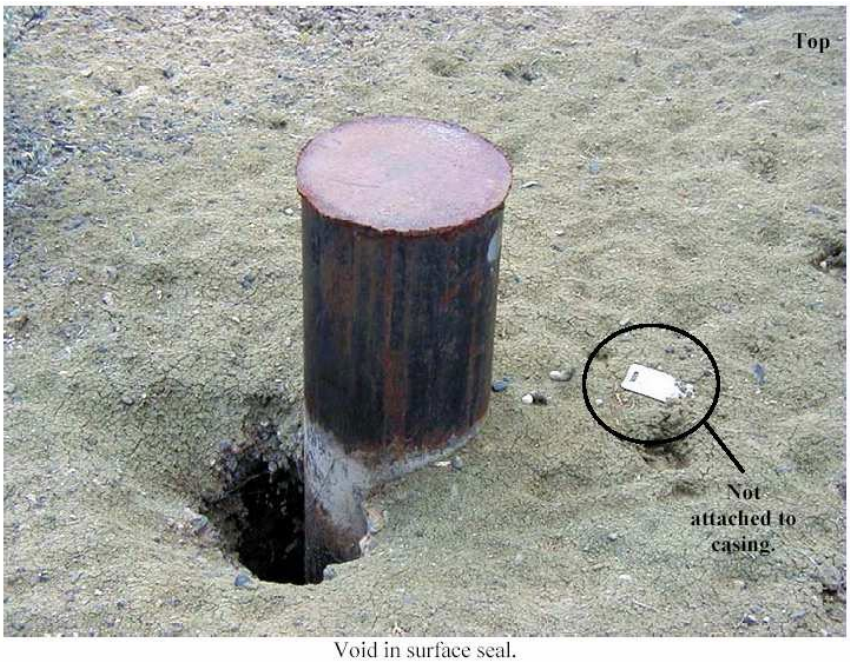
Land activities around a dug well can also contaminate it. While dug wells have been used as a household water supply source for many years, most are "relics" of older homes, dug before drilling equipment was readily available or when drilling was considered too expensive. If a dug well is used for drinking water, check to make sure it is properly covered and sealed. Another problem relating to the shallowness of a dug well is that it may go dry during a drought when the ground water table drops.



"Over-the-well" jet pump

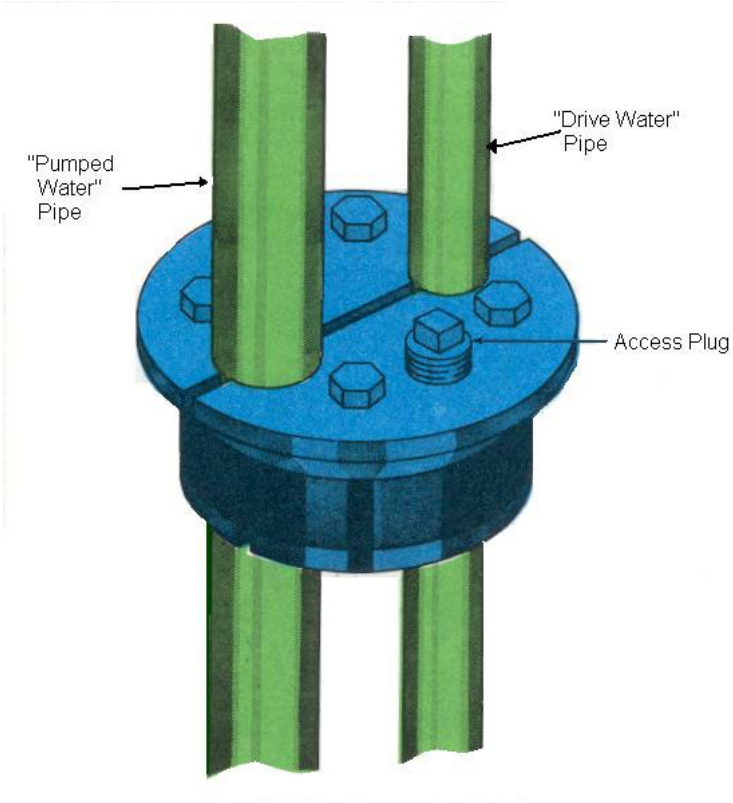


Drilled well with submersible pump

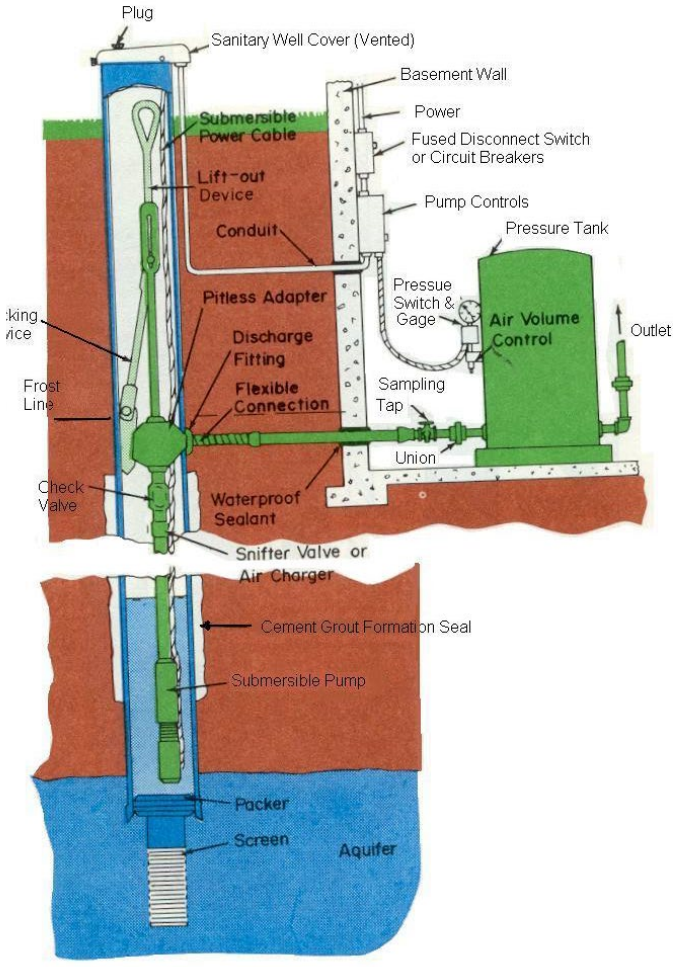


Void in surface seal.

Figure 2. Cement bag seal?

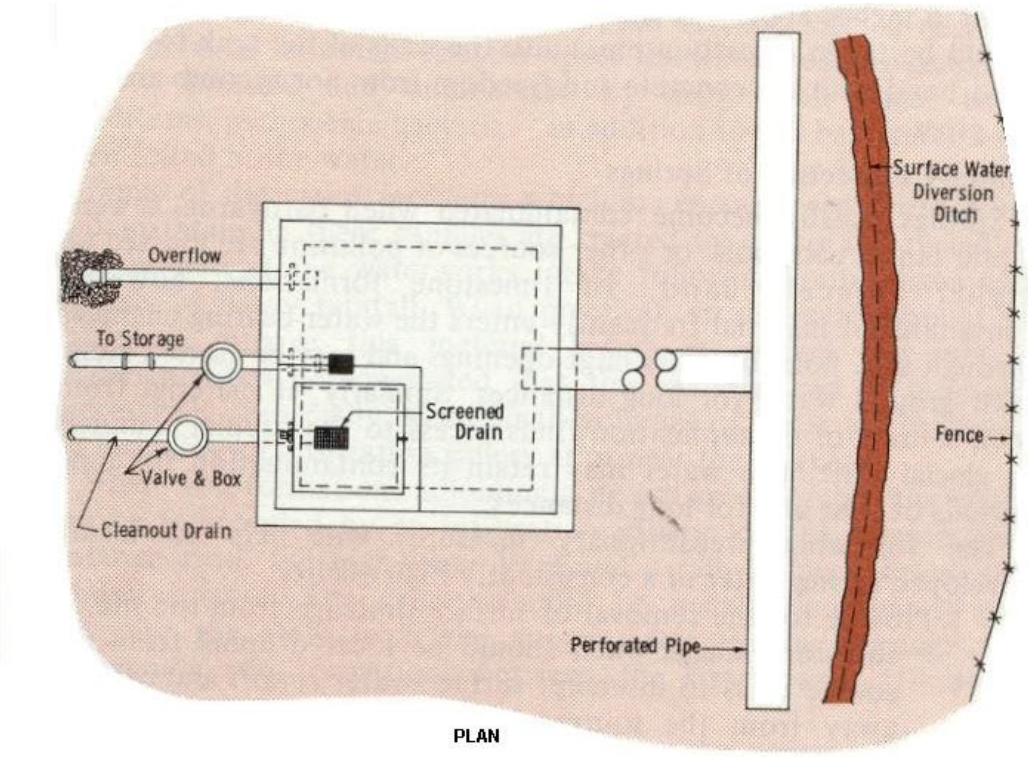


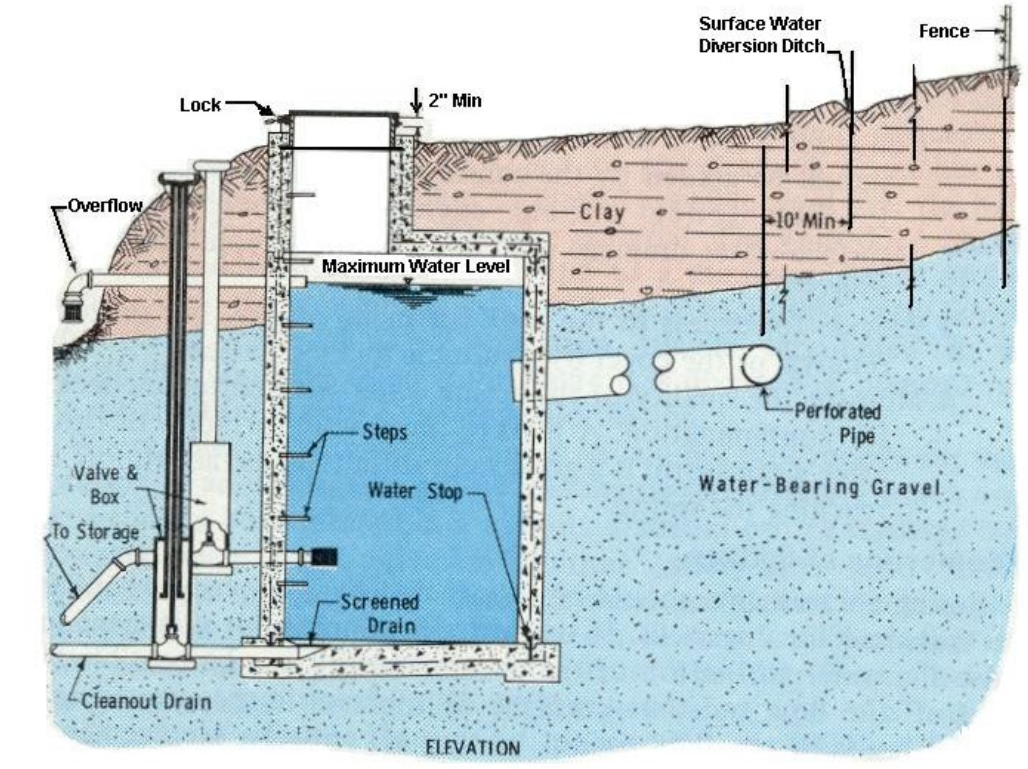
Well seal for jet pump



Pitless adapter with submersible pump

Appendix 3. Spring and Other Source





Spring

Infiltration Gallery

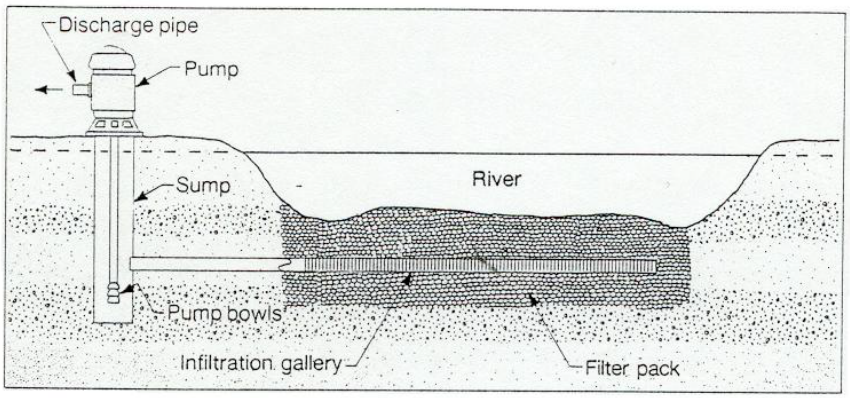


Figure 22.23. Cross section of pump placed in sump of infiltration gallery.

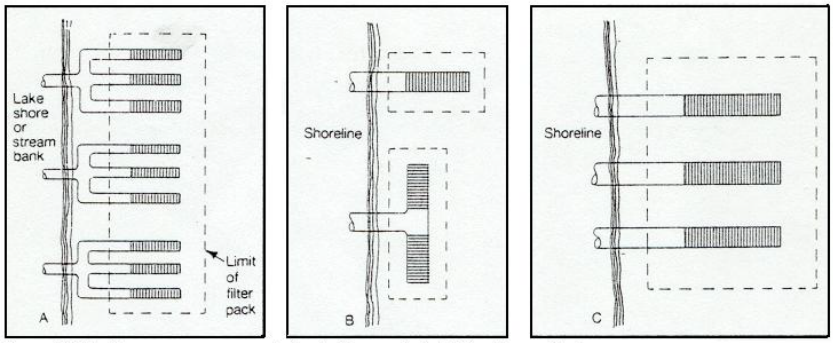


Figure 22.24. Screen arrangements for bed-mounted infiltration galleries

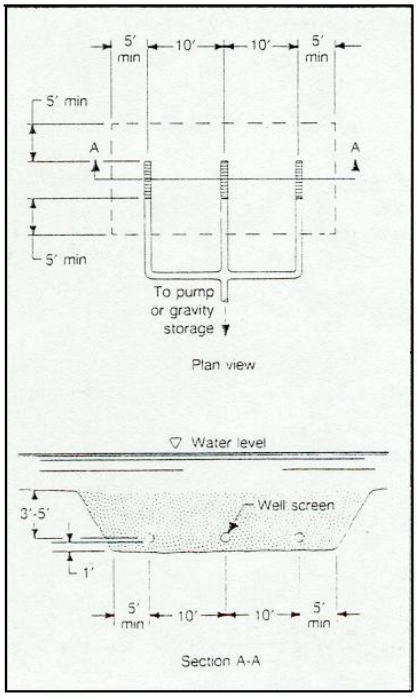


Figure 22.25. Standard spacing and depth setting for infiltration gallery.

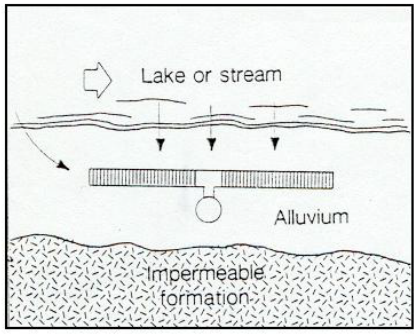


Figure 22.26. On-land infiltration gallery installed adjacent to lake or stream

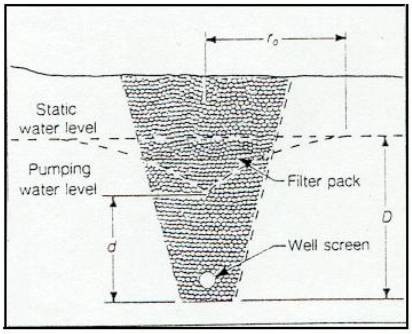


Figure 22.27. Terms used in the equation for determining the flow rate into the screen and the length of the screen

Collector (Ranney) Well

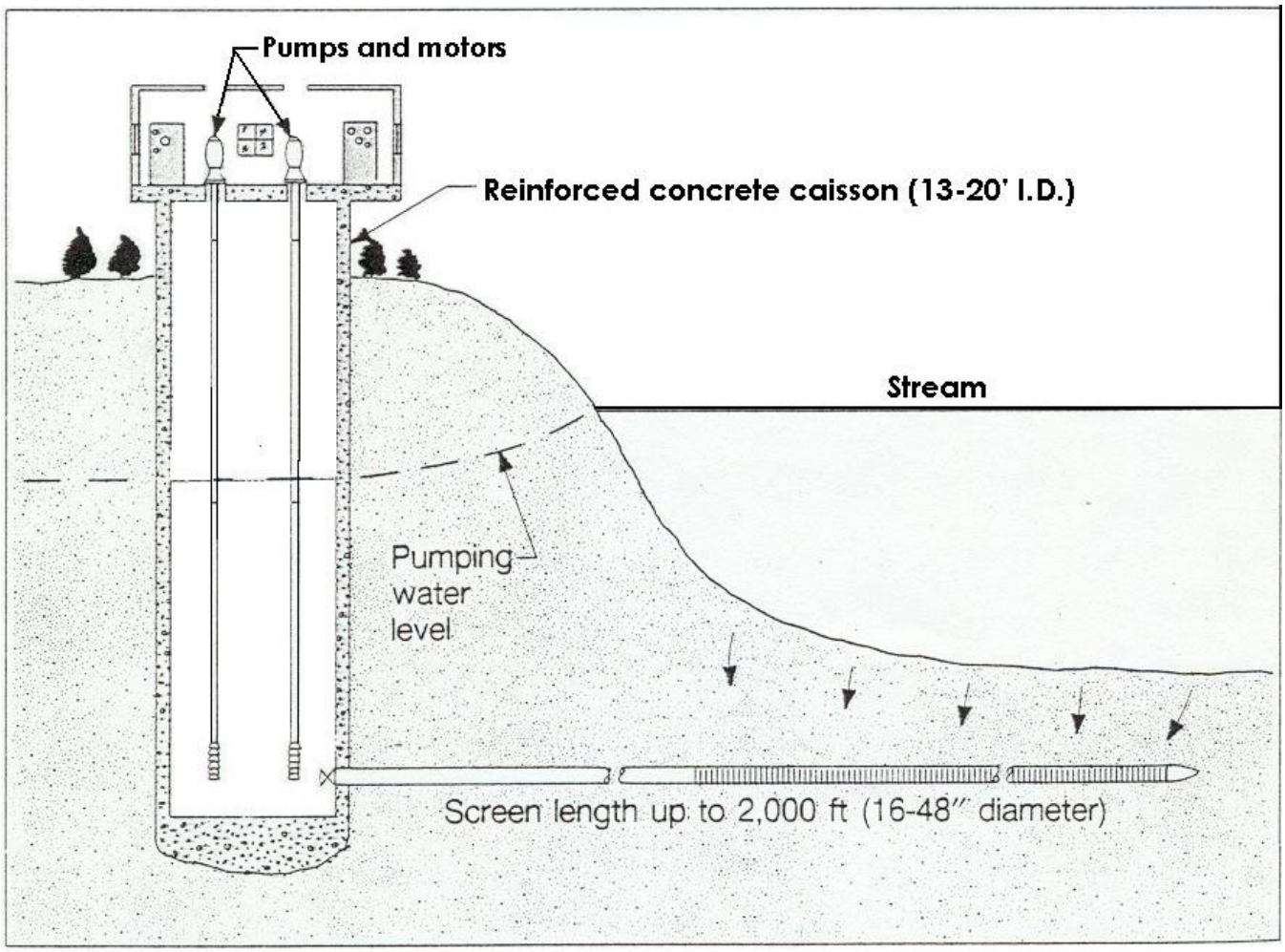
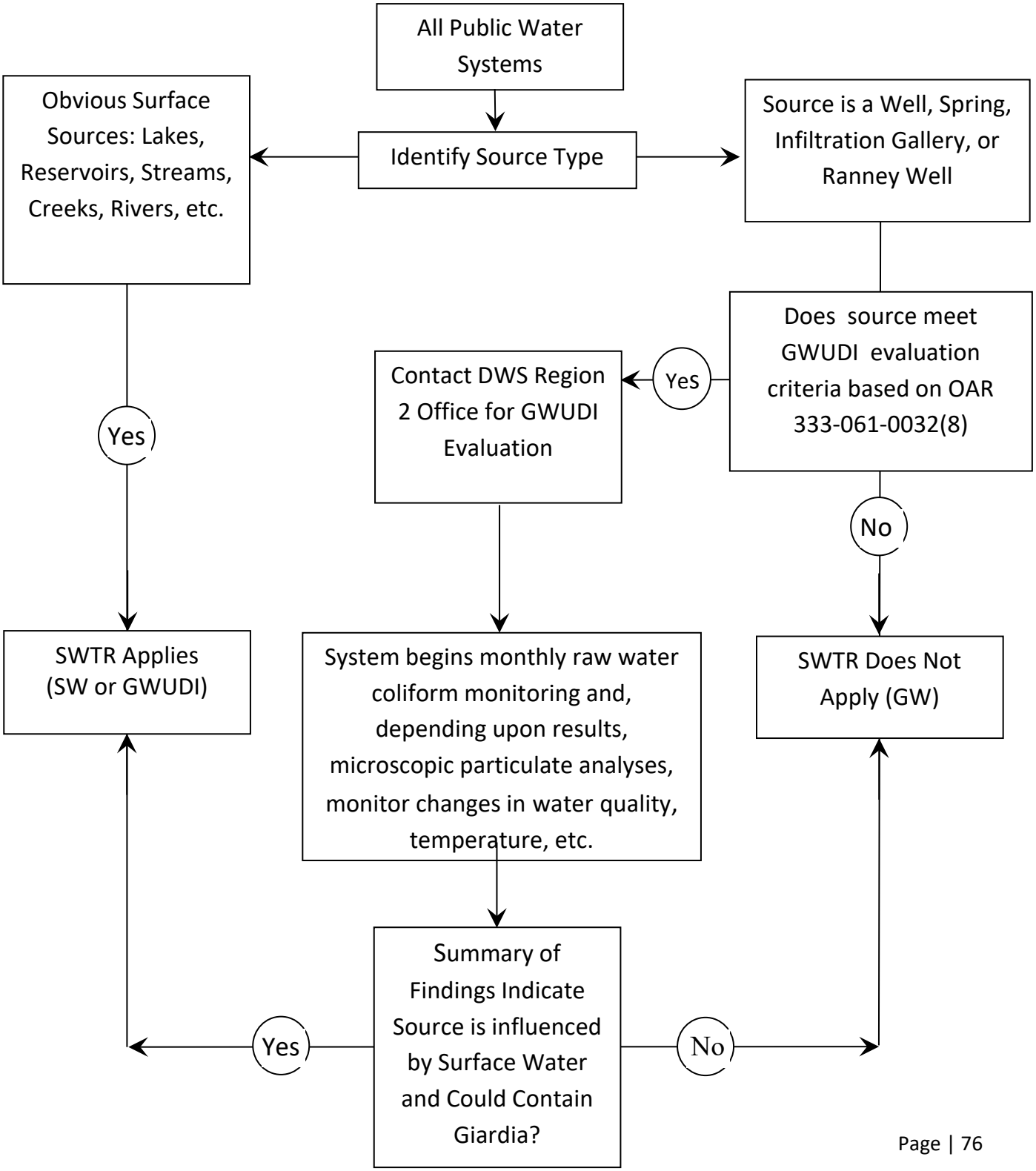
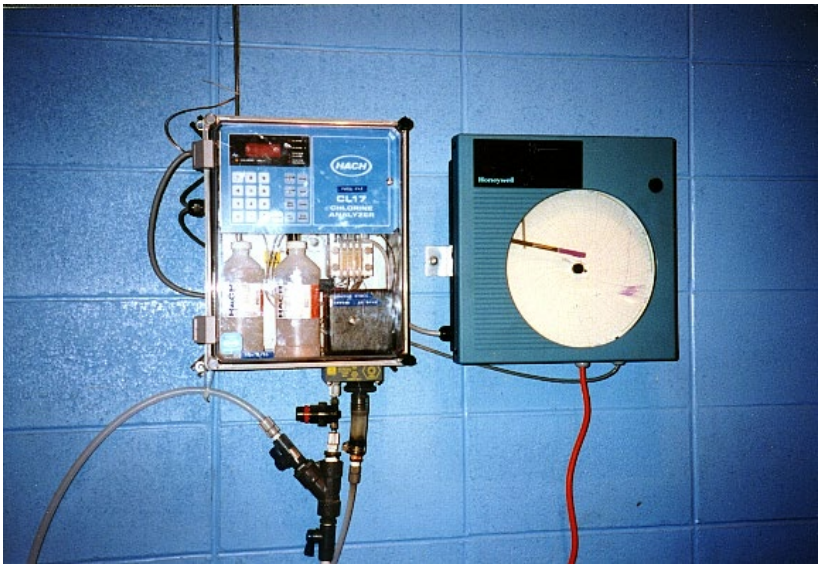


Figure 22.31. Collector well with screen jacked out from a large caisson. *(Hydro Group, Ranney Division)*

Appendix 4 Steps to Determine Source Classification and SWTR Applicability



Appendix 5 Safety Guidelines for Disinfectants and Reservoirs



Safety Guidelines for Disinfectants and Reservoirs

Building requirements for chlorine gas

1. Chlorine gas feeders and gas storage areas shall be enclosed and separated from other operating areas.
2. 100- and 150-pound cylinders need to be restrained by chaining two-thirds of their height from the floor. One-ton cylinders need to be double chocked.
3. The room housing the feeders and cylinders shall be above ground with doors that open outward.
4. The room will be ventilated by mechanical means at floor level and have an air intake located higher than the exhaust ventilation.
5. The room will be located so that if chlorine gas is released it will not flow into any building ventilation systems.
6. Corrosion-resistant lighting and ventilation switches must be located outside the enclosure, adjacent to the door.
7. A platform or hydraulic scale for weighing the cylinders is required.

Additional Guidelines for:

Sodium Hypochlorite and bleach

1. Rubber gloves, apron, and face shield are available for use.
2. Keep hypochlorite and bleach in a safe place protected from vandals.
3. Don’t keep hypochlorite longer than six months.
4. Prevent leakage and clean up any spills quickly.

Calcium Hypochlorite Powder

1. Rubber gloves, apron, and face shield are available for use.
2. Keep safe, dry, and cool.

Reservoirs and vaults

Reservoirs and vaults (booster pump stations located underground, for example) are confined spaces and are subject to confined space rules which may include a permit, an attendee, air testing, and other requirements in order to work inside of them.

These guidelines are not all-inclusive, but rather a list of the most common requirements. Contact OROSHA for a complete list of requirements at 1-800-922-2689.

Appendix 6 Determining Peak Hour Flow

The method of choice for determining chlorine contact time is by a tracer study. This requires the system to increase the amount of disinfectant introduced into the system and recording the time it takes to get to the first user. The system must be operating at maximum flow in order to conduct a tracer study to determine the lowest amount of contact time available. For surface water systems, there are five acceptable methods to obtain a peak hourly flow out of a clearwell or any vessel used for contact time. The acceptable methods were chosen based upon the ability to directly measure or calculate peak hourly flows. These flows are needed for conducting tracer studies. Additionally, these flows are needed to verify that peak hourly flows measured on a daily basis do not exceed 110% of the peak hour flows used at the time of a tracer study. The five acceptable methods and related data sheets are as follows.

1. Clearwell Effluent Flow Meter (peak hour demand flow measurement)
2. Clearwell Effluent Flow Restrictor (maximum liquid flow rate)
3. Clearwell Effluent Pumping Capacity (maximum pumping capacity - all pumps operating)
4. Rate of Change in Clearwell Level (Flow calculations are based upon the rate of change in clearwell levels and clearwell influent flow). Once the peak flow is determined with this method, the flow can be replicated for conducting a tracer study by adjusting influent flows and replicating the drop in clearwell level by opening hydrants or blow-offs.
5. Bernoulli Equation Calculations (neglecting friction losses). Once the peak flow is determined with this method, the flow can be replicated for conducting a tracer study by opening hydrants or blow-offs until the pressure used in line D of worksheet 5 (described below) is replicated at the first user.

Depending upon the applicable alternative chosen, one of the following worksheets should accompany peak hour flow determinations used in a tracer study. For methods 1-4, once a tracer study is completed, if peak hourly flows exceed 110% of the peak hour flow in the tracer study, a new tracer study must be performed. It should be noted that a new tracer is also required if effective volume changes for any reason (e.g., downsize of pipe used for plug flow contact time calculations, installation of a larger clearwell, etc.). For method 5 (Bernoulli Equation), use the Bernoulli Equation Excel worksheet to calculate the pressures that correspond to 110% of the peak hour flow used in the tracer study.

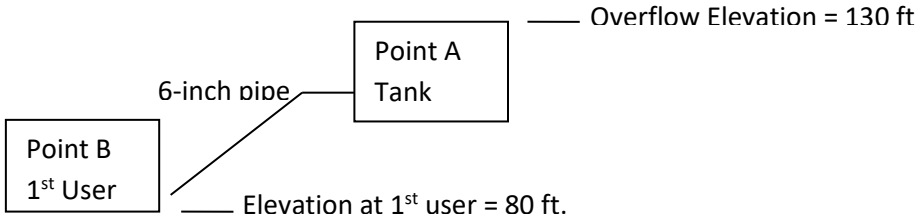
1. Clearwell Effluent Flow Meter Specifications Worksheet		
Meter type*		
Minimum rated flow rate		gpm
Maximum rated flow rate		gpm
Peak hour demand flow		**gpm**

* Differential Pressure, Positive Displacement, Velocity Meter, or True Mass Meter
** The highest peak hour demand flow recorded for the previous 12 months.

2. Clearwell Effluent Flow Restrictor Specifications Worksheet				
Make (if known)				
Model (if known)				
Orifice diameter or size (inches or mm)		Inches		mm
Flow tolerance			%	
Maximum Liquid Flow Rate	**gpm**			

3. Clearwell Effluent Pump Specifications Worksheet		
Maximum rated flow rates:		
Pump #1		gpm
Pump #2		gpm
Pump #3		gpm
Pump #4		gpm
Pump #5		gpm
Pump #6		gpm
Pump #7		gpm
Pump #8		gpm
Total number of pumps available:		**Pumps**
Total capacity (all pumps in service)		**gpm**

4. Rate of Change in Clearwell Level Data Worksheet			
Clearwell influent flow meter/pump specifications:			
Flow meter type (if known) or total number of pumps*			
Minimum rated flow rate (leave blank for pumps) gpm			
Maximum rated flow rate (for pumps, enter the total flow of all the pumps)			gpm
A	Peak hour influent flow based upon the previous 12-months' worth of data (ft.):**		gpm
* Differential Pressure, Positive Displacement, Velocity Meter, or True Mass Meter. Enter the total number of pumps used to pump water into the clearwell or through the filtration plant (max rated capacity). ** The highest peak hour influent flow recorded for the previous 12 months should be reported.			
Clearwell Level Data:			
Indicate how data is captured and recorded (e.g. pressure transducer w/SCADA data capture):			
Highest high water level alarm setpoint (ft): ft			
Lowest low water level alarm setpoint (ft): ft			
B	Maximum clearwell water depth at overflow (ft):		ft
C	Total clearwell volume (gallons):		gal
D	Volume of Water per Foot of Depth (gallons/ft): C/B =		g/ft
E	Maximum operating clearwell water depth (ft):		ft
F	Minimum operating clearwell water depth (ft):		ft
G	Maximum change in clearwell water level (ft): E-F =		ft
H	Highest peak hour drop in clearwell water level based upon the previous 12-months' worth of data. Report dropping clearwell levels as positive numbers in ft/min:		ft/min
I	Highest drop in clearwell level, expressed in gpm: D x H =		gpm
J	Enter the larger of the two values entered in lines A and I (gpm). If the two values in A and I are known to have occurred simultaneously in the previous 12 months or if you wish to use the "worst case" scenario (i.e., you will not have to calculate a value for K, below), add the two values together and enter the result here.		gpm
K	For each hour of recorded measurements during the past 12 months, sum the flow rates going into the clearwell and the flow rates calculated based upon the rate of change in the clearwell and record the maximum calculated flow here (gpm):		gpm
L	**Enter the larger of the two flows in lines J and K Peak hour flow =**		**gpm**

5. Bernoulli Equation Calculations Worksheet (equations neglects friction losses)			
System Diagram (show contact tank/reservoir/clearwell and piping to 1st customer showing any relative elevation differences, pressure regulating valves, and pumping facilities between the contact tank and the 1st user) Example:  			
Tank/Reservoir/Clearwell Information (Point A):			
A	Elevation of max water level in tank (ft) – If unknown, enter the maximum water depth (in feet), enter 0 as the elevation of the 1st user in line "C" below, and record pressure nearest outlet to enter as the pressure for Point B in line "D" below.		ft
B	Pressure maintained inside tank (psi) – If tank is vented to the atmosphere (e.g. not a pressure tank), enter 0.		psi
1st User Information (Point B):			
C	Elevation at first user (ft) – If unknown, enter 0, use max water depth in line A above, and record pressure nearest outlet to enter as the pressure for Point B in line D.		ft
D	Minimum water system pressure at Point B (psi)		psi
E	Pipe diameter (inches) at Point B		in
Calculations:			
F	Difference in elevation between 1st user and tank (ft): A – C =		ft
G	Pressure maintained inside tank (lb/ft$_2$), where 1 ft$_2$ = 144 in$_2$: B x 144 =		lb/ft$_2$
H	Water system pressure at Point B (lb/ft$_2$): D x 144 =		lb/ft$_2$
I	Pipe area (ft$_2$) - πD$_2$/4: (3.14 x E$_2$)/4 =		ft$_2$
J	Velocity at Point B (ft/sec): [(G/62.4) – (H/62.4) + F] x 2 x 32.2]$_{0.5}$ =		ft/sec
K	Flow at Point B (ft$_3$/sec): I x J =		ft$_3$/sec
L	**Peak hour flow at Point B (gpm): 7.48 x 60 x K =**		**gpm**

Estimating Demand for Nonresidential Water Systems

For nonresidential groundwater systems, peak hour demands may be estimated using the following methods.

Nonresidential systems: Typically fall into the NTNC or TNC category. Examples: commercial facilities including retail/wholesale businesses, restaurants, hotels, office buildings, industrial customers that require process water, public facilities such as schools, hospitals, government offices.

The following five methods can be used to estimate demand for nonresidential systems. Staff experience has shown that methods 1 & 2 are the most desirable and should yield similar results. Methods 3 & 4 aren't as "tried and true," however, they can be used to compare with the other methods as desired. Method 5 is for schools only.

Method #1: Fixture Units – Table III

- Count up the total number of fixture units.
- Use the "Instantaneous Flow Demands – Commercial and Industrial" graph to find Total Fixture Units on the x-axis, and then extrapolate up to find "Instantaneous Flow Requirements" in gpm on the y-axis.
- Divide that number by 3 to convert to peak hourly demand flow.

Method #2: Rates of Flow for Certain Plumbing - Table 5-3

- Count up # of each type of fixture from Table 5-3 there are in the system.
- Multiply total number of each fixture type by its corresponding flow rate.
- Add all flow rates together to get a total flow rate for the system in gpm (no conversion factor).

Method #3: Guide for Estimating Average Daily Water Requirements

- Use table with the title above to identify the type of establishment, and then multiply the Average Daily Use (gpd) by the number of users to get total gpd average daily demand.
- Multiply that number by 3-5 (an engineering estimate; 5 is most conservative) to get peak hourly demand flow in gpd.
- Convert gpd to gpm by dividing by 1440.

Method #4: Community Water Systems Source Book

- Use Tables XV and XVI to determine instantaneous flow demand for each type of establishment.
- Divide that number by 3 to convert to peak hourly demand flow.

Method #5: Specifically for Schools:

- Use graph "Instantaneous Demand Flow for School Water Systems".
- Divide that number by 3 to convert to peak hourly demand flow.

Estimating Demand for Recreational Water Systems

Typically fall into the TNC category. Examples: campgrounds, RV parks, seasonal rental units.

- Method #1 most desirable. Use other methods for comparison purposes.

Method #1: Rates of Flow for Certain Plumbing - Table 5-3

- Identify how many of each type of fixture from Table 5-3 there are in the system.
- Multiply total number of each fixture type by its corresponding flow rate.
- Add all flow rates together to get a total flow rate for the system in gpm.

Method #2: Guide for Estimating Average Daily Water Requirements

- Use table with the title above to identify the type of establishment, and then multiply the Average Daily Use (gpd) by the number of users to get total gpd average daily demand.
- Multiply that number by 3-5 (an engineering estimate; 5 is most conservative) to get peak hourly demand flow in gpd.
- Convert gpd to gpm by dividing by 1440.

Method #3: Community Water Systems Source Book

- Use Table XIV to determine instantaneous flow demand for residential areas.
- Divide that number by 4 to convert to peak hourly demand for Recreational areas.

Small Residential Water Systems

Method #1: Small Residential Communities

- Use graph “Instantaneous Demand for Residential Community Water Systems”
- Divide that number by 3 to convert to peak hourly flow.

Method #2: Specifically for Mobile Home Parks

- Use graph “Peak Demand for Mobile Home Park Water Systems”
- Do not divide number.

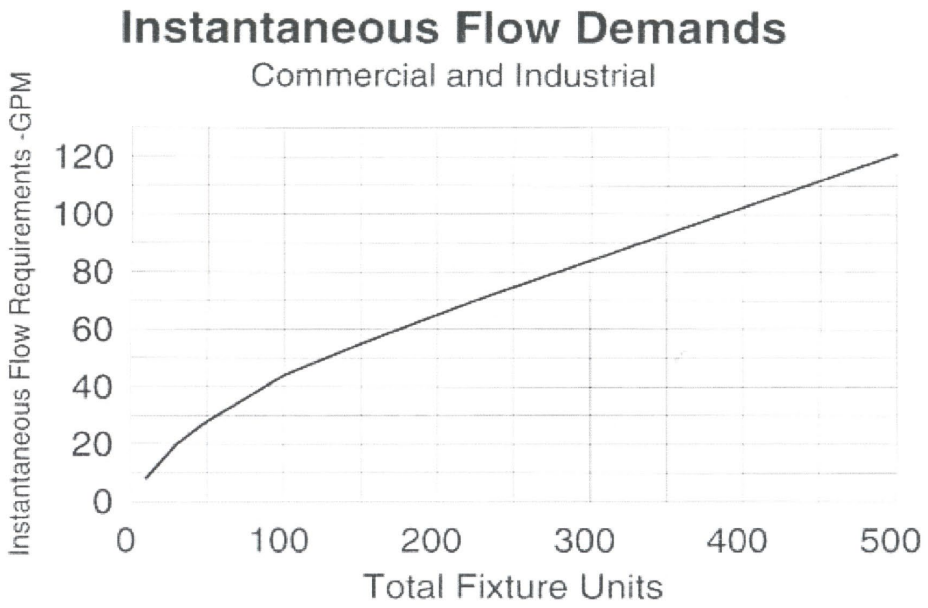
Method #2: Community Water Systems Source Book

- Use Table XIV to determine instantaneous flow demand for residential areas.
- Divide that number by 3 to convert to peak hourly demand flow.

Equivalent fixture nits for water system estimates

TABLE III

Equivalent fixture units for Water System Estimates - Condensed Use Pattern - Commercial & Institutional



Urinal (Stall or Wall Type)		5
Urinal (Flush Tank)		3
Water Closet (Flush Tank)	3	5
Water Closet (Flushometer Valve)	6	(10)

Water supply outlets for items not listed above shall be computed at their maximum demand, but in no case less than:

3/8" outlet	1	2
1/2" outlet	2	4
3/4" outlet	3	6
1" outlet	6	10

Source - Ref. #4

Location	Flow Pressure (1) (*psi)*	Flow Rate (2,3) (gpm)
Ordinary basin faucet	8	2.0
Self-closing basin faucet (1)	8	2.5
Sink faucet, 3/8-inch (10-mm)	8	4.5 (2.5)
Sink faucet, 1/2-inch (13-mm)	8	4.5 (2.5)
Bathtub faucet	8	5.0
• Laundry tub faucet, 1/2-inch (13-mm)	8	5.0
Shower	8	5.0 (2.5)
Ball-cock for water closet (2)	8	3.0 (1.5 gpf)
Flush valve for water closet (2)	15	15.0 - 40.0 (1.5 gpf)
Flushometer valve for urinal (3)	15	15.0 (1.0 gpf)
Garden hose, 50 ft (15-m) (3/4-inch [20-mm] sill cock)	30	5.0
Garden hose, 50 ft (15 m) (5/8-inch [15-mm] outlet)	15	3.33
Drinking fountain	15	0.75
Fire hose, 1-1/2-inch (40 mm) (1/2-inch [13 mm] nozzle)	30	40.0

Notes: 1. Flow pressure is the pressure in the supply near the faucet or water outlet while the faucet or water outlet is wide open and flowing. Flow pressure is measured in pounds per square inch.

2. Washington State 1993 Plumbing Code Standards shown in parentheses "( )".

    1. Lavatory by general public, excluding handicap stations, **must** have spring valve self-closing faucets.
    2. Includes Flushometer and Electrochemical hydraulic toilets.
    3. Urinals or water closets with continual flushing are not permitted.

3. 3. gpf = gallons per flush

Source: Adapted from ***Design and Construction of Small Water Systems: A Guide for Managers***, American Water Works Association, 1984.

Guide for Estimating Average Daily Water Requirements*

(Adapted from various sources for small water systems)

Table of Establishment	THE UNIT IS PER PERSON UNLESS OTHERWISE STATED	**Average Daily Use (gpd)**
Airport (per passenger)		3-5
Assembly Halls (per seat)		2
Camps	– Child, overnight, central facilities	40-50
	– Construction	50
	– Migrant labor	35-50
	– Day type, no meals served	15
Churches (per member)		1
Cottages, seasonal occupancy		50
Clubs	– Residential	100
	– Nonresidential	25
Factories, sanitary uses, per shift		15-35
Food Service	– Restaurants	7-10
	– With bars	9-12
	– Fast food	2
Highway Rest Areas		5
Hotels (2 persons per room)		60
Institutions	– Hospitals (per bed)	250-400
	– Nursing Home (per bed)	150-200
	– Others	75-125
Office Buildings		15-30
Laundries, self-service (per customer)		50
Motel (per bed)		60
Parks	– Day use (with flush toilets)	5
	– Mobile homes (per unit)	200
	– Travel trailers (per unit)	90-100
Picnic Areas (with flush toilets)		5-10
Residential Communities		
	– Multi-family (per bedroom)	120
	– Rooming houses and tourist homes type (per bedroom)	120
	– Single family type (per house)	400
Resort Motels and Hotels		75-100
Retail Stores (per toilet room)		400
Schools	– Day, no showers or cafeteria	15
	– Day, with cafeteria	20
	– Day, with showers and cafeteria	25
	– Residential types	75-100
Shopping Centers per sq. ft. sales area		0.16
Swimming Pools and Beaches		10
Theaters	– Drive-in (per car)	3-5
	– Others (per seat)	3

* The values listed area for normal water requirements and do not include special needs or unusual conditions. To estimate peak hourly demand, multiply the average daily demand by 3-5 (an engineering estimate of peak hourly demand is 3-5 times the average daily demand).

Instantaneous Water Demands for Commercial Areas

Type of Institution	Basis of Flow Demand
Barber Shop	1.5 gpm per chair
Beauty Shop	1.5 gpm per chair
Dentist Office	2.0 gpm per chair
Department Store *	0.5 -1.0 - 1.5 gpm per employee
Drug Store	3.0 gpm
With Fountain Services	add 3.0 gpm
Serving Meals	add 1.0 gpm per seat
Industrial Plant **	0.5 gpm per employee
Laundry	20.0 - 40.0 - 60.0 gpm
Launderette	5.0 gpm per unit
Meat Market, Super Market	1.0 gpm per 100 square feet floor area
Motel, Hotel	2.0 gpm per unit
Office Building*	0.2 gpm per 100 square feet floor area
Physician's Office	2.0 gpm per examining room
Restaurant	1.0 gpm per seat
Single Service	3.0-6.0-10.0 gpm
Drive-In	0.5-1.0-3.0 gpm per car space
Service Station	3.0-5.0-8.0 gpm per wash rack
Theatre	0.3-1.0-2.0 gpm per seat
Drive-In	0.4 gpm per care space
Other Establishments ***	0.3-1.0-3.0 gpm per employee

* Including customer service.
** Not including process water.
*** Non-water using establishments.

Source: *Community Water Systems Source Book – Fifth Edition*. Joseph S. Ameen, 1980

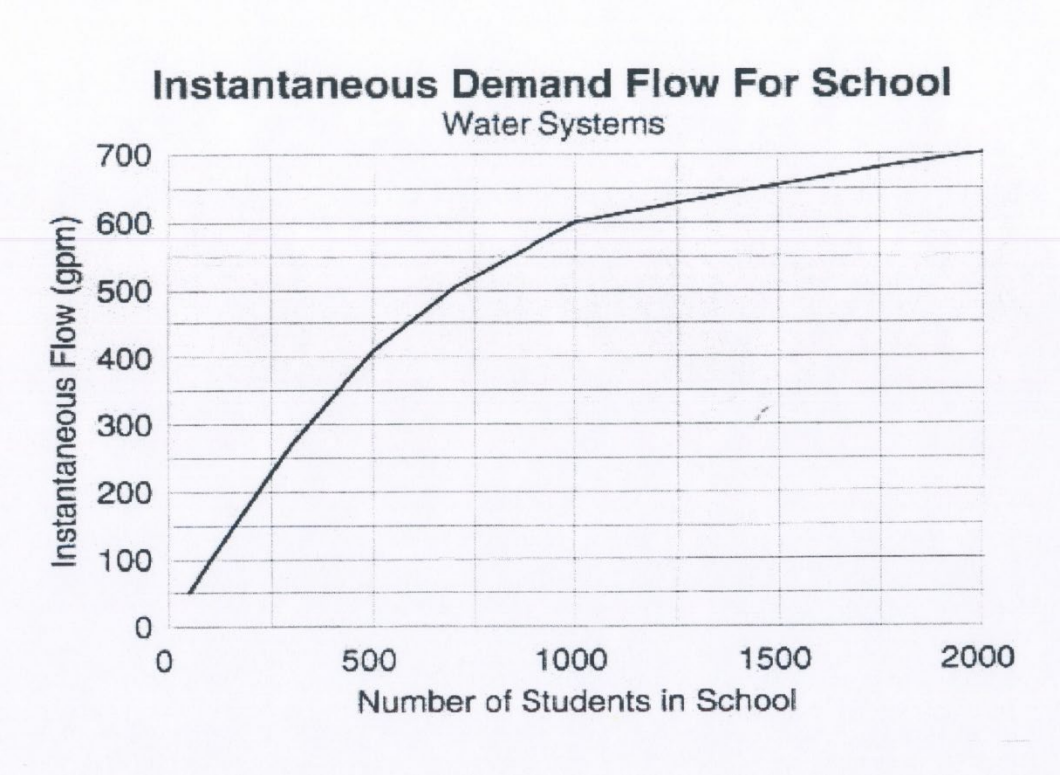
Instantaneous Water Demands for Institutions

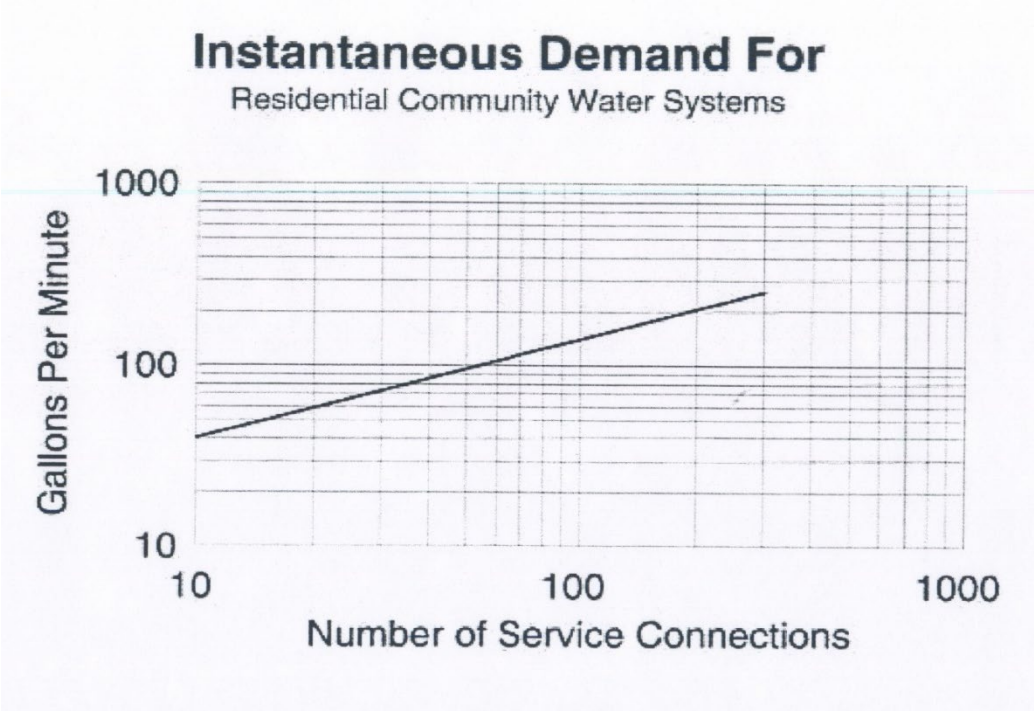
Type of Institution	Basis of Flow Demand
Boarding Schools, Colleges	1.0 gpm per student
Churches	0.2 gpm per member
Clubs, Civic	0.4 gpm per member
Clubs, Country	0.6 gpm per member
Hospitals	4.0 gpm per bed
Nursing Homes	2.0 gpm per bed
Prisons	1.0 gpm per prisoner
Rooming Houses	1.0 gpm per roomer
Summer Camps	0.2 gpm per camper

SCHOOLS: DAY, ELEMENTARY, JUNIOR, SENIOR

Number of Students	GPM Per student	Number of Students	GPM Per Student
0-50	1.0	800	0.68
100	0.97	900	0.66
200	0.94	1,000	0.60
300	0.90	1,200	0.52
400	0.86	1,400	0.46
500	0.82	1,600	0.41
600	0.78	1,800	0.38
700	0.72	2,000	0.35

Source: *Community Water Systems Source Book – Fifth Edition*. Joseph S. Ameen, 1980


Instantaneous Demand Flow For School
Water Systems
Instantaneous Flow (gpm)
700
600
500
400
300
200
100
0
0
500
1000
1500
2000
Number of Students in School


Instantaneous Demand For
Residential Community Water Systems
Gallons Per Minute
1000
100
10
10
100
1000
Number of Service Connections

Instantaneous Water Demands for Residential Areas

Total Number of Residences Served	GPM Per Residence	Total Number of Residences Served	GPM Per Residence
5	8.0	90	2.1
10	5.0	100	2.0
20	4.3	150	1.6
30	3.8	200	1.3
40	3.4	300	1.2
50	3.0	400	0.9
60	2.7	500	0.8
70	2.5	750	0.7
80	2.2	1,000	0.6
RV Camps – Sites use ¼ of above			

Source: *Community Water Systems Source Book – Fifth Edition*. Joseph S. Ameen, 1980

Appendix 7 Treatment

CT requirements & Calculations

CT values are a way to make sure that disinfection is working properly, meaning it is actually killing the pathogenic microorganisms it is supposed to. Any system that uses a disinfectant should understand the concept of CTs. It does not stand for contact time, as is commonly thought.

CT = **C**oncentration of chlorine **X** contact **T**ime

Inactivation or removal of pathogens using disinfection or filtration is measured in terms of "log" inactivation. This is a form of a percentage of pathogens inactivated. It is easy to remember by counting the number of nines.

1.0 log = 90%
2.0 log = 99%
3.0 log = 99.9%
4.0 log = 99.99%

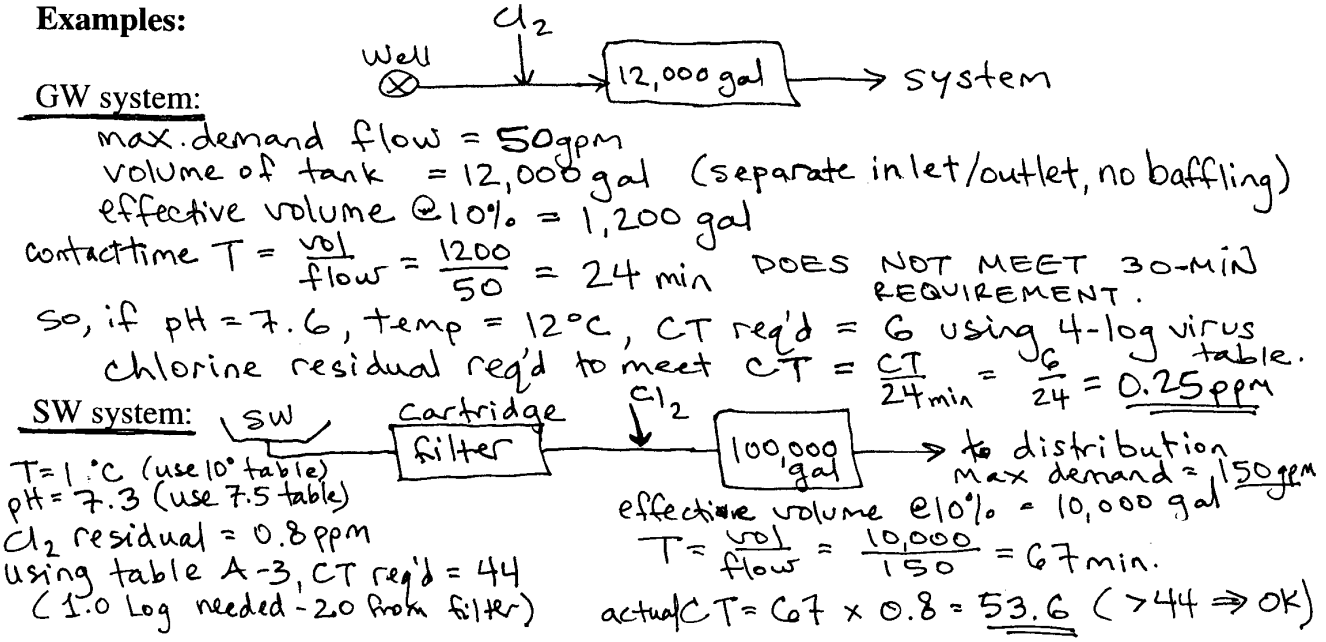
A. Groundwater sources: It is important first to know why the system is disinfecting. If they need to disinfect for source-related coliform or viruses, they have the choice of either:

1. 30 minutes contact time
    a. A popular choice for systems that have contact time and/or don't want to deal with CT calculations every day.
    b. This requirement is based on a 0.2 ppm residual X 30 minutes = CT of 6. This is based on inactivation of coliform bacteria.
    c. Contact time is calculated by: effective volume (See section on Storage reservoirs) divided by the maximum demand flow (See graphs in Source section if unknown), as in example below.
    d. If disinfection facilities went through plan review, contact time is considered during the review process. Review plan review letter and note if it was constructed according to plan (volume, flow....).
2. 4-log removal of viruses
    a. Using the temperature, pH, and chlorine residual (all measured at the first user), consult the CT tables (provided) for the CT requirement.
    b. Determine the lowest allowable chlorine residual by dividing the contact time by the CT requirement.
    c. Review residual records to make sure the concentration never drops below this number.
    d. 4-log removal of viruses will also inactivate coliform bacteria to a sufficient degree.

B. Surface Water Sources

1. The requirement in the Surface Water Treatment Rule (SWTR) is 3.0 total log removal of giardia, using a combination of disinfection and filtration (unless exempted - Portland, Bend, Baker City, and Reedsport).Some removal credit is given for the filtration (2.5-log for conventional and 2.0 for direct and all alternative methods including cartridge filtration IF they are being operated properly). Refer to the latest Comprehensive Performance Evaluation for removal credit given.
3. To get the disinfection requirement, subtract filtration log removal from 3-log.
4. The temperature in Centigrade, pH, and chlorine residual should be taken at the first user each day.
5. To find the CT required,
    a. Find the page that represents the type of disinfectant and the temperature. If it is not exactly what is provided, use the lower temperature (i.e., if the temperature is 8ı C use the 5ı C table). For the mathematically inclined, the numbers can be linearly interpolated for the exact value.
    b. Find the box with the correct pH. Use the higher pH if it doesn't match exactly!
    c. Using the column with the correct log-removal, follow down the column to the appropriate chlorine residual. This value is the CT requirement for that day.
6. To calculate actual CT, multiply actual chlorine concentration by the contact time. Time = effective volume (See Storage section) divided by the maximum demand flow rate, or as determined by a tracer study (See reference in this section). See example below.
7. CT calculations must be done every day!

Examples:



Tracer Study Procedures
Continuous Feed or Step-Dose Method

The purpose of a tracer study is to determine the actual amount of contact time provided in the system during peak flow conditions and minimum contact volume, from the point of disinfection to the first user. Estimates can be calculated, but the degree of short-circuiting is only approximately known unless a tracer study is conducted.

Step 1: The test must be conducted during the **peak demand flow** on the system. Important: This is the peak flow leaving the reservoir or contact chamber, which is not necessarily the same as what comes from the well or through the filtration plant. The study can be done at the known peak flow time (in the morning or early evening), or the effluent pumps can be set for peak flow, if possible. It is also important that the study be conducted **when the reservoir or contact chamber is at the lowest level**, to represent the worst-case scenario.

Step 2: Choose a chemical to use. It is easiest to use something on hand already. Common choices are chlorine or fluoride. Make sure the proper testing equipment is available (chlorine or fluoride test kits).

Step 3: Prepare the data collection sheets in advance. Include columns for time, concentration, a space for the background concentration, and applied concentration.

Step 4: The tracer study parameters and procedure proposal should be submitted to and approved by DWS prior to conducting the study.

Step 5: If using a chemical that already exists in the system at background levels (e.g., chlorine), record this background dosage and residual at the first user before beginning the study.

Step 6: Set the time for zero when the concentration of the tracer study chemical is applied at the normal point of injection for disinfection. This concentration must be consistent at all times throughout the study.

Step 7: Record the concentration of the tracer study chemical at the first user and the time. Tests should be done every minute or so, perhaps as frequently as possible. When the concentration increases by 10% of the additional concentration added, this is used as the contact time. For example, if the system normally is chlorinated at 0.5 ppm and during the tracer study it is increased to 2.5 ppm (a difference of 2.0 ppm), the increase you would be looking for is 10% of 2.0, or 0.2 ppm. So in this example, when the residual reaches 0.7 (0.5 + 0.2) ppm, that is the contact time provided. It is best to continue testing the concentration to make sure it was a good reading, and the concentration indeed is increasing as time goes on. Sometimes the

concentration may inexplicably go up and down before it consistently increases.

Step 8: Keep records of absolutely everything that was done, for future reference. A written report of procedures should accompany all data to justify the conclusion of the tracer study (the actual contact time).

Step 9: Submit the tracer study results to the county health department and DWS for review and approval.

For further information and details, contact DWS or refer to EPA's SWTR Workshop Manual or AWWA Research Foundation's Tracer Studies: Protocol and Case Studies

Recommended Pump Calibration Procedure

1. Isolate pump from system.
2. Fill up column with solution.
3. Turn on pump, set pump output.
4. Time fluid drop in level in column.
5. Convert mLs/min to gph or gpd.

$$\frac{mLs\ hr\ /\text{min} x\ 60\ \text{min}/\ hr}{3.785 mls/\ gal} = gph$$

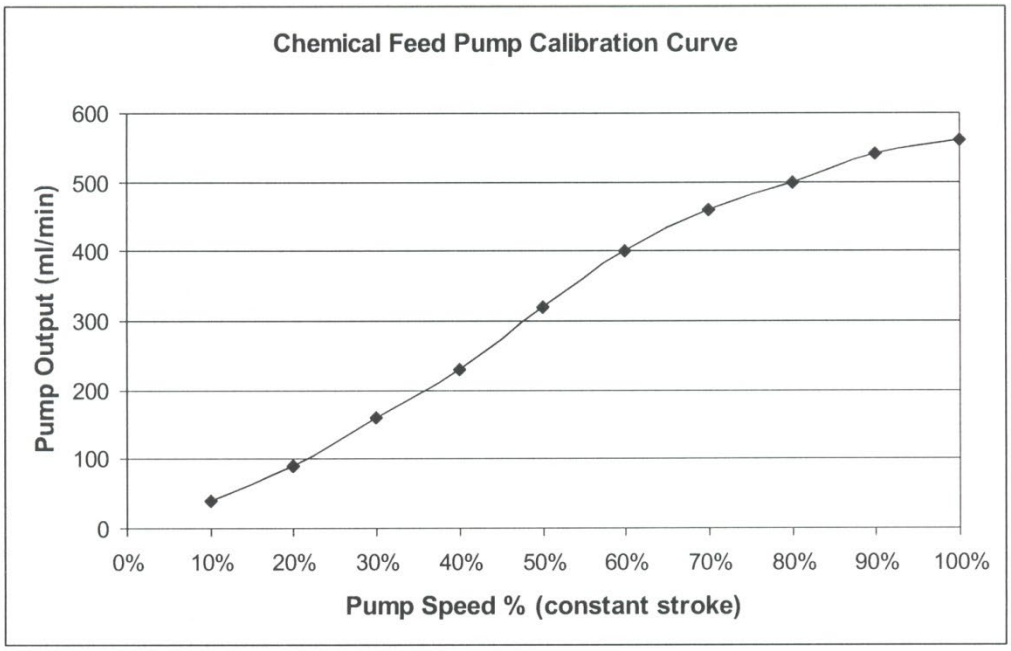
6. Graph setting vs. output (see attached example graph). Keep the stroke constant and use speed at full range for calibration (from 10% - 100% in 10% increments). Pump curve should be smooth and fairly linear. A bouncing or jagged pump curve indicates the pump needs maintenance and re-calibrated. Maintenance needed may include cleaning, diaphragm replacement and/or seal replacement.
7. Repeat calibration process at least annually. Keep records onsite.
8.

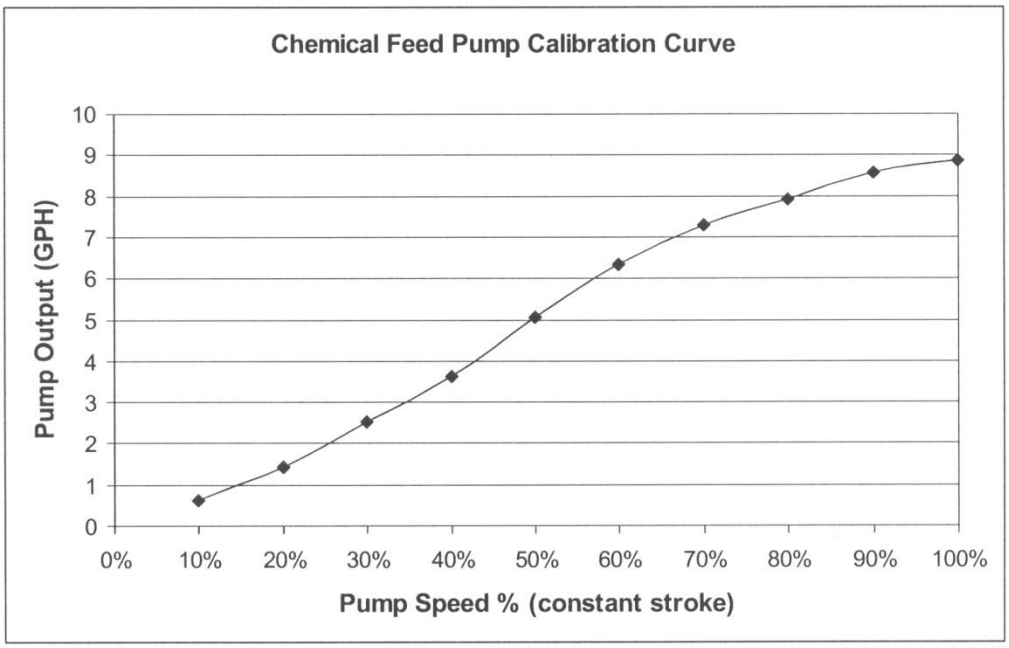
Example Calibration Data Sheet:

Chemical Feed Pump Calibration
Pump Calibration Data

Setting	Time	Volume	Flow Rate	Flow Rate
% Speed	Minutes	ml	ml/min	GPH
10%	**3**	120	40	0.63
20%	**3**	270	90	1.43
30%	**3**	480	160	2.53
40%	**3**	690	230	3.64
50%	**3**	960	320	5.07
60%	**1**	400	400	6.34
70%	**1**	460	460	7.29
80%	**1**	500	500	7.92
90%	**1**	540	540	8.55
100%	**1**	560	560	8.87

Calibration Graphs: Pump Output vs. Pump Speed





Corrosion Control Treatment Alternatives

Precipitation: Insoluble compounds are formed by adjusting H2O chemistry to cause precipitation of compounds onto pipe wall - success depends on the ability to form a precipitate in the water column and the characteristics of the deposited precipitate.

Passivation: less soluble metal compounds are formed by the introduction of carbonates or phosphates, which adhere onto pipe wall.

The main difference in these alternatives is the mechanism of protective film formation:

pH/alkalinity adjustment: encourages the formation of less soluble metal complexes by passivation:

pH/alkalinity adjustment method relies on the formation of less soluble metal species consisting of hydroxyl-carbonate compounds.

Complexes formed:

- Hydroxyl (OH)
- Carbonate (CO3)
- Bicarbonate (HCO3)
- Orthophosphate (PO4)
- Silicate (SiO2)

Minimum Pb/Cu solubility occurs at high pH conditions (9.8) and low alkalinity (30-50 mg/l as CaCO3); however, Cu solubility appears to be more strongly related to pH than alkalinity.

Ca Hardness Adjustment: adjusts the Ca-CO3 system equilibrium to cause CaCO3 precipitation.

Corrosion Inhibitors: specially formulated chemicals with the ability to form metal complexes thus reducing corrosion:

- Orthophosphates

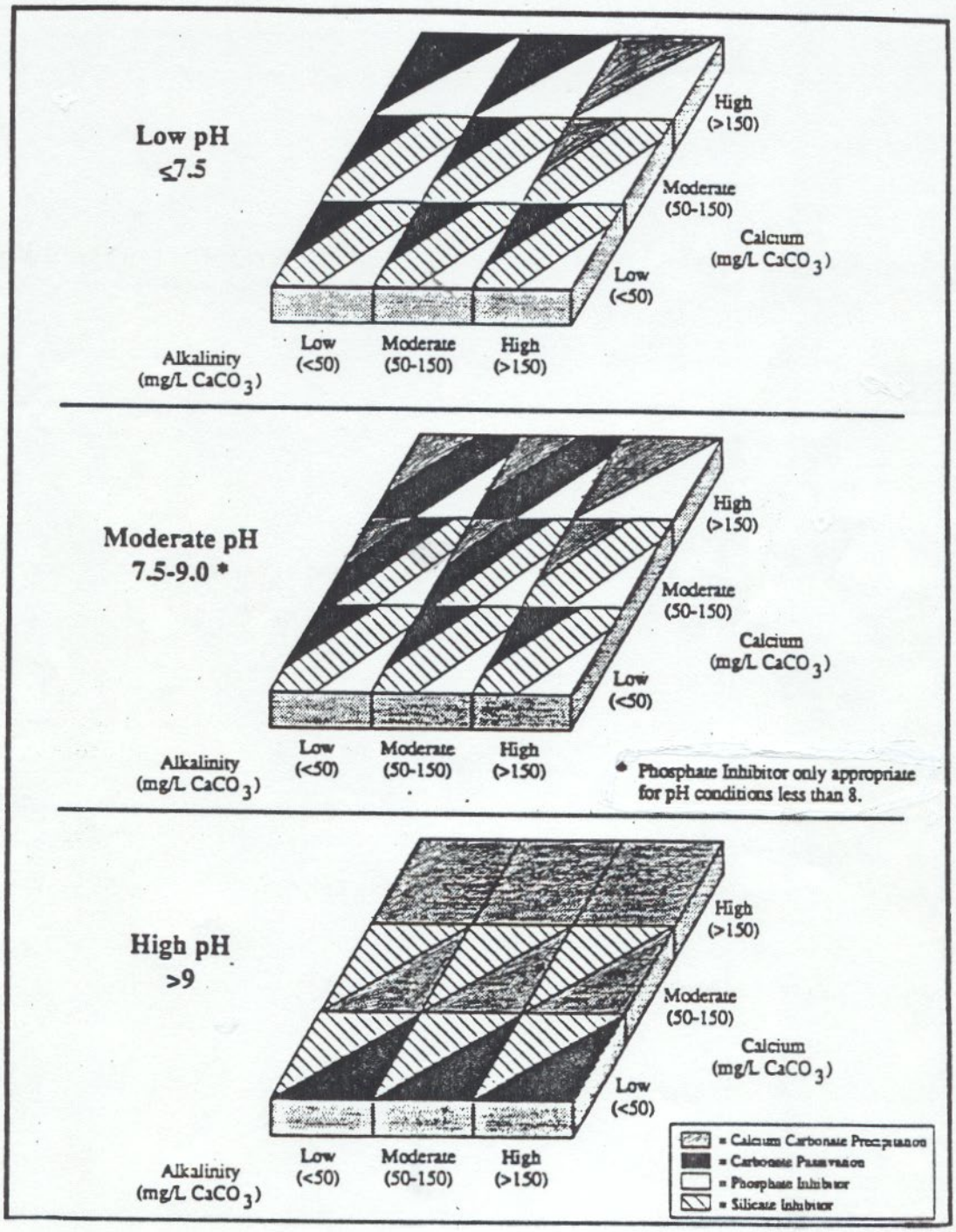


Figure 3-7. Suggested Corrosion Control Approaches Based on Water Quality Characteristics

CHEMICAL FEED CALCULATIONS

Chemicals such as coagulants, flocculants, and filter aids must be used in water treatment to effectively remove colloidal particles from the water. To use these chemicals properly, it is necessary to understand the calculations necessary to prepare stock solutions to be used in jar testing and to determine the appropriate feed rates in the plant. These calculations for alum and polymers are explained in the following paragraphs.

ALUM

Alum Stock Solutions

When conducting a jar test to determine the optimum alum dosage, it is necessary to add varying amounts of alum to the jars. Since the bulk liquid alum is very concentrated, it is necessary to prepare a diluted stock solution. To simplify the addition of alum, it is best if the stock solution contains a concentration of alum so that an even volume of stock solution added to the test jar will result in the desired alum dosage. For example, if the stock solution is made up of a concentration of 5 gm/L (5 mg/mL), adding 1 mL of stock solution will add 5 mg of alum to the jar. If the test jar contains 1 liter, the resulting dosage will be 5 mg/L. Likewise, adding 2 mL to a 1-liter test jar will provide a dosage of 10 mg/L, etc. The procedures for making stock solutions from dry and liquid alum are presented below.

Stock Solution from Liquid Alum

An alum stock solution may be prepared using liquid alum by following the procedure below.

1. Determine the concentration of alum by weighing samples or by reviewing the truck driver's load slip.

   a. Determine the specific gravity of alum by weighing as follows:
   Weigh three 10-mL samples of alum on an analytical balance and calculate the average specific gravity.
   For example, assume the average weight of the 10 mL samples is 13.303 gm. The specific gravity is then 1.3303 gm/mL.

   b. Determine the concentration by reviewing the load slip. For example, the information reveals the liquid alum being delivered is 48.18 percent dry alum.

Using Table 1, the specific gravity is then 1.3303 gm/mL.

2. Determine the equivalent amount of alum in the solution and the pounds of dry alum per gallon using Table 1.
   For example:
   - @ specific gravity (sp gr) of 1.3303
   - The percent of dry alum = 48.18%
   - The lbs of dry alum per gallon = 5.34 lb/gal

3. Determine the dilution of the stock solution. The following table can be used to determine the desired dilution, either as a percent by weight solution or a weight per unit volume solution.

SOLUTION (%)	CONCENTRATION (mg/L)	mg/L DOSAGE PER mL OF STOCK SOLUTION ADDED: To 1 liter jar	To 2 liter jar
0.1	1,000	1	0.5
0.2	2,000	2	1.0
0.5	5,000	5	2.5
1.0	10,000	10	5.0
1.5	15,000	15	7.5
2.0	20,000	20	10.0

4. Prepare the stock solution by a percent solution method, which is a generally accepted method or by a volumetric solution method.

a. Percent Solution Method.

Assume a 0.1% (1,000 mg/L) solution is desired, or every mL of stock solution added to a 1-liter jar equals 1 mg/L.

Sp gr of alum (from above) = 1.3303 gm/mL

Concentration = 5.34 lb/gal

The amount of bulk alum solution that must be added to prepare a 1-liter stock solution may be calculated by using the relationship below.

$$\text{mLs chemical} = \frac{(\%\ \text{solution}) \times (\text{mL solution}) \times (8.34\ \text{lb/gal})}{100 \times (\text{concentration of chemical, lb/gal})}$$

where
- mL chemical = amount of liquid alum that must be added to prepare the desired stock solution.
- % solution = desired weight percent stock solution.
- mL solution = desired volume of stock solution.
- 8.34 lb/gal = weight of water.
- concentration of chemical = concentration of alum being used (obtain from supplier/manufacturer).

In the above example:

$$\text{mL chemical} = \frac{(0.1\%) \times 1{,}000\ \text{mL} \times 8.34\ \text{lb/gal}}{100 \times 5.34\ \text{lb/gal}}$$

$$= 1.56\ \text{mL}$$

b. Volumetric Solution Method.

Assume 1,000 mg/L (0.1%) solution is desired, or every mL of stock solution added to a 1-liter jar equals 1 mg/L.

Sp gr of alum (from above) = 1.3303 gm/mL

Concentration = 640.938 gm/L (from Table 1)

The amount of bulk alum solution that must be added to prepare a 1-liter stock solution may be calculated by using the relationship below.

$$V_1 \times C_1 = V_2 \times C_2$$

$$V_1 = \frac{V_2 C_1}{C_1}$$

where
- V_1 = Volume of bulk alum solution in mL that must be added to 1,000 mL water to form alum stock solution.
- C_1 = Concentration of bulk alum solution in mg/L
- V_2 = Volume of alum stock solution (1,000 m/L)
- C_2 = Concentration of alum stock solution required (1,000 mg/L)

Determine C_1 by converting concentration of bulk alum to mg/L:

$$\text{mg/L alum} = 640.938\ \text{gm/L} \times 1{,}000\ \text{mg/gm}$$

$$= 640{,}938\ \text{mg/L}$$

Therefore:

$$V1 = \frac{(1{,}000\ \text{mL} \times 1{,}000\ \text{mg/L})}{640{,}938}$$

$$V1 = 1.56\ \text{mL}$$

Therefore, the alum stock solution is made up by placing 1.56 mL of alum into a 1,000-mL flask and filling the flask with water to the 1,000-mL mark.

NOTE: When preparing stock solution, the water used to dilute the chemical should be the same as in actual plant conditions. For example, if alum is diluted with plant treated water prior to application, plant treated water should be used to prepare stock solutions. If alum is fed neat (i.e., undiluted), stock solutions should be prepared with distilled or demineralized water.

Stock Solution from Dry Alum

An alum stock solution may be prepared using dry alum by following the procedure below.

1. Determine the desired concentration of alum stock solution (see Item 3 above).
2. Add the appropriate amount of alum to a given volume of water to make the desired stock solution. The amounts of alum that must be added to 1-liter and 2-liter volumetric flasks to obtain various solutions are presented below.

% SOLUTION (%)	CONCENTRATION (mg/L)	mg OF ALUM ADDED: TO 1 LITER JAR	mg OF ALUM ADDED: TO 2 LITER JAR
0.1	1,000	1,000	2,000
0.2	2,000	2,000	4,000
0.5	5,000	5,000	10,000
1.0	10,000	10,000	20,000
1.5	15,000	15,000	30,000
2.0	20,000	20,000	40,000

3. Add the appropriate amount of dry alum and fill the container to either the 1- or 2-liter mark with demineralized, distilled, or tap water (see above note).

4. For other volumes of stock solutions, the following formula can be utilized:

a. $$\text{gm alum} = \frac{(\%\ \text{solution}) \times \text{mL solution}}{100}$$

where % solution = desired weight percent stock solution.
mL solution = desired volume of stock solution.

For example, the grams of dry alum required to make up 1 liter (1,000 mL) of 1 percent stock solution can be calculated as follows:

$$\text{gm alum} = \frac{(1\%) \times 1{,}000}{100}$$
$$= 10 \text{ gm or } 10{,}000 \text{ mg}$$

b. $$\text{gm alum} = \frac{(\text{solution concentration}) \times \text{mL solution} \times 1 \text{ gm}}{10{,}000 \text{ mg}}$$

where Solution concentration = Desired solution concentration in mg/L
mL solution = Desired volume of stock solution

For example, the grams of dry alum required to make up 1 liter (1,000 mL) of 10,000 mg/L stock solution can be calculated as follows:

$$\text{gm alum} = 10{,}000 \text{ mg/L} \times 1 \text{ L} \times \frac{1\text{gm}}{1{,}000 \text{ MG}}$$
$$= 10 \text{ gm}$$

Treatment Plant Alum Dose

The desired alum dose should be determined by jar testing, pilot filters, zeta meter, or other means. Once the dose is determined, calculations must be done to set the chemical feed pumps or dry chemical feeders.

Liquid Alum Feeders

Typically, the chemical feed pump rate is determined by pumping into or out of a graduated cylinder that has the gradations marked in milliliters. As a result, the chemical feed rate in mL/min must be calculated. This can be done as follows.

Assume:

Plant flow = 5 mgd

Alum dose = 10 mg/L

Alum dosage = 5 mgd x 8.34 x 10 mg/L

= 417 lb/day

Convert the dosage in lb/day to mL/min as follows:

Alum dose = 417 lb/day x 1 day/1,440 min x gal/5.34 lb x 3,785 mL/gal

= 205 mL/min

For any flow rate, the alum addition may be calculated as follows:

$$\text{mL/min} = \frac{(\text{lb/day alum})\ (3{,}785\ \text{mL/min})}{(\text{alum concentration in lb/gal})\ (1{,}440)}$$

Dry Alum Feeders

Determine the alum dose in lb/day required, as shown in the example for liquid alum.

Alum dose = 5 mgd x 8.34 x 10 mg/L

= 417 lb/day

From the feeder calculation curve, determine what feed setting is required to feed 417 lb/day. Set the feeder at the appropriate setting.

POLYMER

Polymers can be used as coagulant aids and flocculant or filter aids. The proper application of polymers requires understanding of the calculations necessary to prepare stock solutions for jar testing, preparing dilute feed solutions, and determining the appropriate feed rates in the plant. These calculations are explained in the following paragraphs.

Polymer Stock Solutions

When conducting a jar test to determine the optimum polymer dosage, it is necessary to add varying amounts of polymer to the jars. Since the bulk liquid polymer solutions are very concentrated, preparing a diluted stock solution is also necessary. To make the addition of polymer easy, it is best if the stock solution contains a concentration of polymer so that an even volume of stock solution added to the test jar will result in the desired polymer dosage. For example, if the stock solution is made up of 1 concentration of 1 gm/L (1 mg/mL), adding 1 mL of stock solution will add 1 mg of polymer to the jar. If the test jar contains 1 liter, the resulting dosage will be 1 mg/L. Likewise, adding 2 mL to a 1-liter test jar will provide a dosage of 2 mg/L, etc.

A polymer stock solution may be prepared using liquid polymer by following the procedure below.

1. Determine the density of the polymer in lb/gal from the manufacturers' literature.
2. Determine the dilution of the stock solution. The following table can be used to determine the desired dilution.

SOLUTION (%)	CONCENTRATION (mg/L)	mg/L DOSAGE PER mL OF STOCK SOLUTION ADDED: TO 1 LITER JAR	TO 2 LITER JAR
0.1	1,000	0.5	1
0.2	2,000	1.0	2
0.5	5,000	2.5	5
1.0	10,000	5.0	10
1.5	15,000	7.5	15
2.0	20,000	10.0	20

3. Determine the milliliters of polymer that must be added to a volumetric flask to make the desired dilution using the following formula:

$$\text{mL chemical} = \frac{(\%\ \text{solution}) \times (\text{mL solution}) \times (8.34\ \text{lb/gal})}{100 \times (\text{concentration of chemical, lb/gal})}$$

where
- mL chemical = amount of polymer that must be added to prepare the desired amount of stock solution
- %solution = desired weight percent solution
- mL solution = desired volume of stock solution
- 8.34 lb/gal = weight of water
- concentration of chemical = concentration of polymer being used in lb/gal (obtain from supplier/manufacturer)

For example, the mL of polymer weighing 8.84 lb/gal required to prepare 1,000 mL (1 liter) of 0.1% stock solution can be determined by:

$$\text{mL solution} = \frac{(0.1\%) \times 1{,}000\ \text{mL} \times 8.34}{100 \times 8.84\ \text{lb/gal}}$$

$$= 0.94\ \text{mL}$$

Polymer Dilution

Polymers can be fed as dry product or as a liquid. If liquid polymers are utilized, it is sometimes necessary to activate them prior to feeding. Activating consists of mixing a diluted solution of polymer. This allows the long molecular chains that make up the polymer to "unravel" and thus activate. The manufacturer should be contacted to determine the appropriate dilution at which a polymer should be fed.

To prepare a dilution, the following procedure can be followed.

Assume 500 gallons of 0.5% by weight polymer is to be prepared.

Polymer density = 12.1 lb/gal

The amount of concentrated polymer that must be added to prepare any dilution may be calculated by using a mass basis calculation.

1. Determine the weight of 500 gallons of water.

   Weight = 500 gallons x 8.34 lb/gal
   = 4,170 lb

2. Determine weight of polymer required to prepare 0.5% by wt solution.

   Polymer weight = (0.5%/100) x 4,170 lb
   = 20.85 lb

3. Determine the volume of polymer required.

   Polymer volume = 20.85 lb x (gal/12.1 lb)
   = 1.72 gallons

Therefore, the diluted polymer solution is made up by placing 1.72 gallons of polymer into a 500-gallon barrel and filling the barrel with water to the 500-gallon mark.

NOTE: Liquid polymer can also be weighed, and 20.85 lbs of polymer can be diluted with 500 gallons of water.

Treatment Plant Polymer Dose

The desired polymer dose should be determined by jar testing, pilot filters, zeta meter, or other means. Once the dose is determined, calculations must be done to set the chemical feed pumps. Typically, the chemical feed pump rate is determined by pumping into or out of a graduated cylinder that has the gradations marked in mL. As a result, the chemical feed rate in mL/min must be calculated. This can be done as shown in the following calculations:

Diluted Polymer

Assume:

Plant flow = 2.5 mgd
Polymer dose = 1 mg/L
Polymer dilution = 0.5%
Polymer density = 9.06 lb/gal
Polymer dosage = 2.5 mgd x 8.34 $\frac{\text{lb/mg}}{\text{mg/L}}$ x 1 mg/L
= 20.85 lb/day

Convert the dosage in lb/day to gal/day of polymer solution as follows:

Polymer solution = 20.85 lb/day x gal/8.34 lb x 1/(0.5/100)
= 500 gpd

NOTE: For solutions less than 1 to 2% by weight, the density of water may be used in the calculation.
Convert the dosage in gal/day to mL/min as follows:

Polymer dose = 500 gal/day x 1 day/1,440 min x 3,785 mL/gal
= 1,314 mL/min

For solutions less than 2% the solution feed rate may be calculated as follows:

$$\text{mL/min} = \frac{(\text{lb/day polymer})(3{,}785\ \text{mL/gal})(100)}{(8.34\ \text{lb/gal})(1{,}440\ \text{min/day})(\text{dilution \%})}$$

Concentrated (Neat) Polymer

If concentrated polymer is fed undiluted the solution feed rate in mL/min may be calculated as follows:

$$\text{mL/min} = \frac{(\text{lb/day polymer})(3{,}785\ \text{mL/gal})(100)}{(\text{polymer density, lb/gal})(1{,}440\ \text{min/day})}$$

For example, assume:

Plant flow = 2.5 mgd
Polymer dose = 1 mg/L
Polymer density = 9.06 lb/gal
Polymer dosage = 2.5 mgd x 8.34 x 1 mg/L
= 20.85 lb/day

$$\text{mL/min} = \frac{20.85\ \text{lb/day} \times 3785\ \text{mL/gal}}{9.06\ \text{lb/gal} \times 1440\ \text{min/day}}$$
= 6.05 mL/min

Appendix 8 Finished Water Storage Tanks

The system must conduct an annual inspection in which the tank is inspected inside and out, and a cleaning schedule established. Cleaning schedules can vary depending on the quality of water but should not exceed every 10 years. Continuous disinfection is required for **redwood tanks** only.

Plumbing Configuration: Redwood or cedar tanks must have a separate inlet and outlet configuration. Baffling of tanks is used to increase the chlorine contact time and if it is present has usually gone through plan review.

Table 6-2. Disinfection of Reservoirs

Reservoir size (gals.)	Gallons of 5% bleach to add to achieve a 25ppm chlorine dose
1,000	.5
2,000	1
3,000	1.5
4,000	2
5,000	2.5
10,000	5
20,000	10
30,000	15
40,000	20
50,000	25

Reservoir size (gals.)	Amount (in pounds of dry weight) of 65% strength dry chlorine powder to add to achieve a 25ppm dose
10,000	3.5
20,000	6.5
30,000	10
40,000	13
50,000	16
100,000	32
200,000	64
300,000	100
400,000	130
500,000	160

Table 6-1. Water Storage Tank Linings and Coatings

Material	*Comments*
Hot applied coal-tar enamel	Most common coal-tar based coating used in water tanks; tends to sag or ripple when applied above the waterline when tank walls are heated.
Coal-tar paints	Most commonly used to reline existing water tanks; those paints containing xylene and naphtha solvents give the water an unpleasant taste and odor and should be used only above the waterline. Other coal tar paints containing no solvent bases can be used below the waterline but should not be exposed to sunlight or ice; service life of 5 to 10 years.
Coal-tar epoxy paints	Less resistant to abrasion than coal tar enamel; can cause taste and odor problems in the water; service life of about 20 years.
Coal-tar emulsion paint	Good adhesive characteristics, odorless, and resists sunlight degradation but not as watertight as other coal-tar paints which limits use below waterline.
Vinyl	Nonreactive; hard, smooth surface; service life (about 20 years) is reduced by soft water conditions.
Epoxy	Forms hard, smooth surface; low water permeability; good adhesive characteristics if properly formulated and applied.
Hot and cold wax coatings	Applied directly over rust or old paint; short service life (about 5 years).
Metallic-sprayed zinc coating	Relatively expensive process that requires special skills and equipment, good rust inhibition and service life of up to 50 years.
Zinc-rich paints	Hard surface; resistant to rust and abrasion; relatively expensive.
Chlorinated rubber paints	Used when controlling fumes from application of other linings is difficult or where their use is specified.
Asphalt-based linings	Use is generally limited to relining existing asphalt-lined tanks.

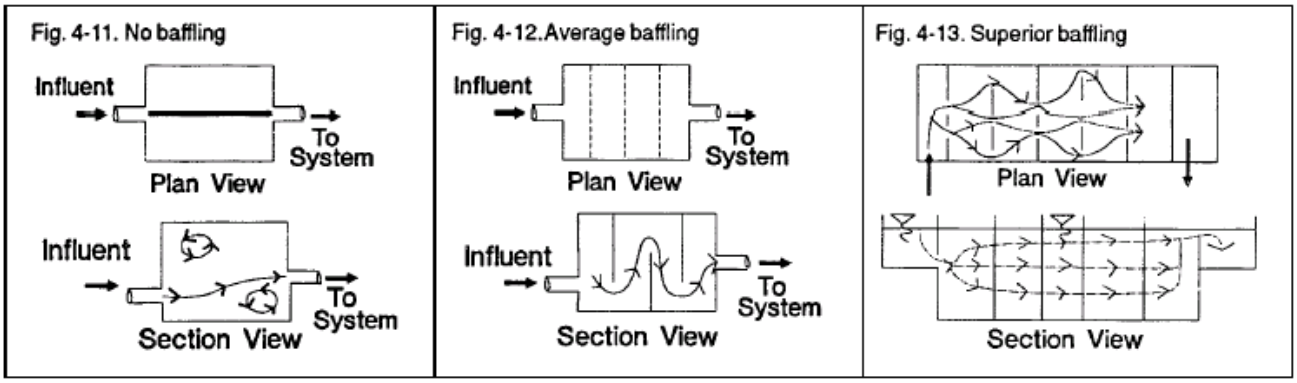
Source: U.S. EPA (1984)

Baffling

Short circuiting can greatly reduce the disinfection contact time, which means the full potential of the reservoir is not realized. EPA suggests using the following table to roughly calculate the effective disinfection contact time; however, a tracer study should be requested if none has been done in the past.

Table 4-1. Baffling

Condition	T_{10}/T	Description
Unbaffled (mixed flow) (Fig. 4-11)	0.1	None, agitated basin, very low length to width ratio, high inlet and outlet flow velocities
Poor	0.3	Single or multiple unbaffled inlets and outlets, no intra-basin baffles
Average (Fig. 4-12)	0.5	Baffled inlet or outlet with some intra-basin baffles
Superior (Fig. 4-13)	0.7	Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders
Perfect (plug flow)	1.0	Very high length to width ratio, (pipeline flow), perforated inlet, outlet, and intra-basin baffles



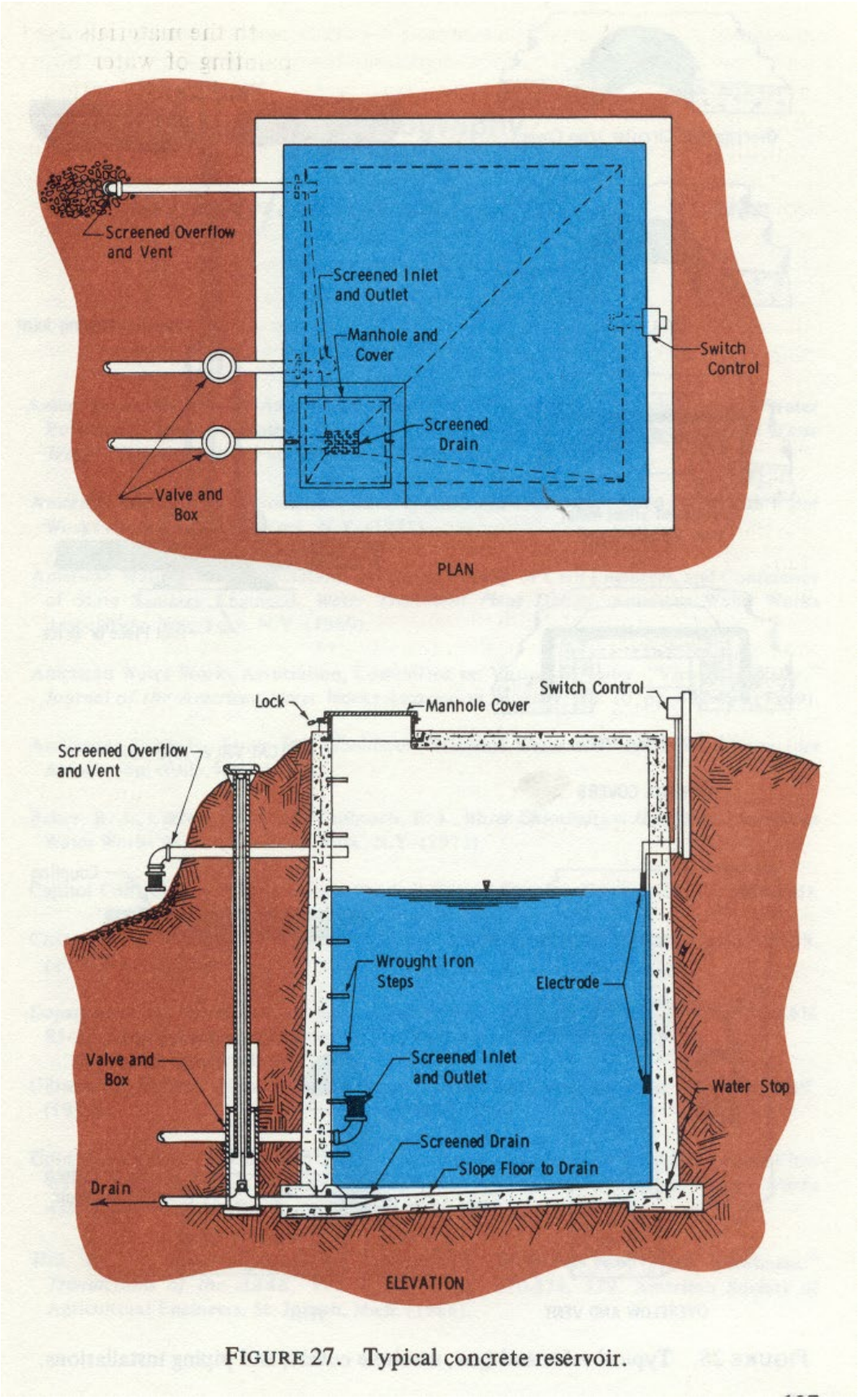


FIGURE 27. Typical concrete reservoir.

Appendix 9 Distribution System

Developing a Cross Connection Control Program for a Small Utility

This article was prepared in 1999 by Bonnie Waybright, P.E., former Cross Connection Program Coordinator for the Oregon Health Services.

Introduction: Establishing a cross connection control program for a small water utility can be a daunting task. The responsibility of creating and implementing the program will often fall on the operator, who will most likely be responsible for water, sewer, roads, parks and other public work projects as well. This can seem overwhelming, but with an organized approach an effective program can be established.

What is a Cross Connection: Before anyone can start a cross connection program, he or she must understand what cross connections are, why they are dangerous, and how they can be corrected. Therefore, the first step must be education. The approach to learning about cross connection control will vary depending on time and funding constraints. The best approach will be to attend a training course that is specifically designed to teach cross connection control practices for public water systems. If this is not possible, then the operator will have to pursue other avenues. Some agencies and organizations offer training courses that include sessions on cross connection control for little or no cost. Some areas have committees, associations or other groups dedicated to cross connection control. These groups can be a great source of information and networking. Many cross connection control publications and videos are available. It is also advisable for the operator to contact neighboring water utilities for information on their cross connection control programs.

Legal Authority: Once the operator has a good understanding of cross connection control, the next task will be to prepare a written document that will establish legal authority for the program. This may be in the form of an ordinance, resolution, by-law, etc., depending on the organization of the water system. This document will define the utility's cross connection control requirements, such as what circumstances will require the installation of a backflow prevention device; who will be responsible for the installation, testing and maintenance costs; program enforcement; approval of backflow prevention device and installation requirements. This document must avoid conflicts with other agencies.

It is important to consider the requirements of local building, plumbing and fire codes in addition to Health Services requirements. It is useful to obtain copies of ordinances from nearby utilities and consider their requirements. It is preferable for utilities to have similar requirements when possible. This will minimize confusion for those who work in several districts and are expected to be familiar with local requirements, such as backflow assembly testers, plumbers and vendors. It will also help avoid critical comparisons between utilities.

"The Board" The cross connection ordinance will be useless without the approval of the board of directors or city council. This fact can present problems of its own. As is often the case, the operator will be given the responsibility of running a cross connection control program but will not have the authority to create and enforce the ordinance. For this reason, it is extremely important to have the support of the board. Board members must be educated about cross

connection control. They need to understand the hazards cross connections present to the safety of the water supply, and the liability they are vulnerable to in the event of a backflow incident. Once they understand the importance of a cross connection control program, they can be strong allies in adopting an effective ordinance and implementing the program.

Organize the Program: Once an ordinance has been adopted, it must be implemented. This requires an organized approach. The responsibilities of each person involved in the program must be clearly defined; a system for coordinating with other agencies must be developed; a plan to educate the public must be in place; an efficient system for keeping records is critical; and various form letters and notices will need to be developed.

Work Responsibilities: It is important to identify who is responsible for each element in the cross connection control program. Who will determine when a backflow prevention device is required? Who will prioritize installations? Who will verify the correct installation of the backflow prevention device? Who will test backflow prevention device? Who will send out letters and notices? Who will track the testing and maintenance of the backflow prevention device in the system? Who will respond to customer inquiries and complaints? These are all questions that need to be answered before the program is presented to the customers.

Agency Coordination: Working with other agencies can be a great benefit to the cross connection control program. The local building department plan review process can be a useful tool. If an agreement can be made to include the water utility in the plan review process, any needed backflow prevention device can be included in the planning stage. A good relationship with local plumbing inspectors can be a great benefit to the program. They can serve as extra eyes to spot any variations from building plans that might create a need for backflow prevention. Working with fire officials is extremely important. The installation of backflow prevention devices on fire lines will increase the pressure loss, and this needs to be considered in the system design. Good working relationships with these officials will eliminate the headache of retrofitting a new building, and the bad publicity that follows a lack of coordination between agencies.

Public Education: Public education is an important aspect of cross connection control that is too often overlooked or minimized. This can have disastrous consequences. If a customer receives a notice to install a backflow prevention device with no explanation, they will often have a negative response. It is important to educate the customers to the dangers of cross connections and the importance of installing backflow prevention devices when needed. It is also very important to explain the program priorities, so the customers don't feel singled out. If one customer is notified to install a backflow prevention device and their neighbor isn't, they will want to know why. It is better for the utility to answer these questions with public education, rather than leave the customers wondering, or worse yet, doubting the sensibility of the cross connection control program. Most customers will be willing to support the cross connection control program when they understand that the safety of their drinking water is at stake.

Record-keeping, Forms and Notices: An active cross connection control program will generate information that must be organized and tracked. It is important to give careful consideration to record keeping methods before information begins to accumulate. Once

information is stored, changing the format becomes quite difficult. A system needs to be in place for notifying customers when backflow prevention devices must be installed, tested or repaired, and for tracking the responses. Backflow prevention devices must be tested regularly, so a system of tracking due dates is needed in order to send notices on time. Certain letters will be sent out frequently, so it is helpful to have a standard form prepared for these occasions. Cross connection software is available to assist with this aspect of the program. The software is available in a wide range of prices and capabilities.

Cross Connection Program Implementation: Once these preparations have been completed, the cross connection control program is ready for implementation. Public education can be initiated to gain customer support for the program. The operator will be ready to identify cross connection hazards in the system and begin the process of eliminating or isolating them. As the program begins to function, the utility will be prepared to handle the paper flow and phone calls that are generated.

Summary: Creating an effective cross connection control program is an important and challenging responsibility. An organized approach in the beginning will help avoid many problems and conflicts once the program begins to function. Once the program is established, the utility can take pride in the knowledge that they are taking an active role in protecting the public water supply from potentially life-threatening contamination.

Cross Connection Resources

Contact	Services
OHA Drinking Water Services Cross Connection/Backflow Prevention Program Michael Perry, Program Coordinator 971- 673-1220 971- 673-0694 fax michael.perry@state.or.us	• Certifies Backflow Assembly Testers and Cross Connection Specialists. • Collects and reports Annual Summary Reports and assists with cross connection regulations and general technical assistance. • Provides lists of: Certified Backflow Assembly Testers and approved Backflow Assemblies. http://170.104.63.9/backflow.php
American Backflow Prevention Association 979-846-7606	• ABPA is a non-profit organization founded in 1984 to educate and offer assistance with backflow prevention & other water interests. • ABPA conducts meetings, seminars and conferences within their twelve local chapters (regions) in the US and Canada. • *ABPA News* is a bi-monthly cross connection magazine for members. Oregon is Region 7.
American Water Works Association 303-794-7711 (info) 800-926-7337 AWWA Bookstore (orders only)	• American Water Works Association conducts meetings, conferences and seminars. • They have several committees including Cross Connection Control & subcommittees including OCCSRS. • AWWA Journal is published monthly for members. Subscriptions and past issues can be purchased by non-members. • Their bookstore offers information in a variety of formats.
Backflow Management, Inc. 503-255-1619 800-841-7689	• Offers Cross Connection Specialist certification training & Backflow Assembly Tester certification training approved by Oregon Health Authority
Clackamas Community College 503-657-6958 ext. 2388	• Offers Cross Connection Specialist certification training & Backflow Assembly Tester certification training approved by Oregon Health Authority.
DW & BP Magazine Laura Curtis, Business Unit Administrator 888-367-3927 Subscription information	• Drinking Water & Backflow Prevention magazine published monthly
Environmental Protection Agency Office of Ground Water & Drinking Water 202-564-3750 800-426-4791	• EPA's Cross-Connection Control Manual (EPA 816-R-03-002) Feb 2003

Eugene Water & Electric Board 541-984-4747	• Offers Backflow Assembly Tester & Cross Connection Specialist certification training approved by the Oregon Drinking Water Services.
Gauge Calibrators 1. BMI **-** Backflow Management Inc 503-255-1619 2. CCC **-** Clackamas Comm College 503-594-3345 (Naomi) 3. EWEB - Eugene Water & Elect Brd 541-984-4747 4. Ray Johnson 541-598-4647 5. Terry Penhollow 541-389-1201 541-419-6471 cell 6. Water Metrics Co West- 503-603-9988 7. Daryl Britzuis, Backflow Test 503-771-4253 8. Branon Instrument Co. Norris Countryman 503-283-2555	• Note that all gauge manufacturers are authorized to calibrate their own gauges. • If you want to have your gauge calibrated by anyone not on the approved list, please call the Cross Connection/Backflow Prevention program (971-673-1220) before you pay to have it done. All gauges must be calibrated when repaired.
Oregon Assoc of Water Utilities 503-837-1212	• OAWU offers general cross connection program assistance, including onsite technical assistance for water-supply systems
Oregon Backflow Testers Association (OBTA) 503-649-2721	• OR-ABPA is an organization whose members have a common interest in protecting drinking water from contamination through cross connections. An organization dedicated to education and technical assistance in our region; and committed to advancing all aspects of backflow prevention for the continued protection of all water users.
Oregon Cross Connection Specialists Regional Subcommittee (OCCSRS) Chairperson - Larry Griffiths City of Medford 541-774-2447 Larry.griffiths@cityofMedford.org Chair Elect - Jesse Di Stefano City of Roseburg 541-492-6896 jdistefano@cityofroseburg.org Secretary - Christine Hollenbeck Clackamas River Water Providers 503-723-3511 christine@clackamasproviders.org	• OCCSRS is a group of Oregon Cross Connection Specialists who meet quarterly to address common problems faced when creating or administering a cross connection program. • This group is a subcommittee of the Cross Connection Control Subcommittee of PNWS-AWWA. • Anyone who is interested may attend the meetings or request meeting notes. Specialist certification is not a requirement to attend.

Treasurer - Kate Mattimore BMI Backflow Management Inc 503-255-1619 bmi@bmibackflow.com	
Pacific NW Section - American Water Works Association (PNWS-AWWA) 503-760-6460 877-767-2992	• PNWS- AWWA offers their Cross Connection Control Manual, Accepted Procedure and Practice, 6th Ed., a widely accepted reference for cross connection control. • Other manuals include Summary of Backflow Incidents and Cross Connection Control Supplement, Sample Letters, Test Report Books and Record Forms.
Pacific NW Section - American Water Works Association, Cross Connection Control Committee Chair - Scott Hallenberg Tacoma Water 253-502-8215 shallenberg@cityoftacoma.org Secretary - Colvin Jergins Idaho National Laboratory 208-526-2352 colvin.jergins@inl.gov	• The Committee meets quarterly to discuss cross connection control issues and sponsors training events. • It represents Oregon, Washington and Idaho. • Training Scholarships are available to cover the cost of the Cross Connection Specialist Course, in honor of Ray Pettie and Bob Stiles. • Water systems with 2,500 or fewer connections are encouraged to apply. Contact Scott Hallenberg for information and application form at 253-502-8215 or shallenb@cityoftacoma.org
USC - FCCHR Univ of Southern California - Foundation for Cross Connection Control and Hydraulic Research Viterbi School of Engineering 866-545-6340 fccchr@usc.edu	• University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research publishes the Manual of Cross-Connection Control 10th Ed. The 9th Edition is the most current issue. • USC-FCCCHR also issues "Certificates of Approval" to backflow prevention devices and assemblies that meet manufacturing standards and pass their laboratory and field tests.

Appendix 10 Water Quality Monitoring

Coliform Sampling Plan

Revised COLIFORM SAMPLING PLAN

For public water systems serving up to 1,000 persons

1. **System Name:** **PWS ID #:** 41

   Contact Person: Phone #: ( ) -

   Date: / /

2. Distribution System Sampling: Collect _____ routine sample(s) every Month / Quarter.
   (Add Number) (Circle One)

   Source Water Assessment Sampling Required? Yes / No every Month / Year.
   (Circle One) (Circle One)

3. Sampling Sites and Collection Rotation Schedule (Include additional sites if necessary):

Distribution Routine Sites (Address/Locations)	**Distribution Repeat & Source Sampling**	**Distribution Repeat & Source Sites** (Address/Locations)
Routine Site 1	Repeat Site 1A	Same as Routine Site 1
	Repeat Site 1B	
	Repeat Site 1C	
	Triggered Source*	
Routine Site 2	Repeat Site 2A	Same as Routine Site 2
	Repeat Site 2B	
	Repeat Site 2C	
	Triggered Source*	
Routine Site 3	Repeat Site 3A	Same as Routine Site 3
	Repeat Site 3B	
	Repeat Site 3C	
	Triggered Source*	

See Section 3 of instructions on other side.

4. Sampling Technique:

   Sample at a non-swivel faucet, removing aerator, screen, hose, or other attachments. Flush tap for 3-5 minutes. While flushing, label sample bottle with all pertinent information: System name and PWS ID; date, time and sample location; sample collector; sample type (distribution routine or repeat, triggered source). Measure and record free chlorine residual if system is chlorinated. Use only sample bottles provided by the lab specifically for bacteriological sampling. Sample bottle should not be opened until the moment of filling. Avoid touching the inside of lid or bottle. Reduce water flow to a steady stream and gently fill the bottle leaving an air space of at least ½ inch at the top. Replace lid immediately. **If the sampling technique is not followed, collect another sample using an unopened bottle.**

5. Refer to map showing locations of coliform sampling sites.

Oregon Health Authority

Revised COLIFORM SAMPLING PLAN

For public water systems serving up to 1000 persons

INSTRUCTIONS

(Required under OAR 333-061-0036(6)(a)(I))

1. Fill in system name, public water system (PWS) ID, contact information and date completed.
2. Fill in number of routine distribution samples and circle sampling frequency. Indicate if source water assessment sampling is required and if so circle how often.
3. Check the box below that best describes your water system. Sampling requirements correspond to treatment if applicable.

   a) ☐ Groundwater system adding chlorine to maintain a detectable residual, applying ultraviolet light or with no treatment. **Must collect 3 repeat samples in distribution system and source sample.***

   b) ☐ Surface water system or groundwater system applying treatment to inactivate viruses (4-log). These systems adding a chemical disinfectant are required to measure/record residual levels daily at or before the first customer and report to Drinking Water Services. **All 3 repeat samples are collected in distribution system with no source sample required.**

Write sampling sites in Section 3 table on other side. Select sites and sample according to table below:

Distribution System Routine & Repeat Sampling: Select routine sampling sites that best represent the entire distribution system and rotate sampling between sites. Routine and repeat samples may be collected at customers' premises, dedicated sampling stations, or other locations determined by the water system.	
Repeat Site A	Collect sample at the **same** location as the routine coliform-positive sample.
Repeat Site B	Collect sample at a location within 5 service connections **upstream** from routine site or other approved location.
Repeat Site C	Collect sample at a location within 5 service connections **downstream** from routine site or other approved location.
***Source Water Sampling:** If checkbox **3a** above applies, sample each groundwater source in use when routine coliform positive occurred. Source water samples must be labeled as **Triggered** or TG for compliance.	

Repeat samples must be collected within 24 hours of being notified of routine coliform positive. Collect all repeat samples on the same day at different sites. Systems with a single connection may be allowed to collect repeat samples over three (3) day period from laboratory notification date. If no repeat samples are collected after a routine coliform positive sample, the water system must conduct a coliform investigation.

4. Use the sampling technique provided. Attach laboratory instructions or sampling technique developed by the water system.
5. Have a map showing locations of water source(s), treatment if applicable, and routine and repeat sampling sites. Be sure sites selected are representative of entire distribution system.

Contact your county Environmental Health Program, Department of Agriculture or OHA Drinking Water Services at (971) 673-0405 with questions about the coliform sampling plan or sampling requirements.

Form revised 3/23/16

Appendix 11 Management and Operations

Frequently Asked Questions about Small Groundwater Certification

(OAR 333-061-0228)

Who is required to have a small groundwater certification?

Any Community or Non-Transient Non-Community water system that has fewer than 150 service connections and uses only groundwater as its source or a system that purchases all its water from a public water system but does not treat it any further.

Am I the operator?

You are if you are designated by the owner of the system to perform or be responsible for the day-to-day operation of the system, which might include any of the following duties: Operation and maintenance of pumps and motors, testing/sampling, leak detection/repairs, and installation of taps/pipelines/service connections.

How much does it cost to obtain a certificate?

There is no cost for the Small Water System Operator (SWSO) certification.

How does a system get the operator certified?

Choose one of the following options:

1. The legal owner or a person authorized to speak on behalf of the system needs to decide who to designate as direct responsible charge (DRC) operator. They fill out the form and return it to DWS along with proof of having attended the Small Water System Operator Training Course within the past three years. (The classes are listed on the OAWU website: https://oawu.net/training-events/swotc-certification/) OAWU is the sponsor for the SWSO training. Information will be sent to all water systems in the county where a class will be held. Call to secure your place in the training, as these will fill up quickly.
2. The online basics course for small water system operators is not currently available.

There are many types of training. What counts toward SWSO certification?

The only training accepted at this time is the DWS Small Water System Operator Training Course, a free class offered around the state from February through November. See OAWU link https://oawu.net/training-events/swotc-certification/ for list of upcoming classes.

How long is the certificate valid?

Certificates are valid for a period of 3 years, expiring July 31 of the third year.

How do I renew?

DWS will send a notice at the beginning of the year to operators whose certificates expire on July 31 of that year. If you've taken the class once since your certification, you can use that certificate to renew for another three years. Otherwise, you'll need to plan to attend the course before it expires.

What if I've taken the training before the required three years?

Submit the renewal application with a copy of the document showing attendance of the most recent training and we will update our records for an additional 3 years from previous expiration date and print you a new certificate.

What happens if I don't send in an application?

You won't be certified, and your system will be considered out of compliance, which may result in a fine or cause difficulty in mortgage loan transactions for any properties on the system.

How many people can be certified as operators for my system?

Only one is required but you can have as many as you want. It is a good idea to have more than one person certified for a water system. When you want more than two (as on the application), just photocopy the application and designate Operator #3, #4, and so forth.

Our people rotate — whom do I certify?

Designate whoever has rotated to the operator in Direct Responsible Charge position (DRC).

If I move on to another system, is my certificate transferable?

No. The certificate is site-specific and is not transferable. You can re-apply for certification at the new system.

Can I operate several small systems and still be certified at all of them?

Yes, but a separate application is required for each small water system.

We have a lab do all our work. I only make repairs. Can the lab be certified?

A lab cannot be certified as an operator. Only a person can be certified.

I took the training class but can't find my certificate. What can I do?

Complete the application, checking the "Water Operator Training" box, and fill in the date and the city where you attended. When DWS receives the application, they will try to verify attendance with our registration lists from the class.

Can we still use a contract operator?

Yes. Contracting with a certified operator is an acceptable way to achieve compliance. Complete the information requested on the form. The contract operator must have a current Oregon certificate in Water Distribution or Water Treatment.

How difficult is the training class?

The training is very basic, need-to-know information designed specifically for small water systems. There is no test — only attendance is required. You'll receive a manual and have the opportunity to ask questions of experts and other operators.

My operator passed away. Can I take the training class now and get certified?

Certainly. This is a good example of why you should have more than one operator listed as the responsible charge of the system.

What if the owner has a property management company in charge?

If a property management company operates the system, the owner still needs to designate someone for certification.

Can I get a list of certified operators?

Check with your local Community water systems for a list of available operators, or advertise for a certified operator in your area. An operator should be able to show you a card indicating his name, certification number, certification level and date of expiration. You may call the Operator Certification Program (971-673-0426 or 971-673-0413) to verify certification of an operator. You may also call the Operator Certification Program and they will send you a list of certified operators by counties and/or the entire state.

Where do I send my forms?

Send in your forms to the Oregon Health Authority, Drinking Water Services, PO Box 14450, Portland OR 97293. The address is on the SWSO application.

333-061-0220
Classification of Water Systems

(1) Water systems are classified as small water, water distribution, and water treatment based on size and complexity, as determined by DWS. The classification of these systems and treatment plants is as follows:

a. A water system is classified, for certification purposes, as a Small Water System if it is a Community or Non-Transient Non-Community water system with fewer than 150 connections and either uses only groundwater as its source or purchases its water from a Community or Non-Transient Non-Community public water system without adding any additional treatment.

b. Water distribution classification is based on the population served, as follows:

Classification	Population Served
Water Distribution 1	1 to 1,500
Water Distribution 2	1,501 to 15,000
Water Distribution 3	15,001 to 50,000
Water Distribution 4	50,001 or more

c. Water treatment plant classification shall be based on a point system that reflects the complexity of treatment. Points are assigned for the treatment of contaminants with a health-based standard. See the Water System Treatment Worksheet in this appendix.

DRC Change Form

Each system is required to submit a **DRC form** (i.e. Direct Responsible Charge) to DWS within 30 days of any change of DRC operator.

Oregon Health Authority **Drinking Water Program**

Water System Operator Designation
DRC Form

If you need this information in an alternate format, please call Operator Certification at (971) 673-0413

Name of System:
Address:
City:
State:
Zip

PWS #:
Required Certifications:

Distribution Level
Treatment Level
Filtration Endorsement
N= None Required

Previous DRC: _____

Indicate the reason for the change: ❑ Retired ❑ New job duties ❑ No longer employed ❑ Other

New DRC DISTRIBUTION	TREATMENT
Name:	Name:
Cert #: Level:	Cert #: Level:
Signature:	Signature:

Does this system contract for a certified operator? YES___ NO___
If **YES** submit a copy of the contract and complete the information below

Name of Business: _____

Name of Operator: Cert. #

Address:

Phone: Signature

This contract is for: Distribution___ Treatment___ Both___

I am the owner or legal representative for the water system. I have reviewed the information on this form and verify that it is true, complete, and accurate to the best of my knowledge.

Signature: _____ Title: _____

Printed Name: _____ Phone _____ Date:_____

Send completed form (with copy of contract, if required) to:
Operator Certification • OHA-Drinking Water Program • PO Box 14450 • Portland, OR 97293-0450

Operator Designation Information on back of form
09/10 Rev 05/2011

Direct Responsible Charge Information

Pursuant to OAR 333-061-0225 the water system owner or authorized agent delegates the responsibility to the certified operator(s) listed of:

- Supervising the technical operations of the system, and
- Establishing and executing specific practices and policies for operating the system in accordance with policies and practices of the owner and the requirements of public water system rules, and
- Are engaged in the actual day-to-day operation and/or on-site supervision of the water system or other operators.

The principal operator must hold a current, valid Oregon certificate at a grade level equal to or one higher than the system's classification level.

Water systems contracting with a certified operator must include name and address of company/individual the contract is with. A copy of the contract must be submitted with this form.

Requirement: All Community and Non-Transient Non-Community Public Water Systems are required to designate and notify the Drinking Water Program (DWP) of the certified operators designated for each treatment plant and distribution system. The operator designation form is to be submitted by the public water system to notify the DWP of any designations or changes. Per Oregon Administrative Rules, this form shall be submitted within 30 days after any change so that the system is not in violation of operator certification regulations. Certified operators should ensure that this form is submitted if they are no longer the operator for a system so that the DWP does not continue to hold them responsible for the system's operation.

Visit the DWP, Operator Certification Website, for additional information at http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/index.aspx

Water System Treatment Worksheet

System Name:

_____

PWS ID #: **41**_____DATE_____ OHA STAFF_____

Item		Points	
Treatment system size (population served or flow whichever is greater)			
Population served	1/10,000 (max 30)		
Average daily flow	1/1 mgd of flow (max 30)		
Treatment system water source			
Groundwater		3	
Surface Water or Groundwater Under the Influence of Surface Water		5	
Chemical Treatment/Addition Process			
Fluoridation		5	
Disinfection			
Ultraviolet		2	
UV with Chlorine Residual		5	
Ammonia/Chloramination		3	
Chlorine		5	
Mixed Oxidants(MIOX® Systems only)		7	
Ozonation (onsite generation)		10	
Residual Maintenance		0	
pH Adjustment			
Slaked-Quicklime (Calcium Oxide)		5	
Hydrated Lime (Calcium Hydroxide)		4	
All others (hydrochloric acid, sodium hydroxide, sulfuric acid, sodium carbonate)		1	
Coagulation & Flocculation process			
Chemical addition (1 point for each type of chemical coagulant or polymer added, maximum 5 points		1-5	
Rapid Mix Units			
Mechanical Mixers		3	
Injection Mixers		2	
In-line blender mixers		2	
Flocculation Units			
Hydraulic flocculators		2	
Mechanical flocculators		3	
Clarification and Sedimentation Process			

Adsorption Clarifier	10	
Horizontal-flow (rectangular basins)	5	
Horizontal-flow (round basins)	7	
Up-flow solid contact sedimentation	15	
Inclined-plate sedimentation	10	
Tube sedimentation	10	
Dissolved air flotation	10	
Filtration Process		
Single media filtration	3	
Dual or mixed media filtration	5	
Microscreens/Membrane Filtration	5	
Direct	5	
Diatomaceous earth	12	

Slow sand filtration	5	
Cartridge/bag filters	5	
Pressure or greensand filtration	10	
Stability or Corrosion Control		
Slaked-Quicklime (calcium oxide)	10	
Hydrated Lime (calcium hydroxide)	8	
Caustic soda (sodium hydroxide)	6	
Orthophosphate	5	
Soda ash (sodium carbonate)	4	
Aeration: Packed tower, Diffusers	3	
Calcite	2	
Others: sodium bicarbonate, silicates	4	
Other Treatment Processes		
Aeration	3	
Packed tower aeration	5	
Ion exchange/softening	5	
Lime-soda ash softening	20	
Copper sulfate treatment	5	
Powdered activated carbon	5	
Potassium permanganate	5	
Special Processes	15	
Sequestering (polyphosphates)	3	
Residuals Disposal		
Discharge to lagoons	5	
Discharge to lagoons and then raw water source	8	
Discharge to raw water	10	
Disposal to sanitary sewer	3	
Mechanical dewatering	5	
Onsite disposal	5	
Land application	5	

	Solids composting	5	
Facility Characteristics			
Instrumentation			
no	The use of SCADA or similar instrumentation systems to provide data with process control	1	
	The use of SCADA or similar instrumentation systems to provide data with partial process control	3	
	The use of SCADA or similar instrumentation systems to provide data with complete process control	5	
Clear well size less than average day design flow		5	
		Total	

Classification of Water Treatment Plants

Class	Points
Water Treatment 1	1-30
Water Treatment 2	31 to 55
Water Treatment 3	56 to 75
Water Treatment 4	76 or more

Filtration Endorsement (FE) is an additional classification that applies when a water treatment plant is classified as a Water Treatment 2 (WT2) and uses conventional or direct filtration treatment to treat surface water or groundwater under the direct influence of surface water. An FE endorsement is required for WT2 operators, but not WT3 or higher.

Land use Compatibility Determination

LAND USE COMPATIBILITY DETERMINATION
(Complete either 2 or 3)

2. PLANNING AUTHORITY STATEMENT: (To be completed by local planning authority)

   a. I certify that this project has been reviewed for compatibility with:

      i. The acknowledged comprehensive plan and land use regulations.

      ii. Statewide planning goals. The goals apply because:

      - There is no acknowledged plan, or
      - Conditions described in OAR 660-31-025(3) apply.

   b. I find that this project **(**circle one**) IS** or **IS NOT** compatible.
   Attach appropriate land use decision(s) written findings as required in ORS 215.416 (8) or (9) or 227.173 (1) OR (2), or OAR 660-31-025 (2) or (3).

   Signed _____ Title _____

   Date _____

3. APPLICANT REQUEST FOR PLAN REVIEW APPROVAL
   I hereby certify that I have applied to the local governments cited in 1.e above for a determination of compatibility with the local acknowledged plan or the statewide planning goals as applicable. I hereby request that the Department issue the plan review approval with the understanding that issuance of said approval is not a finding of compliance with the statewide planning goals or compatibility with the applicable, acknowledged comprehensive plan and land use regulations, but will be conditional, pending the applicant receiving a land use approval from each unit of local government. When signed, such approval shall be forwarded to the Department. I understand that plan review approval for this project will not be effective until and unless the Oregon Health Authority has received a copy of the land use approval and determined it to be complete and adequate.

   Signed_____ Title _____

   Date _____

STATE OF OREGON
OREGON HEALTH AUTHORITY
DRINKING WATER PROGRAM

LAND USE COMPATIBILITY STATEMENT

Certain plan review approvals for drinking water projects have been identified by the Department of Land Conservation and Development as Class B permits affecting land use. The Department of Human Services is therefore required by ORS 197-180, OAR 660-30-065 to - 070, OAR 660-31-010-040, the Department of Human Service=s state agency coordination program and OAR 333-61-062 to ensure that projects defined in OAR 333-61-062(1) are compatible with city and county comprehensive plans and land use regulations. This form or other acceptable documentation and necessary attachments must accompany each set of project plans to ensure that compatibility.

1. GENERAL INFORMATION

   a. Project title_____

   b. Applicant _____
   Name of Water System

   c. Type of project_____
   Treatment, Transmission, Storage, Distribution, Etc.

   d. Project contact person _____
   Engineer, owners, etc., including title

   _____
   Street Address

   _____
   City, State, Zip Code Phone

   e. The local government entity* having comprehensive planning authority over the site of the proposed project is:

   Agency name_____ Phone _____

   Address _____ Zip_____

   (*If the proposed project is located within the jurisdiction of more than one planning authority, all entities must certify compatibility.)

   f. If a statement of compatibility previously has been submitted to the Department to cover a master water system plan, of which this project is a segment, no further information is required. If such a statement has been filed, the date of the submittal was_____.

CONTINUED ON THE BACK

Appendix 12 Outstanding Performance Criteria

OHA Drinking Water Services

Drinking Water Services (DWS) has identified criteria for determining whether a Community public water system has demonstrated outstanding performance. This designation is given at the completion of a water system survey, formerly referred to a sanitary survey. A water system survey is an onsite review of a system's sources, treatment, storage facilities, distribution system, operation and maintenance procedures, monitoring, and management, for the purpose of evaluating the system's capability of providing safe water to the public. Systems that are designated outstanding performers will have their water system survey frequency reduced from every 3 years to every 5 years.

The criteria for outstanding performance are:

1. No Maximum Contaminant Level (MCL), Action Level, or Treatment Technique violations in the last 5 years;
2. No more than one Monitoring and Reporting violation in the last 3 years. The one violation must be resolved (results submitted);
3. No significant deficiencies or unmet rule requirements identified during the current water system survey; and
4. Has not had a waterborne disease outbreak attributable to the water system in the last 5 years.

To check your water system's violation history, go to http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/index.aspx and click on "Drinking Water Data Online." Type in your water system name or PWS ID number. The date of the last survey is listed on this page. Towards the bottom of that page, under "For further information…," click on "Violations".

- An MCL violation will have "MCL" in the Violation Type column.
- Treatment Technique violations are for inadequate surface water treatment or corrosion control.
- If the system has one Monitoring and Reporting violation during the last 3 years, there must be a subsequent monitoring result for that contaminant on record in order to meet criterion #2.

DWS strongly encourages all systems to meet the outstanding performance criteria. DWS will review your system's designation as Outstanding Performer after completion of each water system survey. The designation will remain in effect as long as the criteria continue to be met.

If you have any questions relating to compliance with any of these criteria, please contact your regional DWS or county health department staff person, or contact the DWS Phone Duty person at 971-673-0405.