CHAPTER 7

OPERATION AND MAINTENANCE PROGRAM

INTRODUCTION

There are two primary objectives for this chapter devoted to system operation and maintenance. The first is to provide documentation of satisfactory water system management operations in accordance with WAC 246-290-100 and 246-290-415. The second is to provide a comprehensive reference of system components, procedures and programs to assist the Association in its operations, training, and planning activities.

WATER SYSTEM MANAGEMENT AND PERSONNEL

The Association is governed by a seven member board of trustees. Association staff include a Business Manager, a Water System Superintendent, a back up operator, two meter readers, and one office employee. The Association's Business Manager is Mr. Paul Treadway. The certification status of Association staff is shown below in Table 7-1:

TABLE 7-1

System Personnel and Certification

PROFESSIONAL GROWTH REQUIREMENTS

In order to promote and maintain expertise for the various grades of operator certification, Washington State requires that all certified operators complete not less than three Continuing Education Units (CEU) within each three year period. Programs sponsored by both Washington Environmental Training Resources Center (WETRC) and the American Waterworks Association (AWWA) Pacific Northwest Subsection, Evergreen Rural Water are the most popular source of CEUs for certified operators in Washington State.

Besides providing CEUs, operator training is an important component in maintaining a safe and reliable water system. At a minimum, all personnel performing water system related duties should receive training in the following areas.

- Confined space
- Trenching and shoring
- Traffic Flagging

- Asbestos cement pipe safety
- Cross-Connection Control

The Association evaluates CEUs on an annual basis. Each certified employee is responsible for maintaining their certification. The Association accepts financial responsibility for classes needed by the employees for keeping current with CEUs.

SYSTEM OPERATION AND CONTROL

MAJOR SYSTEM COMPONENTS

The locations of the major system components are shown on Figure 1-3, the system facilities map. A brief description of the Association's facilities is given in the following sections.

WELLS

The Association owns and operates four wells that currently provide all the water used by its customers. Wells No. 1 and No. 2 are located within the City of Seattle Cedar River Watershed. These two wells supply over 80 percent of the total water system demand. The wells are located within CMU buildings, and discharge directly into the 1,215 pressure zone. The wells work on an alternating system with only one well operational at a time. The wells are controlled by probes in the Rattlesnake Tank. When the level in the 50 ft. high (to the overflow level) Rattlesnake Tank is at approximately 47 feet, a well is called on. When the level in the tank is at 50 feet, the well is shutoff. Both well can be powered by a new generator installed at the Well 2 pump house.

Well 3 is located in a CMU building, and Well 3A is located just outside of the Well 3 well house. Well 3A discharge flows into the well house to a common meter that measures the discharge from either or both of the wells, although normal operation is for only one well to operate at a time. The wells discharge to the 793-foot pressure zone under normal operating conditions. The wells are called on when the level in the Edgewick Tanks drops to a selectable preset level. When the level in the tank reaches a higher selectable level, the well is shut off. Well Nos. 3 and 3A are operable during power outages with power coming from the standby generator.

RESERVOIRS

The storage for the water system is held within nine precast, concrete reservoirs with a total volume of 1,549,000 gallons. Table 7-2 provides a summary of the water system reservoirs.

TABLE 7-2

Reservoir Information

Reservoir Name	Overflow Elevation (ft)	Base Elevation (ft)	Height (ft)	Diameter (ft)	Volume (gal)
Rattlesnake Reservoir	1,215.44	1,165.44	50	26	198,000
Uplands Reservoir	1,217.88	1,185.88	35	30	185,000
River Point Reservoir	840	800.05	40	26	158,000
Edgewick Reservoir No. 1	793	738.33	55	26	218,000
Edgewick Reservoir No. 2	793	760	35	26	131,000
Edgewick Reservoir No. 3	793	760	35	26	131,000
Middle Fork Reservoir No. 1	883	848.09	35	30	185,000
Middle Fork Reservoir No. 2	883	848.13	35	30	185,000
Terrel Reservoir	1,009	969.38	40	26	158,000
Total Volume	**-**	**-**	**-**	**-**	**1,549,000**

BOOSTER STATIONS

The distribution system relies on five booster pump stations (BPS) to transfer supply between pressure zones.

The BPS consists of a two 10-hp pumps housed in a vault along with a PRV. This BPS is capable of providing 150 gpm from the 701 zone to the 793 zone utilizing one pump. The pumps alternate under normal operation. In an emergency, both pumps can be activated for a 300 gpm flow. No standby power is available at the site; however, the control panel is equipped with a manual transfer switch and generator plug in receptacle for connecting the Association's mobile generator. The station is called on by the reservoir level controls at the Edgewick site, with operator selection between the Tanner BPS and Well Nos. 3 and 3A and the level set points being made in the Edgewick BPS control panel.

The BPS consists of a one 7-1/2 hp jockey pump that runs continuously, a 40-hp booster pump and four 50-hp high flow pumps. This BPS is capable of providing 3,000 gpm from the 793 Zone to the 920 Zone. There is a 300 KW auxiliary power generator at the site for standby power, with an automatic transfer switch that will reenergize the station within approximately 20 seconds. Control of the BPS is based upon discharge pressure for pump call up and discharge flow for pump shut down. All set points are operator selectable from the control panel.

The BPS consists of a two 15 hp pumps. The BPS is capable of providing 250 gpm from the 701 Zone to the 840 Zone. There is no auxiliary power at the site, however, a plug-in connection and manual transfer switch are available to allow connection of the Association's trailer mounted portable generator.

The BPS consists of a single 7.5-hp pump. The BPS is capable of providing 100 gpm from the 840 Zone to the 1009 Zone. There is no auxiliary power at this site; however, a plug-in connection and manual transfer are available to allow connection of the Association's trailer mounted portable generator.

Table 7-3 provides a brief overview of the BPS.

TABLE 7-3

Booster Pump Stations

Name	Pumps and Size (hp)	Capacity (gpm)	Auxiliary Power	Pumps to Zone
Tanner	2 – 10 hp	150/300	No(1)	793
Edgewick	1 – 7-1/2, 1-40, 4-50 hp	3,200	Yes	920
Lower Mt. Si	2 – 15 hp	250	No(1)	840
River Point	1 – 7.5 hp	100	No(1)	1009

(1) On-site auxiliary power is not available, however a plug-in connection and manual transfer switch allow connection of the Association's trailer mounted portable generator.

PRESSURE REDUCING VALVES (PRVS)

The Association has multiple pressure reducing stations are located throughout the water system. The majority of the PRVs in the system are roll-seal type valves. Cla-Val pressure reducing valves are used in some stations, although less commonly. Table 7-4 provides a list of the station and their settings.

TABLE 7-4

PRV Locations and Settings

(1) PRV settings must be adjusted in field to coordinate operation due to multiple PRVs discharging to the same zone. The actual settings of some of these PRVs have been set to keep them off line due to the interaction. Use these settings as a starting point if the lead PRVs must be changed for some reason.

TELEMETRY

The Association has the following telemetry at these sites within the system shown in Table 6-5.

TABLE 7-5

Available Telemetry

Location		
Well #1	Intrusion Alarm Pump Flow	Pump Fail Pump On/Off
Well #2	Intrusion Alarm Pump Flow Power Fail	Pump Fail Pump On/Off Low Level @ Rattlesnake Tank
Well #3	Intrusion Alarm Pump Flow Power Fail	Pump Fail Pump On/Off Low Level @ Middle Fork and Edgewick
Rattlesnake Tank	Repeater Station	
Uplands Tank	Tank Level	Low Level Alarm

ROUTINE AND PREVENTIVE MAINTENANCE

Planning for present and future maintenance of the water system facilities is an important task. The maintenance effort must be continuous in order for the Association to continue to fulfill its role as a water purveyor in the future. The role of maintenance is to preserve the value of the physical infrastructure and ensure that the Association can continue to provide a safe and reliable water supply. The most cost-effective method for maintaining a water system is a preventive maintenance (PM) program. Through a planned PM program, the optimum level of maintenance activities can be provided for the least total maintenance cost.

The Association's PM program involves defining the tasks to be performed, scheduling the frequency of each task, and then providing the staff necessary to perform the tasks.

Each water system facility is inspected frequently to verify that each component is operating properly. Table 7-6 indicates the frequency at which the Association visits and checks each of its facilities. During each visit, the site is also checked for damage, vandalism, and intrusion.

TABLE 7-6

Preventive Maintenance Monitoring Schedule

Component	Monitoring Schedule
Sources	
Wells 1,2, 3, and 3A	Inspect daily
Storage Facilities	Inspect daily
Booster Stations	Inspect daily
Distribution Facilities	
Water Mains	Dead end mains flushed quarterly
Hydrants	Flush annually
Isolation Valves	Nothing currently in place
Pressure Reducing Valves	Inspect weekly

Table 7-7 provides goals for the Association to meet in terms of its preventative maintenance program.

TABLE 7-7

Preventive Maintenance Programs

Program	Association Goal
Valve Exercising	• Locate and operate all water system valves every 3 years.
Hydrant Operation	• Operate and flow each hydrant annually.
Hydrant Maintenance	• Inspection and repair of water system hydrants. Currently performed when time is available or when a hydrant fails to operate properly.
Blow-Off/Flushing	• Operate and flush all blow-offs and hydrants on dead-end water mains annually, or as needed to maintain water quality.
Leak Detection	• Water system leak detection every three year by private contractor using leak detection equipment.
Reservoirs	• 5-year interior inspection of each reservoir with cleaning performed as needed.
Pressure Reducing Valve Maintenance	• Weekly inspection, often times more frequently.

SOURCES

All source meters are visited a daily during the work week.

STORAGE FACILITIES

An operator visually inspects each reservoir once per week looking for abnormal conditions and evidence of unauthorized entry or vandalism. On a yearly basis, staff thoroughly inspect screens, vents, and exterior surfaces of all reservoirs.

Improperly maintained reservoirs can be a cause of contamination in public water systems. This is a result of contaminants entering the reservoir through cracks or openings at the vent, overflow or drain screens. Deteriorating hatch covers and vandalism can also compromise reservoir water quality. Poorly designed and maintained reservoirs can hamper the emergency operation of a water system. If reservoir drains are not functioning properly, it may be impossible to purge a contaminant from the system. Written documentation of reservoir maintenance must be completed with each inspection and repair, and a copy of the report retained on file.

BOOSTER STATIONS

Association staff perform a visual inspection of the booster station each workday. The inspection includes a check for leaks, excessive vibration, sound, and heat and flow rate.

DISTRIBUTION SYSTEM FACILITIES

The Association operates its hydrants each year. All hydrants that do not operate correctly are fixed as time allows.

Dead-end water lines are susceptible to water quality problems and are flushed at least quarterly or more frequently to remove stagnant water and debris which may have been deposited.

The Association is committed to minimizing the amount of lost water in its distribution system. Every 3 years, the Association will spend time with a leak detection service surveying portions of the system looking for leaks in water mains. Detected leaks are scheduled for replacement or repaired, as necessary.

Meters

Accurate water metering is an essential financial and conservation oriented component of water system infrastructure. A substantial amount of revenue may be lost through inaccurate metering of residential and commercial accounts. The importance of accurate master or source meter readings cannot be over estimated. Without accurate master or source meter readings, the water utility cannot determine lost and unaccounted for water volumes. Service meters, including all Association residential and commercial customer meters, should be calibrated and/or replaced according to the following schedule:

1. 3/4-inch and 1-inch meters should be tested every 8 to 10 years and replaced, if necessary. Replacement is recommended if it is cheaper to replace meters than to test and if necessary, repair meters.
2. 2-inch through 4-inch meters should be tested and calibrated every 2 to 4 years.
3. 6-inch and larger meters should be tested and calibrated annually.

MAINTENANCE RECORD SYSTEM

Keeping accurate and up-to-date maintenance records is important for system evaluations and for scheduling preventive maintenance measures. The Association maintains detailed information on operation and maintenance procedures performed.

SPARE PARTS INVENTORY

The Association has an adequate inventory of parts and supplies on hand to handle most emergencies and normal operational needs. However, the Association has access to parts and supplies in the event of an emergency or repair.

OPERATION AND MAINTENANCE MANUALS

The Operation and Maintenance Manuals, containing operating and maintenance literature provided by manufacturers, parts lists, dimension drawings, as-built drawings of the facilities and any other relevant information that are available, are kept at the Association offices.

SAFETY PROCEDURES

An important consideration of any successful maintenance program is the safety of the employees. The Association's safety program appears to be in compliance with the Occupational Safety and Health Administration (OSHA) and the Washington State Department of Labor and Industries (WISHA) regulations. The scope of this Plan is not intended to document any form of OSHA or WISHA compliance. The safety program addresses the situations that employees may encounter during the performance of operation and maintenance tasks.

CONFINED SPACES

Water system operation and maintenance staff must periodically enter vaults, and empty reservoirs in the course of their duties. Many of these locations are classified as confined spaces due to their configuration and lack of ventilation. The principle hazards associated with confined spaces are oxygen deficiency, explosions, and toxic gases. The Washington State Department of Labor and Industries (L&I) has established regulations

governing entrance into confined spaces in WAC 296-62-141. The regulations include the completion of a Confined Space Entry Permit, the establishment of Safe Operating Procedures, and the completion of a Confined Space Pre-Entry Checklist prior to entry into the confined space, and notification requirements upon completion of the confined space activities.

ELECTRICAL AND MECHANICAL EQUIPMENT

The presence of electrical and mechanical equipment at the Association's booster stations present hazards to personnel during the performance of operation and maintenance tasks. Precautions must be taken whenever working on or near booster station mechanical and electrical equipment.

Rubber mats should be placed on the floor in front of all electrical control panels and auxiliary generators. When working on any piece of electrical equipment, the operator should ensure that all switches are opened and tagged, all electrical equipment is grounded, and all exposed wire is taped. All portable power tools, extension cords, and lights should be of the three-wire grounding type.

Other safety precautions that should be observed by Association personnel are to avoid contact with energized circuits or rotating parts, to avoid bypassing or rendering inoperative any safeguards or protective devices, and to avoid extended exposure in close proximity to machinery with high noise levels.

FIRE HAZARDS

Fires are possible if debris is allowed to accumulate. Precautions should be taken to reduce the possibility of a fire. Oily rags should be kept in tightly sealed metal cans, preferably at a location away from the booster station. All areas should be kept free of clutter or debris, especially if flammable in nature. Gasoline, diesel, and other solvents should only be used in well-ventilated areas, away from sources of ignition. A carbon dioxide type, dry chemical, or foam fire extinguisher should be permanently mounted at each booster station. The extinguisher should be tagged and checked semi-annually to ensure its operational ability.

EMERGENCY RESPONSE PROGRAM

Water utilities have the responsibility to provide an adequate quantity and quality of water in a reliable manner at all times. To do this, utilities must reduce or eliminate the effects of natural disasters, accidents, and intentional acts. The Association has recently completed a Vulnerability Assessment.

EMERGENCY PROCEDURES

Although is not possible to anticipate all potential disasters affecting the Association's water system, formulating procedures to manage and remedy several common emergencies is appropriate.

Water System Personnel Emergency Call-Up List

Table 7-8 provides a list of the various agencies and suppliers the Association may need to access in the event of an emergency or other related situation.

TABLE 7-8

Emergency/Repair Phone List

Agency/Group	Contact	Phone Number
King County Sheriff	--	1-425-888-4433
Eastside Fire & Rescue		1-425-392-3433
Sallal Water Association Office	--	
Water Association Operator	Denny Scott	Day 1-425-531-0518 Night 1-253-639-9132
City of North Bend		1-425-888-1211
Riverbend Water Association		1-425-888-4564
Evergreen Rural Water		1-800-272-5981
DOH NW Office	Sheri Miller, P.E.	1-253-395-6764
DOH NW After Hours		1-877-481-4901
Electrician – Forgey Electric	Mike Forgey	1-425-417-3762
Electrician – Ashford Electric	Michael Ashford	1-425-889-1486
Electric Utility	Tanner Electric	1-425-888-0623
Gas Utility	Puget Sound Energy	1-800-321-4123
Sewer Utility	City of North Bend	1-425-888-1211
Telephone Utility	Century Tel	1-800-201-4102
Plumber	Mt. Si Plumbing	1-425-888-0433
Pump Specialist	Pumptech, Inc.	1-425-644-8501
Soil Excavator/Backhoe Operator	Fury Construction	1-425-888-1596
Equipment Rental (Generator)	R & R Rentals	1-425-888-3083
Equipment Rental (Portable Fencing)	Fencing Connection	1-425-823-0424
Equipment Repair	Ackley Tool Co.	1-206-760-4325
Radio/Telemetry Repair	Systems Interface	1-425-481-1225
Bottled Water	Crystal Springs	1-800-453-0293
Well Drillers	Hayes Drilling	1-800-729-6110
Pipe Supplier	HD Fowler	1-425-746-8400
Leak Detection	American Leak	1-425-747-7118
State Wide One-Call	Utility Locates	1-800-424-5555
Gray & Osborne, Inc.	Seattle Number	1-206-284-0860

Bacteriological Presence Detection Procedure

Notification procedures for notifying system customers, the local health department, and DOH of water quality emergencies are an important component of an emergency response program. Many public water systems will occasionally detect positive coliform samples, mainly as a result of minor contamination in distribution mains or sample taps, or improper bacteriological sampling procedures. However, the persistent detection of coliforms in the water supply, particularly E. coli or fecal bacteria, may require issuing a

public boil water notice to ensure the health and safety of the water customers. Emergencies such as floods, earthquakes, and other disasters can affect water quality as a result of damage to water system facilities, thereby warranting a boil water order in advance of supply. A sample boil water notice is included in Appendix L.
WAC 246-290-320 requires water utilities to follow specific procedures in the event coliform bacteria are detected in the water system. These procedures are outlined in Figure 6-1.

VOC/SOC and Inorganic Chemical/Physical Characteristics Detection Procedures

A procedure to comply with DOH requirements in the event of a volatile organic chemical or synthetic organic chemical procedure is presented in Figure 6-2. A procedure for an inorganic chemical/physical characteristic detection is presented in Figure 6-3.

Power Failure

Various types of weather can cause loss of power, such as wind, lightning, freezing rain, freezing snowstorm. The Association auxiliary power at Well No. 2 and manual transfer switches with the ability to bring in auxiliary power at Mt. Si, Riverpoint, Edgewick, and Well No. 3. In the event of an extended power outage, the Association has the ability to receive a limited amount of water from North Bend and Riverbend. The Association would have to investigate trucking in water for an extended period of time as standby storage is depleted from the reservoirs.

Severe Earthquake

System Component	Action
Wells: Wells may have lost power	• Repair/manipulate wells as needed to continue supply of water to system
Distribution System: Distribution and transmission mains may be broken	• Isolate broken sections and repair
Reservoirs: Reservoirs may be leaking or structurally damaged	• Check reservoirs for structural damage and drain if in danger of bursting • Check reservoirs for cracks and leaks, and seal or drain as required

Severe Snowstorm

Heavy snowfall may bring motor vehicle traffic to a standstill. Employees may not be able to reach problem area.

System Component	Action
Distribution System: Transportation to monitor system and make repairs will be limited	• Plow streets if necessary and if equipment is available • Have chains and other snow gear ready for maintenance equipment and vehicles • Valve locations should be kept current and made available for maintenance personnel
Reservoirs: No immediate effect. Snow may prevent access.	Vehicle access not possible

High Water and Flooding

Heavy snow melt and/or rains cause the water level to rise and reach a flood level.

System Component	Action
Reservoir: No effect. Reservoir is above flood level	No action is necessary

Contamination of Water Supply

Contamination of water supply for such items as main breaks or pollution from an isolated source.

Distribution System Contamination
• Close valves if possible to isolate source
• Repair and or remove source of pollution
• Flush previously contaminated section and test until free of contamination prior to resumption of use

Reservoir Contamination
• Resample to confirm contamination
• Check distribution system for presence of contamination
• Isolate reservoir from system
• Inspect vent screens, hatches, and piping to identify source of contamination
• If reservoir water is contaminated and therefore considered unsuitable for consumption, drain and clean reservoir.
• Consider disinfecting reservoir if bacteriological standards are exceeded. Follow AWWA Standards.

CROSS-CONNECTION CONTROL PROGRAM

The Association has implemented a Cross-Connection Control Program as required by Washington State Regulations WAC 248-54-85. The Association's Cross-Connection Control Program is included in Appendix E. The Association is responsible for ensuring that all actual and potential cross-connections in their service area are eliminated or protected by approved methods or devices. In order to do so, the following steps are taken by the Association.

- Require installation of premises isolation on new connections.
- Surveillance and regulation of backflow prevention assemblies on premises where cross-connections exist, or are likely to occur.

TABLE 7-9

High Hazard Cross-Connections

Agricultural (farms and dairies)
Beverage bottling plants
Car washes
Chemical plants
Commercial laundries and dry cleaners
Premises where both reclaimed water and potable water are provided
Film processing facilities
Food processing plants
Hospitals, medical centers, nursing homes, veterinary, medical and dental clinics, and blood plasma centers
Premises with separate (i.e., dedicated) irrigation systems that use the purveyor's water supply and with chemical addition*
Laboratories
Metal plating industries
Mortuaries
Petroleum processing or storage plants
Piers and docks
Radioactive material processing plants or nuclear reactors +
Survey access denied or restricted
Wastewater lift stations and pumping stations
Wastewater treatment plants +
Premises with an unapproved auxiliary water supply interconnected with the potable water supply

Low health risk hazards may include but are not limited to the following: Irrigation systems; Swimming pools or spas; Ponds; and Boilers.

INSPECTION PROCEDURE

Backflow prevention assemblies are required to be inspected and tested annually by a Department of Health certified backflow assembly tester.

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