



**[Insert the Name of the PWS]
[Insert the PWS Number]**

This Operations & Maintenance (O&M) Manual template was created, in part, to assist water systems with the development of system specific O&M Manuals. Depending on water system specifics, additional information and/or text will need to be added by the O&M Manual developer. Once the final O&M Manual is developed and in use, the document will need to be updated periodically to address any infrastructure, technical (including regulatory) and managerial changes.

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Note: If you need to add pages to the template, it is advised that you not re-number the whole template, but instead create additional numbers for those printed pages. For example: If you add 5 pages at page 6, number the new 5 pages as 6-1, 6-2, 6-3, 6-4, and 6-5. Original page 6 stays page 6.

Save the manual template as follows:

1. Click the Save icon on the menu bar or select the File menu option and then Save (however you normally save a document).
2. Type the PWS name
3. Press the space bar 2-3 times
4. Type PWS
5. Press the space bar 1 time
6. Type the PWS number
7. Press the Enter key

Example: Tucson PWS 1234567

You may have to refresh the screen by doing a Print Preview, but when you print the manual, the footer will contain the System Name and PWS on every page.

Acronyms and Abbreviations

AAC	Arizona Administrative Code
AC	Alternating Current and Asbestos Cement
ADEQ	Arizona Department Environmental Quality
ADOSH	Arizona Division of Occupational Safety and Health
AZPDES	Arizona Pollutant Discharge Elimination System
CWS	Community Water System
DC	Direct Current
HDPE	High-Density Polyethylene
EPA	Environmental Protection Agency
ft	Foot
gpd	Gallons per day
gpm	Gallons per minute
gpm/ft²	Gallons per minute per square foot
GPS	Global Positioning System
in.	Inches
MCL	Maximum Contaminant Level
MGD	Million gallons per day
mg/L	Milligrams per liter
SDS	Safety Data Sheet
mV	Millivolts
NaOH	Sodium hydroxide
NPDES	National Pollution Discharge Elimination System

NTNCWS	Non-Transient Non-Community Water System
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
ppm	Parts per million
psi	Pounds per square inch
PRV	Pressure Reducing (Relief) Valve
RP	Reduced Pressure Backflow Prevention Assembly
PVC	Polyvinyl Chloride
PWS	Public Water System
SAV	Surge Anticipator Valve
SDWA	Safe Drinking Water Act
SWAP	Source Water Assessment Program
SWP	Source Water Protection
TWS	Transient Water System

I. Getting Started

I. Getting Started

An Operations and Maintenance (O&M) Manual is a baseline tool for a facility that describes:

- System Characteristics
- Distribution System (including Maintenance and Sampling)
- Start-Up Procedure, and
- Emergency Operations Plan/Emergency Response Plan.

This tool gives facility operators and manager's instructions, log sheet samples, and technical information for efficient and safe operation of a facility during normal operations or during an unplanned/emergency situation. An O&M Manual may also be used by emergency responders for reference regarding such items as chemical storage and fire flow capabilities.

A. Creating the O&M Manual

Creating your O&M Manual will be much easier using this “electronic” template which allows you to insert your system’s specific information in the spaces and tables provided. The template may also be printed and completed by hand using *Appendix 14: Instructions for Template*.

This template is divided into four main sections:

- System Characteristics
- Distribution System
- Start-Up Procedure
- Emergency Operations Plan/Emergency Response Plan.

The template contains two types of forms: tables and fill-in-the-blank paragraphs.

The tables provide space for the characteristics of the system. For example, when listing pumps in your system, the table has spaces for the pump location, size, and capacity. Some of the tables will provide you with a list of options in a scroll box (those options are also listed in *Appendix 14: Instructions for Template*, for those of you completing this template by hand).

The template also includes fill-in-the-blank paragraphs making the narrative descriptions easy to complete.

B. Navigating the Electronic Template

The template allows you to navigate through it using only three keys (instead of your mouse): F1, TAB, and fn + F1 (if you are using a laptop). See *Figure A, below*.

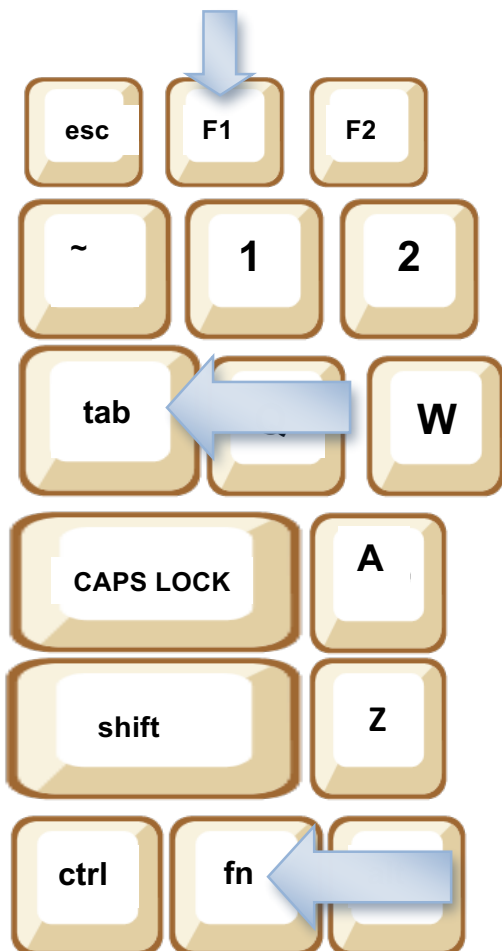


Figure A. Navigating the Electronic Template

To start, grab your mouse and point the cursor to the first gray box on the contact information form. Once the cursor is blinking on the gray box, start typing the answer. After you have provided the information needed, press the tab button to move to the next box.

Table 1, below, shows a table similar to those on the template. Hit “TAB” to move forward through the table, and “SHIFT” and “TAB” to go backward.

<i>Name</i>	<i>Address</i>	<i>Depth</i>	<i>Location</i>
<i>Well 1</i>			<i>1st Avenue</i>

TAB

While pressing
SHIFT key, hit TAB
to go back.

Table 1. Sample Table

C. “Help” Boxes

The template contains pages with information designed to assist you before you start a new section. These pages provide examples, definitions, and hints that will help you complete the section. The template also contains hidden help boxes (see Table 2 below) which you can access by pressing the F1 key. A yellow box will appear containing assistance on that topic. *Also see Appendix 14 for assistance.*

<i>Name</i>	<i>Address</i>	<i>Depth</i>	<i>Location</i>
<i>Well 1</i>			<i>1st Avenue</i>

Table 2. Help Box

Press on F1 to have a “help”
box appear.

II. System Characteristics

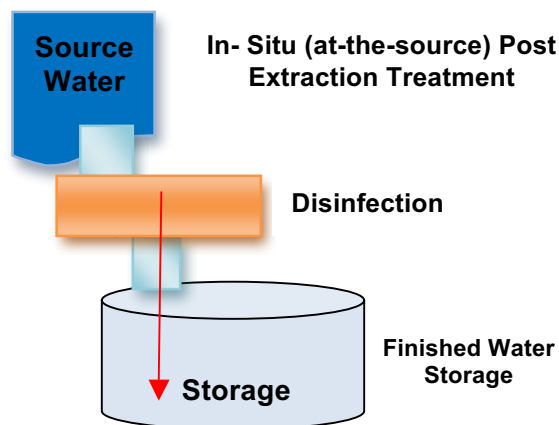
II. System Characteristics

The treatment process used in a public water system depends on the source water used. Most systems have a multi-barrier approach that includes various units of operation.

A. Groundwater System

Groundwater's quality is generally superior to surface water's due to surface water's turbidity and other pollutants. Groundwater treatment focuses on high mineral content: magnesium, manganese, and iron, along with dissolved gases. Arsenic and fluoride can also be a concern.

Treatment may include: air stripping, coagulation, ion exchange, chemical precipitation, membrane processes, disinfection, and absorption.



The system may include the following treatments:

- Defluoridation
- Odor Taste Control
- Removal of Hardness

Figure B. Groundwater System

B. Surface Water System

Common surface water treatment includes: preliminary treatment, coagulation, flocculation, sedimentation, filtration, and disinfection.

Preliminary Treatment can be the screening of raw water with bar screens or wire-mesh to remove large debris. Preliminary treatment may include presedimentation, the removal of settleable solids, and the addition of chemicals.

Coagulation is the addition of chemicals which allow particles in a flash mix to clump together into heavier and larger pieces. The flash mix allows chemicals to distribute evenly by providing rapid agitation. Popular chemicals used in this process are Lime, Alum, Ferric Chloride, and Polyelectrolytes.

Flocculation is the process after the addition of coagulant chemicals in which particles “floc” or clump together. The mixing is very slow to prevent the break up of the “floc.”

Sedimentation is the 1- to 4-hour rest period in which suspended particles and flocs settle to the bottom of the tank. The settled solids are then handled through solids processing.

Filtration is the process whereby treated water is passed through a filter to remove any particles left after the sedimentation process. The filter retains the particles until a specific head loss is reached and then is periodically backwashed.

Backwashing is the process following filtration that is used to clean the filter.

Disinfection is the process which uses heat, ultraviolet radiation, or chemicals to kill or inactivate pathogenic organisms in water. This is not sterilization. Coliform bacteria is an indicator organism used in this process to measure the presence of pathogenic organisms.

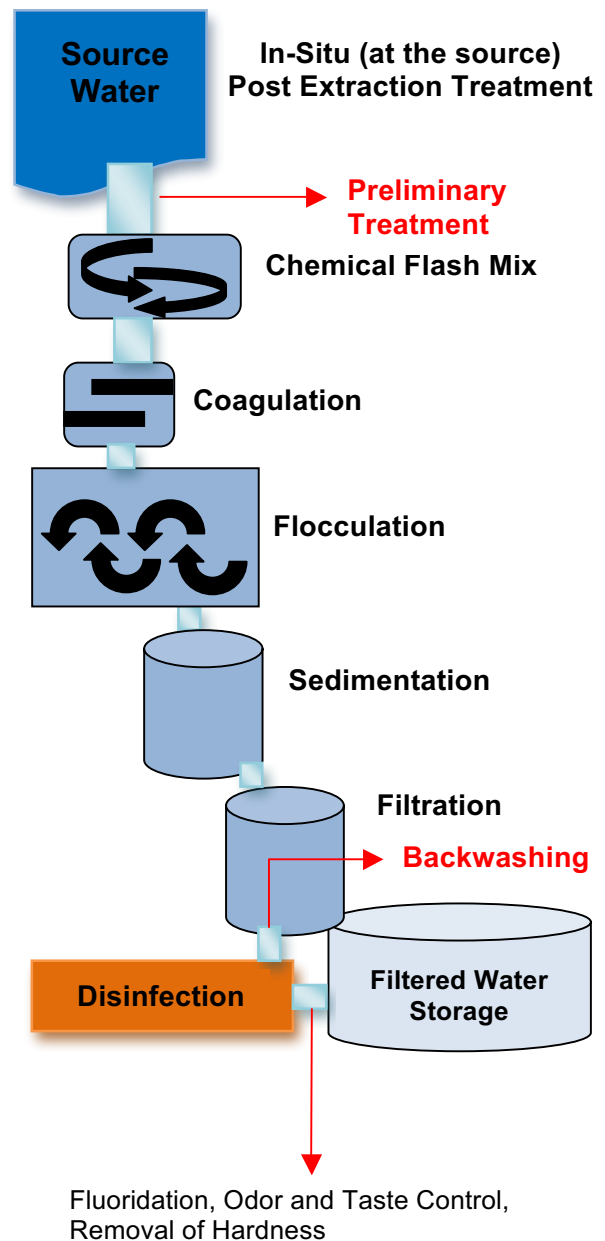


Figure C. Surface Water System

Filtered Water Storage allows for uniform water distribution regardless of customer usage throughout the day.

Other common units include:

In Situ Post Extraction Treatment is treatment done at the water source by adding chemicals before the water enters the system.

Fluoridation is the addition of sodium fluoride, fluorosilicic acid, or sodium fluorosilicate. The addition is for the prevention of dental caries. The concentration of fluoride varies with regional temperature.

Defluoridation is the system used in PWSs where fluoride exceeds the allowed concentration. Packed beds of granular activated alumina are commonly used to remove fluoride.

Odor/Taste Control is a process in which chlorine, potassium permanganate, or activated carbon is used to control the taste and odor of the water.

Corrosion Control is the addition of lime, soda ash, caustic soda, metaphosphate or silicate to control water's corrosive effects.

Removal of Hardness is done by softening the water through two methods: ion exchange and/or chemical addition. Hardness is commonly caused by calcium and magnesium.

C. Narrative Description

This section is a fill-in-the-blank document. If you are using an electronic template, then please review the questions which are highlighted in-between the paragraphs with information about your system. After you "TAB" to move around the document and add your information, the questions disappear and you are left with a completed document.

If you are using a paper template, then please use the questions provided in *Appendix 14* to complete a handwritten document. Each question is numbered with a correspondingly numbered blank space for the answer.

D. System Characteristics: Template Forms

○ Contact Information and Permits	10
○ Operator's Information	11
○ Geography and Maps	12
○ Narrative Description	13
○ Diagram of Treatment Process.....	23
○ Summary Tables: Water Storage Tanks	24
○ Summary Tables: Pressure System (Compressor)	25
○ Summary Tables: Pump Stations	26

SYSTEM CHARACTERISTICS

CONTACT INFORMATION & PERMITS

(See p. 129 for instructions.)

CONTACT INFORMATION

Name of PWS:					
Type of System:	Click	Population			
Physical Address:					
City:		State:		Zip Code:	
Municipality:			County:		
Main Contact:			Telephone:		
E-Mail:					

Person Completing the Manual:		Date of Completion:	
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PERMIT & ID INFORMATION

NAME OF THE PERMIT/ID	ID/PERMIT NUMBER
Public Water System (PWS) ID No. (AZ04-XX-XXX):	AZ04-
Well ID Number (ADWR):	
Arizona Pollutant Discharge Elimination System (AZPDES):	AZPDES
Place ID:	
Place Name:	
Inventory Number:	
APP Number:	

SYSTEM CHARACTERISTICS

OPERATORS' INFORMATION

(See p. 130 for instructions.)

OPERATOR ID NUMBER

Operator's Name	ID Number	Expiration Date	Phone	Address	E-mail
	OP				
	OP				
	OP				
	OP				
	OP				
	OP				

SYSTEM CHARACTERISTICS

GEOGRAPHY AND MAPS

(See p. 131 for instructions.)

Water System Geography and Industry

Geography Near Water System	
-----------------------------------	--

Industry Near Water System	<input type="checkbox"/> Commercial Retail <input type="checkbox"/> Food Service/Restaurants <input type="checkbox"/> Hospitals <input type="checkbox"/> Agriculture <input type="checkbox"/> Manufacturing <input type="checkbox"/> Auto Shops <input type="checkbox"/> Wastewater Treatment Plant <input type="checkbox"/> Other: Describe
----------------------------------	--

Water Source Geography and Industry

Geography Near Water Source	
-----------------------------------	--

Industry Near Water Source	<input type="checkbox"/> Commercial Retail <input type="checkbox"/> Food Service/Restaurants <input type="checkbox"/> Hospitals <input type="checkbox"/> Agriculture <input type="checkbox"/> Manufacturing <input type="checkbox"/> Auto shops <input type="checkbox"/> Wastewater Treatment Plant <input type="checkbox"/> Other: Describe
----------------------------------	--

Maps: *Include a map of the water system, a map of distribution service area, and a map of the watershed that surrounds the water source. Place each map behind the appropriate appendix label.*

APPENDIX 1: WATER SYSTEM MAPS

A. WATER SYSTEM SCHEMATIC

B. AS-BUILT MAP OF THE WATER SYSTEM

APPENDIX 2: SERVICE AREA MAP

APPENDIX 3: SOURCE WATER ASSESSMENT MAP

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 132 for instructions.)

Raw Water Storage

☐ Raw Storage Does Not Apply

The raw storage tank is located [Provide address of raw water storage tank]. The tank is made of [What material is the raw water storage tank made of?] and has an elevation of [What is the elevation of the tank in feet?]ft. The riser pipe is [What is the diameter of the riser pipe in feet?] ft. wide. The holding capacity of the tank is [What is the capacity of the tank in gallons?] gallons. The tank is generally operated at [At what percentage of its total capacity is the tank generally run?] %. The overflow pipe is located [Where is the overflow pipe?] and the drain connection is located [Where is the drain connection?]. The air vent is located [Where is the air vent?]. [How many access hatches are available?] access hatch(es) are located [Where are the access hatches located?]. [Additional information.]

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 133 for instructions.)

In Situ Treatment

☐ In Situ Post Extraction Treatment Does Not Apply

Treatment at the water source is accomplished by applying [What chemicals are used at the source?] at the source. Common examples of chemicals used are a weak chlorine solution, oxidants, or polyphosphates. The concentration used includes [Include the concentration per chemical used at the water source. Example: Chemical xx: 00 ppm, Chemical xxx: 00 ppm.]. The iron concentration in water should be [What is the iron concentration prior to entering the system for a normal operation?] ppm prior to entering the system. The water pH should be [What is the normal water's pH prior to entering the system?] prior to entering the system. [Additional information.]

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 134 for instructions.)

Aquatic Plant Control

☐ Aquatic Plant Control Does Not Apply

The body of water treated has an alkalinity of [What is the normal alkalinity level in the body of water?] and it is [How deep is the body of water in feet?] feet deep.

The chemical use for aquatic control is [What chemical or chemicals do you use for aquatic plant control?]. A dosage of [What dosage is used for aquatic plant control? Provide the chemical then the dosage. Ex. Chemical 1: 00 ppm] ppm is applied every [How often is the body of water treated for aquatic plant control?]. [Additional information.]

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 135-136 for instructions.)

Preliminary Treatment

☐ Preliminary Treatment Does Not Apply

The preliminary treatment consists of Click. The preliminary treatment equipment is inspected [how often is the preliminary treatment inspected?]. [Additional information.]

Coagulation

☐ Coagulation Does Not Apply

Prior to entering the coagulation process, the water has a normal temperature of [What is the raw water's normal temperature prior to entering the coagulation process?], alkalinity [What is the normal raw water's alkalinity prior to entering the coagulation process?], turbidity [What is the normal turbidity of the raw water before entering the coagulation process?], and suspended solids [What is the normal measurement of suspended solids of the raw water prior to entering the coagulation process?]. The chemical(s) and dosage used in the coagulation process include [Provide the chemicals and the dosage used in the coagulation process.]. The coagulant aids used in the process include [What are the coagulant aids used in the process?]. These chemicals are stored in [Where are the coagulant and coagulant aids stored?] and are fed by a Click feeder. The type of feeder is best described as a Click. Once the coagulants have been fed to the raw water, the raw water and coagulant combination go into a mechanical flash mixer. The mechanical flash mixer used in this system is Click. [Additional information.] *An example of a record document for this process is available in Appendix 4: Coagulation-Flocculation Records.*

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 137-138 for instructions.)

Flocculation

☐ Flocculation Does Not Apply

A Click flocculator provides the appropriate detention time for flocs to form. The detention time required is [What is the detention time required for flocs to form?] minutes. The normal pH of the treated water when leaving the flocculation basin is [What is the pH of the water after a normal flocculation?]. The turbidity is [What is the normal turbidity after the flocculation process takes place?] and the filterability is [What is the normal filterability after the flocculation process takes place?]. The coagulation/flocculation process is also monitored by the [Do you use a zeta potential measurement or a streaming current monitor?] and a normal reading is [What is a normal reading for the zeta potential measurement or the streaming current monitor?]. The residual coagulant measurement should be [What is a normal residual coagulant measurement in mg/L at the end of the flocculation process?] at the end of the process. [Additional information.] *An example of a record document for this process is in Appendix 4: Coagulant-Flocculation Records.* (See p. 137 for instructions.)

Sedimentation

☐ Sedimentation Does Not Apply

The treatment also includes sedimentation through a Click. Normal influent turbidity is [What is the normal turbidity measure for the influent?] and normal effluent turbidity is [What is the normal turbidity measurement for the effluent?]. The turbidity is measured [How often is the turbidity measured a day?] per day. If the basin is working properly then the normal rate for weir overflow is [What is the normal weir overflow rate?] and surface overflow rate is [What is the normal surface overflow rate?]. The basins are inspected [How often per year is/are the basin(s) inspected?] a year. The usual amount of sludge that is pumped out of the basin is [What is the usual amount of sludge being pumped out?] per [How often do you pump out the basin?]. The sludge is disposed by [How do you dispose of your sludge?]. [Additional information.]

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 139-140 for instructions.)

Filtration

☐ Filtration Does Not Apply

The filtration process uses a Click filter. A normal filtration process provides [What is a normal filter run in hours?] of filter runs and a flow rate of [What is a normal flow rate for the filtration process in million gallons per day?] mgd. Normal observed head loss is [What is a normal head loss in feet?] feet. A normal backwash water rate for this process is [What is the normal rate of water in gallons per minute?] gallons per minute. The volume of wash water generally used is [Provide the normal volume of water used for washing.]. The backwash process generally takes [How long does the back wash process take in minutes?] minutes and surface wash generally takes [How long does the surface wash process take in minutes?] minutes. The backwash water is disposed by Click. [Additional information.]

Disinfection

☐ Disinfection Does Not Apply

The treatment process or chemical used to get rid of disease-causing organisms is Click. The disinfection application points are located [Where are the application points located in the system for treatment?]. All public water systems are required by federal and state regulations to collect representation samples from the distribution system regularly for coliform analysis. *(Please refer to Appendix 5: Disinfection Records for more information regarding routine monitoring requirements.)* The chemical for treatment is in the Click form and the concentration is [What is the concentration or % strength of the chemical?].

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 141 for instructions.)

Chlorination

☐ Chlorination Does Not Apply

The form of chlorine used for water treatment is Click. The chemical compound used is Click and the concentration is [What is the concentration or % solution of the chlorine?]. The normal amount of contact time is [How long is the water in the piping system?] and the type of residual chlorine that is available after the required contact time is Click. The normal temperature of the water source is [What is the normal temperature of the water source?]. The pH of the water is checked routinely [How often is the pH of the water source recorded?] and the normal range is [What is the normal pH of the water?]. Interfering substances can cause the chlorine to become less effective. The normal turbidity level is [What is the normal turbidity level of the water?] Disinfectants are generally applied at Click.

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 142-143 for instructions.)

Fluoridation

☐ Fluoridation Does Not Apply

The addition of fluoride is intended to provide public health protection from dental decay, or dental caries. Fluoride in water has been found to reduce tooth decay among children, but the uncontrolled concentration of fluoride can cause fluorosis. Fluoride concentration is based on the average air temperature. A drop of .3 mg/L below optimal concentration can reduce the benefits of fluoride while 1.5 over the optimal concentration can cause mottling of the teeth.

In this process, sodium fluoride, fluorosilicic acid, or sodium fluorosilicate are fed through a Click. The optimal concentration of fluoride is [What is the optimal concentration of fluoride for your system?]. [Additional information.].

Defluoridation

☐ Defluoridation Does Not Apply

Defluoridation is needed in a PWS where water naturally exceeds the allowed fluoride concentration. The technique includes beds packed with granular activated alumina. The process includes treatment, backwash, regeneration, and neutralization. Once the alumina beds have been used, and their removal efficiency has depleted, a backwash is used to regenerate the removal efficiency of the bed. Once regenerated, these beds recover their removal capacity. Initially, the alumina beds will discharge a high pH and need to be neutralized with raw water. The beginning stage of the removal process is not as efficient as the late stages when the optimal pH is reached.

In this process, the allowed fluoride amount is [What is the allowed fluoride amount?]. The optimal pH for removal is [What is the optimal pH for efficient removal of fluoride?].

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 143-144 for instructions.)

Backwash

☐ Backwash Does Not Apply

The backwash is [For how long are the beds washed?] minutes. The regeneration includes [Percentage of NaOH used] % of NaOH at [What is the flow of the rinse in gpm/ft²?] gpm/ft² for [For how long are the beds rinse?] minutes.

The process includes a second rinse at [What is the flow of the rinse in gpm/ft²?] gpm/ft² for [How long is the rinse?] minutes. A second regeneration step includes [Percentage of NaOH used] % of NaOH at [What is the flow of the rinse in gpm/ft²?] gpm/ft² for [For how long are the beds rinsed?] minutes.

The lowest measurement allowed in the process before a backwash is needed is [What is the lowest pH allowed before starting the backwash process?]. [Additional information.].

The backwash water is sent to: Click

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 144-145 for instructions.)

Finished Water Storage

☐ Finished Water Storage Does Not Apply

When water is ready for consumption it is stored in a [What is the capacity of the finished water storage tank?] -gallon tank located [Where is the tank located?]. The tank is elevated [What is the elevation of the tank in feet?] ft. and it is made of [What material is the tank made of?]. The tank has a drain that can be opened by [What are the steps required to open the finished water storage tank drain?].

Hydropneumatic Tank(s)

☐ Hydropneumatic Tank(s) Does Not Apply

[How many pressure tanks are used in the system?] pumps within the system work with the tank(s) to maintain consistent pressure in the system. The tank(s) operating ON/OFF pressure levels are [What is the operating range for the pressure levels to turn ON or OFF?] These tank(s) also aid the water storage systems.

(See p. 144 for instructions.)

Distribution Piping

The piping material is [What is the material of the piping?]. The structure is about [How old is the distribution piping?] years old.

(See p. 144 for instructions.)

Flow Rate

☐ Flow Rate Does Not Apply

The flow rate on a normal day is [What is the flow rate on a normal day for your system?] gallons per day. (See p. 144 for instructions.)

SYSTEM CHARACTERISTICS

DIAGRAM OF TREATMENT PROCESS

INSTRUCTIONS:

Water Source: Provide what water source is used in the PWS.

Preliminary Treatment Screen/Pre-sedimentation: Provide Yes or No in the gray box. Yes if unit is used in the PWS or No if it is not used.

A. Shows the water treatment units usually used.

Coagulation, Flocculation, Sedimentation, Filtration: Provide Yes if process is used in the PWS or No if it is not part of it.

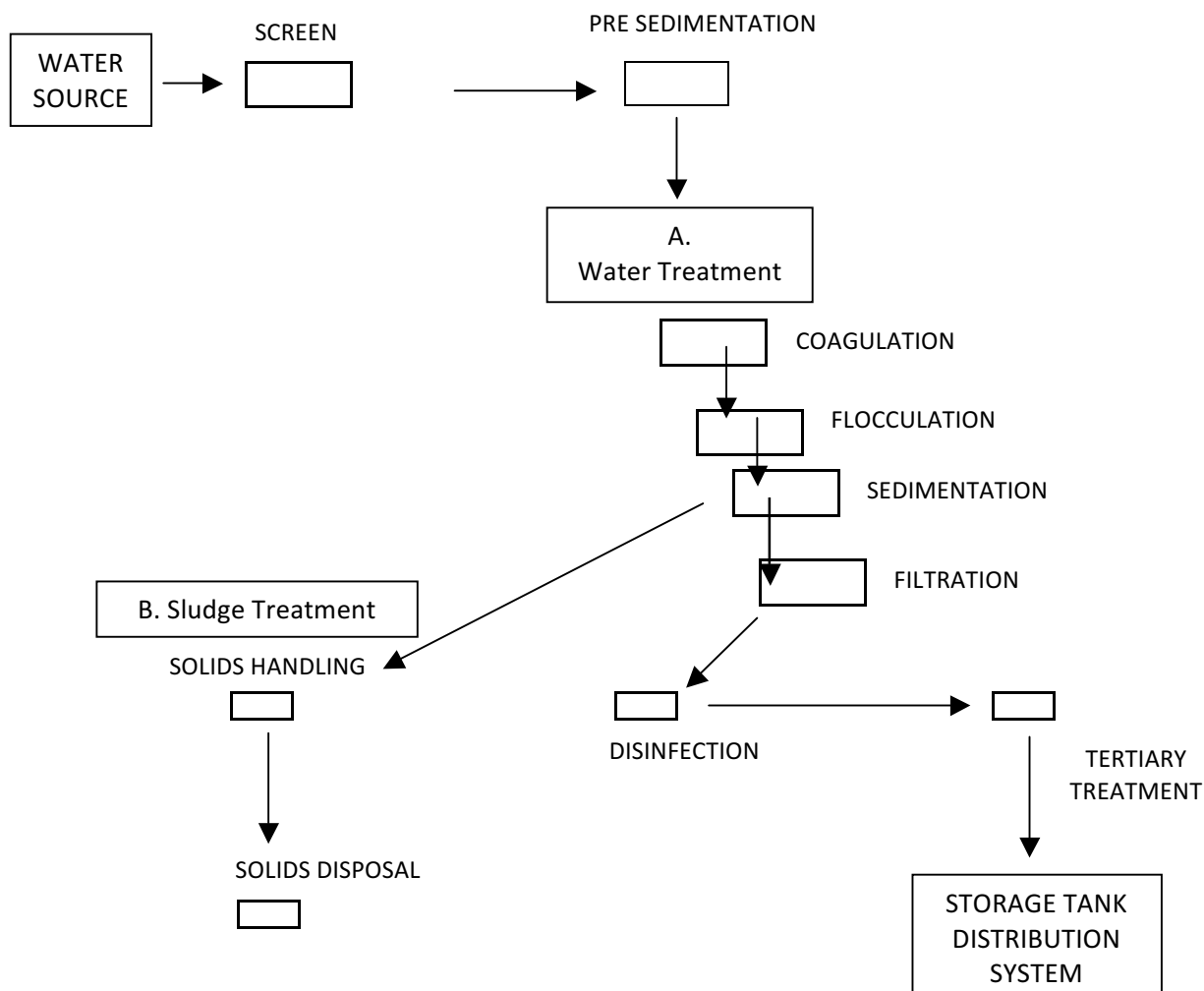
Disinfection: Provide the type of disinfection in the PWS.

Tertiary Treatment: Provide the type of tertiary treatment in the PWS.

B. Shows the sludge treatment

Solids Handling: Provide the treatment used for solids.

Solids Disposal: Provide the type of disposal for PWS solids.



SYSTEM CHARACTERISTICS

SUMMARY TABLES: WATER STORAGE TANKS

(See p. 146 for instructions.)

WATER STORAGE TANK SUMMARY TABLE

Tank Name	Capacity (gallons)	Material	Location	Elevation (ft)	Overflow Location	Drain Valve Location

WATER STORAGE TANK MAINTENANCE SUMMARY TABLE

Tank Name	Operation (% of Total Capacity)	Total Capacity (ft)	Operating Level High (ft)	Operating Level Low (ft)	Manufacturer	Inspection Frequency

More information on tank's inspection is provided in Appendix 9.

SYSTEM CHARACTERISTICS

SUMMARY TABLES: PRESSURE SYSTEM (Compressor)

(See p. 147 for instructions.)

PRESSURE SYSTEM (Compressor) SUMMARY TABLE

System Pressure ID or Name	Size	Location	Operating Pressure PSI (ON/OFF)	Frequency of Replacing/Cleaning Filters for Compressor	Lubrication Frequency for Compressor	Drain Condensate Frequency for Compressor

SUMMARY TABLES: PUMP STATIONS

(See p. 147 for instructions.)

[illegible]

III. Distribution System

III. Distribution System

Water is delivered to a community via a distribution system whose operator has two objectives:

1. To maintain water quality from the time water enters the distribution system to the “*point of use*” (the point of use refers to a point from where a user would access water, for example, a faucet or a sink); and
2. To maintain adequate pressure and flow to satisfy customers’ demands and to meet the needs of fire protection services.

An operator’s primary duty is to know the distribution system and be aware of possible sources and issues that would affect the quality of the water being delivered. Degraded water quality can be the result of issues at the source of the water supply (where water enters the distribution system), within the distribution system itself, or from outside sources.

Water Quality

Two main factors that affect water quality in the distribution system are water age and pipe corrosion.

Water age refers to the time that it takes the water to travel from the PWS to the customer’s tap. When water remains in the distribution system for too long, the disinfection chemicals can dilute and allow microorganisms to grow. Poor taste and odors can develop.

Corrosion of the distribution system piping can also affect water quality. Lead and copper levels can increase if water travels through corroded pipes or comes into contact with corroded fixtures. Both copper and lead are regulated under the EPA’s Lead and Copper Rule. A monitoring and flushing plan is essential for proper distribution system operation.

Contaminated water can enter the distribution system through cross connections and backflows. A quick review of the maintenance of the distribution system and cross connection prevention can be found later in the section “Maintenance and Prevention” on page 34.

A. Components of the Distribution System

Pipes, valves, meters, and pumps are just a few of the components of a distribution system. Knowing the location and function of each one of these parts is critical in properly maintaining the distribution system and preventing degradation of water quality.

1. Pipe Materials

Ductile Iron: Made up of graphite cast iron with a lining made of cement mortar to prevent corrosion. These pipes are susceptible to corrosion.

Concrete: Concrete is favored for its extensive life, though connections are very difficult. It is available in larger diameters. Joints are typically sealed with an O-ring rubber gasket.

Polyvinyl Chloride (PVC): Economical substitute for the ductile iron pipe. Lightweight and easy to handle and connect. Exposure to sunlight and petroleum products will cause damage to the pipe.

Cast Iron: Tough and can withstand high pressures, but can be easily tapped.

Asbestos cement (AC): Composed of asbestos fiber, silica sand, and cement. Pipe material will not burn, corrode, or deteriorate. AC is lightweight, easily tapped but has low bendable capacity.

High Density Polyethylene (HDPE): HDPE is flexible, lightweight, corrosion resistant, and can withstand various environmental conditions. Can also be utilized in various water applications.

2. Valves

Gate Valves: Consist of discs controlled by turning the stem. They are moved downward into the water stream. When the gate reaches the bottom, a wedge engages and causes the gates to spread apart against the seat. By turning the stem in the opposite direction, the pressure is released and allows the gates to create distance from the seats. Gate valves are reliable and very low maintenance. Maintenance should consist of regular valve exercising.



Figure D. Gate Valve

Check Valves: Used to control the flow from going backwards. Check valves have two openings: one for water to enter and the other for water to exit. The outer casing is made of plastic or metal.



Figure E. Check Valve

Butterfly Valves: Consists of a disc with a rubber gasket on its sealing edge, which rotates in the stream from fully open to fully closed. Commonly used for flow regulation. Maintenance requires replacement of the rubber gasket.

Pressure Relief Valves (PRV): Used to relieve high-pressure surge conditions. The valve can be kept closed by a spring pushing against the valve disc. When there is a surge of high pressure, the spring releases and discharges the water pressure. As the pressure is lowered to normal, the spring forces the disc to close.

Globe Valves: The valve is used to regulate flow in a pipeline. The body includes a baffle that separates the spherical body. The baffle has an opening that is closed and opened by a plug. This plug is controlled by the stem. Globe valves have high maintenance requirements.



Figure F. Globe Valve

Surge Anticipator Valves (SAV): An SAV is designed to minimize the effects of water hammer and pressure surges within the distribution system. When the pressure exceeds the setpoint, the valve opens quickly to dissipate the high-pressure surge.

Altitude Valve: This valve controls the level of a water tank. The valve will close at a preset maximum water level to prevent overflow of a ground storage tank or reservoir. It will open to refill when the water level begins to decrease. The opening and closing of the valve is done automatically.

3. Pumps

Centrifugal Pumps: These are the most common type of pumps used in the water system. These pumps use a rotating impeller to increase the pressure of the water. There are many sizes and configurations of centrifugal pumps to meet varying head and flow requirements.

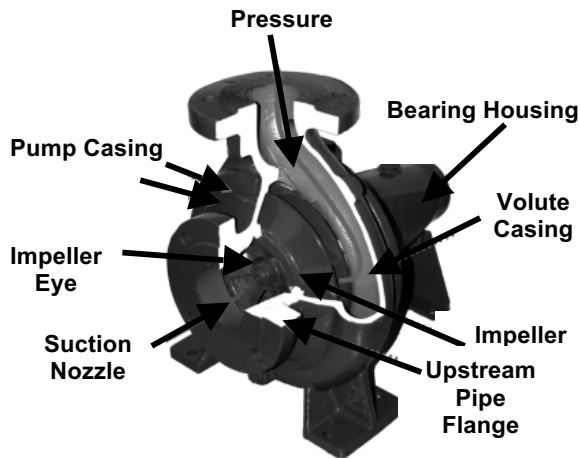


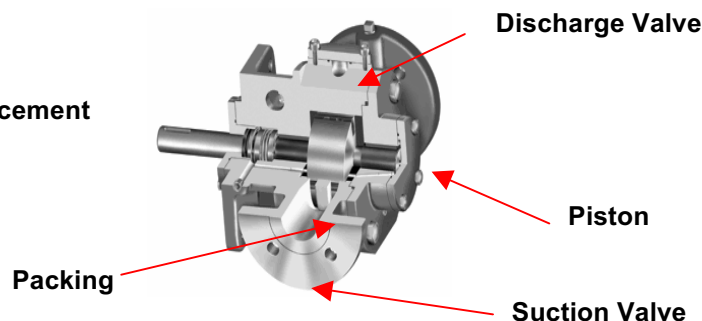
Figure G. Centrifugal Pump
(at left)

Submersible Pumps: Mostly used for pumping groundwater from wells. This pump can be described as a multi-stage centrifugal pump. Most failures occur due to electrical problems with the motors.

Vertical Turbine Pumps: The water flows vertically through the channel with the impeller positioned in the center. The blades of the impeller are shaped so that the water flows in an outward direction. These pumps are relatively more expensive and require extra maintenance.

Positive Displacement Pumps: Commonly used for feeding chemicals. They displace a certain volume of water with each stroke of a piston or gear. More suited for high-pressure and low-flow service.

Figure H. Positive Displacement
Pump (at right)



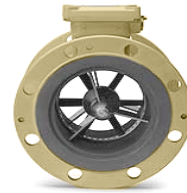
4. Meters

Displacement Meter: Commonly used in residential and small commercial applications. The water must physically shift the moving measuring element in direct relation to the amount of water that passes through the meter. The disc moves the magnet that drives the register.

Multi-jet Meters: These meters are very accurate in small sizes and great for residential and smaller commercial uses. These meters use several ports that surround an internal chamber to create multiple jets of water against an impeller.

Turbine Meter:

These meters are less accurate than displacement and jet meters at low flows. They are great meters for large commercial users, fire protection, and master meters for the distribution system.



**Figure I.
Turbine Meter**

Compound Meter: This type of meter is used for high-flow rates. These meters have two measuring elements and a check valve to regulate flow between them. When flows become too low for the turbine meter to read the flow accurately, a check valve closes to divert water to a smaller meter that can read the low flow accurately. The smaller meter is normally a multi-jet or positive displacement meter.



Figure J. Compound Meter

Electromagnetic Meter: These meters use electromagnetic properties to determine the flow velocity. They require AC or DC electricity from a battery or line to operate the electromagnets. They can also read flow from both directions and use the electronics for measuring and totalizing the flow.

Ultrasonic Meter: These meters use an ultrasonic transducer to send ultrasonic sound waves through the fluid to determine the velocity and measure the water volume.

5. Hydrants

In addition to fire fighting, hydrants are also used for flushing the distribution system and providing high pressure to flush sewer lines. Hydrants may stir up sediment accumulated in the mains. The problem can be reduced by flushing the hydrants regularly. A flushing program can be set up to maintain hydrants, keep the system clean, and prevent customer complaints.

There are two types of hydrants: dry and wet.

Dry hydrants are generally used in freezing weather because the main valve is located under the frost line. Water is not present in the upper part of the stem. Valves located at the base drain leftover water into the ground once the hydrant has been used.

Wet hydrants contain water in the upper part of the stem. These hydrants are used in warm climates.

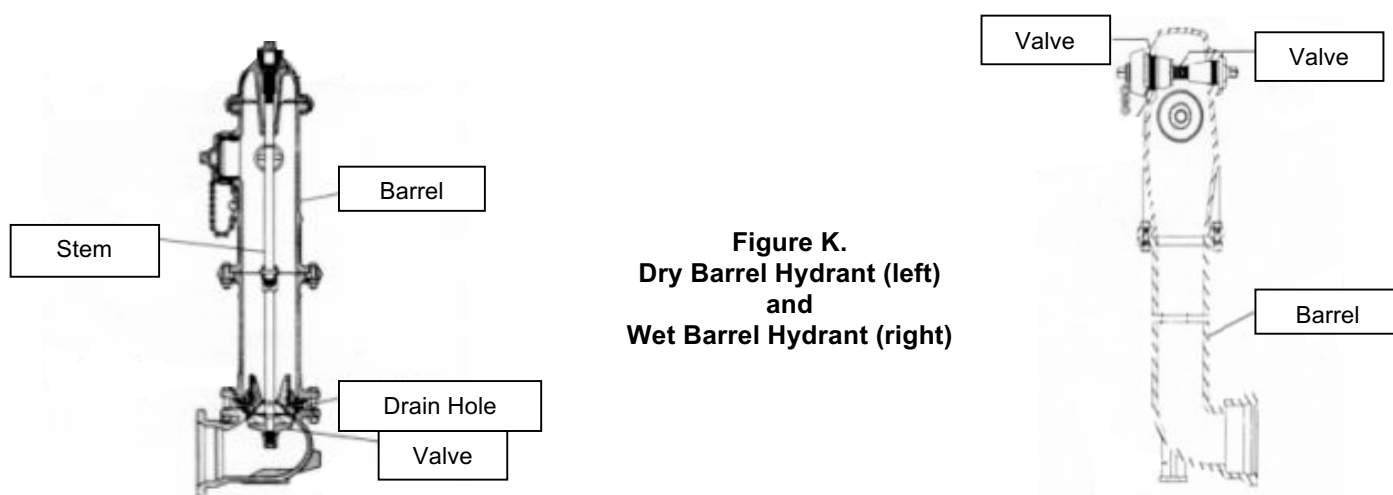


Figure K.
Dry Barrel Hydrant (left)
and
Wet Barrel Hydrant (right)

B. Maintenance and Prevention

As previously discussed, distribution system maintenance is essential in preventing the degradation of water quality as water travels through the system to reach customers. There should be a preventative maintenance program set up to ensure water quality and distribution system components are being properly maintained.

1. Main Flushing

Not all PWSs have problems with sediment accumulation, but those operators who find themselves with problematic systems establish a “flushing program.” Some PWSs combine their flushing program with their hydrant testing. Understanding the distribution system and responding to customer complaints will allow the operator to establish areas that need to be cleaned more often.

If an area needs to be flushed, it is recommended this be done at night or during low peak times when customers will be less affected by the process. It is also recommended that customers are informed of the flushing schedule and be advised to be aware of the water discoloration and possible issues that may result from flushing.

If a large system needs to be flushed, the conventional practice is to start from the plant and work outward. Hydrants should be used to “flush” out the water until it runs clear.

The unidirectional flush is a method in which all the valves to connecting mains are closed in one section. Then the section is flushed in one direction flushing at one hydrant at the end of the section.

2. Cross Connection Control

Cross connections are existing or potential connections between a potable and non-potable supply of water that can cause serious hazards for public health.

A cross connection can happen anywhere in a distribution system. Public places such as hospitals, businesses, and industries are more apt to contain cross connections. Table 3 shows some potential cross connection locations.

If a cross connection is discovered, then according to R18-4-215, the PWS must: submit a written cross connection incident report to the department and the local health authority within five business days after a cross connection problem occurs that results in contamination of the public water system.

Connection
Dentist Office
Car Washes
Funeral Homes
Boilers
Cooling Towers
Printers
Sinks
Chlorinators
Agricultural Pesticide Mixing Tanks

Table 3. Potential Sources for Cross Connections

The report shall address all of the following:

1. Date and time of discovery of the unprotected cross connection,
2. Nature of the cross connection problem,
3. Affected area,
4. Cause of the cross connection problem,
5. Public health impact,
6. A copy of any public health advisory issued (and related correspondence),
7. Each corrective action taken, and
8. Date of completion of each corrective action.
9. Record retention, it is required that records of microbiological and turbidity analyses should be kept for no less than 5 years. Records of chemical analyses shall be kept for no less than 10 years. Records of action taken to correct any violation of regulations should be kept no less than 3 years after the correction action has been taken. Copies of written reports, summaries or communications shall be kept for no less than 10 years. Records concerning a variance or exemption shall be kept for no less than 5 years following the exemption or variance.
10. Backflow prevention assembly inspection should be done at least annually, or more often as directed by the water system or Department.
11. Distribution System: Template Forms

3. Backflow Prevention

Arizona has specific rules about backflow prevention. R18-4-215 provides specific information about the requirements for the PWS if and when a prevention device is needed. This section provides only a brief summary and it is recommended R18-4-215 be reviewed by the operator.

The PWS is responsible for ensuring that a backflow-prevention assembly is installed whenever any of the following occurs:

1. A substance harmful to human health is handled in a manner that could permit its entry into the public water system. These substances include chemicals, chemical or biological process waters, water from public water supplies that has deteriorated in sanitary quality, and water that has entered a fire sprinkler system. A Class 1 or Class 2 fire sprinkler system is exempt from the requirements of this Section;
2. A source of water supply exists on the user's premises that is not accepted as an additional source by the public water system or is not approved by ADEQ.
3. An unprotected cross connection exists or a cross connection problem has previously occurred within a user's premises; or
4. There is a significant possibility that a cross connection problem will occur and entry to the premises is restricted to the extent that cross connection inspections cannot be made with sufficient frequency or on sufficiently short notice to ensure that unprotected cross connections do not exist.

A brief description of the assemblies available for backflow prevention is available in Table 4 (at right).

Once the backflow prevention has been set up, the PWS is responsible for maintaining records about the installation and the tests performed. These records shall be retained by the PWS for at least three years and shall be made available for review by the Department upon request.

These records shall include: An inventory of backflow-prevention assemblies and, for each assembly, all of the following information:

1. Assembly identification number and description,
2. Location,
3. Date of tests,
4. Description of repairs and recommendations for repairs made by the tester, and
5. The tester's name and certificate number.

Table 4. Backflow Prevention Assembly's (right)

Backflow Prevention Assembly	Description
Air Gaps	<p>The air gap must be at least twice the internal diameter of the supply pipe, but not less than 1 inch.</p> <p>There are no moving parts.</p> <p>Surveillance is needed to check for tampering.</p>
(RP) Reduced-Pressure-Backflow Prevention Assembly	<p>Made up of two spring-loaded check valves and a pressure regulated relief valve in between the check valves.</p> <p>More trusted than Double Check Valves because the relief valve prevents leaks.</p> <p>Must be installed where the relief port is not submerged, frozen, or vandalized.</p>
Double Check Valves	<p>No relief valve between the valves.</p> <p>Because of leaks, this device is not recommended for situations in which health hazards may result.</p>
Vacuum Breakers	<p>Two Types: Atmospheric and Pressure.</p> <p>Used in piping connections where there is no backpressure</p>
Complete Isolation	<p>Complete separation of conflicting pipes. Signs and Colors can be assigned to prevent any accidental connection.</p>

C. Sampling in the Distribution System

To ensure the quality of the water in the distribution system, the operator must sample the water in the distribution system. There are two ways an operator can get a water sample: grab sample and composite sample.

A *grab sample* is a certain volume of water collected at one point at one time. The sample represents only the quality of water at the time it was collected. If the analysis of the grab samples is observed to be uniform over a period of time, then the grab sample is representative of the quality of water.

A *composite sample* is a collection of grab samples collected at different times and mixed together. The analysis then provides the average value of all grab samples. A *time composite sample* refers to a composite sample where the same volume was taken at a specific time period. For example, a sample was taken every hour, every two hours, or every 24 hours.

1. Sample Locations

Sample locations have two main requirements:

1. They have to be representative of the water source that enters the system; and
2. They must represent the various conditions within the distribution system.

The frequency of samples is determined by the number of customers served and the water source used. In some cases, samples will be taken from businesses and homes. If this is the case, then notifying the customer where the sampling will take place is appropriate.

2. Collecting a Sample

The point of collection becomes very important in the sampling process. It is advised to run the water for at least five minutes to allow stagnant water to flush out. A steady flow is desired to prevent any splashing. If a sampling point cannot provide a steady flow, then it should not be used.

The sample bottle is prepared with thiosulfate to stop the action of residual chlorine if chlorine disinfection is used. Therefore, it is very important that the sample bottle IS NOT rinsed prior to taking the sample. The sample bottle needs to be labeled properly:

- Name of person sampling
- Time of sample
- Date of sample

- Location of sample (if the location is a customer's house, provide address and specify location of the sink)
- Parameters (type of testing needed for the sample)

The sample bottle may be glass or plastic depending on the analysis requirements.

3. Sample Holding Time

Once the sample has been taken and labeled, it is important to be aware of the holding time of the sample. Depending on the analysis required, some samples will require certain tests to be done on-site such as temperature and pH.

Some bacteriological tests have a 24-hour holding time, meaning that the analysis needs to happen within 24 hours after the sample was collected to be valid. Due to the strict holding rules, it is advised that sampling be done mid-week to insure that a laboratory is available to receive the sample and analyze it within the appropriate timeframe.

D. Source Water Protection Area

The 1996 amendments to the federal Safe Drinking Water Act (SDWA) required states to develop and implement a Source Water Assessment Program (SWAP). Source Water Protection (SWP) is intended to be a proactive measure to protect our critical sources of public water supply. It focuses on pollution prevention practices to protect the water quality in a watershed or wellhead protection area serving a public water supply (i.e., the source water protection area).

Arizona's Source Water Protection Program is designed to protect drinking water sources from becoming contaminated in the future. The program builds upon the Wellhead Protection Program, which was established by the Safe Drinking Water Act in 1986 and was designed to protect groundwater supplies being used to provide drinking water to the public through public water systems. The program provides a mechanism through which ADEQ and local communities throughout Arizona can protect both surface and groundwater drinking water sources.

ADEQ administers this program to assist public water systems, local officials, and utilities in developing and implementing plans to protect surface and groundwater resources by actively coordinating local pollution prevention efforts with existing state programs. Support available from ADEQ includes both assistance with program development and technical resources.

E. Distribution System: Template Forms

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DISTRIBUTION SYSTEM

WATER SOURCES: WELL(S)

(See p. 148 for instructions.)

Well ID Number (ADWR)	Permit Date	Diameter (inches)	Well Depth (feet)	Pump Capacity (gpm)	Casing Length (feet)	Casing Diameter (inches)	Casing Grouted (Yes or No)	Depth of Grout (feet)
							Click	
							Click	
							Click	
							Click	
							Click	
							Click	
							Click	

Well ID Number (ADWR)	Well Driller	Installation Date	Well Location/Physical Address	GPS Latitude/Longitude

DISTRIBUTION SYSTEM

WATER SOURCES: SURFACE WATER

(See p. 149 for instructions.)

Name	ID Permit Number	Date of Permit	Location Address or GPS Latitude/Longitude	Allowance Capacity (gpd)

DISTRIBUTION SYSTEM

WATER SOURCES: PURCHASED WATER

(See p. 149 for instructions.)

Name of Supplier	Start Date of Contract	Contact Person	Telephone Number	Address

Name of Supplier	Pressure (psi)	Is water metered? (Yes/No)	Meter Size (inches)	Average Daily Usage (gpd)	Backflow Prevention Yes/No	Additional Treatment Provided? Yes/No
		Click			Click	Click
		Click			Click	Click
		Click			Click	Click

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: VALVES

(See p. 150 for instructions.)

The following is a table that identifies valves in the distribution map including their locations, descriptions, and functions. This table should serve as a quick reference to the map. The first line has been provided to you as an example.

Valve	Manufacturer/ Model Number	Location	Size (inches)	Description	Function
<i>Valve 001</i>		<i>Main St./1st Rd.</i>	<i>12"</i>	<i>Gate Valve</i>	<i>Shuts off all water to south of Main Street; Open 3rd in flushing routine.</i>
				Click	
				Click	
				Click	
				Click	
				Click	
				Click	
				Click	
				Click	
				Click	
				Click	
				Click	

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: FIRE HYDRANTS

(See p. 150 for instructions.)

Hydrant	Make/Model	Type	Location (GPS if available)	Flow Capacity (gpm)	Inspection Frequency	Color
<i>Hydrant 01</i>	<i>00000/00000</i>	<i>Dry Barrel</i>	<i>Intersection: 1st Ave. and 3rd St.</i>	<i>1500</i>	<i>1/year</i>	<i>Yellow</i>
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				
		Click				

Documents for recordkeeping can be found in Appendix 8: Hydrant Inspection Records

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: BACKFLOW PREVENTERS

Manufacture	Model	Size	Serial Number	Last Test Date	Location	Tester Name	Certified Tester Number

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: PUMPS

(See p. 151 for instructions.)

The following is a table that identifies pumps in the distribution map including their locations, size, and type. This table should serve as a quick reference to the map. The first line has been provided to you as an example.

Pump Name	Manufacturer/Model Number	Pump Location	Flow Capacity (gpm)	RPM	Horsepower (HP)	Type of Pump	Lubrication/ Inspection Frequency
<i>Pump 1</i>		<i>Well # 3</i>	<i>50</i>	<i>100</i>	<i>25</i>	<i>Centrifugal</i>	
						Click	
						Click	
						Click	
						Click	
						Click	
						Click	
						Click	
						Click	
						Click	
						Click	
						Click	
						Click	

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: METERS

(See p. 151 for instructions.)

The following is a table that identifies meters in the distribution map including their locations, size, and type. This table should serve as a quick reference to the map. The first line has been provided to you as an example.

Meter Name	Manufacturer/ Model Number	Meter Location	Pipe Size (in)	Flow Capacity (gal)	Inspection Frequency	Description of Meter
<i>Meter 1</i>		<i>Well # 3</i>	<i>2"</i>	<i>55</i>		<i>Positive Displacement</i>
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click
						Click

SYSTEM FLUSHING

(See p. 152 for instructions.)

[illegible]

DISTRIBUTION SYSTEM

SAMPLING

(See p. 152 for instructions.)

Sample Type: The samples and locations mentioned in this table are conducted within the distribution system. The sample locations are reviewed and approved by ADEQ.

Sample Type	Sample Location (Address or GPS Coordinates)	Frequency	Sampling Procedure
Click			
Click			
Click			
Click			
Click			
Click			
Click			
Click			
Click			

Sampling records are found in Appendix 8: Sampling Records

IV. Start-Up Procedure

IV. Start-Up Procedure

Well-defined organization within a PWS is important in maintaining a high level of communication between management, operators, and decisionmakers. Proper organization requires that the jobs and duties of each staff member be defined and understood.

A. Organization Chart

An organization chart is an hierarchy designed to show the lines of authority in the organization. The chart shows who each manager is and who he manages.

B. Managing a PWS

A PWS is responsible for performing important tasks in order to maintain water quality standards. From maintenance tasks to monitoring tasks, a PWS manager must make sure each task is completed.

1. Tasks

Tasks are divided into two different types: monitoring and maintenance.

Monitoring tasks require the gathering of information about how the PWS units are working. Monitoring tasks include visual observations and sample analysis.

Maintenance tasks are either routine or necessary tasks. Maintenance tasks need to be completed when a monitoring task shows there is a problem in a *unit of treatment*. A unit of treatment refers to a specific part of the treatment, such as disinfection or sedimentation. For example, if the pH in the disinfection unit is abnormal, then a maintenance task needs to be performed to return the pH to normal.

Other times, maintenance tasks must be performed to prevent abnormalities in the system. For example, flushing in the distribution system rids the system of any settled solids in the pipes.

2. Logs

Because the completion of every task is important to maintain the quality of water, each employee must keep track of completed and incomplete tasks.

Logs are an easy way to set up a schedule and keep track of the completion date. Logs should include: a description of the task; the date task was completed; and the outcome of the task.

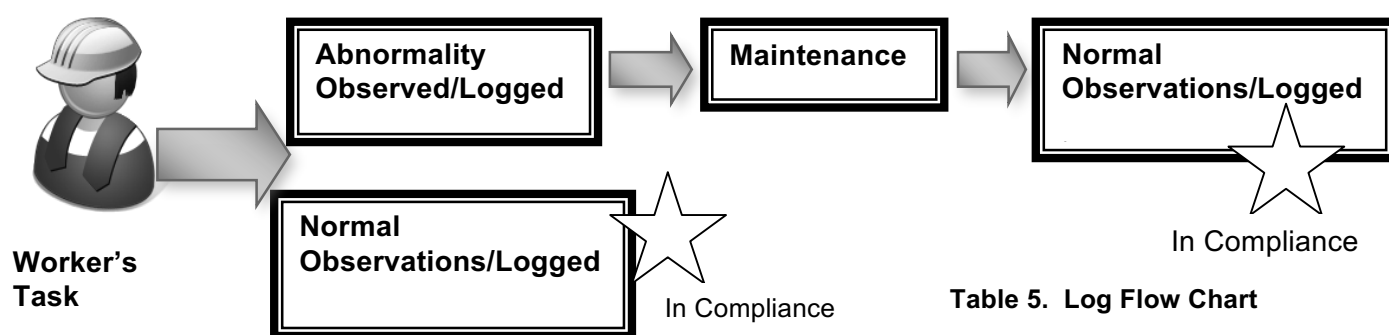
Logs can be categorized according to the frequency of the task. For example, does the task need to be completed daily, weekly, monthly, or yearly. Logs can also be categorized according to treatment units. For example: All chlorination tasks (daily, monthly, and yearly) are included in the chlorination log.

Logs are essential in understanding the PWS treatment process status. Logs are a tool used to track system operations and maintenance.

Logs are used to record normal settings in the process and report abnormal settings. *Normal settings* refer to the settings, such as temperature and pH, which are needed to achieve all compliance requirements.

Logs will also be used to collect information for reports to the decisionmakers of the organization. These decisionmakers can include a managers, board members, and community members.

3. Work Orders



Work orders are used by the manager to communicate, in writing, if any non-routine tasks are needed. Work orders are also used to record completed tasks by the staff for administrative purposes.

There are two parts of the work order: one for the manager and one for the person responsible for completing the task.

The manager's section includes: (1) The task needing completion; (2) Work order date; (3) Date completed; (4) Location; (5) Instructions; and (6) Name of the person to complete the task.

The staff member responsible for the task should: (1) Include the hours needed to complete the task; (2) Identify the equipment and materials used; (3) Return the form to the manager once the task is completed.

Lab Record	Record's Characteristics
Refrigerator Temperature Log	<ul style="list-style-type: none"> • It is used to record the temperature of the refrigerator to assure correct holding temperature for samples. • It includes a space for the Date, Name of Technician performing temperature inspection, and the temperature observed. • It should also include a space to record the first and last day the log was used.
Sample Analysis Records	<ul style="list-style-type: none"> • These records provide information such as the analysis name, date, and the name of the person performing the analysis. • If data was entered into a record system, then the name and signature of the person who entered the data and the name and signature of the person who approved the entered data should be included in the form. • Information such as the reference sample concentration <i>by calculation</i> and the reference sample concentration <i>by analysis</i> should also be included.
Laboratory Equipment Maintenance Log	The log should include: Date, Name of Technician, Maintenance Activity, Reason for Maintenance and a space for notes.
Chain of Custody	<ul style="list-style-type: none"> • This document is of utmost importance for any water treatment sampling procedure. It is a document that keeps track of every person that has handled the sample. • It contains space for the signature of the person who took the sample, and about four more spaces for the signatures of anyone who handles the sample after it was taken. • It also contains: date of the sample, time, identification, container type, sample type, and preservation information.
Conductivity Calibration Log	This form contains the date, name of analyst, reading before calibration, slope, reading after calibration, and notes.
Bench Sheets	<ul style="list-style-type: none"> • This form keeps track of the analysis of the sample: sample date, time, location, and type. • Must include the name of the person who collected the sample, and the name of the analyst; analysis date and time; name and information of the equipment used. <p>For example, if an oven was used, then the record should include time in the oven, time out of the oven, and oven temperature at the time sample was taken out. It should also include a description of the EPA method used.</p>

Table 6. Lab Records

4. Lab Records

In essence, lab records are very important when it comes to showing compliance with the ADEQ's Safe Water Regulations. Lab records include:

- Refrigerator Temperature Log
- Sample Analysis Records
- Laboratory Equipment Maintenance Log
- Chain of Custody
- Conductivity Probe Calibration Log
- Bench Sheets

All of these logs allow for recording different information, but all have the same goal: To record every step and detail of sample handling and sample analysis. If it is not recorded, then for an inspector it never happened.

Examples of Logs, Work Orders, Chain of Custody, and Inspection Forms are included in the Appendices.

C. Safety

Safety is a crucial component of the work tasks in a PWS. Safety is regulated by the Occupational Safety and Health Administration (OSHA) at the federal level and the Arizona Division of Occupational Safety and Health at the state level.

Safety is both a responsibility and a right. Workers have a right to a safe work environment, therefore, PWS management should develop a safety program that trains the PWS staff in the proper safety procedures when working in the PWS. PWS staff likewise have the responsibility to perform tasks in accordance with the established safety procedures. A part of such a safety plan is the duty to report all observed hazards and injuries.

1. Electrical Equipment

A PWS worker is at risk of electrocution or shock because of the damp conditions they work in while using electrical equipment. To avoid accidents:

- Protect electrical equipment and wiring from deterioration.
- Be aware of wet areas nearby.

- Cover any live parts with fittings or enclosures to prevent contact.
- Only permit-qualified individuals should be allowed to work with PWS electrical equipment.
- Install ground fault interrupter where needed.
- Use lock out/tag out procedures to clean, service, or adjust an electrical device.
- Always obey lock out/tag out procedure. *Lock out/Tag out Procedures are described in Table 7.*

2. Pumps

The danger of pumps derives from their moving parts. Pumps may include rotating and cross motions and back & forth movement. To reduce the risk of injury, pumps have many of their moving parts covered.

Safety procedures for pumps should be followed during the performance of any maintenance. If a pump needs to be manually fixed or inspected, then there are two main procedures to follow:

- Identify all potential hazards prior to starting.
- Follow Lock out/Tag out Procedures. *Table 7.*

If possible, all personnel not working on the pump should leave the area until the work is done.

Tag out devices shall warn against hazardous conditions if the machine or equipment is energized and shall include one of the following:
Do Not Start. Do Not Open. Do Not Close.
Do Not Energize. Do Not Operate.

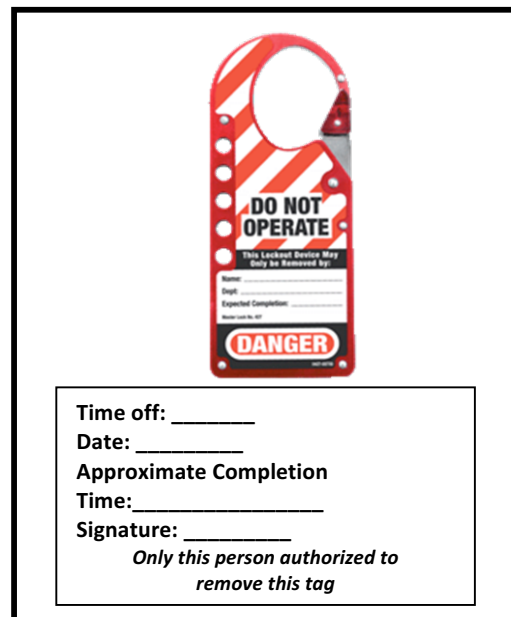


Figure L. Lock Out/Tag Out Tag

BASIC LOCK OUT/TAG OUT	
Communicate	Communicate to all affected PWS staff about why the unit is being locked.
Shut off Unit	Isolate the equipment's energy source. The source may be controlled by a switch or a valve.
Check For Store Energy and Pressure	Energy may be stored in springs, hydraulic systems, and rotating parts. Pressure for steam, gas, air, or water should be restrained or dissipated.
Lock out/ Tag out	<p>Make sure no one is in the unit or close to it.</p> <p>Using an appropriate labeled tag isolate the energy from the unit. <i>Check Figure L.</i></p> <p>Check that the unit has no energy by turning or pressing the “on” setting. The “on” setting should have been disabled and no parts should move.</p>
Completed Work	<p>Once the work or task is completed in the unit:</p> <ul style="list-style-type: none"> • Make sure no one is left in the unit. • Make sure all tools are cleared. • Remove “lock out/tag out” lock. • Enable energy. • Notify affected employees the task is done.

Table 7. Lock Out/Tag Out Procedures

3. Water Storage

Water storage can be especially dangerous during the application of interior coating and inspections of wetwells and treatment basins. This maintenance task requires confined space entry safety procedures.

Confined space is described as a place:

- That is not designed for continuous use or occupancy.
- Has restricted exit and entry.
- Is large enough that an employee can performed assigned work.
- May contain a hazardous environment.

- May contain material that may incapacitate the individual entering.
- May trap or asphyxiate entrant.
- Has been observed to cause hazards to the safety of the individual entering.

Under federal regulations a confined space may or may not require a permit. Non-permit-required confined spaces must be considered a permit-required confined space until a competent person has followed pre-entry procedures and determined the space does not require a permit.

A competent person is defined as an individual who can evaluate and recognize hazards. This person must know how to follow proper procedures to ensure worker safety.

A sample confined entry permit check list is provided in Appendix 11.

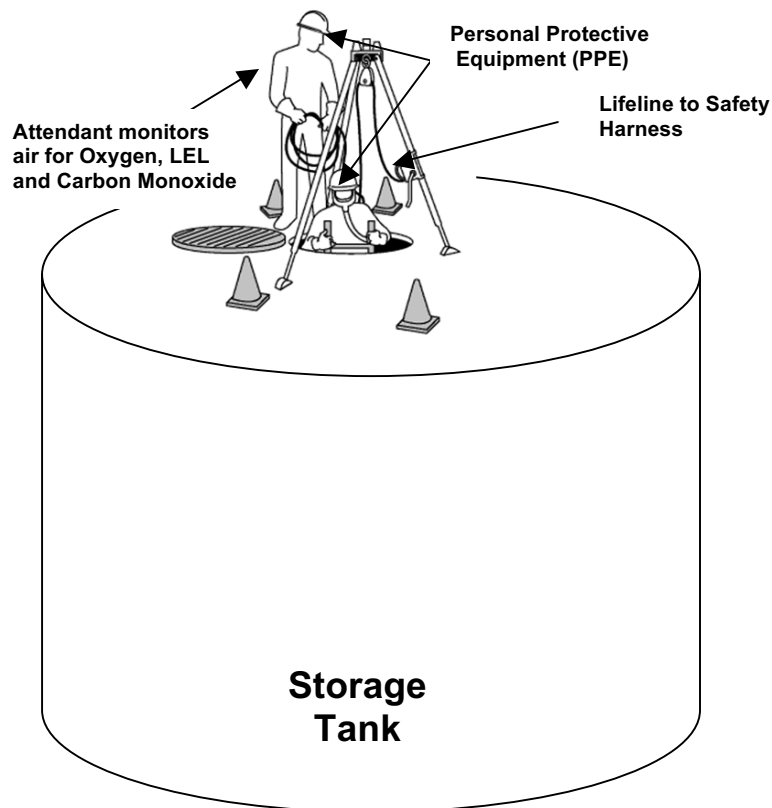


Figure M. Confined Space Entry Graphic

4. Chlorine

Chlorine is highly corrosive and toxic in moist environments. Chlorine can be handled as a gas, liquid, or dry form. Because chlorine is highly corrosive when moist, it should be handled in corrosive-resistant containers such as glass, silver, or Teflon. But if chlorine is in gas form, it should be handled in steel containers because of the gas's high pressure.

Chlorine is dangerous because it can disable a person's sense of smell.

Chlorine can be detected by a person at .3 ppm. A person should never be exposed to any concentrations of 1 ppm or more. Chlorine exposure in small amounts can cause vomiting, heavy coughing, and severe irritation of the nose, mouth, eyes, and lungs. Heavy exposure to chlorine can be fatal.

When working around chlorine, the following personal protective equipment (PPE) should be used:

- Self-contained breathing apparatus
- Boots
- Gloves
- Disposable suits with hoods
- If concentration is high then a chemical suit is appropriate.

5. Other Chemicals

Chemicals have different dangers at different levels of exposure. The PWS staff should be familiar with the chemical prior to working with it. Therefore, it is important to maintain Safety Data Sheets (SDS) for all chemicals handled in the PWS. An SDS contains information necessary to familiarize the PWS staff with the chemicals located in their place of work. An example of an SDS is shown on Figure N, p. 59.

**COMPONENTS OF A
SAFETY DATA SHEET**

Sodium Hypochlorite

Product identification	Sodium Hypochlorite
Figure A Composition	12.52% - 15.6%
Hazards and effects	Severe irritation and burning
First aid	Flush with water. Do not induce vomiting
Fire fighting measures	Water, foam or dry chemical
Accidental release	Flush with water. Use absorbent material
Neutralizing agent	Sodium Bisulfite
Handling and storage	Cool / dark not to exceed 100 F
Reactive data	Ammonia
PPE required	Gloves, goggles
Disposal	In accordance with local, State, and Federal regulations

Figure N. Safety Data Sheet (SDS)

D. Start-Up Procedure: Template Forms

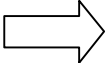
○ PWS Staff Organization Chart	62
○ PWS Staff Task Descriptions	63
○ Inspection of the Distribution Facility	64
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○ Routine Semiannual Tasks	71
○ Routine Annual Tasks	72
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START-UP PROCEDURE

PWS STAFF ORGANIZATION CHART

(See p. 152 for instructions.)

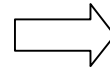
NAME OF THE ORGANIZATION:

1. 

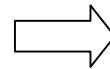
2.



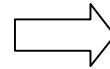
3.



4.



5.



6.

START-UP PROCEDURE

PWS STAFF TASK DESCRIPTIONS

(See p. 153 for instructions.)

Name and Job Title	Task Descriptions

START-UP PROCEDURE

INSPECTION OF THE DISTRIBUTION FACILITY

(See p. 153 for instructions.)

TASK	FREQUENCY	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT
Well Number or ID			
	Click		
	Click		
	Click		
	Click		
Storage Tank			
	Click		
	Click		
	Click		
Pumps			
	Click		
	Click		
	Click		
	Click		
	Click		
Hydrants			
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		

START-UP PROCEDURE

INSPECTION OF THE DISTRIBUTION FACILITY

(See p. 153 for instructions.)

TASK	FREQUENCY	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT
Pipe Number or ID			
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		
	Click		

START-UP PROCEDURE

ROUTINE TASKS

(See p. 154 for instructions.)

DAILY		
TASK	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT
Well		
Disinfection		
Distribution System		

START-UP PROCEDURE

ROUTINE TASKS

(See p. 154 for instructions.)

DAILY		
TASK	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT

START-UP PROCEDURE

ROUTINE MONTHLY TASKS

(See p. 154 for instructions.)

	MONTHLY	
TASK	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT
Record Monthly Source Water Production (daily, if introducing chemicals)		
Date of Submission of Monthly Report to Water Supply Division		
Chemical Solution Tanks Filled		
Collect Tests of Chemical Feed Pump		
Calibrate all Analysis Equipment/Replace Fluids as Necessary/Clean and Flush as Needed		
System Maintenance		
Pumps		
Valves		

START-UP PROCEDURE

ROUTINE MONTHLY TASKS

(See p. 155 for instructions.)

MONTHLY		
TASK	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT

START-UP PROCEDURE

ROUTINE QUARTERLY TASKS

(See p. 155 for instructions.)

QUARTERLY		
TASK	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT
Collect Required Chemical Monitoring Samples		
Calibrate All Analysis Equipment		
pH meter		
Turbidity meter		
Collect Bacteriological Sample for ADEQ Compliance		
Collect Nitrate Sample for ADEQ Compliance		

START-UP PROCEDURE

ROUTINE SEMIANNUAL TASKS

(See p. 155 for instructions.)

SEMIANNUAL		
TASK	EXPECTED RESULT	TROUBLESHOOTING
Inspect Surface Water Intake		
Calibrate all Analysis Equipment		
pH meter		
Turbidity meter		
Inspection of Fire Hydrants <i>Appendix 8: Hydrant Inspection Records</i>		

START-UP PROCEDURE

ROUTINE ANNUAL TASKS

(See p. 156 for instructions.)

ANNUAL		
TASK	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT
Exercise all Valves in Distribution System		
Calibrate all Analysis Equipment		
pH meter		
Turbidity meter		
Anti-siphon and Backflow Prevention Assembly Testing		
Flush Distribution System (Unidirectional)		
Prepare/Distribute Consumer Confidence Report		
Collect Bacteriological Sample for ADEQ Compliance		
Collect Nitrate Sample for ADEQ Compliance		

START-UP PROCEDURE

OTHER ROUTINE TASKS

(See p. 156 for instructions.)

TASK	FREQUENCY	EXPECTED RESULT	TROUBLESHOOTING IN CASE OF UNEXPECTED RESULT
Inspect and Clean Storage Tank	Every 5 years		
Update Monitoring Waivers	Every 3 years		
Apply and Renew Permit to Operate	Based on Permit Expiration Date		
Renew Certified Operator Certification	Every 3 years		

V. Emergency Operations Plan/Emergency Response Plan

V. Emergency Operations Plan/Emergency Response Plan

A PWS must be ready for any emergency situation that might arise from contamination or loss of the water supply. PWS staff must be trained to implement the proper procedures for using an alternative water supply source(s).

An Emergency Operations Plan/Emergency Response Plan must meet the requirements of the Arizona Department of Environmental Quality, Drinking Water Program Title 18, Chapter 4, Article 204 of the Arizona Administrative Code and the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL107-188, referred to as the Bioterrorism Act). In the Bioterrorism Act, Congress recognized the need for drinking water systems to undertake a more comprehensive view of water safety and security. The Act amends the Safe Drinking Water Act and specifies actions community water systems and the U.S. Environmental Protection Agency must take to improve the security of the Nation's drinking water infrastructure.

An Emergency Operations Plan/Emergency Response Plan includes:

- Flow Information
- Emergency Contact List
- Staff Contact List
- Emergency Disinfection Procedures
- Lists of procedures to deal with different scenarios such as water source contamination and loss of water supply.

Once completed, the plan should be updated regularly and the staff should be informed of any changes to the plan.

A. Public Notification

When a PWS is not in compliance with sampling requirements for fecal coliform or nitrate, or a waterborne disease outbreak jeopardizes the health of the community, then the community needs to be notified immediately.

The notice needs to communicate various points to the community as required by the ADEQ and the EPA.

The notice must include:

- PWS Name, ID#, and Date of Distribution.
- What kind of warning the notice is conveying.
- What the warning means to the community. For example, what kind of effects might the contamination have on public health?
- What steps the community should take to prevent health problems.

- What part of the population in the community will be most affected. (Generally, infants are the most affected population in the community.)
- Explain what the PWS is doing to correct this problem.
- Expected date of correction.
- Contact number: where the community can call for questions. The person(s) at this number should be aware of the issue and be prepared to communicate to the community in a professional manner.
- Request for the information to be shared with others.

Public notification also includes communicating with the media.

B. Emergency Operations Plan/Emergency Response Plan: Template Forms

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EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

PWS OVERVIEW

(See p. 156-157 for instructions.)

PWS CHARACTERISTICS					
Name of the PWS:					
Population Served:					
Number of Service Connections					
Type of System		Click			
Average Daily Demands		gal/day			
Design Capacity		gal/day			
# of Wells/Water Source		# of Storage Tanks		# of Pressure Tanks	
LABORATORIES					
LAB		Contact		Phone	
LAB		Contact		Phone	
PWS WATER SOURCE(S)					
Water Source	Water Source ID #		Connection Location		

Date Completed		Completed by:	
----------------	--	---------------	--

LOCAL EMERGENCY RESPONDERS (See p. 157 for instructions.)

Page 79
System Name and PWS No. Insert The Name Of The PWS.Doc

STAFF CONTACT LIST (See p. 157 for instructions.)

[illegible]

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

MAPS

Maps for this system can be found in:

APPENDIX 1: WATER SYSTEM MAPS

A. WATER SYSTEM SCHEMATIC

B. AS-BUILT MAP OF THE WATER SYSTEM

APPENDIX 2: SERVICE AREA MAP

APPENDIX 3: SOURCE WATER ASSESSMENT MAP

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

LOSS OF A SOURCE (R18-4-204) A1

(See p. 159 for instructions.)

LOSS OF A SOURCE			
CONTACTS			
1 st PWS Staff Contact		PHONE	
2 nd PWS Staff Contact		PHONE	
BACKUP WATER SOURCE			
TYPE: WELL, SURFACE, OTHER PWS, BOTTLED WATER IN VOLUME	NAME	LOCATION	CONTACT
Click			
Click			
PROCEDURE STEPS			

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

PROVISION OF ALTERNATIVE SOURCES OF WATER DURING EMERGENCY (R18-4-204) B1

(See p. 159 for instructions.)

PROVISION OF ALTERNATE SOURCES OF WATER DURING EMERGENCY			
CONTACTS			
1 st PWS Staff Contact		PHONE	
2 nd PWS Staff Contact		PHONE	
BACKUP WATER SOURCE			
TYPE: WELL, SURFACE, OTHER PWS, BOTTLED WATER IN VOLUME	NAME	LOCATION	CONTACT
Click			
Click			
PROCEDURE STEPS			

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

CRITICAL PART INVENTORY LIST:

(See p. 160 for instructions.)

PREVENTION OF LOSS OF WATER SUPPLY DUE TO MAJOR COMPONENT FAILURE (R18-4-204) A2, B5

Critical Parts				
Critical Part	Location	In-stock/Location	Supplier	Supplier Contact Number

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

CRITICAL SYSTEM COMPONENTS (R18-4-204) B4

(See p. 160 for instructions.)

Critical System Components					
Critical System Unit	Connected to critical water user?	Critical Water User	Location of Connection	Critical Water User Contact	Critical Water User Contact Phone

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

(See p. 161 for instructions.)

PROCEDURE DESCRIPTION: CRITICAL SYSTEM FAILURE (R18-4-204) B4

PROCEDURE DESCRIPTION CRITICAL SYSTEM FAILURE			
CONTACT			
1 st Contact		Phone	
2 nd Contact		Phone	
3 rd Contact		Phone	
PROCEDURE STEPS			

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

(See p. 161 for instructions.)

DAMAGE OF POWER SUPPLY EQUIPMENT/LOSS OF POWER (R18-4-204) A3

PROCEDURE DESCRIPTION			
DAMAGE OF POWER SUPPLY/LOSS OF POWER			
CONTACT			
1 st Contact		Phone	
2 nd Contact		Phone	
3 rd Contact		Phone	
Primary Electrician		Phone	
Backup Electrician		Phone	
Generators			
Number of Generator			
Location of Generator(s)			
PROCEDURE STEPS			

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

DISTRIBUTION SYSTEM EMERGENCY DISINFECTION PROCEDURE

(R18-4-204) A4, A6, B3

(See p. 162 for instructions.)

CONTACTS					
1 st Contact				Phone	
2 nd Contact				Phone	
3 rd Contact				Phone	
CHEMICALS					
Chemical		In-stock Location		Chemical Supplier/Phone	
STEPS FOR EMERGENCY DISINFECTION PROCEDURE					

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

(See p. 162 for instructions.)

WATER SOURCE EMERGENCY DISINFECTION PROCEDURE (R18-4-204) B7

CONTACTS					
1 st Contact			Phone		
2 nd Contact			Phone		
3 rd Contact			Phone		
CHEMICALS					
Chemical		In-stock Location		Chemical Supplier/Phone	
STEPS FOR EMERGENCY DISINFECTION PROCEDURE					

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

EMERGENCY ISOLATION LIST (R18-4-204) A4, A7, B3

(See p. 163 for instructions.)

[illegible]

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

CONTAMINATION OF THE DISTRIBUTION SYSTEM FROM BACKFLOW INCIDENT

(R-18-4-204) A4

(See p. 163-164 for instructions.)

PROCEDURE DESCRIPTION			
CONTAMINATION OF THE DISTRIBUTION SYSTEM FROM BACKFLOW INCIDENT			
CONTACT			
1 st Contact		Phone	
2 nd Contact		Phone	
3 rd Contact		Phone	
Backflow/Cross Connection Specialist		Phone	
PROCEDURE STEPS			
<ol style="list-style-type: none"> 1. First, contact appropriate staff and regulatory agencies. 2. Second, review Emergency Area Isolation List. 3. Third, review Emergency Disinfection Procedure. 4. Fourth, review media/community notification procedures. 			

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

(See p. 164 for instructions.)

COLLAPSE OF RESERVOIR, RESERVOIR ROOF, OR PUMP HOUSE STRUCTURE
(R18-4-204) A5

PROCEDURE DESCRIPTION COLLAPSE OF STRUCTURE			
CONTACT			
1 st Contact		Phone	
2 nd Contact		Phone	
3 rd Contact		Phone	
HEAVY EQUIPMENT			
HEAVY EQUIPMENT PROVIDER		PHONE	
ON-SITE HEAVY EQUIPMENT NAME		LOCATION	
PROCEDURE STEPS			
<p>1. Contact appropriate staff and regulatory agencies.</p>			

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

(See p. 165 for instructions.)

A BREAK IN A TRANSMISSION OR DISTRIBUTION LINE (R18-4-204) A6

PROCEDURE DESCRIPTION			
BREAK IN A TRANSMISSION/DISTRIBUTION LINE			
CONTACT			
1 st Contact		Phone	
2 nd Contact		Phone	
3 rd Contact		Phone	
HEAVY EQUIPMENT			
HEAVY EQUIPMENT PROVIDER		PHONE	
ONSITE HEAVY EQUIPMENT NAME		LOCATION	
PROCEDURE STEPS			
<p>1. First, contact appropriate staff and regulatory agencies.</p> <p>2. Second, check if area can be isolated.</p>			

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

NOTICE PROCEDURES (R18-4-204) B2

(See pp. 165-166 for instructions.)

PROCEDURE DESCRIPTION PUBLIC NOTICE PROCEDURES			
PWS CONTACT			
PWS Public Relations/Media Specialist		Phone	
1 st Contact		Phone	
2 nd Contact		Phone	
REGULATORY AGENCIES			
REGULATORY AGENCY		PHONE	
NEWSPAPERS			
NEWSPAPER		PHONE	
NEWS CHANNELS			
NEWS CHANNEL		PHONE	
TOPICS TO CONVEY TO THE PUBLIC			

DISINFECTION AND TESTING OF THE DISTRIBUTION SYSTEM (ONCE RESTORED)
(R18-4-204) B3 (See p. 166 for instructions.)

DISINFECTION AND TESTING OF THE DISTRIBUTION SYSTEM ONCE SYSTEM IS RESTORED

CONTACT

PWS Disinfection Manager

LAB

PROCEDURES FOR DISINFECTION TESTING AFTER RESTORATION

Sequenced System Shutdown

Shutdown of the water distribution system may become necessary due to the risk of contamination, natural disasters, or other unsafe conditions. The main objective of any plant/system shutdown is to avoid damage or unstable operating conditions resulting from system shutdowns or valve operations. It is the responsibility of the operator to ensure that the proper procedures are carried out in accordance with reliable operating practices. Below are key factors to keep in mind while developing your shutdown procedures:

- Actions by consumers may affect the hydraulic condition within the water distribution system
- Actions by the operator may influence conditions within the consumer's systems
- Ensure that the temporary pressure generated by a shutdown or valve operations within the pipelines and other equipment is not detrimental to system.

SEQUENCED SYSTEM SHUTDOWN			
CONTACT			
1 st Contact		Phone	
2 nd Contact		Phone	
STEPS TO ENSURE PROPER SYSTEM SHUTDOWN			

Appendices

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APPENDIX 1: WATER SYSTEM MAP

PROVIDE A MAP FOR THE FOLLOWING:

- A. WATER SYSTEM SCHEMATIC
- B. AS-BUILT MAP OF THE WATER SYSTEM

APPENDIX 2: SERVICE AREA MAP

PROVIDE A MAP OF THE SERVICE AREA MAP

APPENDIX 3: SOURCE WATER ASSESMENT MAP

PROVIDE A MAP OF THE SOURCE WATER ASSESMENT

APPENDIX 4: COAGULATION-FLOCCULATION RECORDS

If a form for this section exists and is in use for your system, then add the existing form behind this page.

COAGULATION-FLOCCULATION RECORDS

Start Date:		End Date							
TYPE OF COAGULANT:									
DATE THIS RECORD STARTED:									
ITEM	EXPECTED RESULT	RESULT /DATE							
Coagulant Dosage									
Raw Water									
Temperature (°C)									
pH									
Alkalinity (mg/L as CaCo3)									
Turbidity									
Taste and Odor									
Color									
Suspended Solids (mg/L)									
Algae Content									
Coagulated Water									
Filterability (Volume/Time)									
Zeta Potential (mV)									
Settled-Water Turbidity									
Filtered Water									
Turbidity									
Color									
Taste and Odor									
Algae Content									
Residual Coagulant (mg/L)									

APPENDIX 5: DISINFECTION RECORDS

If a form for this section exists and is in use for your system, then add the existing form behind this page.

DISINFECTION RECORD FORM

Start Date:		End Date:							
Name of Chemical:									
Strength of Chemical (%):									
Form (Liquid, Power, or Gas)									
Size of Container (Gallons or Lbs.)									
Supplier:									
Supplier's Phone:									
ITEM	EXPECTED RESULT	RESULT/DATE							
		Example 00/00/00							
Raw Water									
pH		0							
Chemical									
Dosage (mg/L)		0							
Tests									
Bacteriological Results		0							
Residual Results		0							

CHEMICAL FEEDER INFORMATION

Equipment Number: _____

Manufacturer: _____

Model Number: _____

Pump Specs Attached? YES NO

Capacity of feeder (gallons per day): _____

Pressure gauge reading (psi): _____

Feeder is equipped with these features and parts (please indicate with check mark):

- ☐ Pressure relief valve
- ☐ Calibration chamber
- ☐ Anti-siphon valve
- ☐ Degasser head
- ☐ Backpressure valve
- ☐ Foot valve
- ☐ Diaphragm
- ☐ Ball check
- ☐ Valve seat
- ☐ Valve spring
- ☐ Injection fitting

APPENDIX 6: SAMPLING RECORDS

If a form for this section exists and is in use for your system, then add the existing form behind this page.

SAMPLING FOR COLIFORM

Total coliform bacteria are naturally present everywhere in the near surface environment, and finding total coliform bacteria in the water distribution system is an indicator that the system may have been exposed to contamination such as rain water runoff, dust, dirt, or possibly more serious contamination. The total coliform bacteria group is persistent and is used as an indicator that other, potentially harmful, bacteria may be present. Coliform bacteria found in more samples than allowed is a warning of potential distribution or source water problems. The presence of fecal coliform bacteria in the water system is indicative of animal waste contamination and needs an elevated response level to protect the public health of the water system customers. Through the routine monthly monitoring of coliform bacteria the public water supply system is verifying the integrity of the water system's distribution piping and facilities (tanks).

The Total Coliform Rule is the federal regulation under the Safe Drinking Water Act that sets Maximum Contaminant Level (MCL) and monitoring requirements for certain biological contaminants. Every public water supply is required to periodically collect samples and analyze them for bacteria. The number of routine samples required each month depends on the system size and its source water. Some very small public water supplies with protected groundwater sources may have a reduced monitoring frequency granted to them by the Arizona Department of Environmental Quality (ADEQ) based on historical monitoring data and the public water supply's source water assessment.

Minimum Number of Routine Bacteriological Samples Required		
Type of System	Population Served	Minimum Number of Routine Samples
Community Water Supplies and Non-Community Non-Transient Water Supplies	25 - 1,000	1 sample per month*
	1,001 – 2,500	2 samples per month
	2,501 – 3,300	3 samples per month

*Includes Public Water Supplies which have at least 15 service connections but serve less than 25 people.

All community and non-community public water supplies need to complete a sampling site plan and file this plan with the ADEQ. If you need to update or modify your current sampling site plan you will need to contact the ADEQ for the latest form. To complete this sampling site plan you will need key contact information for the public water supply, the proposed routine monitoring location(s), an upstream monitoring location within five service connections of the routine monitoring location for each routine monitoring location, and a downstream monitoring location within five service connections of the routine monitoring location for each routine monitoring location. If you are a very small public water supply that only collects one bacteriological sample per monitoring period then you will also need to provide an additional repeat monitoring location. At least annually the water system operator needs to review the public water system's sampling site plan and make any necessary corrections to the plan and file these changes with the ADEQ.

The public water supply will collect samples at the routine monitoring sample location(s) each month and submit this sample(s) to a drinking water laboratory certified by the ADEQ or U.S. Environmental Protection Agency (EPA) for bacteriological analysis. If the laboratory results are non-detect for coliform bacteria, then the public water supply will submit the results to the ADEQ promptly. **If the results detect coliform bacteria, additional follow-up repeat sampling is required and the public water supply must notify the ADEQ as soon as possible.**

All repeat samples must be collected according to the public water supply's approved sampling site plan and within 24 hours of being notified of the routine positive results.

Repeat Monitoring Required if Routine(s) Bacteriological Sample(s) Positive		
Type of System	Population Served	Minimum Number of Repeat Samples
Community Water Supplies and Non-Community Non-Transient Water Supplies	25 - 1,000	4 repeats samples (see plan)
	1,001 – 2,500	3 repeat samples per routine positive (see plan)
	2,501 – 3,300	3 repeat samples per routine positive (see plan)

For Groundwater Systems:

In addition to the monitoring in the table above, a raw source water bacteriological sample must be collected from each source water well(s) that operated in the previous 72 hours for each routine sample with positive results, please refer to the public water supply's sampling site plan.

Follow-up with the ADEQ on public notification requirements, emergency treatment protective actions required, and additional monitoring that may be required. These detailed procedures should be part of the Public Water Supply's Emergency Response Plan.

Sample Containers and Laboratory:

Use only sterile sample bottles that have been approved or provided by the laboratory performing the analysis. All drinking water certified laboratories must follow strict quality control and quality assurance practices according to the State of Arizona requirements.

Given the complexity of the analysis procedures and the equipment required, field analysis is not allowed. Bacteria samples must be analyzed at a State of Arizona certified drinking water laboratory. Be sure that the laboratory running the public water supply sample(s) is properly certified to run these samples and has been approved by the ADEQ. A copy of approved drinking water laboratories can be obtained from the ADEQ.

Review with the selected laboratory the time allowed for the sample to reach the laboratory after it is collected and the conditions in which it must be transported refrigerated or iced.



How to Properly Collect a Coliform Sample:

Before you begin sampling, check and make sure you have the following supplies:

- Cooler for shipping and storage of your sample while in transit to the lab
- Ice for your shipping cooler
- Sample bottle with sodium thiosulfate powder or tablet (do not rinse bottle)
- Lab paperwork and labels for sample container identification

Recommended, but not required, items are:

- A chlorine spray and clean towel to clean sampling tap, if needed
- Paper towel for drying off outside of sample bottle after sample is collected and recapped
- Plastic storage baggies for ice and sample container

As a general rule, proper hand-washing both before and after collecting the sample is highly recommended for the person collecting the sample.

It is also recommended that you do not sample with any containers that appear to have been tampered with since this may cause a 'positive' result that is not representative of the drinking water system.

COLLECTING A COLIFORM SAMPLE

	INSTRUCTIONS
1.	Locate the proper sampling tap.
2.	Remove aerator, strainer, or hose that may be present.
3.	Clean the tap if needed.
4.	Turn on the cold water to maximum flow to flush the service line.
5.	Let the water run until line is completely flushed. <i>The sample should be of the distribution system not the building water.</i>
6.	Reduce flow so stream is not greater than ¼ inch in diameter (<i>approximately, the width of a pencil</i>).
7.	While the water is running, fill out labels, tags, and forms.
8.	Place labels on bottles.
9.	Do not change water flow once sampling has started.
10.	Remove the bottle cap.
11.	Do not touch the inside of the cap or the inside of the sample container with your fingers.
12.	Hold cap downward away from potential splashing.
13.	Hold bottle in one hand and the cap in the other.
14.	Do not lay the cap down.
15.	In one smooth motion, fill the bottle to 100 mL. <i>Many bottles have a 100-mL fill line.</i>
16.	Fill the bottle to the shoulder or about ¼ inch from the top.
17.	Recap immediately.
18.	Tighten cap on sample container.
19.	Bag sample separately so as not to risk contamination with ice pack.
20.	Turn off tap and replace aerator, strainer, or hose.
21.	Check that information on label is correct.
22.	Complete all forms that come with sample bottles.

							Signature	Date, time	
						Received by			
							Signature	Date, time	
						Received by			
							Signature	Date, time	
						Received by			
							Signature	Date, time	

[illegible]

APPENDIX 7: PUMPS

If a form for this section exists and is in use for your system, then add the existing form behind this page.

CENTRIFUGAL PUMP CHECKLIST

Daily

- Check Packing
- Check pump for bearings that may be noisy.
- Check bearing oil for water and/or unusual color.
- Check temperature of bearings by feel.
- Inspect all bearing and oil rings.
- Check for oil leaks, especially around gaskets.
- Check that flow indicator and needle valve adjustments are functioning properly.
- Check all mechanical seal conditions.
- Check for leaks at casings and gaskets.
- Listen for cavitation problems

Monthly

- Add oil to the bearing reservoirs, if necessary.
- Check that oil level is correct distance from shaft centerline.
- Clean out debris from bearing brackets.

Every 6 Months

- Apply light coat of rust protection to exposed surfaces.

Yearly

- Inspect couplings for sign of wear. Tighten bolts if necessary.
- Check driver shaft for damage.

Seasonal

- Do an oil change out, if required. Check manual.
- Inspect for damaged or missing insulation.

APPENDIX 8: HYDRANT INSPECTION RECORDS

If a form for this section exists and is in use for your system, then add the existing form behind this page.

HYDRANT INSPECTION	
HYDRANT NAME:	
HYDRANT NUMBER:	
DATE OF INSPECTION:	

INSPECTION OBSERVATION (if yes then pass)		PASS/FAIL	COMMENTS	
STRUCTURE				
Hydrant is accessible for water supply				
Hydrant is upright without bent or deformations				
Dischargers are accessible				
All caps are present				
Caps are hand tight only				
No Leaks from caps				
Hydrant valve in the on position				
No leaks from top of hydrant				
Nozzle threads are not damaged				
Hydrant stem closes properly				
Hydrant drains properly				
PRESSURE		DESIRED PSI	PSI DURING INSPECTION	PASS/FAIL (Pass if desired psi and psi during inspection are the same)
Static Pressure on Hydrant				
Flow Pressure Using Pilot Gauge using 2 ½ discharge				
Flow	DESIRED FLOW	MEASURED FLOW		PASS/FAIL (Pass if desired flow and measured flow are the same)

APPENDIX 9: WATER STORAGE RECORDS

If a form for this section exists and is in use for your system, then add the existing form behind this page.

STORAGE TANK INSPECTION FORM			
LOCATION			
DATE OF EXTERIOR COATING APPLICATION:			
DATE OF INTERIOR COATING APPLICATION:			
DATE OF INSPECTION:			
INSPECTOR:			

INSPECTION	OBSERVATIONS	PASS/FAIL	COMMENTS
Foundation:	If settling, cracks, deterioration are observed, then foundation failed inspection.		
Protective Coating	If rust, pitting, corrosion, and leaks are observed, then coating failed inspection.		
Water Level	If coating of cable access is not protected and inoperable, then water level inspection failed.		
Pressure Tank Operational Status			
Pressure release device			
Pressure gauge			
Air-water volume device			
Roof Hatch:	If low spots allow ponding water, if holes and rust are observed, then roof hatch inspection failed.		
Air Vents	Lack of screens, unsealed edges and seams means inspection failed.		
Access Ladder	If ladder contains loose bolts or rungs, then inspection failed.		
Overflow Pipe:	If flap valve cover is inaccessible, unsealed and or inoperable, then overflow pipe inspection failed.		
Cathodic Protection Anode Plates	If not secured or sealed, then inspection failed.		
Interior Inspection			
Water Quality	If floating insects or debris are observed on the water surface and/or settlement is observed on the bottom, then water quality failed inspection.		
Protective Coating	If rust, corrosion, and/or scarring is observed, then protective coating inspection failed.		

APPENDIX 10: LIST OF VENDORS

If a form for this section exists and is in use for your system, then add the existing form behind this page.

LIST OF VENDORS

COMPANY	CONTACT NAME	TELEPHONE	CELL PHONE	E-MAIL
Water Testing Lab				
Water Testing Lab				
Pump Supplier				
Equipment Vendor				
Equipment Vendor				
Equipment Vendor				
Chemical Supplier				
Chlorine Supplier				
Electrical Contractors				
Safe Dig				
Other:				

APPENDIX 11: CONFINED SPACE ENTRY PERMIT CHECKLIST

If a form for this section exists and is in use for your system, then add the existing form behind this page.

CONFINED SPACE PRE-ENTRY CHECKLIST/CONFINED SPACE ENTRY PERMIT

Start Date and Time: _____ End Date and Time: _____

Job Site/Space ID: _____

Supervisor: _____

Equipment to be Worked on: _____

Work to Complete: _____

Personnel on Standby: _____

1. Atmospheric Checks:

Time _____ Oxygen _____ % Toxic _____ ppm

Explosive _____ % LEL Carbon Monoxide _____ ppm

Tester's Signature:

2. Source Isolation: (No Entry) N/A Yes No

Pumps or lines blinded () disconnected () blocked ()

3. Ventilation Modification: N/A Yes No

Mechanical () Natural Ventilation Only ()

4. Atmospheric Check After Isolation and Ventilation:

Time _____

Oxygen _____ % > 19.5% Toxic _____ ppm < 10 ppm H₂S

Explosive _____ % LFL < 10% Carbon Monoxide _____ ppm < 35 ppm CO

Tester's Signature:

5. Communication Procedures:

6. Rescue Procedures:

7. Entry, Standby, and Backup Personnel Yes No

Successfully completed required training? _____

Is training up to date? _____

8. Equipment: N/A Yes No

Direct reading gas monitor tested: _____

Safety harness and lifelines for entry and standby personnel _____

Hoisting apparatus _____

Powered communications _____

SCBAs for entry and standby personnel _____

Proper protective clothing _____

All electric equipment listed for Class I, Division I, _____

Group D and non-sparking tools _____

9. Periodic atmospheric tests:

Oxygen: _____% Time_____; _____% Time_____; _____% Time_____; _____% Time_____;

Explosive: _____% Time_____; _____% Time_____; _____% Time_____; _____% Time_____;

Toxic: _____% Time_____; _____% Time_____; _____% Time_____; _____% Time_____;

Carbon Monoxide: _____% Time_____; _____% Time_____; _____% Time_____; _____% Time_____;

We have reviewed the work authorized by this permit and the information contained. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any brackets of the above are marked as no. This permit is not valid unless all appropriate items are completed.

Permit Prepared By: (Supervisor) _____ Approved By:
(Unit Supervisor)_____
Reviewed By: (CS Operations Personnel)

This permit is to be kept at the job site. Return job site copy to Safety Office following completion of the job.

APPENDIX 12: WORK ORDER

If a form for this section exists and is in use for your system, then add the existing form behind this page.

WORK ORDER					
ORDER DATE			ORDER COMPLETED DATE		
DESCRIPTION OF TASK NEEDED					
LOCATION					
WORK DESCRIPTION					
LABOR DESCRIPTION		MATERIALS		EQUIPMENT DESCRIPTION	
STAFF NAME	HOURS	TYPE	COST	TYPE OF EQUIPMENT	HOURS
NOTES:					

APPENDIX 13: EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN STAFF TRAINING

If a form for this section exists and is in use for your system, then add the existing form behind this page.

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN STAFF TRAINING

STAFF NAME	DATE OF TRAINING	SIGNATURE

APPENDIX 14: INSTRUCTIONS FOR TEMPLATE

The following is a set of instructions to aid in the completion of the template. The template is composed of tables for you to provide information about your system. Each cell in every table is explained in this section.

SYSTEM CHARACTERISTICS

CONTACT INFORMATION & PERMITS

(See p. 10.)

CONTACT INFORMATION

Instructions: *Complete all that apply.*

Name of PWS: *Provide the legal name of your system.*

System's Type: *Choose Community Water System (CWS), Non-Transient Non-Community Water System (NTNCWS), or Transient Water System (TWS).*

Population Served: *Provide the number of people your system serves.*

Physical Address: *Provide the physical address of your system. Provide city and zip code.*

Municipality: *Provide the name of the municipality where your system is located.*

County: *Provide the name of the county where your system is located.*

Main Contact: *Provide the name of the main contact for your system.*

Telephone: *Provide the telephone number of the main contact for your system.*

E-mail: *Provide the e-mail of the main contact for your system.*

Person(s) Completing the Manual: *Provide the first and last name of the main person(s) completing this plan.*

Date of Completion: *Provide the date when the manual was completed. Ex. 00/00/00.*

PERMIT & ID INFORMATION

Instructions: *Complete all that apply. Use the "other" boxes to provide a permit or ID not mentioned in the table.*

Water System ID: *Provide the ID number that was provided to you by ADEQ to identify your system (starts with AZ04-).*

Well ID Number (ADWR): *Provide the ID (ADWR) number of the well that you use to withdraw water.*

Arizona Discharge Elimination System Permit (AZDES Permit): *Provide the number of your Arizona Discharge Elimination System (NPDES) permit.*

Place ID: *Information provided by the Azurite database.*

Place Name: *Information provided by the Azurite database.*

Inventory Number: *Information provided by the Azurite database.*

APP No.: *Aquifer Protection Permit Number.*

SYSTEM CHARACTERISTICS

OPERATORS' INFORMATION

(See p. 11.)

OPERATORS' ID NUMBERS

Instructions: *Provide the information of all licensed operators working with the water treatment system. The information can be found in the grade certificate provided by ADEQ.*

Operator's Name: *Provide the name of the operator as it appears on the permit.*

Operator Identification Number: *Provide the operator's identification number.*

Expiration Date: *Provide the operator's identification number expiration date.*

Telephone: *Provide the operator's work telephone number.*

Address: *Provide the operator's work address.*

E-mail: *Provide the operator's work e-mail address.*

SYSTEM CHARACTERISTICS

GEOGRAPHY AND MAPS

(See p. 12.)

Instructions: *Provide information as requested.*

Water System Geography and Industry

Geography Near Water System: *Provide a description of the geography that surrounds your system and your water source. Geography is a description of the type of soil that surrounds your water source or where your system is built. The Geography can also include the nearness to a body of water or city/town or it can include a description of your surroundings. The description of the surroundings can include desert-like, mountainous, river basin, etc. For example, your description might read: "System is built on clay-like soil approximately 10 miles away from the "Deep" River and 5 miles away from "Bloomington" City, Arizona.*

Industry Near Water System: *Choose from the list the industry that is located around your system and your water source. Add the industry to the space provided. These will be check boxes and will include all the items checked.*

- ☐ Commercial Retail
- ☐ Food Service/Restaurants
- ☐ Hospitals
- ☐ Agriculture
- ☐ Manufacturing
- ☐ Wastewater Treatment Plant
- ☐ Auto Shops
- ☐ Other: Describe

Industry Near Source Water: *These will be check boxes and will include all the items checked.*

- ☐ Commercial Retail
- ☐ Food Service/Restaurants
- ☐ Hospitals
- ☐ Agriculture
- ☐ Manufacturing
- ☐ Wastewater Treatment Plant
- ☐ Auto Shops
- ☐ Other: Describe

Maps: *Include maps as labeled below.*

APPENDIX 1: WATER SYSTEM MAPS

- A. WATER SYSTEM SCHEMATIC
- B. AS-BUILT MAP OF THE WATER SYSTEM

APPENDIX 2: DISTRIBUTION SERVICE AREA MAP

APPENDIX 3: WATERSHED OF SOURCE WATER MAP

SYSTEM CHARACTERISTICS

NARRATIVE DESCRIPTION

(See p. 13.)

For this section, mark with an 'x' the units of treatment that apply to your system. Then complete the sections you mark. Answer the questions to complete the paragraph. Each question is numbered according to the blank space where the answer will complete a sentence in the paragraph.

Raw Water Storage

☐ Raw Storage Does Not Apply

The raw storage tank is located 1._____.
The tank is made of 2._____ and has an elevation of
3._____ ft. The riser pipe is 4._____ ft. wide. The holding
capacity of the tank is 5._____ gallons. The tank is generally operated at
6._____ %. The overflow pipe is located 7._____
_____, and the drain connection is located 8._____.
The air vent is located 9._____.
10.____ access hatch(es) are located 11._____.
12. (Additional information) _____

1. [Provide address of raw water storage tank.]
2. [What material is the raw water storage tank made of?]
3. [What is the elevation of the tank in feet?]
4. [What is the diameter of the riser pipe in feet?]
5. [What is the capacity of the tank in gallons?]
6. [At what percent of its total capacity is the tank generally run?]
7. [Where is the overflow pipe?]
8. [Where is the drain connection?]
9. [Where is the air vent?]
10. [How many access hatches are available]
11. [Where are the access hatches located?]
12. [Provide additional information if needed.]

In Situ Treatment

☐ In Situ Post Extraction Treatment Does Not Apply

Treatment at the water source is accomplished by applying

1. _____ at the source.

Common examples of chemicals used are a weak chlorine solution, oxidants or polyphosphates. The concentration used includes 2. _____.

The iron concentration in water should be 3. _____ ppm prior to entering the system. The water pH should be 4. _____ prior to entering the system.

5. (Additional Information here) _____

1. [What chemicals are used at the source?]
2. [Include the concentration per chemical used at the water source, for example:
Chemical xx: 00 ppm, Chemical xxx: 00 ppm.]
3. [What is the iron concentration prior to entering the system for a normal operation?]
4. [What is the normal water's pH prior to entering the system?]
5. [Provide additional information if needed.]

(See p. 14.)

Aquatic Plant Control

☐ Aquatic Plant Control Does Not Apply

The body of water treated has an alkalinity of 1. _____ and it is 2. _____ feet deep.

The chemical use for aquatic control is 3. _____.

A dosage of 4. _____.

The body of water is treated 5. _____.

6. (Additional Information Here)

1. [What is the normal alkalinity level in the body of water?]
2. [How deep is the body of water in feet?]
3. [What chemical or chemicals do you use for aquatic plant control?]
4. [What dosage is used for aquatic plant control? Provide the chemical then the dosage, for example: Chemical 1: 00 ppm] ppm is applied every
5. [How often is the body of water treated for aquatic plant control?]
6. [Provide additional information if needed.]

(See p. 15.)

Preliminary Treatment

☐ Preliminary Treatment Does Not Apply

The preliminary treatment consists of 1._____.

The preliminary treatment equipment is inspected 2._____.

3. (Additional information)_____

1. [What best describes the preliminary treatment: Screening, Pre-sedimentation, Microstraining?]
2. [How often is the preliminary treatment inspected?]
3. [Provide additional information if needed.]

Coagulation

☐ Coagulation Does Not Apply

Prior to entering the coagulation process, the water has a normal temperature of

1._____, alkalinity 2._____, turbidity 3._____, and suspended solids

4._____. The chemical(s) and dosage used in the coagulation process include

5._____

_____.

The coagulant aids used in the process include

6._____

_____.

These chemicals are stored in 7._____

and are fed by a 8._____ feeder. The type of feeder is best

described as a 9._____.

Once the coagulants have been fed to the raw water, the raw water and coagulant combination go into a

mechanical flash mixer. The mechanical flash mixer used in this system is
10. _____

_____. An example of a record document for this process is available
in Appendix 4: Coagulant-Flocculation Records.

1. [What is the raw water's normal temperature prior to entering the coagulation process?]
2. [What is the normal turbidity of the raw water before entering the coagulation process?]
3. [What is the normal turbidity of the raw water before entering the coagulation process?]
4. [What is the normal measurement of suspended solids of the raw water prior to entering the coagulation process?]
5. [Provide the chemicals and the dosage used in the coagulation process.]
6. [What are the coagulant aids used in the process?]
7. [Where are the coagulant and coagulant aids stored?]
8. [What type of feeder do you use? Choose solution or dry chemical; provide the type if not solution or dry chemical.]
9. [What best describes the mechanical flash mixer: Choose a single-blade mixer, a multiple-blade mixer, an in-line mixer, a static mixer, composed of baffled chambers, composed of pipe grids. If none of these, then provide a good description.]
10. [Provide additional information if needed.]

Flocculation

☐ Flocculation Does Not Apply

A 1. _____ flocculator provides the appropriate detention time for flocs to form. The detention time required is 2. _____ minutes. The normal pH of the treated water when leaving the flocculation basin is 3. _____. The turbidity is 4. _____ and the filterability is 5. _____. The coagulation/flocculation process is also monitored by the 6. _____ and a normal reading is 7. _____. The residual coagulant measurement should be 8. _____ at the end of the process. 9. _____

_____ *An example of a record document for this process is available as Appendix 4: Coagulant-Flocculation Records.*

1. [What better describes the flocculator? Horizontal paddle-wheel, vertical paddle-wheel, propeller, turbine, walking beam, N/A.]
2. [What is the detention time required for flocs to form?]
3. [What is the pH of the water after a normal flocculation?].
4. [What is the normal turbidity after the flocculation process takes place?]
5. [What is the normal filterability after the flocculation process takes place?]
6. [Do you use a zeta potential measurement or a streaming current monitor?]
7. [What is a normal reading for the zeta potential measurement or the streaming current monitor?]
8. [What is a normal residual coagulant measurement in mg/L at the end of the flocculation process?]
9. [Provide additional information if needed.]

(See p. 17.)

Sedimentation

☐ Sedimentation Does Not Apply

The treatment also includes sedimentation through a 1. _____.

Normal influent turbidity is 2._____, and normal effluent turbidity is

3._____. The turbidity is measured 4._____ per day. If the

basin is working properly then the normal rate for weir overflow is

5._____ and surface overflow rate is

6._____. The basins are inspected 7._____ a year. The

usual amount of sludge that is pumped out of the basin is 8._____

per 9._____. The sludge is disposed by

10._____

_____.

11._____

1. [Does your system have a sedimentation basin or clarifier?].

2. [What is the normal turbidity measure for the influent?]

3. [What is the normal turbidity measurement for the effluent?]

4. [How often is the turbidity measured a day?]

5. [What is the normal weir overflow rate?]

6. [What is the normal surface overflow rate?]

7. [How often per year is/are the basin(s) inspected?]

8. [What is the usual amount of sludge being pumped out?]

9. [How often do you pump out the basin?]

10. [How do you dispose of your sludge?]

11. [Provide additional information if needed.]

Filtration

☐ Filtration Does Not Apply

The filtration process uses a 1. _____ filter. A normal filtration process provides 2. _____ of filter runs and a flow rate of 3. _____ mgd. Normal observed head loss is 4. _____ feet. A normal backwash water rate for this process is 5. _____ gallons per minute. The volume of wash water generally used is 6. _____. The backwash process generally takes 7. _____ minutes and surface wash generally takes 8. _____ minutes. The backwash water is disposed by 9. _____
10. _____

An example of a record document for this process is available as Appendix 6: Sampling Records.

1. [What best describes your filtration process? slow sand, rapid sand, high rate, deep bed monomedium, mixed-media pressure, diatomaceous?]
2. [What is a normal filter run in hours?]
3. [What is a normal flow rate for the filtration process in million gallons per day?]
4. [What is a normal head loss in feet?]
5. [What is the normal rate of water in gallons per minute?]
6. [Provide the normal volume of water used for washing.]
7. [How long does the backwash process take in minutes]
8. [How long does the surface wash process take in minutes?]
9. [What best describes how backwash water is disposed? blending it back with the water, combined with the sedimentation sludge, treated separately, sent to a waste water facility, N/A]
10. [Provide more information if needed.]

(See p. 18.)

Disinfection

☐ Disinfection Does Not Apply

The treatment process or chemical used to destroy disease-causing organisms is

1._____. The disinfection application points are located

2._____

_____.

All public water systems are required by federal and state regulations to collect representation samples from the distribution system regularly for coliform analysis.

(Please refer for more information regarding routine monitoring requirements on Appendix 5: Disinfection Records). The chemical for treatment is in the

3._____form and the

concentration is 4. _____.

1. [What best describes the disinfection process? UV radiation, Bromine, Iodine, Ozone, Potassium Permanganate, Chloride Dioxide, Chlorine, Chlorine Compounds, Oxygen.]
2. [Where are the application points located in the system for treatment?]
3. [What best describes the state of the chemical for the treatment? Gas, Liquid, Solid.]
4. [What is the concentration or % strength of the chemical?]

(See p. 18.)

Chlorination

☐ Chlorination Does Not Apply

The form of chlorine used for water treatment is 1._____. The chemical compound used is 2. _____ and the concentration is 3._____. The normal amount of contact time is 4._____ and the type of residual chlorine that is available after the required contact time is 5._____. The normal temperature of the water source is 6._____. The pH of the water is checked routinely 7._____, and the normal range is 8._____. Interfering substance can cause the chlorine to become less effective. The normal turbidity level is 9._____. Disinfectants are generally applied at 10._____

_____.

1. [What form of chlorine do you use for the treatment? Gas, Liquid, Solid.]
2. [What is the chemical compound? Chlorine, Sodium Hypochlorine, Calcium Hypochlorite.]
3. [What is the concentration or % solution of the chlorine?]
4. [How long is the water in the piping system?]
5. [What is the residual chlorine available after the required contact time? Hypochlorus Acid, Hypochlorite Ion, Trichloramine, Dichloramine, Monochloramine.]
6. [What is the normal temperature of the water source?]
7. [How often is the pH of the water source recorded?]
8. [What is the normal pH of the water?]
9. [What is the normal turbidity level of the water?]
10. [Choose the application locations in your system: Where the raw water enters a treatment plant; Intermediate points throughout the system; After treatment has been completed.]

(See p. 19.)

Fluoridation

☐ Fluoridation Does Not Apply

The addition of fluoride is intended to provide public health protection from dental decay or dental caries. Fluoride in water has been found to reduce tooth decay among children, but the uncontrolled concentration of fluoride can cause fluorosis. Fluoride concentration is based on the average air temperature. A drop of .3 mg/l below optimal concentration can reduce the benefits of fluoride while 1.5 over the optimal concentration can cause mottling of the teeth.

In this process, sodium fluoride, fluorosilicic acid, and sodium fluorosilicate are fed through a 1._____. The optimal concentration of fluoride is 2. _____. 3._____.

1. [Describe the way the chemicals are fed into the system? Dry feeder, solution feeder.]
2. [What is the optimal concentration of fluoride for your system?]
3. [Provide additional information if needed.]

(See p. 20.)

Defluoridation

☐ Defluoridation Does Not Apply

Defluoridation is needed in a PWS where water naturally exceeds the allowed fluoride concentration. The technique includes beds packed with granular activated alumina. The process includes treatment, backwash, regeneration, and neutralization. Once the alumina beds have been used, and their removal efficiency has depleted, a backwash is used to regenerate the removal efficiency of the bed. Once regenerated, these beds recover their removal capacity. Initially, the alumina beds will discharge a high pH and need to be neutralized with raw water. The beginning stage of the removal process is not as efficient as the late stages when the optimal pH is reached.

In this process, the allowed fluoride amount is 1._____. The optimal pH for removal is 2._____.

1. [What is the allowed fluoride amount?]
2. [What is the optimal pH for efficient removal of fluoride?]

(See p. 20.)

Backwash

☐ Backwash Does Not Apply

The backwash is 1._____ minutes. The regeneration includes 2._____ % of NaOH at 3. _____ gpm/ft² for 4. _____ minutes.

The process includes a second rinse at 5. _____ gpm/ft² for 6. _____ minutes. A second regeneration step includes 7. _____ % of NaOH at 8. _____ gpm/ft² for 9. _____ minutes.

The lowest measurement allowed in the process before a backwash is needed is 10._____.

11._____
_____.

1. [For how long are the beds washed?]
2. [Percentage of NaOH used]
3. [What is the flow of the rinse in gpm/ft²?]
4. [For how long are the beds rinsed?]
5. [What is the flow of the rinse in gpm/ft²?]
6. [How long is the rinse?]

7. [Percentage of NaOH used]
8. [What is the flow of the rinse in gpm/ft²?]
9. [For how long are the beds rinsed?]
10. [What is the lowest pH allowed before starting the backwash process?]
11. [Additional information.].

(See p. 21.)

Finished Water Storage

☐ Finished Water Storage Does Not Apply

When water is ready for consumption it is stored in a 1. _____ -gallon tank located 2. _____. The tank is elevated 3. _____ ft. and it is made of 4. _____. The tank has a drain that can be opened by 5. _____

1. [What is the capacity of the finished water storage tank?]
2. [Where is the tank located?]
3. [What is the elevation of the tank in feet?]
4. [What material is the tank made of?]
5. [What are the steps required to open the finished water storage tank drain?]

(See p. 22.)

Hydropneumatic Tank(s)

☐ Hydropneumatic Tank(s) Does Not Apply

1. _____ pumps within the system work with the tank(s) to maintain consistent pressure in the system. The tank(s) operating ON/OFF pressure levels are 2. _____. These tank(s) also aid the water storage systems.

1. [How many hydropneumatic tanks are used in the system?]
2. [What is the operating range for the pressure levels to turn ON or OFF?]

(See p. 22.)

Distribution Piping

The piping material is 1._____.

The structure is about 2._____ years old.

1. [What is the material of the piping?]

2. [How old is the distribution piping?]

(See p. 22.)

Flow Rate

☐ Flow Rate Does Not Apply

The flow rate on a normal day is 1._____ gallons per day.

1. [What is the flow rate on a normal day for your system?]

(See p. 22.)

SYSTEM CHARACTERISTICS

SUMMARY TABLES: WATER STORAGE TANKS

Water Storage Tank Summary Table

Tank Name: *Provide the name of the storage tank. You can use the manufacturer's number or a group of digits that you can quickly recognize. You can also label the tanks as tank 1, tank 2, and tank 3. This number will be a label that anyone working in your system can recognize.*

Capacity: *Provide the capacity of the tank in gallons.*

Material: *What type of material is the tank made of?*

Location: *Provide the address or the location of the tank?*

Elevation: *Provide the elevation of the tank in feet.*

Overflow Location: *Provide the location of the overflow. For example: Outside behind tank across from the entrance door.*

Drain Valve Location: *Where is the drain valve? For example: Marked eight feet from the entrance door.*

(See p. 24.)

Water Storage Tank Maintenance Summary Table

Tank Name: *Provide the name of the storage tank. You can use the manufacturer's number or a group of digits that you can quickly recognize. You can also label the tanks as tank 1, tank 2, and tank 3. This number will be a label that anyone working in your system can recognize.*

Operation (% of total capacity): *Provide the percentage of the total capacity in which the tank operates during a normal day.*

Total Capacity: *Provide the total capacity the tank operates during a normal day.*

Operating Level High (ft): *Provide the level, in feet from the ground, when the pumps shut off because the tank is full.*

Operating Level Low (ft): *Provide the level, in feet from the ground, when the pumps start to fill the tank.*

Manufacturer: *Provide the name of the manufacturer*

Inspection Frequency: *Provide how often you inspect the Storage Tank.*

(See p. 24.)

SYSTEM CHARACTERISTICS

SUMMARY TABLES: PRESSURE SYSTEM

Pressure System (Compressor) Summary Table

System Pressure ID or Name: *Provide the name of the pressure system. You can use the manufacturer's number or a group of digits that you can quickly recognize. You can also label the pressure system as pressure system 1, pressure system 2, and pressure system 3. This number will be a label that anyone working in your system can recognize.*

Size: *Provide the size of the pressure system.*

Location: *Provide the location of the pressure system.*

Operating Pressure PSI (ON/OFF): *Provide the operating pressure, in PSI, when the pressure system is on and off. Example: ON= xxx psi Off=xxx psi*

Frequency of Replacing/Cleaning Filters: *How often do you replace or clean the filters? Example: Clean filters every 5 months or replace filters every 5 months.*

Lubrication Frequency: *How often do you lubricate the pressure system?*

Drain Condensate Frequency: *How often do you drain condensate from the pressure system?*

(See p. 25.)

SYSTEM CHARACTERISTICS

SUMMARY TABLES: PUMP STATIONS

Pump Stations

Pump Station Name: *Provide the name of the pump station. You can use the manufacturer's number or a group of digits that you can quickly recognize. You can also label the pumps as pump 1, pump 2, and pump 3. This number will be a label that anyone working in your system can recognize.*

Number of Hydropneumatic Tanks/Sizes: *Provide the number of Hydropneumatic Tanks that are located in the station.*

Number of Pumps: *Provide the number of Pumps that are located in the station.*

Low/High Pressure (psi): *Provide the pump station pressure range in psi. Example: 30-80 psi.*

Location: *Provide the location of the pump station. (See p. 26.)*

DISTRIBUTION SYSTEM

WATER SOURCES: WELL(S)

Well ID Number (ADWR): *Provide the ID number that identifies your well.*

Permit Date: *Provide the date when the permit was provided to your system.*

Diameter: *Provide the diameter of the well in inches. This measurement does not include the well's casing.*

Well Depth: *What is the total depth of the well in feet?*

Pump Capacity: *What is the capacity of the pump located at this well in gpm?*

Casing Length: *What is the length of the casing in feet?*

Casing Diameter: *What is the diameter of the casing in inches?*

Casing Grouted: *Is the casing of the well grouted? Yes or No.*

Depth of Grout: *If the well's casing is grouted, what is the depth of the grout in feet? If the casing is not grouted, please put N/A.*

Well Driller: *Provide the name of the driller/company that drilled this well.*

Installation Date: *Provide the date when the driller finished the well.*

Well Location/Physical Address: *Provide the physical address of the well. If this does not apply to this well, then write N/A.*

GPS Longitude/Latitude: *If you do not have an address, then provide the coordinates of the location of this well.*

(See p. 41.)

DISTRIBUTION SYSTEM

WATER SOURCES: SURFACE WATER

Name: *Provide the name of the body of water from where your system receives its untreated water.*

ID Permit Number: *Provide the number of your surface water permit. This is provided by Arizona Department of Water Resources.*

Date of Permit: *When was your permit awarded?*

Location Address or GPS Latitude/Longitude: *Provide the address or latitude/longitude of the pump at the water source.*

Allowance Capacity: *Provide the number of gallons per day that you are allowed to pump out of the body of water. If there is not a limit, then write "no limit."*

(See p. 42.)

DISTRIBUTION SYSTEM

WATER SOURCES: PURCHASED WATER

(See p. 43.)

Name of Supplier: *Provide the name of the supplier from where the water is purchased for your system.*

Contract Start Date: *When was the contract signed? Date format should be 00/00/0000. If there is no contract, then write N/A.*

Contact Person: *Provide the name of the main contact to the water supplier.*

Telephone Number: *Provide the telephone number of water supplier's main contact.*

Address: *Provide the address of the water supplier.*

Pressure: *What is the pressure of the water that is leaving the distribution system?*

Is water metered: *Does a meter measure the water usage? Yes or No.*

Meter Size: *If the water is metered, what is the size of the meter in inches. If this does not apply, put N/A.*

Average Daily Usage: *How much purchased water from this supplier do you use in gallons per day?*

Backflow Prevention: *Does your system contain backflow prevention? Yes or No.*

Additional Treatment: *Do you treat the purchased water prior to it entering the system?*

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: VALVES

(See p. 44)

Valve: *Provide a label or name for each valve. You can use the label used on your distribution map or you can number them as shown on the example.*

Manufacturer/Model Number: *Provide the manufacturer/model number of the valve.*

Location: *Provide the address or coordinates where the valve can be found.*

Size: *Provide the size of the valve in inches.*

Description: *Choose: Gate Valves, Butterfly Valves, Check Valves, Pressure Relief Valves, Pressure Regulating Valves, Air Relief Valves, Plug or Ball Valves, Globe Valves, Altitude Valves.*

Function: *Briefly describe the function of the valve. An example is provided to you on the first line of the table.*

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: FIRE HYDRANTS

(See p. 45.)

Hydrant: *Provide a name or label for each hydrant included in the table.*

Make and Model: *Provide the make and model of each hydrant.*

Type of Hydrant: *Choose: Dry Barrel, Wet Barrel, Flushing.*

Location: *Provide an address or intersection where the hydrant is located.*

Flow Capacity: *Provide the maximum flow capacity of the hydrant.*

Inspection Frequency: *Provide how often the hydrant is inspected.*

Color: *Provide the color of the hydrant.*

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: PUMPS

(See p. 47.)

Pump Name: *Provide a name or label for each pump that is included in the table.*

Manufacturer/Model Number: *Provide the manufacturer/model number of the pump.*

Location: *Provide address or location where the pump is located.*

Flow Capacity: *Provide the maximum flow capacity of the pump.*

RPM: *Revolutions per minute.*

Horsepower (watt): *Provide the output units used to measure the output of engines.*

Type of Pump: *Choose Centrifugal, Positive Displacement, Vertical Turbine, Submersible, Reciprocating, Rotary.*

Lubrication/Inspection Frequency: *Provide the frequency of lubrication/inspection.*

DISTRIBUTION SYSTEM

ITEM DESCRIPTION: METERS

(See p. 48.)

Meter Name: *Provide a name or label for each meter that is included in the table.*

Manufacturer/Model Number: *Provide the manufacturer/model number of the meter.*

Location: *Provide address or location where the meter is located.*

Pipe Size: *Provide the size of the metered pipe in inches.*

Flow Capacity: *Provide the maximum flow capacity of the meter.*

Inspection Frequency: *Provide how often the meter is inspected.*

Description of Meter: *Choose: Positive Displacement, Jet, Turbine, Propeller, Magnetic (Mag), Compound, Ultrasonic.*

DISTRIBUTION SYSTEM

SYSTEM FLUSHING

(See p. 49.)

Location: *Provide the street address, intersection, or area that is flushed.*

Hydrant/Flushing Box Number: *Provide the number of the hydrant/flushing box.*

Flushing Volume (gpm): *Provide the flushing volume needed for this procedure.*

Pressure: *Provide the pressure needed to flush this street, intersection, or area.*

Disinfection: *Choose: Yes or No.*

Dechlorination: *Indicate whether system flushing includes dechlorination.*

DISTRIBUTION SYSTEM

SAMPLING

(See p. 50.)

Sample Type: *Provide the sample name: Turbidity, Chlorine, Microbial, Disinfection By-Products, Nitrate, Arsenic, Inorganics, Radionuclides, Lead and Copper.*

Sample Location: *Provide the location or locations where you perform the sample within the distribution system.*

Frequency: *Provide how often each sample is performed per location.*

Sampling Procedure: *Describe the steps to sample. Include type: Grab Sample, Composite Sample. Example: 1. Flush for 5 minutes. 2. Take Grab Sample.*

START-UP PROCEDURE

PWS STAFF ORGANIZATION CHART

(See p. 62.)

NAME OF THE ORGANIZATION: *Please provide the name of your organization.*

1. *Provide the name and job title of the person who supervises the Plant Manager.*

2. *Provide the name of the PWS manager.*

(3.-6.) *Provide the name and title of the staff the PWS manager supervises.*

START-UP PROCEDURE

PWS STAFF TASK DESCRIPTIONS

(See p. 63.)

Name and Job Title: *Provide the names and job titles of all the people included in the organization chart.*

Task Descriptions: *Provide a description of the tasks that each staff member is responsible for completing.*

START-UP PROCEDURE

INSPECTION OF THE DISTRIBUTION FACILITY

(See p. 64. and p. 65)

Task: *Describe the inspection needed for each distribution part. For example If the storage tank coating needs to be inspected, then write "Inspect Coating."*

Frequency: *Provide how often the inspection needs to happen. Daily, Weekly, Monthly, Semi-Annual, Annual, More than Annual.*

Expected Result: *Provide a description of a normal observation during an inspection. For example, if the normal coating of the storage tank inspected should be "Even coating with no observed corrosion," then that would be a description of the expected result of the inspection.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection is not the expected result.*

START-UP PROCEDURE

ROUTINE TASKS

(See p. 66.)

Task: *Describe the daily tasks required under each unit to insure appropriate PWS process.*

Expected Result: *Provide a description of a normal observation during an inspection or an expected result from a sample test. For example if a normal pH reading is 7, then write pH 7 under expected result.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result.*

START-UP PROCEDURE

ROUTINE TASKS

(See p. 67.)

Task: *Describe the daily tasks required under each unit to insure appropriate PWS process.*

Expected Result: *Provide a description of a normal observation during an inspection or an expected result from a sample test. For example if a normal pH reading is 7, then write pH 7 under expected result.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result.*

START-UP PROCEDURE

ROUTINE MONTHLY TASKS

(See p. 68.)

Expected Result: *The tasks have been provided. Provide a description of a normal observation during the task. For example if a normal pH reading is 7, then write pH 7 under expected result. If the task provided does not apply to the PWS, then leave blank.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result. If it does not apply, then leave blank.*

START-UP PROCEDURE

ROUTINE MONTHLY TASKS

(See p. 69.)

Task: *Provide the monthly tasks needed for the PWS that were not included in the tasks provided.*

Expected Result: *Provide a description of a normal observation during the task. For example, if a normal pH reading is 7, then write pH 7 under expected result.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result.*

START-UP PROCEDURE

ROUTINE QUARTERLY TASKS

(See p. 70.)

Task: *Include any tasks not already provided.*

Expected Result: *Provide a description of a normal observation during the task. For example, if a normal pH reading is 7, then write pH 7 under expected result. If the task provided does not apply to the PWS, then leave blank.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result. If task provided does not apply to the PWS, then leave blank.*

START-UP PROCEDURE

ROUTINE SEMIANNUAL TASKS

(See p. 71.)

Task: *Include any tasks not already provided.*

Expected Result: *Provide a description of a normal observation during the task. For example, if a normal pH reading is 7, then write pH 7 under expected result. If the task provided does not apply to the PWS then leave blank.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result. If the task provided does not apply to the PWS, then leave blank.*

START-UP PROCEDURE

ROUTINE ANNUAL TASKS

(See p. 72.)

Task: *Include any tasks not already provided.*

Expected Result: *Provide a description of a normal observation during the task. For example if a normal pH reading is 7, then write pH 7 under expected result. If the task provided does not apply to the PWS then leave blank.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result. If the task provided does not apply to the PWS then leave blank.*

START-UP PROCEDURE

OTHER ROUTINE TASKS

(See p. 73.)

Task: *Include any tasks not already provided.*

Frequency: *Provide how often the task needs to be performed.*

Expected Result: *Provide a description of a normal observation during the task. For example, if a normal pH reading is 7, then write pH 7 under expected result. If the task provided does not apply to the PWS, then leave blank.*

Troubleshooting in case of unexpected result: *Provide a description of the steps to take in case the observation of the inspection or sample is not the expected result. If the task provided does not apply to the PWS, then leave blank.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

PWS OVERVIEW

(See p. 78.)

Name of the PWS: *Provide the name of the PWS for which this plan is being prepared.*

Population Served: *Provide the number of people served by this PWS.*

Number of Service Connections: *Provide the number of service connections.*

Type of System: *Provide the type of System that describes the PWS: CWS, TWS, NTNCWS.*

Average Daily Demands: *Provide the average demand in gallons per day.*

Design Capacity: *Provide the PWS design capacity in gallons per day.*

Wells/Water Sources: *Provide the number of water sources/wells.*

of Storage Tanks: *Provide the number of storage tanks used in the PWS.*

of Pressure Tanks: *Provide the number of pressure tanks used in the PWS.*

Lab: *Provide the name of the lab used by the PWS for sample testing.*

Contact: *Provide the Lab's contact person.*

Phone: *Provide the Lab contact's phone number.*

Water Source: *Provide the name of the water source(s).*

Water Source ID: *Provide the ID of the water source.*

Connection Location: *Provide the location (address or GPS coordinates) of the water source connection to the PWS.*

Date of Completion: *Provide the date when the emergency plan was completed.*

Completed by: *Provide the name of the person that completed the emergency plan.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

LOCAL EMERGENCY RESPONDERS

(See p. 79.)

Name and Title: *Provide the name of the emergency agency, entity, or person. For example, "Police Department."*

Phone Number: *Provide the verified phone number of the agency, entity, or person.*

Cell/Pager Number: *Provide the cell phone verified number of the emergency agency, entity, or person. If one is not available, then add N/A.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

STAFF CONTACT LIST

(See p. 80.)

Name and Title: *Provide the name and title of the PWS staff member.*

Phone Number: *Provide the PWS staff member work phone number.*

Cell/Pager Number: *Provide the PWS staff member work cell phone number or pager.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

MAPS

Maps can be found under Appendix 1 (Water System Map), Appendix 2 (Distribution Service Area Map), and Appendix 3 (Watershed of Source Water Map).

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

LOSS OF A SOURCE (R18-4-204) A1

(See p. 82.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

Type: *Provide the type of backup water source available in case of an emergency: Well, Surface Water, Other PWS, Bottled Water in Volume, None.*

Name: *Provide the name of the backup water source.*

Location: *Address or GPS location of backup water source.*

Contact: *Provide the main contact of the backup water source.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to loss of source. Number each step 1, 2, 3 or start with First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

PROVISION OF ALTERNATE SOURCES OF WATER DURING EMERGENCY

(R18-4-204) B1

(See p. 83.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

Type: *Provide the type of backup water source: Well, Surface Water, Other PWS, Bottled Water in Volume, None.*

Name: *Provide the name of the backup water source.*

Location: *Address or GPS location of backup water source.*

Contact: *Provide the main contact of the backup water source.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to the temporary loss of water source. Number each step 1, 2, 3 or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

CRITICAL PART INVENTORY LIST

(See p. 84.)

Critical Part: *Refers to a part of the PWS that is essential to the continuous PWS function.*

Location: *Provide the location where the critical part exists in the system.*

In Stock/Location: *Provide a Yes or No answer to whether or not a spare part is in stock. If the part is in stock, then provide the location. If no part is in stock, then answer no.*

Supplier: *Provide the name of the company or business that can supply the critical part in the shortest time.*

Supplier Contact Number: *Provide the supplier's contact phone number.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

CRITICAL SYSTEM COMPONENTS (R18-4-204) B4

(See p. 85.)

Critical System Unit: *Refers to a unit of parts in the PWS that is essential to the continuous distribution of water.*

Connected to a Critical Water User? *Answer Y/N. A Critical Water User is a user that cannot continue its essential services if water is shut off from their premises. A few examples are Hospitals, Hospices, Schools, Factories, Daycares etc.*

Location of Connection: *Where is the main connection from the distribution system to the Critical Water User?*

Critical Water User Contact: *Provide the name of the Critical Water User's main contact.*

Critical Water User Contact Phone: *Provide the phone number of the critical user's main contact.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

CRITICAL SYSTEM FAILURE (R18-4-204) B4

(See p. 86.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

3rd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted in case the first and second contacts are not available.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to critical system failure. Number each step 1, 2, 3 or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

DAMAGE OF POWER SUPPLY EQUIPMENT/LOSS OF POWER

(R18-4-204) A3

(See p. 87.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

3rd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted in case the first and second contacts are not available.*

Primary Electrician: *Provide the name and phone number of the main electrician that either works for the PWS or is familiar with the PWS.*

Backup Electrician: *Provide the name and phone number of an electrician who has worked in your PWS but is not your primary electrician.*

Number of Generators: *Provide the number of generators located in your PWS*

Location of Generators: *Provide the location of the generators.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to power failure. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN
DISTRIBUTION SYSTEM EMERGENCY DISINFECTION PROCEDURE
(R18-4-204) A4, A6, B3 (See p. 88.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

3rd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted in case the first and second contacts are not available.*

Chemical: *Provide the name of the chemical used in the disinfection process.*

In-Stock Location: *If chemical is in stock provide the location in the PWS where it can be found. If not in stock, then add "not in stock."*

Chemical Supplier/Phone: *Provide the name and phone number of the chemical supplier.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to a distribution system disinfection. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN
WATER SOURCE EMERGENCY DISINFECTION PROCEDURE
(R18-4-204) B7 (See p. 89.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

3rd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted in case the first and second contacts are not available.*

Chemical: *Provide the name of the chemical used in the disinfection process.*

In Stock Location: *If chemical is in stock provide the location in the PWS where it can be found. If chemical is not in stock, then add "not in stock."*

Chemical Supplier/Phone: *Provide the name and phone number of the chemical supplier.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to the disinfection of the water source. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

EMERGENCY ISOLATION LIST (R18-4-204) A4, A7, B3 (See p. 90.)

Isolation Mechanism: *Provide the type of mechanism used to isolate the area, is it a valve, a pump, shutting off storage tank, etc.*

Isolation Mechanism Location: *Provide the address or GPS coordinates of the mechanism location to isolate the specific area.*

Isolation Area Beginning: *Provide the address or GPS coordinates of the beginning part of the area isolated by the mechanism.*

Isolation Area Ending: *Provide the address of GPS coordinates of the ending part of the area isolated by the mechanism.*

Critical User in Isolation Area: *Provide the name(s) of the Critical Water Users that would be affected if this area is isolated.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

CONTAMINATION IN THE DISTRIBUTION SYSTEM FROM BACKFLOW INCIDENT (R18-4-204) A4 (See p. 91.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

3rd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted in case the first and second contacts are not available.*

Backflow/Cross Connection Specialist: *Provide the name and phone number of your Backflow/Cross Connection Specialist.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to the contamination of the distribution system due to backflow. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

COLLAPSE OF RESERVOIR, RESERVOIR ROOF, OR PUMP HOUSE STRUCTURE (R18-4-204) A5

(See p. 92.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

3rd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted in case the first and second contacts are not available.*

Heavy Equipment Provider: *Provide the name and phone number of the heavy equipment providers used by the PWS. If PWS does not have one, then research the area for one.*

Phone: *Provide a revised phone number to contact the heavy equipment provider.*

Heavy Equipment On-site: *Provide the name or type of heavy equipment located at all times at the PWS.*

Heavy Equipment Location: *Provide the PWS location of the heavy equipment on-site.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining collapse of the reservoir structure or pump house structure. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

A BREAK IN A TRANSMISSION OR DISTRIBUTION LINE (R18-4-204) A6

(See p. 93.)

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

3rd PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted in case the first and second contacts are not available.*

Heavy Equipment Provider: *Provide the name and phone number of the heavy equipment providers used by the PWS. If PWS does not have one, then research the area for one.*

Phone: *Provide a phone number to contact the heavy equipment provider.*

Heavy Equipment On-site: *Provide the name or type of equipment located at all times at the PWS.*

Heavy Equipment Location: *Provide the PWS location of the heavy equipment on-site.*

Procedure Steps: *Provide steps that need to be taken in case of emergency pertaining to a break in the distribution/transmission line. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

NOTICE PROCEDURES (R18-4-204) B2

(See p. 94.)

PWS Public Relations/Media Specialist: *Provide the name and phone number of the person within the PWS that is (or would be) in charge of communicating with the media and the community.*

1st Contact: *Provide the name and phone number of the first contact if the public relations/media specialist is not available to communicate with the media or the community.*

2nd Contact: *Provide the name and phone number of the second contact within the PWS if the public relations specialist and the 1st contact are not available to communicate with the media and the community.*

Regulatory Agency: *Provide the name of the regulatory agency.*

Phone: *Provide the agency's phone number.*

Newspapers: *Provide the name of the local newspapers that would need to be informed of any emergency.*

Phone: *Provide the phone number of the newspaper's main contact.*

Television News: *Provide the name of the television news channel that would need to be informed of any emergency.*

Phone: *Provide the phone number of the television news channel's main contact.*

Procedure Steps: *Provide steps that need to be taken to contact regulatory agencies, the media and the community in case of an emergency. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

DISINFECTION AND TESTING OF THE DISTRIBUTION SYSTEM

(ONCE RESTORED) (R18-4-204) B3

(See p. 95.)

Provide the name and phone number of the person who is in charge of following up with the disinfection process after the system has been restored.

Lab: *Provide the name of the lab that will do the sample testing after the system has been restored.*

Procedure Steps: *Provide steps that need to be taken for sample testing after system has been restored. Number each step 1, 2, 3, or use First, Second, Third to start each step.*

EMERGENCY OPERATIONS PLAN/EMERGENCY RESPONSE PLAN

Sequenced System Shutdown

Shutdown of the water distribution system may become necessary due to the risk of contamination, natural disasters, or other unsafe conditions. The main objective of any plant/system shutdown is to avoid damage or unstable operating conditions resulting from system shutdowns or valve operations. It is the responsibility of the operator to ensure that the proper procedures are carried out in accordance with reliable operating practices. Below are key factors to keep in mind while developing your shutdown procedures:

- Actions by consumers may affect the hydraulic condition within the water distribution system
- Actions by the operator may influence conditions within the consumer's systems.
- Ensure that the temporary pressure generated by a shutdown or valve operations within the pipelines and other equipment is not detrimental to the system.

1st PWS Staff Contact: *Provide the name and phone number of the staff member who should be contacted first.*

2nd PWS Staff Contact: *Provide the name of the staff member who should be contacted second in the procedure line, or should be contacted if the first contact is not available.*

Provide steps to ensure proper system shutdown. Read above for instructions.