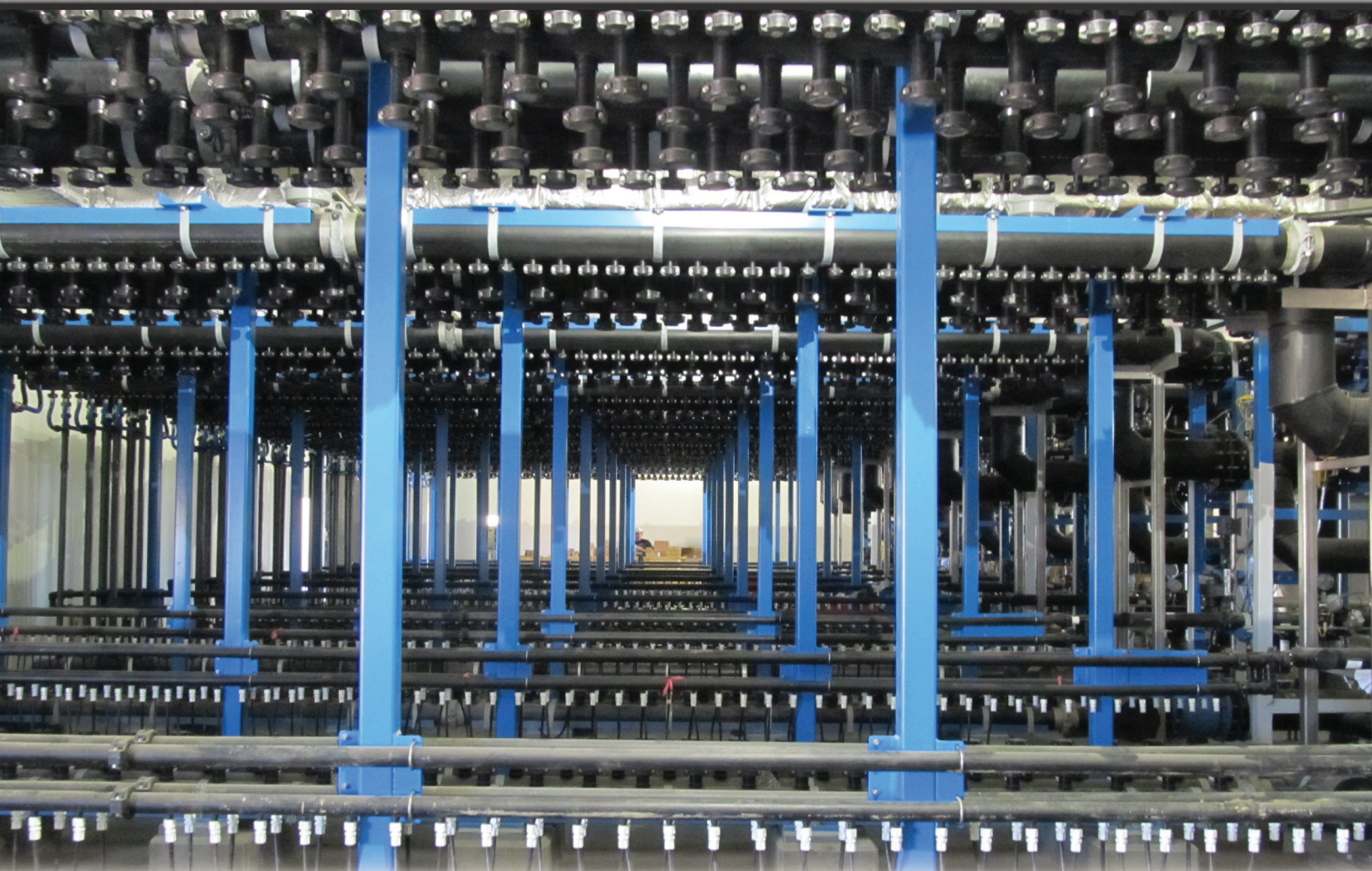


# PUBLIC WATER SUPPLY

## PLANNING GUIDE

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Oklahoma Comprehensive Water Plan

OCWP

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Oklahoma Comprehensive Water Plan

# Public Water Supply Planning Guide



**Oklahoma Water Resources Board**

**September 2012**

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## Acronyms

µg/L	microgram per liter	MG	million gallons
AF	acre-feet	mg/L	milligram per liter
AFY	acre-feet per year	MMM	multimedia mitigation
AGW	alluvial groundwater	MRDLGs	maximum residual disinfectant level goals
AMCL	alternative maximum contaminant level	MRDLs	maximum residual disinfectant levels
BGW	bedrock groundwater	NSCEP	National Service Center for Environmental Publications
CCR	Consumer Confidence Rule	O&M	operation and maintenance
CIP	Capital Improvements Projects	OCC	Oklahoma Conservation Commission
cm/m	centimeters per meter	OCWP	Oklahoma Comprehensive Water Plan
DBP	disinfection byproduct	ODEQ	Oklahoma Department of Environmental Quality
DBPR	Disinfection Byproduct Rule	OWRB	Oklahoma Water Resources Board
DWSRLF	Drinking Water State Revolving Loan Fund	OWRRI	Oklahoma Water Resources Research Institute
EPA	U.S. Environmental Protection Agency	PN	Public Notification Rule
EPS	equal proportionate share	POR	period of record
ESWTR	Enhanced SWTR	psi	pounds per square inch
FACT	Funding Agency Coordinating Team	PSNR	public-supplied nonresidential
fps	feet per second	PSR	public-supplied residential
GIS	geographic information system	PWS	public water supply
GPD	gallons per day per capita	REAP	Rural Economic Action Plan
gpm	gallons per minute	RFP	Request for Proposal
GUDI	groundwater under direct influence	RTCR	Revised Total Coliform Rule
GWR	Groundwater Rule	scfh	standard cubic feet per hour
GWUDI	groundwater under direct influence	scfm	standard cubic feet per minute
HAA5	haloacetic acids	SDWA	Safe Drinking Water Act
IDSE	initial distribution system evaluation	SDWIS	Safe Drinking Water Information System
IESWTR	Interim Enhanced Surface Water Treatment Rule	SOC	synthetic organic chemicals
IOC	inorganic chemicals	STEP	Simple Tools for Effective Performance
ISO	Insurance Services Office	SUVA	specific ultraviolet absorbance
kW	kilowatt	SW	surface water
L/mg-m	liters per milligram-meter	SWTR	Surface Water Treatment Rule
LOX	liquid oxygen	TCR	Total Coliform Rule
LT1	Long Term 1	TOC	total organic carbon
LT1ESWTR	Long Term 1 Enhanced SWTR	TTHM	total trihalomethanes
LT2	Long Term 2	UMCR3	Unregulated Contaminant Monitoring Rule 3
LT2ESWTR	Long Term 2 Enhanced SWTR	USACE	U.S. Army Corps of Engineers
M&I	municipal and industrial	USGS	U.S. Geological Survey
MCL	maximum contaminant level	VOC	volatile organic chemicals
MCLG	maximum contaminant level goal		

## Section 1: Introduction

As part of the *2012 Update of the Oklahoma Comprehensive Water Plan (2012 OCWP Update)*, the Oklahoma Water Resources Board (OWRB) has prepared this *Public Water Supply Planning Guide* to assist public water supply systems in developing plans to meet their specific long-term water needs. While the guide may be most useful for smaller systems that have not prepared water supply plans in the past, the outlined steps and processes for planning are applicable to any size system.

The purpose of this guide is not to provide a single solution that fits every system, but to develop a framework for long-range water system planning. This framework includes collecting data, determining if there are gaps between the existing system and future needs, and developing and assessing strategies to close the gap.

This guide will help identify how public water systems can use the technical information provided by 13 OCWP Watershed Planning Region reports (OCWP Regional Reports) that were published in 2012. These reports present elements of OCWP technical studies pertinent to each of the state's 82 surface water basins (aggregated into 13 planning regions). Each report contains information from both a regional and multiple basin perspective, including water supply/demand analysis results, forecasted supply shortages, potential supply solutions and alternatives, and supporting technical information. Along with the *2012 OCWP Executive Report* and various technical background reports, the 13 Regional Reports are available on the OWRB website at [www.owrb.ok.gov](http://www.owrb.ok.gov).

### Oklahoma Comprehensive Water Plan (OCWP)

The objective of the *2012 OCWP Update* is to establish a reliable supply of water for Oklahoma citizens throughout at least the next 50 years. There are two ultimate goals:

1. Provide a safe and dependable water supply for all Oklahomans while improving the economy and protecting the environment.
2. Provide information so that water systems, policy makers, and water users can make informed decisions concerning the use and management of Oklahoma's water resources.

In accordance with the goals, the *2012 OCWP Update* has been developed utilizing inclusive public participation to build sound water policy complemented by detailed technical evaluations.

OCWP water demand analysis included an intensive focus on all factors impacting Oklahoma's water use throughout the next 50 years. The impacts of forecasted demands on the physical availability of surface and groundwater supplies through 2060 were evaluated and the amount, timing, and probability of potential water shortages were predicted. Some significant statewide findings are listed below:

- Statewide, consumptive demand for water will increase by 33% between 2010 and 2060, not considering the potential decreases in demand that might stem from more aggressive water conservation measures.
- Crop Irrigation is projected to be the largest demand sector.
- Municipal and Industrial (M&I) demand is projected to have the highest growth rate of any demand sector in the Middle Arkansas, Eufaula, Grand, Lower Washita, Beaver-Cache, and Central Regions.
- Surface water gaps, which occur when demand is projected to exceed available water supply, are projected in 55 of the 82 OCWP basins by 2060.
- Bedrock groundwater depletions, which occur when demand is projected to exceed aquifer recharge rate, are projected in 34 OCWP basins by 2060.
- Alluvial groundwater depletions are projected in 64 OCWP basins.

The availability of water for new permits was also considered; limited availability of unpermitted surface water will prevent some basins from meeting forecasted demands. Twenty-two basins were projected to experience insufficient surface water permit availability to meet projected demands. Based on current permitting protocol, groundwater is not projected to be a concern in any planning basin, despite a general decline in some aquifer levels.

Using both current and historical data, water quality trends in all 82 basins were analyzed. Based upon current trends and attainment of standards for beneficial use, 27 basins were considered to exhibit poor surface water quality and thus may face particular challenges in their ability to provide adequate and reliable supply.



## Statewide OCWP Watershed Planning Regions and Basins

OCWP studies were conducted according to specific geographic boundaries (watersheds) rather than political boundaries (counties). The state was divided into 82 surface water basins for water supply availability analysis. Existing watershed boundaries were revised to include a United States Geological Survey (USGS) stream gage at or near the basin outlet (downstream boundary), where practical. To facilitate consideration of regional supply challenges and potential solutions, basins were aggregated into 13 distinct Watershed Planning Regions.



### Water System Sustainability

Sustainability describes activities that meet the needs of the present without compromising the ability of future generations to meet their needs. It includes three integrated dimensions—environmental, economic, and social. The EPA and state agencies work with systems to help ensure the long-term sustainability of water infrastructure. It is critical for systems to consider sustainability as they go through the planning process. More information on sustainability can be found on the EPA's website at [water.epa.gov/infrastructure/sustain/index.cfm](https://water.epa.gov/infrastructure/sustain/index.cfm). The EPA's "Planning for Sustainability" handbook can be downloaded at [water.epa.gov/infrastructure/sustain/upload/EPA-s-Planning-for-Sustainability-Handbook.pdf](https://water.epa.gov/infrastructure/sustain/upload/EPA-s-Planning-for-Sustainability-Handbook.pdf).

### How to Use this Guide

This guide presents basic concepts of water supply strategic planning that will prepare water systems to respond to changing circumstances while maintaining organizational and financial stability.

Water supply strategic planning consists of five main steps: 1) gathering data, 2) identifying future needs, 3) developing and assessing alternatives, 4) implementing selected alternatives, and 5) reassessing based on changes in conditions.

Long-range water planning is an ongoing process. Reevaluating and updating the plan are necessary to reflect the changing conditions or goals of a water system. The guide also includes information on the selection of a professional engineer to conduct detailed studies and design improvements, reassess strategies, and develop an implementation timeline.



## Guide Organization

This guide provides a framework that public water supply systems can use for long-range water supply planning.

- **Section 1: Introduction**
- **Section 2: Rules and Regulations**—government agencies responsible for enforcing drinking water regulations and current and proposed regulations.
- **Section 3: Gathering Data**—collecting or obtaining data necessary for long-term water system planning.
- **Section 4: Inventory Development, System Operation and Maintenance**—developing an inventory and collecting operation and maintenance (O&M) information of water facilities, equipment, and components.
- **Section 5: Water System Management**—identifying all financial data and obligations of a water supply system, including both capital and O&M costs.
- **Section 6: Determining Future Drinking Water Needs**—developing water demand projections and considering various scenarios affecting future demand, including conservation activities and climate change.
- **Section 7: Drinking Water Source and System Capacity Analysis**—analyzing current resources and system assets, identifying shortfalls, and selecting the most critical projects.
- **Section 8: Identifying Conceptual Alternatives**—developing suitable conceptual alternatives to meet water supply challenges.
- **Section 9: Evaluating Alternatives**—suggested methodology for evaluating alternatives that reflects the complex nature of satisfying multiple and potentially conflicting objectives.
- **Section 10: Preparing an Engineering Report and Project Financing**—information about creating a formal engineering report and project financing.
- **Appendix A: Oklahoma Public Water Supply System List**
- **Appendix B: Calculations and Formulas**
- **Appendix C: Resources**

Sections 3-9 contain worksheets for gathering data. These worksheets are intended to be a general guide for collecting information that is necessary for strategic planning, but in many cases will need to be altered or adjusted to be relevant to a particular water system. User-friendly versions of these worksheets are available on the OWRB website in both pdf and excel formats. Please note that if the information on a particular worksheet already exists in another document, it may be attached or referenced in lieu of completing the worksheet.



## Section 2: Rules and Regulations

### Governing Bodies

In Oklahoma, several government agencies are involved in issues related to drinking water supply, including the U.S. Environmental Protection Agency (EPA), Oklahoma Department of Environmental Quality (ODEQ), and Oklahoma Water Resources Board (OWRB). States have been granted the authority to enforce drinking water regulations for public water supply (PWS) systems if they adopt regulations as stringent as federal requirements. Enforcement of drinking water regulations occurs through the ODEQ's Water Quality Division. More information about public water supply and regulations in Oklahoma can be found at [www.deq.state.ok.us](http://www.deq.state.ok.us).

### Current Regulations

Oklahoma Administrative Code outlines regulations on potable water systems, drinking water quality, distribution systems, and operation and maintenance (O&M) of these systems. Most of these regulations can be found in Title 252. Chapter 626 outlines construction requirements and general design guidelines for all aspects of drinking water (from source development to distribution). Chapter 631 requires PWS systems to meet EPA's standards ([water.epa.gov/drink/contaminants](http://water.epa.gov/drink/contaminants)). Chapter 633 outlines the Drinking Water State Revolving Loan Fund (DWSRF) program.

Water treatment regulations are separated into two distinct groups—primary standards and secondary standards. Primary standards are for the protection of public health and include maximum contaminant levels (MCLs) for microorganisms, disinfectants, disinfection byproducts, inorganic chemicals, organic chemicals, and radionuclides. Secondary standards are guidelines for aesthetic considerations—issues affecting the appearance or taste of drinking water but not known to affect public health—and are not federally enforceable.

Legally, “water source” is divided into two categories—surface water and groundwater. Systems are classified as surface water if they have at least one source that is surface water or groundwater under the direct influence (GUDI or GWUDI) of surface water. Systems are classified as groundwater if they do not meet the surface water definition.

The 2012 OCWP *Update* evaluates source water supplies in three categories—surface water, alluvial groundwater, and bedrock

groundwater. A bedrock aquifer is one with porous media consisting of lithified (semi-consolidated or consolidated) sediments, such as limestone, sandstone, siltstone, or fractured crystalline rock. An alluvial aquifer is one with porous media consisting of loose, unconsolidated sediments deposited by fluvial (river) or Aeolian (wind) processes, typical of river beds, floodplains, dunes, and terraces. Generally, alluvial aquifers are filled by infiltration of surface water or precipitation. Given this close interaction with surface water, generally, alluvial aquifers will be classified as GUDI. (For questions on GUDI classification, contact ODEQ.) Sources of stream water and groundwater in each of the 13 OCWP planning regions are discussed in detail in the OCWP Regional Reports.

The primary regulatory drivers for water treatment include federal regulations that address turbidity removal, disinfection requirements, and disinfection byproduct limits. Water utilities should refer to the governing agency websites for the latest information on rules and regulations.

Summary of Drinking Water Regulations\*

	Groundwater	All Public Water Supplies	Surface Water or GUDI
Existing Regulations	<ul style="list-style-type: none"> <li>• Ground Water Rule (GWR)</li> </ul>	<ul style="list-style-type: none"> <li>• Stage 1 Disinfectant and Disinfection Byproduct Rule (DBPR)</li> <li>• Stage 2 DBPR</li> <li>• Arsenic Rule</li> <li>• Lead and Copper Rule</li> <li>• Radionuclides Rule</li> <li>• Phase II/V Rules</li> <li>• Total Coliform Rule</li> <li>• Consumer Confidence Report Rule</li> <li>• Public Notification Rule</li> </ul>	<ul style="list-style-type: none"> <li>• Surface Water Treatment Rule (SWTR)</li> <li>• Interim Enhanced SWTR (IESWTR)</li> <li>• Long Term 1 Enhanced SWTR (LT1 or LT1ESWTR)</li> <li>• Long Term 2 Enhanced SWTR (LT2 or LT2ESWTR)</li> <li>• Filter Backwash Recycling Rule</li> </ul>
Proposed Regulations	<ul style="list-style-type: none"> <li>• Radon Rule</li> </ul>	<ul style="list-style-type: none"> <li>• Revised Total Coliform Rule (RTCR)</li> <li>• Long term Lead and Copper Rule Revisions</li> <li>• Perchlorate Rule</li> </ul>	<ul style="list-style-type: none"> <li>• None known</li> </ul>

\*As of April 2011.

Section 3:Gathering Data

Section 3 provides a guide to collecting a water system’s pertinent data and information. These data will be used in subsequent sections for determining long-term water needs. Most of the information collected will be necessary if the water supply system needs to complete an engineering report to obtain a permit or project funding. A “To-Do” list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed to complete the worksheets.

Table 3-1: Water System Data Gathering To-Do List

System Name			
	Task	Person Responsible	Target Completion Date
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## System Map

Gather maps, photographs, or sketches showing the current service area, surrounding areas, and facilities.

- Indicate facilities owned or operated by the water supply system, including groundwater wells, surface water supply diversions, booster pump stations, water storage tanks, water treatment plants, administrative buildings, etc. In addition to mapping these data, attach copies of ownership documents and legal descriptions of all properties and facilities. This information may be needed for permitting and project funding requirements.
- If the distribution system is not continuous, indicate service areas for various components. It also may be helpful to indicate critical connections with emergency water supply sources (such as neighboring systems), or interconnections between non-continuous system areas.
- Indicate general elevations, pressure planes, and equipment information.
- Indicate land development, density of population, and expected changes. Even if these are “unofficial” trends, knowing where growth or decline in development, demand, or population seems to be occurring is helpful in long-term planning.
- Indicate environmental or cultural resources, such as water bodies, parks, historically significant areas, endangered species, or floodplains, that may affect facility siting.

The OWRB has developed an interactive map viewer containing many data layers to assist with service area mapping, available at [www.owrb.ok.gov/systems](http://www.owrb.ok.gov/systems). The intent of this tool is to provide a general overview of public water supply systems and their facilities studied as part of the 2012 OCWP Update. Data include 775 of the state's major water supply systems. Users can zoom in to view system boundaries, along with locations of system facilities, such as pipelines, wells, and treatment plants.

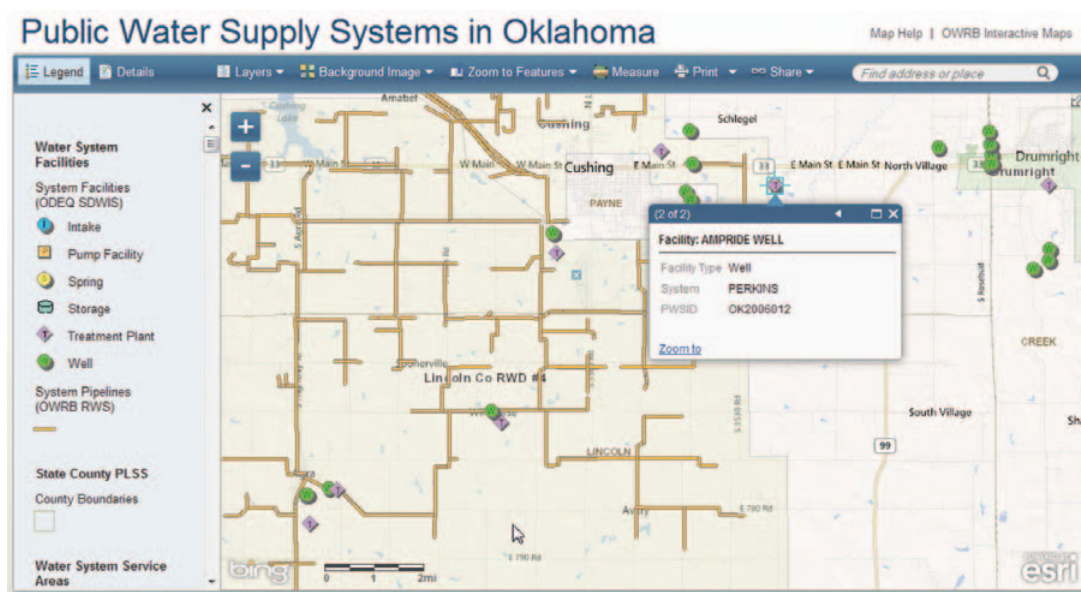


Table 3-2: System Map

System Name		
Attach documentation and/or identify physical and/or electronic location of service area and facility map(s) below.		
Are service area and facility map(s) attached? Yes ____ No ____		
Physical Location	Electronic Location	
Are key facilities identified on the service area map? Yes ____ No ____		
Are future service area changes due to growth or shifts in water demands identified on the map? Yes ____ No ____		
Are known environmental or cultural areas identified on the map? Yes ____ No ____		

## Permits and Agreements

Attach copies of surface water and/or groundwater permits, current construction permits, and discharge (wastewater or stormwater) permits held by the system. It may help to include notes regarding source water availability based on experience. Attach copies of any wholesale agreements to purchase or sell water that may affect long-term water source decisions. Identify nearby water service systems and any other sources of water available for use in an emergency. The provider section of each OCWP Regional Report includes a tabulation of interconnections between major water systems.

**Table 3-3: Water Use Permits and Source Observations**

System Name		
Permit Number:		<i>Please use a separate form for each permit.</i>
Attach documentation and/or identify physical and/or electronic location of permit document(s) below. Is documentation attached? Yes ___ No ___		
Physical Location		Electronic Location
If the permit includes a schedule of use, enter information below.		
Year	Permitted Use (AFY)	Comments
Source Water Availability Observations		
Describe below any period when the system experienced insufficient source water.		
Describe below any foreseen changes in the amount of water purchased from or sold to other providers.		
Explain and state below the amount of any unused storage potentially available in the system's surface water reservoir.		
Source Water Quality Observations		
Describe below how water quality is affected during extreme weather changes or events.		
Describe below how water quality has been affected by changes in the watershed.		



## Population Served

Gather information about the population served by the system. The OCWP Regional Reports contain current (2010) population served data for water systems based on population estimates generated by the Oklahoma Department of Commerce and the 2008 OCWP Provider Survey. Population of counties and municipal areas, including historical data, may be directly obtained from the U.S. Census Bureau at [www.census.gov](http://www.census.gov) or the Oklahoma Department of Commerce at [www.okcommerce.gov](http://www.okcommerce.gov). Other possible sources for historical population are Regional Council of Government organizations and City Master Plans. (County or municipal population will need to be adjusted to reflect the system service area.)

**Table 3-4: System Population Served**

System Name			
Historical population data			
Year	Population Served <sup>1</sup>	Comments	Data Source(s) <sup>2</sup>
Identify and describe below any significant events that have affected changes in area population.			
Year	Event		

<sup>1</sup> If population numbers are unavailable, estimate using number of connections times 2.5 persons per connection.

<sup>2</sup> Data sources may include OCWP reports, U.S.Census Bureau, OWRB or other agency data bases, published documents, etc.

## Water Use Data

Determine trends in past water use. OCWP Regional Reports contain information on individual water supply systems, including estimates of retail water demand per capita.

**Table 3-5: Water Use Data**

System Name						
Past raw water <sup>1</sup> data.						
Year	Population Served	Flow per Capita (GPCD) <sup>2</sup>	Demand (MGD)			Data Source(s)
			Average Daily <sup>3</sup>	Peak Daily <sup>4</sup>	Peak Hourly	
Past finished water <sup>5</sup> data.						
Year	Demand (MGD)			Data Source(s)		
	Average Daily <sup>3</sup>	Peak Daily <sup>4</sup>	Maximum Monthly			
Past wholesale water transactions.						
Year	Raw Water (MGD)		Treated Water (MGD)		Data Source(s)	
	Purchased	Sold	Purchased	Sold		

<sup>1</sup> Untreated water. Estimates may be found using a raw water flow meter or pumping information. Some utilities may sell or purchase raw water.

<sup>2</sup> Gallons Per Capita per Day. This value should include system losses and other non-revenue water.

<sup>3</sup> The amount of water used by the provider's customers under average conditions.

<sup>4</sup> The maximum amount of water used by the provider's customers under extreme conditions. Peak day demands are used to size water system components including treatment and distribution systems.

<sup>5</sup> Treated water. Estimates may be found on the system's monthly operational report. Some utilities may sell or purchase treated water.

## Fire Flow Requirements

Document fire flow requirements. An adequate water system for fire protection often results in lower fire insurance rates. The fire flow requirement is defined as the amount of water necessary to successfully fight a fire and confine it to a small area. Determination or suggestions of the amount of water needed are made by the Insurance Services Office (ISO) or other similar agency. In residential areas, the fire flow typically has a range of 500 gallons per minute (gpm) to 2,500 gpm, with a minimum duration of two hours. The ISO Personal Protection Classification Program web page ([www.isomitigation.com/ppc/0000/ppc0001.html](http://www.isomitigation.com/ppc/0000/ppc0001.html)) contains information related to fire flow needs.

**Table 3-6: Fire Flow Requirements**

System Name	
Insurance Services Office (ISO) Fire Suppression Rating <sup>1</sup>	
If the system currently participates in ISO's Public Protection Classification (PPC) (or similar) program, provide information below.	
Fire suppression rating (ISO): _____ or other: _____ (Name other program below.) Is documentation attached? Yes ____ No ____	
Describe any known plans to increase or decrease classification.	

<sup>1</sup> The Fire Suppression Rating Schedule (FSRS) is the manual ISO uses in reviewing the fire-fighting capabilities of individual communities. The schedule measures the major elements of a community's fire-suppression system and develops a numerical grading called a Public Protection Classification (PPC™). Class 1 represents the best public protection, and Class 10 indicates no recognized protection.



Water Conservation Programs

Document water conservation programs. Conservation can be implemented on both the demand and supply/distribution side of water management. Water supply systems can achieve conservation through a variety of methods including (1) distribution conservation—the effective management of system water losses through metering, metering testing, analysis of water use, line replacement, and leak detection in order to identify and reduce sources of non-revenue water; and (2) M&I demand side conservation techniques—reducing water demand by changing consumer behavior with education programs, promoting the use of water efficient appliances, and enacting conservation pricing. More information about water conservation can be found in Section 6.

Table 3-7: Water Conservation Programs

System Name	
Attach documentation and describe below any conservation program the system currently uses. Is documentation attached? Yes ___ No ___	

Water Quality

Collect all available water quality data that is key to determining treatment processes. Over time, collection of water quality data allows for trending of data to determine if a change in treatment process or source water is required due to significant degradation. Water quality data should include a significant (5-year minimum) period of record (POR), but if this is not available, begin data collection for consideration during future assessments. This data will be helpful when developing and evaluating alternatives, specifically those alternatives related to source water and water treatment. It may also be helpful to include observations on other physical (color, taste and odor, etc.), chemical (iron, manganese, etc.), biological (total coliform, etc.) or radiological characteristics of specific concern to the system.

Source water protection is critical for maintaining the integrity of a drinking water supply by preventing contamination, or if necessary, mitigating contamination quickly. It is important to identify both physical and chemical contamination sources, current methods for controlling/mitigating contamination, and improvement ideas. Some of this information can be collected from records associated with compliance with the Groundwater Rule. Information on surface water and groundwater “protection areas” (administered by the ODEQ) is also provided in the “Water Quality” section of the OCWP Regional Reports. Appendix C of the EPA’s [Manual of Small Public Water Supply Systems](#) provides information on how to identify potential contamination. An additional EPA web page dedicated to source water protection is available at [water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/index.cfm](#). The ODEQ’s source water protection information is available at [www.deq.state.ok.us/wqdnew/sourcewater/index.html](#).

One of the supporting recommendations resulting from the 2012 OCWP Update includes encouraging voluntary best management practices to curtail runoff from agricultural lands, urban stormwater, and suburban developments. Efforts to mitigate impairments due to nonpoint source pollutions should be implemented within the watershed and receiving waters targeting the restoration of impaired beneficial uses. The Oklahoma Conservation Commission (OCC) ([www.ok.gov/conservation](#)) works with the USDA, EPA, and other state, federal, and local partners to implement various nonpoint source pollution control programs.

Table 3-8: Water Quality Data

System Name						
Parameter	Location	Period of Record		Avg.	Min.	Max.
		From	To			
Temperature (°C)	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
Turbidity (NTU)	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
Alkalinity (mg/L as CaCO <sub>3</sub> )	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
pH	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
Hardness (mg/L as CaCO <sub>3</sub> )	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
Chlorides (mg/L)	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
Total Dissolved Solids (mg/L)	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
Other:	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					
Other:	Raw Water Source 1					
Notes	Raw Water Source 2					
	Finished Water Location 1					
	Finished Water Location 2					

Table 3-9: Potential Water Contamination

System Name	
Please identify and describe below any significant changes that have influenced source water quality. Is documentation attached Yes ___ No ___	



Table 3-10: Source Water Protection

System Name		
Physical Contamination <sup>1</sup>		
Contamination Sources	Current Methods for Mitigating	Mitigation Improvement Ideas
Chemical Contamination <sup>2</sup>		
Contamination Sources	Current Methods for Mitigating	Mitigation Improvement Ideas
Other Types of Contamination		
Contamination Sources	Current Methods for Mitigating	Mitigation Improvement Ideas

<sup>1</sup> Such as that occurring from stormwater runoff.<sup>2</sup> Such as that from mine drainage, landfill leakage, municipal and personal wastewater treatment systems, agricultural runoff, etc.

## Section 4: Inventory Development, System Operation and Maintenance

Section 4 provides a guide to developing an inventory and collecting a system's operation and maintenance (O&M) information, which will be used in subsequent sections for determining long-term water needs. Most of the information collected will be necessary for completing an engineering report to obtain a permit or project funding. A "To-Do" list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed to complete the worksheets.

**Table 4-1: Inventory, Operation and Maintenance To-Do List**

System Name			
	Task	Person Responsible	Target Completion Date
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## Water Facilities Inventory

Conduct a component inventory and assessment of the water system. A facilities inventory assists the utility in short- and long-term planning. This inventory aids the utility in determining remaining service life and identifying equipment that needs to be replaced soon (within the next 5 years). Additionally, it summarizes capacity of critical components, which is necessary information when looking at replacement equipment or expanding system capacity. Also, it could identify bottlenecks that hinder existing system performance.

Several worksheets are included in this section to cover the many types of facilities that may be present in the water system. Not all worksheets may be applicable to the system while others will be used multiple times. The information requested is typical of information that would be needed to design a new or replacement system. Fill in as much as possible, but missing information is not unexpected. The base effective useful life is an estimate and is highly dependent on many factors including materials of construction, location, installation method, application, etc. Use information specific to the system's equipment if it is available.

Much of the information for the water facilities inventory is available from the O&M manuals provided by equipment manufacturers, original design documents, or on equipment nameplate data. It is not necessary to complete the inventory in the order that it is presented or complete it all at once. Continue to collect and include additional information or updated information as it becomes available.

**Table 4-2: Wells**

System Name						
Date of assessment (mm/dd/yyyy)						
WELLS (additional forms if needed)						
Number of wells						
		1	2	3	4	5
Common/Official identification: <sup>1</sup>						
Size of well (inches)						
Depth of well (feet)						
Date well was drilled (mm/dd/yyyy)						
Perceived condition (Poor, Fair, Good, Excellent)						

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.

**Table 4-3: Well Pumps**

System Name						
Date of assessment (mm/dd/yyyy)						
EQUIPMENT: (additional forms needed)						
Number of well pumps						
		1	2	3	4	5
Common/Official identification: <sup>1</sup>						
Rated capacity of pump (gpm @ feet TDH)						
Installation date (mm/dd/yyyy)						
Manufacturer						
Horsepower/ Voltage/ Speed (hp, V, rpm)						
Variable or constant Speed?						
CONTROL: (additional forms needed)						
		1	2	3	4	5
Common/Official identification: <sup>1</sup>						
Installation date (mm/dd/yyyy)						
Instrumentation type						
Description of control strategy						
Perceived condition (poor, fair, good, excellent)						

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.

Table 4-4: Facility Pumps

System Name						
	Date of assessment (mm/dd/yyyy)					
	Facility type					
EQUIPMENT: (additional forms if needed)						
	Number of pumps					
		1	2	3	4	5
	Common/Official identification: <sup>1</sup>					
	Rated capacity of pump (gpm @ feet TDH)					
	Installation date (mm/dd/yyyy)					
	Manufacturer					
	Horsepower/ Voltage/ Speed (hp, V, rpm)					
	Variable or constant Speed?					
	Base effective useful life (years)					
	Estimated remaining effective useful life (years)					
	Replacement within next 5 years?					
	STRUCTURE: (additional forms if needed)					
		1	2	3	4	5
	Common/Official identification: <sup>1</sup>					
	Installation date (mm/dd/yyyy)					
	Space for expansion?					
	Base effective useful life (years)					
	Estimated remaining effective useful life (years)					
	Replacement within next 5 years?					
CONTROL: (additional forms if needed)						
		1	2	3	4	5
	Common/Official identification: <sup>1</sup>					
	Installation date (mm/dd/yyyy)					
	Instrumentation type					
	Description of control strategy					
	Base effective useful life (years)					
	Estimated remaining effective useful life (years)					
	Replacement within next 5 years?					
Perceived condition (poor, fair, good, excellent)						

<sup>1</sup> How the equipment is normally referred to in this system if applicable.



Table 4-5: Primary Pipelines

System Name						
	Date of assessment (mm/dd/yyyy)					
PIPELINES (additional forms if needed)						
		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5
Common/Official identification: <sup>1</sup>						
Diameter of pipeline (inches)						
Approximate length of pipeline (feet)						
Installation date (mm/dd/yyyy)						
Pipe material						
Maximum design flow (gpm)						
Maximum velocity (fps)						
Minimum design flow (gpm)						
Minimum velocity (fps)						
Base effective useful life (years)						
Estimated remaining effective useful life (years)						
Replacement within next 5 years?						
Perceived condition (fair, poor, good, excellent)						

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.

Table 4-6: Water Tanks

System Name				
Date of assessment (mm/dd/yyyy)				
STRUCTURE (additional forms if needed)				
		1	2	3
Common/Official identification: <sup>1</sup>				
Purpose				
Type of tank <sup>2</sup> (Coated concrete, steel, etc)				
Type of inlet <sup>3</sup>				
Number of inlets				
Inlet size (inches)				
Type of discharge <sup>4</sup>				
Number of outlets				
Outlet size (inches)				
Additional manway(s)				
Tank dimensions <sup>5</sup>				
Side water depth (feet)				
Storage tank volume <sup>6</sup>				
Operating Elevation (If applicable [feet])				
Treatment Capacity (If applicable [feet])				
Installation date (mm/dd/yyyy)				
Base effective useful life (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
CONTROL (additional forms if needed)				
		1	2	3
Common/Official identification: <sup>1</sup>				
Instrumentation type <sup>7</sup>				
Tank level control strategy				
Installation date (mm/dd/yyyy)				
Base effective useful life (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
Perceived condition (poor, fair, good, excellent)				

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.<sup>2</sup> Including clear wells and storage tanks in distribution.<sup>3</sup> 90° upturned flare, submerged side inlet, etc.<sup>4</sup> Flare to pump suction, submerged side outlet, etc.<sup>5</sup> Length x width x height if rectangular or diameter x height if round.<sup>6</sup> Assuming 2-ft freeboard) (million gallons [MG])<sup>7</sup> Level sensor, altitude valve, etc.

Table 4-7: Aeration and Air Stripping

System Name			
Date of assessment (mm/dd/yyyy)			
AERATION/AIR STRIPPING EQUIPMENT (additional forms if needed)			
		Air Stripping	Aeration
Common/Official identification: <sup>1</sup>			
Type of equipment <sup>2</sup>			
Contaminant(s) to be removed			
Temperature of water (°F)			
Temperature of surrounding air (°F)			
Contact time			
Basin dimensions <sup>3</sup>			
Side water depth (feet)			
Materials of construction			
Diffuser type <sup>4</sup>			
Diffuser depth			
Number of air compressors			
Number of air blowers			
Height of packing			
Water loading rate			
Installation date (mm/dd/yyyy)			
Base effective useful life (years)			
Estimated remaining effective useful life (years)			
Replacement within next 5 years?			
Perceived condition (poor, fair, good, excellent)			

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.<sup>2</sup> Waterfall - spray, multiple tray, cascade, cone, packed column.

Diffusers or Bubble - diffusers, draft tub, in well.

Mechanical - Surface, submerged, or pressure aeration.

<sup>3</sup> Length x width x height if rectangular or diameter x height if round.<sup>4</sup> Perforate pipes, porous plates, sparger, etc.

Table 4-8: Chemical Feed Systems

System Name				
Date of assessment (mm/dd/yyyy)				
Chemical storage location				
CHEMICAL STORAGE TANK(S) (additional forms if needed)				
Number of tanks				
		1	2	3
Common/Official identification: <sup>1</sup>				
Type of tank				
Tank volume (gallons)				
Diameter of tank (feet)				
Sidewall height of tank (feet)				
Assumed freeboard (feet)				
Tank material				
Installation date				
Base effective useful life (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
CHEMICAL FEED PUMP( (additional forms if needed)				
Number of chemical feed pumps				
		1	2	3
Common/Official identification:				
Type of pump				
Rated flow and TDH (gpm, feet)				
Pump operating pressure (psig)				
Pump horsepower (hp)				
Motor horsepower (hp)				
Electrical service (volts, phase, hertz.)				
Assumed efficiency (percent)				
Materials of construction				
Suction connection (Inches)				
Discharge connection (Inches)				
Installation date (mm/dd/yyyy)				
Base effective useful life (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
CHEMICAL FEED PIPING (additional forms if needed)				
		Segment 1	Segment 2	Segment 3
Common/Official identification:				
Diameter of pipeline (Inches)				
Approximate length (feet)				
Pipe material				
Maximum design flow (gpm)				
Maximum velocity (fps)				
Installation date (mm/dd/yyyy)				
Base effective useful life (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
Perceived condition (poor, fair, good, excellent)				

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.



Table 4-9: Clarification

System Name				
	Date of assessment (mm/dd/yyyy)			
	Clarification Type <sup>1</sup>			
	Design overflow rate (gpm/sf)			
STRUCTURE (additional forms if needed)				
	Number of tanks			
		1	2	3
	Common/Official Identification: <sup>2</sup>			
	Type of tank <sup>3</sup>			
	Type of inlet <sup>4</sup>			
	Type of outlet <sup>5</sup>			
	Additional manway(s)			
	Tank dimensions <sup>6</sup>			
	Side water depth (feet)			
	Installation date (mm/dd/yyyy)			
	Base effective useful life (years)			
	Estimated remaining effective useful life (years)			
	Replacement within next 5 years?			
	SOLIDS REMOVAL EQUIPMENT (additional forms if needed)			
	Number of units			
		1	2	3
	Common/Official Identification:			
	Type			
	Horsepower/ Voltage/ Speed (hp, V, rpm)			
	Variable or Constant Speed:			
	Installation date (mm/dd/yyyy)			
	Base effective useful life (years)			
	Estimated remaining effective useful life (years)			
	Replacement within next 5 years?			
	CONTROL (additional forms if needed)			
	Number of units			
		1	2	3
	Common/Official Identification:			
	Instrumentation type			
	Tank level control strategy			
	Installation date (mm/dd/yyyy)			
	Base effective useful life (years)			
	Estimated remaining effective useful life (years)			
	Replacement within next 5 years?			
Perceived condition (poor, fair, good, excellent)				

<sup>1</sup> Conventional, high rate, solids contact, etc.<sup>2</sup> How the equipment is normally referred to in this system, if applicable.<sup>3</sup> Coated concrete, steel, etc.<sup>4</sup> Inlet trough, weir, pipe inlet, etc. and details (number, size, etc.).<sup>5</sup> Launderers, collection pipe, etc. and details (number, size, etc.).<sup>6</sup> Length x width x height if rectangular or diameter x height if round.

Table 4-10: Ozone System

System Name						
Date of assessment (mm/dd/yyyy)						
<b>OZONE GENERATION (additional forms if needed)</b>						
Number of generators						
	1	2	3	4	5	6
Common/Official Identification: <sup>1</sup>						
Manufacturer						
Ozone generator service <sup>2</sup>						
Feed gas supply temperature (°F)						
Feed gas supply pressure (psig)						
Ozone production capacity (ppd) <sup>3</sup>						
Design gas flow rate (scfm at design temp)						
Power factor						
Cooling water design temperature (°F)						
Cooling water flow rate (OG + PSU) (gpm)						
Cooling water pressure (psig)						
Cooling water temperature rise (°F)						
Installation date (mm/dd/yyyy)						
Base effective useful life (years)						
Estimated remaining effective useful life (years)						
Replacement within next 5 years?						
<b>LIQUID OXYGEN (LOX) STORAGE TANK (additional forms if needed)</b>						
Number of units						
	1	2	3	4	5	6
Common/Official Identification:						
Tank capacity, gross (gal)						
Diameter of tank (feet)						
Height of tank (feet)						
Design pressure (psig)						
Operating pressure (psig)						
Inner container design						
Casing material						
Piping material						
Insulation						
Installation date (mm/dd/yyyy)						
Base effective useful life (years)						
Estimated remaining effective useful life (years)						
Replacement within next 5 years?						
<b>AMBIENT LOX VAPORIZER (additional forms if needed)</b>						
Number of units						
	1	2	3	4	5	6
Common/Official Identification:						
Capacity (standard cubic feet per hour [scfh] rating)						
Design temperature (°F)						
Design pressure (psig)						
Operating pressure (psig)						
Dimensions (length x width x height) (in)						

(continued)

Table 4-10 (continued)

Material of construction						
Installation date (mm/dd/yyyy)						
Base effective useful life (years)						
Estimated remaining effective useful life (years)						
Replacement within next 5 years?						
<b>CHILLER (additional forms if needed)</b>						
Number of units						
	1	2	3	4	5	6
Common/Official Identification:						
Type of Chiller						
Capacity, nominal (tons)						
Electrical service (volt, phase, hertz)						
Chilled water flow rate (1 generator and PSU) (gpm )						
Chilled water inlet temperature (°F)						
Chilled water outlet temperature (°F)						
Chilled water pressure drop (psig)						
Design ambient temperature (°F)						
Installation date (mm/dd/yyyy)						
Base effective useful life (years)						
Estimated remaining effective useful life (years)						
Replacement within next 5 years?						
<b>OZONE CONTACTORS (additional forms if needed)</b>						
Number of tanks						
	1	2	3	4	5	6
Common/Official Identification:						
Type of tank						
Detention time, each tank (time at flow rate)						
Baffling factor						
Volume of tank						
Tank dimensions (length x width x height) (feet)						
Side water depth (feet)						
Number of off-gas destruct units						
Number of off-gas fans						
	1	2	3	4	5	6
Common/Official Identification:						
Type of off-gas fan						
Capacity, each (scfm)						
Minimum fan static pressure rating (inches of water)						
Motor horsepower, each (hp)						
Electrical service (volt, phase, hertz)						
Maximum fan speed (rpm)						
Installation date (mm/dd/yyyy)						
Base effective useful life (years)						
Estimated remaining effective useful life (years)						
Replacement within next 5 years?						

(continued)

Table 4-10 (continued)

SIDE STREAM INJECTION SYSTEM (additional forms if needed)						
Type						
Pipeline operating pressure (psig)						
Applied ozone dose (mg/L)						
Ozone gas concentration						
Expected ozone demand ratio (mg/L/mg/L)						
Required ozone injection rate (lb/hr)						
Required ozone gas flow (scfm)						
Calculated gas/liquid ratio (Vg/Vl)						
Mass transfer efficiency (percent)						
Calculated ozone residual (mg/L)						
Number of sidestream pumps						
	1	2	3	4	5	6
Common/Official Identification:						
Pump type (separate form for each)						
Pump capacity, each (gpm)						
Pump head (ft TDH)						
Motor horsepower, each (hp)						
Electrical service (volt, phase, hertz)						
Maximum pump speed (rpm)						
Number of injectors						
	1	2	3	4	5	6
Common/Official Identification:						
Injector type (separate form for each)						
Injector size (inches)						
Inlet pressure (psig)						
Injector flow rate (gpm)						
Injector gas feed (scfm)						
Design back pressure (outlet pressure) (psig)						
Gas pressure (psig)						
Number of pipeline flash reactors						
	1	2	3	4	5	6
Common/Official Identification:						
Material Diameter (inches)						
Number of manifold nozzles						
	1	2	3	4	5	6
Common/Official Identification:						
Gas mixing velocity (fps)						
Installation date (mm/dd/yyyy)						
Base effective useful life (years)						
Estimated remaining effective useful life (years)						
Replacement within next 5 years?						
Perceived condition (poor, fair, good, excellent)						

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.<sup>2</sup> Oxygen at concentration of O<sub>2</sub> + concentration of N<sub>2</sub>.<sup>3</sup> Pounds per day at ozone concentration weight.



Table 4-11 Ultraviolet Disinfection

System Name				
Date of assessment (mm/dd/yyyy)				
REACTORS (additional forms if needed)				
Number of reactors				
		1	2	3
Common/Official Identification: <sup>1</sup>				
Reactor chamber dimensions (l x w x h) (feet)				
Number of lamps per reactor				
Type of lamp used <sup>2</sup>				
Number of ballasts per reactor				
Ballast type (magnetic, electronic)				
Cleaning system type and details				
CONTROLS (additional forms if needed)				
Description of control strategy				
Instrumentation type				
Tank level control strategy				
Installation date (mm/dd/yyyy)				
Base effective useful lives:				
Reactor housing (years)				
Low-pressure lamps (LP and LPHO) (hrs)				
MP lamps (hours)				
Sleeve (years)				
Duty and reference UV sensors (years)				
UVT analyzer (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
Perceived condition (poor, fair, good, excellent)				

<sup>1</sup> How the equipment is normally referred to in this system, if applicable.<sup>2</sup> Low pressure, low pressure high output, medium pressure, etc.

Table 4-12: Membrane Treatment

System Name				
Date of assessment (mm/dd/yyyy)				
MEMBRANE GENERAL INFORMATION (MANUFACTURER)				
Overall rack dimensions (length, height, width)				
Process description				
Number of membrane filtration trains				
Permeate recovery rate				
Number of manifolds per train				
Number of pressure vessels per train				
Number of membrane elements per pressure vessel				
Membrane identification				
Length of membrane element				
Surface area per membrane element				
Instantaneous flux rate at 5°C				
Instantaneous flux rate per train at 20°C				
Spare membrane capacity				
Maximum allowable TMP				
Pressure vessel rating				
Pressure vessel diameter				
Base effective useful life (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
MEMBRANE FEED PUMPS (additional forms if needed)				
Number of pumps				
	1	2	3	
Common/Official Identification: <sup>1</sup>				
Rated capacity of pumps				
Manufacturer				
Horsepower/ Voltage/ Speed (hp, V, rpm)				
Variable speed:				
Premembrane strainers				
Strainer capacity, each				
Installation date (mm/dd/yyyy)				
Base effective useful life (years)				
Estimated remaining effective useful life (years)				
Replacement within next 5 years?				
MEMBRANE BACKWASH PUMPS (additional forms if needed)				
Number of pumps				
	1	2	3	
Common/Official Identification: <sup>1</sup>				
Rated capacity of pumps				
Manufacturer				
Horsepower/ Voltage/ Speed (hp, V, rpm)				
Variable or constant speed:				

(continued)

Table 4-12 (continued)

Backwash pulse duration, frequency			
Installation date (mm/dd/yyyy)			
Base effective useful life (years)			
Estimated remaining effective useful life (years)			
Replacement within next 5 years?			
<b>AIR SCOUR SYSTEM (additional forms if needed)</b>			
Number of blowers			
Number of air compressors			
Installation date (mm/dd/yyyy)			
Base effective useful life (years)			
Estimated remaining effective useful life (years)			
Replacement within next 5 years?			
<b>CLEAN-IN-PLACE SYSTEM (CIP) (additional forms if needed)</b>			
Cleaning Substances			
Cleaning Solution			
pH range			
Temperature range			
Additional notes			
Heats of dilution			
Direction of flow for cleaning solution			
<b>ACID CLEAN-IN-PLACE (additional forms if needed)</b>			
Type Used			
Maximum concentration in cleaning solution			
Minimum pH of cleaning solution			
Specific gravity of maximum concentration cleaning solution			
Concentrate			
Delivery options			
Installation date (mm/dd/yyyy)			
<b>SODIUM HYPOCHLORITE CLEAN-IN-PLACE</b>			
Maximum concentration in cleaning solution			
Minimum pH of cleaning solution			
Specific gravity of maximum concentration cleaning solution			
Concentrate			
Delivery options			
Installation date (mm/dd/yyyy)			
<b>CLEAN-IN-PLACE TANKS (additional forms if needed)</b>			
Number of tanks			
	1	2	3
Common/Official Identification: <sup>1</sup>			
Type of tank			
Tank material			
Tank volume			

(continued)

Table 4-12 (continued)

Diameter of tank			
Height of tank			
Assumed freeboard			
Tank inlet for permeate filling			
Tank inlet for alkaline solution filling			
Tank inlet for citric acid			
Tank inlet/outlet for cleaning solution			
Other outlets			
Tank heater type			
Heater capacity			
Heater material of construction			
Configuration			
Temperature range of cleaning solution			
Heating time			
Estimated tank weight (w/flange connections)			
Estimated fluid weight			
Total estimated live tank weight			
Installation date (mm/dd/yyyy)			
Base effective useful life (years)			
Estimated remaining effective useful life (years)			
Replacement within next 5 years?			
CLEAN-IN-PLACE FEED PUMPS (additional forms if needed)			
Number of CIP feed pumps			
	1	2	3
Common/Official Identification: <sup>1</sup>			
Type of CIP feed pump			
Rated flow and TDH			
Pump operating pressure			
Pump horsepower			
Motor horsepower			
Electrical service (volts, phase, hertz)			
Assumed efficiency			
Materials of construction			
Suction connection			
Discharge connection			
Installation date (mm/dd/yyyy)			
Base effective useful life (years)			
Estimated remaining effective useful life (years)			
Replacement within next 5 years?			
Perceived condition (poor, fair, good, excellent)			

<sup>1</sup>How the equipment is normally referred to in this system, if applicable.



Table 4-13: Filtration

System Name							
Date of assessment (mm/dd/yyyy)							
<b>FILTERS</b>							
Number of filters							
		1	2	3	4	5	6
Common/Official Identification: <sup>1</sup>							
Type of filter							
Design filtration rate							
Empty bed contact time							
Dimensions, each filter cell							
Total surface area							
Filter media							
Underdrain							
Filter media support							
Wash water troughs							
Number of air scour blowers							
		1	2	3	4	5	6
Common/Official Identification: <sup>1</sup>							
Type of blower							
Capacity, each							
Discharge pressure							
Motor horsepower, each							
Electrical service (volt, phase, hertz)							
Maximum blower speed							
Installation date (mm/dd/yyyy)							
Base effective useful life (years)							
Estimated remaining effective useful life (years)							
Replacement within next 5 years?							
<b>MEDIA</b>							
Type of media							
Installation date (mm/dd/yyyy)							
Base effective useful life (years)							
Estimated remaining effective useful life (years)							
Replacement within next 5 years?							
<b>FILTER BACKWASH PUMPS</b>							
Number of pumps							
		1	2	3	4	5	6
Common/Official Identification: <sup>1</sup>							
Rated capacity of pump							
Type of pump							
Manufacturer							
Discharge diameter							

(continued)

Table 4-13 (continued)

	Horsepower/ Voltage/ Speed							
	Type drive							
	Valves and appurtenances							
	Installation date (mm/dd/yyyy)							
	Base effective useful life (years)							
	Estimated remaining effective useful life (years)							
	Replacement within next 5 years?							
FILTER BACKWASH BLOWERS								
	Number of blowers							
		1	2	3	4	5	6	
	Common/Official Identification: <sup>1</sup>							
	Type of blower							
	Installation date (mm/dd/yyyy)							
	Base effective useful life (years)							
	Estimated remaining effective useful life (years)							
	Replacement within next 5 years?							
	Number of air compressors							
		1	2	3	4	5	6	
	Common/Official Identification: <sup>1</sup>							
	Type of compressor							
	Installation date (mm/dd/yyyy)							
	Base effective useful life (years)							
	Estimated remaining effective useful life (years)							
	Replacement within next 5 years?							
	Perceived condition (poor, fair, good, excellent)							

<sup>1</sup>How the equipment is normally referred to in this system, if applicable.

Table 4-14: Other Key Features

System Name			
	Date of assessment (mm/dd/yyyy)		
OTHER KEY FEATURES (for which a table was not provided)			
	Feature	Description/Value, etc.	Condition <sup>1</sup>

<sup>1</sup> Perceived condition (Poor, Fair, Good, Excellent)

## Operation and Maintenance Program

Identify staff and duties necessary to operate and maintain the system in compliance with drinking water regulations. It may be helpful to have the individual responsible for maintenance of the system to complete this section.

More information on public water supply staffing can be found on the ODEQ's website at [www.deq.state.ok.us/rules/710.pdf](http://www.deq.state.ok.us/rules/710.pdf).

**Table 4-15: Personnel**

System Name					
Name	Title/Certification Level	Email	Telephone		
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.
			Day	.	.
			Night	.	.

Table 4-16: Routine and Preventative Maintenance

System Name		
Function		Frequency
List below items to check and/or adjust. <sup>1</sup>		Enter function performance interval below: <sup>2</sup>

<sup>1</sup> Such as adjusting flow control valves, reading flow meters, checking water or chemical levels, exercising critical valves, lubricating equipment, etc.<sup>2</sup> Daily, weekly, monthly, etc.



Table 4-17: Key Element Settings

System Name		
Element <sup>1</sup>		Setting <sup>2</sup>

<sup>1</sup> Such as valve, switch, control, etc.  
<sup>2</sup> Such as valve position, readings for pump controls, gauges, electrical switches, etc.

Table 4-18: Suppliers

System Name				
Supply Item	Contractor/Supplier	Email/Website	Telephone Number	
			Day	• •
			Night	• •
			Day	• •
			Night	• •
			Day	• •
			Night	• •
			Day	• •
			Night	• •
			Day	• •
			Night	• •
			Day	• •
			Night	• •
			Day	• •
			Night	• •
			Day	• •
			Night	• •
			Day	• •
			Night	• •

Table 4-19: Routine Operation and Preventative Maintenance

System Name	
Attach documentation and/or describe routine operation and preventative maintenance programs.	
Is documentation attached?    Yes ____ No ____	

## Section 5: Water System Management

Section 5 provides a guide for identifying all financial data and obligations of a water system, including rate schedules, existing debt, O&M costs, and Capital Improvement Projects (CIP). Guidelines for documenting pertinent system management practices are also provided. Most of the information collected will be necessary for completing an engineering report to obtain project funding. A “To-Do” list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed to complete the worksheets.

**Table 5-1: Water System Management To-Do List**

System Name			
	Task	Person Responsible	Target Completion Date
1			
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3			
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9			
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11			
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13			
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## System Management

Document current system management practices including those related to decision making.

**Table 5-2: System Management**

System Name			
<b>1</b> Select type of system ownership (check all that apply).			
	<input type="checkbox"/>	Water association	
	<input type="checkbox"/>	Local government	
	<input type="checkbox"/>	Corporation	
	<input type="checkbox"/>	Single private owner	
	<input type="checkbox"/>	Partnership	
	<input type="checkbox"/>	Other, describe below.	
<b>2</b> List name(s) of owner(s), below. (Use additional sheet if necessary.)			
<b>3</b> If there are written system rules, attach or identify physical and/or electronic location of information below.			
		Is documentation attached? Yes ____ No ____	
	Physical Location		Electronic Location
<b>4</b> Identify and check below who makes major decisions for the system (such as when to make capital improvements, how to finance improvements, when to expand/consolidate, etc.).			
	<input type="checkbox"/>	Single party (Identify): _____	
	<input type="checkbox"/>	Board, with _____ (number) members who serve for a period of _____ years and are selected by: _____	
	<input type="checkbox"/>	Group of system users selected by: _____	
	<input type="checkbox"/>	Commission, with _____ (number) members who serve for a period of _____ years and are selected by: _____	
	<input type="checkbox"/>	State below any other decision-making individuals or parties not listed above.	
<b>5</b> How often do those responsible for decision making meet?			
	<input type="checkbox"/>	Monthly	
	<input type="checkbox"/>	Annually	
	<input type="checkbox"/>	When necessary	
	<input type="checkbox"/>	Other, describe below.	
<b>6</b> If all system users are notified about these meetings, identify how users are notified:			
	<input type="checkbox"/>	Notice on water bill.	
	<input type="checkbox"/>	Telephone distribution list	
	<input type="checkbox"/>	Email distribution list	
	<input type="checkbox"/>	Notice in local paper	
	<input type="checkbox"/>	Other, describe below.	

(continued)



Table 5-2 (continued)

7	If water bills are mailed, identify frequency below.	
		Monthly
		Other, describe below.
8	If water bills are not mailed, describe below the notification process and frequency.	
9	What is the plan for financing future system improvements (check all that apply)?	
		Reserve account(s)
		Borrowing money
		Grants
		System user rates or one time fees
		Unknown at this time
		Other, describe below.
10	If the system has paid employees and there are policies in place regarding personnel management (salaries, benefits, hiring/firing, supervision, raises, etc.), describe the process and attach documentation or identify physical and/or electronic location of information below. <div style="text-align: right;">Is documentation attached? Yes ____ No ____</div>	
	Physical Location	Electronic Location
11	If the system has an operator, and there a plan in place in the event of operator loss, describe the process and attach documentation or identify physical and/or electronic location of information below. <div style="text-align: right;">Is documentation attached? Yes ____ No ____</div>	
	Physical Location	Electronic Location

(continued)

Table 5-2 (continued)

<b>12</b>	If there is a process to record and respond to customer complaints, describe the process and attach documentation or identify physical and/or electronic location of information below.		Is documentation attached? Yes _____ No _____
	Attach documentation or identify physical and/or electronic location of information below:		
	Is documentation attached? Yes _____ No _____		
	Physical Location	Electronic Location	
<b>13</b>	If the system has insurance policies, check all that apply and list coverage amount(s).		
	Policy Coverage		Coverage Amount
	<input type="checkbox"/>	Commercial General Liability	\$
	<input type="checkbox"/>	Automobile Liability	\$
	<input type="checkbox"/>	Garage Liability	\$
	<input type="checkbox"/>	Excess/Umbrella Liability	\$
	<input type="checkbox"/>	Workers Compensation and Employers Liability	\$
	<input type="checkbox"/>	Employment Practices Liability	\$
	<input type="checkbox"/>	Other, describe below	\$
	Attach documentation or identify physical and/or electronic location of information below:		
Is documentation attached? Yes _____ No _____			
	Physical Location	Electronic Location	
<b>13</b>	If the system has written safety procedures, describe the process and attach or identify physical and/or electronic location of information below.		
	Is documentation attached? Yes _____ No _____		
	Attach documentation or identify physical and/or electronic location of information below:		
	Is documentation attached? Yes _____ No _____		
	Physical Location	Electronic Location	
<b>14</b>	Identify and list below the person/party responsible for conducting financial transactions (maintaining records, customer billings, making debt payments, etc.)		

Table 5-3: System Management Checklist

System Name	
Completed system management table? Yes ____ No ____	
Identified any potential changes to current practices on To-Do list? Yes ____ No ____	
Attached documentation used to develop tables or identify physical and/or electronic location of information? Yes ____ No ____	

## Rate Schedule(s)

Compile information on the existing rate structure. The following table briefly summarizes some common rate structures. Other rate schedules may be possible.

Table 5-4: Rate Schedule Descriptions

Flat Rate	A flat or fixed amount is charged all customers regardless of the amount of water used. This may be used in systems that do not meter water usage. It also may be used in conjunction with other rate structures to cover fixed costs such as administration and customer expenses.
Uniform Rate	A fixed amount per water usage (typically 1,000 gallons) is charged for all customers. This rate allows customers to pay for water used and requires meters.
Declining Block Rate	In this structure, as more water is used, the cost per 1,000 gallons decreases (for example the cost for the first 5,000 gallons is \$2.00/1,000 gal compared to the cost of 5,001-10,000 gallons is \$1.90/1,000 gal). This rate is beneficial to large water users such as commercial users.
Inclining Block Rate	This structure is opposite of the declining block rate. As more water is used, the cost of water per 1000 gallons increases. This rate encourages conservation.

Table 5-5: Rate Schedule Information

System Name			
Describe below the system's rate schedule.			
Attach rate documentation or identify physical and/or electronic location below.			Is documentation is attached? Yes ____ No ____
Physical Location		Electronic Location	
Identify any declining blocks the system has and describe the usage per block by customer type.			
Identify any inclining blocks the system has and describe the usage per block by customer type.			
State below the number of customers identified by customer type and describe the total billable gallons per customer type.			
If a vote is <u>not</u> required to modify the system water rates, please describe below the process for changing water rates.			
If the system meters water usage, what percentage of customers is metered? _____% Describe below the metering process.			
If the system <u>does not</u> meters water usage, describe below the process for billing customers.			

Table 5-6: Existing Debt

System Name							
List below information on the system's existing debt.							
Debt Name	Original Amount	Amount Remaining	Original Time	Time Remaining	Interest Rate	Annual Payment	Payment Interval
	\$	\$			%	\$	
	\$	\$			%	\$	
	\$	\$			%	\$	
	\$	\$			%	\$	
	\$	\$			%	\$	
	\$	\$			%	\$	
	\$	\$			%	\$	

## Known System Improvements

Identify system improvements (repairs, replacements, expansions, etc.) currently planned and funded. It also may be beneficial to include projects that are known but currently unfunded, which will affect the revenue or financing needed by the water system in the future. A CIP Budget is an important part of the planning process. As the system ages and/or expands to accommodate future populations, replacement costs as well as costs to add infrastructure to the existing system need to be planned for and budgeted.

Table 5-7: Funded System Improvement Projects

System Name			
Project Name	Project Description or Purpose	Cost Estimate	Funding Source
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
Known Projects Total Cost		\$	



Table 5-8: Unfunded System Improvement Projects

System Name			
Project Name	Project Description or Purpose	Cost Estimate	Funding Source Suggestion
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
Known Projects Total Cost		\$	

Table 5-9: Capital Improvement Projects Budget

System Name			
Project Name	Project Description or Purpose	Cost Estimate	Year
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
		\$	
CIP Total Cost		\$	

## Operational Costs and Budgets

Document operating budget. Water supply systems are encouraged to develop 5-year operating budgets that include information on revenue, expenses, and financing. Financial solvency affects both a system's ability to obtain funding for CIPs and its ability to meet water quality requirements. Include any contracts or agreements with other water service systems either to buy or sell water. Debt service coverage, renewal/replacement, and reserve funding requirements should also be identified.

**Table 5-10: Operational Budget**

System Name						
Budget Item		Year	Year	Year	Year	Year
<b>A</b>	Operating revenues (including water rates, service impact fees, other)	\$	\$	\$	\$	\$
<b>B</b>	Expenses	Operating Expenses (including salaries and benefits, insurance, routine and preventative maintenance, others less power, chemicals and other variable expenses)	\$	\$	\$	\$
<b>C</b>		Operating expenses due to CIP	\$	\$	\$	\$
<b>D</b>		Other expenses (including emergency or unplanned repairs/projects, professional services, training, etc.)	\$	\$	\$	\$
<b>E</b>		Taxes (paid by the water system)	\$	\$	\$	\$
<b>F</b>		Debt payments	\$	\$	\$	\$
<b>G</b>	Budget Total [ A – (B through F) ]		\$	\$	\$	\$

**Table 5-11: Reserve/Savings Account Balances**

System Name						
Budget Item		Year	Year	Year	Year	Year
<b>A</b>	Operating Reserve Account	\$	\$	\$	\$	\$
<b>B</b>	Emergency Replacement Reserve Account	\$	\$	\$	\$	\$
<b>C</b>	Total Reserve/Savings Account Balances	\$	\$	\$	\$	\$

**Table 5-12: Capital Improvements Budget**

System Name						
Budget Item		Year	Year	Year	Year	Year
<b>A</b>	Capital Improvement Project (CIP) Costs	\$	\$	\$	\$	\$
<b>B</b>	Financing Sources	1. Grants	\$	\$	\$	\$
		2. Reserves	\$	\$	\$	\$
		3. Loans/Bonds	\$	\$	\$	\$
		4. User Charges	\$	\$	\$	\$
<b>C</b>	CIP Total (A – (B1+B2+B3+B4))		\$	\$	\$	\$

Table 5-13: Operational Costs and Budgets Information Checklist

System Name	
Has the operational budget table been completed? Yes ____ No ____	
Has the capital improvements budget table been completed? Yes ____ No ____	
Attached documentation used to develop tables or identify physical and/or electronic location of information. Yes ____ No ____	
Was EPA's Setting Small Drinking Water System Rates for a Sustainable Future document used in this process? Yes ____ No ____	

## Section 6: Determining Future Drinking Water Needs

Section 6 provides a guide for determining future population and water demand projections. A “To-Do” list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed to complete the worksheets.

**Table 6-1: Future Projections To-Do List**

System Name			
	Task	Person Responsible	Target Completion Date
1			
2			
3			
4			
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Population Projections

Determine the projected population of the service area. OCWP Regional Reports contain population projections by system generated from Oklahoma Department of Commerce population projections. It may be helpful to assess how population has grown within the service area in the past and to evaluate this data graphically.

Table 6-2: Population Projections

System Name			
List selected population projections below for the system service area.			
Year	Projected Population	Comments	Source for Projections



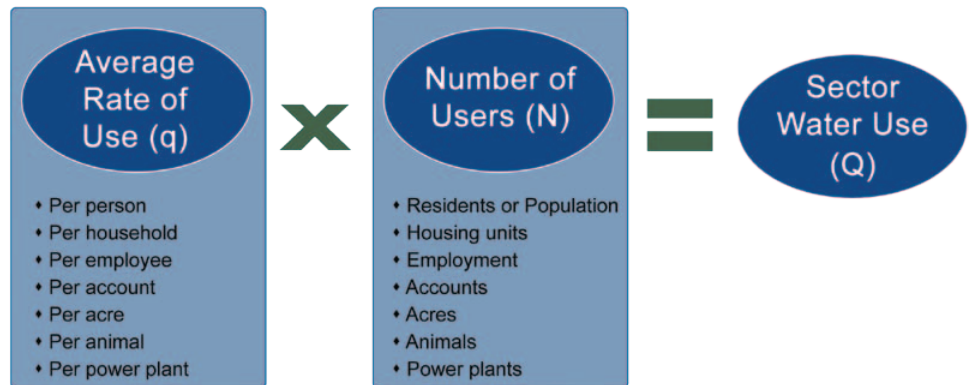
## Water Demand Projections

Determine future water demand. Provider level demand projection data, developed specifically for OCWP analyses and tabulated in the OCWP Regional Reports, focus on retail customers for whom the system provides direct service. Per capita water use information extracted from 2008 OCWP Water Provider Survey results was supplemented with available system data from the OWRB and ODEQ to estimate annual average retail daily demands. Projections presented in the OCWP Regional Reports are based upon retail demands, estimated using the per capita method, and include water sold to residences, businesses, and industries. Each system's total demand was estimated by adding retail to wholesale demands. The demand used to size water system projects varies by project type. For water supply planning, the average day demand is typically used. For water component planning (for example water treatment processes, high service pumps, and distribution piping), the peak day demand is more important. The OCWP projections are for annual average day demands.

The 2012 OCWP *Update* also included a detailed analysis of conservation and climate change impacts that will be useful for adjusting the system level baseline demand projection to account for various forecast assumptions.

Water systems that choose to develop independent water demand projections should calculate a retail per capita rate utilizing three to ten years of data (instead of a single year) to account for varying weather conditions and related factors. Data for unusually dry or wet years may be removed from the calculation.

### Calculation of OCWP Water Demand Projections



## Oklahoma Comprehensive Water Plan

<sup>1</sup> Gallons Per Capita per Day. This value should include system losses and other nonrevenue water. These figures are provided in the OCWP Regional Reports.

<sup>2</sup> Acre Feet per Year. One acre foot (AF) is about 325,850 gallons of water. These figures are provided in the OCWP Regional Reports.

<sup>3</sup> Other demand may include wholesale water sales to other providers and/or additional demand. The OCWP Regional Reports include wholesale water sales.

<sup>4</sup> From upper table.

<sup>5</sup> To convert from AFY to mgd, multiply total demand (AFY) by 0.0008921 (mgd/AFY) to get annual average day demand (mgd).

<sup>6</sup> To calculate peak day demand, multiply the annual average day demand by the peak day ratio. The peak day ratio is defined as the amount of water produced on the highest water use day (peak day demand) divided by the water use on the average day (average day demand). The peak day demand is typically used when developing infrastructure projects.

<sup>7</sup> To calculate peak hour demand, multiply the annual average day demand by the peak hour ratio. The peak hour ratio is defined as the amount of water produced during the highest water use hour divided by the water used on the average day (average day demand). The peak hour demand is typically met by using finished water storage tanks.

## Conservation Impacts on Water Supply and Demand

Evaluate water conservation impacts on demand. Water conservation has been recognized as one of the most effective tools in managing water resources and was emphasized as a priority recommendation in the *2012 OCWP Update*. There are numerous benefits associated with the efficient use of water, including an increase in water availability for both consumptive and nonconsumptive needs, reduced infrastructure operation costs, and decreased energy costs.

Moderately expanded (Scenario I) and substantially expanded (Scenario II) conservation measures were evaluated for the OCWP and are detailed in OCWP Conservation & Climate Change (Water Demand Addendum).

**Table 6-4: Summary of OCWP M&I Conservation Scenarios**

<p>Scenario I</p> <p>Moderately Expanded Conservation</p>	<ul style="list-style-type: none"> <li>• Passive conservation achieved by 2060 for public-supplied residential (PSR) and 2030 for public-supplied non-residential (PSNR). Passive conservation is defined as conservation that can be achieved through government plumbing codes as part of the Energy Policy Act.</li> <li>• 90 percent of water systems in each county will meter their customers, unless current metered percentage is greater than 90 percent.</li> <li>• Non-revenue water (NRW) will be reduced to 12 percent, where applicable.</li> <li>• Conservation pricing will be implemented by 20 percent of purveyors in rural counties, 40 percent in mostly urban counties, and 60 percent in counties with high metropolitan populations.</li> <li>• Water conservation educational programs will be implemented by all systems, which include billing inserts and conservation tip websites, to reduce demands by 3 percent.</li> </ul>
<p>Scenario II</p> <p>Substantially Expanded Conservation</p>	<ul style="list-style-type: none"> <li>• Passive conservation (as described in Scenario I).</li> <li>• All purveyors will meter their customers.</li> <li>• NRW will be reduced to 10 percent where applicable.</li> <li>• Conservation pricing will be implemented by 60 percent of purveyors in rural counties, 80 percent in mostly urban counties, and 100 percent in counties with high metro populations.</li> <li>• Water conservation education programs will be implemented to reduce demands by 5 percent, including school education programs and media campaigns, in addition to billing inserts and a conservation tip website.</li> <li>• High efficiency plumbing code ordinance will be implemented. This ordinance requires use of high efficiency fixtures with lower maximum flow rates than those required under the Energy Policy Act.</li> </ul>

The following types of conservation measures were evaluated for public water supply systems:

- **Passive Conservation**—“Passive conservation” is defined as water savings that are the direct result of implementing state and federal plumbing codes requiring the installation of water-efficient plumbing fixtures in homes and businesses. Passive savings for the public-supplied residential sector build upon the assumption that the U.S. Energy Policy Act (Energy Act) of 1992 will lead to a reduction of indoor water use in the average home from 121 gpd in 1994 to 55 gpd by 2026. Based on a water provider’s general knowledge of current and projected residential connections and households, the indoor water use estimate can be interpolated from 1994 to 2016. For the public-supplied nonresidential sector, passive savings from the Energy Act can be calculated based on an estimated 30 percent reduction in nonresidential employee sanitary water use by year 2030. Based on pre-1994 plumbing fixture standards, average water use per employee is estimated at 39 gallons per employee per day. Based on a water provider’s general knowledge of businesses and institutions served by the system, the percent savings can be interpolated between 0 percent in 1994 to 30 percent in 2030.
- **Commercial and Residential Metering with Reduction in System Losses**—Through universal metering programs, water use is measured on a per unit basis through the installation of individual water meters. Statistics demonstrate that through this direct relationship between usage and the cost of water, connection metering can lead to a 20 percent reduction in end use. Metering also enables system water loss auditing and leak detection. Water losses occur in two distinct manners: apparent and real losses.
  1. An “apparent loss” is water lost due to customer meter inaccuracies, billing system data errors, and/or unauthorized consumption. These losses result in system revenue loss and distort data on customer consumption patterns.
  2. A “real loss” is water that escapes the water distribution system through leakage or storage overflows. These losses include water that is extracted and treated but is never used. The result is inflation of the system’s production costs and stress on water resources. Even small leaks can lead to substantial losses. For example, a 1-inch crack in a distribution main at 100 pounds per square inch (psi) of pressure can leak 57 gpm. Especially for systems facing water shortages, leakage detection and recovery can be an effective strategy for increasing supply.
- **Conservation Water Rates**—An increasing tiered rate structure, or “conservation pricing,” is a pricing method used to allocate costs according to the quantity of water used. An increasing rate structure is one in which the cost per unit of water increases as the customer uses more water. The concept is meant to compel customers to conserve water. According to EPA Conservation Plan Guidelines, an increasing block-rate structure can lead to a five percent overall reduction in end use.

## Section 6: Determining Future Drinking Water Needs

- **Education and Information**—Customer education is a critical component of any water conservation program. Education programs, often integrated into school curriculums, can be targeted at any age level. While educational savings are difficult to estimate, the EPA and other sources estimate a three to five percent reduction in end use.
- **Implementation of a High -Efficiency Indoor Water Use Ordinance**—A key strategy to advancing water efficiency through indoor plumbing fixtures is mandating minimum plumbing and building code requirements that are more stringent than current Energy Act standards. Such requirements can apply to indoor water using fixtures, such as toilets, urinals, shower heads, faucets, clothes washers, and dishwashers. Changes to flow rate requirements will be based on the availability of products with lower flow rates. Some of these products and their associated alternative flow rates are listed on the table to the right.

Toilets are by far the main source of water use in the average home, accounting for nearly 30 percent of indoor water consumption. According to the EPA, replacement of older, inefficient toilets with water-efficient models can save consumers almost 11 gallons per toilet every day. As a local example, if all homes in Oklahoma County were equipped with 1.28 rather than 1.6 gpf toilets in 2060, total water savings in that county alone could reach an estimated 1,350 acre-feet (assuming there are 373,390 households, 2 toilets per household, and 5 flushes per toilet per day).

Savings resulting from high-efficiency (HE) plumbing codes will also impact the nonresidential sector. According to the U.S. Bureau of Reclamation's 2008 WaterSMART guidelines, installation of high-efficiency plumbing fixtures in businesses can improve water use efficiency by 20 percent. These 20 percent savings result in a five gallon per employee per day reduction (in addition to passive savings) by 2045.

**Plumbing Fixture Water Use Rates**

Fixture	Maximum Flow Rate Mandated by Energy Policy Act (1992)	Current Flow Rate Available
Toilet	1.6 gpf	1.0-1.28 gpf
Urinal	1.0 gpf	0.5 gpf
Faucet	2.5 gpm	1.0-2.2 gpm
Shower head	2.5 gpm	2.0 gpm

Potential conservation savings by category on both a basin and county level were evaluated in the OCWP. To estimate savings at the system level, two approaches can be applied. The OCWP Conservation & Climate Change (Water Demand Addendum) report provides equations (Equations 1 through 19) for estimating savings using generally available parameters. These formulas can be applied using system data to estimate savings achieved through a specific conservation activity. Alternatively, applying knowledge of a water system and its demands, an adjustment can be estimated from the county-level information provided in Appendix A of the OCWP Conservation & Climate Change (Water Demand Addendum) report, which provides estimates of potential M&I conservation savings for each county in Oklahoma.

Table 6-5: Conservation Scenario Water Demand Projections

System Name					
List potential conservation activities for your system and corresponding savings below.					
Conservation Activity		Conservation Assumptions	Estimated M&I Water Savings 2030 (AFY) <sup>1</sup>	Estimated M&I Water Savings 2060 (AFY) <sup>1</sup>	Information Source(s)
From the list above, select the conservation activities that seem the most reasonable for your system and list only those in the table below. Note: Combining activities in lieu of implementing individual activities may be the most effective way for recognizing water savings.					
Year	Selected Conservation Activities	Baseline Water Demand (AFY)	Estimated M&I Water Savings (AFY) <sup>1</sup>	Revised M&I Water Demand (AFY)	Information Source(s)
Notes: Corresponding to the year entered above, make notes below describing what actions would be necessary to implement each conservation activity or if further evaluation of activity is needed.					

<sup>1</sup> M&I water savings in the OCWP are estimated at the county level. Estimate the portion of water savings that is applicable to your system.

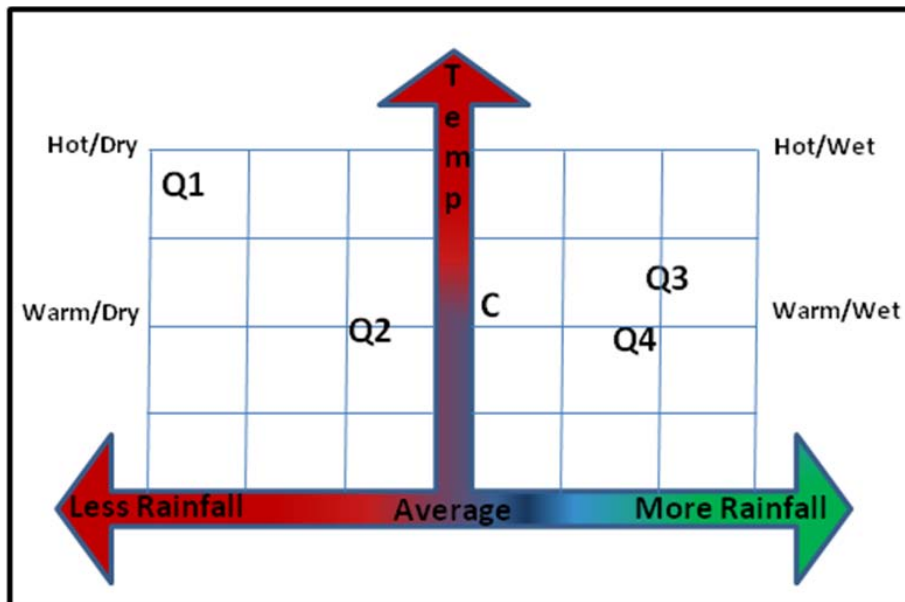


## Climate Change Impacts on Water Supply and Demand

Evaluate climate change impacts. A variable precipitation history and an uncertain future under suspected climate change trends combine to challenge even the most forward-thinking and resourceful water resource managers, including critically vital water supply systems. While there remains significant uncertainty in the potential range of climate change and its impacts, particularly with regard to changes in precipitation, a sensitivity analysis of potential implications was undertaken through OCWP technical studies and are detailed in the Conservation & Climate Change (Water Demand Addendum) at [www.owrb.ok.gov/OCWP](http://www.owrb.ok.gov/OCWP). By assessing the sensitivity of potential impacts on supply and demand from projected changes in climate, the OCWP provides unique insight into how the balance of water supply and water use might change if projections hold true.

In order to assess the potential implication of surface water availability under climate change conditions, one dataset representing historical average conditions was developed along with five climate change scenarios based on selected ensembles of climate projection models: Q1, Q2, Q3, Q4, and C. As illustrated below, Q1 is a hot and dry scenario; Q4 represents a warm and wet scenario (a less significant change in temperature with a slight increase in precipitation); Q2 and Q3 are intermediate scenarios; and “C” is the central tendency of Q1-Q4.

These five scenarios were developed for two different projection horizons: 2030 and 2060. Rather than create demand forecasts for each possible climate scenario, the climate scenario data was analyzed to confirm that Q1 (hot/dry) and Q4 (warm/wet) would bracket a range of potential climate change conditions. The analyses determined that these two scenarios do have the largest variation in climate (of the scenarios evaluated) and represent the extreme ends of predicted climate change, thus were selected for estimating potential future conditions in Oklahoma. The impact on temperature and precipitation under those scenarios was used to estimate the potential implications on both surface water supply and demand throughout the state.



The analyses determined that these two scenarios do have the largest variation in climate (of the scenarios evaluated) and represent the extreme ends of predicted climate change, thus were selected for estimating potential future conditions in Oklahoma. The impact on temperature and precipitation under those scenarios was used to estimate the potential implications on both surface water supply and demand throughout the state.

Statistical results of the OCWP Climate Demand Model and other analyses were used to model the impacts of the climate change scenarios on M&I water demand. Details of the Climate Demand Model are documented in the OCWP Weather Production Model Revised Final Technical Memorandum (CDM, 2010). Variation in both monthly average daily maximum temperature and monthly total precipitation were found to have statistically significant relationships with water production. The analysis of the relationship between weather conditions and municipal water production (demand) and possible impacts of climate change can be used to supplement a water system's baseline water demand forecast by recognizing possible future alternatives in demand projections. Table 6-6 provides the potential M&I impacts by county from the selected climate change scenarios. Alternative demand scenarios under climate change can be calculated at the system level by substituting the system's baseline demands for their respective county demands then applying the associated percent increase.

Table 6-6: Potential Impacts under Climate Change Scenarios

County	Baseline M&I Demand		Hot/Dry		Warm/Wet	
	2030	2060	2030	2060	2030	2060
	AF/Year		%Increase in Demand		%Increase in Demand	
Adair	2555	3526	5.32%	9.53%	2.43%	4.23%
Alfalfa	882	912	5.22%	9.43%	2.27%	3.95%
Atoka	3733	4913	5.12%	9.04%	2.46%	4.21%
Beaver	752	789	5.45%	9.76%	2.39%	4.06%
Beckham	5562	6930	4.98%	8.90%	2.34%	3.94%
Blaine	2918	3642	5.17%	9.31%	2.26%	3.95%
Bryan	9799	12388	5.02%	8.86%	2.45%	4.16%
Caddo	3578	3892	5.03%	8.97%	2.35%	3.98%
Canadian	18000	20884	5.57%	9.95%	2.52%	4.35%
Carter	10048	11643	5.25%	9.30%	2.52%	4.27%
Cherokee	8760	11751	5.32%	9.53%	2.42%	4.22%
Choctaw	1,667	1,790	4.98%	8.72%	2.46%	4.13%
Cimarron	705	746	5.39%	9.79%	2.55%	4.16%
Cleveland	42,804	47,126	5.46%	9.60%	2.54%	4.35%
Coal	805	1,132	5.09%	9.01%	2.36%	4.24%
Comanche	18,717	20,376	4.89%	8.75%	2.34%	3.93%
Cotton	821	869	4.87%	8.75%	2.31%	3.91%
Craig	2,739	3,534	5.29%	9.54%	2.41%	4.19%
Creek	9,391	10,715	5.21%	9.29%	2.35%	4.08%
Custer	5,852	6,414	5.01%	8.96%	2.32%	3.93%
Delaware	5,384	7,377	5.33%	9.67%	2.41%	4.23%
Dewey	1,146	1,197	5.15%	9.27%	2.27%	3.93%
Ellis	730	730	5.34%	9.73%	2.33%	4.11%
Garfield	13,049	13,842	5.60%	10.02%	2.48%	4.33%
Garvin	5,014	5,311	5.25%	9.28%	2.51%	4.26%
Grady	5,848	6,715	5.44%	9.66%	2.53%	4.33%
Grant	752	794	5.59%	10.20%	2.39%	4.28%
Greer	1,049	1,103	4.86%	8.70%	2.38%	3.81%
Harmon	821	894	4.75%	8.50%	2.31%	3.80%
Harper	973	1,001	5.24%	9.69%	2.26%	4.00%
Haskell	1,648	2,243	5.46%	9.54%	2.55%	4.32%
Hughes	2,178	2,866	5.28%	9.35%	2.48%	4.29%
Jackson	5,129	5,590	4.87%	8.71%	2.32%	3.88%
Jefferson	807	866	4.96%	8.89%	2.48%	4.16%
Johnston	2,196	2,923	4.92%	8.69%	2.46%	4.11%
Kay	8,272	8,860	5.77%	10.34%	2.50%	4.40%
Kingfisher	3,529	4,575	5.61%	10.03%	2.47%	4.28%
Kiowa	1,287	1,351	4.97%	8.96%	2.33%	4.00%
Latimer	2,506	2,961	5.35%	9.42%	2.51%	4.36%
Le Flore	7,499	8,895	5.35%	9.41%	2.52%	4.34%
Lincoln	2,745	3,322	5.50%	9.78%	2.51%	4.36%
Logan	5,883	7,483	5.59%	10.01%	2.48%	4.32%
Love	5,455	6,498	5.08%	9.00%	2.51%	4.22%

(continued)

Table 6-6 (continued)

County	Baseline M&I Demand		Hot/Dry		Warm/Wet	
	2030	2060	2030	2060	2030	2060
	AF/Year		%Increase in Demand		%Increase in Demand	
Major	1,013	1,054	5.23%	9.30%	2.27%	3.89%
Marshall	4,333	6,586	4.89%	8.69%	2.42%	4.08%
Mayes	6,526	8,200	5.29%	9.54%	2.41%	4.18%
McClain	5,428	7,400	5.42%	9.57%	2.52%	4.31%
McCurtain	4,685	5,099	4.95%	8.75%	2.45%	4.14%
McIntosh	3,066	4,202	5.32%	9.35%	2.48%	4.28%
Murray	3,216	4,059	5.25%	9.31%	2.52%	4.29%
Muskogee	10,898	11,720	5.18%	9.22%	2.39%	4.14%
Noble	1,815	1,955	5.67%	10.13%	2.53%	4.40%
Nowata	1,412	1,907	5.31%	9.54%	2.41%	4.14%
Okfuskee	1,497	1,616	5.08%	9.10%	2.34%	4.02%
Oklahoma	136,613	146,570	5.54%	9.78%	2.57%	4.42%
Okmulgee	12,415	14,645	5.12%	9.05%	2.38%	4.07%
Osage	8,876	10,073	5.25%	9.45%	2.31%	4.05%
Ottawa	5,918	7,069	5.34%	9.66%	2.42%	4.23%
Pawnee	2,818	3,574	5.22%	9.37%	2.31%	4.00%
Payne	14,671	17,045	5.62%	10.04%	2.48%	4.36%
Pittsburg	9,150	10,471	5.29%	9.34%	2.48%	4.27%
Pontotoc	6,596	7,222	5.43%	9.53%	2.55%	4.35%
Pottawatomie	6,848	7,963	5.49%	9.68%	2.54%	4.37%
Pushmataha	1,371	1,834	5.25%	9.21%	2.55%	4.31%
Roger Mills	626	626	5.11%	9.27%	2.40%	3.99%
Rogers	16,213	20,212	5.26%	9.48%	2.37%	4.14%
Seminole	3,002	3,261	5.50%	9.69%	2.56%	4.42%
Sequoyah	8,886	11,099	5.41%	9.57%	2.51%	4.36%
Stephens	8,866	9,291	5.20%	9.27%	2.53%	4.25%
Texas	5,513	8,242	5.33%	9.79%	2.50%	4.13%
Tillman	1,418	1,521	4.72%	8.48%	2.26%	3.81%
Tulsa	121,517	130,319	5.20%	9.29%	2.35%	4.09%
Wagoner	10,137	12,383	5.21%	9.33%	2.37%	4.11%
Washington	12,486	13,021	5.27%	9.51%	2.32%	4.08%
Washita	1,179	1,244	5.00%	9.00%	2.29%	3.94%
Woods	3,224	3,363	5.30%	9.63%	2.26%	3.90%
Woodward	6,169	6,558	5.32%	9.73%	2.33%	3.98%

Table 6-7: Climate Change Impacts on Water Demand Projections

System Name				
List selected demand projections below.				
Year	Baseline Demand Projection (AFY) <sup>1</sup>	Hot/Dry Scenario Demand Projection (AFY)	Warm/Wet Scenario Demand Projection (AFY)	Data Source(s)
2030				
2060				

<sup>1</sup> Acre Feet per Year.

### Selection of Water Demand Projection Envelope

After considering and compiling several different water demand projections based on various sources and scenarios, a water demand projection must be selected on which to base planning activities in subsequent sections. Consider adjusting the baseline projections in table 6-3 to reflect the system's conservation goals or climate change scenarios if these were evaluated in tables 6-5 and 6-7. It may also be helpful to identify a demand projection "envelope" that includes the selected or baseline projection along with higher demands, such as with a climate change scenario, and lower demands, such as with a conservation scenario. Other high/low alternatives to the baseline could be based on potential changes in the estimated service area, population growth, and/or per capita water demands. The higher and lower projections can provide an estimate on how varying the underlying forecast assumptions might impact projections of future water demand.

# Section 7: Drinking Water Source and System Capacity Analysis

Section 7 provides guidelines for evaluating a system’s capacity and ability to meet future rules and regulations. It is essential for the existence of any gaps between the system’s current capacity and projected future needs to be determined. A “To-Do” list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed to complete the worksheets.

Table 7-1: Capacity Analysis To-Do List

System Name			
	Task	Person Responsible	Target Completion Date
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Neither groundwater nor surface water permits ensure water availability. Reliable water supply is contingent on all of the following considerations:

- Physical water supply availability.
- The right to divert water from surface water or groundwater sources.
- Infrastructure to divert, treat, and convey water to its intended use.
- Adequate water quality for the intended use.

In preparing to meet long-term needs, public water systems should consider strategic factors appropriate to their particular sources of supply and future needs. For example, public water systems that use surface water can seek and obtain a “schedule of use” as part of their stream water permit(s) to address projected growth and consequent increases in stream water use. Such schedules of use can be employed to address increases that are anticipated to occur over many years or even decades. On the other hand, public water systems that utilize groundwater should consider the prospect that it may be necessary to purchase or lease additional land in order to increase their groundwater rights.

The OCWP Water Supply Permit Availability Report identifies the maximum amounts of surface and groundwater that could be permitted according to existing state statutes and water rights permitting protocol. This report includes estimates of projected surface and groundwater permit availability at the basin level. Local estimates are also provided in the 13 OCWP Regional Reports.

The OCWP Physical Water Supply Availability Report compares the physical supply availability projections to demand projections and quantifies anticipated surface water gaps and groundwater depletions. Information on the size and frequency of projected gaps and depletions is provided in detail at the basin level in the OCWP Regional Reports. Projected shortages are tabulated by source (surface water, alluvial groundwater, and bedrock groundwater) and by decade from 2020 through 2060. This report also includes information about the Oklahoma H2O tool, a Microsoft Access and geographic information system (GIS) based analysis tool created to identify potential physical supply availability constraints, more closely examine demand and supplies, and evaluate potential water supply solutions. The tool will perform a variety of “what-if” scenarios, incorporating data on supply and demand to determine physically available surface and groundwater in each OCWP basin. The result is a comparison of physically available supplies to future changes in demand using the year 2010 as the “current” condition.

## Drinking Water System Capacity Analysis

Use information gathered in Sections 3 through 6 to complete the following table. If supplemental information is used, be sure to attach or document the source. In addition, identify any concerns (capacity, treatment, or other) that may affect alternative development or selection. The purpose of the table is to facilitate internal discussions related to anticipated water supply system shortages or excesses. Should shortages exist, the services of a professional engineer should be considered to help determine the amount of additional water required or extent of infrastructure improvements or expansion.

Table 7-2: Drinking Water System Capacity Challenges

System Name			
List specified year and known data below.		System Capacity Challenges (For the specified year, identify any concerns in meeting projected demands.)	
Year <sup>1</sup>		List water supply availability concerns.	
Permitted Surface Water Use (AFY) <sup>2</sup>			
Permitted Groundwater Use (AFY)			
Purchased Water Limitations (if any)			
Selected Population Projection		List raw water system component concerns.	
Selected Water Demand Projections (AFY)			
Raw Water System Capacity (existing and planned projects) <sup>3</sup>			
Treatment Capacity (existing and planned projects)		List treatment capacity concerns.	
		List finished water storage concerns.	
		List finished water distribution system concerns.	

<sup>1</sup> Include as many years as appropriate, using a separate form for each year. Selection of years may be based on permitted schedule of use, planned water supply improvements, dates for demand and/or population projections, etc.

<sup>2</sup> Acre Feet per Year. One acre foot (AF) is about 325,850 gallons of water.

<sup>3</sup> List capacity of major raw water system components such as wells, well fields, pump stations, transmission lines, etc. You may choose to show the limiting capacity (e.g., if the system has groundwater pumping capacity of 8 mgd but only 3 mgd of transmission capacity, the limiting capacity for getting water to your system is the transmission capacity) or identify capacity for all components. Please include additional notes as appropriate.

Table 7-3: Drinking Water System Capacity Analysis

System Name		
Describe previously unknown system capacity concerns.		Supplemental Information Source(s)
Describe regional strategies identified to address these concerns.		Supplemental Information Source(s)
If no regional strategies were identified to address these concerns, explain below.		Supplemental Information Source(s)
List the most significant concerns (may list more than one).		

Selecting the Most Critical Project(s)

Categorize identified projects. The capacity analysis table may have identified more projects than there are funds to complete. Projects must be prioritized and timelines implemented to the advantage of the system. Two simple matrices are provided below. The projects in the Important/Urgent quadrant should be considered high priority projects. The projects in the Important/Not Urgent and Not Important/Urgent quadrants should be evaluated individually to determine relative priority. Projects in the Not Important/Not Urgent quadrant should be re-evaluated for need. This matrix can be expanded to include defined time periods or critical versus noncritical infrastructure as needed to capture the system’s needs. The goal of this exercise is to have a roadmap of where to go and how to get started. Consider the following when making quadrant assignments:

- Does this project involve critical infrastructure?
- Is this project necessary for the protection of employees or customers?
- Is this project necessary to meet regulations?
- When is this project needed? To determine when a project must start, begin with when the project must be operational and subtract the time needed for construction, design, permitting, funding, planning, etc. Use this project start time to determine urgency.
- Does this project involve long lead items such as specialized equipment or permits?
- Are there components increasing the difficulty of the project that may result in additional time needed for completion?
- Can this project be combined with other projects for better efficiency?

The second example allows the incorporation of implementation timeline priorities. The projects are listed in critical and noncritical categories similar to the first example. They are placed in time priority order using the general periods listed on the left.

Project Prioritization Matrix

	Important	Not Important
Urgent	<div></div>	<div></div>
Not Urgent	<div></div>	<div></div>

Project Prioritization With Timeline Matrix

	Critical	Non-Critical
Within 1 year	<div></div>	<div></div>
1 to 3 years	<div></div>	<div></div>
3 to 5 years	<div></div>	<div></div>
5 to 10 years	<div></div>	<div></div>
10 to 25 years	<div></div>	<div></div>
Beyond 25 years	<div></div>	<div></div>

## Section 8: Identifying Conceptual Alternatives

The purpose of Sections 8 and 9 are the identification and evaluation of alternatives associated with a specific project identified in Section 7. These techniques may be used to prioritize projects across multiple system categories or when funding is limited. A “To-Do” list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed to complete the worksheets.

**Table 8-1: Preliminary Alternatives To-Do List**

System Name				
	Task	Person Responsible	Target Completion Date	
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## Developing Alternatives

When developing alternatives, it is important to consider current regulations. Oklahoma Administrative Code Title 252, Chapter 626 provides specific requirements on source development, treatment, chemical application, residuals management, pumping facilities, finished water storage, and distribution systems. Some typical concerns and potential solutions are presented in this section. However, since meeting gaps between existing conditions and future needs is very system-specific, not all solutions may be appropriate.

Alternatives can be divided into five categories: water supply, raw water transmission, water treatment, finished water storage, and finished water distribution.

## Developing Water Supply Alternatives

Many potential water supply alternatives were presented in the OCWP Regional Reports at the regional or basin level that could also be implemented at the system level. Generally, water supply challenges can be addressed in two ways:

1. Demand management (or reducing demand)—achieved through permanent conservation or emergency restrictions on water use for certain demand sectors. The *OCWP Executive Report*, Regional Reports, and Water Demand Forecast Report include a wealth of information on demand reduction.
2. Securing additional supply—achieved through obtaining more water from existing sources, acquiring new sources, or developing non-traditional sources. The OCWP included analysis of the following solutions: increasing surface water use, increasing groundwater use, increased reservoir storage, and use of out-of-basin supplies. Uses of marginal quality water and artificial aquifer recharge also are recognized as potential alternatives to increase water supply. The *OCWP Executive Report* and other OCWP technical reports provide a more in-depth look at additional supply alternatives.

The OCWP Regional Reports contain a detailed analysis of the effectiveness of potential supply alternatives for each basin in light of projected shortages and available supplies. The table on the following page lists typical water supply alternatives and factors to consider.



Table 8-2: Water Supply Options and Considerations

	Factors to consider.
Demand Management	<ul style="list-style-type: none"> <li>The OCWP Conservation and Climate Change Addendum contains an analysis of two permanent conservation scenarios. Moderately expanded conservation is a combination of conservation programs that are most likely to be implemented by water systems based on cost and ease of implementation. This scenario includes passive conservation, expanded metering, leak detection, conservation pricing, and education programs for the M&amp;I sector. Substantially expanded conservation, which includes a high-efficiency ordinance for the M&amp;I sector, is a more aggressive program.</li> <li>How often and for what duration are reductions needed?</li> <li>If frequency and duration of reductions are low, emergency restrictions may be viable. Otherwise, permanent conservation measures may be required.</li> <li>Which demand sectors can achieve demand reductions and by how much? The OCWP analyzed conservation in the M&amp;I and crop irrigation sectors. If M&amp;I demand management was shown to be ineffective in reducing shortages, this may not be a viable option or may require a more detailed review.</li> </ul>
Out-of-Basin Supplies	<ul style="list-style-type: none"> <li>How often and for what duration are out-of-basin supplies needed? Is supply need seasonal?</li> <li>Consider infrastructure sizing and operations associated with constant rate delivery with terminal storage versus peak deliveries.</li> <li>Consider how out-of-basin supply use will impact other users in the basin, region, and state.</li> <li>Information on the previous reservoir studies is summarized in the OCWP Reservoir Viability Study.</li> <li>Is there surface water permit availability?</li> </ul>
Reservoir Storage	<ul style="list-style-type: none"> <li>Are there opportunities for existing reservoir expansion or reallocation of use?</li> <li>Information on previous reservoir studies is summarized in the OCWP Reservoir Viability Study.</li> <li>Is there a potential reservoir site that is feasible in the area? What is the firm yield of the potential new reservoir?</li> <li>What are siting concerns for a potential reservoir? Consider diversion and conveyance challenges from reservoir or downstream for major users.</li> <li>Are there other systems/users that would be interested in developing a new reservoir? How would collaboration be structured? Who would operate the reservoir in the short and long term?</li> <li>Consider developing a small reservoir (less than 500 AF of storage).</li> <li>Is there surface water permit availability?</li> </ul>
Increasing Surface Water Use	<ul style="list-style-type: none"> <li>Information on the physical and permit availability of surface water is included in the OCWP Regional Reports, OCWP Water Supply Permit Availability Report, and OCWP Physical Water Supply Availability Report.</li> <li>Is additional supply available from existing surface water source(s)? Is surface water in the basin fully allocated?</li> <li>Where are reservoirs and streams located relative to the system's treatment facility or major users?</li> <li>What are treatment needs for new surface water sources? Are they substantially different from existing treatment methods?</li> <li>Consider how increased surface water use will impact other users in the basin, region, and state (e.g., increased surface water gaps).</li> <li>Consider use of new reservoirs (see discussion under Reservoir Storage).</li> </ul>
Increasing Groundwater Use	<ul style="list-style-type: none"> <li>Information on the physical and permit availability of groundwater is included in the OCWP Regional Reports, OCWP Water Supply Permit Availability Report, OCWP Physical Water Supply Availability Report, and OCWP Artificial Aquifer Recharge Issues and Recommendations report.</li> <li>Is additional supply available from existing groundwater sources?</li> <li>Where are major and minor aquifers located relative to significant demands?</li> <li>What are typical well yields? Consider using both published data as well as contacting neighboring systems currently using the potential source and OWRB technical staff.</li> <li>What water quality data are available from existing wells in the aquifer or from neighboring systems? What are the treatment needs for new groundwater sources? Are they substantially different from existing treatment methods?</li> <li>Consider how increased groundwater use will impact other users in the basin, region, and state (e.g., increased groundwater depletions and rate of depletions relative to aquifer storage).</li> <li>Are there opportunities for artificial aquifer recharge?</li> </ul>
Marginal Quality Water	<ul style="list-style-type: none"> <li>Marginal quality water supply sources include treated wastewater, stormwater, oil and gas flowback or produced water, brackish water, and water with elevated levels of key constituents. The OCWP Marginal Quality Water Issues &amp; Recommendations report contains more information.</li> <li>Are there viable sources of marginal quality water supply sources available or identified for the area?</li> <li>Are there demands that can be met by marginal quality water? For example, treated wastewater may not be a suitable supply for potable M&amp;I uses but may be a potentially feasible solution for nonpotable M&amp;I demands such as landscape irrigation.</li> <li>Do the locations of marginal quality water supplies correlate with locations of demands?</li> <li>Are regulation changes required to use marginal quality water sources?</li> <li>Consider the additional cost necessary for use of marginal quality water, such as the cost of additional treatment and separate conveyance systems.</li> </ul>

## Section 8: Identifying Conceptual Alternatives

A combination of solutions may be the best way to address a system's challenge. Here are some examples:

- A system may choose to implement all or a portion of the moderately expanded conservation programs to reduce the total demands of the system in conjunction with evaluating new source water supplies.
- A system may choose to purchase water from another system in lieu of developing additional sources. Depending on other system components, the system may choose to purchase treated water to minimize impacts on existing treatment capacity.
- If duration and frequency of projected shortages are low, a system may choose to make an emergency connection with another system and/or implement emergency use restrictions in lieu of implementing permanent changes.
- As part of rehabilitation to existing flood control structures (dams), a system may consider additional multipurpose benefits, like water supply yield.

## Developing Other Water System Alternatives

For raw water transmission, water treatment, finished water storage, and distribution systems, alternatives typically fall within three categories:

- Improving performance—replacing aging equipment/infrastructure and evaluating equipment and processes that require excessive maintenance, which will reduce operating costs along with customer complaints.
- Addressing changed conditions—modifying an existing system to address changes in source water quality or new regulations.
- Increasing capacity—meeting increasing demands by increasing capacity even if the system's existing components are in peak condition.

To address challenges, water systems can evaluate optimizing existing equipment, repairing or rehabilitating existing equipment, replacing existing equipment, or expanding the system. Expansion considerations include determining the parameters for sizing the expansion, physical space needed for expansion, how to implement the project (phased versus full), and if there will be unintended impacts of the expansion (such as bringing other facilities up to code or increasing capacity of other infrastructure, including wastewater systems).

## Cataloging Preliminary Alternatives

At this stage, it is important to consider a wide range of alternatives. Clearly identify the water supply system's overall goals, purpose, and main objective(s) both from the whole system and component perspective. Review existing information and generate (and record) ideas of how to address the challenge. Evaluating ideas will come later. Brainstorming sessions should be relatively brief. Some ideas can be eliminated; others can be left for later discussion.

Document challenges developed in Section 7 and preliminary alternatives from this section on the following tables. Notes include items that need to be investigated, links to other alternatives, or key concepts to consider when evaluating alternatives. Time frames for implementation, both short- and long-term, may be specific dates or general times.

Table 8-3: Source Water Challenges and Preliminary Alternatives

System Name	
Source Water Challenges	
Preliminary Alternatives	
Notes	
Time Frame for Implementation	

Table 8-4: Raw Water Transmission Challenges and Preliminary Alternatives

System Name	
Raw Water Transmission Challenge	
Preliminary Alternatives	
Notes	
Time Frame for Implementation	

Table 8-5: Water Treatment Challenges and Preliminary Alternatives

System Name	
Water Treatment Challenges	
Preliminary Alternatives	
Notes	
Time Frame for Implementation	

Table 8-6: Finished Water Storage Challenges and Preliminary Alternatives

System Name	
Finished Water Storage Challenges	
Preliminary Alternatives	
Notes	
Time Frame for Implementation	



Table 8-7: Finished Water Distribution Challenges and Preliminary Alternatives

System Name	
Finished Water Distribution Challenges	
Preliminary Alternatives	
Notes	
Time Frame for Implementation	

## Section 8: Identifying Conceptual Alternatives

In the following table, develop alternatives (or combinations of preliminary solutions in the previous subsection) to be considered in Section 9. Because of the interconnected nature of utilities, decisions in one category of preliminary alternatives may have a significant impact on other categories. Do some solutions work better together? Do some potential solutions exclude others? Consider the alternative of doing nothing. What happens if no action is taken and no costs or changes to operation are incurred? The “no action” alternative is often required to be evaluated by funding agencies.

**Table 8-8: Conceptual Alternatives**

System Name			
	Conceptual Alternative Name	Description	Will alternative be given further consideration?
1	No Action	This alternative involves continued operation of the existing water utility system without modifications to source water, transmission, treatment, distribution, and storage systems.	Yes <u>X</u> No ____ If No, explain decision below.
2			Yes ____ No ____ If No, explain decision below.
3			Yes ____ No ____ If No, explain decision below.
4			Yes ____ No ____ If No, explain decision below.
5			Yes ____ No ____ If No, explain decision below.
6			Yes ____ No ____ If No, explain decision below.
7			Yes ____ No ____ If No, explain decision below.
8			Yes ____ No ____ If No, explain decision below.
9			Yes ____ No ____ If No, explain decision below.

## Section 9: Evaluating Alternatives

Section 9 provides a method for evaluating the conceptual alternatives developed in Section 8. It may be helpful to work through this section for each project identified due to differences in objectives (for example, the objectives of a water supply project may be significantly different or have different performance measures than a water treatment project). A “To-Do” list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed.

**Table 9-1: Evaluating Alternatives To-Do List**

System Name				
	Task	Person Responsible	Target Completion Date	
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Conceptual alternatives must be evaluated in light of multiple and potentially conflicting objectives. The method provided in this section is only one of several available for deciding between alternatives. It can be completed by hand, on a spreadsheet, or with commercially available software that provides the ability to conduct sensitivity analyses.

Determine Objectives

The first step in evaluating alternatives is to determine the objectives. Objectives facilitate the analysis, comparison, and screening of the alternatives. To the degree practical, the objectives should be designed as follows:

- Distinctive
- Measurable
- Non-redundant
- Understandable
- Concise

Primary objectives are more general; sub-objectives help define the primary objectives in more specific terms. Objectives should incorporate utility, regulatory, and funding priorities. For example, objectives related to sustainability may need to be included. Sustainability sub-objectives may include reducing energy costs or promoting water conservation.

Some objectives may be more relevant for a given stakeholder than others. For example, for a given system, reliability may be more important than cost. Thus, weights will be developed for each objective so that the alternatives analysis better reflects the relative values and priorities of the system. Relative weights are also assigned for sub-objectives, with the total weight of the sub-objectives equaling 100 percent for a given primary objective. In this way, alternatives that score best for the most important objectives will be ranked the highest.

Performance measures are used to assess the degree to which each alternative meets each objective. In cases where performance cannot be quantified, a relative scale of qualitative performance is used to gauge the degree to which alternatives meet objectives.

The following table provides an example of objectives, sub-objectives, and performance measures.

Table 9-2: Example Objectives and Sub-Objectives

	Objective Name	Objective Description	Sub-Objectives	Performance Measure (units)
1	Improve Reliability	Minimize risk of shortages and ensure ability to meet demand in times of drought. Each alternative will be evaluated based upon system redundancy, ramifications of system failure, and use of proven technology.	Provide system redundancy (equipment, treatment trains) to keep system operating during component failure.	Number of trains and N redundancy (N=0 is none, N=1 is single equipment back-up, N=2 is full equipment back-up)
			Reduce ramifications of failure of all or part of the system.	Severity of impacts to treatment operations (qualitative 1-5)
			Use proven technology for treatment.	Use of proven technology in alternative (qualitative 1-5)
			Maximize flexibility in operations (flow path changes, ability to change process).	Ability to change flow path through valve, gate or piping control (qualitative 1-5)
			Reliability of source of supply.	Susceptibility to drought or probability of shortages from OCWP Basin Reports (qualitative 1-5)
2	Minimize Cost	This objective evaluates both capital and life cycle costs of each alternative. Ease of phasing improvements while deferring capital costs is also assessed.	Manage capital costs.	Capital construction cost for improvements (total \$ / qualitative 1-5 for initial screening)
			Phase implementation to defer capital costs.	Degree to which improvements can be phased in (qualitative 1-5)
			Manage life cycle costs.	20-year PW cost for improvements (total \$ / qualitative 1-5 for initial screening)
3	Minimize environmental impacts	This objective will evaluate permit compliance of each alternative. This objective also will evaluate the ability to minimize construction impacts to environmentally sensitive areas.	Minimize construction impacts to environmentally sensitive areas.	Perceived construction impacts (qualitative 1-5)
			Increase energy efficiency.	Perceived reduction in carbon footprint or energy demand (qualitative 1-5)
			Maintain compliance with permit limits.	Ease of maintaining compliance (qualitative 1-5)
4	Operability and integration with existing facilities	This objective will evaluate similarity to existing operational procedures and capabilities, compatibility with staff experience, system complexity, and complexity of individual unit processes or system components.	Match system with existing operational procedures and capabilities, experience of staff.	Staff training requirements (qualitative 1-5)
			Reduce system complexity.	Degree of overall simplification of O&M (qualitative 1-5)
			Reduce complexity of individual unit processes or system components.	Degree of simplification of process operations (qualitative 1-5)
5	Maintainability	This objective will evaluate the maintenance requirements of each alternative.	Reduce/simplify overall maintenance requirements.	Reduction in overall maintenance impacts and individual equipment maintenance requirements (qualitative 1-5)
			Increase ease of maintaining facilities and equipment.	Ease with which improvements can be maintained (qualitative 1-5)
6	Constructability	This objective will measure the ease of constructing each alternative, including the level of disruption to the existing system during construction.	Minimize disruption to existing system during construction.	Level of system disturbance (qualitative 1-5)
			Perceived difficulty of actual construction, considering access, tie-ins and physical limitations.	Perceived ease of construction (qualitative 1-5)
7	Public Acceptance	This objective will assess the public acceptability of each alternative by evaluating perceived public safety and water quality.	Minimize handling hazardous substances and storage quantity of chemicals onsite.	Perceived public safety (qualitative 1-5)
			Provide potable water that is aesthetically pleasing and tastes good.	Perceived level of potable water quality (qualitative 1-5)
8	Maximize Available Water Resources	Utilize existing water rights to the greatest extent possible without compromising long-term sustainability.	None.	Yield (AFY) of water available
9	Timely Implementation	Ability to implement required improvements with minimal technical and regulatory difficulty.	None.	Implementation schedule (number of years)

## Weighting of Objectives

A method called “paired comparisons” can be used to weight each objective. Similar to the brainstorming session in Section 8, it may be helpful to involve several stakeholders.

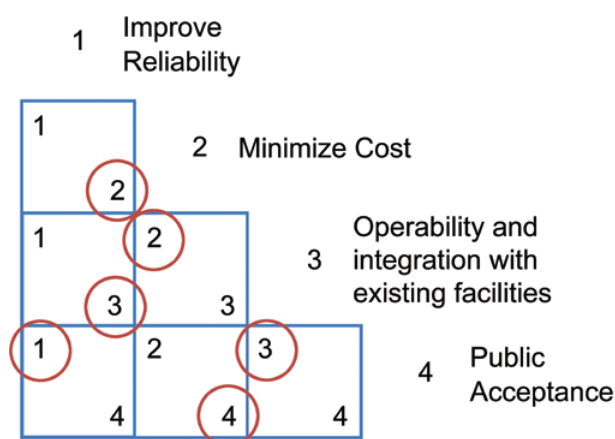
This method is essentially a comparison of two objectives at a time to determine which is more important utilizing the following steps:

- Determine which objective in each box is more important (excluding all other objectives). In this example, the more “important” the objective is circled.
- Calculate the number of times that each objective was selected (circled).
- Tally the total number of times each objective was selected.
- Divide the number of times that each objective was selected by the total number of selections to determine the objective weight (multiply by 100 to determine the weight in percent). The total should be 100 percent.

The figure below represents an objective weighting grid and resulting weights using some of the example objectives listed previously.

If multiple stakeholders are participating in this exercise, gather the weighting grid from each participant, count the number of times each objective is selected, and divide by the total number of squares to determine an average weight.

**Objective Weighting Example**



**Table 9-3: Objective Weighting**

	Improve Reliability	Minimize Cost	Operability and Integration with Existing Facilities	Public Acceptance
Number of circles (Total number of circles = 6)	1	2	2	1
Weight in percentage (Divide number of circles by total number of circles then multiply by 100)	17%	33%	33%	17%



## Scoring and Selection of Preferred Alternatives

Score each of the alternatives against each performance measure on a one through five scale, where a higher score corresponds to better performance. These values can be generated preliminarily by an individual and revised based on larger group discussions.

The following example illustrates a ranking table. Unless one of the sub-objective criteria is more important, generally each sub-objective for a given major objective is weighted equally (or divide 100 by the number of sub-objectives to determine the relative weight of each sub-objective).

At this level it is appropriate to rate the alternatives relative to one another. A few examples are provided.

- Is the cost of Alternative 1 higher than cost of Alternative 2? If the capital cost of Alternative 1 is higher than Alternative 2, then Alternative 1 would receive a lower score than Alternative 2 (remember the higher score indicates better performance or, in this case, lower cost). If the costs are close, score them 1 and 2 (with 2 indicating the lower cost option). If the costs are not close, consider scoring them 1 and 3 (with 3 indicating the lower cost option).
- Does Alternative 1 provide more redundancy than Alternative 2? If Alternative 1 provides more redundancy, it would receive a higher score than Alternative 2. Consider the relative spread of alternatives and separate the score accordingly.
- Does Alternative 1 provide more flexibility than Alternative 2? If Alternative 1 provides more flexibility, it would receive a higher score than Alternative 2.
- Does Alternative 1 use less energy than Alternative 2? If Alternative 1 uses less energy, it would receive a higher score than Alternative 2 (a higher score indicates better performance or, in this case, lower energy consumption).

If quantitative information is known, it can be used in the rating system. Two examples are provided below.

- The costs of various alternatives are known. The following ratio scale may be applied to assign alternative ratings.
- The timeline for implementation of various alternatives is known. The following ratio scale may be applied to assign alternative ratings.

**Table 9-4: Cost Rating**

Cost Range <sup>A</sup>	Alternative Rating <sup>B</sup>
Less than \$5,000	5
\$5,001 to \$25,000	4
\$25,001 to \$100,000	3
\$100,001 to \$500,000	2
Greater than \$500,000	1

*A The cost range should reflect the relative cost differences between the alternatives. For example, if all projects have estimated costs of less than \$10,000, then \$2,000 cost windows may be used to better distinguish between the projects.*

*B Note that the higher ranking indicates a lower cost.*

**Table 9-5: Timeline Rating**

Time for Implementation <sup>A</sup>	Alternative Rating <sup>B</sup>
Less than 1 year	5
1 to 3 years	4
3 to 5 years	3
5 to 10 years	2
More than 10 years	1

*A The time range should reflect the relative cost differences between the alternatives. For example, if all projects can be implemented within three years, it may be more appropriate to look at time on a monthly basis.*

*B Note that the higher ranking indicates a faster implementation.*

Table 9-6: Sample Rating Table

Objective		Sub-Objective			Alternatives		
Weight	Objective	Relative Weight	Sub-Objective	Performance Measure	1	2	3
17%	Improve Reliability	20%	Provide system redundancy (equipment, treatment trains) to keep system operating during component failure	Number of trains and N redundancy (N=0 is none, N=1 is single equipment back-up, N=2 is full equipment back-up)			
		20%	Reduce ramifications of failure of all or part of system	Severity of Impacts to treatment operations (qualitative 1-5)			
		20%	Use proven technology for treatment	Use of proven technology in alternative (qualitative 1-5)			
		20%	Maximize flexibility in operations (flow path changes, ability to change process)	Ability to change flow path through valve, gate or piping control (qualitative 1-5)			
		20%	Reliability of source of supply	Susceptibility to drought or probability of shortages from OCWP Basin Reports (qualitative 1-5)			
33%	Minimize Cost	33%	Manage capital costs	Capital const. cost for improvements (total \$ / qualitative 1-5 for initial screening)			
		33%	Phase implementation to defer capital costs	Degree to which improvements can be phased (qualitative 1-5)			
		34%	Manage life-cycle costs	20-year PW cost for improvements (total \$ / qualitative 1-5 for initial screening)			
33%	Operability and integration with existing facilities	33%	Match system with existing operational procedures and capabilities, experience of staff	Staff training requirements (qualitative 1-5)			
		34%	Reduce system complexity	Degree of overall simplification of O&M (qualitative 1-5)			
		33%	Reduce complexity of individual unit processes or system components	Degree of simplification of process operations (qualitative 1-5)			
17%	Public Acceptance	50%	Minimize handling hazardous substances and storage quantity of chemicals onsite	Perceived public safety (qualitative 1-5)			
		50%	Provide potable water that is aesthetically pleasing and tastes good	Perceived level of potable water quality (qualitative 1-5)			

To determine the alternative sub-objective score, multiply the objective weight times the sub-objective weight times the rating. The sub-objective scores are summed to determine the alternative's total score. For example, Improve Reliability has an objective weight of 17 percent (or 0.17) and System Redundancy has a sub-objective weight of 25 percent (or 0.25). To calculate the score of Alternative 2, multiply 0.17 by 0.25 by the score of 1 ( $0.17 * 0.25 * 1 = 0.435$ ).

Table 9-7: Sample Rating Table with Scores

Objective		Sub-Objective		Alternative 1		Alternative 2	
Weight	Objective	Relative Weight	Sub-Objective	Alternative Rating	Sub-Objective Score	Alternative Rating	Sub-Objective Score
17%	Improve Reliability	25%	Provide system redundancy (equipment, treatment trains) to keep system operating during component failure	0	0	1	0.0425
		25%	Reduce ramifications of failure of all or part of system	1	0.0425	3	0.1275
		25%	Use proven technology for treatment	3	0.1275	3	0.1275
		25%	Maximize flexibility in operations (flow path changes, ability to change process)	2	0.085	4	0.17
33%	Minimize Cost	33%	Manage capital costs	5	0.5445	3	0.3267
		33%	Phase implementation to defer capital costs	5	0.5445	3	0.3267
		34%	Manage life-cycle costs	5	0.561	3	0.3366
33%	Operability and integration with existing facilities	33%	Match system with existing operational procedures and capabilities, experience of staff	5	0.5445	3	0.3267
		34%	Reduce system complexity	3	0.3366	3	0.3366
		33%	Reduce complexity of individual unit processes or system components	3	0.3267	3	0.3267
17%	Public Acceptance	50%	Minimize handling hazardous substances and storage quantity of chemicals onsite	3	0.255	3	0.255
		50%	Provide potable water that is aesthetically pleasing and tastes good	1	0.085	1	0.085
Alternative Score:					3.4528		2.7875

In the previous example, Alternative 1 has a higher score than Alternative 2. Therefore, while Alternative 1 will be considered the preferred alternative, Alternative 2 should not necessarily be eliminated from consideration, since changes in costs or operability could change the preferred alternative and some of the scoring is subjective.

## Summary

The method presented in this section represents a technique for comparing alternatives based on objective and measurable qualities. However, there may be intangible benefits to a system in selecting a lower ranked alternative. While this method can provide benefits for decision making, all decisions should be based on the needs of the water system as a whole including, those factors that cannot numerically be captured.

Completion of Sections 3 through 9 of this guidebook provides a solid framework for long-range water system planning.

## Reassessment of a Water Supply Plan

Periodic reassessment of a water supply plan should be completed as conditions change, action items accomplished, or new challenges arise. Generally, plans should be updated every five years. Alternatively, it is a good idea to update water supply plans at least five years prior to expected major improvements (e.g., water treatment plant upgrade or new source water acquisition) to determine the need for and size of projects.

A water supply plan is a living document. It should be used for prioritizing projects during annual budgeting sessions. It should be used to determine timing of project planning, engineering, and construction. Make notes in the current version of the plan to document evolving conditions, inaccuracies, or items to investigate during the next planning cycle.

# Section 10: Preparing an Engineering Report and Project Financing

Section 10 provides information about project financing, preparing a formal engineering report, and water supply plan reassessment. A “To-Do” list form has been included below to assist with tracking items in this section that need to be investigated further or in listing areas where additional information is needed.

Table 10-1: Preparing an Engineering Report and Project Financing To-Do List

System Name				
	Task	Person Responsible	Target Completion Date	
1				
2				
3				
4				
5				
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24				
25				

## Oklahoma Funding Agency Coordinating Team (FACT)

The Oklahoma Funding Agency Coordinating Team (FACT) is a group of federal and state organizations that offer financing to eligible Oklahoma public entities for water and wastewater projects. The purpose of the team is to facilitate the funding process through communication and streamlined application processes. Several documents have been created by FACT members to provide water and wastewater applicants a single, uniform method for requesting funding and regulatory approvals. These documents can be found on the OWRB website at [www.owrb.ok.gov/fact](http://www.owrb.ok.gov/fact).

## Selecting a Consulting Engineer

After a system determines the need for a project, a consulting engineer must be selected. The Oklahoma FACT provides a sample Request for Proposal (RFP) for Engineering Services, which provides general information about the system, a description of the project, and instructions to engineers. The instructions describe specific items that proposals must contain as well as evaluation and selection criteria. This sample RFP can be modified as needed. To facilitate the review process, a specific response format is sometimes requested. An example format might require the following sections:

- Qualifications
- Approach
- Key Personnel

If there is no solicitation list for the type of work being proposed, the water system may want to contact neighboring utilities, funding agencies, etc. to obtain a list of engineers to send RFPs.

After RFPs are received, they should be reviewed against the evaluation criteria. The engineering companies are ranked based on their qualifications. Interviews may be held with the top ranking firms. The interview provides an opportunity to meet key personnel and discuss the project. After selecting the top engineering firm for this project, contract negotiations begin.

The Oklahoma FACT provides a sample Agreement for Engineering Services. This is the legal contract between the system (owner) and the engineering firm. It should contain provisions describing the following:

- Engineering services required
- Owner's responsibilities
- Time period for performance of services
- Method of payment
- Any special provisions not covered elsewhere in the document

## Preparing an Engineering Report for Water Projects

The Oklahoma FACT provides procedures, guidelines, and checklists for engineering reports for water projects. Consulting engineers will use much of the information gathered in previous sections of this guide to develop the engineering report.

The consulting engineer will develop alternatives, including design criteria, environmental impacts, construction problems, and cost estimates. The advantages and disadvantages of each alternative will be considered and the recommended alternative will be explored further. The conceptual design of the project will be included in the engineering report and provide more detailed information. At this level of design, the following key tasks will have been completed:

- Code regulations and standard requirements
- Evaluation of alternatives
- Additional design information
- Conceptual process and instrumentation diagrams
- Process sizing and hydraulics
- Initial equipment sizing and number
- Civil, site and environmental conditions and constraints defined
- Conceptual facility layout and/or pipeline routing plans

This engineering report is not intended to finalize equipment selection nor will it result in final construction plans. Additional refinements will be made as the design progresses through the subsequent steps of preliminary design, design development, and final design in advance of bidding and construction.

## Potential Funding Sources

The Financial Assistance Division of the OWRB provides information on potential state and federal grant or loan financing for water projects at [www.owrb.ok.gov/financing](http://www.owrb.ok.gov/financing) and maintains an up-to-date Loan and Grant Resource Guide at [www.owrb.ok.gov/financing/resources.pdf](http://www.owrb.ok.gov/financing/resources.pdf) to assist public water systems in identifying funding sources for water and wastewater projects. The guide contains a list of funding sources, the type of funding provided, and relevant contact information.



## Appendix A: Oklahoma Public Water Supply Systems With Region(s) and Basin(s)

Public Water Supply System Name	Region(s)		Basin(s)	
51 EAST CORP	UA		71	0
ACHILLE	BB		13	0
ADA	C	BB	56	9
ADAIR	G		80	0
ADAIR CO RWD #1 (CHERRY TREE)	LA		46	0
ADAIR CO RWD #2	LA		82	46
ADAIR CO RWD #3	LA		82	0
ADAIR CO RWD #4	LA		82	46
ADAIR CO RWD #5	LA		82	0
ADAIR CO RWS & SWMD #6	LA	G	82	80
ADAMSON RURAL WATER DISTRICT #8	E		48	0
AFTON PWA	G		81	0
ALEX	LW		16	15
ALFALFA CO RWS & SWMD #1	UA		68	0
ALFALFA CO RWS & SWMD #1 NORTH	UA		68	0
ALINE	C		64	0
ALLEN PWA	BB	C	8	56
ALTUS	SW		33	38
ALVA	UA	C	68	64
AMES	C		64	0
ANADARKO WATER TREATMENT PLANT	LW	WC	16	17
ANTLERS	SE		6	0
APACHE	BC		29	0
ARAPAHO	WC		19	0
ARBUCKLE MASTER CONSERVANCY DISTRICT	LW		14	0
ARDMORE	LW		21	14
ARKOMA	LA		44	0
ARNETT	WC		59	0
ASHER UTIL DEV AUTH	C		56	0
ATOKA CO RWD # 1 (WARDVILLE)	BB		8	0
ATOKA CO RWD #2	BB		8	9
ATOKA CO RWD #3 (CANEY)	BB		9	0
ATOKA COUNTY RWS & SWMD #4	BB	SE	8	9
ATOKA PWS	BB		8	0
AVANT UTILITIES AUTH	MA		74	0
BAR-DEW WATER ASSOC INC	MA		76	0
BARNSDALL	MA		74	0
BARTLESVILLE	MA		76	0
BEAVER	P		53	55
BEAVER CO RWD #1 TURPIN	P		55	0
BEAVER CO RWD #2 (GATE)	P		65	0
BECKHAM CO RWD # 1	SW	WC	34	36
BECKHAM CO RWD # 2	SW		37	43
BECKHAM CO RWD # 3	SW	WC	34	37
BEGGS	E		48	0
BERNICE	G		81	0
BESSIE	WC		19	0
BETHANY	C		64	51
BIG CABIN PWA	G		80	0
BILLINGS PWA	UA		72	0
BINGER PWA	LW		16	0

Public Water Supply System Name	Region(s)		Basin(s)	
BIRCH CREEK RWD	MA		76	0
BIXBY PUBLIC WORKS AUTHORITY	MA		49	0
BLACKWELL	UA		69	70
BLACKWELL RW CORP	UA		70	69
BLAIR PUBLIC WORKS AUTHORITY	SW		38	42
BLANCHARD	C		57	0
BLUE JACKET PWA	G		80	0
BOISE CITY PWA	P		55	0
BOKCHITO	BB		11	0
BOKOSHE PWA	LA		45	0
BOSWELL PUBLIC WORKS AUTHORITY	BB		7	10
BOWLEGS LIMA WATER	C	E	62	48
BOYNTON PWA	MA		49	0
BRAGGS WATER WORKS	LA		47	0
BRAMAN	UA		70	0
BRECKINRIDGE PWA	UA		71	72
BRIDGEPORT	WC		59	0
BRISTOW MUN AUTH	C		60	0
BROKEN ARROW WTP	MA		49	77
BROKEN BOW PWA	SE		3	0
BROMIDE	BB		9	0
BROOKSVILLE	C		62	0
BRYAN CO RWD #9	BB		13	0
BRYAN COUNTY RW&SD #5	BB	LW	12	13
BRYAN COUNTY RWD # 6	BB		11	9
BRYAN COUNTY RWD #7	BB		11	10
BRYAN COUNTY RWS & SWMD #2	LW	BB	21	12
BUCKHORN RWD	LW		14	21
BUFFALO	P		65	0
BURBANK	UA		72	0
BURLINGTON	UA		68	0
BURNS FLAT PWS	WC	SW	19	34
BURNT CABIN RWD	LA		82	0
BUTLER	WC		19	0
BYARS	LW	C	14	56
CACHE	BC		29	0
CADDO	BB		11	9
CADDO CO RWD #1 (LOOKEBA)	LW		16	0
CADDO CO RWD #3	WC	BC	19	28
CALERA, TOWN OF	BB		13	0
CALUMET	C		51	0
CALVIN	C		56	0
CAMARGO RWD #2	WC		59	0
CAMERON PWA	LA		45	0
CANADIAN CO RWD # 1	C		51	58
CANADIAN CO RWD # 4	C		64	51
CANADIAN CO WATER AUTHORITY	C		51	58
CANTON	C		51	0
CANUTE	WC	SW	19	34
CARMEN	C		64	0
CARNEGIE	WC		19	0

# Appendix A: Oklahoma Public Water Supply Systems

Public Water Supply System Name	Region(s)		Basin(s)	
CARNEY	C	UA	60	63
CARTER	SW		37	36
CASHION	C		64	0
CATOOSA	MA		78	73
CEMENT	LW		16	0
CENTRAHOMA WATER CO INC	BB		9	8
C OKLAHOMA MASTER CONSERVANCY DISTRICT	C		62	58
CHANDLER	C		60	0
CHATTANOOGA PWS	BC		29	30
CHECOTAH	LA	E	47	48
CHELSEA ECONOMIC DEV. AUTH.	G	MA	80	79
CHEROKEE	UA		68	0
CHEROKEE CO RWD # 1 (FT GIBSON)	LA	G	47	80
CHEROKEE CO RWD # 2 (KEYS)	LA		82	47
CHEROKEE CO RWD # 7 (WELLING)	LA		82	0
CHEROKEE CO RWD # 8 (BRIGGS)	LA		82	0
CHEROKEE CO RWD # 9	G		80	0
CHEROKEE CO RWD #11	G		80	0
CHEROKEE CO RWD #12	LA		82	0
CHEROKEE CO RWD #13	LA		82	0
CHEYENNE	WC		20	0
CHICKASHA	LW		16	0
CHOCTAW	C		50	0
CHOCTAW COUNTY RWD #1	BB	SE	10	7
CHOCTAW COUNTY RWSG&SWMD # 3	SE		5	0
CHOCTAW RWD # 6	BB		9	7
CHOCTAW RWD #2	SE		1	3
CHOUTEAU	G		80	0
CIMARRON CITY	C		64	0
CLAREMORE	MA		78	0
CLARITA OLNEY WATER CO INC	BB		9	8
CLAYTON PUBLIC WORKS AUTHORITY	SE		6	0
CLEO SPRINGS	C		64	0
CLEVELAND NORTH	UA		71	0
CLINTON	WC		19	0
COAL CO RWD #5	BB		8	0
COALGATE PWA	BB		8	0
COLBERT PWA	BB		13	0
COLCORD PWA	G	LA	80	82
COLE	C		57	0
COLLINSVILLE	MA		75	0
COMANCHE CO RWD #1	BC		28	0
COMANCHE CO RWD #2	BC		28	0
COMANCHE CO RWD #3	BC		28	25
COMANCHE CO RWD #4	BC	SW	29	30
COMANCHE PUBLIC WORKS	BC	LW	26	23
COMMERCE	G		81	0
CONSOLIDATED RWD #1 LEFLORE CO	LA		45	0
CONSOLIDATED RWD #1 NOWATA AND ROGERS CO	MA		79	0
CONSOLIDATED RWD #3 CREEK CO	MA		49	0
COPAN PWA	MA		76	0

Public Water Supply System Name	Region(s)		Basin(s)	
CORN PWA	WC		19	18
CORNISH	LW		23	0
COTTON CO RWD # 1	BC		31	0
COTTON CO RWD #2	BC		28	27
COVINGTON	UA		63	71
COWETA	MA		49	77
COYLE	UA		63	0
CRAIG CO RWD #1	G		80	0
CRAIG CO RWD #2	G	MA	80	79
CRAIG CO RWD #4	G		80	0
CRAIG CO RWS & SWMD #3	G		80	0
CREEK CO RWD # 1	MA	C	49	60
CREEK CO RWD # 2	MA		49	0
CREEK CO RWD # 4	MA		49	0
CREEK CO RWD # 5	UA		71	0
CREEK CO RWD # 7	MA		49	0
CREEK CO RWD #10	UA	MA	71	49
CRESCENT	C	UA	64	63
CUSHING	UA		71	0
CUSTER CITY PWS	WC		19	59
CUSTER COUNTY RWD #3	WC		19	59
CYRIL	LW		16	0
DACOMA PWA	C		64	0
DAVENPORT UTILITY AUTH	C		60	0
DAVIDSON	BC		31	0
DAVIS	LW		14	0
DEER CREEK	UA		68	0
DEER CREEK RURAL WATER CORP	C		64	0
DEL CITY	C		50	0
DELAWARE	MA		79	0
DELAWARE CO RWD # 1	G		80	0
DELAWARE CO RWD # 3	G		81	0
DELAWARE CO RWD # 7	G		80	0
DELAWARE CO RWD #10	G		81	0
DELAWARE CO RWD #9	G		81	0
DELAWARE RWSG&SW MGMT DIST #6	G		81	0
DEPEW	C		60	0
DEVOL	BC		31	0
DEWAR	E		48	0
DEWEY	MA		76	0
DEWEY CO RWD #1	WC		59	0
DEWEY CO RWD #3	P	WC	52	59
DIBBLE	C	LW	57	15
DILL CITY	SW	WC	34	19
DOUGHERTY	LW		14	0
DOUGLAS	UA		63	0
DOVER PUBLIC WORKS TRUST AUTH	C		64	0
DRUMMOND	C		64	0
DRUMRIGHT	UA		71	0
DUKE C VUE WATER	SW		38	40
DUKE PUBLIC WATER AUTHORITY	SW		38	0
DUNCAN	BC		26	25

Public Water Supply System Name	Region(s)		Basin(s)	
DURANT	BB		12	0
DUSTIN	E		48	0
EAKLY DEVELOPMENT CORP	WC		18	0
EAST C OKLA WATER AUTH	LA		47	0
EDMOND PWA - ARCADIA	C		64	60
EL RENO	C		51	0
ELDORADO	SW		40	0
ELGIN PWS	BC		25	28
ELK CITY	SW		34	37
ELM BEND RWD INC	MA		76	79
ELMORE CITY	LW		14	0
ELMORE CITY RW CORP	LW		14	15
ENID	UA	C	63	64
ERICK	SW		37	0
E PWA	E		48	0
FAIRFAX	UA		72	0
FAIRLAND	G		81	0
FAIRMONT	UA		63	71
FAIRVIEW	C	P	64	52
FARGO	P		54	0
FAXON	BC		29	0
FLETCHER	BC		25	28
FORGAN	P		53	65
FORT COBB	WC		17	0
FORT COBB MASTER CONSERVANCY DISTRICT	WC	LW	17	16
FORT GIBSON	LA	G	47	80
FORT SUPPLY PWA	P		53	0
FORT TOWSON	SE		5	0
FOSS	WC		19	0
FOSS RESERVOIR MCD	WC		20	19
FRANCIS	C		56	0
FREDERICK	BC	SW	31	30
FREEDOM	P		65	0
FRONTIER DEVELOPMENT AUTH	WC		20	19
GAGE	P		54	0
GANS UTIL AUTH	LA		46	0
GARBER	UA		71	72
GARFIELD CO RWD #1 (KREM-HILL)	UA		68	72
GARFIELD CO RWD #4	UA		63	0
GARFIELD CO RWD #5	UA	C	63	64
GARFIELD CO RWD #7	UA		68	63
GARVIN	SE		1	3
GARVIN CO RWD #1	LW	C	14	56
GARVIN CO RWD #2	LW		15	14
GARVIN CO RWD #4	LW		14	15
GARVIN CO RWD #6 (SW PURCHASE)	LW		14	15
GARVIN CO RWD #6 (WELLS)	LW		14	15
GEARY	C		51	58
GERONIMO	BC		28	0
GLENCOE	UA		71	0
GLENPOOL WATER	MA		49	0
GOLDSBY WATER AUTH TRUST	C		58	57

Public Water Supply System Name	Region(s)		Basin(s)	
GOLTRY	C	UA	64	68
GOODWELL	P		55	0
GORE PWA	LA		82	47
GOTEBO	WC		19	0
GOULD PWA	SW		41	38
GRACEMONT PWA	LW		16	0
GRADY CO RWD #1	LW		16	0
GRADY CO RWD #2	LW		16	0
GRADY CO RWD #3	LW		15	0
GRADY CO RWD #6	LW	C	16	58
GRADY CO RWD #7 (NINNEKAH)	LW		16	15
G LAKE PWA	G		81	0
GFIELD	BC		30	31
GVIEW RWD #3	LA	G	82	80
GRANITE PWS	SW		42	36
GRANT COUNTY RWD #1	UA		68	0
GRAYHORSE RWD	UA		72	71
GREENFIELD PWA	C		51	0
GROVE MUNICIPAL SERVICES AUTH.	G		81	0
GUTHRIE	C		64	0
GUYMON	P		55	0
HAILEYVILLE	E		48	0
HALLETT PUBLIC WORKS AUTHORITY	UA		71	0
HAMMON	WC		20	0
HANNA PWA	E		48	0
HARDESTY UTILITIES	P		55	0
HARMON ELECTRIC	SW		38	39
HARMON WATER CORP	SW		41	38
HARPER CO WATER CORP	P		65	53
HARRAH	C		50	0
HARTSHORNE	E		48	0
HASKELL COUNTY WATER COMPANY	LA	E	47	46
HASKELL PWA	MA		49	0
HAWORTH	SE		1	0
HEADRICK	SW		33	0
HEALDTON	LW		22	23
HEASTON RW CORP	C		51	58
HEAVENER UTILITY AUTH/PSG	LA		45	0
HELENA	C		64	0
HENNESSEY	C		64	0
HENRYETTA	E		48	0
HIGHWAY 69 WATER DISTRICT	G		80	0
HILLSDALE PWA	UA		68	0
HINTON	WC	LW	59	16
HITCHCOCK DEV	C		64	51
HOBART	SW	WC	34	19
HOLDENVILLE	C	E	56	48
HOLLIS	SW		41	39
HOLLISTER	BC		30	0
HOMINY	MA		74	0
HOOKER	P		55	0
HUGHES CO RWD #1	E	C	48	50

## Appendix A: Oklahoma Public Water Supply Systems

Public Water Supply System Name	Region(s)		Basin(s)	
HUGHES CO RWD #2	E	BB	48	8
HUGHES CO RWD #3	E	C	48	56
HUGHES CO RWD #4	C		56	0
HUGHES CO RWD #5	E	C	48	56
HUGHES CO RWD #6 (GERTY)	BB	C	8	56
HUGO	SE	BB	5	10
HULBERT PWA	G		80	0
HUNTER	UA		72	0
HYDRO PWA	WC		59	0
IDABEL PUBLIC WORKS AUTHORITY	SE		3	2
INDIAHOMA	BC		29	0
INDIANOLA RWD # 18	E		48	0
INOLA WATER WORKS INC	MA		77	0
IRONSIDE WATER DISTRICT INC	G		80	0
JACKSON CO WATER CORP	SW		33	38
JAY	G		81	80
JEFFERSON	UA		68	0
JEFFERSON CO CONS RWD #1	BC	LW	24	23
JENKS PWA	MA		49	0
JENNINGS	UA		71	0
JET	UA		68	0
JOHNSTON CO RWD #3	LW	BB	21	12
JOHNSTON CO RWS& SWMD #4	BB		12	9
JONES	C		50	0
KANSAS PUBLIC WORKS AUTHORITY	G	LA	80	82
KAW CITY WATER AUTHORITY	UA		72	0
KAW WATER INC	UA		72	0
KAY CO RWD #1	UA		72	0
KAY CO RWD #3	UA		67	72
KAY CO RWD #5 (DALE WATER CORP)	UA		67	72
KAY CO RWD #6	UA		72	71
KAY COUNTY RWD #2	UA		72	0
KAY COUNTY RWD #4	UA		72	0
KENDRICK MUNICIPAL AUTHORITY	C		60	0
KENEFIC	BB		12	0
KEOTA PWA	LA		46	0
KETCHUM PWA	G		81	80
KETCHUM PWA DELAWARE CO SYSTEM	G		80	81
KEYES UTILITY AUTH.	P		55	0
KINGFISHER	C		64	0
KINGFISHER CO RWD #3	C		64	0
KINGFISHER CO RWD #4	C		64	0
KINGSTON PWA	LW		21	0
KIOWA	BB	E	8	48
KIOWA CO RWS & SWMD #1	SW		36	0
KONAWA PWA	C		56	0
KREBS UTILITY AUTHORITY	E		48	0
KREMLIN	UA		68	0
KUSA RWD #3	E		48	0
LAHOMA PWA	C		64	0
LAMONT	UA		68	0
LANGLEY	G		80	81

Public Water Supply System Name	Region(s)		Basin(s)	
LANGSTON PWA	UA		63	0
LATIMER CO RWD #2	SE		6	0
LATIMER CO RWD #4	LA		45	0
LATIMER COUNTY RWD #1	LA	E	45	48
LATIMER RWD #3	LA	SE	45	6
LAVERNE	P		53	0
LAWTON	BC		28	0
LE ANN WATER	MA		76	0
LEE CREEK RWD	LA		46	0
LEEDEY	WC		20	19
LEFLORE CO RWD # 1	LA		45	0
LEFLORE CO RWD # 14	LA		44	45
LEFLORE CO RWD # 15	LA		45	0
LEFLORE CO RWD # 2	LA		44	0
LEFLORE CO RWD # 3	SE		6	0
LEFLORE CO RWD # 5	LA		45	0
LEFLORE CO RWD #17	SE		6	4
LEHIGH	BB		8	0
LENAPAH	MA		79	0
LEON RWD #1 (LOVE COUNTY)	LW		21	0
LEXINGTON	C		56	58
LINCOLN CO RW & SEWER DIST 4	C	UA	60	71
LINCOLN CO RWD #1	C		60	0
LINCOLN CO RWD #2	C		60	0
LINCOLN CO RWD #3	C		60	0
LINDSAY PWA	LW		15	0
LOCUST GROVE	G		80	0
LOGAN CO RWD #1	C		64	60
LOGAN CO RWD #2	C		64	0
LOGAN CO RWS & SWMD #3	UA	C	63	71
LONE CHIMNEY WATER ASSOCIATION	UA		71	0
LONE GROVE	LW		22	21
LONE WOLF	SW		34	0
LONGDALE	C		51	0
LONGTOWN RW&S DISTRICT #1 PITTSBURG CO	E		48	0
LOYAL	C		64	0
LUTHER	C		60	0
MADILL	LW		21	0
MAJOR COUNTY RWD #1	C	P	64	52
MANCHESTER	UA		68	0
MANGUM PWS	SW		38	39
MANITOU	BC		30	0
MANNFORD	UA		71	0
MANNVILLE PUBLIC WORKS AUTHORITY	LW		21	0
MARIETTA PWA	LW		21	0
MARLAND	UA		72	67
MARLOW PWA	LW	BC	14	25
MARSHALL	UA		63	0
MARSHALL COUNTY WATER CORP	LW		21	0
MARTHA	SW		38	0
MAUD	C		61	62
MAYES CO RWD # 2	G	MA	80	77

Public Water Supply System Name	Region(s)		Basin(s)	
MAYES CO RWD # 3	G		81	80
MAYES CO RWD # 5	G	MA	80	79
MAYES CO RWD # 6	G		80	81
MAYES CO RWD # 7	G		80	0
MAYES CO RWD # 8	G		80	0
MAYES CO RWD # 9	G		80	0
MAYES CO RWD #4	G		80	0
MAYSVILLE	LW		15	0
MCALISTER PWA	E		48	0
MCCLAIN CO RWD # 8	LW	C	15	56
MCCORD RWD #3	UA		72	0
MCCURTAIN	LA		46	45
MCCURTAIN CO RWD # 1	SE		1	2
MCCURTAIN CO RWD # 5 (HOCHATOWN)	SE		3	4
MCCURTAIN CO RWD #2	SE		1	3
MCCURTAIN CO RWD #7	SE		1	3
MCCURTAIN CO RWD #8 (MT. FORK WATER)	SE		3	2
MCCURTAIN CO RWD #9	SE		3	0
MCINTOSH CO RWD # 13 (WELLS)	E		48	0
MCINTOSH CO RWD # 3 (VICTOR)	LA	E	47	48
MCINTOSH CO RWD # 6 (VIVIAN)	E		48	0
MCINTOSH CO RWD # 8 (TEXANNA)	E		48	0
MCINTOSH CO RWD #1	LA		47	0
MCINTOSH CO RWD #12 (SHELL CREEK)	E		48	0
MCINTOSH CO RWD #4 (HITCHITA)	E		48	0
MCINTOSH CO RWD #5	LA	E	47	48
MCINTOSH CO RWD #7	LA		47	0
MCINTOSH CO RWS & SWMD #2 (ONAPA)	LA	E	47	48
MCINTOSH CO RWS & SWMD #9	E		48	0
MCCLOUD	C		50	0
MEDFORD	UA		68	0
MEDICINE PARK	BC		28	0
MEEKER PUBLIC WORKS AUTHORITY	C		60	50
MENO	C		64	0
MERIDIAN WATER SUPPLY	C		60	0
MIAMI	G		81	0
MIDWCITY	C		50	0
MILBURN PUBLIC WORKS AUTHORITY	BB	LW	12	21
MILL CREEK	LW		21	0
MINCO	C		58	0
MOORE	C		62	58
MOORELAND	P		52	0
MORRIS	E		48	0
MORRISON PUBLIC WORKS AUTH.	UA		71	0
MOUNTAIN PARK MCD	SW	BC	33	30
MOUNTAIN PARK, TOWN OF	SW		33	0
MOUNTAIN VIEW PWA	WC		19	0
MULDROW PUBLIC WORKS AUTHORITY	LA		46	0
MULHALL	UA		63	0
MURRAY CO RWD # 1	LW	C	14	21
MUSKOGEE	LA	MA	47	49
MUSKOGEE CO RWD # 1(OKTAHA)	LA	MA	47	49

Public Water Supply System Name	Region(s)		Basin(s)	
MUSKOGEE CO RWD # 2(GOOSENECK)	LA		47	0
MUSKOGEE CO RWD # 3	E	MA	48	49
MUSKOGEE CO RWD # 4	LA		47	0
MUSKOGEE CO RWD # 5	LA		47	0
MUSKOGEE CO RWD # 6	LA	MA	47	49
MUSKOGEE CO RWD # 7	LA	G	47	80
MUSKOGEE CO RWD # 9	MA		49	0
MUSKOGEE CO RWD #10	MA		49	0
MUSKOGEE CO RWD #14	MA		49	0
MUSTANG	C		50	58
NASH	UA		68	0
NEW CORDELL UTILITY AUTHORITY	WC	SW	19	34
NEWCASTLE	C		58	57
NEWKIRK	UA		67	72
NICHOLS HILLS	C		60	64
NOBLE	C		58	62
NOBLE CO RWD #1 (LUCIEN)	UA		71	63
NOBLE CO RWD #3	UA		72	67
NOBLE CO RWD #4	UA		72	67
NOBLE COUNTY RWD #2	UA		71	72
NORGE WATER CO	LW		16	0
NORMAN	C		58	62
NORTH BLAINE WATER	C	P	64	52
NORTH MIAMI	G		81	0
NORTH VINITA WATER COOP INC	G		80	0
NOWATA	MA		79	0
NOWATA CO RW & S DIST #1	MA		76	79
NOWATA CO RWD #2	MA		79	0
NOWATA CO RWD #3	MA		79	0
NOWATA CO RWD #5	MA		79	0
NOWATA CO RWD #6	MA		79	0
NOWATA CO RWD #7	MA		79	0
OAKLAND	LW		21	0
OAKS WATER WORKS INC	G		80	0
OAKVIEW WATER CORP	LW		21	0
OCHELATA UTILITY AUTHORITY	MA		76	0
OILTON	UA		71	0
OKARCHE	C		64	0
OKARCHE RWD	C		64	51
OKAY PWA	MA	G	77	49
OKEENE	C		64	0
OKEMAH UTILITIES AUTHORITY	C		50	60
OKFUSKEE CO RWD # 1 (BOLEY)	C		50	0
OKFUSKEE CO RWD # 2	C	E	50	60
OKFUSKEE CO RWD # 3	C	E	60	48
OKLA ORDNANCE WORKS AUTHORITY	G		80	0
OKLAHOMA CITY	C	BB	50	60
OKMULGEE	E		48	0
OKMULGEE CO RWD # 2 (PRESTON)	E	MA	48	49
OKMULGEE CO RWD # 4	E		48	0
OKMULGEE CO/HECTORVILLE RWD # 6	MA	E	49	48
OKMULGEE CO RWD #1	E		48	0

## Appendix A: Oklahoma Public Water Supply Systems

Public Water Supply System Name	Region(s)		Basin(s)	
OKMULGEE CO RWD #20	E	MA	48	49
OKMULGEE CO RWD #21	E		48	0
OKMULGEE CO RWD #5 (BRYANT RWD #5)	E		48	0
OKMULGEE CO RWD #7 (NUYAKA)	C	E	60	48
OLUSTEE PWS	SW		38	0
OPTIMA	P		55	0
ORLANDO	UA		63	0
OSAGE CO RURAL WATER DISTRICT #9	MA		74	0
OSAGE CO RWD # 1	MA		76	74
OSAGE CO RWD # 20 (HULAH)	MA		76	0
OSAGE CO RWD # 5	MA		74	76
OSAGE CO RWD #15	MA		74	0
OSAGE CO RWD #18 (EVERGREEN)	MA		74	0
OSAGE CO RWD #21	UA		72	74
OSAGE CO RWS & SWD #3 (BRADEN)	UA		72	0
OSAGE PWA	UA		71	0
OTTAWA CO RWD # 1	G		81	0
OTTAWA CO RWD # 2	G		81	0
OTTAWA CO RWD # 3	G		81	0
OTTAWA CO RWD # 4	G		81	0
OTTAWA CO RWD #5	G		81	0
OTTAWA CO RWD #6	G		81	0
OTTAWA CO RWD #7	G		81	0
OWASSO	MA		73	75
PADEN	C		60	0
PANAMA PWA	LA		44	0
PAOLI	LW		15	0
PAULS VALLEY	LW		14	0
PAWHUSKA	MA		74	76
PAWNEE	UA		71	0
PAWNEE CO RWD #1	UA		71	0
PAWNEE CO RWD #2	UA		71	0
PAWNEE CO RWD #3	UA		71	0
PAWNEE CO RWD #4	UA		71	0
PAWNEE CO RWD #5	UA		71	0
PAYNE CO RW CORP #3	UA		71	63
PAYNE CO RWD #3	UA		63	71
PAYNE CO RWD #4	UA		71	0
PEGGS WATER COMPANY	G		80	0
PERKINS	UA		63	0
PERRY WATER & LIGHT DEPT	UA		71	0
PHILLIPS RWD #1	BB		8	0
PIEDMONT	C		64	0
PITTSBURG	E		48	0
PITTSBURG CO PWA (CROWDER)	E		48	0
PITTSBURG CO RW&SD #15	E		48	0
PITTSBURG CO RWD # 4 (CANADIAN)	E		48	0
PITTSBURG CO RWD # 5	E		48	0
PITTSBURG CO RWD # 6 (ALDERSON)	E		48	0
PITTSBURG CO RWD # 7 (HAYWOOD)	E		48	0
PITTSBURG CO RWD # 9 MCALESTER	E		48	0
PITTSBURG CO RWD #11 (KIOWA)	BB		8	0

Public Water Supply System Name	Region(s)		Basin(s)	
PITTSBURG CO RWD #14	E	LA	48	46
PITTSBURG CO RWD #16	E		48	0
PITTSBURG CO WATER AUTHORITY	E		48	0
PONCA CITY MUN WATER	UA		72	67
POND CREEK	UA		68	0
PONTOTOC CO RWD # 1 (HOMER)	C	BB	56	8
PONTOTOC CO RWD # 6 (FITTSTOWN )	BB		9	12
PONTOTOC CO RWD # 7	BB	C	8	9
PONTOTOC CO RWD # 8	C	BB	56	12
PONTOTOC CO RWD # 9	BB		9	0
PORTER PWA	MA		77	0
PORUM PUBLIC WORKS AUTHORITY	LA	E	47	48
POTEAU PWA	LA		45	44
POTT CO RWD #2 (TRI COUNTY)	C	E	50	48
POTTAWATOMIE CO DEVELOPMENT AUTH	C		50	62
POTTAWATOMIE COUNTY RWD #3	C		56	0
PRAGUE	C		50	60
PRUE PWA	UA		71	0
PRYOR	G		80	0
PRYOR EAST RWD #1	G		80	0
PURCELL	C	LW	57	15
PUSHMATAHA CO RWD #1	SE		6	0
PUSHMATAHA CO RWD #2 (ALBION)	SE		6	0
PUSHMATAHA CO RWD #3	SE	BB	6	5
PUSHMATAHA CO RWD #5 (NASHOBA)	SE		5	6
PVIA	LA		45	0
QUAPAW	G		81	0
QUAPAW TRIBE	G		81	0
QUARTZ MOUNTAIN REG WATER AUTH	SW		34	0
QUINLAN COMMUNITY RWD #1	P	C	65	52
QUINTON	LA		46	0
R&C WATER CORP	UA		68	0
RALSTON	UA		71	0
RAMONA	MA		76	0
RATLIFF CITY	LW		14	0
RAVIA	LW		21	0
RED BIRD	MA		49	77
RED OAK PUBLIC WORKS AUTHORITY	LA		45	0
RED ROCK	UA		72	0
REED WATER CORP	SW		43	39
RINGLING	LW		23	0
RINGWOOD	C		64	0
RIPLEY PWA	UA		71	63
ROCK CREEK	C		60	0
ROCKY	SW		34	0
ROFF	BB		12	0
ROGER MILLS RWD # 2 (RED STAR)	WC		20	59
ROGER MILLS RWS & SWMD #1	WC		20	0
ROGER MILLS RWS & SWMD #3	WC		20	0
ROGERS CO RWD # 2	MA		78	0
ROGERS CO RWD # 3 COT STA	MA	G	78	79
ROGERS CO RWD # 3 LAKE PLANT	MA	G	78	79



Public Water Supply System Name	Region(s)		Basin(s)	
ROGERS CO RWD # 4	MA		78	75
ROGERS CO RWD # 5	MA		78	73
ROGERS CO RWD # 6	MA		77	78
ROGERS CO RWD # 7	MA	G	78	80
ROGERS CO RWD # 8	MA		78	0
ROGERS CO RWD # 9	MA		78	0
ROGERS CO RWD #12	MA		73	0
ROGERS CO RWD #15	MA		78	0
ROLAND	LA		46	0
ROOSEVELT PWA	SW		35	0
ROUNDHILL RWD #4	BB		8	0
RUSH SPRINGS	LW		14	0
RYAN	BC	LW	24	21
SALINA PWA	G		80	0
SALLISAW	LA		46	0
SALT FORK WATER AUTHORITY	UA		71	0
SAND SPRINGS	MA	UA	49	74
SAND SPRINGS SKYLINE/81ST AREA	MA		49	0
SAPULPA	MA		49	0
SAPULPA RURAL WATER COMPANY	MA		49	0
SARDIS LAKE WATER AUTHORITY	SE		6	0
SASAKWA PWA	C		61	56
SASAKWA RWD	C		56	61
SAVANNA	E		48	0
SAYRE	SW		37	0
SEILING	P		52	0
SEMINOLE	E		48	0
SEMINOLE CO RW&SWMD #3	C	E	50	48
SEMINOLE CO RWD # 1	E		48	0
SEMINOLE CO RWD # 5	E		48	0
SEMINOLE CO RWD #2	E		48	0
SENTINEL PWS	SW		34	0
SEQUOYAH CO RWD # 5	LA		82	46
SEQUOYAH CO RWD #3	LA		46	0
SEQUOYAH CO RWD #4	LA		46	0
SEQUOYAH CO RWD #5	LA		82	46
SEQUOYAH CO RWD #7	LA		46	0
SEQUOYAH COUNTY WATER ASSOC	LA		46	82
SHARON UTILITIES	P		52	0
SHATTUCK	P		54	0
SHAWNEE	C		50	60
SHIDLER	UA		72	0
SKIATOOK PWA	MA		74	0
SLICK	C		60	0
SNYDER	SW		33	35
SOPER	BB		7	0
SOUTH COFFEYVILLE	MA		79	0
SOUTHERN OKLA WATER CORP	LW		21	14
SPAVINAW	G		80	0
SPENCER	C		50	0
SPERRY	MA		74	73
SPIRO	LA		46	44

Public Water Supply System Name	Region(s)		Basin(s)	
SPIRO EAST RWS	LA		46	44
ST LOUIS RWD	C		61	0
STEPHENS CO RW&SD #1	LW		14	23
STEPHENS CO RWD #3 (MERIDIAN)	BC		26	0
STEPHENS CO RWD #4 (LOCO)	LW		23	0
STEPHENS CO RWD #5	LW	BC	14	25
STERLING PWA	BC		25	0
STIGLER	LA		47	0
STILLWATER WATER PLANT	UA		71	0
STILWELL	LA		82	46
STONEWALL PWA	BB		9	0
STRATFORD	C		56	0
STRIKE AXE (CHIMNEY ROCK)	MA		76	0
STRIKE-AXE HWY 60	MA		76	0
STRINGTOWN PWA	BB	SE	8	6
STROUD PUBLIC WORKS AUTHORITY	C		60	0
SULPHUR	LW		14	0
SW WATER INC	UA		68	0
TAFT	MA		49	0
TAHLEQUAH PWA	LA	G	82	80
TALIHINA	SE		6	0
TALOGA	WC		59	0
TECUMSEH UTILITY AUTHORITY	C		50	62
TEMPLE	BC		31	27
TERRAL	LW		21	0
TEXAS COUNTY RWD #1	P		55	0
TEXHOMA	P		55	0
THACKERVILLE	LW		21	0
THIRSTY WATER CORP	SW		43	42
THOMAS	WC		59	0
TILLMAN CO RWD #1	BC		30	31
TIPTON	SW	BC	32	31
TISHOMINGO WTP	LW		21	0
TONKAWA	UA		67	69
TRYON	UA	C	63	60
TULLAHASSEE WATER	MA		77	49
TULSA	MA		73	49
TULSA CO W IMP DIST #14	MA		49	0
TUPELO PWA	BB		9	0
TUTTLE	C		58	0
TYRONE	P		55	0
UNION CITY	C		58	51
VALLIANT PWA	SE		1	3
VERDEN	LW		16	0
VIAN	LA		46	0
VICI	WC	P	52	59
VINITA PWA	G		80	0
WAGONER	MA	G	77	80
WAGONER CO RWD # 1	G	MA	80	77
WAGONER CO RWD # 2	G		80	0
WAGONER CO RWD # 4	MA		77	49
WAGONER CO RWD # 5	MA		49	77

## Appendix A: Oklahoma Public Water Supply Systems

Public Water Supply System Name	Region(s)		Basin(s)	
WAGONER CO RWD # 6	MA	G	77	80
WAGONER CO RWD # 7 (NEW)	MA	G	77	80
WAGONER CO RWD # 9	G		80	0
WAKITA	UA		68	0
WALTERS	BC		28	29
WANETTE	C		56	0
WAPANUCKA	BB		9	0
WARNER	LA		47	0
WASHINGTON	C		57	0
WASHINGTON CO RWD #1	MA		76	0
WASHINGTON CO RWD #2	MA		76	0
WASHINGTON CO RWD #3 (NEW,#1)	MA		75	74
WASHINGTON CO RWD #5	MA		76	0
WASHINGTON CO RWD #7	MA		76	0
WASHITA CO RWD #2	WC		19	18
WATER DIST INC	LA		45	0
WATER IMPROVEMENT DISTRICT #3	MA		73	74
WATONGA	C		51	0
WATTS	LA		82	0
WAUKOMIS PWA	UA	C	63	64
WAURIKA MASTER CONSERVANCY DISTRICT	BC		26	24
WAURIKA PUBLIC WORKS AUTHORITY	BC		26	24
WAYNE	LW	C	15	56
WAYNOKA	P		65	0
WEATHERFORD	WC		59	0
WELCH PWA	G		81	0
WELEETKA	E		48	0
WELLSTON	C		60	0
WEST DAVIS RWD	LW		14	0
WEST SILOAM SPRINGS	LA		82	0
WESTERN CARTER CO WATER CORP	LW		14	23
WESTPORT UTILITY AUTH TRUST	UA		71	0
WESTVILLE	LA		82	0
WETUMKA	C	E	50	48
WEWOKA WATER WORKS	E		48	0
WILBURTON	LA	E	45	48
WILLOW	SW		36	43
WILSON MUNICIPAL AUTHORITY	LW		22	0
WISTER	LA		45	0
WOODS CO RWD #2	P		65	0
WOODS COUNTY RWD # 1	UA		68	0
WOODS COUNTY RWD # 3	UA	P	68	64
WOODWARD	P		53	52
WOODWARD CO RWD #1	P		65	52
WOODWARD CO RWD #2	P		53	52
WRIGHT CITY PWA	SE		3	0
WYNNEWOOD WATER & LIGHT	LW		14	0
WYNONA	MA		74	0
YALE	UA	C	71	0
YUKON	C		51	50

## Appendix B: Calculations and Formulas

### Water Quantity Conversion Factors

		Desired Unit					
		CFS	GPM	GPD	MGD	AFY	AFD
Initial Unit	CFS	—	449	646,300	.646	724	1.98
	GPM	2.22 e-3	—	1,440	.00144	1.61	4.42 e-3
	GPD	1.55 e-6	6.94 e-4	—	1.0 e-6	1.12 e-3	3.07 e-6
	MGD	1.55	695	1,000,000	—	1,120	3.07
	AFY	1.38 e-3	.62	892.2	8.9 e-4	—	2.74 e-3
	AFD	.504	226	325,851	.326	365	—

	Foot	Mile
Foot	—	5,280
Mile	1.89 e-4	—

EXAMPLE: Converting from MGD to CFS. To convert from an initial value of 140 MGD to CFS, multiply 140 times 1.55 to come up with the desired conversion, which would be 217 CFS (140 X 1.55 = 217).

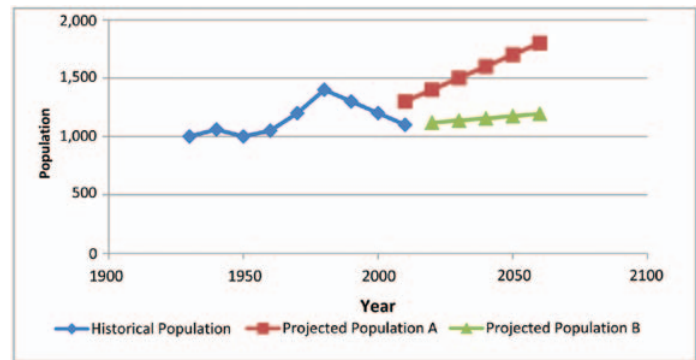
CFS: cubic feet per second  
 GPM: gallons per minute  
 GPD: gallons per day  
 MGD: millions gallons per day  
 AFY: acre-feet per year  
 AFD: acre-feet per day  
 1 acre-foot: 325,851 gallons  
 1 mile: 5,280 feet  
 1 foot: 1.89 e-4 miles

## Appendix B: Calculations and Formulas

It is suggested that OCWP population projections be used for planning purposes unless other sources are available. If OCWP projections are not acceptable and no other population projections are available, then the average historical percent change in population (column G) can be used to estimate future population (column F). This method is illustrated in Projected Population B.

### Population Projections (Example)

A	B	C	D	E	F	G
Year	Historical Population	Percent Change	Projected Population A	Percent Change	Projected Population B	Percent Change
1930	1,000					
1940	1,060	6.00%				
1950	1,000	-5.66%				
1960	1,060	5.00%				
1970	1,200	14.29%				
1980	1,400	16.67%				
1990	1,300	-7.14%				
2000	1,200	-7.69%				
2010	1,100	-8.33%	1,300			
2020			1,400	7.69%	1,118	1.64%
2030			1,500	7.14%	1,136	1.64%
2040			1,600	6.67%	1,155	1.64%
2050			1,700	6.25%	1,174	1.64%
2060			1,800	5.88%	1,193	1.64%



#### Column descriptions:

(B) Historical population available

(C ) Calculated percent change in historical population

(D) Available population projections (e.g. from OCWP)

(E) Calculated percent change in available population projection (column D)

(F) Calculated population projection based on average historical percent change (column G). This method should be used when the OCWP projections are not acceptable and no other Population projections are available.

(G) Assumed percent change used to calculate population projection (column F).

### Population Projections (Working Table)

A	B	C	D	E	F	G
Year	Historical Population	Percent Change	Projected Population A	Percent Change	Projected Population B	Percent Change
1930						
1940						
1950						
1960						
1970						
1980						
1990						
2000						
2010						
2020						
2030						
2040						
2050						
2060						

## Pipeline Capacity

Flow		Velocity	Diameter	
(mgd)	(cfs)	(fps)	Calculated (in)	Normalized (in)
0	-	5	0	0
0.25	0	5	3.87	4
0.50	1	5	5.31	5
0.75	1	5	6.52	6
1.00	2	5	7.54	8
2.00	3	5	10.64	10
3.00	5	5	13.04	14
4.00	6	5	15.07	16
5.00	8	5	16.85	16
10.00	15	5	23.82	24
15.00	23	5	29.17	30
20.00	31	5	33.68	36
25.00	39	5	37.66	36
30.00	46	5	41.26	42
35.00	54	5	44.56	42
40.00	62	5	47.64	48
45.00	70	5	50.53	48
50.00	77	5	53.26	54
55.00	85	5	55.86	54
60.00	93	5	58.34	60
65.00	101	5	60.73	60
70.00	108	5	63.02	66
75.00	116	5	65.23	66
80.00	124	5	67.37	66
85.00	132	5	69.44	72
90.00	139	5	71.46	72
95.00	147	5	73.42	72
100.00	155	5	75.32	78
105.00	162	5	77.18	78
110.00	170	5	79.00	78
115.00	178	5	80.77	78
120.00	186	5	82.51	84
125.00	193	5	84.21	84
130.00	201	5	85.88	84
135.00	209	5	87.52	90
140.00	217	5	89.12	90
145.00	224	5	90.70	90
150.00	232	5	92.25	90
155.00	240	5	93.78	96
160.00	248	5	95.28	96
165.00	255	5	96.75	96
170.00	263	5	98.21	96
175.00	271	5	99.64	102
180.00	279	5	101.06	102
185.00	286	5	102.45	102
190.00	294	5	103.83	102
195.00	302	5	105.18	108
200.00	309	5	106.52	108
205.00	317	5	107.85	108
210.00	325	5	109.15	108
215.00	333	5	110.44	108
220.00	340	5	111.72	114
225.00	348	5	112.72	114
230.00	356	5	114.23	114
235.00	364	5	115.47	114
240.00	371	5	116.69	114
245.00	379	5	117.90	120
250.00	387	5	119.10	120
255.00	395	5	120.28	120
260.00	402	5	121.46	120
265.00	410	5	122.62	120
270.00	418	5	123.77	120
275.00	425	5	124.91	120
280.00	433	5	126.04	132
285.00	441	5	127.16	132
290.00	449	5	128.27	132

## Appendix C: Resources

### Oklahoma Water Resources Board (OWRB)

The OWRB website is available at [www.owrb.ok.gov](http://www.owrb.ok.gov):

- Oklahoma Comprehensive Water Plan—The 2012 OCWP *Update* is available at: <http://www.owrb.ok.gov/ocwp>. From this link, the 2012 OCWP *Executive Report*, the OCWP Watershed Planning Region Reports, the OCWP Study Workgroup and Supplemental Reports, Technical Background Reports, and other OCWP information and reports are available.
- OWRB Water Use Laws and Procedures—appropriation and use of stream water (Ch. 20), the taking and use of groundwater (Ch. 30), information on financial assistance (Ch. 50), and other water-related rules.
- OWRB Financial Assistance Programs (FAP)—water and wastewater project financing information, Oklahoma Funding Agency Coordinating Team (FACT) documents, and the Loan and Grant Resource Guide.

### Oklahoma Department of Environmental Quality (ODEQ)

The ODEQ website is available at [www.deq.state.ok.us](http://www.deq.state.ok.us):

- ODEQ Rules and Regulations—Title 252, Chapter 626 outlines construction requirements and general design guidelines for all aspects of drinking water (from source development to distribution). Chapter 631 requires public water systems to meet EPA's standards. Chapter 633 outlines the DWSRLF program. Chapter 710 provides information on water and wastewater staffing and operators.
- Water Quality Division Programs—Public water supply information, including the Safe Drinking Water Information System (SDWIS), Operator Certification, Source Water Protection, and Water facility construction permit information, annual compliance reports, consumer confidence reports, water system security, forms, and some EPA guides.

### U.S. Environmental Protection Agency (EPA)

The EPA website is available at [www.epa.gov](http://www.epa.gov).

- EPA water page: [www.epa.gov/gateway/science/water.html](http://www.epa.gov/gateway/science/water.html)
- EPA water regulations main page: [www.epa.gov/lawsregs/topics/water.html](http://www.epa.gov/lawsregs/topics/water.html)
- EPA Safe Drinking Water Act (SDWA) page: [water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm](http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm) —includes links to the laws, guidance, and fact sheets.
- EPA National Primary and Secondary Drinking Water Regulations: [water.epa.gov/drink/contaminants/index.cfm](http://water.epa.gov/drink/contaminants/index.cfm) —provides a list of contaminants and their MCL.
- EPA Small Public Water System main page: [water.epa.gov/type/drink/pws/smallsystems/](http://water.epa.gov/type/drink/pws/smallsystems/) —designed to aid small systems with technical assistance and capacity development.
- EPA Regulations 101 page: [water.epa.gov/type/drink/pws/smallsystems/regulations\\_101.cfm](http://water.epa.gov/type/drink/pws/smallsystems/regulations_101.cfm) —designed to aid small systems in understanding key regulations.
- EPA LT2ESWTR Toolbox Guidance Manual: [www.epa.gov/safewater/disinfection/lt2/pdfs/guide\\_lt2\\_toolboxguidancemanual.pdf](http://www.epa.gov/safewater/disinfection/lt2/pdfs/guide_lt2_toolboxguidancemanual.pdf)
- EPA National Service Center for Environmental Publications (NSCEP): [www.epa.gov/nscep/](http://www.epa.gov/nscep/) —provides free EPA print and digital documents using the search feature. One document reviewed in preparation of this guide was Manual of Small Public Water Supply Systems.
- EPA Guidance, Guides and Manuals home page: [water.epa.gov/infrastructure/sustain/Guides.cfm](http://water.epa.gov/infrastructure/sustain/Guides.cfm) —provides links to publications on water rates including several that specifically target water rates for small systems.
- EPA LT2ESWTR Toolbox Guidance Manual document: [www.epa.gov/safewater/disinfection/lt2/pdfs/guide\\_lt2\\_toolboxguidancemanual.pdf](http://www.epa.gov/safewater/disinfection/lt2/pdfs/guide_lt2_toolboxguidancemanual.pdf) —provides technical information on applying the “Toolbox” of Cryptosporidium treatment and management strategies that are part of the LT2ESWTR. Information ranges from watershed management programs to specific treatment technologies.
- EPA Alternative Disinfectants and Oxidants Guidance Manual: [www.epa.gov/safewater/mdbp/alternative\\_disinfectants\\_guidance.pdf](http://www.epa.gov/safewater/mdbp/alternative_disinfectants_guidance.pdf) —offers technical information on disinfectants and oxidants not as widely used as chlorine.
- EPA Sustainable Infrastructure Tool Kit page: [water.epa.gov/infrastructure/sustain/toolkit.cfm](http://water.epa.gov/infrastructure/sustain/toolkit.cfm) —contains several links to publications on management, full cost pricing, water efficiency, and approaches. Also contains links to several of the Simple Tools for Effective Performance (STEP) Guide Series. The Setting Small Drinking Water System Rates for a Sustainable Future, Small Systems Guide to Safe Drinking Water Act, A Small Systems Guide to the Total Coliform Rule, Strategic Planning: A Handbook for Small Systems, and Microbial and Disinfection Byproducts Rules Simultaneous Compliance Guidance Manual are some examples of references available.

### U.S. Geological Survey (USGS)

The USGS is available at [www.usgs.gov](http://www.usgs.gov).

- USGS Water Resources page: [www.usgs.gov/water](http://www.usgs.gov/water).
- USGS Maps, Imagery, and Publications page: [www.usgs.gov/pubprod/](http://www.usgs.gov/pubprod/) —printed maps can be purchased or digital topographic maps can be downloaded to use as a base map for planning activities.



## U.S. Census Bureau

The U.S. Census Bureau website, [www.census.gov](http://www.census.gov), provides information on historical population and household economic information.

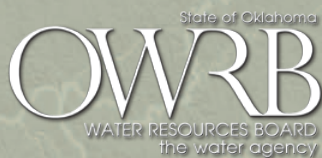
## Oklahoma Department of Commerce

The Oklahoma Department of Commerce website, [www.okcommerce.gov/](http://www.okcommerce.gov/), provides historical measurements, between census estimates, and projections for population.

## Other State References

While other states' specific rules and regulations may be different from Oklahoma's, the technical information may be useful and provide a slightly different perspective during the planning process.

- Missouri Department of Transportation, Value Engineering Program page: [www.modot.mo.gov/ValueEngineering/](http://www.modot.mo.gov/ValueEngineering/) —offers information on how to conduct a systematic process of review and analysis of a project.
- Washington State Department of Health, Division of Environmental Health, Office of Drinking Water page: [www.doh.wa.gov/ehp/dw/default.htm](http://www.doh.wa.gov/ehp/dw/default.htm) —offers several publications on planning and water use efficiency including Small Water System Management Program, Water System Plan, and Water System Design.



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