CITY OF MOSES LAKE
WATER SYSTEM PLAN
TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATIONS

The following abbreviations are used in this report:

AC	**Asbestos-Cement**
ADD	**Average Daily Demand**
APWA	**American Public Works Association**
ASTM	**American Society for Testing and Materials**
CCS	**Cross Connection Specialist**
CI	**Cast Iron**
CWSP	**Coordinated Water System Plan**
CWSSA	**Critical Water Supply Service Area**
D/DBP	**Disinfection/Disinfection Byproducts**
DI	**Ductile Iron**
DOE	**Department of Ecology**
DOH	**Department of Health**
ECV	**Electronic Control Valves**
ERU	**Equivalent Residential Unit**
ft	**Feet**
gpm	**Gallons per Minute**
HGL	**Hydraulic Grade Line**
ISO	**Insurance Services Office**
MCL	**Maximum Contaminant Level**
MDD	**Maximum Day Demand**
MG	**Million Gallons**
MGD	**Million Gallons per Day**
MSL	**Mean Sea Level**
NISP	**Not in Service Presently**
PHD	**Peak Hour Demand**
ppb	**Parts Per Billion**
ppm	**Parts Per Million**
PRV	**Pressure Reducing Valve**
psi	**Pounds per Square Inch of Pressure**
PVC	**Polyvinyl Chloride**
SDWA	**Safe Drinking Water Act**
SEPA	**State Environmental Policy Act**
SOC	**Synthetic Organic Compounds**
TCE	**Trichloroethylene**
UFC	**Uniform Fire Code**
UGA	**Urban Growth Area**
USGS	**United States Geological Survey**
VFD	**Variable Frequency Drive**
VOC	**Volatile Organic Compounds**
WAC	**Washington Administrative Code**
WDM	**Water Distribution Manager**
WFI	**Water Facility Inventory**
WSP	**Water System Plan**
WSRB	**Washington Survey and Rating Bureau**

EXECUTIVE SUMMARY

The 2006 City of Moses Lake Water System Plan (WSP) was developed to provide an analysis of the current condition and status of the water utility and to provide guidance to the Moses Lake City Council, City Management, and staff in preparation for the next 20 years of utility service. The plan should be considered a "living" document, in that specific actions and recommendations may need to be tailored or modified to future needs and growth as they occur. The plan does, however, provide the necessary framework for the City to respond to changes.

The plan looks closely at the specific needs of the utility over the next 6 year period and describes the general needs for the next 20 year period as required by the Washington State Department of Health (DOH).

Planning Considerations

Existing land use information and population projections provided by the Community Development Department were used to develop the plan. Consideration and discussion of the Grant County Coordinated Water System Plan (CWSP) and adjacent water purveyors is included in the plan. These were reviewed to specifically describe and evaluate how the Moses Lake system relates to the regional plan and identify opportunities for cooperation to strengthen the regional water system through water system interties.

The planning period and data shows significant expansion of the existing service area. The impacts of this expansion are discussed. The 2005 water service area population of 20,650 is expected to increase at an annual rate of 3 percent to 24,657 in 2011 and 37,296 by 2025. The growth is due to service area expansion engulfing existing areas and also new (incoming) populations. It is assumed that this increase will cause water demands to increase proportionately.

System Inventory and Evaluation

All of the Moses Lake wells, pump stations, and reservoirs were visited and evaluated as part of the planning process. Most equipment and facilities were in good operating order; however, the need for preventive maintenance and rehabilitation was apparent at some locations.

The City has 18 well locations of which 17 are currently in use. Three of the active wells and the inactive well are drawing water from multiple aquifers and will have to be rehabilitated to draw water from a single aquifer in the future.

All reservoirs appear to be serviceable for future use. The interiors of all eight standpipes have been painted since 1990.

The existing distribution system is considered adequate at present; however, recommendations for a future replacement schedule were made.

The current level of system control and telemetry is adequate for flexible operation, but technology is available to streamline the system. Therefore, the City is converting to a programmable logic controller (PLC) system for both the control and telemetry systems.

Water Resources

The plan includes a brief description of the Quincy Groundwater Subarea, which supplies water to each of the Moses Lake wells. Issues of wellhead protection and groundwater management are discussed. Water resource recommendations include participation in regional groundwater protection programs as well as continuation of a wellhead protection program. Existing water rights are adequate for 2006 conditions, but will not meet the 2025 projected demands. Therefore, all available options for obtaining additional water rights are being pursued.

The Moses Lake water system will continue to be a groundwater supplied system, relying on sufficient supply to meet all customer demands. This approach can only be effective by maintaining a reliable multiple well system.

Design Criteria

Criteria for the Moses Lake water system design and performance are identified in the plan. In all cases, the criteria meet, and often exceed, the minimum standards of the DOH for water system performance.

Water System Analysis

The Moses Lake water distribution system was hydraulically modeled using the WaterCad computer analysis software. Analysis was done for average daily demand,

maximum daily demand, maximum daily demand plus fire flow, and peak hourly demand conditions under present and future conditions. The results of the analysis indicate that the current Moses Lake distribution system is sufficient and will meet the utility's needs for the future with minor improvements. However, significant piping improvements are required to service area expansions. Generally these improvements are installed by property owners requesting service.

Water system supply is presently adequate to meet demands, but a couple of zones are in need of additional supply to provide a comfortable level of redundancy. A schedule for well improvements is presented in the Water System Plan.

Existing storage is adequate to meet fire flow conditions in all pressure zones; therefore, no immediate storage improvements are required, although some improvements may be recommended to improve conditions.

Capital Improvement Program

The plan identifies significant capital improvements for the planning period primarily to meet growth demands. Estimated costs and an implementation schedule for capital improvements identified in the planning process are documented. Key elements of the 6-year Capital Improvement Program (CIP) include additional wells, pump stations, storage, and piping improvements.

Financial Evaluation

A review of Moses Lake financial records from 2001 through 2005 is provided. Records indicate the water utility revenues exceed costs during the period. The combined water and sewer fund balance was 2.4 million dollars at the beginning of 2006. Expenses for operation of the water utility have remained stable over this period and are expected to remain stable. The identified water system CIP is 7.78 million dollars (2006 value) over the next six years. CH^{2}M Hill reviewed the water rate structure including system development charges in 1995.

Operations Program

Included within the plan is documentation and discussion of the current water utility organization and operation.

Chapter 1

Description of Water System

1-1 Ownership and Management

The City of Moses Lake water system is a municipal water system that is referenced by the Washington State Department of Health identification number 56300X.

The organizational chart for the Moses Lake Water Division is shown in Figure 6-1. The Water Division is under the direct supervision of the Public Works Superintendent, who reports to the Municipal Services Director. The Public Works Superintendent is responsible for the Wastewater, Street, Building Maintenance, and Equipment Rental Divisions of the City in addition to the Water Division.

The Water Division Supervisor oversees the water utility and reports directly to the Public Works Superintendent. The Water Division Supervisor currently has seven full-time staff members under his direction, including the Water Division Foreman.

A copy of the current Water Facilities Inventory (WFI) is included in Appendix A.

1-2 System Background

The City of Moses Lake was incorporated in 1938 with a population of 302. The City experienced an early period of rapid growth peaking at a population of 12,662 in 1962. From 1962 until 1990 the City experienced a short decline in population followed by a long stable period. Since then the City has seen a steady increase in its population from 10,960 in 1990 to an estimate of 16,830 by the Washington State Office of Financial Management (WSOFM) for 2006.

The period of early rapid growth began in 1943, when an Army bomber base was established to the north of the city. At the conclusion of World War II, the base was deactivated. In 1948, the base was reactivated as Larson Air Force Base. Activities that contributed to growth and development in the area included the reactivation of Larson Air Force Base, the construction of the Columbia Basin Irrigation and Reclamation Project, the construction of the Boeing Test Center, Activation of the Spokane Air Defense Sector (SAGE) Automatic Radar Installation, utilization of Larson Air Force Base by the Strategic Air Command and the development of nine Titan missile bases and the construction associated with their installation. All of these factors were responsible for the 1962 population peak.

Following the 1962 population peak, the population of the city entered a period of decline driven by the following reasons:

- The closure of the Boeing Test Center in 1959
- Withdrawal of the 62nd Air Force Cargo Squadron in 1959
- Deactivation of the Spokane Air Defense Sector and the Titan missile bases in 1964
- Closure of Larson Air Force Base in 1966

Despite the adverse economic impacts upon the City of Moses Lake, the city population has remained stable ranging from a population in 1970 of 10,310 to a population in 1990 of 10,960. The Office of Financial Management estimates the 2006 population of Moses Lake to be approximately 16,830. The stability of the community has been due to a strong and stable agricultural base, the diversification and expansion of agricultural related industry, an expanding base of non-agricultural industry, and the expansion of the service sector of the local economy.

Continued growth in agricultural related industry, non-agricultural industry, and the service sector will continue to positively influence the community resulting in continued annual commercial, industrial, and residential growth with a corresponding population increase.

The City of Moses Lake is located in Grant County, Washington, on Moses Lake. It is situated adjacent to U.S. Interstate 90 approximately 176 miles east of Seattle, 100 miles west of Spokane, and 83 miles north of Pasco. The terrain is rolling and the climate is semi-arid, with annual average rainfall of approximately 8 inches. The rolling terrain surrounding Moses Lake results in the service area being divided into several pressure zones.

The City of Moses Lake is the largest potable water purveyor in Grant County. Several smaller water purveyors are located within the boundary and adjacent to the external boundary of the Moses Lake water system services area. The maps in Appendices D & N show the locations of these purveyors. The majority of these small purveyors are mobile home parks or small residential areas, which have developed their own wells for the water supply. Some of the larger internal purveyors, such as Basin Water Sources, are located in the Knolls Vista area.

The sections of the Municipal Code governing the water system and the Community Street and Utility Standards are included in Appendices B and C, respectively.

1-3 Inventory of Existing Facilities

The Moses Lake water system is supplied with groundwater by a system of wells and associated pump stations. All the pump stations include chlorination equipment for disinfection. Standpipes are used for equalizing storage, standby storage, and fire flows. Control valves give the system additional flexibility. A piping distribution network links the pumping and storage facilities with the end users. System controls and telemetry allow the system operators to efficiently manage the facilities.

The City does not have any interties with other area water systems.

All of these facilities are described in the following paragraphs.

1-3.1 Wells and Pumps

An inventory of the well head pump stations and associated equipment is shown on Table 1-1. Information on the wells, including water depths is presented in Chapter 3. Well/pump station locations are shown on the map in Appendix N. There are two existing booster pumps in the system that are capable of boosting flows from a lower pressure zone to a higher pressure zone.

A table listing the addresses of these sites is included in Appendix A.

1-3.2 Storage

Data on the water storage facilities is shown on Table 1-2. The storage locations are shown on the map in Appendix N. A table listing the addresses of these sites is included in Appendix A.

1-3.3 Pressure Reducing Valves

The map in Appendix N shows locations of the pressure reducing valves. As a rule, these valves are used to regulate pressure when it is necessary to transfer water from one pressure zone to another; therefore, these valves are generally located at the pressure zone boundaries. A table listing the addresses of these sites is included in Appendix A.

1-3.4 Electric Control Valves

Electric control valves (ECV) in the distribution network, although rarely used, provide the system with the ability to combine pressure zones quickly. These valves are found at various locations in the system between pressure zones. Currently, the Grape Drive ECV is the only site controlled and monitored by the telemetry system. A table listing the addresses of these sites is included in Appendix A.

1-3.5 Chlorination Equipment

Every active pump station in the Moses Lake water system is disinfected. Disinfection is accomplished with sodium hypochlorite that is introduced into the system at the well sites through pumps that provide a constant initial concentration of chlorine.

Table 1-1
City of Moses Lake - Water Supply Facilities

Hydraulic Zone	Well No.	Year Installed *	Motor Size (Hp)	Pump at Well Site	Actual Flow (gpm)	Total Zone Capacity (gpm)
Lakeview	11	1999	200	Ingersoll Dressor 12KKHx10	1,130	
	12	1998	200	Peabody Floway 14DKHx4	1,990	3,120
Montlake	8	1992	150	Peabody Floway 12DKHx7	680	680
Central	4	1972	125	Peerless 12MAx6	930	
	7	1997	200	Byron Jackson 11MQHx9	910	
	10	2005	250	Layne & Bowler 14KH-Mx7	1,720	
	31	1975	150	Peerless 10HHx12	NISP	3,560
Knolls Vista	3	1953	125	Johnston 12CCx8	760	
	9	2001	250	Goulds 12CHCx9	1230	
	14	1993	250	Bryon Jackson 12MQHx8	630	2,620
Larson	21	1993	100	Gould 8RJHC	690	
	23	1999	250	Ingersoll-Dresser 12H135x10	1,480	
	24	2003	250	Peabody Floway 14DKHx5	1,790	
	28	1992	250	Layne & Bowler 10FHHx19	1,640	
	29	1955	50	Byron Jackson KHHx8	700	6,300
Wheeler	17	1995	500	Byron Jackson 12HQRHx14	2,000	
	18	2004	250	Ingersoll-Dressor 14M160x5	2,000	4,000
Moses Pointe	19	N/A	50	Berkeley 8T 725x3	520	520
					TOTAL	20,800

NISP - Not In Service Presently

*Most recent year that the pump was installed, rebuilt, or removed from the hole and inspected.

Table 1-2
City of Moses Lake
Water Storage Facilities

Hydraulic Zone	Storage ID Number	Diameter (ft)	Height to Overflow (ft)	Ground Elevation (MSL)	Overflow Elev. (MSL)	Head Range (ft)	Total Storage (MG)	Usable Storage [a](MG)	Total Zone Usable Storage (MG)
Lakeview	R-5	46.00	153	1,192	1,349	40.0	1.90	1.15	
	R-8	46.00	155	1,190	1,349	40.0	1.90	1.15	2.30
Wheeler	R-6	48.00	152	1,229	1,381	40.0	2.06	1.33	1.33
Montlake	R-2	42.75	96	1,178	1,274	40.0	1.03	0.55	0.55
Central	R-1	52.50	69	1,151	1,220	40.0	1.12	0.68	
	R-4	64.00	134	1,086	1,220	40.0	3.22	1.02	1.70
Knolls Vista	R-3	42.75	96	1,164	1,260	40.0	1.03	0.56	0.56
Larson	T-2	40.00	115	1,188	1,303	27.0	0.25	0.25	
	T-3	40.00	118	1,175	1,293	27.0	0.25	0.25	
	T-5	26.00	138	1,153	1,291	19.0	0.075	0.075	
	R-7	62.00	118	1,182	1,300	30.0	2.66	0.95	1.525
System Total									7.965

Note:
T - identifies storage as an elevated tank
R - identifies storage as standpipe
[a] Usable storage determined from 20 psi service pressure as discussed in Chapter 3

1-3.6 Distribution System

The map in Appendix N shows the existing distribution network for the Moses Lake system. Pipe materials in the existing distribution system include ductile iron, cast iron, steel, asbestos cement (AC) and polyvinyl chloride (PVC).

The Larson area pipe materials vary. The northern one-third of the Larson area is mostly cast iron. The center one-third of the area is generally steel, and the southern one-third is AC.

The remainder of the City water system has a mixture of AC, cast iron, and PVC. Staff estimates that the mix is approximately 48 percent AC, 30 percent iron/steel, and 22 percent PVC. All new pipe installations since 1983 have been AWWA C900 PVC.

1-3.7 System Controls

The water system generally is monitored at the Water Division shop, which is located at 11789 Road 4 NE. Radio telemetry is used to communicate with all pumps, reservoirs, and the Grape Drive electric control valve. The operation of this system is discussed in detail in Chapter 6.

The computer used for telemetry at the Water Division shop records all information received from the remote sites, such as reservoir levels, pump station flow rates, system pressure, well levels, and alarms. The controls allow remote, local, and automatic starting and stopping capabilities of any pump.

1-4 Related Plans

1-4.1 Coordinated Water System Plan

In 1999 Grant County updated the 1982 Coordinated Water System Plan (CWSP). The CWSP was written for areas within the Quincy Groundwater Subarea, in accordance with the requirements of the public Water System Coordination Act of the Revised Code of Washington. The document includes recommended review procedures, minimum design requirements, designated service areas, and other provisions as required by law. The CWSP also addresses the regional resource issues related to the existing and future needs of public water systems within the Grant County Critical Water Supply Service Area (CWSSA). The CWSP provides recommendations for actions the County and water utilities within the area should take to address immediate and long-term water resource issues.

Several objectives were established by the County Commissioners and the Water Utility Coordinating Committee for the CWSP. The objectives that guided the development of the CWSP, which are of interest to the City of Moses Lake, are that the CWSP should:

- Be established and utilized by water utilities as the framework for providing utility service to future growth within the CWSSA.

- Establish uniform procedures for the review and approval of all water service for new development, while discouraging the proliferation of new public water systems in designated service areas within the CWSSA.

- Ensure that the policies and procedures of the CWSP complement the policies regulating land use.

- Identify service areas of responsibility for water utilities which will improve their planning and management abilities

The findings of the CWSP, which are of interest to the City of Moses Lake, are summarized as follows:

- Development of minimum design standards and uniform procedures to evaluate water service requirements.

- Designated service areas and service area agreements were developed to allow utilities to document and commit to providing service to defined areas.

- The availability of shared or intertied regional facilities is utilized on a limited basis. The potential use of additional interties will improve reliability and performance of service.

Recommendations listed in the CWSP, which are of interest to the City of Moses Lake, are as follows:

- All systems should constantly review and modify their Capital Improvement Plans to maximize the benefits of shared facilities and interties. As these projects are identified, they should be submitted for DOH approval as a supplement to individual water system plans and the CWSP.

- A unified leak detection program should be developed to help minimize costs to individual water purveyors.

- Conservation practices should be implemented. Education of water use and effective conservation methods is a good way to promote the reduction of water usage.

- The wellhead protection program once completed, should be used to educate communities in their future development and water usage.

The City's WSP is compatible with this plan and no inconsistencies were identified.

1-4.2 Grant County Comprehensive Plan

The City's WSP is compatible with this plan and no inconsistencies were identified.

1-4.3 City of Moses Lake Sewer System Master Plan

The City's WSP is compatible with this plan. The only differences identified are related to existing and future populations and service area boundaries. These items will be changed in the Sewer Plan to be consistent with the other plans when it is updated.

1-4.4 City of Moses Lake Comprehensive Plan

The City's WSP is compatible with this plan and no inconsistencies were identified.

1-5 Existing Service Area Characteristics

The existing service area for the City of Moses Lake water system is shown in Appendix N. This area is based upon the most recent drawings of the water system. The service area is divided into these distinct pressure zones:

- Wheeler
- Lakeview Terrace
- Montlake
- Central
- Knolls Vista
- Larson
- Moses Pointe

Zoning and land use designations for the property inside the existing and future service areas are shown in Appendix G.

1-6 Future Service Areas

The future service area for the City of Moses Lake water system is shown in Appendix N.

The boundary shown in the map in Appendix N is consistent with the current City of Moses Lake's Urban Growth Area as defined by the Grant County Comprehensive Plan and the Service Area Agreement included in the 1999 Grant County Coordinated Water System Plan (CWSP).

The City has a policy of not extending water and sewer services beyond the Urban Growth Area boundary. The process for amending this boundary is described in Chapter 2 of the County's Comprehensive Plan and Chapter 10 of the City's Comprehensive Plan.

1-7 Service Area Agreements

In 1999 the Grant County Board of Commissioners adopted an updated version of the Grant County Coordinated Water System Plan for this critical water supply service area.

A copy of the Service Area Agreement and a list of all of the water systems who have signed the agreements are included in Appendix D. The map in Appendix D indicates the service area boundaries of all the systems that have completed service area agreements.

1-8 Service Area Policies

Title 13 of the Moses Lake Municipal Code lists city policies for the water utility. Title 13 of the Municipal Code and a Utility Service Request are included in Appendix B.

1-9 Satellite Management Agencies

The City of Moses Lake has no intentions of becoming a Satellite Management Agency.

1-10 Conditions of Service

Several conditions are required for an applicant to receive water service from the City of Moses Lake. First, the property to be served must be located in the City's Urban Growth and Water Service/Retail Service Areas. These areas are typically identical and City attempts to keep these areas as consistent as much as possible. Second the applicant must complete an Utility Service Request form, which is included in Appendix B. The City then provides a timely response, typically within two to five days, informing the applicant of any costs that will need to be paid to the City to connect to the existing system. These include costs for meters, tapping/connecting to the existing main, filling/flushing new main, sampling, system development charges, and reimbursements for existing improvements. If the property is located outside of the City's corporate limits, the applicant must request approval from the City Council to connect to the system. This request is granted with the stipulation that the property to be served must be annexed into the City if its location permits it or the owner signs an annexation agreement. Next the applicant is required to pay for tapping/connecting (Moses Lake Municipal Code Chapter 3-58), filling/flushing (MLMC 3.58), sampling (MLMC 3.58), and reimbursement charges (MLMC 13-08) and construct the improvements necessary to provide adequate service to the property. Finally, the applicant is required to pay any applicable meter costs (MLMC 3.58) and system development charges (MLMC 3.62) prior to obtaining water service. All of the referenced Moses Lake Municipal Codes are included in Appendix B.

1-11 Complaints

Currently, the Water Division handles customer complaints on a case-by-case basis. At this time there is no formal record keeping system to record the number and nature of the complaints or the corrective action taken by the Water Division, though discussions have been held regarding the creation of such a system. Complaints concerning water billings are directed to the Finance

Department.

Chapter 2

Basic Planning Data and Water Demand Forecasting

2-1 Current Population, Service Connections, Water Use, and Equivalent Residential Units

2-1.1 Current Population and Service Connections

As of November 7, 2006 the City of Moses Lake's water system had 7647 connections serving an estimated population of 20,650. According to the 2000 Census the area served by the City's water system had an average population of approximately 2.7 persons per household. A breakdown of the total number of service connections are as follows:

Single-family	6235
Multi-family*	323
Commercial/Governmental/Industrial	1089

*This includes connections to duplexes, apartments, and mobile home parks.

2-1.2 Water Use Data Collection

The City of Moses Lake's water system meets all of the criteria set forth in the Conservation Planning Requirements and the Water Use Data Collection Requirements Checklist. The City has meters at all sources of supply which allow them to record monthly and annual production of each source and maximum day and peak month demands of the system. The City also measures water consumption at all service connections, which allow them to calculate monthly and annual consumption and unaccounted for water. The Water Division has monthly estimates of several accounted for non-revenue water uses. This information is used throughout this document and is summarized in Appendix L. The City collects separate monthly totals for single-family, multi-family, and commercial/governmental/industrial consumption**.**

The criteria for water use data collection in the Conservation Planning Requirements and the Water Use Data Collection Requirements Checklist are included in Appendix L.

2-1.3 Equivalent Residential Units

The Moses Lake Water System served approximately 15,309 Equivalent Residential Units (ERU's) in 2005. This total is broken down in Table 2-1

TABLE 2-1

Consumption, Service Connections, and ERU's by Customer Class (Ave. # of connections in 2005)				
	ADD (gpm)	No. of Service Connections	ERU's	Percent of Total System
Single Family	2,070	5,814	5,814	38.0
Multi-Family	85	170	240	1.6
Residential Subtotal	2,155	5,984	6,054	39.6
Industrial/Commercial/ Governmental	2,520	1,323	7,078	46.2
Non-revenue water	775	N/A	2,177	14.2
TOTAL SYSTEM	5,450	7,307	15,309	100.0

The physical capacity, expressed in ERU's, of the individual system components are described in Table 2-2.

Table 2-2
Physical Capacity of System Components in ERU's

FACILITY	PHYSICAL CAPACITY (ERU's)
Source Capacity	22,242
Treatment Capacity	N/A
Equalizing Storage Capacity	27,233
Standby Storage Capacity	29,868
Distribution Capacity	*
Transmission Capacity	*
Current Water Usage (2005)	15,309
Projected Water Usage (2011)+	18,280
Projected Water Usage (2025)+	27,650

* Hydraulic modeling has been performed on the system and deficiencies are addressed in Chapter 3
+ Based on 3% annual growth

For the system to meet projected water demands, the City will need to obtain additional water rights and increase both source and storage capacities.

2-2 Projected Land Use, Future Population, and Water Demand

2-2.1 Projected Land Use

The City of Moses Lake water system's future service area boundary as set by the Grant County Comprehensive Plan is shown on the map in Appendix N. The service area is divided into these distinct pressure zones:

- Wheeler
- Lakeview Terrace
- Montlake
- Central
- Knolls Vista
- Larson
- Moses Pointe

The boundary shown in Appendix N is consistent with the City of Moses Lake's Urban Growth Area (UGA) as defined by the Grant County Comprehensive Plan and the Service Area Agreement included in the 1999 Grant County Coordinated Water System Plan (CWSP). The boundary encompasses several smaller purveyors which, in general, are mobile home parks or small residential areas with their own wells that are not served by City water. A map from the CWSP and a list of the owners and phone numbers for these private water systems is included in Appendix D.

Several areas are seen as expansion areas for the water system, as shown in Appendix N. The area south of I-90 is expected to be developed as light industrial and residential. Significant expansion west of the City is also expected, and a development entitled Moses Pointe has been proposed in this vicinity. It is also possible that significant residential development in the Cascade Valley area will result in this area being added to the water system.

Land use patterns in the City of Moses Lake are driven primarily by the location and character of industries that have developed. The Wheeler corridor is expected to continue developing as an area associated with industrial land use. The Larson area has been and should continue to develop as a high technology, industrial area. The Central pressure zone includes the business district and older residential areas.

Pressure zones that are primarily residential are Lakeview Terrace, Montlake, Knolls Vista, and Moses Pointe. Residential development should continue in these areas, with substantial residential development expected in the Knolls Vista area. Major residential subdivisions are also likely south, east, and west of the City.

The Paxson Platt Water Association and Basin Water Sources, Inc. are the only internal purveyors (independent purveyors who are surrounded by the Moses Lake water system) that are anticipated to connect to the City system in the next 10 years. The Paxson Platt water system is struggling with an inadequate water supply due to a declining water table. They are applying for grants to cover the costs of connecting to and extending the City’s system to serve their area. The owner of Basin Water Sources, Inc. is attempting to sell the system and the City is a potential buyer.

The assumption that no other purveyors will connect to the City's system is supported by past proposals from some of these internal purveyors to enter the system. None of these proposals have been accepted by the City. Problems associated with the union of the Moses Lake system with these internal purveyors are related to differences in construction standards, which would result in the City having to make major capital improvements after absorption of the purveyor. Differences in valuation of these other facilities have also hindered this process.

2-2.2 Projected Population

The City and Grant County Comprehensive Plans both assume an annual population growth of 3.0 percent for the 20 year planning period. Population forecasts for the incorporated UGA, unincorporated UGA, and the entire service area are summarized in Table 2-3.

Table 2-3
Population Estimates and Projections 2005 - 2025
Incorporated UGA and Unincorporated UGA

Year	Incorporated UGA	Unincorporated UGA	Planning Area Population
2005	16,340	10,315	26,655
2011	19,511	12,317	31,827
2025	29,512	18,630	48,142

2-2.3 Projected Non-Revenue Water

The goal for unaccounted water in a system of this size is below 10 percent. The Moses Lake water system had non-revenue water totaling approximately14.2 percent of production in 2005. Of this total it is estimated a little over half or 8.3 percent was unaccounted for water due to leaks. This places the City's system below the 10 percent criteria, but the Water Division continues to scrutinize and evaluate the water system's status in terms of:

- detection and repair of leaks
- replacement of faulty meters
- meter reading and proper recording

A table of monthly estimates of unaccounted water is included in Appendix L.

2-2.4 Water Rates

The existing water rate schedule is provided in Appendix B. The existing rate structure and proposed changes are discussed in further detail in Chapter 9.

2-2.5 Water Demand Forecasting

For forecasting future water needs a 3.0 percent annual increase in demand was used, which is consistent with population growth projections for the Moses Lake area.

Table 2-4 includes the 6 and 20 year forecasts for population, ERU's, service connections, average daily demand (ADD), maximum daily demand (MDD), peak hour demand (PHD), and annual consumption.

TABLE 2-4
FUTURE WATER DEMANDS

YEAR	POPULATION	ERU'S	SERVICE CONNECTIONS	ADD (MGD)	MDD (GPM)	PHD (GPM)	ANNUAL CONSUMPTION (AC-FT)
2005	20,650	15,309	7,307	7.85	11,390	18,225	8,793
2011	24,657	18,280	8,725	9.37	13,600	21,760	10,499
2025	37,296	27,650	13,197	14.18	20,570	32,915	15,881

YEAR	Source Capacity (mgal/day)	Source Capacity (gpm)	Water Rights Qi (gpm)	Water Rights Qa AC-FT/YR
2005	30.0	20,800	27,405	9,304
2011	33.2	23,050	27,405+	10,500+
2025	44.0	30,550	33,000+	15,900+

The City currently has 12,204 acre-feet of certified, permitted, and claimed water rights. Assuming all of these water rights are valid and a 3.0 percent annual increase in water demand, the City should have adequate water rights until 2016. The City continues to explore several options for obtaining additional water rights in the Quincy Subarea and also from the Bureau of Reclamation. This is discussed in further detail in Chapter 4.

Chapter 3

System Analysis

3-1 System Design Standards

The City of Moses Lake actively participated in the 1999 update of the Grant County CWSP. Minimum water system standards were developed as part of the update of the CWSP approved by the Board of County Commissioners and DOH. The standards established in the CWSP are considered the minimum standards permitted for all new and expanding water systems located in the CWSSA.

For purposes of emphasis, additional detail, and/or more stringent requirements the City supplements the CWSP standards with the City of Moses Lake Community Street and Utility Standards as included in Appendix C.

The City of Moses Lake also uses the following documents for guidance in the design, review, and construction of new facilities added to the system.

- Washington State DOH's Water System Design Manual
- Recommended Standards For Water Works (10 State Standards)
- Washington State DOT's Standard Specifications for Road, Bridge, and Municipal Construction
- Standard Specifications of the American Water Works Association

3-2 Water Quality Analysis

The City of Moses Lake's water source is groundwater from the Quincy Groundwater Subarea, which generally consists of the shallower Wanapum aquifer and the deeper Grande Ronde aquifer. This resource has provided the City with adequate water quality and quantity throughout the years. The City presently has 18 well sites tapping into the aquifers for its water supply source. All of the wells pump water directly into the distribution system. A copy of the City of Moses Lake Water Quality Report for 2006 is included in Appendix F.

The water from the two aquifers have very different characteristics. Water from the Wanapum, or upper, aquifer is hard (65-225 mg/l as CaCO3) with low sodium (17.5-57 mg/l) and fluoride levels(<1.0 mg/l). Water from the Grande Ronde, or lower, aquifer is soft (<14 mg/l as CaCO3) with high sodium (73-93 mg/l) and fluoride levels (2.17-2.55 mg/l).

Inorganic samples taken in 2006 indicated that four wells (Wells 3, 7, 9, and 11) exceeded the secondary level of 2.0 mg/l of fluoride. The City issued a public notification that described the level of fluoride in the drinking water, the problems associated with high fluoride levels, and how to get additional information on the subject.

The City maintains a minimum chlorine residual of 0.5 ppm throughout the system and has not had an unsatisfactory bacteria sample result since full-time chlorination was started in January 1998.

3-3 System Description and Analysis

In Chapter 3 the Moses Pointe area is evaluated as part of the Central pressure zone. Currently, the area has experienced limited development in the lower elevations of the project. Therefore, the Central zone provides adequate pressure and service. Once the development reaches 225 ERU's, the developer is required to have the Moses Pointe reservoir in service. When the reservoir is built the Moses Pointe Booster Pump Station and Well #19 will have a storage facility to pump into and the Moses Pointe area will become a separate pressure zone.

3-3.1 Source

3-3.1a General Description and Condition

The City currently has 18 well sites of which 17 are actively in service. Each site consists of three main components; well construction, pump assembly, and the building. These wells and their associated construction data are listed in Table 3-1.

Well construction at four City wells is inadequate and in need of rehabilitation. Wells 3, 4, and 8 withdraw water from both the Wanapum and Grande Ronde aquifers and Well 31 is believed to have an improper surface seal. The problems at Well 31 must be corrected before it is put back into service. Wells 3, 4, and 8 can continue to operate, but "shall be reconstructed to effectively and permanently separate the Wanapum and Grande Ronde Formations the first time any of the wells are reworked and the pumps removed." in accordance with the DOE's Report of Examination in Appendix O.

The pump assemblies at 13 of the 17 well sites have been installed, or removed, and inspected in the last fifteen years. During the inspection, if the bowls, line shaft, bearings, spiders, column pipe, or motor were not in excellent condition they were rebuilt or replaced. If the pump assemblies at Wells 3, 4, and 8 are removed, the wells will need to be reconstructed. Therefore, the City intends to continue pumping these wells as long as no problems develop.

All City pumphouse buildings built since 1992 (Wells 7, 9, 10, 14, 17, 18, 19, and 23) have had a standard design concept. This design includes a small, removable building built over the motor and well and a larger building consisting of a piping, electrical, and chlorine room. All of the other well buildings are in satisfactory condition, although the Water Division has requested they be replaced with buildings that conform to the standard design concept.

All of the City's wells experience some amount of seasonal fluctuation with the lowest static levels occurring during the summer months. Over the years the static levels have experienced an annual decline in most of the wells. Table 3-2 summarizes these annual declines and seasonal fluctuations associated with each well.

If the water levels continue to decline, which the City anticipates will happen until the DOE reduces the amount of groundwater pumped in the Odessa Basin, the City will have to occasionally lower the bowl assemblies in some wells. To some degree the Water Division can reduce the adverse effects of the declining water tables by choosing which wells to pump the hardest during the summer months and limiting the pumping duration at other sites. Both seasonal fluctuations and annual declines in the groundwater elevation are considered by the City when choosing a new pump and determining the proper depth to set the bowls.

3-3.1b Source Capacity Analysis

The supply and maximum daily demand (MDD)for 2005, 2011, and 2025 in each pressure zone is included in Table 3-3. Supply was calculated using two different scenarios. The first scenario assumed all active supply sources in each zone were producing their maximum sustainable withdrawal rate and no supply being provided by adjacent pressure zones. The second scenario assumed the largest source of supply in the zone was out of service with excess supply from adjacent pressure zones being provided through electric control valves, pressure reducing valves, and/or valve adjustments.

Currently, all zones exceed the MDD with the sources located in the zone.

All pressure zones will require the addition of one new supply source between 2005 and 2025 to have sufficient capacity to meet projected future demands.

A schedule for the supply improvements discussed above is included in Table 3-11.

Table 3-1
Well Construction Data

Pressure Zone	Well #	Ground Elev. (msl)	Well Depth (ft)	[a]Depth to Water		Depth to Top of Bowls (ft)	Aquifer
				Static (ft)	Pumping (ft)		
Wheeler	17	1210	1240	350	395	560	G
	18	1175	585	35	176	360	W
Lakeview	11	1148	805	210	315	450	Wanapum
	12	1199	568	62	72	200	Wanapum
Montlake	8	1092	1045	86	[c]303	350	G & W
Central	4	1079	1000	[d]100	N/A	280	G & W
	7	1065	950	184	348	500	G
	10	1058	692	177	[c]108	350	Wanapum
	31	1056	696	65	N/A	240	W & U
Knolls Vista	3	1070	909	119	[b]221	270	G & W
	9	1108	1100	275	311	550	G
	14	1085	1027	130	268	500	G
Larson	21	1188	712	296	[c]237	400	Wanapum
	23	1167	791	210	343	500	Wanapum
	24	1167	725	226	218	450	Wanapum
	28	1180	750	172	180	410	Wanapum
	29	1154	134	[d]71	70	109	U
Moses Pointe	19	1120	208	92	102	180	U

"a" Water surface depths are from Nov., 2006 well records unless otherwise noted. "b" Water surface depths are from June, 1990
"c" Water surface depths are from March, 2000. "d" Water surface depths are from July, 1994
NOTE: THE CURRENT CAPACITY OF EACH WELL IS LISTED IN TABLE 1-1 AND ON THE WATER SYSTEM DIAGRAM IN APPENDIX N

Table 3-2
Annual Decline and Seasonal Fluctuations
In Static Well Levels

Well	Seasonal Change (ft)	Decline In Summer Static (ft)	Number of Years	Avg. Decline Per Year (ft)	Measurement Span
3	100	110	33	3.3	1959-1992
4	60	40	16	2.5	1959-1975
7	120	255	47	5.4	1959-2006
8	60	45	31	1.5	1961-1992
9	45	175	41	4.3	1965-2006
10	115	55	21	2.6	1971-1992
11	135	140	29	4.8	1977-2006
12	6	5	24	0.2	1982-2006
14	60	13	15	0.9	1991-2006
17 17	50	#	#	#	#
18	23	*	*	*	*
19	16	*	*	*	*
21	60	190	35	5.4	1971-2006
23	85	110	35	3.1	1971-2006
24	75	100	24	4.2	1982-2006
28	100	130	35	3.7	1971-2006
29	2	2	17	0.1	1975-1992
31	90	65	18	3.6	1974-1992

* Not enough measurements taken #Unable to determine due to VFD

Table 3-3
Supply Evaluation

2005 Conditions

Pressure Zone	2005 Supply Zone	2005 Supply b	2005 MDD (gpm)	Surplus (gpm)	
Lakeview	3120	3430	2290	830	
Montlake	681	830	380	300	
Central	3560	2970	2405	565	
Knolls Vista	2620	2430	1685	745	
Larson	6300	4510	3470	1040	
Wheeler	4000	2000	1160	840	

2011 Conditions

Pressure Zone	2011 Supply [(a)] Zone	2011 Supply [(a)] b	2011 MDD (gpm)	Surplus (gpm)	2005-2011 Improvements
Lakeview	3120	3356	2734	386	
Montlake	680	386	454	-68	
Central	5510	4176	2872	1304	Redrill Wells 4, 19, and 31
Knolls Vista	2920	2057	2012	45	Redrill Well #3
Larson	6300	4510	4143	367	
Wheeler	4000	2000	1385	615	

2025 Conditions

Pressure Zone	2025 Supply [(a)] Zone	2025 Supply [(a)] b	2025 MDD (gpm)	Surplus (gpm)	2011-2025 Improvements
Lakeview	4620	5310	4136	484	1 Well (1500 gpm)
Montlake	2180	1364	686	678	1 Well (1500 gpm)
Central	5510	4952	4344	608	
Knolls Vista	4420	3163	3043	120	1 Well (1500 gpm)
Larson	7800	6510	6267	243	1 Well (1500 gpm)
Wheeler	5500	3500	2095	1405	1 Well (1500 gpm)

[a]Assuming wells are added per improvement schedule
[b]This supply total is based on the largest source in the zone being out of service and excess supply provided from adjacent zones through ECVs, PRVs, and/or valve adjustments

3-3.2 Water Treatment

3-3.2a General Description and Condition

Disinfection of the water system is accomplished by injecting sodium hypochlorite into the discharge piping at each well site. The injection pumps are sized so they can chlorinate the maximum amount of water that each well site can supply. All of the sodium hypochlorite pumps were installed between 1995 and 1998 and are in working condition, but the Water Division intends to replace them with non-pulsating pumps. The new pumps should require less maintenance, produce fewer leaks, and provide a safer working environment The City maintains a chlorine residual between 0.5 and 1.0 ppm of free chlorine in the distribution system.

3-3.2b Water Treatment Capacity Analysis

All of the treatment facilities have sufficient capacity to meet the existing and projected demands.

3-3.3 Storage

3-3.3a General Description and Condition

The City's water storage facilities consist of eight steel standpipes and three elevated steel tanks as summarized in Table 1-2. In general the standpipes and tanks in the system are in good condition. Because the coating system preserves the structural integrity of the facility, coating failure is of great concern. Several of the facilities have had their interior coating systems removed and replaced and their exterior coating systems overcoated in the last sixteen years. Table 3-4 summarizes the last time the interior and exterior surfaces at each site have been inspected or painted. Currently, Tanks 2, 3, and 5 have an interior coal tar coating.

Proper maintenance (inspection and recoating) of the existing storage facilities should allow them to provide reliable service beyond the planning horizon of this document.

Tanks 2, 3, and 5 in the Larson pressure zone are currently out of service. Under certain operating conditions, all three sites have periods when their altitude valves close for extended periods of time and prevent water from entering and exiting the tanks. In the summer this produces volumes of unpleasantly warm water that could enter the distribution system. Therefore, these structures will likely be removed upon the construction of the Larson Reservoir.

Table 3-4 Storage Facility Maintenance					
	Year Built	**Last Painting**		**Last Inspection**	
		Interior	**Exterior**	**Interior**	**Exterior**
R-1	1953	1990	2000	2000	2006
R-2	1955	1990	2000	2000	2006
R-3	1955	1994	2000	2000	2006
R-4	1978	2001	1978	2001	2006
R-5	1976	1999	1999	2000	2006
R-6	1982	2002	1982	2002	2006
R-7	1992	1992	1992	1993	2006
R-8	1997	1997	1997	1999	2006
T-2	1957	1974	1974	Mid 1980's	2006
T-3	1952	1974	1974	Mid 1980's	2006
T-5	1954	1974	1974	Mid 1980's	2006

3-3.3b Storage Capacity Analysis

System storage is used in a water system to meet peaking demands and provide a water supply in the event of a fire or failure of supply sources. A table listing the diameter, height, elevation, and storage capacities of all the storage facilities was previously shown in Chapter 1.

The total required storage volume for each zone consists of the following parts:

- Equalizing Storage (ES)
- Standby Storage (SB)
- Fire Suppression Storage (FSS)

A majority of the storage facilities in Moses Lake are standpipes which have an amount of "dead" unusable storage at the bottom of the tank. Useable storage is defined as the volume between the overflow and the 25 psi fire flow level. The fire flow minimum level is determined by adding 25 psi (20 psi residual plus 5 psi dynamic loss) of head pressure to the highest ground surface elevation in the pressure zone served by the storage facility.

Equalizing Storage

Minimum equalizing storage is the quantity of storage needed to meet short duration peak demands that exceed the supply capacity. Typically the duration of the equalizing storage is required for 2-1/2 hours.

Equation 9-1 in Section 9.0.3 of the DOH's "Water System Design Manual" was used for determining both present and future equalizing storage requirements.

Standby Storage

The DOH standards also recommend an emergency or reserve storage volume called "standby storage". Standby storage is defined as the storage necessary to meet demands during an emergency such as a pump station out of service due to power failure, transmission pipeline failure, or a pressure reducing valve out of service for repair.

Equation 9-3 in Section 9.0.4 of the DOH's "Water System Design Manual" was used for determining both present and future standby storage requirements.

Fire Suppression Storage

The Insurance Services Office (ISO) provides guidelines for fire flow demands. These demands can then be calculated to a total volume of water necessary to combat a fire. These guidelines are administered by the Washington Survey and Rating Bureau (WSRB). The ISO specifies that storage and supply capacity shall meet required fire fighting flows during the MDD.

The fire fighting volume required by the ISO guidelines is the amount needed to meet the recommended fire fighting flow for a minimum of 2 hours. For flows in excess of 2,500 gpm, 1 hour of flow duration is required for every 1,000 gpm of flow required. The required fire flows for selected locations, as determined by the WSRB, are shown in Table 3-5, and are used for the fire flow storage volume calculation. The most severe fire in any given pressure zone provides the basis for the fire flow storage volume calculation.

Table 3-5
WSRB Fire Flow Requirements

Location	Pressure Zone	Fire Flow (gpm)	Duration(hrs)	Storage Volume (MG)
Super 8 Motel	Central	5500	5	1.65
Wal-Mart	Central	4928	4	1.18
Vista Village	Knolls Vista	3500	3	0.63
Food Pavilion	Knolls Vista	3500	3	0.63
South Campus	Lakeview	5000	5	1.50
Chief Moses Middle School	Lakeview	5000	5	1.50

Since the WSRB did not calculate fire flow requirements for any structures located in the Montlake, Larson, and Wheeler zones, the following demands were used to calculate fire flow storage:

Montlake	3000 gpm	3 hours	540,000 gallons
Wheeler	4000 gpm	4 hours	960,000 gallons
Larson	4000 gpm	4 hours	960,000 gallons

These quantities exceed the Washington Administrative Code minimum fire flow storage requirements as stated in WAC 248-57-500.

Tables 3-6, 3-7, and 3-8 summarize the present, 6, and 20 year storage requirements. It was assumed that required fire flow storage did not change throughout the planning period. Future equalizing and standby storage requirements are based on additional sources of supply being added to each zone in accordance with the time line listed in Table 3-11.

Table 3-6
2005 Storage Analysis
(Million Gallons)

Pressure Zone	Equalizing Storage	Standby Storage	Fire Flow Storage	Minimum Total Useable Storage Required	Existing Useable Storage	Additional Required Usable Storage
Central	0	0.62*	1.65	1.65	1.70	0
Knolls Vista	0	0.43*	0.63	0.63	0.56	0.07
Lakeview	0	1.39*	1.50	1.50	2.30	0
Wheeler	0	0.43*	0.96	0.96	1.33	0
Larson	0	0.89*	0.96	0.96	1.525	0
Montlake	0	0.50*	0.54	0.54	0.55	0

* This volume is consolidated as allowed per Section 9.3.3 of the DOH's "Water System Design Manual" and is not included in the total storage requirement.

Table 3-7
2011 Storage Analysis
(Million Gallons)

Pressure Zone	Equalizing Storage	Standby Storage	Fire Flow Storage	Minimum Total Useable Storage Required	Existing Useable Storage	Additional Required Usable Storage
Central	0	0.74*	1.65	1.65	1.70	0
Knolls Vista	0.04	0.52*	0.63	0.67	0.56	0.11
Lakeview	0	1.97	1.50*	1.97	2.30	0
Wheeler	0	0.52*	0.96	0.96	1.33	0
Larson	0.05	1.06	0.96*	1.11	3.33	0
Montlake	0.01	0.60	0.54*	0.61	0.55	0.06

* This volume is consolidated as allowed per Section 9.3.3 of the DOH's "Water System Design Manual" and is not included in the total storage requirement.

Table 3-8
2025 Storage Analysis
(Million Gallons)

Pressure Zone	Equalizing Storage	Standby Storage	Fire Flow Storage	Minimum Total Useable Storage Required	Existing Useable Storage	Additional Required Usable Storage
Central	0.22	1.12*	1.65	1.87	1.70	0.17
Knolls Vista	0.07	0.78	0.63*	0.85	0.56	0.29
Lakeview	0	1.66	1.50*	1.66	2.30	0
Wheeler	0	0.79*	0.96	0.96	1.33	0
Larson	0.33	1.61	0.96*	1.94	3.33	0
Montlake	0	0.18*	0.54	0.54	0.55	0

* This volume is consolidated as allowed per Section 9.3.3 of the DOH's "Water System Design Manual" and is not included in the total storage requirement.

Tables 3-6, 3-7, and 3-8 indicate the Central, Knolls Vista, and Montlake zones all experience minor shortages in usable storage during the 20-year planning period. These tables do not account for additional storage that is available from adjacent and up-gradient pressure zones.

The Wheeler and Larson zones may need more storage if the WSRB calculates a larger fire storage requirement than the volume assumed in the table.

When the Moses Pointe development reaches 225 ERU's, a portion of the Central zone will become a separate pressure zone and require an additional standpipe due to the location and elevation of the area. This facility shall be built and paid for by the developer.

3-3.4 Distribution System

3-3.4a General Description and Condition

In general, the existing piping is considered to be sound. As discussed in Chapter 2, water loss is relatively low, and leaks observed by the Water Division staff are relatively few. However, some of the pipe in the system may have questionable integrity.

AC piping, comprising most of the existing Moses Lake system, is fragile and susceptible to damage. Areas of high construction activity usually have resulted in damaged AC pipe. Because of the large percentage of AC in the system, a replacement schedule for the AC is not practical at this time. In addition, disposal of AC pipe is costly and difficult due to current regulations.

The map in Appendix N shows the existing distribution network for the Moses Lake system. The distribution system is comprised of approximately 802,120 linear feet of water main. A breakdown of lengths of pipe by material and diameter is included in Table 3-9.

Table 3-9
Breakdown of Type and Size of Pipe in Distribution System

Material	Length (ft)	Percent of Total	Size (in)	Length (ft)	Percent of Total
Asbestos Cement	389,055	48.5	4	13,770	1.7
			6	303,760	37.9
PVC	172,290	21.5	8	297,280	37.1
Cast & Ductile Iron	138,780	17.3	10	82,190	10.2
Steel	101,995	12.7	12	91,470	11.4
			14	13,580	1.7
			16	70	0.0
TOTAL	802,120	100%	TOTAL	802,120	100%

Hydraulic modeling of the system for both the 2005 and 2011 conditions did not reveal any system pressures over 100 psi or under DOH minimum standards.

The City has pressure gauges located at all well and reservoir sites and at the Grape Drive Electric Control Valve (ECV). The readings from these gauges are sent to and recorded by the computer at the Water Division office. These readings help to monitor the daily system pressures.

Any improvements or additions to the distribution system are manually drawn on the City's water master and periodically added to the computer mapping system.

3-3.4b Hydraulic Capacity Analysis

This section discusses the analysis of the Moses Lake water distribution system. The City's six pressure zones were analyzed using the current and future water demand estimates. The analysis included average day, maximum day, and peak hour demand conditions, and simulated fire flows. Simulation results were compared with minimum performance standards set by the DOH to help identify deficiencies and recommend distribution system improvements.

CYBERNET water analysis software by Haestad Methods with Autocad release 14.01 was used to simulate the hydraulics of the Moses Lake water system. The purpose of the analysis was to determine the hydraulic capacity of the distribution system and identify how it interacts with the supply and storage facilities. The model used the Hazen-Williams formula to analyze the system and assumed a water temperature of 20NC. The following friction coefficients were used for the various type of pipe:

Asbestos Cement	140
PVC	150
Cast Iron	100
Ductile Iron	130
Steel	70

The results from the model have been compared to actual daily conditions and fire flow tests to help calibrate and improve confidence in the model.

The analysis determined the majority of the distribution system has sufficient capacity to meet existing conditions; in addition, it has the capacity to meet much of the future demand conditions. Most of the listed improvements are recommended to improve fire flow capacities, reduce high water velocities in pipes near wells, and network dead-end water mains. These improvements are shown on the map in Appendix N.

3-4 Summary of System Deficiencies

This section provides a list of the system deficiencies that exist or are anticipated in the 6-year planning period. The deficiencies are organized by pressure zone and prioritized by importance.

Lakeview

High velocities and pressure losses in water mains near Well 12.

Wheeler

No improvements planned.

Montlake

Several locations with dead-end lines.

Well #8 needs to be rehabilitated to meet current construction standards.

Central

Wells 4 and 31 need to be re-drilled to meet current construction standards.

Dead-end lines located on Dusty, Windy, and Davy Streets.

Relocate Division Street PRV.
Sections of steel and A.C. pipe should to be replaced.

Heat tape on Alder fill bridge needs to be replaced.

Knolls Vista

Low fire flows in the northeast section of the pressure zone by 2011**.**

Shortage of supply developing in approximately 2010.

Larson

Building 5820, currently occupied by Genie Industries, is built over the existing water main. If a break were to occur, it could be very costly and difficult to repair and this line is the only water main that connects Well 29 and Tank 5 with the rest of the system.

Several locations with dead-end lines.

Low pressures and fire flows in several locations.

Tanks 2, 3, and 5 are not in service and could be removed.

No foot valves installed on approximately 100 hydrants in the pressure zone.

Moses Pointe

Well #19 needs to be re-drilled to increase the depth, diameter, and production.

A storage facility is required.

3-5 Selection and Justification of Proposed Improvement Projects

The following is a list of distribution system, source of supply, and storage improvements to address existing and anticipated deficiencies in the Moses Lake Water System.

Table 3-10
Distribution System Improvements

Location	Improvement	Benefit	Cost
Central & Knolls Vista - Replace heat tape on bridges	Heat Tape	Improve freeze protection on Alder Fill and Stratford Road bridges	40,000
Larson - Reroute line around Genie Industries' building	1,300' of 12" Main	Eliminate a section of distribution main under an existing industrial structure	60,000
Knolls Vista - Extend water lines into Cascade Valley	1,750' of 12" Main	Extend water into Cascade Valley	600,000
Montlake - From Ashley Way to Eastlake Drive	400' of 8" Main	Improve fire flows and eliminate dead end lines on Ashley Way and Eastlake Drive	10,000
Central - Westshore Drive from Montana Street to 1600' South	2,000' of 10" Main	Improve fire flows and eliminate dead end lines on Dusty, Windy, and Davy	100,000
Wheeler - Road “N” from end of system to 2400' North	2,400' of 12" Main	Extend water service to industry	0
Lakeview - Road "L" from Well	1,700' of 12" Main	Reduce pressures and high velocities in lines near Well 12	100,000
Knolls Vista - Beacon Rd. from Grape Dr. to Longview Dr.	2,600' of 12" Main	Improve fire flows	125,000
Montlake - Install PRV at Balsam St. and Hill Ave.	8" Pressure reducing valve	Better connect the Lakeview and Montlake pressure zones	40,000
Central - Relocate Division St. PRV	8" Pressure reducing valve	Eliminate two dead end lines	40,000
Central - Replace 6" steel water main on Broadway Ave.	1,200' of 8" Main	Improve flows	80,000
Central - 5th Ave. between Alder and Division	400' of 8" Main	Replace A.C. water main that has a history of breaking	30,000

Larson - Install foot valves on hydrants	100 sites	Bring hydrants up to current city standards	150,000

Table 3-11
Supply Improvements

Pressure Zone	Year Planned	* Cost	Improvement
Moses Pointe	2007	$400,000	Redrill Well #19
Central	2007	$300,000	Redrill Well #31
Knolls Vista	2007	$300,000	Redrill Well #3
Central	2008	$400,000	Build Well #31 Pumphouse
Knolls Vista	2009	$400,000	Build Well #3 Pumphouse
Central	2010	$400,000	Redrill Well #4
Central	2011	$400,000	Build Well #4 Pumphouse
Montlake	2012	$500,000	Rehab Well #8
Knolls Vista	2014	$1,000,000	New Well
Larson	2016	$1,000,000	New Well
Lakeview	2018	$1,000,000	New Well
Wheeler	2020	$1,200,000	New Well
Montlake	2022	$1,000,000	New Well

Table 3-12
Storage Improvements

Location	* Cost	Benefit
Moses Pointe Reservoir	$0	Serve the Moses Pointe Zone
Larson Reservoir	$1,500,000	Increase pressure in the Larson Zone
Remove Tanks #2, #3, and #5	$300,000	Tanks no longer needed
Raise Reservoir #7	$700,000	Increase storage in the Larson Zone

* All costs are calculated using the value of the dollar in year 2006.

The Moses Pointe Reservoir is proposed to be 50 feet in diameter with an overflow elevation 120 feet taller than the highest ground elevation in the development. The standpipe will be constructed adjacent to Well #19 and hold 1.76 million gallons of water.

The Larson Reservoir is proposed to be 62 feet in diameter with an overflow height of 140 feet. The standpipe will be constructed at the Tank #2 location next to Well #21. Once the new reservoir is complete, the existing

Reservoir #7 will be raised to match its height. Each reservoir will hold approximately 3.2 million gallons of water.

Chapter 4
Conservation Program, Water Right Analysis, System Reliability, and Interties

4-1 Conservation Program Development and Implementation

4-1.1 Required Measures for All Systems

The City of Moses Lake has met all of the measures required by the Conservation Program section of the DOE/DOH Conservation Planning Requirements (CPR). How the City has met these requirements is described in this section. Source meters are installed at all active well sites. The City has promoted water conservation by including short messages encouraging conservation on water bills, having several articles in the newspaper describing the City's status with water rights, and enforcing plumbing code regulations requiring efficient plumbing fixtures. Additionally, the City has individual service meters and a rate structure that promotes conservation. Although the City has not experienced unaccounted-for water in excess of 20 percent, it has performed leak detection from 1996 to 1999 and has implemented a commercial flowmeter testing program.

4-1.2 Other Recommended Measures and Level of Implementation

For systems the size of Moses Lake's, the CPR requires an evaluation of the following recommended water conservation methods:

Program Promotion
Purveyor Assistance
Customer Assistance
Bill Showing Consumption History
Source Meters
Service Meters
Unaccounted Water/Leak Detection
Single-Family/Multi-Family Kits
Nurseries/Agriculture
Landscape Management/Playfields - Xeriscaping
Conservation Pricing

The steps the City has taken to meet each of these recommended conservation methods are described in Section 4-1.3b.

4-1.3 Conservation Program Outline

4-1.3a Conservation Objectives

The objective of the City's water conservation program is to minimize the amount of unaccounted-for water and to encourage consumers to use water in an efficient and useful manner.

4-1.3b Evaluation of Conservation Measures

The recommended measures are placed into four general categories: not applicable; fully implemented; partially implemented; and measures to be implemented.

The following measures are not applicable to the City:

Purveyor Assistance - The City does not have any wholesale customers.

Nurseries/Agriculture - The City has no agriculture services and only one nursery connected to the system. The nursery property also utilizes water from the East Columbia Basin Irrigation District.

The following measures are fully implemented by the City:

Source Meters - Meters are installed at all well sites.

Service Meters - Meters are installed on all services.

Unaccounted Water/Leak Detection - From 1996 to 1999 the City hired a contractor to detect and locate leaks in the water system. The City intends to have the water system surveyed for leaks again in the coming years and repair any substantial leaks that are found. The City has a program for testing commercial flowmeters as described in Table 6-1.

Conservation Pricing - The City's water rate schedule promotes water conservation by charging extra for all water consumed over 500 cubic feet per month. The rates are increased annually by the City Council.

The following measures are partially implemented by the City:

Program Promotion - Several articles have been written in the local newspaper educating the public on the status of the City's water rights. The City includes short messages that encourage water conservation on customer water bills.

Customer Assistance - The City's software package identifies large fluctuations in a consumer's month to month water usage. If a large variation is detected the City will read the meter again. If the reading is correct, the City will notify the customer that they may have a leak in their piping.

Single-Family/Multi-Family Kits - The City Building Department enforces the State requirements for low-flow fixtures in all new construction and remodeling projects.

Landscape Management/Playfields - Xeriscaping - The City irrigates five park facilities with water pumped from Moses Lake and has landscape ordinances that encourage the use of drought-tolerant species.

Bill Showing Consumption History - The City does include the past 12 month history of consumption on the customers bill.

4-1.3c Identification of Selected Conservation Activities

The above measures used by the City of Moses Lake have resulted in a decline in the average daily demand (ADD) per residential connection. In 1991 the ADD per residential connection was approximately 600 gallons per day. The amount has shown a steady decline to 564, 531, and 513 gallons per day respectfully in 1998, 2004, and 2005.

The City hopes to remove two additional park facilities from the Moses Lake Water System and irrigate with water from the lake. These changes will cost over $300,000 and there is no time line for these improvements to be completed.

4-1.3d Target Water Savings Projections

The conservation measures currently implemented by the City appear to be producing results. The City hopes that this trend continues, but realistically the City should see diminishing returns as consumers become more efficient. The impressive long term results that the City has seen in residential use still amounts to less than 1 percent per year.

The City intends to continue with the locating and repairing of leaks and the testing of water meters for under registering of flow, but this work may only keep up with newly developing leaks and the wearing out of meters.

Because the results are expected to be only minor, the City intends to use a 3.0 percent annual increase in water demand to be consistent with the estimated 3.0 percent annual population increase used for the Moses Lake area.

4-1.4 Regional Conservation Programs

The Grant County Coordinated Water System Plan 1999 (CWSP) discusses some of the options for improving water conservation and the objectives that might be achieved from a conservation program. However, as of 2006 there is no regional program is in place.

4-2 Source of Supply Analysis

4-2.1 Enhanced Conservation Measures

The City will evaluate other measures recommended in the Conservation Planning Handbook in addition to measures that have been successfully implemented by other water systems.

4-2.2 Water Right Changes

The City of Moses Lake has submitted twenty applications for change to the DOE to add additional points of withdrawal to their existing seventeen certificates, two claims, and one permit. These applications also request changes to the descriptions of purpose and place of use on the City's water rights so they are consistent.

4-2.3 Interties

Due to the small size of the neighboring purveyors and their lack of excess water rights, an intertie would not be able to supply a sufficient amount of water to the Moses Lake Water System. Therefore, this is not a viable alternative to the development of a new source.

4-2.4 Artificial Recharge

The surface water in the Moses Lake area is not of a high enough quality for artificial recharge. Due to the amount of irrigation and agricultural activity in the area, the quality of the surface water would likely degrade the water in the deeper aquifers.

4-2.5 Use of Reclaimed Water, Reuse and other Non-Potable Sources

4-2.5a Reclaimed Water

The City has evaluated the option of performing additional treatment to the effluent at the City's two wastewater treatment plants to meet the standards for reclaimed water. At this time, it is not an economically attractive option since the additional construction and operating costs far exceed the costs to purchase water rights. However, the design of the Larson Wastewater Treatment Plant allows for the implementation of additional treatment necessary to meet the requirements for reclaimed water if it becomes economical in the future.

4-2.5b Reuse Water

When evaluating reuse water there are several reasons, such as location, other treatment options, and lack of potential users, that make this option economically impracticable.

4-2.5c Non-Potable Water

Moses Lake is a non-potable source of water that can be used as an alternative to the Moses Lake Water System. Several of the City's parks that are located near the lake are irrigated with water from Moses Lake. The lake is also used by private property owners for irrigating an unknown number of lakefront lots.

4-2.5d Greywater

Individual greywater systems have a potential to reduce water demand from the Moses Lake Water System, but the construction, operation, and maintenance costs associated with these systems do not make them an attractive option at this time.

4-3 Water Right Evaluation

4-3.1 Permits, Certificates, Claims and Applications

Copies of the City's water right certificates, permits, claims, applications for change, and applications for new water rights are included in Appendix O. The City currently has 17 certificates of water rights, one permit, and two water right claims, which are described in Section 4-3.2 and Table 4-1.

The City has several applications for new water rights on file with the DOE.

4-3.2 Narrative Description

The source type for all of the City's water rights is ground water. A list describing the location of the City's 24 points of withdrawal is included in Appendix O. Currently 15 of the City's certificates and it's only permit are allowed to pump from 22 points of withdrawl. All 16 of these water rights have applications for change submitted to add an additional 15 points of withdrawl. Certificate 892-A is only allowed to pump from the Well 19 location and Certificate 2091-A is only allowed to pump from the Well 18 and 23 sites.

The following provisions were described in the DOE's Report of Examination No. G3-28169P.

> "The total quantity of water that can be withdrawn from the 22 wells is 24,905 gallons per minute and 8,766 acre feet per year for municipal supply under Certificates 52-A, 80-D, 328-A, 876-A, 2091-A, 2099-A, 4031-A, 4138-A, 5223-A, G3-00637C, G3-00638C, G3-00842C, G3-01326C, G3-26379C, and Permit No. G3-28169P."
>
> "The place of use is area served by the City of Moses Lake municipal water supply distribution system."

"Certificates No. 80-D and G3-01326C, when reissued, shall not exceed the maximum annual quantity that can be obtained at their certificated rate in gallons per minute."

"Wells Nos. 3, 4, 5, 7, 8, 9 and 11 shall be reconstructed to effectively and permanently separate the Wanapum and Grand Ronde Formations the first time any of the wells are reworked and the pumps removed."

"The total quantity, in gallons per minute and acre feet per year, shall be put to full beneficial use by December 31, 1999. Certificates water rights will be issued for the quantities developed and put to beneficial use under the subject water rights as of that date."

"An approved measuring device shall be installed and maintained on all wells in accordance with RCW 90.03.360 and/or WAC 508-64-020 through 508-64-040." (Installation, operation and maintenance requirements attached hereto).

"The installation of an access port, described in Ground Water Bulletin #1, shall be required prior to issuance of a final certificate of water right. In addition, an airline and pressure gage shall be installed and maintained in operating condition. The pressure gage shall be equipped with a standard tire valve and placed in an accessible location. The airline shall extend from land surface to the top of the pump bowls and the total airline length shall be reported to the Department of Ecology upon completion of the pump system."

"All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under RCW 18.104 (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Water Wells)."

Table 4-1
Existing Water Rights Status

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Existing Consumption		Current Water Right Status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi) (gpm)	Maximum Annual Volume (Qa) (ac-ft)	Maximum Instantaneous Flow Rate (Qi) (gpm)	Maximum Annual Volume (Qa) (ac-ft)	Maximum Instantaneous Flow Rate (Qi) (gpm)	Maximum Annual Volume (Qa) (ac-ft
1. 52-A	Town of Moses Lake	11/19/45	22 Points	Primary	500	500	500	500		
2. 80-D	Town of Moses Lake	9/40	22 Points	Primary	300	490	300	490		
3. 328-A	A.A. Elmore	7/29/48	22 Points	Primary	300	273	300	273		
4. 876-A	City of Moses Lake	5/18/50	22 Points	Primary	750	564	750	564		
5. 892-A	Clarence Wahl	3/1/50	Well 19	Primary	1,000	88	1,000	88		
6. 2091-A	US Army Corps of Eng	11/18/52	Well 18 & 23	Primary	1,000	1,600	1,000	1,600		
7. 2099-A	City of Moses Lake	12/5/52	22 Points	Primary	800	750	800	750		
8. 4031-A	City of Moses Lake	10/17/60	22 Points	Pri/Sup	1,535	1029/1427	1,535	2,456		
9. 4138-A	Town of Westlake	5/7/59	22 Points	Primary	1,600	160	1,600	160		
10. 5223-A	City of Moses Lake	3/28/63	22 Points	Supplemental	1,500	2,400	1,500	2,400		
11. G3-00637C	City of Moses Lake	3/15/71	22 Points	Primary	6,000	1,200	6,000	1,200		
12. G3-00638C	City of Moses Lake	4/13/71	22 Points	Supplemental	2,000	3,200	2,000	3,200		
13. G3-00842C	City of Moses Lake	4/13/71	22 Points	Supplemental	970	1,500	970	1,500		
14. G3-01326C	City of Moses Lake	6/2/69	22 Points	Supplemental	2,150	3,440	2,150	3,440		
15. G3-01465C	Palmer E. Schrag	3/18/68	22 Points	Primary	1,000	226	1,000	226		
16. G3-01550C	Palmer E. Schrag	6/16/69	22 Points	Primary	500	224	500	224		
17. G3-26379C	City of Moses Lake	10/22/79	22 Points	Primary	4,500	2,000	4,500	2,000		
18. G3-28169P	City of Moses Lake	5/28/86	22 Points	Primary	1,000	200	1,000	200		
TOTAL					27,405	9,304	20,800	8,793	+ 6,605	+ 511

Table 4-1 Continued
Water Right Claim Status

Claim Number	Name of Claiment	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Existing Consumption		Current Water Right Status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi) (gpm)	Maximum Annual Volume (Qa) (ac-ft)	Maximum Instantaneous Flow Rate (Qi) (gpm)	Maximum Annual Volume (Qa) (ac-ft)	Maximum Instantaneous Flow Rate (Qi) (gpm)	Maximum Annual Volume (Qa) (ac-ft
1. 004020	City of Moses Lake	1/42	Well 21	Primary	1,300	2,100	800	1,200		
2. 004021	City of Moses Lake	1/43	Well 22	Primary	1,100	1,700	# 1,100	# 1,700		

This amount is produced by wells other than Well 22.

Table 4-2
Existing Water Rights that the City is Attempting to Acquire

Water Right Cerrtificate	Name on Permit	Priority Date	Primary or Supplemental	Water Rights	
				Maximum Instantaneous Flow Rate (Qi) Requested (gpm)	Maximum Annual Volume (Qa) Requested (ac-ft)
1. 356-A	Mary Schiffner	5/18/48	Primary	800	200
2. 853-D	Mary Schiffner	5/5/47	Primary	900	300
3. G3-28923	Dune Lake Farms	1991	Primary		1,100
4. 3739-A	Buell and Dorothy Throop	02/04/55	Primary	525	270
5. 4484-A	Lincoln Development, Inc.	06/23/62	Primary	750	112
Approximate total of existing water rights that City is attempting to acquire from the above water rights.					1,982

Table 4-3
Applications for New Water Rights

Pending Water Right Application	Name On Application	Priority Date	Primary or Supplemental	Pending Water Rights Application	
				Maximum Instantaneous Flow Rate (Qi) (gpm)	Maximum Annual Volume (Qa) (ac-ft)
1. G3-29169	City of Moses Lake	2/24/92	Primary	606.5	978.1
2. G3-29592	City of Moses Lake	12/07/93	Primary	2,400	0
3. G3-29915	City of Moses Lake	6/19/95	Primary	1,500	370
4.	City of Moses Lake	12/11/98*	Primary	9,000	4,500
5. G3-30260	City of Moses Lake	2/18/99*	Primary	1,600	600
TOTAL				15,106.5	6,448.1

*Application sent to the Dept. of Ecology on this date

4-3.3 Water Rights, Current Water Usage and Projected Needs

The City has seventeen existing ground water certificates and one permit that authorize the withdrawal of 27,405 gpm and 9,304 acre-feet of water per year. The City also has two claims that total an additional 2,400 gpm and 3,800 acre-feet of water per year.

In 2005 the Moses Lake Water System used approximately 20,800 gpm and 8,793 acre-feet of water. The projected water demands for the year 2025 are a peak hour demand of 32,915 gpm and 15,881 acre-feet.

The City needs additional water rights to meet the projected 20-year water needs. The City intends to meet these needs by using water associated with the City's water right claims, acquiring existing water rights from other owners, and through applications that have been submitted to the DOE for new water rights. The claims, water rights, and applications associated with these options are listed in Tables 4-1, 4-2, and 4-3.

Assuming the water demand experiences an annual increase of 3.0 percent, the City will exceed it's certified and permitted water rights in approximately 2008 and it's claimed water rights by 2019.

The City has an ordinance that requires new services to provide water rights or payment for the purchase of water rights in the amount required to serve them.

The estimated schedule for developing new sources is included in Table 3-11.

4-3.4 Water Reservations

The DOE has not granted any water reservations to the water rights owned by the City of Moses Lake.

4-4 Water System Reliability Analysis

4-4.1 Summary of System Reliability Efforts

4-4.1a Source Reliability

The Wanapum and Grande Ronde aquifers have been reliable sources of water in the past for not only the Moses Lake Water System, but also for a large portion of the agricultural activity that takes place in the region.

The City's water system has several characteristics that help to ensure that an adequate quantity of water is available to meet demands. Several of the efforts that the City has made to provide a reliable quantity of water are as follows:

Well location - The location of the City's wells are spread out over the entire service area. This reduces the number of wells that may be affected by a single power outage or contamination incident.

Well depth - The depth of the City's wells reduce the influence of surface activity on the quality of water being produced.

Number of wells - Since the City has eighteen wells, water can be produced from a number of different locations. Therefore, the system does not rely on any single site or location to produce and supply water for the entire system.

Intertied zones - This provides redundancy since zones with surplus supply can provide water to a zone that may not meet demand.

Efforts by the City to provide a reliable quality of water include the following:

Wellhead protection program - The City has completed several elements of their wellhead protection program. This program is explained in further detail in Chapter 5.

Well construction - All of the City's wells, except Wells 19 and 29, are over 500 feet deep and extend into the Wanapum and/or Grande Ronde aquifers. This greatly reduces the influences of surface activities on the quality of water being pumped by the well.

Studies - The City contracted with Golder Associates, Inc. to write the Groundwater Supply Augmentation Program. This study included a contaminant source inventory for the entire future service area for the Moses Lake Water System. This inventory not only helps to identify potential hazards for existing wells, it also helps determine the best locations for future wells.

4-4.1b Water Right Adequacy

Section 4-3.3 and Tables 4-1, 4-2, and 4-3 provides a summary of the City's current water rights, current and projected water demands, and how the City intends to meet those demands.

The City of Moses Lake has 9,304 acre-feet of permitted and certified water rights and 3.800 acre-feet of water right claims. The City’s goal is to always have enough water rights to meet it’s current and future demands and only rely on the water claims as a temporary solution. Assuming a 3.0% annual increase in water demand, the City’s current water rights will meet the demand until 2008. The City is pursuing additional water rights and will continue to aggressively explore all options of obtaining enough to meet demands in advance of actual needs.

Currently, if the City did not acquire any new water rights through new permits, transfers, purchases, or condemnations, the City’s water claims would meet the anticipated demands until 2019.

4-4.1c Facility Reliability

The following is an overview of the findings from the system analysis in Section 3-3 of this document:

In general the entire Moses Lake Water System is in satisfactory condition. A majority of the pump assemblies have been installed or inspected in the last 10 years. The wellhouses are in satisfactory condition, but the Water Division has requested that several of the facilities be replaced with buildings that conform to the City's current standard design concept. The standpipes and tanks are in good condition with a majority of them having had their interior and exterior coatings replaced/recoated in the last 16 years. The distribution system is sound with relatively low water loss. All improvements required to maintain the existing facilities and to meet future growth are included in the Improvement Program in Chapter 8.

4-4.2 Water Shortage Response Planning

The City of Moses Lake's Water Shortage Response Plan defines a minor, moderate, and severe shortage as follows:

> Minor shortage - when the wells are pumping all night just to keep the reservoirs filled.
>
> Moderate shortage - when the wells are pumping all night, the reservoirs are not refilled, and pumping levels are approaching the pump bowls.
>
> Severe shortage - when the wells are pumping all night, the reservoirs are not refilled, and pumping levels are at the pump bowls.

The plan lists the following options that are dependent upon the severity of the water shortage:

Minor shortage
- Issue news releases to the media.
- Distribute DSHS water saving guidelines.
- Promote intensive leak detection and repair.

Moderate shortage
- Impose minor shortage options and
- Alternate landscaping watering days.
- Continue public information program.
- Reduce park irrigation and street flushing.
- Reduce lawn watering to once a week.

Severe shortage
- Impose minor and moderate shortage options and
- Further reduce irrigation.
- Increase water rates.
- Impose fines for wasting water.
- Impose monthly limits with high surcharges.

Chapter 13.06 of the Moses Lake Municipal Code addresses the City's ability to order and enforce water rationing. This chapter is included in Appendix B.

4-4.3 Monitoring Well Levels

The Water Division recorded monthly static and pumping levels in nearly all of the City's wells until 1992. From 1992 until the present, levels were not taken on a consistent schedule at all of the sites. A majority of the sites have a transducer set just above the pump bowls that continuously measures the water elevation. This reading is recorded in the Water Division's SCADA computer. Table 3-2 summarizes the seasonal change and the average decline in summer static levels associated with each of the City's wells.

4-5 Interties

The City of Moses Lake has no existing or proposed interties or intertie agreements with neighboring purveyors.

Chapter 5
Source Water Protection

5-1 Wellhead Protection Program

5-1.1 Overview

According to WAC 246-290-135(4), all water systems using groundwater as a source are required to develop and execute a wellhead protection program. The wellhead protection program shall contain the following elements: a susceptibility assessment; a wellhead protection area (WHPA) around each well; a list of actual and potential ground water contaminant sources located within the defined WHPA(s); documentation of purveyor's notification to all owners/operators of actual and potential sources of ground water contamination within the WHPA(s); documentation of purveyor's notification to regulatory agencies and local governments of the boundaries of the WHPA(s) and the findings of the WHPA inventory; a contingency plan to ensure consumers have an adequate supply of potable water in the event the principal source of supply is contaminated; and documentation of coordination with local emergency spill responders.

The City of Moses Lake believes that several elements of the mandatory wellhead protection program are written for shallow well conditions and are not beneficial in deep well situations. The requirements of delineating a WHPA, documenting potential sources of contamination, and notifiying owners/operators around a well that has a low susceptibility rating and is properly sealed to a depth of nearly 700 feet do not appear logical. However, the City has met the requirements at all well sites.

5-1.2 Susceptibility Assessment

On August 24, 1994 the City of Moses Lake sent the DOH completed Ground Water Contamination Susceptibility Assessment Surveys for 21 wells. Since that time five wells (Wells 5, 13, 22, 32, and the Municipal Airport Well) are no longer in use and have been properly abandoned and two additional wells (Wells 18 and 19) have been added to the system. The susceptibility ratings, as determined by the DOH, for all of the City's active wells are summarized in the DOH's Water Quality Monitor Report in Appendix F.

5-1.3 Wellhead Protection Area Information

The WHPA around each well was determined by using the "Calculated Fixed Radius" method. The method was used to estimate the distance ground water would travel in a 6 month, 1 year, 5 year, and 10 year time period. This information was included in the Ground Water Contamination Susceptibility Assessment Surveys completed by the City in 1994 and is shown on the map in Appendix H.

5-1.4 Contaminant Source Inventory

An inventory of potential sources of ground water contamination for an area that includes the entire Moses Lake Water System service area has been completed by VISTA Information Solutions, Inc. (VISTA). The inventory is included in the "Groundwater Supply Augmentation Program - Phase 1: Well Siting Study" report completed by Golder Associates, Inc. on December 21, 1999. VISTA searched State and Federal environmental agency databases, performed additional review of EPA databases via the internet, reviewed additional non-American Society for Testing and Materials (ASTM) records, and reviewed aerial photographs from 1973 and 1998 in an attempt to provide a complete inventory. The database review was limited to sites known to federal and state environmental agencies. A field survey of each WHPA was completed by City staff in January of 2001 to verify the inventory and to identify potential contamination sources that are not registered.

A total of 437 sites were identified in the study area by the VISTA report. Some sites are listed on more than one database and a few sites include multiple facilities. The following is a summary of the number of sites identified on ASTM and non-ASTM databases.

ASTM Databases

1 National Priorities List (NPL) site
No Corrective Action Report (CORRACTS) sites
1 Treatment, Storage, or Disposal (TSD) site
3 State Priority List (SPL) sites
2 Suspected Contaminated Sites (SCL) sites
3 Comprehensive Environmental Response, Compensation and Liability Information System/No Further Action Planned (CERCLIS/NFRAP) sites
17 Leaking Underground Storage Tanks (LUST) sites
No Solid Waste Landfill (SWLF) sites
4 Toxic Release Inventory System (TRIS) sites
99 Underground Storage Tank (UST) facilities
28 Resource Conservation and Recovery Act (RCRA) facilities
8 RCRA sites with regulatory violations
5 Emergency Response Notification System (ERNS) facilities

Non-ASTM Databases

553 USGS water well, Federal Index System (FINDS), and/or WA-TOXIC facilities

A large majority of the sites listed on the non-ASTM databases are USGS water well locations.

The City received the detailed information on potential sources of ground water contamination on January 28, 2000. The City has determined which sites are located in the WHPA of each individual well.

5-1.5 Notification of Findings

The City has identified and verified potential sources of ground water contamination that are located in WHPAs and they have notified the owners/operators of those sites.

The City has notified the Grant County and City of Moses Lake Planning Departments of the boundaries of the WHPAs and the findings of the WHPA inventory.

The City has notified the Department of Emergency Management, who is the local emergency incident responder, of the WHPA boundaries, results of the susceptibility assessments, inventory findings, and contingency plan. Copies of the city's notification letters are included in Appendix H.

5-1.6 Contingency Plan

If a well becomes contaminated or for any other reason stops producing water, the system will rely on the other wells to increase production to meet demands until the problem is corrected and the well is put back into the system. If a water shortage develops, the City would first attempt to redirect water from zones with surplus production to the zone experiencing the shortage. Next, they would inform the community of the shortage through the media and request that consumers conserve water. Finally, if additional steps are needed, a notice of water rationing would be ordered by the Municipal Services Director pursuant to Chapter 13.06 of the Moses Lake Municipal Code.

If a City well becomes contaminated, the City will have to look at several options for correcting the problem. Some of the possible corrective actions that can be taken include:

-Seal off the contaminated portion of the well. This was successfully performed at Wells 21 and 28 to rectify TCE problems at these wells.

-Treat the contaminated water before it enters the distribution system. The process and the costs associated with the treatment will vary greatly depending on the type and level of contamination.

-Drill a new well to replace the contaminated well.

The costs for these improvements can vary from minimal expenditures to over $1,000,000 if drilling a new well is required.

5-1.7 Spill Response Planning

The Grant County Department of Emergency Management is the local agency that is responsible for the coordination of the cleanup and notifying the proper state and local agencies of any spills in Grant

County. The City Water Division is currently notified if any water lines or wells are located in the area of a spill. The City has provided the Grant County Department of Emergency Management with documentation showing not only the WHPA boundaries for each well, but the entire system service area; susceptibility assessments for each well; contaminant source inventory; and a contingency plan if the spill is an actual or potential threat for contaminating the water system.

Chapter 6
Operation and Maintenance Program

6-1 Water System Management and Personnel

The organizational chart for the Moses Lake Water Division is shown in Figure 6-1. The Water Division is under the direct supervision of the Public Works Superintendent, who reports to the Municipal Services Director. The Public Works Superintendent is responsible for the Wastewater, Street, Building Maintenance, and Equipment Rental Divisions for the City in addition to the Water Division.

The Water Division Supervisor oversees the water utility and reports directly to the Public Works Superintendent. The Water Division Supervisor currently has seven full-time staff members under his direction, including the Water Division Foreman.

The Water Division Supervisor performs administrative functions only, except for on-call situations. The Water Division Foreman is normally half-time in the office and half-time in the field. The Water Division Foreman normally serves as field foreman when field work is taking place.

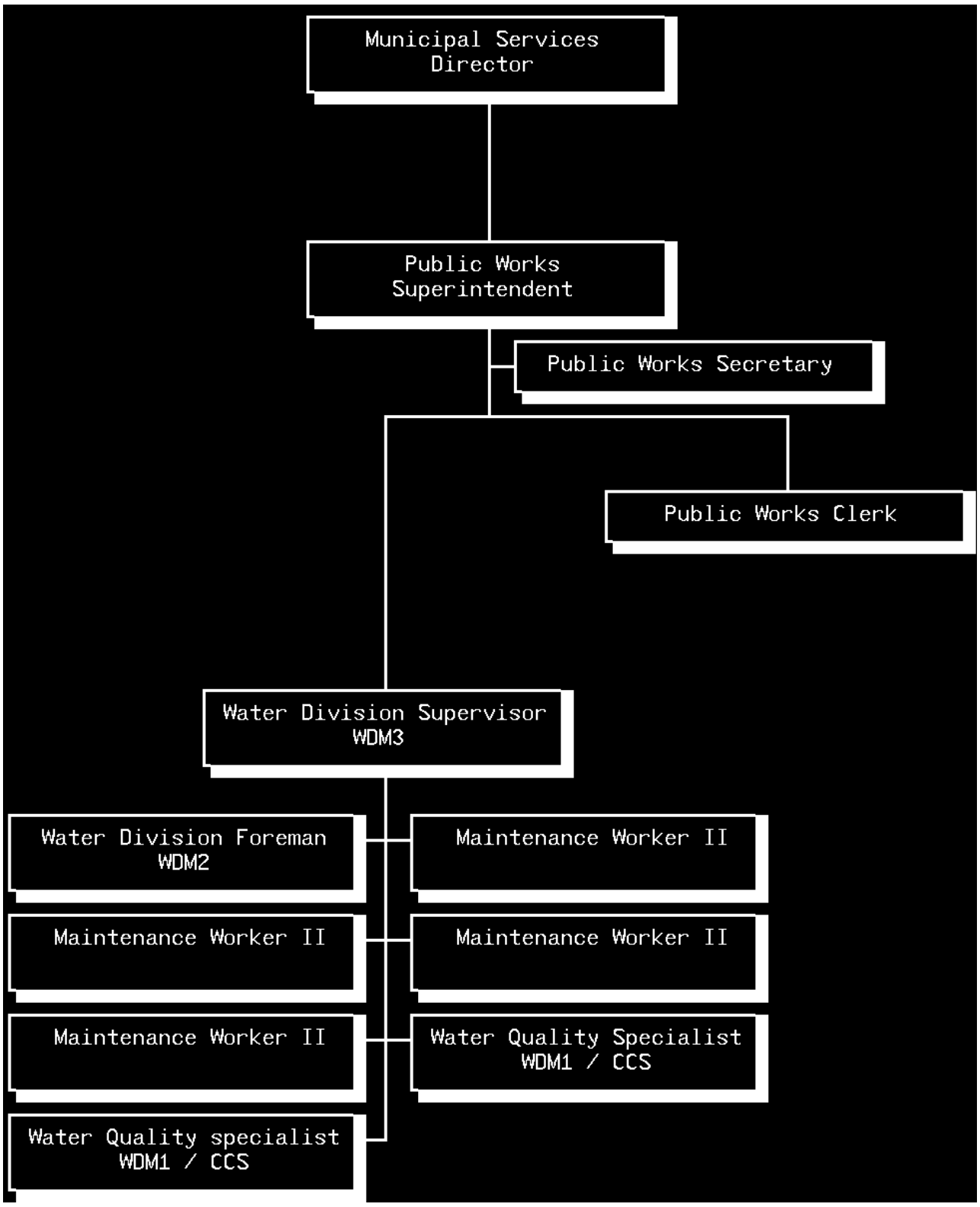
The Water Quality Specialist staff positions have the responsibility to:

- Inspect commercial, industrial, and residential water lines and sprinkler systems for cross connections
- Regularly communicate with, and educate, the public concerning the requirements for backflow protection
- Maintain a file of backflow devices installed within the City water system and verify they are tested annually, if applicable
- Contact property owners and advise of cross connection problems requiring correction
- Maintain a file of all commercial and residential customers and assure that premise inspections are done annually
- Maintain records of water quality and assure testing is completed pursuant to state and federal regulations
- Prepare annual Water Quality Report
- Arrange sampling and testing, collect samples to be tested, and test for chlorine residuals
- Review plans and inspect all new commercial and industrial building permits, plans and drawings, and construction for compliance with Cross Connection Control Standards

- Calculate dosages and adjust chemical feed pumps for the chlorination process.
- Maintain chemical pumps, sampling stations, and chlorine residual monitoring stations
- Perform other work as assigned.

The Maintenance Worker II staff positions have the responsibilities of:

- Pump station maintenance, including motor control centers and valves
- Electrical control maintenance
- Miscellaneous equipment maintenance
- Minor reservoir maintenance
- Valve and valve box repair
- Cross-connection control device inspections
- Removal/replacement/installation of water services and meters
- Chlorine residual sampling
- Construction flagging
- General assistance to the Water System Supervisor
- Cleaning and painting well houses
- Water main taps



Water Division Organizational Chart
Figure 6-1

The current employee roster and their certification for the positions identified in Figure 6-1 are shown below:

Municipal Services Director -	Gary G. Harer, P.E., P.L.S.
Public Works Superintendent -	Tim Varney, WDM3, CCS, GRP2WW
Water Division Supervisor -	Bill Maddox, P.E., WDM3, CCS
Public Works Secretary -	Karen Wilson, Notary
Public Works Clerk -	Jennifer Guenther
Water Division Foreman -	Kent Wilmot, WDM3, CCS
Maintenance Worker II -	Randall Stewart, WDM2, CCS
	Ken Shauerman
	Roger Thornton
	Bo Hancock
Water Quality Specialist -	Chad Strevy, WDM1, CCS, GRP2WW
	Judi Ellis, WDM1, CCS

6-2 Operator Certification

The Public Works Superintendent, Water Division Supervisor, and Water Division Foreman are certified as Water Distribution Manager 3 (WDM 3), as shown in Section 6-1. These individuals are also certified Cross Connection Specialists (CCS). These levels of certification are adequate for the size of the Moses Lake water system in accordance with WAC 246-292.

The City provides and encourages the staff to attend outside classes and seminars to maintain their certification(s) and to keep them and the City current on new technologies and regulations.

6-3 System Operation and Control

6-3.1 Identification of Major System Components

The water distribution system is composed of 18 wells (17 used in 2005), 8 standpipes and 3 tanks, and distribution piping. Valves in the system include altitude valves on some of the storage facilities and pressure reducing valves and/or electric control valves between pressure zones. These facilities are described in detail in the system inventory in Chapter 3.

The system is divided into seven pressure zones. They are as follows:

- Wheeler
- Lakeview Terrace
- Montlake
- Central
- Knolls Vista
- Larson
- Moses Pointe

The wells and reservoirs by zone are shown in Chapter 3.

Each of the zones operate under a separate hydraulic grade line (HGL) under normal conditions, but the pressure zones are interconnected by distribution system piping and control valves.

If water is moved from one zone to another, it is generally passed from the zone with the higher HGL to the zone with the lower HGL. The exceptions to this rule exist through the use of the City's two booster pump facilities. Reservoir overflow elevations, indicating the relative elevation difference between zones, are shown in Chapter 3.

In general, when water is moved from higher to lower zones the following routes can be used:

- Wheeler to Lakeview Terrace
- Lakeview Terrace to Montlake
- Montlake to Central
- Central to Montlake (via booster)
- Knolls Vista to Central
- Larson to Knolls Vista
- Lakeview Terrace to Central
- Moses Pointe to Central

With the help of some valve adjustments the following wells can pump into the higher hydraulic zone listed.

- Well 7 to Knolls Vista
- Well 8 to Lakeview Terrace
- Well 9 to Larson
- Well 11 to Wheeler
- Well 12 to Wheeler
- Well 14 to Larson

These patterns of water movement become important if a well or reservoir is out of service. Moving water from zone to zone to avoid water supply problems has been used by the system operators during certain periods in the past.

6-3.2 Routine System Operation

The pumps at all wells and the storage facilities are connected by telemetry to the control panel at the Water Division shop. The controls at the shop allow the pumps to be started or stopped remotely.

Each pump may be controlled by the level in a reservoir. In general, any pump in any given pressure zone may be controlled by the level of any reservoir in the system. For example, in the Central pressure zone (which contains reservoirs 1 and 4 and pumps 4, 7, 10, and 31), any combination of the four pumps could be controlled by the level in either Reservoir 1 or Reservoir 4.

The pumps in any given zone may be set to run in either a lead/lag arrangement or to start simultaneously when a pump is called for by the controls. Historically, the simultaneous start arrangement has been used. Using this arrangement, the operator selects the appropriate number of pumps for operation at any given time and sets their controls to automatic. When a low level in the controlling reservoir is reached, the controls start all of the pumps selected for operation at once, and the reservoir is filled. This operational method requires some operator experience to ensure that adequate pumping capacity is turned on to match system demands.

When selecting which pumps to operate in each zone, other factors are also considered. Water from some wells taste different than others; for example, in the Lakeview Terrace pressure zone, Well 12 water is harder which has a better taste to the public and Well 11 water is softer which produces complaints from the public because of strange taste. In some cases, industries must be notified of changes in operation because these differences in water hardness impact the settings on the boiler systems. This has led to the development of the priority service list shown in Appendix I.

6-3.3 Preventative Maintenance Program

Flowmeters

Commercial flowmeter testing is contracted out to an independent contractor by the City, and is performed on the basis of the following frequencies:

Table 6-1
Commercial Flowmeter

Size	Test Frequency	Size	Test Frequency
5/8"	10 years	3"	2 years
1"	6 years	4"	2 years
1½"	4 years	6"	1 year
2"	4 years	8"	1 year
		10"	1 year

Flowmeters at the pump stations are not maintained or calibrated on a regular basis but are repaired when they malfunction. Current policy is to have broken meters repaired and calibrated by the manufacturer when repairs are needed.

Motors

Approximately every five years a pump manufacturer's representative performs a vibration test on the motors. Motors with heavier vibration are scheduled first for maintenance. Motor oil is changed every 3000 hours. Megger tests of the motor windings are not routine maintenance, but megger tests are performed after any operation of the breakers on the motors.

Pumps

Maintenance of the vertical turbine pumps is performed only on an as-needed basis. Vibration tests are also used as an indicator of possible maintenance needs for the pumps. The local irrigation companies have been used to adjust the pump bowls and head shaft when conditions warrant.

Valves

The City is currently using it's global positioning equipment to record the location of the valves in the system. Approximately 90% of the valves have been recorded at this time. The City attempts to exercise all of the system valves once every 10 years.

Standpipes and Elevated Storage Tanks

Standpipes and elevated tanks are scheduled to be drained approximately once every 10 years, silt is removed from the bottoms of the reservoirs, and the tank lining is inspected. Flushing is provided by the regular filling and emptying cycles of the reservoirs.

Distribution System

The Water Division staff performs some leak detection to reduce system losses. The Water Division Supervisor and Water Division Foreman have received training in use of leak detection equipment, and the City has listening equipment on hand. The listening equipment, in conjunction with low pressure reports and visual evidence, allow the staff to locate leaks effectively. The staff has also made it a practice to tour the system occasionally on frosty winter mornings, because a lack of frost in an area provides an indication of a leak. From 1996 to 1999 the City hired a contractor to listen for leaks. A small number of minor leaks were found and then repaired by the Water Division.

6-3.4 Equipment, Supplies, and Chemical Listing

Rolling stock and equipment assigned to the Water Division is listed as follows:

- 2000 Dodge Caravan
- 1996 Ford F-250 Pickup w/liftgate
- 1999 Ford F-250 Pickup
- 1997 Ford F-350 w/utility body/crane
- 2000 Chevrolet 3500HD w/utility body/liftgate
- 1990 Dodge D-350 w/utility body/crane
- 1994 GMC 10 Yard Dump Truck
- 1995 Case 580L Backhoe
- 1979 Case 580C Backhoe
- 1994 Honda Portable Generator
- 2000 Honda Portable Generator 3000w
- 1988 Eager Beaver 12 Ton Tiltbed Equipment Trailer
- 2-2000 Honda Pumps
- 2002 Honda Pressure Washers
- 1995 Wacker Rammer
- 1990 Wacker PD3A Diaphragm Pump
- 1989 3200 lb. Crane (mounted on 1997 Ford)
- 1989 3200 lb. Crane (mounted on 1990 Dodge)
- 1980 Hypro Piston Pump
- 1992 Stihl Portable Cut-off Saw
- 1992 Fairmont Portable Hyd. Power Unit
- 1991 Kenwood Base Radio
- 14 Motorola\Johnson\Kenwood Radios
- Motorola FM Pager

A materials inventory is maintained at the Water Division shop and the inventory is restocked based upon usage. A supply of materials is available for 6 months to 1 year of standard operations. The parts and materials inventory for December, 2005 is included in Appendix J.

Sodium hypochlorite is the only chemical of significant volume kept on hand. The material is stored in the same vessels in which it is used. The material is delivered to each well site by the supplier. Disinfection equipment exists at all of the pump stations in service.

6-4 Comprehensive Monitoring (Regulatory Compliance) Plan

The Safe Drinking Water Act (SDWA) of 1974, amended in 1996, established specific roles for federal and state governments and for public water suppliers. The United States Environmental Protection Agency (EPA) develops national drinking water regulations and oversees the implementation of the act. State governments are expected to adopt the federal law and accept the primary responsibility for administration and enforcement. Public water suppliers are assigned the day-to-day responsibility of meeting the regulations by incorporating monitoring, recording, and sampling procedures into their O & M programs.

The sampling and reporting requirements for the City's water supply system are described in this section. It is important for the City to meet these requirements, and any future ones, to ensure that they are providing safe drinking water and to avoid any fines or additional sampling demands.

Sampling and monitoring requirements for public water systems are published in WAC 246-290. The purpose of this section of the WAC is to protect the health of consumers by establishing monitoring and sampling requirements, maximum contaminant levels (MCLs), and follow-up actions in the event MCLs are exceeded.

The DOH currently provides Moses Lake with a spreadsheet that summarizes the system's sampling status and upcoming requirements. This service greatly simplifies the job of keeping up with the sampling requirements, but every original summary has contained several erroneous requirements that have been corrected once the City discusses them with the DOH. The most recent DOH spreadsheet for the City is included in Appendix F with several comments from the Water Quality Specialist. A description of each contaminant and the testing requirements are given below.

Coliform Bacteria

Description: Coliform bacteria describes a broad category of organisms routinely monitored in potable water supplies. Though not all coliform bacteria are pathogenic in nature, they are relatively easy to identify in laboratory analysis and, if present, indicate that pathogenic organisms may also be present. The DOH strictly monitors and regulates bacterial contamination in a water supply since they can cause a number of water borne diseases.

Sampling Requirements: The regulations require all potable water distribution systems to take a number of monthly samples for coliform bacteria from the distribution system. Due to the size of the system the City must collect, test, and report 20 samples per month. If coliform bacteria are present in a routine sample, repeat samples must be collected.

City Status: The City is in compliance and usually collects more than 20 samples in case some samples are damaged en route to the lab or test results are lost by the lab. The City has not had an unsatisfactory bacteriological result since full time chlorination began in January, 1998.

Inorganic Chemicals

Description: This category includes several inorganic elements and compounds. The allowable limits of inorganic chemicals in drinking water are divided into "primary" and "secondary" MCLs. Primary MCLs are levels that are believed to pose some risk to human health. Secondary MCLs are associated with undesirable characteristics in potable water, but are not believed to pose any great degree of risk to human health.

Many of the inorganic chemicals are elemental metals such as mercury, arsenic, and iron. Some non-metallic constituents such as chloride, fluoride, and sulfate are also included. Physical properties under this category include turbidity, specific conductivity, total dissolved solids, and color.

Sampling Requirements: Samples for testing for inorganic chemicals must be taken every three years from active supply sources.

City Status: The City is in compliance with all the wells having been sampled for inorganic chemicals since August 2006. The City is required to provide public notification since several of the City's wells occasionally exceed the secondary MCL for fluoride. Arsenic, barium, and/or cyanide have been detected within allowable levels in some of the City's wells. A summary of the past results from the tests for each well is included in Appendix F.

Nitrates

Description: Nitrates are inorganic compounds regulated separately from the inorganic chemicals under the SDWA. Nitrates in drinking water are associated with methemoglobinemia, or "blue baby syndrome" and the formation of cancer causing nitrosamines.

Sampling Requirements: Samples for testing for nitrates must be taken every year from active wells unless a source exceeds the secondary Maximum Contaminant Level (MCL) of 5.0 parts per million (ppm). Any source that exceeds the secondary level must be sampled quarterly.

City Status: The City is in compliance since all the wells were last sampled for nitrates in August or September of 2006 and were below the secondary MCL. A summary of the past results from the tests for each well is included in Appendix F.

Volatile Organic Chemicals

Description: Volatile organic chemicals (VOCs) are manufactured, carbon-based chemicals that vaporize quickly at normal temperatures and pressures. VOCs include many hydrocarbons associated with fuels, paint thinners, and solvents. This group does not include organic pesticides, which are regulated separately as synthetic organic chemicals. VOCs are divided into two groups: regulated and unregulated compounds. Regulated VOCs are those that have been determined to pose a significant risk to human health. Unregulated VOCs are those for which the level of risk to human health has not yet been established.

Sampling Requirements: Samples for testing for VOCs must be taken every three years from all active wells unless the DOH determines more frequent testing is necessary. VOC tests can be composited.

City Status: Due to the past history of trichloroethylene (TCE) contamination the City is currently sampling wells 19, 21, and 23 more frequently. The City has fulfilled all testing requirements to date and and the City is in compliance. Results from the most recent tests are included in Appendix F.

Synthetic Organic Compounds

Description: Synthetic organic chemicals (SOCs) are a group of manufactured, carbon-based chemicals that include pesticides such as Aldicarb, herbicides such as 2 4-D, PCBs, pentachlorophenol, and dioxin.

Sampling Requirements: Samples for testing for SOCs must be taken every three years from all active wells unless the system applies for and is granted a waiver from this requirement. As with VOC tests, SOC tests can be composited.

City Status: The City has fulfilled all testing requirements and is in compliance.

Lead and Copper

Description: Lead and copper are corrosion byproducts that leach into the water system from meters and other plumbing fixtures when the source water is corrosive. Historically, Moses Lake's source water has been relatively stable and noncorrosive with a Langlier Index of 0.3. While the Langlier Index does not include all factors that contribute to corrosion, it is a useful tool for screening possible mitigation treatments. The test results from the samples collected in 2005 and a copy of the City's sampling protocol are included in Appendix F.

Sampling Requirements: The City is currently waiting for direction on any future testing requirements.

City Status: The City has met all past DOH sampling requirements for copper and lead.

Asbestos

Description: Asbestos is the name for a group of naturally occurring, hydrated silicate minerals with fibrous morphology.

Sampling Requirements: One sample for testing for asbestos is required every nine years for the entire system.

City Status: The City tested for asbestos in July, 1999, so they are in compliance until July, 2008.

Disinfection By-products

Description: Disinfection by-products are unintended by-products of the disinfection process that may pose a health risk.

Sampling Requirements: The City performed quarterly sampling for three treatment plants in 2005. Due to the low levels of disinfection by-products found in those samples the City was able to reduce the number of required samples to one per year for each of the three treatment plants..

City Status: The City tested for disinfection by-products in September of 2006, so they are in compliance until 2007.

6-5 Emergency Response Program

6-5.1 Water System Personnel Emergency Call-up List

The Public Works Superintendent, Water Division Supervisor, Water Division Foreman, and one of the Maintenance Workers are continuously on call, through the telemetry system, to answer emergency situations when not at work. Alarms from the City's telemetry system are announced at the Water Division shop control panel, and lack of response at the control panel initiates an automatic call to the Fire Department. The Fire Department then makes the appropriate calls to Water Division staff based on the list of emergency contacts shown in Appendix K. The Water Division Supervisor is the first tried, then the Water Division Foreman, and so on. The Water Division Supervisor has the option of calling out another staff person to respond. This procedure has worked well in the past, so no plans to modify the procedure are anticipated at this time.

The Water Division conducts a training program to educate its operations staff in the appropriate response to water system emergencies, including:

- Broken water mains
- Flooding
- Loss of water service to a customer
- Sudden changes in water appearance (color, clearness, taste, or odor)
- Power failure at the wells or booster pump stations
- Spills
- Overflow or leak at storage facility

The staff members listed on the emergency contact list in Appendix K have received this training and are qualified to direct the actions necessary to respond to the emergency.

6-5.2 Notification Procedures

If a water quality emergency develops, the current procedure is for the Public Works Superintendent to contact the DOH either at work or at home and discuss the situation. If it is determined that public notification is necessary the Municipal Services Director, or if he cannot be reached the Public Works Superintendent, will notify the local radio stations (KWIQ and KDRM), and the local newspaper

(Columbia Basin Herald) as soon as possible. The Public Works Superintendent shall notify the Grant County Health Department that day or the following work day if during non-working hours. In addition, businesses who serve the public, such as restaurants, will be individually notified of the situation. If it is deemed necessary, fliers may be delivered to the service connections that are affected.

The home phone numbers for the Municipal Services Director and the Public Works Superintendent are included on the emergency contact list included in Appendix K.

6-5.3 Vulnerability Analysis

A vulnerability analysis of the water system was conducted to identify and assess the major water system facilities particularly vulnerable to a disruption of service. It should be conducted by City staff on an annual basis in an effort to continually evaluate the system and make improvements to increase performance and reliability. The evaluation serves as the basis for development of an operations program suited to specific utility needs. Some of the major categories relevant to the Moses Lake Water System are as follows:

Source of Supply Vulnerability

One of the most significant concerns of the City is the vulnerability of certain wells to contamination. The wells of most concern are:

- Well 29, which is a shallow well located in the Larson Zone
- Well 12, which is a shallow well located next to the parking area at Cascade Diesel and an agricultural area
- Wells 21, 23, and 24, and 28 located in the TCE plume in the Larson area
- Well 17, which is located near some improperly constructed wells, that penetrate into the Grande Ronde aquifer.

Fortunately, the City has enough redundancy in the number of source of supply wells from two different aquifers to deal with the loss of one well in most situations.

Distribution System Vulnerability

Portions of the distribution system are vulnerable to loss of water service because of the lack of redundant piping in these areas. Some examples include the 12-inch diameter pipeline that serves the industrial area of the Wheeler zone and the pipeline across the I-90 bridge from the Central zone to the western portion of the Central zone. Although this situation typically can be rectified by constructing additional pipelines to form a loop in the distribution system, due to the length of pipe required and the lake, this is not a viable option for either scenario. The Wheeler zone has Well 17, Reservoir 6, and in an emergency Well 12 that can serve this area from both ends of the system. The western portion of the Central zone has Well 19 to supply water, but at this time there is no standpipe to regulate pressures or for storage.

Loss of Telemetry System

Another concern is the potential for loss of the telemetry system, which controls the operation of the supply wells based on reservoir elevations. The existing telemetry system is a radio-based system. This system of communication has been more dependable than the telephone-based communication system that it replaced in 1998.

Power Failure

Loss of power is not a serious concern to the Water Division because power has been historically restored within a few hours. Since the system has a sufficient amount of storage to meet demands for this limited time, back-up power facilities have not been installed at any of the well sites.

6-5.4 Contingency Operational Plan

If a source of supply becomes contaminated or for any other reason stops producing water, the system will rely on the other redundant sources to increase production to meet demands until the problem is corrected and the well is put back into the system. If a water shortage develops, the City would first attempt to redirect water from zones with surplus production to the zone experiencing the shortage. Next, they would inform the community of the shortage through the media and request that consumers conserve water. Finally, if additional steps are needed, a notice of water rationing would be ordered by the Municipal Services Director pursuant to Chapter 13.06 of the Moses Lake Municipal Code.

When a portion of the distribution system is damaged or must be taken out of service, the area is isolated, repaired, and placed back into service as soon as possible. When a section cannot be placed back into service in a timely manner (i.e.: waiting for parts or test results) or service cannot be interrupted to a customer, a temporary service may be used to provide water.

When the telemetry system is not operational, the water system is operated manually.

In the event of a power failure the water system has enough reservoir storage to supply demands for the duration of typical power outages, and water can be moved from the Wheeler and Larson Zones to the rest of the system by gravity.

6-6 Safety Procedures

The Water Division staff has a safety meeting every Friday for 30 minutes. A plan is also prepared annually for training of all staff members, which includes safety training. A City safety committee meets twice annually. The Public Works Superintendent and the Water Division Supervisor are on this committee.

All appropriate Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Administration (WISHA) regulations are followed.

6-7 Cross-Connection Control Program

The purpose of the City of Moses Lake's cross-connection control program is to protect the health of water consumers by reducing the possibility of contamination due to existing or potential cross-connections. Chapter 13.09 of the Moses Lake Municipal Code, which establishes the legal authority to implement and operate the program, is included in Appendix B. A copy of the Standard Operating Procedures (SOP) for the cross-connection control program is included in Appendix C. The SOP addresses the required elements of a cross-connection control program described in WAC 246-290-490(3).

6-8 Customer Complaint Response Program

Currently, the Water Division does not have a formal record keeping or filing system for consumer complaints that are received, but all complaints are handled immediately on a case by case basis. On an average, the Water Division receives between five to twelve complaints per year dealing with water quality. All of these complaints are directed to and handled by the Water Division Supervisor or the Water Quality Specialist who is responsible for sampling and testing the system. Typically, each one of these complaints is unique, but most fall into one of two major categories, discolored water complaints or questions whether a certain illness or condition could have been caused by City water. In the instance of discolored water complaints, the City attempts to determine the cause (i.e.: fire hydrant usage, contractor activity, water main flushing, etc.) and alleviate the problem. When presented with inquiries concerning health issues, the Water Division routinely provides information on water sample results in the area of the complaint; provides any DOH literature they have on the subject; and/or directs them to the Grant County Department of Health.

All questions or complaints about water bills are directed to and handled by the Finance Department.

6-9 Record Keeping and Reporting

The following records are collected on the Moses Lake water system and kept at the Water Division offices at 11789 Road 4 NE. At this time all records are kept indefinitely or until they are considered obsolete.

- Water quality sample results. (Bacteriological, VOC, SOC, inorganic, nitrates, lead, copper, and chlorine residual)
- Daily flowmeter readings at each of the pump stations
- Monthly static water and pumping levels at most wells
- Hydrant test data, along with out-of-service hydrants
- Outlet pressure at well sites
- Equipment and maintenance record folders for each well
- Individual large meter information, including test data by independent contractors, repairs, and parts used

Other departments of the City are involved in maintaining other records, such as information on major system equipment, meter readings, financial information, and consumption data.

6-10 O & M Improvements

The following is a list of recommendations for operation and maintenance improvements for the system:

- Continue with establishing, implementing, and enforcing the cross-connection control program.
- Reestablish a policy of measuring and recording monthly static well levels, pumping well levels, and motor vibrations.
- Develop a formal filing system for recording complaints and actions that are taken in response to the complaints.
- Promote or investigate additional conservation procedures and practices.

The Water Division should be able to address these items with existing personnel. Therefore, there should be no financial impact on the system.

Chapter 7
Distribution Facilities Design and Construction Standards

7-1 Project Review Procedures

Projects designed by the Moses Lake Engineering Division are prepared by one of the three engineers or one technician on staff. The plans and specifications for these projects are then reviewed and stamped by a professional engineer licensed in the State of Washington, which currently includes the City Engineer, Assistant City Engineer, and Project Engineer. During the review process, the designs are checked to assure they are in conformance with the City of Moses Lake Community Standards, City of Moses Lake Municipal Code, Washington State Department of Health's Water System Design Manual, Recommended Standards for Water Works (Ten State Standards), American Public Works Association Standards, and American Water Works Association Standards.

7-2 Policies and Requirements for Outside Parties

When an outside party, such as a developer, requests to extend the City's water system, one of the Development Engineers is assigned to the project. The outside party is required to provide a set of construction drawings that are stamped by a professional engineer who is licensed in the State of Washington. The Development Engineer reviews the construction drawings to assure they are in conformance with the City of Moses Lake Community Standards, City of Moses Lake Municipal Code, Washington State Department of Health's Water System Design Manual, Recommended Standards for Water Works (Ten State Standards), American Public Works Association Standards, and American Water Works Association Standards. The drawings are signed by the Municipal Services Director and approved for construction when they have met all the requirements of the above mentioned standards.

7-3 Design Standards (Performance Standards and Sizing Criteria)

7-3.1 Distribution System

The function of the distribution system is to convey water to customers at adequate service pressures and to provide fire flow. A normal operating range of 40 to 100 psi satisfies DOH requirements. The capacity of the distribution system shall be such that it will meet peak hour demands with pressures no less than 30 psi. The distribution system shall also be able to provide the required fire flows during the MDD. The minimum system pressure permitted during a fire flow is 20 psi. This minimum pressure requirement prevents backflow from a customer service into the system even under fire flow conditions.

Usually, the inability to meet the above demand conditions is due to inadequate distribution capacity; that is, pipes are not large enough or pipeline network is poor. The capacity of the distribution system is greatly reduced when head loss of the pipeline system is greater than about 10 feet per 1,000 feet of pipe length under normal flow conditions.

Conversely, distribution system improvements become less effective once head loss per 1,000 feet of pipeline is below 10 feet.

The minimum pipeline diameter is dictated by the minimum residential fire flow requirement. State law allows a minimum of 6-inch pipe, but the City requires an 8-inch pipe unless an engineer can verify that the minimum fire flows can be obtained with smaller lines. It is recommended that 8 inches be the minimum pipe diameter in order to keep the velocity in the pipe below 10 feet per second during high flow conditions.

Normal engineering practice is to design systems with pipeline velocities between 3 and 5 feet per second during MDD for pumped systems, allowing 7.5 feet per second for peak conditions. Velocities up to 10 feet per second are also commonly allowed within the yard piping of a pump station to reduce capital costs of appurtenances at the station.

7-3.2 Storage

Storage volume requirements are determined as the sum of the equalizing, standby, and fire flow components. Equalizing storage is calculated for any pressure zone that cannot meet and exceed the peak daily demand with the sources of supply located in that zone. Standby storage is based on the zone's ability to meet and exceed the maximum daily demand with the largest source is out of service. This provides a margin of system reliability for emergency and unusual conditions. Fire storage requirements for each zone are based on the largest fire flow demand in each zone as determined by the Washington Surveying and Ratings Bureau (WSRB) using Insurance Services Office (ISO) guidelines. The City assumed fire flow demands that exceed the WAC requirements for the Montlake, Larson, and Wheeler zones since the WSRB did not rate any facilities in these zones.

Useable storage is defined as the volume between the overflow and the 25 psi fire flow level. The fire flow minimum level is determined by adding 25 psi (20 psi residual plus 5 psi dynamic loss) of head pressure to the highest ground surface elevation in the pressure zone served by the reservoir.

Standby and fire suppression components were consolidated while analyzing the storage requirements of the system as allowed per WAC 246-290-235(4).

7-3.3 Source

The required amount of supply for each pressure zone is based on the maximum daily demand (MDD) for that zone. The City attempts to provide enough water to each pressure zone to exceed the MDD with the largest source of supply out of service. To accomplish this the City relies not only on the wells located in the zone, but also interties with adjacent pressure zones. By using these interties to transfer water from a zone with a surplus of supply to a zone in need, the City is able to provide a higher level of reliability.

7-4 Construction Standards (Materials and Methods)

The City's Community Standards (included in Appendix C), Section 9-30 of the Washington State Department of Transportation's Standard Specifications for Road, Bridge, and Municipal Construction, Chapter 8 of the Water System Design Manual, and Part 8 of the Recommended Standards for Water Works specify the construction materials and methods required by the City of Moses Lake for the distribution system.

For water storage facilities the construction materials and methods are in accordance with AWWA Standard D100, Chapter 9 of the Water System Design Manual, and Part 7 of the Recommended Standards for Water Works.

In the development of new or the rehabilitation of existing sources of supply, the construction materials and methods are in accordance with AWWA Standard A100, Chapter 7 of the Water System Design Manual, and Part 3 of the Recommended Standards for Water Works. In addition, these projects require written DOH approval.

7-5 Construction Certification and Follow-up Procedures

The City inspects the construction materials and methods to assure that the improvements are installed in accordance with the approved drawings. City inspectors are present during all pressure testing. Personnel from the Water Division collect required water samples and send them to an approved testing lab. The City inspector is responsible for recording any changes, additions, or deletions from the improvements shown on the construction plans and recording them on the record drawings. After the project is complete, municipal improvements are accepted by the City Council. A Construction Report is then sent to the DOH if required.

Chapter 8
Improvement Program

8-1 Improvement Schedule

This chapter presents a summary of the recommended improvements for the City of Moses Lake water system. The estimated construction costs for these improvements are shown for the distribution, supply, storage, and miscellaneous improvements. All estimates are calculated using the year 2006 costs. Inflation is not factored into these estimates.

This study has projected future improvements based on the anticipated growth and the condition of the existing components of the water system. The schedule for implementing modifications, replacements, and improvements ensures that projected and potential demands can be met. Tables 8-1 through 8-7 list the improvements identified for the 20-year planning period. Since planning is a dynamic process dependent on several unknown factors, the actual improvement schedule will vary from Tables 8-1 through 8-7.

The cost estimates provided in the plan are based on trends which have been observed for similar facilities. Detailed cost estimates have not been calculated. Actual costs will vary from these estimates. The final costs will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, actual inflation costs, and other variables. Thus, project feasibility and funding needs must be reviewed before making specific financial decisions. Costs for each project planned should be re-estimated using project-specific data before budgets are finalized.

Estimates of contingencies, engineering, and administration costs are included in the cost estimates shown in Tables 8-1 through 8-7. No costs are included for legal involvement, lawsuit judgements, or settlements. The map located in Appendix N shows the general location of the improvements.

Table 8-1
Improvement Schedule - 2006

Project Title	Type of Improvement	Description	Page Where Identified	Estimate of City Costs	Financing Source
Water Comp Plan	Miscellaneous	Update 2000 Comprehensive Water Plan	N/A	$30,000	W/S Fund
Distribution System Improvements	Distribution	Complete projects identified in Table 3-10 to improve fire and system flows; eliminate dead ends; and revise the distribution system	3-15	$250,000	W/S Fund

Table 8-2
Improvement Schedule - 2007

Project Title	Type of Improvement	Description	Page Where Identified	Estimate of City Cost	Financing Source
Redrill Well #19	Supply	Redrill Well #19 to increase the size	3-16	$400,000	W/S Fund

		and production of the source			
Redrill Well #31	Supply	Redrill Well #31 to provide a properly sealed well	3-16	$300,000	W/S Fund
Moses Pointe Reservoir	Storage	Storage to serve the Moses Pointe pressure zone	3-16	0	Private
Distribution System Improvements	Distribution	Complete projects identified in Table 3-10 to improve fire and system flows; eliminate dead ends; and revise the distribution system	3-15	$100,000	W/S Fund
Road N Water Main	Distribution	Extend water main for new industry	3-15	0	CERB grant and industry participation

Table 8-3

Improvement Schedule - 2008

Project Title	Type of Improvement	Description	Page Where Identified	Estimate of City Cost	Financing Source

Well #31 Pumphouse	Supply	Construct a pumphouse for Well #31	3-16	$400,000	W/S Fund
Peninsula & Lakeshore water main replacement	Distribution	Replace 6-inch water main prior to new road section being built	3-15	$900,000	W/S Fund
Cascade Valley water main extension	Distribution	Extend water main across the lake into Cascade Valley	3-15	$600,000	W/S Fund
Larson Reservoir	Storage	Storage to serve the Larson pressure zone	3-16	$1,500,000	W/S Fund
Redrill Well #3	Supply	Redrill Well #3 to meet current DOE standards	3-16	$300,000	W/S Fund

Table 8-4
Improvement Schedule - 2009

Project Title	Type of	Description	Page	Estimate	Financing

	Improvement		Where Identified	of City Cost	Source
Well #3 Pumphouse	Supply	Construct a pumphouse for Well #3	3-16	$400,000	W/S Fund
Distribution System Improvements	Distribution	Complete projects identified in Table 3-10 to improve fire and system flows; eliminate dead ends; and revise the distribution system	3-15	$600,000	W/S Fund

Table 8-5

Improvement Schedule - 2010

Project Title	Type of Improvement	Description	Page Where Identified	Estimate of City Cost	Financing Source
Redrill Well #4	Supply	Redrill Well #4 to meet current DOE well construction standards	3-16	$300,000	W/S Fund

Raise Reservoir #7	Storage	Raise Reservoir #7 to match the elevation of the proposed Larson reservoir	3-16	$700,000	W/S Fund

Table 8-6
Improvement Schedule - 2011

Project Title	Type of Improvement	Description	Page Where Identified	Estimate of City Cost	Financing Source
Well #4 Pumphouse	Supply	Construct a pumphouse for Well #4	3-16	$400,000	W/S Fund
Distribution System Improvements	Distribution	Complete projects identified in Table 3-10 to improve fire and system flows; eliminate dead ends; and revise the distribution system	3-15	$600,000	W/S Fund

Table 8-7

Improvement Schedule - 2012 - 2025

Project Title	Type of Improvement	Description	Page Where Identified	Estimate of City Cost	Financing Source	Year
Water Comp Plan	Miscellaneous	Update the 2006 Water Comp Plan	N/A	$30,000	W/S Fund	2012
Well #8 Rehab	Supply	Rehabilitate Well #8 to meet current DOE construction standards	3-16	$500,000	W/S Fund	2012
Remove Tanks #2, 3, and 4	Storage	Remove 3 unused elevated tanks	3-16	$300,000	W/S Fund	2013
Knolls Vista Well	Supply	Drill a new well in the Knolls Vista Zone	3-16	$1,000,000	W/S Fund	2014

Larson Well	Supply	Drill a new well in the Larson Zone	3-16	$1,000,000	W/S Fund	2016
Lakeview Well	Supply	Drill a new well in the Lakeview Zone	3-16	$1,000,000	W/S Fund	2018
Wheeler Well	Supply	Drill a well in the Wheeler Zone	3-16	$1,200,000	W/S Fund	2020
Montlake Well	Supply	Drill a new well in the Montlake Zone	3-16	$1,000,000	W/S Fund	2022

Chapter 9
Financial Program

9-1 Past and Present Financial Status

Table 9-1 shows historical revenues and expenses for the water utility for the period from 2001 through 2005. Non-operating revenues include interest accrued by funds being held for water utility capital projects.

Table 9-1
Summary of Historical Revenue and Expenses
Moses Lake Water Utility

	2001	2002	2003	2004	2005
Number of Customers	6641	6693	6873	7110	7450
Operating Revenues:					
Service Fees	$3,053,000	$3,169,000	$3,594,000	$3,910,000	$3,705,000
Other	28,000	21,000	28,000	445,000	48,000
Total Operating Revenue	3,081,000	3,190,000	3,622,000	4,355,000	3,753,000
Operating Expenses:					
Operation	584,000	650,000	788,000	926,000	901,000
Maintenance	877,000	1,022,000	886,000	688,000	709,000
Administration	341,000	394,000	619,000	1,539,000	2,775,000
Depreciation	467,000	517,000	548,000	593,000	563,000
Total Operating Expenses	2,269,000	2,583,000	2,841,000	3,746,000	4,948,000
Net Operating Revenue (loss)	812,000	607,000	781,000	609,000	(1,195,000)
Non-Operating Rev (Exp)	74,000	85,000	199,000	474,000	2,473,000
Transfers	(331,000)	(122,000)	(831,000)	(1,588,000)	(1,294,000)
Net Income (loss)	555,000	570,000	149,000	(505,000)	(16,000)

The current rates being collected are adequate to meet the operating expenses of the utility. Funding for capital projects, other than standard maintenance and rehabilitations, are taken from a separate capital fund, which is held for both the water and sewer utility. The balance of this fund at the beginning of 2006 was approximately $2,392,000.

9-2 Available Revenue Sources

The planned improvements may be funded through grants, low interest loans, municipal bonds, or user rates. A combination of these methods will most likely be used.

9-3 Allocation of Revenue Sources

Table 9-2 shows revenue and expense projections for the water utility throughout the planning period. The capital improvements identified in Chapter 8 are also shown. Table 9-2 shows the planned capital improvements being funded entirely with user rates and the reserve account. In response to a capital shortfall, projects would have to be funded from additional sources, either internal or external.

9-4 Program Justification

Table 9-2 is based upon the following assumptions and information:

A 3.0% annual rate of inflation.

A 3.0% annual increase in service connections to match the 3.0% growth rate for the Moses Lake area as stated in the Grant County Comprehensive Plan

A 3.0% increase in water rates for the years 2006 through 2011.

Table 9-2
Financial Projections (All Costs in Thousands of Dollars)

Year	2005	2006	2007	2008	2009	2010	2011
No of Connections	7450	7675	7900	8140	8385	8635	8895
Usage $/Connection	497	512	527	543	560	576	594
Actual Revenues	3705						
Projected Usage Rev.		3930	4163	4420	4696	1974	5284
Actual Expenses	4948						
Inflated Expenses		2900	2987	3077	3169	3264	3362
CIP Costs (2006 $)		280	1100	3400	1000	1000	1000
Inflated CIP Costs			1133	3607	1093	1126	1159
SUMMARY	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**

Year							
Projected Revenues		3930	4163	4420	4696	4974	5284
Projected Expenses		2900	2987	3077	3169	3264	3362
Net Income		1030	1176	1343	1527	1710	1922
Capital Improvements		280	1133	3607	1093	1126	1159
Annual COP Account Status		750	43	(2264)	434	584	763
CIP Account Total	2392	3142	3185	921	1355	1939	2702

9-5 Assessment of Rates

User fees for the water system fall into four main categories; utility connection fees, system development charges, water rates, and reimbursements. These fees are described in detail in the following sections of the Moses Lake Municipal Code included in Appendix B:

Fee	Section
Water connection fees	3.58
System development charges	3.62
Water rates	13.12
Reimbursements	13.08

Since 1999 the City Council has increased the water rates for both the residential and commercial water services by the All Urban, All West City Average, December to December, Consumer Price Index. The increases in the rates for both the minimum charge and additional usage are typically 3.0 percent or more each year. The current rates are included in Appendix B. These increases are expected to only have a minimal effect on water usage and conservation.

These rate increases will allow the system to adequately meet the needs for the next 6 years, but additional rate increases may be required to meet long range financial demands. Therefore, a study of the water system rates would be appropriate in the future to determine the financial requirements of the system. This will also help to justify any rate increases required to meet these demands.

Chapter 10
Miscellaneous Documents

10-1 Supportive Documents

10-1a State Environmental Policy Act

A SEPA checklist has been submitted for the Water System Plan (WSP) to the City of Moses Lake Community Development Department. The final copy of the WSP shall include a Determination of Non-Significance (DNS), a mitigated DNS, or a Final Environmental Impact Statement (EIS). All projects required to eliminate or mitigate environmental impacts noted in the SEPA checklist or EIS will be added to the Improvement and Financial Programs.

10-1b Other Supportive Documents

A copy of the City of Moses Lake Community Street and Utility Standards is included in Appendix C.

10-2 Agreements

A copy of the service area agreement and a map showing the water service area boundaries for several water systems in the area is included in Appendix D. The City of Moses Lake's Water Service Area is consistent with the Grant County Coordinated Water System Plan and the Grant County Comprehensive Plan.

The City is in the process of developing an interlocal agreement with Grant County for determining construction standards for improvements within the unincorporated Urban Growth Area (UGA). This agreement should have little, if any, affect on the water system since all extensions to the water system are built to City standards.