
Final

Lebanon Water System Master Plan

Prepared for
City of Lebanon, Oregon

May 2007

CH2MHILL



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Executive Summary

Executive Summary

The City of Lebanon's 2007 Water Master Plan provides a road map for the coming years, enabling Lebanon to continue to meet its customers' needs in a cost-effective manner. The evaluations and findings of this study are summarized in the capital improvements plan section of this report. This capital improvement plan identifies specific project needs and provides anticipated dates for their implementation.

A second component of the master plan was the development of a financial plan. Working closely with city staff, revisions to the city's water service rates and system development charges have been proposed.

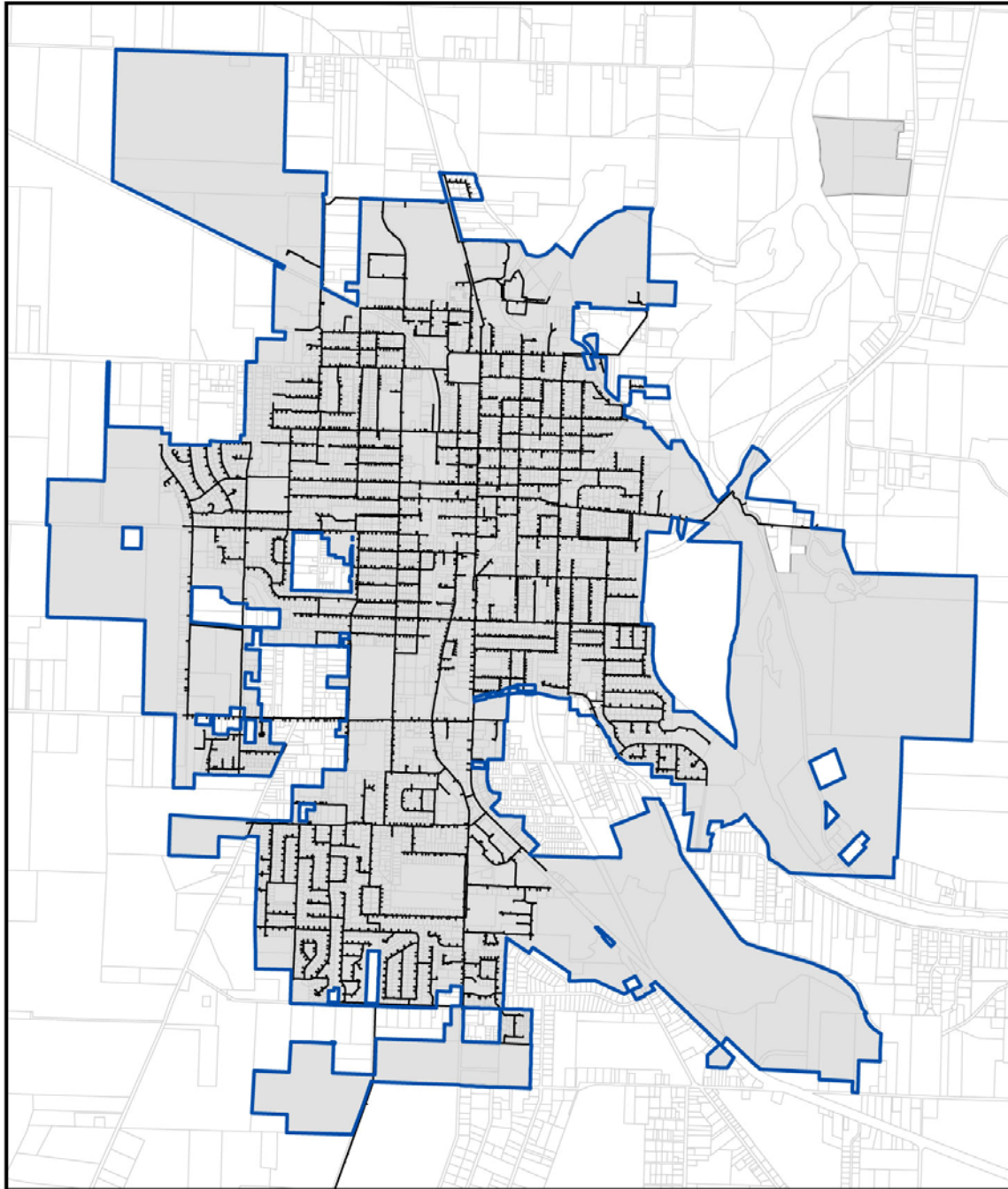
Master Plan Goals

The 2007 update to the city's Water Master Plan was undertaken by the city because of the following reasons:





1. The city anticipates significant residential, commercial, and industrial growth in the coming years.
2. Many of the recommendations in the city's last master plan, prepared in 1989, have either been implemented or are no longer valid. The city was due for an update to this plan.
3. Water treatment capacity and reliability is a concern. The city withdraws water from the Santiam Canal, which is vulnerable to human-caused contamination events. The processes and equipment used in the water treatment plant are dated and worn, and it is an appropriate time for the city to initiate its replacement.
4. Development of a supplemental groundwater supply has been recommended in past studies, but the city has not installed this system. This master plan provided an opportunity to finalize direction for developing a groundwater supply based on the evaluations that have been completed prior to and during this study.
5. An updated plan was needed as a basis for reviewing and adjusting water rates and system development charges.

Population and Water Use

Lebanon's water system served approximately 13,500 people in 2005. This accounts for a small number of customers that live outside of the city limits and the few city residents that live within the city but are not connected to the city water system. The water system service area is shown on the map in **Exhibit ES-1**.

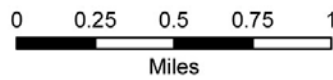


Legend

-  Water Lines
-  Tax Lots
-  Service Area
-  City Limits

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**Exhibit ES-1
Service Area**

Lebanon Water Master Plan



Annually, the system supplied nearly 700 million gallons of water to the customers or an average of 1.84 million gallons per day (mgd). All services are metered.

As typical for Oregon utilities, Lebanon's water demands are twice as high during the summer months as they are during the winter months because of outdoor irrigation. Summer demands also fluctuate from one year to the next because of variations in temperatures and rainfall. The highest recorded single day demand in the system was 3.8 mgd.

On a per capita basis, the average use has been 143 gallons per person per day in recent years. It reaches 250 gallons per person on a peak summer day. These values include all water that is used (residential, commercial, and industrial), divided by the total service area population. Residential use accounts for 56 percent of the use within the system. Commercial and industrial customer use is 41 percent of the total, and governmental agencies (city parks, schools, etc.) use the remaining 3 percent.

Unaccounted-for water in Lebanon's system, or the difference between water delivered to the system and water sold to water customers, has averaged 22 percent in recent years. This means that on average the city is not accounting for 420,000 gallons each day. The Water Resources Department's goal for municipal water suppliers is ten percent or less.

Projected Water Use

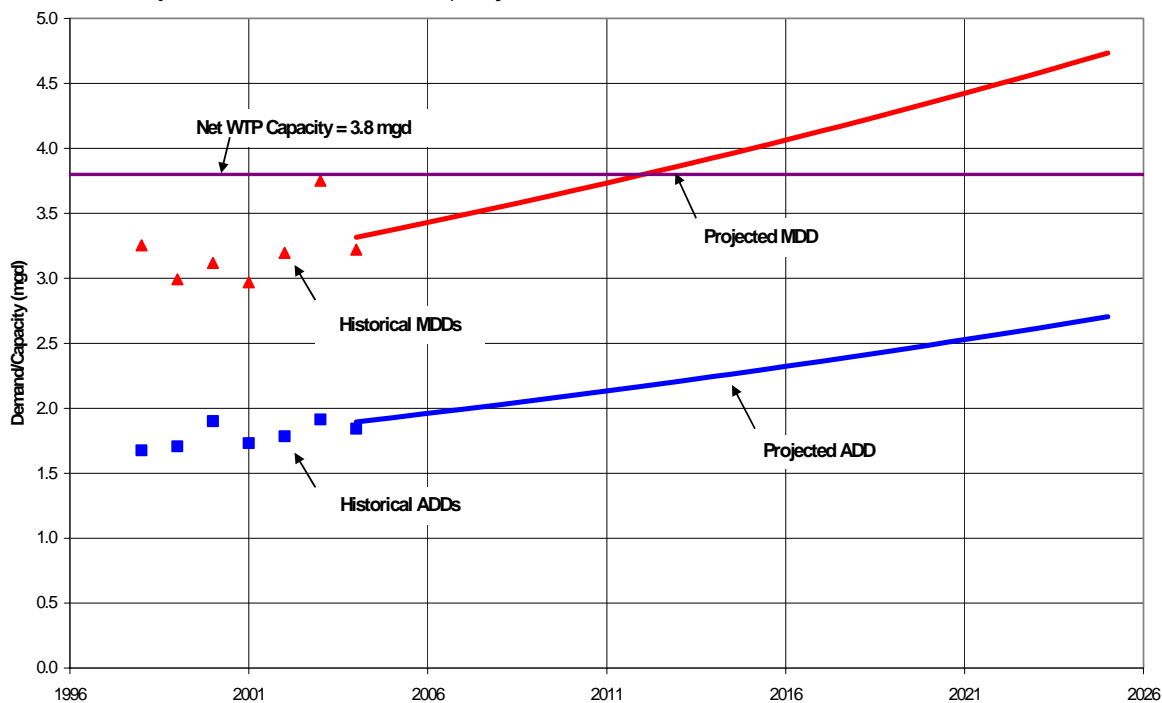
Future demands on the City of Lebanon water system were projected by applying per capita water use values to available population projections. The 2005 service population was estimated as 13,487. At an annual population growth rate of 1.71 percent, Lebanon's service population is expected to equal 18,931 in 2025. This represents an increase of approximately 40 percent over the 20-year planning period.

Exhibit ES-2 summarizes historic values and projections for average and maximum water demand within Lebanon's service area. The current capacity of Lebanon's single water treatment plant (WTP) is also shown. Maximum day demand is expected to approach the capacity of the WTP by approximately 2012. Additional water capacity will be needed prior to that time to avoid water shortages. The average day demand is projected to reach 2.7 mgd and the maximum day demand is projected to reach 4.7 mgd in 2025.

Regulatory Review

Two new federal drinking water regulations may impact the city's system. The Long-Term 2 Enhanced Surface Water Treatment Rule may require treatment process changes at the city's water treatment plant, depending on the outcome of newly required monitoring of the source water. The Stage 2 Disinfection By-Products Rule may also require changes to the treatment process depending on monitoring results within the distribution system. Both rules were signed into law in December 2005 and will be implemented over the next 2 to 5 years.

EXHIBIT ES-2
Historical and Projected Demands and WTP Capacity



In addition to these new rules, the city must maintain vigilance in its corrosion control program. Since making adjustments in 2004, the city has remained in compliance.

Water Supply

The city's existing water supply system consists of a withdrawal intake on the Santiam Canal and treatment through a single water treatment plant (WTP). Both the intake and WTP are located on a city block bounded by the Santiam Canal to the south, 2nd Street to the west, A Street to the north, and Main Street to the East. This master plan evaluated the city's water rights and assessed the water treatment plant. In addition, alternative withdrawal locations and treatment plant locations for a surface supply were considered. Finally, a supplemental or replacement groundwater supply was evaluated. The results and recommendations from each evaluation are summarized below.

Water Rights

The City of Lebanon holds four water rights: three for use of surface water from the South Santiam River, and one relatively minor groundwater right for irrigation of 5.5 acres. All three of the surface water rights identify the Santiam Canal as the authorized point of diversion. The three surface water rights provide for use of water for municipal purposes. Two were originally authorized for municipal use and one was changed from industrial use to municipal use by Transfer Application T-6110. Two of the three surface water rights were confirmed and authorized as part of the adjudication and Circuit Court decree of pre-1909

water rights in the Santiam River Basin. The other surface water right was approved through OWRD's permit application process.

The city's surface water source, the South Santiam River, provides reliable streamflow. The city's certificated surface water rights (priority date 1890 and 1900) enjoy very senior priority dates and would not likely ever be regulated in favor of other water right holders. It is also unlikely that the city's 1979 permit S-44389 would be regulated in favor of senior water right holders and senior minimum perennial streamflows. However, the long-term utility of permit S-44389 is unknown until the city successfully completes the permit extension process currently before OWRD.

The following recommendations to protect and maximize the city's existing water rights are provided for the city's consideration:

- 1. Water Right T-6110 (1890 date for 10 cubic feet per second on the South Santiam River).** Use OWRD's Reimbursement Authority to expedite the issuance of the confirming certificate. The water right certificate confirming the changes approved in T-6110 (industrial use to municipal use) has not been issued by OWRD.
- 2. Groundwater right 37744 (1968 date for 0.7 cubic feet per second for irrigation).** To ensure the protection of this water right, continue to use the water right for beneficial irrigation use at least once every 5 years and document the use.
- 3. Water right permit S-44389 (1979 date for 18.0 cubic feet per second on the South Santiam River).** The city will not have legal access to the water under permit S-44389 until it receives a Final Order approving its permit extension application. The city should consider seeking professional guidance in negotiating the permit extension process with OWRD, especially with respect to the finding OWRD is required to make about the impact of the water use on listed fish species.
- 4. Begin development of a Water Management and Conservation Plan.** Upon successful completion of its permit extension, the city will not be authorized to access any water under the permit until OWRD approves a Water Management and Conservation Plan submitted by the city under the provisions of OAR Chapter 690, Division 86. Using the Water System Master Plan data being developed, the city should consider beginning to develop its Water Management and Conservation Plan. The city's Water Management and Conservation Plan can be a valuable tool in the permit extension process by providing a comprehensive story as to why the water is needed, and it provides an opportunity for the city to document existing and evaluate additional water management and conservation efforts.

Existing Water Treatment Plant

The city's water treatment plant is the sole water supply for the city. It treats water withdrawn from the Santiam Canal, which flows from the South Santiam River. The water treatment plant uses a conventional coagulation-filtration process. The processes that most limit capacity in the plant are coagulation, flocculation, and settling, which all occur in the single Accelator© treatment unit. The recommended maximum capacity of the unit is 4.0 mgd. The maximum water demand of the system has approached this value (3.75 mgd in 2003). Furthermore, there is only a single Accelator© unit, meaning that there is no

redundancy for this component. Should the unit fail because of mechanical or electrical problems, water treatment operations will be severely impacted.

The existing facilities are marginally adequate for near-term demands. A sudden demand increase, resulting from a new commercial or industrial customer, may quickly exhaust the available capacity and put the city's supply into a deficit condition.

Furthermore, many of the individual facilities within the plant are approaching the reasonable end of their design life. Any plan involving continued long-term use of existing facilities must be carefully considered for the following reasons:

- The Accelator® is nearly 60 years old. Deficiencies in existing parts resulting from corrosion have been identified. If the Accelator® fails, the WTP cannot operate at its rated capacity without impacts to its treatment effectiveness. At a minimum, this unit must be replaced or rehabilitated.
- Two of the operating filters are at least 25 years old. This is approaching the range of typical design life. Parts are difficult to procure. Two filters already have been abandoned for structural reasons.
- Corrosion and weak spots in the filter gallery piping have been identified. Treating pipes for corrosion control will be costly and difficult, with limited long-term success. Replacing pipes or valves while the system operates will also be difficult.
- Crumbling concrete in the clearwell requires maintenance to prevent water from corroding underlying reinforcing material.
- Chemical systems, backwash and Accelator® waste handling, and clearwell capacity will need to be expanded to meet future demands. Space within current facilities is very limited, and the overall WTP site is small. Property acquisition may become necessary if existing systems are to be expanded to meet future or buildout demand.
- Existing facilities lack redundancy, and clearwell storage volume is not large enough to provide water for a prolonged, unplanned shut down. The single Accelator® unit and reliance on the Santiam Canal as the sole raw water source are liabilities.
- Original filter controls are beginning to require maintenance. Parts from an unused control unit are salvaged to repair functioning units. New controls may be necessary in the near future.

Surface Water Source Analysis

The existing withdrawal point on the Santiam Canal and alternative withdrawal locations upstream on the canal or on the South Santiam River were compared on the basis of water quality and risks.

The canal's proximity to commercial enterprises, roads, parking lots and road/driveway crossings increases the risk of possible contamination from accidental spills. The potential contaminant source inventory in Lebanon's *Source Water Assessment Report*, updated in November 2005, identifies 88 sources of potential contamination downstream of the canal headworks (between the South Santiam River and the city's withdrawal point).

Both the river and the canal flow through agricultural and developed areas and are exposed to runoff from each type of land use. However, the canal is considered more susceptible to contaminants from these uses because: a) More than 60 homes are located within 100 feet of the canal upstream of the city's intake; b) Three ditches carry stormwater runoff into the canal; c) There is potential for groundwater seepage from Cheadle Lake into the canal. Because Cheadle Lake was formerly a lumber mill pond, seepage represents a potential source of contaminants that leech from the lake sediments. In addition to these specific concerns for the canal, the river flow is 6 to 90 times the canal flow, thereby providing greater dilution.

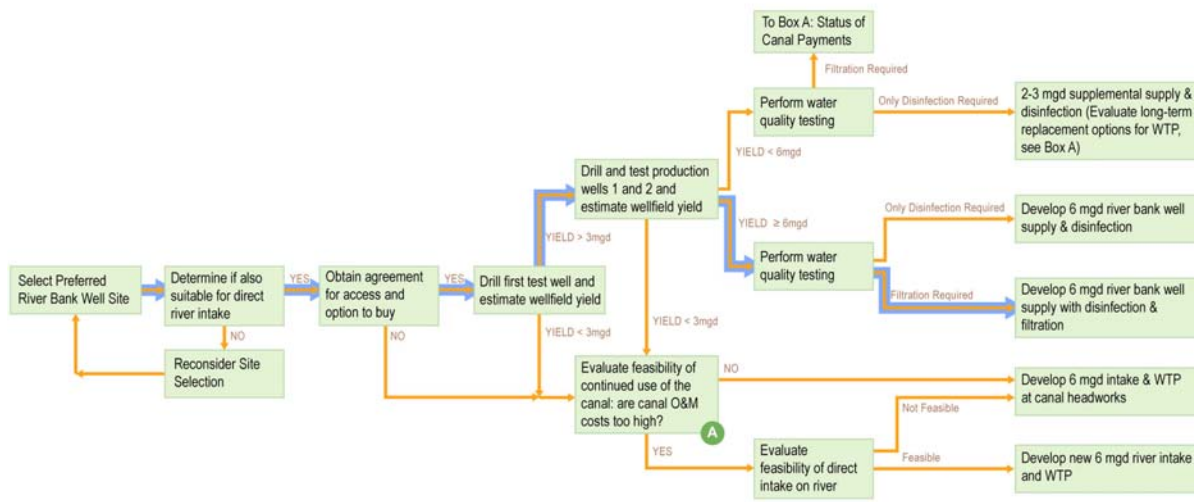
From a water quality protection standpoint, it is recommended that the city move the intake to the South Santiam River or upstream on the canal. If the city chooses to maintain an intake on the canal, moving the intake upstream of Cheadle Lake eliminates 17 of 20 road crossings, approximately 80 of 88 potential contamination sites, many of the neighboring homes, and the potential introduction of contaminants from Cheadle Lake.

Groundwater Analysis

Three potential groundwater supplies were evaluated as part of this master plan. Two of them, development of groundwater supply wells as a supplemental supply, and development of an aquifer storage and recovery system that stores treated drinking water during the low-demand winter period in an aquifer beneath the city, proved to be unfeasible. A third option, development of river bank wells that target higher permeability sediments near the South Santiam River as a replacement to the city's existing raw water supply on the Santiam Canal, was found to be worthy of further investigation.

The optimum result of installing river bank wells would be for them to provide a sufficient quantity of high-quality raw water, requiring only disinfection treatment, to meet the city's long term needs. The ability of river bank wells to achieve this result is uncertain. Therefore, **Exhibit ES-3** provides a decision flow chart to guide the city as it moves forward in expanding its water supply. This chart shows the steps necessary during the investigation of river bank wells and provides decision points at which the city may want to abandon river bank wells in favor of a potentially more costly surface water intake on either the Santiam Canal or the South Santiam River.

The capital improvements plan (CIP), presented in Chapter 10 is based on an alternative which relies upon successful production from river bank wells, but with water quality that requires filtration. This scenario is the highlighted pathway on Exhibit ES-3.



Note: Highlighted path is the basis for the capital improvements plan; however, the actual outcome is uncertain pending field investigations.

EXHIBIT ES-3
Supply Development Flowchart
Lebanon Master Plan

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Recommended Supply and Treatment Plan

The master plan recommends that the city proceed with long-term investments in the water supply and treatment system by relocating the withdrawal location and by replacing the WTP with a new facility. The following factors contributed to this recommendation:

1. Water demands within Lebanon will exceed the existing plant capacity within a few years.
2. Structural, mechanical, and electrical components of the existing plant are nearing the end of their useful life. The plant lacks redundancy of major components. The existing plant site is severely constrained and will not allow cost-effective expansion.
3. A supplemental well supply, one that could meet the city's needs during high demand periods and provide a redundant source, is not feasible.
4. The existing intake on the Santiam Canal is significantly more vulnerable to chemical spills and other detrimental water quality events than is a location upstream on the canal or on the South Santiam River.

The use of river bank wells along the South Santiam River may provide a cost-effective water supply for the city. However, both the water quantity and quality is uncertain in advance of field investigations. A supply development flowchart, illustrated in Exhibit ES-3, was developed to provide guidance to the city in moving ahead with supply and treatment improvements.

Immediate Recommendations

The city has indicated that funding limitations may delay construction of a new WTP for 5 to 10 years. The delay presents the city with a significant risk of water shortages (because of demand growth) and interruptions in supply (because of mechanical failures in the existing plant).

In particular, there is a concern regarding the reliability of the Accelerator[®] unit. It is old and there is evidence of significant corrosion and mechanical wear. If there is a mechanical failure of one of the main systems of this unit, Lebanon will not be able to supply potable water (or possibly, the city will be able to supply potable water but only in limited quantities) for a period of 6 to 10 weeks while replacement parts are manufactured and installed. Given the severity of this situation, CH2M HILL recommends that the city obtain a replacement gear/impeller to have on hand for immediate replacement.

Distribution System Evaluation

A significant task of the water master plan was updating and revising the hydraulic model of Lebanon's distribution system and using this model to evaluate the distribution system's capability of meeting both current and projected needs. This model was used to evaluate alternative solutions for deficiencies that were found. It was submitted to Lebanon at the conclusion of the project for continued use by staff.

The primary recommendations from the distribution system analyses follow:

- Recommended improvements to the existing distribution system include replacement of the 6-inch and 8-inch lines along Main Street from Elmore Street to Airport Road with 20-inch-diameter pipeline, and the extension of an existing 12-inch line along Main Street from Russell Drive to Division Way. The total length of these improvements is approximately 5,000 feet.
- Other recommended pipeline improvements, presented in detail in the CIP, are to be added as the city grows within the urban growth boundary. The proposed improvements create a loop around the city that provides a backbone for transmission and system redundancy.
- Because development east of the river is imminent, CH2M HILL recommends that the city acquire property in proximity to the East Grant Street Reservoir, and build a new 2.6 MG reservoir to serve 2025 storage needs.
- New developments at elevations above 400 ft are expected to be served by new closed-end pump stations.
- Three possible locations for a new WTP were modeled. Pipelines connecting a new WTP to the existing system were assumed, and all locations were found to be satisfactory from a distribution system stand point.

Capital Improvements Plan

One of the goals for the City of Lebanon' Water Master Plan was to develop long-term guidance for decision-making: what facilities to build and when to build them; how to prioritize investments in the maintenance, repair, and rehabilitation of existing facilities; and how to adjust to changing conditions or intervening events. The outcome is presented in a comprehensive CIP table in Chapter 10. The largest projects are summarized in **Exhibit ES-4**, and a cash flow chart that includes costs for both maintenance of the existing system and capacity growth is presented in **Exhibit ES-5**.

EXHIBIT ES-4

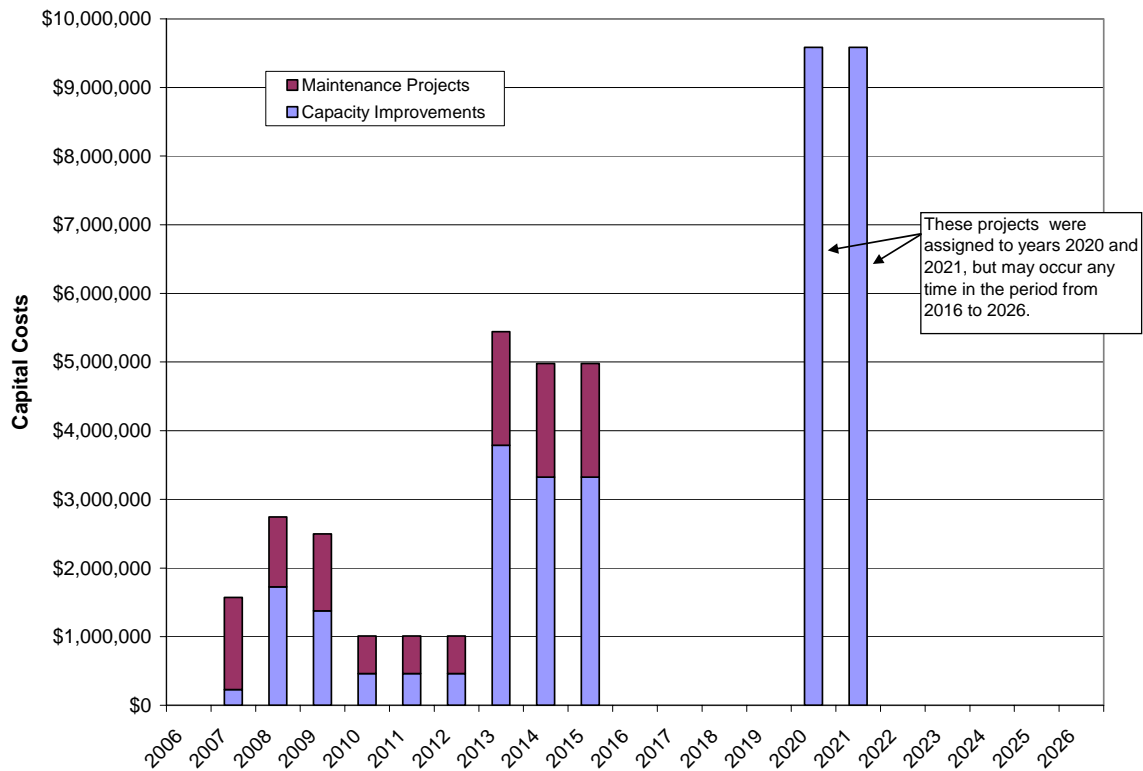
Major Projects Identified in the Capital Improvements Plan

Start Date	End Date	Project Title	Description	Total Capital Cost
2007	2015	Small diameter pipeline replacement program	On-going program to replace old and small-diameter pipes.	\$4,910,000
2008	2009	New distribution reservoir tank	3.0 MG, located near the East Grant Street Reservoir; at same overflow elevation	\$2,230,000
2008	2008	River bank production wells No. 1 and No. 2	Design, construct, and test two 1-mgd production wells	\$610,000
2010	2013	River bank wells No. 3, 4, 5, and 6	Design, construct, and test four 1-mgd production wells	\$1,860,000
2013	2015	Water treatment plant to treat river bank well water	Includes land purchase, water treatment plant, new 2 MG clearwell, high service pump station, and finished water transmission pipeline	\$13,300,000
2020	2021	Southeastern distribution improvements	New 24" river crossing, approx. 1200' in length. Located near Riverview School. Assume 30" (approx. 25" ID) HDPE pipe, with Dimension Ratio of 13.5.	\$922,000

The CIP project dates are approximate. Lebanon will adjust the projects and their implementation schedules to ensure that the system is managed efficiently to meet customer needs.

EXHIBIT ES-5

Lebanon Water System Capital Projects: Cash Flow Projections



Financial Plan

A water system financial plan was prepared at the conclusion of the master plan project. It provides rate and system development charge (SDC) plans that will be sufficient to fund existing programs, and the capital projects that have been recommended in this master plan. The city is in the process of increasing water SDCs based on a program recommended by a citizen advisory committee. Rates determined using the city's current plan for SDC escalation and an alternative SDC analysis are provided in Chapter 11.