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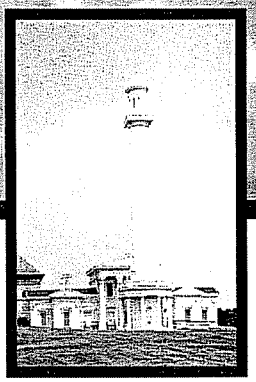

2002–2021 FACILITIES PLAN

VOLUME 1 OF 2

Institutional, Managerial,
and Financial Elements

LOUISVILLE WATER COMPANY

BLACK & VEATCH
Corporation

2002

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Executive Summary

Louisville Water Company (LWC or the Company) has long been a leader in the water industry, as demonstrated by its high level of customer satisfaction and wide recognition among its peers. However, the Company understands that is must continue to evolve to keep up with a changing industry and to continue its excellent performance.

Recognizing the changing industry, LWC's strategic planning process focused on the key issues of Water Sales, Competitiveness, and Water Quality. These issues provided the Company with guidelines for identifying their goals and objectives and associated strategies for future operation. The issues also provide direction for the development of the *Institutional, Managerial and Financial Elements of the 2002 – 2021 Facilities Plan.* The Water Sales issue is examined in the Business Development section, Competitiveness is addressed in the Customer Service section and Water Quality is addressed in Operations Review and in the *Capital Program Elements of the 2002-2021 Facilities Plan.* Summarized below are the findings and recommendations of each section of this report.

Business Development

LWC provides water and related services to consumers in Jefferson County and surrounding areas. The City of Louisville wholly owns the Company. Their accounting policies conform to generally accepted accounting principles for water utilities. LWC has developed a financial planning process incorporating a 5-year financial plan that is revised and extended annually. Strategic goals of the Company are to keep annual revenue adjustments less than the Consumer Price Index. As detailed in the *Annual Inspection Report - 2001* LWC operates in a sound financial manner. The Company's practices, policies, and procedures are applicable and have historically supported its operations well.

As it continues to expand its services regionally, the Company may wish to consider the following comments, recommendations and adjustments in operations.

Regionalization

One of the Company's stated long-term strategic objectives is to become a regional water purveyor. In this light, LWC has clearly identified a number of potential areas in which to expand service. Consistent with this approach is the Company's plans to comply with Senate

Bill 409. Implementation of regionalization plans will be dependent on further analysis of population and demographic projections, regulatory review, as well as consumer acceptance.

Rate Structures

The Company's current rate structure supports ongoing activities as recognized by its AA1 bond rating, low rates and high customer satisfaction. As the Company further expands its role as a regional water purveyor, the following financial practices would support the transition.

Incorporating alternative capital financing and long-range comprehensive financial planning into the rate-making process.

Given the significant capital expenditures associated with improving existing facilities, meeting new drinking water regulations and serving new customers, comprehensive financial planning including alternative methods for financing capital would clearly illustrate the relationship between capital requirements, debt financing, cash flow, and the cost of service analysis. Revisions in cost allocation among customer classes could be easily traced to the respective revenue requirement.

Modifying the cost allocation process to reflect current AWWA methodology.

LWC's wholesale customer base may increase with increased regionalization. Wholesale customers are generally charged based on daily peaking. Modifying the allocation process allows for recovery of all costs associated with serving maximum-day customers.

Incorporating return on rate base into the cost of service analysis.

Regionalization and the potential of servicing independent water districts will require a greater interaction with the regulatory agencies. Utility-based analysis with return on rate basis reflects industry trends for calculating cost of service. Incorporation of return on rate base into the Company's current return on equity analysis would provide management with information needed for sound financial decision making.

Expansion

System Development Charges

System Development Charges (SDCs) are an alternative source of revenue for financing major capital expenditures. They are most frequently collected as a permanent contribution in aid of construction that ultimately reduces a utility's rate base.

If a utility needs a source of front-end financing, SDCs may be an option. In order to address the concern of the potential long-term erosion of rate base and the ability to pay adequate

dividends to cover business and investment risks, an SDC could be implemented and, instead of booking it as contributions, it would be booked as debt to be repaid from revenue actually received from the new connections.

Developer Extensions

For administrative purposes, LWC may want to simplify its extension policy. In order to simplify the administrative effort associated with the current policy, the Company may want to investigate a policy that allows for the refunding of the net present value of the payments. The discount rate used to calculate the net present value should at a minimum reflect the Company's cost of debt.

Customer Service

The mission of the Louisville Water Company is:

"To serve the water needs of our customers through outstanding quality, service and value at a market return to our stockholder."

Supporting the mission is the customer goal of "meeting and exceeding customer needs and expectations, including providing appropriate information on product quality and services." In order to achieve the customer service goals, the Company should recognize the impact of technology and information systems on customer expectations.

Customer Expectations

Surveys indicate an increased interest from customers in e-commerce. In order to meet LWC's objectives of enhancing customer satisfaction and confidence, the Company will have to address the issue in the near future. A market analysis of customer needs will provide the information needed for a decision on the timing for such a change. The Company must also be ready to support the implementation of e-commerce with qualified employees. A review of existing job descriptions, responsibilities and corresponding compensations may be needed to support implementation.

Metering

The productivity and accuracy metrics for LWC's meter reading department ranks near the top of the industry. As such, if LWC can maintain these productivity levels, switching from hand-held meter reading devices to automatic meter reading tools may be a challenging

business case. LWC may consider structuring the meter reading department so that they can provide external services as well. For remote or sparsely populated regions of the service area, LWC's approach of assessing the viability of automatic meter reading devices is appropriate.

Operations Review

Potential areas associated with the optimization of operations include information technology, fleet utilization, real property inventory, and distribution facilities maintenance.

Information Technology Program

Relative to counterparts in the utility industry, LWC has a solid foundation for further development of information technology solutions. The philosophies and operations of the Supplying Information technology System (SITS) exceed the industry norm and the Information Technology Strategic Plan (ITSP) is well founded. While the findings and recommendations presented in this review are high-level in nature, they can serve as a strategic guide to enhance the ITSP and the SITS.

Fleet Utilization

Overall, the Company's fleet operations seem to be well organized and have a sense of direction. Implementing utilization reporting would aid the Company in managing and optimizing its fleet makeup. Maintenance activities should be re-evaluated to ensure that the current requirements of the manufacturers are met. Under-maintaining a unit jeopardizes its reliability; however, over-maintaining a unit drains resources and increases operating costs. Finally, LWC should consider conducting a more detailed evaluation of the key cost drivers for fleet operations in order to determine whether centralizing operations would be more beneficial. The Company should also consider the benefits of eliminating the fueling facilities and using one of a number of available fleet fuel programs currently in the market.

Real Property Inventory

Overall, LWC's real property management has been very successful at identifying and acquiring properties required for future activities. The Company is cautious, like many of its governmental counterparts, when it comes to selling property. This caution in parting with acquired property may be unnecessarily increasing LWC's exposure to liability. LWC continues trying to find alternative uses, and thus, sources of revenue, for under-utilized

properties. This effort should continue, particularly if the Company considers consolidating activities such as fleet maintenance and distribution.

Operations and Facilities

Black & Veatch engineers and operations specialists conducted interviews and assessments to review LWC's facilities and operations. The areas reviewed included supply and treatment infrastructure (with an emphasis on chemical storage and feed equipment), high service pumping stations, booster pumping stations, storage facilities, and operation and maintenance programs. Operation and maintenance activities are generally in accordance with industry practices and in some areas exceed the norm. Potential areas where the Company may increase efficiency and effectiveness are detailed in the report. LWC's activities adequately support the company's goal of reliably providing the required quantity and quality of finished water to its customers.

Design Standards

The design standards and specifications that were reviewed included packaged booster pumping stations, tank coatings, ductile iron pipe, prestressed concrete cylinder pipe, polyvinyl chloride pipe, butterfly valves, gate valves, and fire hydrants. Detailed suggestions were identified to improve these standards for future projects.

Management Tools

Hydraulic Models

Since recent and applicable calibration data is not available, it is recommended that LWC establish a current, calibrated hydraulic model adequate for capital improvements planning. The model should be available before design and construction of any major capital improvements projects. LWC should dedicate one staff position responsible for hydraulic modeling. The actual modeling tasks could either be completed as a consultant activity or by LWC staff, depending on LWC preferences, staffing availability, and skills.

Demand Management

LWC currently has a number of demand management capabilities, including the readiness to implement the Water Shortage Response Plan in the event of an emergency. The plan follows American Water Works Association and Kentucky Division of Water guidelines. The plan appears to provide an adequate basis for LWC's emergency response to a water outage event.

Pipeline Replacement and Rehabilitation Program

LWC has a very effective and well-organized Main Replacement and Rehabilitation Program (MRRP). The average number of water main breaks has gradually been decreasing due to the replacement of problem pipes. Areas where further improvement to the program may be achieved include post-rehabilitation evaluation and fostering of emerging semi-structural and fully structural pipeline rehabilitation technologies.

It is recommended that LWC consider establishing a Comprehensive Water Infrastructure Improvement Program (CWIIP) with the following elements:

- "Level of Service" concept as the basis for water distribution/replacement improvement selection criteria
- Ductile Iron Protection Program (DIPP) to address unwrapped ductile iron pipes in the LWC system
- PCCP Protection Program to address critical PCCP transmission mains in the LWC system
- Leak Detection & Monitoring Program
- Post-Rehabilitation Monitoring Program
- Evaluation of New Inspection & Rehabilitation Technologies Program

The current valve exercise and pipeline flushing programs should be incorporated into the CWIIP.

Geographic Information Systems (GIS) Plan

A review of available data indicates that the primary functions of LWC's GIS/Infrastructure Systems Planning Process are management of infrastructure location maps and data warehousing/management. Either because of the preliminary nature of the current GIS or lack of accurate measure of user activity, the current GIS is seldom used as a spatial analysis/data analysis tool. The future development of GIS at LWC includes Automated Mapping/Facilities Management (AM/FM). Information developed during implementation of the AM/FM potentially is a source for a Computerized Maintenance Management System (CMMS). Integration of a CMMS with the AM/FM is a future goal of LWC.

CMMS and AM/FM GIS mutually enhance the value of each other. The best value in a CMMS is one that provides the required capabilities with a minimum of custom

programming. Therefore, LWC should select a CMMS designed specifically for the water industry.

GIS have the capacity to prepare powerful, meaningful, and valuable analysis, if all parts of the system have been designed to function together toward the same end. It is recommended that the purposes of LWC's GIS be identified and stated explicitly, clearly, and concisely as a guiding principal through the many years of service the GIS will provide.

1.0 Introduction

The Louisville Water Company's (LWC's or the Company's) strategic planning process focused on three key issues:

- ***Water Sales*** – *Increase water revenue by selling more water*
- ***Competitiveness*** – *Transform the systems and culture of the company to that of a competitive organization that centers on the customer's needs and expectations for quality product, service, and value, and demonstrates leadership in a competitive marketplace*
- ***Water Quality*** – *Invest in treatment and delivery systems and technologies that deliver a quality of water service proven to assure public health, meet customer expectations, and exceed regulatory standards*

These issues provided the Company with guidelines for identifying its goals and objectives and associated strategies for future operation. The issues also provide direction for the development of the Institutional, Managerial and Financial Elements of Black & Veatch's *2002 – 2021 Facilities Plan (Facilities Plan)*.

Volume 1 of the Facilities Plan is divided in to the following sections:

Business Development
Customer Service
Operations Review

Each of the Company's key issues is addressed in a respective section. The *Water Sales* issue is examined in the **Business Development** section, reviewing the impact of regionalization, rate structures and expansion on the Company's ability to increase revenue by selling more water. *Competitiveness* is addressed in the **Customer Service** section, investigating the impact of changing customer expectations and alternative metering options on the Company's goal of improved customer service. Identification of potential areas to improve Company operations are summarized in the **Operations Review** section.

Volume 2 of *2002-2021 Facilities Plan* addresses the capital program elements.

2.0 Business Development

LWC provides water and related services to consumers in Jefferson County and surrounding areas. The City of Louisville wholly owns the Company. The Company's accounting policies conform to generally accepted accounting principles for water utilities. LWC has developed a financial planning process incorporating a 5-year financial plan that is revised and extended annually. A strategic goal of the Company is to keep annual revenue adjustments less than the Consumer Price Index (CPI). As detailed in the *Annual Inspection Report - 2002* LWC operates in a sound financial manner. The Company's practices, policies, and procedures are applicable to and have historically well-supported its operations.

Figure 2-1 illustrates the history of water sales from 1978 through 2000. As shown in the figure, LWC experienced a decline in water sales from 1978 to the beginning of the 1980s and then essentially flat sales through the end of the decade, with the exception of normal variations due to weather and other factors. However, from the mid-1990's, LWC experienced an overall trend of slightly increasing water sales. This increase in water sales is consistent with the strategic objective of increasing revenues by selling more water.

Figure 2-1
Historic Water Sales

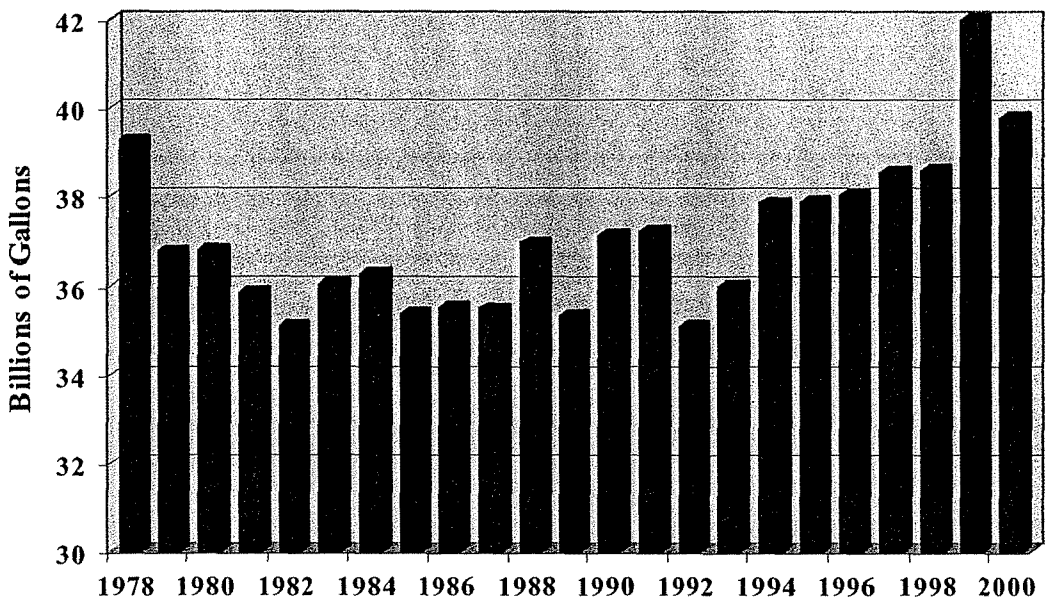
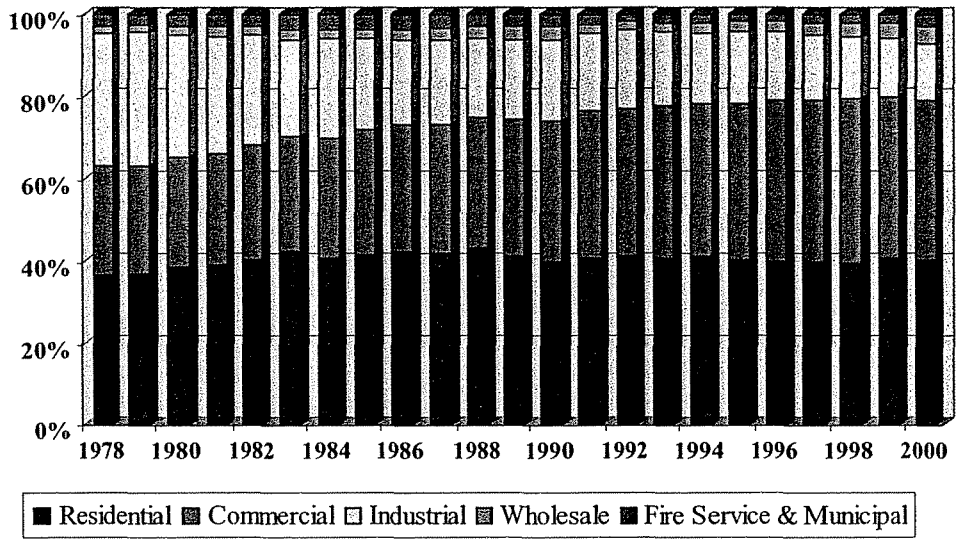


Figure 2-2 shows the historic sales distribution by customer class from 1978 through 2000. Over this 12-year period, residential sales have remained essentially flat, commercial sales

have increased and industrial sales have decreased. Realizing the limited market for increased retail sales, the Company pursued other avenues, including water demands generated from new wholesale customers. The addition of Goshen Utilities in Oldham County and the recently completed merger with Kentucky Turnpike Water Districts #1 and #2 in Bullitt County are examples of LWC transitioning from a local utility to a regional water supplier.

Figure 2-2
Historic Distribution of Water Sales by Customer Class



Achievement of the goal of increasing water revenue by selling more water can be realized through a number of avenues. Regionalization and business develoment activites can identify potential wholesale and retail customers. Alternative rate structures can benefit high demand users, encouraging new industry to locate in the Company's service area. Changes in extension policies could encourage residential and commercial development in previously unserved areas. A review of the applicability and potential impact of these issues is presented below.

2.1 Regionalization

Since its formation in 1854, the Louisville Water Company has consistently included expanding its service area as a key strategic element of its growth. Prior to World War I, the Company's growth was primarily through annexation of new development areas into the City of Louisville. During World War II and in the years following, the formation of water

districts in the surrounding communities hampered LWC's growth. Although these districts were able to grow and serve their communities, by the early 1960's it became apparent that a lack of capital resources would force a consolidation of districts. As a result, in 1965 and 1966, many of the surrounding water districts merged into the LWC system. At the time of the mergers, LWC assumed the outstanding debt for the merged systems and committed over time to equalize water rates in the districts with those paid inside the City of Louisville. LWC also committed to a large capital construction program to integrate the LWC system and the district systems into a fully integrated area-wide water utility.

It was also in the 1960's that LWC first began considering offering wholesale and retail service to areas outside of Jefferson County. The first area served outside of Jefferson County was Oldham County Water District #1 (OCWD#1). An agreement between the District and LWC was reached whereby LWC committed to operating and maintaining the system; funding a 12-inch water main into the system; and providing a storage facility for the system. The initial system construction was funded through bonds and the debt was paid off via a surcharge OCWD#1 applied to LWC's rates.

From the 1970's through the present, LWC has added seven wholesale customers to its customer base. This does not include systems acquired or merged into LWC, such as Goshen Utilities and KTWD. Ft. Knox will have service available in 2002. In addition, all the water districts within Jefferson County have been incorporated into the LWC system. Population forecasts for the region indicate that the greatest opportunity for expanding LWC's service area lies outside of Jefferson County. As such, as part of its regionalization policy, the Company needs to evaluate the factors that may hinder its success in becoming the regional water purveyor of choice for the area.

2.1.1 Regionalization Feasibility

The following discussion focuses on assumptions / philosophies, LWC strengths, and external opportunities / strategies, all of which have been used as a basis for developing a regionalization approach.

2.1.1.1 Assumptions/Philosophies

The following is a list of regionalization assumptions / philosophies developed by LWC representatives:

- "Growth pays for growth"; i.e., existing ratepayers will not fund service to a new wholesale customer or retail service area.

- Most utilities will prefer to continue operating their own system.
- Employees, attorneys, consulting engineers, elected officials, and regional planning groups may be affected by and will influence regionalization decisions.
- LWC may be viewed as a threat by some utilities (i.e., fear of the unknown).
- Regulatory requirements will increase.
- LWC has adequate treatment capacity to serve regionalization needs.
- Primary impact of regionalization will be on transmission, pumping, and storage. Given the unknown locations of regionalization opportunities, assumed transmission connection points must be identified.
- Relationship-building and customer satisfaction (e.g., water quality, cost, and reliability) will be the primary regionalization business development approach.
- Criteria for analyzing potential regionalization customers will include: public health; economic analysis; magnitude of unserved liabilities; and/or leveraging other investments.
- More water must be sold to distribute increasing production/treatment and distribution costs.
- Investments will continue to be made in existing production/treatment and distribution infrastructure, including selected rehabilitation of facilities, versus replacing these facilities.
- SWOT Analysis

The purpose of a SWOT analysis is to isolate key issues and to facilitate a strategic approach to decision making. A SWOT analysis also provides a framework for identifying and analyzing critical issues that have the most impact on the situation. The analysis addresses significant **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats that characterize the situation. Strengths are positive aspects internal to the entity: Weaknesses are negative aspects internal to the entity. Opportunities are positive aspects external to the entity. Threats are negative aspects external to the entity. In order to effectively evaluate the feasibility of regionalization, an initial SWOT analysis has been performed by LWC and is summarized in Table 2-1.

Table 2-1
Regionalization SWOT Analysis

	Positive	Negative
Internal	*Strengths* (1) LWC's leadership in the industry (2) Abundant supply and capacity (3) High water quality (4) Financially sound (5) Trained operation and maintenance staff (6) Good customer relationships (7) Regionalization policies (8) Leverage associated with Countywide Water Extension Program and Bullitt County Extension Program	*Weaknesses* (9) Capital requirements associated with expanding service (10) Minimal interaction with regulatory institutions (11) Slow decision-making process
External	*Opportunities* (12) Participation in regional water planning council to build relationships and provide professional expertise (13) Develop one-on-one relationships with existing and potential customers as well as the area development districts (14) Develop a list of potential interconnections (15) Increase LWC visibility (e.g., participate in Kentucky and Indiana Rural Water Associations, Kentucky League of Cities, Kentucky Association of Counties, etc.) (16) Develop a better understanding of Kentucky Public Service Commission (PSC) and Indiana Utility Regulatory Commission (IURC) regulations (17) Maintain and strengthen communications with elected officials from within and outside the existing service boundaries to ensure sensitive political issues are being addressed	*Threats* (18) Acquisition by private company (19) Consolidation of outlying water utilities, creating potential rival water districts

2.1.1.2 Regulatory Issues

PSC Implementation of Simpson County Water District v. City of Franklin. On December 18, 1998, the PSC issued guidelines to all municipal utilities providing wholesale utility service to public utilities, thereby formalizing its implementation of the Kentucky Supreme Court's decision regarding *Simpson County Water District v. City of Franklin.*[1]

[1] In *Simpson County Water District v. City of Franklin*, Ky., 872 S.W.2d 460 (1994), the Kentucky Supreme Court held that the PSC has jurisdiction over contracts between municipal utilities and public utilities. This ruling reverses the finding established in 1961 in *McClellan v. Louisville Water Company*, Ky., 351 S.W.2d 197 (1961), which held that municipal utilities are exempt from the statutory definition of "utility" and that the exemption provided for in the Kentucky Revised Statutes 278.010(3) extends to all retail operations outside of a city's boundaries.

According to the PSC's guidance letter[2], municipal utilities have two methods for changing rates charged for utility service to a public utility:

- **File a New Rate Schedule.** This method, governed by Kentucky Revised Statutes (KRS) 278.180 and PSC Regulation 807 Kentucky Administrative Regulation (KAR) 5:001, is the easiest and faster means of adjusting rates. The municipal utility simply files a rate schedule containing the new rates. If the new rate is part of a new contract with a public utility, the contract is filed. The rate schedule must be filed with the PSC not less than 30 days before the effective date of the new rate. As part of the filing, the municipal utility must provide written proof that the public utility customers were notified of the change in rate.
- **Formally Apply for PSC Approval.** PSC Regulation 807 KAR 5:001 is the governing regulation for this process. Under this method, the municipal utility makes a formal application to the PSC for approval of its proposed rates. The PSC requires that the application must be filed with the PSC not less than 30 days before the effective date of the proposed rates. As part of the application, the municipal utility must notify its public utility customers of the proposed rate change.

Whether a municipal utility chooses to file a new rate schedule or opt for a formal rate application, the PSC requires a filing even if the wholesale customer has agreed to the proposed rate adjustment. The guidance clearly indicates that a failure to file will prevent the proposed rates from becoming effective.

Once a rate schedule or formal application is filed, the PSC has 30 days to suspend the rate for further review. If a proposed rate is suspended, it may not be placed into effect for five months. Should the PSC not approve the rate during the five-month period, the municipal utility may place the proposed rate into effect subject to refund. The PSC must rule on the proposed rate within 10 months of the rate schedule or application filing.

Indiana Utility Regulatory Commission. IURC staff indicate that should the Company wish to expand its service area into Indiana and provide water service to Indiana residents, any proposed rates would be subject to review by the IURC. Whether or not the Company can charge Indiana residents a rate of return on investment as part of rates charged will depend on whether the IURC considers LWC to be a "for profit" or a municipal entity. The consideration will in part be impacted on what corporate structure LWC adopts to conduct business in Indiana. A precedent exists in Indiana regarding the treatment of quasi-

[2] *PSC Guidance on Municipal Utility Rate Adjustment*, December 12, 1998.

governmental entities: Rate case filings for Citizen's Gas, a quasi-governmental entity, are made based on revenue requirements (cash-basis) and the rate of return earned is limited to the true debt/equity structure of the company. Should LWC expand service into Indiana, there is a possibility that it will be treated in the same category as Citizen's Gas, and any rates charged to Indiana residents would be based on revenue requirements only. LWC does have the option of contesting such a ruling; however, a cost benefit analysis should be considered prior to such an action.

2.1.1.3 Senate Bill 409

The Kentucky Infrastructure Authority (KIA) was created in 1988 to provide a mechanism for funding construction of local public works projects in the state. Senate Bill 409 (SB 409), adopted in 2000, expanded the role of KIA to include financing, planning, management and development of water and wastewater services for all of Kentucky. SB 409 also directed KIA to work with other state agencies to encourage and promote economies of scale through regionalization.

SB 409 provides for:

1. Development of a Water Resource Information System (WRIS) under KIA management.
2. Establishment of Water Management Planning Councils (WMPC's) by July 2001. Area Development Districts (ADD's) currently organize the councils.
3. Establishment of Water Management Areas (WMA's) throughout Kentucky. The WMA's are currently being formed with guidance from the WMPC's and ADD's.
4. Update of existing county water supply plans by July 2001.
5. Establishment of Water Supply Coordinators to serve the WMPC's.
6. Water Management Planning Councils to identify and prioritize projects for un-served and underserved areas in Kentucky and submit recommendations to KIA by July 2001, and annually thereafter.
7. Establishment of a 2020 Water Service Account to fund water infrastructure projects in Kentucky.
8. Establishment of a Uniform System of Accounts standard for use by water systems throughout Kentucky.
9. Encouragement of water system audits for water loss and leakage to determine performance of water systems.

10. KIA to develop project prioritization criteria and incentive programs for regionalization.
11. Revision of KIA Board membership to include representation from the water industry.
12. Promulgation of Kentucky Administrative Regulations (KAR) that will define the project application and selection process. These regulations are currently under development by KIA.
13. Ability of a city to sell its water system by a majority vote of its legislative body. Previously, the sale of a city system required a majority vote of the legal voters of the city.

Governor Patton's 2020 Program. The 2000 General Assembly approved a $50 million bond issue, leveraged by $5 million in tobacco settlement funds, to be used to support the initiatives in SB 409 and to advance the governor's goal of providing potable water to all Kentuckians by the year 2020.

In April 2001, the KIA Board established the 2001-02 guidelines for 2020 Program project prioritization. Priority will be given to projects identified as being:

a. Regional projects
b. Small projects
c. All other projects, based on the following criteria:
   - with the highest numbers of households served;
   - involving regionalization of systems (physical or managerial);
   - having no other funding sources;
   - that allow for a degree of geographic equality;
   - that benefit communities where the median household income is less than the state average;
   - with a reasonable cost per connection within a regional context;
   - that are "ready to go"; and
   - that are consistent with their respective water management plan.

Initially, 2020 Program funds will be disbursed as grants. Additional opportunities for LWC directly resulting from passage of Senate Bill 409 include LWC's eligibility for KIA 2020 Program grant funds and state government priority on regional water systems.

LWC's Response Actions. LWC has responded to the requirements of SB 409 in several ways that include the following.

1. Providing the KIA board member whom represents the Kentucky Section of the American Water Works Association. This board member, LWC's Director of Engineering, is also on the board committee responsible for prioritizing and recommending projects for KIA 2020 Program grant funding. Being represented on both the KIA board and the 2020 Program Committee gives LWC access to direct and current information about KIA policies and actions as well as a voice in those policies and actions.
2. Providing representatives to the Jefferson, Bullitt and Oldham County WMPC's and the KIPDA Regional WMPC. Involvement in these councils increases communication between LWC and neighboring utilities and gives LWC a voice in prioritizing projects to serve unserved areas at the county and regional (ADD-wide) levels.
3. Providing general system mapping to KIPDA to be used in KIA's WRIS.

Recommendations. The following adjustments to the LWC *2001-2005 Strategic Plan* are recommended to meet the requirements of SB 409 and to coordinate actions with surroundings agencies:

1. In addition to productivity enhancements and aggressive cost control to keep rate increases at or below the anticipated CPI, LWC should consider the use of government funds such as KIA 2020 Program grants, when available.[3]
2. As well as forming external partnerships to achieve strategic objectives, LWC should strengthen existing relationships that have resulted from the provisions of SB 409 such as those with the KIA board and staff; utilities represented by the Jefferson, Bullitt, and Oldham County WMPC's, and the KIPDA Regional WMPC; and the KIPDA Water Management Coordinator.
3. Kentucky Infrastructure Authority; Jefferson, Bullitt, and Oldham County WMPC'; and the KIPDA Regional WMPPC should be included in the list of groups with whom LWC should strengthen partnerships and relationships.

[3] The Company currently has over 375 projects submitted for grant aid considerations of which seven projects received preliminary approval for 50% grant funding. Given the limited funds available, it is not known at this time how many projects will be funded through grants.

2.1.2 LWC Regionalization Policies

LWC's Board of Water Works adopted regionalization policies for serving retail, wholesale, and lease agreement customers in 1999. The retail service area of the Louisville Water Company includes all of Jefferson County, Kentucky. Areas in adjacent counties may be served on a retail basis, but only if the system is built in accordance with urban or modified urban water supply system standards. Table 2-2 summarizes the policies for providing service to new areas.

Table 2-2

Summary of Louisville Water Company Policies

Retail Service Area	Wholesale Customers	Lease Agreement
LWC, at its discretion, will consider acquiring systems or portions of systems in adjacent counties and serving those customers on a retail basis if:	LWC, at its discretion, will consider providing water on a wholesale basis when the following conditions are met:	LWC, at its discretion, will consider entering into agreements to operate and maintain systems in adjacent counties when the following conditions are met:
➢ The system meets urban or modified urban water supply system standards, or can be adapted to meet those standards with capital investments which will be funded by the benefiting acquired service areas via direct funding by the prior service area provider, increased volume of water sales, surcharges to the rate structure applicable to the acquired service area, rate differential between the previously established water rates for the acquired service area and LWC retail rates, and/or grants ➢ The supplier currently serving the customers willingly agrees to transfer the customer to LWC on a retail basis ➢ It is in the best interest of the customers to become direct retail customers of LWC ➢ It is in the long-term interest of existing customers of LWC to add such new areas and customers (e.g., growth pays for growth policy)	➢ The systems currently serving the customers willingly agrees to wholesale service ➢ It is the best interests of the customers of the system acquiring wholesale service ➢ It is in the long-term interest of existing customers of LWC to add such new areas and customers ➢ In instances where the water sales are to a PSC-regulated system, the PSC gives its approval to the wholesale agreement, including the provision in such agreement relating to the rates and services to be supplied there under by LWC	➢ The term of the lease is adequate to justify setup costs ➢ The system is designed and built in accordance with urban or modified urban water supply system standards, including capacity to provide water for fire fighting purposes ➢ The water system has a resource base to fund capital improvements and service debt ➢ The system may merge with LWC at the end of the lease upon mutual agreement
➢ LWC can recover cost of acquisition from the benefiting customers within a reasonable amount of time (five years or less) ➢ The service area boundaries of the acquired system are defined	➢ Water will be delivered at the Jefferson County line, or at another mutually agreeable point in nearby counties. LWC may own and operate water transmission lines to wholesale customers in adjacent counties.	➢ It is in the long-term interest of existing customers of LWC to add such new areas and customers ➢ In instances where the lease agreement is with a PSC-regulated system, the PSC gives its approval to the lease agreement, including the provision in such lease relating to the rates and services to be supplied there under by LWC

2.1.3 Potential Service Areas

The Company developed its first regionalization plan in 1998. Since the original plan was conceived, the area of interest has increased, and the boundaries and definitions of the

potential service areas have been revised to reflect the LWC charter. The charter allows LWC to provide retail service to customers located in counties bordering Jefferson County. These bordering counties are referred to as the "First Tier." The counties that border the First Tier counties are referred to as the "Second Tier." The LWC charter allows only wholesale service to these Second Tier counties. Jefferson County and the First and Second Tier counties comprise the 23-county Expanded Service Area (ESA).

2.2 Business Development Activities

LWC's business development staff utilizes local and regional planning resources and internal activities in identifying potential needs for potable water. Feasibility studies address alternatives for providing sufficient volume in the appropriate location to meet the needs of new customers. Business Development staff prepares water supply contracts to support a partnering feasibility which has been identified as a win-win scenario. The staff is also responsible for developing capital infrastructure funding requests on behalf of all of our retail and wholesale customers when such funding is necessary to meet the customer needs for required capital infrastructure construction.

Primary objectives guiding the Business Development staff in analyzing the feasibility of supplying new customers include:

- Protect public health, safety and welfare
- Support economic development
- Distribute increasing production and distribution costs
- Increase sales while maintaining a reasonable return on investment (ROI)
- Make available LWC expertise for reasonable ROI or to offset costs

2.2.1. Marketing Opportunities

Business development marketing opportunities can be categorized in three areas: (1) expansion of traditional water sales, (2) creation of non-traditional water sales, and (3) sale of services.

2.2.2.1. Traditional Water Sales

Traditional water sales can be increased through increased sales to existing retail customers, attracting new industries to the area, or expanding the wholesale customer base. In order to

increase sales to existing retail customers, LWC will have to demonstrate a financial or political benefit the customer will realize by switching from an alternative water source. Financial benefits may be illustrated through lower unit costs or demand based rates. Depending on the needs of the existing customer, water quality issues or regulations may also factor into the decision to increase water purchased from LWC. Political benefits should be addressed in conjunction with the local governing body.

New high-volume users can be attracted to the area by offering demand-based rates. Such a rate structure recognizes the low peaking requirements of many high volume users and passes the lower cost onto the industry. Implementation of a demand-based rate requires the installation of meters or a meter reading system capable of monitoring demand use in addition to total volume.

Implementation of LWC's regionalization policies will address expansion of the wholesale customer base. Continuation of the policy to be open and responsive to all inquiries is especially critical to development of new business. Maintaining working relationships with local and regional water providers will position LWC for future wholesale arrangements.

2.2.2.2. Non-Traditional Water Sales

Three areas for non-traditional water sales are bottled water, non-potable industrial supply and raw water. LWC currently provides "*Louisville Pure Tap*" bottled water for promotional activities. Although the bottled water market is very strong in the states, transition from promotional use to sales would involve addressing such issues as health inspections at the bottling facilities, market analysis, marketing campaigns, and pricing strategies to name just a few. A market analysis and business plan should be considered before the Company expands beyond the promotional use of bottled water.

Non-potable industrial supply is a viable option for expanding water sales. Consideration must be given to the distribution requirements associated with providing non-potable water. If an industry is located within servicing distance of the treatment facilities, it could be financially feasible to provide water with limited treatment at lower costs than potable water.

Due to potential liability issues, sale of raw water should take into consideration the end user. Sale to a customer with treatment capabilities would have a lower risk than sale to a customer planning on using untreated water.

2.2.2.3. Services for External Clients

Many services that support the function of LWC could be developed into new business ventures that serve external clients. These may include but are not limited to water audits, laboratory services, billing and collection services, engineering services, and construction services. Conflict of interest between internal and external clients is the most significant barrier to the success of such business ventures. Prior to the decision to embark on a venture, a review of the internal needs and the resources to meet the needs should be performed. Business plans should address how the existing level of service to internal clients will be maintained while an external client base is developed.

2.2.2. Current Activities

As mentioned in the Marketing Opportunities, establishing and maintaining contact and networks is critical to the development of new business activities. LWC has established an informal network with a number of entities including:

- ✓ Economic Development Partnership
- ✓ Waterfront Development Corporation
- ✓ Kentucky Cabinet for Economic Development
- ✓ Louisville Central Area
- ✓ Local elected officials in surrounding communities
- ✓ Officials in Southern Indiana
- ✓ Riverport Authority
- ✓ Major Lending institutions
- ✓ State legislators in surrounding districts
- ✓ Greater Louisville, Inc.
- ✓ KIPDA regional water management planning council

Topics addressed by the informal network include:

- ✓ Wholesale, retail, alternate, and non-traditional services
- ✓ Participation in OHINKY (Ohio, Indiana, Kentucky) conferences
- ✓ Information transfer
- ✓ Promotion of existing customer satisfaction and retention
- ✓ Consider customer service retention teams
- ✓ Other utilities approach to business' development
- ✓ The need for and creation of brochures and advertisements
- ✓ Industry/customer-specific recruitment folders
- ✓ Establish customer maintenance system to secure and foster relationships
- ✓ Contact other utilities concerning their program

2.2.3. Potential Water Sales

As noted in the "*LWC Business Development Plan*," one priority is additional water sales to existing LWC large volume customers and large volume alternate supply users in Jefferson

County. Table 2-3 presents 20 large volume LWC customers. Average usage for these customers is 424.0 million gallons per month, or 13.95 MGD. This is approximately 13 percent of LWC's daily sales. Therefore, it is recommended that LWC implement a business development feasibility process to foster additional water sales to these customers.

Table 2-3

Existing Large Volume Customers – Louisville Water Company

User	Type	2001 Average Monthly Usage[1]
Oxy Vinyls	Industrial	90.8
Ford Motor Company – Westport	Industrial	44.4
American Synthetic Rubber	Commercial	40.9
Louisville & Jefferson County MSD	Commercial	31.0
General Electric	Industrial	30.6
E. I. DuPont	Industrial	28.1
Brown Forman	Industrial	18.9
Protein Technologies, Inc.	Industrial	18.2
Ford Motor Company – Fern Valley	Industrial	16.5
Louisville Gas & Electric	Industrial	13.3
Harshaw/Filtrol	Industrial	13.0
Carbide Graphite	Industrial	12.1
United Catalysts – Crittenden	Industrial	11.3
Borden Chemical	Industrial	9.5
United Catalysts – 12th	Industrial	9.2
Fischer Packing Company	Industrial	8.2
Frito-Lay, Inc.	Industrial	7.8
Opta Food	Industrial	7.0
Zeochem	Industrial	6.9
Baptist Hospital East	Commercial	6.5
Total Usage		**424.0**

[1]Representative of January through May 2001. All volumes in million gallons

Table 2-4 lists the 10 largest volume alternative supply users in Jefferson County. In the first five months of 2001, average daily usage for these customers was a substantial 14.0 MGD. This is approximately 12 percent of LWC's current average daily demand. It is recommended that LWC take the following actions with respect to these potential customers:

- Initiate and maintain contact to build relationships.
- Identify needs and discuss LWC as a backup source to their current surface or ground water supply.

- Discuss potential problems with their current alternate supply (e.g., well water contamination, in tank clogging due to zebra mussels, etc.).
- Investigate LWC ownership and operation of non-potable industrial water supply.

Table 2-4

Large Volume Alternative Supply Users in Jefferson County

Company	Permit Type	2000 Usage (MGD)
E.I. Dupont	Surface Water	94
Rohm & Haas	Surface Water	65
Louisville &Jefferson County MSD	Groundwater	7.0
E.I. Dupont	Groundwater	4.3
Monfort, Inc.	Groundwater	2.4
Kosmos Cement Company	Groundwater	2.3
Borden Chemical	Groundwater	2.0
D.J. Incorporated	Groundwater	2.0
Humana	Groundwater	0.25
Kosmos Cement Company	Groundwater	0.088
Total		**177**

2.2.4. Regionalization Possibilities

As previously discussed, the LWC should position itself to provide regional water service to entities in nearby counties for the following reasons:

- Protect public health, safety and welfare.
- Support economic development.
- Distribute increasing production and distribution costs.
- Increase sales while maintaining a reasonable return on investment (ROI).
- Make available LWC expertise for a reasonable ROI or to offset costs.

Attempting to project increased sales for existing regional customers as well as demands for future regional customers is challenging. Tables 2-5 and 2-6 present information on a number of existing water utilities and distributors operating within the ESA. For both tables, a LWC wholesale customer is defined as a non-Jefferson County utility that is sold water at a bulk rate through transmission facilities and a master meter. A LWC lease customer is a non-Jefferson County utility that is provided operation and maintenance services. Retail customers within Jefferson County are provided full service.

The 2000-01 information for Kentucky was obtained from the Kentucky DOW and PSC, summaries of water plans from the Water Resource Development Commission, and LWC. Corresponding information for Indiana was obtained from the IURC, the Indiana Department of Environmental Management, the US Environmental Protection Agency (USEPA), and LWC. In some cases, direct contact was made with individual water utilities in both states to request data that could not be found through the previously listed sources. It should be noted that information on utilities with less than 100 service connections is not included in Tables 2-5 or 2-6.

Table 2-5

Existing Water Utilities in Expanded Service Area Counties within Kentucky

Number	Utility	PSC Regulated	Source	Plant Capacity (mgd)	Storage Capacity (MG)	Service Connections/ Population[1]	Average Day Demand (mgd)	Average Gallons per Capita Day	Average Monthly Bill[2]
			Oldham County						
K1	Goshen Utilities, Inc.[1]	Yes	Wells (3) and Purchase – Louisville Water Company (Wholesale) and Oldham County Water Dist.	0.6	0.3	1,650 / 5,560	0.4	72	$19.68
K2	Henry County Water District No. 2	Yes	Wells (6)	4.0	3.4	6,203 / 20,910	1.9	91	$38.40
K3	Oldham County Water District	Yes	Wells (4)	7.0	4.4	6,000 / 20,220	5.0	247	$17.40
K4	LaGrange Utilities Commission	No	Purchase – Oldham County Water District	N/A	1.0	2,500 / 8,426	0.70	83	$14.82
			Shelby County						
K5	West Shelby Water District	Yes	Purchase – Louisville Water Company (Wholesale) and Shelbyville	N/A	0.95	1,139 / 3,839	0.52	136	$27.00
K6	Henry County Water District No. 2	Yes	Wells (6)	4	3.4	6,203 / 20,910	1.9	91	$38.40
K7	North Shelby Water District	Yes	Purchase - Louisville Water Company (Wholesale), Shelbyville, West Shelby, and Frankfort	N/A	0.83	3,185 / 19,140	0.57	30	$26.00
K8	Shelbyville Municipal Water and Sewer	No	Guist Creek Reservoir	4.6	2.5	5,570 / 18,771	2.9	154	$37.32
K19	US 60 Water District	Yes	Purchase - Frankfort Electric & Water	N/A	0.80	1,477 / 4,978	0.23	46	$33.18
K10	Taylorsville Water Works	No	Purchase - Louisville Water Company (Wholesale)	N/A	0.80	3,429 / 11,556	1.30	112	$45.00
			Spencer County						
K11	Taylorsville Water Works	No	Purchase - Louisville Water Company (Wholesale)	N/A	0.80	3,429 / 11,556	1.30	112	$45.00
K12	North Nelson Water District	Yes	Purchase – Bardstown Municipal Water Department	N/A	0	2,911 / 9,810	0.60	66	$20.46
K13	US 60 Water District	Yes	Purchase - Frankfort Electric & Water	4.6	0.80	1,477 / 4,978	0.22	44	$33.18
			Nelson County						
K14	North Nelson Water District	Yes	Purchase – Louisville Water Company (Wholesale) and Bardstown Municipal Water Dept.	N/A	0	2,911 / 9,810	0.60	66	$20.46
K15	Bloomfield Water and Sewerage Department	No	Purchase – Bardstown Municipal Water Department	N/A	0.49	1,200 / 4,044	0.27	67	$27.98
K16	Bardstown Municipal Water Department	No	Sympson Lake	6.0	4.0	12,000 / 40,040	4.5	11	$14.74
K17	New Haven Municipal Water Works	No	Purchase – Bardstown	N/A	0.21	534 / 1,800	0.12	67	
K18	Marion County Water District	Yes	Purchase – Lebanon	N/A	0.73	4,276 / 14,411	1.00	69	$31.05
K19	Larue County Water District No. 1	Yes	Purchase - Green River Valley, New Haven, Hodgenville, Bardstown, Campbellsville, and HCWD No. 2	N/A	0.51	2,258 / 7,610	0.39	51	$32.67
			Bullitt County						
K20	Shepherdsville Water Company	No	Purchase - Louisville Water Company (Wholesale)	0.6	0.4	1,179 / 3,973	0.4	101	$27.84
K21	Mount Washington Water Company	No	Purchase - Louisville Water Company (Wholesale)	0.3	0.5	5,053 / 17,029	0.9	53	$28.50
K22	Lebanon Junction Water Works	No	Purchase – Louisville Water Company (Wholesale)	0.3	0.6	880 / 2,970	0.2	67	$31.50
K23	North Nelson Water District	Yes	Purchase – Louisville Water Company (Wholesale) and Bardstown Municipal Water Dept.	N/A	0	2,911 / 9,810	0.60	66	$20.46
K24	Taylorsville Water Works	No	Purchase – Louisville Water Company (Wholesale)	N/A	0.80	3,429 / 11,556	1.30	112	$45.00
			Hardin County						
K25	West Point Water Department	No	Wells (2)	0.25	0.083	450 / 1,517	0.1	66	$19.20
K26	Hardin County Water District (HCWD) No. 1	Yes	Wells (3), Rough River, and Spring and Purchase-Fort Knox	2.8	0.27	9,100 / 30,670	2.2	72	$22.62
K27	Vine Grove Water Department	No	Brushy Fork and Purchase - Hardin County Water District No. 1	0.67	N/A	1,450 / 4,887	0.35	72	
K28	Hardin County Water District No. 2	Yes	Purchase - Hardin County Water District No. 1 and Nolin River	2.7	4.2	11,500 / 38,760	1.9	55	$35.34
K29	Elizabethtown Water Department	No	Wells (7), Freeman Lake, and Springs and Purchase – Hardin County District No. 2	5.5	2.7	7,453 / 25,117	3.1	123	
K30	Fort Knox/Engineering and Housing	No	Otter Creek, Spring, and Wells	3.5	6.6	3,290 / 42,400	3.0	71	N/A
			Meade County						
K31	Muldraugh Water Supply	No	Purchase - Fort Knox	2.0	N/A	370 / 1,247	0.1	80	
K32	Brandenburg Water Works	No	Wells (2)	0.70	0.30	1,041 / 3,509	0.53	151	$22.62
K33	Meade County Water District	Yes	Wells (3) and Purchase – Brandenburg and Hardin County Water District No. 1	0.29	0.40	2,125 / 7,162	0.32	45	$48.06
K34	Doe Valley Utilities, Inc.	No	Doe Valley Lake			484 / 1,632	0.12	74	$21.00

[1]Goshen Utilities Inc. was merged into LWC on July 31, 2002.

Table 2-5 (Continued)

Existing Water Utilities in Expanded Service Area Counties within Kentucky

Number	Utility	PSC Regulated	Source	Plant Capacity (mgd)	Storage Capacity (MG)	Service Connections/ Population[1]	Average Day Demand (mgd)	Average Gallons per Capita Day	Average Monthly Bill[2]
			Carroll County						
K35	Carroll County Water District No. 1	Yes	Wells (6) and Purchase-Carrollton Utilities	0.52	0.67	2,033 / 6,150	0.64	105	$29.40
K36	Carrollton Utilities	No	Wells (3)	1.5	1.0	1,785 / 6,016	0.72	120	31.55
K37	Henry County Water District No. 2	Yes	Wells (6)	4.0	3.4	6,203 / 20,910	1.9	91	$38.40
K38	Trimble County Water District No. 1	Yes	Wells (4)	N/A	0.47	1,307 / 4,405	0.30	68	$35.59
K39	West Carroll Water District	Yes	Purchase - Carrollton Utilities, Trimble County, Henry County, and Milton	N/A	0.094	896 / 2,100	0.19	90	$33.36
K40	Milton Water and Sewer Department	Yes	Wells (3)	0.72	0.15	1,068 / 3,600	0.35	97	$39.00
			Trimble County						
K41	Milton Water and Sewer Department	Yes	Wells (3)	0.72	0.15	1,068 / 3,600	0.35	97	$39.00
K42	Trimble County Water District No. 1	Yes	Wells (4)	N/A	0.47	1.307 / 4,405	0.30	68	$35.59
K43	Henry County Water District No. 2	Yes	Wells (6)	4.0	3.4	6,203 / 20,910	1.9	91	$38.40
K44	West Carroll Water District	Yes	Purchase - Carrollton Utilities, Trimble County, Henry County, and Milton	N/A	0.094	896 / 2,100	0.19	90	$33.36
			Henry County						
K45	Campbellsburg Water Works[3]	No	Purchase - Henry County Water District No. 2	N/A	0.05	320 / 1,079			$45.00
K46	Eminence Water Works	No	Purchase - Henry County Water District No. 2	N/A	0.38	1000/ 3,370	0.20	59	$27.81
K47	Henry County Water District No. 2	Yes	Wells (6)	4.0	3.4	6,203 / 20,910	1.9	91	$38.40
K48	New Castle Water Works	No	Purchase - Henry County Water District No. 2	N/A	0.50	460 / 1,551	0.085	55	$42.15
			Washington County						
K49	Springfield Water Works	No	City Reservoir, Willisburg Lake, and Allens Run	2.0	0.75	2,480 / 8,358	0.81	97	$32.04
			Marion County						
K50	Marion County Water District	Yes	Purchase – Lebanon Water Works Company	N/A	0.73	4,276 / 14,411	1.00	69	$31.05
K51	Lebanon Water Works Company	Yes	Rolling Fork River and Fagan Branch Reservoir	3.6	2.8	2,450 / 8,257	2.2	97	$18.18
			Larue County						
K52	Hodgenville Waterworks	Yes	Salem Lake	1.0	0.75	1,600 / 5,392	0.55	102	$26.52
K53	Larue County Water District No. 1	Yes	Purchase - Green River Valley, New Haven, Hodgenville, Bardstown, Campbellsville, and HCWD No. 2	N/A	0.51	2,258 / 7,610	0.39	51	$32.67
			Grayson County						
K54	Caneyville Municipal Water Works	No	Caneyville Reservoir		0.12	680 / 2,292	0		
K55	Grayson County Water District	Yes	Purchase – Leitchfield Water Works	N/A	1.0	4,405 / 14,845	0.63	43	$39.36
K56	Leitchfield Water Works	Yes	Rough River Reservoir	2.7	0.2	2,500 / 8,425	2.0	240	
			Breckenridge County						
K57	Cloverport Water and Sewer System	No	Wells	0.5	0.29	614 / 2,070	0.19	92	$27.50
K58	Hardinsburg Water Works	No	Rough River Reservoir	1.8	1.2	2,776 / 9,356	0.7	75	$28.44
K59	Irvington Water System	Yes	Purchase – Hardinsburg Water Works	N/A	0.15	463 / 1,560	0.13	83	$51.73
			Totals	**56.2**	**48.8**	**132,098 / 843,302**	**45.4**	**87**	**$29.31**

[1]3.37 people per connection assumed (when information not available) per Kentucky Division of Water.

[2]Based on 6,000 gallons usage, residential service 5/8-inch or 3/4 inch meter.

[3]Campbellsburg Water Works is planned to merge with Henry County Water District No. 2 in late 2002.

Table 2-6

Existing Water Utilities in Expanded Service Area Counties within Indiana

Number	Utility	URC Regulated	Source	Plant Capacity (mgd)	Storage Capacity (MG)	Service Connections/ Population[1]	Average Day Demand (mgd)	Average Gallons per Capita Day	Average Monthly Bill[1]
			Clark County						
I1	Borden-Tri-County Water District	No	Lake Borden	1.0	0.6	1,600 / 4,432	0.3	68	
I2	Charlestown Municipal Water Department	Yes	Wells (4)	1.5	1.8	2,400 / 6,800	1.3	196	$10.56
I3	Indiana American Water Company	Yes	Wells (11)	11.5	3.6	29,828 / 80,536	12.7	158	$14.00
I4	Marysville-Otisco-Nabb Water Corporation	Yes	Purchase – Charlestown	N/A	0.15	1,638 / 4,125	0.27	65	$13.00
I5	Oak Park Conservation District	No	Purchase – Charlestown	N/A		423 / 1,120	0.08	71	$23.17
I6	Riverside Water Company (WC)	Yes	Wells (2)	0.25	0.075	800 / 1,850			$16.62
I7	Rural Membership Water Corporation	Yes	Purchase – Sellersburg	N/A	0.29	1,814 / 4,897	0.3	61	$14.25
I8	Sellersburg Municipal Water	Yes	Wells (4)	2.0	1.8	3,300 / 9,720	1.4	144	$15.00
I9	Silver Creek Rural Water Corporation	Yes	Purchase - Indiana-American Water Company	N/A	0.8	2,900 / 8,033	0.6	75	$19.00
I10	Stucker Fork Conservancy District	Yes	Muscatatuck River	12.3	2.5	7,200 / 15,197	3.7	243	$25.76
I11	Washington Township Water	No	Wells (4) and Purchase – Kent County Water Company	0.44	0.12	800 / 2,430	0.2	82	
I12	Watson Rural Water Company	No	Wells (3)	0.9	0.6	2,799 / 5,446	0.56	103	$21.50
			Floyd County						
I13	Borden-Tri-County Water District	No	Lake Borden and Purchase - Indiana-American Water Company	1.0	0.6	3,340 / 9,000	0.3	68	
I14	Edwardsville Water Corporation	Yes	Wells (4)	1.3	1.3	2,720 / 7,507	0.8	107	$23.79
I15	Elizabeth Municipal Water System	Yes	Purchase - Edwardsville Water Company	N/A	0.26	950 / 2,632	0.13	49	$29.22
I16	Floyds Knob Water Company	Yes	Purchase - Ramsey WC and Borden-Tri-County Water District	N/A	0.6	1,640 / 4,428	0.2	45	$18.46
I17	Georgetown Water Department	No	Purchase - Ramsey Water Company	N/A		1,185 / 3,200	0.2	63	$11.16
I18	Greenville Water Utility	No	Lake Greenville and Purchase – Ramsey Water Company and Edwardsville Water Company	0.2	0.2	1,526 / 4,120	0.3	73	$29.88
I19	Indiana American Water Company	Yes	Wells (11)	11.5	3.6	29,828 / 80,536	12.7	158	$13.41
I20	Palmyra Municipal Water Utility	Yes	Purchase - Ramsey Water Company and East Washington Rural WC	N/A	0.15	1,200 / 3,100	0.18	58	$15.10
I21	Ramsey Water Company	Yes	Wells (3) and Purchase – Indiana-American Water Company	2.5	3.0	3,300 / 9,141	1.6	175	$18.08
I22	Silver Creek Rural Water Corporation	Yes	Purchase - Indiana Cities Water Company	N/A	0.8	4,650 / 12,555	0.6	75	$20.94
I23	South Harrison Water Corporation	Yes	Wells (2)	1.0	1.8	2,507 / 6,800	0.62	91	$43.05
			Harrison County						
I24	Corydon Municipal Water Works	Yes	Wells (3)	1.4	2.7	1,713 / 4,745	0.9	190	$18.49
I25	East Harrison Water Company	Yes	Purchase – Corydon Municipal Water Works	N/A	0.8	240 / 665	0.06	90	
I26	Edwardsville Water Corporation	Yes	Wells (4)	1.3	1.3	2,720 / 7,507	0.8	107	$29.73
I27	Elizabeth Municipal Water System	Yes	Purchase - Edwardsville Water Company	N/A	0.26	1,321 / 3,566	0.13	49	$35.34
I28	Lanesville Water Works	No	Lanseville Lake	0.29	0.24	300 / 831	0.09	108	$28.17
I29	Palmyra Municipal Water Utility	Yes	Purchase - Ramsey Water Company and East Washington Rural WC	N/A	0.15	1,200 / 3,100	0.18	58	$17.92
I30	Posey Township Water Corporation	Yes	Purchase – Ptaoka Water Company and Wells (4)	N/A	0.35	1,200 / 3,519	0.28	78	$30.22
I31	Ramsey Water Company II	Yes	Purchase - Indiana-American Water Company	N/A		585 / 1,580			
I32	South Harrison Water Corporation	Yes	Wells (2)	1.0	1.8	2,507 / 6,800	0.62	91	$43.05
			Crawford County						
I33	Crawford County Water Company, Inc.	No	Purchase – Leavenworth	N/A	0.65	840 / 2,268	0.30	132	$22.36
I34	English Water Works Company	Yes	Purchase – Patoka Lake Regional Water and Sewer District	N/A	0.29	285 / 694	0.055	79	$40.16
I35	Leavenworth Municipal Water Works	Yes	Wells			197 / 302			$11.96
I36	Milltown Municipal Water	No	Wells			474 / 1,280			
I37	Ramsey Water Company	Yes	Wells (3) and Purchase – Indiana-American Water Company	2.5	3.0	3,300 / 9,141	1.6	175	$18.08

Table 2-6 (Continued)

Existing Water Utilities in Expanded Service Area Counties within Indiana

Number	Utility	URC Regulated	Source	Plant Capacity (mgd)	Storage Capacity (MG)	Service Connections/ Population[1]	Average Day Demand (mgd)	Average Gallons per Capita Day	Average Monthly Bill[1]
			Jefferson County						
I38	Hanover Water Department	No	Purchase – Kent Water Company	N/A	0.30	1,008 / 3,610	0.30	83	$23.38
I39	Kent Water Company	No	Wells (2)	0.3	0.49	2,400 / 6,480	0.45	69	$21.82
I40	Madison Municipal Water	Yes	Wells (7)	N/A	3.8	5,300 / 13,000	3.0	231	$9.03
I41	Rykers Ridge Water Company	No	Purchase – Madison Municipal Water	N/A		720 / 1,944			
I42	Stucker Fork Conservancy District	Yes	Surface Water	0	0	6,633 / 14,000	0	0	$22.60
			Scott County						
I43	Kent Water Company	No	Wells (2)	0.3	0.49	2,400 / 6,480	0.45	69	$21.82
I44	Marysville-Otisco-Nabb Water Corporation	Yes	Purchase – Charlestown	N/A	0.15	1,638 / 3,478	0.27	65	$13.00
I45	Scottsburg Municipal Water Department	Yes	Scottsburg Reservoir	2.0	1.0	2,600 / 5,520	1.0	181	$25.94
I46	Stucker Fork Conservancy District	Yes	Muscatatuck River	12.3	2.5	7,200 / 15,197	3.7	243	$25.76
			Washington County						
I47	Campbellsburg Water Works	No	Wells			230 / 606			
I48	East Washington Rural Water	Yes	Purchase	N/A		2,280 / 6,156			$37.19
I49	New Pekin Water Utility	No	Purchase – Salem Municipal Water Works	N/A	0.3	704 / 1,200	0.14	117	$8.88
I50	North Brown Water Corporation	No	Purchase	N/A		125 / 260			
I51	Palmyra Municipal Water Utility	Yes	Purchase – Ramsey Water Company and East Washington Rural WC	N/A	0.15	1,200 / 3,100	0.18	58	$17.92
I32	Posey Township Water Corporation	Yes	Purchase – Ptaoka Water Company and Wells (4)	N/A	0.35	1,200 / 3,519	0.28	78	$30.22
I53	Salem Municipal Water Works	Yes	Surface Water			3,250 / 8,775			$19.49
I54	Stucker Fork Conservancy District	Yes	Muscatatuck River	12.3	2.5	7,200 / 15,197	3.7	243	$25.76
			Totals	**38.9**	**30.7**	**96,619 / 252,427**	**32.3**	**108**	**$20.99**

[1]Based on 6,000 gallons usage, residential service 5/8-inch or 3/4 inch meter.

The purpose of summarizing data on counties in the ESA as shown in Tables 2-5 and 2-6 is to develop a better understanding of regionalization possibilities and to approximate potential water demands within the ESA. Table 2-7 provides a summary of the data for the counties in each state and a comparison with corresponding capacity and operational data of LWC.

Table 2-7
Summary of Capacity and Operational Data
For Counties in ESA and LWC

Parameter	Kentucky	Indiana	Total	LWC
Storage Capacity, MG	48.8	30.7	79.5	58.8
Treatment Capacity, mgd	56.2	38.9	95.1	240[1]
Average Day Demand, mgd	45.4	32.3	77.7	131
Service Connections	132,100	96,620	228,720	249,684
Average Gallons/Capita Day	87	108	–	151
Average Monthly Bill	$29.31	$20.99	–	$13.99

[1] 180 MGD at Crescent Hill Water Treatment Plant and 60 MGD at B.E. Payne Water Treatment Plant.

Through its business development activities, LWC has accumulated an extensive knowledge of regional water issues and conditions that might induce new customers to approach LWC for treated water supply. Using that information, five regionalization scenarios were developed to assess capital project requirements for this plan.

2.2.5 Regionalization Scenarios for the 2002 – 2021 Facilities Plan

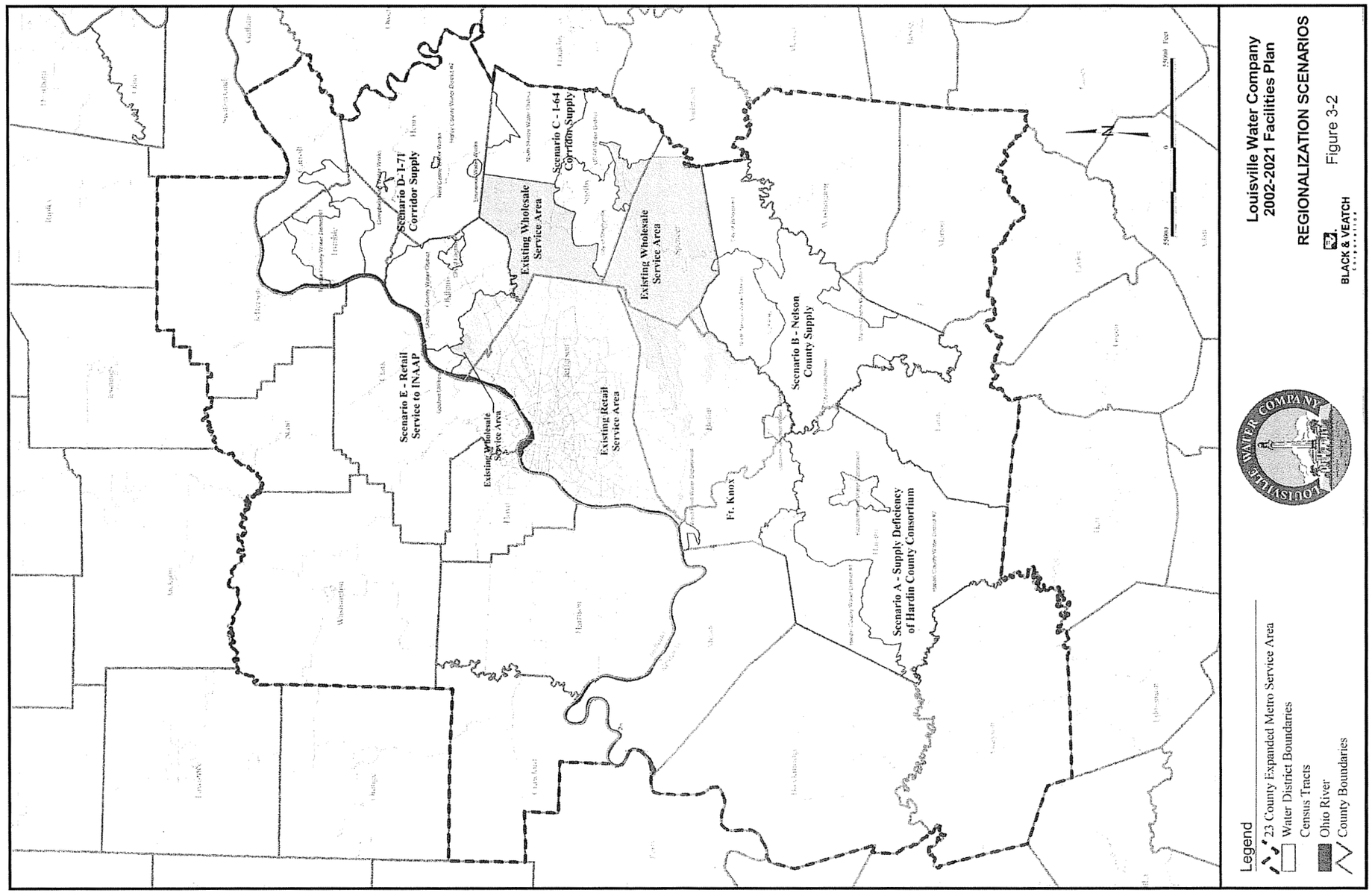
Based on discussions between LWC and Black & Veatch, five scenarios for potential extension of LWC water service have been developed. The geographic area that each scenario covers is shown on Figure 2-3. These five scenarios will be the focus of regionalization efforts associated with the *2002 – 2021 Facilities Plan.* Each scenario represents a logical development of wholesale water service, considering economic corridors, relationships between existing water agencies and the perceived potential water supply needs for these utilities. It should be noted that each scenario could be developed independent of the others. The scenarios represent areas likely to request LWC service during the 20-year planning period and are summarized as follows.

2.2.5.1 Scenario A – Hardin County (U.S. Highway 31 Corridor)

This scenario consists of supplying a portion of the Hardin County Water Consortium's demands. The Consortium includes Elizabethtown Water Department and Hardin County Water District No. 1 (both of which reportedly experienced supply difficulties during the 1999 drought), and Hardin County Water District No. 2. The Consortium has discussed with

Figure 2-3

Regionalization Scenarios



LWC future water supply needs ranging from 2 to 15 million gallons per day. Water could be supplied via potential transmission mains installed along either U.S. Highway 31 East or Interstate Highway 65 from the LWC system to Elizabethtown.

West Point Water Department is also located in Hardin County and has informally approached LWC about purchasing West Point's system. West Point Water Department is not a member of the Consortium. Fort Knox is also located in Hardin County but is not considered a candidate for future water service. The Fort currently has a supply capacity of 30 mgd, which far exceeds the existing demand. However, Fort Knox will not provide wholesale service to surrounding water utilities because the Fort must maintain sufficient supply capacity for any possible future demands related to wartime mobilization.

2.2.5.2 Scenario B – Nelson County (U.S. Highway 31 East Corridor)

Scenario B consists of supplying the Bardstown Municipal Water Department in Nelson County, which experienced supply deficiencies during the 1999 drought, as well as its wholesale customers: Lebanon Junction Water Works, Bloomfield Water Department, and New Haven Municipal Water Works. Lebanon Junction Water Works is a strong candidate to become a wholesale customer of the Company, regardless of service to Bardstown, since its service area is adjacent to existing Company mains. Hodgenville Water Works, located in Larue County, is also a wholesale customer of Bardstown. However, Hodgenville is not included in Scenario B since it also receives treated water from other utilities. Water supply from LWC could be extended from existing mains along U.S. Highway 31 East to Bardstown, or from the vicinity of Lebanon Junction to Bardstown. An existing 8-inch main between Lebanon Junction and Bardstown is available but may not be reliable.

2.2.5.3 Scenario C – Interstate Highway 64 Corridor

LWC already supplies wholesale water to the western portion of Shelby County via West Shelby Water District and North Shelby Water District. Increased sales may be realized as these utilities purchase more water from LWC. Eminence Water Works in Henry County is included in Scenario C because it purchases water from North Shelby. Shelbyville Municipal Water Company is excluded as a potential wholesale customer for the *2002 - 2021 Facilities Plan*, since it appears to have adequate treatment capacity. The U.S. 60 Water District is located east of Shelbyville in Shelby County. The U.S. 60 Water District is included in Scenario C because its current supply from Frankfort Electric & Water may be at risk due to expected capacity limitations. Construction of portions of the previously proposed Bluegrass Pipeline along Interstate Highway 64 would extend service into the areas of Scenario C.

2.2.5.4 Scenario D – Interstate Highway 71 Corridor

Scenario D consists of supplying water on a wholesale basis to existing utilities in three counties: Oldham, Henry, and Trimble. Oldham County customers would include Oldham County Water District and its wholesale customers, Goshen Utilities and LaGrange Utilities Commission. Henry County customers would include Henry County Water District No. 2 and its wholesale customers: Campbellsburg, Eminence, and New Castle Water Works. Trimble County Water District is the only customer being considered in Trimble County.

Goshen Utilities currently purchases a portion of their supply from LWC. The amount of water purchased by Goshen may increase regardless of whether Scenario D is implemented. Potential regulatory impacts on the current treatment process at the Henry County Water District No. 2 facility mean that this utility is a potential future customer.

2.2.5.5 Scenario E -- Retail Service to Indiana Army Ammunition Plant

LWC is currently evaluating purchase of the lease for water supply to the Indiana Army Ammunition Plant (INAPP). Water to the INAAP is supplied by a set of wells installed near the facility in Clark County, Indiana. If the lease is secured, LWC could perhaps then develop capability to provide retail service to the INAAP.

2.3. Rate Structure Evaluation

Consistent with the directives of the Board of Water Works, LWC has a long history of increasing rates at levels that mirror the CPI. For 2001, LWC implemented a 3.5 percent rate increase. This rate is slightly higher than the CPI.

As part of LWC's benchmarking activities, LWC compares its rates to those of similarly sized utilities in the region and in neighboring states. For most jurisdictions, LWC's small retail customers pay less for a given level of service, while moderate and large customers pay rates that are in the median range for comparable utilities.

2.3.1. Rate Structure Analysis

Charges for metered water service consist of three components, a service charge; a commodity charge; and a surcharge for elevated service areas. The charges are applied to seven customer classes located within three service areas. This rate structure reflects generally accepted industry standards.

The intent of a service charge is to recover costs associate with functions not directly related to consumption. These include metering, billing and other customer service functions.

The rate structure for retail customer's consumption is a declining block charge. The intent of the declining block rate is to correlate the unit charge for water use with the average cost of providing the service. In general, low consumption blocks reflect a greater peaking demand on the system than do higher consumption blocks. Pilot studies of usage patterns indicate residential customers exhibit relatively low average use per account with relatively high day and hour peaking factors. The opposite end of the spectrum, relatively high average use per account with relatively low day and hour peaking factors, reflects the usage patterns of industrial users. Commercial users fall somewhere between residential and industrial users.

The intent of the elevated service area surcharge is to recover costs associated with delivering water to customers located in an elevation higher that the Crescent Hill / Cardinal Hill Systems.

2.3.2. Rate-Making Process

The rate-making methodology followed by LWC is consistent with the recommended methods of the American Water Works Association (AWWA) from the late 1970's. The generally accepted industry standard for rate-making is the AWWA process. Since the late 1970s, AWWA's recommended methodology has undergone several revisions, reflecting changes in engineering design, employed technologies, and customer demand characteristics. LWC's process includes identifying system costs by functional area, allocating these costs to customer classes using the Base-Extra Capacity Method, and designing a rate structure to recover cost of service from each customer class. The difference between LWC's process and the current methodology recommended by AWWA lies in the allocation between Base, Maximum Day, and Maximum Hour under the Base-Extra Capacity Method. The present AWWA methodology recognizes that when facilities are designed to handle maximum hour demands, a portion of the design also provides reliability for maximum day demands. The change in methodology recognizes that customers who are allocated costs on a maximum day basis also benefit from facilities designed for hourly peak demands. The shift of allocations from maximum hour to maximum day will shift corresponding costs from peak hour users (residential) to peak day users (wholesalers). LWC should consider revising its current rate-making methodology to follow the current industry standard and evaluate the impact this change may have on its wholesale customer rates.

Other than the recommended change for maximum day/maximum hour allocations, the LWC rate process is consistent, defensible, and follows sound rate-making practices. The current process recognizes the additional costs associated with serving elevated service areas and appropriately allocates these costs to those customer classes that generate the additional cost. In addition, the LWC approach also recognizes varying demand characteristics within customer classes thereby striving to ensure that rates are also equitable within classes. The demand-metering program performed in 1999 collected data for select customer classes. At present, this program has not been implemented system-wide.

As part of the schedule of charges, LWC assesses system development charges for new customer connections. The system development charge follows a "growth pays for growth" approach and minimizes the extent to which existing customers pay for facilities benefiting new users. The Company is also currently evaluating its developer refund policy.

2.3.3. Return on Equity and Return on Rate Base

The Company uses a return on equity approach in its rate development process. LWC establishes the target rate by annually reviewing ten investor-owned utilities. The current target rate is approximately 9 percent. If the Company expands its services into certain areas, rates charged to wholesale customers may fall under the purview of the PSC. The PSC allows utilities to earn a "reasonable" return based on *rate base* (net plant investment less contributed capital), which may be less than LWC's return on equity target. As discussed earlier, if the Company expands its service into Indiana, rates charged to Indiana customers will be regulated by the IURC and any return allowed will be based on whether the IURC considers LWC to be a municipal or "for profit" entity.

In the rate-making process, return on equity and return on rate base are not mutually exclusive approaches. The return on rate base approach enhances the return on equity method by providing the utility with information that is not readily apparent from the return on equity approach. In utility rate-making methodology, the rate base represents used and useful investment that the utility has made in providing service to its owner and non-owner (e.g., wholesale) customers. The standard employed by almost all public service authorities in calculating a fair rate of return on the rate base is the weighted average cost of capital (WACC) approach. In calculating a utility's WACC, determining the utility's rate of return on equity capital is the challenge. Typically, if capital is needed, municipal utilities have the ability to raise rates or connection charges from new customers. Many utilities establish a rate of return on equity by adding a risk premium to an appropriate index, such as the 30-year Treasury bond. Although LWC operates in a similar fashion to an investor-owned utility, the

Company enjoys the benefits of tax-exempt debt. On the other hand, it has no equity market to attract equity capital. The Company's use of a return on equity, as discussed above, is adequate to meet its current needs. We recommend the Company investigate analyzing their return on rate base in order to provide additional information to management when discussing needed revenue adjustments.

LWC's rates are reviewed annually thereby allowing the Company to maintain an appropriate rate schedule and address revenue needs on a timely basis. The current tool used by LWC to evaluate the need for any necessary rate adjustments is a series of linked spreadsheets. However, the spreadsheets do not have the ability to handle sophisticated "what-if" scenarios addressing alternative rate structures and do not provide all the benefits of a comprehensive financial planning model. LWC should consider using a financial planning model that fully links revenue requirements (capital improvement program needs, debt financing) to cost-of-service development to rate design. Using a full financial model enables LWC to assess the impact that alternative rate structures, such as take-or-pay, may have as well as offering the flexibility to evaluate different regionalization scenarios.

2.3.4. Other Revenue Sources

Provision of water services is highly capital intensive as compared to other utility services and, even more so, as compared to most other business enterprises. As a result, the way water system extensions to new customers (i.e. growth) are paid for is critical to the financial health of the utility. Because investor-owned utilities are regulated with respect to policies and charges, the capital intensity impacts are compounded and even more important. Decisions to extend water service must include consideration of the financial impact on both the utility owner and on its customers.

During the past several decades, utilities have been in an environment that usually resulted in the capital investment to serve a new customer exceeding that embedded to serve average existing customers. Two principal factors contribute to this:

- ✓ The declining value of the dollar, particularly in periods of high inflation.
- ✓ The greater cost, in constant value dollars, of developing the next increment of supply and the extension of water transmission distances.

In a scenario where all customers are charged equal rates, the greater than average embedded capital investment needed for new customers results in a cross subsidy of those "new" customers by the then existing "old" customers, at least in the short term. It can be argued, however, that in the long term replacement of systems serving the "old" customers will

eliminate this subsidy and the newer customers may actually provide subsidy to the older customers at some future date.

Many water utilities, in an effort to mitigate the financial impacts of connecting new customers, have initiated policies to require capital contributions by customers prior to connection. Such contributions are identified by various nomenclatures but are commonly referred to as "System Development Charges" (SDCs). Water utility industry trends indicate the use of SDCs to be more prevalent in publicly-owned utilities as opposed to investor-owned utilities. Advantages and disadvantages of design methodologies and implementation are largely supported by experiences of public utilities. Lack of experience in the investor-owned utilities does not preclude the implementation of such fees. It does, however, require an SDC feasibility analysis to include factors that are unique to investor-owned utilities.

2.3.4.1. Impacts of System Development Charges

SDCs can generate a portion of the funds needed to finance capital improvements. Proper accounting of SDCs (i.e. contributed capital) is required for rate-making, financial statements, and financial planning purposes. Commentary on public-owned utilities and potential impacts on investor-owned utilities is presented below.

Cash Flow. The three elements of cash flow impacted by SDCs are operating expenses, depreciation and return. Historically, investor owned utilities have not been allowed returns on contributed investment and margin on operating expenses. The utilities are permitted to collect depreciation annually. Under such conditions, the contributed capital creates short-term positive cash flow. However, the annual depreciation expense recovered from ratepayers maintains the contribution on the books at its original level while reducing the investment in the plant purchased with contributed capital. Under these conditions, the contributed investment creates a negative rate base after the first year.

Balance Sheet Impact. Common practice is to credit contributed capital to an appropriately labeled contributions equity account. Offsetting the equity is cash or the plant in service purchased from the SDC revenue. Contributions, in the form of SDCs, are recorded as equity; however, neither publicly- nor investor-owned utilities indicate an ownership position for those who made the contributions.

Regulatory Impact. Although investor-owned utilities can improve cash flow with SDC revenues, the gain is short-term. In the long-term, regulatory treatment of SDCs adversely impact rate-making.

Rate Base. For rate-making purposes, contributed capital is normally excluded from rate base and the utility is unable to recover a return on the investment. Rate base is not a critical issue for publicly-owned utilities. The goal of a public utility is to generate adequate revenue from rates to pay for operating and capital costs. The rate analysis is cash flow based where the return on investment is an outcome of the analysis.

Rate base is critical for investor-owned utilities. A reduced rate base results in lower return on investments for the utility's investors. The primary objective of an investor-owned utility is to attract cost-effective capital which will minimize customer's rates. Eventually, the utility will be required to replace the contributed plant and water rates will have to reflect the cost of financing the capital replacement. In the meantime, the rate base and return on investment will be at an artificially low level.

Financial Analysis. Comparing the net present value of the cash flow of systems with and without contributed capital (SDCs) provides a financial tool for making the decision to implement SDCs. The following tables illustrate the rate base and annual cash flow associated with a $1,000 investment in year zero that has been financed with and without contributions. In order to compare the two scenarios, the present worth of the net cash flows has been calculated. The data shown in the examples is for key years during the 50-year facility life.

Depreciation and Return and Cash Flow Impacts with SDCs

	Year 0	Year 1	Year 17	Year 18	Year 50
Rate Base					
Undepreciated Plant Investment	$1,000	$1,000	$1,000	$1,000	$1,000
Annual Depreciation		$20	$20	$20	$20
Depreciated Plant Investment	$1,000	$980	$660	$640	$0
Less Contributions	$1,000	$1,000	$1,000	$1,000	$1,000
Net Rate Base	$0	$0	-$320	-$340	-$980
Annual Cash Flow					
Depreciation Expense	$0	$20	$20	$20	$20
Return					
Rate Base	$0	$0	-$320	-$340	-$980
Rate of Return	$0	$0	$0	$0	$0
Return	$0	$0	-$19	-$20	-$59
Net Cash Flow		$20	$1	$0	-$39
Net Present Value of Net Cash Flow		$54			

With the investment financed by SDCs, the net present value of the cash flow, in this simple example, is a positive $54, without any capital investment by the utility. The positive net present worth of contributions indicates the financing of capital with SDCs does not cost the utility over the life of the facilities.

Without SDC investment, the net present value is $1,000, which equals the utility's initial investment of capital. Comparison of the net present value in both cases suggests that, in the long term, the decision to finance with or without SDCs would have minimal financial impact on the utility.

Depreciation and Return and Cash Flow Impacts without SDCs

	Year 0	Year 1	Year 17	Year 18	Year 50
Rate Base					
Undepreciated Plant Investment	$1,000	$1,000	$1,000	$1,000	$1,000
Annual Depreciation	$0	$20	$20	$20	$20
Depreciated Plant Investment	$1,000	$980	$660	$640	$0
Less Contributions	$0	$0	$0	$0	$0
Net Rate Base	$1,000	$1,000	$680	$660	$20
Annual Cash Flow					
Depreciation Expense	$0	$20	$20	$20	$20
Return					
Rate Base	$1,000	$1,000	$680	$660	$20
Rate of Return	$0	$0	$0	$0	$0
Return		$60	$41	$40	$1
Net Cash Flow		$80	$61	$60	$21
Net Present Value of Net Cash Flow		$1,000			

2.4. Developer Extensions

As discussed in the **Other Revenue Sources**, water utilities nationwide are experiencing similar impacts related to system growth. Financially sound utilities establish capital financing programs that meet the capital construction expenditures for system improvements and expansions. Conflicts of financial interests can arise between existing and new customers when construction expenditures result in the need to raise and service large amounts of capital. In an effort to avoid burdening existing ratepayers for the cost of improvements needed to serve the new connections, in addition to or as an option to system development charges, utilities often implement extension policies that involve up-front developer investment.

LWC's extension policy requires the developer to install needed water main extensions and all appurtenances per LWC specifications in a public right of way or publicly dedicated water main easement. Upon completion and LWC acceptance, all right, title and interest in and to the extension is vested with the Company. The company agrees to refund the developer an amount not to exceed the initial investment. Conditions of the refunding include a 20-year time period, no interest charge, monthly payments based on billing service size, and monthly billing revenues in excess of refund credit.

LWC's current policy is complex and requires extra administrative effort to track connections, monthly bills, payments, and outstanding balances. In order to simplify this administrative effort, the Company may want to investigate a policy that allows for the refunding of the net present value of the payments. The discount rate used to calculate the net present value should at a minimum reflect the Company's cost of debt.

2.5. Business Development Summary and Recommendations

2.5.1. Regionalization

One of the Company's stated long-term strategic objectives is to become a regional water purveyor. In this light, LWC has clearly identified a number of potential areas in which to expand service. Consistent with this approach is the Company's plans to comply with SB 409. Implementation of regionalization plans will be dependent on further analysis of population and demographic projections, regulatory review, as well as consumer acceptance.

2.5.2. Rate Structures

The Company's current rate structure supports ongoing activities as recognized by its AA1 bond rating, low rates and high customer satisfaction. As the Company moves towards becoming a regional water purveyor, the following financial practices would support the transition.

2.5.2.1. Incorporating long-range comprehensive financial planning into the rate-making process

Comprehensive financial planning including alternative methods for financing capital would clearly illustrate the relationship between capital requirements, debt financing, cash flow, and the cost of service analysis. Revisions in cost allocation among customer classes could be easily traced to the respective revenue requirement.

2.5.2.2. Modifying the cost allocation process to reflect current AWWA methodology

LWC's wholesale customer base may increase with increased regionalization. Wholesale customers are generally charged based on daily peaking. Modifying the allocation process allows for recovery of all costs associated with serving maximum-day customers.

2.5.2.3. Incorporating return on rate base into the cost of service analysis

Regionalization and the potential of servicing independent water districts will require a greater interaction with the regulatory agencies. Utility-based analysis with return on rate basis reflects industry trends for calculating cost of service. Incorporation of return on rate base into the Company's current return on equity analysis would provide management with information needed for sound financial decision making.

2.5.3. Expansion

2.5.3.1. System Development Charges

SDCs are most frequently, if not always, collected as a permanent contribution in aid of construction. A major deterrent to investor-owned utilities implementing SDCs is the concern that they ultimately reduce the company's rate base. Capital investment, which results in an attractive rate of return, is the major reason for a company to take risks associated with running a utility. Therefore, SDCs generally are in direct conflict with a company's principal goals.

However, if a company needs a source of front-end financing, SDCs may be an option. In order to address the concern of the potential long term erosion of rate base and the ability to pay adequate dividends to cover business and investment risks, an SDC could be implemented and, instead of booking it as contributions, it would be booked as debt to be repaid from revenue actually received from the new connections. The part of revenue applied to repayment could be based on an analysis of the use of revenue from typical existing customers. Such repayments would be limited to connections made within a limited time and for a limited number of years for each qualifying connection.

2.5.3.2. Developer Extensions

The Company may want to consider simplifying its extension policy. In order to minimize the administrative effort associated with the current policy, the Company may want to investigate a policy that allows for the refunding of the net present value of the payments. The discount rate used to calculate the net present value should at a minimum reflect the Company's cost of debt.

3.0 Customer Service

3.0 Customer Service

The mission of the Louisville Water Company is:

> *"To serve the water needs of our customers through outstanding quality, service and value at a market return to our stockholder."*

Supporting the mission is the customer goal of "meeting and exceeding customer needs and expectations, including providing appropriate information on product quality and services". In order to achieve the customer service goals, the Company needs to recognize the impact of changes in technology and information systems on customer expectations.

3.1 Changing Customer Expectations

The water industry is moving towards commonly accepted benchmarks or indices that address such issues as customer satisfaction and operational efficiencies. Identifying the targets or standards for the benchmarks is complicated by ever changing customer expectations in a more competitive marketplace. As customers become more technically informed, they expect service providers to match their level of technology. Recognizing the customer's expectations, many utilities are expanding customer service to include on-line bill payment and access to customer account data. In addition to improved technology, customers continue to expect safe water to be where they want it when they want at a reasonable price despite changing environmental conditions and increasingly stringent quality requirements.

In response to ever-changing customer expectations, the Core Business System for Serving Customers has developed a plan to enhance customer satisfaction and confidence. The plan, scheduled for implementation between 2000 and 2003, consists of the following key elements:

> Key Element 1 – Improve processes to understand customer values, needs and expectations.
>
> Key Element 2 – Enhance customer service effectiveness of all LWC employees by emphasizing the importance of internal and external customer focus and effectively managing customer expectations.

Key Element 3 – Enhance customer education program and effectiveness of community involvement.

Key Element 4 – Provide reliable and timely access to information through implementation of new open systems technology.

Key Element 5 – Provide balanced and effective training for all employees to meet customer expectations.

Implementation of the plan to *Enhance Customer Satisfaction and Customer Confidence* will require resources supporting the training and retaining of customer service representatives, the investigation and piloting of alternative meter reading systems, and the investigation and piloting of expanded e-commerce activities.

3.2 Customer Service Representatives

Activities within the Core Business System for Serving Customers include responding to customer inquirers, generating customer invoices, collecting revenue and providing the Company with corresponding reports. Recently, new information technology has been implemented to improve the effectiveness of providing such services. In order to effectively utilize the technology, the skills of many customer service representatives required upgrading. As evidenced by the improved customer satisfaction ratings, many representatives met the demand for improved skills and are effectively using the new technology. Key to continuing the high customer satisfaction rating is retaining the newly trained representatives. Today's labor market is open for employees with all types of computer skills. In order to avoid a loss of trained personnel, the job classifications, skill levels and corresponding compensations for customer service representatives should be reviewed and updated to reflect current working conditions.

3.3 Water Metering Technology

For many customers, the accuracy and timeliness of their water bill dictates their impressions about the quality of service that the Company provides. Bills that are accurate, easy-to-read, and provide clear explanations for charges and payment terms, consistently reinforce a positive image for the Company. The key to accurate and timely bills is meter reading.

3.3.1 Meter Reading System

LWC currently has a pool of 20 meter readers (18 positions were budgeted for 2001). Readers work one shift per day, five days per week and use LWC-provided vehicles. Readers are union represented.

The majority of LWC's approximately 250,000 meters are read and billed on a bi-monthly basis; some commercial and industrial accounts are read and billed monthly. Over the years, the Company has managed to move meters from inside customer premises outside and where possible, into meter pits. The currently used meter reading process is very manual. Meter readers gain access to the meter, visual read the meter, and then enter the data into electronic hand-held Itron® devices.[4]

Despite the labor-intensive nature of the current process, LWC's readers average approximately 500 meters per day with an accuracy rating of greater than 99.5 percent. The industry average for hand-held meter reading systems is approximately 300 meters per day with a misread rate of about 2 percent. LWC's industry-leading achievements in this area are in large part due to a tremendous effort on the part of Company management to reduce employee turnover and implement programs to reduce employee accidents.

3.3.2 Meter Reading Process Improvements

The Company currently has three major projects focused on improving meter reading services.

3.3.2.1 Route Optimization

LWC is in the process of re-sequencing existing meter reading routes to optimize routes. An anticipated consequence of this process is a temporary disruption of regularly scheduled billing for those customers on re-sequenced routes. How effectively Customer Service handles customer relations during this process may impact how well customers receive future changes to the financial systems and other systems.

3.3.2.2 Demand Metering

The Company is currently evaluating the feasibility of providing demand metering to those customers who request this service as well as to wholesale customers. Ideally, demand metering would provide the customer with water use information (via the Customer Information System [CIS]) that would help them manage their operations. Additionally, the data gathered could be used by LWC to determine demand factors and develop water rate charges for customers based on these demand factors.

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[4] Until the Company completes its evaluation of automated meter reading technologies, replaced meters are being equipped with touch pads and also have the capability for radio-read conversion. Meters in remote locations or which have problematic access are equipped with touch pads.

3.3.2.3 Meter Reading Technologies

Like most of LWC's peers in the water utility industry, the Company is not on the bleeding edge of technology when it comes to meter reading systems. Although automatic meter reading (AMR) technologies have been in existence for the past two decades, like others in the industry, the Company is using a conservative "pilot-scale" approach to evaluate the available options. LWC is in the process of implementing a radio drive-by pilot program within remote and sparsely populated areas of Kentucky Turnpike Water District I and II. The intent of the pilot program is to assess the effectiveness of the radio drive-by technology and to see whether any operational efficiency can be gained. The implementation of the pilot program is anticipated to be "turn-key": the selected vendor will install, read and maintain the system.

Depending on the successfulness of the radio drive-by pilot program, the Company may implement a system-wide conversion to an AMR technology. In so doing, the Company should consider the following system changeover issues:

Technology

- Will systems be compatible will all types of meters currently in service.
- Can selected system be easily upgraded to alternative system.
- How are remotely read meters checked for damage and tampering.
- How vulnerable is meter reading system to potential vandalism or accidental damage.

Customer Satisfaction

- Where will meter reading equipment be located.
- Who is responsible for potential damage to customer's premise during installation.
- Will there be customer resistance due to perceived electronic intrusion.

Monetary Impact

- Will it be cost effective to install a new meter reading system.
- How will capital costs be funded.
- Will the additional benefits associated with the new system be greater than the cost of implementing the new technology.

Staffing Impact

- What will be the impact on overall staffing levels and current meter reading staff in particular.
- Will there be control checks on productivity.

3.3.3 Considerations for Implementing New Meter Reading Systems

Evaluation of alternative meter reading technologies requires a review of tangible factors such as capital costs, revenue impacts and operating costs and intangible factors such as customer satisfaction and employee reaction.

3.3.3.1 Tangible Factors

Tangible factors are those assets or elements that are able to be appraised for value, have real substance and are easily understood. Factors such as meters, equipment, wages, and installation services are classified as tangible.

Capital. Capital costs recognizes that a change in meter reading technology may require a change-out or retrofit of existing meters and will require some type of data transfer device. Both these element will have some type of installation charge associated with them. Once the data are made available in a form that is compatible with alternative reading technologies, a capital investment in the actual meter reading equipment will be needed. This may or may not include vehicle costs.

Continuation of the existing meter reading system will require no additional investment in meters, beyond that associated with the normal meter replacement program. Moving up the ladder of meter reading technology, implementation of remote meter reading, using some type of touchpad or radio read technology, will require, at a minimum, retrofitting a portion of the LWC's meters and installing a meter data transfer device.[5]

In general, meter accuracy starts declining after 10 to 15 years of use. The average age of meters in LWC's system is approximately 15 years. The Company's meter replacement program is currently based on performance: ⅝" meters are statistically sampled every 2 years based on purchase year. Approximately 70 to 80 meters per purchase year are tested. LWC has found that field testing larger meters (1½" and 2" meters) is not cost-effective. Consequently, the Company identifies those meters with the highest consumption levels and

[5] The Company estimates that if a radio read technology is implemented, approximately 40 percent of existing meters would require dial changes and 60 percent would require total (meter plus data transfer device) replacement.

these meters are then tested. Three-inch meters are field tested – the top 50 accounts are tested every 6 months, the next 50 top accounts are tested once a year, and all remaining accounts are tested every 2 years.

Costs associated with remote meter reading systems using radio communication are dependent upon the selection of walk-by or drive-by receivers. Walk-by technology requires an investment in handheld units that can receive radio signals from the meters. Such units can cost up to $5,000 each. Drive-by technology eliminates the need for multiple hand held units. However a significant investment in appropriately equipped vehicles is needed. Completely equipped vehicles can average $50,000. As a proactive move, the Company's policy is to replace removed meters with those capable of radio read technology.

Automated meter reading technology utilizing a fixed network requires an investment of approximately $4,500 per data collection point.

As noted earlier, meter readers utilized Company-provided vehicles. Implementation of touchpad or remote radio walk-by technologies would have no impact on the vehicle capital costs. For radio drive-by technology, the Company would have to invest in fully equipped vehicles. However savings in vehicle fleet rentals and monthly charges would be realized. For fixed network meter reading system, the capital costs for meter reading vehicles would be virtually eliminated.

Revenue Impacts. Changing meter reading technology has the potential to impact the flow of revenues in two ways. The first is a one-time impact resulting from a change from bi-monthly to monthly bills. If a radio drive-by or fixed station technology is implemented, productivity improvements will allow the Company to generate monthly bills.
The other revenue impact may result from improved meter accuracy. Industry standards indicate that after 10 years, meter accuracy begins to diminish. In most cases, meters begin to under register.

Operating. The greatest operational savings are generally labor-related and increase as the level of technology implemented increases. For LWC, increases in productivity may not be significant if technologies lower than radio drive-by are implemented.

3.3.3.2 Intangible Factors

Intangible factors are those elements that cannot be quantified with hard numbers or cost data, but will still impact the successful implementation of a new system. The source of

these factors is internal and external to the organization. External factors focus on customer service, whereas internal factors focus on employee reaction.

External. Improving customer service is an essential element for the justification of capital expenditure associated with changing meter reading technology. Maintaining LWC's current system will not require a significant capital outlay and therefore should not significantly impact rates. It can be argued that such action should have little impact on customer satisfaction. However, customer satisfaction may decrease with this perceived "do nothing" approach. Regardless of the justification for a rate increase, customers expect improved service with higher rates.

As the Company has already experienced, the implementation of any new system, such as the CSI, is never problem-free. Moreover, depending on how smoothly the route optimization project proceeds, there may be resistance from customers (expressed in the form of complaints) should a new meter reading system be implemented.

Internal. Change is difficult to implement in any organization. The perception of most meter reading staff is that changes to a more advanced meter reading technology parallels a reduction in staff. To a certain extent, this is a valid observation. However, new technology will not mean the elimination of a job category. With proper planning, reduction in staff during the implementation of a new system can be phased in with minimal impact on employees. Training activities, which prepare employees for new position in other sectors of the organization, can be combined with normal attrition to achieve the desired employee level.

3.3.4 Potential Revenue Sources

LWC's meter reading program is continuing to improve its processes and leads the industry in the area of productivity. Once some of the planned enhancements to the CIS are put into place, the Company may wish to consider spinning off the meter reading and possibly the billing group as a separate entity. This new entity would be able to offer its services to other water districts that would benefit from outsourcing their meter reading/billing activities. The Indianapolis Water Company successfully utilized this strategy.

3.4 Customer Information System Enhancements

Customer service trends in the utility industry are concentrating on incorporating e-commerce into everyday business activities. In addition to establishing and maintaining

informational web sites, many utilities are providing interactive capabilities ranging from account access to bill payment. LWC maintains a very informative web site located at http://www.louisvillewater.com. Users are able to obtain information on new services, rates, Company policies, annual water quality reports and planning activities. The site also provides for e-mail communication. Prior to expanding the capabilities of the web site, LWC should consider the market demand for additional services and security issues.

3.4.1 Market Demand

According to a recent survey of 1,900 city and county governments, 95 percent had a web site in place or planned to have one in place this year. Ninety percent reported that if they did not already provide the ability to pay tickets, taxes, or utility bills on-line, they soon would provide those services.[6] A shortage of information technology workers, too little money, and a technological pace that exceeds the speed of most public entities have hindered implementation of e-commerce in the public utility sector. Regardless, customers have indicated a desire for e-services. Their perception is that, with e-service, they will avoid long lines, get more convenient hours for service, and increase the speed of the service they receive. Supporting this recent survey is information complied by the US Census Bureau (Bureau). The Bureau found that 42 percent of U.S. households could log on to the Web in 2000, up from 18 percent three years earlier. However, a gap still existed among different socioeconomic groups. Older Americans and families with smaller incomes are less likely to have computers.

The decision to offer on-line bill payment should be made in response to a strategic objective. On-line bill payment should not be implemented just because it is an industry trend. If feedback from customers indicates alternative payment options are needed to improve customer relations or if the Company begins to experience a drop-off in collections, on-line bill payment should be investigated. However, other options should be investigated, including credit card payments or direct withdrawal.

A market analysis of potential users of the web site would provide LWC with information needed to determine the feasibility and usability of on-line bill payments. Options to a full fledge market study would be an informal survey of users of the current web site or a bill stuffer requesting feedback on bill payment options.

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[6]Cleland, Bartlett D (2001). E-Government: Coming to a Town Near You. *Technology* Retrieved November 14, 2001 http://heartland.org/ia/mayjun01/technology.htm

3.4.2 Security

> *"Although the number of households that pay their bills online is expected to mushroom from today's 1.8 million to more than 18 million in 2003, some analysts feel that such projections are much too high - especially in light of the security issues that currently surround e-commerce."*[7]

As indicated in this quote from *E-Commerce Times*, security is a major stumbling block to the implementation of on-line bill payment. Most utilities do not have in-house expertise to address e-commerce security needs. A utility places their reputation on the line when they offer on-line payment services. As such, selection of bill payment software should strongly emphasize security issues, not just for the utility but also for the consumer.

3.5 Customer Service Summary and Recommendations

3.5.1 Customer Expectations

Surveys indicate an increased interest from customers in e-commerce. In order to meet LWC's objectives of enhancing customer satisfaction and confidence, the Company will have to address the issue in the near future. A market analysis of customer needs will provide the information needed for a decision on the timing for such a change. The Company must also be ready to support the implementation of e-commerce with qualified employees. A review of existing job descriptions, responsibilities and corresponding compensations may be needed with the implementation.

3.5.1. Metering

The productivity and accuracy metrics for LWC's meter reading department ranks near the top of the industry. As such, if LWC can maintain these productivity levels, switching from hand-held meter reading devices to automatic meter reading tools will not provide significant cost savings. Instead, LWC may consider restructuring the meter reading department so that they can provide external services as well. For remote or sparsely populated regions of the service area, LWC's approach of assessing the viability of AMR devices is appropriate.

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[7] Dembeck, Chet (1999). Sun and Netscape Team To Provide Bill-Paying Service *E-Commerce Times*:

4.0 Operations Review

Investing in treatment and delivery systems and technologies that deliver a quality of water service proven to assure public health, meet customer expectations, and exceed regulatory standards is a key element of LWC's strategic plan. The first step in optimizing the Company's investment in systems and technologies is an assessment of the existing operating systems. The initial assessment will identify the strengths and weaknesses of each program and indicate those areas that could benefit from further investigation. This section of the report will present an overview of LWC's information technology program, fleet utilization, real property inventory, operations and facilities, design standards and management tools.

4.1 Information Technology Program

Today's competitive environment forces LWC to operate efficiently in order to achieve its business objectives of enhancing water quality, increasing competitiveness, and increasing water sales. A major element for the Company to achieve these strategies is the sound management of its information technology. The Supplying Information Technology System (SITS) fulfills this need.

Black & Veatch conducted a high-level review of the SITS. The following commentary presents key findings and recommendations from the review in addition to an overview of SITS. While high-level in nature, the Information Technology (IT) assessment provided notable insight on the present SITS operations. The process used to develop the SITS review involved interviews, a review of the *2001-2003 Information Technology Strategic Plan* (ITSP), and a review of documentation outlining the Company's IT infrastructure.

The objective of this review is to:

1. Determine alignment of the ITSP to overall Company goals.
2. Assess the validity of the ITSP in terms of schedule and industry standards.
3. Identify key issues of concern within the SITS.
4. Determine areas for outside IT assistance to the Company.

4.1.1 Information Technology Strategic Plan

4.1.1.1 Overview

The SITS recognizes the need to provide sound information management for the LWC and has responded with the update of its ITSP. This plan provides the direction for the SITS and serves as the key tool to assess the status of the SITS.

The *2001-2003 Information Technology Strategic Plan* consists of five key components:

1. IT support of the Company's Goals
2. Information management
3. Evolution of the Company's IT
4. IT Architectures
5. Budgeting and Schedules

This review provides a brief description of each component.

4.1.1.2 IT Support of the Company's Goals

The ITSP demonstrates a strong correlation to the Company's overall business strategies by focusing on the following key aspects:

- Recognition of the LWC's business strategies and the key performance measures within the plan.
- Stating support for all Company employees to be effective decision makers and contributors by providing "the right information, in the right format, in a timely manner."
- Creating a description of information flow across the organization both vertically and horizontally to develop an infrastructure of data sharing to enhance business flexibility and responsiveness.
- Stating an advocacy for process reengineering and refinement to enhance service quality and to support company-wide efficiencies.

4.1.1.3 Information Management

By utilizing Process Synopsis Reviews, which assess the inputs and outputs for the various business processes, the SITS has been able to ascertain the specific needs of its users. Integrating the various information needs into an overview, the SITS has established a sound understanding of how information is used and shared by the various business functions of the Company at both the tactical and strategic level. This understanding is stated within the ITSP and serves as the foundation for all information management planning.

4.1.1.4 Evolution of the Company's IT

The SITS has a keen awareness of the trends associated with information technology during the last ten years. This is reflected in the ITSP illustration of the agency moving from a closed, proprietary-computing environment with custom applications to an open systems architecture using commercial off the shelf software (COTS). This also encompasses LWC's migration to integrated voice and data communication networks during this time. The plan follows a moderately conservative introduction of emerging technologies as the newer technologies show stability. This includes the use of the Internet and Application Service Providers (ASP).

4.1.1.5 IT Architectures

The information technology architectures described in the ITSP are based on industry leading, standard products and services. The SITS organizes and manages its architectures as follows.

1. **Technical Architecture** - includes network development, organization of services, workstations, printers, voice communications, storage management, system reliability, software support.
2. **Data Architecture** - entails the appropriate database standards such as the user of Oracle or DB2, the deployment of data warehousing, and overall data sharing mechanisms.
3. **Information Supply Architecture** - defines the appropriate business application or COTS to achieve the operational need of the Company. This also includes the selection and implementation of systems in accordance with business process re-engineering.
4. **Organizational Architectures** - provides the guiding organizational structure and managing philosophies for the SITS to appropriately serve the Company including resource allocation of staff, internal processes, and budget maintenance.

4.1.1.6 Budgets and Schedules

Budget. The budget presented in the ITSP totals $15,658,789 for the years of 2001-2003. Compared to other water utilities of similar size and demographics, the Company's ratio of IT spending to overall spending is in-line with the industry standard.

Schedule. The project schedule to implement key IT Strategies consists of the following:

Initiative	Time Frame
Automated Mapping and Facilities Management (AM/FM/GIS)	2000-2003
Plant and Production Systems (SCADA)	2000-2002
Work Management and Field Force Automation System.	2001-2003
Business Resource Management Systems	2001-2004
Integrated Voice Response/Computer Telephony Integration	2000-2001
Automated Dispatch, Customer Scheduling, and Field Force Automation	2001-2002
Business to Customer Internet Applications	2001-2002

4.1.2 SITS Description

SITS is organized around a partnership agreement between the System Owner and the employees in concert with Local 1683. This collaborative effort is built upon honest communication, collaborative decision making, and shared accountability for the operational success of SITS. The SITS receives guidance and input from the System Advisory Council (SAC) comprised of representatives from various Business Systems within LWC. The SITS Owner is responsible for assessing inputs and recommendations from Business System owners. He or she will then determine appropriate budgets and timeframes based on resources, business need, and the Company's goals.

The purpose of this organizational structure is to support LWC's use of Total Quality tools and analysis methods. Because IT initiatives require the involvement and ownership of staff at all levels across various departments, this structure insures collaboration and shared ownership. In addition, it provides an avenue for clearly defined roles and fair compensation for process stakeholders who are affected by IT initiatives.

4.1.2.1 SITS Personnel

SITS consists of 16 members including the System Owner. The SITS is comprised of developers, networking specialists, management analysts, and database analysts.

The time commitment of staff is allocated over three broad categories:

Categories	Targets	4Q 00	1Q 01
Architectural Development	35%	43%	63%
Traditional Development	15%	0%	0%
Maintenance and Enhancements to Existing Systems	50%	57%	37%

Staff responded to 889 total work orders at 2366 hours in 1Q2001 at an estimated O/M cost of $107,082. This is an average cost of service of $120.45 per work request. The technical

and data architecture requests are primarily reactive in nature and include hardware, software, and networking support work orders.

4.1.2.2 Technical Components

Infrastructure. SITS utilizes 17 servers to support approximately 350 personal computers. SITS has shifted its focus from custom software development and legacy mainframe maintenance to increased implementation of COTS. System analysts provide support and development for a few custom applications as well as COTS enhancements. SITS maintains Oracle, DB2, and SQL Server databases and utilizes Cisco products in its network.

System Reliability. The system reliability measures provide information regarding the main computer servers, network, database, and transaction processing systems (TIP). Measures are being developed for telecommunications systems.

TIP Transaction Processing System (IMS). The TIP system reliability objective is 99.7 percent average uptime. The 1Q2001 uptime measured at 99.9 percent with a yearly average of 99.9 percent.

Reliability. The reliability goal for mission critical servers is 99.7 percent uptime in a 24x7 operating environment. The 1Q2001 reliability was 99.9 percent.

4.1.3 Evaluation of SITS

Organized by degree of strength, B&V believes the following to be the key findings:

Strengths	Awareness Issues
• Organization / Leadership • SITS leadership has a business user focus opposed to the common IS standards focus. • The ITSP is based on the information needs of individual users and the organization as a whole. • The ITSP is driven by LWC business strategies and key performance measures. • An emphasis is placed on business process reengineering prior to implementing a system. • The SITS has a balanced approach between data management, hardware management, and application functionality to achieve business needs. • Based on past endeavors (CIS), LWC is willing to utilize outside resources to offset demanding workload. • IS management realizes the implementation of all systems may take an additional 1-2 years. • Currently, SITS is evaluating its resource allocation of all projects with a workload matrix. Gaps from this analysis will be used to determine where and when outside help will be necessary during the next 1-3 years. • The SITS is continually developing performance measures to ensure quality service.	• Organization and Leadership • Based on workload of current IS staff and the business owners, these projects are moderately aggressive for this utility. The current customer service information system provides a baseline; whereupon, time requirements were greater than anticipated despite a well organized initiative • As LWC moves to commercial off-the-shelf software, business systems are assuming more IS responsibility. Upper management may not be fully aware of the challenges of implementation and need to invest in resources to maintain applications by the business system as opposed to IS maintenance.
<u>Technical</u> • Continuing a phased approach, LWC realizes the need to build an appropriate IT infrastructure prior to implementing various applications. • The ultimate goal is to promote data sharing and ease accessibility to system wide data. • Data sharing will be developed gradually as needed and as users gain a greater awareness of the system functionality and data available to them. • Patience is present as new technologies evolve. Business needs are the primary focus as opposed to "bells & whistles". • Recognition exists to address data storage issues.	<u>Technical</u> • The projected time frame is moderately aggressive for the projects scheduled in the 2001-2003 ITSP. • Maintaining various databases requires a cross-trained staff. LWC will be maintaining three different database types with the installation of SCADA: Oracle, DB2, SQL Server. • Information sharing needs to be promoted between various operational groups. Evaluating potential business scenarios/models to enhance water quality, increase customer service, and to promote financial gain. • An IT risk management plan needs to be developed in accordance with LWC strategies. • The implementation of a Storage Area Network (SAN) is moderately aggressive. • The development of a data warehouse foundation is moderately aggressive.
<u>Personnel</u> • The current staff is willing to adapt and learn new platforms and database structures to meet user needs. • Awareness exists on the need to train end users and to shift focus from IT staff maintaining the system to business users maintaining the application. • Willingness exists to provide the appropriate resources to maintain various database types if the application offers the most benefit to the business system. This is based on cost/benefit analysis.	<u>Personnel</u> • Approximately 30 percent of the staff will be retiring in the next 3-5 years. • Business users are assuming more IS responsibility as LWC shifts to off the shelf applications. Current job grades of application users are not in alignment with these additional IS responsibilities. For example, some customer service staff have to perform assigned duties plus serve as a liaison to a software vendor.

4.1.4 Recommendations

4.1.4.1 Organization and Leadership

- From a high-level perspective and based on industry experience, there is an adequate request for funding for the described initiatives. Further investigate of the itemized cost breakdowns for each project could provide a more accurate assessment of the projections.
- The proposed schedules are moderately aggressive for this utility. Recognizing the time frames associated with historical IT changes, the Company may wish to review resource allocation and schedules with the consideration of expanding project time frames.
- Meetings and observations with Business System staff would help LWC Leadership to gain awareness of job changes due to IT implementations.

4.1.4.2 Technical

- Investigate the use of network-attached storage in addition to SAN solutions. These two approaches should be evaluated from both a performance and cost perspective.
- Develop a disaster recovery plan.
- Consider the standardization of databases to simplify maintenance and reduce the need for cross-trained staff.
- Develop an information map of the organization, including the key information exchanged between various departments and its frequency. This would assist with the evaluation of the need to develop a data warehouse or to integrate systems.
- Purchase a common reporting tool linked to various measurement systems (i.e., Performance measurement software). This would enhance the Company's strong use of Total Quality performance measures.
- Depending on the application, customization should be limited if possible. Only if modules add significant business value should they be developed.

4.1.4.3 Personnel

As the Company initiates future software implementations, it may want to evaluate outsourcing various software implementation tasks such as:

- needs assessments
- process re-engineering
- assistance with RFP and spec development

- vendor selection
- configuration
- change management
- training

This is based on the excessive workload placed on Company staff during the implementation of the Customer Service Software.

- Reclassification of job grades as more IS responsibility is placed on application owners.
- Develop a succession plan and cross training of staff due to retiring staff. Considerations should be made to outsourcing opportunities.
- Consider outsourcing for a portion of the services based on current workload placed on the staff.

4.2 Fleet Utilization

For most utilities, an often-overlooked drain on resources is fleet maintenance. Regular reviews of fleet composition and utilization can optimize the value of the investment in vehicles and equipment. As part of the development of the *2002-2021 Facilities Plan*, Black & Veatch conducted a high-level review of LWC's fleet utilization. The following discussion presents key findings and recommendations from this review.

4.2.1 Overview

4.2.1.1 Fleet Composition

The Company's fleet consists of 439 total units with an original book value of $7,677,013. There are 163 passenger vehicles with an original purchase price of $2,726,259. In addition, the Company has 99 major pieces of equipment, including crew trucks, which it maintains. The original book value of this equipment totals $4,112,245.

4.2.1.2 Operations

Fleet maintenance operations take place at three locations – the Allmond Avenue facility, Crescent Hill and Middletown Substation. At the Allmond facility, maintenance personnel work on one of two shifts (day or night). This facility staffs 4 mechanics, 1 mechanic helper, and a light equipment mechanic. At Middletown, only 1 mechanic working during the day is scheduled, and the site also serves as a base of equipment and vehicle storage. The Crescent

Hill facility is only used as a base for some equipment and vehicles. All locations are equipped with fueling facilities.

The Process Owner of Fleet Services manages all day-to-day operations. All operations report to the Business System Owner, Managing Distribution Operations.
Fleet requirements are requisitioned through the Process Owner to the Business System Owner. All requisitions are submitted, in writing, to the President for approval. Fleet personnel are involved in preparing all requisitions and selecting units.

Approximately 80 percent of all maintenance activities are performed in-house. The Company places a high priority on training its personnel. Currently there are 3 Master ASE-certified mechanics on staff. Training is offered through Ford Motor Company, in-house courses, and at local technical schools. A Total Quality Management approach is used for decision-making: decisions in the maintenance area are made as a team, involving the mechanics and the Process Owner. Results of decisions are reported to the Business System Owner.

4.2.2 Findings

4.2.2.1 Fleet Age

As noted earlier, the Company's fleet consists of 439 total units. The average age of the fleet is 66 months with a median age of 48 months. The newest units are 0 months old, while the oldest are in excess of 360 months. The oldest units are "limited use only" vehicles.

Of the 439 units, 163 are passenger vehicles. These vehicles consist of automobiles, pickup trucks, right-hand drive jeeps and sport utility vehicles. The average age of these vehicles is 44 months with a median age of 36 months. The newest units are 0 months old and the oldest units are 167 months old. The fleet has 267 units less than 5 years of age, representing 60 percent of the total fleet with an original book value of $5,181,484.

There are 99 major pieces of equipment in the Fleet Services inventory. These consist of crew trucks, backhoes and dump trucks. The average age of this equipment is 73 months with a median age of 51 months. The newest units are 0 months old while the oldest are 143 months old.

4.2.2.2 Fleet Cost

Total fleet operating costs in 2000 have increased 20 percent over 1999 levels and year-to-date 2001 costs are currently 10 percent higher than 2000 figures. LWC staff is concerned

about the rapidly rising fleet costs. Major operating costs include fuel, labor, preventative maintenance (PM) labor, parts, PM parts, administration, and depreciation.

- Fuel costs for 2000 are 52 percent higher than 1999 expenditures. Year-to-date 2001 fuel costs are running 28 percent higher than 2000 levels.
- Labor costs in 2000 were 24 percent higher than 1999 costs. Costs for 2001 are 27 percent higher than 2000 figures.
- PM labor costs for 2000 rose 39 percent over 1999 levels. 2001 PM labor costs are tracking at 7 percent over 2000 figures.
- Parts costs in 2000 were 21 percent greater than in 1999. For 2001, parts costs are projected to run 30 percent higher than in 2000.
- PM parts costs were 12 percent higher in 2000 than in 1999 and are anticipated to run 30 percent higher in 2001 than in 2000.
- Administration costs continue to increase. 2000 administration costs were 24 percent higher than 1999 and 2001 costs are expected to run 27 percent higher than 2000 levels.
- Depreciation costs for 2000 were 11 percent higher than in 1999. 2001 depreciation expense is tracking at 10 percent over 2000 figures.

4.2.3 Recommendations

4.2.3.1 Fleet Composition

Fleet availability is a measure of the number of units available for service if required. LWC staff reports that fleet availability is in excess of 98 percent, which implies that the vehicles are maintained in generally good working condition.

In order to evaluate if the current fleet composition is adequate, it is also necessary to develop a method of tracking utilization. Utilization is the amount of time a unit is in operation, compared to the overall activity of the Business Systems. Utilization parameters need to be established by the fleet team with representatives from the Business Systems using the equipment. To be effective, the parameters need to be measurable. Once guidelines are established for each type of equipment/vehicle, they are tracked and used to establish an optimal fleet composition. Emergency workload requirements would also need to be included in the guidelines.

4.2.3.2 Fleet Age

Determining the optimum fleet age should incorporate the Company's strategic objectives and values. Younger fleets carry more costs in the area of acquisition and depreciation. Newer vehicles tend to reduce the overall repair costs by having fewer repairs and the advantage of using manufacturer warranties. Fewer repairs will increase availability. Another advantage to maintaining a younger fleet is the perception of the employees using the equipment that they are valued and worth the investment. Most customers also value the newer fleet.

Aging fleets have an advantage of reducing the acquisition and depreciation costs for the operation. Older vehicles increase repair and maintenance costs due to increased failures and the absence of warranties. Employees and customers also tend to view aging fleets negatively.

The current age of the LWC fleet seems to be well managed. The current policy keeps the more highly utilized critical equipment on the younger side. Less frequently used equipment is left to age, which does not appear to impact operations.

4.2.3.3 Maintenance

The Company should review the maintenance requirements for each type of equipment and vehicle owned. Manufacturers have changed these requirements over the past few years to take advantage of equipment and vehicle improvements. Some areas of note include increased intervals between tune-up and cooling system service. Still critical to the optimum operation of equipment are the preventative maintenance requirements. LWC should consider and oil and fluid analysis as a preventative maintenance tool. A properly implemented oil and fluid analysis program allows monitoring of the drain intervals to obtain optimum life. It also provides a method of identifying problems prior to a major failure.

4.2.3.4 Acquisition

The diverse nature of activities that LWC engages in makes standardization of equipment and vehicles very difficult. There are ways however to reduce the likelihood of procuring units that will have poor performance or increased ownership costs. The Company currently uses life-cycle analysis as a management tool. Ownership cost reports can be used to augment the life-cycle analysis. Detailed documentation on equipment performance and reliability is crucial when justifying a purchase decision for a more costly unit. Ownership cost reports should have information on frequency of failures and the associated costs. Issues such as lost productivity and dealer satisfaction should weigh into future decisions.

Availability of manufacturer training and its quality should also be considered. Results of demonstrations should be written by those involved in the evaluation (mechanics, operators, and fleet administration). These evaluations must also be weighed into the decision.

LWC staff reports that rental purchase options (RPO) are difficult to exercise. This option should be reviewed to see if there are ways to take advantage of the benefits this option offers. One of the fastest means of reducing overall fleet costs is to reduce ownership to only those units most needed (the highest utilized vehicles). Other equipment needed on a seasonal basis or during peak activity could be set up as an RPO. If activity remains high, these pieces of equipment can be converted to a purchase. By taking advantage of the rent paid, the acquisition remains lower, reducing the depreciation burden.

Advance notice to the Process Owner-Fleet Services concerning new hires or the additions of work crews would help in the planning process. Concerns voiced over the apparent shortage of equipment could be addressed if all personnel understood how much lead-time is required for procurement and equipment preparation.

4.2.3.5 Disposal

Like other utilities, LWC holds annual auctions to dispose of equipment and vehicles no longer required. This auction is limited to LWC assets and performed at a peak time of the year to produce higher results. By offering good equipment on a regular basis, the auction produces a good source of revenue for LWC. This method of disposing of equipment should be continued.

4.2.3.6 Centralization

Centralizing fleet maintenance activities is always an option to reduce costs. Should LWC wish to pursue this alternative, a more detailed assessment of fleet activities including fleet use and key cost drivers should be conducted. Another option for LWC is to eliminate the three fueling facilities, or use them only for the remote dispatch of units used daily in those locations. Instead of the fueling locations, LWC would employ a fleet fuel card. The maintenance of fueling sites requires strict adherence to State and Federal regulations, which in turns requires additional administration of the accounts and maintenance of the units. There are fleet fuel programs available that would offer LWC the same level of security and control that currently exists and also increase the number of fueling locations.

4.3 Real Property Inventory

In addition to physical assets such as plants, pipes and pumps, LWC also has an inventory of real property to manage. Effective management of all assets optimizes the investment in owning and operating a system while providing quality service. Implementation of an asset management strategy should be consistent with the strategic plan of the utility. LWC's asset management strategy for real property attempts to utilize all property to the benefit of the utility. Unfortunately this is not always possible. Technically, property that is not used and useful to the utility should not be included in the rate base of the utility.[8]

For under-utilized properties, finding an alternative use for the site may allow the asset to be considered as part of the net plant investment (rate base). Inclusion in rate base allows the Company to earn a rate of return on the asset via water rates. When alternative uses cannot be found, the Company should evaluate the costs and benefits of leasing or selling the property.

LWC owns and operates a number of major facilities in its service area. Many of these facilities are located on property owned by LWC; others are located within easements or are located within public right-of-ways. The majority of LWC-owned property is fully utilized. However, for some parcels, facility use has been discontinued, and unless alternative uses can be found, there may be no reason to retain ownership of the property. Moreover, unused properties may increase LWC's liability risk.

As part of the development of the *2002-2021 Facilities Plan*, Black & Veatch has conducted a high-level review of LWC's real property listings. The following discussion presents key findings and recommendations from this review.

4.3.1 Major Property Holdings

Table 4-1 presents a listing of the major properties owned by LWC as of October 25, 2001. Information pertaining to the size of each property, together with a description of its current use, and cross-references to the LWC Pipeline Book and Deed Book are also on the table.

[8] In accordance with AWWA, rate of return is only earned on assets included in rate base.

Table 4-1

Property Owned in Fee Simple by LWC

Facility Location	Pipeline Book Location	Deed Location	Acres	Remarks
Allmond Avenue (Allmond Ave. & Strawberry Lane)	425-852	DB 4057, 234 DB 4480, 354 DB 4032, 354	12.75	Site of Distribution Center.
Bardstown Road Standpipe	476-832	DB 4772, 485	3.67	Site of 5 MG standpipe.
Baxter Avenue Property (Baxter Ave. & Bardstown Road)		DB 375, 288	0.10+	Tract was purchased for the installation of a 48-inch main.
Buechel Pump Station (Bardstown Road & Buechel Terrace)	458-856	DB 4046, 577		Former site of 0.1MG clearwell and booster pumping station.
Billtown Road Tank Site (Billtown Rd. & Shaffer Lane)	482-844	DB 4046, 577 DB 7323, 717	5.48	Site of 0.5 MG elevated tank. Verify if leasing to Jehovah's Witness parking lot (100 foot frontage) still occurring.
Blackburn Avenue Property (Blackburn Ave. & Claremont Ave.)	449-882	DB 619, 545 DB 1652, 518 DB 620, 385	0.20	To be used as a drainage avenue for the seepage from the reservoirs and groundwater in the area.
Blankenbaker Crossing Tank Site	488-862	DB 6423, 212	1.23	Site of one (1) 1MG elevated tank.
Belvins Gap Tank Site	392-814	DB 3351, 79	1.01	Site of 0.5 MG Standpipe. Tank was taken out of service in 1994.
Brooks Hill Pump Station	437-810		0.01	Site of two (2) 0.72 MGD pumps.
Brooks Hill Standpipe & Brooks Hill II Pump Station Site	434-794	DB 246, 038	Lot #16	Site of one (1) 0.3 MG Standpipe and two (2) 0.25 MGD pumps.
Cardinal Hill Reservoir (Between Manslick Rd., Palatka Rd., & St. Anthony Church Rd.)	413-844 413-840 413-842 410-842 410-840 407-842 407-840	DB 1472, 337 & 376 DB 1473, 277 DB 1474, 233 DB 1480, 375 DB 1481, 383; 525; 568 DB 1482, 328; 245; 562 DB 1493, 392 DB 1527, 532	159.75	Site of a 30 MG underground reservoir. 18.71 acres leased to YMCA. Agreements with law enforcement agencies and the Corps of Engineers to maintain radio antennas on the property. 23.96 acres are active and the remaining is inactive. Some property has been leased for farm land. 10 acres were acquired from Farley/Harness Lawsuit.
Cedar Grove Standpipe Site	446-774	DB 530, 463	4.35	Site of one (1) 0.5 MG standpipe.
Coral Ridge Tank(Feller Ave. near National Turnpike)	431-822	DB 4068, 119	0.91	Site of 0.5 MG standpipe.
Crescent Hill Property (Between Stilz Ave., Frankfort Ave., and Sacred Heart Lane)	446-882 446-880	DB 203, 171 DB 207, 558 DB 334, 497 DB 377, 200 DB 404, 396 DB 417, 96 DB 500, 585 DB 676, 630 DB 849, 235 DB 4758, 867	151.3	Sites of reservoirs and basins used in pumping and treatment process. 41.38 acres are Crescent Hill Golf Course. Site of public swimming pool and park.
Crestwood Tank (Between Lagrange Rd. & L&N RR)	509-908 446-880	DB 100, 117	0.20	Site of a 0.5 MG tank.
Dawn Drive Tank Site (Oak Hill Tank Site)	407-848	DB 4067, 342	0.23	Acquired from Louisville Extension Water District.

Table 4-1 (Continued)

Property Owned in Fee Simple by LWC

Facility Location	Pipeline Book Location	Deed Location	Acres	Remarks
English Station Tank (English Station Rd. at Shelbyville Rd.)	497-878 497-876	DB 4153, 58	18.59	Site of a 0.5 MG elevated tank and 10 MG standpipe and Middletown District Substation.
Evergreen Road Tank (Evergreen Rd. & Lakeland Rd.)	488-888	DB 3641, 504	0.23	Site of 0.3 MG elevated tank.
Former KT Offices – 3396 Burkland Blvd.	449-806	DB 368, 319	Lots 69 & 70	Site of Bullitt County Office Building.
Freys Hill Pump/Tank (Freys Hill Rd. & Westport Rd.)	482-894 497-876	DB 4081, 404	1.00	Site of 0.5 MG elevated tank and booster pump station. Tank is out of service.
Gospel Kingdom Tank Site	413-790	DB 527, 315 (Easement followed by purchase)		Site of 0.25 MG elevated tank for 1030 PZ under fabrication.
Grinstead Drive Property			8.96	Purchased for transmission main.
Harrods Creek Property/BE Payne WTP (Between River Rd. & Jacobs School Lane)	461-916, 461-914, 461-912, 461-910, 458-914, 458-912, 458-910, 464-914, 464-912	DB 4165, 190 DB 4167, 275 DB 4409, 497 DB 4421, 407	286.45	Site of BE Payne Water Treatment Plant and residual lagoons.
Highview Tank Site (S. Watterson Trail & Glaser Lane)		DB 4046, 577	1.99	Site of former 0.1 MG elevated tank and a 0.5 MG elevated tank.
Hikes Point Booster Pump Station (Between Taylorsville Rd. & Rosemont Ave.)	461-868	DB 4570, 184	0.23f	Site of booster pump station.
Hurstbourne Lane Pressure Reducing Station (Hurstbourne Parkway & Shelbyville Rd.)	476-878	DB 4024, 535	0.25	Site of active PRV station and inactive 0.1 MG clearwell and booster pumping station.
Jeffersontown Bluegrass Tank and BPS	482-868	DB 6468, 182		Site of 0.5 MG tank which is no longer in use. Also site of new BPS constructed in 1994. Property reverts to City of Jeffersontown if not used for water distribution purposes.
KT Booster Pump Station #3	467-776	DB 215, 351	0.25	Former KTWD BPS. Site of three (3) 0.3 MGD pumps.
LaGrange Road/Reamers Road Tank Site	497-896	DB 7024, 341	2.43	Site of 1 MG elevated tank.
Middletown Tank (Shelbyville Rd. & Evergreen Ave.)		DB 4024, 535	0.55	Site of former tank no longer in use. In the past, office building has been leased to Middletown Jaycees. Verify ownership.
Parkridge tank Site	413-838	DB 6870, 501	1.28	Site of 0.25 MG elevated tank.
Rausch Drive Property (Rausch Dr. near Cane Run Rd.)	404-862	DB 4284, 511 DB 3938, 562 DB 5311, 674	0.25	Property purchased for pipeline.
River Road Country Club (River Rd. & Zorn Ave.)	443-888 440-888	DB 98, 197 DB 1559, 573	27.07	9 hole golf course and clubhouse. Golf course leases property from LWC and the City of Louisville.
Smyrna Pumping Station (Smyrna Rd. & Outer Loop)	458-838	DB 4072, 113 DB 3763, 116	2.86	Site of 2.3 MG underground reservoir and a booster pumping station.

Table 4-1 (Continued)

Property Owned in Fee Simple by LWC

Facility Location	Pipeline Book Location	Deed Location	Acres	Remarks
Top Hill Road Property	413-816	DB 5969, 403	3.58	
Third Street Office Property (435 South Third Street)	425-880	DB 107, 304 DB 145, 140 DB 193, 313 DB 511, 620 DB 536, 383 DB 696, 431 DB 1686, 55 DB 1637, 145 DB 4650, 95	1.21	Site of the former main office.
Third & Chestnut – Corporate Office (550 South Third Street)	425-878	DB 6640, 284	0.62	Office building only. Parking lot property leased.
Waverly Tank Site Property (Dixie Hwy. & Sunset)	401-836	DB 4067, 342	0.91	Site of former tank property, may have been sold.
Westport Road BPS and Tank (Westport Rd. & Watterson X-way)	464-884	DB 3369, 57	1.39	Site of 1 MG elevated tank and a booster pumping station.
Windsor Forest Standpipe (Lakeridge Dr. & 3rd Street Rd.)	407-836	DB 4116, 564 DB 3763, 116	1.00	Site of 0.5 MG standpipe.
Zoneton BPS	455-812		0.19	Site of two (2) 0.14 MGD pumps.
Zoneton Tank	461-808	DB 131, 527 DB 307, 325	0.39	Site of one (1) 0.15 MG Standpipe.
Zorn Pumping Station (Zorn Ave. & River Rd.)	440-890 440-888	DB 209, 192	28.52	Site of main raw water pump station. Site is also presently being used by Crescent Hill Athletic Association for ball diamonds and soccer fields.
Zorn Avenue Pipeline to CHWTP	443-890 443-888	DB 218, 467 DB 219, 414 DB 218, 200 DB 829, 593 DB 1104, 86 DB 1378, 556 DB 1367, 166	10.96	Pipeline from Zorn Pump Station to Crescent Hill Water Treatment Plant..

Most of the Company's property is located at the B.E. Payne Water Treatment Plant (BEPWTP), the Crescent Hill Water Treatment Plant (CHWTP), and the Cardinal Hill Reservoir. The BEPWTP site is the largest holding at 286.45 acres. This site contains the treatment plant and solids lagoons. Approximately 40 acres of the site are currently not used by LWC. In the past, this land has been leased for farming. The Cardinal Hill Reservoir site contains 159.75 acres. The Cardinal Hill Reservoir (30 MG) is located at the site. A large portion of this site is also not currently being used. The CHWTP site contains 151.3 acres. In addition to the presedimentation reservoirs and treatment plant, the site contains the Crescent Hill Public Golf Course. Other major parcels include the Zorn Pumping Station (ZPS) property (28.52 acres), the River Road Country Club (27.07 acres), the English Station Tank Site (18.59 acres), and the Allmond Avenue Distribution Center (12.75 acres). As

noted in the table, where possible, LWC has actively tried to lease or find alternative uses for unused portions of parcels, particularly at the largest holdings.

A number of LWC's major facilities are located on property that is either in the public right-of-ways (PROWs) or is being used by easement. A listing of these major facilities, along with Pipeline Book references and descriptions of current use, is presented in Table 4-2. Most of these sites are actively being used.

Table 4-2

Facilities Located on Property Not Owned by LWC

Facility Location	Pipeline Book Location	Type of Use	Acres	Remarks
Anchorage Pump Station	485-866	DB 3641, 498	0.45	Property owned by City of Anchorage – BPS removed.
Aiken Road Booster Pump Station	512-884	DB 7506, 769	50' x 30' easement	Easement.
Big Valley Hydropneumatic Station		KTWD No. 1 PROW		Site of hydropneumatic BPS.
Blevins Gap Hydropneumatic Station		PROW		Site of 0.43 MGD hydropneumatic station.
Cabin Creek Hydropneumatic Station		KTWD No. 1 – PROW		Site of hydropneumatic BPS.
Finley Hill Standpipe	419-836	LWC ESMT (See DB 4068, 117)		Site of 0.3 MG Standpipe.
Finley Hill BPS	419-836	LWC ESMT		Site of two (2) 0.3 MG Standpipes.
Heritage Estates	413-842	PROW		Site of two (2) 86,000 GPD hydropneumatic pumps.
Highway 22 BPS	488-904	DB 7506, 772	10' Easement	Station in easement & PROW.
Highway 480 Pump Station	443-780	DB 528, 81 DB 527, 320	50' x 60' Easement	Site of three (3) 1 MGD pumps.
Jefferson County Memorial Forest Tank Site	425-816	DB 6595, 983		Easement – Site of 0.15 MG elevated tank.
Kenwood Hill Reservoir	419-844	LWC ESMT #422		Site of 0.1 MG reservoir and two (2) 0.05 MGD hydropneumatic pumps.
Kenwood Hill BPS	419-844	LWC ESMT #422		Site of two (2) 0.14 MGD pumps.
Kosmosdale Tank	383-808	LWC ESMT #822	2.5	Site of 0.5 MG tank.
KT BPS #2	446-780			Former STWD BPS. Site of two (2) 0.58 MG pumps.
Long Run Park Standpipe	521-884	LWC ESMT #2212	1.3	Site of 0.85 MG tank.
Martin Hill Road BPS Site	410-800	DB 535, 729	60' x 80' Easement	Planned site for three (3) 400 GPM pumps.
Mitchell Hill Road Standpipe	422-818	PROW		Site of 0.05 MGD pump.
Oak Hill Standpipe	410-844	LWC ESMT		Site of 0.6 MG tank.
Oak Hill BPS	410-844	PROW		Back up to Frey's Hill Pump Station.
Parkridge BPS		LWC ESMT	0.13	Site of two (2) 0.28 MGD VFD and one (1) 0.07 MGD CSD Pumps.

Table 4-2 (Continued)

Facilities Located on Property Not Owned by LWC

Facility Location	Pipeline Book Location	Type of Use	Acres	Remarks
Peaceful Valley BPS	446-776	DB 528, 78	40' x 60' Easement	Easement.
Peaceful Valley Standpipe Site	446-772			Site of 0.235 MG Standpipe.
Phelps Knob Standpipe	434-794	LWC ESMT #754		Site of 0.5 MG Standpipe.
Pleasure Ridge BPS		On Cardinal Hill Reservoir Property owned by LWC.		Site of three (3) 1.29 MGD pumps.
Prospect Tank	470-920	LWC ESMT #474 Oldham County DB 104, 590	0.23	Site of 0.5 MG elevated tank.
Shady Acres BPS	476-852	DB 7669, 196	60' x 50' Easement	Site for three (3) 1 MGD pumps
South Park Pump Station	437/440-830			Associated tank site sold to Common wealth of Kentucky for Gene Snyder Freeway. Former tank sites associated with PBS removed.
Shelbyville Road BPS		PROW		Site of two (2) 0.86 MGD pumps.
Standard Country Club Tank	470-892	LWC ESMT #1611	0.86	Site of 0.5 MG tank.

4.3.2 Recommended Property Purchases

Table 4-3 summarizes properties needed for future capital improvements. The Company is currently in the process of acquiring several of these properties. If riverbank infiltration (RBI) is incorporated as the method to provide an additional barrier of protection against pathogens, riverfront property or easements between ZPS and Goose Creek should be acquired for construction of RBI facilities. It is estimated that between 10 to 15 acres would be required. There is also a need to acquire property for landfilling material excavated from pipeline projects. Preferably, this property would be located in the south central part of the system to minimize travel time to get to the site. All of the other properties recommended for purchase are for storage tank sites needed to meet future growth or to improve pressure.

Table 4-3

Properties for Acquisition

Property	Explanation	Size
Barralton Hill BPS Site	➢ Planned site for three (3) 300 GPM pumps.	
Barralton Hill Elevated Tank Site	➢ Site for a 0.15 MG elevated tank for 900 PZ.	
Dryridge Pump Station Site	➢ Planned site of three (3) 400 gpm pumps.	
Dryridge Elevated Tank Site	➢ Site of a 0.25 MG elevated tank for 900 PZ.	
East Highway 480 Elevated Tank Site	➢ Site for a 0.25 MG elevated tank for 760 PZ or 800 PZ.	
East Highway 480 BPS Site	➢ Planned site for three (3) 400 GPM pumps.	
Hillcrest Elevated Tank Site	➢ Site for a 1 MG elevated tank for 820 PZ.	
Rams Run Road Tank Site	➢ Site for a 0.15 MG elevated tank for 900 PZ.	
Rams Run Road BPS	➢ Planned site for three (3) 300 GPM pumps.	
Tucker Station/Taylorsville Road & Sweeney Lane Tank Site	➢ New tank will probably be needed to meet future demand in this area. ➢ Exact location has not yet been identified.	2 to 5 acres
Sandy Hill BPS Site	➢ Hydropneumatic booster pump station.	
West Oldham Tank Site	➢ Future tank needed in this area to meet future demands.	2 acres
Taylorsville Road and Hurstbourne Corridor/770 PP Tank Sites	➢ Needed to extend 770 PP. ➢ Location still undetermined.	2 to 4 acres
Ohio River Front Property	➢ Needed for construction of River Bank Infiltration Wells. ➢ For CHWTP (180 mgd – 12 wells) ➢ For BEPWTP (45 mgd – 3 wells, construct on property already owned by LWC.)	10 to 15 acres
Property to Landfill Excavated Material near Allmond Avenue Distribution Center	➢ LWC needs site to dispose of excavated material from pipeline construction. ➢ Location in south-central portion of service area would minimize travel time. ➢ Would provide greater control by LWC and reduce liability. ➢ Could possibly be site used in conjunction with MSD and other agencies having similar needs.	10 to 50 acres

4.3.3 Properties Requiring Further Evaluation

Table 4-4 identifies several properties that are no longer being used and also lists properties that potentially require a re-evaluate of use. The Company should evaluate the costs of converting any of these properties to an alternative use (e.g., storage facility, farm land, landfill site, lease property) and determine whether it would be more beneficial to convert the parcel or sell it.

Table 4-4

Properties Requiring Further Evaluation

Property	Explanation
Allmond Distribution Center, Crescent Hill, and Middletown Substation – Fleet Distribution Centers	➢ Consolidation of fleet maintenance activities would make additional land available. ➢ Crescent Hill facility is under utilized.
B.E. Payne Property	➢ Site has unutilized or under-utilized property. ➢ Future additional needs at site are for solids disposal and riverbank infiltration wells. ➢ Portions of site are developable for other uses.
Blevins Gap Tank Site	➢ Tank is currently out of service. ➢ Tank is structurally in question.
Buechel Pump Station Site	➢ No longer in use. ➢ Building is vacant.
Cardinal Hill Reservoir Property	➢ Large portion of the property is not currently been used. ➢ Property originally acquired for potential future treatment plant, which, with construction of the BEPWTP, now is not needed. ➢ Location of property (elevation) is critical to LWC operations. ➢ Approximately 90 acres of site could be converted to another use such as lease agreements for public or private uses. LWC prefers leasing property so it could be retained for long-term future needs as they become identified.
Crescent Hill Golf Course	➢ Property originally acquired for possible future WTP expansion. ➢ Established golf course use. ➢ Treatment plant capacity expansion not anticipated in foreseeable future. ➢ Near term (next 20 years) treatment plant upgrade on existing site more likely. ➢ Long term (20 years +) if new treatment plant is built would have to keep old plant in service during construction. This may require plant to be built on adjacent land. ➢ Site has been used for landfilling street excavation material. ➢ LWC needs more places to landfill.
Highview Tank Site	➢ Tanks no longer in service. ➢ Could be future tank site if 770 PP is expanded.
Lakeland Standpipe/Pump Station Site	➢ No longer in use..
Middletown Tank Site	➢ No longer in use..
River Road Country Club	➢ Possible retention for buffer around old landfill site. ➢ Could be used for infiltration wells. ➢ Portion of the golf course is leased from the City of Louisville – could consolidate ownership under one government jurisdiction. ➢ Current use of property may be its best use. In flood-prone area, would require considerable build-up for development.
Third Street Office Property	➢ New offices at Third Street and Chestnut. ➢ No need to keep old building.
Timber Hills Property	➢ No longer in use.
Waverly Tank Site	➢ No longer in use.

There is property at both BEPWTP and Cardinal Hill Reservoir that is currently not being used or which could be put to a better use. Putting some of this property to better use through lease agreements for public or private use is preferable to LWC because it still allows retainage of the property for future, but as yet undefined, LWC uses. A large portion of the property at Crescent Hill is being used for public benefit as a golf course. Because it is adjacent to the CHWTP, and since it is certain that because of age and/or regulations, future

modifications to the treatment facilities will be needed, retaining the property is preferred. Once future treatment facility needs are firmly defined, its disposition may be re-evaluated. Because of its location in a flood-prone area and its proximity to an old landfill, the River Road Property is already being used for its best use. However, if the property does not provide LWC with any additional or future use, the Company should consider transferring ownership to the City of Louisville so that the entire River Road Country Club is under the ownership of a single government entity. The Highview Tank Site could be retained until after LWC determines if and how it is going to extend the 770-pressure plane. If LWC decides not to do this, there is no reason for retaining the property.

4.4 Operations and Facilities Review

Black & Veatch engineers and operations specialists conducted interviews and assessments to review Louisville Water Company's facilities and operations. Among the review efforts completed for this Facilities Plan were:

- The 2002 Annual Inspection, completed in September 2002, which focused on the supply and treatment infrastructure. (For reference, the 2002 Annual Inspection summary results are presented in Table 4-5.)
- Interviews with plant and distribution operations and maintenance staff.
- Site visits to transmission and distribution facilities.
- Targeted inspection of treatment plant chemical feed and storage system

The Facilities Plan reviews indicate that LWC's operations and maintenance staff are competent and well motivated. Operation and maintenance activities are generally in accordance with industry practices and in some areas exceed the norm. The infrastructure is well operated. Significant findings and recommendations are summarized in Tables 4-6 to 4-10 below.

Table 4-5
Summary of 2002 Annual Inspection Results

Facility	Observations	Recommendations	Priority
General Facilities	A filter media preventive maintenance program should be considered primarily because of the potential for bacteriological activity on the media. A secondary filter maintenance program should evaluate the filter media for deposition buildup.	Institute an annual filter media preventive maintenance program to include: ➢ Re-disinfection per AWWA standards. ➢ Media probing down to underdrain system. ➢ Acid solubility testing per AWWA standards.	High
	The existing pump and motor preventive maintenance program should provide operational reliability and minimize downtime.	Continue program. Develop a valve replacement program and a valve exercise program for the plants and major pump stations.	High
	Reinstate maintenance and testing program to inspect, clean, and calibrate all 13.8-kV electrical switchgears and 480-V substations.	Consideration should be given to re-instituting this maintenance program on an annual basis.	Medium
	Several panelboards and power panels in the older facilities are corroded.	Develop a facilities-wide replacement program for lighting panelboards and power panels.	Medium
	LWC has an informal program for inspecting and painting elevated tanks.	Develop a formal tank inspection and painting program to assess status of tanks in a periodic cycle.	Medium
	Many of the electrical receptacles were not protected by ground fault interrupters (GFIs).	Install receptacle GFI protection, especially in all wet or damp environments.	Medium
	In general, painting related to the facilities and structures requires more attention.	Re-evaluate the existing painting program for increased activity, particularly in priority areas such as filter gallery piping, pumping station piping, and basin structures.	Routine
	Overall, the buildings and grounds were well cleaned and maintained.	Continue housekeeping efforts.	Routine
B.E. Payne Low Service Pump Station	The electrical switchgear has reached the end of its service life and repair parts are scarce.	These concerns should be addressed in the B.E. Payne WTP Reliability and Expansion Project.	High
	The electrical switchgear lacks redundancy and is supplied by a single source	These concerns should be addressed in the B.E. Payne WTP Reliability and Expansion Project.	High
	In the event of a utility power loss, the standby generator powers only the lights and elevators.	The standby generator-loading factor should be determined. If possible, the sump pumps should also be powered by the generator in the event of a utility power loss to protect against flooding.	High
	Based on a history of leakage and recommendations from prior annual inspections, valve actuators for Pump No. 3 and Pump No. 4 have been replaced.	Complete the valve actuator replacement for Pump Nos. 1 and 2.	Medium

Table 4-5 (Continued)
Summary of 2002 Annual Inspection Results

Facility	Observations	Recommendations	Priority
B.E. Payne Water Treatment Plant	All valves associated with filtration have maintenance and leakage problems. Valve replacement would require a total plant shutdown.	Problem valves should be identified and replaced in the B.E. Payne WTP Reliability and Expansion Project. In addition, the project should add isolation valves to avoid a total plant shutdown for repairs.	High
	The filter backwash system has design flow limitations (maximum 15 gallons per minute / square foot), which may affect recommended bed expansions when water temperature is greater than 20°C.	Backwash system limitations should be evaluated in the B.E. Payne WTP Reliability and Expansion Project. (Typically, backwash design flow velocities range up to 20 gpm/sq. ft.).	High
	The emergency chlorine scrubber system does not function properly. This a safety issue.	Evaluate, design, and implement repairs.	High
	The electrical switchgear is relatively old, and availability of parts for the units is questionable. The power supply system lacks redundancy.	Power supply issues will be addressed in the B.E. Payne WTP Reliability and Expansion Project.	High
	Due to the layout of the plant and lay of the land, lime slurry and chemical spills drain to a catch basin that discharges into a storm water channel that directs flow east of the site.	It is recommended that LWC evaluate the risks associated with a chemical spill and consider capturing and redirecting this flow to a controlled location for treatment and/or disposal.	High
	The filtration process is not equipped with filter-to-waste capabilities.	A filter-to-waste system is included in the scope of the B.E. Payne Reliability and Expansion Project and is required by KDOW.	High
	The new bulk chemical storage system and feeders have been installed, but only the fluoride system is in service.	Evaluate and correct any remaining problems with the caustic and ferric systems and place both systems into service.	Medium
	The new bulk chemical storage base slab and containment walls do not appear to have a protective coating to protect concrete in case of chemical spill. In addition, cracks in the base slab may not fully contain a chemical spill.	Recommend repairing cracks and applying a protective coating on the base slab and walls.	Medium
	The reliability and expansion project currently under design will expand the facility to a firm capacity of 60 MGD. Current KDOW regulations require clearwell capacity equal to 15% of the daily finished water production. The plant's clearwell capacity of 6 MG does not meet this standard.	Evaluate the need for additional clearwell capacity to ensure the plant production rates are not constantly being adjusted to match system demands.	Medium
	A scheduled maintenance program for cleaning and inspecting the coagulation, flocculation, and sedimentation process equipment is established on a 3-year cycle. This maintenance program is behind schedule.	Continue scheduled maintenance program and restore scheduled frequency. Evaluate the need for a painting program to increase the structural life of process components.	Medium

Table 4-5 (Continued)
Summary of 2002 Annual Inspection Results

Facility	Observations	Recommendations	Priority
B.E. Payne Water Treatment Plant (cont.)	Overall coagulation and softening basin structural condition should be evaluated. The coating system has failed in the flocculation chambers and concrete spalls have exposed concrete reinforcing.	Evaluate structural condition of basin structures and implement repairs where necessary.	Medium
	The weir plates associated with each treatment train have heavy buildup. Buildup increases potential for structural damage due to inner corrosion. Also, buildup may interfere with design flow distribution.	Increase the frequency of cleaning for weir plates.	Medium
	The softening train may require increased cleaning of the weirs and launders in the reaction basin.	Evaluate the scaling buildup and maintain a cleaning program to ensure proper flow distribution. Also, excessive calcium buildup on the weirs and launders may solidify, thus increasing the overall weight of the weirs.	Medium
	The solids handling process for the filter backwash system lacks lagoon redundancy piping for disposal. Lagoon No. 3 is reaching capacity and piping is not available to direct flows into an alternate lagoon.	This issue should be addressed in the on-going solids handling study and/or evaluation and corrected by means of a capital project which has already been budgeted for 2002.	Medium
	A water leak was observed at the south side of Reaction Basin No. 1 effluent channel. An approximately 20-millimeter wide transverse crack is located on the top slab at this location.	Repair these cracks and nay cracks below the water level. The softening train may have to be out of service to repair cracks below water.	Medium
	Several patches have been performed on the lime silo supply piping. Piping is in excess of 20 years old in severe service.	Evaluate condition of piping and consider replacing.	Low
	The resistive heaters in the filter gallery do not function.	Evaluate heating design of this building space and implement improvements.	Low
	The plant influent line is equipped with a hydraulic jet, inline mixer for coagulant addition upstream of the flocculation basins. The operational effectiveness of the mixer is a concern.	Evaluate the plant influent inline mixer during the next scheduled shutdown. Also, investigate the feasibility of a rapid mixing chamber upstream of flocculation to replace the inline mixer, particularly if plant design capacity is increased.	Low
	Condensation was observed in the filter piping gallery, which increases corrosion potential.	Dehumidifying equipment should be evaluated and replaced by the B.E. Payne Reliability and Expansion Project.	Low
B.E. Payne High Service Pump Station	Spool pieces have been altered and structure cracking has been observed due to pipe movement over the years.	Repair and re-design the discharge piping and header to provide adequate thrust restraint. Support discharge piping and valves independently of the pump to avoid undue stress on pump housing. Evaluate and repair this condition with the upcoming B.E. Payne Reliability and Expansion Project.	High

Table 4-5 (Continued)
Summary of 2002 Annual Inspection Results

Facility	Observations	Recommendations	Priority
Zorn Avenue Pump Station	The mechanical screening facility has greatly exceeded its useful life expectancy and requires complete renovation. The screens are in poor mechanical condition and should be considered unreliable. A maintenance schedule with contract divers evaluates the mechanical screens below the water level. Their inspection confirms that the screens' structural integrity below the water surface has deteriorated and requires attention. Interim repairs are being accomplished as-needed to keep the facility functional. The electrical and control systems associated with the mechanical screen building are aged and corroded.	The building support systems (HVAC, lighting, etc.) are quite old and should be investigated as part of the screen rehabilitation project. LWC should implement Capital Project 00-401 as soon as possible.	High
	As a part of the pump and motor preventive maintenance program, the suction and discharge valves are scheduled for replacement.	In addition to the valve replacement program, develop a valve exercising program to reduce scaling buildup on the valve bodies and seats. Evaluate the risks associated with exercising old valves that have not been operated regularly. For old valves where the integrity is in question, it may be unadvisable to exercise the valves. It is recommended that LWC staff use their best judgment and proceed with a valve exercising program accordingly.	Medium
	According to LWC staff, to replace valves for Pump Nos. 6 and 7, the south presedimentation basin must be in service.	Upon completion of the renovation of the south presedimentation basin, schedule the valve replacements for Pump Nos. 6 and 7.	Medium
	Due to dust problems, the emergency eyewash has been covered to prevent settling of dust. This is a safety concern.	A dust control system should be implemented for the potassium permanganate dry feed system.	Medium
	The 480-V substation equipment is relatively old, replacement parts may not be available, and it is difficult to remove the drawout units.	Proceed with replacement of the 480-V unit substation.	Medium
	LWC staff indicated the 13.8-kV electric switchgear is scheduled for replacement.	Proceed with this replacement. Suggest upgrading to vacuum interrupting contactors.	Medium
	Flooding has caused an accumulation of mud on the walls, and oil is present on the floors.	Remove mud cake from pump station walls from previous floods. Pressure wash floor with cleaner to cut oil and reduce slip hazard.	Medium
	Severe spalling and exposed reinforcing bars are visible at the bottom and the sides of bridge connecting to the chimney.	Because the flue duct is no longer used, it is not necessary that LWC perform repairs. However, for safety reasons, it is recommended that a barrier be set up to not allow vehicle or personnel access to the area below the flue duct.	Low

Table 4-5 (Continued)
Summary of 2002 Annual Inspection Results

Facility	Observations	Recommendations	Priority
Crescent Hill Filter Plant	The coagulation basin equipment (floc chamber and clarifier) has substantial metal loss. The coagulation basin structures have several substantial vertical and longitudinal cracks. A general preventative maintenance program for cleaning and inspecting the coagulation basins is performed every 2 to 3 years. LWC staff indicate that this program is behind schedule.	Coagulation basin equipment should be replaced sequentially. It is recommended that all mechanical components associated with the coagulation basin complex be replaced and repairs to the structures made accordingly. Re-establish preventative maintenance program and maintain its scheduled frequency.	High
	The washwater storage system size is inadequate and pumping is unreliable.	Evaluate the feasibility of providing redundant washwater storage system and pipeline to B.E. Payne lagoon. Re-design pumping station to provide dry pit slurry pumps due to severe grit service.	High
	Numerous lighting circuits have failed throughout the coagulation basin complex. This is a safety and security issue.	Replace circuits and restore adequate lighting to this area.	Medium
	The solids handling process for the coagulation clarifiers does not have adequate flow control. Hydraulic restrictions during solids transmission to the lagoons are also a concern.	Complete the on-going engineering study of the solids handling process for the entire system (Crescent Hill Filter Plant, B.E. Payne WTP, and the disposal lagoons). Implement recommended corrective measures.	Medium
	Lime slaker concrete pier foundation is failing.	Repair/replace pier as required.	Medium
	The softening basin equipment (slow mix chamber and clarifier) has substantial metal loss. The basin structures (floc chamber and clarifier) have several substantial vertical and longitudinal cracks. A general preventative maintenance program for cleaning and inspecting the softening basins is performed every 2 to 3 years. LWC staff indicate that the program is behind schedule.	Softening basin equipment should be replaced sequentially. It is recommended that all mechanical components associated with softening basin complex be replaced and repairs to the structures made accordingly. Re-establish preventative maintenance program and maintain its scheduled frequency.	Medium
	The filtration process does not support filter-to-waste capabilities. It is likely that KDOW will require a filter-to-waste system as part of the next filter upgrade.	Evaluate the feasibility of a filter-to-waste system when consideration is given to a filter upgrade.	Medium
	Coagulant is applied into a pipeline on the discharge side of the Venturi flow tubes. (Absence of a rapid mix process, which may increase coagulant dose.)	Evaluate if this dosing method is providing sufficient mixing, uniform coagulant distribution, and adequate detention times.	Low
	A painting program for the structural components of the coagulation basins and softening basins should be considered to extend the structural life of the components.	Develop a general preventative maintenance painting program.	Low
	Several handrail posts are not anchored properly around the north coagulation basin walkways. Parts of the handrail base supports are corroded and not supported.	Replace deteriorated posts and repair as required.	Low

Table 4-5 (Continued)
Summary of 2002 Annual Inspection Results

Facility	Observations	Recommendations	Priority
Crescent Hill Filter Plant (cont.)	It is believed that softening basin no. 6 is leaking considerably as evidenced by presence of substantial concentration of cat tails in the berm. This has the potential to affect adjacent property nearby.	Verify the source and implement corrective actions.	Low
	A severe deposition of rust exists on the grating support beams near the lime silo.	Sandblast and repaint beams.	Low
	Lime from the slaker is not evenly distributed among the slow mix basins.	Identify and implement a better method for lime distribution to achieve uniform pH stabilization to each slow mix basin. This is a low priority as long as basins are not being used for softening.	Low
	The east filter piping galleries have a condensation problem.	Install dehumidifiers to reduce condensation for corrosion control on piping.	Low
	The heating unit substation is 24 years old and approaching the end of its useful life.	The substation must be replaced. This is currently in the 2002 CIP.	Low
	Holes were observed in the roof drain piping for the North Coagulation Building.	Replace the piping for the roof drains.	Routine
	In the North Coagulation Building, washers and nuts were missing on the south roof support channel.	Install washers and nuts or weld bolt to support channel.	Routine
	Leaks appeared to be present on the North/South filter Building roof at several locations.	Evaluate the roof condition and repair or replace.	Routine
	Severe spalls and a number of cracks are visible around the softening basin walkway, especially at the slab intersections.	Repair cracks and spalls.	Routine
Crescent Hill High Service Pump Station	Electrical equipment in 13.8-kV switchgear room does not have adequate protection from moisture. A makeshift plastic tent has been installed over the switchgear to redirect roof leakage.	Repair roof leakage or install a more substantial protective enclosure for electrical equipment.	High
	There are several concerns with the pump station valves and piping.	A detailed engineering study should be performed on the pump station valves, piping, and flow control devices. Recommended improvements should be designed and implemented as soon as possible. Failure of the discharge piping could cause a long-term shutdown of treated water service to many LWC customers.	High

Table 4-5 (Continued)
Summary of 2002 Annual Inspection Results

Facility	Observations	Recommendations	Priority
Crescent Hill High Service Pump Station (cont.)	The northeast corner of the Annex Room structure is leaking considerably. The leak has been present for several years, and attempts to stop the leaking have been unsuccessful. However, the leakage has increased considerably from this time last year. LWC staff indicates leakage has increased tenfold compared to the 2001 inspection. Such a rapid increase of leakage in a relatively short time may be an indicator of a larger problem or imminent structural failure.	It is recommended that LWC pursue this issue more aggressively to determine source of water and design / implement solution to remedy the situation.	High
	LWC staff indicated that the 480-V substation is scheduled for replacement.	Proceed with this replacement.	Medium
Shelbyville Road Booster Pump Station	No deficiencies identified.		
Brooks Hill Booster Pump Station	In general, this pump station has severe deterioration of the steel vault. The floor slope is insufficient to allow water to drain to sump. As a result, the pump, motor, and pump base have significant deterioration as a result of moisture corrosion. Electrically, pump station requires major rehabilitation to replace aged components. Per LWC staff, pumps and motors are scheduled for replacement as part of major maintenance.	B&V recommends replacing electrical panels and motor starter equipment. LWC should consider major overhaul of the station or possible replacement.	Medium
	Water leak at main service disconnect is allowing water to collect in disconnect and flow to station power distribution panel.	Repair as necessary.	Medium
Brooks Hill Tank (standpipe)	Base of tank is not properly grouted to direct condensation away from tank base. As a result, the tank has significant corrosion around perimeter of base. Corrosion is also present at all welded joints.	B&V recommends the tank be taken out of service and thoroughly inspected. The accumulation of condensation at the tank base should be resolved and the tank painted.	Medium
	The top rail of the chain link fence was damaged and the barbed wire was missing.	Repair perimeter fence as necessary.	Low
Peaceful Valley Booster Pump Station		Install vehicle guardposts to keep maintenance vehicle traffic off top of tank.	Low
Peaceful Valley Tank (standpipe)	The top rail of the chain link fence and barbed wire were damaged.	Repair perimeter fence as necessary.	Low
	The overhead electrical service entrance conductors interfere with trees.	Trim trees as required.	Low
	Bolted steel standpipe tank. Overall tank in great condition. No significant corrosion identified.		Routine
KT #3 Booster Pump Station	Pipe supports are inadequate. Supports are comprised of standpipe type supports typical to residential construction. The supports are inadequate for the size piping.	Suggest replacing all pipe supports with standard industry available supports intended for this service.	Low

Table 4-6
Supply and Treatment Facilities

Facility/System/ Program	Observations	Recommendations
Zorn Pump Station	The potassium permanganate system overflows due to gravity feed line plugging. Dust from dry permanganate is a nuisance.	Provide a new batch solution system with metering pumps to supply the potassium permanganate solution to the application points.
Crescent Hill Water Treatment Plant	Powdered activated carbon is more effective if fed ahead of ferric chloride.	Feed PAC ahead of ferric chloride, preferably at Zorn Pump Station.
	Rapid mixing of coagulant ahead of flocculation is not provided.	To optimize treatment, rapid mix improvements should be included in treatment plant upgrades.
	Nitrification occurs at points within the distribution system.	Perform nitrogen speciation testing after coagulation, pH adjustment, and filtration to determine the nitrogen species. Using this information, chlorine and ammonia feed might be optimized to reduce nitrification.
	Lime slaking process appears to be inefficient due to large of amount of grit in channels.	Provide rapid mixing for more efficient lime application.
	Fluoride is applied at 4 ppm ahead of filtration. Finished water fluoride is 1 ppm. Fluoride is adsorbed onto ferric hydroxide floc within the filters. The plant physical configuration makes post-filtration fluoridation difficult.	Evaluate improvements to reduce fluoride use by moving application to after filtration.
	Several problems were reported for the powdered activated carbon systems: 1) Overflows from the carbon slurry bunkers; 2) Carbon slurry fouls pump check valves; 3) Carbon dust during truck unloading is difficult to contain n the bunker.	Provide system improvements to include: 1) A step-stop meter on the inlet water supply line; 2) Ultrasonic transmitters to measure slurry tank levels; 3) Peristaltic pumps for slurry pumping; 4) Dust collector for unloading.
	Problem reported with ferric chloride systems: 1) Clogging due to insoluble particles delivered in chemical; 2) No method to monitor chemical application or pump failure; 3) Poor mixing.	Operations should be improved by: 1) Specifying higher liquid ferric chloride with limits on quantity and size of insoluble particles; 2) Install small capacity flow meters in pump discharges; 3) Install rapid mixing chambers.
	Polymer storage day tank overflows.	Install a high level probe in the tank. Wire the probe to a valve requiring manual opening and automatic closing when day tank has reached the maximum level.
	Chlorine is fed to remote vacuum eductors at the coagulation basins. During the winder months a vacuum pressure loss is experienced to remote eductors. This is likely due to water freezing in the eductors due to lower pressure.	Heat tracing should be provided around the eductors to warm them and prevent freezing.

Table 4-6 (Continued)
Supply and Treatment Facilities

Facility/System/ Program	Observations	Recommendations
Crescent Hill Water Treatment Plant (cont.)	No leak detection is provided in the ammonia feed room. Direct-gas pressurized ammonia has the potential to leak.	Ammonia feed equipment should be housed in a dedicated room with separate ventilation. Or ammonia gas detection equipment should be provided to warn of a leak. An ultrasonic level indicator could be provided on the ammonia storage to for monitoring purposes.
	Lime is poorly mixed and scales on channel and basin walls. Lime particles are carried over to filtration. Rapid mixing of lime is not provided.	Mechanical mixers should be provided to adequately mix the lime ahead of the softening basins. Ultrasonic level devices should be installed to replace Bindicator devices.
	Ventilation in the fluoride building is inadequate. Bindicator devices are used for fluoride level indication.	A make-up air unit should be installed to provide adequate heat and ventilation during winter months. Bindicators should be replaced with ultrasonic devices.
B.E. Payne Water Treatment Plant	The coagulation process is reported to have the following problems: 1) Mixing of ferric chloride in the raw water is inadequate; 2) Flocculation equipment does not provide decreased velocity gradient; 3) Ferric chloride quality varies; 4) Pin floc is present in the coagulation basins; 5) Floc carryover to filtration.	Improvements should be provided: 1) Rapid mixing of ferric chloride ahead of flocculation; 2) Perform a hydrometer test on each ferric delivery to confirm batch concentration and facilitate adjustments to feed rates; 3) Perform jar testing to determine the optimum feed rate with varying turbidity.
	Algae growth was determined to be present in several basins.	Depending on DBP by-product formation potential, chlorine could be applied further upstream to control algae growth in basins.
	Potassium permanganate system problems were reported similar to Zorn PS.	Install a new potassium permanganate system similar to that recommended for Zorn PS.
	The powder activated carbon system experiences problems similar to those at Crescent Hill.	Provide system improvements similar to those recommended for Crescent Hill.
	The ferric chloride systems have the following problems: 1) Tank level transmitters do not operate properly; 2) Concrete liner in bulk storage area is corroded and cracked; 3) New system experiences siphoning from tanks to application points; 4) New and old tanks do not have common overflows.	Improvements should be provided to include: 1) Install back-pressure valves on metering pumps to prevent siphoning; 2) Provide a common overflow on the new tanks with a piping loop one foot above to permit overflows between tanks before discharging to an area sump.
	Polymer storage tank levels are monitored manually.	Ultrasonic level transmitters should be installed for automatic level monitoring.

Table 4-6 (Continued)
Supply and Treatment Facilities

Facility/System/ Program	Observations	Recommendations
B.E. Payne Water Treatment Plant (cont.)	Lime slakers and slurry troughs become clogged with lime scaling and slurry overflows onto the building floor into the parking lot and a storm drain pipe.	Lime scaling is a common problem with lime systems. Diligent maintenance is required to prevent clogging. The drain line should be routed re-routed to avoid uncontrolled discharges. It should be routed to the wash water lagoons.
	The chlorine feed system has one eductor and one feed point ahead of coagulation. There is no back-up and the plant would have to be shut down in case the eductor failed.	Plant staff has initiated plans to install a back-up eductor and feed point. This work should be completed. A channel-type diffuser should be provided at the alternate feed point located near the filter gallery.
	There is leak risk in the ammonia feed area similar to that for Crescent Hill.	Provide isolation and ventilation or leak detection improvements similar to as recommended for Crescent Hill. Similarly, ultrasonic level transmitters can be provided for ammonia storage.
	Sodium hydroxide storage tanks have level transmitter, siphoning, and overflow deficiencies similar to the ferric chloride system.	Provide improvements similar to as recommended for the ferric chloride systems.
	Problems with the fluoride systems were reported as follows: 1) Siphoning of liquid from the tanks through the pumps; 2) Improperly operating level transmitters; 3) Heating tracing and insulation electrical circuits do not function; 4) No common tank overflow.	Improvements should be provided similar to those recommended to the ferric chloride systems.

Table 4-7
High Service Pump Stations

Facility/System/ Program	Observations	Recommendations
Crescent Hill Pump Station	Plant staff reported the following problems: 1) The valves in the discharge piping are in poor condition, and several valves have failed in the past. Replacement valves have been purchased by the LWC, but a lack of manpower has prohibited them from being installed. 2) The discharge headers are not equipped with an adequate number of electrically-actuated valves, so flow rate must be controlled by adjusting pump operating speed.	The LWC should assign a high priority to installing the replacement valves for the Crescent Hill pumping station discharge header. These valves are necessary to perform pump maintenance and also to isolate portion of the header as required.
B. E. Payne High Service Pump Station	Plant staff indicated the following general problems: 1) The pumping station is equipped with only one transmission main and is the primary source of supply for the 860, 900, and 940 pressure zones. 2) If all high service pumps are started simultaneously, severe water hammer conditions are usually created in the discharge piping. 3) There has been a major failure in the discharge line at least once every two years. 4) Peak demands within the portion of the LWC distribution system served by the B. E. Payne WTP are approaching the firm capacity of the pumping station.	The LWC should continue with the B. E. Payne Reliability and Expansion Project to upgrade the facility. The project includes provisions to address the capacity limitations of the high service pumping station and the reliability and redundancy issues of the discharge force main.

Table 4-8
Booster Pump Stations

Facility/System/ Program	Observations	Recommendations
Booster Pumping Stations in General	LWC staff indicated the following general problems: 1) Critical booster pumping stations have only a single discharge line and/or supply a single transmission line to a pressure plane. 2) Several older booster pumping stations require repair or replacement. 3) There are a number of booster pumping stations that supply only a single pressure zone. These stations include Oak Hill, Kenwood Hill, Pleasure Ridge Park, Parkridge, Finley Hill, Zoneton, Jefferson Forest, KT No.1, Cedar Grove, Peaceful Valley, and KT No.3.	It is acknowledged that it is not cost effective to install piping to connect several of the pumping stations and corresponding storage tanks that supply a single pressure zone. However, the LWC should consider installing mains to allow these booster pumping stations and tanks to receive or supply water to another pressure zone in the distribution system. This should be a goal of the LWC where feasible, especially when the service area is expanded.
Frey's Hill Booster Pumping Station	LWC staff indicated the following problems: 1) The pumping station operates above its design capacity on a daily basis. 2) The pump station is equipped with two discharge lines, but these lines discharge into a single force main to provide the water for the entire 940 pressure zone. 3) The shutoff valves in the discharge lines do not have isolation valves, so the pumping station must be taken off-line when work is performed on a shutoff valve. 4) One of the LWC's major industrial customers, Ford Motor Company, is located in the 940 pressure zone and is greatly affected by disruptions in its water service.	In addition to the Reamers Road elevated tank, it is recommended that the LWC provide another transmission main to the 940 pressure zone for redundancy purposes. The Frey's Hill booster pumping station could be expanded and another discharge line equipped with an adequate number of valves could be installed.
Westport Transfer Booster Pumping Station	The Westport Transfer booster pumping station is currently under construction. This station will provide increased capacity to lift water from the 660 pressure zone, which is supplied by the Crescent Hill WTP, to the elevated service area, which is primarily served by the B. E. Payne WTP. The Westport Transfer station will not be placed into service until the location of the proposed ramp from Westport Road to Interstate Highway 264 is finalized. This ramp will be located in the vicinity of the pumping station.	It is recommended that the appropriate agencies be consulted to determine a tentative date for finalization of the highway ramp location. If it is determined that ramp location will not be finalized in the foreseeable future, then an alternative method for lifting water from the 660 pressure zone to the elevated service area should be discussed. This is due to the possible capacity limitations of the B. E. Payne WTP in the future.

Table 4-8 (Continued)
Booster Pump Stations

Facility/System/ Program	Observations	Recommendations
Westport Booster Pumping Station	The Westport booster pumping station currently lifts water from the 660 pressure zone to the elevated service area. However, this station will be replaced by the Westport Transfer booster pumping station at some time in the future. The Westport station is a relatively old facility, and aging of the electrical panels is apparent. All of the pumps appear to be in good condition.	If the Westport booster pumping station remains in operation for a significant length of time, routine maintenance such as painting and cleaning should be performed. The Westport station appears to be in such a condition that, if properly maintained, would provide reliable service for at least the next several years.
Brooks Hill Booster Pumping Station	1) This pumping station is a relatively old facility. 2) Valves within the pumping station are corroded and are not painted to prevent corrosion. 3) The electrical panel shows wear. 4) LWC staff reported that one of the pumps in the station was not aligned properly, causing the bearing to wear prematurely. The bearings on this particular pump require replacement on a monthly basis.	This booster pumping station requires rehabilitation or replacement of pumping and electrical equipment.
Hydropneumatic Booster Pumping Stations in General	The hydropneumatic systems have a tendency to nitrify if not operated frequently in the summer months.	It is recommended that, whenever possible, a closed piping loop with transmission mains be provided.
Prospect Pressure Reducing Valve	1) Due to grading changes after installation, this PRV vault floods regularly after rainfall events. 2) The discharge line from this PRV station to the 770 pressure zone is the sole source of supply across Harrod's Creek to the Ford Motor Company plant in northeast Jefferson County.	Relocate the PRV to an area with lower surrounding elevation or install a sump pump to remove stormwater from the vault.
Cardinal Hill Reservoir and Pleasure Ridge Park Booster Pumping Station	1) There is only a single transmission main leading from the reservoir. This line has experienced leaks in the past and as a result was rehabilitated in the summer of 2001. 2) The security fence surrounding the reservoir site needs to be repaired in several locations. Vandalism is apparent on the pumping station structure and yard facilities. 3) Access hatches to the reservoir interior are quite corroded. 4) Entry ladders below-grade to the reservoir interior are corroded and not securely fastened. 5) The interior surfaces of the booster pumping station require cleaning and painting.	

Table 4-9
Storage Facilities

Facility/System/ Program	Observations	Recommendations
Elevated Tanks and Standpipes in General	In general, tanks and standpipes appeared to be in good condition externally. LWC staff indicated the following general problems: 1) There is inadequate storage available within the distribution system in case of pumping station failure. 2) Many storage facilities supply only a small number of customers. 3) Due to the storage as well as pumping configuration within the distribution system, the LWC cannot develop pumping strategies to take advantage of lower electric utility rates during off-peak times of day. 4) Due to the volume of select tanks in relation to the demands within the areas they serve, these tanks experience long detention times. As a result, water in these tanks nitrifies in the summer months. 5) The bottom elevation of several tanks in relation to the ground elevation within the areas they serve prevents use of the lower portions of the tanks. After these tanks were installed, customers moved to locations within the tank service areas that are at higher elevations than existing customers. The tank design elevations were based on the elevations of customers served at that time.	1) Inspection reports of individual facilities should be reviewed to determine the internal condition of tanks and standpipes. 2) The City of Louisville department responsible for issuing building permits for new construction should be aware of the elevations that can be serviced by a certain tank in a given area. This would prevent customers from moving to locations within the tank service areas that are at higher elevations than existing customers.
Mitchell Hill Standpipe	The contents of this standpipe are subject to nitrification.	It is recommended that the LWC investigate transmission main looping to decrease the detention time. This would reduce the number of nitrification events.
Phelps Knob Standpipe	The contents of this standpipe are subject to nitrification at times.	It is recommended that the LWC investigate transmission main looping to decrease the detention time. This would reduce the number of nitrification events.
Oak Hill Standpipe	The contents of the standpipe are subject to nitrification at times.	It is recommended that the LWC investigate transmission main looping to decrease the detention time. This would reduce the number of nitrification events.
Parkridge Elevated Tank	During summer months, water merely flows through the tank before reaching the Windsor Forest elevated tank. Water is not typically stored in the Parkridge tank during warm weather months due to nitrification concerns.	Refer to Chapter 6, Volume 2 – Delivery and Storage Alternatives for information regarding recommendations for the Parkridge elevated tank.

Table 4-9 (continued)
Storage Facilities

Facility/System/ Program	Observations	Recommendations
Windsor Forest Elevated Tank	Like the Parkridge tank, the Windsor Forest elevated tank services customers within the 660 pressure zone in the vicinity of the Cardinal Hill reservoir. However, the Windsor Forest tank is the only tank that services this area because of nitrification concerns with the Parkridge tank.	Refer to Chapter 6, Volume 2 – Delivery and Storage Alternatives for information regarding recommendations for the Windsor Forest elevated tank.
Kosmosdale Elevated Tank	The tank contents are subject to nitrification on a regular basis during the summer months. The bottom elevation of this tank in relation to the ground elevation within the area it serves prevents use of the lower portion of the tank.	It is recommended that the LWC install piping to connect the tank to other portions of the distribution system to allow the tank to service areas at lower elevations. The City of Louisville department responsible for issuing building permits for new construction should be aware of the elevations that can be serviced by a certain tank in a given area. This would prevent customers from moving to locations within the tank service areas that are at higher elevations than existing customers.
Zoneton Elevated Tank	This tank is undersized for the area that it serves. When the transmission mains within the service area of the Zoneton tank are flushed or the tank is out of service, the remainder of the distribution system in the 660 pressure zone is affected.	It is recommended that the LWC investigate transmission main looping for the tank. The LWC should also determine if increased storage or pumping capacity is needed for the area served by the Zoneton tank.
Brooks Hill Standpipe	The contents of this standpipe are subject to nitrification. Nitrification occurs because of the relatively long length of the transmission main to the tank. In addition, the area served by the transmission main has relatively low demands	As the area served by the Brooks Hill standpipe develops, the LWC should install looping transmission mains in the area.
Jefferson Memorial Forest Elevated Tank	This tank currently has a relatively long detention time. However, as the area served by the tank develops, the tank contents will probably be used more frequently.	As the area served by the Jefferson Memorial Forest elevated tank develops, the LWC should install looping transmission mains in the area.
Peaceful Valley Standpipe	The contents of this standpipe are subject to nitrification. Nitrification occurs because of the relatively long length of the transmission main to the tank. In addition, the area served by the transmission main has relatively low demands.	As the area served by the standpipe develops, the LWC should install looping transmission mains in the area.

Table 4-9 (continued)
Storage Facilities

Facility/System/ Program	Observations	Recommendations
Prospect Elevated Tank	The contents of the tank do not turnover frequently and are subject to nitrification. The bottom elevation of the tank in relation to the ground elevation within the area it serves prevents use of the lower portion of the tank. After the tank was installed, customers moved to locations within the tank service area that are at higher elevations than existing customers. When the Prospect tank is filled, the surrounding distribution system is affected. To fill the tank, water must be obtained from areas that are prone to nitrification.	Refer to Chapter 6, Volume 2 – Delivery and Storage Alternatives for information regarding recommendations for the Prospect elevated tank.
Evergreen Standpipe	The standpipe is currently not in service. The bottom elevation of the standpipe in relation to the ground elevation within the area it serves prevents its use. After the standpipe was installed, customers moved to locations within the standpipe service area that are at higher elevations than existing customers. The design elevations were based on the elevations of customers served at that time.	It is recommended that the LWC install piping to connect the standpipe to other portions of the distribution system to allow it to service areas at lower elevations. The City of Louisville department responsible for issuing building permits for new construction should be aware of the elevations that can be serviced by a certain standpipe in a given area. This would prevent customers from moving to locations within the service areas that are at higher elevations than existing customers.
English Station Standpipe	1) The standpipe capacity is 10 million gallons; however, only 2-4 million gallons in the tank can be used. The bottom elevation of the standpipe in relation to the ground elevation within the area it serves prevents use of the lower portions of the standpipe. 2) If the level in the tank level decreases below half-full, the surrounding area is issued a boil-order due to decreased system pressure. 3) The contents of this standpipe nitrified during the summer of 2001. As a result, the standpipe was drained twice in 2001. Due to the relatively large volume of the English Station standpipe, draining of the standpipe's contents is not a cost effective method for dealing with nitrification.	It is recommended that the LWC install piping to connect the standpipe to other portions of the distribution system to allow it to service areas at lower elevations. Alternatively, piping could be installed from the standpipe to other booster pumping stations. The LWC may want to consider increasing the capacity of the Frey's Hill booster pumping station to draw more water from the standpipe, decreasing the detention time.

Table 4-10
Operation and Maintenance Programs

Facility/System/ Program	Observations	Recommendations
Distribution and Maintenance Programs in General	1) LWC has given increasing attention to the distribution system within the last five years. 2) A Geographic Information System (GIS) has been developed to maintain records and has improved the system in general. 3) The distribution system is also monitored by the TIPS program, which contains information on hydrants, valves, and service lines. The program allows LWC to query the database to determine required improvements.	The LWC should continue development and use of the GIS and TIPS program to facilitate distribution system maintenance.
Fire Hydrant Replacement Program	1) The fire hydrant replacement program consists of replacing old and "winter" hydrants. 2) 100 old hydrants are scheduled for replacement each year. 3) Old hydrants are generally replaced every 85 years, if not sooner due to faulty operation. 4) Winter hydrants are units affected by local groundwater elevations in the vicinity of the installations. 5) There are provisions in the capital program to replace 110 winter hydrants annually. 6) LWC is also developing a means of communicating to maintenance staff and fire departments that a particular hydrant is plugged.	1) To increase reliability, the LWC should consider a 50-year replacement cycle for old hydrants as opposed to an 85-year replacement schedule. This would require replacement of about 360 hydrants per year, over three times the number of hydrants currently replaced annually. 2) Winter hydrants that are replaced should be relocated in order to prevent groundwater influence. 3) The LWC should continue with efforts to modify the language in the hydrant replacement program guidelines to address plugging of winter hydrants.

Table 4-10 (Continued)
Operation and Maintenance Programs

Facility/System/ Program	Observations	Recommendations
Meter Testing and Replacement Program	1) Large meters are tested in the field, and small meters are tested at the Allmond Avenue Distribution Center. The LWC has established a goal of testing 750 meters per year. 2) The metering group did not meet the annual goal in 2000 due to personnel issues associated with field testing. 3) The meter testing and replacement program has typically provided the replacement of 10,000 water meters per year. 4) The corresponding meter vault is generally replaced when a meter is replaced. 5) A backhoe is required for removal of large vaults, and one is not dedicated to the metering group. All work that must be performed with a backhoe must be coordinated with the activities of another LWC group. 6) The LWC currently has a number of water meters that must be read manually. In 2001, a pilot program was established that consists of installing 4,000 to 5,000 automated meters in lieu of manual meters.	1) Finished water flow meters at the treatment plants should also be tested regularly. This would ensure their accuracy. The increased accuracy would translate into more accurate water loss determinations. 2) Field testing of large meters should be contracted to an outside firm. Field testing staff injuries on the job and a high turnover rate have contributed to the lack of experience within this group. This lack of experience was the primary reason LWC's meter testing goal was not met in 2000. 3) The group responsible for meter vault replacement should be provided with a dedicated backhoe. When the workload of the meter vault replacement group is low, the crew and backhoe could assist with replacement of valve boxes within the distribution system. 4) Upon successful completion and acceptance of the pilot program, automated meters should be installed when a manual meter requires replacement. Also, the minimum number of water meters replaced annually should be equal to the number of manual meters replaced annually prior to implementation of the pilot program.

Table 4-10 (Continued)
Operation and Maintenance Programs

Facility/System/ Program	Observations	Recommendations
Flushing Program	1) Because of the use of chloramine, water quality within the distribution system exhibits seasonal trends. Nitrification has occurred during warm weather months in lines not frequently used or when finished water must travel relatively far from the treatment plants. 2) Water quality is monitored throughout the year at designated sampling locations and also following a main failure. Weekly nitrification sampling usually begins in June of a given year. Samples are also taken monthly during colder weather months. 3) Each sample is analyzed for total coliform, chlorine residual, turbidity, heterotrophic plate count, ammonia, and pH. Nitrate and nitrite concentrations are not measured in a given sample unless a low total chlorine residual concentration is detected. 4) The flushing program is conducted throughout the year, and flushing frequency is generally increased when the water temperature in the lines increases. In summer, lines that experience low flow rates are flushed more often. In addition, select tanks and standpipes are drained during warm weather conditions due to nitrification concerns.	1) The LWC should consider monitoring nitrite and nitrate levels in samples obtained from areas subject to nitrification. This would provide an indication that complete nitrification is occurring and that nitrifying bacteria are present. An increase in nitrate levels together with a decrease in total ammonia levels indicates nitrification within the system and that actions should be taken to address the problem. Monitoring for nitrite and nitrate would provide the LWC with another tool to help identify nitrification events. 2) Typically, the total chlorine residual will decrease as water flows through the distribution system. If the LWC is not already doing so, baseline total chlorine residual concentrations should be established at the various sampling locations. This would provide the LWC with levels to compare to the results of the total chlorine residual sampling analysis. The LWC may find that samples with relatively low total chlorine residuals may not indicate that nitrification is occurring when compared to baseline levels of total chlorine residual.

4.5 Design Standards

4.5.1 Booster Pumping Stations

The LWC distribution system is equipped with a number of packaged, underground booster pumping stations. Several of these pumping stations are hydropneumatic type. Sample technical specifications were reviewed to provide comments on LWC's design standards.

The specifications for the Billtown Road underground pumping station were reviewed. For LWC's consideration, comments and suggestions for additional requirements in the specifications are presented as follows. The comments are intended to provide LWC with a more thorough and explicit specification.

- It is suggested that each magnesium anode for corrosion protection be equipped with two wire leads to provide redundancy in case one wire lead is broken during backfill operations.
- In Paragraph 2.3, the Hydraulic Institute Standards should be referenced as the governing standard.
- Black & Veatch recommends that an operating head range be specified. Establishing a head range protects the buyer from warranty issues if the pump operates beyond the rated head. In almost all pump applications, the pump will probably never or rarely operate at the rated head condition.
- It is recommended that the efficiency be specified at the rated head. For booster pumping applications, the pump capacity is generally governed by the system head; i.e., tank water levels. Hydraulic Institute standards permit a 10 percent positive tolerance on capacity but no minus tolerance, which almost always results in over-sizing of the impeller by a significant amount. If the efficiency is specified at the rated head, the system efficiency will be guaranteed because pump operation is a function of the system head, regardless of the impeller over-sizing. If pump efficiency is specified in relation to rated capacity, the highest efficiency could be achieved under a head condition that the pump will never operate at.
- The shut-off head should be specified to be a maximum or minimum value. It is difficult for several pump manufacturers to all provide a pump with an exact shut-off head value, and there is no need to require this. A minimum shutoff head should be specified if a large operating head range is desired. Alternatively, a maximum shutoff head should be specified if operating pressures in the discharge piping and distribution system are limiting.
- The maximum horsepower allowed should be specified for the entire operating head range. As indicated previously, a pump will rarely operate at the rated capacity. As currently stated, the LWC specification allows a higher power requirement at any other flow than the one indicated.
- For booster pumping applications, the maximum suction pressure should be indicated in addition to the maximum discharge pressure. The booster pumps should be hydrostatically tested at a pressure equal to the maximum suction pressure plus 150 percent of the pump shutoff head. This could affect the pump material selected.
- The impeller diameter specification is somewhat restrictive. Since the operating conditions of the pumps are specified, it should be left to the manufacturer to determine the required impeller diameter. The motor speed and impeller diameter are specified as 1750 rpm and 11.125 inches, respectively. However, it is very likely that the motor supplied will operate at a speed of 1780 rpm or greater, in which case the specified impeller

diameter would be oversized. Also, specifying the diameter to one-thousandths of an inch may be an excessive tolerance limit considering the precision of the impeller casting process. While an impeller can be trimmed to a level as precise as this, pattern shifts and other casting imperfections do not allow the diameter of an impeller to be established to a 0.001-inch standard.

- The materials of the impeller and wearing rings should be specified. In addition, LWC should require each impeller to be dynamically balanced.
- The material of the shaft sleeves should be specified. For this type of application, Black & Veatch typically specifies either Type 304 stainless steel or bronze.
- The cathodic protection requirements should be coordinated with the installation specification. If insulated joints are not provided in the suction and discharge piping, the cathodic protection system of the pumping station must protect the pipeline as well.
- Instead of specifying a particular value, it is suggested that the rated capacity of the trolley and hoist system be specified as a given minimum value or as required to lift the pump and motor. This places the ultimate responsibility of providing an adequately sized trolley and hoist on the supplier.
- Since soft-start motors and surge relief valves are specified, LWC can reduce project costs by using the soft-starters to gradually start and stop each pump. The soft-start motors would simulate the function of the electric check valves specified. In lieu of the electric check valves, dual check valves could be installed. This would eliminate the drainage from the electric check valves and would simplify the pump control system.

The specifications for the Sandy Hill hydropneumatic booster pumping station were also reviewed. Since this type of station is similar to non-hydropneumatic stations, the same comments presented for the Billtown Road booster station apply. In addition, it is suggested that silicon carbide be specified for the pump mechanical seal assemblies instead of tungsten carbide. Silicon carbide can withstand higher temperatures than tungsten carbide.

Lastly, the specifications for the Shady Acres Lane booster pumping station were reviewed. The Shady Acres Lane installation specification appears to be in fairly good order. The only suggestion that Black & Veatch has is that LWC should specify that an insulating joint be provided in the buried suction and discharge piping. This would provide an electrical disconnect between the cathodic protection system of the booster pumping station and the buried piping.

4.5.2 Tank Coatings

The elevated multi-column storage tank specification Section 13200 included in the Martins Hill Elevated Water Storage Tank contract documents (LWC Project No. 01-531) was reviewed and compared to B&V tank coating standards.

Overall, the specifications appear to be thorough, complete and well organized. Proper reference to AWWA D100 and D102 are noted where pertinent. While there are no major items of concern, a few minor comments are presented for consideration.

- Recommending a coating manufacturer can sometimes leave the final coating system open to interpretation among the manufacturer and contractor. Black & Veatch usually specifies one, two or three specific products, instead of only a single manufacturer, and close the recommendations with an "or equal" clause. This provides the contractor and manufacturer with a specific system to base the bid on but also provides flexibility if another system is recommended. An example is presented in Table 4-11.

Table 4-11
Example Painting Material Specifications

Exterior Paint System	Three-coat, high-build epoxy/aliphatic urethane system. Total minimum dry film thickness 8.0 – 15.0 mils.
Primer	Tnemec "Series 135 Chembuild", or equal; 3.0 – 5.0 mils dry film thickness.
Intermediate Coat	Tnemec "Series 27 – Typoxy", or equal; 2.0 – 4.0 mils dry film thickness.
Finish Coat	Tnemec "Series 74 – Endurashield", or equal; 2.0 – 4.0 mils dry film thickness.

- Surface preparation for the interior of new water storage tanks is specified as SSPC-SP10. This is an abrasive blast cleaning which will remove 100 percent of rust, mill scale, paint, and other materials and allows a maximum of five percent of every nine square inches to contain staining or discoloration. This type of surface preparation is also recommended for repainting projects of the interior of existing water storage tanks. This will remove all existing material and provide a surface profile adequate for proper adhesion of coating systems. Most NSF-approved coating systems for use in potable water storage tanks require SSPC-SP10 surface preparation for application.

- Surface preparation for exterior surfaces of an existing water storage tank can be specified as SSPC-SP6. This level of surface preparation requires an abrasive blast cleaning which removes 100 percent of rust, mill scale, paint and other materials, and allows a maximum of 33 percent of every nine square inches to contain staining or discoloration. Specifying an

SSPC-SP6 level of preparation on the exterior of an existing tank to be recoated can provide savings of material and labor costs. A given area blasted to SSPC-SP10 requirements requires more time and blasting materials than one blasted to an SSPC-SP6 level of surface preparation. Few exterior coating systems require a surface preparation in excess of SSPC-SP6.

Incorporating comments in the LWC specification to cover these items will provide contractors with a specific preparation and coating system to base bids on, providing more competitive pricing and reducing project costs without compromising quality.

4.5.3 Pipe and Valve Design and Installation Standards

Piping and valve technical specifications developed and used by LWC were compared against the latest corresponding Black & Veatch specifications. Based on the review, a general recommendation is presented for LWC's consideration. For all piping and valve specifications, LWC should require all shop drawings submitted to clearly indicate the country of origin of all cast gray iron or ductile iron components. It has been Black & Veatch's experience that iron pipe and valve materials manufactured in foreign countries are sometimes of inferior quality. By requiring such information, LWC may be able to identify potentially substandard items before installation or problems develop. Periodically, organizations which establish industry standards (e.g., AWWA, ASME, NBBPVI, etc.) may issue advisories or notices regarding possible improperly manufactured or defective materials, which are sometimes specific to particular locations or origin.

The following sections present suggestions and comments from the review of each specification section.

4.5.3.1 Ductile Iron Pipe

LWC specifies ductile iron pipe (DIP) for both small and large diameter applications within the distribution system. The LWC ductile iron pipe and fittings specification Section 02502 was reviewed and compared to B&V specification Sections 15061 – Ductile Iron Pipe and 02704 – Pipeline Pressure and Leakage Testing.

In general, the LWC ductile iron piping specifications are not as stringent as the Black & Veatch requirements. For LWC's consideration, suggestions for additional requirements in the specifications are presented as follows:

- To ensure proper installation of large diameter transmission main piping, LWC may want to consider requiring site visits by a manufacturer's field service representative.

- An emergency repair manual from the manufacturer should be required. The manual should address procedures for handling emergency calls and repairs; a list of stock replacement pipe sections, closures, and other parts needed for emergency repairs; names and emergency telephone numbers of the pipe manufacturer's engineering staff and factory-trained service representatives who can be contacted during an emergency; response and delivery times; and installation instructions for the materials and methods used in making repairs. Manuals should be obtained for each major project or pipe shipment, and at least annually from each manufacturer supplying pipe to LWC to ensure having the most current contact information.

- The following should be required to be submitted: certification by manufacturer that each item complied with AWWA standards, gasket certification, and laying schedule.

- Require that gaskets be suitable for potable water service and certified as suitable for chlorinated and chloraminated potable water.

- To protect the integrity of the pipe, specify that restrained joints utilizing set screws or pipe clamps shall not be used.

- Specify that flange gaskets shall be full-face type to provide maximum coverage.

- If flexible grooving is permitted, provisions should be made to accommodate approximately ¼ inch of longitudinal movement. If shouldered pipe is used with flexible grooved couplings, LWC should be aware that this arrangement allows both longitudinal and angular movement. (Note, in general B&V discourages the use of shouldered pipe and grooved coupling type joints.)

- As stated in the Cast Iron Pipe Manual 3-26, the use of hydraulic squeeze type cutters should not be permitted.

- Specify that lubricant for push-on joints shall be stored in closed containers and kept clean to prevent contamination.

- LWC specifies that two layers of polyethylene encasement are required for all buried ductile iron pipe and joints. Black & Veatch typically only specifies double polyethylene wrapping for cathodic protection at crossings with steel gas mains or where piping is installed in corrosive soils. [Note: Mr. Alan Cox of the Ductile Iron Pipe Research Association (DIPRA) was contacted regarding the corrosivity of soils within Louisville and the surrounding area. Mr. Cox indicated that, based on his experience, soils

within Louisville and Jefferson County were not corrosive, except for select areas in the vicinity of Fern Valley Road in Louisville.] For all other applications, Black & Veatch generally requires only a single layer of polyethylene encasement, as suggested by AWWA C105. However, the cost of polyethylene is relatively minor, so double wrapping does not add much material cost to a project versus single wrapping. Also, double wrapping provides additional protection from damage that may occur during installation. However, it is important that designers take into account the effect of double-wrapping pipe on the resulting friction calculations for restrained joints and thrust.

- To provide piping flexibility, a pipe joint should be installed within 12 inches of each end of concrete encasement, if installed. This also reduces the risk of shearing the pipe at the face of the concrete encasement if there is any settlement after installation.
- Regarding pipeline pressure and leakage testing, requirements related to disposal of water used in testing should be provided.
- The following requirements for pipeline pressure and leakage testing are suggested:
  - Pipeline shall be flushed and cleaned prior to testing.
  - Temporary bulkheads shall be provided as required to protect valves, hydrants, existing lines, and new lines already put into service.
  - Testing shall be conducted prior to connections to existing lines or new lines already put into service.
- Repair of pipeline leaks detected during the correction period should be addressed. Failure to notify affected parties (contractors and/or suppliers) promptly may provide potential means for them to avoid responsibility.

LWC could perform metallurgical testing on DIP materials to ensure that the products being supplied conformed to the manufacturer's submittals. However, if materials are being provided by a reputable manufacturer, it would be considered a very unusual circumstance when such items were not in compliance. It is B&V's opinion that the cost of performing metallurgical tests does not justify the extremely few occurrences when improper products would be furnished.

4.5.3.2 Prestressed Concrete Cylinder Pipe

LWC specifies prestressed concrete cylinder pipe (PCCP) for large diameter applications within the distribution system. The LWC prestressed concrete cylinder pipe and fittings specification Sections 02503 and 15115 was reviewed and compared to B&V specification Section 02612 – Prestressed Concrete Cylinder Pipe.

In general, the LWC prestressed concrete cylinder piping specifications are in fairly good order. However, LWC Section 15115 did not appear to specify as many details as LWC Section 02503. LWC should compare the requirements of each prestressed concrete cylinder pipe specification to ensure that items are coordinated. For the Company's consideration, suggestions for additions to the specifications are presented as follows. The comments may apply to one or both of LWC concrete piping specifications reviewed.

- To ensure proper installation, the LWC may want to consider requiring site visits by a manufacturer's field service representative.
- An emergency repair manual and compression tests results from the manufacturer should be required.
- For quality control, the following items should be submitted in the shop drawings:
  - Identification of admixtures.
  - Welding details.
  - ACPPA Compliance Audit and Certification Program Certification.
  - Proof-of-design documentation for joints. (Note: This is a requirement in the AWWA standard for ductile iron. Black & Veatch believes that joints for prestressed concrete cylinder pipe should also be tested.)
  - Concrete mix design details if the compressive strength is between 6,500 and 7,000 psi.
- The 28-day rodded test cylinder concrete compressive strength used for the design of the pipe should not exceed 7,000 psi. To obtain concrete strengths above 6,500 psi, admixtures must be used. It is very difficult to properly mix concrete with strength over 7,000 psi and maintain consistent quality.
- The compressive stress in the core of the pipe should not be less than 600 psi.
- Materials for prestressing wire, joint lubricant, joint grout, joint diapers, steel plates used in the fabrication fittings and specials, and steel sheets for pipe cylinders should be specified.
- Cold rolled steel sheets for pipe cylinders should not be permitted. When welding cold rolled steel, the heat produced can cause cold rolled steel to decrease in strength up to 60 percent. The requirements of AWWA C301 reference ASTM 611, which specifies cold rolled steel sheets. However, it should be noted that only medium-high grades of C and D are allowed. Cold rolled steel sheets are allowed by the national standards, but

consistent quality is difficult to maintain and enforce and is not economically justified.

- Joint ring and flange gaskets should be synthetic rubber and certified as suitable for chlorinated potable water. Natural rubber should not be acceptable because bacteria can attack natural rubber.
- The use of metal lifting lugs on fittings for ease of handling should not be permitted. When the lugs are removed by the Contractor prior to installation, the exposed steel is not always properly protected against corrosion.
- Black & Veatch recommends that welding of restrained joint rings not be permitted. The primary reason for this is that welding of joints creates a beam loading on the prestressed concrete cylinder pipe. This type of pipe is not usually designed for beam loads. Also, heat produced by the welding operation can melt the gaskets. Therefore, if welding is allowed, a full watertight weld should be specified. Black & Veatch does allow welding as an alternative for repairing a joint in the field, as there are some circumstances when no other method is practical. The pipe manufacturer should be consulted before attempting any welding of joints.
- Repairs to PCCP may be accomplished by use of a saddle if the damaged area is not too large. It is recommended that the pipe manufacturer be contacted prior to attempting repairs. In general, care should be taken to ensure adequate support is maintained under the pipe following any repairs to avoid creating a beam loading condition on the pipe.
- Details of protective coatings should be specified.
- To ensure proper installation and for ease of identification, pipe markings should be required and specified.
- Laying direction of bell ends should be provided.
- LWC may want to provide additional installation requirements and details for alignment, jointing, connections with existing lines, concrete encasement and blocking, and pipeline pressure and leakage testing.

4.5.3.3 Polyvinyl Chloride (PVC) Pipe

LWC specifies polyvinyl chloride (PVC) piping for small diameter (16 inches or less) applications within the distribution system. The LWC technical specifications were reviewed against B&V specification Section 02630 – Polyvinyl Chloride (PVC) Pressure Pipe. The PVC piping installation requirements of the LWC Technical Specifications for Facilities and Pipeline Construction (1997) were also compared to this B&V standard specification.

In general, the LWC PVC piping specifications are in very good order. Suggestions for minor improvements to the specifications include the following:

- To ensure installation in a sound and undamaged condition, specify that pipe and fittings be handled in accordance with Chapter 6 of AWWA Manual M23.
- Specify the direction of laying for piping with bell ends.
- State that cutting of pipe shall comply with the pipe manufacturer's recommendations and with Chapter 7 of AWWA Manual M23.
- Require that joint lubricant be suitable for use in potable water and be stored in closed containers to decrease contamination during construction.
- Specify that tapping saddles or tapping sleeves shall be used for all service connections 2 inches and smaller. Do not allow direct tapping of PVC piping to prevent damage to the pipe wall.

4.5.3.4 Butterfly Valves

LWC butterfly valve specification Section 15155 was reviewed and compared to B&V specification Section 15101 – AWWA Butterfly Valves.

In general, the LWC butterfly valve specification is in good order. Recommendations to improve the specification include the following:

- Specify that all mechanical joints conform to ANSI/AWWA C111/A21.11.
- Include delivery and storage requirements.
- For quality control, specify that valves be furnished with all necessary parts and accessories required for a complete, properly operating installation and that valves shall be the latest standard products of a manufacturer regularly engaged in the production of valves.
- Require that the country of origin of all cast gray iron and ductile iron valve components be indicated on submittal information. Also require that certified copies of all test results as required by Section 5 of ANSI/AWWA C504, with an affidavit of compliance as indicated in Section 6.3 of C504, be submitted before the valves are shipped.
- State that the use of a stop of lug cast integrally with or secured to the body for the purpose of limiting disc travel by means of direct contact or interference with the valve disc (in either the open or closed position) will not be acceptable. The travel range of the disc should be limited by the

actuator. When disc travel is limited by the valve body, operators will often exceed the actuator torque limits and damage the actuator.

- The use of shafts having a hexagonal cross section is not recommended. Although hexagonal shafts would provide an equivalent shaft diameter, the shape provides a reduced cross-sectional area to resist torque forces compared to a circular cross-section.
- Specify that the connection between the shaft and the disc shall be mechanically secured by means of solid, stainless steel monel taper pins or dowel pin. Do not allow the use of set screws, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices instead of the pins specified. Monel taper and dowel pins are solid and corrosion resistant. Other types of pins are either not solid or not corrosion resistant. In addition, these types of pins are often difficult to remove when maintenance is required.
- State that valve seat configurations that rely on the mating pipe flange to hold the seat in position in the valve body will not be acceptable. Valve seats that are connected to the body provide increased durability. Experience on many Black & Veatch projects and feedback from client staff performing maintenance reported superior performance of the seat-in-the-body configuration.
- Require that shaft seals be of the chevron type.
- Specify pressure and leakage testing requirements.

4.5.3.5 Gate Valves

LWC gate valve specification Section 15156 was reviewed and compared to B&V specification Section 15104 – Resilient-Seated Gate Valves.

Overall, the LWC gate valve specification is in fairly good order. Suggestions to further enhance the specification include the following:

- Include delivery and storage requirements.
- Require that the name of the county of origin shall be cast on the exterior body of the valve and that the name of the country where the gate was manufactured shall be molded into the resilient seat material.
- Specify that that certified copies of all test results, with an affidavit of compliance as indicated in Section 1.5 of AWWA C509, be submitted before the valves are shipped.
- Specify that all bronze valve components in contact with liquid shall contain less than 15 percent zinc to inhibit dezincification. Also require

that all aluminum bronze components in contact with liquid shall be heat treated in accordance with Section 2.2 of AWWA C504 to inhibit dealuminization.

- Require gaskets to be free of asbestos and corrosive components.
- To ensure proper installation, specify that valves be handled and installed in accordance with the recommendations set forth in the Appendix to AWWA C509 and with the recommendations of the manufacturer.

4.5.3.6 Fire Hydrants

The fire hydrant equipment specification included in LWC Bid Number 96-57: Fire Hydrants and Fire Hydrant Extension Kits was reviewed and compared to B&V specification Section 15100 – Miscellaneous Valves. The fire hydrant installation requirements of Paragraph 9 of the LWC Technical Specifications for Facilities and Pipeline Construction (1997) were reviewed with Section 15010 – Valve Installation of the B&V standard.

In general, the LWC fire hydrant specifications are in very good order. Suggestions for minor improvements to the specifications include the following:

- Require identifying number plates on each fire hydrant for ease of identification after installation..
- Specify shop coatings for interior and exterior surfaces and accessories for corrosion protection.
- Require O-ring stem seals to prevent leakage.
- Specify that the operating nut and outlet nozzle cap shall be the Louisville Standard with respect to shape and size.
- To ensure proper hydrant operation, require that fire hydrant be thoroughly cleaned and opened and closed to determine if all parts are in working order, with valves seating correctly and drain valve operating freely.

4.6 Management Tools

4.6.1 Hydraulic Models

This section provides an assessment of the distribution network computer models currently available for the LWC system for use in capital improvements planning.

4.6.1.1 Available LWC Models

The *CH2M Hill 1995 Facilities Plan* (1995 Plan) was developed without the benefit of a current model. As a recommendation of the 1995 Plan, the *1996 Distribution System Hydraulic Master Plan* (1996 Plan) was prepared. The 1996 Plan provided a complete update to the LWC's earlier model datasets by re-digitizing the skeletonized network, reassigning average day water demands, and conducting a pressure observation test for model calibration. The skeletonized network includes pipes 10 inches and larger, plus some smaller pipes. LWC personnel reported that the current model status is:

- 660 Pressure Plane, modeled in KYPIPE program dating from the 1996 study.
- 770 Pressure Plane, not modeled.
- 860 Pressure Plane, modeled in KYPIPE program dating from the 1996 study.
- 940 Pressure Plane, not modeled.
- Revised 900 Pressure Plane, modeled in Pipe2000 program, which is the current version of KYPIPE.
- New Billtown Road Pressure Plane, modeled in Pipe 2000 program.

According to LWC records, the hydraulic model calibration was performed to reproduce field conditions recorded on December 26, 1994. The field program consisted of simultaneous pressure measurements at about 30 locations throughout the distribution network. LWC indicated that the calibration was difficult in some areas because of closed system valves. The adequacy of the calibration program is limited for the current system because of:

- Minimal water demands were observed during the test period. In order to observe the greatest possible head losses across the system, most field testing programs concentrate on high demand periods.
- A tabulation of modeled vs. observed pressures at the test points showed that the accuracy achieved was limited, with several locations having up to a 5 psi difference between test and modeled values.
- The calibration work is no longer current.

The Technical Memorandum on Billtown and Long Run Hydraulic Updates, dated April 18, 2000, documents recent computer model updates. A new model in the PIPE2000 program was constructed for the Billtown area, as a proposed 900 pressure plane. The future water

requirements in that model were assigned at 200 spd for residential areas, a 2.0 ratio of maximum day to average day demand, plus an allowance for golf course irrigation.

The options given in the Billtown memorandum for eventual conversion of the remaining pressure zone models were to either (1) convert the KYPIPE data files and digitize the node maps; or (2) construct the models from the planned Geographical Information System (GIS) when that system is completed.

The Technical Memorandum noted that the model was not calibrated, and future calibration work should be performed.

4.6.1.2 Hydraulic Model Recommendations

It is recommended that:

- LWC establish a current, calibrated hydraulic model adequate for capital improvements planning. The model should be available before design and construction of any of the major capital improvements recommended in Volume II of this report. Principal activities required to establish the model would include:
- Select modeling software.
- Determine whether a model for each service level is desired, or whether a system-wide model should be constructed. System-wide models can be more difficult to use for localized questions (such as main extensions) but are most valuable for major improvements that affect larger areas. Some of the available modeling programs include facility management tools that allow a single model dataset to include both system-wide and pressure plane models, and scenario management tools to allow a variety of demand conditions and design years to be simulated.
- Establish model network for principal mains (at least 12 inch-diameter and larger).
- Establish pumping and storage facility information.
- Establish current and future water demand by sub-areas and allocate demands to the model nodes.
- Conduct existing system model calibration based on peak day operating data from the Supervisory Control and Data Acquisition System SCADA system, plus any desired additional field measurements.

- Conduct future system base analyses to determine proper operation with proposed capital improvements under year 2005 and 2020 demands, with and without regionalization demands.
- Provide model documentation, training, and delivery.
- At a future date when the GIS system development and quality control is complete, the GIS would be the most accurate data source for the model network.
- LWC dedicate one staff position responsible hydraulic modeling. The actual modeling tasks could be either done as a consultant activity or by LWC staff, depending on LWC preferences, staffing availability, and skills.

4.6.2 Demand Management

LWC's present demand management capabilities include:

- Coordination with Ford Motor Company on the timing of filling its day-tank. This customer is a significant demand on the 940 pressure plane.
- System performance monitoring via the SCADA at both treatment facilities.
- Operational management of storage and pumping facilities.
- System flexibility to respond to emergencies due to having abundant supply, two separate treatment and pumping facilities, redundant power sources, a well-gridded distribution system, and adequate emergency water storage within the distribution system.
- Readiness to implement the Water Shortage Response Plan in the event of an emergency.

The Water Shortage Response Plan is a key component of the Emergency Preparedness and Disaster Services Response Plan. The plan follows AWWA and Kentucky Division of Water Guidelines. The plan considers the design flexibility present in the LWC supply, treatment, pumping and distribution systems, and considers that a water shortage may occur with little warning and/or quickly increase in severity.

Given the Company's attributes and characteristics and the nature of emergencies that can cause a water shortage in the metro area, the response plan is designed with three phases. Each successive phase increases the response effort significantly. While the plan may be initiated and progress from phase to phase, the plan may also be initiated by going directly to any one of the three phases.

This plan also distinguishes between essential drinking water use and non-essential drinking water use. As the severity of the situation increases, the phases progress from restricting non-essential use to ultimately rationing drinking water.

The phases of the plan are as follows:

Alert Phase

- If evaluation indicates the need, LWC and agencies jointly issue water shortage alert requesting voluntary conservation

Emergency Phase

- If evaluation indicates the need, LWC and agencies jointly issue water shortage emergency declaration.

Water Rationing Phase

- If evaluation indicates the need, LWC and agencies jointly issue declaration for rationing drinking water, institute monitoring and penalties to prevent unsanctioned use, and issue Boil Water Advisory or Notice.

The plan defines an Evaluation Team to be responsible for managing an emergency and implementing the appropriate phases of the plan. The plan outlines the factors to regarding the need for each phase, the agencies to coordinate with and communicate to, and types of actions that may be taken. The plan appears to provide an adequate basis for LWC's emergency response to a water outage event.

4.6.3 Pipeline Replacement and Rehabilitation Program

The LWC has approximately 3,330 miles of transmission, distribution and service pipes ranging in diameter from 1 inch to 60 inches. The pipe materials include lined and unlined cast iron (both pit cast and centrifugally cast, also referred to as Delavaud pipe), lined ductile iron (wrapped and unwrapped), asbestos cement, reinforced concrete, prestressed concrete cylinder, PVC, and HDPE. Service connection materials are lead, copper, or galvanized steel.

4.6.3.1 Overview of LWC Distribution/Transmission System and its Performance

Table 4-12 shows the miles of main by diameter and pipe material. The 6 and 8-inch water mains constitute about 70 percent of the system. Approximately 320 miles of water mains (about 10 percent of the total) are transmission mains ranging from 14 inches to 60 inches in diameter.

Table 4-12
LWC Miles of Main by Diameter and Material

Pipe Material	Diameter (inches)														Total
	<4	4	6	8	10	12	14	16	20	24	30	36	48	60	
Lined Delavaud Cast Iron	0	11	777	308	5	137	2	11	3	5					1,258
Wrapped & Lined Ductile Iron	1	7	87	168		193		81	4	1	4		2	2	551
PVC	1	77	112	211		91		1							492
Lined Ductile Iron		1	136	133		94		21							385
Pit /Sand Cast Iron		10	197	27	1	21		12	19	3	9	8	13		322
Prestressed Concrete Cyl.										25	24	6	10	27	92
Asbestos Cement		6	52	13	3	12	2								87
Unlined Delavaud Cast Iron			24	12		7		1	1	3					48
Other	13	2	48	6	0	4	1	1		11	0	1	4	6	97
Total	**15**	**114**	**1,433**	**878**	**9**	**559**	**5**	**128**	**27**	**48**	**37**	**15**	**29**	**35**	**3,332**

The oldest water mains in LWC were installed in the 1850s. The material used was unlined pit cast iron. The pipes installed in the in the 1862-1865 period have exhibited high frequency of failure and have been targeted for replacement. About 80 percent of the unlined cast iron pips installed from 1866 to 1925 have proven to be reliable and have been targeted for rehabilitation by cleaning and lining. The other 20 percent are targeted for replacement by 2005.

About 48 miles of unlined Delavaud cast iron pipe were installed in the period of 1926 to 1933. This pipe was manufactured by centrifugal casting of the molten iron against a mold. This class of pipe has not performed well due to internal corrosion, and has been targeted for replacement over the past 15 years.

The most common material in the LWC water system is cement lined Delavaud cast iron pipe (DCI). There are approximately 1260 miles (38 percent of the total) of DCI pipe in the LWC system. This type of pipe was installed from 1933 to 1970. As such, 1933 was the first time that LWC used cement lined cast iron pipe. The performance of this class of pipe has been generally satisfactory.

LWC started using ductile iron pipe in the early 1970s. Initially, ductile iron was not polywrapped. There are about 385 miles of cement lined ductile pipes which do not have polywrapping for external corrosion protection. They were installed from 1965 to 1981. There is a concern about the long-term performance of this class of pipe due to external corrosion.

There are also about 551 miles of cement lined ductile iron pipe that is polywrapped. This class of pipe has been used since 1977. The performance of this class of pipe has been generally satisfactory.

LWC used PVC pipe for the first time in 1977. Since 1986, LWC has installed about 490 miles of PVC up to 12 inches in diameter. About one mile of 16 inch PVC has also been installed. The performance of PVC has been generally satisfactory, although problems have occurred when tapping the pipe.

LWC has also approximately 87 miles of asbestos cement pipe ranging in size from 4 inches to 14 inches. This class of pipe was installed over a 20-year period, from 1945 to 1965. The performance of asbestos cement pipe has been generally satisfactory.

LWC has also approximately 92 miles of prestressed concrete cylinder pipe (PCCP), ranging in size from 24 inches to 60 inches. This class of pipe has been installed since 1954. It constitutes a significant portion of the transmission mains in the LWC system. The performance of this class of pipe has been generally satisfactory, although several joint failures have been experienced. Some of these joint leaks were attributed to the failure of the filet weld between the spigot extension piece and the pipe's steel cylinder, which in turn occurred by the settlement of the adjacent pipe lengths and the inability of the welded joint to rotate and relieve the stresses.

LWC has also about 11 miles of pre-tensioned reinforced concrete pipe (RCP) with lead wool gaskets which leak frequently. There were three such leaks in 2001. These leaks are repaired by exposing the steel cylinder and welding from the outside. If internal access is viable, such joints are repaired by Weko seal. In such cases, the Weko seal is used on a few joints both upstream and downstream of the failed joint. This will minimize the potential for these joints to fail.

LWC has recently started to use HDPE pipe as well. There is approximately 8 miles of HDPE installed to date. It is expected that the use of HDPE will increase with time. An advantage of HDPE is that taps can be made easily utilizing fusion bonding technology.

4.6.3.2 Main Replacement & Rehabilitation Program

The Company has an ongoing Main Replacement and Rehabilitation Program (MRRP) since 1985. The focus of the program is on reducing the number of water main breaks; increasing

the hydraulic capacity of the system; improving the quality of water delivered to the customer; and increasing the longevity of the water distribution/transmission system asset.

The material of choice for pipe replacement has been polywrapped ductile iron pipe or PVC pipe. The rehabilitation method of choice has been cleaning and cement mortar lining of unlined cast iron pipes, although several other trenchless rehabilitation methods have also been tried on a limited basis. Trenchless methods used include pipe bursting and sliplining in the Central Business District, and installation of water mains through auger bored steel casings under railroads. Horizontal directional drilling has also been used for river crossings. Joint rehabilitation is performed either externally or internally. Internal joint rehabilitation often consists of installing a Weko seal.

The program has specifically targeted the following classes of pipe:

- Replacement of high maintenance water mains; typically unlined cast iron water mains installed from 1862-1865, and unlined Delavaud cast iron water mains installed from 1926-1931.
- Rehabilitation of sound unlined pit cast iron water mains installed from 1866 to 1926. These lines are rehabilitated by cleaning and cement mortar lining. About 80 percent of such lines are deemed to be structurally sound and suitable for rehabilitation. The other 20 percent are targeted for replacement.
- System grid connections of dead-ended or poor circulating mains to improve water quality.
- Abandonment and plugging of unlined cast iron water mains which have parallel existing mains.

All replacement projects include the transfer and/or renewal of lead service lines and fire hydrants connected to the main. On rehabilitation projects, lead service lines are renewed only if exposed at the main during rehabilitation. Fire hydrants installed after 1937 with high maintenance incidents are renewed. For fire hydrants installed prior to 1937, both the fire hydrant and the supply lines are renewed.

From 1856 to 1936, LWC had installed approximately 40,300 lead service lines which contained wiped joints. In 1994 LWC conducted record reviews and field surveys to verify the presence of lead services and has since replaced approximately 1,500 per year. LWC currently replaces lead service lines through main replacement projects, customer requests,

and stand-alone projects. A records review in March 2002 indicated approximately 26,200 lead services remaining in service (active). However, given that initial field verification surveys show that as high as one third of these records could be in error, only about 15,000 to 17,000 services are likely to still be of lead construction.

The list of projects selected for replacement or rehabilitation is developed on an annual basis and is based on the use of the MRRP Natural Work Team, MRRP database, a Pipe Evaluation Model, Utility Coordination Committee (UCC) input, and staff and executive management reviews. The UCC consists of members of utilities and public works agencies in Jefferson County. The UCC has facilitated the establishment of inter-agency relationships resulting in coordination of work activities among member agencies. The LWC coordinates the development of its MRRP with paving and road construction projects at the City, County and State level.

The 2001 primary MRRP includes 10.5 miles of new water main installations; 10.5 miles of water mains to be retired; 25.2 miles of rehabilitation projects; an estimated 723 lead service renewals from main to service property line connection; and an estimated 285 fire hydrant renewals. The estimated budget for these projects is approximately $10 million.

It is anticipated the rehabilitation of unlined cast iron water mains and the replacement of unlined Delavaud cast iron mains will be completed by 2005. LWC is currently studying what the focus of its efforts should be after 2005.

4.6.3.3 Pipe Evaluation Model

As part of the MRRP, LWC developed a Pipe Evaluation Model (PEM) in November 1993. PEM is a decision support tool to aid the development of the MRRP. It is a distributed network GIS application that utilizes various hardware and software systems. The facilities data incorporated into the model is managed by the Company's Oracle relational database management system. The PEM evaluates the entire service area on a street segment, or block level. Twenty-three criteria are used to evaluate the condition of existing water mains. The criteria are derived from the integration of LWC information systems and data obtained from other sources and agencies. The PEM integrates facility, hydraulic, and maintenance data from the LWC's Facilities Management System (FMS), Automated Mapping System (AMS), Work Order System, and the City of Louisville Department of Public Works paving data to formulate the database for the assessment of the distributions system.

Currently, the LWC service area is divided into 23 geographical areas or zones, most of which fall into older neighborhoods within the city limits of Louisville. Zone 23 was added in 2001 to represent those portions of Oldham County, where LWC sells water. Additional zones are anticipated to cover growing service areas.

The PEM has served its purpose well; however, it may be beneficial to revisit the decision criteria and revise it to meet the future needs of LWC. Water quality concerns and customer expectation are emerging as the drivers of future infrastructure rehabilitation projects. This would have an impact on the decision criteria used in the PEM. It is recommended to base the decision criteria on the "level of service" concept. Under this concept, the decision criteria will be based on the following:

- Water quality
- Water pressure
- Water interruption

For each criterion, three levels of service will be established: Level 1- acceptable; Level 2 - moderately unacceptable; and Level 3 - highly unacceptable. Not all items categorized as Level 3 will be given the highest priority. The priority list will be based on the highest rate of return concept (cost benefit analysis). A point system is setup for any action which improves the level of service from one level to a higher level. For example a discolored water problem affecting a large number of customers which can be resolved by an inexpensive regular flushing program will take priority over a pressure problem which affects only a few customers and can only be resolved by upsizing several miles of an existing water main involving significant costs.

4.6.3.4 Evaluation of the MRRP

Review of the available documents and our interviews with LWC key staff point to a very effective and well organized main replacement and rehabilitation program. The average number of water main breaks has gradually been decreasing due to the replacement of problem pipes. The positive aspects of the MRRP are listed below:

- Clear objectives
- Long term planning
- Adequate funding
- Team work
- Inter-agency coordination
- Comprehensive Pipe Evaluation Model

- Utilizing advanced tools such as Geographic Information Systems (GIS0) and Oracle Database Management Systems
- Utilizing comprehensive data on maintenance history
- Dynamic decision making process

Areas where further improvement to the program may be achieved include:

- Post-rehabilitation evaluation
- Fostering of emerging semi-structural and fully structural pipeline rehabilitation technologies

The post-rehabilitation evaluation would indicate how effective the rehabilitation practices have been. For example, there is concern that the Weko Seals used to rehabilitate joints in large water mains may have a limited service life.

The MRRP rightly targeted the replacement of problem pipes; namely the unlined cast iron pipes installed from 1862-1865 and 1926-1931. The unlined pit cast iron pipe installed prior to 1926 was also rightly targeted for rehabilitation by cleaning and cement mortar lining, extending their service life significantly. Cement mortar lining is an effective non-structural rehabilitation technique, which has been used extensively in the United States with great success. In the U.K., the use of cement mortar lining has not been as successful, and its use is virtually non-existent today. Instead, epoxy lining is being used extensively in the U.K. The main reason is the leaching of cement mortar lining due to the softness of the drinking water there. Since the LWC water source is not considered soft, it does not need to be concerned about this issue.

As was discussed earlier, LWC has about 385 miles of cement lined ductile iron pipe, which is not polywrapped. These pipes are subject to external corrosion, especially in southern parts of the City where corrosive soil exists, and can lead to pinholes and eventual failure of the ductile iron pipe. Although ductile iron is more robust than cast iron, the ductile iron pipe wall thickness is significantly smaller than a cast iron pipe wall thickness. This means that the pipe wall can be penetrated by the external corrosion process in a much shorter timeframe. Fortunately, LWC has used class 54 ductile iron pipe that is thicker than the standard class 50 pipe. Currently, LWC specifications require ductile iron pipe of pressure class 350. While our interviews with LWC's staff indicate that the polywrapped ductile iron pipes in the LWC system have performed well, some utilities have experienced external

corrosion even when polywrapping was used. It appears that groundwater fluctuation may lead to corrosion of ductile iron pipe even with polywrapping. It therefore is logical to target the protection of ductile iron pipe for the period after 2005 when the current cast iron pipe replacement and rehabilitation is substantially complete. The elements of such program include:

- Development of a soil corrosivity map based on available information.
- Constituting a soil sampling and testing program to develop a database of corrosive soils.
- Conducting corrosion potential surveys to monitor corrosion activities and sources of stray current.
- Development of a system for evaluating soil corrosion potential, similar to the DIPRA 10-point system.
- Developing technique for practical cathodic protection systems; either by sacrificial anodes or by impressed current techniques.
- Developing standard details for and installing corrosion monitoring test stations.

Another class of pipe deserving attention is the approximately 92 miles of prestressed concrete cylinder pipe (PCCP) which constitutes a major portion of LWC's transmission system, and its performance is of paramount importance to the reliability of the system. For example, a 60-inch PCCP water main conveys water from the BEPWTP to the English Station Road Reservoir. The failure of this line would significantly reduce the ability of LWC to serve its customers. The Company retained a consultant in 1996 to develop a plan for the internal inspection of this line. A comprehensive inspection plan was developed; however, it does not appear that the plan was implemented.

Due to failure of large PCCP water mains over the past 20 years all over the world, a number of monitoring, condition assessment, and rehabilitation techniques have been developed. LWC should consider utilizing such techniques in developing a long term PCCP Protection Program. Fortunately, the PCCP water mains in LWC do not have any class IV wire that is susceptible to hydrogen embrittlement and has been the cause of many failures in other utilities systems. Nevertheless, it is prudent to establish a long term PCCP Protection Program. Elements of such a program include:

- Pilot testing of relevant inspection and rehabilitation technologies for both the pipe sections and joints
- Establishing a formal inspection program; the frequency of inspection will depend on the condition of the pipe.
- Collection of all relevant data.
- Establishing the decision criteria
- Data analysis and condition assessment
- Rehabilitation
- Post-rehabilitation monitoring

Other areas of interest include leak detection and monitoring and flushing programs. Traditionally, these programs have been implemented as maintenance activities. If the "level of service" concept is adopted, these programs should be brought under the same umbrella as the inspection, condition assessment and rehabilitation programs. New technologies such as un-manned leak detection equipment, and the uni-directional flushing technique should be incorporated into future plans.

4.6.3.5 Recommendations

It is recommended that LWC consider establishing a Comprehensive Water Infrastructure Improvement Program (CWIIP) which would have the following elements:

- "Level of service" concept as the basis for water distribution/replacement improvement selection criteria
- Ductile Iron Protection Program (DIPP) to address unwrapped ductile iron pipes in the LWC system
- PCCP Protection Program to address the PCCP transmission mains in the LWC system
- Leak Detection & Monitoring Program
- Regular and Uni-directional Flushing Program (program component exists)
- Valve Exercise and Renewal Program (program component exists)
- Post-Rehabilitation Monitoring Program
- Evaluation of New Inspection & Rehabilitation Technologies Program

The post-rehabilitation monitoring program will evaluate the condition of the rehabilitated cast iron mains since 1985 and any other lines, which may be rehabilitated in the future.

4.6.4 GIS Plan

Geographic Information Systems (GIS) are applicable to virtually any data management problem. Effective implementation of a GIS requires identifying the problems that the GIS design is intended to solve. GIS capabilities include:

- Spatial Analysis (e.g., project water volume by area, compare sales to production by area, identify high and low maintenance pipe segments)
- Data Management (e.g., organize historical data, maintenance of existing data)
- Data Requests (e.g., find quantity at location, find address, identify customer at location)
- Map Management (e.g., standardize appearance of paper copy maps, prepare standardized set of index maps)
- Base Map Extraction (e.g., prepare spatial data sets for other uses besides core business)

Spatial analysis is the capability that distinguishes GIS from other forms of information management. Spatial analysis derives the relationships between objects and/or events based on their locations. Examples of spatial analysis include:

- Discovery of the relationship between pipe failures and certain soil types or conditions
- Identification of leaky water mains through comparison of flow to metered sales
- Prediction of growth areas through trend analysis

Use of a GIS for spatial analysis is possible only if the data is available and the database has been designed to accept it. GIS database design may optimize the system for preparation of specific types of spatial analysis. Programs (applications) may be written for GIS that produce specialized analysis.

On review of the Infrastructure Quality Measures, March 2001 report we found the Process Measures section by the GIS/Infrastructure Systems Planning Process. This report details requests from users only and does not measure GIS use by the users. The majority of GIS

users by core business system are the infrastructure managers (35 of 50). Customer service users are the next largest group with eight users of 50 total. By number of requests (16 of 27) and by number of hours (178.25 of 197), maps lead requests for data (8 of 27), and base map extraction (3 of 27). From this data, we conclude that the current GIS/Infrastructure Systems Planning Process primary functions are management of infrastructure location maps and data warehousing/management. Either because of the preliminary nature of the current GIS or lack of accurate measure of user activity, the current GIS is seldom used as a spatial analysis/data analysis tool.

The future development of GIS at LWC includes Automated Mapping/Facilities Management (AM/FM). AM/FM includes standardizing the generation of maps, and standardizing collection, recording, and reporting of data. AM/FM focuses on recording, organizing, and maintaining data about a utility's assets including pipes, pumps, valves, storage facilities, pressure reducers, and hydrants. Information developed during implementation of the AM/FM potentially is a source for a Computerized Maintenance Management System (CMMS). Integration of a CMMS with the AM/FM is a future goal of the Company.

CMMS and AM/FM GIS mutually enhance the value of each other. AM/FM GIS can provide the infrastructure assets and descriptive information to the CMMS. If the CMMS shares data with the AM/FM GIS, spatial analysis of maintenance information is enabled. Examples of spatial analysis of data in CMMS include:

- Development of predictive failure models based on location, age, condition, materials, and inspections
- Planning and tracking of water meter maintenance program
- Planning and tracking of water valve exercise program
- Water quality tracking based on location
- Spatial tracking of customer complaints

There are currently many CMMS products on the market today. Most of the industry's standard CMMS products are at least capable of sharing data with ESRI AM/FM GIS products. The best value in a CMMS is the one which provides the required capabilities with a minimum of custom programming. LWC should select a CMMS designed specifically for the water industry.

GIS is a system of data management tools, data analysis tools, hardware, data, and personnel, which have the capacity to prepare powerful, meaningful, and valuable analysis, if the all of the parts of the system have been designed to function together toward the same end. We recommend that the purposes of a GIS be identified at the start of development and stated explicitly, clearly, and concisely as a guiding principal through the many years of service the GIS will provide.

4.7 Operations Review Summary and Recommendations

4.7.1 Information Technology Program

Relative to counterparts in the utility industry, LWC has a solid foundation for further development of information technology solutions. The philosophies and operations of the SITS exceed the industry norm and the ITSP is well founded. While the findings and recommendations presented in this review are high-level in nature, they can serve as a strategic guide to enhance the ITSP and the SITS.

4.7.2 Fleet Utilization

Overall, the Company's fleet operations seem to be organized and have a sense of direction. The availability rate is required in this type of fleet. However, implementing utilization reporting would aid the Company in managing and optimizing its fleet makeup. Maintenance activities should be re-evaluated to ensure that the current requirements of the manufacturers are met. Under-maintaining a unit jeopardizes its reliability; however, over-maintaining a unit drains resources and increases operating costs. Finally, LWC should consider conducting a more detailed evaluation of the key cost drivers for fleet operations in order to determine whether centralizing operations would be more beneficial. The Company should also consider the benefits of eliminating the fueling facilities and using one of a number of available fleet fuel programs currently in the market.

4.7.3 Real Property Inventory

Overall, LWC's real property management has been very successful at identifying and acquiring properties required for future activities. The Company is cautious, like many of its governmental counterparts, when it comes to selling property. This caution in parting with acquired property may be increasing LWC's exposure to liability unnecessarily. LWC continues trying to find alternative uses, and thus, sources of revenue, for under utilized properties. This effort should continue, particularly if the Company considers consolidating activities such as fleet maintenance and distribution.

4.7.4 Operations and Facilities

Black & Veatch engineers and operations specialists conducted interviews and assessments to review LWC's facilities and operations. The areas reviewed included supply and treatment infrastructure (with an emphasis on chemical storage and feed equipment), high service pumping stations, booster pumping stations, storage facilities, and operation and maintenance programs. Operation and maintenance activities are generally in accordance with industry practices and in some areas exceed the norm. Potential areas where the Company may increase efficiency and effectiveness are detailed in the report. LWC's activities adequately support the company's goal of reliably providing the required quantity and quality of finished water to its customers.

4.7.5 Design Standards

The design standards and specifications that were reviewed included packaged booster pumping stations, tank coatings, ductile iron pipe, prestressed concrete cylinder pipe, polyvinyl chloride pipe, butterfly valves, gate valves, and fire hydrants. Detailed suggestions were identified to improve these standards for future projects.

4.7.6 Management Tools

4.7.6.1 Hydraulic Models

Since recent and applicable calibration data is not available, it is recommended that LWC establish a current, calibrated hydraulic model adequate for capital improvements planning. The model should be available before design and construction of any major capital improvements projects. The Company should dedicate one staff position responsible for hydraulic modeling. The actual modeling tasks could either be completed as a consultant activity or by LWC staff, depending on LWC preferences, staffing availability, and skills.

4.7.6.2 Demand Management

LWC currently has a number of demand management capabilities, including the readiness to implement the Water Shortage Response Plan in the event of an emergency. The plan follows AWWA and Kentucky Division of Water guidelines. The plan appears to provide an adequate basis for LWC's emergency response to a water outage event.

4.7.6.3 Pipeline Replacement and Rehabilitation Program

The Company has a very effective and well-organized Main Replacement and Rehabilitation Program. The average number of water main breaks has gradually been decreasing due to the replacement of problem pipes. Areas where further improvement to the program may be

achieved include post-rehabilitation evaluation and fostering of emerging semi-structural and fully structural pipeline rehabilitation technologies.

It is recommended that LWC consider establishing a Comprehensive Water Infrastructure Improvement Program (CWIIP) with the following elements:

- "Level of Service" concept as the basis for water distribution/replacement improvement selection criteria
- Ductile Iron Protection Program (DIPP) to address unwrapped ductile iron pipes in the LWC system
- PCCP Protection Program to address critical PCCP transmission mains in the LWC system
- Leak Detection & Monitoring Program
- Post-Rehabilitation Monitoring Program
- Evaluation of New Inspection & Rehabilitation Technologies Program

With the transition of LWC's MRRP program into later vintage piping (1943 and later) anticipated between 2005 and 2007, it is recommended that a comprehensive lead service renewal effort be developed as a component of the evolving MRRP capital improvement effort. Such a program would contribute to improved water quality for LWC customers and should be coordinated with local street paving programs to achieve unit cost efficiencies by utilizing a block renewal approach. Such a program would require additional funding of about $500,000 annually for six years in addition to those MRRP funds used to renew lead services.

The current valve exercise and pipeline flushing programs should be incorporated into the CWIIP.

4.7.6.4 Geographic Information Systems Plan

A review of available data indicates that the primary functions of the LWC's GIS/Infrastructure Systems Planning Process are management of infrastructure location maps and data warehousing/management. Either because of the preliminary nature of the current GIS or lack of accurate measure of user activity, the current GIS is seldom used as a spatial analysis/data analysis tool. The future development of GIS at LWC includes Automated Mapping/Facilities Management (AM/FM). Information developed during implementation

of the AM/FM potentially is a source for a Computerized Maintenance Management System (CMMS). Integration of a CMMS with the AM/FM is a future goal of LWC.

CMMS and AM/FM GIS mutually enhance the value of each other. The best value in a CMMS is one that provides the required capabilities with a minimum of custom programming. Therefore, LWC should select a CMMS designed specifically for the water industry.

GIS have the capacity to prepare powerful, meaningful, and valuable analysis, if all parts of the system have been designed to function together toward the same end. It is recommended that the purposes of LWC's GIS be identified and stated explicitly, clearly, and concisely as a guiding principal through the many years of service the GIS will provide.