5 FUTURE FACILITY IMPROVEMENTS

This section of the Master Plan identifies the basis for planning wastewater collection and treatment facilities to serve the ultimate build out of the City of Lee’s Summit. The basis of this effort is that all future improvements are made with the consideration of what is needed at the ultimate development condition. In some cases, the future improvements are new sewers and/or pumping facilities that will be sized for the ultimate growth at the time the facilities are constructed. However, many of improvements represent upgrades to existing facilities as these facilities play a significant role in serving the City at full build out. Phased improvements to match growth have been considered. The Master Plan also considers the anticipated growth that will take place in the City through the Year 2015 and reflects improvements to address this growth.

The City’s hydraulic model was an important tool used to assess the impacts of growth on the existing facilities. This model was used to evaluate the impact of aging sewers, with increasing extraneous flow, as well as the impact of development of undeveloped land on the existing infrastructure. The same model was used to predict the size of facilities that will be constructed in the future to serve the ultimate growth condition. A summary of the City’s model is included in the Appendix.

Finally, the master planning of Lee’s Summit is not complete without consideration of the impacts that the City may have on the LBVSD and MBC, who convey and treat 100 percent of the wastewater generated within the City. Coordinated planning efforts for future growth within the City and these wholesale wastewater conveyance and treatment providers are critical to this long-term planning.

5.1 COLLECTION AND CONVEYANCE SYSTEM

Collection and conveyance system planning is based upon projected land use and wastewater flow rates generated by these land uses. The peak flow rates (experienced during wet weather storm events) are the most critical for pipe line sizing since the major purpose of the sewer network is to collect and convey wastewater from its sources to the location of storage and/or treatment facilities without causing overflows and sewer backups. Gravity collection and conveyance systems are designed to convey wastewater by gravity flow with no more than a full pipe. However, when the wastewater flow rate exceeds the full-pipe capacity of the system, the system becomes surcharged and the wastewater level builds up in the manholes to a level above the top of the pipe. Wastewater systems normally have the ability, due primarily to the pipelines depth, to withstand low to moderate surcharging. However, at some point, excessive surcharging of wastewater collection and conveyance systems may cause the back up of wastewater into residences and/or businesses connected to the system. Also, excessive surcharging may cause the wastewater to surcharge to a level at or above the tops of manholes and overflow into adjacent drainage courses. These are referred to as sanitary sewer overflows (SSO).

The proper design and operation of the City’s wastewater collection system should allow the City to eliminate all excessive surcharging that could cause basement backups and sanitary sewer overflows. To that end, the City commissioned studies that generated a methodology for estimating the amount of flow for which the City’s sewers should be sized to convey. Subsequently, Section 6500 of the City’s Design and Construction Manual was adopted to require new sewers to be constructed based on specific design criteria. A copy of the portion of Section 6500 addressing sewer capacity is included in Appendix 9.2. As part of this master planning process, Archer/CH2M HILL compared the methodology adopted by the City to design criteria that has been established in other communities. The City of Independence, Missouri and the Johnson County Unified Wastewater Districts commissioned studies to flow monitor and to derive sizing criteria for sewers. Like Lee’s Summit, these curves are based on ultimate build-out
of land and based on peak wet weather flow rates. Figure 5-1 provides a summary of the design curves for these three sewer systems.

It should be noted that the design curves in Independence and JCUWWD predict peak flows higher than the 50-year frequency curve that was derived for Lee’s Summit.

Ultimately, all of the wastewater collected in the City is conveyed to regional conveyance facilities owned by LBVSD and MBC. Operation of the City’s system is dependent upon the operation of these regional systems. Excessive surcharging within these systems has a direct impact on the operation of the City’s system.

5.1.1 City Owned

The first step in planning wastewater collection and conveyance systems is to establish the conveyance plan for the City for the ultimate build-out condition. As stated earlier, layout and sizing of sewers today should consider ultimate conditions to avoid excessive surcharging and future limitations for growth. Figure 5-2 is the recommended wastewater conveyance plan for the City of Lee’s Summit. Following is a description of the conveyance plan by watershed:

**Blue Springs Watershed:** Service to this watershed will continue to be provided by unmetered connections to the LBVSD’s Interceptor under and downstream of Blue Springs Lake. It is recommended that the Arbores Pump Station be eliminated and a gravity connection be provided.

**Maybrook Watershed:** Wastewater collected in the Maybrook Watershed and pumped to this watershed from the Tudor Road Pump Station (West and South Prairie Lee Watersheds) is conveyed to the LBVSD Interceptor at the Maybrook Meter Structure. It is recommended that the West and South Prairie Lee wastewater be redirected to the Little Cedar Creek Watershed for ultimate conveyance to the LBVSD. A detailed evaluation supporting this recommendation is included in Section 6. Previous reports recommended that the City continue to pump 16 million gallons per day from the West and South Prairie Lee Watersheds to the Maybrook Watershed. This recommendation also included the construction of an excess flow holding basin in the Maybrook Watershed to decrease the peak flows to acceptable surcharge levels in the Maybrook Interceptor. Redirecting the flow to the Little Cedar Creek Watershed offers several long-term benefits to the City. First, the need to construct an excess flow holding basin in the Maybrook Watershed is eliminated. Due to the location of the Maybrook Interceptor, this basin would have to be located somewhere near I-470 and would most likely require the City to acquire relatively expensive commercial or industrial land for its construction. Second, pumping wastewater into the Maybrook Watershed presents higher risks of system overflows and corrosion to the interceptor under Lakewood, even with the use of an EFHB.

The City will continue to operate its pump stations in the north portion of this watershed during peak wet weather events to avoid potential surcharging from the LBVSD Interceptor. In the future, it may be necessary to construct an additional pump station near Lee’s Summit Road to serve an area that cannot be served by a gravity sewer.

**Jacomo Watershed:** This watershed naturally drains towards Lake Jacomo. There are no lake bottom sewers under Lake Jacomo, such as the sewers constructed under Lakewood, Blue Springs Lake, Longview Lake and Raintree Lake. Therefore, it is recommended that wastewater collected in this watershed be collected and pumped to other watersheds. The Savannah Woods area is currently being developed with a pump station that will pump north into the Blue Springs Watershed. The remaining portion of the watershed, most of which is PRI property, will be conveyed by gravity to pump stations and excess flow holding basins located near the boundaries of Fleming Park. It is recommended that the wastewater from these pump stations be pumped into the Maybrook Watershed for conveyance to the LBVSD Interceptor. Due to limitations to the Maybrook Interceptor under Lakewood, it is
Figure 5-1
Peak Wastewater Flow (50-year) Comparison

Design Flow Rate (cfs/acre) vs. Tributary Area (acres)

- Johnson County Wastewater Sewer District
- City of Independence
- City of Lee's Summit
recommended that each pump station be constructed with an EFHB that will allow the peak flows to be stored until capacity in the Maybrook Interceptor is available. It is recommended that an interceptor be extended to the site of the existing pump station near Rice Road as part of the ultimate wastewater conveyance improvements.

Little Cedar Creek Watershed: It is recommended for the ultimate wastewater service plan that the Little Cedar Creek Interceptor serve as the major conveyance system for the wastewater flows from the Little Cedar Creek, West Prairie Lee, and South Prairie Lee Watersheds to the LBVSD Interceptor. This interceptor connects to the LBVSD Interceptor at the Little Cedar Creek Meter Structure. This interceptor was upgraded in the 1990s to convey up to 4 million gallons per day from West and South Prairie Lee Watersheds. It is recommended that this system be upgraded for the ultimate plan to convey 24 million gallons per day from the West and South Prairie Lee Watersheds. This will require upgrades to the Little Cedar Creek Interceptor and the construction of a new 24-inch force main along Tudor Road from M 291 Highway to near Douglas.

West and South Prairie Lee Watersheds: Service to these two watersheds has been studied for more than 20 years. In the 1980s, a study was completed to evaluate the feasibility of constructing an interceptor under Prairie Lee Lake and Lake Jacomo to convey the wastewater to the LBVSD. At that time, the costs were significant. The major reason why this alternative is not feasible is the lack of capacity of the LBVSD Interceptor under Blue Springs Lake. Therefore, it would be necessary to construct pumping facilities at the downstream location of the proposed sewer under Lake Jacomo and several miles of force main to pump the peak flows to the LBVSD’s main interceptor somewhere near its crossing of I-470. This is cost prohibitive and is not recommended.

A recent engineering study by CTE considered alternatives for these watersheds. After review of this study and completion of a cost comparison, it is recommended that the ultimate wastewater conveyance plan for the West and South Prairie Lee Watersheds be as shown in Figure 5-3 and as follows:

a. Serve the east portion (also referred to as the East Prairie Lee Watershed) of the South Prairie Lee Watershed by pumping the wastewater from the Woodland Shores, Legacy Park, and Legacy Wood Pump Stations west to the Scruggs Road Pump Station. Construct the Legacy Wood Excess Holding Basin as planned. Retire the Summit Mill Lift Station.

b. If the City annexes property east towards Lake Lotawana as shown on Figure 5-2, this wastewater should also be pumped west to the Scruggs Road Pump Station. An EFHB should be included to limit pumping to the Scruggs Road Pump Station during a peak flow event. Since this is outside the boundaries of the LBVSD, it is recommended that the City formally request permission to pump this wastewater into the District prior to annexation and development of this area.

c. Upgrade the Scruggs Road Pump Station to a capacity of 16 million gallons per day. Upgrade the force main and gravity interceptor from the pump station to the Tudor Road Pump Station to the same capacity. Expand the Scruggs Road EFHB so that pumped wastewater from the Scruggs Road Pump Station does not exceed 16 million gallons per day.

d. Upgrade the Tudor Road Pump Station to a capacity of 24 million gallons per day.

e. Provide assistance to the residents in the Prairie Lee Lake area to provide a low pressure sewer collection system to eliminate all septic tanks in this area.
Figure 5-3
West and South Prairie Lee Watershed Pumping/Storage Schematic

West Prairie Lee Watershed

Little Cedar

Tudor Road Pump Station

5A/5B EFHB

5.3 Million Gallons

11.5 MGD

PS 6 EFHB

1.5 Million Gallons

Prairie Lee Lake

Tudor Road EFHB

.65 Million Gallons

16 MGD

Scruggs Road Pump Station

Woodland Shores Pump Station

Scruggs Road EFHB

1.4 Million Gallons (3.9 Future)

1 MGD (4.7 Future)

25.5 MGD

Legacy Park Pump Station

Future Legacy Wood EFHB

2.4 Million Gallons

Legacy Wood Pump Station

South Prairie Lee Watershed

24 MGD

10 MGD
**Bogg’s Hollow Watershed:** This watershed is served by a gravity interceptor. In the past, the Cities of Kansas City and Lee’s Summit have shared this interceptor. The City of Kansas City is currently in the process of constructing a new parallel interceptor to convey most of Kansas City’s wastewater in the watershed to the LBVSD Interceptor. One Kansas City subdivision will remain connected to Lee’s Summit’s interceptor. It is recommended that Lee’s Summit continue to convey wastewater from this watershed to the LBVSD Interceptor (Boggs Hollow Meter Structure) in the existing interceptor.

**Cedar Creek:** The Cedar Creek Watershed is served by a gravity collection and conveyance system. It is recommended that this conveyance plan be maintained. Wastewater is conveyed and connected to the LBVSD Interceptor at the Vale Meter Structure.

**Mouse Creek Watershed:** The Mouse Creek Watershed conveys wastewater collected in the southwest part of Lee’s Summit and a portion of Kansas City, Missouri, south of Hook Road to the Little Blue Interceptor at Longview Lake. The interceptor is located under the Mouse Creek branch of Longview Lake. Wastewater is also pumped from the Middle Big Creek Sub-District to the Mouse Creek Interceptor for conveyance to the LBVSD wastewater treatment plant. It is recommended that the City continue to use this interceptor for conveyance of Mouse Creek Watershed wastewater to the Little Blue Valley Sewer District. As part of the Middle Big Creek Sub-District, the City should work with the other customers of the Sub-District to implement a plan for a regional wastewater treatment plant in the Middle Big Creek/Big Creek Watersheds.

**Middle Big Creek Watershed:** The Middle Big Creek Watershed is served by a gravity conveyance system that is located under Raintree Lake. The capacity of the interceptors under the lake is limited and expansion is not feasible. It is recommended that the City utilize EFHBs in the sub watershed areas upstream of the lakes to reduce peak wastewater flows and avoid excessive surcharging. It is recommended that the City proceed with the construction of the proposed EFHB west of Ward Road, serving the north branch of the conveyance system. In addition, EFHBs should be required of new developments west of Ward Road that contribute to the south branch of the conveyance system. One of these basins was recently constructed at Kensington Farms. Prior to developing, an EFHB should be constructed in the undeveloped part of the watershed south of Kensington Farms.

Conveyance facilities, including the Raintree Pump Station and force main and the Lake Winnebago Interceptor and Pump Station, owned by the MBC, are reaching capacity. It is recommended that the City work with the other MBC customers to implement a plan for a regional wastewater treatment plant in the Middle Big Creek/Big Creek Watersheds.

**Big Creek Watershed:** The portion of the City in the Big Creek Watershed is served by a gravity interceptor system that conveys wastewater from Lee’s Summit and Greenwood to the Greenwood Pump Station, owned by the MBC. The City shared in the cost of the interceptor and “owns” 6 million gallons per day capacity in this pipe. It is recommended that the City provide EFHBs in the City upstream of Greenwood to limit Lee’s Summit wastewater peak flow to this interceptor to the capacity owned by the City. It is recommended that the City work with the other Middle Big Creek Sub-District customers to implement a plan that upgrades the Greenwood Pump Station prior to the time that wastewater flow from Lee’s Summit and Greenwood exceed the pump station capacity. In addition, it is recommended that the City work with the customers of the Sub-District to implement a plan for a new interceptor to replace the Greenwood pump station and to construct a regional wastewater treatment plant in the Middle Big Creek/Big Creek Watershed.

The City is considering annexation of land east along US 50 Highway. Some of this potential annexation land is located in the upper part of the Big Creek Watershed. Ultimately, development of the Big Creek Watershed, which is included in the legal boundary of the Middle Big Creek Sub-District, will include gravity interceptors to this property. However, since growth in the area is probably contingent upon future annexations of cities other than just Lee’s Summit, it is recommended that the City plan for conveyance of this wastewater back to the north by pumping. It is recommended that sufficient storage
be provided at the pump station to restrict the flow being pumped into the South Prairie Lee Watershed during peak wet weather periods. Since this property falls outside of the boundaries of LBVSD, it is recommended that the City request approval of the District prior to annexation and development of this new area. In addition, other alternatives, such as sub-regional wastewater treatment and a gravity interceptor to the Middle Big Creek Sub-District facilities should be considered. Interim treatment facilities for that area within MBC should be evaluated.

5.1.2 Little Blue Valley Sewer District Owned

The Little Blue Valley Sewer District completed a master plan for its conveyance and treatment systems in 2000, a facility plan for the improvements in 2001, and an interceptor capacity evaluation in 2005. As a result, the District has initiated plans for expansion of the capacity of their conveyance systems to accommodate growth of its customers through the Year 2020. The Master Plan and Facility Plan recommended the construction of three peak flow pump stations along the interceptor starting in the year 2011. Upon completion of these pump stations, totaling approximately $30 million, the interceptor would be increased its capacity to convey wastewater from approximately 300 million gallons per day to approximately 400 million gallons per day.

During the wet weather experienced in the spring of 2004, peak flows exceeded 360 million gallons per day. As a result, a study to evaluate the use of storage as a way to reduce peak flows was completed. This study concluded that the most cost effective, phased approach to adding conveyance capacity was to construct excess flow holding basins at two locations along the interceptor. The first location is a site at 103rd Street and I-470, where Kansas City operated a four-cell lagoon treatment plant until it was retired in the 1970s. An EFHB at this site was the most cost-effective alternative for reducing peak flows by diverting all of the interceptor flow at that location during a peak event and then releasing it into the interceptor after the event. The next most cost-effective location was a site in Raytown. Again, Raytown operated lagoons at this location until the interceptor allowed the City to retire the plant in late 1970’s.

The cost of these EFHBs was estimated to be less than $20 million. The LBVSD Technical Advisory Committee was in favor of further consideration of this solution for interceptor improvements. Discussions were held during the Technical Advisory Committee meeting related to the schedule of these improvements as it related to surcharging problems experienced by Lee’s Summit during the 2004 peak flow events. The District is in the process of applying for a State Revolving Fund loan to provide for construction of the improvements, including the storage basins.

Future improvements to increase capacity of the District’s interceptor system may include additional storage facilities and peak flow pump stations.

It is recommended that the City remain proactive in its support of the construction of the proposed EFHBs, as soon as possible, to limit the risk of excessive surcharging of the Little Blue Interceptor.

5.1.3 Middle Big Creek-Owned

Improvements to the Middle Big Creek Sub-District conveyance system will be required to accommodate the projected growth in the Big Creek and Middle Big Creek watersheds. Besides Lee’s Summit, growth is projected in the Cities of Greenwood, Raymore, and Lake Winnebago. In addition, the City of Pleasant Hill is facing growth pressures and the need to expand its wastewater treatment facilities. If the Sub-District makes the decision to expand its conveyance system, it is projected that improvements will be required by 2010 for the Greenwood and Lake Winnebago Pump Stations; eventually, the Raintree Pump Station will need to be expanded; and a parallel force main from the Raintree pump station to its connection to the Mouse Creek Interceptor will need to be constructed. Expansion of the Middle Big Creek Sub-District conveyance facilities will be limited by capacity of the LBVSD Interceptor under Longview Lake and the Mouse Creek Interceptor in Lee’s Summit. To accommodate the predicted peak flows, EFHBs will be required. Expansion of the Sub-District’s EFHB southeast of Lake Winnebago
may also be required. In addition, an EFHB in the Mouse Creek Watershed and upgrading of the Mouse Creek Interceptor will be needed.

A preliminary engineering study has been completed by Archer Engineers for the Middle Big Creek Sub-District. This study evaluated the alternatives of expanding the existing conveyance system as well as several alternatives to expand the Sub-District to include Pleasant Hill and for the Sub-District to construct a regional wastewater treatment plant near Pleasant Hill. The Sub-District Board and customers are considering these alternatives. An application for State Revolving Fund loans to finance improvements to the Sub-District’s system was submitted in November 2006.

It is recommended that the City work with the other customers of the Middle Big Creek Sub-District and the LBVSD to move forward with a plan for the construction of a regional wastewater treatment plant.

5.2 WASTEWATER TREATMENT FACILITIES

5.2.1 City-Owned
The City currently owns no wastewater treatment facilities. All wastewater that is collected in the City is conveyed to the LBVSD wastewater treatment plant. As the City considers alternatives to expand and annex to the east and south, expansion of its conveyance system is recommended as discussed in Article 5.1. However, as Lee’s Summit’s growth continues into the upper portions of the Big Creek and Sni-A-Bar (Lake Lotowana) Watersheds and due to limitations in capacity within the City’s conveyance system, alternatives for sub-regional wastewater treatment should be considered.

5.2.2 Little Blue Valley Sewer District-Owned
LBVSD operates a wastewater treatment plant on an 80-acre site approximately one mile south of the Missouri River. The treatment plant was constructed in the early 1980s and was recently expanded to an average flow capacity of 52 million gallons per day with a peak flow capacity of 400 million gallons per day. Treated effluent from the plant is conveyed for discharge to the Missouri River.

The current capacity was provided with the first phase of a two-phase project that resulted from the 2001 Facility Plan. The second phase of the plant improvements are scheduled to take place in 2011. These improvements include replacement of the sludge conditioning system with sludge drying equipment. The Phase 1 and 2 improvements are intended to provide treatment capacity for the LBVSD’s customers through 2020.

As part of the 2001 Facility Plan, future expansion (beyond 2020) was considered. The treatment plant site has sufficient area to expand the average capacity of the plant to at least 100 million gallons per day. Peak flow treatment capacity beyond the current 400 mgd capacity is limited due to interceptor and influent pump station capacity.

Changing environmental regulations may force improvements at the LBVSD’s treatment plant, regardless of the need to increase capacity. In the short term, disinfection and ammonia limits are being considered by the MDNR. In the long term, total nitrogen and phosphorus may be considered.

5.2.3 Middle Big Creek-Owned
The Middle Big Creek Sub-District currently pumps all of the wastewater collected within its service area to the Little Blue Valley Sewer District for treatment. The customers of the Sub-District are considering alternatives to address the growth within the Sub-District. One of the alternatives is to expand the Sub-District to include Pleasant Hill and to construct a regional wastewater treatment plant southeast of Pleasant Hill to serve the Sub-District. It is recommended that the City remain proactive in these discussions.