

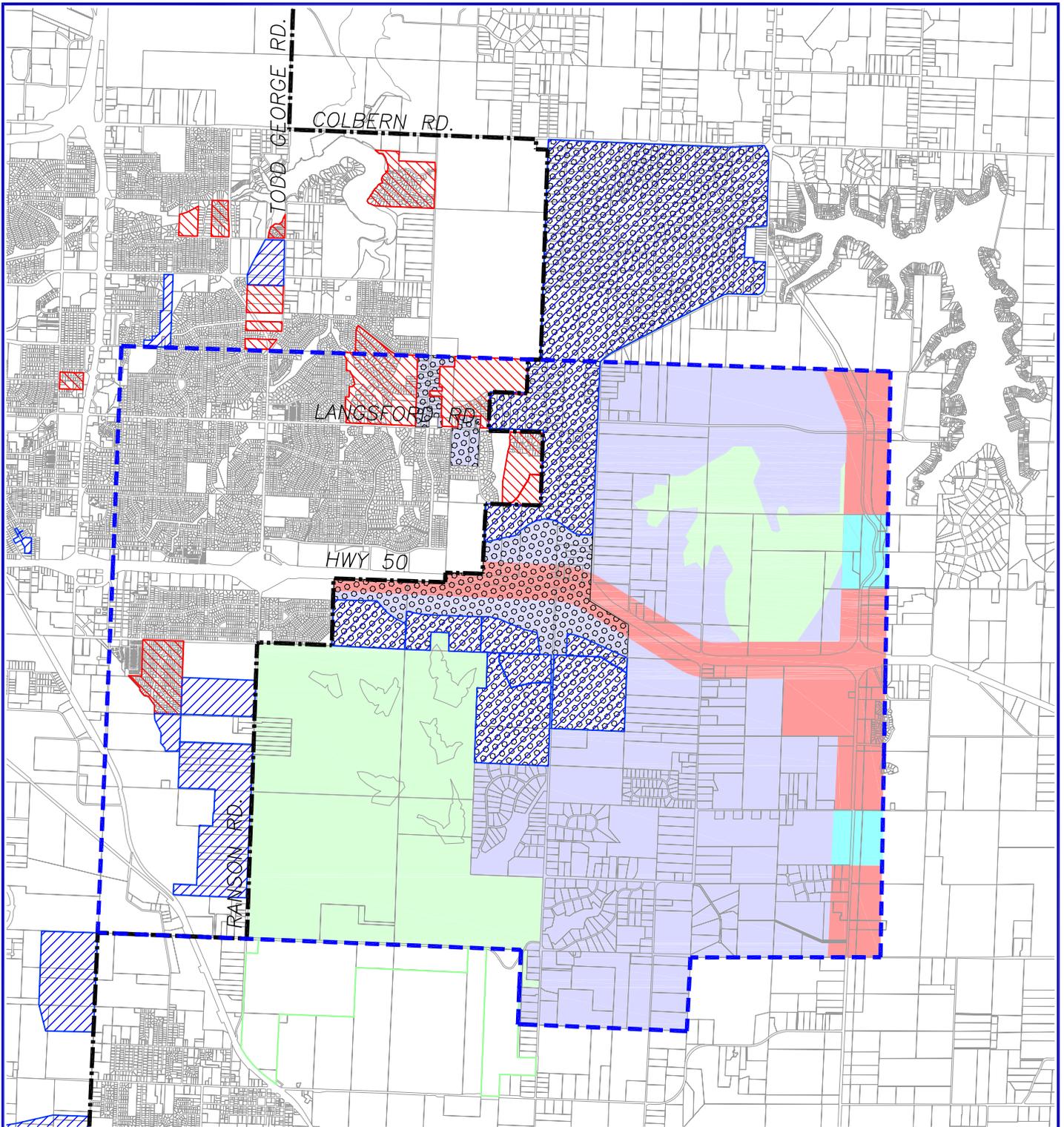
## PLANNING CRITERIA

The basic information needed for this report relates to water use for consumption, irrigation, domestic use and fire protection. Population projections and growth patterns determine where the water is needed. Projected maximum day demands and the fire flow requirements determine the amounts of water needed.

### **Population Projections**

Population projections and development patterns within Lee's Summit and potential annexation areas are described in the City's map titled *Growth Projections to 2015 and Build-out* and the accompanying spreadsheet dated May 2006. Lee's Summit also supplies water and operational support to Public Water Supply District 14 which is not fully considered in the City's growth projections. This report considers all populations served water by the City. Some of that population lies outside of the city limits (primarily District 14) and some of the population within the city limits is not served water by the City (portions of District 13). For the purposes of this document, the future population and land use of Water District 14 outside of Lee's Summit is assumed to be as shown on Figure 3. Other information considered included the current zoning maps and interviews with the Planning and Development staff and the Development Coordinator.

Table 5 compiles population and maximum day water demand information from 1998 to the ultimate build-out population. It is understood that the PRI property will not be developed in the foreseeable future but that eventually it may be developed. Population numbers shown in Table 5 do not include development of the PRI property until ultimate build-out (last line of Table 5). The PRI property represents a potential 27,000 additional residents. The population projections are used along with per capita demand estimates and maximum day to average day ratios to project maximum day water demands. In Lee's Summit, these demands are influenced by population,



- |   |  |   |                                    |
|---|--|---|------------------------------------|
|  | MED. DENSITY RESIDENTIAL<br>(10 PEOPLE/ACRE) |  | ACTIVE RESIDENTIAL AREA            |
|  | COMMERCIAL                                   |  | ANNEXATION POTENTIAL               |
|  | INDUSTRIAL                                   |  | FUTURE BUILDOUT<br>PROJECTION AREA |
|  | ZERO DEMAND AREA<br>(JAMES REED, QUARRY)     |  | CITY LIMIT                         |
|   |  |  | WATER DISTRICT 14                  |

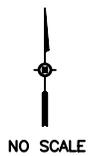


Table 5 - Population and Water Demands (MGD)

Year	Population <sup>1</sup>	Usage GPCD <sup>5</sup>	Actual Data			Projections					
			Avg. Day (MGD)	Max. Day (MGD)	Max-Avg Ratio	North & South <sup>2</sup> (MGD) <sup>9</sup>	Wholesale Contracts <sup>7</sup> (MGD)	Technology Campus <sup>8</sup> (MGD)	Avg. Day (MGD)	Max. Day (Low) <sup>3</sup> (MGD)	Max. Day (High) <sup>4</sup> (MGD)
1998	65,139	---		16.0							
1999	68,101	---		18.0							
2000	71,064	135	9.6	17.6	1.83						
2001	74,026	124	9.2	18.7	2.03						
2002	76,989	142	10.9	20.5	1.88						
2003	79,951	131	10.5	25.6	2.44						
2004	82,913	110	9.1	15.4	1.69						
2005	85,876	125		19.7		10.7	0.3	1.0	12	23	28
2006	88,838	125		25.4		11.1	0.3	1.0	12	24	29
2007	91,801	125				11.5	0.0	1.0	12	24	29
2008	94,763	125				11.8	0.0	1.0	13	25	30
2009	97,726	125				12.2	0.0	1.0	13	25	31
2010	100,688	125				12.6	0.0	1.0	14	26	32
2011	103,650	125				13.0	0.0	1.0	14	27	33
2012	106,613	125				13.3	0.0	1.0	14	28	33
2013	109,575	125				13.7	0.0	1.0	15	28	34
2014	112,538	125				14.1	0.0	1.0	15	29	35
2015	115,500	125				14.4	0.0	1.0	15	30	36
2016	118,462	125				14.8	0.0	1.0	16	31	37
2017	121,425	125				15.2	0.0	1.0	16	31	38
2018	124,387	125				15.5	0.0	1.0	17	32	39
2019	127,350	125				15.9	0.0	1.0	17	33	40
2020	130,312	125				16.3	0.0	1.0	17	34	41
2021	133,274	125				16.7	0.0	1.0	18	34	41
2022	136,237	125				17.0	0.0	1.0	18	35	42
2023	139,199	125				17.4	0.0	1.0	18	36	43
2024	142,162	125				17.8	0.0	1.0	19	37	44
2025	145,124	125				18.1	0.0	1.0	19	37	45
2026	148,087	125				18.5	0.0	1.0	20	38	46
2027	151,049	125				18.9	0.0	1.0	20	39	47
2028	154,011	125				19.3	0.0	1.0	20	40	48
2029	156,974	125				19.6	0.0	1.0	21	40	49
2030	159,936	125				20.0	0.0	1.0	21	41	49
Ult. <sup>11</sup>	184,500	125				23.1	0.0	1.0	24	47	57
Ult. <sup>12</sup>	211,500	125				26.4	0.0	1.0	27	54	65

Notes:

1. Population projection based on the Lee's Summit Planning & Development "Growth Projections to 2015 and Buildout" map.
2. Includes Water District 14
3. Assuming a Maximum Day to Average Day ratio of 2.0
4. Assuming a Maximum Day to Average Day ratio of 2.4 and 1.5 MGD (full contract amount) at the Lee's Summit Technology Campus.
5. The Usage in Gallons per capita per day for 1998 was shown based on actual data. Per capita demands after 2005 are assumed to increase by 1 gpcd and then level off at 125 gpcd.
6. Information provided by City Staff.
7. Assuming that connections to wholesale customers are discontinued
8. Maximum = 1.5 MGD, Minimum = 0.4 MGD (375,000 gallons per day).
9. MGD = Million Gallons Per Day
10. GPCD = Gallons Per Capita Per Day
11. Without PRI property included. All demands thru 2030 do not include PRI property development.
12. With PRI property included

development and irrigation practices. The projected annual water demands for Lee's Summit are listed in Table 5.

### **Water Usage**

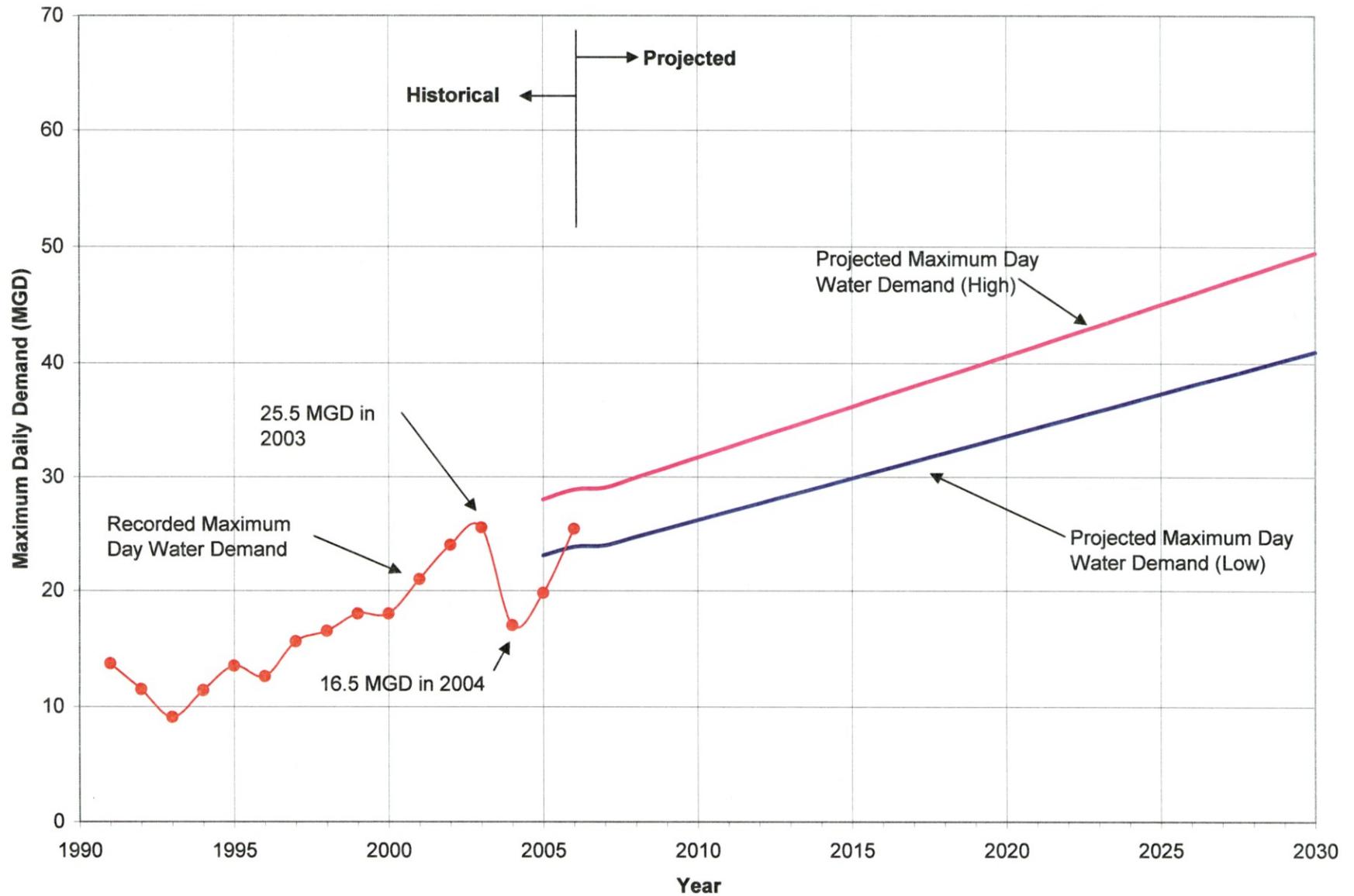
Figure 4 plots the historical and projected maximum day water demands. The steady increase in water demands over time relates directly to the steady population growth during the same time period. Erratic fluctuations in the actual maximum day demands relate to rainfall and temperature patterns in the summer months from May to September. These influences are demonstrated in comparing the actual summer demands between 2003 and 2004. The summer of 2003 was relatively hot and dry resulting in a maximum day water demand of 25.6 MGD. The summer of 2004 was relatively wet and cool resulting in a maximum day demand of 15.4 MGD.

The projections are presented in a range to account for these historical influences. The early projections immediately after 2005 are flat because the loss of wholesale customers offsets the increase in population growth. Actual demands can vary significantly depending on the actual growth rates, weather patterns and types of development, especially large water using industries. These maximum day demand ranges are 6 to 10 MGD higher than projections completed in 2004 *Water Supply Alternatives Study* by Bartlett & West Engineers for two reasons:

- The *Growth Projections to 2015 and Build-out* map indicates higher density development within Lee's Summit as compared to prior planning documents.
- This plan assumes medium density (10 people per acre) development in Water District 14 where prior plans have assumed low densities (5 people per acre). The revised assumption is more consistent with recent development proposals.

Another aspect of water demand to be considered as part of the planning criteria is fire flow. The required fire flow for a given area is based on zoning. Areas with a potential for larger fires require a greater minimum available fire flow for longer

Figure 4 - Historical and Projected Maximum Day Demands



duration. The fire flow criteria used for each of the zoning types are indicated in Table 6. Every parcel of land in the study area was classified as either residential, commercial, or industrial. Areas that could not meet the fire flow criteria in the table were identified using the model.

**Table 6 – Fire Flow Criteria**

Zoning	Fire Flow (gpm)	Duration (hours)
Residential	1,000 <sup>1</sup>	1
Commercial	1,500 <sup>1</sup>	2
Industrial	3,500 <sup>2</sup>	3

- Notes: 1. Source: Lee’s Summit Design and Construction Manual.  
 2. Source: Highest fire flow considered by the Insurance Services Office  
 3. gpm is the abbreviation for gallons per minute.

As actual events occur that differ from the assumptions in this report, the plan should be updated. Examples of changes include new wholesale customers, revisions to current zoning plans, changes in the service arrangements to Water District 14, etc.

**Water Supply**

Lee’s Summit is supplied water from the Cities of Independence and Kansas City, Missouri. Since the early 1990’s, increases to the overall supply have come from the City of Kansas City. As the population continues to grow, additional supplies will be needed in 2010, 2013 and 2024. Kansas City continues to offer the most economical and readily available opportunity to increase water supplies in the next 10 years. Beyond the next 10 years, other viable supply sources include the City of Independence and Tri-County Water Authority (TCWA).

Lee’s Summit’s total water supply capacity in 2006 is 21.5 MGD. This includes 7.5 MGD from the City of Independence, 7.0 MGD from the City of Kansas City along Lee’s Summit Road and 7.0 MGD from Kansas City at the South Terminal Pump

Station. The water purchase agreement with Independence was signed on January 4, 2001 and is valid for 20 years and renewable with notification 120 days prior the expiration. The water purchase agreement with Kansas City was signed on May 6, 2002 and is valid for 33 years with two renewal options, each for an additional 33 years. Future supply opportunities described in the *Water Supply Alternatives Evaluation* report by Bartlett & West Engineers, dated September 2004 include:

- The City of Kansas City, Missouri (KCMO)
- The City of Independence, Missouri
- Tri-County Water Authority (TCWA)

The 1999 Cooperative Agreement for Transmission System Improvements (Cooperative Agreement) with Kansas City includes Phase I, II, III and IV of the Jackson-Cass Transmission System and the South Terminal Pump Station as shown on Figure 5. Phase I included a 54" and 42" pipeline along the old Rock Island Rail Road alignment from I-70 to Ward Road and a connection to existing transmission lines near 75<sup>th</sup> and Woodson. The existing transmission lines feed into Lee's Summit to three locations along Lee's Summit Road between the airport and Lakewood Boulevard. Phase II included a tie back into the Kansas City system. This was an intermediate project intended to get more water to Lee's Summit while the remaining phases of the transmission system were developed. This project was later abandoned in favor of moving forward on Phase III. Phase III includes a 54" pipeline that will connect Phase I to Kansas City's East Bottoms Pump Station. This project is under construction and scheduled for completion by mid 2007.

Another alternative to Phase IV called the Cross Town Transmission Line was evaluated in 2005. The Cross Town Transmission Line was proposed to take advantage of excess pumping capacities in the western portion of the Kansas City system. The availability of excess pumping capacity on the western side of the Kansas City system did not overcome the long term operational, reliability and economic advantages of the



Phase IV project, based on evaluations by Kansas City. In December 2005, the Cross Town Transmission Line was abandoned in favor of the Phase IV project. Phase IV includes a 72" transmission line from the south end of the river tunnel to the East Bottoms Pump Station. The timing to complete this project is being finalized.

Other projects shown on Figure 5 but not included in the Cooperative Agreement include:

- Future East Leg of the Jackson-Cass Transmission System.
- Future East Terminal storage and pump station to deliver this supply into Lee's Summit.
- Future Standby Pumping improvements at the East Bottoms Pump Station.
- Future Intermediate Booster Pump Station improvements to the Jackson-Cass Transmission System.

Table 7 summarizes the impacts of the planned improvements to the total capacity of the Jackson-Cass Transmission System. Today, the system can deliver 10.5 MGD to the South Terminal Pump Station. Of this 10.5 MGD, 7.0 MGD is designated for Lee's Summit in the Cooperative Agreement. Adding Phases III and IV as defined in the Cooperative Agreement increases Lee's Summit's share to 13 MGD and 20 MGD at the South Terminal Pump Station, respectively. Adding a Standby Pumping Station to the East Bottoms Pump Station will increase the supply to South Terminal to 36 MGD. When the East Leg and East Terminal Pump Station are added Kansas City will not be able to supply both the East Terminal and the meters along Lee's Summit Road. This results in a gain of 21 MGD but a loss of 7 MGD for a net gain of 14 MGD. The total transmission system capacity will increase to 52 MGD but the supply to South Terminal will decrease from 36 MGD to 31 MGD. Adding an Intermediate Booster Pump Station will increase the transmission system capacity to 75 MGD.

Lee's Summit's share of any additional supply after the addition of Standby Pumps at the East Bottoms Pump Station is undefined at this time. All the information in Table

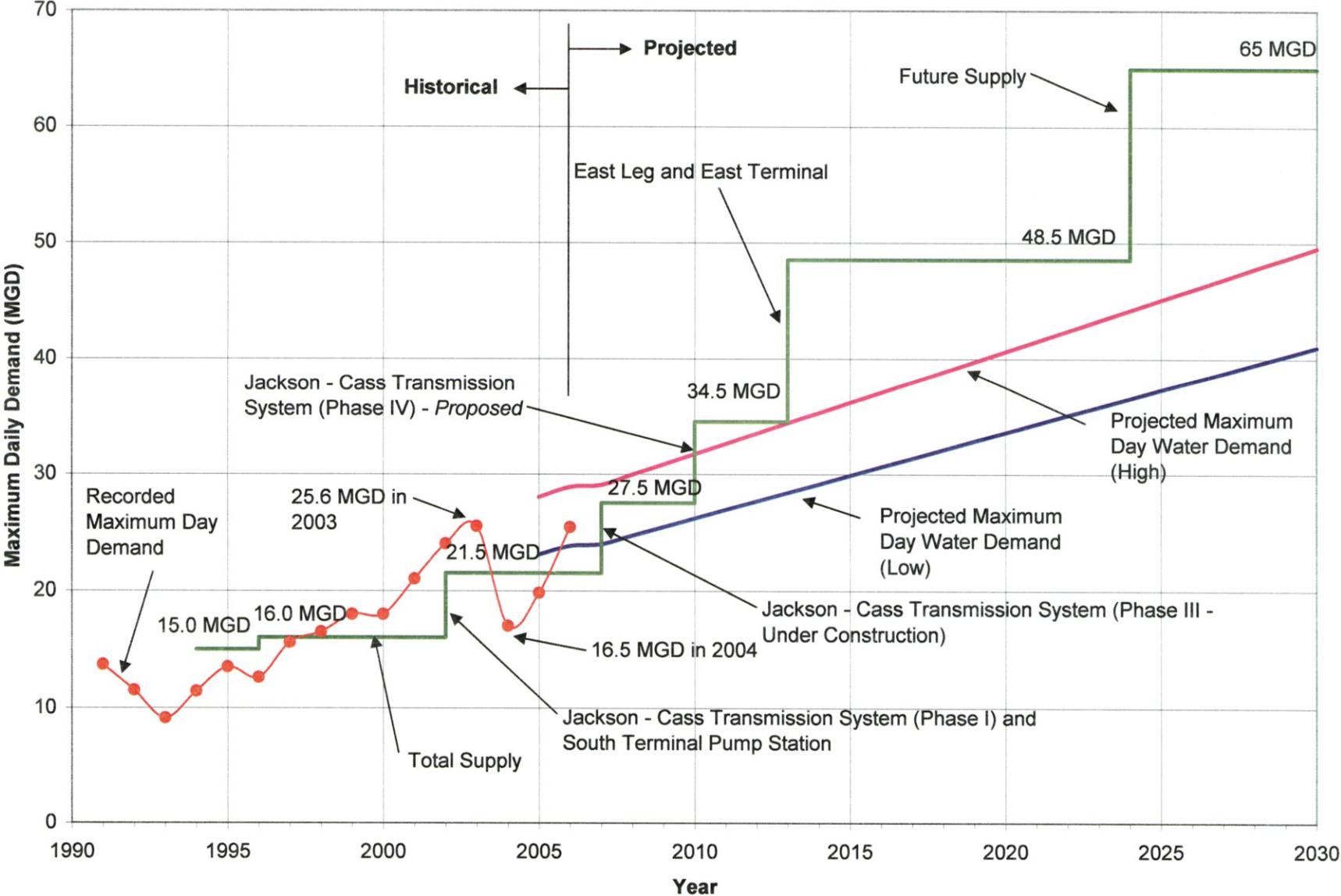
7 is based on the assumption that no flow is being diverted to Kansas City's South System through the Raytown Road Pump or through the 24" inter-connect near 75<sup>th</sup> and Woodson. The potential impacts of these operational conditions are not well defined at this time. Kansas City is continuing to develop a final operations plan for the entire Jackson-Cass Transmission System.

Additional information gathered on the Kansas City supply in 2006 supplements this report but does not alter the basic conclusion that maximizing the Kansas City Supply is the most economical alternative to the year 2024. Table 8 summarizes the projected changes to Lee's Summit's water supply capacity. Figure 6 superimposes water demands over the water supply capacity for the period of 1991 to 2030. After 2024, there are three choices for additional water supplies: Kansas City, Independence or Tri-County Water Authority (TCWA). This Master Plan assumes that supplies after 2024 will come from TCWA for these reasons:

- TCWA offers a third source of supply for increased reliability.
- With existing supplies from the north (Kansas City and Independence) and west (Kansas City) a TCWA supply delivers water to a strategic location on Lee's Summit's eastern border.

The timing to increase water supply capacities relates directly to risk management. Figure 6 indicates that in seven of the last nine years, the supply systems delivered supplies greater than the capacities included in the water supply agreements with Kansas City and Independence. These successes have occurred as a result of dedication and collaboration among the staffs of all three communities. The projects needed to increase the water supply capacity are highly complex multi-jurisdictional projects that require several years to plan, negotiate, design and construct. Ideally, the contractual supply capacity should always exceed the projected demands. Table 8 and Figure 6 present a sequence of recommended events to maintain a supply capacity 10 percent greater than the projected maximum day demand after 2013.

**Figure 6 - Projected Demand and Supply (MGD)**



**Table 7 – Capacity of the Jackson-Cass Transmission System (MGD)**

Jackson-Cass Improvements <sup>1</sup>	Total Supply to South Terminal	Total Supply to East Terminal	Total Supply to Jackson-Cass System	Lee’s Summit Share of Jackson-Cass System	Comments
Phase I	10.5 <sup>4</sup>	0	10.5	7 <sup>5</sup>	Completed in 2001
Add Ph III (54’)	22 <sup>3</sup>	0	22	13 <sup>6</sup>	Completion by May 2007
Add Phase IV (72’)	22 <sup>3</sup> 27 <sup>7</sup>	0	27	20 <sup>7</sup>	See Note 8
Add Standby Pump to East Bottoms PS <sup>2</sup>	36 <sup>3</sup>	0	36	20 <sup>7</sup>	See Note 8
Add the East Leg and East Terminal PS	31 <sup>3</sup>	21 <sup>3</sup>	52	41	Assumes expanding the Cooperative Agreement
Add Intermediate Booster PS	50 <sup>3</sup>	25 <sup>3</sup>	75	41	Assumes expanding the Cooperative Agreement

Notes:

1. All phasing references are described in the 1999 Cooperative Agreement for Transmission System Improvements between Kansas City and Lee’s Summit (Cooperative Agreement). These projects are listed in chronological order.
2. PS is an abbreviation for pump station.
3. Presentation of the draft *Jackson-Cass Transmission System Operational Plan* (Operational Plan) by Black and Veatch, December 6, 2005.
4. Cooperative Agreement, Page 8, Article III, Paragraph 3.
5. Cooperative Agreement, Page 8, Article III, Paragraph 4.
6. Cooperative Agreement, Page 13, Article VI, Paragraph 5.
7. Cooperative Agreement, Page 14, Article VII, paragraph 4.
8. According to the draft Operational Plan, the standby pumping needs to be added to the East Bottoms Pump Station at the same time Phase IV is completed to meet the terms of the Cooperative Agreement.
9. Under certain operational circumstances, water from the Jackson-Cass Transmission System may feed Kansas City’s South System via the Raytown Road Pump Station and/or the 24” interconnect at 75<sup>th</sup> and Woodson.
10. Kansas City’s other wholesale customers fed through the South Terminal include the Cities of Raymore, Pleasant Hill, Greenwood and the Aries power plant.

**Table 8 – Projected Water Supply Capacity**

Year	Water Supply Description/Changes (MGD)	Total Supply (MGD)
2005	<ul style="list-style-type: none"> <li>• Independence: 7.5</li> <li>• KCMO at Lee’s Summit Road: 7.0</li> <li>• KCMO at South Terminal Pump Station: 7.0</li> </ul>	21.5
May 2007	<ul style="list-style-type: none"> <li>• Add Phase III of Jackson-Cass System: +6.0</li> </ul>	27.5
May 2010	<ul style="list-style-type: none"> <li>• Add Phase IV of Jackson-Cass System: +7</li> </ul>	34.5
2013	<ul style="list-style-type: none"> <li>• Add Standby Pumping, East Leg and East Terminal Pump Station: +21</li> <li>• Delete KCMO at Lee’s Summit Road: -7</li> <li>• Net increase is 14</li> </ul>	48.5
2024 to 2030	<ul style="list-style-type: none"> <li>• Gain additional supply from TCWA, Independence or KCMO: +16.5</li> </ul>	65

In this plan, Lee’s Summit’s total supply capacity will need to be increased to 48.5 MGD to satisfy the projected maximum day demand to the time frame of 2025 to 2030.

The water supply assumptions used for the remainder of this report include:

- The Jackson-Cass Transmission System will continue to develop and ultimately deliver 20 MGD to the South Terminal Pump Station and then 21 MGD to a future East Terminal Pump Station. All other connections to Kansas City will be abandoned or used as emergency connections only.
- Independence will continue to deliver 7.5 MGD to Lee’s Summit’s northern boundary.
- Tri-County Water Authority, Independence or Kansas City could eventually deliver another 16.5 MGD to Lee’s Summit to meet the ultimate build-out, maximum day demand of 65 MGD.