ORDINANCE NO. 1032

AN ORDINANCE ADOPTING THE WATER SYSTEM MASTER PLAN AS AN ELEMENT OF THE SOUTHLAKE 2030 PLAN, THE CITY'S COMPREHENSIVE PLAN UPDATE.

WHEREAS, a Home Rule Charter of the City of Southlake, Texas, was approved by the voters in a duly called Charter election on April 4, 1987; and,

WHEREAS, the Home Rule Charter, Chapter XI requires an update to the City's comprehensive plan elements every four years,

WHEREAS, the City Council recognizes that the Water System Master Plan is an element of the Southlake 2030 Plan, the City's Comprehensive Master Plan,

WHEREAS, the City Council has determined that the Water System Master Plan complies with the Southlake 2030 Vision, Goals, & Objectives,

WHEREAS, the City Council has deemed that the Water System Master Plan has been formulated with adequate public input,

WHEREAS, the City Council has deemed that the recommendations in the Water System Master Plan herein reflect the community's desires for the future development of the City,

WHEREAS, the City Council has determined it is in the best interest of the public's health, safety and welfare to establish utility facility requirements for the provision of potable water for city residents and businesses,

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SOUTHLAKE, TEXAS, THAT:

Section 1. All of the findings in the preamble are found to be true and correct and the City Council hereby incorporates said findings into the body of this ordinance as if copied in its entirety.

Section 2. The statements in 'Exhibit 1' are hereby adopted as the Water System Master Plan of the Southlake 2030 Plan.

Section 3. The different elements of the Comprehensive Master Plan, as adopted and amended by the City Council from time to time, shall be kept on file in the office of the City Secretary of the City of Southlake, along with a copy of the ordinance and minute order of the Council so adopting or approving the same. Any existing element of the Comprehensive Master Plan which has been heretofore adopted by the City Council shall remain in full force until amended by the City Council as provided herein.

Section 4. This ordinance shall be cumulative of all provisions of ordinances of the City of Southlake, Texas, except where the provisions of this ordinance

are in direct conflict with the provisions of such ordinances, in which event the conflicting provisions of such ordinances are hereby repealed.

Section 5. It is hereby declared to be the intention of the City Council that the phrases, clauses, sentences, paragraphs and sections of this ordinance are severable, and if any phrase, clause, sentence, paragraph or section of this ordinance shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs and sections of this ordinance, since the same would have been enacted by the City Council without the incorporation in this ordinance of any such unconstitutional phrase, clause, sentence, paragraph or section.

Section 6. The City Secretary of the City of Southlake is hereby authorized to publish this ordinance in book or pamphlet form for general distribution among the public, and the operative provisions of this ordinance as so published shall be admissible in evidence in all courts without further proof than the production thereof.

Section 7. This ordinance shall be in full force and effect from and after its passage and publication as required by law, and it is so ordained.

PASSED AND APPROVED on the 1st reading the 15 day of May, 2012.

MAYOR

ATTEST:

CITY SECRETARY

SOUTHLAKE, TEXAS

PASSED AND APPROVED on the 2nd reading the 5 day of June, 2012.

MAYOR

ATTEST:

CITY SECRETARY

APPROVED AS TO FORM AND LEGALITY:

CITY ATTORNEY

DATE: June 5, 2012

ADOPTED: June 5, 2012

EFFECTIVE: June 5, 2012

CITY OF SOUTHLAKE

WATER SYSTEM MASTER PLAN

2012

A Study of

SUPPLY

DISTRIBUTION SYSTEM

STORAGE

PUMPING

PREPARED BY:

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Executive Summary

The City of Southlake contracted with Neel-Schaffer/Cheatham & Associates to develop Master Plan Updates which are being used in the development of the Southlake 2030 Plan – Water, Wastewater and Stormwater. We utilize existing documents such as previous plans, system maps and construction documents as a basis for the Water System Master Plan Update. Neel-Schaffer/Cheatham & Associates also met with Southlake officials and staff and performed limited site visits to verify data and better understand the priorities of the City of Southlake. Existing population and growth data from the North Central Texas Council of Government (NCTCOG) was also used, along with data from previous engineering studies, reports and designs performed for the City.

This City of Southlake Water System Master Plan was performed on several separate elements of the system and the results are presented in this report. Major elements of the study included Water Demand Projection, Water Supply, Storage, Pump Stations, Distribution System, Recommended System Improvements, and Exhibits/System Maps.

Based on population projections from the NCTCOG, total water demand is expected to increase from a peak day demand of 26.94 million gallons per day (MGD) in 2012 to a peak day demand of 34.22 MGD at Ultimate Build-out of the City of Southlake in the year 2025 and beyond. Water supply and pumping capacity recommendations are based on these peak day projections.

Based on industry standards and Southlake historical data, we assume a Peak Hour Demand of 2.0 times the peak day demand. Analyses and recommendations for the distribution system and elevated storage are based on the peak hour demand, since these elements of the system must meet the peak hour demand even if it exceeds the supply and pumping capacity.

The modeling and analysis that Neel-Schaffer/Cheatham performed, indicated several areas that need immediate improvements and also longer term needs based on future growth. Significant projects currently under construction are a 20” distribution line along Hwy 114 and a 30” supply line into the T.W. King Pump Station. The 20” line will be completed in the Spring of 2012 and the 30” line is scheduled for completion in the Spring of 2013.

Other needed capital projects have been prioritized as Tier 1, Tier 2, and Tier 3 projects. The highest priority projects (Tier 1) identified are shown below:

- Install pressure reducing valves to allow emergency water flow between the higher and lower pressure planes of the water system.
- Add an additional 5 million gallon ground storage tank and two additional 5 MGD pumps at the T.W. King Pump Station to pump water supplied by the new 30" supply line.
- Upgrade existing pumps at the Pearson Road Pump Station to increase capacity in the Higher Pressure Plane.
- Add a 16" distribution line from the Pearson Road Pump Station to Johnson Road.

Longer term projects include looping of key distribution lines, an additional 1.5 million gallon elevated storage tank and additional water supply. Detailed recommendations are included in Section 7.0.

The City of Southlake has implemented water conservation measures including public education and mandatory water use restrictions. A more comprehensive water conservation plan is recommended to include consideration of a water reuse program. The first phase, information gathering, has begun to evaluate future supply options. These options include additional pumps in Fort Worth, alternate water supply sources, and the potential for water reuse options.

SECTION 1.0:

Background and History

In 2010, the City contracted with Cheatham & Associates to provide Water and Wastewater System Master Plan Updates. The purpose for the updates is to assist the City's 2030 Master Plan Committee by identifying and prioritizing infrastructure that will require improvements to meet the projected growth anticipated by the year 2030.

The City of Southlake incorporated in approximately 1956 as a rural sparsely developed bedroom community. At that time, residents were dependent on wells as their sole water supply source. By 1985, the City had grown to a population of approximately 5,000 people. The City had four water wells, including 2 Trinity Sand and 2 Paluxy Sand. There was one 500,000 gallon elevated tank and two 300,000 gallon ground storage tanks.

Since the total capacity of the four wells was 1.3 *million gallons per day* (MGD), it was apparent that the City needed a surface water supply to provide for future growth. In addition, the two Trinity Wells were high in minerals and salts, which made the water undesirable to the customers.

When Grapevine Lake was constructed in 1955, the water rights were granted to the City of Dallas, Park Cities, and the City of Grapevine. Since the City of Southlake had no water rights to Grapevine Lake and had no other available raw water sources, the construction of a treatment plant was not an option. Therefore, the City officials began to explore other potential sources for the City's long-term supply. These sources included the Trinity River Authority (TRA), the City of Grapevine, and the City of Fort Worth.

The Trinity River Authority (TRA) has a treatment plant serving a number of cities in the area including Grapevine and Colleyville and was contacted as a potential supply source. However, due to the high combined cost of purchasing water from TRA and constructing the necessary supply lines to connect onto the system, City of Southlake officials decided against pursuing TRA as a source of supply.

Another option was obtaining water from the City of Grapevine, which operates a plant to treat raw water from Grapevine Lake. However, this allocation of water from the lake to the City of Grapevine was not large enough to satisfy Grapevine's own water demands,

necessitating the purchase of additional water from the TRA. Due to this shortage, the City of Grapevine could not supply water to the City of Southlake.

The final option involved obtaining water from the City of Fort Worth. After considering several factors, including an abundant supply of water from the City of Fort Worth and the relatively close proximity of a supply connection, City officials chose this option as the supply source for the City of Southlake.

A 5.0 million gallon (MG) ground storage tank belonging to the City of Fort Worth is located just west of S.H. 377 on Alta Vista Road, which is on the west side of Keller. Therefore, it was necessary to construct the supply line through Keller. The cost of this supply line was shared between the City of Southlake and the City of Keller in a joint venture agreement. This new supply line resulted in the City of Keller constructing a ground storage tank and pumping station north of F.M. 1709, on Pearson Lane, to serve the eastern portion of their city.

A pumping station was built at the Alta Vista ground storage tank, and a 36" and 30" supply line was constructed through Keller along F.M. 1709, and connected to the Keller storage tanks on North Pearson and the City of Southlake's system at Pearson Road and F.M. 1709. The total capacity of this line is 20 MGD, 10 MGD for Keller and 10 MGD for Southlake. The line and pump station at Alta Vista have been in operation since 1986. Originally, it pumped water directly into the 1.5 MG elevated tank on North White Chapel, and a 0.5 MG elevated tank at Bicentennial Park.

From 1986 to the present, several additions have been made to the City's distribution system allowing the City to keep pace with the residential and commercial growth, including additional pumps at Alta Vista. In 1996, The City constructed a 5.0 MG ground storage tank and booster pump station at Pearson Road and F.M. 1709. This allowed the Alta Vista pumps to discharge into a ground storage tank, rather than the elevated tanks. As a result, additional water could be delivered to the City of Southlake. The water was then pumped into the system and into the elevated tanks from the Pearson Road Facility. A second 1.5 MG elevated storage tank was constructed at Bicentennial Park in 1989, and the 0.5 MG elevated storage tank, which was at the park, was moved to the Florence Road Site. This tank relocation intentionally set a higher overflow elevation than the other elevated tanks in the city, which created an "upper pressure plane". This hydraulic grade change was necessary to serve the west central portion of the City, since it is at a much higher elevation than the remainder of town. Next, a third 1.5 MG elevated storage tank

was constructed in 1998 at the Miron Site along F.M. 1709, west of the Woodland Heights subdivision. This tank boosts the pressure in the eastern portion of town, and provides better fire protection to this vicinity. And finally, in 2006 the City replaced the existing 0.5 MG elevated tank at the Florence Road site with a 1.5 MG elevated tank to serve the upper pressure plane.

The City of Fort Worth has a ground storage tank west of Keller known as the Caylor Tank. The cities of Southlake and Keller jointly constructed a 42" water line from the Caylor Tank through Keller, which is connected to the Pearson Road facilities of both cities. This supply line provides a second source of supply to both cities from Fort Worth. Currently the water flows by gravity in the 42" line from the Caylor site to the Pearson Road tanks of Keller and Southlake with a total capacity of 29 MGD. In 1998, a 5.0 MG ground storage tank and pump station was built on T.W. King Road, North of S.H. 114. This facility will serve as a future second delivery point of water supply from the City of Fort Worth.

SECTION 2.0:

Population Analysis / Water Demand Projections

Data Source

In 2007, City officials updated the water and wastewater impact fees based upon the most recent land use and population projections adopted by the City Planning Department (2025). The planning staff subsequently, published a report containing a water and wastewater plan conforming to these expected projections for the City of Southlake's water and wastewater service area. The Service area only includes the City limits since there is no extra-territorial jurisdiction (ETJ) area to be annexed or served by the City of Southlake. The City is currently in the process of updating the Future Land Use Map (2030). These Land Use and Population Projections shown below are a result of this recent updating of the 2007 Impact Fee Study.

Residential Growth

Population, housing and acre estimates can be derived from the land use study for three periods of time:

1) **Current as of October 1, 2009.** The current population is estimated to be 26,650 people. This represents approximately 77.96% of the ultimate population and the ultimate water and wastewater requirements for the residential sector, which is the predominate land use projected for Southlake.

2) **Growth for the ten-year period from 2012 to 2020.** The growth for the ten-year period is estimated to be 5,000 people. This means that 14.62% of the ultimate residential sector utility demands will be added in the ten-year period. When added to the existing residential base, 92.56% of the water demands from the residential sector are estimated to be made by the end of the ten-year period

3) **Ultimate capacity or growth for the City to 2025 and beyond.** The ultimate population estimate is 34,188 people. The remaining population, 2,538 or 7.42% of the ultimate utility demand from the residential sector, is projected to occur between 2020 and 2025.

Population and Water Demands

As stated above, the City of Southlake year 2009 population has been estimated to be 26,650 by the *North Central Texas Council of Governments* (NCTCOG). Using the 2025 Land Use Assumptions Report the system build-out population is projected at 34,188.

To review the projected water demands the following sources were used: The City of Southlake's water production data and the historical water use data over the last five years indicates an increasing trend in the per capita water usage. This trend is principally due to increased use of irrigation systems. The results of the last five years of consumption data and the projected per capita use are illustrated in **Table 2.1**. Based upon the historical increase in per capita water usage, it is recommended that the average day per capita water demand of 385 *gallons per capita day* (GPCD) be used for the projection of future water demands.

Table 2.1

Historical Water System Demand Summary

Year	Estimated Population	Water Demands (MGD)			Demand Factor	GPCD
		Average Day	Peak Day	Peak Hour*		
2005	21,519	6.251	15.646	31.292	2.503	290
2006	25,654	11.014	20.049	40.098	1.820	429
2007	25,700	6.749	16.334	32.668	2.420	263
2008	26,100	8.525	25.390	50.780	2.978	327
2009	26,650	8.139	19.799	39.598	2.433	305
2010	26,650	8.494	18.322	36.644	2.157	319
2011	26,650	12.210	21.925	43.850	1.796	458

* Peak Hour Estimated Based upon Peak Day Multiplied by 2.0.

As shown in 2009 the system wide population was 26,650, and the per capita water usage was an average day water demand of 8.454 MGD or 317 GPCD. The water distribution system needs to be capable of supplying the peak day demands with the supply coming from Fort Worth. A peak hour to peak day ratio of 2.0 was selected for the water system analysis for the City of Southlake. The distribution system will typically supply the peak hour demand using the pumping facilities in combination with the elevated storage tanks. The method shown above was used to compute the average day, peak day and peak demands for the years 2015, 2020 and ultimate (2025).

Table 2.2

Water System Demand Summary				
Year	Population	Average Day Demand (MGD)	Peak Day Demand (MGD)	Peak Hour Demand (MGD)
2012	26,917	10.36	26.94	53.89
2015	29,245	11.26	29.27	58.54
2020	31,717	12.21	31.75	63.50
Ultimate	34,188	13.16	34.22	68.44

Projected Residential and Non-Residential Build-Out / Ultimate Demand

As shown in **Table 2.2**, the projected population of Southlake at build-out is 34,188 persons. The water system must serve this population, as well as the non-residential development. It is projected that the residential and non-residential build out will occur in approximately 15 years or 2025. Growth rates in water consumption are assumed to be the same for the residential and non-residential sectors. While the overall growth rate of the non-residential sector will likely be higher, this sector also has a great conservation potential as it includes large water users. The peak day demand is a factor of 2.6 times the average day, and the peak hour demand is 2.0 times the peak day.

SECTION 3.0:

Supply, Conservation, and Reuse

Supply

The City of Southlake currently receives its water supply from the City of Fort Worth through two pipelines. Up to 10 MGD is pumped through a 30" and 36" pipeline from the Alta Vista Tank in Fort Worth to the Pearson Road Pump Station in Southlake. Water flows by gravity through a 42" pipeline from the Caylor Tank in Fort Worth to the Pearson Road Pump Station in Southlake. A 30" supply line is under construction from this 42" line at the intersection of Florence Road and Pearson Road, through the Town of Westlake to the existing T.W. King Pump Station in Southlake. As part of the negotiations with Westlake, Southlake agreed to give Westlake 2 MGD capacity from the 30" line.

Based on the negotiated agreements between the cities, the 42" and 30" lines will provide Keller with 7 MGD, Westlake with 2 MGD, and Southlake with 20 MGD. This new 30" line will allow the T.W. King Pump Station to contribute over 40% of the peak demand with the result being less water needed from the Pearson Road Pump Station. With the 10 MGD capacity in the 30"/36" line from Alta Vista and the 20 MGD capacity in the 42" and 30" lines from Caylor, the existing total supply capacity for the City of Southlake is 30 MGD.

An 8" emergency interconnection exists with the City of Grapevine for emergency use only, in the event of failure of one of the systems. Increasing this to a 12" emergency interconnection and adding a second 8" emergency interconnection are planned to help with emergency fire flow in the event of system failure.

As shown in this report, the future build-out peak day demand is projected to be 34.22 MGD. To meet successive peak day demands, the City must evaluate alternatives due to the supply shortfall. Additional study is needed to evaluate these alternatives, which may include the following:

- Construct a pump station at the existing Fort Worth Caylor Tank Site to increase the supply capacity from Fort Worth by approximately 5 MGD.
- Evaluate alternative supplies that may be available such as The Trinity River Authority (TRA) or Upper Trinity Regional Water District. This would provide the City with a secondary supply source and would provide a supply redundancy.

- Evaluate options for reuse infrastructure that would reuse wastewater plant effluent for large water users such as irrigation for parks, golf courses, and large commercial/industrial users. Water reuse options could include partnership with a wastewater plant operator such as the TRA Denton Creek Wastewater Plant and would be part of a citywide water conservation plan.
- Evaluate alternatives and timing of a combination of 2 or more of the above mentioned alternatives, that would provide the most feasible overall solution for the City. The first phase of this study, data gathering and development of alternatives is underway, and future phases will include concept design, cost estimates and comparison of alternatives.

Conservation

With the limits on potable water supplies for municipal services, increasing, Southlake and other local governments have enacted conservation measures to reduce per capita demands. Such conservation programs have focused on education, low water use fixtures/landscaping, alternative water supplies, modified rate schedules and irrigation audits. Water systems that have seen success in reducing their demands have used a combination all these aspects tailored to their community.

Education programs have varied from simple mail outs, to active programs promoting low demand irrigation, low volume fixtures, and on-going school programs. Some programs have been tied to city ordinances where days and hours of irrigation are limited and customers not following such requirements receive focused attention. The landscaping community is also promoting the use of native vegetation which is more tolerant to seasonal precipitation variations and more resistant to native pests and diseases.

Low water use ordinances are becoming increasingly common in the U.S. Many home improvement stores provide as part of their inventory various low and no flow fixtures along with irrigation controls to limit use in the event of rainfall. Low water use landscaping has gained popularity where new developments or new construction is required to use such systems. Reduction in water impact fees may be used to entice such construction. Many of these ordinances are also passed with new tiered utility rate structure that encourages lower water use or provides a lower cost by using an alternative water supply.

Southlake's water consumption is heavily dominated by residential water use, followed by commercial use. Industrial water use is not a major component of the city's demand. During the summer months, demand is heavily impacted by irrigation uses. The irrigation

uses during the Summer months can account for approximately 60% of the total water demand. With the trend toward needing to reduce the city's overall water consumption, the community must find ways to decrease its water consumption wherever and whenever possible. As a recommendation of the 2030 Water Plan, the Committee would recommend that staff undertake the development of an overall Water Conservation Master Plan. The Committee envisions that this plan would provide the following information:

1. An analysis of the community's demographics as it relates to the use of potable water;
2. Estimate the effectiveness of recent water conservation and drought contingency measures; and,
3. Develop a 10-year plan for effective water conservation measures that could be used to reduce the consumption of potable water based upon the city's specific demographics through the implementation of water conservation measures.

Reuse and Alternative Water Supply

Perhaps the single program that directly reduces per capita usage is alternative water supply for irrigation. Extensive programs throughout the U.S. have been developed that provide reuse water back to customers. In many instances this water is provided free or at a reduced cost versus potable water rates.

Initial programs in the U.S. have utilized treated wastewater meeting what has been deemed "public access" standards. This level of treatment, which requires wastewater to be filtered and treated with enhanced disinfection, is acceptable for irrigation. Water reuse also requires pumping and distribution systems back to the customers. Frequently, with the existing customers and subdivisions, the cost to provide the distribution network is prohibitive. Many reuse system have focused on new development areas such that the infrastructure can be added as the new subdivisions come on line. Secondly, major existing water users such as golf courses, parks and schools can be more effectively retrofitted if planned in conjunction with new development areas.

SECTION 4.0:

Ultimate Storage Requirements

The following section summarizes an evaluation of the storage requirements for the City based on criteria used by the industry. These criteria are typically more stringent than TCEQ requirements and take into consideration additional factors including operational flexibility and fire protection.

Total Ground Storage Required:

The City has two 5 million gallon tanks at the Pearson Road site, and one 5 million gallon tank at T.W. King. The two tanks at Pearson are adequate to provide storage to meet approximately one-third of the ultimate peak day demands of 34.22 MGD. The one 5 million gallon tank at the T.W. King facility can meet approximately 15 percent the peak day demands; however a second tank is planned in the future. Once this second tank at the T.W. King site is on line, the City would have 20 million gallons of water in ground storage plus 7.5 million gallons of elevated storage for a total of 27.50 million gallons. This would allow the City to operate for approximately 19 hours without any additional supply if an emergency situation rendered the supply unavailable. (14 hours based on ground storage only.)

The recommended amount of ground storage is the equivalent of 12 hours of the maximum day demand. **Table 4.1** displays the existing and proposed ground storage capacities with the amount of drain time available to meet peak day demands. With the proposed additional 5.0 MGD ground storage at the T.W. King Pump Station, there will be 14 hours of the maximum day demand at ultimate build-out.

Table 4.1

Ground Storage Recommendation					
	Maximum Day Demand (MGD)	**Existing Ground Storage (MG)**	**Hours of Total Ground Storage Available[1]**	**Total Existing and Proposed Ground Storage (MG)**	**Hours of Ground Storage with Proposed Improvements***
2012	26.94	15.0	13.4	15.0	13.4
2015	29.27	15.0	12.3	15.0	12.3
2020	31.75	15.0	11.3	20.0[2]	15.1
Ultimate	34.22	15.0	10.5	20.0	14.0

[1] Hours of drain time available under maximum day demands
[2] Includes additional 5.0 MGD at T.W. King

Total Elevated Storage Required:

The design criteria used to analyze existing elevated storage tank capacity is the ability to provide adequate storage for peak hour demands plus emergency storage for fire protection. It is typically assumed that half of the elevated storage tank capacity is used to meet peak hourly demands in excess of the peak day rate (equalization volume), while the other half of the tank is used for fire protection and emergency conditions (fire/emergency volume). According to the Insurance Services Office (ISO), the maximum fire flow a municipality is required to provide is 3,500 gpm for a 3-hour duration. While typical residential and commercial fire flow requirements are 1,000 gpm and 1,500 gpm, respectively, some industrial fire flows can approach the 3,000 to 3,500 gpm range or greater. Therefore, for the elevated storage requirement a fire flow requirement of 3,500 gpm for a 3-hour duration was selected.

Table 4.2 provides a summary of the elevated storage requirements using two criteria. Criteria 1 represents twice the required equalization volume, while Criteria 2 represents the equalization volume plus the fire/emergency volume. The upper pressure plane is proposed to have 2486 connections at build-out. This is approximately 20 percent of the total number of connections for the entire city (12,432). Therefore, the build-out peak day of the upper pressure plane is approximately 20 percent of 34.22 MGD or 6.84 MGD. Similarly, the peak day of the lower pressure plane is projected to be 27.38 MGD at build-out.

Table 4.2

Elevated Storage Requirements		
Proposed Upper Pressure Plane		
	Criteria 1	**Criteria 2**
Build-out Peak Day Demand (MGD)	6.84	6.84
Build-out Peak Hour Demand (MGD)	13.68	13.68
40% of Peak Hour Demand (MGD)	5.47	5.47
Required Equalization Volume (MG) [(1)]	0.68	0.68
Required Fire Volume (MG) [(2)]	N/A	0.63
Required Total Volume (MG)	1.37[(3)]	1.31[(4)]
Minimum Required (MG)	1.37	
Proposed Lower Pressure Plane		
	Criteria 1	**Criteria 2**
Build-out Peak Day Demand (MGD)	27.38	27.38
Build-out Peak Hour Demand (MGD)	54.76	54.76
40% of Peak Hour Demand (MGD)	21.90	21.90
Required Equalization Volume (MG) [(1)]	2.74	2.74
Required Fire Volume (MG) [(2)]	N/A	0.63
Required Total Volume (MG)	5.48[(3)]	3.37[(4)]
Minimum Required (MG)	5.48	

[(1)]The volume required to meet 40% of the peak hour demand for a duration of 3 hours
[(2)] The volume required to meet a 3,500 gpm fire flow for 3 hours
[(3)]Twice the required equalization volume
[(4)]Required equalization volume plus the required fire flow

Based on the calculations and a peak hour factor of 2.0, a fourth 1.5 million gallon elevated tank on the low pressure plane at the T.W. King elevated tank site will be required. The City currently owns this site, which is north of the existing T.W. King Pump station site. It is recommended that the City's Water System Master Plan be reviewed and updated every two to three years, to determine if additional storage tanks are necessary to provide service to the projected water demands, based upon any changes in the land use and growth patterns of the City. Four pressure reducing valves we recommended at the boundary between the higher and lower pressure plane to provide additional fire flow by allowing water to automatically flow across this boundary under emergency conditions.

The criteria established by the State Board of Insurance (Key Rate Schedule) requires a ground storage tank capable of holding a capacity based upon 130 gallons per capita for a 24-hour period or 4.44 million gallons of ground storage for 34,188 persons and an elevated storage capable of holding a 10-hour supply. Elevated storage capable of holding a 10-hour supply of water yields 1.85 million gallons of elevated storage. Therefore, the

City's existing ground and elevated storage tanks more than meet the requirements of The State Board of Insurance.

The following **Table 4.3 and Table 4.4** summarize the existing elevated and total storage requirements based on TCEQ criteria:

Table 4.3

Existing Elevated and Total Storage - TCEQ Requirements							
		Total Storage (MG)			Elevated Storage (MG)		
Pressure Plane	**Existing Connections**	**Existing***	**TCEQ Minimum**	**Excess of TCEQ**	**Existing**	**TCEQ Minimum**	**Excess of TCEQ**
Lower	7,710	17.00	1.54	16.61	4.50	0.77	4.11
Upper	1,965	4.00	0.39	3.64	1.50	0.20	1.14
Total	**9,675**	**21.0**	**1.94**	**20.25**	**6.00**	**0.97**	**5.25**

*Pearson ground storage 7.5 MG lower, 2.5 MG upper

The following **Table 4.4** is a summary of the proposed build-out elevated and total storage requirements based on TCEQ criteria:

Table 4.4

Proposed Build-out Elevated and Total Storage - TCEQ Requirements							
		Total Storage (MG)			Elevated Storage (MG)		
Pressure Plane	**Estimated Build-out Connections**	**Existing and Proposed***	**TCEQ Minimum**	**Excess of TCEQ**	**Existing and Proposed**	**TCEQ Minimum**	**Excess of TCEQ**
Lower	9,946	22.00	1.99	20.01	6.00	0.99	5.01
Upper	2,486	5.50	0.50	5.00	1.50	0.25	1.25
Total	**12,432**	**27.50**	**2.49**	**25.01**	**7.50**	**1.24**	**6.26**

*Pearson ground storage 7.5 MG lower, 2.5 MG upper

The following **Table 4.5** illustrates the size and location of existing and proposed storage tanks.

Table 4.5

Total Water Storage Capacity		
Location	Type	Size (MG)
Existing		
Dove Road at White Chapel	Elevated	1.50
Bicentennial Park	Elevated	1.50
Miron Site	Elevated	1.50
Florence Site (Upper Pressure Plane)	Elevated	1.50
T.W. King Site	Ground	5.00
Pearson Site	Ground	*10.00
Sub Total (Existing Storage)		**21.00**
Future		
T.W. King Site (Lower Pressure Plane)	Elevated	1.50
T.W. King Site	Ground	5.00
Sub Total (Future Storage)		**6.50**
TOTAL STORAGE (Build-out)		**27.50**

*7.5 MG Lower, 2.5 MG Upper

SECTION 5.0:

Booster Pump Stations

Interim Pumping Conditions

The City of Southlake currently has two pump stations. One is located at F.M. 1709 and Pearson Lane, which is the City boundary on the west. The second pumping station is on T.W. King Road just north of S.H. 114. This station is also situated on the west City limit line. The Pearson Road pumping station site has two 5.0 million gallon ground storage tanks in place, and the T.W. King location has one existing 5.0 million gallon tank with a provision for a second 5.0 MG tank in the future.

Due to the interim supply conditions mentioned in the previous section, the City has been using the T.W. King pump station on a limited basis during the past two years. This is accomplished by pumping water through the distribution system, to the T.W. King storage tank, during the off peak periods at night. The tank fills each night during summer months and the pump station pumps into the system during the peak time demands to assist in meeting the system peak day demands.

Therefore, both pump stations are used for the peak periods in summer months. This process has enabled the City to keep pace with the increased demand over the last two years. However, with continued City growth, the T.W. King Pump station facility must be capable of contributing more to the future system demands. Once the new 30" supply line is in place, and is capable of filling the T.W. King tank from the Fort Worth supply, both pump stations will be available for continuous operation. Construction of this line is scheduled for completion in the spring of 2013. Until then, the City will only be able to use the T.W. King facility on a limited basis. This places a strain upon the system during summer months, and does not allow for any interruption of the Pearson Road facility, without possibly resulting in a water shortage situation. The City implemented a pump maintenance rotation program in 2007. Based upon run times of the pumps, the pumps will be reconditioned approximately every 5 years.

Future Pumping Conditions

On **Table 2.2,** it was determined that the ultimate peak hour demand will be approximately 68.44 MGD. This demand must be met from a combination of pumping and supply from elevated storage. The peak day demand at build-out was shown to be 34.22 MGD. The pump stations should be capable of supplying 1.25 times the peak day demand or 42.78 MGD, with one pump out of service at each station. Additional peak hour flow will be

provided by the elevated tanks. Of this amount (42.78 MGD), 25.25 MGD should be supplied by the Pearson Road pump station, and 17.53 MGD from the T.W. King Pump Station. This is based upon the water flow projections for the T.W. King and Pearson Road Pumping Stations. The projections indicate that 41 percent of the build-out peak day be supplied by the T.W. King Pump Station, and 59 percent of the build-out peak day be supplied by the Pearson Road Pump Station. Therefore the flow to be supplied at the Pearson Road Pump Station is 42.78 MGD x 59 percent = 25.25 MGD.

The Pearson Road Pump Station serves both the high pressure plane and the low pressure plane. The ultimate system peak hour demand to be furnished by the Pearson Road station is 25.25 MGD. The ultimate build-out of the upper pressure plane is estimated to be 2486 connections, or 20 percent of the estimated total City build-out connections of 12,432. Therefore the peak hour demand on this station for the upper pressure plane is 20 percent of 42.78 MGD or 8.55 MGD. A flow of 8.55 MGD is required by the high pressure plane and 16.70 MGD by the low plane at the Pearson Road Station. This pump station was constructed in 1996, and currently has three pumps for the high pressure plane, and four pumps for the low pressure plane. The required pumping capacity at build-out is 17.53 MGD all on the lower plane.

The T.W. King facility only serves the low pressure plane. The required pumping capacity at build-out is 17.53 MGD all on the lower plane. This station currently has three pumps.

The following **Tables 5.1, 5.2, 5.3 and 5.4** illustrate the existing pump station firm capacities, TCEQ requirements, and ultimate pumping capacity.

Table 5.1

Year	Rated Capacity	*Operating Capacity	**Pump Station Total Operating Firm Capacity
	GPM	GPM	MGD
Pearson BPS – Upper Pressure Plane			
Pump 1	2250	2360	6.80
Pump 2	2250	2360	
Pump 3	2250	2360	
Pearson BPS – Lower Pressure Plane			
Pump 1	3474	4600	19.90
Pump 2	3474	4600	
Pump 3	3474	4600	
Pump 4	3474	4600	
T.W. King - Lower Pressure Plane			
Pump 1	3474	4350	12.50
Pump 2	3474	4350	
Pump 3	3474	4350	
Total Pumping Capacity			39.20

*

Operating Capacity: Pumping capacity while operating against system pressure.
**Total Operating Capacity: Capacity with largest pump out of service and operating against system pressure.

Table 5.2

Existing Pump Station Capacity - TCEQ Requirements					
				Pump Capacity (MGD)	
Pressure Plane	Existing Connections	Elevated Storage (MG)	Elevated Storage (gal/connection)	Total Capacity	TCEQ Required Minimum (Total)
Lower	7,710	4.50	584	32.40	6.66
Upper	1,965	1.50	763	6.80	1.70

TCEQ Requirement: 0.60 GPM/Connection

Table 5.3

Ultimate Pump Station Capacity - TCEQ Requirements					
				Pump Capacity (MGD)	
Pressure Plane	Estimated Build-out Connections	Elevated Storage (MG)	Elevated Storage (gal/connection)	Total Capacity	TCEQ Required Minimum (Total)
Lower	9,946	6.00	452	34.23	8.59
Upper	2,486	1.50	603	8.55	2.15

Table 5.4

Ultimate Required Pump Station Capacities			
Pressure Plane	Ultimate Capacity Required MGD	Existing Operating Capacity (MGD)	Additional Capacity Required (MGD)
Pearson Upper	8,55	6.80	1.75
Pearson Lower	16.70	19.90	0
T.W. King Lower	17.53	12.50	5.02
Total	42.78*	39.20	6.77

*Total ultimate pumping capacity is 1.25 times the peak day demand from Table 2.2

As shown in **Table 5.5**, the Pearson Road pumping station's low plane pumps have an existing pumping capacity of 19.90 MGD. The build-out requirement for the lower pressure plane is 19.90 MGD. Therefore the existing pumps are adequate for build-out.

The existing high pressure plane pumps at the Pearson Road facility must be upgraded in the future. Currently, there are three pumps with an operating capacity of 6.80 MGD. In the year 2015, each of the two low capacity pumps need to be replaced with higher capacity pumps resulting in an operating capacity of 8.55 MGD to the high pressure plane. This will provide the high pressure plane with 100% of the ultimate requirement of 8.55 MGD.

Table 5.5 also indicates the pumping requirements for the T.W. King Pump Station. As shown, the existing pump operating capacity is 12.50 MGD. Two additional pumps will be needed in the future to obtain an ultimate operating capacity of 17.51 MGD.

Table 5.5

Pump Station Capacity Requirements Summary					
Year	**Required Pump Capacity***	**Available Capacity**	**Additional Capacity Required**	**Total Pump Capacity**	**Improvement**
	MGD	MGD	MGD	MGD	
Pearson BPS - Higher Pressure Plane					
2012	6.74	6.80	0	6.80	
2015	7.22	6.80	0.42	8.55	Change out impellers upsize motors and electrical increase from 6.08 MGD to 8.55 MGD
2020	7.72	8.55	0	8.55	
Build-out	8.55	8.55	0	8.55	
Pearson BPS - Lower Pressure Plane					
2012	14.44	19.90	0	19.90	
2015	14.07	19.90	0	19.90	
2020	15.05	19.90	0	19.90	
Build-out	16.68	19.90	0	19.90	
T.W. King - Lower Pressure Plane					
2012	12.50	12.50	0	12.50	
2015	14.79	12.50	2.29	18.79	Add one or two 5.0 MGD pumps
2020	15.82	18.79	0	18.79	
Build-out	17.55	18.79	0	18.79	
Total Both Pump Stations – Both Pressure Planes					
2012	33.68	39.20	0	39.20	
2015	36.08	39.20	2.71	47.24	
2020	38.59	47.24	0	47.24	
Build-out	42.78	47.24	0	47.24	

*Required pump capacity is 1.25 times the water system demand from Table 3.2, split between the two pump stations and two pressure planes.

Each pumping station is currently providing service to the water system. Both stations were designed so that additional pumps could be added, as required, to enable the pumping capacity to meet or exceed the system demands.

The following **Figure 5.1** illustrates the existing pumping equipment at the Pearson Road pump station.

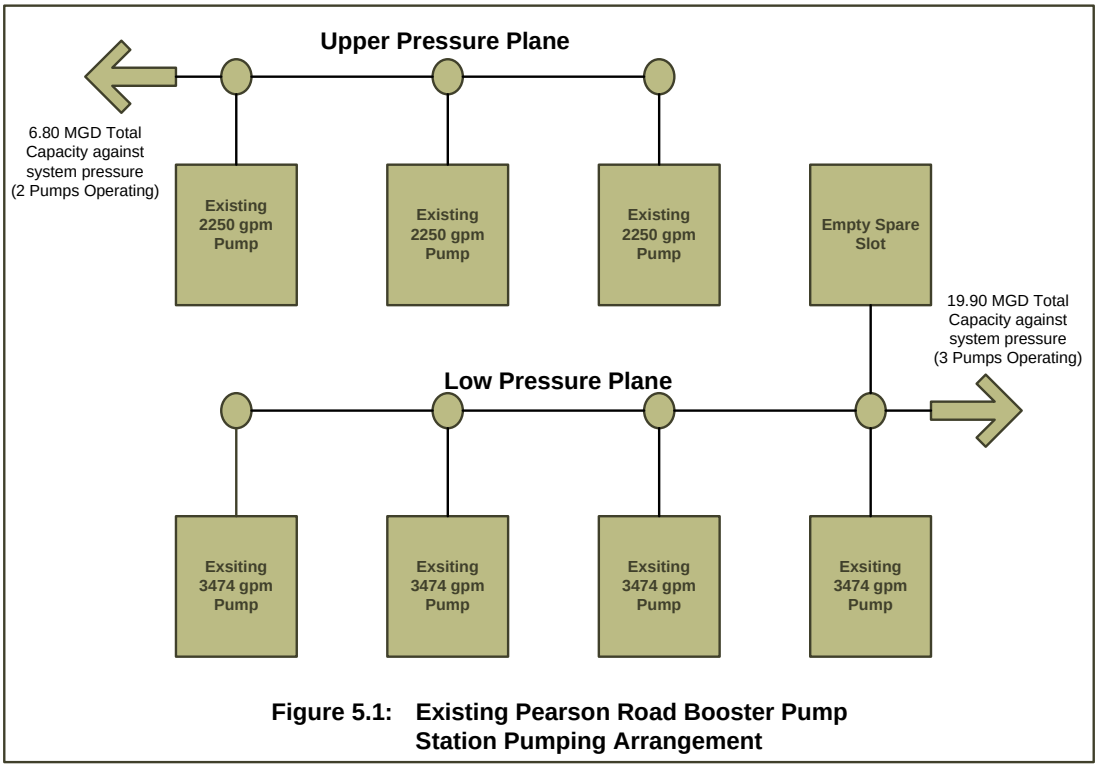

Figure 5.1: Existing Pearson Road Booster Pump Station Pumping Arrangement

The following **Figure 5.2** illustrates the existing pumping equipment at the T.W. King Booster pump station.

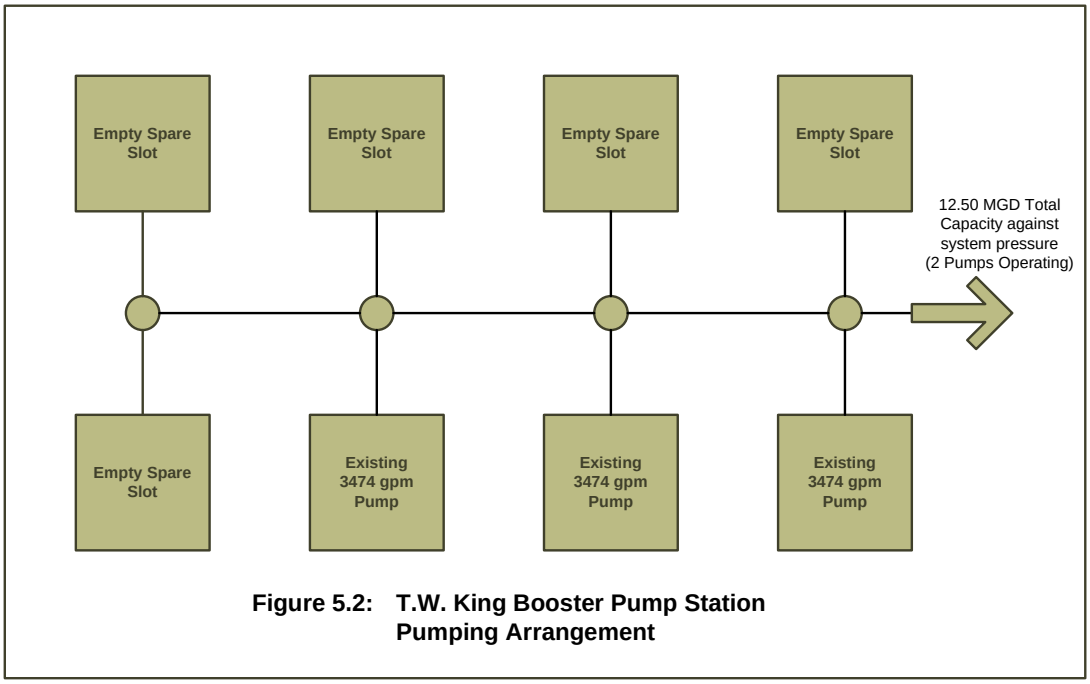

Figure 5.2: T.W. King Booster Pump Station Pumping Arrangement

The following **Figure 5.3** illustrates the ultimate pumping equipment at the Pearson Road pump station.

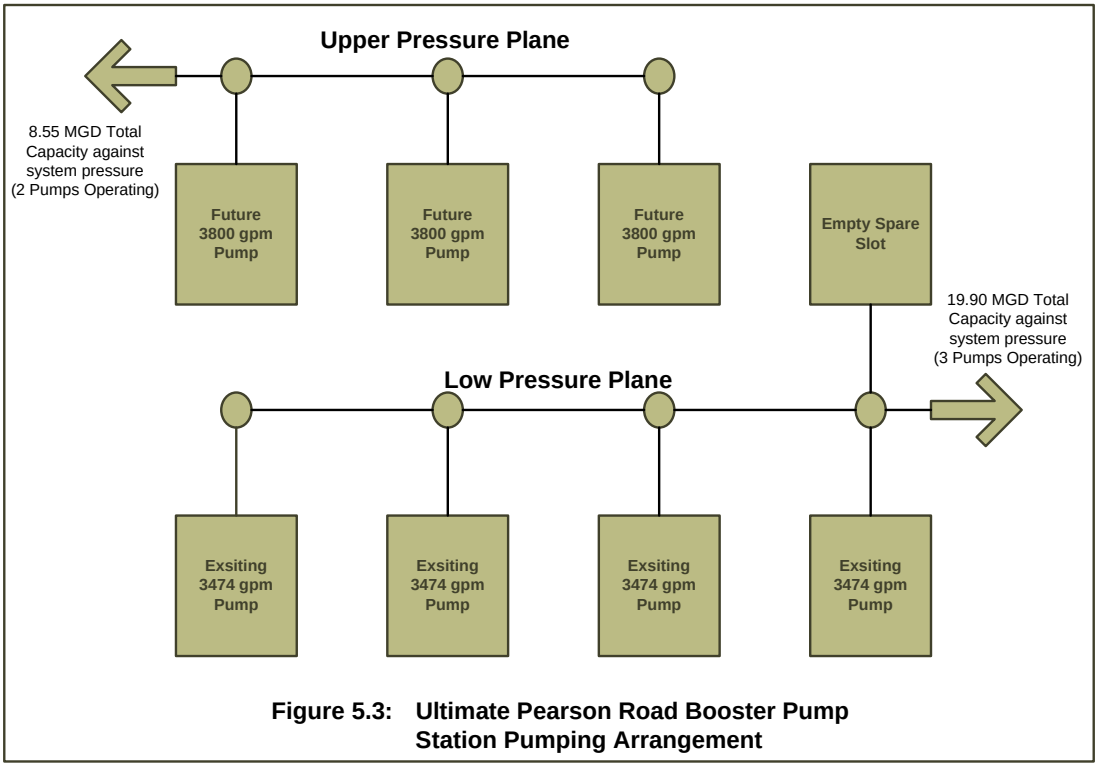

Figure 5.3: Ultimate Pearson Road Booster Pump Station Pumping Arrangement

The following **Figure 5.4** illustrates the ultimate pumping equipment at the T.W. King Booster pump station

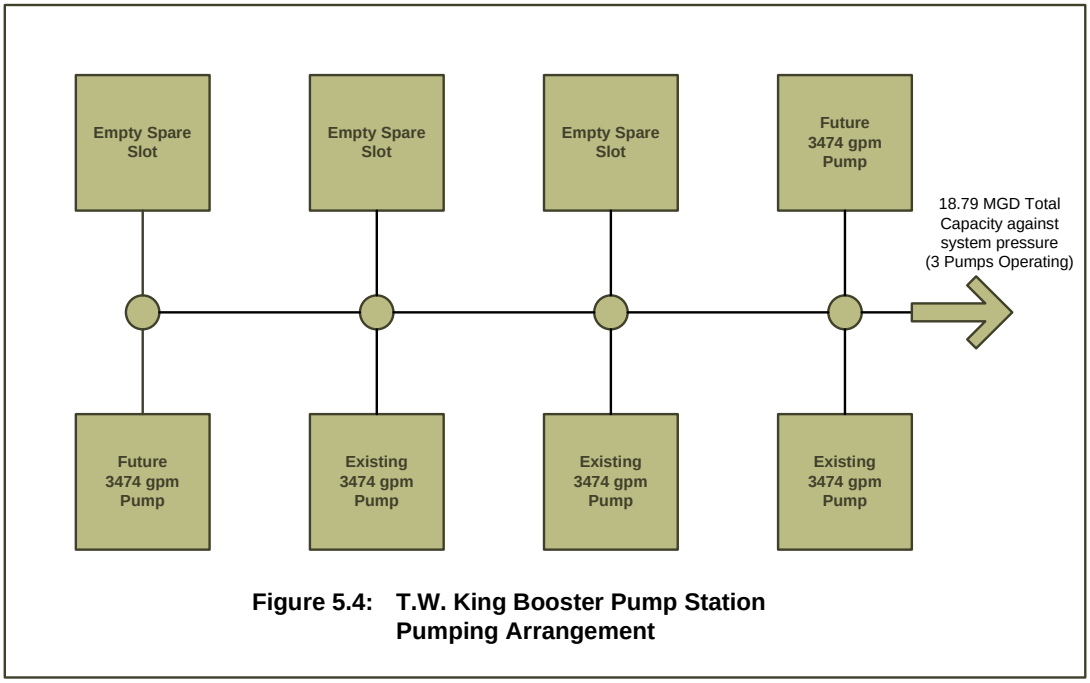

Figure 5.4: T.W. King Booster Pump Station Pumping Arrangement

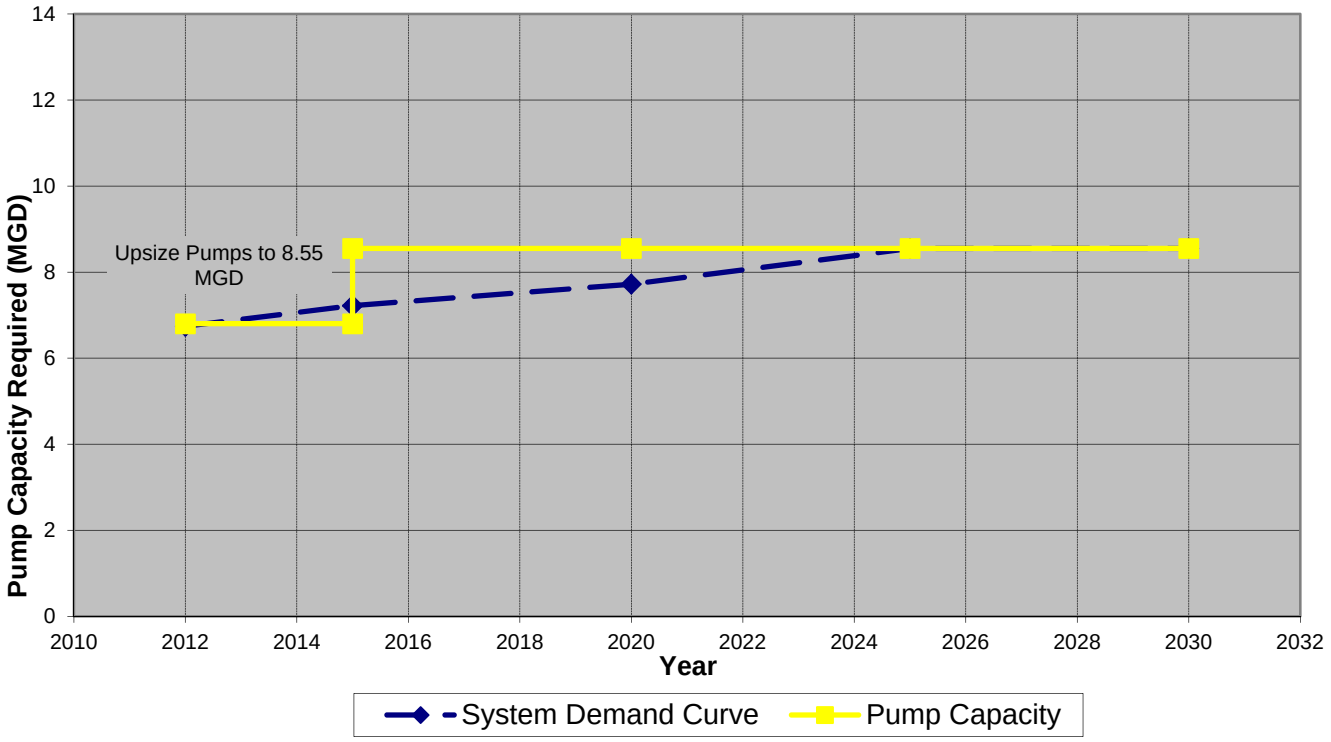

Figure 5.5: Pumping Requirements for Pearson Road Station High Pressure Plane

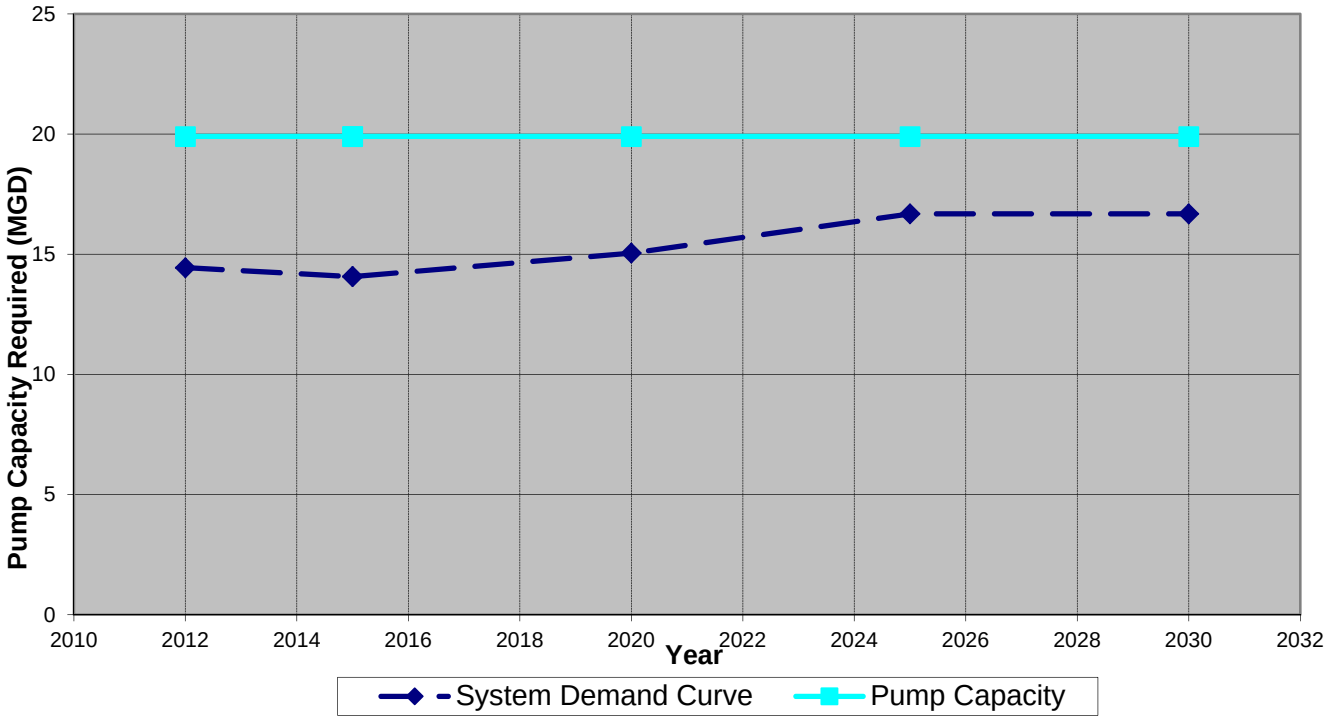

Figure 5.6: Pumping Requirements for Pearson Road Station Low Pressure Plane

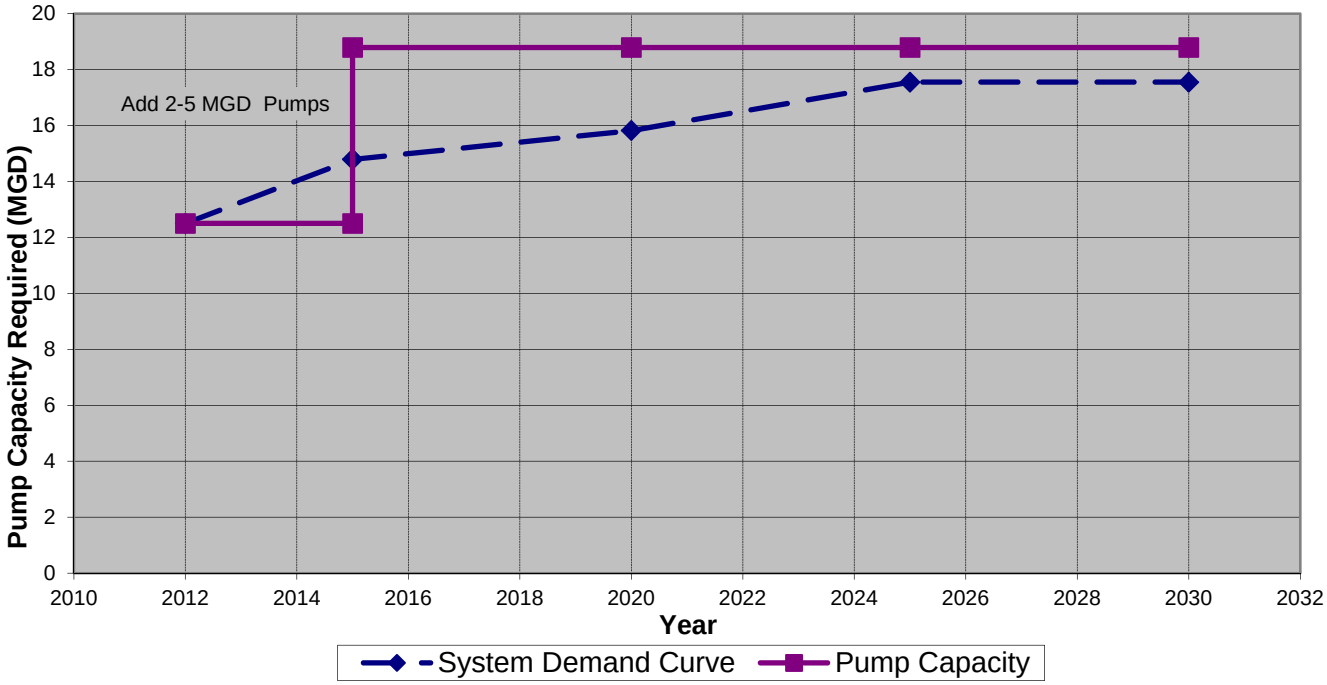

Figure 5.7: Pumping Requirements for T.W. King Station Low Pressure Plane

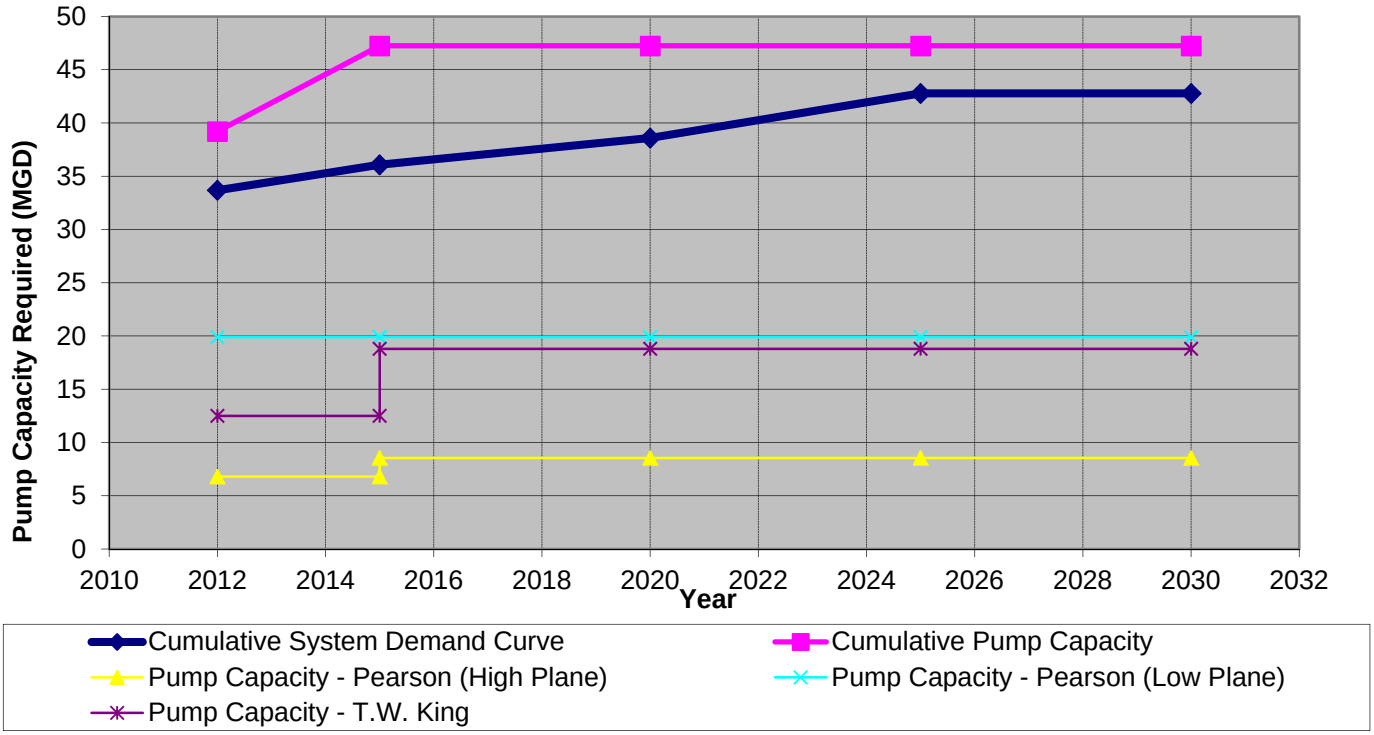

Figure 5.8: Cumulative System Pumping Requirements Low and High Pressure Plane

SECTION 6.0:

Water Distribution System Analysis

Domestic/Non-Residential Requirements

The City's water system was analyzed for the 2012, 2015, 2020, and ultimate water demands (2025). This analysis was performed on a computer using the program WaterCAD version by Bentley Systems, Inc. software.

Due to variations in the terrain and ground elevations throughout the City, the City's water system is split into two pressure planes. The majority of the City is served by the low pressure plane, which is governed by the elevated storage tanks with an overflow elevation of 801 feet. The remainder of the City is served by the high pressure plane with an overflow elevation of 860 feet.

The model analysis can be structured to simulate any water demand on the system. If the results indicate that there is adequate water pressure throughout the entire system, it is assumed that the distribution system, which is either in place at the time, or is proposed in the future, is adequate for that situation. The worst situation for analysis is the peak hour condition. If the system can meet the peak hour flows, it can also meet any situation, which may occur from a water system demand standpoint.

The model analysis results produce the pressures throughout the system. The goal of the analysis is to determine if the system can maintain a minimum pressure of 35 PSI, while providing the system with the peak hour demands.

If however, the analysis indicates inadequate pressure anywhere in the system, some improvement to the system will be required. Additional lines are added which are indicated on the ultimate system plan, until the repeated analysis indicates that the low pressure situation has been corrected. This process results in recommended lines, which will be required prior to that particular frame of time.

Simulating the water demands of the 2012 peak hour with the existing distribution system was the initial model run. A similar analysis was made of the peak hour demands for the high and low pressure plane systems for 2012, 2015, 2020, and 2025 conditions. This analysis was based upon the following system demands in **Table 6.1.** This analysis

indicates the need for additional water lines and looping of existing lines in the distribution system.

Table 6.1

High and Low Pressure Plane Demand Summary						
	Water Demands (Peak Day)			Water Demands (Peak Hour)		
Year	Low Pressure Plane	High Pressure Plane	Total	Low Pressure Plane	High Pressure Plane	Total
2012	21.55	5.39	26.94	43.11	10.78	53.89
2015	23.39	5.89	29.27	46.77	11.77	58.54
2020	25.38	6.37	31.75	50.74	12.76	63.50
Ultimate	27.38	6.84	34.22	54.68	13.76	68.44

Fire Flow Requirements

The determination of the amount of *Minimum Fire Flow Required* (MFFR), or the minimum flow rate necessary to provide sufficient water for fire protection, is dependent on many factors which may vary throughout the City limits. Some factors that may affect the MFFR include the following:

- Type of Construction (Noncombustible, Fire Resistive, etc.)
- Distance between Structures
- Square Footage of Structure
- Occupancy Classification (manufacturing, non-manufacturing, etc.)
- Sprinkled or Non-sprinkled Structures

There are several methods that have been developed by different agencies and institutions to determine the MFFR for a particular facility. These methods consist of a MFFR formula to represent the dependent factors mentioned above, as well as others not listed. From a water system planning prospective, it would be very difficult to determine the MFFR for all locations throughout the City for both the existing and future developments. Even if this information was available, there most likely will be several areas throughout the city that would not be economically feasible to provide the MFFR solely from the city's water distribution system. At these locations, the owner(s) of the future development must provide additional fire protection facilities, such as interior sprinkler facilities, and/or private booster pumps to obtain the MFFR. In water system planning, the Public Works Department, Fire department, and City Engineers should work together to mutually agree

on a MFFR that not only adequately provides fire protection, but also is economically feasible.

For the purposes of this water system study, we have determined the MFFR to be 1750 (GPM), and a minimum pressure of 20 PSI. Furthermore, we made other assumptions necessary for the fire flow analysis. These assumptions are as follows:

1. Booster Pumps Active with Largest Pump Out-of-Service
2. Elevated Storage Tanks Approximately One-Half Full
3. Minimum Residual Pressure at Fire Flow Location = 20 (PSI)
4. Minimum Residual Pressure for System = 20 (PSI)
5. Fire Flow analysis during peak hour demand

We developed a computer model of the City's water system and with these assumptions, analyzed the amount of fire flow available at water line intersection points or junction nodes throughout the system. We performed this analysis on the existing system, as well as the water system for 2015, 2020, and 2025 or (Ultimate build-out). We then compared the results of the computer model for each of these years to the previously determined MFFR. This comparison indicated several existing dead end lines that we recommend be upgraded to a minimum size of 8" diameter. In addition, there are a few locations where we recommend the construction of new water lines to provide a "looped" system necessary to obtain the MFFR. We also recommend pressure reducing valves (PRVs) be installed at four locations between the high and low pressure planes. This will allow water to flow from the low plane to the high plane if the pressure in the high plane becomes lower than the pressure in the low plane during an emergency situation. This results in vastly improved fire flow capacity in the high plane, since the low plane pumps and elevated tanks will now be able to contribute during a fire flow event. In addition, the valves may also allow for the upper plane to contribute to the lower plane under certain pressure conditions. **Exhibits 1.2 and 1.3** illustrate the improvement in fire flow protection that the PRV valves will provide.

Distribution System Maps

The City's distribution system has been analyzed to determine what will be required from a water distribution standpoint to provide adequate service to the potential water customers. In the appendix there are **Exhibits 1.2 through 1.5**, which illustrate the distribution lines required for the years 2012, 2015, 2020, and build-out. It was determined in the system analysis that these additional lines will be necessary to meet minimum system pressures and to provide fire protection.

Each map in the exhibits is color coded to indicate the lines and sizes, which should be in place prior to the year indicated on the map. The City staff can use these maps for planning purposes to budget for future water projects. It is recommended that the water system model and analysis be updated every year to assure that new information regarding upcoming development has not changed the need for new lines from the previous studies. Also, if a new development, being commercial, industrial, or residential is proposing to be constructed, the additional water system improvements should be added to the computer model to determine the amount of domestic and fire flow available at the proposed project location. The fire flow information should only be furnished to a developer or owner with the understanding that the fire flow results are not guaranteed, and it is the responsibility of the owner and the fire protection designer to determine the facilities required in order to provide adequate fire protection for a particular project.

SECTION 7.0:

Recommended System Improvements

The City of Southlake has implemented mandatory water use restrictions and conservation measures, including public education. Development of additional conservation measures is recommended. The City has begun information gathering, on water reuse and additional supply alternatives. A second phase of study of these options is recommended.

The City routinely monitors disinfection of water in the distribution system. Chloramine injection could be an option if this monitoring indicates disinfection problems in the future. Consideration will be given to property purchases when property becomes available in strategic locations for future water system improvements.

The following **Table 7.1** is a summary of the additional lines, pumps, and storage facilities, which will be required in the future based upon the current land use plans and growth trends of the City of Southlake. Any changes in those plans should result in a new analysis of the water system.

Table 7.1

Capital Improvement Plan Projects							
Tier 1 (1-3 years)							
8" WL	12" WL	16" WL	20" WL	Pumps / Valves	Storage	Project No.	Description
(FT)	(FT)	(FT)	(FT)				
				4 - PRVs		1	PRV Valves between the Upper / Lower pressure planes
		2390				2	Along N. Pearson from Booster Station to Johnson Road
			8580			3	Along SH 114 from Town Center to N. White Chapel Blvd. (Under Construction)
				2@3474GPM	5.0 MG	4	T.W. King Low Pressure Plane Pumps / Storage
				Impellar / Motors		5	Pearson - High Pressure Plane Pumps
		2390	8580				Total
Capital Improvement Plan Projects							
Tier 2 (3-6 years)							
					1.5 MG	6	New 1.5 MG Elevated at T.W. King Site
	1680					7	Along SH 114 from Reserve St to S. Carroll
	4350					8	Along SH 114 from Briarwood Dr. to N. Carroll
	3640					9	Along SH 114 from Highland to White Chapel
505						10	Loop System from IHOP to Bank St.

Capital Improvement Plan Projects (Continued):							
Tier 2 (3-6 years)							
425						11	Loop System from Bent Wood to Ownby Lane
1070						12	Loop System from Fox Glen Ct. to Ravenaux Ct to Countryside Ct.
2263						13	Along Lonesome Dove Ave. / Burney Lane/ Lake Dr.
1462						14	Loop System along Bob Jones Rd. to Walnut Brooks
	4845					15	Along E Highland from N Carroll to N Kimball Ave
	5995					16	Along Union Church and Pearson Ln. from FM 1938 to FM 1709
	2150					17	Along N. Peytonville from Concho Ct. to Southridge Lakes Pkwy
	5170					18	Along Shady Oaks Dr. from W. Highland to W. Dove
	2645					19	Along Randol Mill Ave. from Morgan to Roanoke Dove Rd.
	2105					20	Along N. Carroll and Dove
	1162					21	Along E. Continental Ave. to Breezeway
							Add pumps at Caylor Tank or other water supply/reuse options
6787	24072						Total

Capital Improvement Plan Projects							
Tier 3 (6 to 18 years)							
8" WL	12" WL	16" WL	20" WL	Pumps / Valves	Storage	Project No.	Description
(FT)	(FT)	(FT)	(FT)				
2280						22	Loop System from S. White Chapel and White Chapel Ct. to Silverwood Cir.
1225						23	Loop System from Lorch Meadow Ct to Harbor Ct.
5100						24	Loop System from N. White Chapel to Brooks Ct.
3690						25	Loop System from Austin Oaks Dr to south side SH 114
			3590			26	Along SH 114 from N. White Chapel to W. Dove Rd
	3900					27	Along SH 114 from White Chapel to W Dove St.
3680						28	Loop System W. Dove Rd. along SH 114 and Sam School Rd
15975	17160		0			Total	
Non-Capital Improvement Plan Projects							
2067							Loop System from Ashleigh Ln. to S. Carroll Ave.
4337							Loop System from Chapel Downs to Lake Wood Dr. and SH 114
3450							Loop System SH 114 to Boulder Dr.
4635							Loop System from E. Highland to SH 114
14489			0			Total	

Table 7.2

Project Number	Project Name	Project Costs
	TIER 1 PROJECTS	
1	PRV Valves between the Upper / Lower pressure plans	$134,400
2	16" WL along N. Pearson from Booster Station to Johnson Road	$420,793
3	20" WL along SH 114 from Towne Center to N. White Chapel Blvd.	$1,402,598
4	T.W. King Low Pressure Plane Pumps / Storage	$4,858,560
5	Pearson - High Pressure Plane Pumps	$336,000
	TIER 1 COSTS	**$7,152,351**
	TIER 2 PROJECTS	
6	1.5 MG Elevated at TW King Site	$2,929,920
7	12" WL along SH 114 from Reserve to S. Carroll	$167,274
8	12" WL along SH 114 from Briarwood Drive to N. Carroll	$480,077
9	12" WL along SH 114 from E. Highland St. to White Chapel Blvd.	$362,584
10	8" WL loop system from IHOP to Bank St.	$45,790
11	8" WL loop system from Bent Wood to Ownby Lane	$56,549
12	8" WL loop system from Fox Glen Ct. to Ravenaux Ct. to Countryside Ct.	$94,389
13	8" WL along Lonesome Dove Ave. / Burney Lane / Lake Dr.	$301,106
14	8" WL loop system along Bob Jones Rd. to Walnut Brooks	$182,203
15	12" WL along E. Highland from N. Carroll to N. Kimball Ave.	$696,750
16	12" WL along Union Church and Pearson Lane from FM 1938 to FM 1709	$862,129
17	12" WL along N. Peytonville From Concho Ct. to Southridge Lakes Parkway	$309,187
18	12" WL along Shady Oaks Drive From Highland to W. Dove	$743,487
19	12" WL along Randol Mill Ave. From Morgan to Roanoke Dove Rd.	$380,372
20	12" WL along N. Carroll and Dove	$302,716
21	12" WL along E. Continental Ave to Breezeway	$167,105
	Additional Supply (Caylor and/or TRA)	TBD
	TIER 2 COSTS	**$8,081,639**
	TIER 3 PROJECTS	
22	8" WL loop system from S. White Chapel and White Chapel Ct. to Silverwood Ct.	$210,228
23	8" WL loop system from Lorch Meadow Ct. to Harbor Ct.	$110,074
24	8" WL loop system from N. White Chapel to Brooks Ct.	$691,085
25	8" WL loop system from Austin Oaks Dr. to south side SH 114	$569,426

TIER 3 PROJECTS (Continued):		
26	20" WL along SH 114 from N. White Chapel to W. Dove Rd.	$581,347
27	12" WL along SH 114 from White Chapel to Dove St.	$383,040
28	8" WL loop system from W. Dove Rd. along SH 114 and Sam School Rd.	$321,243
	TIER 3 COSTS	**$2,866,443**
	Total CIP Cost	**$18,100,433**
	NON-CAPITAL IMPROVEMENT PLAN PROJECTS	
1A	8" WL loop system from Ashley Lane to S. Carroll Ave.	$177,795
2A	8" WL loop system from Chapel Downs to Lake Wood Dr. and SH 114	$551,803
3A	8" WL loop system from SH 114 to Boulder Dr.	$474,970
4A	8" WL loop system from E. Highland to SH 114	$666,550
	Total Non-CIP Cost	**$1,871,118**
	Total CIP and Non CIP Cost	**$19,971,551**

APPENDIX

Ref. No.	Issues	Recommendations	Implementation Metric	Strategic Link	VNT Link	VGO Tie	Responsible Department
WWS1	Upper and Lower pressure planes lack redundancy for emergency and fire flow conditions	Install PRV Valves	Tier I – 1-3 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS2	Existing 12" waterline is creating bottleneck for pumping into upper pressure plane	Install parallel 16" water line from Pearson Pump Station to Johnson Road	Tier I – 1-3 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS3	Major Transmission needed to pump water from TW King pump station to central and southeast portion of town	Install 20" water line from White Chapel Blvd. to Town Square to complete transmission line	Tier I – 1-3 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS4	Existing TW King pump station under capacity for meeting current maximum day usage	Install pump upgrades and a new 5 million gallon ground storage tank at the TW King site	Tier I – 1-3 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS5	Existing Pearson Road pump station under capacity for meeting current maximum day usage in the upper plane	Install pump upgrades to the upper pressure plane pumps	Tier I – 1-3 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS6	Limits on potable water supply	Develop a 10 year plan for effective water conservation measures	Tier I – 1-3 years	Infrastructure, F2	Environmental Stewardship	10.1	PW
WWS7	Single water supply source the City of Fort Worth	Evaluate alternatives for providing additional water supply sources	Tier I – 1-3 years	Infrastructure, F2	Efficient Growth	10.1	PW

WWS8	Existing total elevated storage capacity is below requirements for meeting projected peak hour usage	Install new 1.5 million gallon elevated storage tank to the lower pressure plane	Tier II – 3-6 years	Infrastructure, F2	Efficient Growth	10.1, 10.2	PW
WWS9	Key distribution system lines need to be constructed to complete system along major corridors	Install 12” water lines along remaining major thoroughfares	Tier II – 3-6 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS10	Various looping lines required to eliminate dead-end lines to improve circulation and fire flow	Install 8” water lines along remaining major thoroughfares	Tier II – 3-6 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS11	Supply capacity deficient for meeting projected maximum day demands	Add pumps at Caylor Tank site and/or other water supply/reuse options	Tier II – 3-6 years	Infrastructure, F2	Efficient Growth	10.1, 10.2	PW
WWS12	Distribution system lines need to be constructed to complete system along perimeter major corridors	Install 12” water lines along remaining minor r thoroughfares	Tier III – 6-18 years	Infrastructure, F2	Efficient Growth	10.1	PW
WWS13	Various minor looping lines required to eliminate dead-end lines to improve circulation and fire flow	Install 8” water lines along remaining major thoroughfares	Tier III – 6-18 years	Infrastructure, F2	Efficient Growth	10.1	PW

Recommendations Table Legend

Ref. No. = Reference number.
Issues = A brief description of the issue requiring action.
Recommendations = Recommendations to address the issues.
Implementation Metric = A quantifiable goal, often with a deadline for achievement.
Strategic Link = The Strategic Focus Area(s) from the City's Strategy Map that relate to the issue and recommendations.
VNT Link = The guiding principle(s) from Vision North Texas that relate to the issue and recommendations.
VGO Tie = Specific objective(s) from the adopted Southlake 2030 Vision, Goals and Objectives that relate to the issue and recommendations.
Responsible Department = The department(s) that will take the lead on implementing the recommendation. PDS = Planning & Development Services; PW = Public Works; CS = Community Services; ED = Economic Development; DPS = Department of Public Safety

North Texas 2050 Guiding Principles

Excerpted from *North Texas 2050*

www.visionnorthtexas.org

1. **Development Diversity** – Meet the needs of changing markets by providing a mix of development options and land use types in communities throughout the region.

2. **Efficient Growth** – Promote reinvestment and redevelopment in areas with existing infrastructure, ensure that new infrastructure supports orderly and sustainable growth, and provide coordinated regional systems of natural and built infrastructure.

3. **Pedestrian Design** – Create and connect pedestrian- (and bicyclist) oriented neighborhoods, centers and places throughout the region.

4. **Housing Choice** – Sustain and facilitate a range of housing opportunities and choices that meet the needs of residents of all economic levels and at all stages of life.

5. **Activity Centers** – Create mixed use developments that are centers of neighborhoods and community activities and serve as hubs of non-automobile transportation systems.

6. **Environmental Stewardship** – Protect, retain or enhance the region's important natural assets (including its air, water, land and forests) and integrate these natural features and systems into the character of the region's communities and the experiences of its residents.

7. **Quality Places** – Strengthen the identities of the region's diverse communities through preservation of significant historic structures and natural assets, creation of new landmarks and gathering spaces, use of compatible architectural and landscape design, and support for the activities and institutions that make each community unique.

8. **Efficient Mobility Options** – Invest in transportation systems, facilities and operations that provide multi-modal choices for the efficient and sustainable movement of people, goods, and services.

9. **Resource Efficiency** – Design buildings, sites, communities and regional systems to use water, energy, and renewable resources responsibly, effectively and efficiently, and to retain non-renewable resources for the use of future generations.

10. **Educational Opportunity** – Provide opportunities for all North Texans to have access to the schools, people and technology they need for success in learning throughout their lives.

11. **Healthy Communities** – Identify and support functional, sustainable infrastructure and institutions that offer North Texans access to affordable, nutritious foods, opportunities for physical activity, and access to wellness and primary care services.

12. **Implementation** – Achieve the region's vision by adoption of compatible comprehensive plans and ordinances for cities and consistent investment plans for regional systems; involve citizens and stakeholders in all aspects of these planning processes.