CARROLLTON TAX INCREMENT REFINANCING ZONE #1

INFRASTRUCTURE STUDY

Including

DOWNTOWN CARROLLTON AND TRINITY MILLS TRANSIT-ORIENTED DEVELOPMENT (TOD) DISTRICTS

ENGINEERING REPORT

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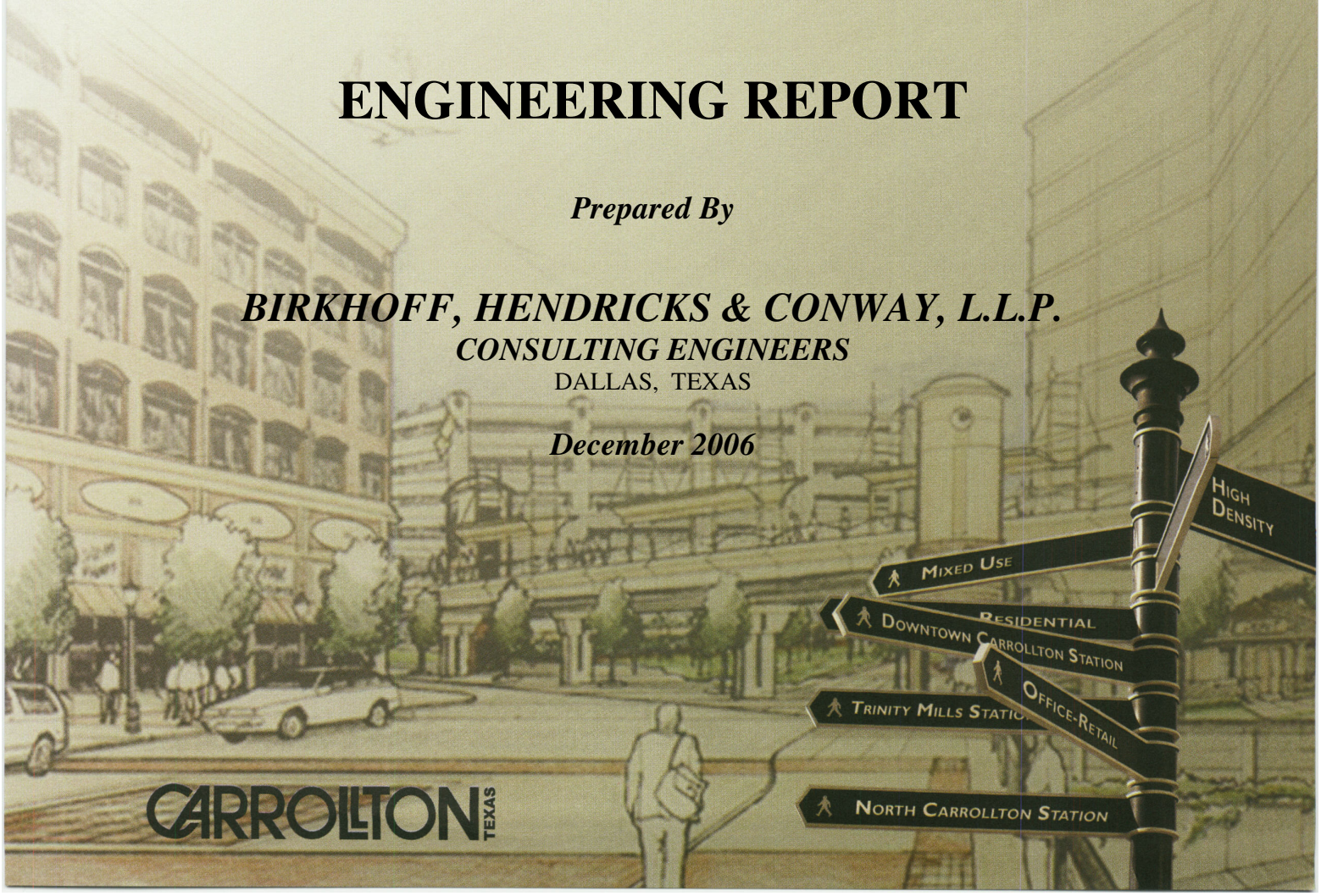
December 2006



CARROLLTON TEXAS

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EXECUTIVE SUMMARY

DOWNTOWN CARROLLTON & TRINITY MILLS TRANSIT ORIENTED DEVELOPMENT (TOD) DISTRICT INFRASTRUCTURE STUDY

Redevelopment plans for the City of Carrollton along Interstate Highway 35 around two proposed Dallas Area Rapid Transit (DART) Stations have brought about the need for an analysis of these areas, known as Transit Oriented Development (TOD), and the effects on the City's water distribution and the wastewater collection systems. The areas are generally located along IH35E at the intersections of Belt Line Road (Old Downtown Station) and the President George Bush Turnpike (Trinity Mills Station). The water analysis is based on a 72-hour extended period computer simulation on the days of maximum usage and sewer requirements were based on the water demands. This analysis and report presents a plan for system improvements to serve the TOD Area at build-out conditions. This plan is based on the best available information on existing and projected future land uses.

The TOD lies within two of the City's Water Distribution Service Areas. Each of the service areas was reviewed to determine the effects on pumpage, storage and distribution working dynamically. The focus was to determine what facilities are required to meet a maximum hourly demand of 5.48 MGD within the TOD from the existing system. The study generally shows that the city's water system can support the additional growth but that new lines around the TOD areas themselves will be required for the increased demands. Most of these lines, which range in size from 8 to 12-inches, are located along the IH35E corridor and around the Trinity Mills area since the area on the west side of IH35E is undeveloped. Distribution lines inside the redeveloped areas are not included in this analysis as specific line sizes and locations will be determined by the individual redevelopment projects as they occur. The study also showed that the elevated storage tank on Josey Lane will need to be expanded from 1.5 to 3 million gallons and that some planned pumps need to be larger than originally planned although only part of the additional capacity is the result of TOD.

Wastewater collection within the TOD is split between the Hutton Branch and Furneaux Creek systems. The existing trunk lines in each basin were reviewed to determine if additional capacity is required for the additional 2.0 MGD that will be generated from the TOD. It was determined that the existing 15-inch main south of Beltline Road through the Valwood Improvement Area needs to be upgraded to an 18-inch trunk main. As with the water system, collection lines within the TOD that will be required due to redevelopment were not determined.

The impact to the backbone water system, facilities and the wastewater trunk system in 2007 dollars is in the range of $4,600,000.00, which includes design, testing and inspections.

Any development within the TOD area, depending on the impact on the water and waste water system, can prompt any one of these projected improvements to occur at an earlier time frame.

SUMMARY OF CAPITAL COST

WATER

	Projected Capital Cost	
Water Facilities	Capital Cost	TOD Share of Cost
Pump Station	$ 250,000.00	$ 112,500.00
Josey Elevated Storage Tank	$ 3,500,000.00	$ 700,000.00
Backbone Water Supply Lines		
Old Downtown Station	$ 1,337,375.00	$ 1,337,375.00
Trinity Mills Station	$ 1,396,375.00	$ 1,396,375.00
Total Capital Cost:	**$ 6,483,750.00**	**$ 3,546,250.00**
Design, Testing & Inspection	$ 1,296,750.00	$ 709,250.00
TOTAL WATER PROJECT:	**$ 7,780,500.00**	**$ 4,255,500.00**

SEWER

	Projected Capital Cost	
Sewer Trunk Main	Capital Cost	TOD Share of Cost
Old Downtown Station	$ 1,232,500.00	$ 147,900.00
Lift Station	$ 1,100,000.00	$ 132,000.00
Total Capital Cost:	**$ 2,332,500.00**	**$ 279,900.00**
Design, Testing & Inspection	$ 466,500.00	$ 55,980.00
TOTAL SEWER PROJECT:	**$ 2,800,000.00**	**$ 340,000.00**

*All dollars in 2007 dollars.

PROJECTED TOTAL COST:	**$ 10,600,000.00**	**$ 4,600,000.00**

PROJECTED SCHEDULE FOR IMPROVEMENTS

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
WATER:											
Pump Station Improvements											
			***Trinity Mills Waterlines**								
							***Elevated Storage Tank**				
							***Downtown Waterlines**				
SEWER:											
							***Sanitary Sewer Improvements**				
							***Lift Station**				

**Any development within the TOD area, depending on the impact on the water and waste water system, can prompt any one of these projected improvements to occur at an earlier time frame.*

I. WATER DISTRIBUTION SYSTEM

A. PLANNING AREA

The TOD planning area lies inside the city limits, and is designed to serve approximately 980 acres of land. The TOD lies within two existing water service areas.

The Low Service Area serves approximately 175 acres of the TOD area and 805 acres are within the Medium Service Area, The Low and Medium Service Areas have high water levels at their corresponding elevated tanks of 640 feet and 699 feet, respectively.

Table 1 provides a summary of the land use areas calculated from the City's 2000 Comprehensive Land Use Map after applying the Feasibility Analysis Report prepared by Schrader & Cline, LLC provided to us by the City. The Gross Area represents the entire acreage for a particular land use. The net area removes approximately 25% of the inhabitable area from residential and non-residential land uses from the City's land use plan. This inhabitable area is for right-of-way, easements and areas not intended for irrigation.

TABLE 1

LAND USE BREAKDOWN

Land Use	Total Gross Area (AC)	Total Net Area (AC)
Low Density Residential	8,004	6,003
Medium Density Residential	296	222
High Density Residential	1,009	757
TOD Residential	170	119
Office/Commercial/Industrial	2,263	1,697
Office/Commercial/Industrial IH-35E & GB	3,881	2,911
Corporate Commercial	580	435
Public/semi-public	1,395	1,046
Parks/Recreation (Soccer Fields)/Open Space	3,676	2,757
TOD Non-Residential	810	567
Totals:	**22,084**	**16,514**

B. POPULATION

The demand for water within the TOD community will be closely related to its residential population. Total population of a fully developed TOD area along with commercial and industrial

demand dictates the ultimate size of facilities required, whereas the rate of growth is important to determine the timing of the construction of system improvements within this area.

The acreage of non-developed low-density residential, medium density and high-density residential land was calculated from the City's 2000 Comprehensive Land Use Map. The acreage for non-developed TOD urban center residential, townhouse residential, medium density residential, and low density/multi family residential land was calculated from the Feasibility Analysis Schrader & Cline Report. The densities used for calculating the existing and build-out residential population are shown in Table 2. The densities used for calculating projected build-out residential population are shown in Table 3.

TABLE 2

RESIDENTIAL UNIT AND POPULATION DENSITIES

Land Use	Units Per Acre	Population Per Unit
Low Density Residential	3.5	3.1
Medium Density Residential	10.0	2.9
High Density Residential	15.0	2.5

TABLE 3

TOD RESIDENTIAL UNIT AND POPULATION DENSITIES

TOD Land Use	Units Per Acre	Population Per Unit
Low Density / Multi-Family	3.5	3.1
Medium Density Residential	10.0	2.9
Townhouse Residential	15.0	2.3
Urban Center Residential	25.0	2.3

Because the estimated water demand in this analysis is based on the Schrader & Cline Report, any change may affect the estimated demand rates and facility projections. Carrollton's build-out population is calculated to be an estimated 140,901 persons. It includes 8,173 persons that are envisioned to populate the TOD development areas. The projected build-out residential population of each land use is shown in the following table:

TABLE 4

RESIDENTIAL POPULATION PROJECTIONS FOR EACH LAND USE

Land Use	Population
Low Density Residential	88,365
Medium Density Residential	5,583
High Density Residential	38,780
TOD Residential	8,173
Total at Build-Out:	**140,901**

C. PROJECTED WATER USE

The design of the water distribution system involves various rates of water use which are generally, referred to as water demand**.** The three most significant rates and a definition of each are:

1) Maximum Daily Demand: This is the total amount of water used during the day of heaviest consumption in any given year and the minimum rate, which the high service pumps must be capable of pumping. Water must be supplied to the pumps at this rate.

2) Maximum Hourly Demand: This is the rate at which water is drawn from the entire distribution system during the hour of maximum consumption on the day of maximum demand. This rate is generally of a short duration and is most economically provided for by the use of elevated storage in addition to water supplied to the system by pumps. The distribution system, including storage and pumping capacity, must be able to satisfy this demand.

3) Minimum Hourly Demand: This is the rate at which water is drawn from the entire distribution system during the hour of minimum demand on the day of maximum demand. This demand rate is used in the water distribution analysis to determine the adequacies of the system to replenish elevated storage.

Analysis and design of the proposed water distribution system is based on the maximum water demand and the distribution of that demand according to the projected future land use anticipated in the City of Carrollton. This maximum demand typically occurs after an extended period of consecutive 100°F days, which most often occurs within the months of July, August and September. A water demand study was completed by obtaining pumping and elevated storage

records, provided by the City, from the summer of 2005, July 2006, and August 2006 in order to establish the highest calculated residential per capita water rate in gallons per capita per day (g.p.c.d.), which occurred in August 2006. A demand summary table of the August 16-18, 2006 City records is shown in Appendix "A".

In the summer of 2006, the City was under Stage 1 of the City's Conservation Plan, which allowed for odd last digit addresses to water Saturdays and Wednesdays, even last digit addresses to water Sundays and Thursdays, and no watering the other days of the week. The results from a non-watering day in August 2006 were used for this analysis, described as the City undergoing water restrictions. Table 5 provides a summary of the residential design demand rates, with Water Restrictions. For design, a peaking factor of 1.78 was utilized for TOD residential users.

TABLE 5

RESIDENTIAL WATER DESIGN DEMAND RATES WITH WATER RESTRICTIONS

	Residential - 2006 Water Restrictions		
Land Use	**Max Day Per Capita g.p.c.d.**	**Max Hour Per Capita g.p.c.d.**	**Peaking Factor**
Low Density Residential	425	750	1.76
Medium Density Residential	425	750	1.76
High Density Residential	425	750	1.76
TOD Residential	225	400	1.78

Non-residential demand rates were maintained from the City's 2001 Water Distribution Master Plan. The TOD non-residential demand rates were obtained by applying the same non-residential demand rates currently used for the City's IH35E/PGBT Office/Commercial/ Industrial land use. These rates were the same with No Water Restriction as well as with Water Restrictions. Table 6 summarizes the non-residential land uses and the design demand rate applied to the TOD water distribution system. For design, a peaking factor of 1.3 (2001 Water Distribution Master Plan) was utilized for non-residential usage, with the exception of the public/semi-public zoned areas.

TABLE 6

LAND USE AND DESIGN DEMANDS

Land Use	Non-Residential - 2006 Water Restrictions		
	Max Day Per Acre g.p.a.d.	Max Hour Per Acre g.p.a.d.	Peaking Factor
Office/Comm/Industrial	1,500	1,950	1.30
IH35E/PGBT Office/Comm/Industrial	3,000	3,900	1.30
Corporate Comm.	3,000	3,900	1.30
Public/Semi-Public	3,000	3,000	1.00
Open	0	0	
Parks/Rec	1,500	1,500	1.00
TOD Non-Residential	3,000	3,900	1.30
ROW	0	0	

A global demand factor of 50% of the Max Day and Max Hour Design Rates has been applied to the TOD Non-Residential for Parks and Green Space.

The following table presents the projected design demand rates in million gallons per day placed on the overall water distribution system at build-out.

TABLE 7

BUILD-OUT WATER DEMANDS BY SERVICE AREA, INCLUDING TOD

Service Area	Total Demand Water Restrictions***	
	Max Day (MGD)	Max Hour (MGD)
Low Service Area	5.20	6.44
Medium Service Area*	49.55	75.87
High Service Area**	36.02	47.52
Total:	**90.77**	**129.83**

* *Medium Service Area Max Day Demands include 3.55 MGD to bleed into Low Service Area through PRV*

** *High Service Area Max Day Demand includes a 6.5 MGD to bleed into Medium Service Area through Columbian Club Vault.*

** *Includes Midway Service Area and Golden Bear Service Area*

** *A max day demand of 2.40 MGD to Hebron is included in the High Service Area (junction node J-2009)*

*** *Water Restrictions analyzed are two (2) days per week.*

The total TOD demands are included in the Low and Middle Service Area for both With and With No Water Restrictions, and are as follows:

Total TOD Max Day ..... **3.54 MGD**

Total TOD Max Hour ..... **5.48 MGD**

D. WATER DISTRIBUTION SYSTEM ANALYSIS

The analysis of the water distribution system, which included the TOD, was performed utilizing Water CAD computer software to aid in reviewing the overall system of water mains, storage facilities and pump stations to serve the City of Carrollton with the TOD as now envisioned. Hydraulic models were created at projected build-out, to aid in the development of system improvements within the TOD.

The development of the build-out water distribution system was based on a 72-hour extended period computer simulation (EPS). A design 72-hour diurnal curve was developed from Carrollton's summer of 2000 demand study (Appendix "A") and from diurnal curves generated in other North Central Texas cities similar to Carrollton. Figure 1 represents the 72-hour diurnal curve input into the EPS model. Modeling the water distribution system over a 72-hour period allowed for verification of the ability to draw down and refill ground storage reservoirs and elevated storage tanks under severe conditions.

1) Low Service Area

The existing pressure divide between the Low and Medium Service Areas is generally located along IH35E and Sandy Lake Road. Ground elevations range from 400-feet MSL to 500-feet MSL within the Low Service Area. The Hutton Elevated Storage Tank serves the Low Service Area and it has a high water level established at 640 feet. This service area contains areas primarily zoned as industrial. The City of Dallas' Burning Tree delivery point maintains pressure in this service area with a backup supply demand of approximately 3.55 MGD from the Don Cline Pump Station, through pressure reducing valves.

2) Medium Service Area

The existing pressure divide between the Medium and High Service Areas is generally located near Kelly Blvd. Ground elevations west of Old Denton Road range from 500-feet MSL to 560-feet MSL while east of Denton road, the ground elevations range from 500-feet MSL to 560-feet MSL within the Medium Service Area. The Josey Elevated Tank, Hebron Elevated Tank, and Columbian Club Elevated Tank serve the Medium Service Area and have a high water level established at 699 feet.

E. WATER SUPPLY

Potable water in the City of Carrollton is supplied by Dallas Water Utilities (DWU) at four existing delivery points and a future delivery point at Bobby Ballard Pump Station. Two of the supply locations are located at the Columbian Club Pump Station, Vault 1 and Vault 2. The third supply location is at the Jackson Road Vault and the fourth supply location is at the Burning Tree Vault. The contractual rate of delivery of treated water to the City is based on the maximum daily demand rate. Currently, the incoming flow rate from Dallas Water Utilities for the City of Carrollton is 53.10 MGD (from summer 2006 records). Through the Extended Period Simulation Computer Model, it was determined that a build-out supply of approximately 80.29 MGD with the City under Water Restrictions will be required to meet the maximum daily demand placed on the system. These maximum daily supplies include a fixed maximum day rate of approximately 2.40 MGD to Hebron, approximately 1.85 MGD to Mustang Park, and approximately 3.54 MGD demand for the TOD. Table 8 presents the supply rates modeled in the hydraulic models with Water Restrictions.

TABLE 8

INCOMING SUPPLY FLOW

Service Area	Projected Build-Out Supply with Water Restrictions Max Day (MGD)
Columbian Club Vault*	20.50
Jackson Road Vault	40.00
Bobby Ballard Vault	18.50
Burning Tree Vault	1.80
Total:	**80.80**

**Combined amount at Columbian Club Vault 1 and 2.*

F. PUMP STATIONS & GROUND STORAGE

1) Don Cline Pump Station

The Don Cline Pump Station is located on Old Denton Road, south of Jackson Street, east of the Dallas Water Utilities' Elm Fork Water Treatment Plant. The Don Cline Pump Station currently serves as the primary source of supply for the TOD area that is within the Medium Service Area, and as a backup source for the Low Service Area. The site contains two 10-million gallon concrete ground storage reservoirs. Each reservoir has a head range of 40.5 feet with a base elevation of 460 feet and a diameter of 200 feet. Seven vertical turbine

pumps are presently utilized at this pump station. One additional slot is available as a build-out backup pump. The pumpage from the Don Cline Pump Station is at full capacity in its existing state without the backup pump. The system should have the capability to operate with the largest pump out at any given pump station. An overview of the existing Don Cline Pump Station's pump components is shown in Table 9.

TABLE 9

DON CLINE PUMP STATION PUMPS

Pump Number	MGD	Gal/Min	Horsepower
Existing Pump #1	11.08	7,700	600
Existing Pump # 2	7.20	5,000	400
Existing Pump # 3	5.04	3,500	250
Existing Pump # 4	5.04	3,500	250
Existing Pump # 5	5.04	3,500	250
Existing Pump # 6	5.04	3,500	250
Existing Pump # 7	7.20	5,000	400
Proposed Backup Pump #8	11.08	7,700	600
Total Pumping Capacity at Build-Out*	**45.64**		

**Total pumping capacity with one large pump out, which will be utilized as a backup pump.*

2) <u>Columbian Club Pump Station</u>

The Columbian Club Pump Station is located on Country Club Road, east of Kelly Blvd. The Columbian Club Pump Station consists of three separate pump stations that currently serve the High Service Area and the Medium Service Area. The Medium pump station contains a slot for a proposed vertical turbine pump that will serve the Medium Service Area, including the TOD. An overview of the proposed Columbian Club Pump Station's pump component for the Medium Pump Station is shown in Table 10.

TABLE 10

COLUMBIAN CLUB PUMP STATION PUMPS

Medium Pump Station: Pump Number	MGD	Gal/Min	Horsepower
Future Pump # 3	7.0	4,900	225
Total: **Medium Pumping Capacity at Build-Out***	**7.0**		

G. ELEVATED STORAGE

The required volume of elevated storage in this analysis was based on the difference in the maximum hourly demand and the maximum daily pumping capacity.

A 72-hour extended period simulation (EPS) was performed to ensure the existing and proposed elevated tanks would discharge and refill within an acceptable range, based on the size of the elevated storage tanks. The EPS was run by placing controls on pumps and linking them to the water level in the elevated tanks. As the water level in elevated storage tanks begin to drop, pumps will turn on according to the pump control settings. When the water level in the elevated storage tanks begins to rise, pumps will turn off according to the pump control settings. This allowed the maximum pumping capacity at each pump station to be optimized to the maximum pumping rates. The elevated storage requirements at build-out for each service area are provided in Table 11. In the Appendix, Figures 3 through 5 show the results of each elevated storage tank in the service areas during the 72-hour EPS.

TABLE 11

ELEVATED STORAGE REQUIREMENTS PER SERVICE AREA
LOW SERVICE AREA AND MEDIUM SERVICE AREA

Service Area	Elevated Storage Tank	Tank Volume
EXISTING ELEVATED STORAGE		
Low	Hutton	2.0 MG
Medium	Josey*	1.5 MG
Medium	Hebron	3.0 MG
Medium	Columbian Club**	0.5 MG
Subtotal: Existing	**3 Tanks**	**6.5 MG**
ADDITIONAL ELEVATED STORAGE REQUIRED		
Medium	Proposed Josey	3.0 MG
Subtotal: Proposed	**1 Tank**	**3.0 MG**
Total Elevated Storage at Build-Out:	**3 Tanks**	**8.0 MG ****

* *Existing 1.5 MG Josey Lane Elevated Tank is to be replaced with a proposed 3.0 MG elevated tank.*

** *Existing Columbian Club 0.5 MG Elevated Tank Was Not Included in the TOD Plan.*

The existing Columbian Club 0.50 MG Elevated Tank is scheduled to be removed from the system. This elevated tank is located at the Columbian Club Pump Station. The location of the elevated tank caused it to be ineffective and interferes with optimum operation of the distribution system.

The existing Josey 1.5 MG Elevated Tank is to be removed and replaced with the proposed Josey 3.0 MG Elevated Tank to assist in meeting the maximum hourly demands in the Medium Service Area, which includes an additional 5.48 MGD demand by the TOD.

H. FIRE FLOW ANALYSIS

A fire hydrant is an element of the water distribution system that provides for public fire-protection service. The usage of a fire hydrant as a source of water for fire fighting is the primary purpose for which the element is installed. A fire flow analysis was performed on the TOD's water distribution system as well as the complete water distribution system utilizing the Water CAD software. The system was analyzed for fire protection during the maximum daily and maximum hourly demand at Build-out. A design 72- hour fire diurnal curve (appendix "A") was created and applied to certain junction nodes within the TOD to simulate for fire flow. Every pipeline in the Model was analyzed in order to meet the following constraints, which meet or exceed TCEQ standards:

1) Fire Flow Required for a Given Junction (1 hydrant) ..... 1.44 mgd (1,000 gpm)
2) Maximum Acceptable Pipeline Velocity with a Fire in the System .... 5 fps

A single fire hydrant has a maximum discharge rate of 1.44 MGD (1,000 gpm). The analysis consisted of adding a fire flow demand to those junction nodes with the fire flow curve applied to it. The fire curve would peak the demand during the maximum daily demand as the elevated tanks are emptying to determine if the system could deliver the required fire flow while maintaining pipe velocities at or under 5 feet per second. The Low and Medium Service Areas met the minimum TCEQ requirements for fire flow in the build-out model, after running up to four fire hydrants within the TOD. The four junction nodes that had the fire flow demand applied to were junction node J-1044, J-1046, J-869, and J-870, all in the east area of the Beltline and IH-35 intersection inside the TOD. A copy of the results of the fire flow analysis of the Build-out model can be found in the Appendix as "Fire Flow Results".

I. RECOMMENDATIONS FOR SYSTEM IMPROVEMENT

1) Pump Stations Improvements and Storage Facilities

The following facilities outlined in Tables 12 and 13 will need to be placed into service to improve pump stations and increase elevated capacities to meet system demands.

TABLE 12

PROPOSED PUMP STATION IMPROVEMENTS

Service Area	Pump Station Pump	Capacity
Medium	Additional Pump at Columbian Club Pump Station	7.0 MGD*

**TOD requires 3.1 MDG of the 7 MGD plus backup pumpage.*

TABLE 13

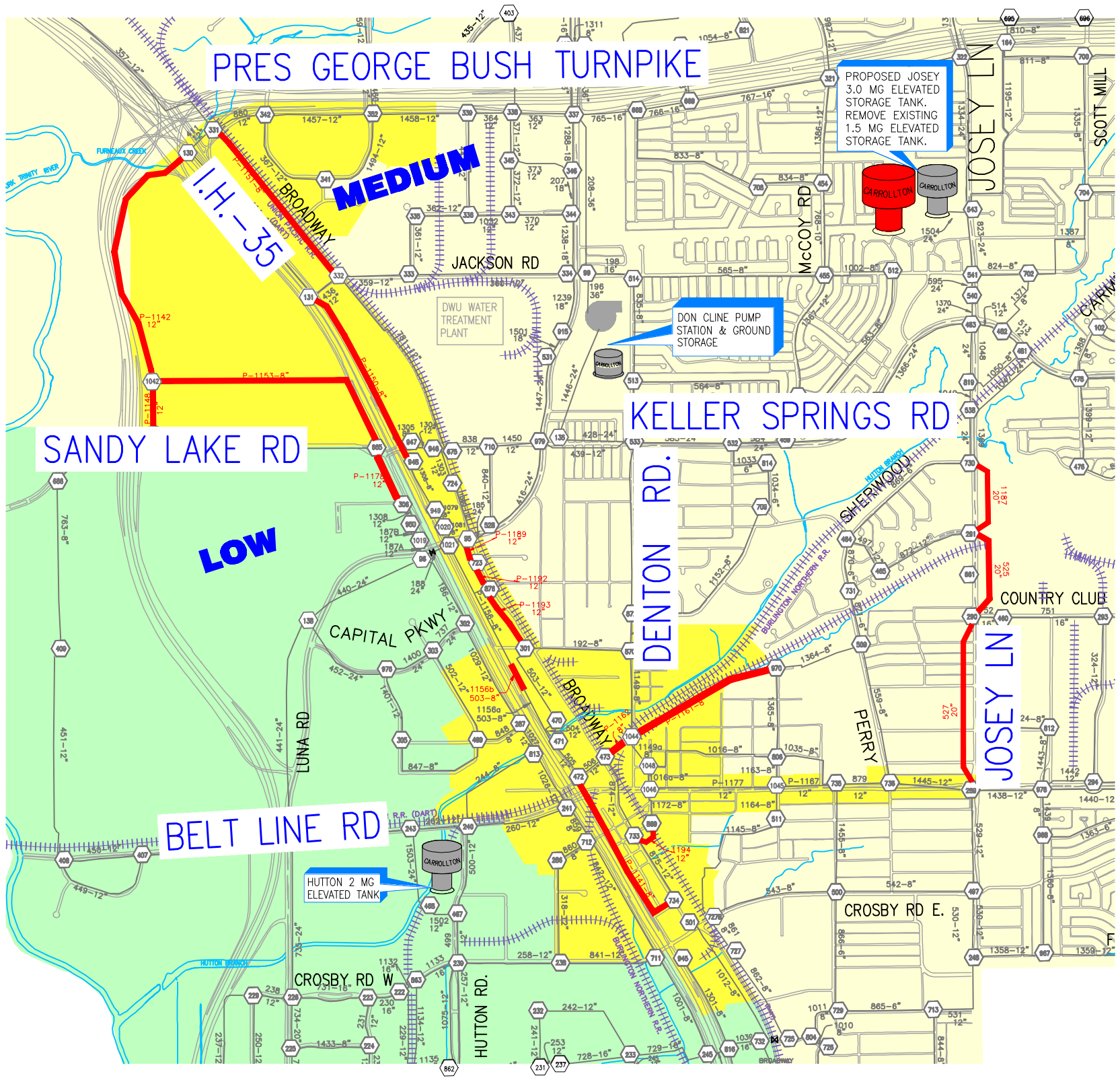
PROPOSED ELEVATED STORAGE TANKS

Service Area	Elevated Storage Tank	Capacity
Medium	Josey Lane Elevated Storage Tank	3.0 MG*

** TOD requires 0.5 MG of the3.0MG storage tank capacity.*

2) Distribution Lines

The following proposed waterlines outlined in Table 14 will need to be placed into the TOD area to service projected development improvements while maintaining pressures and velocities during the maximum hourly demand, and to fill in missing water distribution lines needed to complete closed loops within the system. The following map shows the proposed TOD waterlines.



CARROLLTON TEXAS

TRANSIT ORIENTED DEVELOPEMENT
WATER AREA MAP

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

LEGEND

- MEDIUM SEWER AREA
- LOW SERVICE AREA
- TOD
- 202-8" EXISTING WATER LINE & SIZE
- 202-8" PROPOSED WATER LINE & SIZE

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OCTOBER, 2007

PLOTTED BY: AMATA ON 9/18/2007
PLOT STYLE: Carrollton Cybernet.ctb
PLOT SCALE: 1:2000
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REVISED: 9/18/07 - AMATA

TABLE 14

PROPOSED DISTRIBUTION WATER LINES

Service Area	Distribution Line (General Location)	Pipeline Label	Diameter (Inches)	Length (Feet)
Medium	I-35 Northbound Service Road	P-1141	8	2,810
Medium	George Bush Turnpike	P-1142	12	4,570
Medium	George Bush Turnpike	P-1148	12	1,080
Medium	I-35 Northbound Service Road	P-1150	8	2,805
Medium	Broadway	P-1151	8	2,810
Medium	I-35 South Service Road	P-1153	8	4,170
Medium	I-35 Northbound Service Road	P-1156b	8	400
Medium	BNSF Railroad	P-1161	8	2,480
Medium	BNSF Railroad	P-1162	8	540

J. EQUIVALENT LINE SIZES

The following proposed parallel waterlines would need to be placed into service to improve and maintain velocities in the water distribution system. The proposed parallel water lines in the Low and Medium Service Area are for fire protection during the Maximum Hourly Demand. An equivalent line size of the existing line and the proposed parallel line within the TOD area is shown in Table 15.

TABLE 15

EQUIVALENT LINE SIZES

Service Area	Existing Line Number	Existing Line Dia. (Inches)	Proposed Line Number	Proposed Line Dia. (Inches)	Length (Feet)	Equivalent Line Size (In.)
Low	P-761	8	P-1178	12	975	12
Medium	P-438	8	P-1189	12	390	12
Medium	P-1158	8	P-1192	12	450	12
Medium	P-1157	8	P-1193	12	1,265	12
Medium	P-1146	6	P-1194	12	265	12
Medium	P-868	12	P-1187	16	1,090	20
Medium	P-753/P-873	12	P-525	16	1,295	20
Medium	P-322	12	P-527	16	2,680	20

K. OPINION OF PROBABLE CONSTRUCTION COST

The following tables contain probable costs for improvements to the water distribution system within the TOD area. Table 16 contains the proposed project costs for pump station and elevated storage tank improvements. Table 17 contains the proposed water distribution lines for future TOD development.

TABLE 16
PROPOSED SYSTEM IMPROVEMENTS

Proposed System Improvement Descriptions	Total Capacity Improvement	Opinion of Probable Construction Cost	Projected Cost Related to TOD Development
SERVICE AREA PUMP STATIONS			
Proposed Pump Station Expansions			
Columbian Club Pump Station (1 Pump-Medium Service Area)	*7 MGD	250,000.00	112,500.00
Total: Columbian Club Pump Station		**250,000.00**	**112,500.00**
Design, Testing, & Inspection		**50,000.00**	**22,500.00**
TOTAL		**300,000.00**	**135,000.00**
ELEVATED STORAGE FACILITIES			
Proposed Elevated Storage Tanks			
Josey Elevated Storage Tank (Medium Service Area)	**3 MG	3,500,000.00	700,000.00
Total: Elevated Storage Tank		**3,500,000.00**	**700,000.00**
Design, Testing, & Inspection		**700,000.00**	**140,000.00**
TOTAL		**4,200,000.00**	**840,000.00**

**TOD accounts for 45% of the future pump cost, based on requiring 3.1 MDG of the 7 MGD plus backup pumpage.*
***TOD accounts for20% of the future elevated tank, based on requiring 0.5 MG of the3.0MG storage tank capacity.*

TABLE 17

PROPOSED WATER LINE IMPROVEMENTS

Proposed Distribution Lines (General Location)	Location Old-Downtown to Trinity Mills	Line Number	Diameter (inches)	Length (Feet)	Unit Cost ($)	Opinion of Probable Construction Cost
Josey Lane	D-Town	P-525	20	1,295	$125	$161,875.00
Josey Lane	D-Town	P-527	20	2,680	$125	$335,000.00
I-35 Northbound Service Road	D-Town	P-1141	8	2,810	$75	$210,750.00
George Bush Turnpike	T-Mills	P-1142	12	4,570	$100	$457,000.00
George Bush Turnpike	T-Mills	P-1148	12	1,080	$100	$108,000.00
I-35 Northbound Service Road	T-Mills	P-1150	8	2,805	$75	$210,375.00
Broadway	T-Mills	P-1151	8	2,810	$75	$210,750.00
I-35 South Service Road	T-Mills	P-1153	8	4,170	$75	$312,750.00
I-35 Northbound Service Road	D-Town	P-1156b	8	400	$75	$30,000.00
BNSF Railroad	D-Town	P-1161	8	2,480	$75	$186,000.00
BNSF Railroad	D-Town	P-1162	8	540	$75	$40,500.00
I-35 Southbound Service Road	T-Mills	P-1178	12	975	$100	$97,500.00
Josey Lane	D-Town	P-1187	20	1,090	$125	$136,250.00
Broadway	D-Town	P-1189	12	390	$100	$39,000.00
Broadway	D-Town	P-1192	12	450	$100	$45,000.00
Broadway	D-Town	P-1193	12	1,265	$100	$126,500.00
Broadway	D-Town	P-1194	12	265	$100	$26,500.00
			Old Downtown Station	**13,665**		**$1,337,375.00**
			Trinity Mills Station	**16,410**		**$1,396,375.00**
			Total Backbone Supply Lines			**$2,733,750.00**
			Design, Testing, & Inspection			**$546,750.00**
			TOTAL			**$3,280,500.00**

II. WASTEWATER COLLECTION SYSTEM

A. PLANNING AREA

The total TOD planning area for the wastewater collection system is encompassed within three drainage basins inside the city limits. These drainage areas are the Hutton Branch Drainage Basin, the Valwood Drainage Basin, and the Furneaux Creek, which will cover approximately 980 acres of the total TOD Area. The wastewater collection system analysis is based calculating sewer capacities of the City's delineated drainage basins along the TOD Area.

The Hutton Branch drainage area that is within the TOD totals approximately 510 acres, the Valwood drainage area totals approximately 360 acres, and the Furneaux drainage area totals approximately 110 acres. As in the water analysis, the gross area represents the entire acreage for a particular land use. The net area removes approximately 30% from the TOD Area from residential and non-residential land uses of inhabitable land determined after comparing the Schrader & Cline TOD Report to the City Land Use Map. This area is for right-of-way, easements and areas not intended for development. Therefore, approximately 357 acres of the TOD are in the Hutton drainage basin, approximately 280 acres are in the Valwood drainage basin, and approximately 48 acres are inside the Furneaux drainage basin. These will be used to determine build-out sewer capacities.

B. POPULATION

The collection basins are at or near residential build out. The Hutton Basin has approximately 7,070 people envisioned in the TOD, and the residential TOD population envisioned for the Furneaux Basin is approximately 1,103 people. The Valwood Basin lies within commercial/industrial zone and therefore will have no residential population. The Schrader & Cline TOD Report was utilized to assist in determining the approximate residential populations. The following table summarizes the population and land usage areas utilized in this evaluation.

TABLE 18

DRAINAGE BASIN LAND USAGE FOR TOD AREA

Drainage Basin	Residential Population	Residential Acres	Commercial Acres
Hutton Basin	7.070	112	245
Valwood Basin	0	0	280
Furneaux Basin	1,103	7	41
Totals:	**8,173**	**119**	**566**

C. SERVICE AREAS

The drainage basins are generally defined by the City's natural topography. The City of Carrollton's Sanitary Sewer Maps delineate these drainage basins. Flows generated from the Hutton drainage basin, the Valwood drainage basin, and the Furneaux drainage basin are conveyed by existing gravity lines as well as pumped by force mains and into TRA trunk sewer system. The Hutton Drainage Basin will convey the majority of the TOD residential flow. The Valwood and Furneaux will convey the majority commercial flows, mainly at the intersection of IH-35 and the George Bush Turnpike. The following map delineates the TOD Area within drainage basins.

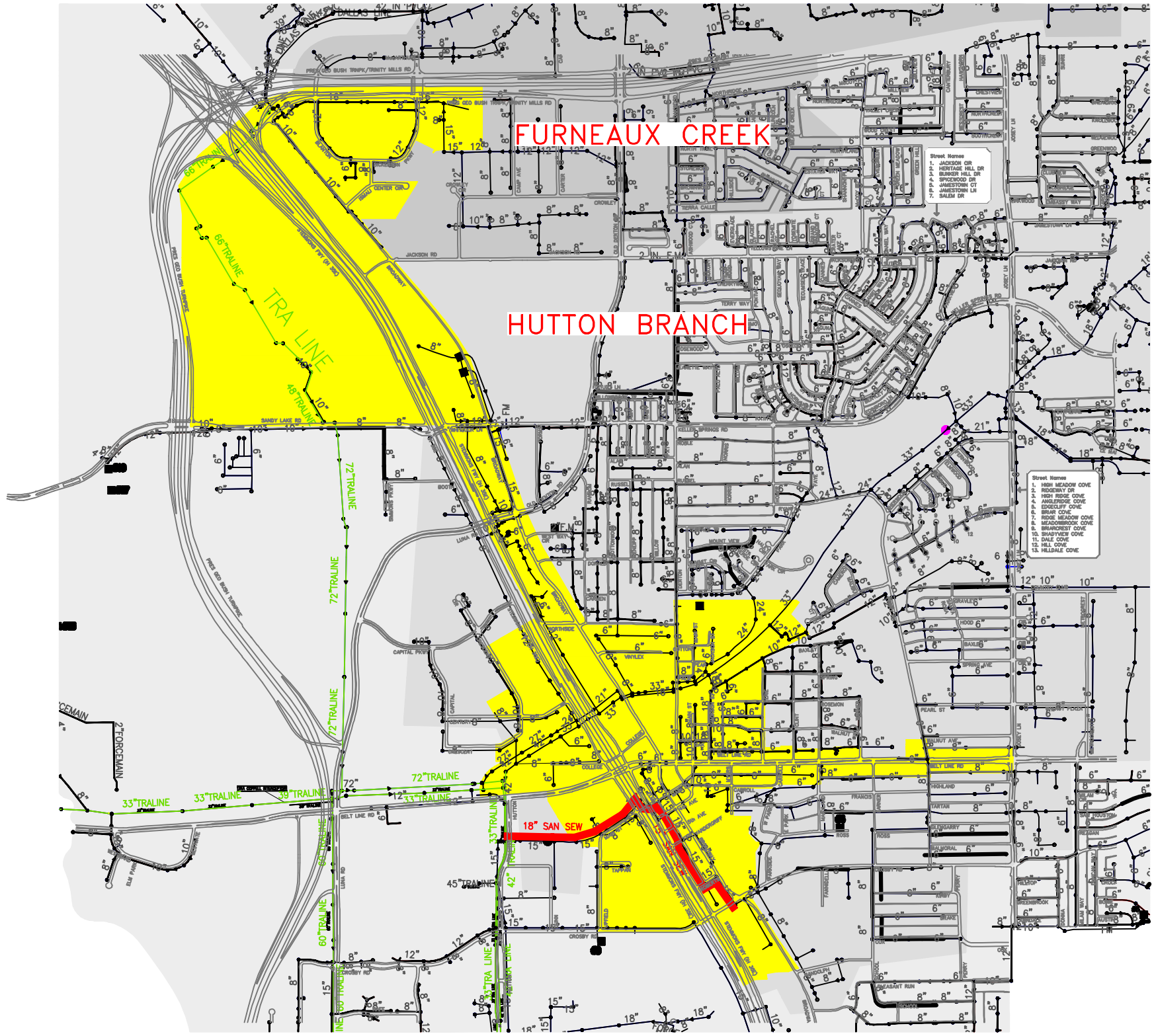
D. WASTEWATER FLOWS

Residential and non-residential flow rates were established by utilizing neighboring city records, such as City of Plano's 2004 Wastewater Flow Criteria. Table 19 summarizes the residential and non-residential flow rates used in for each land use, as well as the flows for inflow and infiltration (I & I) allowance for both residential and non-residential land use types.

TABLE 19

LAND USE AND DESIGN FLOW RATES

Land Use	Residential Flow Per Capita g.p.c.d.	Residential Flow Per Acre g.p.a.d.	Non-Residential Flow Per Acre g.p.a.d.
Low Density Residential	125		
Medium Density Residential	125		
High Density Residential	125		
TOD Residential Areas	125		
Infiltration & Inflow		700	
Office/Comm/Industrial			1,500
IH35E/PGBT Office/Comm/Ind			1,500
Corporate Comm.			1,500
TOD Non-Res			1,500
Public / Semi-Public			1,500
Infiltration & Inflow			700



CARROLLTON TEXAS

TRANSIT ORIENTED DEVELOPEMENT
SEWER AREA MAP

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

LEGEND

- FURNEAUX CREEK DRAINAGE BASIN
- HUTTON BRANCH DRAINAGE BASIN
- TOD AREA
- 10" EXISTING SEWER LINE & SIZE
- TRA EXISTING TRA TRUNK LINE & SIZE
- 42" PROPOSED SEWER LINE & SIZE

BIRKHOFF, HENDRICKS & CONWAY, L.L.P.
CONSULTING ENGINEERS
Dallas, Texas
OCTOBER, 2007

PLOTTED BY: AMATA ON 9/18/2007 PLOT STYLE: ---- PLOT SCALE: 1:2000 H:\Projects\Carrollton\2006132\Water Study\Power Point\TOD Sewer Map.dwg REVISED: 9/18/07 – AMATA

Flows were then peaked in accordance with Curve A of the ASCE Design Manual "Gravity Sanitary Sewer Design and Construction", page 39 to simulate wet weather peak conditions. A comparison was then made to determine the additional the projected drainage flow and the amount of flow caused by the development of the TOD. Tables 20-22 presents the projected design flows in million gallon per day for the three drainage basins with the TOD area and without the TOD.

TABLE 20

HUTTON DRAINAGE BASIN
BUILD-OUT SEWER FLOWS BY LAND USE

Buildout Hutton Branch Drainage Basin Summary		
	Total Max. Flow (MGD)	
LAND USE	with TOD	w/o TOD
Low Density Residential	8.57	8.66
Medium Density Residential	1.60	1.60
High Density Residential	4.22	4.35
TOD Residential Areas	2.07	0.00
Office/Comm/Industrial	2.44	2.73
IH35E/PGBT Office/Comm/Industrial	2.18	2.60
Corporate Comm.	0.00	0.00
TOD Non-Residential	0.54	0.00
Public / Semi-Public	0.79	0.79
Totals:	**22.41**	**20.73**

Difference – 1.68 MGD

TABLE 21

VALWOOD DRAINAGE BASIN
BUILD-OUT SEWER FLOWS BY LAND USE

Buildout Valwood Drainage Basin Summary		
	Total Max. Flow (MGD)	
LAND USE	with TOD	w/o TOD
Low Density Residential	1.54	1.54
Medium Density Residential	0.00	0.00
High Density Residential	0.09	0.09
TOD Residential Areas	0.00	0.00
Office/Comm/Industrial	1.72	1.72
IH35E/PGBT Office/Comm/Industrial	2.94	3.55
Corporate Comm.	0.00	0.00
TOD Non-Residential	0.62	0.00
Public / Semi-Public	0.48	0.49
Totals:	**7.39**	**7.39**

Difference – 0.00

TABLE 22

FURNEAUX DRAINAGE BASIN
BUILD-OUT SEWER FLOWS BY LAND USE

Buildout Furneaux Drainage Basin Summary		
	Total Max. Flow (MGD)	
LAND USE	with TOD	w/o TOD
Low Density Residential	9.53	9.53
Medium Density Residential	0.18	0.18
High Density Residential	2.91	2.91
TOD Residential Areas	0.31	0.00
Office/Comm/Industrial	0.49	0.49
IH35E/PGBT Office/Comm/Industrial	1.93	2.01
Corporate Comm.	0.20	0.20
TOD Non-Residential	0.09	0.00
Public / Semi-Public	0.36	0.38
Totals:	**16.00**	**15.70**

Difference – 0.30 MGD

E. SUMMARY & RECOMMENDATIONS

The Hutton Drainage Basin accounts for most of the TOD area flow conveyed into the existing TRA trunk lines, with approximately 1.68 MGD difference. Some of the TOD collection lines will connect to the existing 27-inch and 42-inch trunk sewers, having a total capacity of approximately 26.19 MGD, calculated from data provided by the City. The flow conveyed into these lines, including the projected TOD development, is approximately 19.84 MGD, resulting in both trunk sewers having capacity. Other collection lines within the Hutton Drainage Basin will connect to an existing 15-inch sanitary sewer originating in Old Downtown. This sewer line has a capacity of approximately 1.77 MGD. The flow conveyed into this sewer line, including projected TOD development, is approximately 2.57 MGD, resulting in the 15-inch sewer line not having adequate capacity. We recommend replacing the existing 15-inch sewer line with at an 18-inch sewer line, which has a capacity of approximately 2.88 MGD.

The Valwood Drainage Basin and the Furneaux Drainage Basin had minor flow differences. The Valwood Drainage Basin accounts for 0.30 MGD, and the Furneaux Drainage Basin has 0.00 MGD additional flow conveyed to the existing sewer lines. These lines will connect to the existing trunk lines, which have adequate capacity.

All lines within the TOD should be replaced as development occurs. The future collection lines within the TOD will need to be sized as development occurs The following table contains the proposed project cost for the additional sewer line needed to convey the flow.

TABLE 23

PROPOSED SEWER SYSTEM IMPROVEMENTS

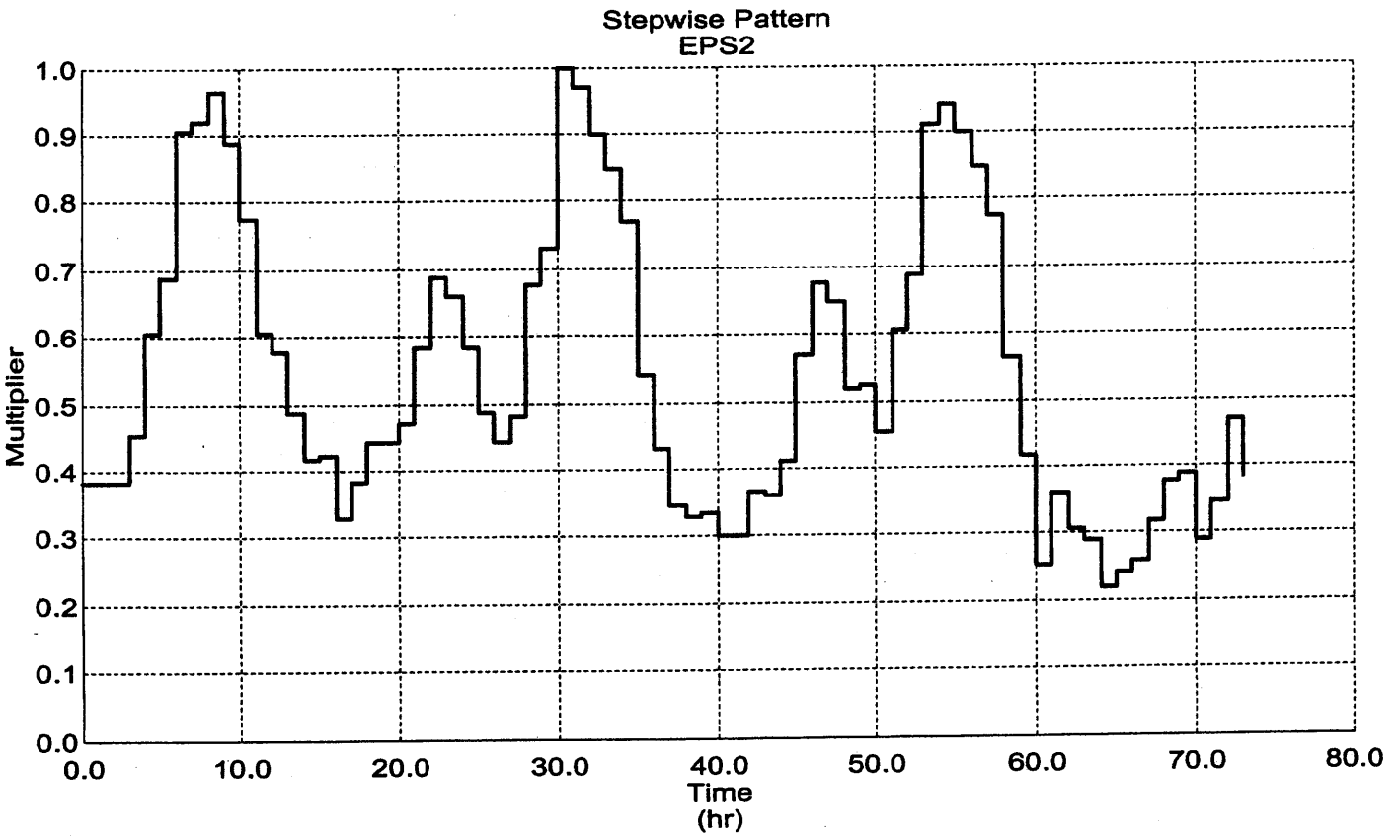
Proposed Sewer Lines (General Location)	Diameter (inches)	Length (Feet)	Unit Cost ($)	Opinion of Probable Construction Cost	Projected Cost Related to TOD Development
*Main Street Sanitary Sewer	18	4,930	$250	$1,232,500.00	$147,900.00
Lift Station				$1,100,000.00	$132,000.00
Subtotal:				**$2,332,500.00**	**$279,900.00**
Design, Testing, & Inspection				$466,500.00	$55,980.00
Total:		**4,930**		**$2,800,000.00**	**$340,000.00**

**TOD accounts for 12% of the sewer line cost, based on requiring additional 2.61 MDG flow from the total 22.41 MGD flow.*

CARROLLTON TEXAS

TRANSIT ORIENTED DEVELOPMENT (TOD) STUDY

APPENDIX "A"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EPS2
Multiplier
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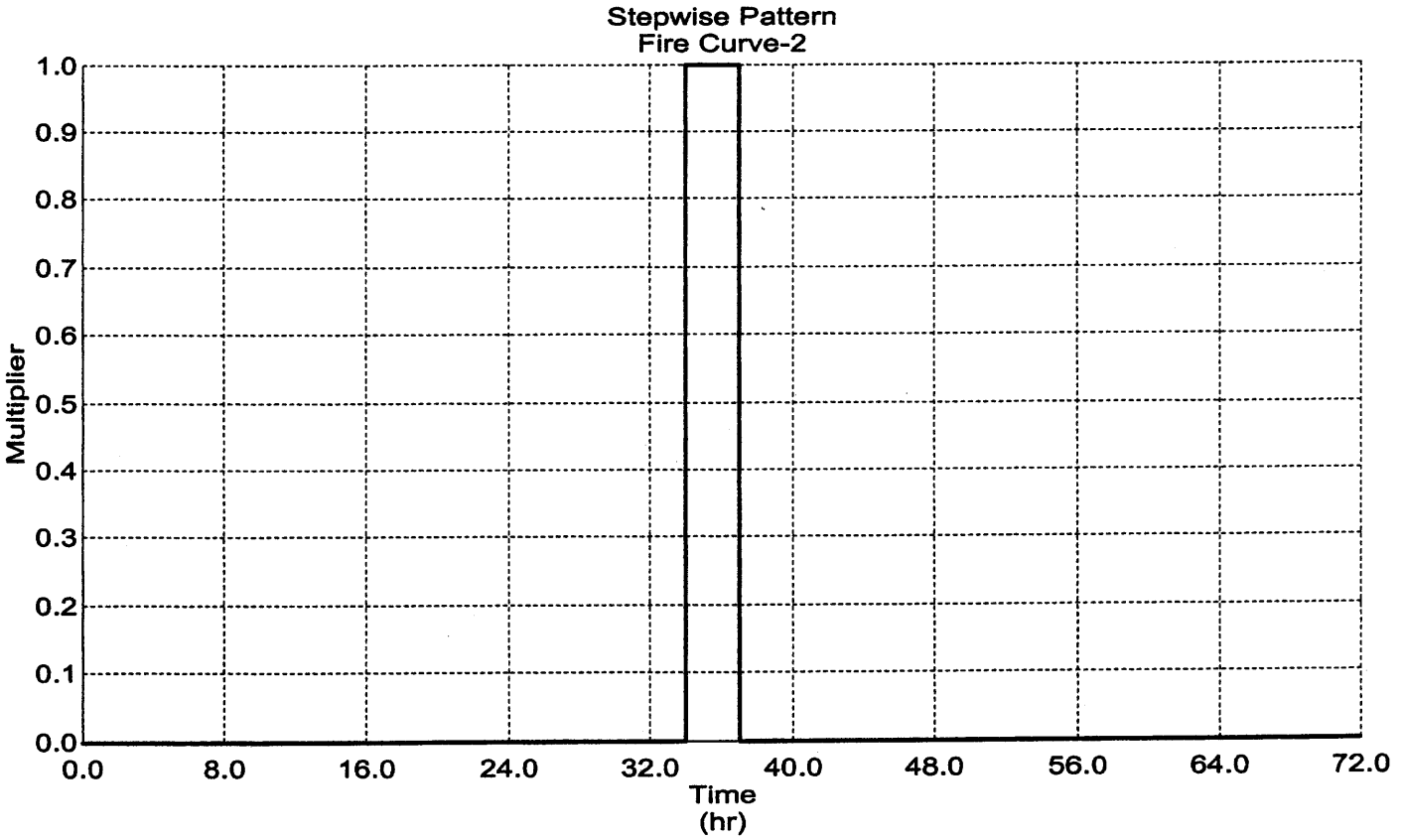
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
Time
(hr)


Stepwise Pattern
Fire Curve-2
Multiplier
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
8.0
16.0
24.0
32.0
40.0
48.0
56.0
64.0
72.0
Time
(hr)

CARROLLTON TEXAS

DATE: March 13, 2006

SUBJECT: 2006 Estimated Population per NCTCOG

The North Central Texas Council of Governments (NCTCOG) has released their official 2006 population estimate for area cities. The January 1, 2006 population for Carrollton is estimated at 118,711. Carrollton has historically utilized a round-off number; therefore, our estimate for public release will be **118,700**.

NCTCOG also revised their 2005 population estimate upward from 116,480 to 117,845, largely attributable to an increase in the apartment occupancy rate (from 89% to 93%).

Including the 2006 estimate, our average annual growth rate since 2000 is approximately 1.3%.

Historical Carrollton Population Data:

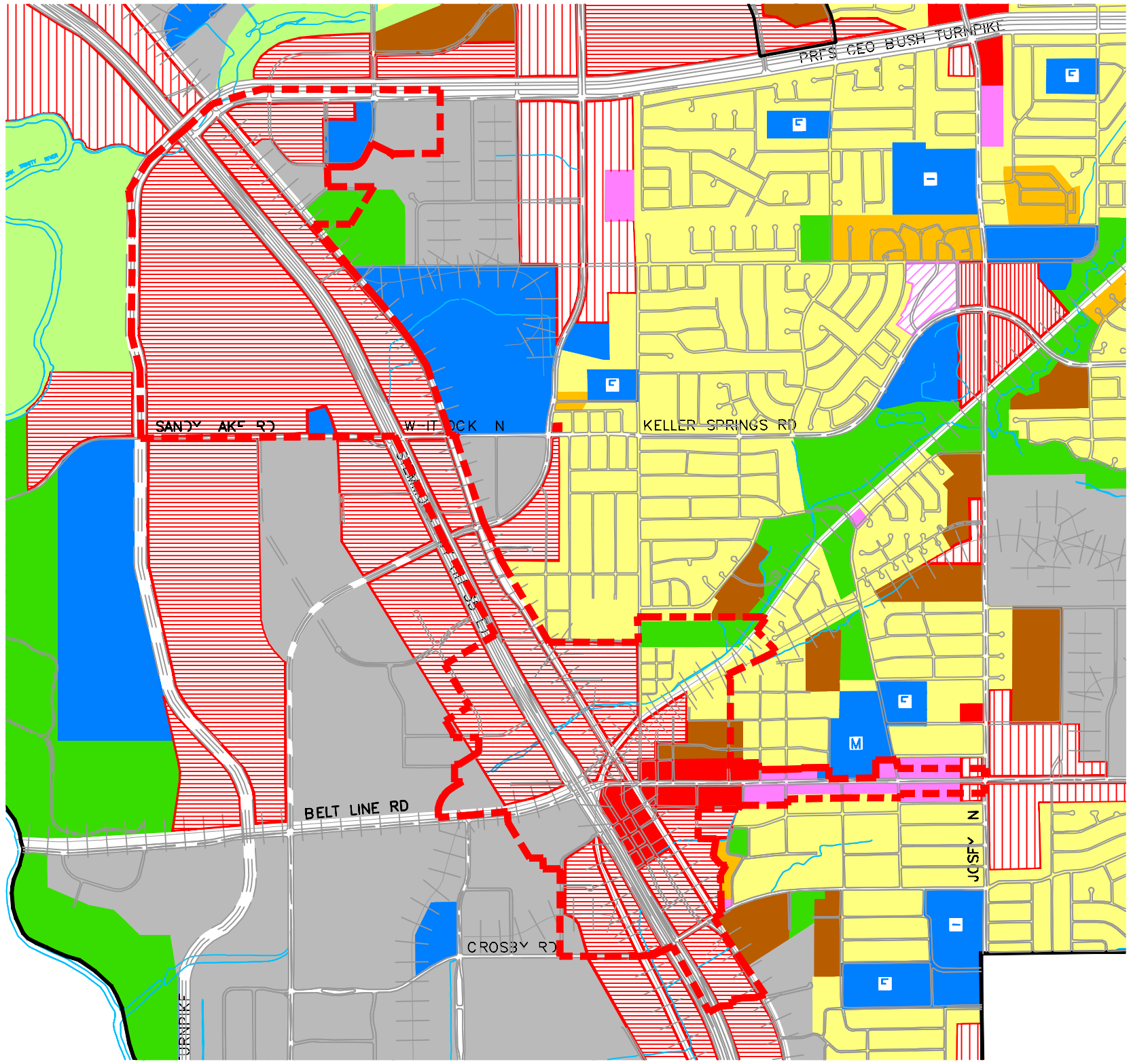
2000 109,576 (Census)
2001 111,000 (NCTCOG revised)
2002 112,300 (NCTCOG revised)
2003 112,400 (NCTCOG revised)
2004 115,000 (NCTCOG revised)
2005 117,800 (NCTCOG revised)
2006 118,700 (NCTCOG)

2006 Population Estimate by Housing Type

Housing Type	Population	% of Total Pop
Single Family Dwellings	85,079	71.67%
Multi-Family Dwellings	32,195	27.12%
Mobile Homes	795	0.67%
Group Quarters (Nursing Homes/Assisted Living Centers)	642	0.55%
Total	118,711 (round-off) 118,700	

TABLE 2: DEMAND SUMMARY
AUGUST 16-18, 2006

DATE	Time (hr)	Total Hourly Pumpage (GAL)	Volume into Elev. Storage (GAL)	Volume out of Elev. Storage (GAL)	Difference Between Vol. into Elev. Stor. & Out of Elev Storage (GAL) ( ) Represents Refill Deficiency	Net System Demand (GAL)	HOURLY Net System Demand (GAL/DAY)	HOURLY PEAKING FACTOR
WED., August 16, 2006	00:00	2,812,916.7	0.0	0.0		2,552,083.3	61,250,000.0	1.15
	01:00	2,935,833.3	(241,944.6)	87,510.2		2,447,232.3	58,733,574.4	1.11
	02:00	2,895,000.0	(66,066.9)	81,566.3		2,576,332.7	61,831,984.7	1.17
	03:00	3,049,166.7	(11,195.7)	142,422.3		2,939,560.0	70,549,440.4	1.33
	04:00	3,003,750.0	(5,567.9)	180,168.7		3,017,517.4	72,420,418.2	1.36
	05:00	2,993,750.0	0.0	400,630.9		3,296,547.6	79,165,142.7	1.49
	06:00	3,129,166.7	(27,953.6)	443,925.7		3,452,638.7	82,863,329.2	1.56
	07:00	3,275,000.0	(55,788.0)	154,236.0		3,280,948.0	78,742,752.4	1.48
	08:00	3,092,500.0	(141,303.2)	34,207.1		2,889,570.6	69,349,693.3	1.31
	09:00	2,545,416.7	(238,028.5)	3,472.7		1,768,362.9	42,440,710.0	0.80
	10:00	2,383,333.3	(229,970.0)	1,736.4		1,606,766.4	38,562,393.7	0.73
	11:00	2,138,750.0	(284,304.6)	42,892.7		1,343,171.4	32,236,114.5	0.61
	12:00	2,189,583.3	(284,057.1)	0.0		1,356,359.6	32,552,630.4	0.61
	13:00	2,125,833.3	(369,602.8)	0.0		1,201,230.6	28,829,533.3	0.54
	14:00	2,058,750.0	(414,226.2)	0.0		1,087,857.1	26,108,571.3	0.49
	15:00	2,112,916.7	(411,174.8)	0.0		1,148,408.5	27,561,804.5	0.52
	16:00	1,882,916.7	(381,885.5)	93,889.0		1,043,253.5	25,038,084.1	0.47
	17:00	2,111,250.0	(295,920.2)	11,085.3		1,273,915.1	30,573,961.6	0.58
	18:00	1,374,166.7	(98,270.3)	111,125.6		844,522.0	20,268,527.1	0.38
	19:00	2,295,000.0	(62,472.2)	590,983.5		2,291,844.6	55,004,271.1	1.04
	20:00	2,666,666.7	(101,601.0)	220,516.3		2,453,915.3	58,893,966.9	1.11
	21:00	2,828,333.3	(4,148.7)	326,769.1		2,990,953.7	71,782,889.7	1.35
	22:00	3,129,583.3	(30,944.6)	252,351.6		3,253,490.3	78,083,767.9	1.47
	23:00	3,065,000.0	(126,148.5)	97,879.1		2,939,230.7	70,541,536.0	1.33
						DAILY DEMAND		
Total		62,094,583.3	(3,882,572.9)	3,277,368.6	605,204.3	53,057,712.4		
THUR., August 17, 2006	00:00	2,969,583.3	(192,469.5)	127,573.1		2,642,186.9	63,412,485.7	1.25
	01:00	2,837,500.0	(164,260.3)	196,472.6		2,815,045.6	62,761,094.3	1.24
	02:00	2,704,583.3	(66,875.2)	209,563.1		2,519,771.3	60,474,510.1	1.19
	03:00	2,380,833.3	(12,337.3)	503,590.7		2,548,753.4	61,170,081.7	1.21
	04:00	2,795,000.0	(11,896.7)	577,731.7		3,032,501.7	72,780,040.3	1.44
	05:00	3,043,333.3	(37,093.2)	318,338.4		2,997,911.8	71,949,884.1	1.42
	06:00	3,102,083.3	(19,226.8)	190,806.7		2,942,829.8	70,627,916.1	1.39
	07:00	2,803,333.3	(20,619.4)	218,607.2		2,913,821.2	69,931,708.1	1.38
	08:00	2,752,500.0	(13,033.4)	173,210.9		2,823,510.8	67,764,259.1	1.34
	09:00	2,579,583.3	(310,584.0)	0.0		2,171,499.3	52,115,984.3	1.03
	10:00	2,468,333.3	(232,086.1)	2,070.6		1,768,317.9	42,439,629.9	0.84
	11:00	2,069,583.3	(339,131.3)	0.0		1,263,785.3	30,330,848.2	0.60
	12:00	1,877,500.0	(193,290.4)	0.0		1,025,043.0	24,601,031.0	0.49
	13:00	1,726,250.0	(118,100.4)	35,698.3		1,183,014.5	28,392,348.9	0.56
	14:00	1,630,833.3	(152,170.7)	10,744.5		1,028,573.7	24,685,769.5	0.49
	15:00	1,507,500.0	(172,402.0)	934.3		875,199.0	21,004,776.2	0.41
	16:00	1,438,333.3	(224,754.9)	113,134.6		863,379.7	20,721,113.6	0.41
	17:00	1,571,250.0	(233,644.2)	153,299.5		1,035,072.0	24,841,727.4	0.49
	18:00	2,101,666.7	(204,312.8)	82,758.1		1,520,945.3	36,502,686.6	0.72
	19:00	2,239,583.3	(136,374.5)	10,483.4		1,519,525.6	36,468,614.6	0.72
	20:00	2,900,416.7	(48,875.4)	310,389.7		2,576,931.0	61,846,343.4	1.22
	21:00	2,937,083.3	(55,968.4)	423,146.0		2,816,761.0	67,602,264.0	1.33
	22:00	3,136,250.0	(26,134.7)	348,013.3		3,206,461.9	76,955,086.7	1.52
	23:00	3,174,583.3	(181,807.2)	39,618.0		2,775,727.5	66,617,459.5	1.31
						DAILY DEMAND		
Total		58,547,500.0	(3,167,448.6)	4,048,184.5	(880,736.0)	50,666,569.3		
FRI., August 18, 2006	00:00	3,046,250.0	(105,885.1)	104,033.7		2,705,232.0	64,925,567.9	1.40
	01:00	2,935,000.0	(218,449.3)	108,200.1		2,399,750.8	57,594,018.7	1.24
	02:00	2,777,500.0	(102,205.7)	89,077.2		2,341,038.1	56,184,914.8	1.21
	03:00	3,254,166.7	(37,572.5)	147,871.5		2,941,132.4	70,587,178.4	1.52
	04:00	3,241,666.7	(139,951.0)	99,612.7		2,778,828.4	66,691,882.2	1.44
	05:00	3,170,833.3	(62,351.7)	146,561.2		2,921,709.5	70,121,027.2	1.51
	06:00	2,883,750.0	(63,166.1)	200,164.7		2,688,248.7	64,517,967.9	1.39
	07:00	2,630,416.7	(1,861.9)	293,449.0		2,594,503.7	62,268,089.9	1.34
	08:00	2,615,833.3	(26,997.8)	199,147.5		2,451,316.3	58,831,590.9	1.27
	09:00	2,503,750.0	(183,326.9)	8,933.5		1,901,023.3	45,624,558.0	0.98
	10:00	2,046,250.0	(225,141.2)	3,021.1		1,390,796.6	33,379,118.1	0.72
	11:00	2,101,666.7	(243,932.5)	18,971.7		1,324,205.9	31,780,942.1	0.69
	12:00	2,159,583.3	(321,126.8)	0.0		1,285,123.2	30,842,955.9	0.67
	13:00	2,093,333.3	(357,627.9)	0.0		1,178,205.4	28,276,929.9	0.61
	14:00	1,895,416.7	(391,154.2)	0.0		949,262.5	22,782,299.3	0.49
	15:00	1,703,333.3	(224,945.3)	146,500.1		1,071,554.8	25,717,315.4	0.56
	16:00	968,750.0	(25,809.8)	468,979.5		891,086.3	21,386,071.8	0.46
	17:00	1,513,750.0	(36,173.4)	184,169.0		1,120,912.2	26,901,892.9	0.58
	18:00	2,022,500.0	(296,744.7)	8,801.9		1,147,890.5	27,549,371.9	0.59
	19:00	2,366,666.7	(197,166.9)	115,236.5		1,719,736.3	41,273,671.3	0.89
	20:00	1,877,083.3	(161,123.4)	160,576.1		1,376,536.0	33,036,864.3	0.71
	21:00	2,713,333.3	(82,728.0)	76,796.7		2,379,068.8	57,097,650.6	1.23
	22:00	2,743,333.3	(147,014.5)	5,858.2		2,357,810.4	56,587,449.8	1.22
	23:00	2,755,000.0	(131,611.7)	40,962.2		2,411,850.6	57,884,413.2	1.25
						DAILY DEMAND		
Total		58,059,166.7	(3,784,068.2)	2,626,724.1	1,157,344.2	46,326,822.5		



0 1000 2000 3000

HORIZONTAL SCALE IN FEET

CARROLLTON TEXAS

TRANSIT ORIENTED DEVELOPEMENT AREA LAND USE AREA MAP

December, 2007

LEGEND

RESIDENTIAL
- Low Density (0-6 du/ac)
- Medium Density (6-12 du/ac)
- High Density (12+ du/ac)

OFFICE
- Low Intensity (FAR less than 0.5:1)
- Medium Intensity (FAR between 0.5:1 and 1:1)
- High Intensity (FAR 1:1+)

COMMERCIAL
- Low Intensity (FAR less than 0.33:1)
- Medium Intensity (FAR between 0.33:1 and 0.5:1)
- High Intensity (FAR 0.5:1+)
- Corporate Commercial

INDUSTRIAL
- Industrial

PARK, RECREATION, & OPEN SPACE
- Park and Recreation
- Open Space

PUBLIC/SEMI-PUBLIC
- School, Police or Fire Station, Etc.

TOD AREA

KIRKHOFF, HENDRICKS & CONWAY, L.L.P.
CONSULTING ENGINEERS
Dallas, Texas

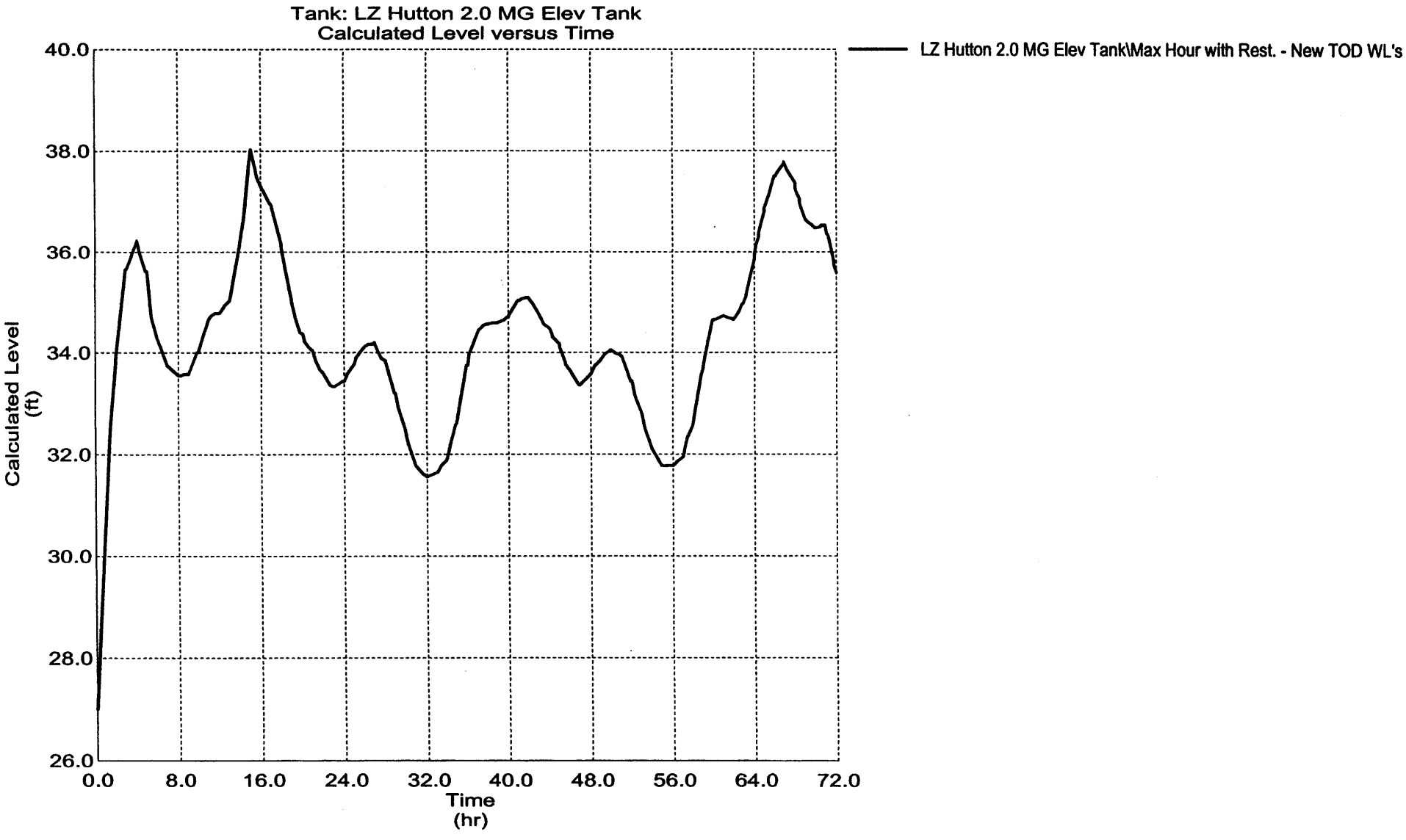
REVISED: 5/7/07 - AMATA H:\Projects\Carrollton\2006132\TOD Land Use Map\TOD Land use Map.dwg PLOT SCALE: 1:2000 PLOT STYLE: ---- PLOTTED BY: AMATA ON 12/20/2007

CARROLLTON TEXAS

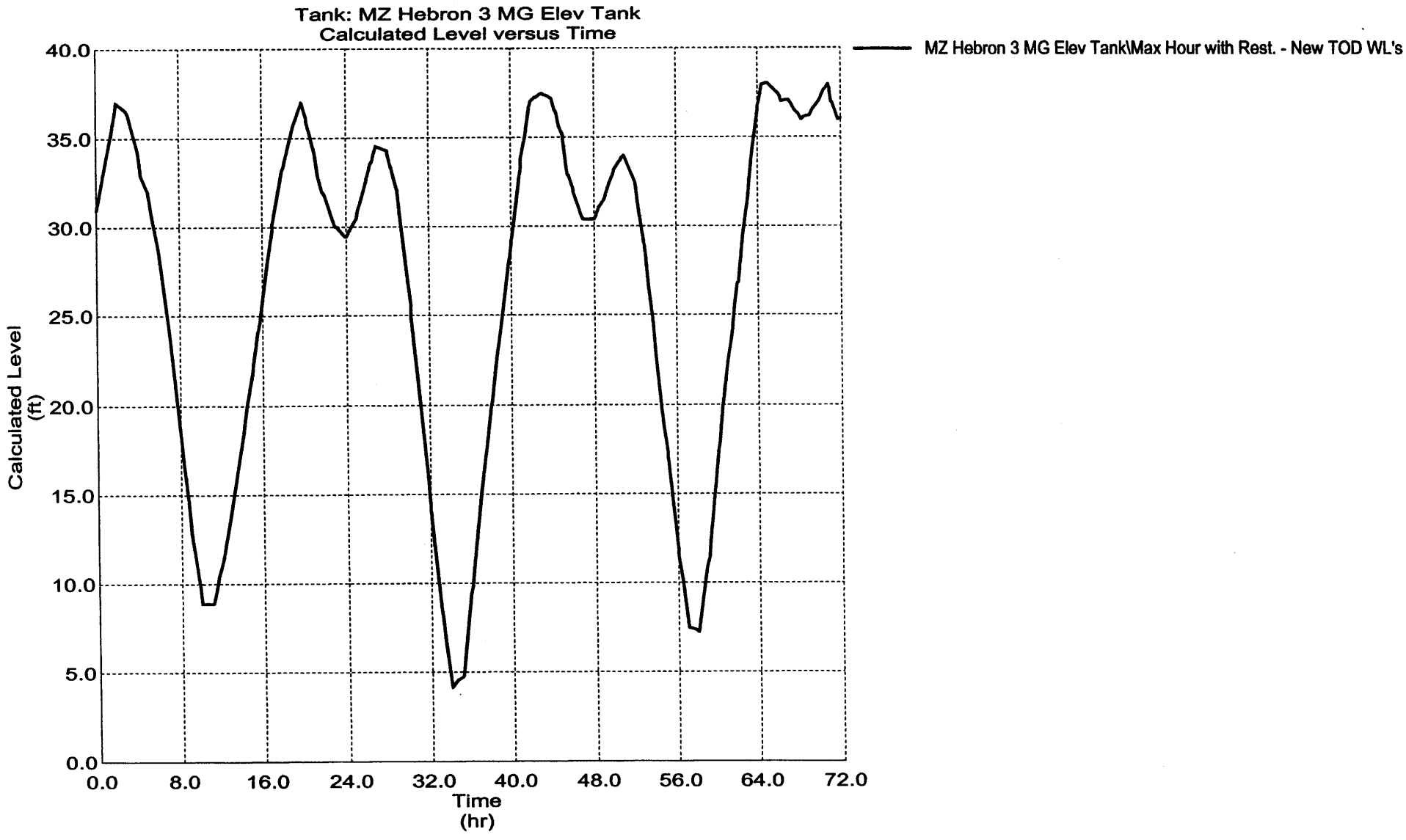
TRANSIT ORIENTED DEVELOPMENT (TOD) STUDY

• ELEVATED TANK RESULTS

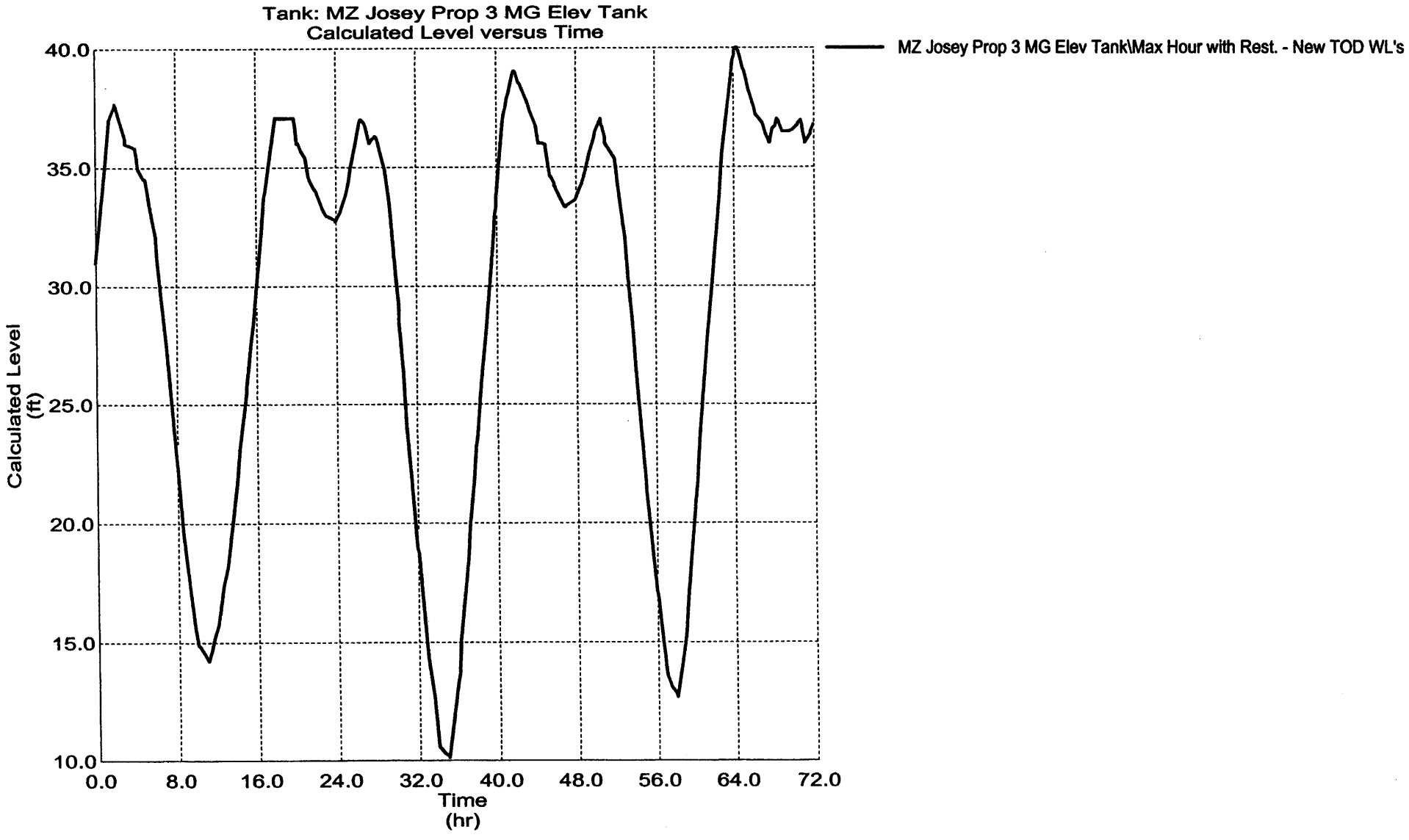
Graph


Tank: LZ Hutton 2.0 MG Elev Tank
Calculated Level versus Time
LZ Hutton 2.0 MG Elev Tank\Max Hour with Rest. - New TOD WL's
Calculated Level (ft)
40.0
38.0
36.0
34.0
32.0
30.0
28.0
26.0
0.0
8.0
16.0
24.0
32.0
40.0
48.0
56.0
64.0
72.0
Time (hr)

Graph


Tank: MZ Hebron 3 MG Elev Tank
Calculated Level versus Time
MZ Hebron 3 MG Elev Tank\Max Hour with Rest. - New TOD WL's
Calculated Level (ft)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
8.0
16.0
24.0
32.0
40.0
48.0
56.0
64.0
72.0
Time (hr)

Graph


Tank: MZ Josey Prop 3 MG Elev Tank
Calculated Level versus Time
MZ Josey Prop 3 MG Elev Tank\Max Hour with Rest. - New TOD WL's
Calculated Level (ft)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
0.0
8.0
16.0
24.0
32.0
40.0
48.0
56.0
64.0
72.0
Time (hr)

CARROLLTON TEXAS

TRANSIT ORIENTED DEVELOPMENT (TOD) STUDY

TOD AREA
MAX HOUR

- *JUNCTION NODE RESULTS*
- *PIPE RESULTS*

Scenario: Max Hour with Rest. - New TOD WL's
Extended Period Analysis: 30.00 hr / 72.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (Calculated) (mgd)	Calculated Hydraulic Grade (ft)	Pressure Head (ft)	Pressure (psi)
J-469	447.00	Low Service Area	Demanc	0.10477	633.44	186.44	80.67
J-286	450.00	Low Service Area	Demanc	0.05272	631.52	181.52	78.54
J-96	448.00	Low Service Area	Demanc	0.22757	634.82	186.82	80.83
J-241	450.00	Low Service Area	Demanc	0.08839	632.36	182.36	78.90
J-945	440.00	Low Service Area	Demanc	0.04582	630.99	190.99	82.63
J-1019	449.00	Low Service Area	Demanc	0.00000	634.99	185.99	80.47
J-711	440.00	Low Service Area	Demanc	0.07879	631.51	191.51	82.86
J-306	450.00	Low Service Area	Demanc	0.15847	635.45	185.45	80.24
J-665	449.00	Low Service Area	Demanc	0.15847	636.90	187.90	81.30
J-287	449.00	Low Service Area	Demanc	0.03567	633.01	184.01	79.61
J-1043	0.00	Low Service Area	Demanc	0.00000	652.16	652.16	282.16
J-1022	450.00	Low Service Area	Demanc	0.03567	632.49	182.49	78.95
J-501	445.00	Low Service Area	Demanc	0.04582	630.96	185.96	80.46
J-813	449.00	Low Service Area	Demanc	0.03567	632.70	183.70	79.48
J-712	449.00	Low Service Area	Demanc	0.05272	631.60	182.60	79.00
J-131	450.00	Medium Service Area	Demanc	0.41318	683.56	233.56	101.05
J-724	455.00	Medium Service Area	Demanc	0.04895	688.70	233.70	101.11
J-1045	0.00	Medium Service Area	Demanc	0.00000	659.75	659.75	285.44
J-710	460.00	Medium Service Area	Demanc	0.07202	689.94	229.94	99.49
J-130	450.00	Medium Service Area	Demanc	0.41318	676.56	226.56	98.02
J-334	500.00	Medium Service Area	Demanc	0.08981	692.56	192.56	83.31
J-341	451.00	Medium Service Area	Demanc	0.18458	677.75	226.75	98.10
J-1042	0.00	Medium Service Area	Demanc	0.00000	654.82	654.82	283.31
J-869	449.00	Medium Service Area	Demanc	0.25067	666.24	217.24	93.99
J-1046	0.00	Medium Service Area	Demanc	0.00000	663.18	663.18	286.93
J-733	449.00	Medium Service Area	Demanc	0.25067	666.50	217.50	94.10
J-872	480.00	Medium Service Area	Demanc	0.30488	675.20	195.20	84.45
J-331	450.00	Medium Service Area	Demanc	0.13451	676.71	226.71	98.09
J-332	449.00	Medium Service Area	Demanc	0.30089	684.87	235.87	102.05
J-947	449.00	Medium Service Area	Demanc	0.04895	688.51	239.51	103.63
J-333	452.00	Medium Service Area	Demanc	0.08981	687.68	235.68	101.97
J-301	455.00	Medium Service Area	Demanc	0.25406	676.83	221.83	95.98
J-1021	453.00	Medium Service Area	Demanc	0.04895	688.51	235.51	101.90
J-948	449.00	Medium Service Area	Demanc	0.00000	688.43	239.43	103.59
J-533	505.00	Medium Service Area	Demanc	0.42754	693.54	188.54	81.57
J-876	460.00	Medium Service Area	Demanc	0.04895	683.57	223.57	96.73
J-339	465.00	Medium Service Area	Demanc	0.34026	686.23	221.23	95.72
J-473	451.00	Medium Service Area	Demanc	0.47391	667.95	216.95	93.86
J-949	455.00	Medium Service Area	Demanc	0.04895	688.44	233.44	101.00
J-870	470.00	Medium Service Area	Demanc	0.35383	673.27	203.27	87.94
J-734	430.00	Medium Service Area	Demanc	0.25067	666.50	236.50	102.32
J-723	457.00	Medium Service Area	Demanc	0.04895	686.19	229.19	99.16
J-727B	445.00	Medium Service Area	Demanc	0.54988	649.64	204.64	88.54
J-289	528.00	Medium Service Area	Demanc	0.57730	666.51	138.51	59.93
J-337	493.00	Medium Service Area	Demanc	0.20574	691.25	198.25	85.77
J-1020	455.00	Medium Service Area	Demanc	0.04895	688.45	233.45	101.00
J-675	455.00	Medium Service Area	Demanc	0.12097	688.76	233.76	101.14
J-95	455.00	Medium Service Area	Demanc	0.08123	688.79	233.79	101.15
J-472	450.00	Medium Service Area	Demanc	0.04895	669.43	219.43	94.94
J-979	468.00	Medium Service Area	Demanc	0.27713	692.38	224.38	97.08
J-470	452.00	Medium Service Area	Demanc	0.04895	673.19	221.19	95.70
J-471	450.00	Medium Service Area	Demanc	0.04895	672.18	222.18	96.13

Scenario: Max Hour with Rest. - New TOD WL's
Extended Period Analysis: 30.00 hr / 72.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (Calculated) (mgd)	Calculated Hydraulic Grade (ft)	Pressure Head (ft)	Pressure (psi)
J-736	520.00	Medium Service Area	Demanc	0.32223	661.85	141.85	61.37
J-342	452.00	Medium Service Area	Demanc	0.19040	677.09	225.09	97.39
J-735	500.00	Medium Service Area	Demanc	0.50807	660.06	160.06	69.25
J-1044	0.00	Medium Service Area	Demanc	0.00000	667.81	667.81	288.93
J-727	450.00	Medium Service Area	Demanc	0.15021	648.79	198.79	86.01
J-338	475.00	Medium Service Area	Demanc	0.20574	688.13	213.13	92.21
J-352	451.00	Medium Service Area	Demanc	0.39614	678.83	227.83	98.57
J-946	455.00	Medium Service Area	Demanc	0.12552	688.65	233.65	101.09

Scenario: Max Hour with Rest. - New TOD WL's
Extended Period Analysis: 30.00 hr / 72.00
Pipe Report

Label	From Node	To Node	Diameter (in)	Length (ft)	Hazen-Williams C	Open?	Velocity (ft/s)	Pressure Pipe Headloss (ft)	From Elevation (ft)	Description
P-1141	J-734	J-472	8	2,809.00	110.0	true	1.15	2.93	430.00	TOD
P-1142	J-130	J-1042	12	4,572.00	120.0	true	3.68	21.74	450.00	TOD
P-1148	J-1042	J-1043	12	1,079.00	120.0	true	2.58	2.66	0.00	TOD
P-1150	J-131	J-948	8	2,803.00	110.0	true	1.52	4.87	450.00	TOD
P-1151	J-331	J-332	8	2,810.00	110.0	true	2.00	8.16	450.00	TOD
P-1153	J-1042	J-665	8	4,171.00	110.0	true	2.47	17.92	0.00	TOD
P-1156	J-1021	J-471	8	3,458.00	110.0	true	2.60	16.34	453.00	TOD
P-1161	J-970	J-1044	8	2,482.00	110.0	true	1.82	6.04	460.00	TOD
P-1162	J-1044	J-473	8	539.00	110.0	true	0.54	0.14	0.00	TOD
P-1167	J-735	J-1045	8	936.00	110.0	true	0.62	0.31	500.00	TOD
P-1177	J-1045	J-1046	8	1,979.00	110.0	true	1.51	3.43	0.00	TOD
P-1178	J-665	J-306	12	1,042.00	120.0	true	1.89	1.45	449.00	TOD
P-1189	J-95	J-723	12	470.00	120.0	true	3.99	2.60	455.00	TOD
P-1192	J-723	J-876	12	496.00	120.0	true	3.90	2.62	457.00	TOD
P-1193	J-876	J-301	12	1,334.00	120.0	true	3.80	6.74	460.00	TOD
P-1194	J-733	J-869	12	458.00	120.0	true	1.18	0.26	449.00	TOD
P-260	J-240	J-241	12	1,639.00	120.0	true	0.11	0.01	445.00	
P-367	J-341	J-342	12	1,655.00	120.0	true	0.96	0.66	451.00	
P-414	J-130	J-131	12	2,495.00	120.0	true	2.77	7.00	450.00	
P-411	J-331	J-130	16	536.00	120.0	true	0.97	0.15	450.00	
P-848	J-469	J-287	8	706.00	110.0	true	0.87	0.44	447.00	
P-842	J-711	J-712	12	2,194.00	120.0	true	0.29	0.10	440.00	
P-187B	J-1019	J-950	12	322.00	120.0	true	1.27	0.21	449.00	
P-847	J-305	J-469	8	1,966.00	110.0	true	0.26	0.13	445.00	
P-359	J-332	J-333	12	1,093.00	120.0	true	2.64	2.81	449.00	
P-318	J-238	J-286	12	1,594.00	120.0	true	0.08	0.01	440.00	
P-456	J-946	J-675	12	87.00	120.0	true	1.83	0.11	455.00	
P-502	J-469	J-303	12	1,559.00	120.0	true	0.48	0.17	447.00	
P-363	J-337	J-338	12	966.00	120.0	true	2.98	3.11	493.00	
P-244	J-813	J-240	8	1,782.00	110.0	true	0.47	0.35	449.00	
P-360	J-333	J-334	12	2,526.00	120.0	true	2.26	4.88	452.00	
P-364	J-338	J-339	12	651.00	120.0	true	2.83	1.90	475.00	
P-838	J-675	J-710	12	725.00	120.0	true	2.06	1.18	455.00	
P-503	J-301	J-470	12	1,601.00	120.0	true	2.47	3.65	455.00	
P-761	J-306	J-665	8	974.00	110.0	false	0.00	0.00	450.00	
P-504	J-470	J-471	12	477.00	120.0	true	2.37	1.01	452.00	
P-187A	J-96	J-1019	12	259.00	120.0	true	1.27	0.17	448.00	
P-185	J-528	J-95	24	464.00	125.0	true	3.58	0.87	460.00	
P-506	J-472	J-473	12	508.00	120.0	true	2.83	1.48	450.00	
P-781	J-946	J-332	12	3,150.00	120.0	true	1.75	3.78	455.00	
P-544	J-727B	J-501	8	216.00	110.0	false	0.00	0.00	445.00	
P-875	J-733	J-734	12	1,181.00	120.0	true	0.02	0.00	449.00	
P-861	J-727	J-727B	8	623.00	110.0	true	1.33	0.85	450.00	
P-841	J-238	J-711	12	1,503.00	120.0	true	0.10	0.01	440.00	
P-874	J-473	J-733	12	1,337.00	120.0	true	1.65	1.44	451.00	
P-505	J-471	J-472	12	656.00	120.0	true	3.44	2.75	450.00	
P-186	J-302	J-96	12	1,279.00	120.0	true	1.53	1.20	449.00	
P-859	J-241	J-712	8	586.00	110.0	true	1.29	0.76	450.00	
P-860	J-712	J-286	8	536.00	110.0	true	0.41	0.08	449.00	
P-1028	J-471	J-813	12	310.00	120.0	false	0.00	0.00	450.00	
P-1029	J-302	J-287	12	1,781.00	120.0	true	0.89	0.61	449.00	

Scenario: Max Hour with Rest. - New TOD WL's
Extended Period Analysis: 30.00 hr / 72.00
Pipe Report

Label	From Node	To Node	Diameter (in)	Length (ft)	Hazen-Williams C	Open?	Velocity (ft/s)	Pressure Pipe Headloss (ft)	From Elevation (ft)	Description
P-1027	J-813	J-287	12	509.00	120.0	true	1.20	0.31	449.00	
P-880	J-331	J-342	12	754.00	120.0	true	1.10	0.38	450.00	
P-876	J-734	J-501	12	483.00	120.0	false	0.00	0.00	430.00	
P-879	J-735	J-736	12	832.00	120.0	true	2.39	1.79	500.00	
P-1445	J-289	J-736	12	1,345.00	120.0	true	3.10	4.66	528.00	
P-1449	J-533	J-872	8	2,655.00	110.0	true	3.20	18.35	505.00	
P-1309	J-949	J-950	8	336.00	110.0	false	0.00	0.00	455.00	
P-1026A	J-1022	J-813	12	566.00	120.0	true	0.93	0.21	450.00	
P-1026B	J-241	J-1022	12	403.00	120.0	true	0.86	0.13	450.00	
P-1160	J-1044	J-869	8	1,471.00	110.0	true	1.16	1.57	0.00	
P-1079	J-949	J-1020	8	212.00	110.0	true	0.29	0.02	455.00	
P-1080	J-1019	J-1020	8	348.00	110.0	false	0.00	0.00	449.00	
P-1158	J-876	J-723	8	444.00	110.0	false	0.00	0.00	460.00	
P-1084	J-1022	J-472	12	407.00	120.0	false	0.00	0.00	450.00	
P-1144	J-665	J-1043	8	3,500.00	110.0	true	2.49	15.26	449.00	
P-1081	J-1020	J-1021	8	264.00	110.0	true	0.51	0.06	455.00	
P-1146	J-733	J-869	6	264.00	110.0	false	0.00	0.00	449.00	
P-1001	J-711	J-245	8	1,787.00	110.0	true	0.52	0.43	440.00	
P-1012	J-501	J-732	8	2,231.00	110.0	true	0.20	0.09	445.00	
P-1159	J-870	J-1044	8	1,303.00	110.0	true	2.44	5.46	470.00	
P-1157	J-301	J-876	8	1,266.00	110.0	false	0.00	0.00	455.00	
P-1145	J-511	J-727B	8	2,493.00	110.0	true	2.02	7.35	500.00	
P-1306	J-948	J-949	8	1,192.00	110.0	true	0.07	0.01	449.00	
P-1302	J-945	J-734	8	1,072.00	110.0	false	0.00	0.00	440.00	
P-438	J-95	J-723	8	392.00	110.0	false	0.00	0.00	455.00	
P-439	J-533	J-979	12	1,501.00	120.0	true	1.38	1.17	505.00	
P-1305	J-947	J-948	8	52.00	110.0	true	1.44	0.08	449.00	
P-1303	J-946	J-724	16	566.00	120.0	true	0.51	0.05	455.00	
P-1301	J-816	J-945	8	1,723.00	110.0	true	0.20	0.07	449.00	
P-188B	J-1021	PRV-3	24	173.00	125.0	true	1.92	0.10	453.00	
P-188A	J-95	J-1021	24	342.00	125.0	true	2.29	0.28	455.00	
P-188C	PRV-3	J-96	24	153.00	125.0	true	1.92	0.09	450.00	
P-190	J-872	J-870	8	584.00	110.0	true	2.15	1.93	480.00	
P-436	J-131	J-332	12	426.00	120.0	true	2.91	1.31	450.00	
P-192	J-870	J-301	8	1,405.00	110.0	true	1.86	3.57	470.00	
P-1457	J-342	J-352	12	1,671.00	120.0	true	1.62	1.74	452.00	
P-1450	J-710	J-979	12	782.00	120.0	true	2.92	2.43	460.00	
P-1455	J-735	J-500	8	1,660.00	110.0	true	2.21	5.80	500.00	
P-1308	J-950	J-306	12	251.00	120.0	true	1.58	0.25	448.00	
P-1458	J-352	J-339	12	1,476.00	120.0	true	3.78	7.40	451.00	
P-1494	J-341	J-352	12	1,504.00	120.0	true	1.33	1.08	451.00	
P-1163	J-806	J-1045	8	462.00	110.0	true	0.71	0.20	505.00	
P-1164	J-1045	J-511	8	496.00	110.0	true	2.84	2.76	0.00	
P-1304	J-946	J-947	12	555.00	120.0	true	0.74	0.13	455.00	
P-1172	J-1046	J-869	8	606.00	110.0	true	2.70	3.06	0.00	
P-1300	J-724	J-95	16	908.00	120.0	true	0.56	0.10	455.00	
P-1171	J-806	J-1046	8	2,940.00	110.0	true	1.18	3.23	505.00	

CARROLLTON TEXAS

TRANSIT ORIENTED DEVELOPMENT (TOD) STUDY

TOD BUILDOUT MODEL
FIRE FLOW RESULTS

Scenario: Max Hour with Rest. - New TOD WL's
Extended Period Analysis: 34.00 hr / 72.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (Calculated) (mgd)	Calculated Hydraulic Grade (ft)	Pressure Head (ft)	Pressure (psi)	Pattern
J-1043	450.00	Low Service Area	Demand	0.00000	648.60	198.60	85.93	EPS2
J-287	449.00	Low Service Area	Demand	0.02375	633.03	184.03	79.62	EPS2
J-665	449.00	Low Service Area	Demand	0.10549	636.68	187.68	81.20	EPS2
J-1022	450.00	Low Service Area	Demand	0.02375	632.35	182.35	78.90	EPS2
J-712	449.00	Low Service Area	Demand	0.03509	631.88	182.88	79.12	EPS2
J-813	449.00	Low Service Area	Demand	0.02375	632.62	183.62	79.44	EPS2
J-501	445.00	Low Service Area	Demand	0.03050	631.66	186.66	80.76	EPS2
J-306	450.00	Low Service Area	Demand	0.10549	635.47	185.47	80.24	EPS2
J-96	448.00	Low Service Area	Demand	0.15149	634.83	186.83	80.83	EPS2
J-286	450.00	Low Service Area	Demand	0.03509	631.84	181.84	78.68	EPS2
J-469	447.00	Low Service Area	Demand	0.06975	633.61	186.61	80.74	EPS2
J-241	450.00	Low Service Area	Demand	0.05884	632.18	182.18	78.82	EPS2
J-711	440.00	Low Service Area	Demand	0.05245	631.84	191.84	83.00	EPS2
J-1019	449.00	Low Service Area	Demand	0.00000	635.01	186.01	80.48	EPS2
J-945	440.00	Low Service Area	Demand	0.03050	631.68	191.68	82.93	EPS2
J-1020	455.00	Medium Service Area	Demand	0.03258	674.89	219.89	95.14	EPS2
J-337	493.00	Medium Service Area	Demand	0.13696	678.52	185.52	80.26	EPS2
J-675	455.00	Medium Service Area	Demand	0.08053	675.28	220.28	95.31	EPS2
J-472	450.00	Medium Service Area	Demand	0.03258	627.08	177.08	76.62	EPS2
J-95	455.00	Medium Service Area	Demand	0.05407	675.15	220.15	95.25	EPS2
J-289	528.00	Medium Service Area	Demand	0.38430	651.98	123.98	53.64	EPS2
J-870	470.00	Medium Service Area	Demand	1.67554	626.80	156.80	67.84	Composite
J-949	455.00	Medium Service Area	Demand	0.03258	674.89	219.89	95.14	EPS2
J-734	430.00	Medium Service Area	Demand	0.16686	619.34	189.34	81.92	EPS2
J-727B	445.00	Medium Service Area	Demand	0.36605	627.93	182.93	79.15	EPS2
J-723	457.00	Medium Service Area	Demand	0.03258	668.89	211.89	91.68	EPS2
J-727	450.00	Medium Service Area	Demand	0.09999	627.53	177.53	76.81	EPS2
J-1044	455.00	Medium Service Area	Demand	1.44000	619.98	164.98	71.38	Fire Curve-2
J-338	475.00	Medium Service Area	Demand	0.13696	676.04	201.04	86.98	EPS2
J-946	455.00	Medium Service Area	Demand	0.08356	675.15	220.15	95.25	EPS2
J-352	451.00	Medium Service Area	Demand	0.26371	668.37	217.37	94.05	EPS2
J-735	500.00	Medium Service Area	Demand	0.33822	636.73	136.73	59.16	EPS2
J-470	452.00	Medium Service Area	Demand	0.03258	636.63	184.63	79.88	EPS2
J-979	468.00	Medium Service Area	Demand	0.18448	679.25	211.25	91.40	EPS2
J-471	450.00	Medium Service Area	Demand	0.03258	634.13	184.13	79.66	EPS2
J-342	452.00	Medium Service Area	Demand	0.12674	667.19	215.19	93.10	EPS2
J-736	520.00	Medium Service Area	Demand	0.21450	640.88	120.88	52.30	EPS2
J-473	451.00	Medium Service Area	Demand	0.31547	623.16	172.16	74.49	EPS2
J-1042	450.00	Medium Service Area	Demand	0.00000	650.58	200.58	86.78	EPS2
J-341	451.00	Medium Service Area	Demand	0.12287	667.67	216.67	93.74	EPS2
J-869	449.00	Medium Service Area	Demand	1.60686	617.63	168.63	72.96	Composite
J-733	449.00	Medium Service Area	Demand	0.16686	619.18	170.18	73.63	EPS2
J-1046	455.00	Medium Service Area	Demand	1.44000	616.94	161.94	70.06	Fire Curve-2
J-334	500.00	Medium Service Area	Demand	0.05978	680.06	180.06	77.91	EPS2
J-724	455.00	Medium Service Area	Demand	0.03258	675.15	220.15	95.25	EPS2
J-131	450.00	Medium Service Area	Demand	0.27505	672.37	222.37	96.21	EPS2
J-1045	500.00	Medium Service Area	Demand	0.00000	628.09	128.09	55.42	Fixed
J-130	450.00	Medium Service Area	Demand	0.27505	666.94	216.94	93.86	EPS2
J-710	460.00	Medium Service Area	Demand	0.04794	676.55	216.55	93.69	EPS2
J-948	449.00	Medium Service Area	Demand	0.00000	674.97	225.97	97.77	EPS2
J-1021	453.00	Medium Service Area	Demand	0.03258	674.89	221.89	96.00	EPS2
J-533	505.00	Medium Service Area	Demand	0.28461	679.67	174.67	75.57	EPS2

Scenario: Max Hour with Rest. - New TOD WL's
Extended Period Analysis: 34.00 hr / 72.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (Calculated) (mgd)	Calculated Hydraulic Grade (ft)	Pressure Head (ft)	Pressure (psi)	Pattern
J-339	465.00	Medium Service Area	Demand	0.22650	674.60	209.60	90.68	EPS2
J-876	460.00	Medium Service Area	Demand	0.03258	662.41	202.41	87.57	EPS2
J-301	455.00	Medium Service Area	Demand	0.16912	645.29	190.29	82.33	EPS2
J-331	450.00	Medium Service Area	Demand	0.08954	667.03	217.03	93.90	EPS2
J-872	480.00	Medium Service Area	Demand	0.20295	638.42	158.42	68.54	EPS2
J-332	449.00	Medium Service Area	Demand	0.20030	673.34	224.34	97.06	EPS2
J-333	452.00	Medium Service Area	Demand	0.05978	675.82	223.82	96.83	EPS2
J-947	449.00	Medium Service Area	Demand	0.03258	675.04	226.04	97.80	EPS2

Scenario: Max Hour with Rest. - New TOD WL's
Extended Period Analysis: 34.00 hr / 72.00
Pipe Report

Label	From Node	To Node	Diameter (in)	Length (ft)	Hazen-Williams C	Open?	Velocity (ft/s)	Pressure Pipe Headloss (ft)	From Elevation (ft)	Description
P-1156	J-1021	J-471	8	3,458.00	110.0	true	4.26	40.76	453.00	TOD
P-1177	J-1045	J-1046	8	1,979.00	110.0	true	2.86	11.15	0.00	TOD
P-1150	J-131	J-948	8	2,803.00	110.0	true	1.08	2.60	450.00	TOD
P-1192	J-723	J-876	12	496.00	120.0	true	6.35	6.49	457.00	TOD
P-1161	J-970	J-1044	8	2,482.00	110.0	true	2.14	8.19	460.00	TOD
P-1162	J-1044	J-473	8	539.00	110.0	true	2.94	3.18	0.00	TOD
P-1167	J-735	J-1045	8	936.00	110.0	true	3.74	8.65	500.00	TOD
P-1142	J-130	J-1042	12	4,572.00	120.0	true	3.15	16.36	450.00	TOD
P-1178	J-665	J-306	12	1,042.00	120.0	true	1.72	1.21	449.00	TOD
P-1148	J-1042	J-1043	12	1,079.00	120.0	true	2.20	1.98	0.00	TOD
P-1189	J-95	J-723	12	470.00	120.0	true	6.41	6.26	455.00	TOD
P-1151	J-331	J-332	8	2,810.00	110.0	true	1.74	6.31	450.00	TOD
P-1193	J-876	J-301	12	1,334.00	120.0	true	6.29	17.12	460.00	TOD
P-1194	J-733	J-869	12	458.00	120.0	true	3.06	1.55	449.00	TOD
P-1153	J-1042	J-665	8	4,171.00	110.0	true	2.16	13.90	0.00	TOD
P-1141	J-734	J-472	8	2,809.00	110.0	true	1.95	7.74	430.00	TOD