Greater Texoma Utility Authority

GTU09166

Final Technical Report

Regional Wastewater Facility Concept Planning for the Upper East Fork Basin

STATE OF TEXAS
SCOTT A. COLE
98813
LICENSED
PROFESSIONAL ENGINEER

09/24/10

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

September 2010

Prepared for:

Greater Texoma Utility Authority

Prepared by

Freese and Nichols, Inc.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
(817) 735-7300

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FREESE AND NICHOLS

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EXECUTIVE SUMMARY

The Greater Texoma Utility Authority contracted with Freese and Nichols, Inc. to develop a regional wastewater facility conceptual plan for the Upper East Fork Basin through 2030. As the growth in north Collin and south Grayson counties continues northward, it has become increasingly important to have a comprehensive, long term plan for wastewater service in place. The participating entities for this study include the Cities of Anna, Celina, Howe, McKinney, Melissa, Princeton, Van Alstyne and Weston. The North Texas Municipal Water District (NTMWD) currently serves as a wholesale wastewater service provider for the cities of McKinney, Princeton and Melissa and was a key member of the project team. A map of the GTUA study area is shown in **Figure ES1**.

The scope of work for this project includes:

- Description of existing conditions for the planning area, such as population, wastewater flows and existing wastewater facilities.
- Projection of future population and wastewater flows
- Discussion on additional planning considerations, such as water conservation, water reuse opportunities, water quality, treatment plant siting and permitting, and financial and administrative issues
- Analysis of alternatives for wastewater service for the following three scenarios:
    - Individual treatment facilities
    - A single regional facility
    - Multiple regional facilities

1.0 EXISTING CONDITIONS

Historical and existing populations were developed using completed surveys from each participating city along with the North Central Texas Council of Government (NCTCOG) population estimates where gaps in the survey data were present. The 2009 population values are from 2009 NCTCOG population estimates. The cities of Howe, Van Alstyne and Weston are not members of NCTCOG, therefore the historical population for those cities was determined by interpolating between 2000 Census population data and projected populations provided by each respective city. **Table ES 1** shows the population for each city from 2004 to 2009.

Table ES 1 Historical Population by City from 2004 to 2009

Year	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston
2004	4,945	3,100	2,655	85,865	1,900	3,750	2,675	761
2005	6,538	3,665	2,720	94,733	2,300	4,000	2,725	797
2006	7,635	4,424	2,785	104,853	2,900	4,550	2,790	834
2007	7,800	4,620	2,860	115,198	3,500	5,100	2,915	873
2008	7,962	4,850	2,915	120,978	4,752	5,843	2,940	913
2009	8,100	5,100	2,960	121,800	5,070	6,124	2,950	956

Historical wastewater flows were obtained from each city, if available, and are shown below in **Table ES 2.** The cities of Celina and Anna have their own wastewater treatment plants and provided their historical wastewater flow data. NTMWD currently serves the cities of McKinney, Melissa and Princeton and provided historical flow data for each of those entities. The City of Howe currently sends all of its flow to the City of Sherman but does not have historical flow meter records and the City of Weston consists of entirely septic customers. The City of Van Alstyne has its own wastewater treatment plant but did not have historical flow meter data.

Table ES 2 Historical Average Annual Wastewater Flow by City from 2004 to 2009

Year	Average Annual Flow (MGD)				
	Anna	Celina	McKinney	Melissa	Princeton
2004	0.20	0.40	-	-	-
2005	0.23	0.57	11.21	-	0.31
2006	0.35	0.45	11.73	-	0.35
2007	0.54	0.46	16.00	0.31	0.52
2008	0.49	0.39	14.46	0.28	0.49
2009	0.43	0.52	13.46	0.40	0.50

The existing wastewater treatment facilities in Celina, Anna, and Van Alstyne were evaluated as part of this study. Existing capacities and potential to serve as part of the GTUA wastewater system were evaluated as part of the study.

2.0 PROJECTION OF FUTURE POPULATION AND FLOWS

In order to determine this study's adopted population projections, three population projection growth scenarios were analyzed: a moderate growth scenario, a fast growth scenario and the Region C growth scenario. It was decided to use the Region C population projections if they were the highest of the three population projections and to never use a population for any city less than that of Region C. In cases where the moderate growth projections were higher than Region C projections, the difference was split down the middle between the Region C population and the moderate growth scenario population for each city. The City of Celina was handled in a unique manner by assuming that the City will send 25% of their flow to this proposed regional system. **Table ES 3** shows the adopted population projections for each city to be used for this regional study.

Table ES 3 Adopted Populations for this Regional Facility Planning Study

Year	Anna	Celina[1]	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	Totals
2010	9,000	1,270	3,000	130,000	5,065	6,228	3,000	2,000	159,563
2020	14,000	6,353	4,927	200,000	23,000	12,356	8,385	4,000	273,021
2030	21,000	13,450	8,368	275,000	35,000	18,000	17,475	7,000	395,293

[1] Celina only includes 25% of total city flow

All proposed infrastructure will be sized to serve the wastewater flows in 2030. The projected annual average flows will be used to size treatment plant capacity and the peak flows will be used to size interceptor and lift station capacity. A future planning per capita of 115 gpcd will be used for all cities and planning years. The projected average annual wastewater flows for each city and planning period are shown in **Table ES 4**.

Table ES 4 Projected Average Annual Wastewater Flows

	Flows in MGD								
Year	Anna	Celina[1]	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	Totals
2010	1.04	0.16	0.35	14.95	0.58	0.72	0.35	0.23	18.38
2020	1.61	0.73	0.57	23.00	2.65	1.42	0.96	0.46	31.40
2030	2.42	1.55	0.96	31.63	4.03	2.07	2.01	0.81	45.48

[1] Celina only includes 25% of total city flow

Using NTMWD flow meter data and recognizing that I/I can increase as the system ages, it was determined that a 3.0 planning peaking factor will be used to convert average annual flows to peak flows for all planning years. **Table ES 5** shows the projected peak wastewater flows for each city for the 2010, 2020 and 2030 planning periods.

Table ES 5 Projected Peak Wastewater Flows

	Flows in MGD								
Year	**Anna**	**Celina[1]**	**Howe**	**McKinney**	**Melissa**	**Princeton**	**Van Alstyne**	**Weston**	**Totals**
2010	3.11	0.44	1.04	44.85	1.75	2.15	1.04	0.69	55.07
2020	4.83	2.19	1.70	69.00	7.94	4.26	2.89	1.38	94.19
2030	7.25	4.64	2.89	94.88	12.08	6.21	6.03	2.42	136.4

[1] Celina only includes 25% of total city flow

3.0 ADDITIONAL PLANNING CONSIDERATIONS

As part of this regional wastewater study, the following planning considerations were explored and discussed in Section 3 of this report:

- Water Conservation Plans
- Water Reuse Opportunities
- Water Quality
- Treatment Plant Siting and Permitting
- Financial and Administrative Issues

4.0 ALTERNATIVES FOR WASTEWATER SERVICE

To meet the future wastewater needs for the Greater Texoma Utility Authority (GTUA) service area, the following alternatives for wastewater service were evaluated:

- Scenario 1: Multiple wastewater treatment plants (WWTPs) operated by the individual cities
- Scenario 2: Two regional WWTPs, Expand Existing Wilson Creek WWTP and Build Future Sister Grove WWTP
- Scenario 3: A single regional WWTP, Expand Existing Wilson Creek WWTP

Evaluation of treatment facility location, required facility sizing, transportation requirements, conveyance requirements, and cost projections were made for each alternative. Collection and conveyance costs were only considered when an interceptor to collect flow from multiple cities was required for the treatment alternative. Collection and conveyance costs associated with individual entity collection systems were not considered, as this was outside the scope of this study.

4.1 Scenario 1 - Individual Treatment Facilities

Multiple small facilities would distribute wastewater treatment throughout the GTUA region, rather than conveying all the wastewater to one or two locations. This decentralized approach may be beneficial for reuse opportunities and decrease large transmission lines, but can lead to increased construction costs and operation and maintenance costs.

4.2 Scenario 2 - Multiple Regional Facilities

If regionalization of wastewater facilities is pursued in the GTUA region, incorporation of two regional plants may be beneficial. Wastewater effluent could be transferred away from the Wilson Creek Cove, helping to decrease loadings to that portion of Lake Lavon. A multiple regional facility plan was evaluated with two regional facilities: the existing Wilson Creek WWTP and a proposed Sister Grove WWTP. The Sister Grove WWTP would be located on the East side of Princeton, with Sister Grove Creek receiving the effluent from the WWTP. This would help to distribute the wastewater effluent to other areas of Lake Lavon, alleviating some of the water quality concerns in the Wilson Creek cove. The proposed Sister Grove WWTP would treat flows from Anna, Celina, Howe, Melissa, Van Alstyne, and Weston. The Wilson Creek WWTP would continue to treat flows from McKinney, Princeton, and the flows from the non-GTUA region.

4.3 Scenario 3 - Single Regional Facility

The second option for regionalization of wastewater treatment in the GTUA region is transferring all flow to a single facility. The existing Wilson Creek WWTP is projected to be used as this regional facility. Utilizing a single regional facility would require similar collection and conveyance infrastructure as two regional facilities, but would focus all treatment efforts at one location helping to stream line operations and maintenance. The Wilson Creek WWTP would treat all flows in the GTUA region, as well as the existing flows from the non-GTUA region.

4.4 Alternatives Analysis

The cost associated with Scenario 1, Scenario 2, and Scenario 3 was associated with one of four categories: capital treatment costs, capital regional conveyance costs, operations and maintenance, and Upper East Fork Interceptor Fees (UEFIS) fees. Each of these components is discussed in Section 4. Total costs for each scenario are summarized in **Table ES 6**. The projected 20-year costs for Scenario 1, 2 and 3 are $768.39, $821.90 and $749.74 million, respectively.

Table ES 6 Total Cost By Scenario

	20-Year Total Cost (2010$ Millions)		
	Scenario 1	**Scenario 2**	**Scenario 3**
Anna	$47.72	$55.23	$50.61
Celina	$27.79	$26.92	$24.72
Howe	$24.13	$26.87	$25.18
McKinney	$498.87	$548.95	$498.87
Melissa	$65.55	$71.82	$65.55
Princeton	$43.04	$35.66	$32.42
Van Alstyne	$41.54	$39.47	$36.57
Weston	$20.30	$16.98	$15.62
TOTAL	**$768.39**	**$821.90**	**$749.54**

5.0 RECOMMENDATION

Based on the advantages associated with a centralized wastewater management system, it is recommended that Scenario 2 or 3 be pursued by the GTUA study participants. Currently, Scenario 3 is shown to be the most cost effective scenario over the twenty year planning period using existing assumptions. However, there are some additional considerations, such as loadings to Lake Lavon, intermediate and interim options, growth outside the study area and beyond the planning period that should be considered in the future and may impact the feasibility of Scenario 3 and the overall economic comparison for the GTUA region. Collection system modification and upgrades upstream of the North McKinney Lift Station were identical for Scenario 2 and 3 for the next 10 years. Wilson Creek will need to be expanded in the next 10 years in either scenario, but the need for the infrastructure associated with a Sister Grove WWTP would not be needed for 10 to 15 years, depending on growth and the desired flow capacity of the Sister Grove WWTP. Therefore, it is not necessary to make an immediate decision on whether to have a single regional WWTP (the Wilson Creek WWTP) or to have two regional WWTPs (the Wilson Creek WWTP or the Sister Grove WWTP). The overall recommended direction for the study area is to pursue regionalization of wastewater collection and treatment in the GTUA region, with continued discussion between the GTUA member entities and NTMWD to determine the direction for wastewater treatment facilities.

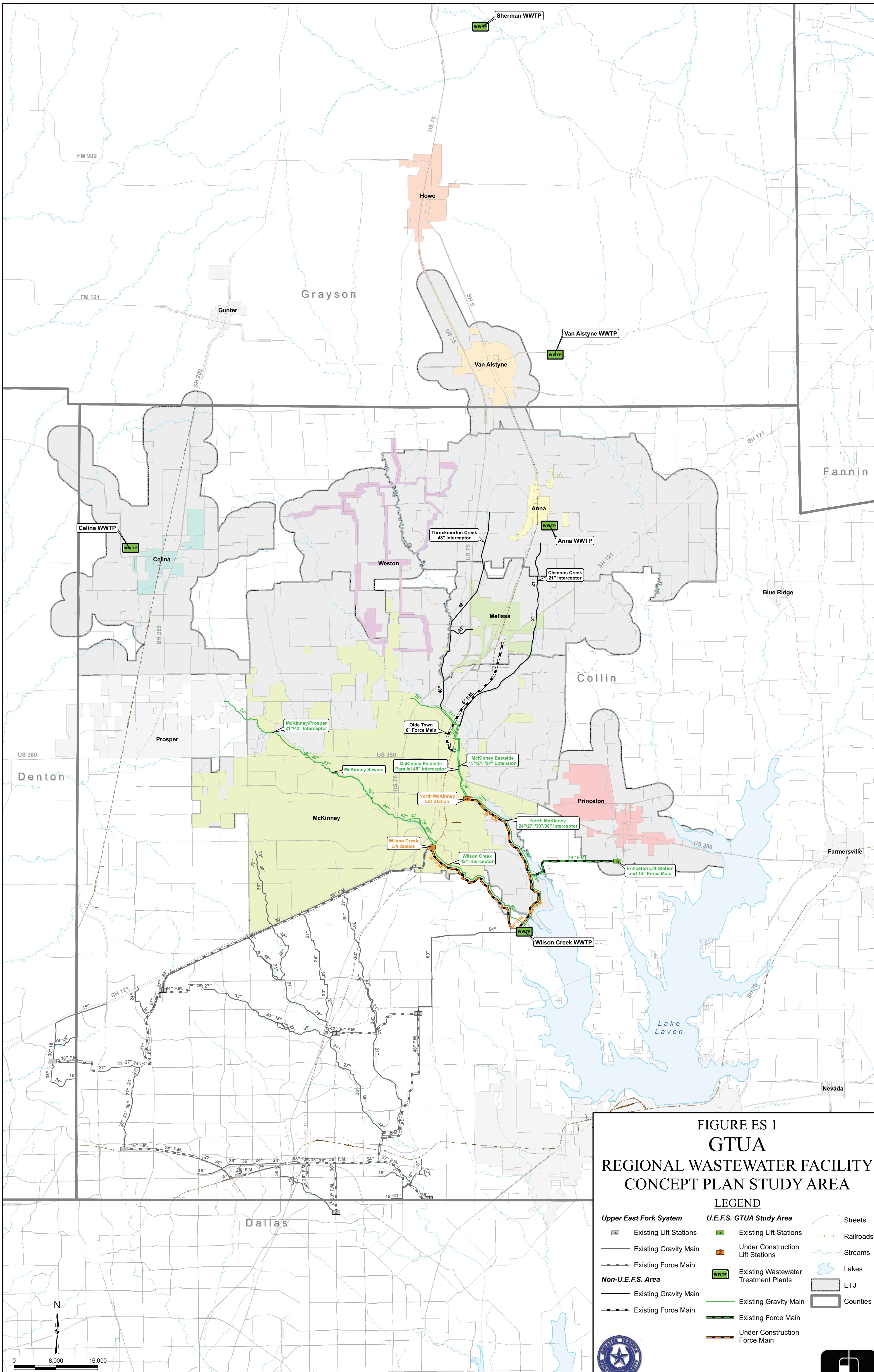

FIGURE ES 1
GTUA
REGIONAL WASTEWATER FACILITY
CONCEPT PLAN STUDY AREA
LEGEND
Upper East Fork System
Existing Lift Stations
Existing Gravity Main
Existing Force Main
Non-U.E.F.S. Area
Existing Gravity Main
Existing Force Main
U.E.F.S. GTUA Study Area
Existing Lift Stations
Under Construction Lift Stations
Existing Wastewater Treatment Plants
Existing Gravity Main
Existing Force Main
Under Construction Force Main
Streets
Railroads
Streams
Lakes
ETJ
Counties
Freese and Nichols
N
0
8,000
16,000
SCALE IN FEET
Sherman WWTP
Van Alstyne WWTP
Celina WWTP
Anna WWTP
Wilson Creek WWTP
Throckmorton Creek 48" Interceptor
Clemons Creek 21" Interceptor
McKinney/Prosper 21"/42" Interceptor
Olde Town 6" Force Main
McKinney Eastside 15"/21"/24" Extension
McKinney Eastside Parallel 48" Interceptor
McKinney Sewers
North McKinney Lift Station
North McKinney 24"/27"/30"/36" Interceptor
Wilson Creek Lift Station
Wilson Creek 42" Interceptor
Princeton Lift Station and 14" Force Main
Grayson
Collin
Denton
Dallas
Fannin
Howe
Gunter
Van Alstyne
Anna
Celina
Weston
Melissa
Blue Ridge
Prosper
McKinney
Princeton
Farmersville
Nevada
Lake Lavon
US 75
US 380
SH 5
SH 121
SH 289
SH 78
FM 902
FM 121

1.0 DESCRIPTION OF EXISTING CONDITIONS

1.1 Population

Historical and existing populations were developed using completed surveys from each participating city along with the North Central Texas Council of Government (NCTCOG) population estimates where gaps in the survey data were present. The 2009 population values are from 2009 NCTCOG population estimates. The cities of Howe, Van Alstyne and Weston are not members of NCTCOG, therefore the historical population for those cities was determined by interpolating between 2000 Census population data and projected populations provided by each respective city. **Table 1.1** shows the population for each city from 2004 to 2009.

Table 1.1 Historical Population by City from 2004 to 2009

Year	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston
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2005	6,538	3,665	2,720	94,733	2,300	4,000	2,725	797
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2008	7,962	4,850	2,915	120,978	4,752	5,843	2,940	913
2009	8,100	5,100	2,960	121,800	5,070	6,124	2,950	956

1.2 Wastewater Flows

Historical wastewater flows were obtained from each city, if available, and are shown below in **Table 1.2**. The cities of Celina and Anna have their own wastewater treatment plants and provided their historical annual wastewater flow data. NTMWD currently serves the cities of McKinney, Melissa and Princeton and provided annual historical flow data for each of those entities. The City of Howe currently sends all of its flow to the City of Sherman but does not have historical flow meter records and the City of Weston consists of entirely septic customers. The City of Van Alstyne has its own wastewater treatment plant but did not have historical flow meter data. Dry weather and maximum monthly flows were not provided. The annual average wastewater flows will be used as the basis for projecting peak wet weather flows as well as future planning period wastewater flows.

Table 1.2 Historical Average Annual Wastewater Flow by City from 2004 to 2009

Year	Average Annual Flow (MGD)				
	Anna	Celina	McKinney	Melissa	Princeton
2004	0.20	0.40	-	-	-
2005	0.23	0.57	11.21	-	0.31
2006	0.35	0.45	11.73	-	0.35
2007	0.54	0.46	16.00	0.31	0.52
2008	0.49	0.39	14.46	0.28	0.49
2009	0.43	0.52	13.46	0.40	0.50

1.3 Existing Wastewater Facilities

As part of the description of existing conditions, Freese and Nichols staff conducted site visits to each of the existing wastewater treatment plants within the study area. The cities that have these facilities are City of Celina, Anna and Van Alstyne. This section contains a detailed description of each facility and its permit status and operations capability.

1.3.1 City of Celina

A. ***Current Permit***

The Celina Wastewater Treatment Plant (WWTP) is permitted for a total average day flow of 0.5 million gallons per day (MGD) by the Texas Commission of Environmental Quality (TCEQ). The peak 2-hour flow rate is 1,389 gallons per minute (gpm) (2.0 MGD). The permit expires August 1, 2010. The TCEQ permitted effluent levels are shown in **Table 1.3**. In addition to the effluent permitted values, the effluent is also required to have a chlorine residual of at least 1.0 mg/L but not higher than 4.0 mg/L; the pH must be greater than 6 but less than 9 standard units; and the effluent must have a dissolved oxygen of 4.0 mg/L or greater.

Table 1.3 TCEQ Permitted Effluent Values for the Celina WWTP (Permit WQ0014246001)

	Daily Average mg/L(lbs/day)	7-day Avg mg/L	Daily Max mg/L	Single Grab mg/L
Carbonaceous Biochemical Oxygen Demand (cBOD5)	10 (42)	15	25	35
Total Suspended Solids	15 (63)	25	40	60
Ammonia Nitrogen	3 (13)	6	10	15

B. *Existing Facilities*

The WWTP consists of two parallel treatment trains, with common headworks and solids processing. An aerial view of the WWTP is shown on **Figure 1.1**, with the process flow diagram shown on **Figure 1.2**. The current average daily flow is 0.45 MGD.

Figure 1.1 Aerial View of Celina WWTP

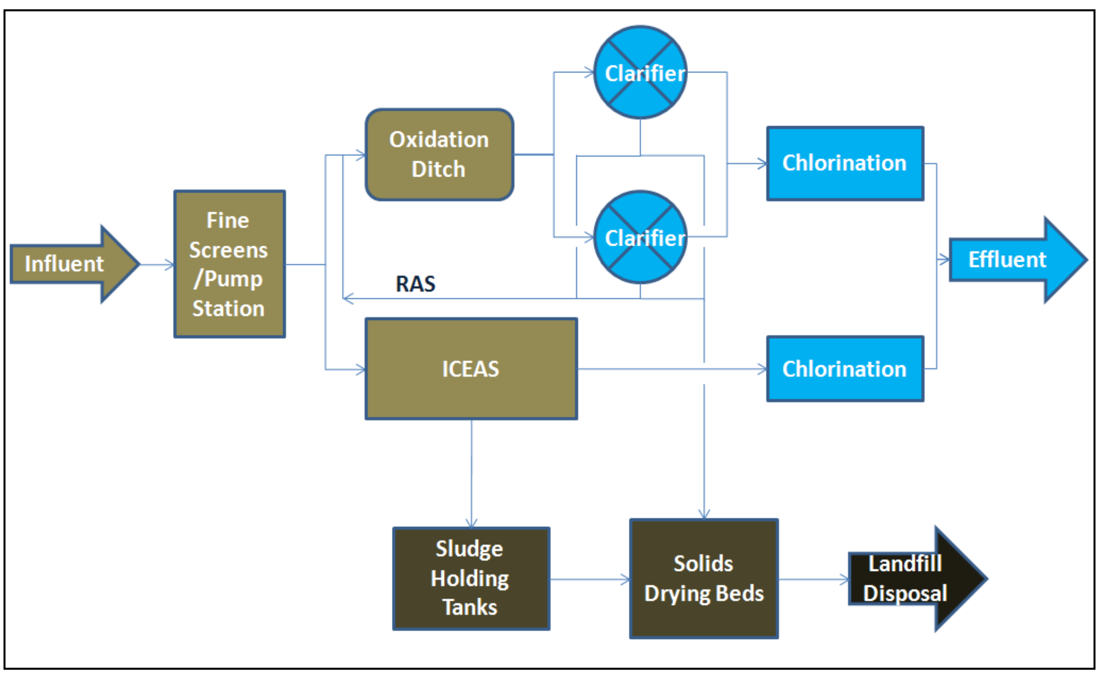


Figure 1.2 Process Flow Diagram for the Celina WWTP

Influent wastewater flows to a common headworks structure, where a single perforated plate traveling screen removes the screenings from the influent (**Figure 1.3**). A parallel bar screen exists in a bypass channel. After screening, the flow is distributed to the two treatment trains by an influent pump station, which houses six pumps. No grit removal is present in the primary treatment area, which could lead to grit accumulation in the basins and additional pump wear through the facility. Three pumps are devoted to the newer treatment train, two pumps are devoted to the older treatment train, and one flexible backup pump is included.

Figure 1.3 Influent Fine Screens at the Celina WWTP

The older portion of the plant is a mechanically aerated oxidation ditch with parallel secondary clarifiers. The oxidation ditch was constructed in 1987 and is shown on **Figure 1.4**. The current influent pump station configuration delivers 20 to 30% of the current average daily influent flow to the oxidation ditch, which is between 0.09 and 0.14 MGD. Significant solids have accumulated within the oxidation ditch itself; however, the effluent appeared clear from the secondary clarifiers. The performance of the oxidation ditch is not known as only a mixed effluent sample is analyzed that contains both the oxidation ditch and the newer treatment train. Return activated sludge (RAS) is returned from the clarifiers to the oxidation ditch. Waste activated sludge (WAS) from the secondary clarifiers is pumped to the solids drying beds located on the site. The liquid effluent flows to a dedicated chlorine contact chamber before flowing to the effluent outfall.

Figure 1.4 Oxidation Ditch at the Celina WWTP

The newer treatment train at the Celina WWTP is an Intermittent Cycle Extended Aeration System (ICEAS), a modification of the traditional sequencing batch reactor (SBR) that incorporates a continuous influent flow rate. The ICEAS is a two basin process, as shown on **Figure 1.5**. The ICEAS decants on a cyclic basis, resulting in a non-continuous effluent flow rate. The ICEAS train treats 70 to 80% of the current average day influent flow, which is approximately 0.32 to 0.36 MGD. The ICEAS treatment train has been operational since 2005. The liquid effluent from the ICEAS flows to a dedicated chlorine contact chamber before flowing to the effluent outfall. Solids flow to an aerobic solids holding tank attached to the ICEAS basins before being pumped to the solids drying beds.

Figure 1.5 Parallel Basins in the ICEAS at the Celina WWTP

The separate chlorine contact chambers are similar in structure, with a serpentine flow pattern to maximize chlorine contact time. To achieve the permitted chlorine concentration of between 1.0 and 4.0 mg/L, chlorine gas is dosed to the effluent water. Each chlorine contact chamber has separate chlorine feed system, and 150 pound cylinders are used for chlorine gas storage. Secondary aeration is accomplished downstream of the chlorine contact chambers before the final outfall.

The solids from both the oxidation ditch and the ICEAS are dewatered in solids drying beds, shown on **Figure 1.6**. Polymer is mixed with the solids before entering the drying beds. Screenings from the influent fine screens are mixed with the waste solids in the drying beds. As solids accumulate and dry, they are transferred to dumpsters and disposed of in a landfill.

Figure 1.6 Solids Dewatering Beds at the Celina WWTP

Based on the discharge monitoring reports (DMRs) for the last three years, the Celina WWTP is performing well within the permitted effluent limits. Effluent ammonia averages less than 1.0 mg N/L, BOD averages less than 3.0 mg/L, and effluent solids average less than 6.0 mg/L. Effluent pH and dissolved oxygen are well within the permitted range, and no TCEQ violations have been reported.

C. *Equipment Evaluation*

The influent fine screens and influent pumping station are in good working condition. The influent climber screen was rebuilt with stainless steel within the last three years, and the influent pumps were included with the ICEAS expansion.

At the time of the site visit, the oxidation ditch had only one operational surface aerator, which leads to significant foam/scum accumulation on the surface of the basin (**Figure 1.7**). This decreased velocity in the basin will also lead to increased grit and solids accumulation within the basin. The secondary clarifiers associated with the oxidation ditch appear to be in good working condition; however, the secondary clarifiers would not meet the new TCEQ Chapter 217 in the event that upgrades to the oxidation ditch were required.

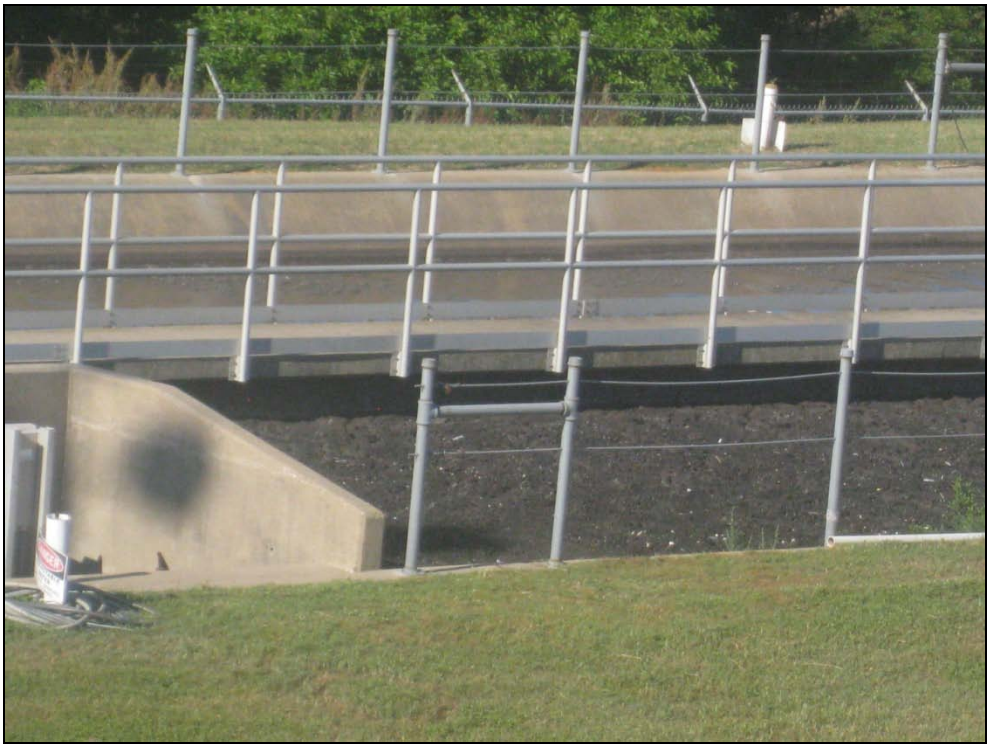


Figure 1.7 Solids Accumulation in the Oxidation Ditch at the Celina WWTP

The ICEAS treatment train is in good operating condition. Several issues concerning the decant equipment were noted at startup, but have since been resolved. The one area of concern on the ICEAS treatment train is the inclusion of above water PVC air piping. Typically, PVC does not withstand the high temperatures associated with compressed air for aeration. This air piping represents a critical failure point, and replacement of this piping would be desirable if future expansions were undertaken.

The chlorine contact chambers are adequately sized and all associated equipment appeared to be in good working condition. The solids dewatering beds are also serving the facility well, and outside of the concrete containment walls there is little to no equipment. The one area of concern is the large accumulation of solids within the containment area. If these solids begin to leave the containment area and accumulate on the ground surface, a TCEQ violation would result. Improvements to include a concrete pad for storage of the solids disposal dumpsters so these solids can be removed effectively should be implemented, as the dumpster is currently placed on an earthen pad and settling makes removal difficult.

D. ***Future Capabilities***

The ICEAS train of the plant is capable of handling low level ammonia requirements, but high levels of treatment with the existing oxidation ditch may be difficult. It is likely that the ICEAS is removing ammonia to well below the 3 mgN/L permit limit, and given that the oxidation ditch is only treating 20 to 30% of the influent flow, the higher ammonia levels from this treatment train are nullified by the 70 to 80% of the flow that is treated to a very high quality in the ICEAS treatment train.

The ability of the Celina WWTP to meet any future nutrient effluent permits through strictly biological processes would be limited by the oxidation ditch and the ICEAS operation. Both of the treatment trains would be capable of producing low level total nitrogen effluents if operated for nitrogen removal, but biological phosphorus removal would be limited. It is likely that future phosphorus permits, if applied to the Celina WWTP, would need to be met through chemical precipitation.

Although expansion area has been planned for the Celina WWTP, future expansion is expected to be limited by directing a large portion of the flow to the Upper Trinity Regional Water District (UTRWD) system, flowing to the UTRWD Riverbend WWTP. An interceptor line is expected to be completed by the end of 2010, alleviating any increases in the influent flow. Under these conditions, the existing facilities should be suitable for treatment of a portion of the City of Celina wastewater flows well into the future. The existing WWTP may also prove to be a valuable reuse facility located within the city boundaries.

1.3.2 City of Van Alstyne

A. ***Current Permit***

The Van Alstyne WWTP is permitted for a total average day flow of 0.95 MGD by the TCEQ. The peak 2-hour flow rate is 2,639 gallons per minute (gpm) (3.8 MGD). The permit expires October 1, 2011. The TCEQ permitted effluent levels are shown in **Table 1.4**. In addition to the effluent permitted values, the effluent is also required to be disinfected by ultra-violet (UV) light; the pH must be greater than 6 but less than 9 standard units; and the effluent must have a dissolved oxygen of 4.0 mg/L or greater.

Table 1.4 TCEQ Permitted Effluent Values for the Van Alstyne WWTP (Permit WQ0010502001)

	Daily Average mg/L(lbs/day)	7-day Avg mg/L	Daily Max mg/L	Single Grab mg/L
Carbonaceous Biochemical Oxygen Demand (cBOD5)	10 (79)	15	25	35
Total Suspended Solids	15 (119)	25	40	60
Ammonia Nitrogen	2 (16)	5	10	15
Fecal coliform bacteria colonies per 100 mL	200 colonies	400	N/A	800

B. *Existing Facilities*

The Van Alstyne WWTP is a single train Orbal® oxidation ditch system. The abandoned clarigester systems are still on site, but are no longer in service. The WWTP is also adjacent to the original lagoons that were used for treatment. These lagoons have since been abandoned and filled. The aerial view of the facility is shown on **Figure 1.8**, with a process flow diagram shown on **Figure 1.9**. The current average daily flow rate to the plant is 0.2 MGD.

Figure 1.8 Aerial View of the Van Alstyne WWTP

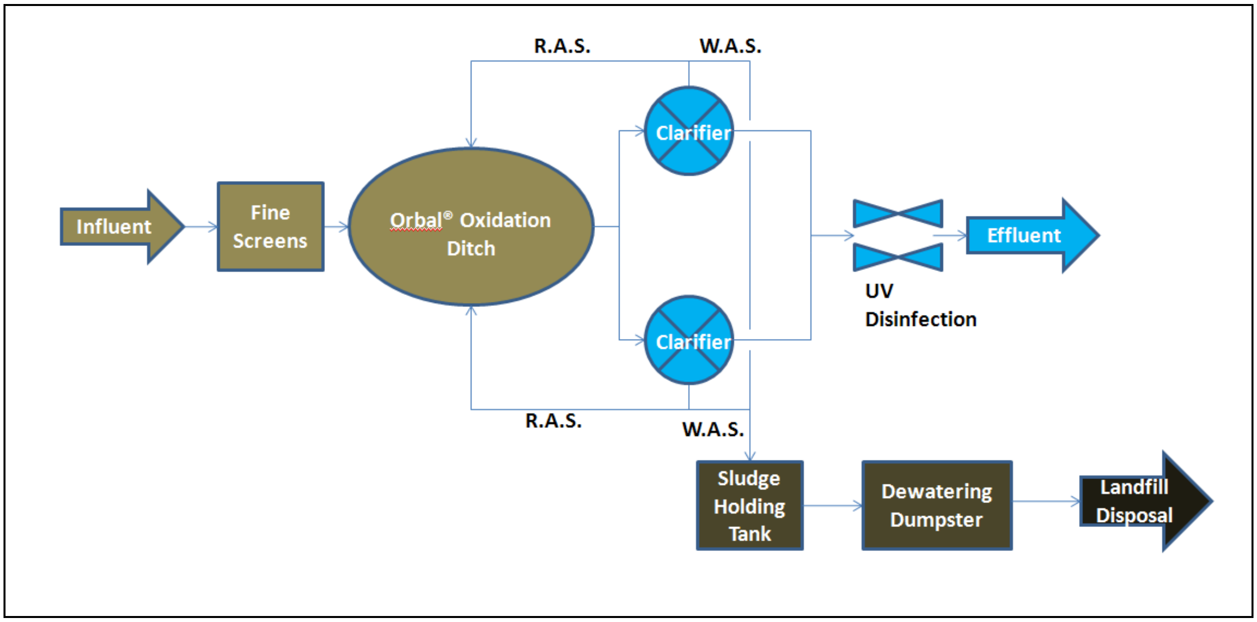


Figure 1.9 Process Flow Diagram for the Van Alstyne WWTP

Influent enters the Van Alstyne WWTP and passes through a fine step screen, shown on **Figure 1.10**. A bypass channel is in place for the fine screens, but this bypass channel does not include bar screens. Bypassing the fine screens during peak flow events could lead to significant accumulation of rags and inert material in the basin. After passing through the fine screens, the wastewater flows by gravity to the Orbal® basin. No grit removal capabilities are currently in place at the WWTP.

Figure 1.10 Influent Fine Screen at the Van Alstyne WWTP

The Orbal® oxidation ditch consists of two concentric rings, each aerated by surface aerators (**Figure 1.11**). Influent and RAS is delivered to the inner ring of the basin, and flow moves from the inner ring to the outer ring before flowing to the secondary clarifiers. RAS from the secondary clarifiers is returned to the oxidation ditch using airlift pumps. One pump is in place for each clarifier. WAS from both clarifiers is pumped to an aerobic solids holding tank. The liquid effluent flows to ultra violet (UV) light disinfection before final outfall.

Figure 1.11 Orbal ® Oxidation Ditch at the Van Alstyne WWTP

Disinfection is accomplished with vertical UV lamps placed in an effluent channel, shown on **Figure 1.12**. Three banks of UV lamps are in place, and automated controls adjust for the number of lamps receiving power and also indicate the number of lamps that are burned out. The WWTP staff is in charge of bulb replacement and management, and a significant number of burned out bulbs are stored on-site for lack of an adequate disposal method.

Figure 1.12 UV Disinfection Channel at the Van Alstyne WWTP

Solids are stored in an aerobic holding tank after being wasted from the clarifiers. The aerobic holding tank has two chambers, as shown on **Figure 1.13**. After storage in the solids holding tank, solids are transferred to a dewatering dumpster. Polymer is mixed with the solids as they are pumped to the dumpster, and parallel membrane sheets separate the liquid from the solids. This system is shown on **Figure 1.14**. The liquid is returned to the head of the plant, and solids are landfilled for disposal.

Figure 1.13 Aerobic Solids Holding Tank At The Van Alstyne WWTP

Figure 1.14 Solids Dewatering Dumpster at the City of Van Alstyne

DMRs were never received from the City of Van Alstyne. The effluent appeared to be clear, although significant algal growth was present in the UV effluent channel. This could lead to occasional spikes in effluent solids concentration. No TCEQ violations have been reported.

C. *Equipment Evaluation*

The majority of equipment at the Van Alstyne WWTP is in good working condition. The influent fine screen, Orbal® basin, clarifiers, solids processing equipment, and UV system were for the most part in good operating condition. However, one of the secondary clarifiers did not have a functioning skimmer, and significant solids and algae have accumulated on this clarifier, shown on **Figure 1.15**.

Figure 1.15 Secondary Clarifier with Non-Operational Skimmer

Maintenance at the Van Alstyne WWTP is less than ideal due to staff demands in other areas of the city. There is no full-time operator at the facility, and proper maintenance on the UV channel, fine screens, and secondary treatment equipment is lacking. Although the facility is operating well now, unless an increase in maintenance is allocated, a decrease in reliability may result.

D. *Future Capabilities*

The Orbal® process is well suited to meet any increase in nutrient permitting at the Van Alstyne WWTP. There is land available for expansion on site as the area grows, and multiple Orbal® basins and clarifiers are planned in the future. Expansion of the UV system would be difficult in the existing channel, but multiple parallel channels could be installed. Land for expansion of the UV channel appears to be available.

1.3.3 City of Anna

A. *Current Permit*

The Anna WWTP has two permitted outfalls. Outfall No. 001 is permitted for a total average day flow of 0.25 MGD, with no peak discharge rate. This outfall is associated with the original lagoon treatment system that is only used during wet weather flows to alleviate peaking at the new WWTP. Outfall No. 002 is for the newer WWTP designed in 2002. Outfall No. 002 is currently rated for 0.5 MGD of average daily flow, with a 2-hour peak discharge of 1,325 gpm (1.9 MGD). Future expansion of the newer WWTP will increase the permitted effluent flows to an average daily flow of 0.95 MGD; however, this expansion is not currently in place. The permit expires October 1, 2011.

The TCEQ permitted effluent levels for Outfall No. 001 and No. 002 are shown in Table 1.5 and Table 1.6, respectively. In addition to the effluent permitted values, the effluent is also required to have a UV disinfection; the pH must be greater than 6 but less than 9 standard units; and the effluent must have a dissolved oxygen of 6.0 mg/L or greater.

Table 1.5 TCEQ Permitted Effluent Values for the Anna WWTP, Discharge No. 001 (Permit WQ0011283001)

	Daily Average mg/L(lbs/day)	7-day Avg mg/L	Daily Max mg/L	Single Grab mg/L
Carbonaceous Biochemical Oxygen Demand (cBOD5)	30 (63)	45	70	100
Total Suspended Solids	90 (188)	135	N/A	N/A
Ammonia Nitrogen	4 (8.3)	6	10	15
Fecal Coliform, CFU per 100 ml	N/A	N/A	N/A	Report

Table 1.6 TCEQ Permitted Effluent Values for the Anna WWTP, Discharge No. 002 (Permit WQ0011283001)

	Daily Average mg/L(lbs/day)	7-day Avg mg/L	Daily Max mg/L	Single Grab mg/L
Carbonaceous Biochemical Oxygen Demand (cBOD5)	10 (42)	15	25	35
Total Suspended Solids	15 (63)	25	40	60
Ammonia Nitrogen	2 (8.3)	5	10	15
Fecal Coliform, CFU per 100 ml	200	400	N/A	800

B. *Existing Facilities*

The Anna WWTP is a package plant activated sludge system, with the original Imhoff tanks and ponds still available for wet weather flow. The package plant was designed in 2002. An aerial view showing the WWTP as well as the pond system is shown on **Figure 1.16**, with a process flow diagram on **Figure 1.17**. The WWTP is permitted as Outfall No. 002, and the ponds are permitted as Outfall No. 001. The current average daily flow to the WWTP is 0.42 MGD. This flow rate is 84% of capacity for Outfall No. 002. To meet the TCEQ 75/90 rule, which requires expansion when the average daily flow rate is 90% of the design capacity, the City of Anna is in the process of completing a diversion to direct a portion of their flow to the Throckmorton Creek Interceptor. This improvement was nearing completion at the time of the site visit in June 2009. The Throckmorton Creek interceptor will take flow from Anna and Melissa to Wilson Creek WWTP. Flow rates to the existing Anna WWTP will be limited to 0.25 MGD.

Figure 1.16 Aerial View of the Anna WWTP

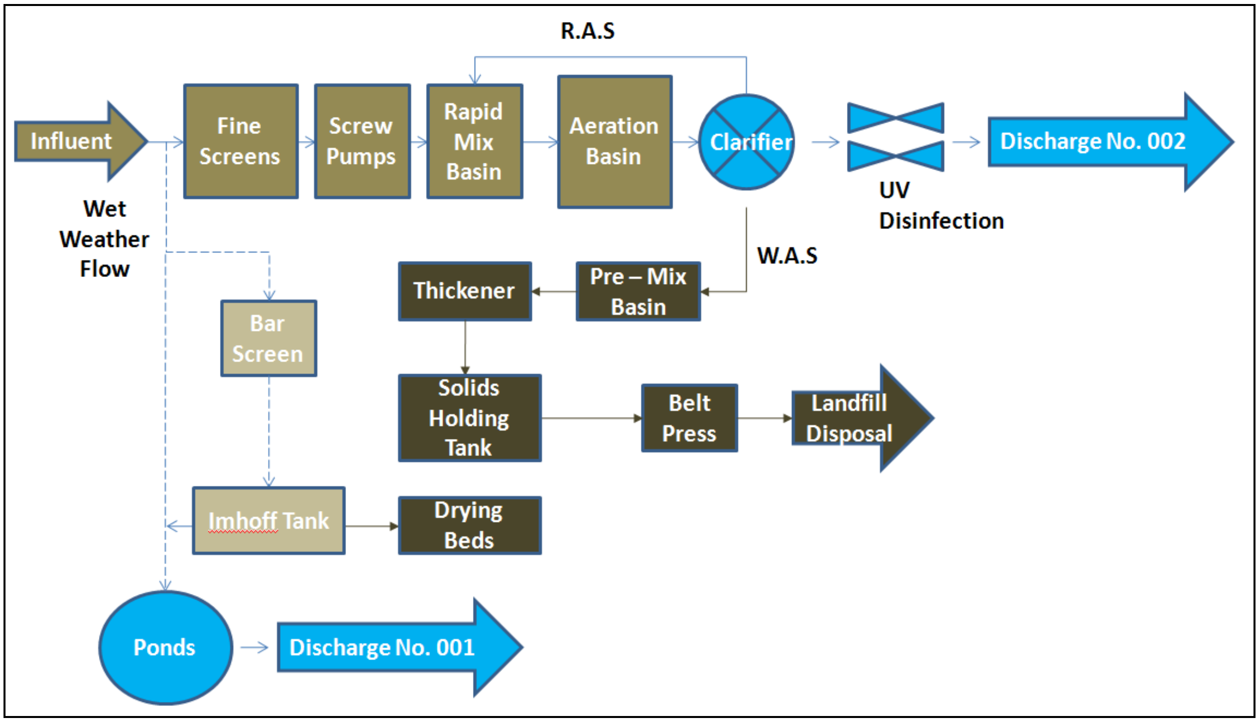


Figure 1.17 Process Flow Diagram for the Anna WWTP

Influent flow is screened through a single step screen, shown on **Figure 1.18**, before being pumped by parallel screw pumps to the treatment units, shown on **Figure 1.19**. A bypass channel is in place for the step screen, but no coarse screen is present in the bypass channel. No grit removal currently occurs at the Anna WWTP.

Figure 1.18 Influent Fine Screens at the Anna WWTP

Figure 1.19 Influent Screw Pumps at the Anna WWTP

After being lifted by the screw pumps, flow enters a pre-mix basin. RAS is also pumped to this basin, and influent and RAS mix before entering the aeration basin. The pre-mix basin and aeration basin are shown on **Figure 1.20**. The aeration basin is a single, complete mixed tank with coarse bubble aeration. Flow from the aeration basin enters a submerged weir and is directed to the center of the single secondary clarifier.

Figure 1.20 Pre-mix Basin and Aeration Basin at the Anna WWTP

The secondary clarifier returns solids to the pre-mix basin and secondary effluent flows to a drop box upstream of UV disinfection. A significant amount of grease accumulated in the secondary clarifier, as shown on **Figure 1.21**. This grease is skimmed and returned to the pre-mix basin, which results in ineffective removal of the grease from the system.

Figure 1.21 Secondary Clarifier at the Anna WWTP

Disinfection at the Anna WWTP is accomplished with in-pipe UV technology, shown on **Figure 1.22**. After disinfection, the effluent flows over a secondary aeration weir. Due to the ineffective grease removal in the system, significant grease is present in the effluent drop box, which could lead to occasional spikes in effluent BOD and solids readings. The grease may also coat the UV bulbs and decrease the transmission of UV light in the water, leading to decreased disinfection. The grease present in the effluent flow box can be seen on **Figure 1.23**.

Figure 1.22 In-pipe UV System at the Anna WWTP

Figure 1.23 Surface Grease Present in the Final Effluent Flow Box

Solids are wasted on an intermittent basis throughout the operational day. A portion of the solids returned to the pre-mix basin are diverted to a thickening basin before flowing to the aerobic solids holding, shown on **Figure 1.24**. Solids are aerated until they are dewatered by a 1 meter belt press. Dewatered solids are stored in dumpster prior to landfill disposal.

Figure 1.24 Thickener and Aerobic Holding Tank at the Anna WWTP

Based on the discharge monitoring reports (DMRs) for the last three years, the Anna WWTP meets permitted limits for the majority of the year. Effluent ammonia averages less than 1.0 mgN/L, average monthly BOD is less than 10.0 mg/L, and effluent solids average less than 6.0 mg/L. However, regular spikes occur in the BOD, which is possibly associated with the visible grease in the effluent being incorporated into the effluent sample. The BOD spikes could also be associated with peak flow conditions. Effluent pH and dissolved oxygen are well within the permitted range, and no TCEQ violations have been reported.

C. *Equipment Evaluation*

The majority of process equipment appears in good working condition. One area of concern is the influent screw pumps, which are exhibiting significant corrosion, shown on **Figure 1.25**. The influent pumps are exposed to relatively high levels of hydrogen sulfide, which leads to corrosion of non-stainless steel equipment. It appears that these pumps are not a high quality stainless steel, and failure of the influent pumps would be a critical point for adequately treating the wastewater flows for the city. The grease removal system is also of concern, as grease is recycled in the system and only leaves in the effluent. Correcting this problem may be as simple as routing the grease to the aerobic holding tank rather than the pre-mix basin, and could help to eliminate grease in the effluent.

Figure 1.25 Visible Corrosion on the Influent Screw Pumps at the Anna WWTP

D. *Future Capabilities*

The Anna WWTP is designed for an identical package plant to be constructed parallel to the existing facility, sharing several of the existing walls. This expanded facility will be able to treat increased flows to the current permitted values; however, if nutrient requirements are placed on the facility, significant modifications to the current process would be required to achieve phosphorus and nitrogen permit values.

The City of Anna is currently planning to divert a large portion of their flow into the Throckmorton Creek Interceptor, which was completed in Fall 2009. The Throckmorton Creek interceptor will take flow from Anna and Melissa to Wilson Creek WWTP. Flow rates to the existing Anna WWTP will be limited to 0.25 MGD. There are plans for a reuse loop around the City of Anna, and the existing plant may serve well as a future satellite facility geared to reuse in the city limits.

2.0 PROJECTION OF FUTURE CONDITIONS

2.1 Population

The planning area for this regional wastewater planning study has only recently begun to experience appreciable development activity. The planning years for this study are 2010, 2020 and 2030. Traditionally, population projections from the North Central Texas Council of Governments (NCTCOG) and Texas Water Development Board Region C have been used as the projection data for this type of study. While NCTCOG data has been reasonably accurate on a region wide basis, the methodology used in the projections focuses on the region as a whole and then allocates that growth based on historical trends. Unfortunately, this methodology can sometimes fail to recognize unique community circumstances and growth realities, even after multiple years of demonstrated growth. Therefore, there may be significant inaccuracies for individual cities. The following steps were taken to assess the potential population growth of the participants in the study:

- Residential building permit data for the last four years was obtained to secure a near term view of development activity.
- The current (2009) estimate was projected for each City and updated to a January, 2010 estimate to serve as the base line beginning point. The current population was determined from the most recent NCTCOG or local city estimate.
- Developer activity and entitlement activity were considered to assess continuing or new potential growth.
- The dramatic trends of McKinney and Frisco were reviewed to assess the potential number of residential units that can reasonably install infrastructure and be marketed in a relatively short window of time. The practical limitations of managing and installing infrastructure and then attracting prospective growth was applied based on the experiences observed in McKinney, which serves as the most recent Central Expressway corridor rapid growth city and the largest city in the study area.
- A simple model illustrating the potential number of residential units that might be added to a community was developed for each participant City except McKinney (which has established trends and projection methodology).

- It was recognized that the recent economic slowdown (recession) has had a profound impact on the housing industry resulting in a major slowdown in building permits and new subdivisions. Assessments were made that as the economic recovery emerges, the housing industry will similarly recover, but such a recovery will probably take several years to return to construction levels experienced two to three years ago within this region. Projections were thus adjusted to reflect a slower growth in near term years and are reflective of real time economic and construction realities.

Rather than rely on a single projection for each of the participant cities, both a "moderate" and a "fast" growth projection were developed for each City. Then, the moderate and faster projections were compared with the Region C projections to assign a reasonable range of population projections. From this range, adopted population projections were developed for this study. **Table 2.1** shows the Region C population projections for this planning area. The population projections for the moderate and fast growth scenarios are shown below in **Table 2.2** and **Table 2.3**, respectively.

Table 2.1 Region C Population Projections

Year	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	Totals
2010	9,000	5,000	3,000	130,000	5,000	6,178	3,000	2,000	163,178
2020	14,000	25,414	4,500	200,000	23,000	12,356	7,500	4,000	290,770
2030	21,000	53,798	6,500	275,000	35,000	18,000	13,500	7,000	429,798

Table 2.2 Population Projections based on Moderate Growth Scenario

Year	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	Totals
2010	8,158	5,200	3,000	125,750	5,130	6,278	3,000	1,000	157,516
2020	14,000	11,279	5,353	160,591	16,948	10,500	9,269	4,000	231,940
2030	21,000	24,229	10,236	225,999	34,783	17,100	21,450	7,000	361,797

Table 2.3 Population Projections based on Fast Growth Scenario

Year	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	Totals
2010	8,158	5,200	3,000	125,750	5,130	6,278	3,000	1,000	157,516
2020	19,091	13,114	6,342	195,000	20,847	14,761	10,883	6,625	286,663
2030	40,580	29,949	13,056	255,000	44,568	28,144	26,108	19,645	457,050

Current populations (January 2010) for the moderate and faster growth scenarios were set to be the same and those estimates were considered the most accurate population projection estimates available. The future 2020 and 2030 total populations for the faster growth scenario were similar to the Region C projections. In some cases, the Region C projections for individual cities were lower than the projections in the moderate growth scenario.

In order to determine this study's adopted population projections, it was decided to use the Region C population projections if they were the highest of the three population projections and to never use a population for any city less than that of Region C. In cases where the moderate growth projections were higher than Region C projections, the difference was split down the middle between the Region C population and the moderate growth scenario population for each city. The City of Celina was handled in a unique manner by assuming that the City will send 25% of their flow to this proposed regional system. This percentage was determined using the populations from the City's master plan for their western and eastern basins. The city can send flow by gravity to the new regional system from their eastern basin and therefore, the adopted population for Celina will only include the population from their eastern basin (25% of total calculated population). **Table 2.4** shows the adopted population projections for each city to be used for this regional study.

Table 2.4 Adopted Populations for this Regional Facility Planning Study

Year	Anna	Celina[1]	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	Totals
2010	9,000	1,270	3,000	130,000	5,065	6,228	3,000	2,000	159,563
2020	14,000	6,353	4,927	200,000	23,000	12,356	8,385	4,000	273,021
2030	21,000	13,450	8,368	275,000	35,000	18,000	17,475	7,000	395,293

[1] Celina only includes 25% of total city flow

Appendix A shows charts for each city, as well as the overall study area, that demonstrate the adopted population projections compared to the projections from Region C and the moderate and fast growth scenarios. The total adopted population for each planning period matches up within 1% of the Region C population and represents an overall average annual growth of over 3% for the region. Such a staggering growth potential only further points to the value that this study can bring to each city individually and to the region in the form of major economies of scale and higher qualities of treatment thus impacting quality of life and enhanced regional water quality.

2.2 Wastewater Flows

The next step in the projection of future conditions is to determine the future annual average and peak wastewater flows for each city for the years 2010, 2020 and 2030. All proposed infrastructure will be sized to serve the wastewater flows in 2030. The projected annual average flows will be used to size treatment plant capacity and the peak flows will be used to size interceptor and lift station capacity. Since the areas are close in proximity and composition, the historical wastewater gallons per capita day (gpcd) data for the existing NTMWD Upper East Fork Interceptor System (UEFIS, which already includes the City of McKinney) was used to determine the future average annual per capita for each city in this study. It is assumed that the future per capita will remain constant for the future planning years due to historical trends in wastewater flow in this region showing the system gpcd leveling off and not increasing in recent years, seemingly due to the successful efforts of water conservation in the region. The average annual per capita from 2007 to 2009 was 113 gpcd for the existing UEFIS, therefore a future planning per capita of 115 gpcd will be used for all cities and planning years. This per capita flow rate will account for decreased water production rates but increased inflow/infiltration due to aging infrastructure. The projected average annual wastewater flows for each city and planning period are shown in **Table 2.5**. Dry weather flow data was not available for the participating entities; therefore analysis was based on average day and wet weather flow rates.

Table 2.5 Projected Average Annual Wastewater Flows

	Flows in MGD								
Year	**Anna**	**Celina[1]**	**Howe**	**McKinney**	**Melissa**	**Princeton**	**Van Alstyne**	**Weston**	**Totals**
2010	1.04	0.16	0.35	14.95	0.58	0.72	0.35	0.23	18.38
2020	1.61	0.73	0.57	23.00	2.65	1.42	0.96	0.46	31.40
2030	2.42	1.55	0.96	31.63	4.03	2.07	2.01	0.81	45.48

1 Celina only includes 25% of total city flow

For determining the peaking factor to convert average annual flows to peak flows, a similar approach was taken. NTMWD uses a 3.0 peaking factor for their internal planning efforts and confirmed that value is conservative for planning purposes by conducting flow monitoring in parts of their existing UEFIS that recorded peak flows at 2.5 times their annual average flows. Using this real world data and recognizing that I/I can increase as the system ages, it was determined that a 3.0 planning peaking factor will be used to convert average annual flows to peak flows for all planning years. **Table 2.6** shows the projected peak wastewater flows for each city for the 2010, 2020 and 2030 planning periods.

Table 2.6 Projected Peak Wastewater Flows

Year	Flows in MGD								
	Anna	Celina[1]	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	Totals
2010	3.11	0.44	1.04	44.85	1.75	2.15	1.04	0.69	55.07
2020	4.83	2.19	1.70	69.00	7.94	4.26	2.89	1.38	94.19
2030	7.25	4.64	2.89	94.88	12.08	6.21	6.03	2.42	136.4

[1] Celina only includes 25% of total city flow

3.0 ADDITIONAL PLANNING CONSIDERATIONS

3.1 Water Conservation Plans

All of the participants in the Regional Wastewater Facility Concept Planning for the Upper East Fork Basin except Weston have adopted water conservation and drought contingency plans pursuant to Texas Commission on Environmental Quality rules. (Because of its small size and groundwater supply, Weston is not currently required to have a water conservation plan or a drought contingency plan.)

As customers of the North Texas Municipal Water District, McKinney, Melissa and Princeton based their plans on NTMWD's Model Drought Contingency and Water Emergency Response Plan for NTMWD Member Cities and Customers. As customers of the Greater Texoma Utility Authority, Anna, Howe and Van Alstyne follow a GTUA model plan which is based on the NTMWD model plan. Celina's plan addresses the state requirements but does not have all of the extra elements discussed below.

<u>Water Conservation Plans</u>

The NTMWD and GTUA model plans address the requirements of the Texas Commission on Environmental Quality for conservation plans, which are given in Section 288.2 of the Texas Administrative Code and include:

- Utility Profile
- Specific, Quantified Goals
- Accurate and Universal Metering
- Determination and Control of Unaccounted Water
- Public Education and Information Program
- Non-Promotional Water Rate Structure
- Reservoir System Operation Plan
- Means of Implementation and Enforcement
- Coordination with Regional Water Planning Group
- Review and Update of Plan
- Leak Detection, Repair, and Water Loss Accounting

- Record Management System
- Requirement for Water Conservation Plans by Wholesale Customers

The NTMWD and GTUA model plans also encourage additional conservation measures beyond state requirements, including:

- Implementation of time of day watering restrictions from April through October to minimize losses to evaporation.
- Maintaining unaccounted water at 12 percent or less for NTMWD, 15 percent or less for GTUA.
- Implementation of conservation-oriented rate structures, in which the unit cost for water increases with use.

NTMWD, which supplies all or a part of the water needs of all entities involved in the study except Celina and Weston has also adopted water conservation measures in its own operations. The District operates its water supply reservoirs as a system, considering yield, water quality, the efficient use of supplies and the cost of power for pumping. The District also has a substantial program for the reuse of treated wastewater, extending its supplies and delaying the need for development of new supplies.

Drought Contingency Plans

The NTMWD model plan addresses the requirements of the Texas Commission on Environmental Quality for drought contingency plans, which are given in Section 288.20 of the Texas Administrative Code and include:

- Provisions to Inform the Public and Provide Opportunity for Public Input
- Provisions for Continuing Public Education and Information
- Coordination with the Regional Water Planning Group
- Criteria for Initiation and Termination of Drought Stages
- Drought and Emergency Response Stages
- Specific, Quantified Targets for Water Use Reductions
- Water Supply and Demand Management Measures for Each Stage
- Procedures for Initiation and Termination of Drought Stages

- Procedures for Granting Variances
- Procedures for Enforcement of Mandatory Restrictions
- Consultation with Wholesale Supplier
- Notification of Implementation of Mandatory Measures
- Review and Update of Plan

The plans for McKinney, Melissa, and Princeton have drought stages triggered in response to NTMWD drought stages or local conditions in the cities. The plans for Anna, Howe, and Van Alstyne have drought stages triggered in response to GTUA drought stages or local conditions in the cities. Celina's plan is based on local conditions in the city and conditions at UTRWD.

3.2 Water Reuse Opportunities

3.2.1 Existing Reclaimed Water Use within Planning Area

A. ***City of Anna Wastewater Treatment Plants***

The City of Anna currently owns and operates two wastewater outfalls in the Study planning area. Outfall No. 001 and No. 002 are located on the same tract of land south of downtown Anna. Outfall No. 001 is the original lagoon system and currently has a permitted discharge of 250,000 gallons per day. Outfall No. 002 is a newer activated sludge WWTP and currently has a permitted discharge of 500,000 gallons per day, with a rating of 975,000 gallons per day following the master planned expansion. The treated effluent from both plants discharges into an unnamed tributary; thence to Slayter Creek; thence to Throckmorton Creek; thence to the East Fork of the Trinity River; thence to Lake Lavon.

Lake Lavon is a raw water supply source for the North Texas Municipal Water District which provides treated water to approximately 1.5 million customers in the north Texas area including the City of Anna, which is supplied through the Collin-Grayson Municipal Alliance's system.

There appear to be no current permitted instances where effluent from the City of Anna wastewater treatment plants is being reused within the Study planning area.

B. *City of Celina Wastewater Treatment Plants*

The City of Celina currently owns and operates one wastewater treatment plant in the Study planning area. This single wastewater treatment plant operates two parallel trains that share a common permitted discharge outfall and are located on the same tract of land Northwest of Downtown Celina. The combined permitted discharge for both treatment trains is 500,000 gallons per day. The treated effluent from both plants discharges into an unnamed tributary; thence to Little Elm Creek; thence to Lake Lewisville.

Lake Lewisville is a raw water supply source for the City of Denton, Dallas Water Utilities (DWU), and the Upper Trinity Regional Water District (UTRWD) which provides treated water to customers in north Texas. However, neither the Dallas Water Utilities nor the City of Denton directly supplies water to the City of Celina. Currently the City of Celina water supply partially comes from water wells in the area and is supplemented by UTRWD surface water. Dallas Water Utilities does supply some raw water to the Upper Trinity River Water District which supplies treated water to a portion of Celina.

There appear to be no current permitted instances where effluent from the City of Celina wastewater treatment plants is being reused within the Study planning area.

C. *City of Van Alstyne Wastewater Treatment Plant*

The City of Van Alstyne currently owns and operates one wastewater treatment plant in the Study planning area. The wastewater treatment plant is located on a tract of land east of downtown Van Alstyne. The Van Alstyne Wastewater Treatment Plant currently has a permitted discharge of 950,000 gallons per day. The treated effluent from the plant discharges into an unnamed tributary; thence to West Prong Sister Grove Creek; thence to Sister Grove Creek; thence to Lake Lavon.

Lake Lavon is a raw water supply source for the North Texas Municipal Water District which provides treated water to approximately 1.5 million customers in the north Texas area including the City of Van Alstyne, which is supplied through the Collin-Grayson Municipal Alliance’s system.

There appear to be no current permitted instances where effluent from the City of Van Alstyne wastewater treatment plant is being reused within the Study planning area.

3.2.2 Potential Reclaimed Water Use within Planning Area

All three of the cities mentioned above, along with the other entities participating in the study, are expected to develop at a moderate rate over the next few years and with development there is expected to be ample opportunities to implement reuse systems throughout the study planning area. Examples of potential development of reuse systems might be irrigation systems for potential golf courses, irrigation systems for future thoroughfares, irrigation systems for future parks and open spaces as well as future reuse opportunities as the industrial sectors develop. If the study determines and the entities decide that a regional approach is the best option for the study planning area future scalping plants might be developed at strategic locations within the study planning area to assist in the development of reuse systems for the purposes described above. However, it should be noted that while the NTMWD's Policy 32 encourages Treated Wastewater Effluent use through direct reuse over raw water or potable water use, wastewater effluent that is returned to Lavon Lake is reused by the NTMWD. Return flows that originate from NTMWD raw water supplies that discharge into Lake Lewisville will, in the near future, be traded to the City of Dallas for an equivalent amount of return flows discharged to the Main Stem of the Trinity River from Dallas wastewater treatment plants and pumped to the NTMWD's East Fork Raw Water Supply Project.

As noted in the Region C Water Plan, there are a number of benefits associated with water reuse as a water management strategy, including: reuse represents an effective water conservation measure, providing a reliable source that remains available in a drought, quantities increase as population increases, demands are often near the reuse sources and provides a viable way to defer and avoid construction of new surface water impoundments.

3.2.3 Membrane System Waste Streams

Two types of membrane technologies are currently used for water reuse applications, reverse osmosis (RO) membrane filtration and membrane bioreactor (MBR) scalping plants. RO membrane filtration can be implemented for drinking water reuse applications. These systems produce drinking water quality finished product, but also produce concentrate waste streams. These concentrate waste streams have elevated total dissolved solids (TDS) concentrations, ranging from 500 to 20,000 parts per million (ppm) depending on the source water and the type of membrane implemented. This concentrate can account for 10 to 35% of the original water source, and the disposal must be accounted for when planning membrane applications.

One method for disposal of this concentrate waste stream is discharge into the sanitary sewer, and treatment at the WWTP. This method is typically an option for source waters that are low in TDS concentration and separate from the wastewater effluent and those where the source water quantity/availability is relatively small. In the GTUA region, membrane applications would focus on reuse applications, where the wastewater effluent is the source water. In this scenario, the dissolved solids would be removed from the effluent stream, returned to the head of the WWTP, and then be removed again, along with the TDS entering the plant in the influent. This constant cycling would result in accumulation of TDS in the WWTP, eventually causing decreased biological activity and decreased treatment efficiency. Therefore, the application of membranes for reuse would not be applicable if the disposal method relied on the existing wastewater treatment system.

If membrane filtration was implemented for reuse applications in the region, an alternative disposal method would be required to remove the solids from the wastewater system. Methods such as evaporation, deep well injection, and conjunctive use with oil/gas field operations would need to be evaluated.

A second application of membranes in water reuse is membrane bioreactor scalping plants. Scalping plants are decentralized facilities located in a centralized collection and treatment system. They are used to scalp a portion of flow out of an interceptor, and treat that portion of flow to gray water standards for reuse applications such as irrigation and industrial applications. Given that several small plants are already in existence in the GTUA region, application of MBRs in the future for reuse is a definite possibility.

Scalping plants typically do not have decentralized solids processing facilities, and the waste solids stream from these facilities is typically discharged back into the collection system. This waste stream should not impact a centralized treatment system, given that the primary treatment system at the wastewater treatment plant is designed to account for the increased solids load generated at the scalping plant.

3.2.4 Reclaimed Water Program Implementation Plan

The purpose of including this provision in the report is to serve as an impetus for the developing municipalities to maintain awareness of the potential for wastewater reuse. Considering the future explosion of population among the eight participating Cities, there will be many industrial and economic development initiatives pursued over the next several decades to enhance tax base values and to create jobs. Creating sustainable industrial and business opportunities is already frequently mentioned as an objective by various municipalities participating in the project. This report will serve as a continuing reminder that water reuse is considered highly desirable by the sponsors of this project and these entities will be positive contributors to assisting with the attraction and nurturing of water reuse opportunities.

For the customers within this project study area, there are two projected opportunities for reclaimed water: industrial and municipal. At the present time however, there are no industrial facilities that offer reclaimed water use potential. Since the study area has multiple major highways and rail lines that cross through the area and serve the various municipalities, it can be assumed that there will be future opportunities for industrial activity that may well offer water reuse potential.

Reuse of wastewater is the primary municipal oriented opportunity for water reuse. The NTMWD has already demonstrated a strong commitment to the reclamation of wastewater for drinking water purposes. This is expected to continue with any regional wastewater treatment plants that may be built in the Upper East Fork watershed above Lake Lavon. It is anticipated that construction of a regional wastewater treatment plant and the transmission capacity to carry effluent to the facilities is probably more than a decade in the future. While subsequent sections of this report will discuss plant sizing, location, and related matters in more detail, it simply does not appear that there is or will be sufficient concentration of adequate density to provide the daily effluent flow or the revenue base to support such a plant.

Considering the expansive size of the study area, it is likely that there will be development initiatives in areas with limited or no access to an existing wastewater treatment plant or where constructing transmission facilities in the short term to an existing treatment facility is not viable. The distance from proposed developments to wastewater treatment facilities may be extensive and thus prohibitive, particularly considering that existing treatment facilities have very limited capacity to receive additional flow from new development. It is projected that developers will instead pursue the concept of localized package plants. This is particularly true for large master planned communities, which there are several land holdings in the study area that qualify as such. Additionally, at least one growing municipality in the study area has talked with multiple land owners and developers about the prospect of joining together to construct package plants with local collection and transmission lines to serve the developments and convey the wastewater flow to the package plants. A similar concept was used in Rockwall County in the Heath area near Lake Ray Hubbard by NTMWD, who also operated the plants to ensure water quality until such time as a regional plant in the area could be justified and funded.

The prospect of the development community installing package plants in select areas will clearly be dependent on the implementation offering sufficient development incentive to allow such a major capital investment. It is proposed that a combination of project magnitude or joining projects together coupled with adequate time or incentive to allow the development community to recover the considerable expense to fund treatment facilities. In order for this concept to be desirable over the entire study area, it is suggested that GTUA, NTMWD, or other regional entity be considered as the area wide operator of the facilities to ensure water quality. Developer operations should be discouraged, even to the extent of only supporting the projects that are proposed to have an acceptable public entity operator and meet the design requirement of NTMWD in order to protect Lake Lavon water quality. Should all the participating municipalities join together with GTUA and NTMWD, it is suggested that such regional planning for regionalizing package plant location and operation will greatly influence the permitting agencies.

There can also be long term benefits that will accrue to large master planned or cooperating development projects. Specifically, it can be expected that golf courses or other large open space amenities will be designed as integral components of significant development projects (some of which are already being discussed and entitled). These developments can be encouraged to fund or participate in funding sub-regional package plants by extending water re-use opportunities to the large open space amenities, thus reducing the operational cost of those amenities. Simultaneously, the potable water demands can be reduced by the amount of package plant reuse that is produced. A golf course or similar open space can easily use up to a million gallons of water a day during the initial development and up to a half a million during normal operations. Allowing package plants to be retained as scalping plants returning treated effluent to irrigation holding lakes even after regional or sub-regional treatment plants are constructed can be a strong incentive for major projects, even if the ownership of the package plant is vested in the local municipality and operated by a regional entity. In this scenario, the open space irrigator would purchase the treated effluent at a cost to reflect any advantage over treatment at the regional facility and return transmission to the irrigator's holding lake.

Such a system as described above would maintain water quality, reduce demand and cost of potable water, including the transmission cost of that water from a regional water treatment plant to the respective municipal pressure system, and serve to provide cost effective irrigation for major open space projects that enhance quality of life across the study area. Finally, any further runoff of irrigation water will ultimately flow to the area water supply reservoirs having been processed both by the scalping plant process and by nature as it filters through the vegetative landscape and flows down the respective tributaries and creeks. It is believed that there will probably be demand for at least six to eight (and potentially more) such scalping plants and related developer or municipal irrigation contracts. These could provide for a million or more gallons of effluent reuse per day, thus reducing significant long term capacity investment in the major regional wastewater treatment facilities.

3.3 Water Quality Issues

The existing three municipal wastewater plants in the study area (Anna, Celina, and Van Alstyne) all contribute their treated effluent outflow back to the natural drainage basins with that flow going to either Lake Lewisville or Lake Lavon. As noted in the study area map, a very high percentage of the study area flows to Lake Lavon and as such, Lavon will be the ultimate receiving reservoir for the corresponding percentage of study area effluent. Should any of the existing plants be expanded or new municipal plants planned, such facilities should be designed to treat the local effluent to the same levels as NTMWD's Wilson Creek WWTP to blend into the raw water supply of the region.

Nutrient removal from wastewater is an increasingly common requirement in TCEQ permitted discharges. Several plants in North Texas already have nutrient permits, and several more facilities are anticipating nutrient removal requirements in upcoming permits. Increased removal of phosphorus, ammonia, and total nitrogen is driven by the discharge water body quality and discharge volume for wastewater treatment plants.

Past indications from TCEQ are that minor discharges (less than 1.0 MGD) would most likely not require advanced nutrient removal, unless discharging in close proximity to a sensitive water body. Currently, the three facilities located in the GTUA region are less than 1.0 MGD, and do not face imminent nutrient removal criteria. However, as the area continues to grow and flows exceed 1.0 MGD, nutrient removal will be controlled by the receiving water bodies.

Both of the two lakes the GTUA region discharge into, Lake Lavon and Lake Lewisville, have a history of nutrient removal requirements for WWTPs located near the lakes. The Wilson Creek WWTP, located adjacent to Lake Lavon, has a phosphorus discharge permit of 0.5 mg/L. The Stewart Creek WWTP, located in The Colony, and the Upper Trinity Regional Water District (UTWRD) Riverbend WWTP, located near Lincoln Park, both discharge to Lake Lewisville, and both facilities have a phosphorus discharge permit of 1.0 mg/L. All of these plants have ammonia discharge permits below 3.0 mgN/L. No total nitrogen permits are currently in place at the existing facilities.

The Van Alstyne WWTP discharges to a tributary of Sister Grove Creek, and the Anna WWTP discharges to a tributary of the East Fork Trinity River (see Figure 3.1). Sister Grove Creek and the East Fork Trinity River both discharge to Lake Lavon, into similar coves as the one that Wilson Creek discharges to. For this reason, it is likely that discharges to Sister Grove Creek and the East Fork Trinity River will eventually have a phosphorus discharge permit between 0.5 and 1.0 mg/L.

The Celina WWTP discharges to a different watershed than Van Alstyne and Anna. The Celina WWTP discharges to a tributary of Little Elm Creek, which discharges to Lake Lewisville, as shown on **Figure 3.1**. The UTRWD Riverbend WWTP discharges directly to Little Elm Creek. Stewart Creek WWTP discharges directly to Lake Lewisville. Discharges to this watershed would most likely have a phosphorus permit between 0.5 and 1.0 mg/L.

Ammonia discharges are currently regulated at all three plants in the GTUA region to 3 mgN/L. Unless new dissolved oxygen modeling is completed by TCEQ, it is unlikely that a more stringent ammonia discharge will be required in the near future. Total nitrogen is not currently regulated at existing WWTPs discharging to Lake Lavon and Lake Lewisville, and unless national nutrient permits are enforced, a total nitrogen discharge permit is not likely in this region.

Another possible water quality parameter in the future is total dissolved solids (TDS). Although there are few TDS permits currently in place, several studies have indicated that TDS may be a concern for Lake Lavon.

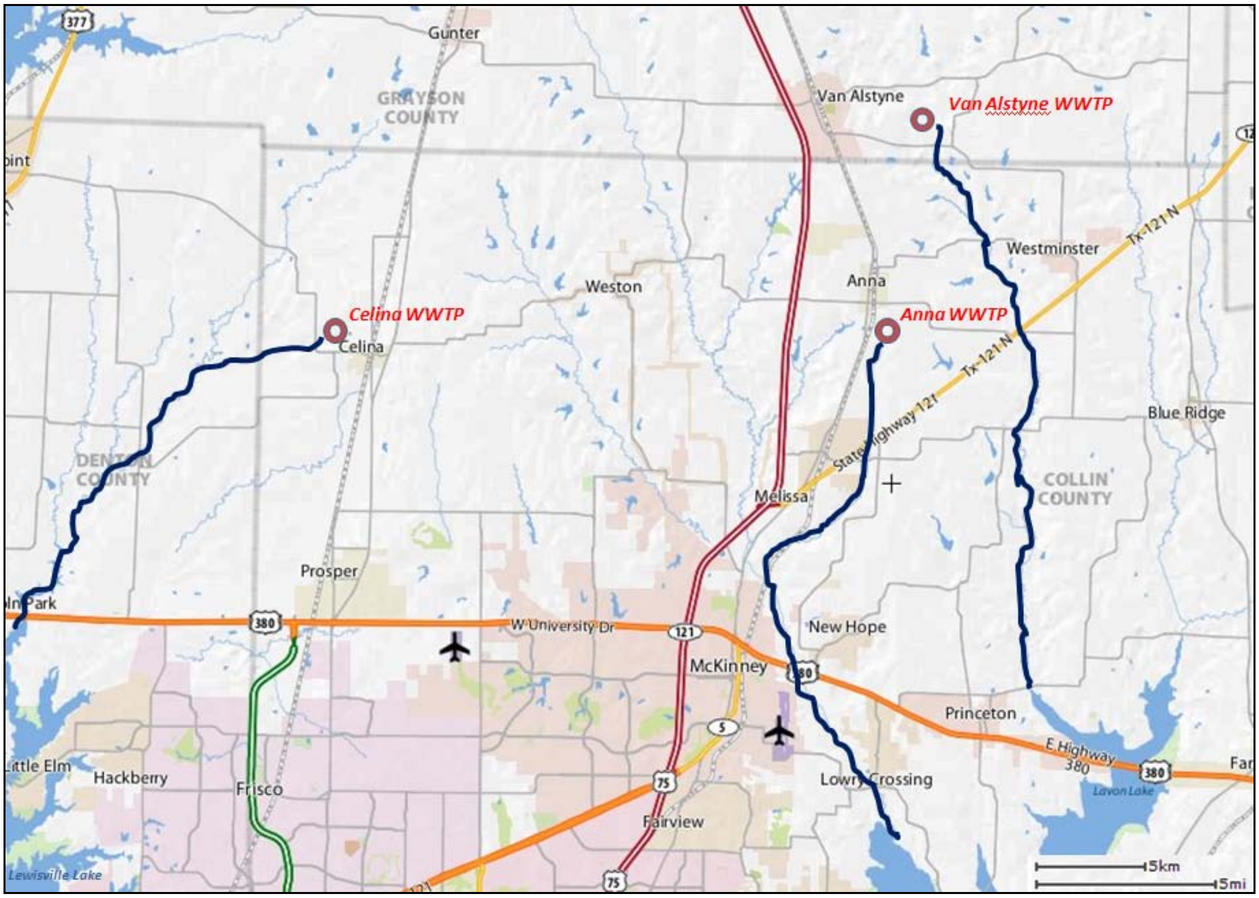


Figure 3.1 Approximate Location of WWTPs Evaluated in this Study and the Ultimate Discharge Points for the Facilities.

3.4 Treatment Plant Siting and Permitting Issues

As the GTUA region continues to grow, increased wastewater treatment capacity will be required. Three options exist for treatment expansion: individual treatment facilities for each entity, a single regional facility, or multiple regional facilities. Individual facilities would involve expansion of the existing WWTPs or construction of new entity specific facilities, and should not require any new regional land acquisition and permitting issues. Although the expansion would be substantial, permitting and site acquisition would be less difficult than obtaining a site and permitting a new regional WWTP.

A single regional facility would focus on expansion of the Wilson Creek WWTP, which would also be less difficult than obtaining a site and permitting a new WWTP. The current average day capacity of the Wilson Creek WWTP is 48 MGD, with a build-out capacity of 112 MGD (Wilson Creek Parallel Pipeline Study, TM 2, CH2M-Hill, 2008).

The projected 2030 GTUA region population is approximately 395,000 and the projected per capita flow rate is 115 gal/capita-day. This results in a total projected annual average flow of 45.5 MGD. The increased flow from the GTUA area combined with the other areas served by the Wilson Creek WWTP would likely approach the 112 MGD build-out capacity of the Wilson Creek WWTP. While expanding the Wilson Creek WWTP would not present the site and permitting issues associated with new facilities, further analysis to determine if the Wilson Creek WWTP will be able to treat all of the flow increase in the GTUA area will need to be completed.

The third option, moving to multiple regional facilities, would require land acquisition and permitting of new plants. It may be difficult to expand the existing individual WWTPs to absorb the increased flows, as the majority of growth is expected south of Celina, Van Alstyne, and Anna and conveying flow north to these plants may present a challenge. The sites would most likely be adjacent to Lake Lavon, as discussed in a previous study (Wilson Creek Parallel Pipeline Study, TM 1, CH2M-Hill, 2008). Locating multiple regional facilities adjacent to Lake Lavon would be difficult due to land availability, location relative to population growth, and water quality in Lake Lavon. Another challenge with locating multiple regional facilities adjacent to Lake Lavon is infrastructure cost. A large amount of increased conveyance capacity would be required to transport wastewater to these sites, and then new treatment facilities would be required. A similar conveyance system cost would be required to transport the flow to the Wilson Creek WWTP, and expansion of an existing plant is typically more economical than constructing a new facility.

3.5 Financial and Administrative Issues

The options for implementing this study's findings from a financial and administrative standpoint are one of the following:

1. Use of either NTMWD or GTUA for joint management and funding
2. City manages and funds project individually
3. Contracting via a smaller alliance among selective Cities – might involve contract with NTMWD or GTUA or might be managed by one of the Cities or an independent Board

NTMWD or GTUA Management & Funding

At the present time, six of the Cities participating in this study have some either direct or indirect connection to the North Texas Municipal Water District. All six of these Cities are connected to NTMWD via contracts for potable water. McKinney and Princeton are original members of the District and receive water through the member City structure. Anna, Howe, Melissa, and Van Alstyne have contracts with GTUA through the Collin Grayson Municipal Alliance water program that contracts with NTMWD for water that is delivered via a pass-through agreement with McKinney; it is noted that only Melissa is actually receiving water via this mechanism at this date, but the others plan to begin taking water from the GTUA contract in the near future. Additionally, Melissa has a contract relationship that provides a water connection with the McKinney system that was structured to accommodate the delivery of water to the NTMWD solid waste disposal facility in Melissa several years ago.

Four of the Cities in the study, Anna, McKinney, Melissa, and Princeton are either directly or indirectly current wastewater treatment customers of NTMWD. McKinney and Princeton are both District Member Cities and members of the NTMWD Upper East Fork Wastewater Transmission System and the related Treatment System. Melissa has a contract with the District for both the transmission and treatment of wastewater and Anna is provided service as a customer to Melissa for transmission and treatment. Thus, NTMWD is a known and well respected provider of wholesale water and wastewater treatment services to municipalities in the study area. Additionally, five to six of the Cities have direct experience with GTUA as a water and/or wastewater operational or debt servicing entity. Clearly, these relationships (with NTMWD and GTUA) would seem to indicate that use of one of these existing entities would be the most desirable legal and management alternative for long term wastewater planning, system implementation, facility funding, facility operations and management, and overall system administrative coordination. McKinney is clearly the largest City currently in the study and will be the dominant city by population and effluent volume for many years. Therefore, it could be reasonably projected that McKinney related growth may well drive the earliest phase of any new wastewater treatment and transmission system. It is unlikely that McKinney would want to deviate from the long-standing contractual relationship with NTMWD considering the economies of scale that NTMWD can provide for a new facility plan by proportionately sharing in District overhead and management expertise. Finally, there is no entity that has greater interest in preserving the water quality and reuse of water in the Lake Lavon water shed than NTMWD; therefore, the NTMWD should be considered as the prime candidate to operate and manage a new regional wastewater treatment and transmission facility.

Individual City Management & Funding

Each City in the study has the right and opportunity to review the option of self planning, funding, constructing, and managing their respective wastewater transmission and treatment facilities. In actuality, as much of the collection system as feasible per local sub-division ordinance will be constructed by City regulation and agreements with the development community. Some funding for treatment may also be available, although the limitations on utility impact fees will typically direct those funds to purely local wastewater facilities since it is impractical to collect more than 50% of total system cost; thus the treatment component and regional transmission is typically funded solely by user fees through the local utility rate structure. Absent utility rates, the Cities have virtually no other major source of utility system funding as most Cities do not rely on any tax revenues for utility system construction or operations. Given this funding consideration, the utility customer will fund the system regardless of the management entity decision. Therefore, the decision of each City of whether to fund and operate the treatment system independently or through an entity such as NTMWD will probably revolve around the analysis of:

- Cost savings by aggregating capital expenditures into a larger facility
- Cost savings and added value available through a larger entity that can provide greater expertise and management of technical facilities, bring efficiencies of quantity purchasing, and provide economies in such areas as larger more energy efficient pumps and related matters.
- Cost savings through better debt management and reduced net revenue to debt service coverage, thus reducing utility rates.

Historically, these are the precise area of cost saving that have benefited McKinney, Allen, Plano, Frisco, Prosper, Princeton and Richardson in their joint wastewater treatment and transmission projects through NTMWD. It can be expected that such economies will continue to be present in the future.

Selective Alliance Contracts between Cities

This scenario may be accomplished by contracting with a regional entity to provide unbiased management for two or more cities or with one of the Cities taking the lead responsibility. Such a scenario can provide for at least some of the economies available via the regional concept detailed earlier, but could provide some short term benefits due to varying growth rates in the study area and thus varying demand for service. It is also noted that such a concept could provide for others to join the entity at a later date. If two or more Cities desire to join together and form a sub-regional entity with an independent Board that will manage the system, it is likely they would need a GTUA or NTMWD to serve as the base legal entity as using the existing structure would be far more cost effective than creating a new entity and providing both office facilities and staffing.

Administrative Principles and Prorating Cost

The successes of the NTMWD in the overall service area make it difficult to imagine a system that will benefit the Cities, their citizens, and the overall area any better or more cost effectively than the NTMWD concept. This concept has historically been based on cost sharing or proration per unit of service by municipality served with all paying the same basic rate subject to a minimum take or pay provision. The minimum take or pay provisions provide the initial and continuing base required volume of the respective commodity to fund both annual operations and debt service. Additional volumes above the annual minimum take or pay are typically discounted for that year with the minimum then being adjusted to the subsequent year to accommodate any additional cost required for the “district” to continue to provide the same level of service to the local municipality. It is suggested that this basic concept be followed with any entity developed or expanded to serve the wastewater transmission and treatment needs of the participating Cities.

The Texas Water Development Board currently has debt outstanding with Celina and (through GTUA) Howe, Melissa, Anna, Van Alstyne and Princeton. The regional system would only absorb the debt for the projects that will be used regionally. Based on the recommendations of this study, only the Throckmorton Interceptor would be utilized in a regional manner. This interceptor was paid for by Anna and Melissa using TWDB funding assistance. The more participants who discharge wastewater flows into this facility the less the two existing partners will need to pay as the other new participants pay their share

As the study progresses to completion, cost estimates may be available that will allow some general assumptions to be made that will allow some projection of debt and operational cost under two or more different administrative and funding scenarios.

4.0 ALTERNATIVES ANALYSIS

4.1 Scenario 1: Individual Treatment Facilities

4.1.1 Location

The existing wastewater treatment plants were evaluated in Section 1, and these facilities would be the focus of a multiple, small treatment facility plan. Existing regional infrastructure was considered for all entities, but for Scenario 1 all additional infrastructure was assumed to be in distributed treatment facilities. The treatment facilities in Anna, Celina, and Van Alstyne would continue to be operated. New facilities would be constructed in Weston, Howe, and Princeton to address their future wastewater needs. The currently constructed interceptors for Anna, Melissa, McKinney, and Princeton would convey all or part of the flow from these entities to the Wilson Creek WWTP. **Figure C-1** in **Appendix C** shows a map of the system under Scenario 1.

4.1.2 Wastewater Treatment Plant Size

The sizing of wastewater treatment facilities is based on the projected annual average day wastewater flows from Section 2 of this regional study. A twenty year flow projection was completed for each entity. Existing infrastructure for each entity was considered, and existing interceptors to regional facilities (i.e. UTRWD or NTMWD) would not be abandoned in this analysis. The total average daily flow capacity of existing interceptors and WWTPs was used to determine when WWTP expansion would be required. For Scenario 1, expansion of the WWTPs would be required when the projected annual average daily flow exceeds the total capacity. All capacities discussed in this section are with respect to average daily flow. Interceptor capacity at average flow was based on the peak capacity of the interceptor divided by the peaking factor. From Section 2 of this report, the peaking factor is approximately 3.0 for the GTUA region.

A. *Anna*

The City of Anna addresses their wastewater needs with two separate systems: a small WWTP and a recently commissioned interceptor system. The WWTP rated capacity is 0.75 MGD. The interceptor capacity consists of 21 and 48 inch gravity lines that eventually combine with wastewater flow from Melissa. The total system capacity is the combination of the WWTP capacity and interceptor capacity. As shown in **Figure 4.1**, the projected flow for the City of Anna does not exceed the existing total capacity. Therefore, expansion of the existing WWTP is not projected in the next 20 years.

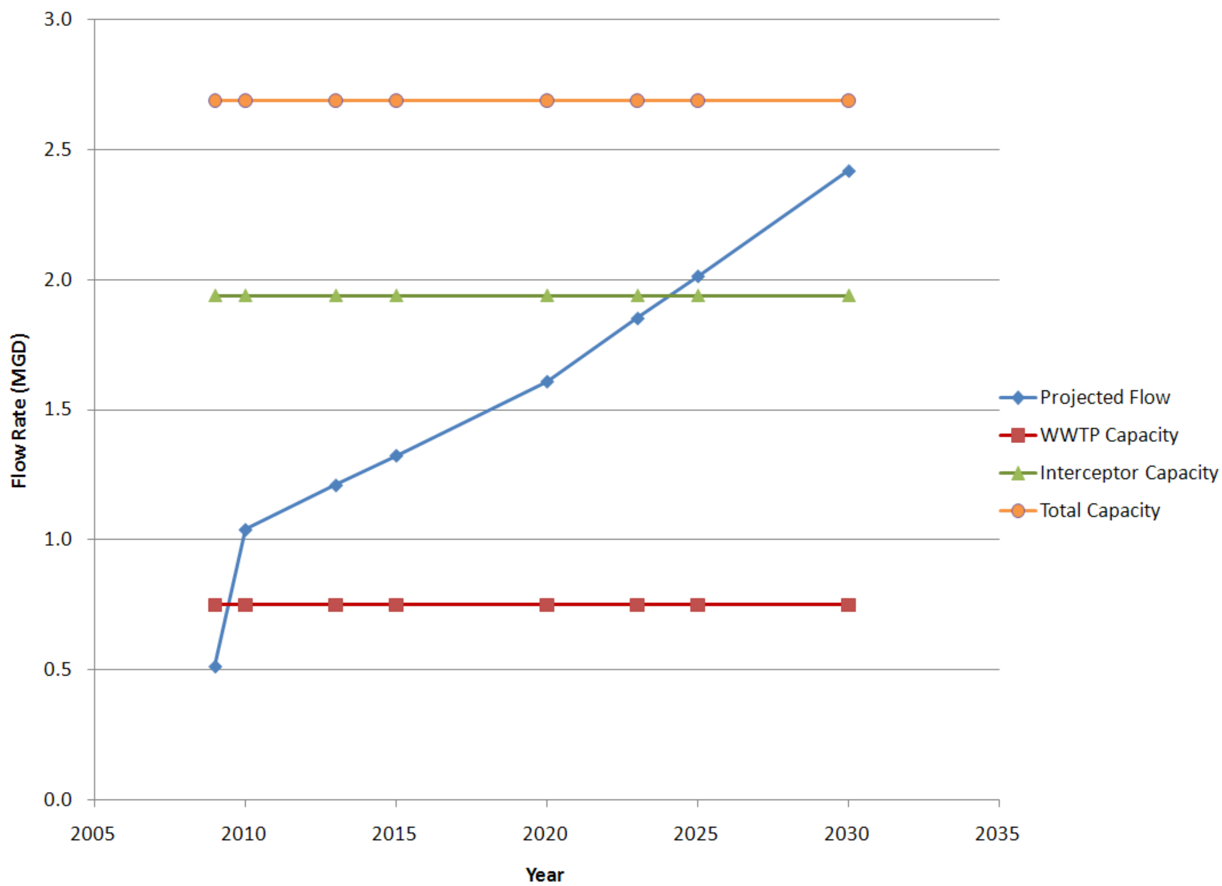


Figure 4.1 Wastewater Treatment/Collection Capacity for the City of Anna

B. ***Celina***

The City of Celina is in a similar situation as the City of Anna. The City has an existing WWTP with a rated capacity of 0.5 MGD, and is in the process of commissioning an interceptor that would convey a portion of the wastewater flow to the UTRWD Riverbend WWTP (see Section 1). The interceptor capacity for this portion of the flow was assumed to be 0.5 MGD, which would match the proposed total wastewater treatment capacity from the TPDES permit in 2005. For this study, the flow identified in Section 2 as the portion that would contribute to the total GTUA flow was used to determine additional treatment capacity for the City of Celina. Even though Celina is unlikely to expand their treatment facilities, this study was commissioned to determine whether a regional system or distributed system would be most economical for the region. Existing regional infrastructure was considered for all entities, but for Scenario 1 all additional infrastructure was assumed to be in distributed treatment facilities. The treatment capacity increases discussed here are only the increases that would be caused by the GTUA flow. Depending on the treatment decision for the remaining flow from the City of Celina (i.e. treating at the WWTP or transferring to UTRWD), the actual expansion of the WWTP may be different. The Celina WWTP would need to expand by the volumes shown in **Figure 4.2** to meet the increased WWTP needs for the GTUA portion of Celina's flow.

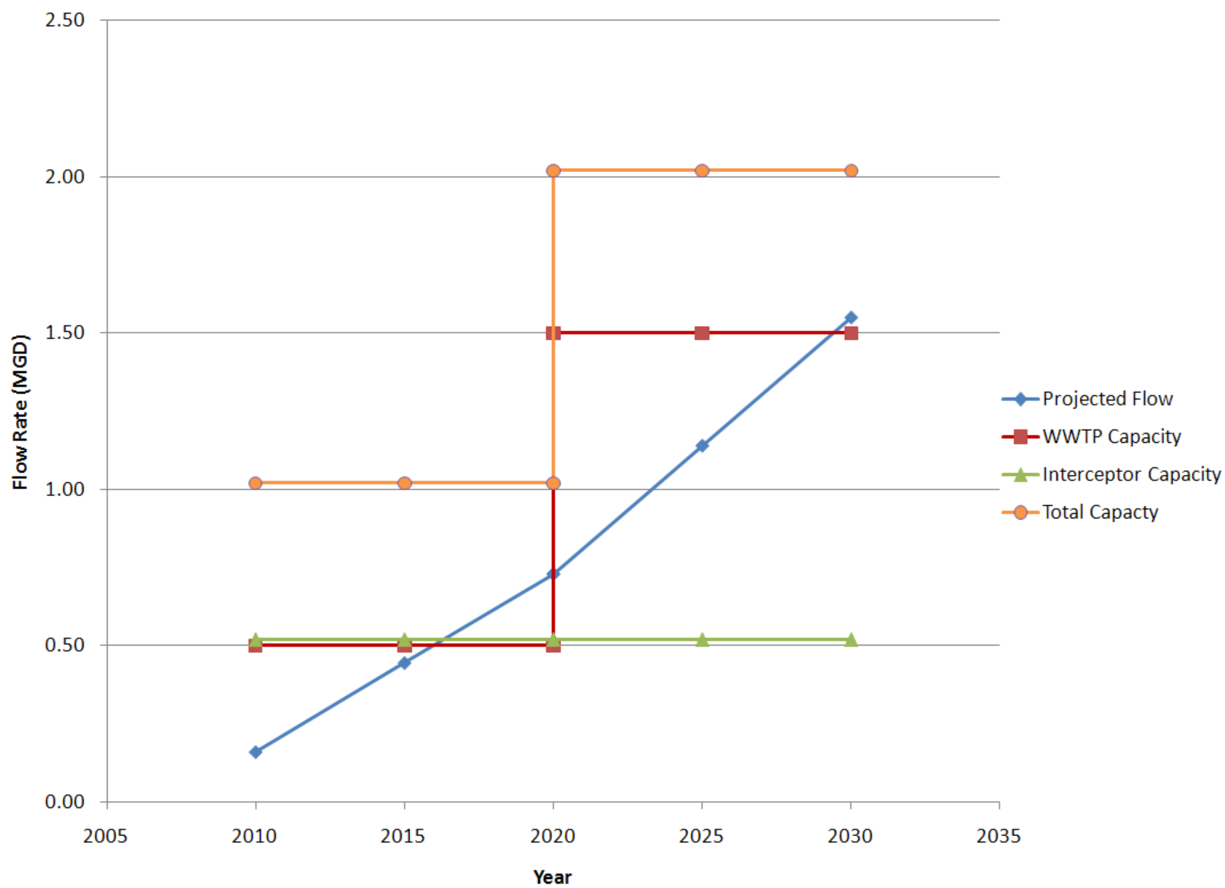


Figure 4.2 Wastewater Treatment Capacity for the City of Celina

C. *Howe*

The City of Howe currently sends all of its wastewater flows to the City of Sherman WWTP. As part of this study, a projection of the required WWTP capacity was developed, and construction of a new 1 MGD facility was projected in 2020. Based on the growth rate of Howe, this WWTP could be constructed to meet wastewater requirements for the duration of the study period, as shown in **Figure 4.3**. It is not known what the existing interceptor capacity is for Howe. The location of the WWTP would likely be at or near the main lift station/interceptor junction for the existing Sherman interceptor.

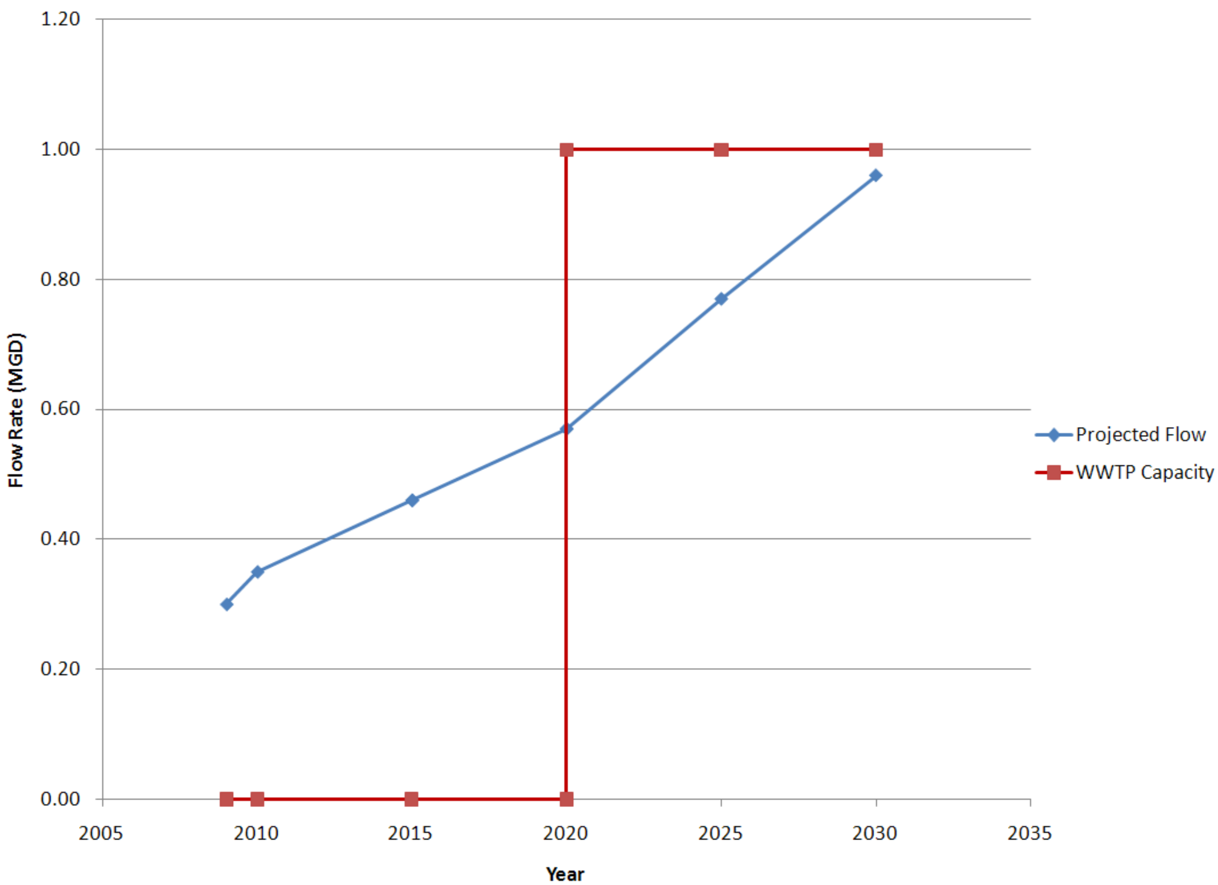


Figure 4.3 Wastewater Treatment Capacity for the City of Howe

D. *McKinney*

The City of McKinney currently sends all of its wastewater to the Wilson Creek WWTP and is a member of the Upper East Fork Regional System. A significant amount of infrastructure is currently in place for the City of McKinney as part of the Upper East Fork Regional System. Previous studies conducted by the City of McKinney concluded that the addition of a stand-alone WWTP in McKinney was not the treatment alternative that would be pursued by the City, and an evaluation was not completed as part of this study. McKinney flows to Wilson Creek WWTP are included in the expansion projections discussed in 4.1.2.I.

E. *Melissa*

The City of Melissa has several existing interceptor lines that convey wastewater to the Wilson Creek WWTP. The interceptors include 21 inch, 6 inch, and 48 inch gravity lines. As shown in **Figure 4.4**, the total existing interceptor capacity for the City of Melissa exceeds the anticipated flows for the 20 year study period. Therefore, no immediate expansion needs are required to meet Melissa's wastewater needs.

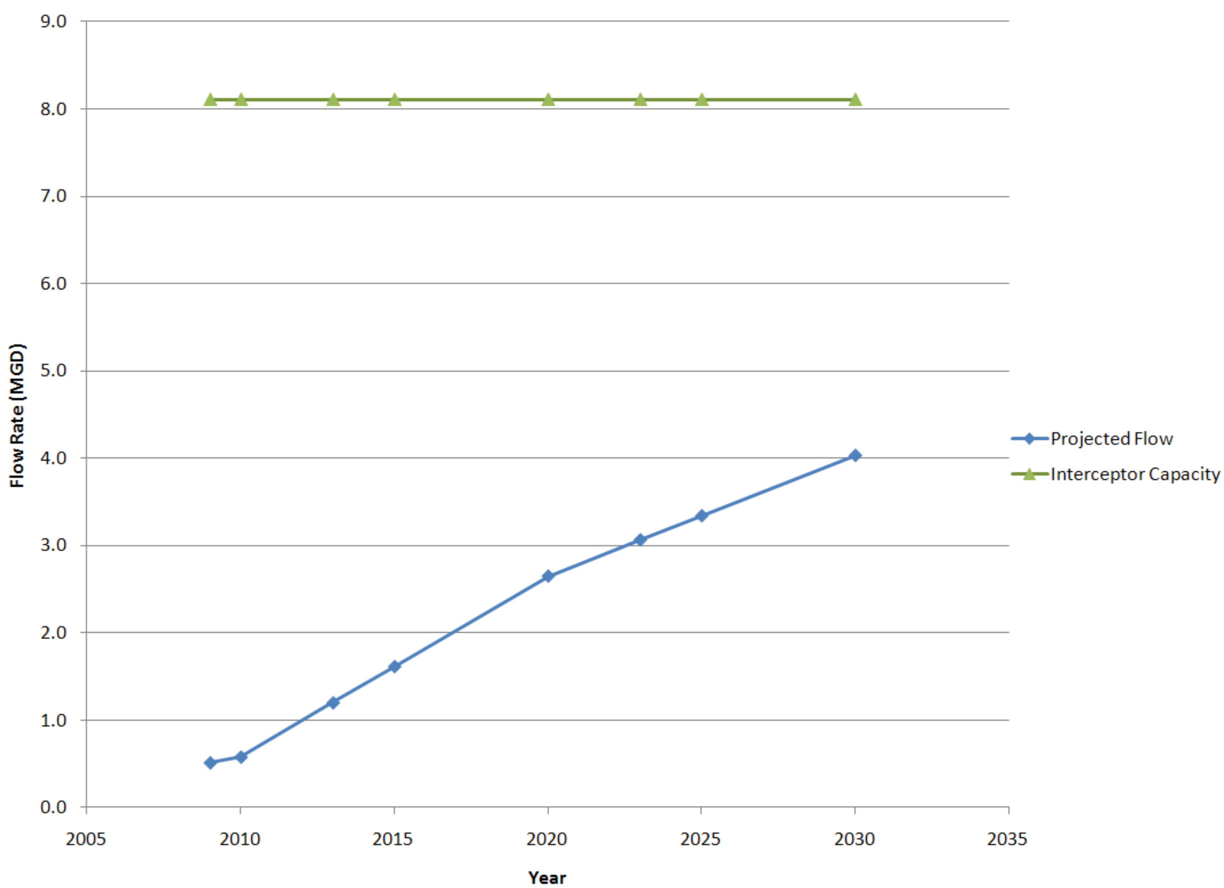


Figure 4.4 Wastewater Treatment/Collection Capacity for the City of Melissa

F. *Princeton*

The City of Princeton currently meets all of their wastewater needs with an interceptor that conveys flow to the Wilson Creek WWTP. A 14 inch force main is currently in place, but this will not be sufficient to meet the future wastewater flows. A new WWTP for the City of Princeton could be constructed to assure that the total capacity of the system meets future flow projections. Construction of a 1.25 MGD WWTP would ensure that sufficient wastewater capacity is in place for the next 20 years, as shown in **Figure 4.5**. The new WWTP would likely be located on the eastern half of Princeton's jurisdiction, to allow gravity flow and also to transfer some flow loading away from the Wilson Creek cove. The existing interceptor would continue to transfer a portion of the flow to the Wilson Creek WWTP.

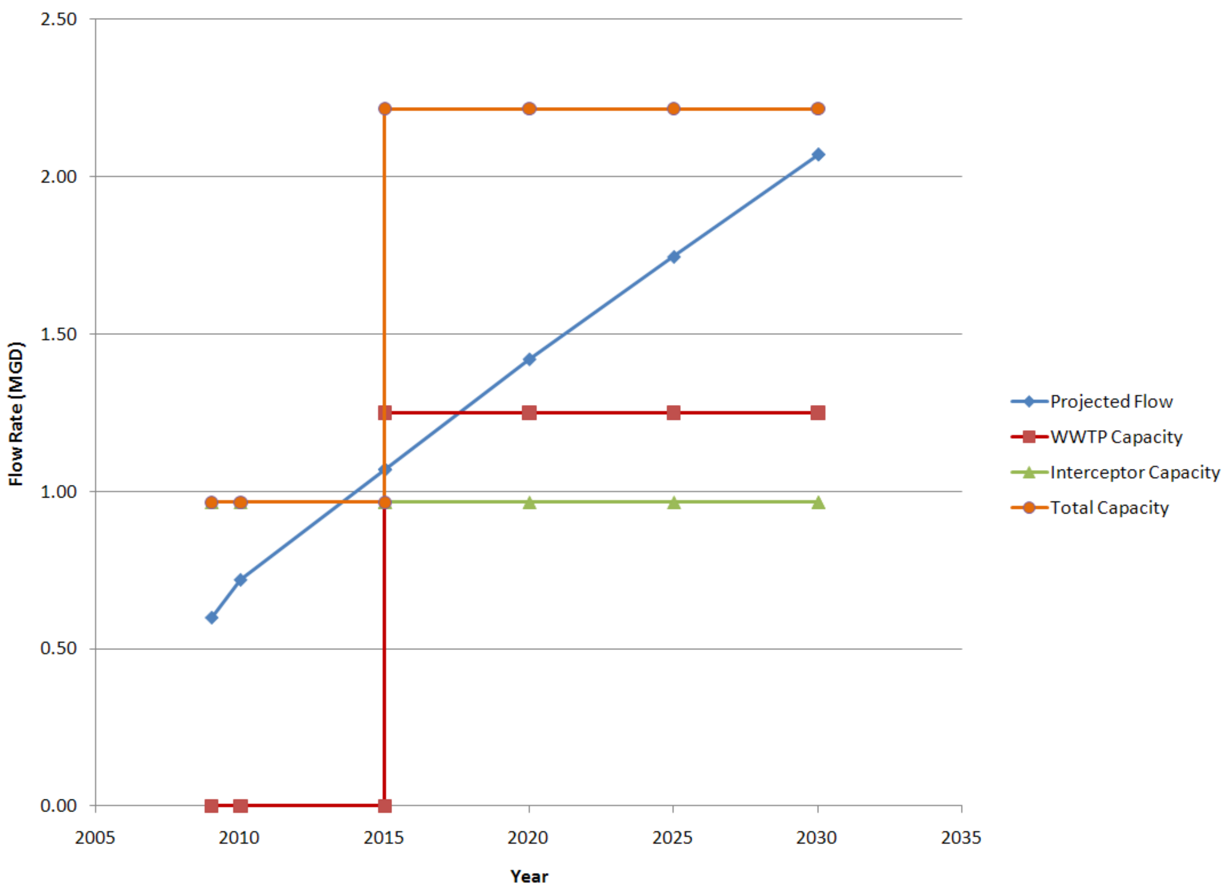


Figure 4.5 Wastewater Treatment/Collection Capacity for the City of Princeton

G. *Van Alstyne*

The City of Van Alstyne treats all of its wastewater at an existing WWTP which has a capacity of 0.95 MGD, with no existing interceptor capacity (see Section 1). Therefore, if multiple facilities are pursued, all of Van Alstyne's wastewater capacity needs would need to be met by expansion of their existing facility. As shown in **Figure 4.6**, two expansions of the existing WWTP would be required during the 20 year study period, with each expansion increasing the capacity by 1.0 MGD. Based on flow projections, the capacity would need to increase to 2.0 MGD by 2018 and to 3.0 before 2030. All expansion would occur at the current site, and no additional land requirements are anticipated based on the current property owned by the City. The excess capacity in 2030 is a result of the assumption that all expansions would be duplicates of the existing 0.95 MGD treatment train.

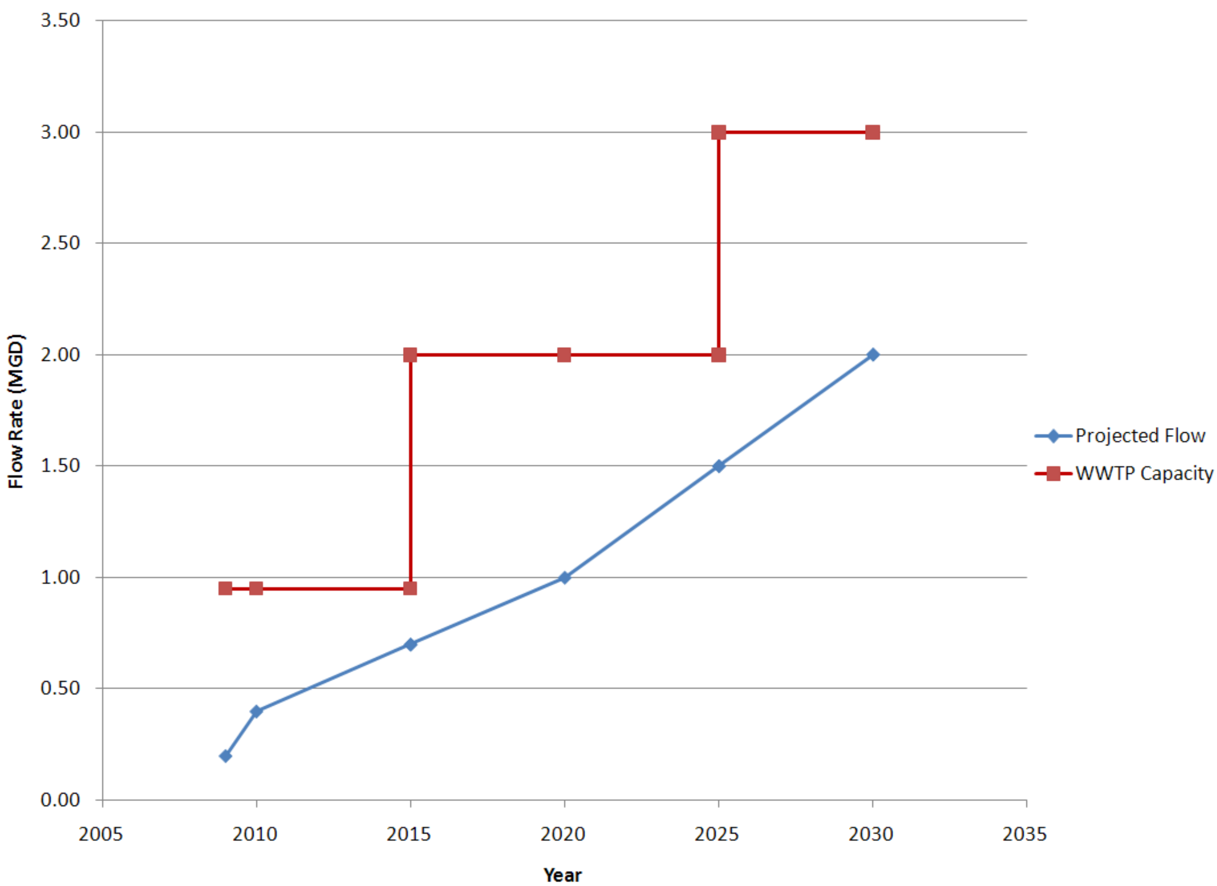


Figure 4.6 Wastewater Treatment Capacity for the City of Van Alstyne

H. *Weston*

Weston is in a unique situation, as it currently has no interceptor capacity and no existing WWTP. Currently, wastewater within the Weston jurisdiction is treated with dispersed septic systems. A wastewater discharge permit has previously been filed with TCEQ for a Wood Oak Hollow WWTP. This would likely be the site of a new WWTP, should GTUA pursue multiple small treatment facilities rather than interceptor infrastructure in the future. Projected flows, as well as projected WWTP capacity, are shown in **Figure 4.7**. A 0.9 MGD wastewater treatment facility was projected for 2020, which would provide sufficient capacity through 2030.

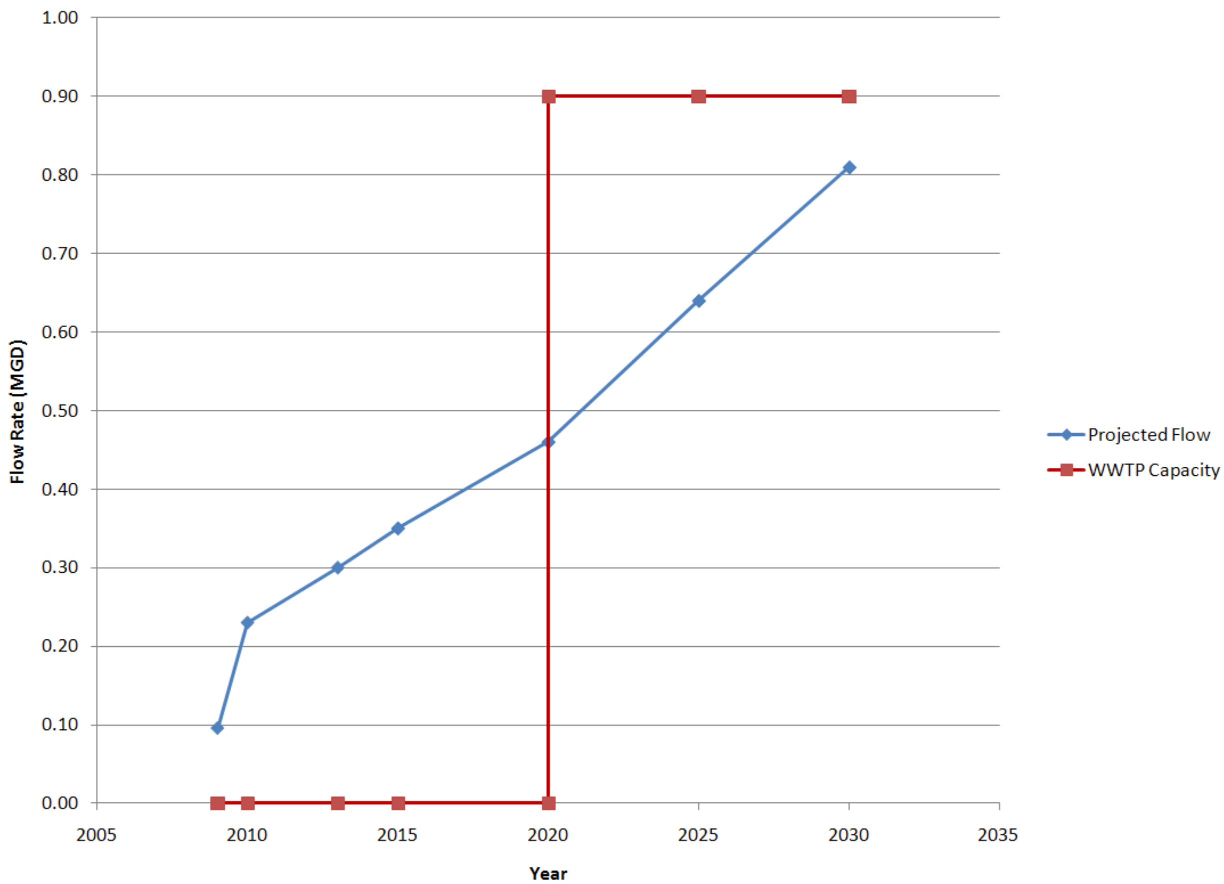


Figure 4.7 Wastewater Treatment Capacity for the City of Weston

I. *Wilson Creek WWTP*

Although the Wilson Creek WWTP is not a GTUA entity, the flow rates of several entities impact the expansion of this facility. To predict when the flow contributions from the GTUA entities currently contributing to the Wilson Creek WWTP (Anna, Melissa, Princeton, and McKinney) would require Wilson Creek WWTP to expand, the non-GTUA flow contribution needed to be assumed. Non-GTUA flow contributions were defined as flows from Allen, Fairview, Frisco, Lucas, Richardson, Parker, Plano, and Prosper. Based on discussions with the NTMWD, little to no increase in flow outside of the GTUA region is anticipated to contribute to the Wilson Creek WWTP. Based on historical flow records from 2005 through 2009, the base flow outside of the GTUA region contributing to the Wilson Creek WWTP was 20.9 MGD. This was assumed as the non-GTUA flow. Increased flow from Anna, Melissa, Princeton, and McKinney taken to the Wilson Creek WWTP was added to this non-GTUA flow. The exceptions to flow from these entities were:

- 0.75 MGD of the Anna flow will continue to be treated by the Anna WWTP
- 1.0 MGD of flow from Princeton will begin to be treated at a Princeton WWTP after 2013

The flow projections and resulting capacity increases at the Wilson Creek WWTP are shown in **Figure 4.8**. If Scenario 1 is pursued by GTUA, the Wilson Creek WWTP would require two expansions over the next 20 years. The first expansion to 56 MGD would be required by 2015, with an expansion to 72 MGD by 2025. These expansions would be possible on the existing site owned by the NTMWD.

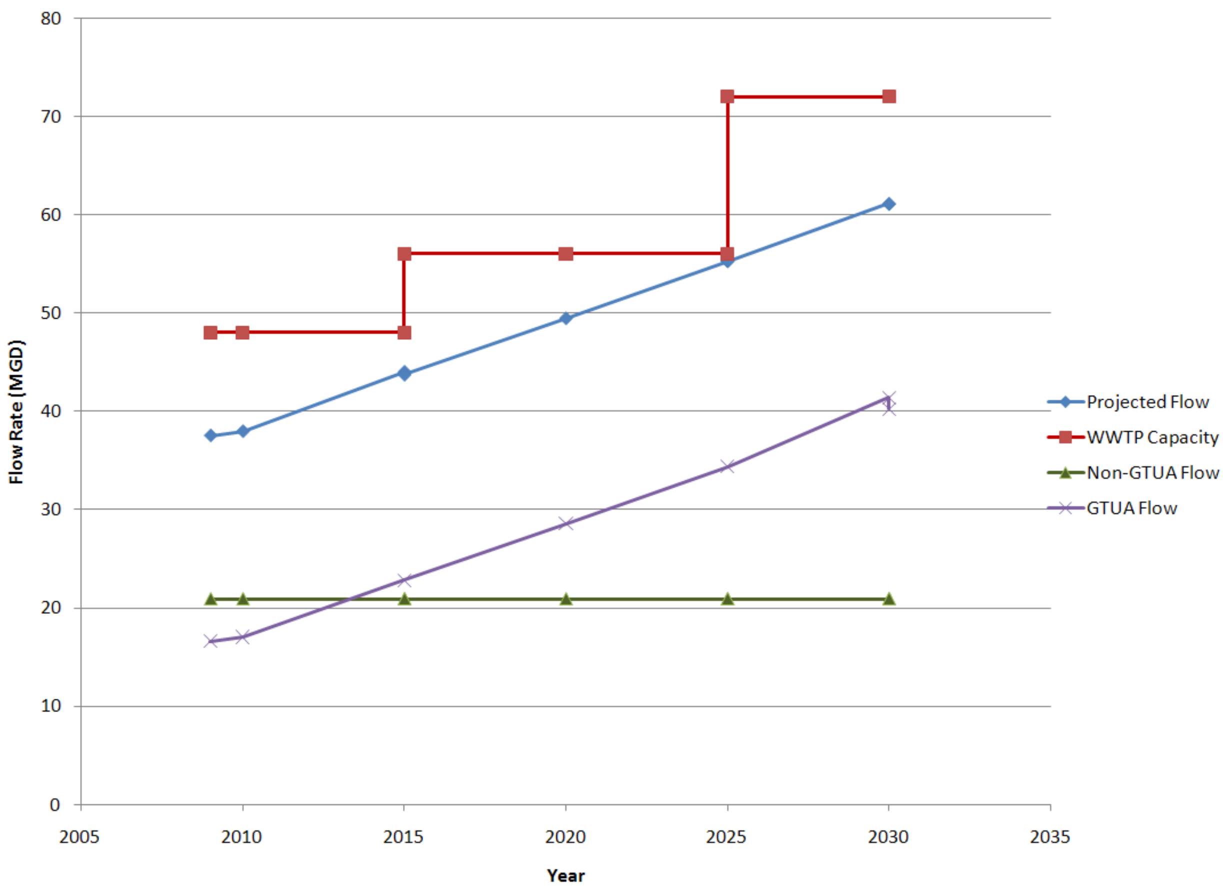


Figure 4.8 Wastewater Treatment Capacity for the Wilson Creek WWTP

J. ***Total System Treatment Capacity***

The combined average day treatment capacity for all of the WWTPs in Scenario 1 would be approximately 81 MGD in 2030.

4.1.3 Transportation Requirements

Access to large highways and railways is a large bonus for drinking water treatment facilities. However, transportation requirements for wastewater treatment facilities are not as critical as biological processes are the main form of treatment, rather than chemical. This significantly reduces chemical deliveries, and access to railways is not typically critical, particularly for the size facilities in the GTUA region. The one transportation concern is with respect to waste solids disposal, as significant truck traffic occurs.

4.1.4 Conveyance Requirements

For this study, only large interceptors and lift stations used for regional purposes were considered. The required improvements to collection and conveyance associated with internal improvement projects and growth in the individual entities were not included. The Upper East Fork Interceptor System (UEFIS), operated by NTMWD, has several projects that are under design or construction at the time of this study. These projects are the following:

- Wilson Creek Lift Station and 36/42" Force Main
- North McKinney Lift Station and 36" Force Main
- North McKinney Eastside 48" Parallel Interceptor

These projects are expected to be in service before the end of 2011. The collection system improvements recommended in this study are sized under the assumption that these ongoing projects are in service.

Once these projects are completed, the UEFIS would only need the following conveyance improvements for Scenario 1 to serve the 2030 peak flows from the participant cities (only McKinney) and deliver it to the regional WWTPs:

- 36" McKinney-Prosper Parallel Interceptor (parallels existing 24/42" McKinney/Prosper Interceptor)
- 42"/48" McKinney Sewers Parallel Interceptor
- Expansion of Wilson Creek Lift Station from 20 MGD to 25 MGD (has future slots for additional pumps)

These three improvements would be made to the UEFIS due to growth of the existing UEFIS customers. All costs for these capital improvements would be incurred by the UEFIS and included in the UEFIS fee charged to customers that contribute flow to that system. The Cities of Anna and Melissa shared the cost on the construction of the existing Throckmorton Creek Interceptor, which was completed in 2009. The capital cost of the interceptor was $7.30 million (Anna's cost is $4.45 million and Melissa's cost is $2.85 million). The cost of this interceptor was included in this Scenario due to Anna and Melissa incurring the capital cost and sharing the capacity before sending flow into the UEFIS.

4.1.5 Opinion of Treatment Expansion Cost

A budgetary level opinion of construction cost was developed for each entity's wastewater treatment needs. Conveyance costs were not included in this estimate, as each entity would be responsible for infrastructure internal to their jurisdiction. Probable construction costs for the Wilson Creek WWTP were based on past NTMWD construction estimates and expansion costs developed in a previous study (*Wilson Creek Parallel Pipeline Study, TM 2,* CH_2M-Hill, 2008). Costs for the smaller WWTPs were based on budgetary estimates from previous Freese and Nichols projects of similar sized facilities. For new WWTPs with average daily flow ratings below 1 MGD, a price of $10 per gallon was assumed; for expansions between 1 and 5 MGD, a price of $8.50 per gallon was assumed. These costs are highly variable depending on the specific site conditions and expansion requirements, and should present a conservative estimate of probable expansion costs. NTMWD costs were not used for the smaller facilities due to the difference in scale. Treatment expansion costs are shown in **Table 4.1**.

Table 4.1 Projected Treatment Expansion Costs for Scenario 1 (2010$)

	Annual Treatment Expansion Costs (Millions)					
	2010	**2015**	**2020**	**2025**	**2030**	**Total**
Anna	$0	$0	$0	$0	$0	**$0.00**
Celina	$9.50	$0	$0	$0	$0	**$9.50**
Howe	$0	$0	$10.00	$0	$0	**$10.00**
Melissa	$0	$0	$0	$0	$0	**$0.00**
Princeton	$0	$10.63	$0	$0	$0	**$10.63**
McKinney	$0	$0	$0	$0	$0	**$0.00**
Van Alstyne	$0	$8.93	$0	$8.50	$0	**$17.43**
Weston	$0	$0	$9	$0	$0	**$9.00**
Wilson Creek	$0	$16	$0	$31.62	$0	**$47.73**
Total	**$9.50**	**$35.66**	**$19.00**	**$40.12**	**$0.00**	**$104.28**

4.1.6 Operation and Maintenance Cost

Operation and maintenance of each individual WWTP in Scenario 1 was estimated. Operation and maintenance costs were estimated based on three sources: Panther Creek WWTP (NTMWD), Muddy Creek WWTP (NTMWD), and Trinity River Authority of Texas (TRA) planning studies. The average operation and maintenance cost was estimated as $3.00 per 1,000 gallons, which included energy costs but not collection system operation and maintenance. The 20-year cost of operating individual WWTPs is shown in **Table 4.2**. Yearly operation and maintenance costs are shown in **Appendix B**.

Table 4.2 20-Year O&M Costs for Each GTUA Entity (2010$)

Entity	20-Year O&M Cost (Millions)
Anna	$17.25
Celina	$18.29
Howe	$14.13
McKinney	$0.00
Melissa	$0.00
Princeton	$10.25
Van Alstyne	$24.11
Weston	$11.30
Total	**$95.33**

4.1.7 Upper East Fork Interceptor System Cost

For the entities that send all or a portion of their flow in Scenario 1 to the Wilson Creek WWTP, wastewater will be transported to the Wilson Creek WWTP using the Upper East Fork Interceptor System (UEFIS). For Anna, Melissa, and Princeton, the operation and maintenance cost for the portion of flow treated by Wilson Creek was calculated using the Upper East Fork Interceptor System (UIFES) rate of $3.00 per 1,000 gallons, plus 20% for Melissa and Princeton and Anna because these entities are non UEFIS member entities. For Princeton and McKinney, all flow would be treated by the Wilson Creek WWTP, and the $3.00 per 1,000 gallon rate was used. This UEFIS cost includes the operation and maintenance of the collection system. The 20 year UEFIS cost for each participant is shown in **Table 4.3** below.

Table 4.3 20-Year UEFIS Costs for Each GTUA Entity

Entity	20-Year UEFIS Cost (in 2010$ Millions)
Anna	$25.47
Celina**	$0.00
Howe**	$0.00
McKinney	$498.87
Melissa	$62.70
Princeton	$22.16
Van Alstyne**	$0.00
Weston**	$0.00
Total	**$609.20**
**Cities will not send flow to UEFIS in Scenario 1	

4.1.8 GTUA Entity Costs

The total 20-year cost for each entity for Scenario 1: Individual Treatment Facilities is $761.09 million. The 20-year cost breakdown per entity for treatment, O&M and UEFIS fees is summarized in **Table 4.4**. The Scenario 1 costs do not include conveyance costs within each entity. Each entity would be responsible for its own WWTP construction and operation.

Table 4.4 GTUA Entity Costs for Scenario 1

	Cost (in million 2010$)				
	Treatment Capital Cost	**O&M (20 Years)**	**UEFIS (20 Years)**	**Conveyance Capital Cost**	**Total**
Anna	$0.00	$17.25	$25.47	$4.45	**$47.17**
Celina	$9.50	$18.29	$0.00	$0.00	**$27.79**
Howe	$10.00	$14.13	$0.00	$0.00	**$24.13**
McKinney	$0.00	$0.00	$498.87	$0.00	**$498.87**
Melissa	$0.00	$0.00	$62.70	$2.85	**$65.55**
Princeton	$10.63	$10.25	$22.16	$0.00	**$43.04**
Van Alstyne	$17.43	$24.11	$0.00	$0.00	**$41.54**
Weston	$9.00	$11.30	$0.00	$0.00	**$20.30**
Total	**$56.56**	**$95.33**	**$609.20**	**$7.30**	**$768.39**

4.2 Scenario 2: Multiple Regional Treatment Facilities

4.2.1 Location

A multiple regional facility plan was evaluated with two regional facilities: the existing Wilson Creek WWTP and a proposed Sister Grove WWTP. The Sister Grove WWTP would be located on the East side of Princeton, with Sister Grove Creek receiving the effluent from the WWTP. This would help to distribute the wastewater effluent to other areas of Lake Lavon, alleviating some of the loading concerns in the Wilson Creek Cove. Determining the exact location of the Sister Grove WWTP was beyond the scope of this study, but several locations have previously been proposed for this facility. A significant amount of regional infrastructure for collection and conveyance of wastewater would be required for Scenario 2 and is discussed in Section 2.4. A map of the Scenario 2 regional wastewater system is shown in **Appendix C** on **Figure C-2**.

4.2.2 Wastewater Treatment Facility Size

The proposed Sister Grove WWTP would treat flows from Anna, Howe, Melissa, Van Alstyne, Weston, and the eastern portion of Princeton. Construction of the Sister Grove WWTP would be driven by the need for expansion capacity in these contributing entities. Rather than expanding the existing WWTPs, Sister Grove would be constructed to coincide with the increased capacity needs of its contributing entities. The Wilson Creek WWTP would continue to treat flows from McKinney, Celina, the western portion of Princeton, and the Upper East Fork flows from the non-GTUA region.

Projected flow rates to each facility are shown in **Figure 4.9**. The Wilson Creek WWTP would require two expansions in the next 20 years, to 56 MGD in 2020 and 64 MGD in 2030. These expansions would be as discussed in a previous study (*Wilson Creek Parallel Pipeline Study, TM 2*, CH_2M-Hill, 2008). The Sister Grove WWTP would need to be constructed in 2020 to meet the flow production of the GTUA region. A 15 MGD WWTP would provide enough capacity for over 10 years of population growth in the region. The Sister Grove WWTP would rely on a similar treatment process train as the Wilson Creek WWTP. The total average day treatment capacity for the combined WWTPs would be 79 MGD in 2030.

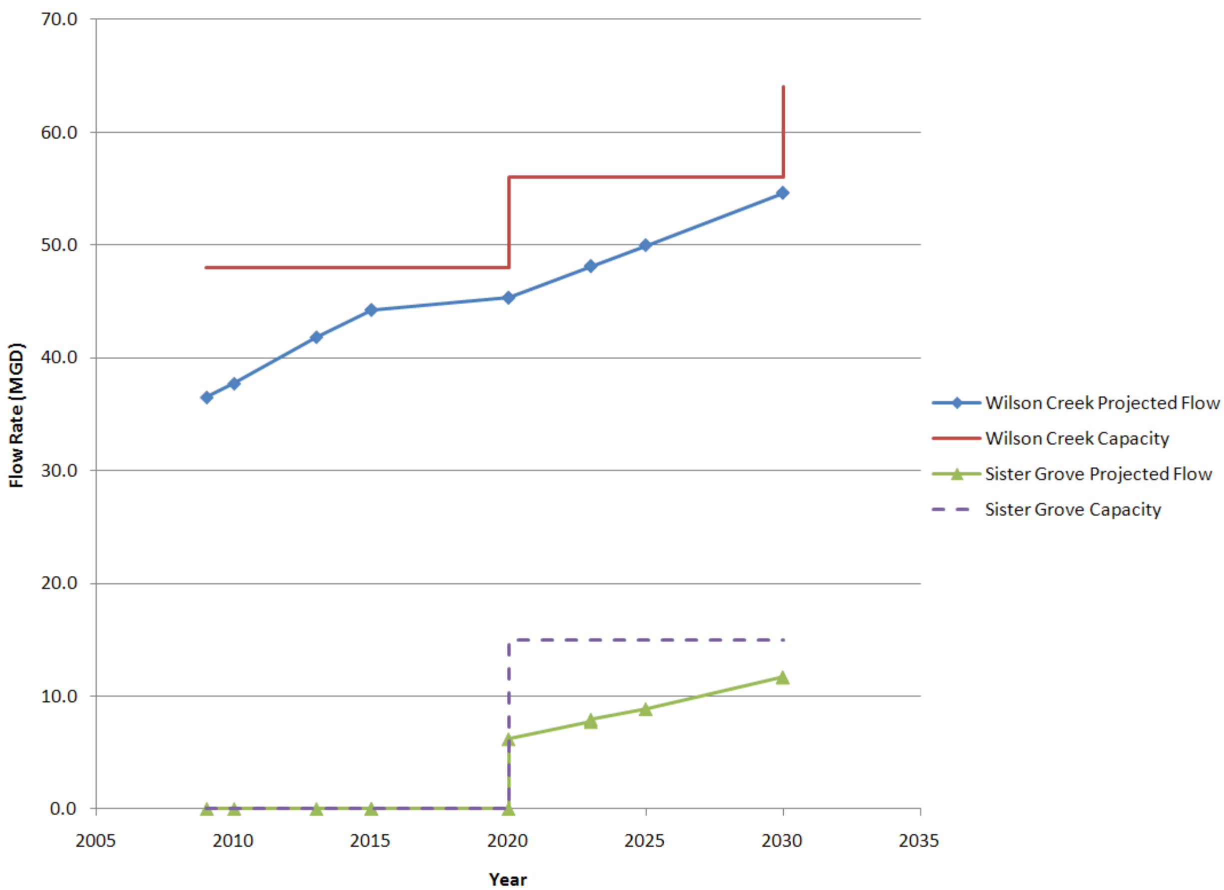


Figure 4.9 Wastewater Treatment Capacity for Wilson Creek and Sister Grove WWTPs

4.2.3 Transportation Requirements

Access to large highways and railways is a large bonus for drinking water treatment facilities. However, transportation requirements for wastewater treatment facilities are not as critical as biological processes are the main form of treatment, rather than chemical. This significantly reduces chemical deliveries, and access to railways is not typically critical, particularly for the size facilities in the GTUA region. The one transportation concern is with respect to waste solids disposal, as significant truck traffic occurs. This would result in a requirement for improved roadways to all of the facilities discussed above.

4.2.4 Conveyance Requirements

A map of the regional infrastructure for collection and conveyance of wastewater for Scenario 2 is shown on Figure C-2 in Appendix C. The Upper East Fork Interceptor System (UEFIS) would need to make the following conveyance improvements under Scenario 2:

- 42" McKinney/Prosper Parallel Interceptor (parallels existing 24"/42" McKinney/Prosper Interceptor)\
- 42"/48" McKinney Sewers Parallel Interceptor (parallels existing McKinney Sewers, which has a mixture of interceptors with various diameters)
- Expansion of Wilson Creek Lift Station from 20 to 30 MGD (has future slots for additional pumps)
- Expansion of the North McKinney Lift Station from 25 to 50 MGD (has future slots for additional pumps)
- 36" Force Main from the North McKinney Lift Station to the Sister Grove WWTP (44,000 LF)

All costs for these capital improvements would be incurred by the UEFIS and included in the UEFIS fee charged to customers that contribute flow to that system.

The participant cities that do not already send flow to the UEFIS would need to build the necessary infrastructure to deliver flow to the UEFIS. There are opportunities to share in regional infrastructure and the capital costs with each entity paying the percentage of the cost based on the percentage of the flow that they contribute to that particular piece of infrastructure.

The City of Celina would need to construct a new 27" interceptor along Wilson Creek to flow into the McKinney Sewers and eventually the Wilson Creek Lift Station. The cities of Howe, Van Alstyne and Weston would require new interceptors to convey their peak wastewater flow to the existing North McKinney collection system. The City of Howe would require a 21" interceptor along Whites Creek. The City of Van Alstyne would require a 30" interceptor along Hurricane Creek. The City of Weston would be able to send the southern/western half of the City to a 15" Honey Creek Interceptor to be shared with McKinney and the northern/eastern half of Weston would flow into the North and South Weston Interceptor which are 24" and 42", respectively. The 24" North Weston Interceptor would collect the flow from the City of Howe and parts of Weston. The 42" South Weston Interceptor would collect the flow from the North Weston Interceptor as well as the flow from Van Alstyne via the Hurricane Creek Interceptor. The South Weston Interceptor would flow into 48" Throckmorton Creek Interceptor that serves Melissa and Anna and then eventually all the flow ends up in the North McKinney Interceptor (21/24/27/30/36") and the recently constructed 48" North McKinney Eastside Parallel Interceptor. The length and size of these interceptors could potentially change based on a number of factors, such as developer contributions, a change in the location of the point of entry into the regional collection system, etc. A summary of the improvements needed as well as each entity's contributing flow percentage is shown in **Table 4.5** below.

Table 4.5 Participant City % Flow Contribution to Collection Facilities for Scenario 2

Collection Facility	Length (Feet)	City % of Flow Contribution
21" Celina – Wilson Creek Interceptor	24,000	Celina 100%
15" Honey Creek Interceptor	16,000	Weston 85%, McKinney 15%
42" South Weston Interceptor	17,000	Weston 12%, Howe 28%, Van Alstyne 60%
24" North Weston Interceptor	12,000	Weston 30%, Howe 70%
30" Hurricane Creek Interceptor	32,000	Van Alstyne 100%
21" Whites Creek Interceptor	52,000	Howe 100%

4.2.5 Opinion of Cost

A. ***Treatment***

A budgetary level opinion of construction cost was developed for each regional WWTP. Probable construction costs for the Wilson Creek WWTP and the Sister Grove WWTP were based on past NTMWD construction estimates and expansion costs developed in a previous study (*Wilson Creek Parallel Pipeline Study, TM 2,* CH_2M-Hill, 2008). A summary of the opinion of the yearly expansion cost and the opinion of total expansion cost for the two regional WWTPs is shown in **Table 4.6**. The total probable cost for the two WWTPs in the GTUA region would be $74.34 million, in 2010 dollars. This would not include conveyance cost or yearly operation and maintenance costs. The expansion capital cost per entity for the Wilson Creek and Sister Grove WWTPs would be included in the UEFIS fees paid by each entity.

Table 4.6 Projected Construction Costs for Scenario 2 Treatment System

	Expansion Cost (2010$ Millions)					
Facility	**2010**	**2015**	**2020**	**2025**	**2030**	**Total**
Wilson Creek	$0	$0	$16.11	$0	$14.28	$30.39
Sister Grove	$0	$0	$43.95	$0	$0	$43.95
Total	**$0**	**$0**	**$60.06**	**$0**	**$14.28**	**$74.34**

B. ***Collection and Conveyance***

The total opinion of construction cost in 2010 dollars for the collection and conveyance system for Scenario 2 is shown in **Table 4.7**. All of the collection lines would be needed by 2020 and sized to meet 2030 peak wastewater flows. The Cities of Anna and Melissa shared the cost on the construction of the existing Throckmorton Creek Interceptor, which was completed in 2009. The capital cost of the interceptor was $7.30 million (Anna's cost is $4.45 million and Melissa's cost is $2.85 million). This interceptor was included in this scenario due to the potential of other upstream entities using its capacity before flowing into the UEFIS. A unit cost of $5.50 per diameter-inch was used for the collection system cost projections and was based off bid tabs on recent NTMWD wastewater line projects. The total projected construction cost for Scenario 2 is $20.89 million.

Table 4.7 Projected Construction Costs for Scenario 2 Collection System (2010$)

Collection Facility	Length (Feet)	Unit Cost ($ per LF)	Total Cost (Millions)
21" Celina – Wilson Creek Interceptor	24,000	115.5	$2.77
15" Honey Creek Interceptor	16,000	82.5	$1.32
42" South Weston Interceptor	17,000	231	$3.93
24" North Weston Interceptor	12,000	132	$1.58
30" Hurricane Creek Interceptor	32,000	165	$5.28
21" Whites Creek Interceptor	52,000	115.5	$6.01
Total			**$20.89**

Using the projected capital costs in Table 4.7 above and assigning the appropriate percent of flow contribution from each entity in Table 4.5 to each collection facility, the costs per entity can be determined. A summary of the conveyance capital costs per entity for Scenario 2 is shown below in **Table 4.8**.

Table 4.8 Projected Conveyance Capital Costs per Entity for Scenario 2

Entity	Capital Conveyance Cost (2010$ Millions)
Anna**	$4.45
Celina	$2.77
Howe	$8.22
McKinney	$0.20
Melissa**	$2.85
Princeton	$0.00
Van Alstyne	$7.64
Weston	$2.06
Total	**$28.19**

** Anna and Melissa contains the actual capital cost for the existing Throckmorton Interceptor

C. *Upper East Fork Interceptor System Cost*

For Scenario 2, wastewater will be transported to the Wilson Creek WWTP or the Sister Grove WWTP using the UEFIS. The UEFIS rates vary depending on an entity's status as a member entity or not. For Anna, Melissa, Celina, Howe, Van Alstyne, and Weston, the operation and maintenance cost for the portion of flow treated by Wilson Creek and Sister Grove was calculated using the UEFIS rate of $3.30 per 1,000 gallons, plus 20% because these entities are non UEFIS member entities. The rate includes the increased capital, operation, and maintenance costs associated with the collection system and treatment facilities for the Sister Grove WWTP. For McKinney and Princeton, which are UEFIS entities, flow will be treated by the Wilson Creek WWTP, and the $3.30 per 1,000 gallon rate was used. The 20 year UEFIS cost for each entity is shown in **Table 4.9**.

Table 4.9 20-Year UEFIS Costs for Each GTUA Entity for Scenario 2

	20-Year UEFIS Cost (Millions)
Anna	$50.78
Celina	$24.15
Howe	$18.65
McKinney	$548.75
Melissa	$68.97
Princeton	$35.66
Van Alstyne	$31.83
Weston	$14.92
Total	**$793.71**

D. *GTUA Entity Costs*

Based on required conveyance improvements and UEFIS fees, the 20 year total cost for each entity for Scenario 2 is summarized in **Table 4.10**. The current UEFIS fee rate was used for the entire 20-year period, as the cost values are presented in 2010 dollars. This total cost does not include collection system improvement costs within an entity's collection system.

Table 4.10 GTUA Entity Costs for Scenario 2

	Cost (2010$ Millions)		
	UEFIS Fees (20 Years)	Conveyance Capital Cost	Total
Anna	$50.78	$4.45	**$55.23**
Celina	$24.15	$2.77	**$26.92**
Howe	$18.65	$8.22	**$26.87**
McKinney	$548.75	$0.20	**$548.95**
Melissa	$68.97	$2.85	**$71.82**
Princeton	$35.66	$0.00	**$35.66**
Van Alstyne	$31.83	$7.64	**$39.47**
Weston	$14.92	$2.06	**$16.98**
TOTAL	**$793.71**	**$28.19**	**$821.90**

4.3 Scenario 3: Single Regional Treatment Facility

4.3.1 Location

The second option for regionalization of wastewater treatment in the GTUA region is transferring all flow to a single facility. The existing Wilson Creek WWTP is projected to be used as this regional facility. Utilizing a single regional facility would require similar collection and conveyance infrastructure as two regional facilities, but would focus all treatment efforts at one location helping to streamline operations and maintenance. A map of the Scenario 3 regional wastewater system is shown in Appendix C on Figure C-3.

4.3.2 Wastewater Treatment Facility Size

In the single regional facility plan, the Wilson Creek WWTP would treat all flows from study participants in the GTUA region, as well as the existing flows from the non-GTUA region. A significant amount of infrastructure is already in place to convey wastewater to Wilson Creek from Anna, Melissa, Princeton, and McKinney. Flows from Celina, Howe, Van Alstyne, and Weston would be added to the system. All existing WWTPs would be decommissioned, with the exception of the Wilson Creek WWTP. The projected flow and required capacity for the Wilson Creek WWTP are shown in Figure **4.10**. Two expansions of the Wilson Creek WWTP would be required in the next 20 years, in 2015 and 2025. Each expansion would increase the capacity by 16 MGD, resulting in a total average day capacity of 80 MGD in 2030.

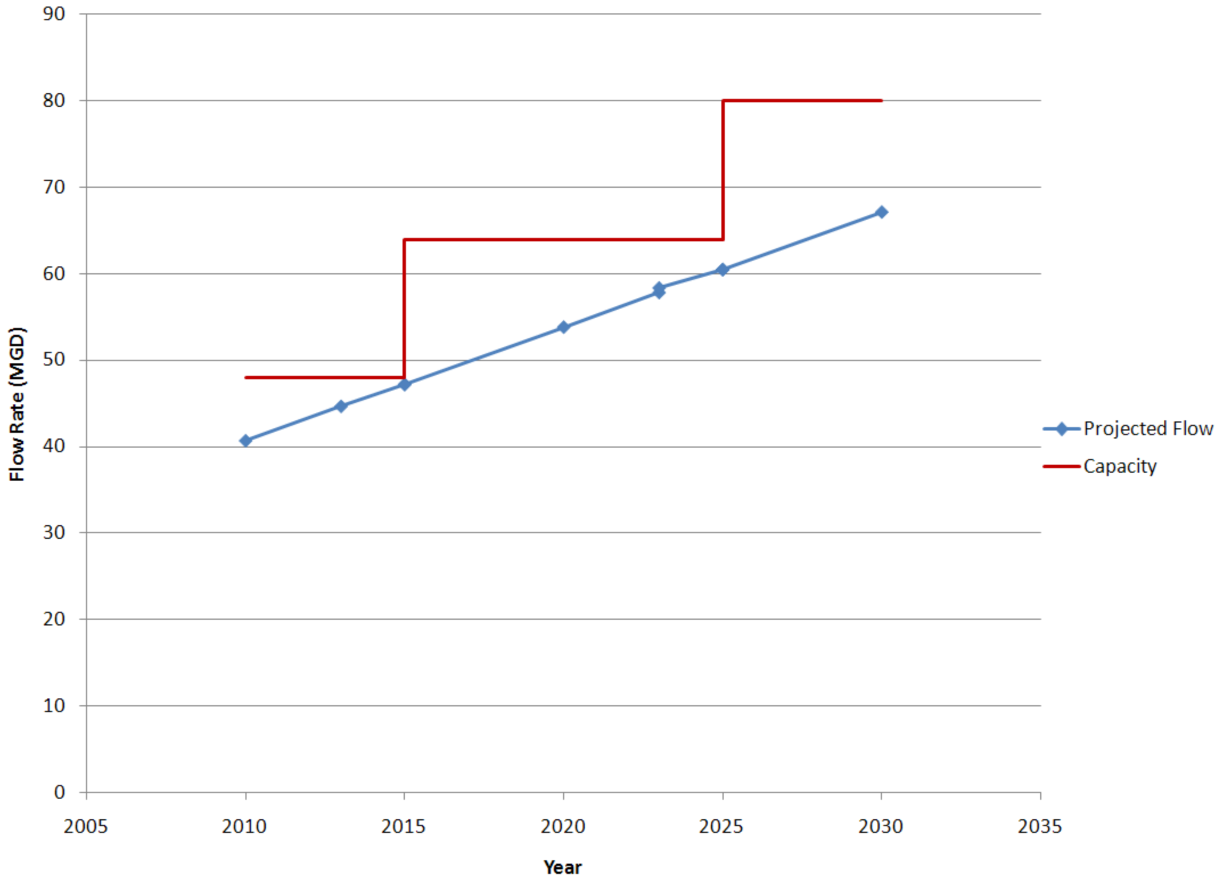


Figure 4.10 Wastewater Treatment Capacity for the Wilson Creek WWTP

The timing of expansion of the Wilson Creek WWTP is dependent on the treatment capacity needs of the individual GTUA entities. A summary of the contributions to the Wilson Creek WWTP is shown in **Table 4.11**. Currently, all of the flow from McKinney, Melissa, and Princeton are routed to the Wilson Creek WWTP. Anna currently has infrastructure in place to convey the majority of their flow to the Wilson Creek WWTP, and thus it was assumed that the flow from Anna would begin to be diverted to the Wilson Creek WWTP in the near future. Celina would reach their current system's capacity in 2020, and would be diverting 25% of their flow to the Wilson Creek WWTP by 2025. Van Alstyne would require capacity upgrades in 2020, which would lead to flows being conveyed to the Wilson Creek WWTP in this scenario. Flows from Weston and Howe would likely tie into the system in 2020.

Table 4.11 Summary of Wastewater Flow Contributions to the Wilson Creek WWTP

Year	ADF - MGD							
	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston
2010	1.04	0.16	0.35	14.95	0.57	0.72	0.35	0.23
2020	1.61	0.73	0.57	23	2.65	1.42	0.96	0.46
2030	2.42	1.55	0.96	31.63	4.03	2.07	2.01	0.81

Note: Blue = Individual WWTP/Septic; Green = Wilson Creek

The expansion phasing for Wilson Creek presented here is slightly different than the expansion plan presented in a previous study (*Wilson Creek Parallel Pipeline Study, TM 2*, CH_2M-Hill, 2008). The previous study had suggested four 8 MGD expansions to reach 80 MGD of capacity. This plan would simply combine those expansions into two 16 MGD expansions. In order to accommodate 10 years of population increase during each expansion, as suggested by the Texas Water Development Board, 16 MGD expansions would be required in 2015 and 2025.

4.3.3 Transportation Requirements

Access to large highways and railways is a large bonus for drinking water treatment facilities. However, transportation requirements for wastewater treatment facilities are not as critical as biological processes are the main form of treatment, rather than chemical. This significantly reduces chemical deliveries, and access to railways is not typically critical, particularly for the size facilities in the GTUA region. The one transportation concern is with respect to waste solids disposal, as significant truck traffic occurs. This would result in a requirement for improved roadways to all of the facilities.

4.3.4 Conveyance Requirements

The collection and conveyance improvements for Scenario 3 would be similar to those required for Scenario 2. The major difference would be that the North McKinney Lift Station would send its flow through a 36” parallel force main to the Wilson Creek WWTP instead of the Sister Grove WWTP so the need to redirect the flow at the North McKinney Lift Station would be eliminated as all flow in the study area would go to the Wilson Creek WWTP. A map of the regional infrastructure for conveyance and treatment of wastewater for Scenario 3 is shown in **Appendix C** on **Figure C-3**. The

Upper East Fork Interceptor System (UEFIS) would need to make the following conveyance improvements under Scenario 3:

- 42" McKinney/Prosper Parallel Interceptor (parallels existing 24"/42" McKinney/Prosper Interceptor)
- 42"/48" McKinney Sewers Parallel Interceptor (parallels existing McKinney Sewers, which has a mixture of interceptors with various diameters)
- Expansion of Wilson Creek Lift Station from 20 to 30 MGD (has future slots for additional pumps)
- Expansion of the North McKinney Lift Station from 25 to 50 MGD (has future slots for additional pumps)
- 36" Force Main from the North McKinney Lift Station to the Wilson Creek WWTP junction box (35,000 LF)
- Expansion of Princeton Lift Station from 3 MGD to 7MGD and construct a 16" parallel force main

All costs for these conveyance capital improvements would be incurred by the UEFIS and included in the UEFIS fee charged to customers that contribute flow to that system.

All of the regional interceptors (which serve the non UEFIS participant entities) that would be required for Scenario 2 would also be necessary under Scenario 3. These interceptors would include the same percent contribution from each entity in both scenarios. The length and size of these interceptors could potentially change based on a number of factors, such as developer contributions, a change in the location of the point of entry into the regional collection system, etc. This is summarized in **Table 4.12** below.

Table 4.12 Participant City % Flow Contribution to Collection Facilities for Scenario 3

Collection Facility	Length (Feet)	City % of Flow Contribution
21" Celina – Wilson Creek Interceptor	24,000	Celina 100%
15" Honey Creek Interceptor	16,000	Weston 85%, McKinney 15%
42" South Weston Interceptor	17,000	Weston 12%, Howe 28%, Van Alstyne 60%
24" North Weston Interceptor	12,000	Weston 30%, Howe 70%
30" Hurricane Creek Interceptor	32,000	Van Alstyne 100%
21" Whites Creek Interceptor	52,000	Howe 100%

4.3.5 Opinion of Cost

A. *Treatment*

Budgetary probable construction costs for the Wilson Creek WWTP were based on past NTMWD construction estimates and expansion costs (*Wilson Creek Parallel Pipeline Study, TM 2*, CH_2M-Hill, 2008). A summary of the opinion of the yearly expansion cost and the opinion of total expansion cost for the Wilson Creek WWTP are shown in **Table 4.13**. The total probable cost for expansion of the Wilson Creek WWTP to treat all flows (for study participants) in the GTUA region would be $63.86 million, in 2010 dollars. This would not include conveyance cost or yearly operation and maintenance costs. The expansion cost per entity for the Wilson Creek WWTP is included in the UEFIS fees paid by each entity.

Table 4.13 Projected Construction Costs for Scenario 3 Treatment System

Expansion Cost (in 2010$ Millions)					
2010	**2015**	**2020**	**2025**	**2030**	**Total**
$0	$30.40	$0	$0	$33.46	$63.86

B. *Collection and Conveyance*

The total opinion of construction cost in 2010 dollars for the collection and conveyance system for all of the collection facilities needed for Scenario 3 is shown in **Table 4.14**. All of the collection lines and force mains would be needed by 2020 and sized to meet 2030 peak wastewater flows. The Cities of Anna and Melissa shared the cost on the construction of the existing Throckmorton Creek Interceptor, which was completed in 2009. The capital cost of the interceptor was $7.30 million (Anna's cost is $4.45 million and Melissa's cost is $2.85 million). This interceptor was included in this scenario due to the potential of other upstream entities utilizing its capacity before flowing into the UEFIS. A unit cost of $5.50 per diameter-inch was used for the collection system cost projections and was based on bid tabs on recent NTMWD wastewater line projects. The total projected construction cost for Scenario 2 was $20.89 million.

Table 4.14 Projected Construction Costs for Scenario 3 Collection System (2010$)

Collection Facility	Length (Feet)	Unit Cost ($ per LF)	Total Cost (Millions)
21” Celina – Wilson Creek Interceptor	24,000	115.5	$2.77
15” Honey Creek Interceptor	16,000	82.5	$1.32
42” South Weston Interceptor	17,000	231	$3.93
24” North Weston Interceptor	12,000	132	$1.58
30” Hurricane Creek Interceptor	32,000	165	$5.28
21” Whites Creek Interceptor	52,000	115.5	$6.01
Total			**$20.89**

Using the projected capital costs in Table 4.14 above and assigning the appropriate percent of flow contribution from each entity in Table 4.12 to each collection facility, the costs per entity can be determined. A summary of the conveyance capital costs per entity for Scenario 3 is shown below in **Table 4.15**.

Table 4.15 Projected Conveyance Capital Costs per Entity for Scenario 3

Entity	Capital Conveyance Cost (2010$ Millions)
Anna**	$4.45
Celina	$2.77
Howe	$8.22
McKinney	$0.20
Melissa**	$2.85
Princeton	$0.00
Van Alstyne	$7.64
Weston	$2.06
Total	**$28.19**

** Anna and Melissa contains the actual capital cost for the existing Throckmorton Interceptor

C. *Upper East Fork Interceptor System Cost*

For Scenario 3, wastewater will be transported to the Wilson Creek WWTP using the UEFIS. The UEFIS rates vary depending on an entities status as a member entity or not. For Anna, Melissa, Celina, Howe, Van Alstyne, and Weston, the operation and maintenance cost for the portion of flow treated by Wilson Creek was calculated using the

UEFIS rate of $3.00 per 1,000 gallons, plus 20% because these entities are non UEFIS member entities. For McKinney and Princeton the $3.00 per 1,000 gallon rate was used as both entities are UEFIS entities. This UEFIS cost includes the operation and maintenance of the collection system. The 20 year UEFIS cost for each entity is shown in **Table 4.16**.

Table 4.16 20-Year UEFIS Costs for Each GTUA Entity for Scenario 3

	20-Year UEFIS Cost (Millions)
Anna	$46.16
Celina	$21.95
Howe	$16.96
McKinney	$498.87
Melissa	$62.70
Princeton	$32.42
Van Alstyne	$28.93
Weston	$13.56
Total	**$721.55**

D. *GTUA Entity Costs*

Based on required conveyance improvements and UEFIS fees, the total 20 year cost for each entity for Scenario 3 is summarized in **Table 4.17**. The current UEFIS fee rate was used for the entire 20-year period, as the cost values are presented in 2010 dollars. This total cost does not include collection system costs within an entity's collection system.

Table 4.17 GTUA Entity Costs for Scenario 3

	Cost (2010$ Millions)		
	UEFIS Fees (20 Years)	Conveyance Capital Cost	Total
Anna	$46.16	$4.45	**$50.61**
Celina	$21.95	$2.77	**$24.72**
Howe	$16.96	$8.22	**$25.18**
McKinney	$498.87	$0.20	**$499.07**
Melissa	$62.70	$2.85	**$65.55**
Princeton	$32.42	$0.00	**$32.42**
Van Alstyne	$28.93	$7.64	**$36.57**
Weston	$13.56	$2.06	**$15.62**
TOTAL	**$721.55**	**$28.19**	**$749.74**

4.4 Summary of Costs

The cost of Scenario 1, 2, and 3 for the participating GTUA entities is summarized in **Table 4.18**. Scenario 1 costs consist of the capital cost for constructing or expanding treatment facilities, the operations and maintenance cost associated with those treatment facilities and the UEFIS fees for the entities that send flow to the UEFIS. Scenarios 2 and 3 include the capital cost for constructing new conveyance infrastructure and the UEFIS fees for sending flow to the UEFIS. The UEFIS fees for Scenario 2 are 10% higher due to the cost that the UEFIS would have to incur to construct the regional infrastructure under Scenario 2. The projected 20-year costs for Scenario 1, 2 and 3 are $768.39, $821.90 and $749.74 million, respectively.

Table 4.18 Cost Comparison of the Three Scenarios

	Scenario 1 Cost (2010$ Millions)					Scenario 2 Cost (2010$ Millions)			Scenario 3 Cost (2010$ Millions)		
	Treatment Capital Cost	**City O&M Costs (20 Years)**	**UEFIS Fees (20 Years)**	**Conveyance Capital Cost**	**Total**	**UEFIS Fees (20 Years)**	**Conveyance Capital Cost**	**Total**	**UEFIS Fees (20 Years)**	**Conveyance Capital Cost**	**Total**
Anna	$0.00	$17.25	$25.47	$4.45	**$47.17**	$50.78	$4.45	**$55.23**	$46.16	$4.45	**$50.61**
Celina	$9.50	$18.29	$0.00	$0.00	**$27.79**	$24.15	$2.77	**$26.92**	$21.95	$2.77	**$24.72**
Howe	$10.00	$14.13	$0.00	$0.00	**$24.13**	$18.65	$8.22	**$26.87**	$16.96	$8.22	**$25.18**
McKinney	$0.00	$0.00	$498.87	$0.00	**$498.87**	$548.75	$0.20	**$548.95**	$498.87	$0.20	**$498.87**
Melissa	$0.00	$0.00	$62.70	$2.85	**$65.55**	$68.97	$2.85	**$71.82**	$62.70	$2.85	**$65.55**
Princeton	$10.63	$10.25	$22.16	$0.00	**$43.04**	$35.66	$0.00	**$35.66**	$32.42	$0.00	**$32.42**
Van Alstyne	$17.43	$24.11	$0.00	$0.00	**$41.54**	$31.83	$7.64	**$39.47**	$28.93	$7.64	**$36.57**
Weston	$9.00	$11.30	$0.00	$0.00	**$20.30**	$14.92	$2.06	**$16.98**	$13.56	$2.06	**$15.62**
TOTAL	**$56.56**	**$95.33**	**$609.20**	**$7.30**	**$768.39**	**$793.71**	**$28.19**	**$821.90**	**$721.55**	**$28.19**	**$749.54**

5.0 RECOMMENDATION

An evaluation of centralized and distributed wastewater collection, conveyance, and treatment was completed in Sections 1-4. The total cost, regionalization benefits, and secondary drivers for each scenario were evaluated. Three scenarios were evaluated:

- **Scenario 1:** Multiple wastewater treatment plants (WWTPs) operated by the individual cities

- **Scenario 2:** Two regional WWTPs - expand existing Wilson Creek WWTP and build future Sister Grove WWTP

- **Scenario 3:** A single regional WWTP - expand existing Wilson Creek WWTP

Currently, Scenario 3 is shown to be the most cost effective scenario over the twenty year planning period. However, Scenario 2 may become more cost effective and feasible as water quality criteria change and growth outside of the current study area increases (i.e. in the Sister Grove basin). Collection system modification and upgrades upstream of the North McKinney Lift Station were identical for Scenario 2 and 3 for the next 10 years, as discussed in Section 4. Wilson Creek will need to be expanded in the next 10 years in either scenario, but the need for the infrastructure associated with a Sister Grove WWTP would not be needed for 10 to 15 years, depending on growth and the desired flow capacity of the Sister Grove WWTP. Therefore, it is not necessary to make an immediate decision on whether to have a single regional WWTP (the Wilson Creek WWTP) or to have two regional WWTPs (the Wilson Creek WWTP or the Sister Grove WWTP). ***The recommendation is to move forward with regionalization of wastewater collection and treatment in the GTUA region, with continued discussion between the GTUA member entities and NTMWD to determine the direction for wastewater treatment facilities.***

The next steps to move forward with regionalization in the GTUA region would be:

- Begin planning, design, and construction of the regional collection infrastructure upstream of the North McKinney Lift Station (see Figure C-2 and C-3).

Collection infrastructure will need to be in place by 2020 to accommodate increased flows without having each entity expand their treatment facilities.

- Continue evaluation of secondary drivers at Wilson Creek WWTP that would make shifting flow to the Sister Grove WWTP more economically feasible.
- Determine the wastewater collection and treatment needs for the Sister Grove basin outside of the GTUA study area.
- Evaluate the impact of the Sister Grove basin wastewater needs and determine if increased flow from that basin would be a driver for a Sister Grove WWTP.
- If entities in the Sister Grove basin outside of the GTUA study area express interest in participating in a regional Sister Grove WWTP, reevaluate benefits of a single regional WWTP (Scenario 3) versus two regional WWTPs (Scenario 2)
- A determination of whether the long term treatment needs of the region are best met by a single regional facility or two regional facilities needs to be made before 2020. Making this decision before 2020 will allow the North McKinney lift station to be expanded to accommodate either a single wastewater treatment facility or two regional wastewater treatment facilities, and would allow the Sister Grove WWTP to be constructed at the appropriate time to meet increased wastewater flows.

The overall recommended direction for the study area is to pursue full regionalization. The following sections discuss the basis for the recommendations including the primary and secondary drivers as well as other additional considerations.

5.1 Basis for Recommendation

5.1.1 Total System Regionalization Benefits

The concept of regionalizing the GTUA study area for both transmission and treatment of wastewater can provide a number of benefits to the respective entities and to the sub-region as a collective whole. These benefits are summarized as follows:

A. ***TCEQ and TWDB Initiatives***

As the study area continues to grow, wastewater transmission and treatment will require expansion and enhancement necessitating State Regulatory review and approvals.

Approvals may be in the form of State loan or grant programs or purely in the form of regulatory authorizations. In either case, review and approvals are required by both TCEQ and the TWDB. Both agencies have acknowledged preferences for regional programs. Failure to follow preferences of the state regulatory agencies results in extra analysis and cost as each phase of expansion is pursued by having to justify why a regional solution is not being pursued. This also potentially results in an expansion of project cost and lengthens the respective project review and approval timelines.

B. *Prior Regionalization Success*

The successes of regionalization in the northern portions of the DFW Metroplex, specifically Collin County and South Grayson County, have been evidenced for the last 50 years. Beginning with the creation and implementation of the North Texas Municipal Water District (NTMWD) surface water supply system in the mid-1950's and continuing through more recent service provisions, many Cities have embraced the regional concept and have benefits by cost savings and operational enhancements.

Beginning with the first NTMWD project, various municipalities have joined together and created other sub-agencies for wastewater transmission, wastewater treatment, and solid waste transfer and disposal. In each case, costs have been reduced, the product has been enhanced, and individual cities have been freed from the tedious application and review processes. More recently on a smaller scale, the Collin Grayson Municipal Alliance (CGMA), working through the Greater Texoma Utility Authority (GTUA) as its legal and contracting entity, has planned and constructed a surface water supply system. This system will provide future potable water to the Cities of Melissa, Anna, Van Alstyne, Howe and potential to other adjacent areas which were previously dependent on ground water, which has been a depleting and increasingly limited resource for an area in the process of urbanization. These projects range from large to relatively small regional infrastructure projects, but each has provided cost savings, operational benefits, dependability and enhanced quality (which translates into environmental and other benefits) that could not have been attained by the entities working independently.

Regionalization can be expected to continue providing similar benefits in the future. It is noted that as permit requirements continue to become more stringent, regionalization of the wastewater treatment at a single wastewater treatment plant may be replaced by having two or three sub-regional facilities. This concept would continue all the other benefits outlined above.

C. ***Operational Enhancements***

Operational and maintenance staffing levels per MGD tend to decline as the magnitude of the operation increases. Either a single wastewater plant or dual wastewater plants in the regional system will result in significantly fewer overall staff requirements than if each City were to construct and operate wastewater plants independently. Larger facilities can also justify increasingly technical and specialized staffing, helping treatment facilities meet the increasingly high scientific and technological standards being required by regulatory agencies.

5.1.2 Cost Benefits

The cost associated with Scenario 1, Scenario 2, and Scenario 3 was associated with one of four categories: capital treatment costs, capital regional conveyance costs, operations and maintenance, and UEFIS fees. Each of these components was discussed in Section 4. Total costs for each scenario are summarized below in **Table 5.1**, with the most cost effective scenario for each entity highlighted. Based on this study's assumptions, the only entity that would have a cost advantage for a scenario other than Scenario 3 is the City of Howe, and the cost difference is less than 5% over the 20-year study period.

Table 5.1 Total Cost by Scenario

	20-Year Total Cost (2010$ Millions)		
	Scenario 1	**Scenario 2**	**Scenario 3**
Anna	$47.72	$55.23	$46.16
Celina	$27.79	$26.92	$24.72
Howe	$24.13	$26.87	$25.18
McKinney	$498.87	$548.95	$498.87
Melissa	$62.70	$71.82	$62.70
Princeton	$43.04	$35.66	$32.42
Van Alstyne	$41.54	$39.47	$36.57
Weston	$20.30	$16.98	$15.62
TOTAL	**$766.09**	**$821.90**	**$742.24**

5.2 Secondary Drivers

The recommendation to move forward with regionalization in the GTUA study area was primarily based on cost and regionalization benefits, but secondary drivers will also influence future wastewater management in the GTUA region. The two main secondary drivers that influenced the recommendation are regulatory implications and political ramifications in the region.

5.2.1 Regulatory

Regulatory requirements for wastewater effluent flows are continuously being evaluated by the TCEQ, and increasingly stringent permits are being issued on an annual basis. Inclusion of effluent nutrient limitations is increasingly common in the State of Texas, and the Wilson Creek WWTP has one of the more stringent effluent phosphorus limitations in the state. National trends can also impact wastewater permitting in Texas, and there is a large movement within EPA to include numerical nutrient criteria in secondary treatment permits. The State of Florida recently had numeric nutrient criteria proposed by the EPA, and this trend is likely to spread throughout the nation. Many other states already include phosphorus limitations in the majority of their permitted effluent flows, and nitrogen limitations are common in many coastal regions. It is increasingly likely that nutrient removal criteria will become common place in the State of Texas, and this has a significant impact on capital cost, operation and maintenance cost, and operational complexity associated with treatment.

With the regulatory drivers for nutrient removal in mind, all analysis for wastewater treatment plant construction and/or expansion was based on nutrient removal facilities with the same effluent limitations of the Wilson Creek WWTP. This increases capital costs and operation and maintenance costs for the facility, and also increases the complexity of operation. Increased operator education, operator training, and system control complexity are ancillary costs that were not considered in the cost analysis, but can make operation of small, distributed systems challenging to operate cost effectively. Large, centralized treatment facilities are typically more conducive to operations designed to meet nutrient removal limitations.

5.2.2 Political

As the study area moves forward, it is important to recognize that there will be a number of political constraints that will impact the implementation of a regional wastewater program. These constraints include the following:

- Maintaining the strong commitment of each entity - Strong communication and persistent pursuit of the regionalization objective will be required. Frequently, such projects require a local “champion” to maintain interest and awareness of all involved participants. The earlier a legal entity can be established and begin effective operations, the more likely success will be achieved.
- Local Politics - The NTMWD is over 50 years old and it has over a dozen members, some of whom compete vigorously with one another for economic development and other issues, but have recognized that by working together on mutual issues, they each are stronger than they could be on their own.
- Individual City Budget Constraints - Short term cost impacts frequently can over shadow the decades of savings and economy available through cooperative regional facilities.
- The politics of piecing together a regional cooperative program that benefits all entities in a similar fashion can be a challenging task. The NTMWD model

already exists and is a five decade example of the benefits. Due to the differences in the build-out level of some potential participants in a GTUA wastewater entity, it will be necessary to be able to illustrate how all benefit in a similar fashion and thus should be similarly entitled participants.

It will also be necessary to enlist state political support in order to compete for and achieve approval for permitting and potential funding, if such is available in the future.

5.3 Additional Considerations

Scenario 1, Scenario 2, and Scenario 3 are based on assumptions that the GTUA region would either pursue completely centralized or completely distributed treatment, with a recommendation based mainly on cost considerations and the benefits of centralized systems. However, several additional considerations may impact the enacted wastewater management strategy for the GTUA region. These additional considerations are the following:

- Lake Lavon Loading Concerns
- Long Term Population and Flows
- Intermediate Options
- Interim Options
- Reclaimed Water Reuse Considerations
- Continued Use of Interim Facilities as Scalping Plants

Each of these considerations may impact the decision on whether to send all flow to Wilson Creek WWTP or sending some flows to a new Sister Grove WWTP. These additional considerations are discussed in more detail in the following sections.

5.3.1 Lake Lavon Loading Concerns

The Wilson Creek WWTP currently discharges into a cove on Lake Lavon. Effluent loading concerns have been discussed for this cove, and future regulations may make increasing the discharge from the Wilson Creek WWTP to this cove less financially viable. A multiple regional facility plan would include a proposed Sister Grove WWTP, which would be located on the East side of Princeton. Sister Grove Creek would receive the effluent from this WWTP upstream from Lake Lavon, and Sister Grove Creek discharge into a different location than the Wilson Creek WWTP. Transferring effluent loading to another area of Lake Lavon would help to distribute the wastewater effluent to other areas, alleviating some of the loading concerns in the Wilson Creek Cove. Depending on future regulatory developments, Scenario 2 may become more environmentally and economically feasible than Scenario 3.

5.3.2 Long Term Population and Flows

The standard TWDB project time period for a study such as this one is twenty years. As a general rule, this twenty year time frame is based on the typical outer range for growth projections founded on trending and reasonable inference of factors impacting growth. It would be highly impractical to plan and fund a wastewater transmission and treatment system with more capacity than would be needed within a twenty year time horizon. Large excess capacities in place multiple decades before need are wasteful and thus inappropriate. Debt funding for major projects is typical through 15 to 25 year bonded indebtedness or impact fees. If debt is the chosen funding mechanism, the annual payments are funded by the ratepayer base during the debt period paying the cost through user fees. It is hard to justify ratepayers funding project cost that are not even needed during the debt retirement period. Additionally, if the capacity is extended out to serve decades past the debt period, much of the value of the improvement may be depreciated before it is ever needed.

One of the objectives of this study was to perform a cursory analysis of the potential capacity requirements or needs beyond the 2030 planning period. In the case of the Upper East Fork Wastewater System, both transmission and treatment, buildout is well beyond this study's twenty year horizon and probably in the range of 50 to 60 years. While it is highly unlikely any portion of a sub-regional system will be built in the next

20 years that would serve build-out needs (limited areas of the system involving McKinney might be an exception), it is instructive for both planners and decision makers to be aware of ultimate needs. The following are specific benefits for the Cities and the overall region from a long term population and flow perspective:

1. New regional or sub-regional wastewater treatment plant sites can be sized (acreage) thus allowing subsequent phases of plant construction to be added as needed. It will be increasingly difficult to add a wastewater treatment plants in growth areas, thus, assuring an adequately sized site for all required future expansions and enhanced treatment processes.
2. Easements and Right of Way should almost always be acquired at the ultimate needed size as they can be very costly to add to in future years after development has occurred. By considering longer term planning horizons, an analysis can project the number of times a sewer basin might need to have parallel lines constructed in order to serve build-out flows. The subject study area, however, has multiple extended reach basins and a build out horizon that may extend well over 50 years. The cities or a regional entity will be able to project and acquire appropriate easement widths to accommodate whatever number of parallel lines may be needed to carry the ultimate design flows. Most of the larger regional basins will have the sewer mains constructed in or adjacent to floodplains of up to 50 foot wide easements. Most of the cities are protecting floodplain areas as open space and may be acquiring some level of public access rights in portions of the floodplain. Open space, parks, trail systems, and nature areas co-exist very well with wastewater transmission mains so long as some type of adequate access for maintenance is provided.

A comparison has been made between 2030 population and flow projections (discussed in Section 2 of this report) and the Region C 2060 population and flow projections. Region C 2060 population and the corresponding flow projections are about 200% higher than this study's 2030 population projections, clearly illustrating the need for this planning area to be aware of the longer term issues and needs. There is also the potential of this study area experiencing additional growth beyond even the 2060 time period. **Table 5.2** illustrates this study's 2030 and Region C 2060 population and wastewater flow by City. It is clear that significant long term planning recognition beyond the 2030 time horizon of this study is important for the Cities.

Table 5.2 Year 2030 and Region C 2060 Population and Flow Projections

City	**2030 Population	2030 Average Flow (MGD)	2030 Peak Flow (MGD)	Region C 2060 Population	Estimated 2060 Average Flow (MGD)	Estimated 2060 Peak Flow (MGD)
Anna	21,000	2.42	7.25	60,000	6.90	20.70
Celina	53,798	6.19	18.56	168,118	19.33	58.00
Howe	8,368	0.96	2.89	10,781	1.24	3.72
McKinney	275,000	31.63	94.88	380,000	43.70	131.10
Melissa	35,000	4.03	12.08	77,044	8.86	26.58
Princeton	18,000	2.07	6.21	75,000	8.63	25.88
Van Alstyne	17,475	2.01	6.03	19,200	2.21	6.62
Weston	7,000	0.81	2.42	60,000	6.90	20.70
Totals	**431,850**	**50.10**	**150.30**	**850,143**	**97.77**	**293.30**

** 2030 Population were projected and discussed in Section 2 of this report

5.3.3 Intermediate Options

Intermediate options would consist of a combination of potential solutions from Scenario 1, Scenario 2, and Scenario 3. The City of Anna is a current example of an intermediate solution between completely centralized and completely distribution wastewater management. The City of Anna maintains a 0.75 MGD wastewater treatment permit, but has capped their flow and is sending their remaining flow to the Wilson Creek WWTP. The City of Celina is also pursuing a similar strategy in conjunction with the UTRWD.

The City of Howe and the City of Van Alstyne may present a situation where an intermediate option would be feasible and economical. The City of Howe could route their wastewater to the existing Van Alstyne WWTP to take advantage of their existing facility. The City of Van Alstyne could continue operating their existing WWTP. As the City of Van Alstyne grows to the West, it may be more feasible for the City to send the flows from their western districts to a centralized facility (either Wilson Creek or Sister Grove) while continuing to treat their existing service area with their existing WWTP so long as it is cost effective. Other intermediate options could potentially exist and pursued by the participant cities.

5.3.4 Interim Options

The pace of growth in the outer areas of the study region, quantities of wastewater flows, and the absence of major project initiation funding will likely limit the construction of regional facilities for at least five to ten years. Considering these time constraints, it is necessary to identify options available to the participant entities not already connected to the NTMWD Wilson Creek WWTP. In Section 3 of this study, there was considerable discussion on this issue wherein optional considerations of a limited scale could be employed to provide service. For example, the Cities of Anna, Van Alstyne, and Celina currently have wastewater treatment plants that could be considered for minor expansions to serve limited growth opportunities. These expansions would probably all be in the range of 0.5 MGD up to a maximum of 1.0 MGD.

Developer funded package plants, whether for specific very large projects or City coordinated package plants serving multiple new development projects could be considered. Combining multiple development project needs into a project of appropriate magnitude and allowing adequate time or incentive for the development community to recover the considerable expense to fund treatment facilities could be an immediate answer to early treatment capacity need. It is emphasized that in order for this concept to be desirable over the entire study area, GTUA, NTMWD, or other regional entity should be considered as the area wide operator of the facilities to ensure consistent water quality. Developer operations should be discouraged, even to the extent of only supporting the projects that are proposed to have an acceptable public entity operator and meet the design requirement of NTMWD in order to protect Lake Lavon water quality and be serviceable for an adequate period of time to recoup the required capital. Permit and treatment technology issues for these localized alternatives were covered in Section 3. It is important as part of the recommendation, however, to include these interim options as alternatives available to the participant cities as tools to serve limited needs until sufficient demand to fund one of the regional scenarios materializes.

5.3.5 Reclaimed Water Reuse Considerations

All of the cities participating in the study are expected to develop at a moderate rate of water reuse demand in the near future, and increased development may produce new opportunities to implement reuse systems throughout the study planning area. Examples of potential development of reuse systems might be irrigation systems for potential golf courses, irrigation systems for future thoroughfares, irrigation systems for future parks and open spaces as well as future reuse opportunities as the industrial sectors develop.

5.3.6 Continued Use of Interim Facilities as Scalping Plants

Large master planned communities may well be incentivized to install package plants that can become long term scalping plants and thus provide an economic incentive to fund facilities that can be in place for decades as sources of irrigation water. Specifically, it can be expected that golf courses or other large open space amenities will be designed as integral components of significant development projects (some of which are already being discussed and entitled). These developments can be encouraged to fund or participate in funding sub-regional package plants by extending water re-use opportunities to the large open space amenities, thus reducing the operational cost of those amenities. Simultaneously, the potable water demands can be reduced by the amount of package plant reuse that is produced. A golf course or similar open space can use up to a million gallons of water a day during the initial development and up to a half a million during normal operations. Allowing package plants to be retained as scalping plants returning treated effluent to irrigation holding lakes even after regional or sub-regional treatment plants are constructed can be a strong incentive for major projects, even if the ownership of the package plant is vested in the local municipality and operated by a regional entity. In this scenario, the open space irrigator would purchase the treated effluent at a cost to reflect any advantage over treatment at the regional facility and return transmission to the irrigator's holding lake.

5.4 Financial and Administrative Issues

The options for implementing this study's findings from a financial and administrative standpoint were discussed in detail in Section 3. The three options were identified as follows:

1. Use of either NTMWD or GTUA for joint management and funding
2. City manages and funds project individually
3. Contracting via a smaller alliance among selective Cities – might involve contract with NTMWD or GTUA or might be managed by one of the Cities or an independent Board

Considering the three scenarios that have been detailed in this study for delivering wastewater, the three financial and administrative options previously outlined appear to still be the options.

If the regional concept is followed under Scenario 2 (more than one regional plant, such as Wilson Creek and a new plant on Sister Grove Creek), NTMWD would be the logical vehicle to finance and administer the program. It would be possible for NTMWD to operate the Wilson Creek portion and a different entity, such as GTUA, to operate the second sub-regional plant. Considering the interconnectivity of the flow and that it would all be going to Lake Lavon, it is recommended that NTMWD would be the preferred vehicle to operate, finance, and manage administrative issues. If Scenario 3 (all wastewater flow to Wilson Creek) is followed, the use of NTMWD is clearly apparent with all the noted economies of scale and benefits being applied to the project.

For Scenario 1, where individual City ownership and operation of wastewater treatment facilities is pursued, funding option 2 or 3 would be the likely funding pursuit. In these options, the entities manage and fund projects individually or entities could join together and contract via a smaller alliance, which could use a regional entity, such as GTUA, as project manager and operator. This would also apply in any of the various interim options for wastewater treatment. However, it is restated that if the interim option of package and other small treatment plants is pursued until a full regional system is implemented, the permitting and management and operation of those plants should be contracted through either GTUA or NTMWD to ensure consistent cross-region quality of permitting and treatment.

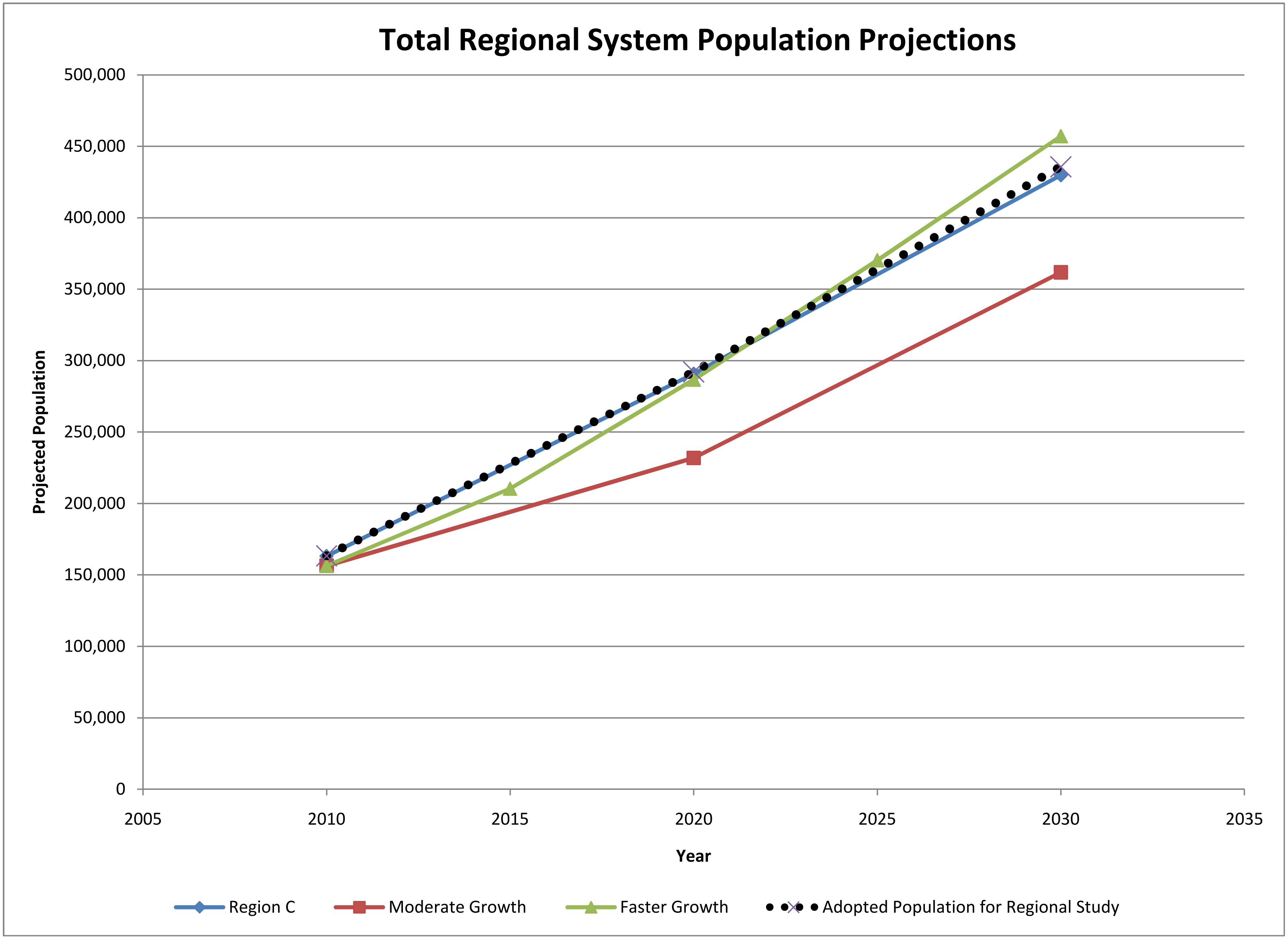
5.4.1 NTMWD – Recommended Provider

The ubiquity of the NTMWD in the study area was detailed in Section 3 and provided a strong indication that the study area is already highly dependent on NTMWD facilities and operations. Continuing that trend with the full operation of regional wastewater management and operations is recommended as the best quality and overall best value option for the region.

5.4.2 Contract Refinement and Implementation Pursuit

As wastewater collection and treatment needs progress over the next several years in the study region, further analysis and potential contract provisions may be considered that can make the regional alternative the most cost effective for each City. It is recommended that following the adoption of this study, the participating Cities that are not members of the Water District or members of the Wilson Creek Treatment and existing Upper East Fork Interceptor System should participate in the further studying of contracting options and discussions with NTMWD. Structuring an arrangement that will serve the best interest of all involved entities could potential take several years, and adequate planning is required. Such a concept is the same as the one that the GTUA cities pursued in developing the existing surface water supply system. The pursuit of such an arrangement following acceptance could put the Cities and the region in position to implement the desired program as soon as wastewater flow reaches the demand levels needed to justify and support the program. It is likely to take at least three to five years to accomplish the contracting and administrative and financial arrangement needed to achieve objectives.

APPENDIX A
POPULATION PROJECTIONS COMPARISON CHARTS


Total Regional System Population Projections
Projected Population
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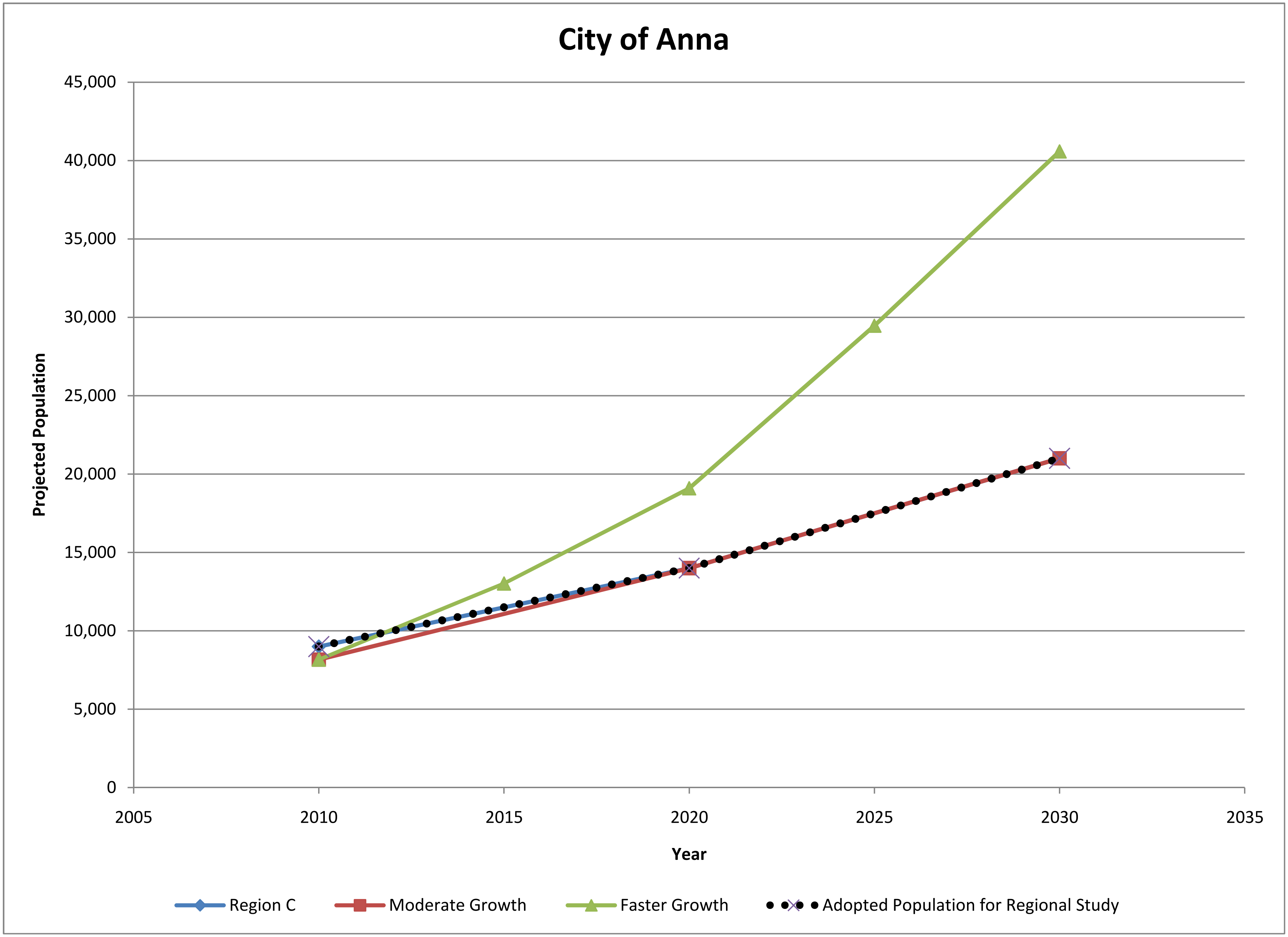
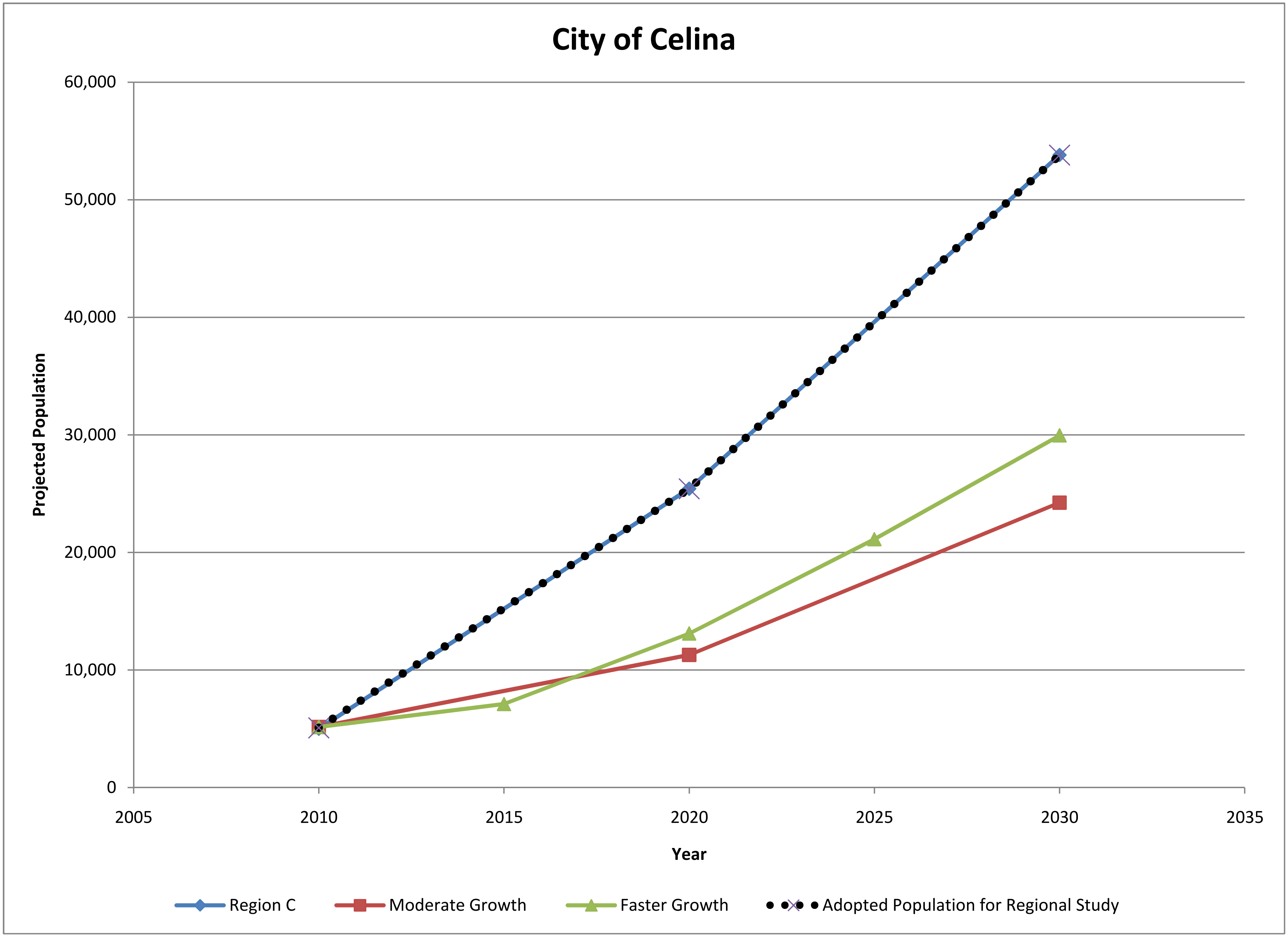
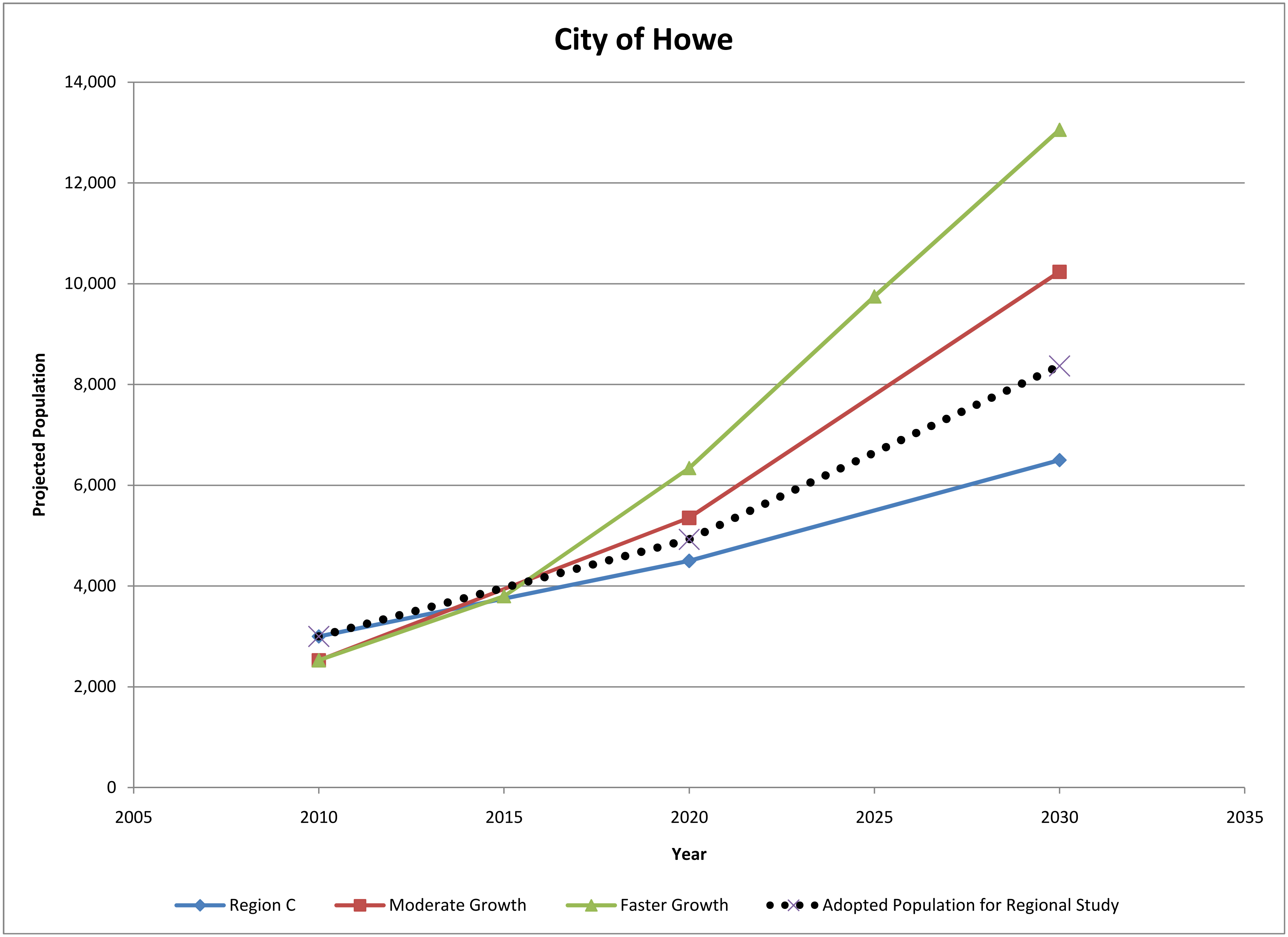
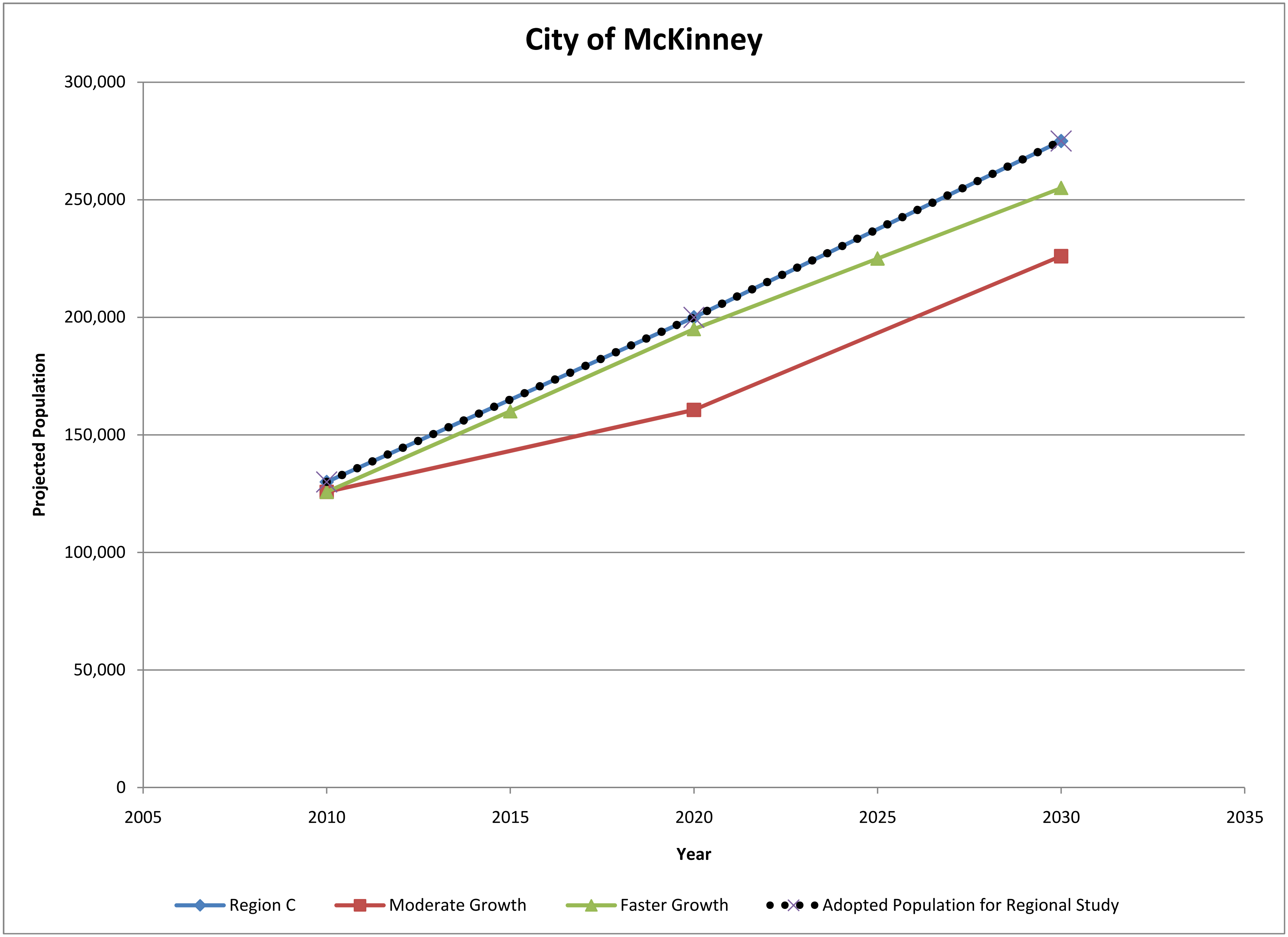
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study

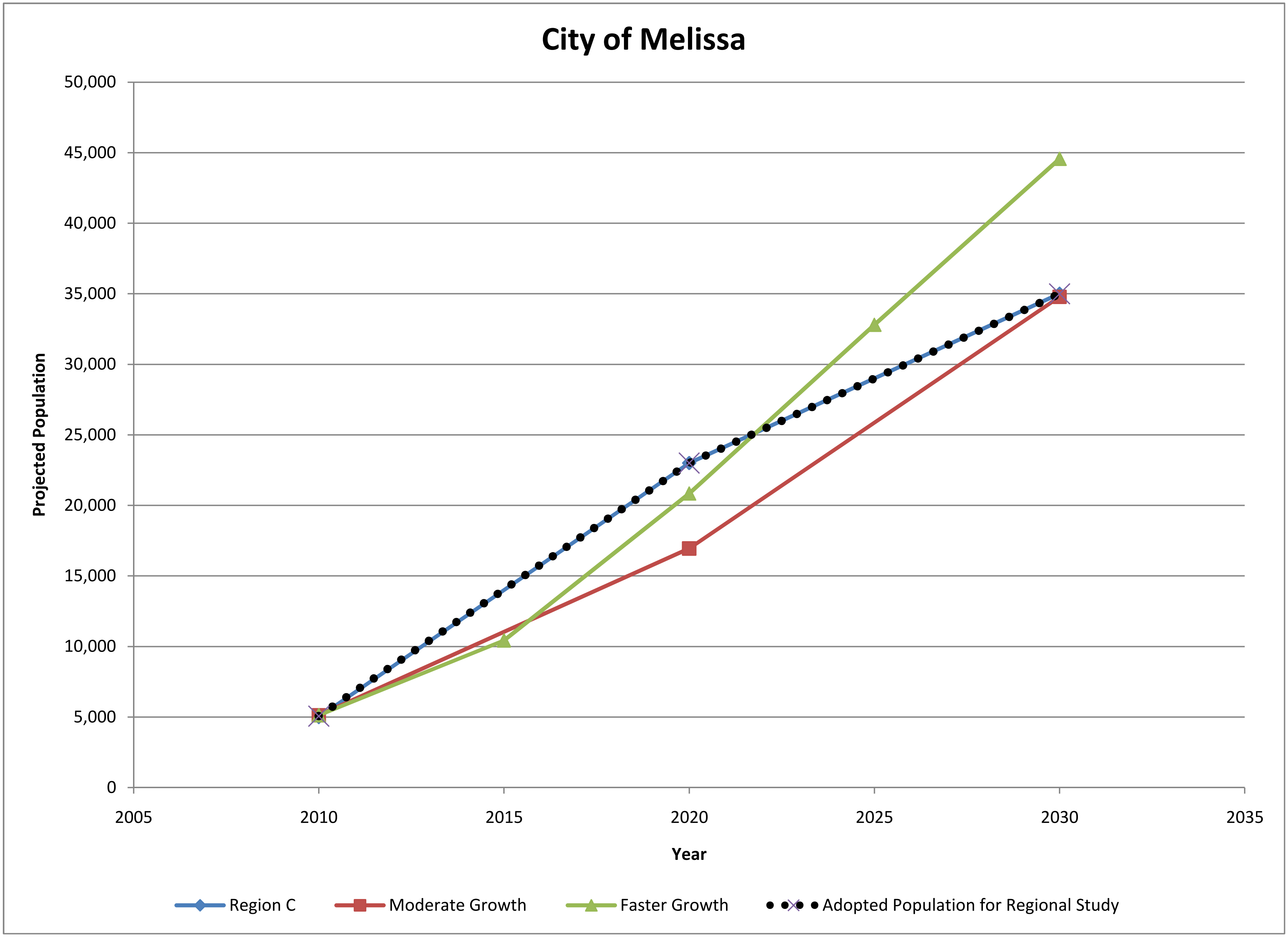

City of Anna
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Projected Population
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study

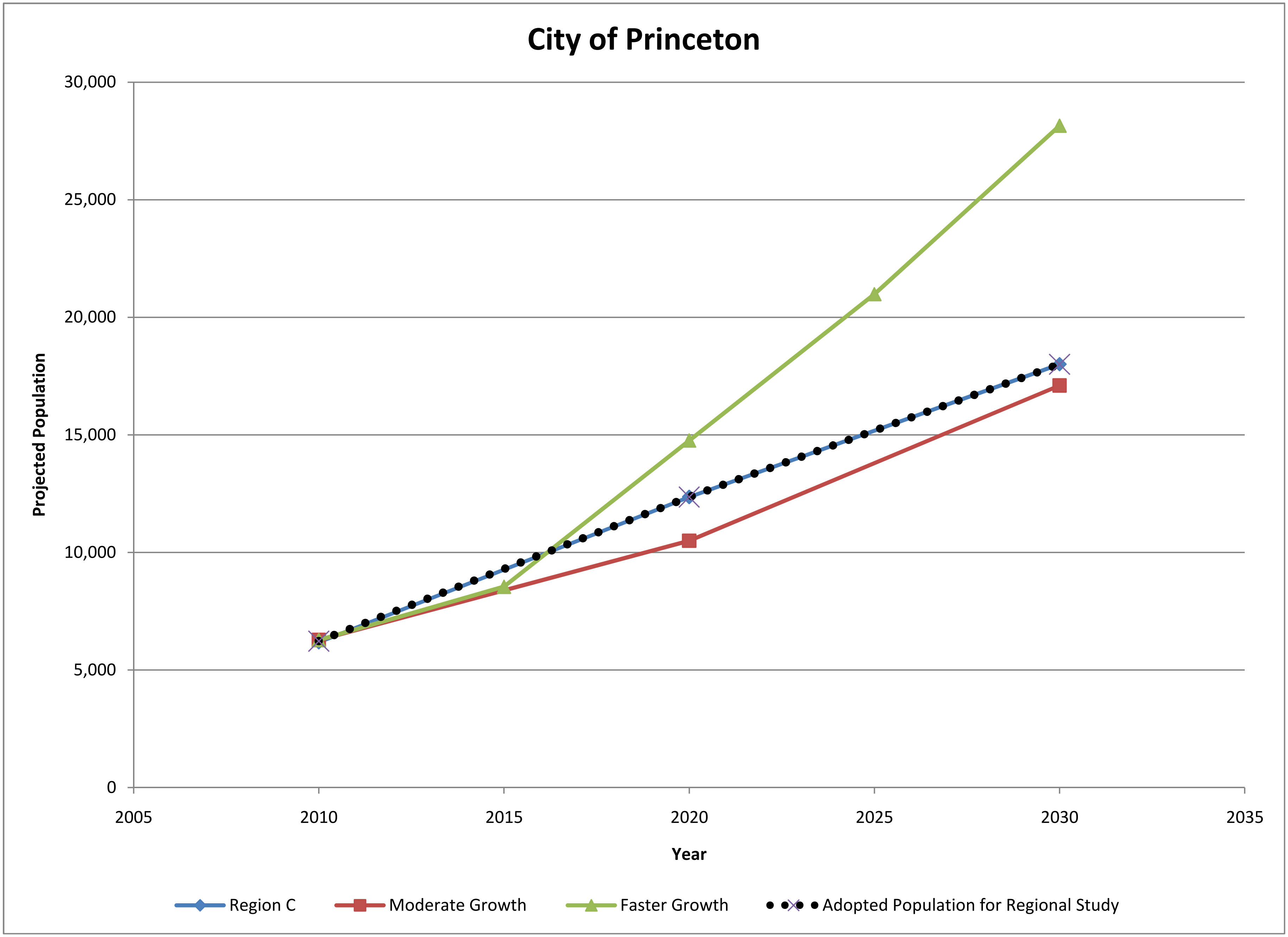


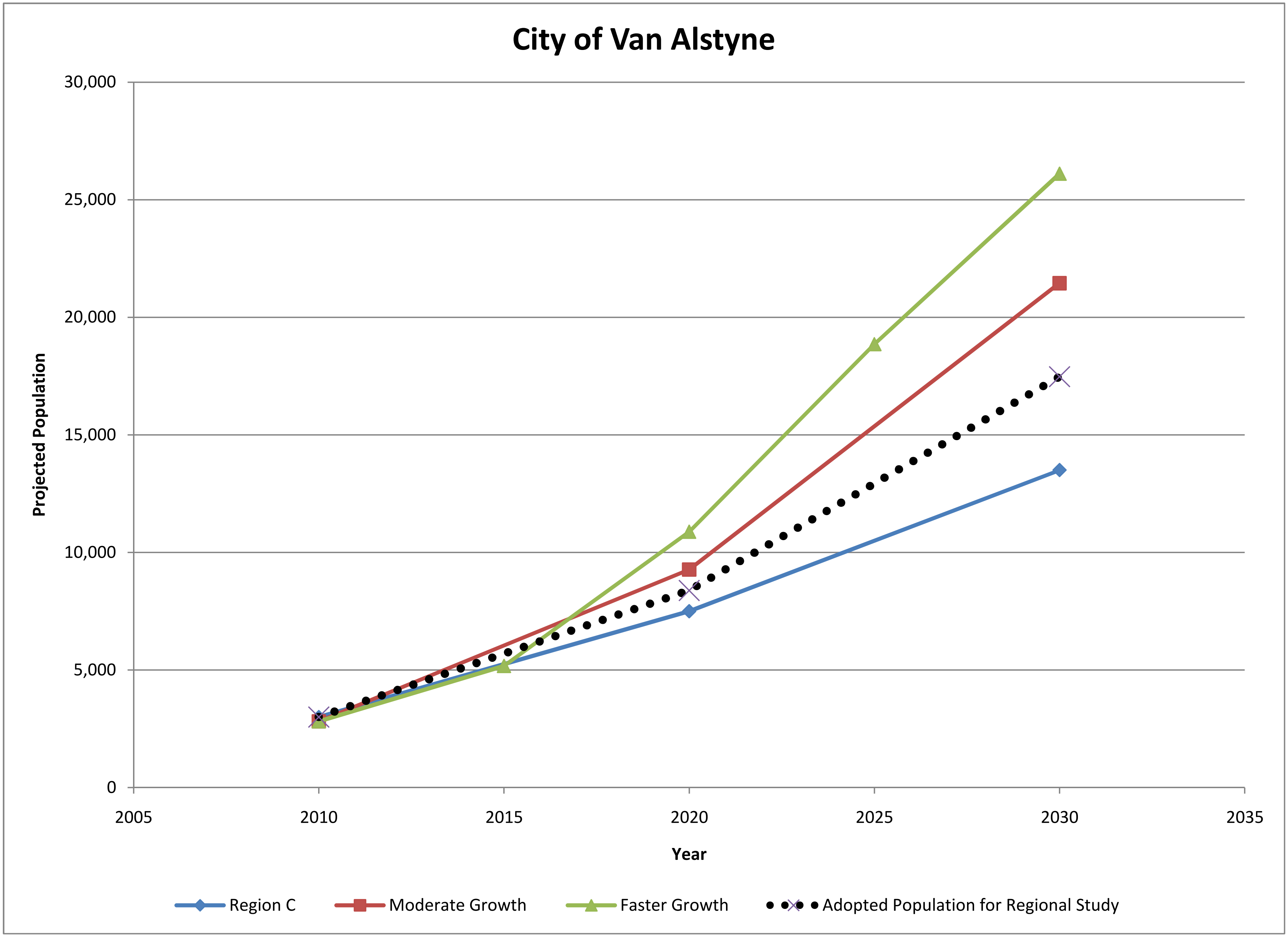
City of Celina
Projected Population
60,000
50,000
40,000
30,000
20,000
10,000
0
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study

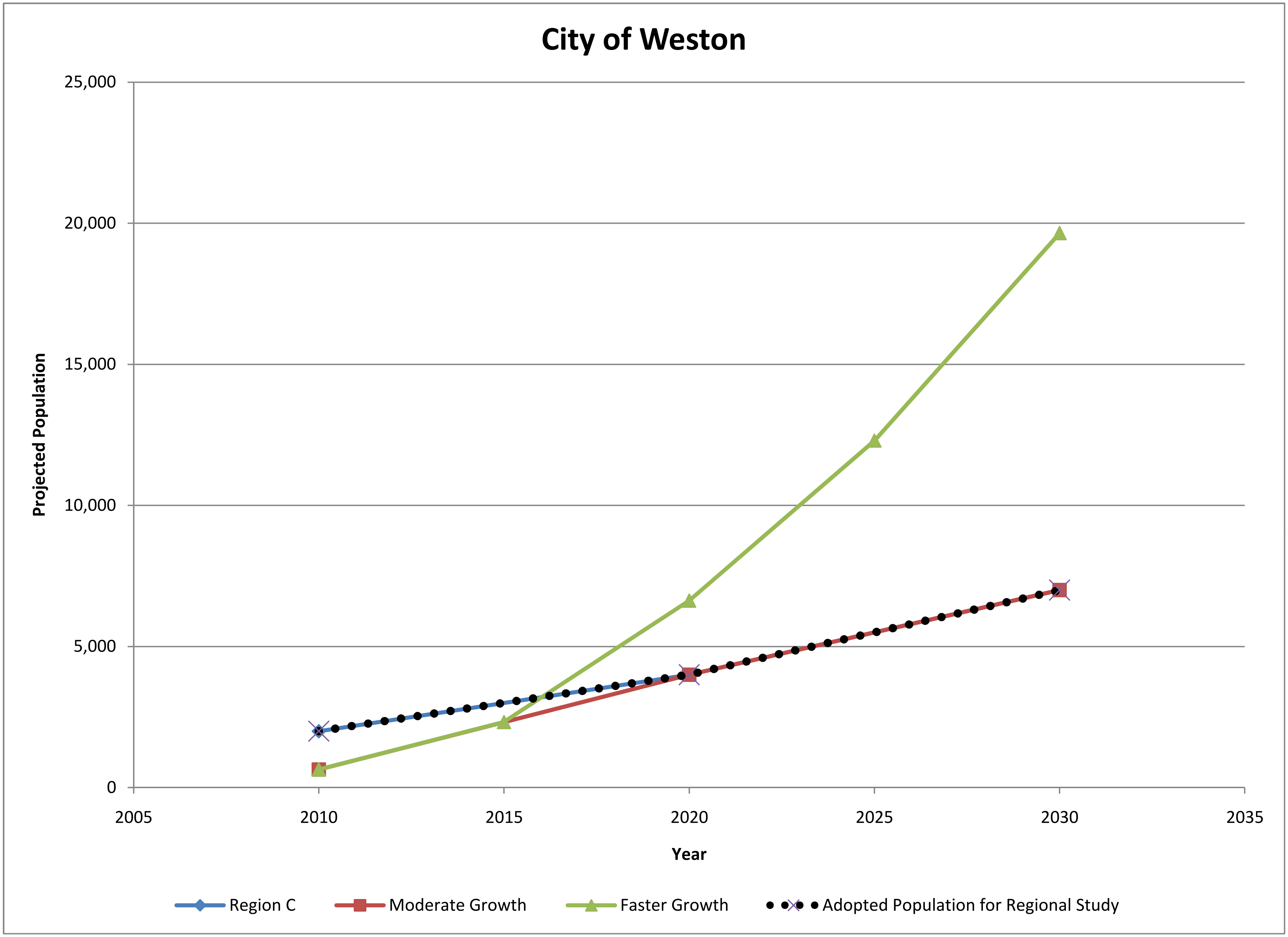

City of Howe
Projected Population
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study


City of McKinney
300,000
250,000
200,000
150,000
100,000
50,000
0
Projected Population
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study


City of Melissa
Projected Population
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study


City of Princeton
Projected Population
30,000
25,000
20,000
15,000
10,000
5,000
0
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study


City of Van Alstyne
Projected Population
30,000
25,000
20,000
15,000
10,000
5,000
0
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study


City of Weston
Projected Population
25,000
20,000
15,000
10,000
5,000
0
2005
2010
2015
2020
2025
2030
2035
Year
Region C
Moderate Growth
Faster Growth
Adopted Population for Regional Study

APPENDIX B
YEARLY OPERATION AND MAINTENANCE COSTS

Table B.1 Cost Estimation Methodology

	Scenario 1	Scenario 2	Scenario 3	Source
Treatment Expansion Costs	<1 MGD: $10/gallon capacity 1-5 MGD: $8.5/gallon capacity Regional WWTP: Previous Studies	NTMWD: Previous Studies	NTMWD: Previous Studies	FNI Project Experience NTMWD Costruction Cost Databases Previous NTMWD Studies
Treatment O&M	$3/1000 gallons of flow	-	-	NTWMD cost databases TRA operating costs
UEFIS Fees	$3/1000 gallons of flow	$3/1000 gallons of flow	$3/1000 gallons of flow	Current UEFIS fee
UEFIS Surcharge	20%	20%	30% (higher due to increased costs of new Sister Grove WWTP	Recommended surcharge for non members by NTMWD
Collection Capital	15": $231/LF 21": $115.5/LF 24": $132/LF 30": $165/LF 42": $231/LF	15": $231/LF 21": $115.5/LF 24": $132/LF 30": $165/LF 42": $231/LF	15": $231/LF 21": $115.5/LF 24": $132/LF 30": $165/LF 42": $231/LF	NTMWD Construction Bid Tabs

Table B.2 Scenario 1 Annual O&M (2010$)

Annual O&M Cost = (Treatment Plant Flow Rate)*($3.00/1000 gal)*(365 days)

Year	Yearly O&M Costs (2010$)								
	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	SUMS
2010	$0.82	$0.18	$0.38	$0.00	$0.00	$0.00	$0.38	$0.25	$20.65
2011	$0.82	$0.24	$0.41	$0.00	$0.00	$0.00	$0.45	$0.28	$20.71
2012	$0.82	$0.30	$0.43	$0.00	$0.00	$0.00	$0.51	$0.30	$20.78
2013	$0.82	$0.36	$0.46	$0.00	$0.00	$0.00	$0.57	$0.33	$20.84
2014	$0.82	$0.42	$0.48	$0.00	$0.00	$0.00	$0.63	$0.35	$20.90
2015	$0.82	$0.49	$0.50	$0.00	$0.00	$0.00	$0.72	$0.38	$28.72
2016	$0.82	$0.55	$0.53	$0.00	$0.00	$0.14	$0.78	$0.40	$28.78
2017	$0.82	$0.61	$0.55	$0.00	$0.00	$0.20	$0.84	$0.43	$28.84
2018	$0.82	$0.67	$0.58	$0.00	$0.00	$0.26	$0.90	$0.45	$28.90
2019	$0.82	$0.74	$0.60	$0.00	$0.00	$0.33	$0.97	$0.48	$28.97
2020	$0.82	$0.80	$0.62	$0.00	$0.00	$0.46	$1.05	$0.50	$36.78
2021	$0.82	$0.89	$0.67	$0.00	$0.00	$0.55	$1.14	$0.54	$36.87
2022	$0.82	$0.98	$0.71	$0.00	$0.00	$0.64	$1.23	$0.58	$36.96
2023	$0.82	$1.07	$0.75	$0.00	$0.00	$0.73	$1.32	$0.62	$37.05
2024	$0.82	$1.16	$0.79	$0.00	$0.00	$0.81	$1.41	$0.66	$37.14
2025	$0.82	$1.25	$0.84	$0.00	$0.00	$0.82	$1.63	$0.70	$45.84
2026	$0.82	$1.34	$0.88	$0.00	$0.00	$0.90	$1.71	$0.73	$45.93
2027	$0.82	$1.43	$0.92	$0.00	$0.00	$0.99	$1.80	$0.77	$46.01
2028	$0.82	$1.52	$0.97	$0.00	$0.00	$1.08	$1.89	$0.81	$46.10
2029	$0.82	$1.61	$1.01	$0.00	$0.00	$1.17	$1.98	$0.85	$46.19
2030	$0.82	$1.70	$1.05	$0.00	$0.00	$1.17	$2.20	$0.89	$54.89
Total	$17.25	$18.29	$14.13	$0.00	$0.00	$10.25	$24.11	$11.30	$717.84

Table B.3 Scenario 1 Annual UEFIS Costs (2010$)

Annual UEFIS Cost = (UEFIS Flow Rate)*($3.00/1000 gal)*(365 days)*(UEFIS surcharge for non-members[1.4])

Year	Yearly UEFIS Costs (Millions)								
	Anna	Celina	Howe	McKinney	Melissa	Princeton	Van Alstyne	Weston	SUMS
2010	$0.38	$0.00	$0.00	$16.37	$0.76	$0.79	$0.00	$0.00	$19.33
2011	$0.46	$0.00	$0.00	$16.43	$0.84	$0.85	$0.00	$0.00	$22.61
2012	$0.53	$0.00	$0.00	$16.50	$0.91	$0.91	$0.00	$0.00	$22.68
2013	$0.61	$0.00	$0.00	$16.56	$0.99	$0.98	$0.00	$0.00	$22.75
2014	$0.68	$0.00	$0.00	$16.62	$1.06	$1.04	$0.00	$0.00	$22.82
2015	$0.76	$0.00	$0.00	$20.78	$2.12	$1.17	$0.00	$0.00	$22.89
2016	$0.83	$0.00	$0.00	$20.84	$2.20	$1.10	$0.00	$0.00	$31.44
2017	$0.91	$0.00	$0.00	$20.90	$2.27	$1.10	$0.00	$0.00	$31.51
2018	$0.98	$0.00	$0.00	$20.96	$2.35	$1.10	$0.00	$0.00	$31.58
2019	$1.06	$0.00	$0.00	$21.03	$2.42	$1.10	$0.00	$0.00	$31.65
2020	$1.13	$0.00	$0.00	$25.19	$3.48	$1.10	$0.00	$0.00	$31.72
2021	$1.24	$0.00	$0.00	$25.27	$3.59	$1.10	$0.00	$0.00	$40.28
2022	$1.34	$0.00	$0.00	$25.36	$3.69	$1.10	$0.00	$0.00	$40.37
2023	$1.45	$0.00	$0.00	$25.45	$3.80	$1.10	$0.00	$0.00	$40.47
2024	$1.56	$0.00	$0.00	$25.54	$3.91	$1.10	$0.00	$0.00	$40.57
2025	$1.66	$0.00	$0.00	$29.91	$4.39	$1.10	$0.00	$0.00	$40.66
2026	$1.77	$0.00	$0.00	$30.00	$4.50	$1.10	$0.00	$0.00	$50.19
2027	$1.88	$0.00	$0.00	$30.09	$4.60	$1.10	$0.00	$0.00	$50.29
2028	$1.98	$0.00	$0.00	$30.18	$4.71	$1.10	$0.00	$0.00	$50.39
2029	$2.09	$0.00	$0.00	$30.26	$4.81	$1.10	$0.00	$0.00	$50.48
2030	$2.19	$0.00	$0.00	$34.63	$5.30	$1.10	$0.00	$0.00	$50.58
Total	$25.50	$0.00	$0.00	$498.90	$62.70	$22.20	$0.00	$0.00	$609.20

Table B.4 Scenario 2 Annual UEFIS Cost (2010$)

Annual UEFIS Cost = (UEFIS Flow Rate)*($3.00/1000 gal)*(365 days)*(UEFIS surcharge for non-members[1.4])

	Annual Cost								
Year	**Anna**	**Celina**	**Howe**	**McKinney**	**Melissa**	**Princeton**	**Van Alstyne**	**Weston**	**SUMS**
2010	$1.50	$0.23	$0.51	$18.01	$0.84	$0.87	$0.51	$0.33	$22.79
2011	$1.59	$0.31	$0.54	$18.08	$0.92	$0.94	$0.59	$0.37	$23.32
2012	$1.67	$0.40	$0.57	$18.14	$1.00	$1.00	$0.67	$0.40	$23.86
2013	$1.75	$0.48	$0.60	$18.21	$1.09	$1.07	$0.75	$0.43	$24.39
2014	$1.83	$0.56	$0.63	$18.28	$1.17	$1.14	$0.84	$0.47	$24.92
2015	$1.92	$0.64	$0.66	$22.86	$2.33	$1.29	$0.95	$0.50	$31.15
2016	$2.00	$0.73	$0.70	$22.92	$2.42	$1.36	$1.03	$0.53	$31.68
2017	$2.08	$0.81	$0.73	$22.99	$2.50	$1.43	$1.11	$0.57	$32.21
2018	$2.16	$0.89	$0.76	$23.06	$2.58	$1.49	$1.19	$0.60	$32.74
2019	$2.24	$0.97	$0.79	$23.13	$2.66	$1.56	$1.28	$0.63	$33.27
2020	$2.33	$1.06	$0.82	$27.70	$3.83	$1.71	$1.39	$0.66	$39.50
2021	$2.44	$1.17	$0.88	$27.80	$3.95	$1.81	$1.50	$0.72	$40.27
2022	$2.56	$1.29	$0.94	$27.90	$4.06	$1.91	$1.62	$0.77	$41.05
2023	$2.68	$1.41	$0.99	$28.00	$4.18	$2.00	$1.74	$0.82	$41.82
2024	$2.80	$1.53	$1.05	$28.09	$4.30	$2.10	$1.86	$0.87	$42.59
2025	$2.91	$1.65	$1.11	$32.90	$4.83	$2.10	$2.15	$0.92	$48.56
2026	$3.03	$1.77	$1.16	$33.00	$4.94	$2.20	$2.26	$0.97	$49.33
2027	$3.15	$1.88	$1.22	$33.10	$5.06	$2.30	$2.38	$1.02	$50.10
2028	$3.26	$2.00	$1.27	$33.19	$5.18	$2.39	$2.50	$1.07	$50.88
2029	$3.38	$2.12	$1.33	$33.29	$5.30	$2.49	$2.61	$1.12	$51.65
2030	$3.50	$2.24	$1.39	$38.10	$5.82	$2.49	$2.91	$1.17	$57.62
Total	$50.78	$24.15	$18.65	$548.76	$68.97	$35.66	$31.83	$14.92	$793.70

Table B.5 Scenario 3 Annual UEFIS Cost (2010$)

Annual UEFIS Cost = (UEFIS Flow Rate)*($3.00/1000 gal)*(365 days)*(UEFIS surcharge for non-members[1.4])

	Annual Cost								
Year	**Anna**	**Celina**	**Howe**	**McKinney**	**Melissa**	**Princeton**	**Van Alstyne**	**Weston**	**SUMS**
2010	$1.37	$0.21	$0.46	$16.37	$0.76	$0.79	$0.46	$0.30	$20.72
2011	$1.44	$0.29	$0.49	$16.43	$0.84	$0.85	$0.53	$0.33	$21.20
2012	$1.52	$0.36	$0.52	$16.50	$0.91	$0.91	$0.61	$0.36	$21.69
2013	$1.59	$0.43	$0.55	$16.56	$0.99	$0.98	$0.68	$0.39	$22.17
2014	$1.67	$0.51	$0.58	$16.62	$1.06	$1.04	$0.76	$0.42	$22.65
2015	$1.74	$0.58	$0.60	$20.78	$2.12	$1.17	$0.86	$0.45	$28.32
2016	$1.82	$0.66	$0.63	$20.84	$2.20	$1.23	$0.94	$0.48	$28.80
2017	$1.89	$0.73	$0.66	$20.90	$2.27	$1.30	$1.01	$0.51	$29.28
2018	$1.97	$0.81	$0.69	$20.96	$2.35	$1.36	$1.09	$0.54	$29.77
2019	$2.04	$0.88	$0.72	$21.03	$2.42	$1.42	$1.16	$0.57	$30.25
2020	$2.12	$0.96	$0.75	$25.19	$3.48	$1.55	$1.26	$0.60	$35.91
2021	$2.22	$1.07	$0.80	$25.27	$3.59	$1.64	$1.37	$0.65	$36.61
2022	$2.33	$1.17	$0.85	$25.36	$3.69	$1.73	$1.47	$0.70	$37.31
2023	$2.43	$1.28	$0.90	$25.45	$3.80	$1.82	$1.58	$0.74	$38.02
2024	$2.54	$1.39	$0.95	$25.54	$3.91	$1.91	$1.69	$0.79	$38.72
2025	$2.65	$1.50	$1.01	$29.91	$4.39	$1.91	$1.95	$0.83	$44.15
2026	$2.75	$1.61	$1.06	$30.00	$4.50	$2.00	$2.06	$0.88	$44.85
2027	$2.86	$1.71	$1.11	$30.09	$4.60	$2.09	$2.16	$0.93	$45.55
2028	$2.97	$1.82	$1.16	$30.18	$4.71	$2.18	$2.27	$0.97	$46.25
2029	$3.07	$1.93	$1.21	$30.26	$4.81	$2.27	$2.38	$1.02	$46.95
2030	$3.18	$2.04	$1.26	$34.63	$5.30	$2.27	$2.64	$1.06	$52.38
Total	$46.16	$21.95	$16.96	$498.87	$62.70	$32.42	$28.93	$13.56	$721.55

APPENDIX C
MAPS FOR EACH SCENARIO

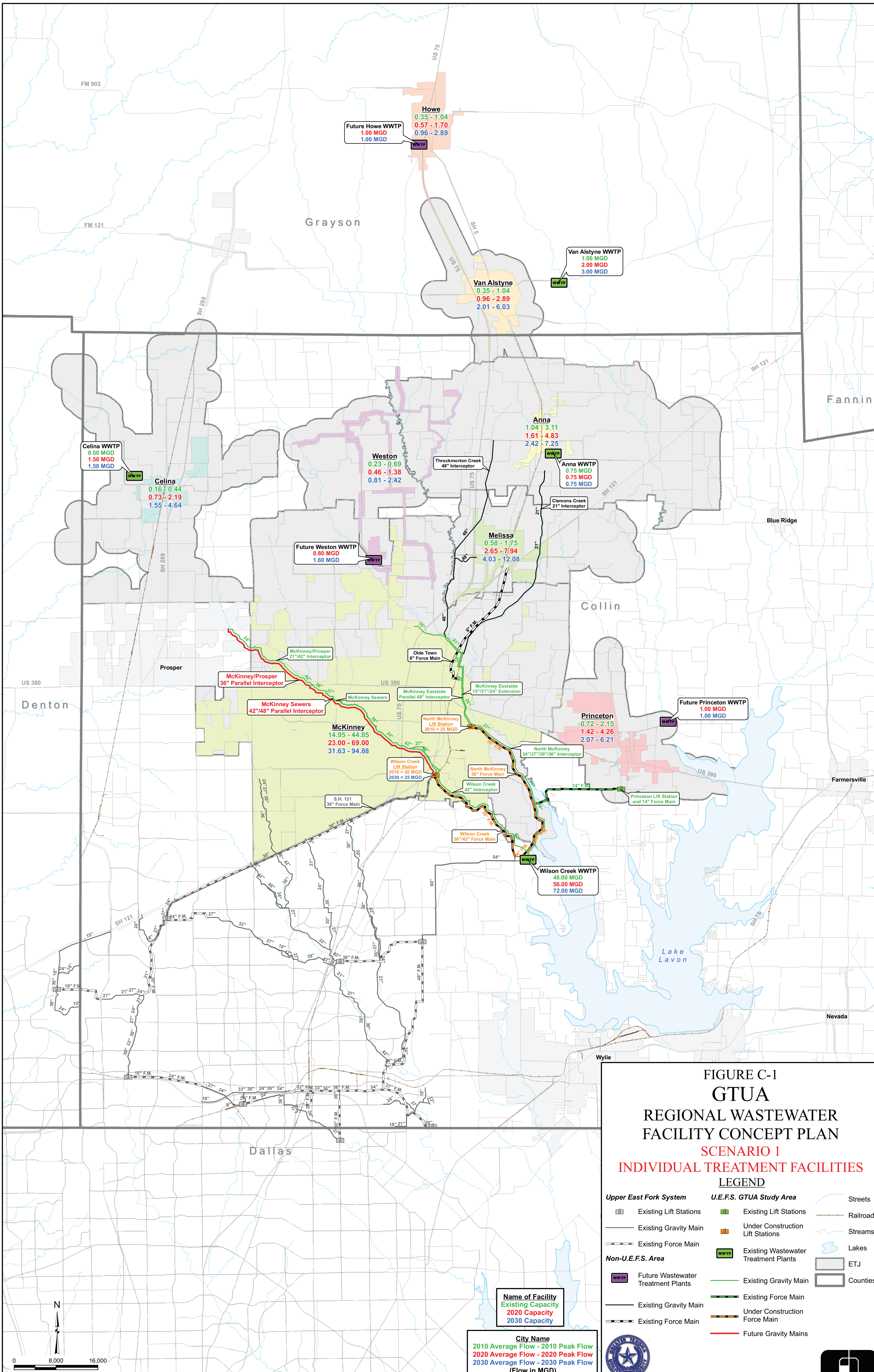


FIGURE C-1
GTUA
REGIONAL WASTEWATER FACILITY CONCEPT PLAN
SCENARIO 1
INDIVIDUAL TREATMENT FACILITIES

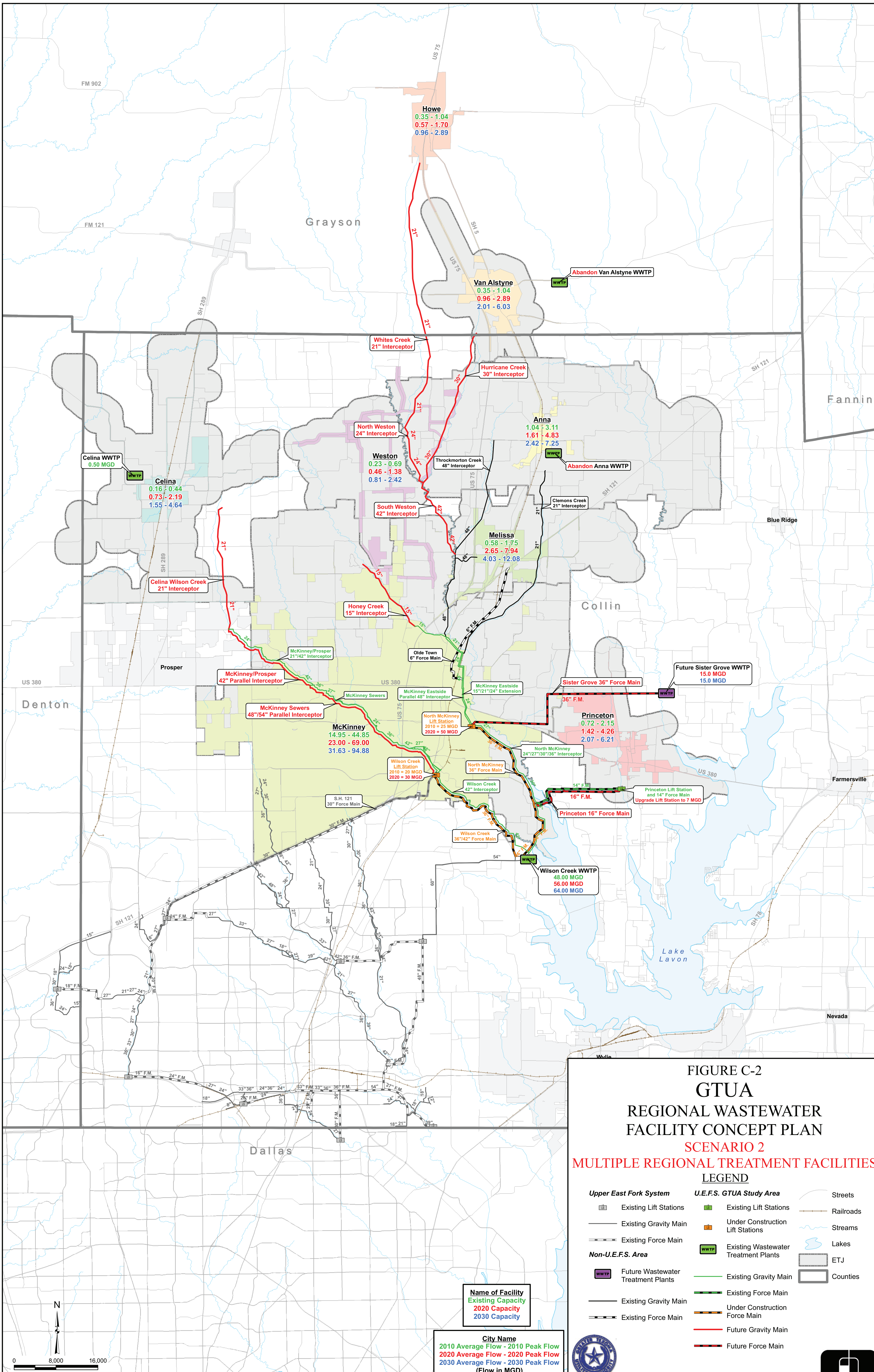


FIGURE C-2
GTUA
REGIONAL WASTEWATER FACILITY CONCEPT PLAN
SCENARIO 2
MULTIPLE REGIONAL TREATMENT FACILITIES
LEGEND
Upper East Fork System
Existing Lift Stations
Existing Gravity Main
Existing Force Main
Non-U.E.F.S. Area
Future Wastewater Treatment Plants
Existing Gravity Main
Existing Force Main
U.E.F.S. GTUA Study Area
Existing Lift Stations
Under Construction Lift Stations
Existing Wastewater Treatment Plants
Existing Gravity Main
Existing Force Main
Under Construction Force Main
Future Gravity Main
Future Force Main
Streets
Railroads
Streams
Lakes
ETJ
Counties
Name of Facility
Existing Capacity
2020 Capacity
2030 Capacity
City Name
2010 Average Flow - 2010 Peak Flow
2020 Average Flow - 2020 Peak Flow
2030 Average Flow - 2030 Peak Flow
(Flow in MGD)
SCALE IN FEET
0
8,000
16,000
N
Freese and Nichols
Grayson
Collin
Denton
Dallas
Fannin
Howe
0.35 - 1.04
0.57 - 1.70
0.96 - 2.89
Van Alstyne
0.35 - 1.04
0.96 - 2.89
2.01 - 6.03
Abandon Van Alstyne WWTP
Whites Creek 21" Interceptor
Hurricane Creek 30" Interceptor
Anna
1.04 - 3.11
1.61 - 4.83
2.42 - 7.25
Abandon Anna WWTP
North Weston 24" Interceptor
Weston
0.23 - 0.69
0.46 - 1.38
0.81 - 2.42
Throckmorton Creek 48" Interceptor
Clemons Creek 21" Interceptor
South Weston 42" Interceptor
Celina WWTP
0.50 MGD
Celina
0.16 - 0.44
0.73 - 2.19
1.55 - 4.64
Melissa
0.58 - 1.75
2.65 - 7.94
4.03 - 12.08
Blue Ridge
Celina Wilson Creek 21" Interceptor
Honey Creek 15" Interceptor
Olde Town 6" Force Main
McKinney/Prosper 21"/42" Interceptor
McKinney/Prosper 42" Parallel Interceptor
Prosper
Future Sister Grove WWTP
15.0 MGD
15.0 MGD
Sister Grove 36" Force Main
McKinney Eastside 15"/21"/24" Extension
McKinney Eastside Parallel 48" Interceptor
McKinney Sewers
McKinney Sewers 48"/54" Parallel Interceptor
36" F.M.
Princeton
0.72 - 2.15
1.42 - 4.26
2.07 - 6.21
North McKinney Lift Station
2010 = 25 MGD
2020 = 50 MGD
McKinney
14.95 - 44.85
23.00 - 69.00
31.63 - 94.88
North McKinney 24"/27"/30"/36" Interceptor
Wilson Creek Lift Station
2010 = 20 MGD
2020 = 30 MGD
North McKinney 36" Force Main
Wilson Creek 42" Interceptor
Princeton Lift Station and 14" Force Main Upgrade Lift Station to 7 MGD
16" F.M.
Princeton 16" Force Main
Farmersville
S.H. 121 30" Force Main
Wilson Creek 36"/42" Force Main
Wilson Creek WWTP
48.00 MGD
56.00 MGD
64.00 MGD
Lake Lavon
Nevada
Wylie
US 75
US 380
SH 5
SH 121
SH 289
SH 78
FM 902
FM 121

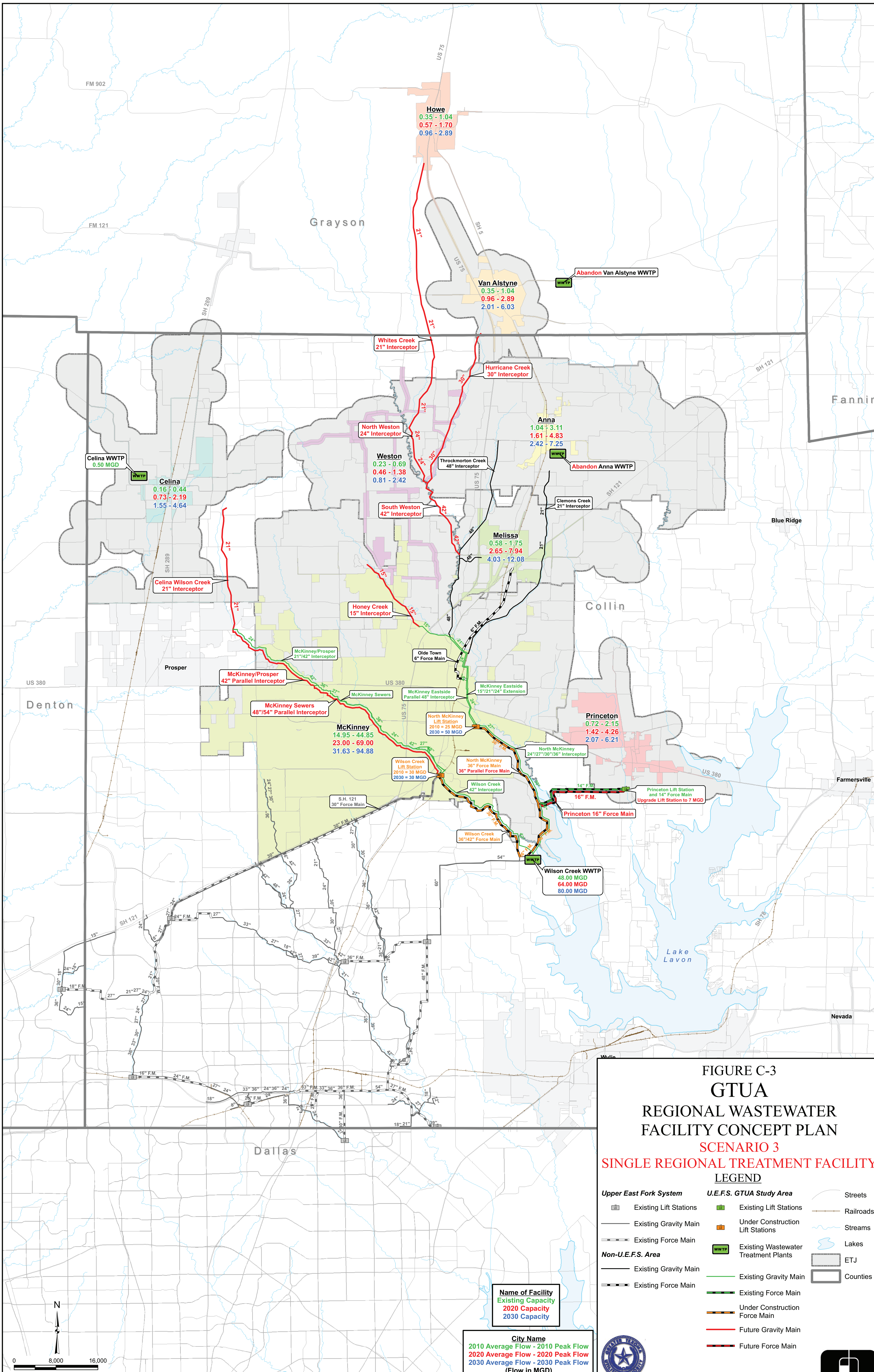


FIGURE C-3
GTUA
REGIONAL WASTEWATER FACILITY CONCEPT PLAN
SCENARIO 3
SINGLE REGIONAL TREATMENT FACILITY
LEGEND
Upper East Fork System
Existing Lift Stations
Existing Gravity Main
Existing Force Main
Non-U.E.F.S. Area
Existing Gravity Main
Existing Force Main
U.E.F.S. GTUA Study Area
Existing Lift Stations
Under Construction Lift Stations
Existing Wastewater Treatment Plants
Existing Gravity Main
Existing Force Main
Under Construction Force Main
Future Gravity Main
Future Force Main
Streets
Railroads
Streams
Lakes
ETJ
Counties
Name of Facility
Existing Capacity
2020 Capacity
2030 Capacity
City Name
2010 Average Flow - 2010 Peak Flow
2020 Average Flow - 2020 Peak Flow
2030 Average Flow - 2030 Peak Flow
(Flow in MGD)
SCALE IN FEET
0
8,000
16,000
Freese and Nichols
Grayson
Collin
Denton
Dallas
Fannin
Lake Lavon
Howe
0.35 - 1.04
0.57 - 1.70
0.96 - 2.89
Van Alstyne
0.35 - 1.04
0.96 - 2.89
2.01 - 6.03
Abandon Van Alstyne WWTP
Whites Creek 21" Interceptor
Hurricane Creek 30" Interceptor
Anna
1.04 - 3.11
1.61 - 4.83
2.42 - 7.25
Abandon Anna WWTP
North Weston 24" Interceptor
Weston
0.23 - 0.69
0.46 - 1.38
0.81 - 2.42
Throckmorton Creek 48" Interceptor
Clemons Creek 21" Interceptor
South Weston 42" Interceptor
Celina WWTP
0.50 MGD
Celina
0.16 - 0.44
0.73 - 2.19
1.55 - 4.64
Melissa
0.58 - 1.75
2.65 - 7.94
4.03 - 12.08
Blue Ridge
Celina Wilson Creek 21" Interceptor
Honey Creek 15" Interceptor
Olde Town 6" Force Main
McKinney/Prosper 21"/42" Interceptor
Prosper
McKinney/Prosper 42" Parallel Interceptor
McKinney Sewers
McKinney Eastside Parallel 48" Interceptor
McKinney Eastside 15"/21"/24" Extension
McKinney Sewers 48"/54" Parallel Interceptor
North McKinney Lift Station
2010 = 25 MGD
2030 = 50 MGD
McKinney
14.95 - 44.85
23.00 - 69.00
31.63 - 94.88
Princeton
0.72 - 2.15
1.42 - 4.26
2.07 - 6.21
North McKinney 24"/27"/30"/36" Interceptor
Wilson Creek Lift Station
2010 = 30 MGD
2030 = 30 MGD
North McKinney 36" Force Main
36" Parallel Force Main
Wilson Creek 42" Interceptor
S.H. 121 30" Force Main
Princeton Lift Station and 14" Force Main
Upgrade Lift Station to 7 MGD
16" F.M.
Princeton 16" Force Main
Farmersville
Wilson Creek 36"/42" Force Main
Wilson Creek WWTP
48.00 MGD
64.00 MGD
80.00 MGD
Nevada
Wylie
US 75
SH 5
SH 121
SH 289
SH 78
US 380
FM 902
FM 121

APPENDIX D

TEXAS WATER DEVELOPMENT BOARD DRAFT FINAL REPORT COMMENTS

August 13, 2010

RECEIVED
AUG 19 2010
GTUA

Jerry W. Chapman
General Manager
Greater Texoma Utility Authority
5100 Airport Drive
Denison, Texas 75020-8448

Re: Regional Facility Planning Grant Contract between the Texas Water Development Board (TWDB) and Greater Texoma Utility Authority (GTUA), TWDB Contract No. 0804830847, Draft Final Report Comments

Dear Mr. Chapman:

Staff members of the TWDB have completed a review of the draft report prepared under the above-referenced contract. ATTACHMENT I provides the comments resulting from this review. As stated in the TWDB contract, the GTUA will consider incorporating draft report comments from the EXECUTIVE ADMINISTRATOR as well as other reviewers into the final report. In addition, the GTUA will include a copy of the EXECUTIVE ADMINISTRATOR'S draft report comments in the Final Report.

The TWDB looks forward to receiving one (1) electronic copy of the entire Final Report in Portable Document Format (PDF) and six (6) bound double-sided copies. The GTUA shall also submit one (1) electronic copy of any computer programs or models, and, if applicable, an operations manual developed under the terms of this Contract.

If you have any questions concerning the contract, please contact David Meesey, the TWDB's designated Contract Manager for this project at (512) 936-0852.

Sincerely,

C L Brittin

Carolyn L. Brittin
Deputy Executive Administrator
Water Resources Planning and Information

Enclosures

c: David Meesey, TWDB

Attachment I

Greater Texoma Utility Authority

Regional Wastewater Facility concept Planning

for the Upper East Fork Basin

(Contract No. 0804830847) Draft Report Review Comments

1. Page ES-8, Figure ES-1: The title on Figure ES-1 states that it is a "Facility Concept Plan" but the map appears to only include existing conditions and does not include facilities for Sherman and Howe. Please revise as appropriate.

2. Scope of Work Task 1-2-a states that historical wastewater flow characteristics will be defined (including dry weather, annual average, maximum monthly, etc.) The report contains only a brief discussion of wastewater flows in Section 1.2. Please consider including additional information about historical wastewater flow characteristics and data.

3. Scope of Work Task 1-2-b states that coefficients would be developed for factoring population to wastewater flow in order to project flow conditions. The report briefly discusses this in Section 2.2. However no comparison of annual, dry weather, and wet weather flow rates appear to be included in the report. Please consider including this analysis discussion in the report.

4. Section 1.3.1 D, Page 1-9, paragraph 3: The report references an interceptor for the City of Celina to be completed by the end of 2010. Please consider clarifying if this is the same interceptor intended to convey flow to the UTRWD Riverbend WWTP (referenced on page 4-2) and provide the design capacity of the interceptor.

5. Section 1.3.3 B-D, Page 1-17 and 1-26: The report appears to reference the City of Anna's new interceptor by different names ("Slater Creek" on page 1-17 and "Throckmorton Creek" on page 1-26.) Please consider clarifying if these are the same interceptor and provide the design capacity.

6. Scope of Work Task 3-1 states that Water Conservation Plans will be considered, in establishing wastewater flows. It is unclear how the report considers Water Conservation and Drought Contingency Plans in Section 2.2 to establish projections of wastewater flows. Please consider including descriptions as appropriate of how such plans would impact flows, particularly in times of dry weather conditions.

7. Section 3.4, Page 3-12, paragraph 1: The report states that Scenario 1 would involve expansion of existing treatment plants only, with no new WWTPs being constructed. Page 4-1, paragraph 1, states that three new facilities would need to be constructed in Scenario 1 for cities of Howe, Weston, & Princeton. Please revise as appropriate.

8. Section 3-5: The Texas Water Development Board currently has debt outstanding with Celina, and (through GTUA) Howe, Melissa, Anna, Van Alstyne, and Princeton. The report does not appear to reference this outstanding debt. Please consider including financial information regarding the existing wastewater facilities debt and how the proposed regionalization would impact this agreement.

9. Section 4.1 and Appendix B: The methodology for cost estimates does not appear to be provided in the report. Please consider including descriptions and references for cost estimates methodology.

10. Section 4.1.2 Page 4-4: The report references plans for current and future flows to be sent to Wilson Creek WWTP but does not discuss the capacity of Wilson Creek WWTP to treat additional flows. Please consider including information on existing capacity or expansion plans as appropriate.

11. Page 4-9, 2nd paragraph and Figure 4.8: The text states the 2025 expansion will increase plant capacity to 64 MGD, however Figure 4.8 shows plant capacity increasing to approximately 72 MGD in 20205. Please revise as appropriate.