
WASTEWATER TREATMENT FACILITIES FUTURE IMPROVEMENTS

24.1 INTRODUCTION

This chapter identifies future improvements to the two existing WWTF's. Currently there are two WWTF's, the Theresa Street WWTF and the Northeast WWTF. The current service areas for these two facilities are shown in Figure 24.1.

It is important to determine when the treatment facility expansions will be required in order to plan for future funding. In the past, the City has planned for improvements at the treatment facilities based on 1.5 percent growth, and as capacity and regulations require. This method has worked successfully in the past, and will be continued for this Master Plan Update.

Specific improvements are outlined in the following sections below. Where applicable, specific improvements identified in the current CIP were incorporated into this document. All improvements identified are considered planning level, and detailed engineering studies are recommended to finalize location and design criteria for each project.

24.2 THERESA STREET WWTF - FUTURE IMPROVEMENTS

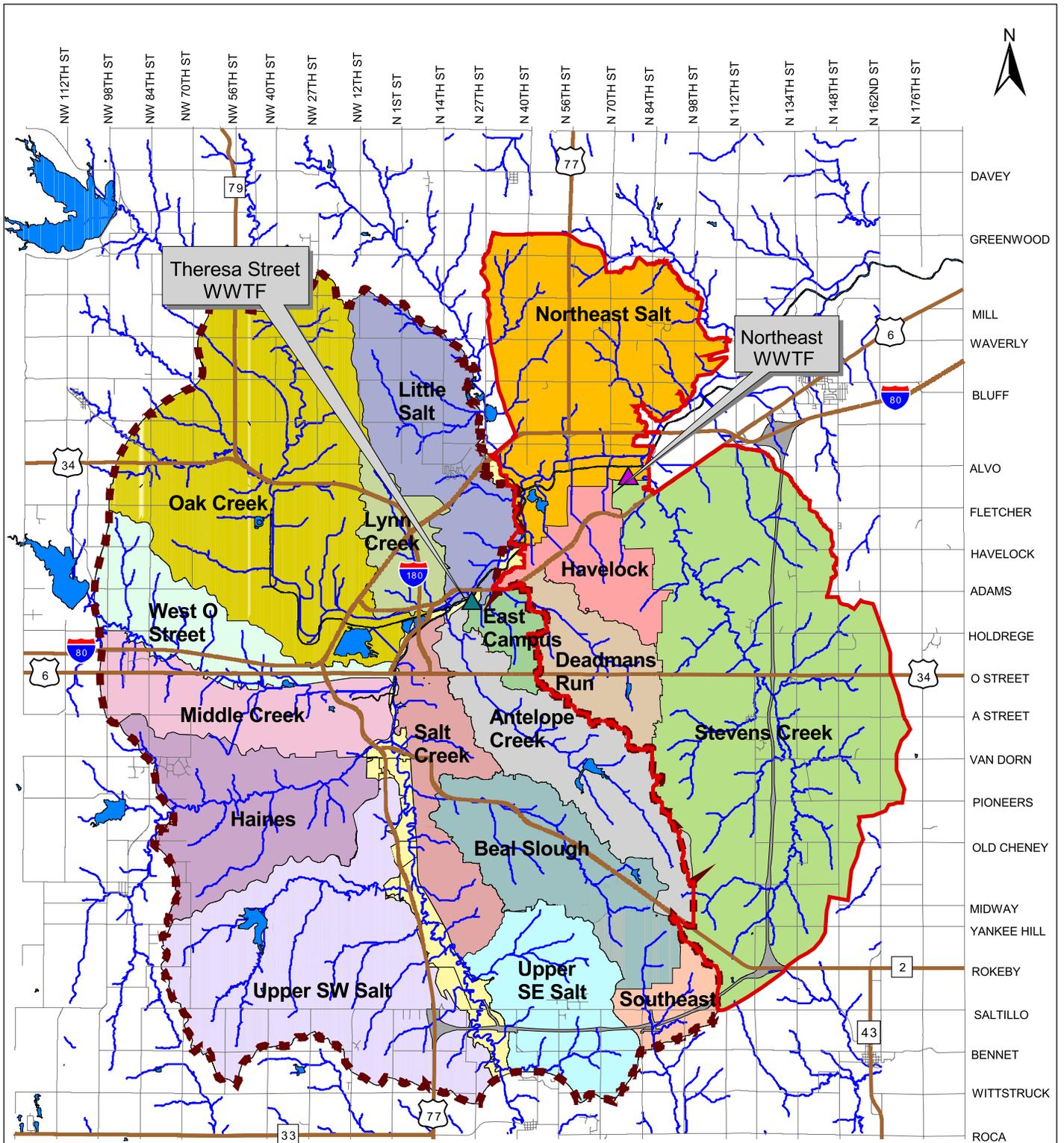
24.2.1 Current Through Tier II Improvements

To estimate the timing when improvements at the Theresa Street WWTF will be needed the MMAD flows were projected at 1.5 percent growth over the planning period as shown in Figure 24.2. The estimated timing for the two planned major capacity expansions through the Tier II period are also shown on Figure 24.2. These expansions are also shown schematically in Figure 24.3. A summary of the estimated planning costs for these improvements is presented in Table 24.7. Tier III alternatives are discussed at the end of this section.

24.2.2 Recent and Current Improvements

Currently, the Theresa St WWTF is undergoing a major capacity improvement including nitrification treatment process improvements. This project will bring the treatment capacity of the treatment facility to a MMAD of 27.4 mgd. The project consists primarily of primary clarifiers, activated sludge basins and equipment, and secondary clarifiers. This project is anticipated to be completed in 2007.

Other recently completed projects to the facility were listed in Chapter 5.



LEGEND

- ▲ Northeast WWTF
- ▲ Theresa Street WWTF
- Northeast WWTF Service Area
- Theresa St WWTF Service Area
- Highways
- Streets
- ~ Streams and Lakes
- Beltway

0 1 2 3 Miles

Note:
Service areas shown extend to Tier III (2105) boundaries per the 2030 Comprehensive Plan.



Figure 24.1 Existing WWTF Service Areas
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

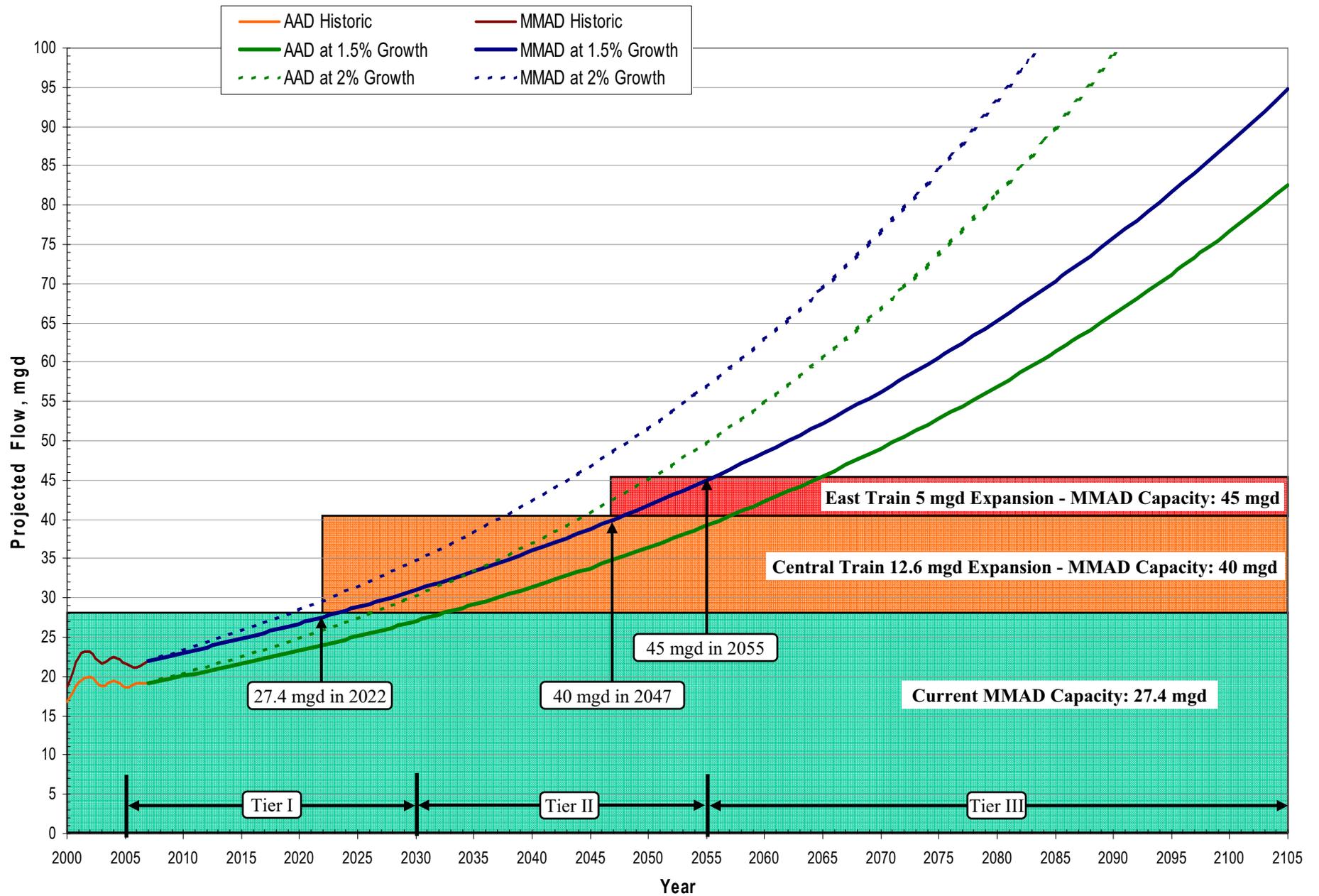


Figure 24.2 Theresa Street WWTF Projected MMAD Flows
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska

1. Influent Pump Station / Headworks
2. Grit Removal Facilities
3. Primary Clarifiers
4. Recirculation Pump Station
5. Aeration Blower Building – Central Train
6. Pre-nitrification Basin
7. Aeration Basins
8. Final Clarifiers
9. Pre-Nitrification Basin
10. Solids Dewatering Building
11. Sludge Pumping Stations
12. Future Aeration Basins
13. Odor Control Facilities
14. Ultraviolet Disinfection Facilities
15. Chlorine Contact Basin
16. Digesters
17. Sludge Storage

18. Aeration/Solids Thickening Building
19. Scum Pump Building
20. Divisional/Administration Building
21. Main Electrical Switchgear Building
22. Collection System Operations and Maintenance Building
23. Electric Co-generation Building
24. Effluent Discharge Structure
25. Laboratory Building
26. Treatment Facility Maintenance Building
27. Liquid Waste / Grit Receiving Station
28. Liquid Waste / Septage Receiving Station
29. Future Primary Clarifier
30. Future Aeration Basin
31. Future Secondary Clarifier
32. Future Digester.

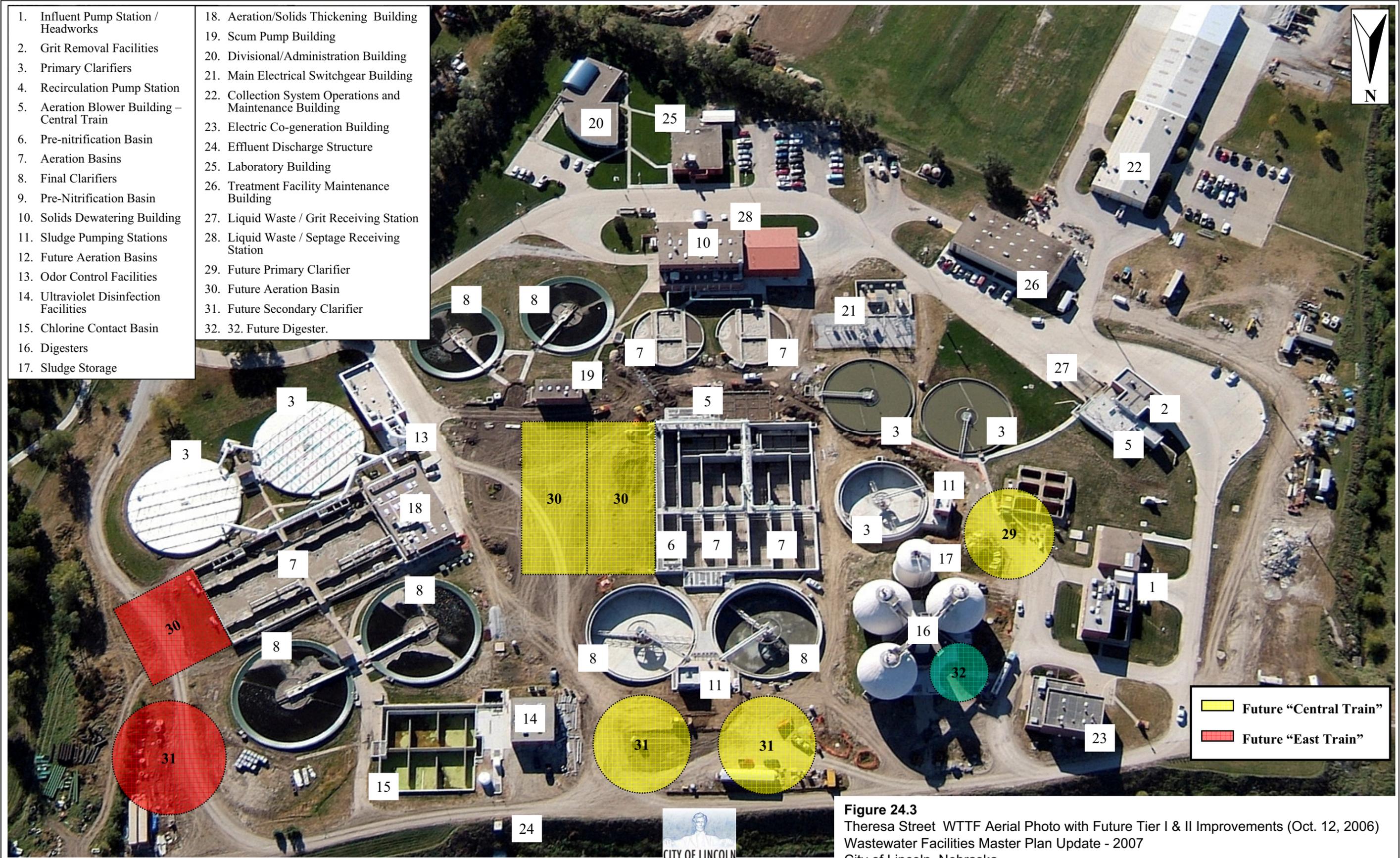


Figure 24.3
 Theresa Street WTTF Aerial Photo with Future Tier I & II Improvements (Oct. 12, 2006)
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska



24.2.3 Tier I Improvements - Current and Recommended

Salt Creek Bank Stabilization Project. This project has been planned and designed and will be under construction in 2007-08 time period. The project is designed to stabilize and stop the recent bank erosion on the south side Salt Creek.

Odor & Corrosion Control Facilities for the Solids Dewatering Facilities. This project is designed, and is planned for construction in 2008 or 2009.

Solids Handling Improvements Projects. As identified in a recent report titled, "*Study and Evaluation of Solids Treatment and Handling at the Theresa Street and Northeast Wastewater Treatment Facilities*", HDR, January 2007, the following solids handling improvements have been identified for the Theresa Street WWTF:

1. Upgrade the sludge presses in 2008.
2. Add Rotary Drum Thickeners in 2010.
3. Construct Solids Storage Pad in 2012.
4. Digester Mixing Improvements starting in 2013 and ending in 2015.

Trucked Waste Improvements Project. Due to continuing growth in the quantity of trucked liquid wastes that this facility receives, it is projected that a liquid waste and septage handling facilities upgrade and expansion project would be needed in 2010.

Electrical Power Reliability Project. It is recommended that the reliability of the electrical power feed to the facility be evaluated and improvements made. These improvements may be in the form of confirming that there are separate power circuits supplying the facility, and that the power poles and other equipment are adequate to withstand high wind and ice loads. Additionally, the installation of on-site standby electrical generators should be incorporated for critical processes for redundancy and reliability. The timing for this process is suggested as 2010 and be completed within five years.

Influent Wastewater Pump Replacement Project. Replacing Influent Pumps No. 5 and 6. These pumps currently incorporate Eddy Current Drivers and have right angle gear boxes connected to Caterpillar Diesel engines that drive the pumps in the event of a power outage. These pumps are nearing the end of their useful life and should be replaced. It is recommended this project be started as flows require, but be completed in the Tier I period. For planning purposed it was assumed these improvements would be operational by 2015.

On-going Odor Control Projects. These projects should plan for and incorporate odor control facilities as required.

Wet Weather Treatment Improvements. As flows increase, wet weather treatment facilities will likely be required to treat or store the hydraulic peaks. The actual timing of these

improvements will depend on the development pattern of the drainage basins tributary to the treatment facility. At this time, it is envisioned that these improvements will be in the form of an equalization basin and possibly the use of ballasted sand flocculation. For planning, it was assumed that this project would be completed between 2012 and 2015 with 1 MG of storage.

Theresa Street Wastewater Treatment Facility Expansion. The facility has been designed for a 12.6 mgd Central Train expansion. This expansion will bring the MMAD capacity of the treatment facility to approximately 40 mgd. This expansion will primarily consist of additional aeration basins, primary and secondary clarifiers, and improvements to operations and control facilities. This project is estimated to be online by the year 2022. For planning purposes, it is estimated that the planning and design will begin in 2017.

24.2.4 Tier II Improvements

Additional Wet Weather Treatment Improvements. As flows increase, wet weather treatment facilities will likely be required to treat or store the hydraulic peaks. The actual timing of these improvements will depend on the development pattern of the drainage basins tributary to the treatment facility. For planning, it was assumed that this project would be completed between 2030 and 2033 with 4 MG of storage.

Theresa Street Wastewater Treatment Facility Expansion. The Theresa Street WWTF has been designed for a 5 mgd East Train expansion. This expansion is shown graphically along with the MMAD projected flows in Figures 23.2. Based on the projected flows increasing at 1.5 percent this expansion will need to be online at 2055. For planning purposes, it was assumed that the planning and design would begin in 2050. This expansion will bring the MMAD capacity of the treatment facility to 45 mgd.

Construct a Fourth Anaerobic Digester (Previous Study by HDR in 2007, “*Study and Evaluation of Solids Treatment and Handling at the Theresa Street and Northeast Wastewater Treatment Facilities*”). This project will add a fourth anaerobic digester in 2030.

Additional Wet Weather Treatment Improvements. As flows increase, wet weather treatment facilities will likely be required to treat or store the hydraulic peaks. The actual timing of these improvements will depend on the development pattern of the drainage basins tributary to the treatment facility. For planning, it was assumed that this project would be completed between 2050 and 2053 with 5 MG of storage.

24.2.5 Tier III Improvements

As previously discussed in Chapters 10 and 14, the Salt Valley Trunk Sewer, with the identified storage and optimization improvements in place, will reach its capacity near the end of the Tier II planning period. At that time, the Theresa Street WWTF will reach its MMAD capacity of 45 mgd. This assumption is based on current treatment technology that is employed at the facility is still in use at the end of the 50 year period. Due to the Salt

Valley Trunk Sewer and Theresa Street WWTF reaching their respective capacities at the end of the Tier II planning period, the following four alternatives have been identified to convey, store, and/or treat the Tier III flows from the southwestern portion of the City.

Storage at Theresa Street WWTF was not identified for Tier III flows since storage to manage peak flows cannot be realistically predicted that far in the future. Storage at the Theresa Street WWTF should be re-evaluated as the Tier III time period approaches.

24.2.5.1 New WWTF Located in the Upper Southwest Basin - Alternative 1

This alternative involves constructing a new Southwest WWTF (SW WWTF) in the Upper Southwest Drainage Basin. For the purpose of the hydraulic collection system modeling, a WWTF was located near Denton Road and SW 1st Street. This is also the site identified as the South WWTF in the 2007 Siting Study: Southwest Wastewater Facility performed by Black and Veatch. Locating a WWTF near this location, assuming that the improvements identified in the previous collection system modeling chapters are incorporated, would maximize the existing trunk sewer system assuming the Theresa Street WWTF is expanded to treat a MMAD flow of 45 mgd as described in the Tier I and II improvements above. It should be emphasized the actual location of a SW WWTF in this area should be determined through a detailed siting study.

The service area for the SW WWTF discussed in this section, is shown in Figure 24.4, and would include Tier III flows from the Upper Southwest, Upper Southeast, Southeast, and Haines Branch drainage basins as shown in Figure 24.4. As outlined in Table 24.1 below, the drainage area to be served would be 35,223 acres. Using 7.2 people per acre (reference Table 3.3) and a flow of 105 gallons per person per day (reference Figure 5.23) this equates to an AAD flow of 26.62 mgd. Multiplying this flow by a MMAD:AAD ratio of 1.16 (reference table 5.2) results in a MMAD capacity of 31 mgd.

The Theresa Street WWTF would need to be expanded to treat the additional flows. As shown in Table 24.1, the Tier III Theresa Street WWTF drainage basin area is 72,440 acres. Using the planning population of 7.2 people per acre and a per capita flow rate of 105 gpcd results in an AAD capacity of 54.8 mgd. Multiplying this value by a MMAD:AAD ratio of 1.16 results in a Tier III MMAD capacity of 63.5 mgd. Subtracting the Tier II MMAD treatment capacity of 45 from this total value results in an additional required MMAD capacity of 18.5 mgd.

Table 24.1 Modeled Tier III Theresa Street and SW WWTF Drainage Areas ^(1,2) Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska		
Basin	Theresa Street WWTF Area (acres)	SW WWTF Area (acres)
Salt Valley	5,475	
Antelope Creek	8,336	
Beal Slough	8,750	
Upper Southeast Salt		7,279
Upper Southwest Salt		18,041
Haines Branch		6,409
Middle Creek	7,489	
West 'O' Street	7,059	
Oak Creek	21,767	
Lynn Creek	3,323	
Little Salt Creek	9,376	
East Campus	865	
Southeast		3,494
Totals	72,440	35,223
Notes:		
1. Areas as of July 1, 2006.		
2. Based on information provided by LWWS.		

The estimated planning level costs for this alternative are outlined in Table 24.2 below. It should be noted that the first 10 mgd of capacity for the SW WWTF are calculated at \$12.50/gal for new construction, and the costs for the remaining 21 mgd of capacity were calculated at a cost of \$8.00/gal for an expansion. The costs for this alternative also include an 18.5 mgd expansion at Theresa Street WWTF.

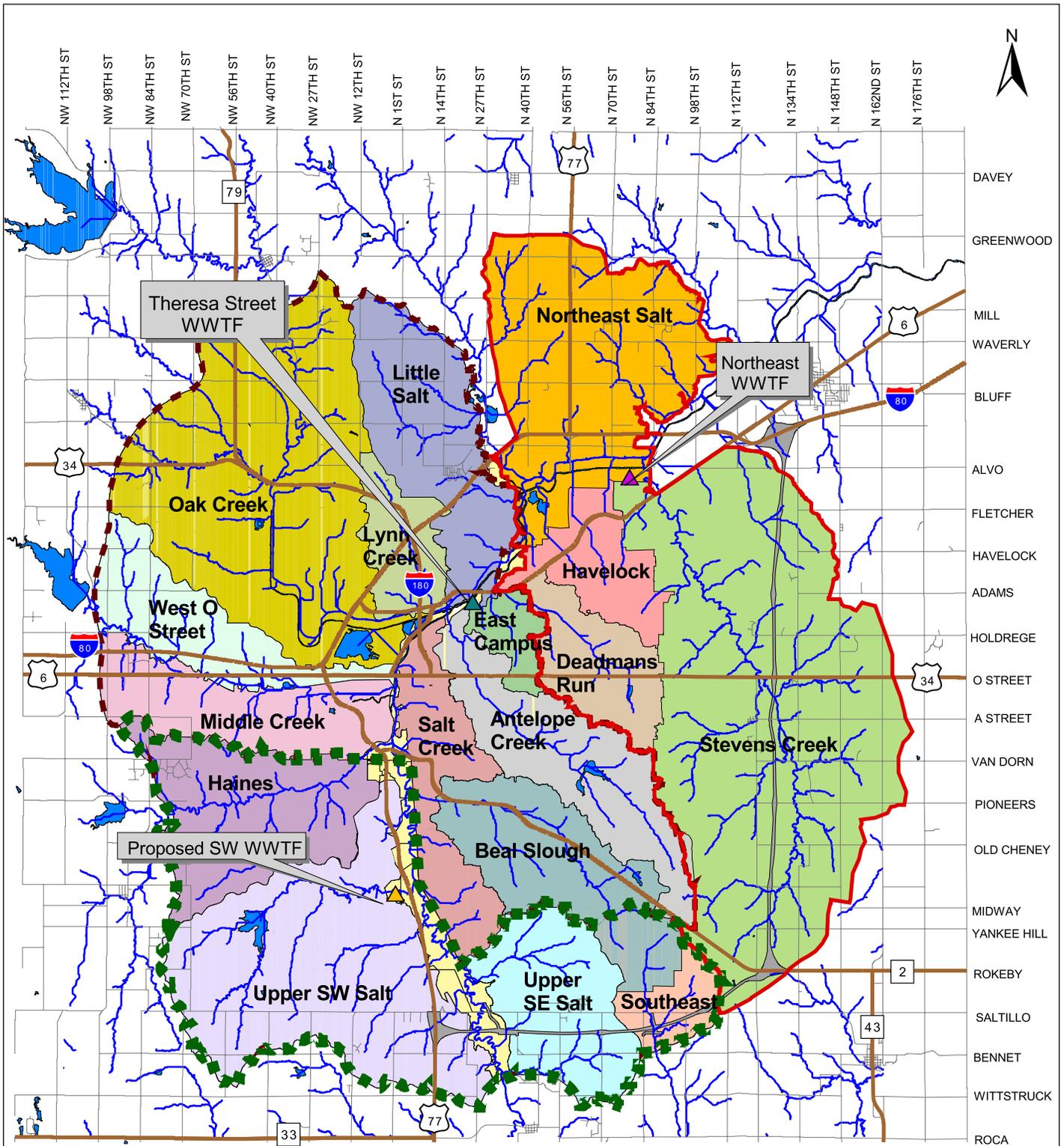
Table 24.2 New SW WWTF - Tier III Alternative 1 Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska			
Description	Parameter	Unit Price	Planning Costs ⁽¹⁾
SW WWTF (first 10 MGD)	10 mgd	12.50/gal	\$125,000,000
SW WWTF (remaining 21 mgd)	21 mgd	\$8.00/gal	\$168,000,000
Theresa Street WWTF Expansion	18.5 mgd	\$8.00/gal	\$148,000,000
Totals			\$441,000,000
Notes:			
1. ENR CCI for Kansas City = 8512 (July 2006).			

24.2.5.2 New West Side Salt Creek Trunk Sewer - Alternative 2

This alternative involves the addition of a new trunk sewer on the west side of Salt Creek. This trunk sewer would extend from the 4 MG storage facility in the Upper Southwest Basin recommended in Chapter 14 and flow north along the west side of Salt Creek. As the trunk sewer progresses northward it would intercept and convey the flows from the 3 MG storage facility in the Haines Branch Basin (Chapter 15) and terminate at the proposed J Street lift station in West O Street Basin identified in Chapter 16. A schematic of this alternative is shown in Figure 24.5. This is similar to the Alternative 1 Collection System Improvement identified in the 1981 Wastewater Facilities Plan for Lincoln, Nebraska Salt Valley Study Area Report, prepared by Black & Veatch Consulting Engineers.

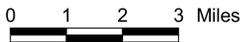
The size of this trunk sewer would be 60 inches in diameter and be approximately 25,000 feet in length. This is based on utilizing the storage previously identified in Chapters 14, 15, and 16. In addition to the storage previously identified, an additional 1.5 MG of storage would be required at the proposed J Street Lift Station in West 'O' Street Basin.

The J Street Lift Station as proposed in Chapter 16 would be designed to pump the wastewater from the West 'O' Street and Middle Creek Basins across Salt Creek to the existing Salt Valley Trunk Sewer. To accommodate the Tier III flows from the Upper Southwest, Haines Branch, West 'O' Street, and Middle Creek Basins, the lift station would need to be modified with larger pumps to convey the wastewater directly to the Theresa Street WWTF. Since the flow is equalized and peak flows are stored prior to the lift station, the size of the force main is minimized. Based on modeling results, an additional 8 mgd of capacity at the J Street Lift Station and a 24-inch force main is needed for this application. The force main will need to be approximately 15,500 feet long from the new lift station to the Theresa Street WWTF. A siphon across Haines Branch and one across Middle Creek will also be needed.



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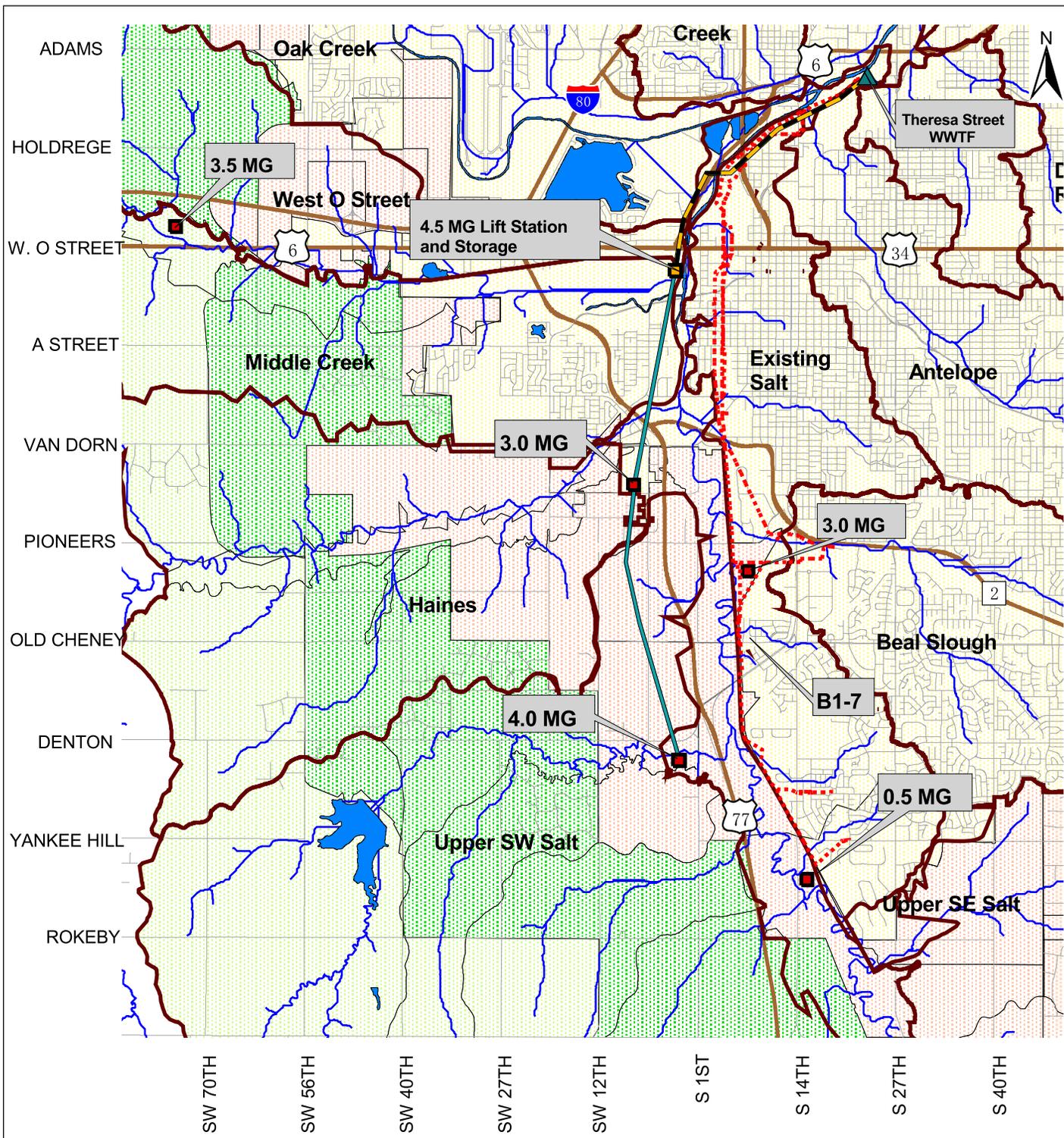
- ▲ Proposed SW WWTF
- ▲ Northeast WWTF
- ▲ Theresa Street WWTF
- SW WWTF Proposed Service Area
- Northeast WWTF Service Area
- Theresa St WWTF Proposed Service Area
- Highways
- Streets
- ~ Streams and Lakes
- Beltway



Note:
Service areas shown extend to Tier III (2105) boundaries per the 2030 Comprehensive Plan.



Figure 24.4 Proposed Southwest WWTW Service Area - Alternative 1
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska



LEGEND

-  Theresa Street WWTF
-  24" West Side Force Main
-  60" West Side Sewer
-  Existing Salt Creek Trunk Sewer
-  Basin Boundaries
-  J Street Lift Station and Storage
-  Storage Basins
- Growth Tiers**
-  Existing
-  Tier 1
-  Tier 2
-  Tier 3



Figure 24.5 West Side Salt Creek Trunk Sewer Alternative 2
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska

The Theresa Street WWTF would need to be expanded to treat the additional flows. As shown in Table 23.1, the Tier III Theresa Street WWTF drainage basin area is 107,663 acres. Using the planning population of 7.2 people per acre and a per capita flow rate of 105 gpcd results in an AAD capacity of 81.4 mgd. Multiplying this value by a MMAD:AAD ratio of 1.16 results in a Tier III MMAD capacity of 94 mgd. Subtracting the Tier II MMAD capacity of 45 mgd from this total value results in an additional MMAD treatment capacity of 49 mgd, or essentially doubling the size of the current build out conditions. The planning level costs of this alternative are outlined in Table 24.3 below.

Table 24.3 New West Side Salt Creek Trunk Sewer - Tier III Alternative 2 Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska			
Description	Parameter	Unit Price	Planning Costs ⁽¹⁾
60-inch Diameter Trunk Sewer	25,000 lf	\$750/lf ⁽²⁾	\$18,750,000
Siphon Across Haines Branch and Middle Creek	2	\$1,000,000	\$2,000,000
Additional Storage	1.5 MG	\$4.00/gal	\$6,000,000
Lift Station Improvements	8 mgd	\$1.00/mgd	\$8,000,000
Force Main	15,500 lf	\$192/lf ⁽³⁾	\$2,976,000
Theresa Street WWTF Expansion	49 mgd	\$8.00/gal	\$392,000,000
Totals			\$429,726,000
Notes:			
1. ENR CCI for Kansas City = 8512 (July 2006).			
2. Based on \$12.50/in-dia-ft.			
3. Based on \$8.00/in-dia-ft.			

24.2.5.3 Parallel East Side Salt Creek Trunk Sewer - Alternative 3

This alternative involves the addition of a new parallel trunk sewer located on the east side of Salt Creek as shown in Figure 24.6. For evaluation purposes, this sewer was routed adjacent and parallel to the existing Salt Creek Trunk Sewer. It should be noted that the difficulties of routing and constructing a sewer in this highly developed and congested corridor would be challenging at best.

The trunk sewer would start near Manhole B1-7 located near Old Cheney Road and Salt Creek. The trunk sewer would then progress northward to the Theresa Street WWTF. The storage facility improvements previously identified in Chapters 10, 13, 14, 15, and 16 would still be required. For planning purposes, the size of this trunk sewer would be 84-inch

diameter and be approximately 34,200 feet in length. It may be possible to reduce the size of the trunk sewer between manhole B1-7 and B1-310 if storage is increased in the Upper Southwest basin.

The Theresa Street WWTF would need to be expanded to treat the additional flows. As shown in Table 23.1, the Tier III Theresa Street drainage basin area is 107,663 acres. As previously identified in the Alternative 2 discussion above, the Theresa Street WWTF would need to be expanded to treat a MMAD flow of 94 mgd, resulting in a Tier III MMAD expansion of 49 mgd. The planning level costs for this alternative are outlined in Table 24.4 below.

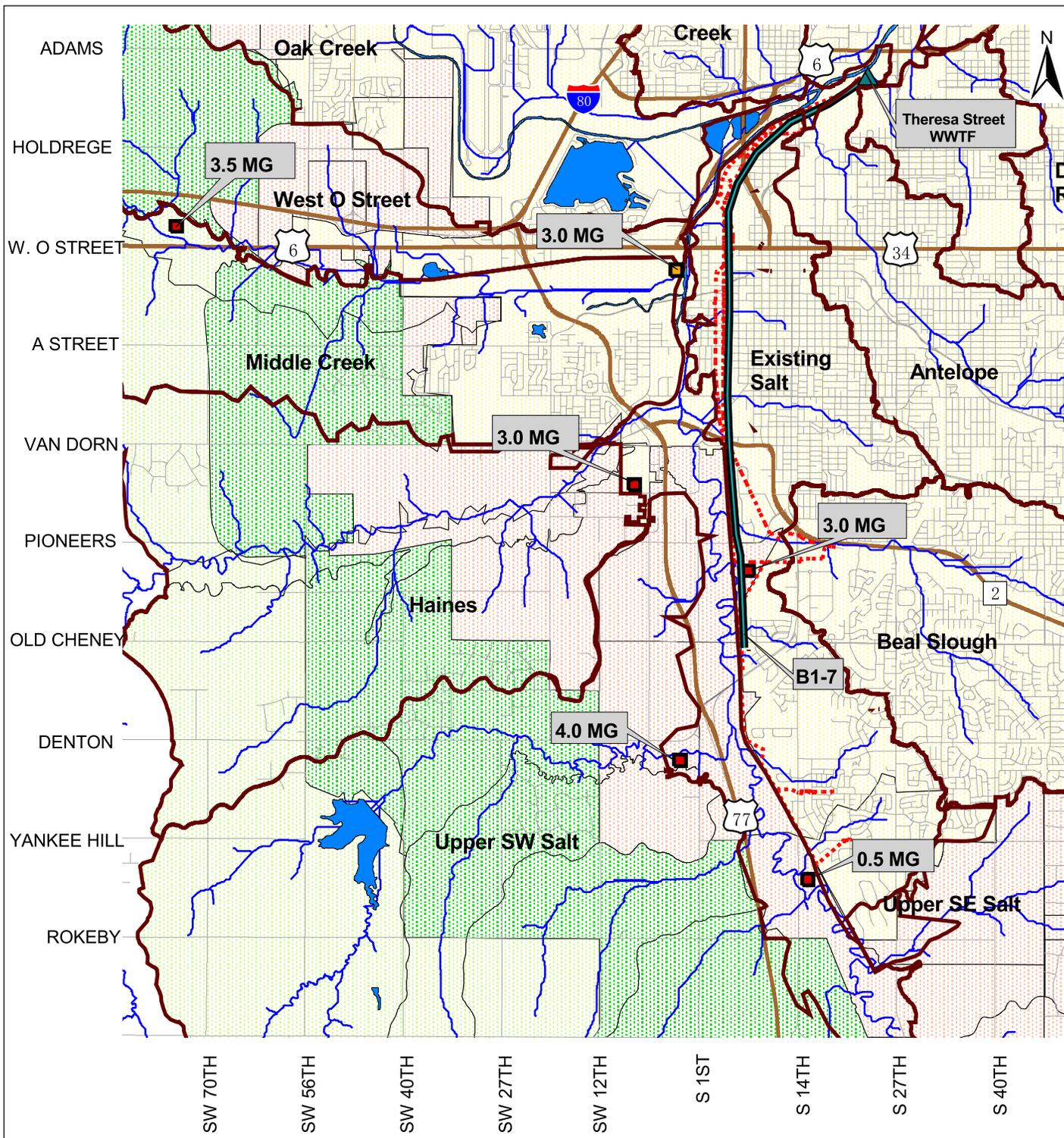
Table 24.4 Parallel East Side Salt Creek Trunk Sewer - Tier III Alternative 3 Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska			
Description	Parameter	Unit Price	Planning Costs ⁽¹⁾
84-inch Diameter Trunk Sewer	34,200 lf	\$1,050/lf ⁽²⁾	\$35,910,000
Theresa Street WWTF Expansion	49 mgd	\$8.00/gal	\$392,000,000
Totals			\$427,910,000
Notes:			
1. ENR CCI for Kansas City = 8512 (July 2006).			
2. Based on \$12.50/in-dia-ft due to urbanized area and additional tunneling and ROW requirements.			

24.2.5.4 Increased Storage - Alternative 4

This alternative would increase and add peak flow storage in the Salt Creek Trunk Sewer Drainage areas such that the existing Salt Creek Trunk Sewer can convey the Tier III flows to the Theresa Street WWTF. A Tier III hydraulic model was prepared to simulate this scenario. The modeling results show that an additional 3.0 MG of storage was required on the Upper Southwest Basin resulting in a total of 7.0 MG of storage at this location. The storage previously identified in the Haines Branch modeling would be increased from 3.0 MG to 6.0 MG. Storage locations are shown in Figure 24.7.

In addition to the storage, the Theresa Street WWTF will need to be expanded by 49 mgd to treat the Tier III flows from the Haines Branch, Upper Southwest, Upper Southeast, and Southeast drainage basins as previously identified in Alternative 2 and 3 above. The planning level costs of this alternative are outlined in Table 24.5 below.

Table 24.5 Increased Storage - Tier III Alternative 4 Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska			
Description	Parameter	Unit Price	Planning Costs ⁽¹⁾
Additional Storage in the Upper Southwest Basin	3.0 mg	\$4.00/gal	\$12,000,000
Additional Storage in the Haines Branch Basin	3.0 mg	\$4.00/gal	\$12,000,000
Theresa Street WWTF Expansion	49 mgd	\$8.00/gal	\$392,000,000
Totals			\$416,000,000
Notes:			
1. ENR CCI for Kansas City = 8512 (July 2006).			

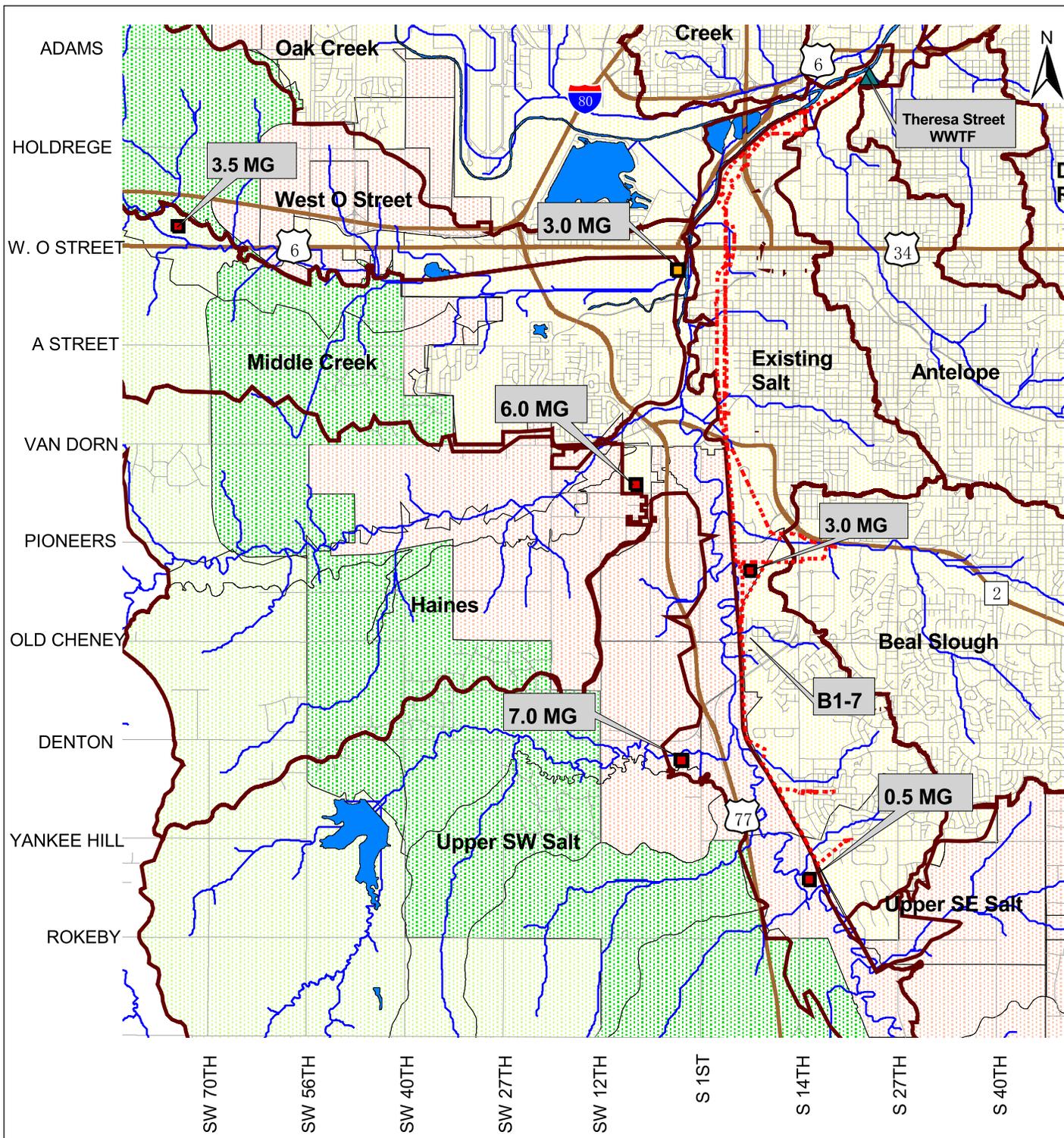


LEGEND

- Theresa Street WWTF
- Basin Boundaries
- 84" Parallel Sewer
- Existing Salt Creek Trunk Sewer
- J Street Lift Station and Storage
- Storage Basins
- Growth Tiers
 - Existing
 - Tier 1
 - Tier 2
 - Tier 3



Figure 24.6 Parallel East Side Salt Creek Trunk Sewer Alternative 3
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska



LEGEND

-  Theresa Street WWTF
-  Existing Salt Creek Trunk Sewer
-  Basin Boundaries
-  J Street Lift Station and Storage
-  Storage Basins
- Growth Tiers**
-  Existing
-  Tier 1
-  Tier 2
-  Tier 3



Figure 24.7 Increased Storage
 Alternative 4
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska

24.2.6 Summary of Tier III Improvements

The planning level costs for the four alternatives identified are outlined in Table 24.6 below. The costs of the alternatives ranges from \$416,000,000 for Alternative 4 (Increased Storage) to \$441,000,000 for Alternative 1 (SW WWTF). The difference between these costs is low at only 6 percent. The four alternatives identified for Tier III needs represent “equal” solutions with regard to handling Tier III flows. Each alternative provides a means to handle the Tier III flows. Additional alternatives and variations of the alternatives presented need to be considered in the future as the time and necessity for these improvements nears. For planning purposes, since improvements are not needed for 50 years, the costs for the alternatives presented are nearly equal.

Table 24.6 Summary of Tier III Planning Level Costs Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska	
Description	Planning Costs ⁽¹⁾
Alternative 1 - New SW WWTF	\$441,000,000
Alternative 2 - West Side Sewer	\$429,726,000
Alternative 3 - East Side Sewer	\$427,910,000
Alternative 4 - Increased Storage	\$416,000,000
Notes: 1. ENR CCI for Kansas City = 8512 (July 2006).	

During the next 50 years, treatment technology will likely become more efficient, pipeline construction more water tight, and water conservation and I/I improvements more noticeable, all of which will influence the direction the City will take to handle Tier III flows. Emerging technologies such as the use of membrane bioreactors will likely be in common use within the next 50 years. This technology requires a smaller footprint (less area) than that required by the current activated sludge process, and produces a very high quality effluent. If utilized, the Theresa Street WWTF may be capable of treating flows in excess of the 45 mgd using its existing tankage. Regardless, the configuration and treatment capacity of the Theresa Street WWTF as well as the capacity of the trunk sewers and storage facilities should be periodically reviewed, updated, and modifications made as regulations change and as wastewater flows increase.

Alternative 4, “Increased Storage”, is the preferred alternative and is the basis for all improvements and calculations of the Wastewater Facilities Master Plan. The costs for this alternative are spread over a 20-year period starting in the year 2055. Figure 24.8 shows City property adjacent to the existing Theresa Street WWTF facilities that can be used for Tier III Improvements.



Area for Tier III Expansion



Figure 24.8
Theresa Street WTF Tier III Improvements Area
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

24.2.7 Summary of Theresa Street WWTF Improvements

Tier I Projects

- 2008 - Salt Creek Bank Stabilization Project.
- 2008 - Upgrade Sludge Presses.
- 2009 - Odor & Corrosion Control Facilities for the Solids Dewatering Facilities.
- 2010 - Add Rotary Drum Thickener.
- 2010 - Trucked Waste Improvements Project.
- 2010 - Electrical Power Reliability Project.
- 2012 - Construct Solids Storage Pad.
- 2012 - 2015 - Wet Weather Improvements.
- 2013 - 2015 - Digester Mixing Improvements.
- 2015 - Influent Wastewater Pump Replacement Project.
- 2017 - 2022 - 12.6 mgd Expansion.
- On-going Odor Control Projects.

Tier II Projects

- 2030 - Construct Fourth Anaerobic Digester.
- 2030 - 2033 - Peak Flow Storage or Treatment.
- 2050 - 2055 - 5 mgd Expansion.
- 2050 - 2053 - Peak Flow Storage or Treatment.

Tier III Projects

- 2055 - 2075 - Tier III Capacity Improvements.

24.3 NORTHEAST STREET WWTF

24.3.1 Overview

As discussed in Chapter 5, the Northeast WWTF was recently expanded to its current MMAD nitrification capacity of 10 mgd. There is one expansion project identified in the current CIP for the Northeast WWTF. Additional treatment trains will need to be constructed to treat increased flows in the future. Since the City owns a large parcel of property around the existing facilities, it is assumed that available land for the expansions would not be an issue.

It is important to determine when the treatment facility expansions will be required in order to plan for future funding. A 2005-2006 MMAD flow of 6.5 mgd was used in flow projection calculations. Previous studies have used higher initial flows experienced at the treatment facility in the past, i.e. 6.8 mgd in 2000. The future growth of the drainage basins serving the Northeast WWTF is difficult to determine since most of the area is largely undeveloped at this time. Due to the uncertainty in future growth, an annual increase of 1.5-percent was used to develop flow projection curves for the Northeast WWTF as shown in Figure 24.9. Using a projected growth rate of 1.5 percent, which is consistent with the City Planning Department and past Master Plans, a 5.0 mgd expansion would be required in approximately 2036 with a second 5 mgd expansion around 2063. Projecting flows this far into the future is difficult at best. It is recommended that the City closely monitor the actual flows and continually update the planning as required for the next WWTF expansion. These expansions are also shown schematically in Figure 24.10. Specific improvements are outlined below. A summary of the estimated planning costs for these improvements is located in Table 24.7.

24.3.2 Tier I Improvements

Grit Removal Improvements. This project is designed and waiting to be constructed in 2008 to 2010.

Northeast Wastewater Treatment Facility Expansion. This project will include additional nitrification, primary and final clarifiers, and associated facilities. For planning it was assumed that this expansion will provide an additional 5 mgd of capacity with the costs being distributed between 2010 and 2018 as identified in the City's current CIP. This timing is different than that identified in Figure 24.9. The actual timing of this expansion will need to be closely monitored.

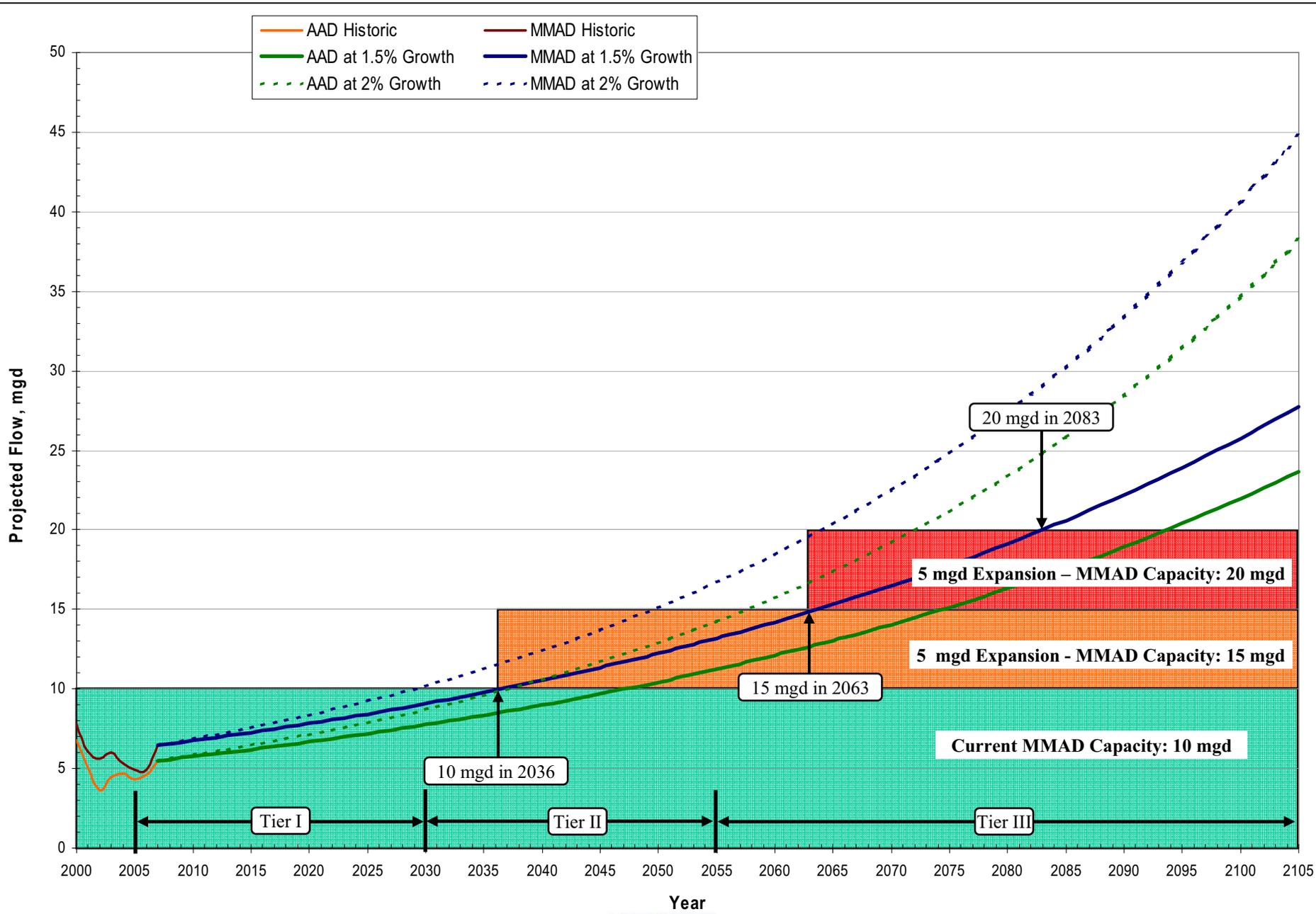


Figure 24.9 Northeast WWTF Projected MMAD Flows
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska



NOTES:

1. NOT ALL FUTURE FACILITIES SHOWN.

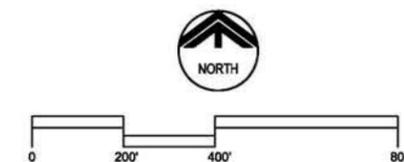


Figure 24.10
 Northeast WTF Future Improvements
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska

Wet Weather Treatment Improvements. As flows increase, wet weather treatment facilities will likely be required to treat or store the hydraulic peaks. The actual timing of these improvements will depend on the development pattern of the drainage basins tributary to the treatment facility. It is currently envisioned that these improvements will be in the form of equalization basins and possibly the use of ballasted sand flocculation. For planning, it was assumed that this project would be completed between 2011 and 2014.

Electrical Power Reliability Project. The reliability of the electrical power feed to the facility should be evaluated and improvements made. These improvements may be in the form of confirming that two separate feed circuits are currently providing power to the facility and that the power poles and other equipment are adequate to withstand high wind and ice loads. Additionally, the use of standby generator should be incorporated for critical processes for redundancy and reliability. For planning purposes, it was assumed that this project would begin in 2010 and take 5 years to complete.

On-going Odor Control Projects. These projects should plan for and incorporate odor control facilities as required.

Solids Handling Improvement Projects. As identified in a recent report titled, “*Study and Evaluation of Solids Treatment and Handling at the Theresa Street and Northeast Wastewater Treatment Facilities*”, HDR, January 2007, the following solids handling improvements have been identified:

1. Odor Control for the Thickened WAS storage facility is planned in 2007.
2. Expand the Solids Injection Site in 2012.
3. Replace the Rotary Drum Thickeners in 2022.

24.3.3 Tier II Improvements

Peak Flow Storage or Treatment. An additional 5 MG of storage has been added to the planning level costs to provide for Tier II peak flow storage or treatment.

Construct a Third Anaerobic Digester. Construct a third anaerobic digester in 2034.

24.3.4 Tier III Improvements

Northeast Wastewater Treatment Facility Expansion. An additional MMAD capacity expansion of 5 mgd was assumed for the Tier III planning period.

Peak Flow Storage or Treatment. An additional 5 MG of storage has been added to the planning level costs to provide for Tier III peak flow storage or treatment.

24.3.5 Summary of NE WWTF Improvements

Tier I Projects

- 2007 - Odor Control for the Thickened WAS Storage Facility.
- 2010 - Grit Removal Improvements.
- 2010 - 2018 - Northeast Wastewater Treatment Facility Expansion.
- 2011 - 2014 - Wet Weather Treatment Improvements.
- 2010 - 2015 - Electrical Power Reliability Project.
- 2012 - Expand the Solids Injection Site.
- 2022 - Replace the Rotary Drum Thickeners.
- On-going Odor Control Projects.

Tier II Projects

- 2025 - Peak Flow Storage or Treatment.
- 2031 - 2036 - 5 MGD Northeast Wastewater Treatment Facility Expansion.
- 2034 - Construct a Third Anaerobic Digester.

Tier III Projects

- 2055 - Peak Flow Storage or Treatment.
- 2058 - 2063 - 5 MGD Northeast Wastewater Treatment Facility Expansion.

24.4 EMERGING WASTEWATER TREATMENT TECHNOLOGIES AND OTHER CONSIDERATIONS

The wastewater treatment industry is continually growing and improving. New technologies are emerging and being implemented on a continual basis to meet increasing regulatory requirements as well as to treat wastewater more efficiently.

Technologies that are currently being developed and in some cases implemented include membrane bioreactors, reverse osmosis, ultra filtration, pasteurization, sludge minimization technologies as well as others. In addition to liquid treatment, advances are being made in the solids handling and digestion processes. These include two phase digestion, pasteurization, and thermophilic digestion.

As the availability of high quality water becomes more valuable, the reuse of wastewater will become more economical. Water reuse is already being heavily used in the arid Southwest United States and in Florida. This reclaimed water is being used to irrigate parks, athletic fields, common grounds, and freeway landscaping.

Currently, LES is using treated water from the NE WWTF as cooling water. This trend of using reclaimed wastewater for industrial uses is expected to continue as the availability of water becomes more expensive and scarce, and the quality of the treated water increases.

Another process worth considering is the use of liquid only or "satellite" WWTF's. These facilities are located in strategic areas where reclamation quality water is desired. These facilities are generally sized to produce a certain quantity of reclaimed water. The solids

produced are then discharged back into the trunk sewer where they are treated at the larger facilities.

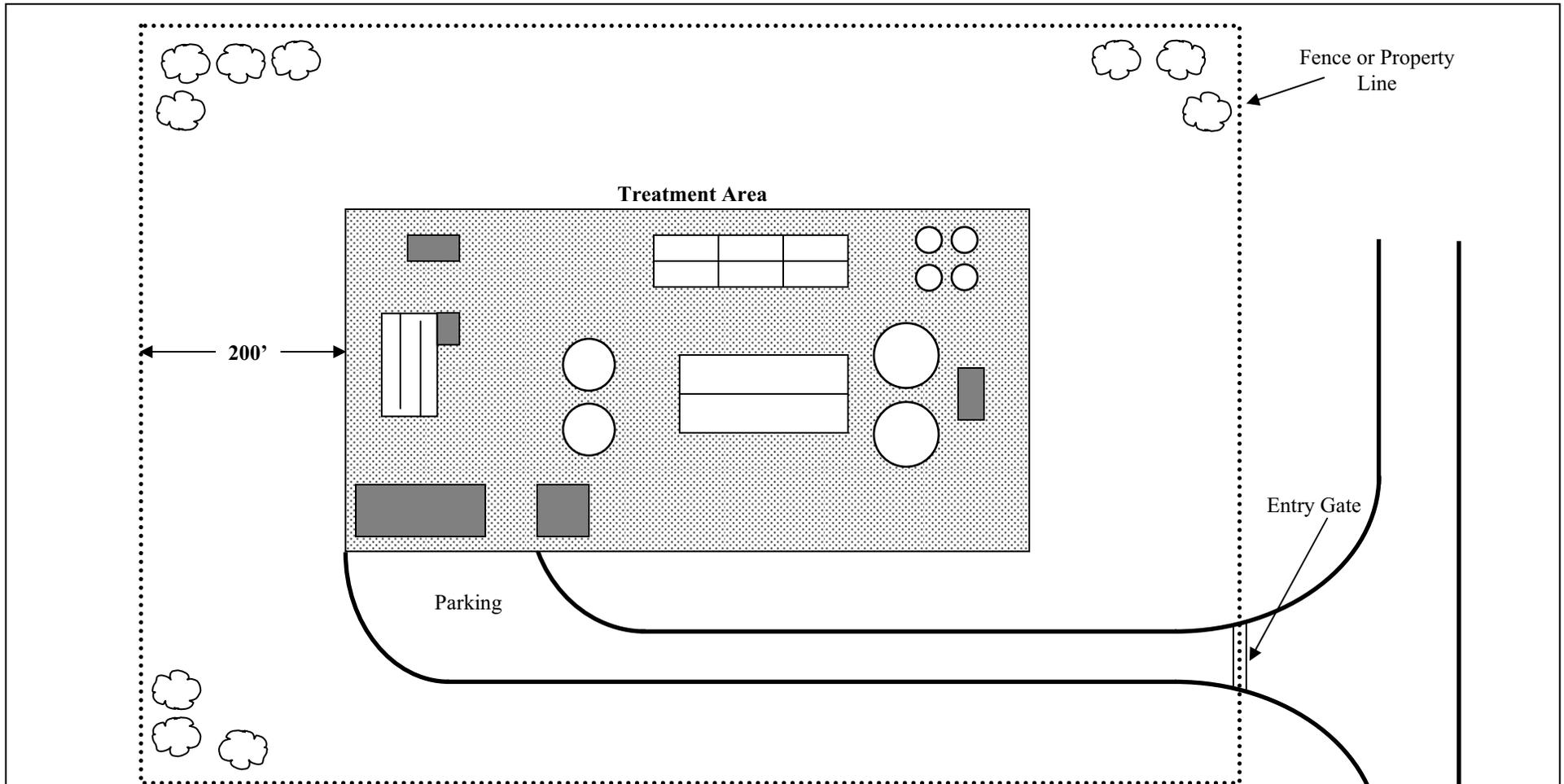
Two additional WWTF's alternatives for the northern portion of the service area may have merit in the future as the City grows. The first WWTF alternative is to locate a WWTF in the northwest area of the City in the Oak Creek Basin. A WWTF in this area of the City may have advantages due to the large size of the Oak Creek Drainage basin and the capacity constraints that the Oak Creek Trunk Sewer will experience as the identified Tier II and Tier III (25 - 100 years) land areas are developed.

The second WWTF alternative is to explore a regional facility with the City of Waverly as the City grows to the east during the Tier III growth period (50 to 100 years).

24.5 SUMMARY OF IDENTIFIED WWTF IMPROVEMENTS

Tables 24.7 and 24.8 outline the identified improvements and planning level costs for the Theresa Street WWTF and the NE WWTF. It is recommended that more detailed engineering and planning studies be completed to further define the actual design and refine the estimated costs of the projects as capacity, regulations, or other requirements dictate.

A generalized planning level schematic site plan for WWTF's is shown in Figure 24.11. Included in this figure are planning level land area requirements including minimum buffer zones. It should be noted that the actual size of the WWTF's, land area requirements, and buffer zones should be determined based on detailed engineering and siting studies.



Treatment Capacity (mgd)	Treatment Area (acres)	Site Width (ft)	Site Length (ft)	Site Area (acres)
5	5	730	1,060	18
10	10	867	1,333	27
15	15	972	1,543	34
20	20	1,060	1,720	42
25	25	1,138	1,876	49
30	30	1,208	2,017	56
35	35	1,273	2,146	63

Notes:

1. One acre per mgd of treatment used for estimating land requirements.
2. Treatment area and site dimensions sized assuming 2:1 length to width ratio.
3. Site dimensions/area includes 200 ft buffer around treatment area.



Figure 24.11
 General Layout of WWTF Site
 Wastewater Facilities Master Plan Update - 2007
 City of Lincoln, Nebraska

**Table 24.7 Recommended Improvements – Theresa Street Wastewater Treatment Facility
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska**

Tier	ID	Description	Location	Parameters	Unit Price	Planning Cost ⁽¹⁾
I	T-1	Salt Creek Bank Stabilization (CIP Project 13.f)	Theresa Street WWTF			\$14,000,000 ⁽²⁾
I	T-2	Odor and Corrosion Control (CIP Project 13.b)	Theresa Street WWTF			\$660,000 ⁽²⁾
I	T-3a	Upgrade Sludge Presses (CIP Project 13.d)	Theresa Street WWTF			\$3,183,000 ⁽²⁾
I	T-3b	Add RTD Thickener (CIP Project 3.d)	Theresa Street WWTF			\$4,500,000 ⁽²⁾
I	T-3c	Construct Solids Storage Pad (CIP Project 3.d)	Theresa Street WWTF			\$290,000 ⁽²⁾
I	T-3d	Digester Mixing Improvements (CIP Project 3.d)	Theresa Street WWTF			\$2,260,000 ⁽²⁾
I	T-4	Septage and Trucked Waste Facility (CIP Project 13.e)	Theresa Street WWTF			\$1,600,000 ⁽²⁾
I	T-5	Electrical Reliability	Theresa Street WWTF	1 LS	\$1,000,000	\$1,000,000
I	T-6	Replace Raw Wastewater Pumps 5 and 6	Theresa Street WWTF	1 LS	\$1,500,000	\$1,500,000
I	T-7	On-going Odor Control Projects	Theresa Street WWTF	1 LS	\$1,000,000	\$1,000,000
I	T-8	Wet Weather Treatment (CIP Project 13.c)	Theresa Street WWTF			\$2,576,000 ⁽²⁾
I	T-9	13 mgd Central Train expansion	Theresa Street WWTF	12,600,000 gal	\$8.00/gal	\$100,800,000
II	T-10	Additional Peak Flow Treatment/Storage	Theresa Street WWTF	4 MG	\$4.00/gal	\$16,000,000
II	T-11	5 mgd East Train expansion	Theresa Street WWTF	5,000,000 gal	\$8.00/gal	\$40,000,000
II	T-12	Add fourth digester	Theresa Street WWTF	1 LS	\$5,000,000	\$5,000,000
II	T-13	Additional Peak Flow Treatment/Storage	Theresa Street WWTF	5,000,000 gal	\$4.00/gal	\$20,000,000
III	T-14	Capacity Improvements: Treatment/Storage/Conveyance	Theresa Street WWTF Drainage Area	-	-	\$416,000,000

Notes:

1. ENR CCI for Kansas City = 8512 (July 2006).
2. Costs from current City CIP.
3. This cost represents the lowest cost of the Tier III alternatives presented in Table 26.4.

**Table 24.8 Recommended Improvements – Northeast Wastewater Treatment Facility
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska**

Tier	ID	Description	Location	Parameters	Unit Price	Planning Cost ⁽¹⁾
I	NE-1	Treatment Process Capacity Improvements and Upgrades	Northeast WWTF			\$23,635,000 ⁽²⁾
I	NE-2	Grit Facilities Improvements (CIP Project 14.b)	Northeast WWTF			\$3,200,000 ⁽²⁾
I	NE-3	Wet Weather Treatment (CIP Project 14.c)	Northeast WWTF			\$1,969,000 ⁽²⁾
I	NE-4	Electrical Reliability	Northeast WWTF	1 LS	\$1,000,000	\$1,000,000
I	NE-5a	On-going Odor Control Projects	Northeast WWTF	1 LS	\$1,000,000	\$1,000,000
I	NE-5b	Odor Control for TWAS Storage (CIP Project 14.d & e)	Northeast WWTF			\$600,000 ⁽²⁾
I	NE-6	Expand Solids Injection Site (CIP Project 14.d & e)	Northeast WWTF			\$5,300,000 ⁽²⁾
I	NE-7	Replace RDT's (CIP Project 14.d & e.)	Northeast WWTF			\$800,000 ⁽²⁾
II	NE-8	Third Digester	Northeast WWTF	1 LS	\$5,000,000	\$5,000,000
II	NE-9	Additional Peak Flow Treatment/Storage	Northeast WWTF	5,000,000 gal	\$4.00/gal	\$20,000,000
III	NE-10	5 mgd expansion	Northeast WWTF	5,000,000 gal	\$8.00/gal	\$40,000,000
III	NE-11	Additional Peak Flow Treatment/Storage	Northeast WWTF	5,000,000 gal	\$4.00/gal	\$20,000,000

Notes:

1. ENR CCI for Kansas City = 8512 (July 2006).
2. Costs from current City CIP.