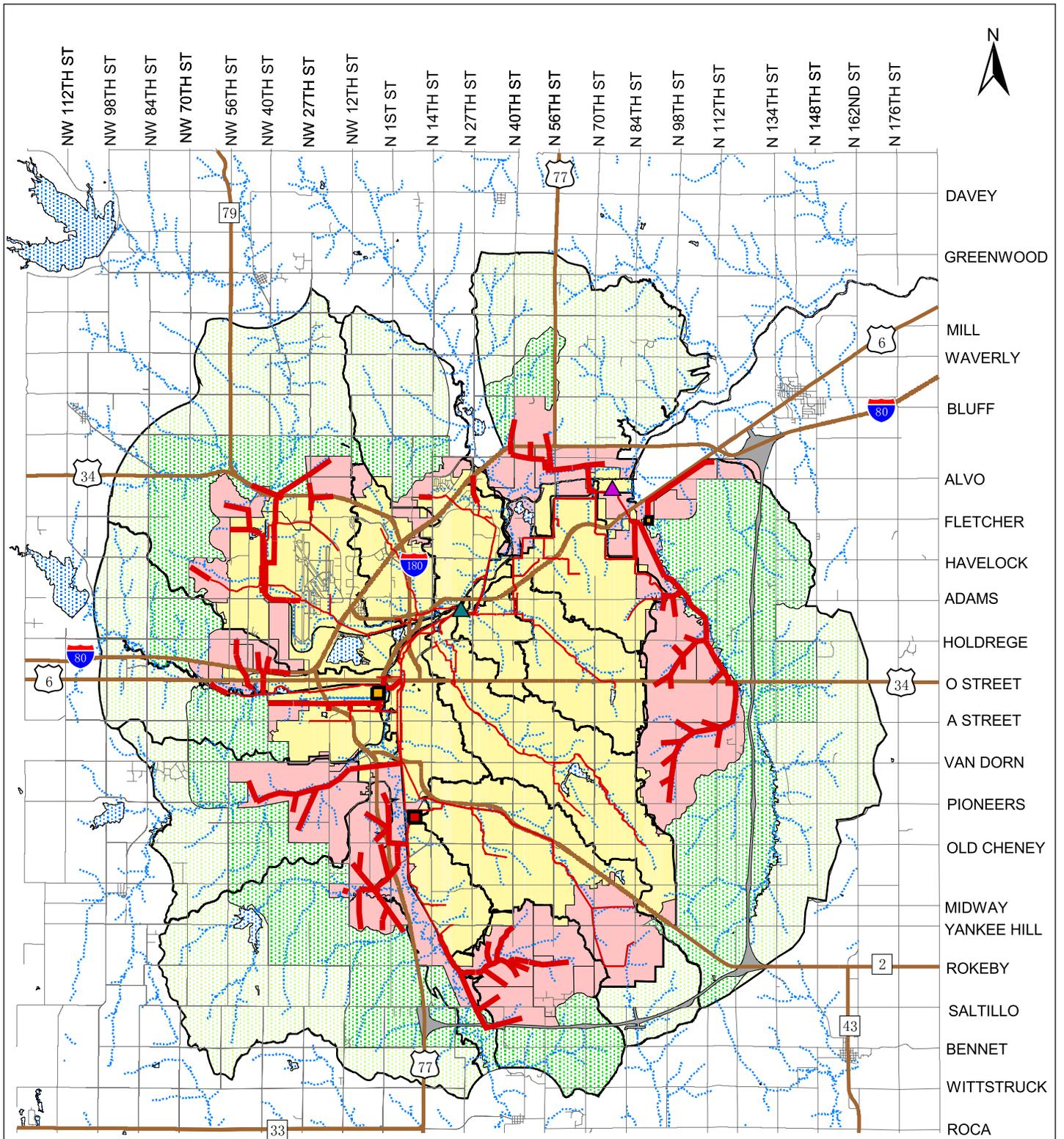


## COLLECTION SYSTEM SUMMARY

### 23.1 SUMMARY OF IMPROVEMENTS

The results of the collection system modeling discussed in Chapters 10 through 22, is summarized in Tables 23.1 and 23.2 below, and shown graphically in Figures 23.1, 23.2, 23.3, and 23.4. The modeling identified the addition of over one million feet of pipeline over the 100 year planning period. Storage was a critical aspect of the identified improvements with 42.0 million gallons of collection system storage identified for the planning period to maximize the use of existing pipelines and minimize surcharging. Lift station improvements were also identified in the West 'O' Street, Middle Creek, Haines Branch, and Southeast Basins. All improvements identified are considered planning level, and detailed engineering studies are recommended to finalize location and design criteria for each project.

<b>Table 23.1 Summary of Collection System Pipeline Improvements <sup>(1)</sup> Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska</b>				
<b>Basin</b>	<b>Tier I <sup>(2)</sup></b>	<b>Tier II <sup>(3)</sup></b>	<b>Tier III <sup>(3)</sup></b>	<b>Basin Total</b>
Salt Valley <sup>(4)</sup>	5,700 ft	-	-	5,700 ft
Antelope Creek	-	-	-	-
Beal Slough	-	-	-	-
Upper SE Salt	41,543 ft	16,198 ft	-	57,741 ft
Upper SW Salt	47,668 ft	75,636 ft	48,158 ft	171,462 ft
Haines Branch	66,268 ft	35,949 ft	36,897 ft	139,114 ft
West 'O' & Middle Creek	43,780 ft	68,031 ft	74,572 ft	186,383 ft
Oak Creek & Lynn Creek	44,936 ft	39,852 ft	104,065 ft	188,853 ft
Little Salt Creek	8,942 ft	26,981 ft	31,412 ft	67,335 ft
Deadmans Run, East Campus, Havelock	-	-	-	-
Northeast Salt	41,216 ft	31,290 ft	96,425 ft	168,931 ft
Stevens Creek	96,163 ft	177,282 ft	94,953 ft	368,398 ft
Southeast	-	-	32,134 ft	32,134 ft
<b>Total</b>	<b>396,216 ft</b>	<b>471,219 ft</b>	<b>518,616 ft</b>	<b>1,386,051 ft</b>
Notes:				
1. Includes all sizes of pipes including forcemains.				
2. Tier I values include pipelines 10-inches and larger.				
3. Tiers II and III values generally includes pipelines 15 inches and larger.				
4. Relining existing pipe				

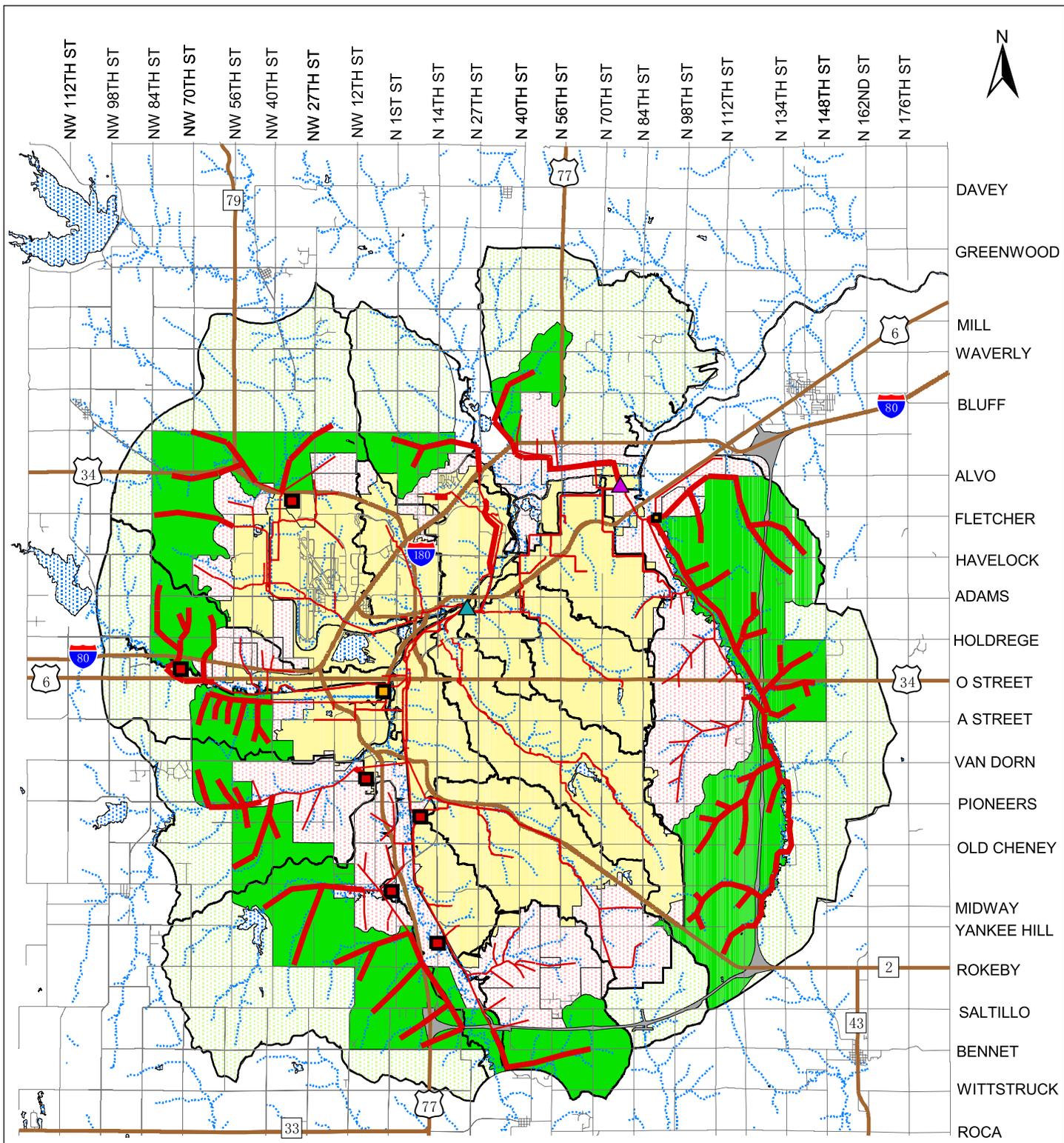


**LEGEND**

- Northeast WWTF
- Theresa Street WWTF
- Lift Station
- Storage
- Existing Sewers
- Tier I Sewers
- Growth Tiers**
- Existing Service Area
- Tier I
- Tier II
- Tier III



Figure 23.1 Planning Area Tier I Improvements  
Wastewater Facilities Master Plan Update - 2007  
City of Lincoln, Nebraska

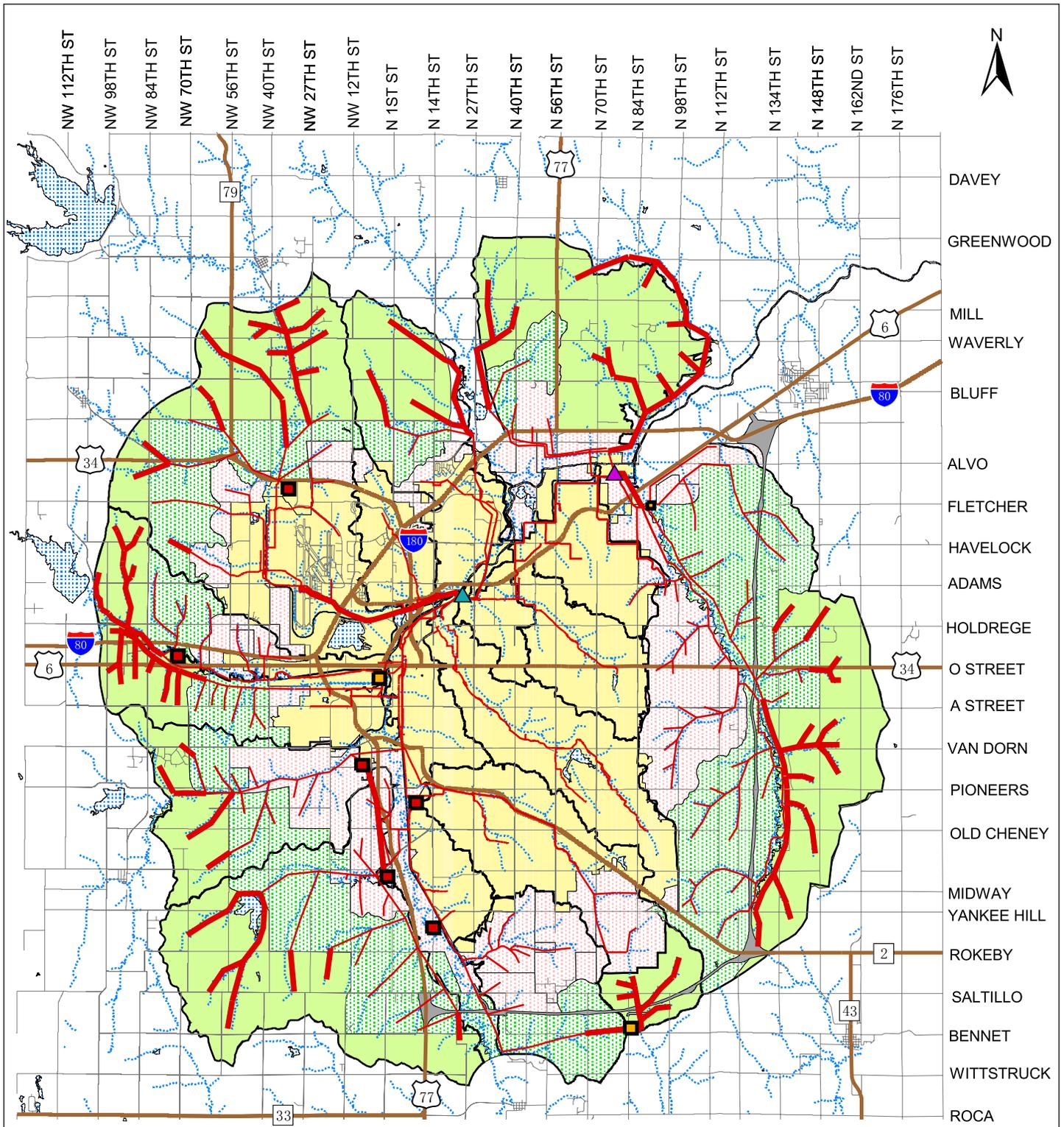


**LEGEND**

-  Northeast WWTF
-  Theresa Street WWTF
-  Lift Station
-  Storage
-  Existing & Tier I Sewers
-  Tier II Sewers
- Growth Tiers**
-  Existing Service Area
-  Tier I
-  Tier II
-  Tier III



Figure 23.2 Planning Area Tier II Improvements  
Wastewater Facilities Master Plan Update - 2007  
City of Lincoln, Nebraska

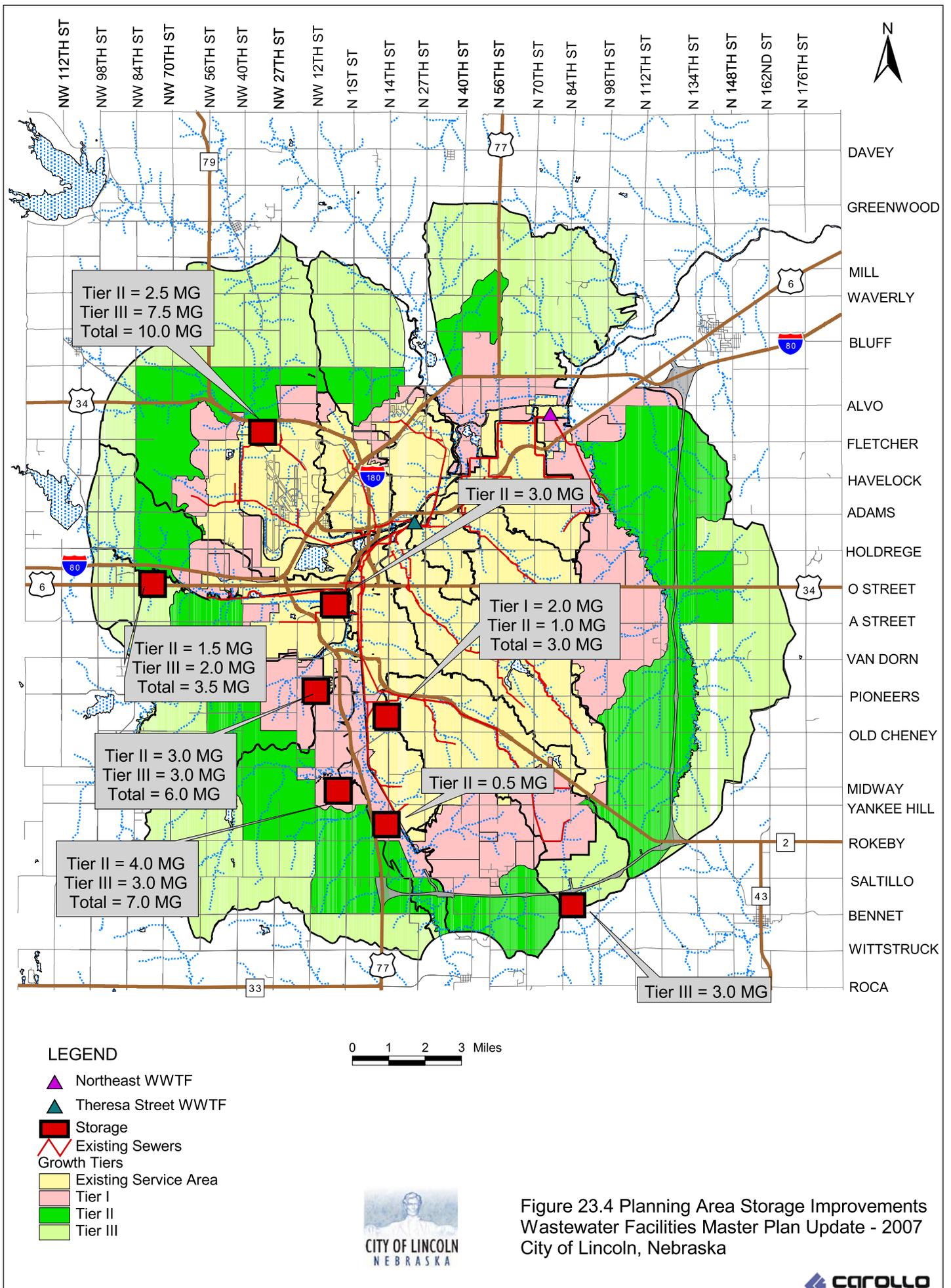


**LEGEND**

-  Northeast WWTF
-  Theresa Street WWTF
-  Lift Station
-  Storage
-  Existing, Tier I, & Tier II Sewers
-  Tier III Sewers
- Growth Tiers**
-  Existing Service Area
-  Tier I
-  Tier II
-  Tier III



Figure 23.3 Planning Area Tier III Improvements  
Wastewater Facilities Master Plan Update - 2007  
City of Lincoln, Nebraska

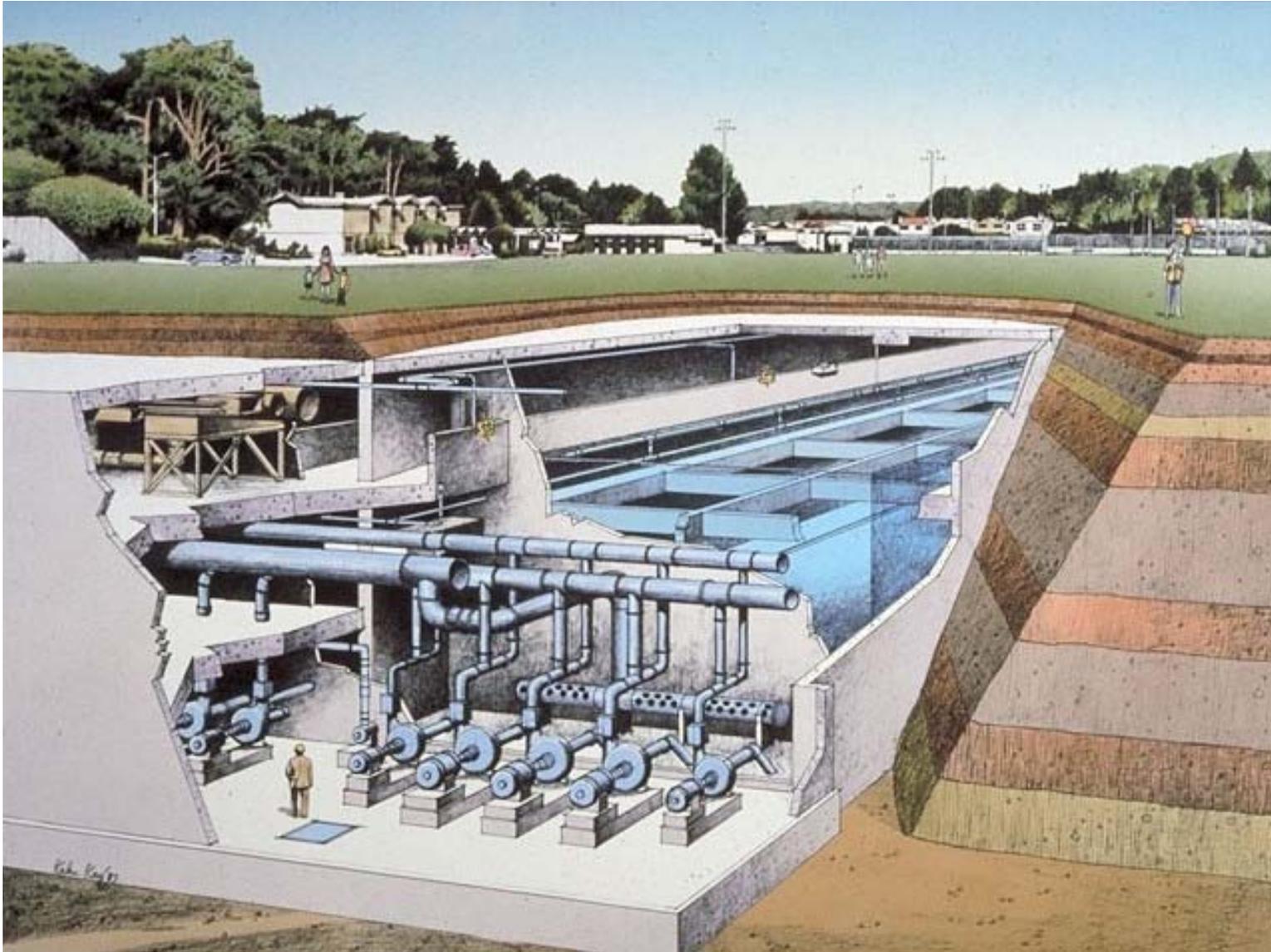


<b>Table 23.2 Summary of Collection System Storage Improvements <sup>(1)</sup> Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska</b>				
<b>Basin</b>	<b>Tier I</b>	<b>Tier II</b>	<b>Tier III</b>	<b>Basin Total</b>
Salt Valley	2.0	1.5		3.5
Upper SW Salt		4.0	3.0 <sup>(2)</sup>	7.0
Haines Branch		3.0	3.0 <sup>(2)</sup>	6.0
West 'O' & Middle Creek		4.5	2.0	6.5
Oak Creek & Lynn Creek		2.5	7.5	10.0
Southeast			3.0	3.0
Salt Creek Basin Tier III Improvements			6.0	6.0
<b>Total</b>	<b>2.0 MG</b>	<b>15.5 MG</b>	<b>18.5 MG</b>	<b>42.0 MG</b>
Notes: 1. Values are in millions of gallons (MG). 2. Additional storage of 3.0 MG each located at Haines Branch and Upper Southwest Basins as identified Theresa St WWTF drainage basins Tier III improvements Alternative 4 in Chapter 24.				

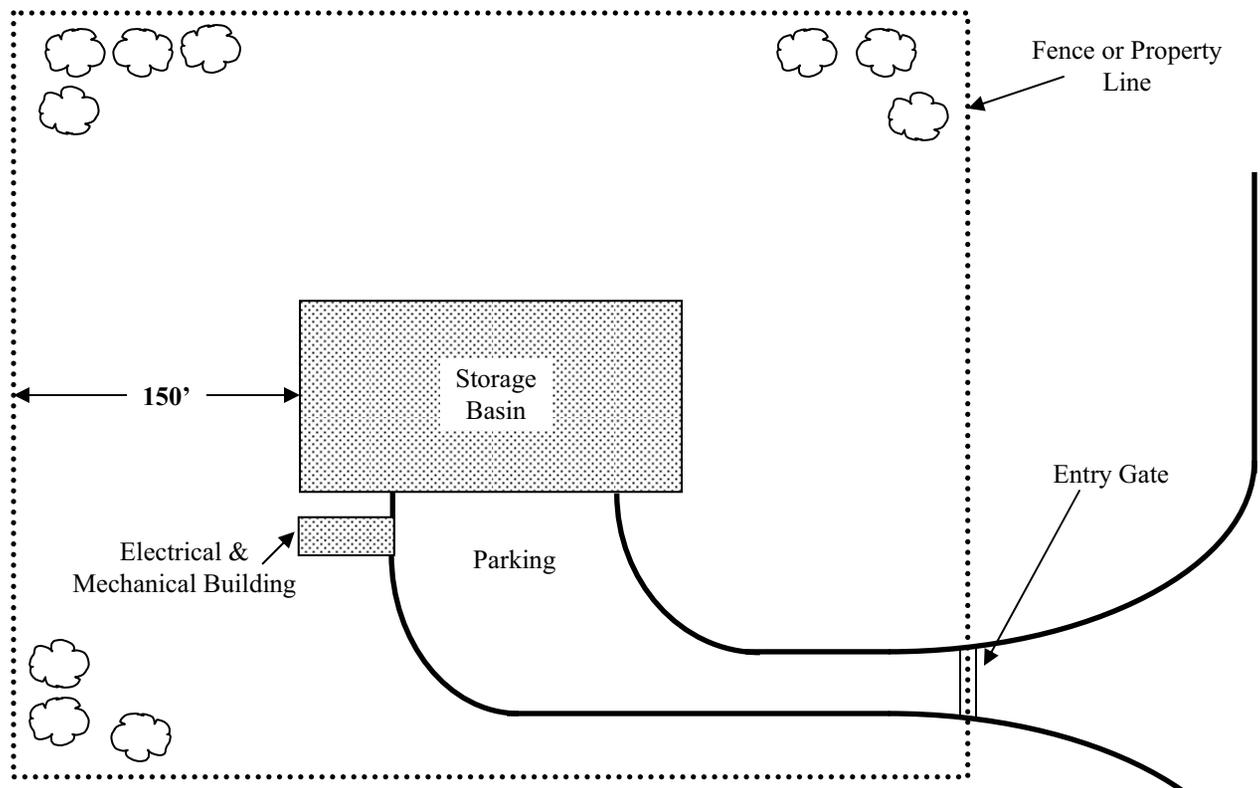
A schematic drawing showing an example of a storage facility is shown in Figure 23.5. A generalized site plan showing a layout of storage facilities is shown in Figure 23.6. Included in Figure 23.6 are planning level land area requirements including minimum buffer zones. It should be noted that the actual size of the storage facility, land area requirements, and buffer zones be determined on a site specific basis through detailed engineering and siting studies.

It is envisioned that the storage facilities will include coarse screening equipment to remove large material and solids handling pumps to deliver the stored wastewater back to the collection system when the peak flows recede. Provisions need to be incorporated into the design to allow the facilities to be flushed and cleaned. Arrangements will need to be made to dewater the screenings and remove them from the site when needed. It is strongly recommended that the use of odor control be considered, especially if the storage facility is located in a residential or commercial area.

Instrumentation to monitor liquid level in the storage facility, liquid level in the receiving trunk sewer, and flows at the receiving treatment plant are recommended. In addition, controls for the pumps and screens will be required. It is recommended that critical signals be transmitted through the SCADA system to the Theresa Street WWTF so that the operation of the storage facilities can be remotely monitored and controlled.



**Figure 23.5**  
Schematic Drawing of Storage Facilities  
Wastewater Facilities Master Plan Update - 2007  
City of Lincoln, Nebraska



Storage Size (MG)	Basin Width (ft)	Basin Length (ft)	Site Width (ft)	Site Length (ft)	Site Area (acres)
1	58	116	358	416	3.4
2	82	164	382	464	4.1
3	100	200	400	500	4.6
4	116	231	416	531	5.1
5	129	259	429	559	5.5
6	142	283	442	583	5.9
7	153	306	453	606	6.3
8	164	327	464	627	6.7
9	173	347	473	647	7.0
10	183	366	483	666	7.4

- Notes:
1. Storage basin sized based on 20 feet working depth.
  2. Basin dimensions sized assuming 2:1 length to width ratio.
  3. Site dimensions/area includes 150 ft buffer around storage basin.



**Figure 23.6**  
 General Layout of Storage Facilities  
 Wastewater Facilities Master Plan Update - 2007  
 City of Lincoln, Nebraska

Provisions for backup power should be made, either by incorporating a standby generator, or providing the proper connections to allow a trailer mounted generator to be utilized. Planning level operation and maintenance costs for collection system storage facilities have been included as shown in Figure 23.7.

## **23.2 LIFT STATION IMPROVEMENTS**

### **23.2.1 Summary**

As previously mentioned in Chapter 4, there are currently fourteen collection system lift stations, C-1 through C-14, that serve the collection system in Lincoln. These lift stations are maintained by Lincoln Wastewater System. Additional information for each of the lift stations is located in Appendix C. All of the stations are currently in good mechanical condition and are well maintained. The routine maintenance and inspection of the lift stations is largely fulfilled using 1 to 2 maintenance staff. Current funding levels for lift station maintenance and equipment replacement ranges from \$150,000 to \$200,000 per year.

It is recommended that the City continue to fund an aggressive repair and replacement program to keep the wastewater lift stations in good operating condition. As the collection system grows, and improvements are made, opportunities for the elimination or combining of lift stations should be explored.

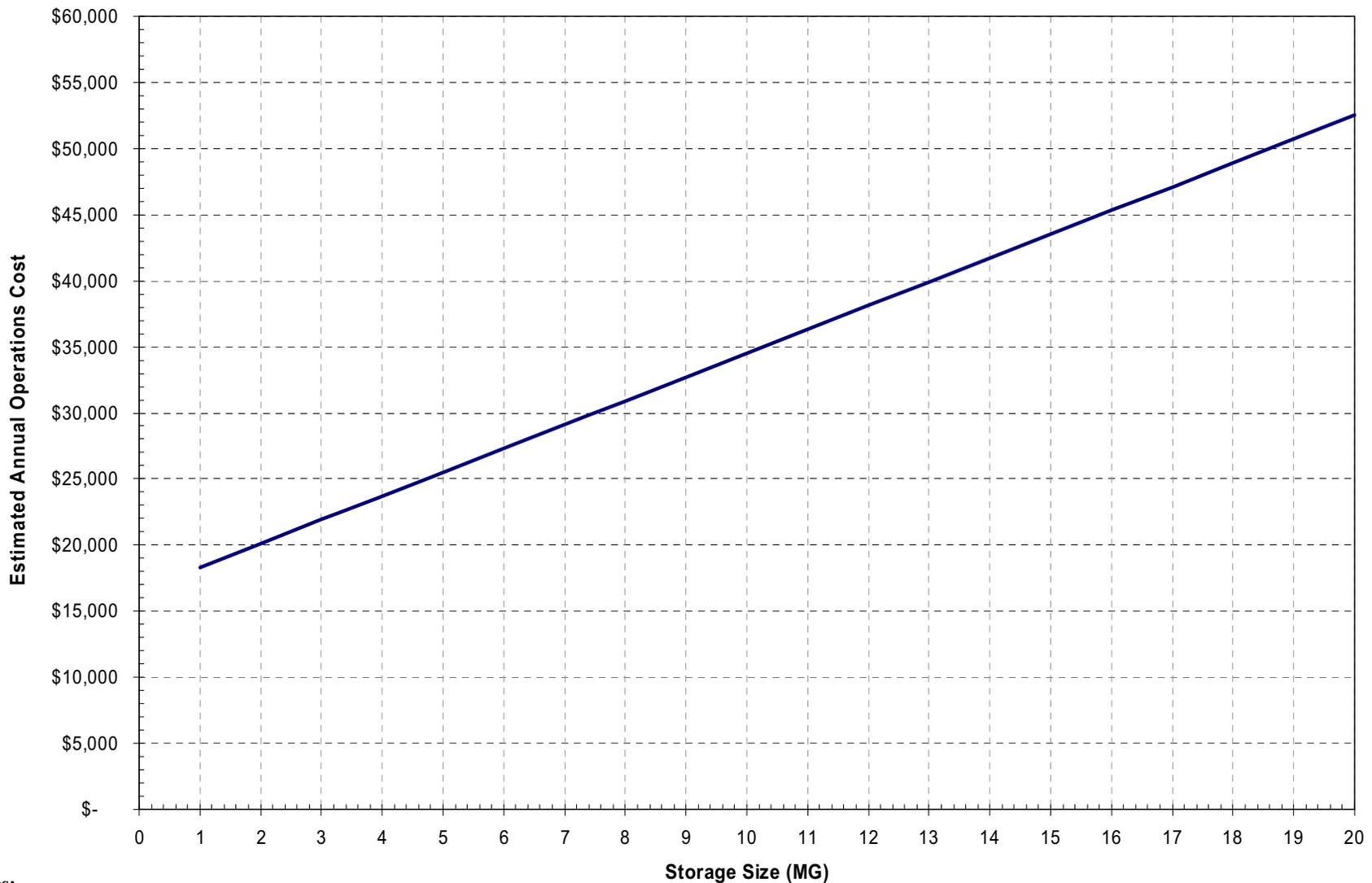
### **23.2.2 Recommended Improvements to Existing Lift Stations**

The recommendations discussed below are currently funded from the Infrastructure Replacement program.

Currently there is an ongoing project that will upgrade the SCADA systems at the lift stations to radio communication. This project is expected to be completed in 2008 and will improve the communications with the lift stations

Lift Station C-3 is experiencing corrosion problems in the control panel and the access hatch. There is a large maple tree adjacent to the station and the roots from this tree have intruded into the surrounding vitrified clay sewer line. These roots have been responsible for plugging of the sewer line and property damage to the adjacent house. The Wastewater Division is currently working with the homeowner to have the tree removed so that rehabilitation of the station can occur.

Lift Station C-6 has exterior deficiencies including masonry, exposed metals, and a large sinkhole on the north side of the building. There have been a few complaints associated with generator noise when in operation. It is recommended that these concerns be addressed and repairs made.



**Notes:**

1. Assumes basins are pumped (dewatered) over a 12 hour period once per day.
2. Assumes 500 labor hours per year for maintenance at a labor rate of \$30/hour, which includes daily or weekly regular maintenance as well as two basin cleanings per year assuming 40 hours per cleaning.
3. Assumes power costs of \$0.05/kWh with pump usage of 12 hours per day to empty entire basin volume with 20 feet of pumping head.
4. Total cost includes power costs for pumping, annual labor costs, and 10% contingency for additional maintenance, parts replacement, and other site work



**Figure 23.7**  
 Planning Level O&M Costs for Storage Facilities  
 Wastewater Facilities Master Plan Update - 2007  
 City of Lincoln, Nebraska

The wetwell for Lift Station C-7 has a dividing wall. This dividing wall essentially reduces the operating volume of the lift station. It is recommended that this dividing wall be removed.

Lift Stations C-8 and C-9 have been identified to be replaced as discussed in Chapter 16.

The wetwell for Lift Station C-11 has experienced accumulation of grease and debris. A wetwell mixer needs to be installed in the near future.

It is recommended that standby generators or the capability to connect a portable generator be evaluated for each lift station that does not currently have standby generation capacity.

### **23.2.3 Anticipated New Lift Stations**

At the present time, there are three additional wastewater lift stations that are planned for the Lincoln area. One is located near the intersection of Warlick Road and Hwy 77 serving the Cardwell Branch drainage area. The second lift station will be located within the Stevens Creek watershed near 105<sup>th</sup> St & Holdrege St. The third lift station will be the new J Street Lift Station discussed in Chapter 16.

## **23.3 SUMMARY OF COLLECTION SYSTEM MODELING**

To determine the peak hydraulic conditions at the WWTF's the flows from the individual trunk sewers are combined to generate the peak collection system modeling flows at the two WWTF's. The modeled flows are generally higher than the flows that are anticipated at the WWTF's due to many factors, a few of which are outlined below.

1. The peak flows derived by the model are considered an instantaneous peak or very short duration peaks. These instantaneous peaks are generally much greater than hourly or daily peaks.
2. These peaks usually are dampened as they enter the treatment facilities due to the hydraulics of the influent pumping system, as well as the effects of storage in the large trunk sewers immediately upstream from the treatment facilities.
3. The model applied the peak flows across the whole City simultaneously. It is unlikely that the precipitation needed to generate these peak flows would occur across the entire metropolitan collection system drainage area at these rates over the same 24 hour period.
4. The existing model includes land that is not yet served, but plans or studies have been completed and service is expected in the near future.
5. Model input flows for some of the existing and Tier I areas are based on several different sources including recent detailed reports and studies from other Consultants. Where no recent reports or studies were available for an existing or Tier I area, the City's Peak Flow Equation was used, which was derived from flows received during a wetter than normal period in 1993. Since that time there has not been extended periods of precipitation that equate to the 1993 precipitation events.

It should be emphasized that the collection system needs to be capable of conveying the peak flows from their respective drainage area (basins) to the treatment facilities without excessive surcharging or overflows. Based on this, and the factors outlined above, the modeled peak flows presented are reasonable for planning purposes. It is recommended that the City continue to monitor and expand the collection system flow monitoring program as discussed later in Chapter 25 to better refine the current peak flow equation for calculating such peak flows.

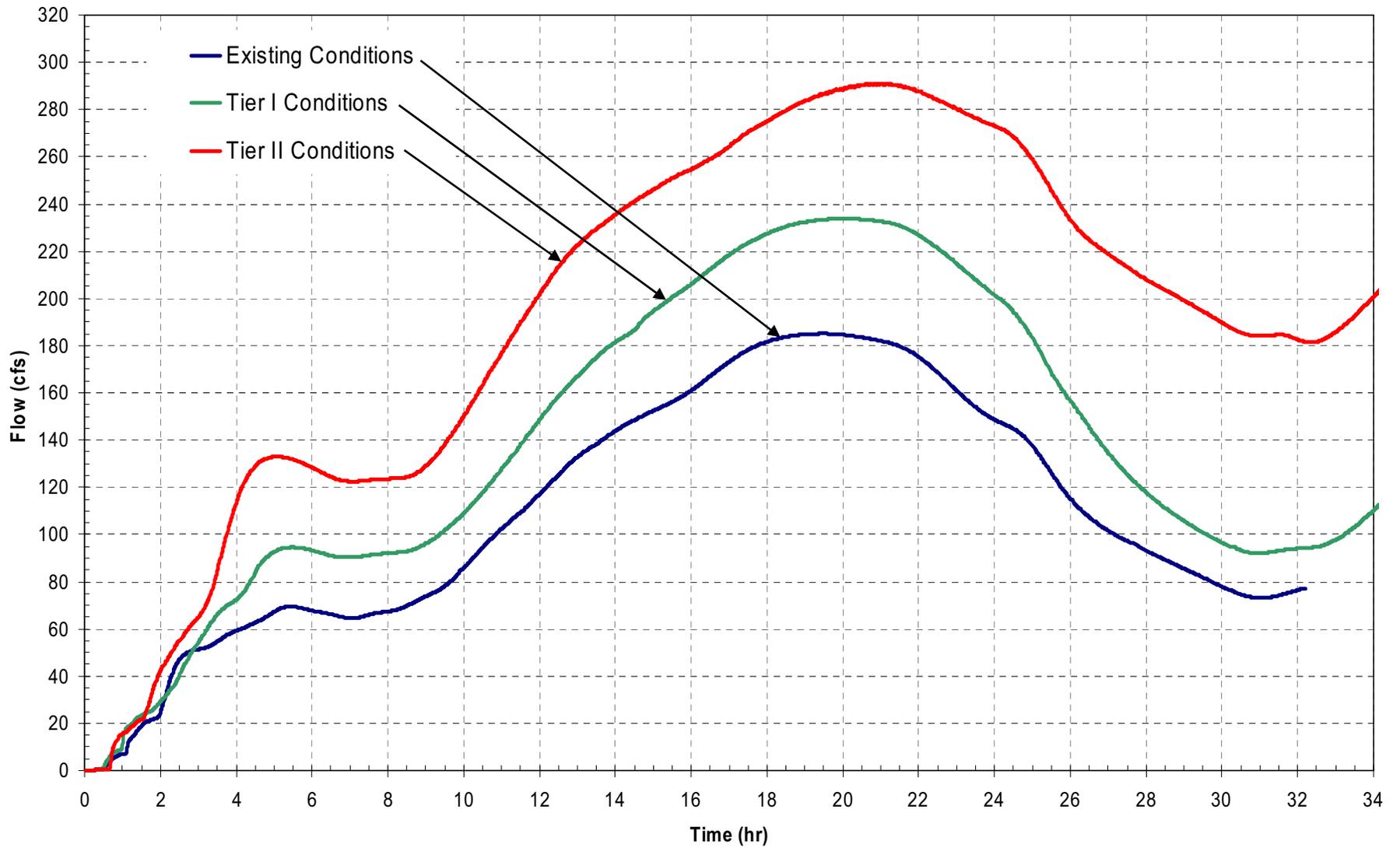
### **23.3.1 Theresa Street WWTF Drainage Areas**

The flows from the drainage basins tributary to the Theresa Street WWTF were combined at the Influent Pump Station and hydrographs for the influent modeled flows were generated for the existing, Tier I, and Tier II model runs shown in Figure 23.8. The areas that were used to calculate these flows are shown in Table 23.3 below.

### **23.3.2 NE WWTF Drainage Areas**

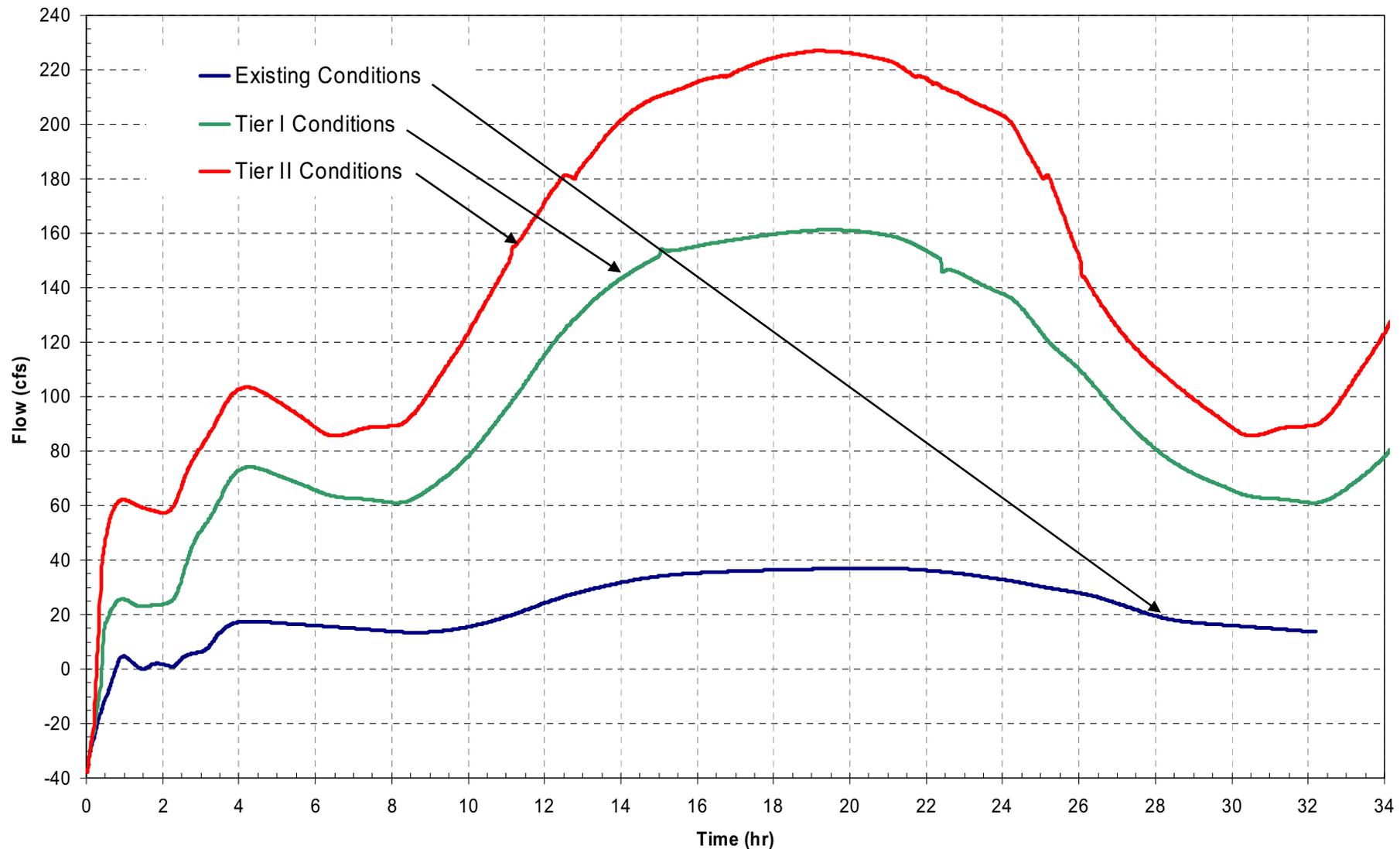
Likewise, the flows from the drainage basins tributary to the NE WWTF were combined at the Influent Pump Station and hydrographs for the influent modeled flows were generated for the existing, Tier I, and Tier II model runs shown in Figure 23.9. The drainage areas that were used to calculate these flows are shown in Table 23.4 below.

<b>Table 23.3 Modeled Theresa Street WWTF Drainage Areas <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska</b>				
<b>Basin</b>	<b>Existing Area (acres)</b>	<b>Tier I Area (acres)</b>	<b>Tier II Area (acres)</b>	<b>Tier III Area (acres)</b>
Salt Valley	5,475	5,475	5,475	5,475
Antelope Creek	7,866	8,336	8,336	8,336
Beal Slough	6,874	8,750	8,750	8,750
Upper Southeast Salt	0	4,119	7,279	7,279
Upper Southwest Salt	0	2,078	8,405	18,041
Haines Branch	297	1,117	5,095	6,409
Middle Creek	1,389	2,936	4,839	7,489
West 'O' Street	1,042	2,785	4,833	7,059
Oak Creek	4,538	7,162	13,342	21,767
Lynn Creek	2,865	3,323	3,323	3,323
Little Salt Creek	3,314	3,864	5,308	9,376
East Campus	865	865	865	865
Southeast	0	0	0	3,494
<b>Totals</b>	<b>34,525</b>	<b>50,810</b>	<b>75,850</b>	<b>107,663</b>
<b>Notes:</b>				
1. Areas as of July 1, 2006.				
2. Based on information provided by LWWS.				



**Figure 23.8**  
 Modeled Peak Flows at Theresa Street WWTF  
 Wastewater Facilities Master Plan Update - 2007  
 City of Lincoln, Nebraska

<b>Table 23.4 Modeled NE WWTF Drainage Areas <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska</b>				
<b>Basin</b>	<b>Existing Area (acres)</b>	<b>Tier I Area (acres)</b>	<b>Tier II Area (acres)</b>	<b>Tier III Area (acres)</b>
Deadmans Run	4,898	4,898	4,898	4,898
Havelock	3,881	4,681	4,681	4,681
Northeast Salt	264	2,610	4,213	13,717
Stevens Creek	366	9,409	26,642	36,450
<b>Totals</b>	<b>9,409</b>	<b>21,598</b>	<b>40,434</b>	<b>59,746</b>
Notes: 1. Areas as of July 1, 2006. 2. Based on information provided by LWWS.				



**Figure 23.9**  
 Modeled Peak Flows at Northeast WWTF  
 Wastewater Facilities Master Plan Update - 2007  
 City of Lincoln, Nebraska