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## EXISTING WASTEWATER TREATMENT FACILITIES

### 5.1 THERESA STREET WWTF

#### 5.1.1 Overview

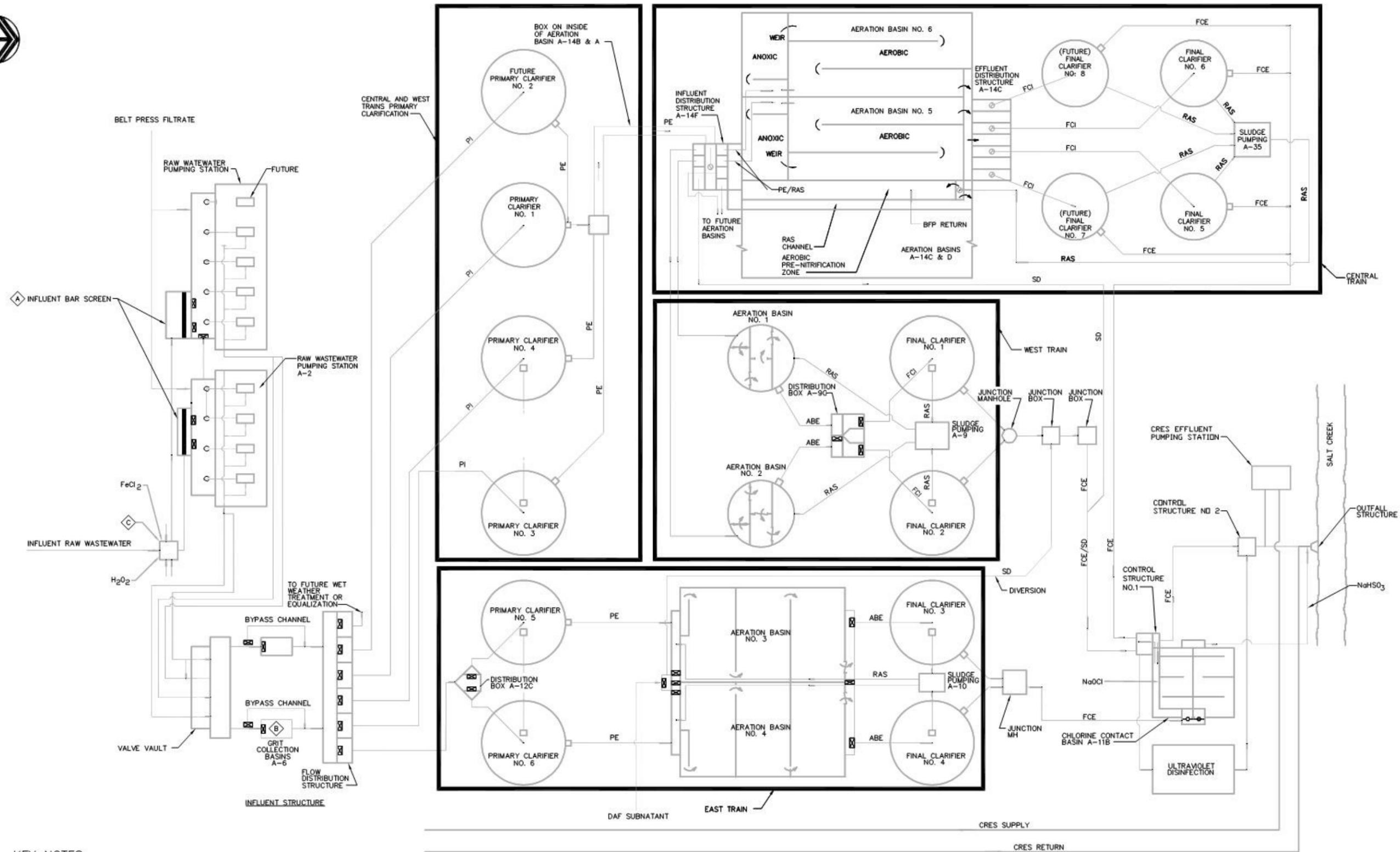
The Theresa Street WWTF is the larger of the two wastewater treatment facilities owned and operated by the City of Lincoln Public Works and Utilities. This WWTF is located at 2400 Theresa Street. The site is bordered by Salt Creek to the north, Nebraska Innovation Campus property to the west and south, and residential property to the east. The 100-year floodplain elevation around the facility varies from near 1148 to 1149 feet above mean sea level (MSL). Nearly all structures in the treatment process have a top of wall elevation greater than the 100-year flood level to allow treatment during flood conditions at Salt Creek.

The original treatment facilities were constructed in 1923 and consisted of influent pumps, imhoff tanks, fixed nozzle trickling filters, secondary clarifiers, and sludge drying beds. Upgrades in the 1940's and 1950's added primary clarifiers, additional trickling filters and anaerobic digestion. In 1968 the West Side activated sludge system and solids dewatering equipment was added. Major improvements including the construction of a 10 mgd activated sludge process, an influent pumping station and chlorination facilities for effluent disinfection were added in 1973. Egg shaped anaerobic digesters and a co-generation facility to produce electricity from biogas were added in 1992. Improvements to existing aeration basins to provide nitrification and denitrification were completed in a period from 1998 to 2003. In 2007 the Central Train Nitrification Improvements Project was completed which results in the current 27 mgd facility.

Since the addition of activated sludge treatment, there have been several other improvements that have increased the capacity of the treatment facility. The current configuration of the Theresa Street WWTF consists of preliminary, primary, and secondary treatment, followed by disinfection. The liquid process schematic for the current configuration is shown in Figure 5.1, and the hydraulic profile is shown in Figure 5.2. The solids generated at the facility are anaerobically digested and dewatered. The dewatered biosolids are then trucked to agricultural lands within Lancaster County for disposal. A schematic of the solids handling process is shown in Figure 5.3. A current aerial photograph of the facility is shown in Figure 5.4. An overview of the treatment facility processes is outlined below. The current rated treatment capacity for the Theresa Street WWTF is shown in Table 5.1 below.

The wastewater treatment facilities are staffed and operated 24/7 in accordance with the Nebraska Department of Environmental Quality (NDEQ) Title 197 Rules and Regulations for Certification of Wastewater Treatment Operations in Nebraska. Current staffing for the

Theresa Street WWTF and Northeast WWTF includes 35 employees. These positions include administration, maintenance staff, treatment operators, technicians, and control/instrumentation staff. The Theresa Street WWTF currently has nine fulltime certified Grade IV wastewater treatment operators that operate the facility 24 hours per day, seven days a week. The facility operators rotate on three 8-hour shifts per day. Figure 2.1 in Section 2 shows the organization chart for the wastewater Section.

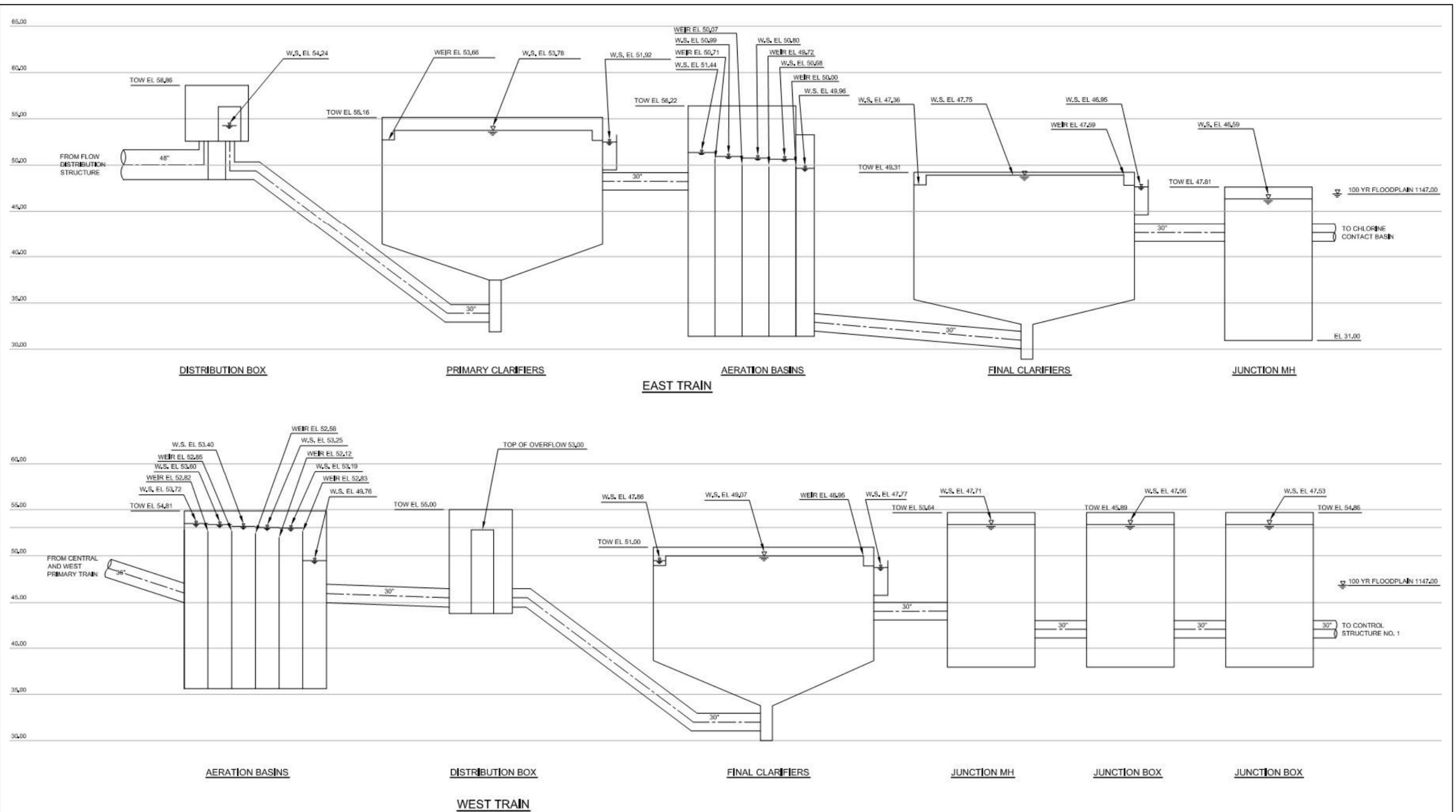


**KEY NOTES:**

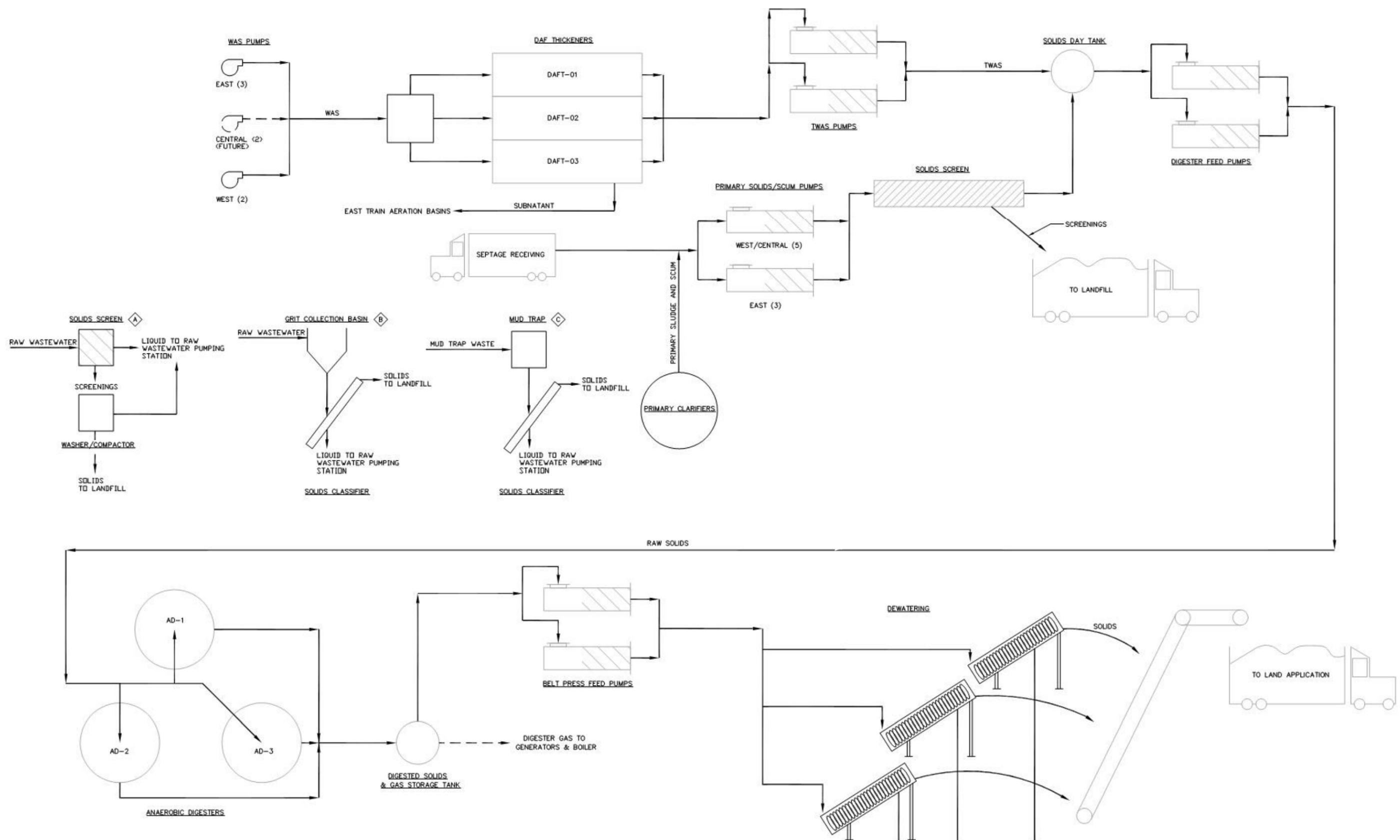
- Ⓐ SCREENING (SEE FIGURE 5.3)
- Ⓑ GRIT COLLECTION (SEE FIGURE 5.3)
- Ⓒ MUD TRAP (SEE FIGURE 5.3)

**FIGURE 5.1 – THERESA STREET LIQUID PROCESS SCHEMATIC**  
 WASTEWATER FACILITIES MASTER PLAN UPDATE - 2014  
 CITY OF LINCOLN, NEBRASKA

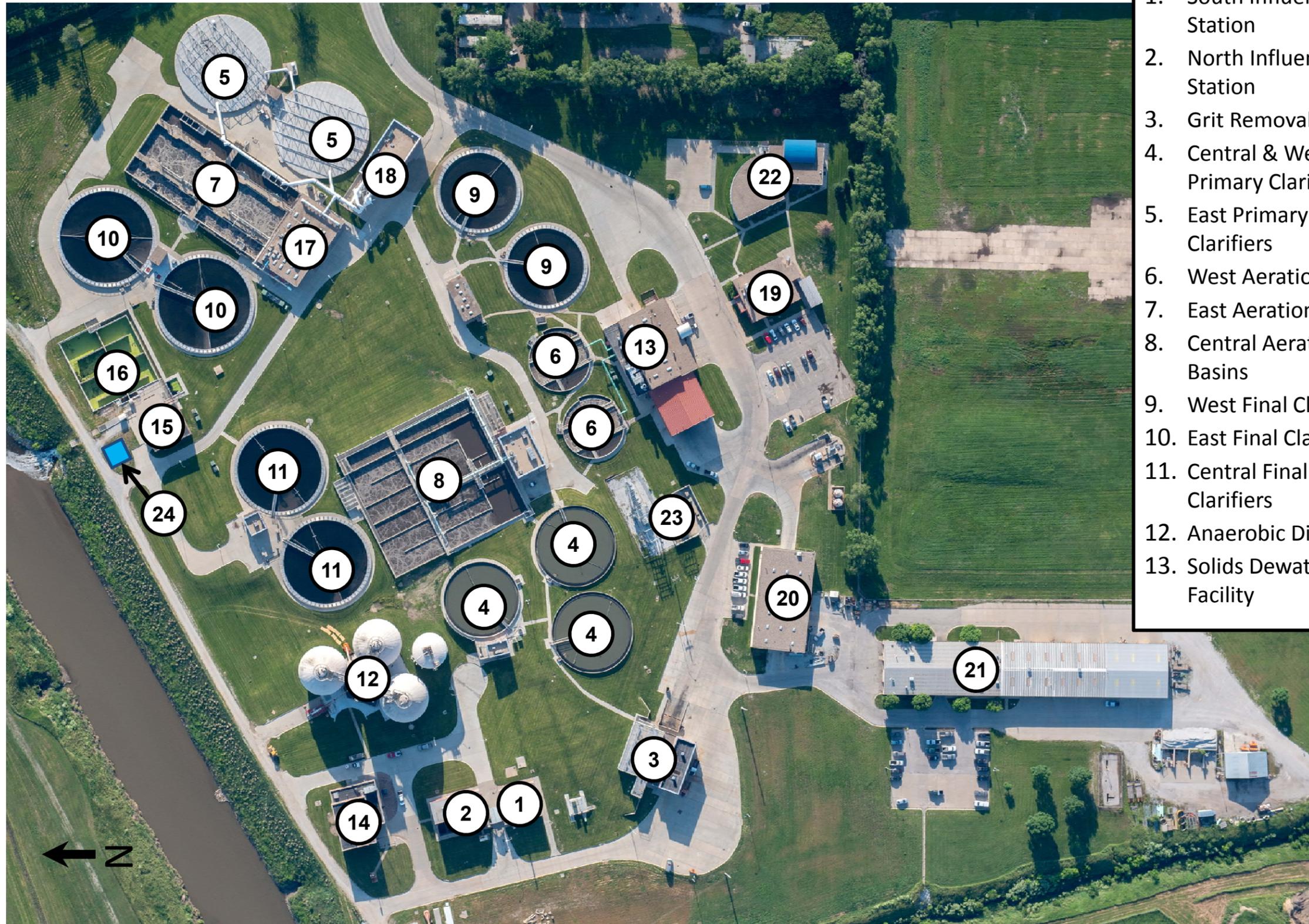




**FIGURE 5.2B – THERESA STREET WWTf HYDRAULIC PROFILE – EAST AND WEST TRAIN**  
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**FIGURE 5.3 – THERESA STREET WWTF SOLIDS PROCESS SCHEMATIC**  
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 CITY OF LINCOLN, NEBRASKA



- |                                      |                                    |
|--------------------------------------|------------------------------------|
| 1. South Influent Pump Station       | 14. Co-Generation Facility         |
| 2. North Influent Pump Station       | 15. UV Disinfection Facility       |
| 3. Grit Removal Facility             | 16. Chlorine Contact Basins        |
| 4. Central & West Primary Clarifiers | 17. Secondary Solids Thickening    |
| 5. East Primary Clarifiers           | 18. Odor Scrubber Facility         |
| 6. West Aeration Basins              | 19. Laboratory                     |
| 7. East Aeration Basins              | 20. Treatment Facility Maintenance |
| 8. Central Aeration Basins           | 21. Collection System Maintenance  |
| 9. West Final Clarifiers             | 22. WW Division Administration     |
| 10. East Final Clarifiers            | 23. Electrical Substation          |
| 11. Central Final Clarifiers         | 24. CRES Effluent Pumping Station  |
| 12. Anaerobic Digesters              |                                    |
| 13. Solids Dewatering Facility       |                                    |

**FIGURE 5.4 – THERESA STREET WWTP AERIAL PHOTO**  
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<b>Table 5.1 Rated Capacity of the Theresa Street WWTF Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>				
<b>Parameter</b>	<b>Units</b>	<b>AAD</b>	<b>MMAD</b>	<b>PHF</b>
Flow <sup>(1)</sup>	mgd	24 <sup>(5)</sup>	27.4 <sup>(5)</sup>	87.0
Flow <sup>(2)</sup>				68.2
Flow <sup>(3)</sup>				65.0
BOD <sub>5</sub>	mg/l	260	329	N/A
	lbs/day	52,040 <sup>(5)</sup>	74,080 <sup>(5)</sup>	N/A
COD	mg/l	555	694	N/A
	lbs/day	111,088	156,275	N/A
NH <sub>3</sub> <sup>(4)</sup>	mg/l	23	30	N/A
	lbs/day	4,604	6,755	N/A
TKN <sup>(4)</sup>	mg/l	40	50	N/A
	lbs/day	8,010 <sup>(5)</sup>	11,260 <sup>(5)</sup>	N/A
TSS	mg/l	270	333	N/A
	lbs/day	54,040 <sup>(5)</sup>	74,990 <sup>(5)</sup>	N/A

**Notes:**

1. Based on Influent firm pumping capacity.
2. Based on Secondary Clarifier Overflow Rates of 1,000 gpd/ft<sup>2</sup> , with all six secondary clarifiers in service.
3. Based on Hydraulic Capacity
4. Does not include loadings from DAF subnatant to the East Train.
5. October 13, 2006 Theresa Street WWTF Treatment Capacity Letter, HDR.

A Supervisory Control and Data Acquisition (SCADA) system has been in place at the WWTF's for many years. The SCADA system has been upgraded numerous times to stay current with software and hardware technology. The current system uses fiber optic connections between the Theresa Street WWTF and Northeast WWTF to monitor treatment processes and allow for changes to operations as needed.

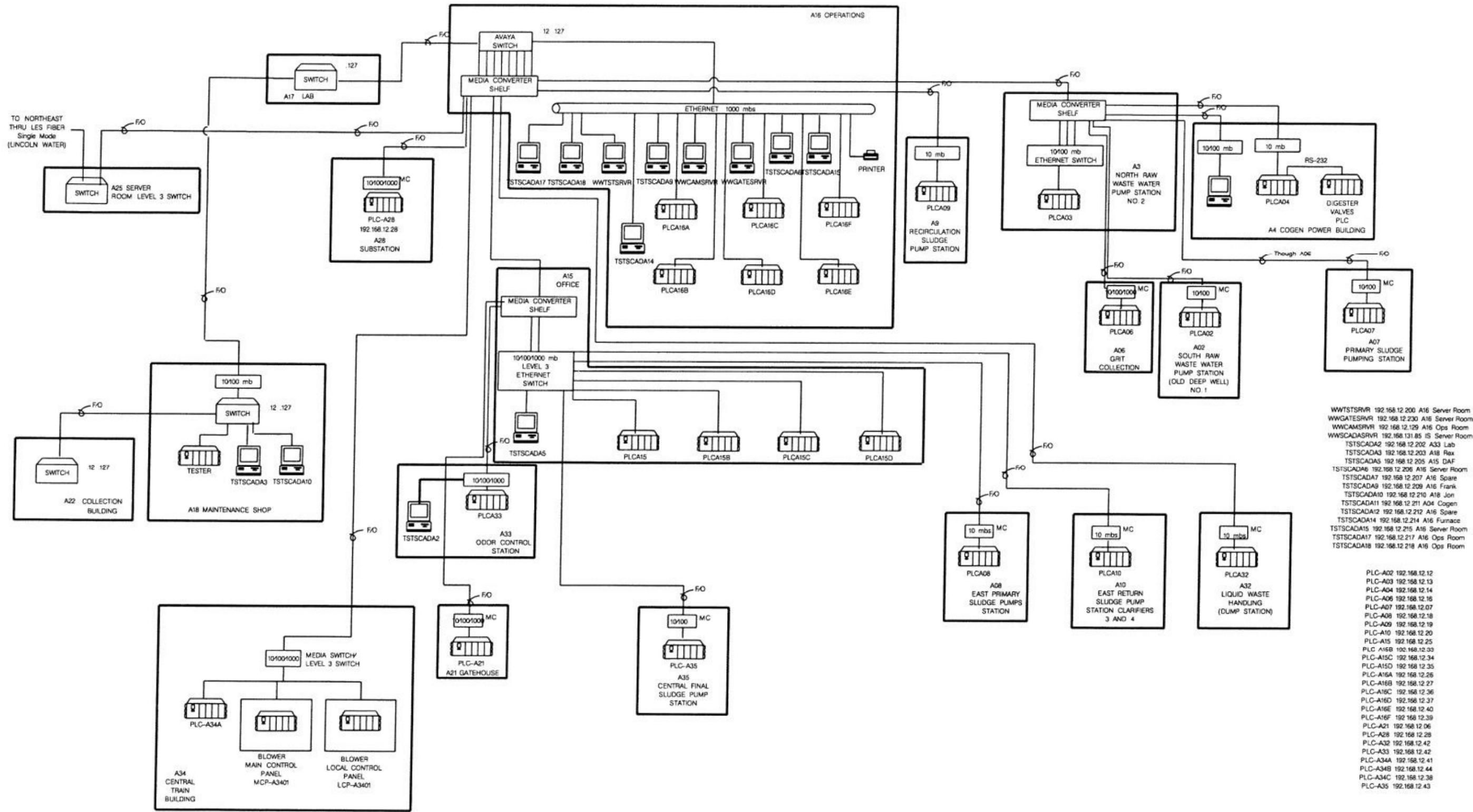
The system originated as a monitoring tool with very little control or automation function. Currently the system employs extensive control and automation strategies to assist the operation, maintenance and administrative staff. Many of the plant processes have been automated by SCADA and some of the traditional operational decision making tasks are less time consuming. Some automated processes include but would not be limited to are ; Activated Sludge SRT Control, Primary Solids Inventory and Pumping, Digester Feed, Ultraviolet Disinfection and Dewatered Solids Loading.

The Human Machine Interface (HMI) uses workstation PC's running Genesis32 by Iconics. Data informational screens are created and maintained by WWTF staff. The system provides for remote control access and for monitoring process performance in real time and

historical trends. It also provides equipment and process alarming in addition to data management including custom weekly and daily reporting. A schematic of the SCADA control system for Theresa Street WWTF is shown in Figure 5.6.

In addition to the SCADA system, a Computerized Maintenance Management System (CMMS) is utilized to manage the work flow and maintain records to effectively maintain the WWTF's. The CMMS tracks and automates all maintenance activities and effectively manages both planned and unplanned work order logistics.

This includes preventative maintenance scheduling, equipment checklists, and the ability to add additional information for each piece of equipment such as repair/replacement history, maintenance logs, and photographs. The MMS has been effective for efficient scheduling and reporting of equipment maintenance.



- WWTTSRVR 192.168.12.200 A16 Server Room
- WWGATESRVR 192.168.12.230 A16 Server Room
- WWCAMSRVR 192.168.12.129 A16 Ops Room
- WWSCADSRVR 192.168.131.85 IS Server Room
- TSTSCADA2 192.168.12.202 A33 Lab
- TSTSCADA3 192.168.12.203 A18 Rex
- TSTSCADA5 192.168.12.205 A15 DAF
- TSTSCADA6 192.168.12.206 A16 Server Room
- TSTSCADA7 192.168.12.207 A16 Spare
- TSTSCADA9 192.168.12.209 A16 Frank
- TSTSCADA10 192.168.12.210 A18 Jon
- TSTSCADA11 192.168.12.211 A04 Cogen
- TSTSCADA12 192.168.12.212 A16 Spare
- TSTSCADA14 192.168.12.214 A16 Furnace
- TSTSCADA15 192.168.12.215 A16 Server Room
- TSTSCADA17 192.168.12.217 A16 Ops Room
- TSTSCADA18 192.168.12.218 A16 Ops Room

- PLC-A02 192.168.12.12
- PLC-A03 192.168.12.13
- PLC-A04 192.168.12.14
- PLC-A06 192.168.12.16
- PLC-A07 192.168.12.07
- PLC-A08 192.168.12.18
- PLC-A09 192.168.12.19
- PLC-A10 192.168.12.20
- PLC-A15 192.168.12.25
- PLC-A16A 192.168.12.03
- PLC-A15C 192.168.12.34
- PLC-A15D 192.168.12.35
- PLC-A16A 192.168.12.26
- PLC-A16B 192.168.12.27
- PLC-A16C 192.168.12.36
- PLC-A16D 192.168.12.37
- PLC-A16E 192.168.12.40
- PLC-A16F 192.168.12.39
- PLC-A21 192.168.12.06
- PLC-A28 192.168.12.28
- PLC-A32 192.168.12.42
- PLC-A33 192.168.12.42
- PLC-A34A 192.168.12.41
- PLC-A34B 192.168.12.44
- PLC-A34C 192.168.12.38
- PLC-A35 192.168.12.43

**FIGURE 5.5 – THERESA STREET SCADA SYSTEM DIAGRAM**  
 WASTEWATER FACILITIES MASTER PLAN UPDATE - 2014  
 CITY OF LINCOLN, NEBRASKA

### 5.1.2 Liquid Treatment

Preliminary treatment consists of influent pumping, screening, and grit removal. The removed screenings and grit are hauled to the landfill for disposal. The firm influent pumping capacity is 87 mgd with the largest pump out of service and the total pumping capacity is 109 mgd with all pumps operating. There are three influent pumps rated at 10 mgd, one pump rated at 12 mgd, three pumps rated at 15 mgd, and one pump rated at 22 mgd. The current capacity of the grit handling facilities is 100 mgd.

Primary treatment consists of five primary clarifiers, two serving the east secondary treatment train, and three that serve the central and west secondary treatment trains. Each clarifier has sludge and scum equipment. The clarifiers range in size from 100 to 125 feet in diameter.

Secondary treatment consists of activated sludge process designed for BOD oxidation and nitrification. The secondary treatment process at this facility consists of three treatment trains. The capacity of each train is outlined in Table 5.2 below.

<b>Train</b>	<b>Rated MMAD Capacity</b>	<b>Number of Aeration Basins</b>	<b>Number of Clarifiers</b>
East	10 mgd	2	2
Central	13 mgd	2	2
West	4.4 mgd	2	2
Total MMAD Capacity	27.4 mgd	N/A	N/A

The primary method of disinfection at the Theresa Street WWTF is provided by UV disinfection. The UV disinfection system is designed for a peak flow of 36 mgd. Flows above 36 mgd can be disinfected using the liquid sodium hypochlorite system that is also used for odor control. The chlorine system can also be used to provide redundancy and reliability in the event that the UV system is off line.

### 5.1.3 Biosolids Treatment

The solids generated at the Theresa Street Wastewater Treatment Facility are from three separate sources in the WWTF.

1. Primary thickening and surface scum from the primary clarifiers.
2. Waste activated sludge, scum, and aeration basin foam and scum from the final clarifiers.
3. Solids from the Septage Receiving Station.

The primary sludge and septage is screened using a Parkson Strain Press prior to being mixed with the thickened waste activated sludge. The waste activated sludge (WAS) is

thickened from 0.5 percent to 1.0 percent solids using the dissolved air flotation process to 4 percent to 5 percent solids. The thickened WAS, primary sludge, and septage is then pumped to a 6000-gallon solids equalization tank prior to being pumped to three egg-shaped anaerobic digesters that are operating in the mesophilic temperature range in parallel operation.

The digester bio-gas generated by the anaerobic digestion process is used for heating of the digesters and to produce electricity. The electricity is produced in two Waukesha internal combustion engines that drive two 450-kilowatt generators. The waste heat from the engines is used to heat the digesters, digester facility building, and co-generation building. The electricity that is produced averages 440,000 kw-hrs/month and supplements the power provided by Lincoln Electric System local electric utility. This electrical generation provides approximately 40 to 60-percent of the Theresa Street facility electrical needs and reduces overall operating costs.

Following the 18 to 20 day detention time in the digesters, overflow from the digesters goes to a 500,000-gallon sludge storage tank. The resultant digested biosolids are currently dewatered by three, two-meter belt filter presses to a solids content ranging from 15 to 17 percent. The belt presses operate approximately 45 to 50 hours per week generating approximately 1,100 cubic yards of dewatered digested sludge or biosolids per week. The City is in the process of replacing the existing belt presses with three (3) Andritz D6LXE2 centrifuges. Each machine will be sized for 175 gpm / 2400 lbs. of solids per hour feed to produce a 22-24 percent cake with maximum polymer usage at 20-22 lbs. / active polymer per dry ton solids. Commissioning of the new centrifuges and emulsion polymer system is expected to be in April 2015.

The dewatered biosolids generated by the belt presses (centrifuges) are loaded into 32-yard transport trailers and then transported to agricultural ground located in Lancaster County as part of the Land Application Program. The Land Application Program is a partnership between the City of Lincoln and the University of Nebraska Cooperative Extension in Lancaster County. This partnership began in 1992 just after the egg-shaped anaerobic digesters came into operation. Prior to 1992, raw solids were hauled to the sanitary landfill.

County Extension coordinates the distribution of dewatered biosolids to the participants and determines the appropriate cropland loading rates, maps and records applications using GIS software, and educates local farmers on the benefits of biosolids usage. Typically, there are 20 to 25 farmers participating in the program.

If weather conditions prevent hauling biosolids to the field, the biosolids are hauled to the Bluff Road Sanitary Landfill to a dedicated holding facility where biosolids can be stored until field conditions improve.

Table 5.3 shows the annual volumes for biosolids applied on cropland for the Land Application Program

<b>Table 5.3 Theresa Street WWTF Annual Biosolids Land Application Volumes <sup>(1)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>	
<b>Year</b>	<b>Biosolids Volume (Dry Tons)</b>
2003	7,245
2004	6,500
2005	5,843
2006	6,437
2007	5,698
2008	6,813
2009	6,886
2010	8,079
2011	5,618
3023	5,300
2013	6,750
<b>Notes:</b> 1. From City records.	

The biosolids program has been very successful. The participants are realizing the benefits of using the biosolids and there have been very few complaints from surrounding neighbors.

#### **5.1.4 Odor Control**

The Theresa Street WWTF incorporates several methods of odor control, and is currently constructing odor control improvements for the liquid waste receiving station. The receiving station will utilize a two-stage bio-trickling filter/bio-filter system with synthetic permanent rock media.

Headworks odor control is accomplished by using the US Peroxide PRI-SC process. The process is a proprietary hydrogen sulfide odor and corrosion control technology that combines the use of iron salts and hydrogen peroxide whereby iron salts are added as the primary sulfide control agent in the upper reaches of the collection system, and hydrogen peroxide is added at specific point downstream to regenerate the spent iron. This system has worked effectively for many years.

Primary clarifier odor control at the east side of the facility is accomplished with chemical oxidation wet scrubbers.

With development of Innovation Campus adjacent to the treatment facility to the south and west additional odor improvements to the West Side primary clarifiers and grit distribution structure may be necessary.

### **5.1.5 Recently Completed Improvements**

Since the last Master Plan Update in 2007, the following projects that were identified have been completed at the Theresa Street WWTF.

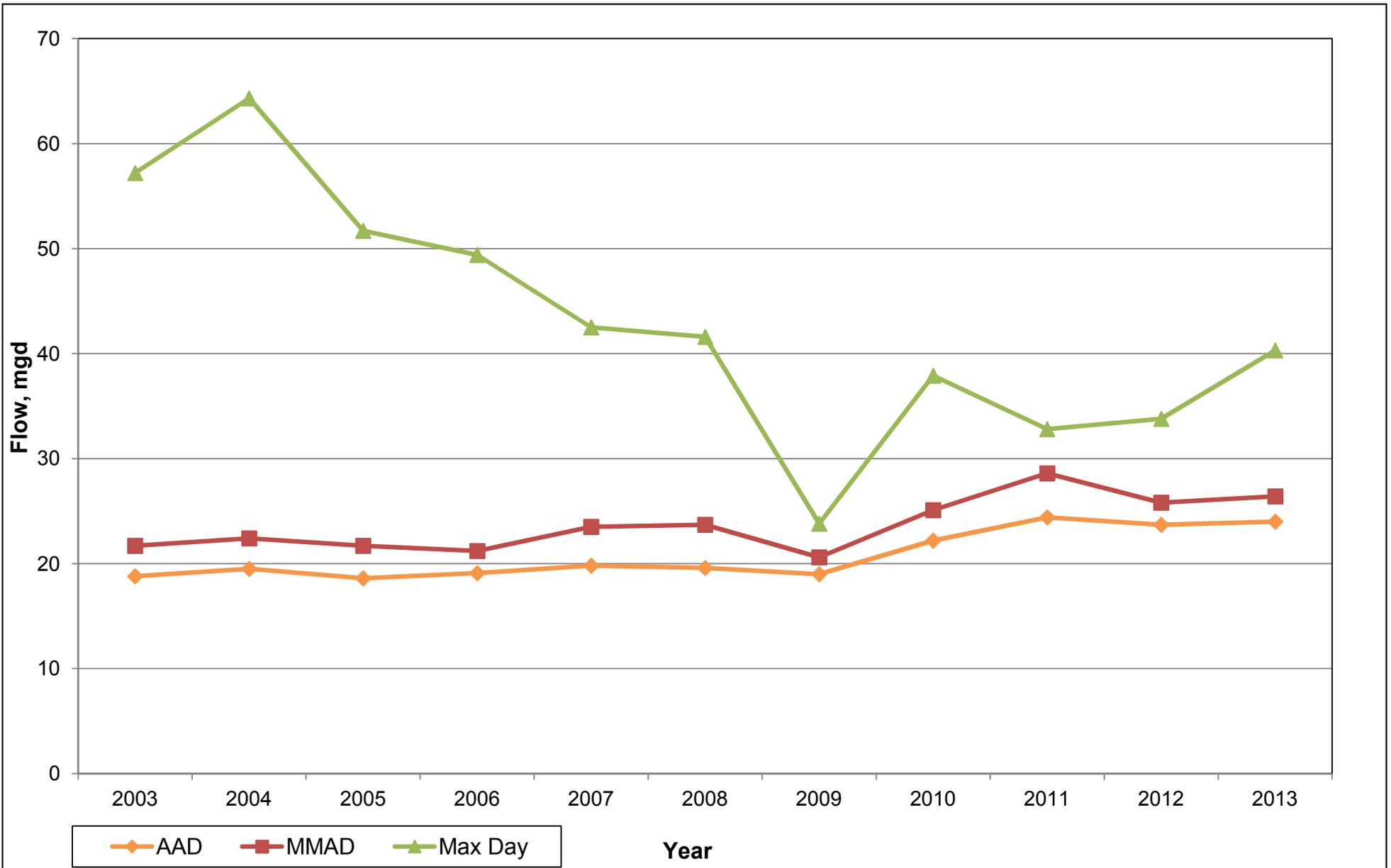
1. Digester Mixing Improvements.
2. Replacement of the belt filter presses with centrifuges is in progress.
3. Headworks pump replacement is an ongoing progressive project.
4. Electrical substation improvements.
5. Odor control improvements at septage receiving station.
6. Site security Improvements.
7. Site Surveillance.
8. HVAC improvements at both WWTF's

### **5.1.6 Historical Influent Flows**

Historical influent flows to the Theresa Street WWTF from 2004 through 2013 are shown in Figure 5.6 and Table 5.4. The flows shown represent the annual averages for the annual average daily flow (AAD), maximum monthly average day flow (MMAD), and peak daily flow (PDF). Ratios for the MMAD:AAD and PDF:AAD are provided to depict how the flows MMAD and PDF change in comparison to the AAD flows.

<b>Table 5.4 Theresa Street WWTF Historical Influent Flows Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>					
<b>Year</b>	<b>AAD (mgd)</b>	<b>MMAD (mgd)</b>	<b>Max. Day PDF (mgd)</b>	<b>MMAD:AAD Ratio</b>	<b>PDF:AAD Ratio</b>
2004	19.5	22.4	64.3	1.15	3.29
2005	18.6	21.7	51.7	1.16	2.78
2006	19.1	21.2	49.4	1.11	2.59
2007	19.8	23.5	42.5	1.19	2.15
2008	19.6	23.7	41.6	1.21	2.12
2009	19.0	20.6	23.8	1.08	1.25
2010	22.2	25.1	37.9	1.13	1.71
2011	24.4	28.6	32.8	1.17	1.34
2012	23.7	25.8	33.8	1.09	1.43
2013	24.0	26.4	40.3	1.10	1.68
Avg.	-	-	-	1.14	2.13
<u>Notes:</u> 1. From City records.					

The average MMAD:AAD ratio at the Theresa Street WWTF for this time frame varied from 1.08 to 1.21 with an average of 1.14. The PDF:AAD ratio varied between 1.25 to 3.29 with an average of 2.13. These factors as well as the AAD, MMAD, and PDF are all important considerations when evaluating and designing improvements to the facility.



**FIGURE 5.6 – THERESA STREET WWTF INFLUENT FLOW COMPARISON**

WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
CITY OF LINCOLN, NEBRASKA

### 5.1.7 Historical Influent Quality

Influent loading to the Theresa Street WWTF is shown in Table 5.5 and Figure 5.7. The AAD and MMAD concentration values for the influent BOD<sub>5</sub>, COD, and TSS are shown for years 2004 to 2013. In addition to the concentrations, the influent mass loadings are shown in Table 5.6 and shown graphically in Figure 5.08.

<b>Table 5.5 Theresa Street WWTF Average Influent Loading Concentrations <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>										
Year	BOD (mg/l)		CBOD (mg/l)		COD (mg/l)		TSS (mg/l)		TKN (mg/l)	
	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD
2004	281	324	244	284	574	646	299	336	48	54
2005	289	330	271	311	563	646	275	337	51	57
2006	256	281	223	250	517	563	232	256	51	54
2007	260	295	220	255	542	595	268	288	46	55
2008	272	336	235	292	553	634	255	286	40	47
2009	287	337	248	289	577	667	234	265	43	52
2010	249	323	237	291	526	659	228	249	40	47
2011	262	343	261	326	528	686	218	287	41	46
2012	265	346	282	348	563	680	240	278	44	50
2013	295	344	295	338	585	656	157	228	45	51

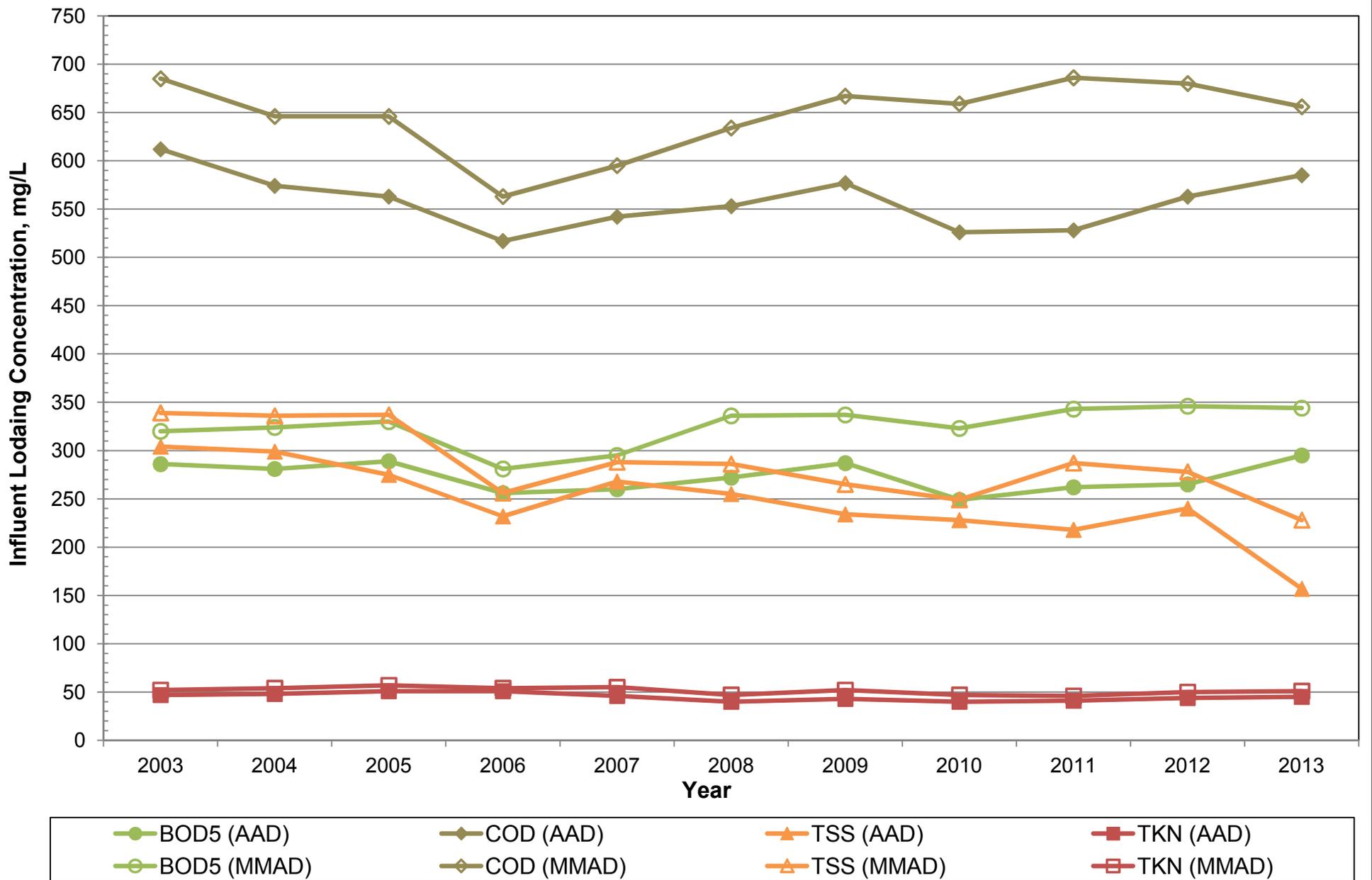
**Notes:**  
 1. AAD = Annual average day from City daily records.  
 2. MMAD = Maximum month average day (calendar month) from City daily records.

**Table 5.6 Theresa Street WWTF Average Influent Mass Loading <sup>(1,2)</sup>  
Wastewater Facilities Master Plan Update - 2014  
City of Lincoln, Nebraska**

Year	BOD (lbs/day)		CBOD (lbs/day)		COD (lbs/day)		TSS (lbs/day)		TKN (lbs/day)	
	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD
2004	45,699	60,528	39,682	53,056	93,350	120,683	48,626	62,770	7,806	10,088
2005	44,831	59,723	42,039	56,284	87,335	116,912	42,659	60,990	7,911	10,316
2006	40,779	49,683	35,523	44,202	82,355	99,956	36,956	45,263	8,124	9,548
2007	42,521	47,169	35,979	40,767	89,325	116,554	44,175	52,329	7,594	10,804
2008	43,826	49,748	37,803	42,189	90,250	125,216	41,712	53,602	6,461	9,376
2009	45,462	53,233	39,237	45,539	91,480	114,414	37,178	41,845	6,829	8,913
2010	46,347	65,061	43,845	59,150	97,435	138,126	42,023	50,255	7,372	9,768
2011	53,267	73,106	53,134	68,799	107,385	163,627	44,213	60,534	8,443	10,915
2012	52,710	68,644	55,631	69,715	111,066	146,413	47,464	56,236	8,770	10,748
2013	59,495	67,951	59,070	65,834	128,745	131,355	45,763	52,656	9,983	10,205

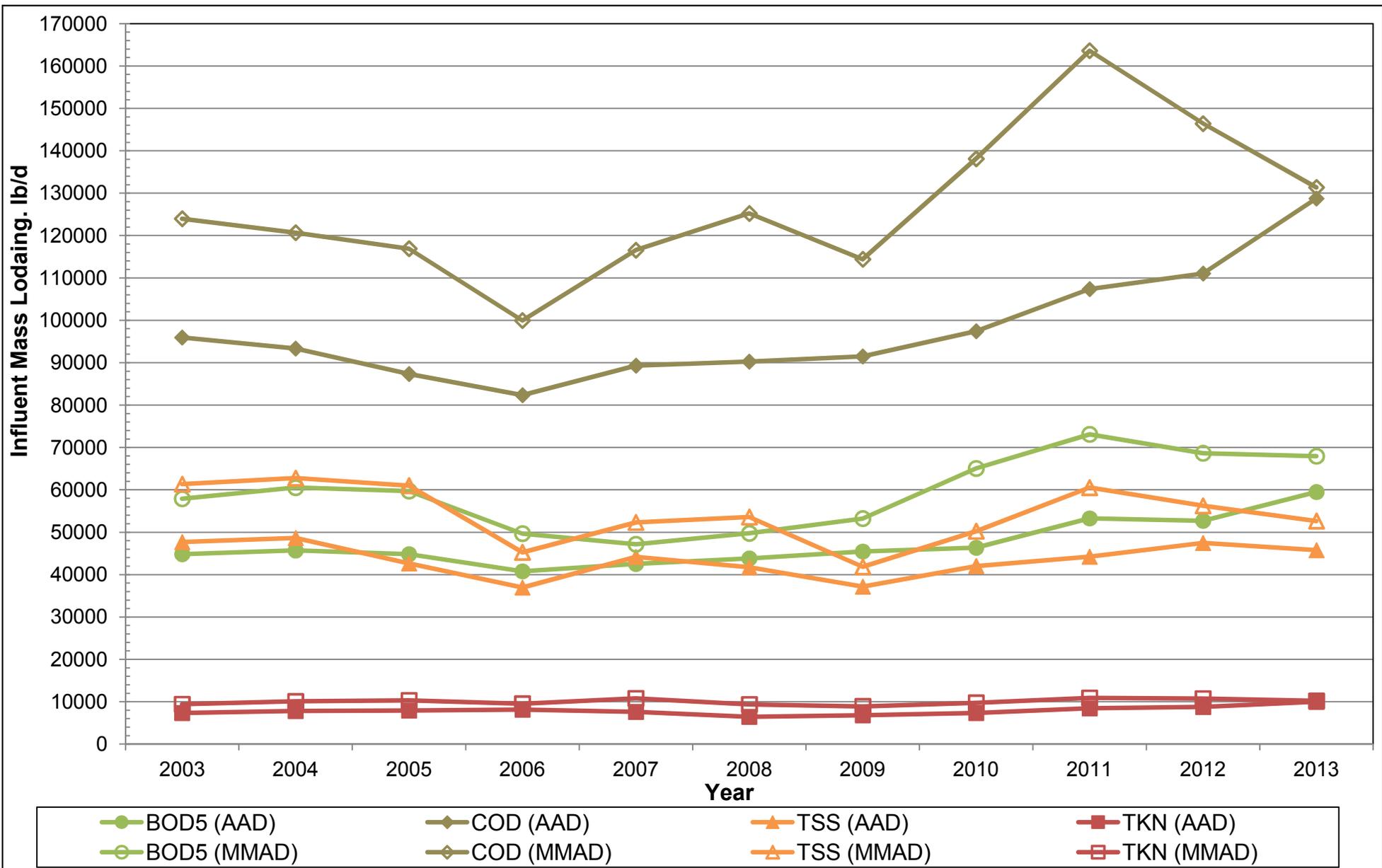
**Notes:**

1. AAD = Annual average day from City daily records.
2. MMAD = Maximum month average day (calendar month) from City daily records.



**FIGURE 5.7 – THERESA STREET WWTF INFLUENT LOADING CONCENTRATIONS**

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CITY OF LINCOLN, NEBRASKA



**FIGURE 5.8 – THERESA STREET WWTF INFLUENT MASS LOADING**

WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
CITY OF LINCOLN, NEBRASKA

### **5.1.8 Treatment Facility Performance**

The average effluent concentrations of BOD<sub>5</sub>, CBOD, COD, TSS, and ammonia (NH<sub>3</sub>-N) are shown in Table 5.7 and Figure 5.9 and reflect the level of treatment being provided by the Theresa Street WWTF for the years 2004 to 2013. Table 5.8 reflects the pollutant removal being accomplished by the WWTF for the same period.

### **5.1.9 Discharge Permit**

The National Pollutant Discharge Elimination System (NPDES) effluent discharge permit for the Theresa Street WWTF is located in Appendix A. The permit limits require the Theresa Street WWTF to meet a monthly average CBOD of 25 mg/l and a monthly average TSS of 30 mg/l throughout the year.

The discharge limitations for NH<sub>3</sub> vary based on the time of the year and are divided into three separate seasonal requirements (spring, summer, and winter). The current permit limits from March 1 to May 31 require the monthly average NH<sub>3</sub>-N to be 8.3 mg/l or less. For the period from June 1 to October 31, the monthly average NH<sub>3</sub>-N limit is 3.0 mg/l. For the period from November 1 to February 28 (29), the monthly average NH<sub>3</sub>-N limit is 9.8 mg/l.

The current NPDES permit requires a seasonal limit for *E. Coli* in the effluent from May 1 to September 30. The permit limits the monthly geometric mean of the effluent sample to a maximum of 126 CFU per 100 ml. This permit requirement was placed into effect in 2009. Prior to that the City was required to test the effluent for fecal coliform bacteria. Table 5.9A presents the effluent fecal coliform concentrations for years 2005 and 2008, while table 5.9B presents the effluent results for *E. Coli*.

Currently the WWTF is meeting the permit requirements for the above described constituents. The NPDES permits for facilities expired on March 31, 2014 and the City has applied for a new permit. The existing permits have been extended beyond the expiration date by letter notification from the NDEQ.

### **5.1.10 Future Capacity**

The Theresa Street WWTF is designed for expansion from a MMAD treated flow of 27 mgd to a MMAD treated flow of 45 mgd. This is planned to be accomplished with a 13 mgd Central Train expansion and a 5 mgd East Train expansion. Future treatment facility expansion requirements and timing are discussed in more detail in Chapter 10.

**Table 5.7 Theresa Street WWTF Average Effluent Concentrations <sup>(1)</sup>  
Wastewater Facilities Master Plan Update - 2014  
City of Lincoln, Nebraska**

<b>Year</b>	<b>BOD<sub>5</sub> (mg/l)</b>	<b>CBOD (mg/l)</b>	<b>COD (mg/l)</b>	<b>TSS (mg/l)</b>	<b>NH<sub>3</sub>-N (mg/l)</b>
2004	26.5	8.6	47.5	18.5	11.9
2005	23.3	8.6	45.0	12.9	10.8
2006	24.6	6.5	41.0	10.4	8.4
2007	23.4	6.1	40.1	8.8	7.2
2008	11.5	4.5	35.3	6.9	1.3
2009	5.8	3.4	32.9	6.0	0.1
2010	7.2	4.1	36.2	8.3	0.2
2011	6.5	4.0	37.8	7.1	0.1
2012	4.6	3.0	38.4	7.1	0.1
2013	6.5	4.4	49.5	7.8	0.1

Notes:

1. From City records.

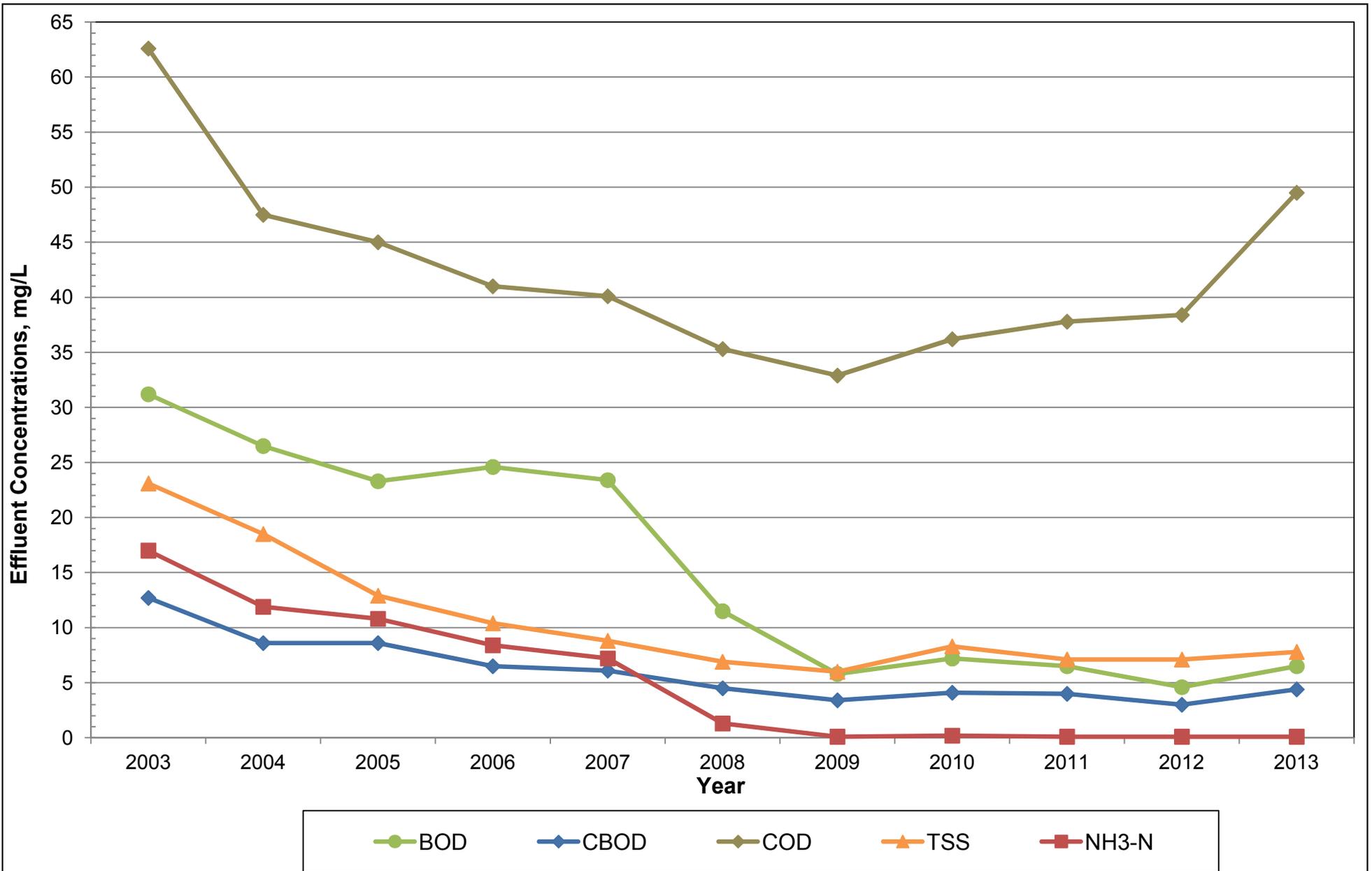
<b>Table 5.8 Theresa Street WWTF Average Influent Removal <sup>(1)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>				
<b>Year</b>	<b>BOD (%)</b>	<b>CBOD (%)</b>	<b>COD (%)</b>	<b>TSS (%)</b>
2004	90.6	96.5	91.0	93.8
2005	91.9	96.8	92.0	95.3
2006	90.4	97.1	92.1	95.5
2007	91.0	97.2	92.6	96.7
2008	95.8	98.1	93.6	97.3
2009	98.0	98.6	94.3	97.4
2010	97.1	98.3	93.1	96.4
2011	97.5	98.5	92.8	96.7
2012	98.3	98.9	93.2	97.0
2013	97.8	98.5	91.5	95.3
Average	94.8	97.8	92.6	96.1
<b>Notes:</b> 1. The percent removal is based on annual average influent and effluent values.				

<b>Table 5.9A Theresa Street WWTF Fecal Coliform Concentrations <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>					
<b>Month/Year</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>
2005	7.3	20.3	10.1	14.1	16.8
2006	33.1	156.9	35.4	19.8	35.4
2007	13.38	15.64	31.54	46.57	18.58
2008	6.09	6.47	4.95	8.19	8.08
<b>Notes:</b> 1. Data provided by City for NPDES monitoring from May through September 2. Monthly Geometric Mean					

**Table 5.9B Theresa Street WWTF Effluent E Coli Concentrations <sup>(1,2)</sup>**  
**Wastewater Facilities Master Plan Update - 2014**  
**City of Lincoln, Nebraska**

<b>Month/Year</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>
2009	2.59	5.06	4.77	7.15	6.37
2010	4.11	7.4	16.76	10.01	14.37
2011	24.44	21.91	10.42	14.01	30.12
2012	5.74	12.16	16.04	11.02	9.83
2013	14.62	36.61	33.86	58.67	21.23

**Notes:**  
1. Data provided by City for NPDES monitoring from May through September  
2. Monthly Geometric Mean



**FIGURE 5.9 – THERESA STREET WWTF EFFLUENT CONCENTRATIONS**  
 WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
 CITY OF LINCOLN, NEBRASKA

## 5.2 NORTHEAST WWTF

### 5.2.1 Overview

The Northeast WWTF is the smaller of the two wastewater treatment facilities owned and operated by the City. The treatment facility is located at 7000 North 70th Street. The site is bordered by Salt Creek to the north, City of Lincoln property to the west and east, and private property to the south. Generally, the site is undeveloped and is readily usable for future expansion. The 100-year floodplain elevation is 1131.75 feet above mean sea level (MSL). Nearly all structures in the treatment process have a top of wall elevation greater than the 100-year flood level to allow treatment during flood conditions at Salt Creek.

The original treatment facilities were constructed in 1980 with a capacity of 8 mgd and included two treatment trains consisting of influent screening and pumping, aerated grit removal, primary clarification, trickling filters, aeration basins, final clarifiers, and chlorine disinfection. Effluent disinfection improvements consisting of ultraviolet light (UV) and liquid sodium hypochlorite disinfection facilities were completed in 2003 and are used to disinfect flows up to 16 mgd. Flows in excess of 16 mgd are disinfected by the liquid sodium hypochlorite system.

A treatment facility expansion in 2004 increased the maximum month treatment facility nitrification capacity to 10 mgd with the construction of a new treatment train, process upgrades, and modifications to the existing treatment system. The 2004 expansion included construction of two new aeration basins, new aeration blowers and building, and one new final clarifier. The original trickling filter towers were demolished at this time as well.

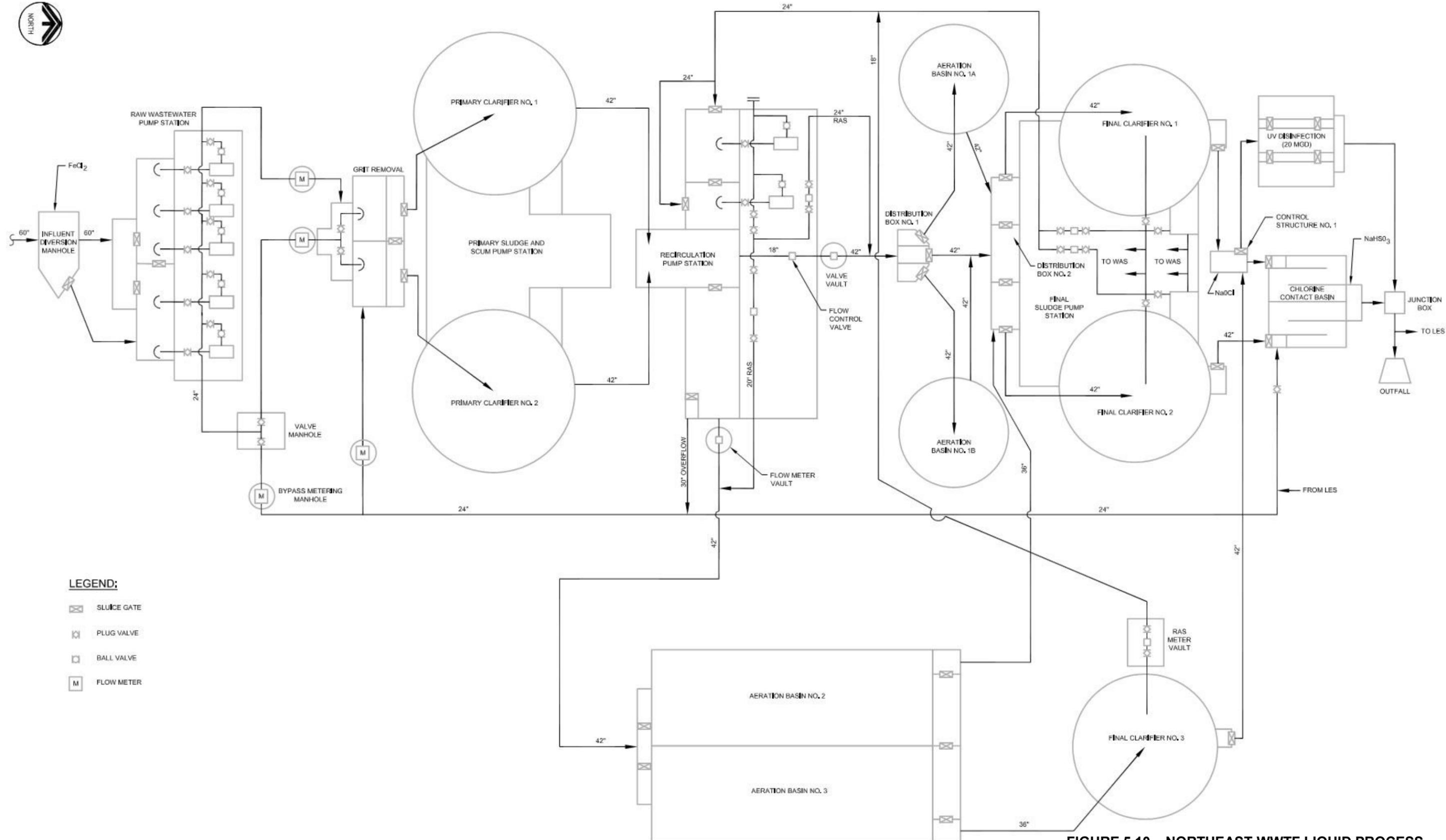
The liquid process schematic for the current configuration is shown in Figure 5.10, and the hydraulic profile is shown in Figure 5.11.

The solids generated at the facility are thickened, anaerobically digested, and transferred to a biosolids storage lagoon prior to subsurface injection. The City has approximately 440-acres for biosolids injection on property 2 miles north of the Northeast WWTF. The City also contracts with private contractors to transport and inject biosolids to private farm fields in a 5 mile radius to the holding lagoon. Application quantities are shown in Figure 5.12. Excess liquid biosolids can be transported to the Theresa Street WWTF for dewatering.

A schematic of the solids handling process is shown in Figure 5.13. A current aerial photograph of the facility is shown in Figure 5.14. An overview of the treatment facility processes is presented below. The current rated capacity for the Northeast WWTF is shown in Table 5.10.

Current staffing for the Theresa Street WWTF and Northeast WWTF includes 35 employees. These positions include administration, maintenance staff, treatment operators, technicians, and control/instrumentation staff. The Northeast WWTF has one fulltime

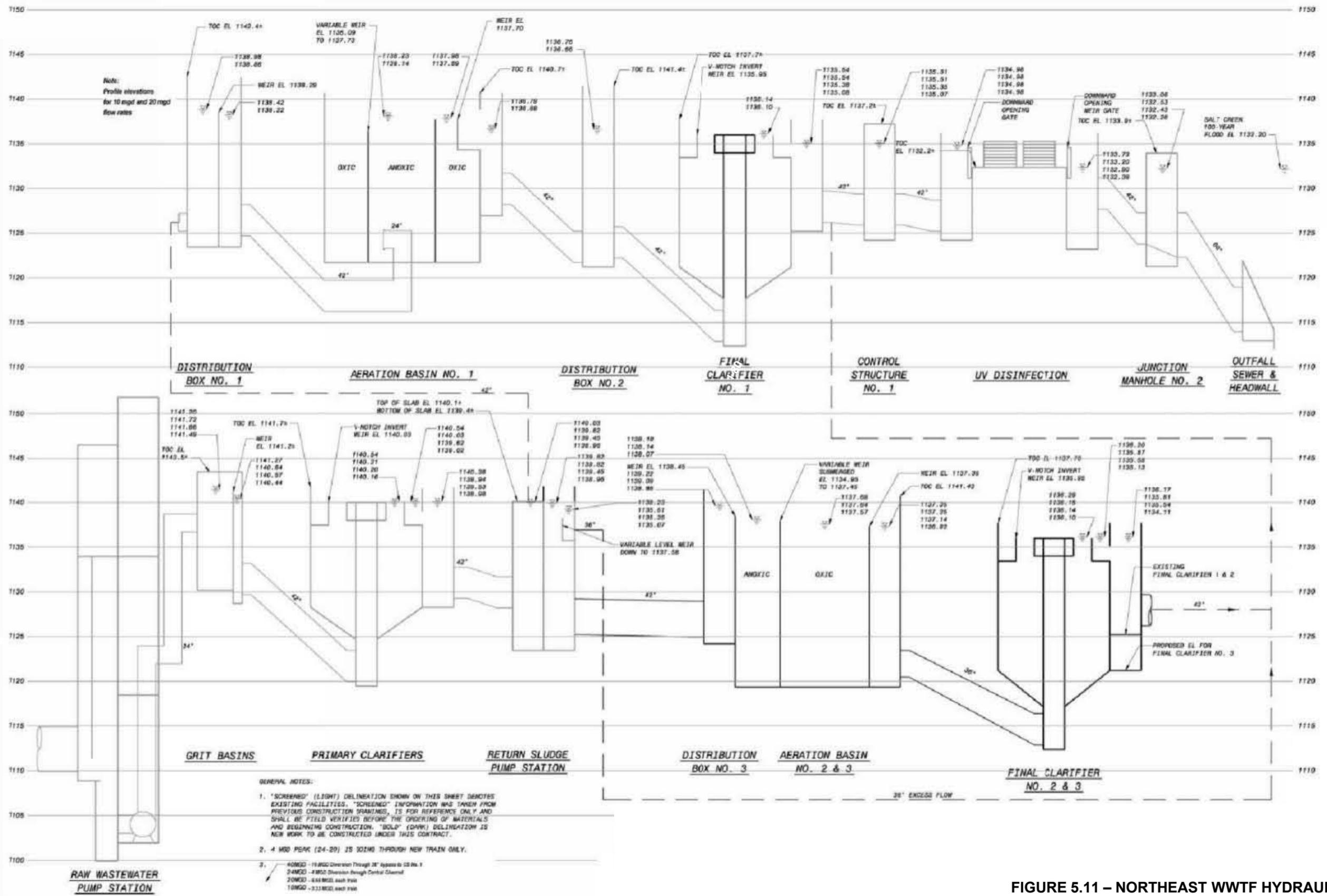
certified Grade IV wastewater treatment operator at the site each day. The operator position is supplemented by Grade IV licensed maintenance staff. The treatment facility is staffed nine hours a day and is unstaffed and monitored with SCADA from the Theresa Street WWTF from 4:00PM to 7:00AM. Figure 2.1 in Section 2 shows the organization chart for the Wastewater Section.



**LEGEND:**

-  SLUICE GATE
-  PLUG VALVE
-  BALL VALVE
-  FLOW METER

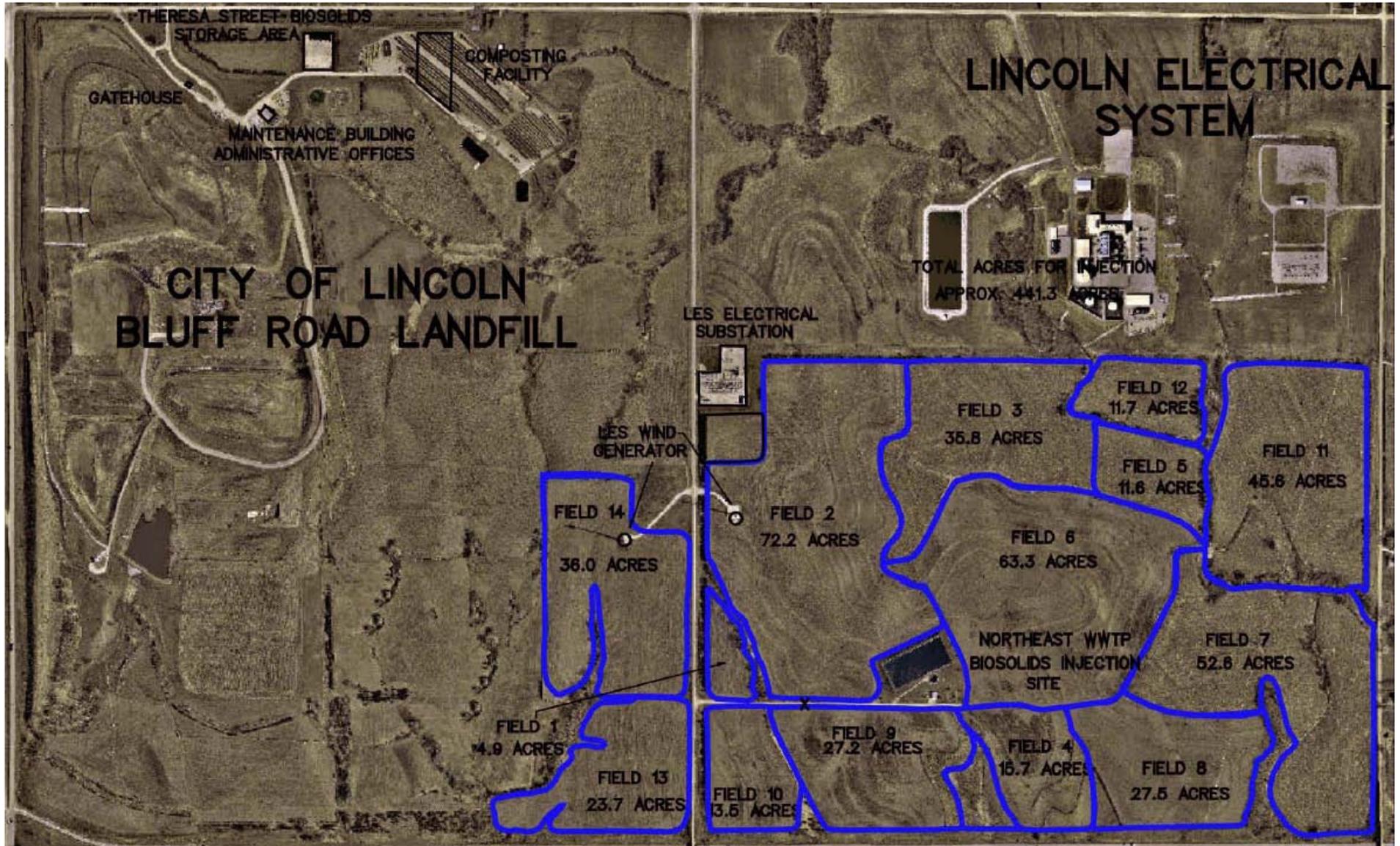
**FIGURE 5.10 – NORTHEAST WWTf LIQUID PROCESS SCHEMATIC**  
WASTEWATER FACILITIES MASTER PLAN UPDATE - 2014  
CITY OF LINCOLN, NEBRASKA



GENERAL NOTES:

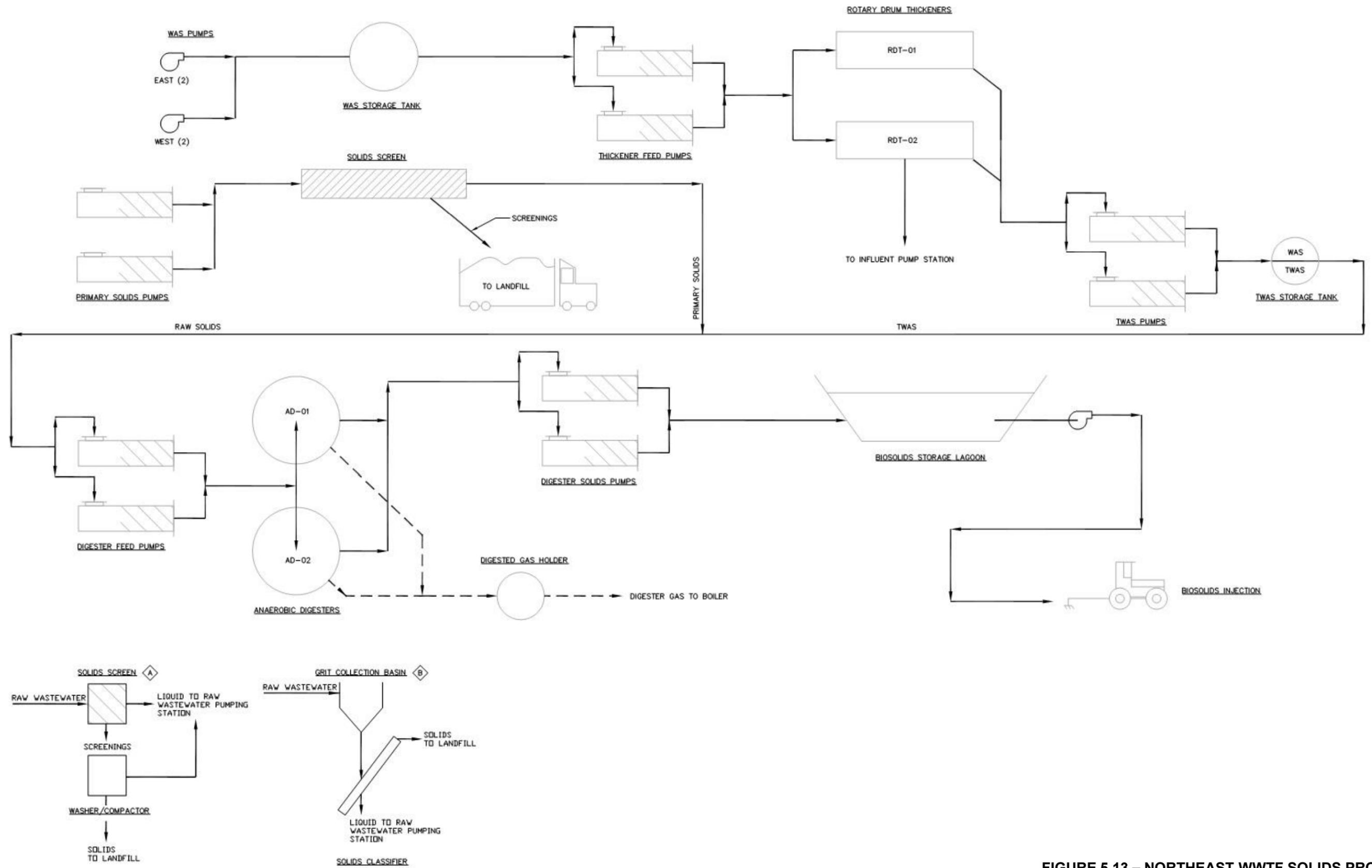
1. "SCREENED" (LIGHT) DELINEATION SHOWN ON THIS SHEET DENOTES EXISTING FACILITIES. "SCREENED" INFORMATION WAS TAKEN FROM PREVIOUS CONSTRUCTION DRAWINGS. IS FOR REFERENCE ONLY AND SHALL BE FIELD VERIFIED BEFORE THE ORDERING OF MATERIALS AND BEGINNING CONSTRUCTION. "SOLID" (DARK) DELINEATION IS NEW WORK TO BE CONSTRUCTED UNDER THIS CONTRACT.
2. 4 MGD PS&K (24-29) IS 30" THROUGH NEW TRAIN ONLY.
3. 40MGD - 18"ØØ Overturn Through 36" Appear to US No. 1  
 24MGD - 48"ØØ Overturn Through Central Channel  
 20MGD - 48"ØØ each Train  
 10MGD - 24"ØØ each Train

**FIGURE 5.11 – NORTHEAST WWTF HYDRAULIC PROFILE**  
 WASTEWATER FACILITIES MASTER PLAN UPDATE - 2014  
 CITY OF LINCOLN, NEBRASKA

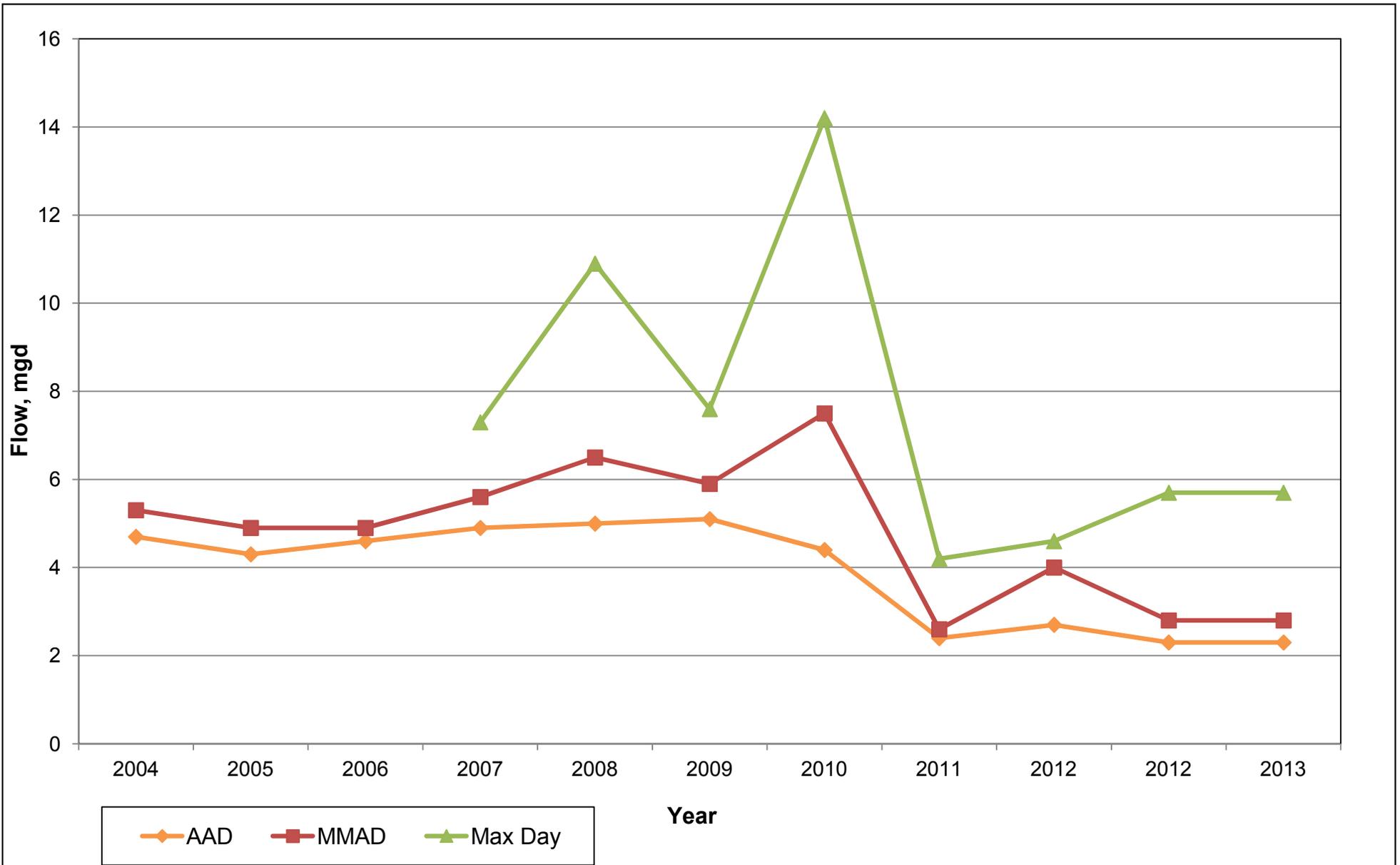


**FIGURE 5.12 – NORTHEAST WWTf BIOSOLIDS INJECTION SITES**

WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
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**FIGURE 5.13 – NORTHEAST WWTF SOLIDS PROCESS SCHEMATIC**  
 WASTEWATER FACILITIES MASTER PLAN UPDATE - 2014  
 CITY OF LINCOLN, NEBRASKA



**FIGURE 5.14 – NORTHEAST WWTF INFLUENT FLOW COMPARISON**

WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
CITY OF LINCOLN, NEBRASKA

## **5.2.2 Liquid Treatment**

Preliminary treatment consists of influent pumping, screening, and aerated grit removal. The removed screenings and grit are hauled by truck to the landfill for disposal. The firm influent pumping capacity is 34 mgd with the largest pump out of service and the total pumping capacity is 44 mgd with all pumps operating. There are three influent pumps rated at 8 mgd and two pumps rated at 10 mgd. The current average daily flow capacity of the grit handling facilities is 8 mgd.

Primary treatment consists of two primary clarifiers serving the two secondary treatment trains. Each clarifier has sludge and scum equipment. The clarifiers range in size from 100 to 125 feet in diameter.

Secondary treatment consists of activated sludge process designed for BOD oxidation and nitrification. The secondary treatment process at this facility consists of three treatment trains. The capacity of each train is outlined in Table 5.11 below.

UV disinfection facilities are used for most flows. The rated capacity of the UV disinfection facilities is 16 mgd. If flow through the treatment facility exceeds 16 mgd, the excess flow is disinfected with the liquid sodium hypochlorite system.

## **5.2.3 Odor Control**

The NE WWTF incorporates iron salts chemical feed to facility headworks for odor control. Currently there are no homes and few businesses in close proximity to the WWTF. However, this may change in the future, due in part to the current planning trends and the recently completed Stevens Creek Trunk Sewer Phase I, II, III, and IV projects. As development occurs the City will review the needs for additional odor control.

<b>Table 5.10 Rated Capacity of the Northeast WWTF Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>				
<b>Parameter</b>	<b>Units</b>	<b>AAD</b>	<b>MMAD</b>	<b>PHF</b>
Flow <sup>(1)</sup>	mgd	9.0 <sup>(4)</sup>	10.0 <sup>(4)</sup>	20.0
Flow <sup>(2)</sup>				19.0
Flow <sup>(3)</sup>				20.0 <sup>(4)</sup>
BOD <sub>5</sub>	mg/l	183	200	N/A
	lbs/day	13,740 <sup>(4)</sup>	16,680 <sup>(4)</sup>	N/A
COD	mg/l	555	694	N/A
	lbs/day	41,658	57,880	N/A
NH <sub>3</sub>	mg/l	23	30	N/A
	lbs/day	1,725	2,502	N/A
TKN	mg/l	29	32	N/A
	lbs/day	2,180 <sup>(4)</sup>	2,670 <sup>(4)</sup>	N/A
TSS	mg/l	193	210	N/A
	lbs/day	14,490 <sup>(4)</sup>	17,514 <sup>(4)</sup>	N/A
<b>Notes:</b>				
1. Based on Influent pumping capacity.				
2. Based on Secondary Clarifier Overflow Rates of 1,000 gpd/ft <sup>2</sup> , with all three secondary clarifiers in service.				
3. Based on Hydraulic Capacity				
4. Design Memorandum Black & Veatch, Olsson Associates, October 2003				

<b>Table 5.11 Northeast WWTF Secondary Treatment Summary Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>			
<b>Train</b>	<b>Capacity</b>	<b>Number of Aeration Basins</b>	<b>Number of Clarifiers</b>
1 A&B	3.34 mgd	2	1
2	3.33 mgd	1	1
3	3.33 mgd	1	1
MMAD Capacity	10.00 mgd	N/A	N/A

### 5.2.4 Biosolids Treatment

Solids at the Northeast WWTF are generated from two separate sources in the WWTF.

1. Primary sludge, and surface scum from the primary clarifiers.
2. Waste activated sludge, scum, and aeration basin foam and scum from the final clarifiers.

The primary sludge at this facility is screened using a Parkson strain press prior to being pumped to anaerobic digesters. The waste activated sludge (WAS) solids are thickened using rotary drum thickeners (RDT's). The WAS thickening facilities include WAS pumps to pump from the clarifiers to storage, aerated WAS storage tanks, thickener feed pumps, two RDT's, thickened waste activated sludge (TWAS) pumps, polymer feed equipment, and a TWAS solids storage tank. WAS is typically thickened to 5-percent to 6-percent solids.

Primary solids and TWAS can be pumped separately to the anaerobic digesters but are currently combined in storage prior to pumping. The anaerobic digestion facilities include two anaerobic digesters, a membrane type gas holder, pumping equipment, piping, and heat exchangers. Digested solids are pumped to an 8-million gallon biosolids storage lagoon located on city owned land north of the WWTF.

The digested biosolids disposal system in addition to the storage lagoon consists of a holding basin, an injection pump, lagoon pumping equipment, a tractor drawn plow injector, and approximately 500 acres of land. Ductile iron piping and a series of fixed hydrants are in place for area coverage to subsurface inject biosolids as pumped from the holding basin.

Additionally the City utilizes contractual services to have biosolids hauled and injected on privately owned farm ground or hauled to the Theresa Street WWTF for dewatering.

### **5.2.5 Recently Completed Improvements**

Since the last Master Plan Update in 2003, the following projects have been completed at the Northeast WWTF.

1. Grit Removal Project.
2. WAS/TWAS Odor Control Project (Vapex).
3. Facility Conversion from Propane to Natural Gas
4. Process Video Upgrades and Site Surveillance

### **5.2.6 Historical Influent Flows**

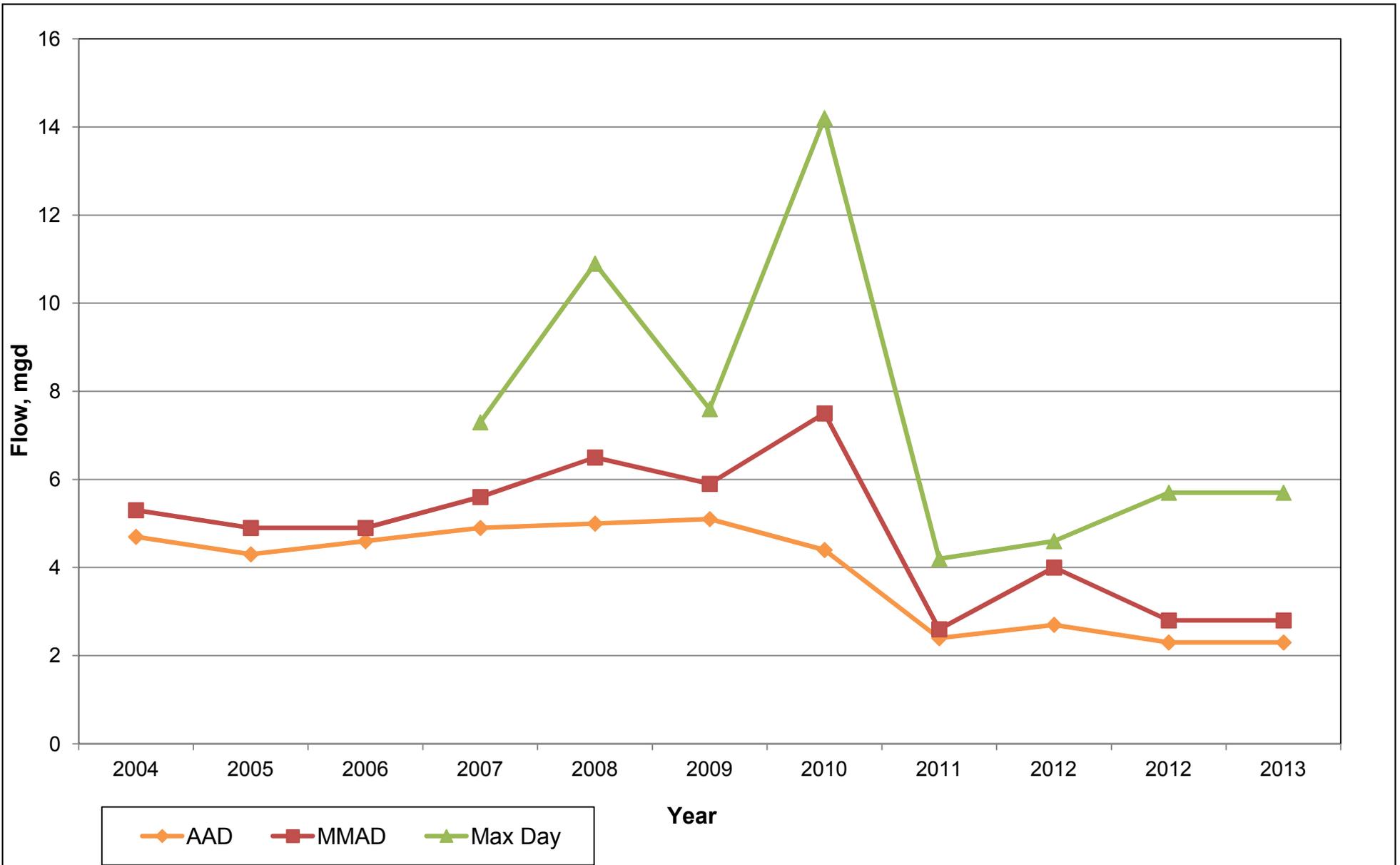
Historical influent flows to the Northeast WWTF from 2004 through 2013 are shown in Figure 5.15 and Table 5.12. The flows shown represent the annual averages for the annual average daily flow (AAD), maximum monthly average day flow (MMAD), and peak daily flow (PDF). Ratios for the MMAD:AAD and PDF:AAD are provided to depict how the flows MMAD and PDF change in comparison to the AAD flows.

**Table 5.12 Northeast WWTF Annual Average Flows <sup>(1)</sup>  
Wastewater Facilities Master Plan Update - 2014  
City of Lincoln, Nebraska**

Year	AAD (mgd)	MMAD (mgd)	Max. Day PDF (mgd)	MMAD:AAD Ratio	PDF:AAD Ratio
2004	4.7	5.3	-	1.14	-
2005	4.3	4.9	-	1.15	-
2006	4.6	4.9	-	1.06	-
2007	4.9	5.6	7.3	1.14	1.50
2008	5.0	6.5	10.9	1.30	2.18
2009	5.1	5.9	7.6	1.16	1.49
2010	4.4	7.5	14.2	1.70	3.23
2011	2.4	2.6	4.2	1.08	1.75
2012	2.7	4.0	4.6	1.48	1.70
2013	2.3	2.8	5.7	1.22	2.48
Avg				1.24	2.10

Notes:

1. From City records.



**FIGURE 5.15 – NORTHEAST WWTF INFLUENT FLOW COMPARISON**

WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
CITY OF LINCOLN, NEBRASKA

## 5.2.7 Historical Influent Quality

Influent loading to the Northeast Street WWTF for the years 2004 to 2013 are shown in Table 5.13 and Figure 5.16. In addition to the concentrations, the influent mass loadings are shown in Table 5.14 and shown graphically in Figure 5.17.

<b>Table 5.13 Northeast WWTF Average Influent Loading Concentrations <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>										
Year	BOD (mg/l)		CBOD (mg/l)		COD (mg/l)		TSS (mg/l)		TKN (mg/l)	
	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD
2004	226	255	193	234	483	549	213	241	39	46
2005	262	296	243	271	516	605	234	251	38	42
2006	269	286	228	251	556	583	251	278	38	41
2007	262	291	215	236	554	604	270	302	39	46
2008	255	296	214	265	541	604	247	269	35	40
2009	271	286	225	244	577	612	270	291	39	42
2010	250	290	215	239	530	626	243	268	33	39
2011	381	487	334	381	796	1,089	337	512	33	37
2012	331	391	295	345	734	837	302	326	36	43
2013	395	579	345	421	835	1,042	304	375	38	43

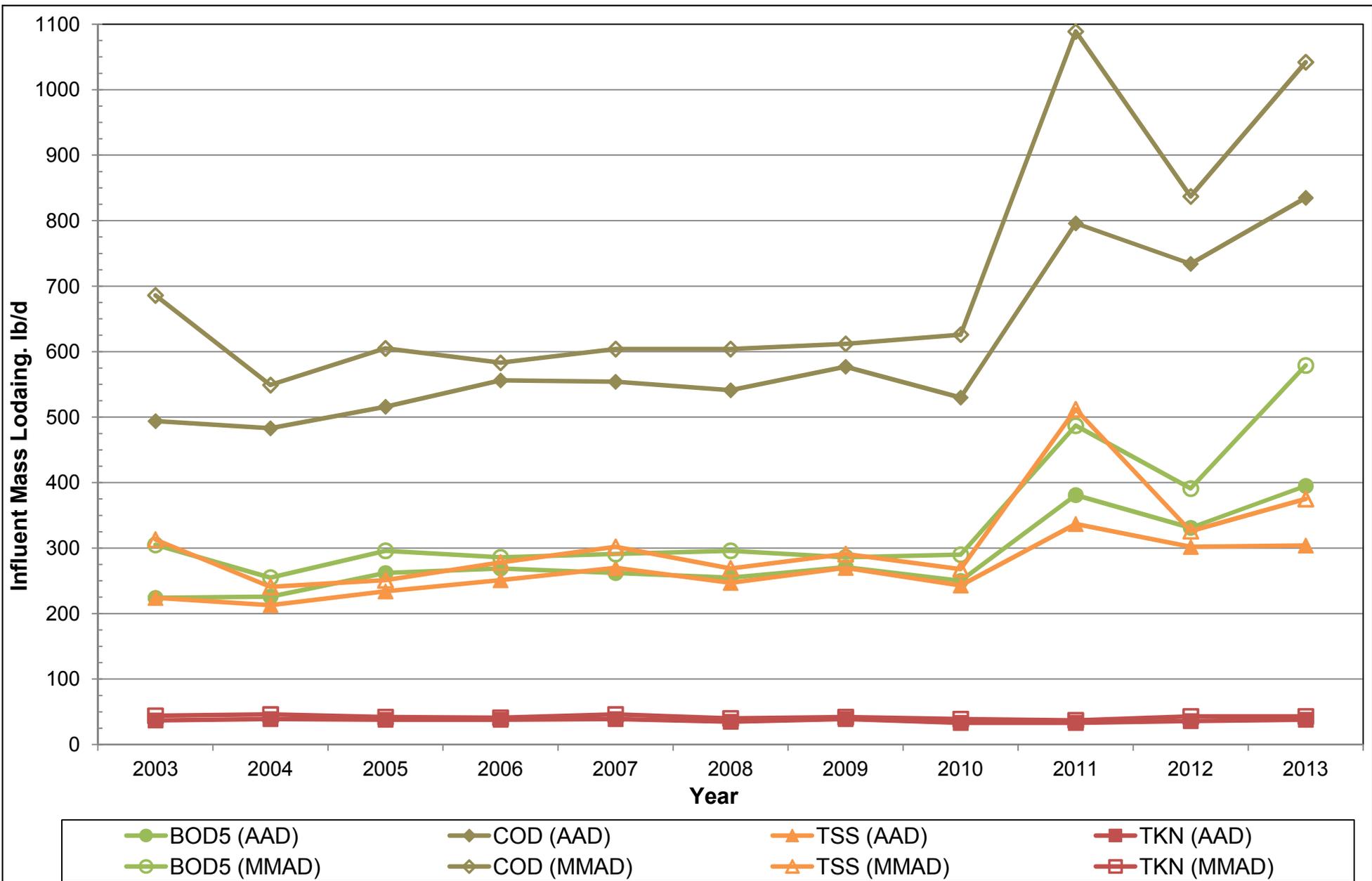
**Notes:**  
 1. AAD = Annual average day from City daily records.  
 2. MMAD = Maximum month average day (calendar month) from City daily records.

**Table 5.14 Northeast WWTF Average Influent Mass Loading <sup>(1,2)</sup>  
Wastewater Facilities Master Plan Update - 2014  
City of Lincoln, Nebraska**

Year	BOD (lbs/day)		CBOD (lbs/day)		COD (lbs/day)		TSS (lbs/day)		TKN (lbs/day)	
	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD
2004	8,859	11,272	7,565	10,343	18,933	24,267	8,349	10,653	1,529	2,033
2005	9,396	12,096	8,714	11,075	18,505	24,724	8,392	10,257	1,363	1,716
2006	10,320	11,688	8,747	10,257	21,330	23,825	9,629	11,361	1,458	1,676
2007	10,707	11,538	8,766	9,441	22,730	28,439	11,080	12,004	1,583	2,170
2008	10,410	11,485	8,724	10,336	22,372	32,706	10,152	11,920	1,468	2,190
2009	11,546	13,173	9,565	10,504	24,621	30,195	11,561	13,130	1,669	2,084
2010	9,112	13,588	7,625	11,251	19,359	39,120	8,681	13,798	1,216	2,419
2011	7,857	9,963	6,784	9,675	16,090	23,999	6,879	10,723	675	825
2012	7,556	10,915	6,523	8,397	16,450	28,236	6,788	10,200	808	1,451
2013	7,577	11,304	6,647	9,203	19,637	19,991	5,670	7,773	815	895

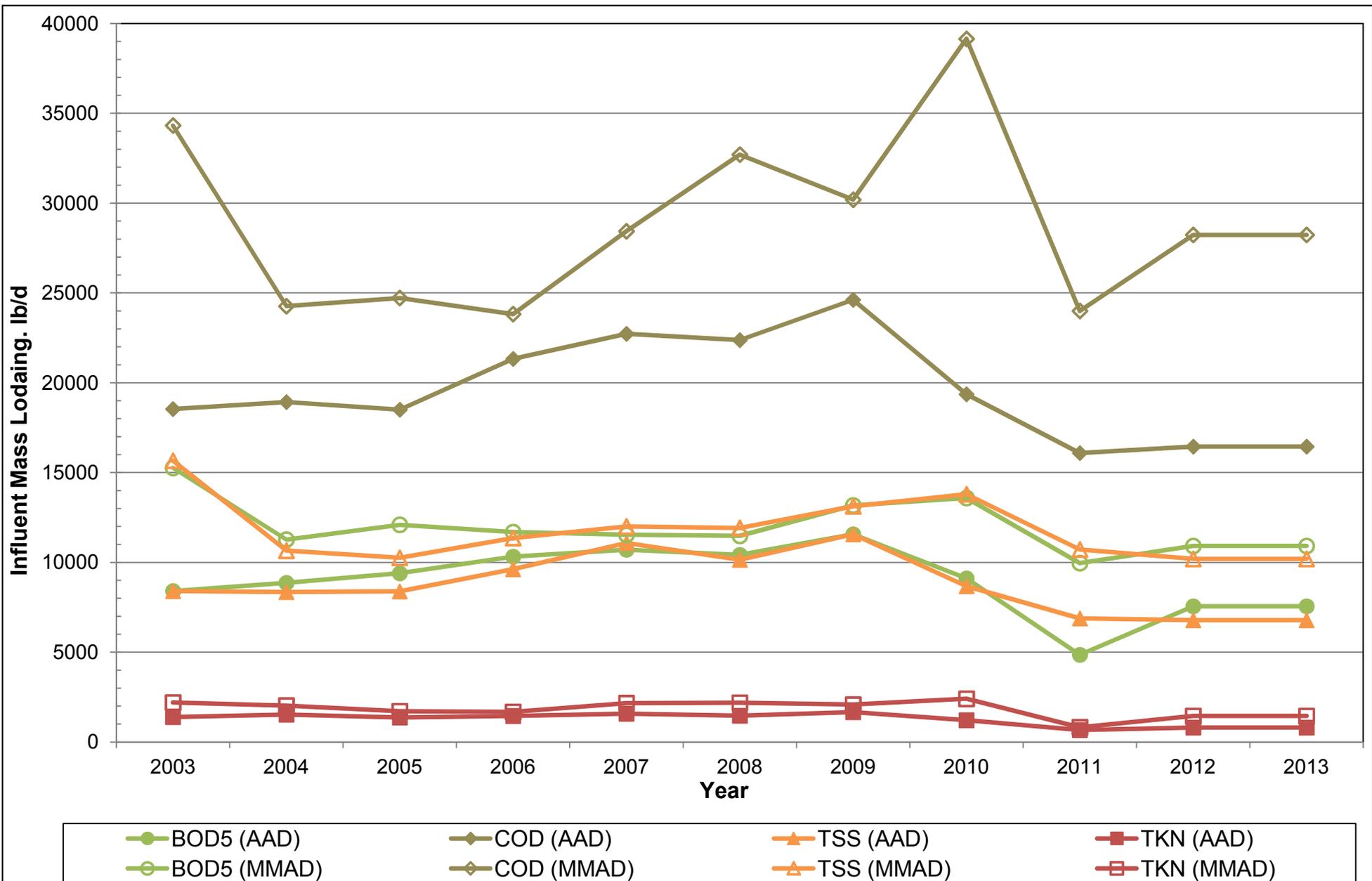
**Notes:**

1. AAD = Annual average day from City daily records.
2. MMAD = Maximum month average day (calendar month) from City daily records.



**FIGURE 5.16 – NORTHEAST WWTF INFLUENT LOADING CONCENTRATIONS**

WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
CITY OF LINCOLN, NEBRASKA



**FIGURE 5.17 – NORTHEAST WWTF INFLUENT MASS LOADING**

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CITY OF LINCOLN, NEBRASKA

## 5.2.8 Treatment Facility Performance

Effluent concentrations of BOD, CBOD, COD, TSS, and ammonia (NH<sub>3</sub>-N) show the level of treatment provided by the Northeast Street WWTF. Tables 5.15, 5.16, and Figure 5.18 present effluent discharge concentrations and percent removal values for years 2004 to 2013.

The Northeast WWTF implemented an advanced treatment project and improvements using nitrification process in 2006. This is evidenced by the drop in influent ammonia shown in the data below.

<b>Table 5.15 Northeast WWTF Average Effluent Concentrations <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>										
Year	BOD (mg/l)		CBOD (mg/l)		COD (mg/l)		TSS (mg/l)		NH <sub>3</sub> -N (mg/l)	
	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD	AAD	MMAD
2004	16.2	24.5	3.7	12.5	35.6	49.0	5.8	13.0	7.7	15.0
2005	16.5	23.6	11.7	16.1	59.2	72.5	12.5	25.1	19.4	22.4
2006	7.0	10.1	3.7	4.8	35.4	42.0	5.8	7.3	0.3	0.9
2007	5.0	7.5	3.0	4.3	29.6	34.9	3.8	7.0	0.2	0.7
2008	4.1	6.1	2.9	4.5	29.5	31.6	3.7	4.7	0.2	0.6
2009	3.4	4.3	2.4	2.8	28.3	47.0	3.5	4.3	0.2	0.6
2010	2.8	4.2	2.3	3.2	23.2	30.2	3.5	6.6	0.4	1.4
2011	2.7	4.5	2.3	2.7	29.7	34.6	2.8	4.2	0.2	0.6
2012	2.1	2.8	2.0	2.4	32.7	43.8	2.7	3.6	0.3	1.9
2013	2.8	3.5	2.7	3.1	36.0	53.8	3.5	6.1	0.2	0.4

**Notes:**  
 1. AAD = Annual average day from City daily records.  
 2. MMAD = Maximum month average day (calendar month) from City daily records.

<b>Table 5.16 Northeast WWTF Average Influent Removal <sup>(1)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>				
<b>Year</b>	<b>BOD (%)</b>	<b>CBOD (%)</b>	<b>COD (%)</b>	<b>TSS (%)</b>
2004	92.8	98.1	92.6	97.3
2005	93.7	95.2	88.5	94.7
2006	97.4	98.4	93.6	97.7
2007	98.1	98.6	94.7	98.6
2008	98.4	98.7	94.5	98.5
2009	98.7	98.9	95.1	98.7
2010	98.9	98.9	95.6	98.6
2011	99.3	99.3	96.3	99.2
2012	99.4	99.3	95.5	99.1
2013	99.3	99.2	95.7	98.8
Average	97.6	98.5	94.2	98.1
<u>Notes:</u> 1. The percent removal is based on annual average influent and effluent values.				

### 5.2.9 Discharge Permit

The National Pollutant Discharge Elimination System (NPDES) effluent discharge permit for the Northeast WWTF is located in Appendix A. The permit limits require the WWTF to meet a monthly average CBOD of 25 mg/l and a monthly average TSS of 30 mg/l. As indicated in Table 5.15 the Northeast WWTF is meeting these requirements.

The discharge limitations for NH<sub>3</sub> vary based on the time of the year and are divided into three separate seasonal requirements (spring, summer, and winter). The current permit limits from March 1 to May 31 require the monthly average NH<sub>3</sub>-N to be 17.5 mg/l or less. For the period from June 1 to October 31, the monthly average NH<sub>3</sub>-N limit is 11.2 mg/l. For the period from November 1 to February 28 (29), the monthly average NH<sub>3</sub>-N limit is 12.7 mg/l. The Northeast WWTF implemented full nitrification treatment in 2006. As a result, the effluent ammonia-nitrogen concentrations have been reduced significantly and are well below the discharge permit limits.

The current NPDES permit requires a seasonal limit for *E. Coli* in the effluent from May 1 to September 30. The permit limits the monthly geometric mean of the effluent sample to a maximum of 126 CFU per 100 ml. This permit requirement was placed into effect in 2009. Prior to that the City was required to test the effluent for fecal coliform bacteria. Table 5.17A presents the effluent fecal coliform concentrations for years 2005 and 2008, while table 5.17B presents the effluent results for *E. Coli*.

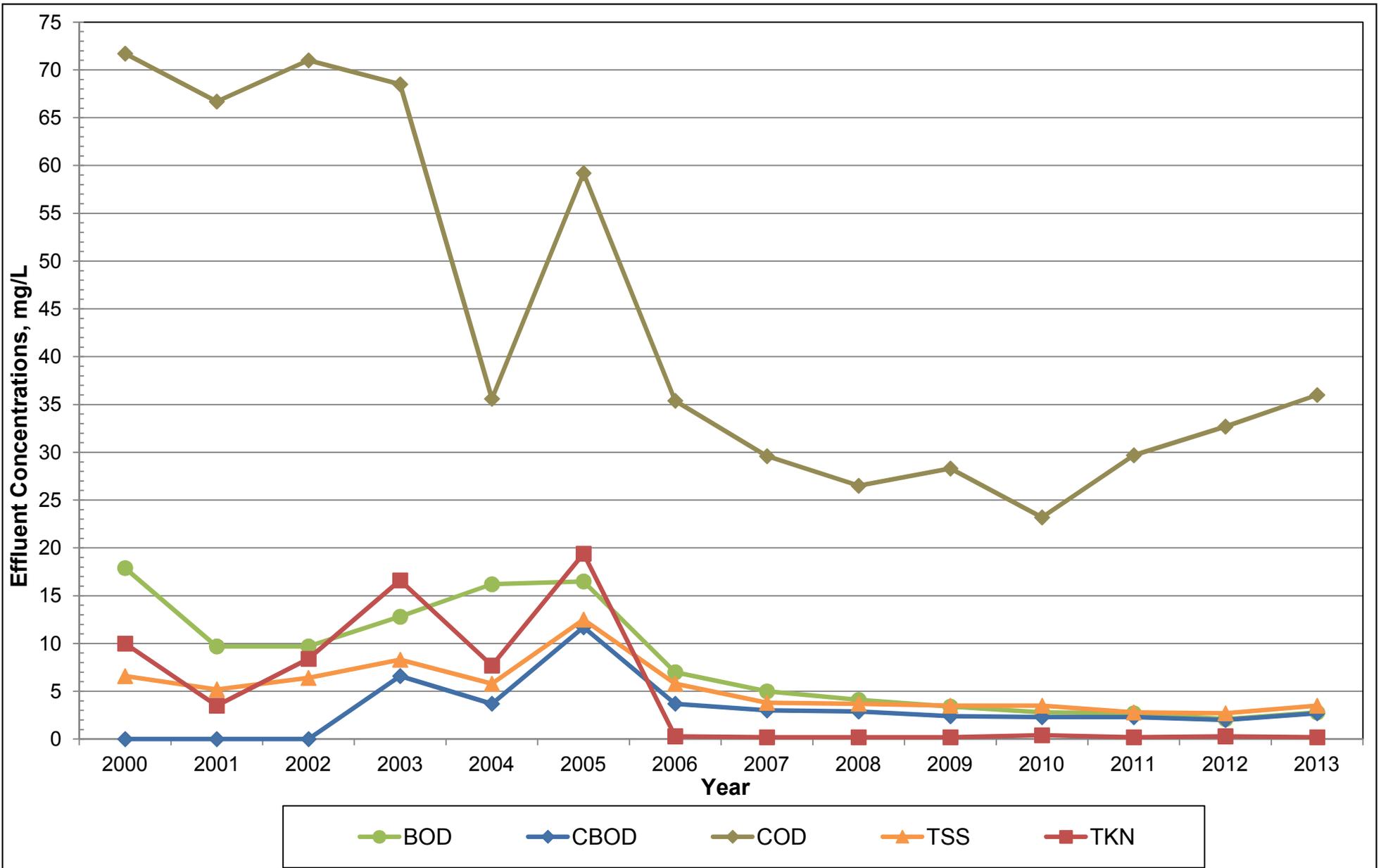
Currently the WWTF is meeting the permit requirements for the above described constituents. The NPDES permits for facilities expired on March 31,2014 and the City has applied for a new permit. The existing permits have been extended beyond the expiration date by letter notification from the NDEQ.

<b>Table 5.17A Northeast WWTF Fecal Coliform Concentrations <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>					
<b>Month/Year</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>
2005	18.9	5.5	6.6	8.0	5.3
2006	4.8	6.1	4.0	4.2	4.2
2007	8.93	9.88	7.12	3.65	4.89
2008	5.31	5.08	7.41	6.68	8.55
<b>Notes:</b> 1. Data provided by City for NPDES monitoring from May through September. 2. Monthly Geometric Mean.					

<b>Table 5.17B Northeast WWTF Effluent E Coli Concentration <sup>(1,2)</sup> Wastewater Facilities Master Plan Update - 2014 City of Lincoln, Nebraska</b>					
<b>Month/Year</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>
2009	1.99	5.92	1.94	4.76	2.89
2010	2.16	4.29	2.95	3.31	2.09
2011	4.73	1.92	2.67	5.72	4.84
2012	4.28	8.16	14.22	6.32	2.45
2013	2.28	1.27	1.48	3.22	5.32
<b>Notes:</b> 1. Data provided by City for NPDES monitoring from May through September. 2. Monthly Geometric Mean.					

### 5.2.10 Future Capacity

The Northeast WWTF has is rated for a MMAD flow of 10.0 mgd. Future expansion and improvements will require construction of new facilities on land adjacent to the existing facilities. Future treatment facility expansion requirements and timing are discussed in more detail in Chapter 10.



**FIGURE 5.18 – NORTHEAST WWTF EFFLUENT CONCENTRATIONS**  
 WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
 CITY OF LINCOLN, NEBRASKA

### 5.3 COMPARISON OF WATER USAGE TO WASTEWATER FLOW

Data provided by the City was used to compare the wastewater flows as recorded at the two wastewater treatment facilities to the water consumption for the City. The winter season is used to compare the wastewater flow to the water consumption. Table 5.18 shows the winter average influent flows at both wastewater treatment facilities as well as the water use for the same period from the City drinking water system. The winter months of December, January, and February were used to compare the values since water loss from irrigation, lawn watering, and other outdoor uses and the influence of rain events are minimal during the winter months. The winter season wastewater flows when compared to the water consumption for the same period provides an indication of the 'water tightness' of the collection system. Additionally, this data should correlate and be relatively constant over time, with the wastewater flows being less than the water consumption values. As shown in Table 5.18, the City's collection system has averaged approximately 93.6 percent of the water consumption over the last 10 years.

<b>Year <sup>(1)</sup></b>	<b>Theresa St WWTF Flow <sup>(1)</sup> (MGD)</b>	<b>Northeast WWTF Flow <sup>(1)</sup> (MGD)</b>	<b>Total WW Flow <sup>(1)</sup> (MGD)</b>	<b>Total Water Usage <sup>(2)</sup> (MGD)</b>	<b>Percent of WW flow to Water Usage (%)</b>
2004	17.1	5.3	22.4	25.7	87.0
2005	18.2	4.9	23.1	25.8	89.6
2006	19.4	3.8	23.3	26.8	87.0
2007	19.4	5.0	24.3	25.8	94.2
2008	20.4	5.1	25.2	26.4	95.5
2009	19.4	4.6	24.0	25.9	92.6
2010 <sup>(3)</sup>	22.2	2.3	24.5	24.6	99.6
2011 <sup>(3)</sup>	22.8	2.4	25.2	25.4	99.2
2012 <sup>(3)</sup>	23.0	2.2	25.2	26.1	96.5
2013 <sup>(3)</sup>	22.3	2.2	24.5	25.9	94.6
Period Average	--	--	--	--	93.6

**Notes:**  
1. Winter months only - December of year indicated through February of the following year.  
2. Total flow from drinking water system. Source: City of Lincoln metered water records.  
3. The drop in flows to the NE WWTF for these years is due to additional flow being directed from the NE WWTF to the Theresa St. WWTF

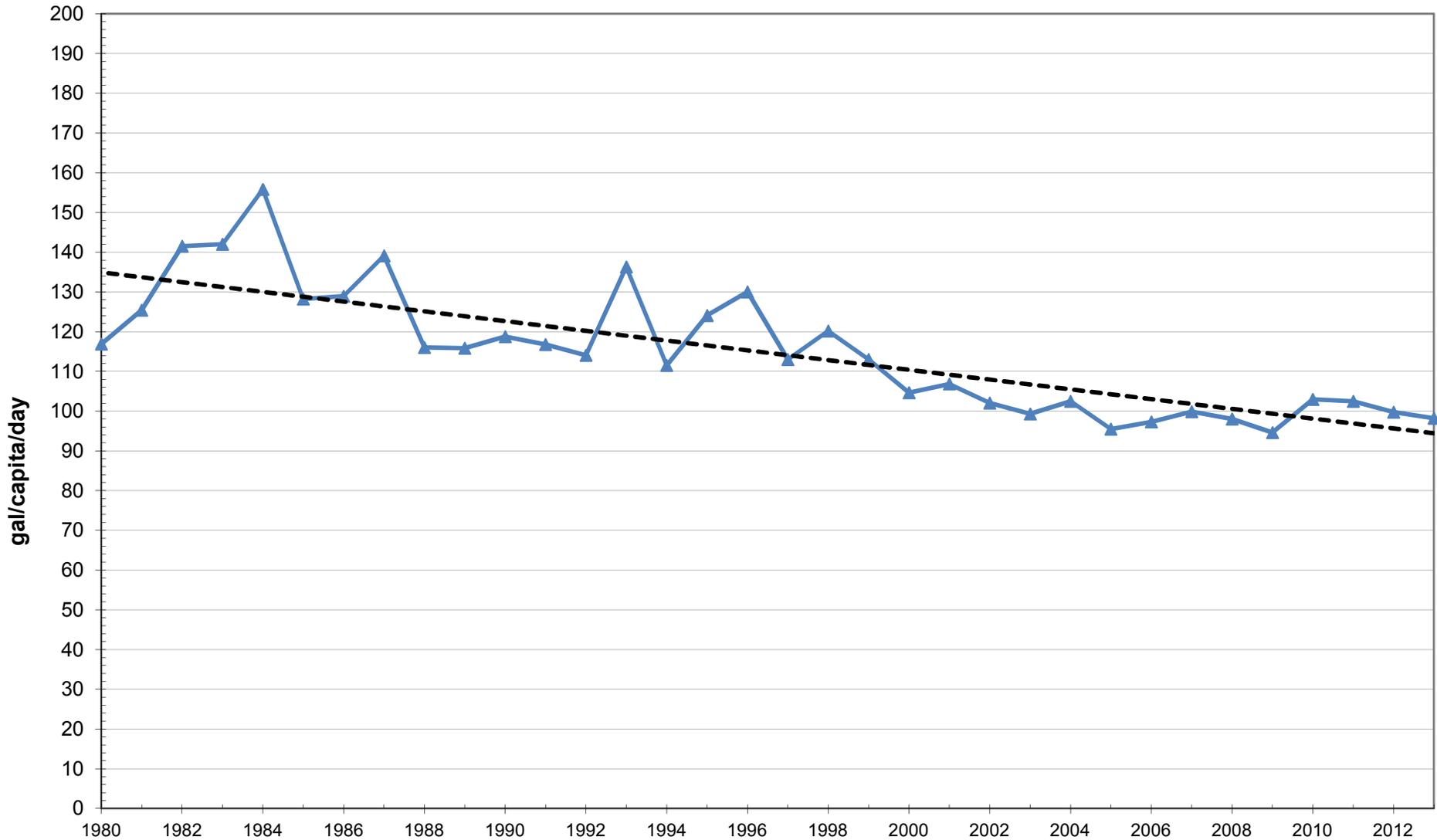
## 5.4 HISTORICAL PER CAPITA WASTEWATER FLOW

Figure 5.19 shows the average historical per capita wastewater flow for the City treatment facilities. The sum of the annual average day flows from the Theresa Street WWTF and Northeast WWTF was divided by the City of Lincoln population for a given year to determine the average per capita wastewater flow. As shown in Figure 5.19, the average per capita wastewater flows vary year to year but have generally been declining over the last 30 years as illustrated by the linear trend line included in the graph. This decline is a result of improved sewer construction practices, replacement of older sewers, increased water conservation practices by industry and consumers, and possibly by the recent lower than normal precipitation accumulations. The 2013 per capita contribution was approximately 98 gpcd.

## 5.5 INDUSTRIAL CONTRIBUTIONS

The City of Lincoln currently has 44 industrial dischargers. Of these 44 industrial dischargers, 27 are monitored as part of the industrial pre-treatment program. Eighteen of these dischargers are tributary to the Theresa Street WWTF, and the remaining 9 are tributary to the Northeast WWTF. A summary of the industrial contributions for each of the WWTF's is combined flow for the year 2012 averaged is shown in Table 5.19 below.

<b>Parameter</b>	<b>Theresa St</b>	<b>Northeast</b>	<b>Combined</b>
Flow (mgd)	5.8 %	23.8 %	7.4 %
TSS (lbs/day)	4.8 %	21.9 %	6.7 %
BOD <sub>5</sub> (lbs/day)	40.2 %	47.4 %	41.0 %
COD(lbs/day)	33.2 %	41.5 %	34.2 %
TKN (lbs/day)	9.6 %	12.9 %	9.9 %



Year



**FIGURE 5.19 – HISTORICAL PER CAPITA WASTEWATER FLOW**

WASTEWATER FACILITIES MASTER PLAN UPDATE – 2014  
CITY OF LINCOLN, NEBRASKA