CHAPTER 4
CURRENT SITUATION

This chapter presents a summary of the current wasteloads received at the NSWWTP and a review of the operating performance of the NSWWTP solids handling system.

WASTEWATER FLOWS AND LOADINGS

A thorough evaluation of historical plant loadings at the NSWWTP was prepared for the District's 50-year Master Plan. The information in this report was developed to be in agreement with the Master Plan. Technical Memorandum No. 1: *Basis of Design* (TM-01) contains an analysis of existing plant loadings to provide a design basis for solids projections. Wastewater influent data taken from the Master Plan for the years 2003 through 2007 are summarized in Table 4-1.

Table 4-1
NSWWTP Loadings
Annual Plant Influent Loadings

Year	Flow (mgd)	BOD_5		TSS		TKN		Total -P	
		(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)
2003	38.56	243	78,115	261	83,769	35.2	11,342	6.49	2,087
2004	41.93	231	80,860	251	86,915	33.9	11,915	6.21	2,186
2005	39.37	245	81,648	243	80,197	37.5	12,439	6.39	2,132
2006	41.22	245	83,722	229	78,214	38.2	13,185	6.29	2,165
2007	43.00	240	84,396	212	75,592	36.4	12,955	5.95	2,125

The NSWWTP is a biological nutrient removal plant, utilizing a variation of the University of Cape Town (UCT) process to achieve nitrogen and phosphorus removal. The plant has been performing extremely well in terms of meeting discharge permit effluent limits. Table 4-2 provides a summary of the plant effluent quality.

Table 4-2 NSWWTP Performance Summary Effluent Quality						
Year	**Badfish Creek Effluent Flow (mgd)**	**Badger Mill Creek Effluent Flow (mgd)**	**BOD (mg/L)**	**TSS (mg/L)**	**Ammonia (mg/L)**	**Total P (mg/L)**
2003	36.85	2.99	3	5	0.28	0.29
2004	40.22	2.78	3	5	0.22	0.44
2005	37.47	3.11	4	5	0.27	0.39
2006	38.63	3.08	4	5	0.21	0.42
2007	41.68	3.24	4	4	0.12	0.39

SLUDGE PRODUCTION

Current sludge production at the NSWWTP, estimated from current loadings on the plant, is summarized in Table 4-3. These estimates serve as the basis for projecting future sludge production to be used as the solids handling system design basis.

Table 4-3 NSWWTP Solids System Current Sludge Production Estimates[1]		
Process Parameter	**Average**	**Maximum Month**
Plant Influent		
Flow, mgd	42.9	54.8
TSS loading, ppd	75,700	90,800
BOD loading, ppd	85,100	102,100
N loading, ppd	12,900	15,500
P loading, ppd	2,100	2,300
Primary Sludge		
Total solids, ppd	60,800	73,000
Waste Activated Sludge		
Total solids, ppd	49,700	59,600
Thickened Sludge (digester feed)		
Total solids, ppd	106,300	127,600
Volatile solids, ppd	80,800	97,000
(1) From Table 1.3, TM-01		

For more than thirty years the District has recycled biosolids to agricultural land through its Metrogro program, in which liquid sludge is hauled from NSWWTP for land application of Class B biosolids. Table 4-4 provides a summary of Metrogro operations.

Table 4-4 NSWWTP Metrogro Summary Class B Biosolids Land Application						
Year	**Total Volume Recycled (million gal)**	**Dry Solids Recycled (tons)**	**Land Area Applied (acres)**	**Total Program Cost ($1000)**	**Liquid Cost ($/1000 gal)**	**Dry Solids Cost ($/dry ton)**
2003	40.0	8,827	5,285	$1,359	$33.91	$154
2004	38.4	8,397	4,923	$1,440	$37.48	$171
2005	34.0	7,086	4,376	$1,238	$36.39	$175
2006	35.9	7,185	4,431	$1,301	$36.23	$181
2007	38.2	7,380	4,758	$1,335	$35.13	$181

SOLIDS HANDLING SYSTEM PERFORMANCE

The existing solids handling system at the NSWWTP is depicted in Figure 4-1. In the 10th Addition to the NSWWTP, MMSD converted its conventional mesophilic anaerobic digestion system to an advanced temperature phased anaerobic digestion (TPAD) process. The 10th Addition to the NSWWTP encompassed eight years of testing, planning, design, construction, and start-up activities. One of the primary aspects of the 10th Addition was the conversion of the solids handling system to an advanced anaerobic digestion process (TPAD), with the goal of producing a Class A biosolids product. The TPAD process at NSWWTP was designed to operate in a batch-feed, two-stage configuration, with a thermophilic first stage followed by a mesophilic second stage. Three thermophilic digesters were to run in sequential batch feed / digest / drawdown modes, with each mode lasting 12 hours. The 12-hour digestion time at 135 °F would meet the regulatory requirements for producing Class A biosolids. Substantial modifications to the existing anaerobic digestion

facilities included new Digester No. 7, gas mixing systems, sludge recirculation and transfer pumping, boilers, and heat exchangers.

The 10th Addition facilities have not achieved the original objectives for a Class A biosolids product after two years of start-up and testing. A series of operational issues have arisen, generally described as follows:

- Process instability resulting in digester foaming
- Heat transfer inhibition leading to inadequate digester heating

The District made process modifications in an effort to address these difficulties, incorporating an acid-phase digester prior to the thermophilic stage. The District also made a series of modifications to address related issues:

- Progressing cavity pumps replaced centrifugal sludge transfer pumps to eliminate gas binding.
- Higher ferric chloride doses were employed to mitigate struvite formation downstream of the thermophilic digesters. The iron dosing rate must be balanced against the potential to form vivianite in the secondary heat exchangers.
- Glass-lined piping was installed to replace struvite-laden sludge lines in the Solids Tunnel.
- A grinder was installed in the raw sludge line to reduce ragging in the heat exchangers.
- A gas treatment system was added to remove impurities in the biogas.

The 10th Addition digestion system operated in the modified acid-thermo-meso mode of operation, with all sludge being fed through Digester No. 7 as the acid phase digester (as shown on Figure 4-1). Due to some of the materials handling limitations and the configuration of Digester No. 7, the system did not operate in a manner to achieve a Class A status, and process instability continued to be problematic. The system performance was erratic and the maintenance was extremely labor intensive. In the summer of 2008 the District began process modifications to convert the solids handling system back to a mesophilic mode. Reverting back to mesophilic operations was completed in the fall of 2008, with the Metrogro program continuing with Class B biosolids. This mode of operation is familiar to the plant staff and the process has been stable. This is intended to be an interim

operation until the Solids Handling Facilities Plan and resultant construction (11th Addition to the NSWWTP) can be completed.

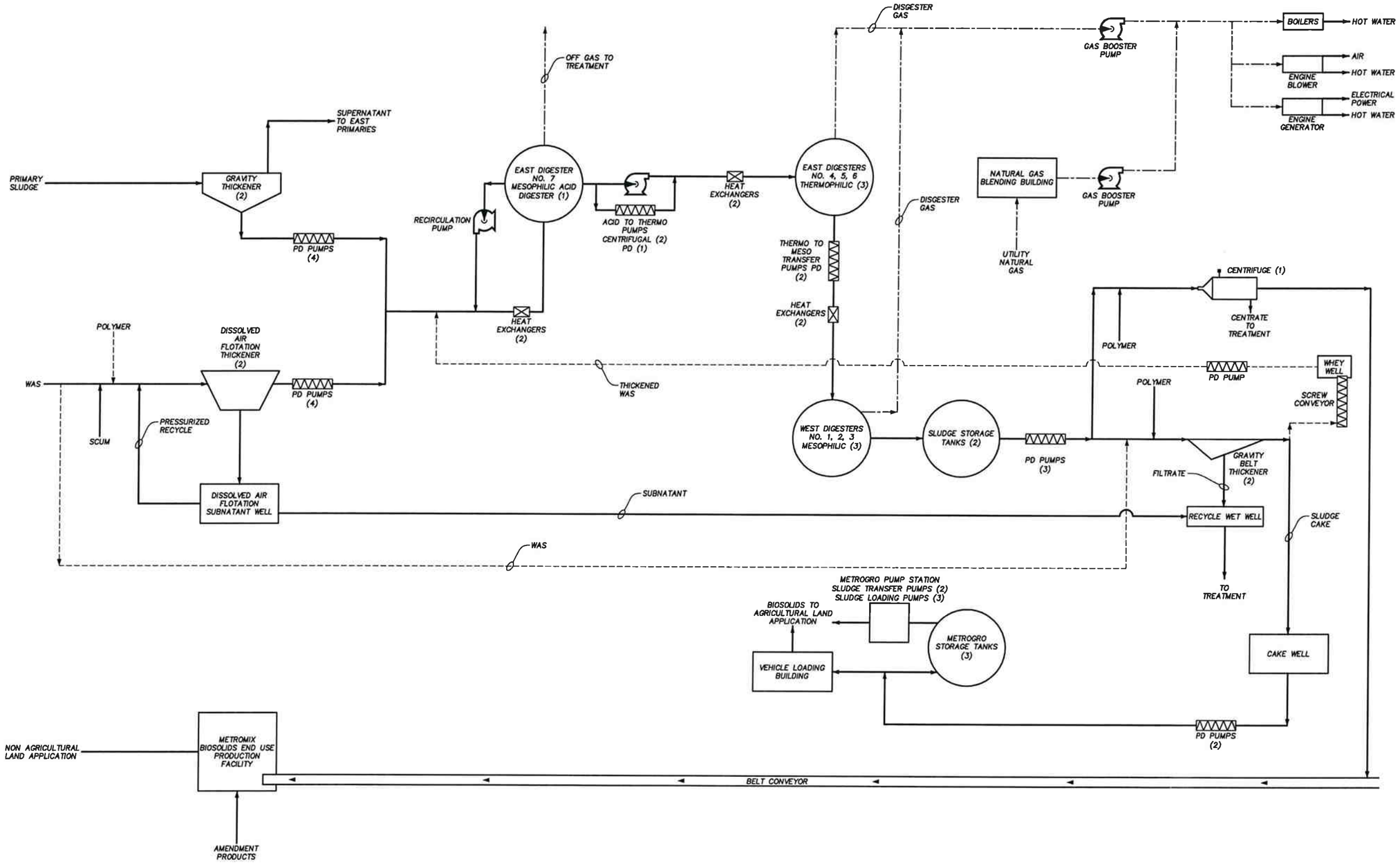

FIGURE 4-1
SOLIDS PROCESS SCHEMATIC
Madison Metropolitan Sewage District