

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 11-45

*ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER
RECLAMATION DISTRICT OF GREATER CHICAGO FACILITIES
DURING 2010*

December 2011

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**ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO FACILITIES DURING 2010**

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ACKNOWLEDGMENTS

The authors wish to acknowledge the assistance of the Maintenance and Operations Department personnel in carrying out odor monitoring activities at various facilities.

The efforts of the laboratory technicians, Messrs. Robert Bodnar, Marc Byrnes, Mohammad Darwish, Anthony Haizel, Kim Iu, Shawn Kowalski, and Harold Robinson in the Wastewater Treatment Process Research Section who carried out the odor monitoring surveys and maintained the database are greatly appreciated.

Thanks are also due Ms. Laura Franklin, Principal Office Support Specialist, for her diligence in typing this report.

DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

SUMMARY

The Metropolitan Water Reclamation District of Greater Chicago (District) maintains a program of monitoring odors at five water reclamation plants (WRPs), one solids drying site (SDS), one solids processing site (SPS), and five solids drying areas (SDAs). This program started in 1990. Both the Monitoring and Research Department (M&R) and Maintenance and Operations Department (M&O) personnel make subjective observations regarding the type and intensity of any odor perceived. The M&R staff records instantaneous hydrogen sulfide (H₂S) measurements using a handheld monitor at each monitoring site. The number of locations at each facility varies from 4 to 19. The frequency of monitoring varies from one day per week at the Ridgeland Avenue Solids Management Area (RASMA) to seven days per week during the summer months at the James C. Kirie (Kirie) WRP. Each odor observation is characterized as very strong, strong, easily noticeable, faint, very faint, or no odor.

During 2010 one very strong odor, out of 5,191 observations, was observed at the Stickney WRP. Three very strong odors were observed at the Calumet WRP, two very strong odors were observed at the Kirie WRP, and two very strong odors were observed at the SDAs and SPS. No very strong odors were observed at the North Side or John E. Egan (Egan) WRPs. The majority of the observations at the five WRPs were characterized as faint to no odor from 69 to 98 percent of the time. At the seven SDAs and sites, observations were characterized as faint to no odor from 65 to 92 percent of the time.

At each of the WRPs there are specific locations which have noticeable odors. A summary of the locations which had occasional strong odors is presented in [Table 1](#). For example, at the Calumet WRP the area where most strong odors were observed is in the vicinity of the Sludge Concentration Building and the Preliminary Tanks. At the Stickney WRP the areas where most strong odors were observed are the Preliminary Tanks, Sludge Concentration Tanks, Laramie Avenue and 40th Street, and the Centrifuges (Pre) building. While strong odors are generally infrequent, the monitoring shows there is the potential for odors from these areas. Strong odors occurring along Laramie Avenue were identified as typical odors coming from the Koppers Industries, Inc., plant, which is just east of the Stickney WRP.

The H₂S levels generally followed a pattern similar to the odor observations with occasional high values. The average level of H₂S ranges from 4.7 to 58.4 ppbv (parts per billion by volume) at the WRPs. At the Stickney WRP the average H₂S levels along the periphery of the plant were 6 to 30 ppbv and 8 to 58 ppbv at the majority of locations within the WRP.

TABLE 1: STRONG ODOR OBSERVATIONS – 2010

Facility	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Calumet WRP			
Plant Entrance	1		
Lagoon #19 SW Corner	3		
Sludge Concentration Building	15	1	
Lagoon #18 NE Corner	3		
Aeration Battery A – West	1		
TARP Pump Station	3	1	
Preliminary Tanks	7	1	
Between Lagoons #7 and #8	1		
Lagoons #1 and #2	<u>3</u>	<u>—</u>	
	Total 37	3	2,398
Calumet SDS			
Drying Cell #1 SW	1		
Hopper Building	1		
Drying Cell #8 NE	1		
Drying Cell #8 SE	5		
Drying Cell #1 at Gate	5		
West Drying Cell #4	<u>4</u>	<u>0</u>	
	Total 17	0	1,743
Egan WRP			
	<u>0</u>	<u>0</u>	
	Total 0	0	350
Kirie WRP			
Plant Entrance	2		
Road C1	3		
Return Channel	2		
East Gallery - North Channel	1		
Road C4	5		
Airlift A1	10	1	
Airlift A2	9		

TABLE 1 (Continued): STRONG ODOR OBSERVATIONS – 2010

Facility	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Kirie WRP (Continued)			
Road C5	1		
Ridge Lane - Point #1	1		
Marshall and Pleasant - Point #2	1		
Pump Station	—	$\frac{1}{2}$	10,071
	Total 35		
North Side WRP			
Main St. Covered Sludge Conc. Tanks	$\frac{2}{2}$	$\frac{0}{0}$	
	Total 2		675
Stickney WRP			
Imhoff Tanks	4		
Digesters Sixth Avenue & B Street	1		
West Digester Cont. Bldg.	2		
Centrifuges (Pre)	9		
Centrifuges (Post)	2		
Sludge Concentration Tanks	23		
Preliminary Tanks	40		
Laramie Ave. & 40th St.	10		
Laramie Ave. & 39th St.	3		
Preliminary 10 th Avenue	—	$\frac{1}{1}$	
	Total 94		5,191
HASMA, Marathon, and Vulcan SDAs, and LASMA SPS			
HASMA	9		
HASMA Center	8		
Vulcan North	2	1	
Vulcan CS	1	1	
Vulcan TARP Well	4		
Lagoon #24	1		
Lagoon #30	3		
Cell 1E – 1W	1		

TABLE 1 (Continued): STRONG ODOR OBSERVATIONS – 2010

Facility	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
HASMA, Marathon, and Vulcan SDAs, and LASMA SPS (Continued)			
Cell 2E – 2W	1		
Cell 3E – 3W	2		
Cell 4E – 4W	2		
Cell 5E – 5W	1		
Marathon	1		
Marathon West	<u>1</u>		
	Total 37	<u>2</u>	2,099
RASMA SDA ¹	<u>0</u>	<u>0</u>	
	Total 0	0	0
Stony Island SDA			
Entrance @ 122nd St.	1		
NE Corner Cell #5	<u>1</u>	<u>0</u>	
	Total 2	0	486

¹RASMA was not used as a biosolids drying site during 2010.

NOTE: HASMA = Harlem Avenue Solids Management Area.

LASMA = Lawndale Avenue Solids Management Area.

RASMA = Ridgeland Avenue Solids Management Area.

SDA = Solids Drying Area.

SDS = Solids Drying Site.

SPS = Solids Processing Site.

WRP = Water Reclamation Plant.

INTRODUCTION

M&R in conjunction with M&O has been conducting an odor monitoring program at various District facilities for the past 20 years. The initial program started with the solids processing and drying sites at Lawndale Avenue Solids Management Area (LASMA), Harlem Avenue Solids Management Area (HASMA), Marathon, and Vulcan in 1990, and was expanded to the WRPs and other drying sites. The latest additions were the RASMA and Stony Island solids drying sites in 2001.

At each location a similar procedure is followed to monitor odors. M&R personnel, and at some facilities M&O personnel, visit various stations at each facility on a regular basis. The odor monitoring personnel make subjective observations regarding the character and intensity of odors at each of the stations. The odor intensities are ranked on a scale of 0, no odor; 1, very faint; 2, faint; 3, easily noticeable; 4, strong; and 5, very strong odor. In addition to the subjective odor measurements, the ambient air is sampled and analyzed for H₂S using a Jerome Model 631-X H₂S meter.

The objective of this program is to collect and maintain a database of odor levels within and around each WRP, and associated solids processing areas. The data are used to study the trends in odor levels associated with WRP operations, and to correlate odor levels to conditions related to WRP operations or changing conditions within the WRP, such as installation of odor control equipment, or sometimes to conditions unrelated to the WRP. Since several residential areas surround the WRPs in the program, the odor monitoring activities are also designed to provide early warning of odorous conditions that develop within the WRPs, and to allow control of them before they come to the notice of the surrounding residents. If a very strong odor is observed, the incident is reported at the time of observation to the respective plant operations personnel.

A summary of the odor monitoring program is presented in Table 2. This table includes a brief description of the program with regard to when the monitoring commenced at each facility, the number of monitoring locations, the frequency of the monitoring, and who conducts the monitoring.

Maps showing the odor monitoring sites at each WRP and SDA are presented in Appendix AI.

The number of monitoring locations at each facility varies from 4 to 19, depending upon the size of the facility and the history of odor episodes in those facilities. The Calumet and Stickney WRPs and SDAs are monitored from three to five days per week. At the Kirie WRP, M&O monitors the facility every day, once per shift, from the spring through fall months.

Odor complaints in 2010 at the various facilities ranged from none at the Calumet SDS, RASMA SDA, and Stony Island SDA, to 26 at the Stickney WRP.

This report presents the odor monitoring data for the year 2010. The odor monitoring data in terms of frequency of occurrence, locations of possible odor sources, and H₂S levels have been reviewed and summarized.

TABLE 2: ODOR MONITORING PROGRAM FOR 2010

Facility	Number of Locations Monitored	Year Began	Months of Year	Days per Week	Departments Participating	H ₂ S Measured	Number of Odor Complaints	Number of Complaints Verified
Calumet WRP	15	1992	12	3 2	M&R M&O	Yes	14	12
Calumet SDS	9	1992	12	3 2	M&R M&O	Yes	0	0
Egan WRP	7	1993	12	1 ND	M&R M&O	Yes	1	0
Kirie WRP	17	1996	12	1 7 ¹	M&R M&O	Yes	5	4
North Side WRP	13	1992	12	1 ND	M&R M&O	Yes	1	0
Stickney WRP	19	1991	12	3 2	M&R M&O	Yes	26	6
HASMA, Vulcan, and Marathon SDA, and LASMA SPS	17	1990	12	3	M&R	Yes	1	1

TABLE 2 (Continued): ODOR MONITORING PROGRAM FOR 2010

Facility	Number of Locations Monitored	Year Began	Months of Year	Days per Week	Departments Participating	H2S Measured	Number of Odor Complaints	Number of Complaints Verified
RASMA SDA	4	2001	12	1 to 2	M&R	Yes	0	0
Stony Island SDA	4	2001	12	1	M&R	Yes	0	0

Note: HASMA = Harlem Avenue Solids Management Area
 LASMA = Lawndale Avenue Solids Management Area
 ND = Not determined.
 RASMA = Ridgeland Avenue Solids Management Area
 SDA = Solids Drying Area.
 SDS = Solids Drying Site.
 SPS = Solids Processing Site.
 WRP = Water Reclamation Plant.

¹At Kirie, M&O Department personnel conduct odor monitoring surveys 7 days a week 3 times a day from May through November.

RESULTS OF ODOR MONITORING AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO FACILITIES IN 2010

The results of the various odor monitoring programs at each of the District facilities for 2010 are summarized in Table 3. The results have been divided into two major groups: detected odors, which include the very strong, strong, and easily noticeable odor categories, and nondetected odors, which are either faint, very faint, or no odor.

A general observation drawn from the table is that at those facilities where both M&R and M&O personnel conducted odor monitoring, the M&O personnel show a lower percentage of odors detected. This may be due to the fact that the M&O personnel are exposed to the specific area on a daily basis as compared to the M&R personnel which can result in olfactory desensitization. Thus, they may not differentiate especially well between faint and easily noticeable odors.

Calumet Water Reclamation Plant

In general, the majority of the odor monitoring observations ranged from faint to no odor, 71 percent of the time by M&R personnel and 97 percent of the time by M&O personnel, respectively. The strong odors mainly occurred around the sludge concentration building and preliminary tanks. Areas which had easily noticeable odors were mostly in the vicinity of the preliminary tanks, sludge concentration tanks, southwest corner of Lagoon #19, northeast corner of Lagoon #18, Tunnel and Reservoir Plan (TARP) pump station, and Lagoons #1 and #2.

The H₂S measurements made at the time of the odor monitoring by the M&R personnel are summarized in Table 4. The highest instantaneous readings were at the Preliminary Tanks, TARP Pump Station, and Sludge Concentration Building.

Figure 1 summarizes the monthly observations of easily noticeable, strong, and very strong odors made during 2010 in terms of frequency of occurrence. The frequency of easily noticeable observations ranged between 9.5 and 28.3 percent each month with the highest percentage occurring in June. Strong odors were observed about two percent of the time on average, and very strong odors were observed less than one percent of the time during 2010.

Fourteen odor complaints pertaining to the Calumet WRP were received in 2010, of which 12 were verified.

Calumet Solids Drying Site

The Calumet SDS consists of the East SDA, located east of the Calumet WRP, and the West SDA, located west of the Calumet WRP. As with the Calumet WRP, the occurrence of strong odors at the drying areas, which also includes the centrifuge building located at the East SDA, was infrequent. The majority of the observations were described as faint to no odor. No

TABLE 3: ODOR MONITORING RESULTS FOR 2010

Facility	Departments Participating	Total Number of Observations	Number of Observations Odors were Detected			Number Non-Detects ¹	Percent Non-Detects
			Very Strong	Strong	Easily Noticeable		
Calumet WRP	M&R	1,654	3	36	442	1,173	71
	M&O	744	0	1	22	721	97
Calumet SDS	M&R	1,245	0	17	220	1,008	81
	M&O	498	0	0	10	488	98
Egan WRP	M&R M&O ²	350	0	0	31	319	91
Kirie WRP	M&R	822	0	2	67	753	92
	M&O	9,249	2	33	281	8,933	97
North Side WRP	M&R M&O ²	675	0	2	106	567	84
Stickney WRP	M&R	2,623	1	82	721	1,819	69
	M&O	2,568	0	12	135	2,421	94
HASMA, Vulcan and Marathon SDA and LASMA SPS	M&R	2,099	2	37	703	1,357	65

TABLE 3 (Continued): ODOR MONITORING RESULTS FOR 2010

Facility	Departments Participating	Total Number of Observations	Number of Observations Odors were Detected			Number Non-Detects ¹	Percent Non-Detects
			Very Strong	Strong	Easily Noticeable		
RASMA SDA ³	M&R	0	0	0	0	0	0
Stony Island SDA	M&R	486	0	2	36	448	92

Note: HASMA = Harlem Avenue Solids Management Area.
 LASMA = Lawndale Avenue Solids Management Area.
 RASMA = Ridgeland Avenue Solids Management Area.
 SDA = Solids Drying Area.
 SDS = Solids Drying Site.
 SPS = Solids Processing Site.
 WRP = Water Reclamation Plant.

¹Non-detects are all observations of faint, very faint, or no odor.

²The M&O Department conducts periodic odor monitoring surveys at these facilities but the data are not included in this Table.

³RASMA was not used as a biosolids drying site during 2010.

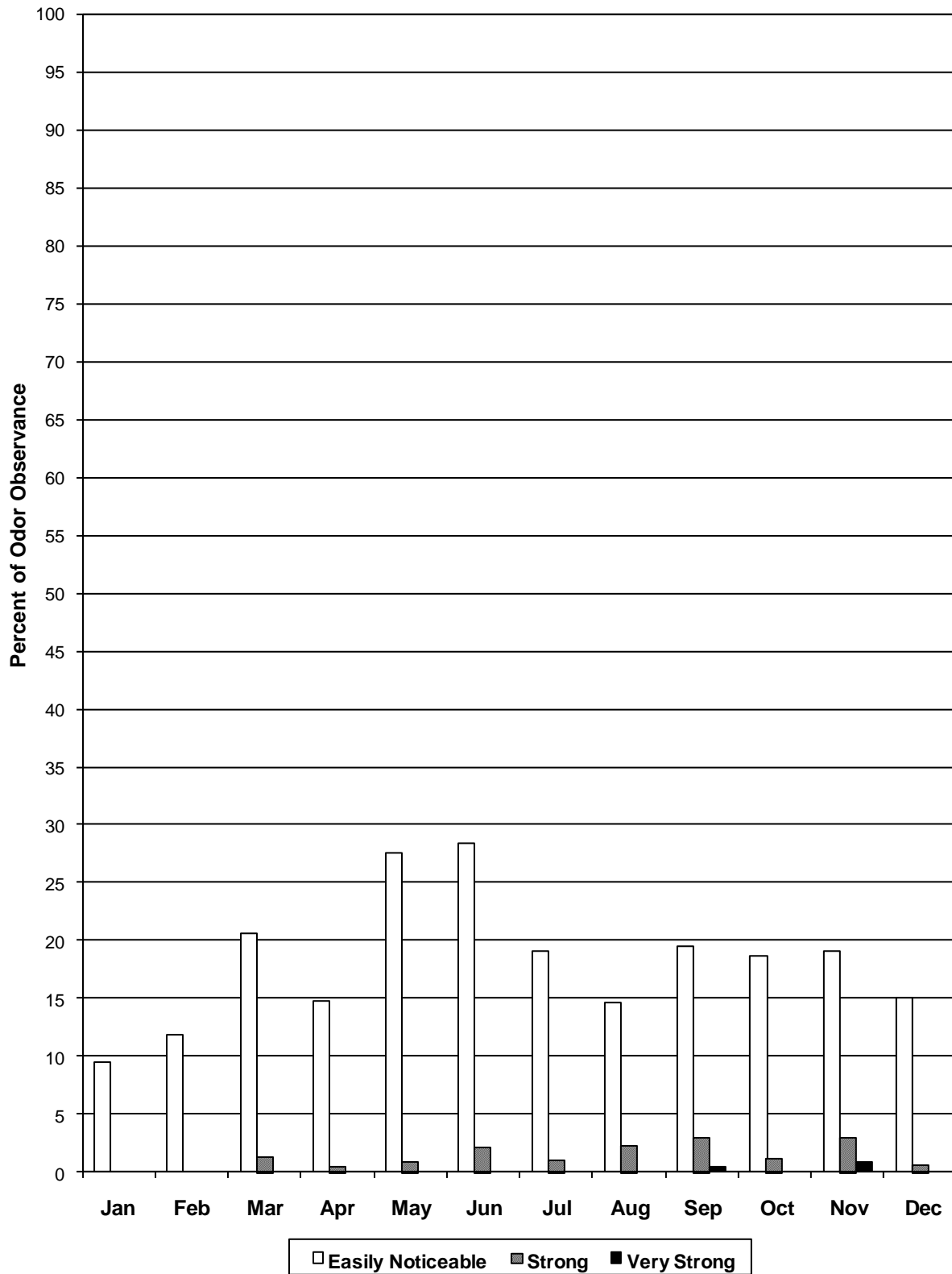
TABLE 4: HYDROGEN SULFIDE READINGS AT THE
CALUMET WATER RECLAMATION PLANT – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Plant Entrance (1) ²	5.4	0	23
Lagoon #19 SW Corner (2)	6.8	2	22
Sludge Conc. Bldg. (3)	19.8	3	340
Lagoon #18 NE Corner (4)	8.0	2	41
Sludge Digester Tanks (5)	6.7	1	28
Aeration Battery A – West (6)	6.6	1	28
TARP Pump Station (7)	18.2	3	490
Preliminary Tanks (8)	48.7	0	740
Gate Near Lagoon #9 (9)	6.2	0	73
Between Lagoon #7 & #8 (10)	8.1	2	76
Lagoon #1 & #2 (11)	11.5	0	97
Lagoon #3 & #4 (12)	7.6	1	43
Ellis Ave. & 130th St. (13)	5.2	0	11
H ₂ S Monitor – 130th St. (23)	4.7	0	11
North H ₂ S Monitor (24)	10.0	0	88

¹ ppbv = Parts per billion by volume.

² Numbers in parentheses correspond to Station numbers in Figure AI-1.

FIGURE 1: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE CALUMET WATER RECLAMATION PLANT - 2010



very strong odor was detected in 2010. Strong odors were observed at the drying areas in March through November. Strong odors were observed mostly under two percent of the time on a monthly basis except for March. Easily noticeable odors occurred between 3 and 20 percent of the time throughout the various drying area locations. Figure 2 presents the monthly frequency of occurrence of the easily noticeable, strong, and very strong odor observations. The easily noticeable odors were highest during June 2010.

The average H₂S levels were between 5.3 and 6.9 ppbv, as shown in Table 5. The highest value observed (87 ppbv) was at the East Drying Cell #8 NW.

No odor complaints were received with regard to the Calumet SDS during 2010.

John E. Egan Water Reclamation Plant

There were no very strong or strong odor observations at the Egan WRP in 2010. Faint, very faint, or no odors were reported 91 percent of the time. The easily noticeable odor observations occurred 9 percent of the time and occurred most frequently in the vicinity of the primary tanks and near the waste gas burner.

The percentage of observations at which easily noticeable, strong, and very strong odors were observed during 2010 are presented by month in Figure 3.

The average H₂S measurements ranged from 5.6 to 6.4 ppbv, as shown in Table 6. The highest average level and highest instantaneous level were observed at the location of the primary tanks.

One odor complaint pertaining to the Egan WRP was received in 2010, but it was not verified as being associated with odors originating in the WRP.

James C. Kirie Water Reclamation Plant

There were 35 strong odor observations at the Kirie WRP during 2010, and there were two very strong odor observations. Faint, very faint, or no odors were reported 92 percent (M&R) and 97 percent (M&O) of the time. The easily noticeable odors generally occurred in the vicinity of air lift station A-1, the return channel, and air lift station A-2.

Figure 4 summarizes the observations of easily noticeable, strong, and very strong odors observed by month during 2010. Thirty-seven strong or very strong odor episodes were observed by M&R and M&O personnel during June through December 2010.

The measured H₂S levels are summarized in Table 7. The highest maximum and average levels of H₂S, 14 ppbv and 6.1 ppbv, respectively, were measured in the vicinity of Air Lift A-1. All the other locations had averages ranging from 5.0 to 5.7 ppbv.

FIGURE 2: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE CALUMET WATER RECLAMATION PLANT SOLIDS DRYING SITES – 2010

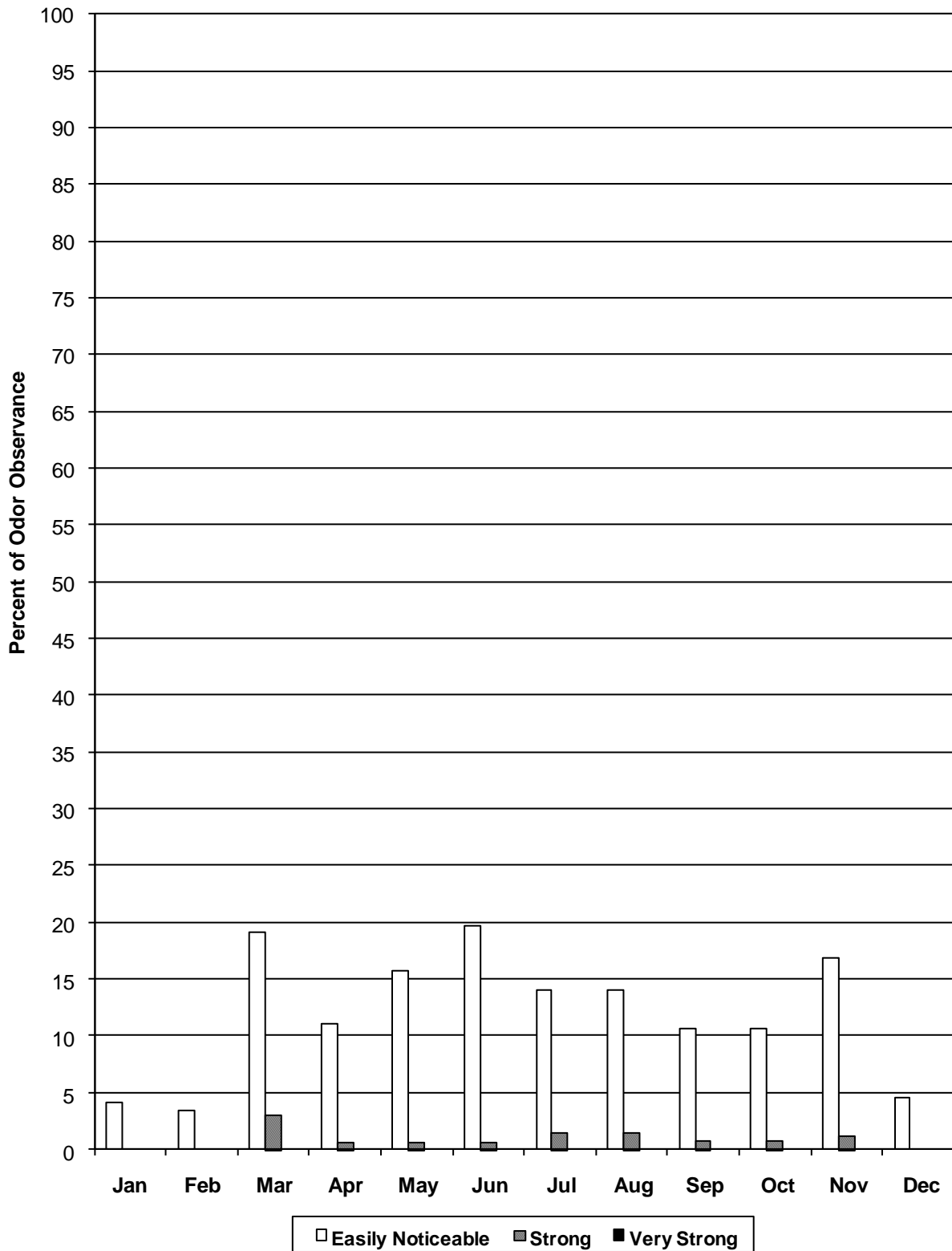


TABLE 5: HYDROGEN SULFIDE READINGS AT THE CALUMET
SOLIDS DRYING SITES – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
East Drying Cell #1 SW (14) ²	6.6	1	44
Hopper Building (15)	6.6	1	51
East Drying Cell #8 NW (16)	6.7	2	87
East Drying Cell #8 NE (17)	5.7	1	15
Truck Scale/Centrifuge (18)	6.4	1	12
East Drying Cell #1 SE (19)	6.9	1	37
West Drying Cell #1 @ Gate (20)	5.6	1	24
West Drying Cell #4 (21)	6.0	1	31
Bituminous Road @ Gate (22)	5.3	0	16

¹ ppbv = Parts per billion by volume.

² Numbers in parentheses correspond to Station numbers in [Figure AI-1](#).

FIGURE 3: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE JOHN E. EGAN WATER RECLAMATION PLANT - 2010

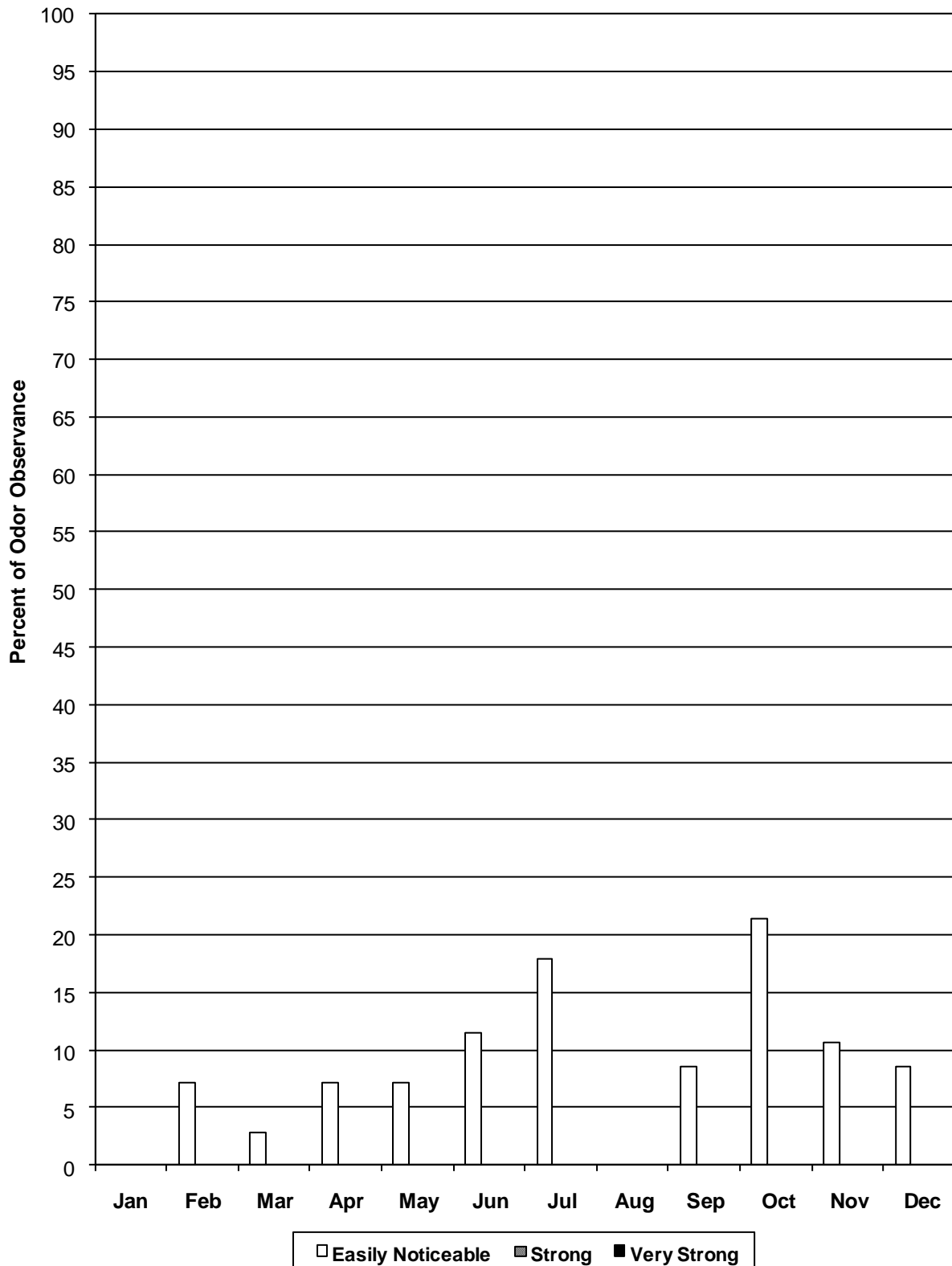


TABLE 6: HYDROGEN SULFIDE READINGS AT THE JOHN E. EGAN WATER RECLAMATION PLANT – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
West Entrance Gate (1) ²	5.8	1	19
Near Waste Gas Burner (2)	6.1	1	17
Primary Tanks (3)	6.4	2	40
South End “A” Drive (4)	5.6	2	15
Final Tanks (5)	5.6	2	13
East Entrance Gates (6)	5.9	2	14
West of Storage Building (7)	5.6	2	13

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-2](#).

FIGURE 4: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE JAMES C. KIRIE WATER RECLAMATION PLANT - 2010

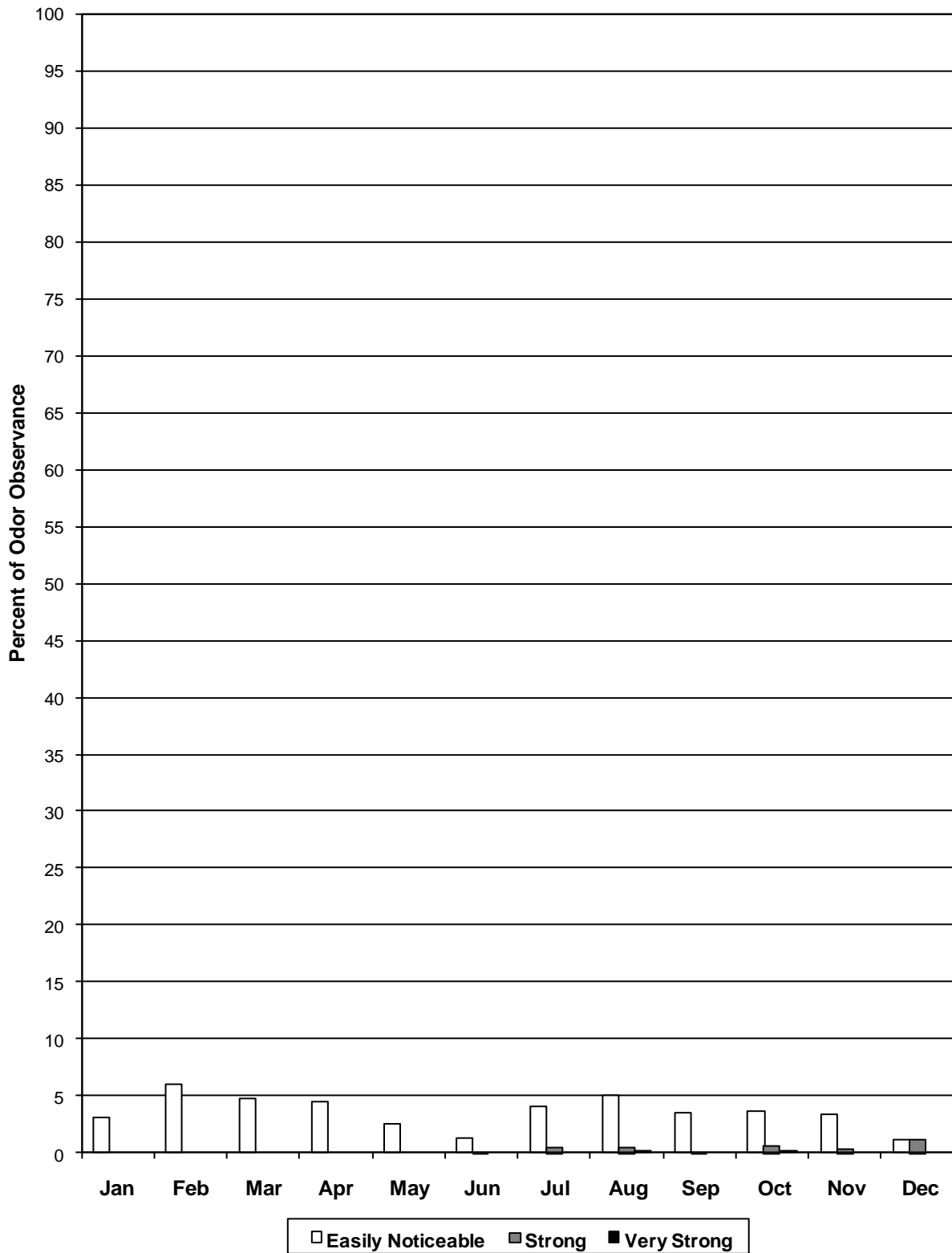


TABLE 7: HYDROGEN SULFIDE READINGS AT THE JAMES C. KIRIE WATER RECLAMATION PLANT – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Plant Entrance (1) ²	5.5	1	13
Pump Station (2)	5.5	1	13
Air Lift B1 (3)	5.7	2	13
Road C-1 (4)	5.6	2	10
Return Channel (5)	5.7	1	10
East Gallery – North (6)	5.6	1	10
Road C-2 (7)	5.4	2	10
Road C-3 (8)	5.0	2	10
Road C-4 (9)	5.6	2	10
Air Lift A-1 (10)	6.1	2	14
Air Lift A-2 (11)	5.5	2	10
Road C-5 (12)	5.4	2	11
Road C-6 (13)	5.5	1	11
Road C-7 (14)	5.6	2	10
Air Lift B2 (15)	5.5	2	10
Ridge Lane – Point #1 (16)	5.5	2	12
Marshall and Pleasant Lane – Point #2 (17)	5.4	1	13

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-3](#).

Five odor complaints were received regarding the Kirie WRP, of which four were verified as resulting from Kirie WRP operations.

North Side Water Reclamation Plant

The majority of the observations at the North Side WRP were faint to no odor. There were no very strong odor observations and two strong odor observations at this WRP during 2010. The easily noticeable odors accounted for 16 percent of the total observations, with the greatest frequency around Preliminary Tank 3.

The monthly percentage of observations at which easily noticeable, strong, and very strong odors were observed are shown in [Figure 5](#). The frequency of occurrence of easily noticeable odors was highest in May, October, and November 2010.

The measured H₂S levels are summarized in [Table 8](#). The highest mean and maximum readings were at Howard Street east of McCormick Road (19.1 ppbv and 600 ppbv, respectively). All other locations had averages between 4.7 ppbv to 15.3 ppbv.

One odor complaint regarding the North Side WRP was received in 2010, but it was not verified as being associated with odors originating in the WRP.

Stickney Water Reclamation Plant

At the Stickney WRP, the majority of the observations in 2010 were faint to no odor, with 69 percent of M&R and 94 percent of M&O observations being in this classification, respectively. Overall, there were one very strong odor observation and 94 strong odor observations, which accounts for 2 percent of the total number of observations. Most of these strong odors occurred in the vicinity of the preliminary tanks, sludge concentration tanks, and Laramie Avenue and 40th Street. The strong odors observed at Laramie Avenue and 40th Street, along with some of the strong odors in the vicinity of the Imhoff tanks, were identified as a tar-like odor which was attributed to the adjacent chemical plant operated by Koppers Industries, Inc.

[Figure 6](#) shows the percentage of easily noticeable, strong, and very strong odors observed each month at the Stickney WRP. The frequency of occurrence of easily noticeable odors ranged from 12 percent to 23 percent of the time. The noticeable odors were mostly observed at the pre-digestion and postdigestion centrifuges, preliminary tanks, concentration tanks, and Imhoff tanks with the highest occurring in June. The strong odor occurrences were spread out over the year.

The highest average H₂S level was recorded at the Preliminary 10th Avenue sampling location, with a value of 58.4 ppbv, and the highest instantaneous H₂S level of 2,800 was observed at 40th Street and Laramie Avenue ([Table 9](#)).

Twenty-six odor complaints were received regarding the Stickney WRP, of which six were verified as originating at the Stickney WRP. Almost all verified complaints were made in afternoon and evening hours. The verified complaints originated from the digesters, centrifuge buildings, and TARP pumpback.

FIGURE 5: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE NORTH SIDE WATER RECLAMATION PLANT - 2010

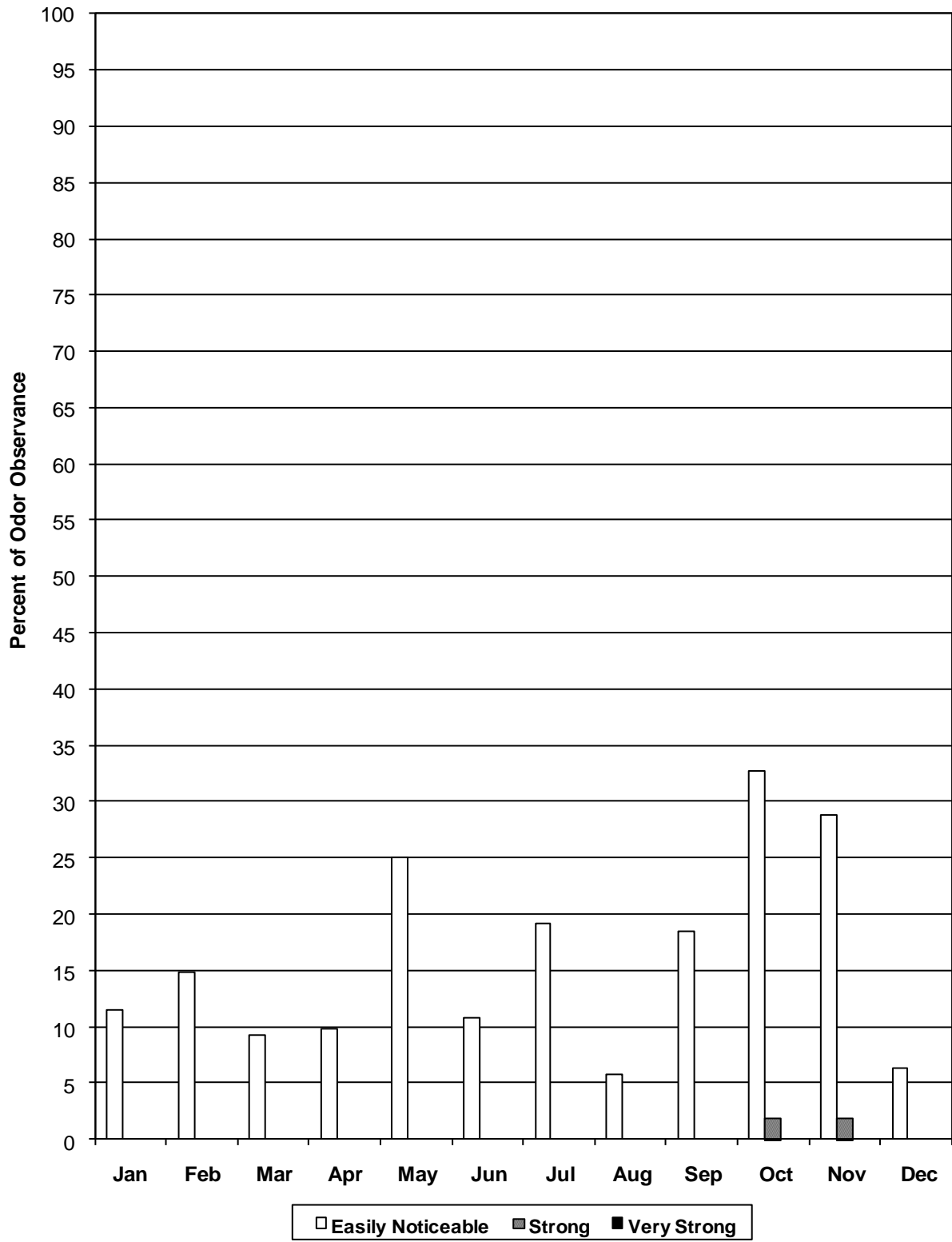


TABLE 8: HYDROGEN SULFIDE READINGS AT THE NORTH SIDE WATER RECLAMATION PLANT – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Howard Street West End (1) ²	5.3	0	11
Howard Street East of McCormick Road (2)	19.1	1	600
McCormick Road (3)	6.3	2	20
P&B Building (4)	5.5	0	27
North Ave. Rect. Tank A6 (5)	4.7	1	10
North Ave. Rect. Tank B6 (6)	4.7	0	10
North Ave. Rect. Tank C6 (7)	4.7	0	10
Final Tank Batt. D3 (8)	4.7	2	10
Gallery Bldg. of Batt. D Mix Channel (9)	5.3	2	11
Main Street and Avenue E (10)	4.8	1	10
Covered Weir Prel. Tank 10 (11)	6.6	3	24
Preliminary Tank 3 (12)	7.1	2	26
Main St. Covered Sludge Conc. Tanks (13)	15.3	2	110

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-4](#).

FIGURE 6: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE STICKNEY WATER RECLAMATION PLANT - 2010

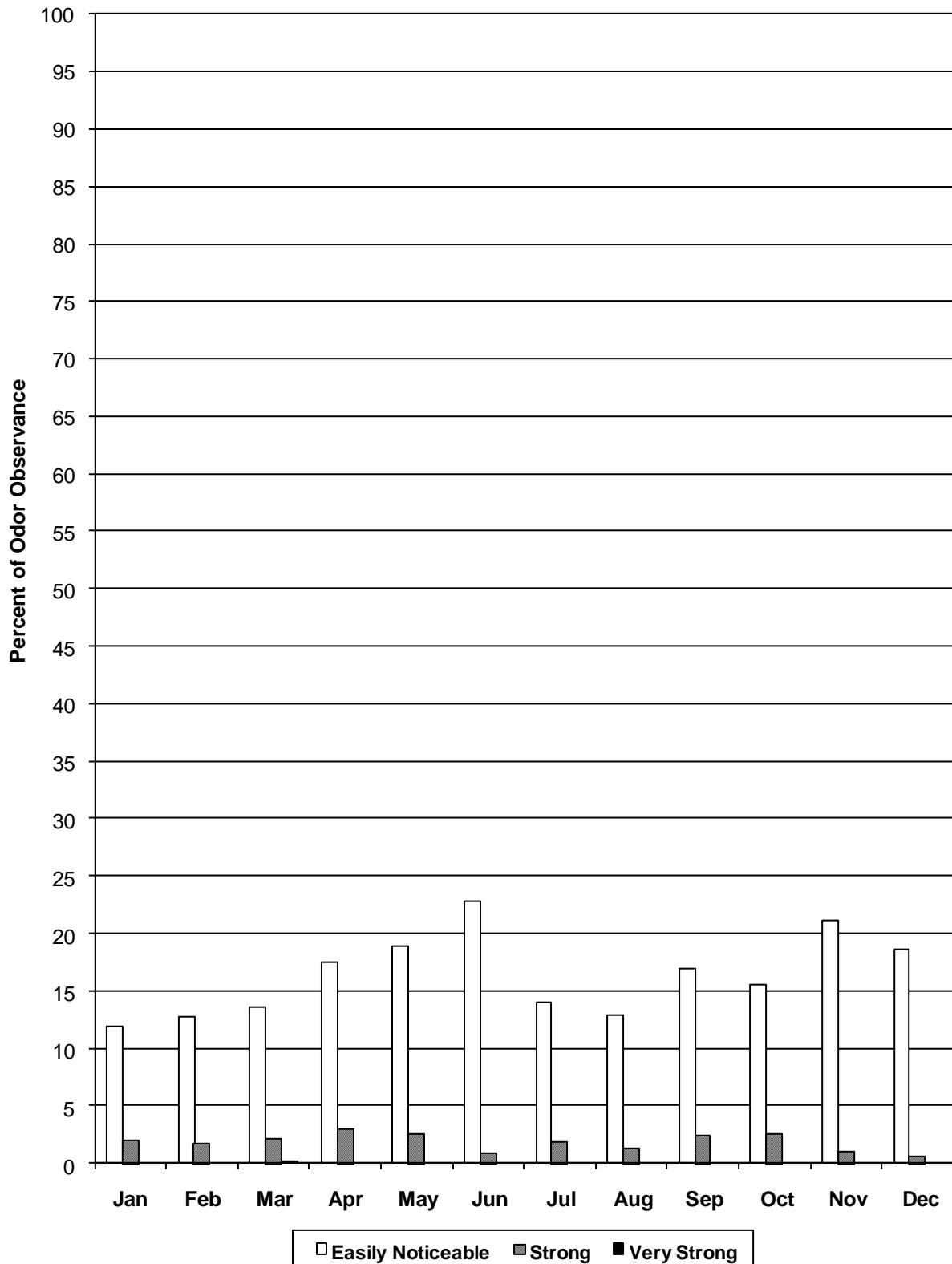


TABLE 9: HYDROGEN SULFIDE READINGS AT THE
STICKNEY WATER RECLAMATION PLANT – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
Imhoff B St./3rd Ave. (1) ²	14.6	3	624
Imhoff B St./4th Ave. (2)	15.2	0	110
Imhoff B St./5th Ave. (3)	9.2	0	62
Digester 6th Ave. @ B St. (4)	8.7	0	80
West Digester Cont. Bldg. (5)	8.4	0	90
Centrifuges 6th Ave. @ Pre. (6)	38.0	0	370
Centrifuges 6th Ave. @ Post (7)	10.7	0	120
Concentration G St. North (8)	34.6	0	380
Concentration D St. South (9)	19.3	0	190
Preliminary 12th Ave. (10)	35.2	0	580
Preliminary 10th Ave. (11)	58.4	0	999
39th St./Central Ave. (12)	7.3	0	24
39th St./Morton College Ent. (13)	7.5	0	29
39th St./Dig. @ 57th Ave. (14)	7.2	0	17
39th St./Between Austin and Lombard (15)	6.8	0	17
Battery D, B St/13th Ave. (17)	7.9	0	160
Lombard Ave. @ Gate/39th St. (18)	6.3	0	26
Laramie and 40th St. (19)	29.8	0	2,800
Laramie and 39th St. (20)	12.1	0	450

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-5](#).

Harlem Avenue Solids Management Area, Vulcan, and Marathon Solids Drying Areas, and Lawndale Avenue Solids Management Area Solids Processing Site

The HASMA, Vulcan, and Marathon SDAs and the LASMA SPS had 65 percent of the total observations characterized as faint to no odor. There were two very strong and 37 strong odor observations out of 2,099 total observations. The strong odor observations were spread among the various locations (HASMA, HASMA Center, Vulcan, LASMA Cells, Lagoons 24 and 30, and Marathon) depending upon the activity at the time.

The percentage of observations at which easily noticeable, strong, and very strong odors were observed was plotted by month and is presented in [Figure 7](#). The frequency of observed odors is generally highest during the late spring through the fall months (April through November) when solids processing and drying is being carried out. The easily noticeable odor observations ranged from 28 to 57 percent during this time period.

The average H₂S levels at the various locations around these SDAs and SPS ranged from 6.8 and 10.2 ppbv as shown in [Table 10](#).

One odor complaint was received and verified in 2010 with regard to the LASMA SPS.

Ridgeland Avenue Solids Management Area and Stony Island Solids Drying Areas

The RASMA SDA was not used as a biosolids drying site during 2010.

The Stony Island SDA had 92 percent of the observations characterized as faint to no odor, with two strong and no very strong odor observations in 2010. The easily noticeable odors accounted for approximately seven percent of the total observations.

A monthly summary of the observations at the Stony Island SDA of easily noticeable, strong, and very strong odors during 2010 is presented in [Figure 8](#) expressed as frequency of occurrence.

The average H₂S levels around the Stony Island SDA, as shown in [Table 11](#), varied from 5.0 to 5.8 ppbv.

No odor complaints were received in 2010 with regard to the RASMA and Stony Island SDAs.

FIGURE 7: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, MARATHON SOLIDS DRYING AREAS AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE - 2010

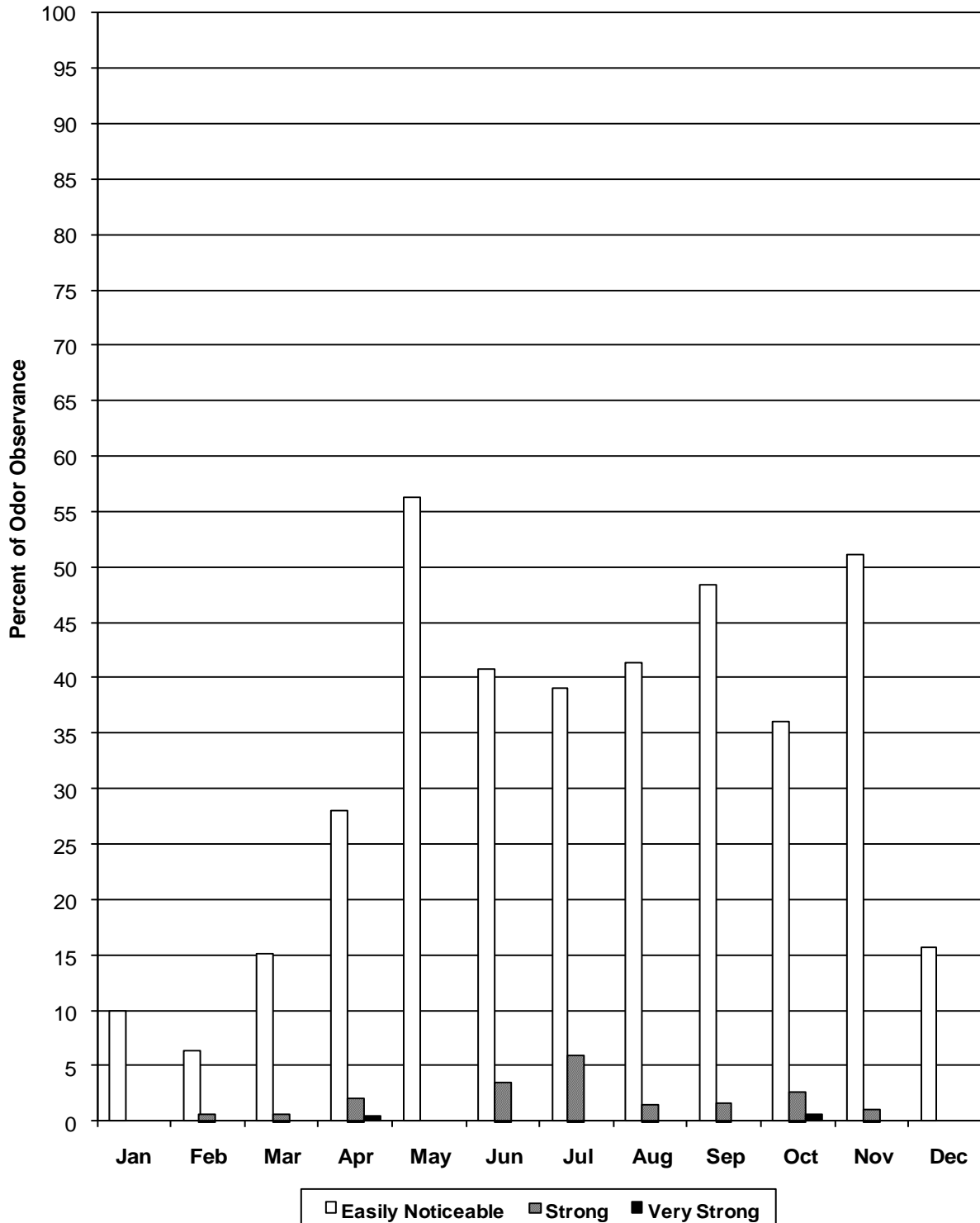


TABLE 10: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, MARATHON SOLIDS DRYING AREAS AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
HASMA (1) ²	10.2	0	130
HASMA Center (1.5)	10.0	0	140
Vulcan South (2)	7.1	0	46
Vulcan North (3)	10.1	1	180
Vulcan TARP Drop Shaft (4)	8.8	1	99
Vulcan TARP Well (5)	8.5	1	67
LASMA Lagoon 1 (6)	7.1	2	25
LASMA Lagoon 16 (7)	6.8	1	37
LASMA Lagoon 24 (8)	8.6	0	34
LASMA Lagoon 30 (9)	7.6	0	23
LASMA Cell 1E-1W (10)	7.4	1	32
LASMA Cell 2E-2W (11)	7.2	0	31
LASMA Cell 3E-3W (12)	7.6	0	58
LASMA Cell 4E-4W (13)	8.0	0	40
LASMA Cell 5E-5W (14)	7.5	0	33
Marathon (15)	7.7	0	50
Marathon West (16)	8.2	0	72

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-6](#).

FIGURE 8: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE STONY ISLAND SOLIDS DRYING AREA – 2010

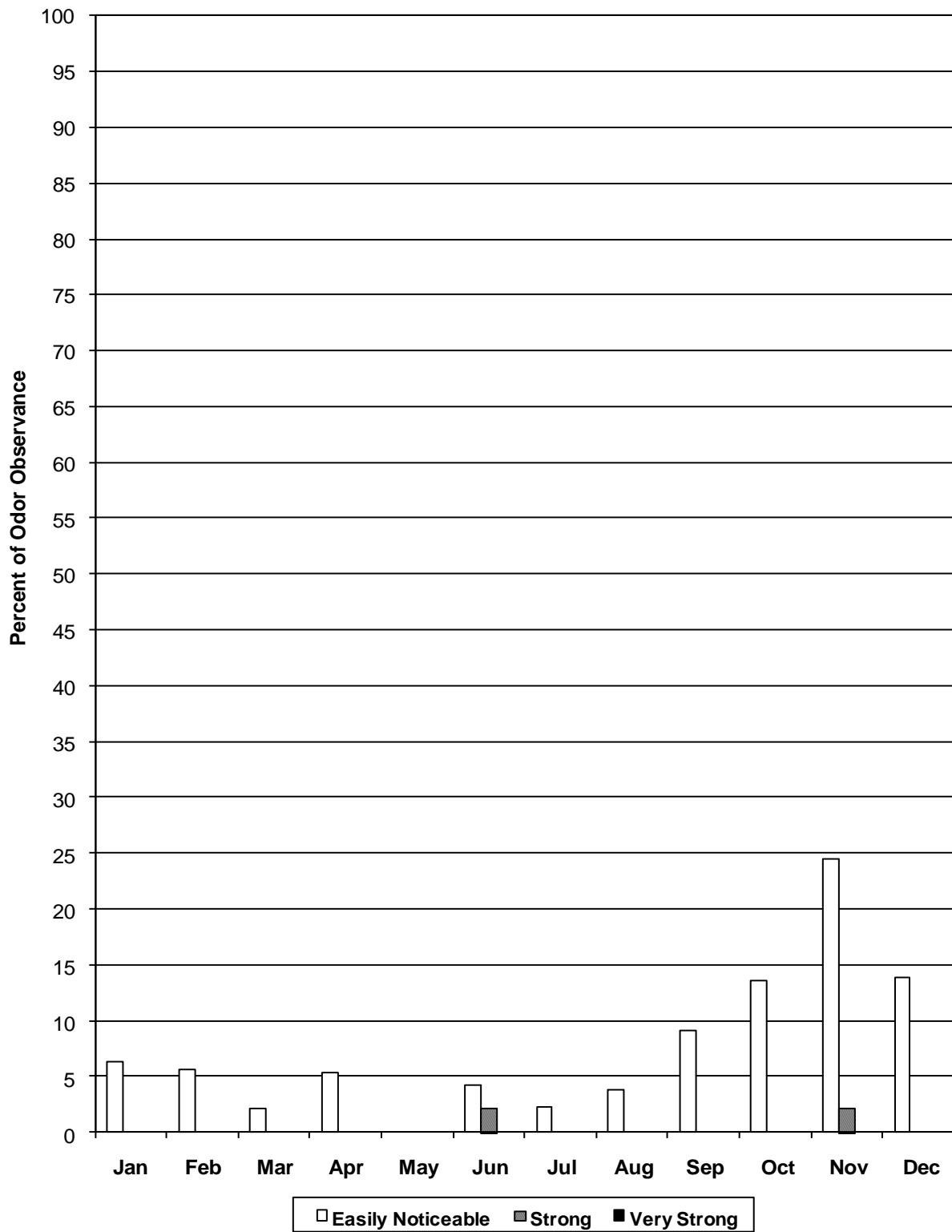


TABLE 11: HYDROGEN SULFIDE READINGS AT THE RIDGELAND AVENUE SOLIDS MANAGEMENT AREA AND STONY ISLAND SOLIDS DRYING AREAS – 2010

Location	Hydrogen Sulfide, ppbv ¹		
	Mean	Minimum	Maximum
RASMA			
SW Parking Area (1) ²	0	0	0
North of Cell 2W (2)	0	0	0
NE Corner Cell 5E (3)	0	0	0
South of Cell 5 (4)	0	0	0
Stony Island			
Entrance 122nd St (1) ³	5.8	0	19
NE Corner Cell 5 (2)	5.1	0	10
South End Cells 4 & 7 (3)	5.0	0	12
West Side of Cell 3 (4)	5.5	1	10

¹ppbv = Parts per billion by volume.

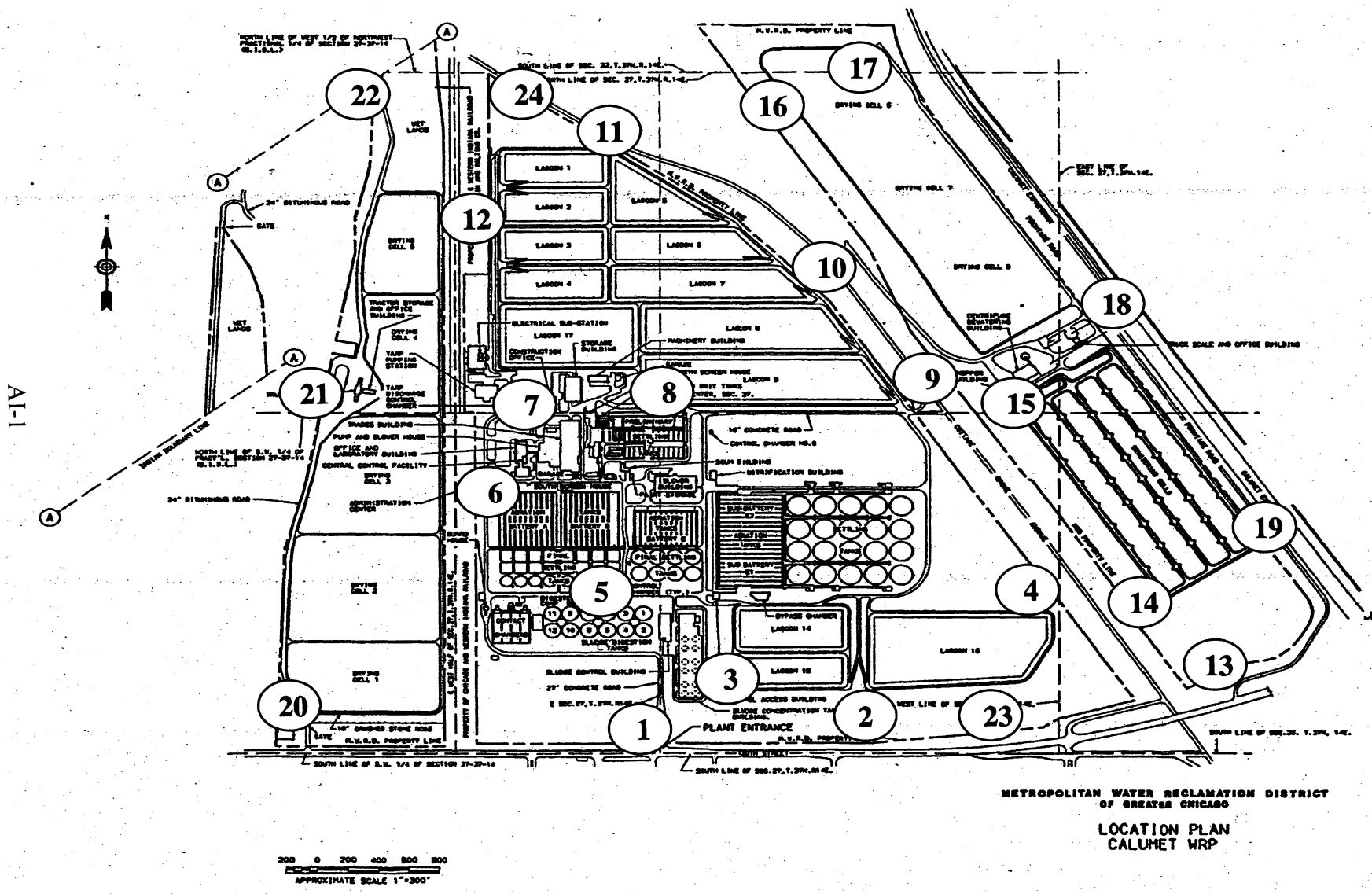
²Numbers in parentheses correspond to Station numbers in [Figure AI-7](#).

³Numbers in parentheses correspond to Station numbers in [Figure AI-8](#).

APPENDIX AI

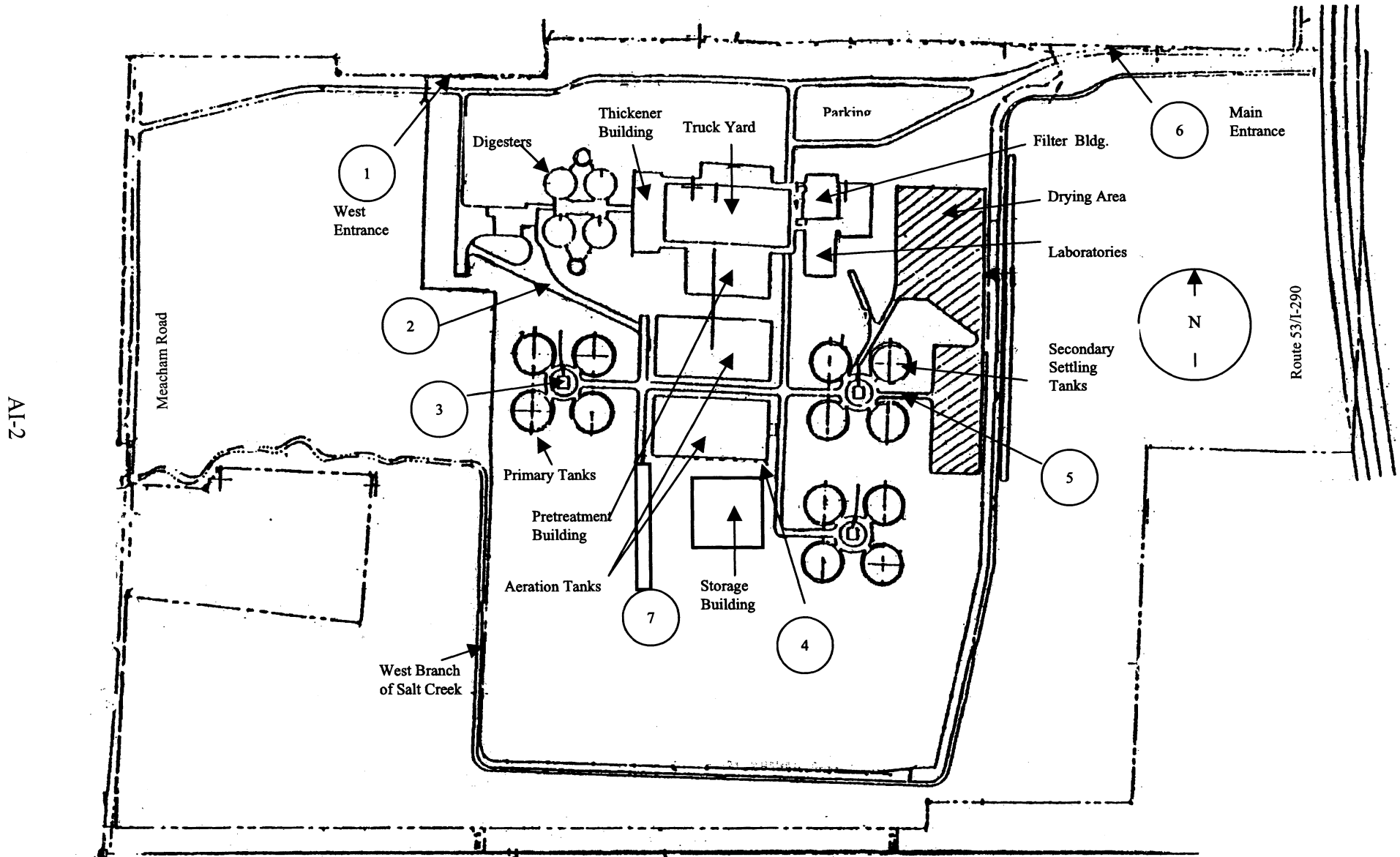
**LOCATION OF ODOR MONITORING STATIONS AT THE METROPOLITAN WATER
RECLAMATION DISTRICT OF GREATER CHICAGO WATER RECLAMATION PLANTS,
SOLIDS DRYING AREAS, AND SOLIDS PROCESSING SITES**

FIGURE AI-1: CALUMET WATER RECLAMATION PLANT AND CALUMET WATER RECLAMATION PLANT SOLIDS DRYING AREAS*



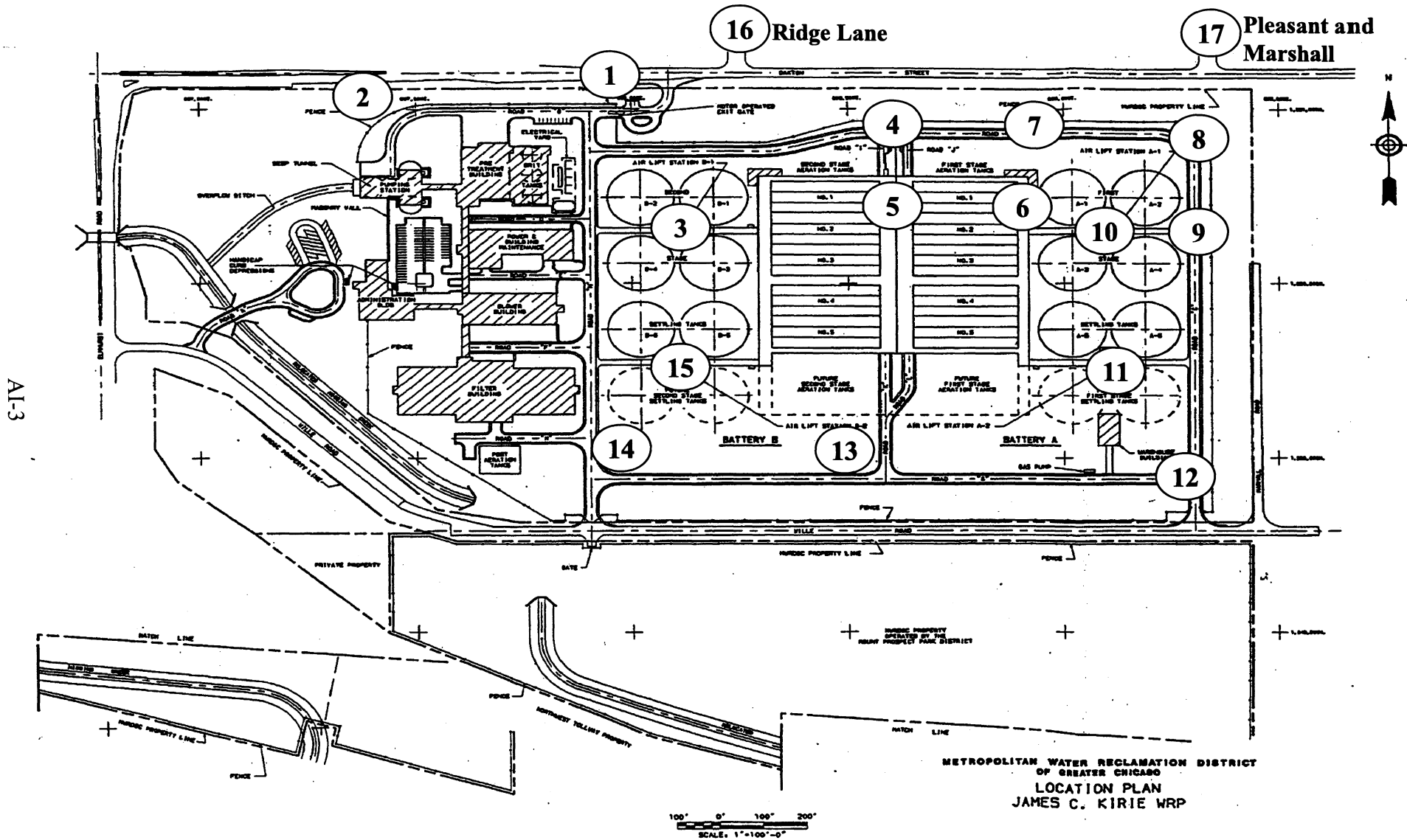
*Numbered circles indicate odor monitoring stations.

FIGURE AI-2: JOHN E. EGAN WATER RECLAMATION PLANT AND SOLIDS DRYING AREA*



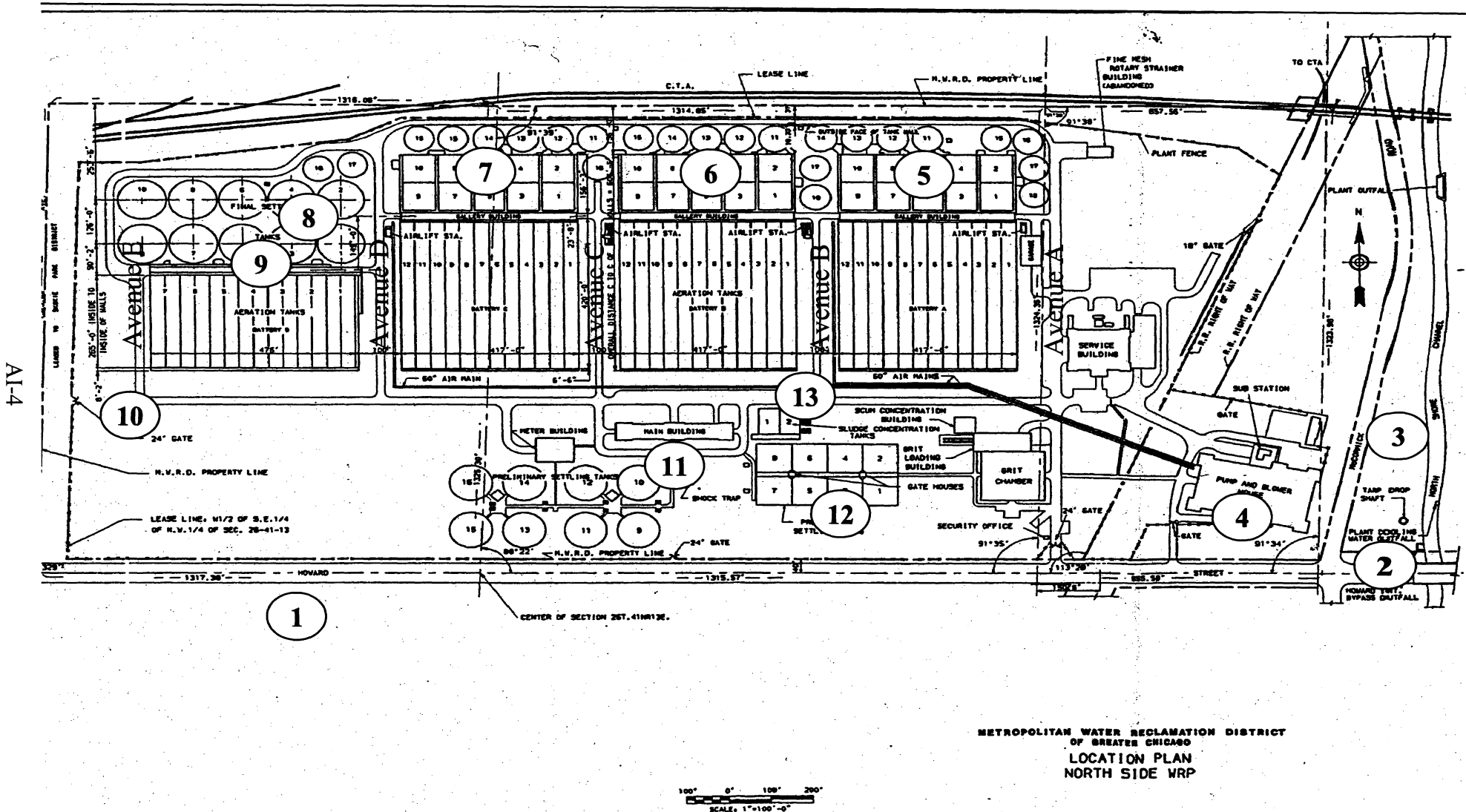
*Numbered circles indicate odor monitoring stations.

FIGURE AI-3: JAMES C. KIRIE WATER RECLAMATION PLANT*



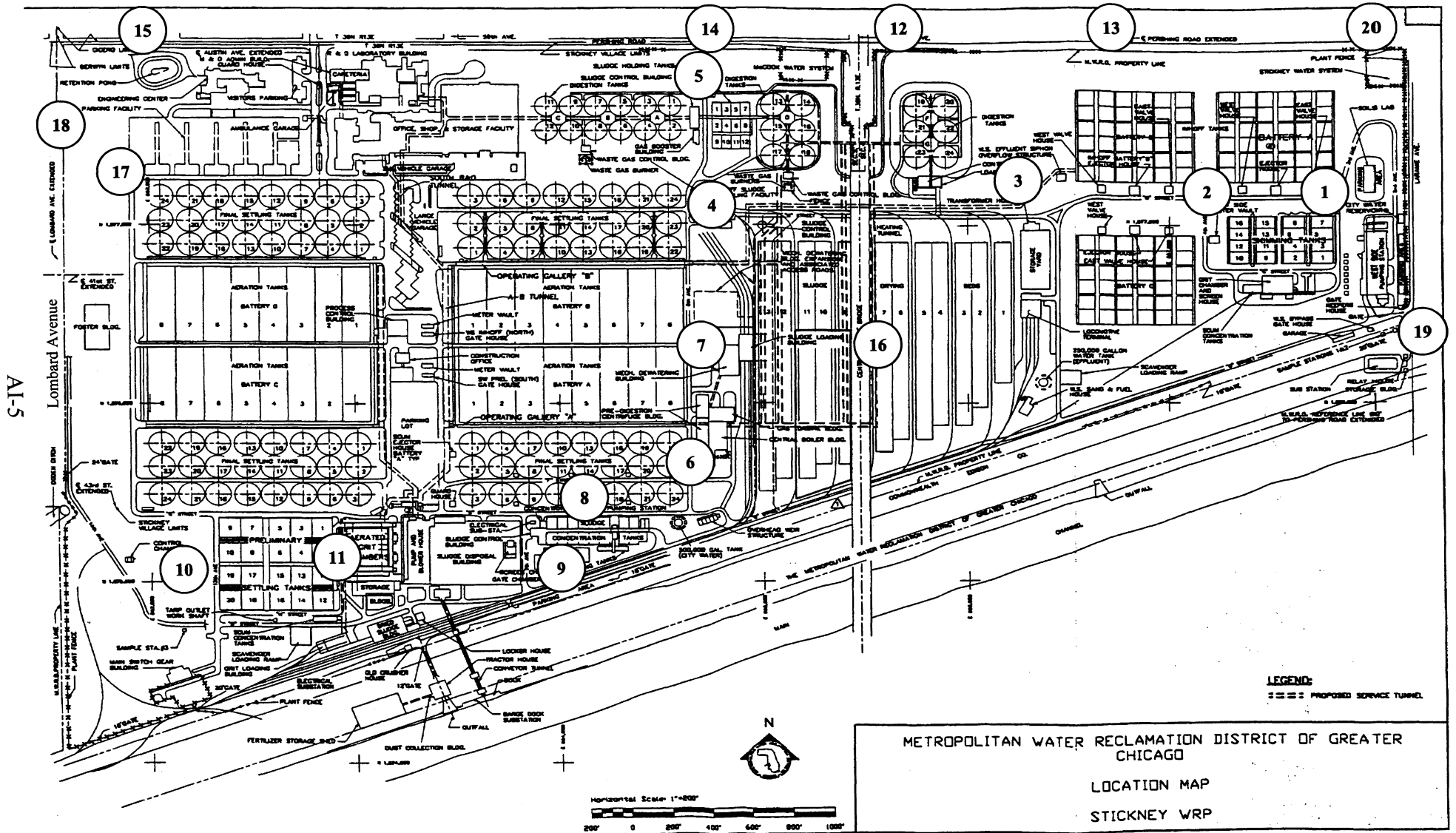
*Numbered circles indicate odor monitoring stations.

FIGURE AI-4: NORTH SIDE WATER RECLAMATION PLANT*



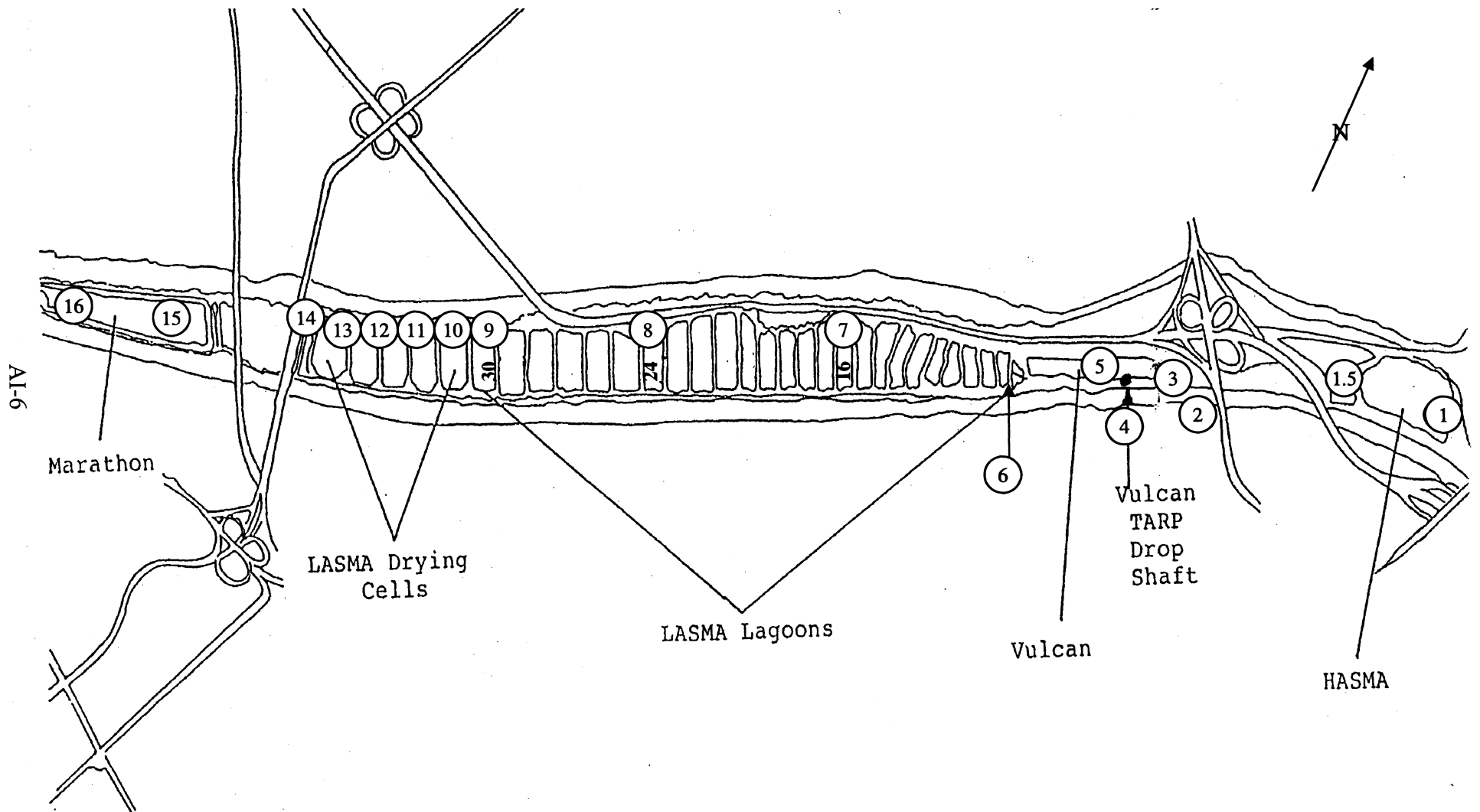
*Numbered circles indicate odor monitoring stations.

FIGURE AI-5: STICKNEY WATER RECLAMATION PLANT*



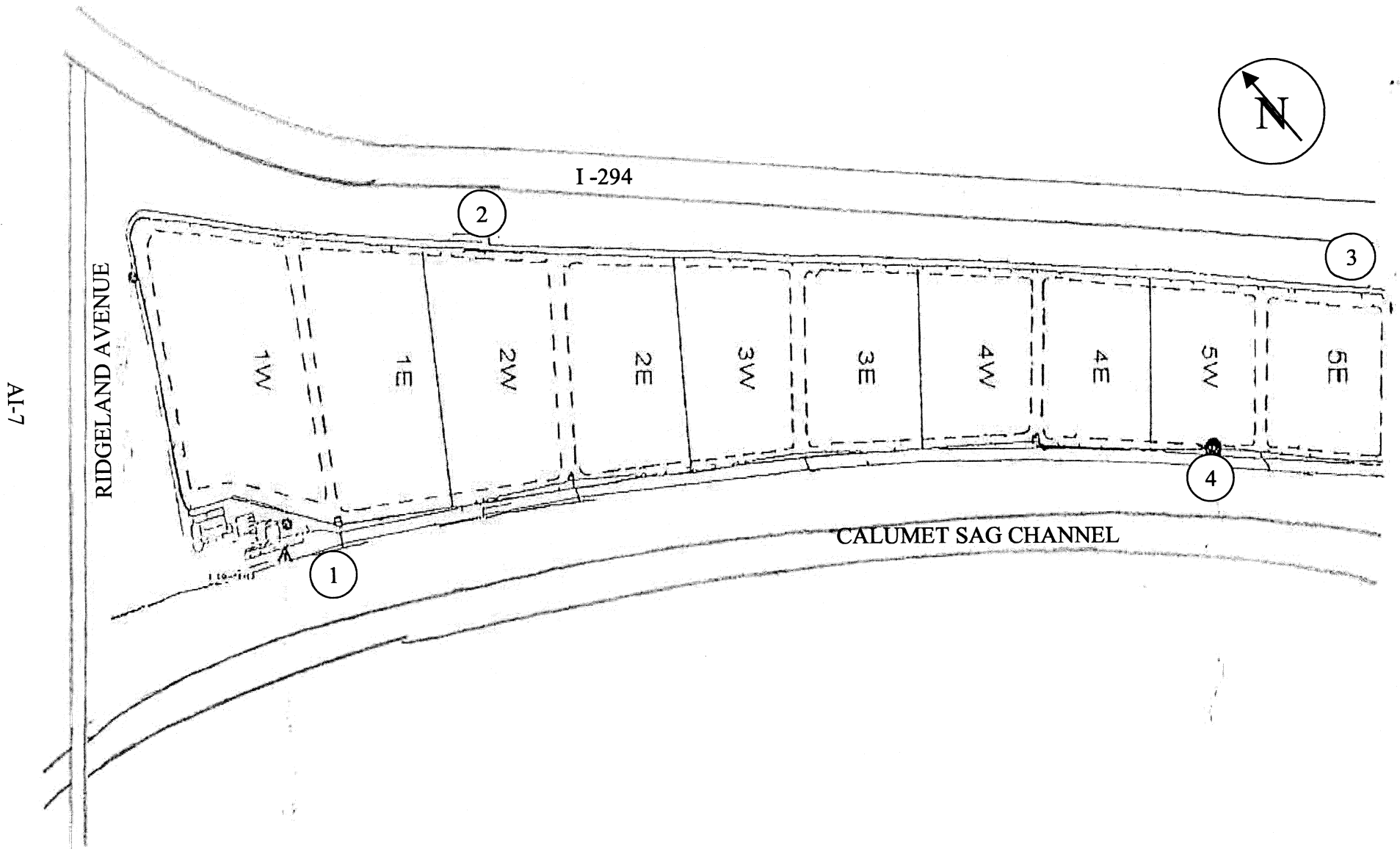
*Numbered circles indicate odor monitoring stations.

FIGURE AI-6: HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, AND MARATHON SOLIDS DRYING SITES, AND LAWDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE*



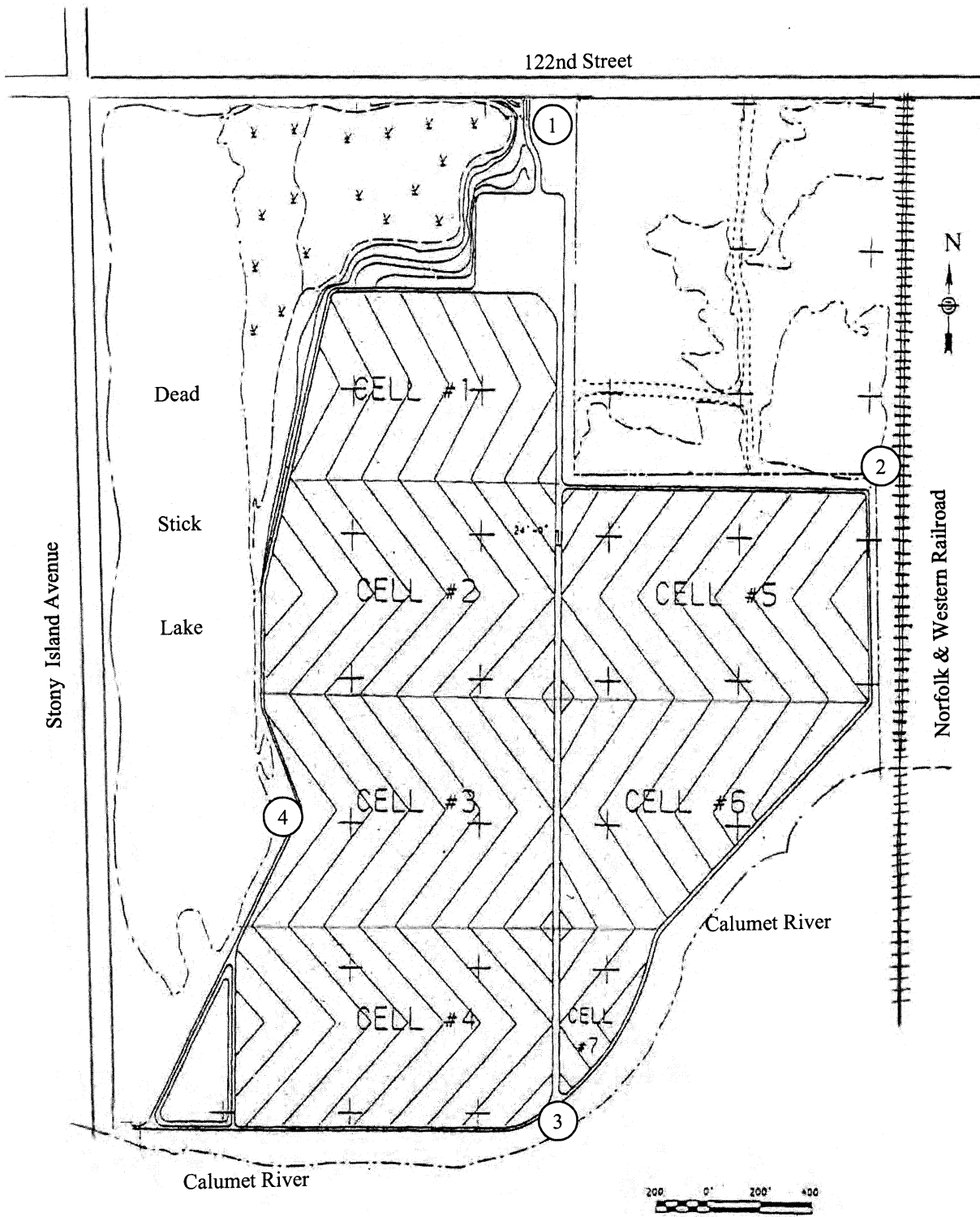
*Numbered circles indicate odor monitoring stations.

FIGURE AI-7: RIDGELAND AVENUE SOLIDS MANAGEMENT AREA SOLIDS DRYING AREA*



*Numbered circles indicate odor monitoring stations.

FIGURE AI-8: STONY ISLAND SOLIDS DRYING AREA*



*Numbered circles indicate odor monitoring stations.