USACHPPM

U.S. Army Center for Health Promotion and Preventive Medicine

WASTEWATER MANAGEMENT STUDY NO. 32-EE-4636-96
STORM WATER CHARACTERIZATION
NEW HAVEN DEFENSE NATIONAL STOCKPILE CENTER
NEW HAVEN, INDIANA
20-24 APRIL 1996

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Readiness Thru Health

U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE

The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) lineage can be traced back over a half century to the Army Industrial Hygiene Laboratory which was established at the beginning of World War II under the direct jurisdiction of The Army Surgeon General. It was originally located at the Johns Hopkins School of Hygiene and Public Health with a staff of three and an annual budget not to exceed three thousand dollars. Its mission was to conduct occupational health surveys of Army-operated industrial plants, arsenals, and depots. These surveys were aimed at identifying and eliminating occupational health hazards within the Department of Defense's (DOD) industrial production base and proved to be extremely beneficial to the Nation's war effort.

Most recently, the organization has been nationally and internationally known as the U.S. Army Environmental Hygiene Agency (AEHA) and is located on the Edgewood area of Aberdeen Proving Ground, Maryland. Its mission had been expanded to support the worldwide preventive medicine programs of the Army, DOD and other Federal agencies through consultations, supportive services, investigations and training.

On 1 August 1994, the organization was officially redesignated the U.S. Army Center for Health Promotion and Preventive Medicine and is affectionately referred to as the CHPPM. As always, our mission focus is centered upon the Army Imperatives to that we are optimizing soldier effectiveness by minimizing health risk. The CHPPM's mission is to provide worldwide scientific expertise and services in the areas of:

- Clinical and field preventive medicine
- Environmental and occupational health
- Health promotion and wellness
- Epidemiology and disease surveillance
- Related laboratory services

The Center's quest has always been one of customer satisfaction, technical excellence and continuous quality improvement. Our vision is to be a world-class center of excellence for enhancing military readiness by integrating health promotion and preventive medicine into America's Army. To achieve that end, CHPPM holds everfast to its core values which are steeped in our rich heritage:

- Integrity is our foundation
- Excellence is our standard
- Customer satisfaction is our focus
- Our people are our most valuable resource
- Continuous quality improvement is our pathway

Once again, the organization stands on the threshold of even greater challenges and responsibilities. The CHPPM structure has been reengineered to include General Officer leadership in order to support the Army of the future. The professional disciplines represented at the Center have been expanded to include a wide array of medical, scientific, engineering, and administrative support personnel.

As the CHPPM moves into the next century, we are an organization fiercely proud of our history, yet equally excited about the future. The Center is destined to continue its development as a world-class organization with expanded preventive health care services provided to the Army, DOD, other Federal agencies, the Nation, and the world community.

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO
ATTENTION OF

EXECUTIVE SUMMARY
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STORM WATER CHARACTERIZATION
NEW HAVEN DEFENSE NATIONAL STOCKPILE CENTER
NEW HAVEN, INDIANA
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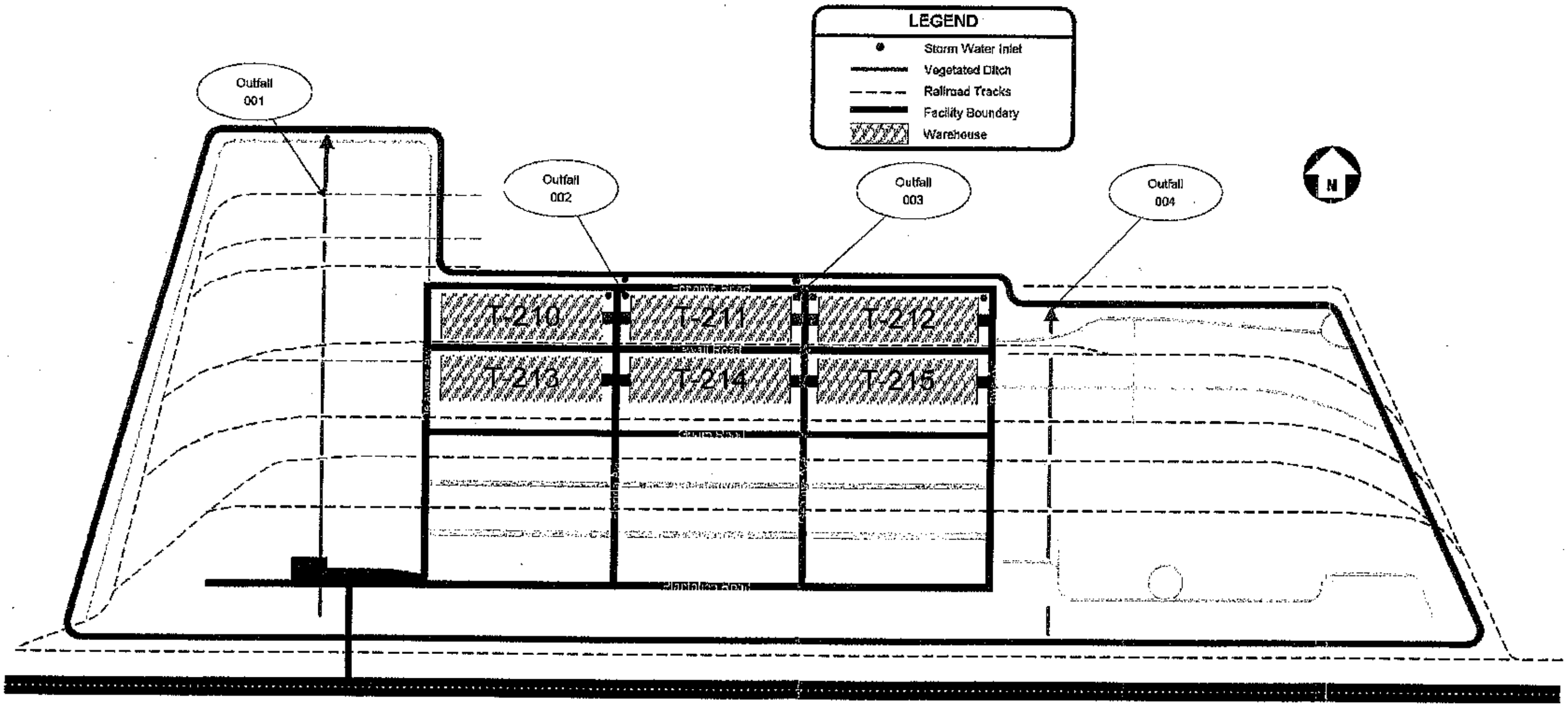
1. PURPOSE. The purpose of this study was to gather information for preparing a facility Storm Water Pollution Prevention Plan (SWPPP).

2. SUMMARY. Data from this report and the information gathered during the onsite evaluation will be used to develop an SWPPP, to be forwarded under separate cover. Site-specific recommendations and best management practices will be included as part of that comprehensive plan. The site visit and the storm water characterization revealed the following: the facility did an excellent job of minimizing storm water pollution through good housekeeping, preventive maintenance, and frequent inspections; a few parameters were detected above benchmark concentrations at nearly all the outfalls; nitrite/nitrate-nitrogen, detected at every outfall, is most likely due to run-on from the surrounding nitrogen-rich farm land; aluminum, iron, zinc, and total suspended solids were detected above benchmark concentrations at Outfall 001; aluminum and iron detected in the storm water runoff are presumed to be a direct result of solids in the runoff.

FIGURE 1. New Haven Defense National Stockpile Center



c. Sample Collection.

(1) Sample Locations. Four sample locations were selected to best characterize the storm water runoff from outdoor storage areas. The sample locations are described in Table 1 and shown on Figure 1 (general facility map). Site-specific maps are in Appendix C.

(2) Sampling Procedure. Storm water regulations required the collection of two samples from each storm water outfall (references 1 and 2). The first sample was a grab sample collected within the first 30 minutes of initial runoff. The second sample was a flow-weighted composite sample collected for the first 3 hours of the rain event. A valid rain event is classified as a minimum of 0.1 inches of rain fall, at least 72 hours after the previous "valid" storm. Table 2 provides the necessary information about the rain event sampled for this study.

TABLE 1. DESCRIPTION OF SAMPLE LOCATIONS

Sample Location	Description
001	Storm water drainage ditch located on the northwest end of the facility. The exact location is shown on Figure 1. This area was chosen to characterize the runoff from the stockpiles and open storage areas located west of Delaware Avenue.
002	Storm water drainage manhole located on the north end of the facility at the intersection of Panama Road and Florida Avenue (between Buildings T-210 and T-211). The exact location is shown on Figure 1. This manhole receives runoff from the warehouses and open storage areas at the south central end of the facility.
003	Storm water drainage manhole located on the north end of the facility at the intersection of Panama Road and Georgia Avenue (between Buildings T-211 and T-212). The exact location is shown on Figure 1. This manhole receives runoff from the warehouses and open storage areas at the south central end of the facility.
004	Storm water drainage ditch located on the northeast end of the facility. The exact location is shown on Figure 1. This area was chosen to characterize the runoff from the stockpiles and open storage areas located east of Iowa Avenue.

TABLE 2. STORM WATER DATA RECORDED DURING STORM WATER MONITORING

New Haven Defense National Stockpile Center
New Haven, Indiana

Outfall	Date of Rain Event	Duration of Storm (minutes)	Total Rainfall During Rain Event (inches)	Number of Hours Between Beginning of Storm Measured and the End of Previous Measurable Rain Event	Maximum Flow Rate During Rain Event (gpm)	Total Flow From Rain Event (gallons)	Season Sample Was Collected	Form of Precipitation (rainfall or snow melt)
001	4/22/96	180	0.7	168 †	2,210	317,880	Spring	Rain
002	4/22/96	180	0.7	168 †	1,530	184,910	Spring	Rain
003	4/22/96	180	0.7	168 †	1,170	146,970	Spring	Rain
004	4/22/96	180	0.7	168 †	450	76,160	Spring	Rain

↓ Description of the Method Used to Measure or Estimate Flow ↓

Outfall 001 Flow was measured and recorded using an area velocity flow meter. The flow meter was setup to measure flow through a 48" round pipe.

Outfall 002 Flow was measured and recorded using an area velocity flow meter. The flow meter was setup to measure flow through a 24" round pipe.

Outfall 003 Flow was measured and recorded using an area velocity flow meter. The flow meter was setup to measure flow through a 24" round pipe.

Outfall 004 Flow was measured and recorded using a bubble type flow meter. The flow meter was setup to measure flow through an 18" rectangular weir with end contractions.

† Information from the previous rain event was obtained from the Midwestern Climate Center located in Champaign, Illinois. The previous rain event produced 0.25 inches on 15 April 1996.

d. Analytical Data. All samples were collected and preserved per 40 CFR 136 (reference 3) and the USAEHA Sampling Guide (reference 4).

5. FINDINGS AND DISCUSSION.

a. General.

(1) Outdoor storage areas at the New Haven DNSC have the potential for generating storm water pollution. The majority of bulk materials stored on the facility are uncovered and stockpiled directly on the ground. Storm water which contacts the materials could contribute to pollution by washing off solids or dissolving pollutants. Table 3 lists the materials stored on the facility which potentially could come in contact with storm water.

(2) The facility did an excellent job of minimizing and preserving storm water pollution through good housekeeping practices, preventive maintenance, and frequent inspections.

TABLE 3. MATERIALS STORED ON THE FACILITY

Open Area Storage	Warehouse Storage	
Aluminum Oxide, Fused, Crude	Asbestos, Amosite	Mica MF
Aluminum Oxide, Abrasive Grain	Asbestos, Chrysotile	Mica MS
Antimony	Beryllium Metal	Mica PB
Ferrochrome, High Carbon	Cadmium	Mica PS
Ferrochromium, Low Carbon	Ferrochromium, Low Carbon	Nickel
Ferromanganese, High Carbon	Ferrochromium, Silicon	Quartz
Ferromanganese, Medium Carbon	Chromium - Exothermic	Quinine Sulphate
Fluorspar, Acid Grade	Chromium, Vacuum	Rare Earth
Fluorspar, Metallurgical Grade	Cobalt	Rubber
Kyanite	Ferrocolumbium	Sebacic Acid
Lead	Columbium - Tantalum Source Material	Talc
Silicomanganese	Columbium Carbide Powder	Tantalum Metal Capacitor Grade
Tin	Fluorspar, Acid Grade	Tantalum Source Material
Titanium	Graphite, Natural, Ceylon and Amorphous Lump	Tin
Zinc	Graphite, Natural, Other Than C&M. Cryst.	Tungsten O & C Scheelite
Zirconium Ore (Baddeleyite)	Iodine	Tungsten O & C Ferb Hubn Wolf
	Lead	Tungsten Carbide Powder
	Electrolytic Manganese	Tungsten Powder, Hydrogen Reduced
	Manganese Dioxide, Battery Grade, Synthetic Dioxide	Ferrotungsten
	Mercury	Tungsten Metal Powder, Carbon Reduced
	Mica MB O/T Cond + Elec Qual	Vegetable Tannin Extract, Chestnut
	Mica MB Electronic T Quality	Vegetable Tannin Extract, Quebracho
	Mica MB - Condenser Quality	Vegetable Tannin Extract, Wattle
	Mica MB Stained B and Lower	Zinc

b. Storm Water Characterization. Since site-specific storm water discharge limits for the facility have not been developed, U.S. Environmental Protection Agency (EPA) water quality criteria (reference 5) and EPA benchmark concentrations (reference 6) were used in this document strictly as a reference to compare with storm water data. The values listed do not represent effluent limits for these particular storm water discharges. Table 4 compares the storm water monitoring data to these standards.

(1) Water Quality Criteria. EPA water quality criteria establish water use and numeric water quality standards for protecting and maintaining the integrity of the Nation's waters. Water quality criteria are in-stream standards and should not be interpreted as effluent limitations. A combination of mixing zone data, water quality criteria, and discharge and stream flows are used to develop numerical discharge limits for National Pollutant Discharge Elimination System (NPDES) permits.

(2) EPA Benchmark Concentrations. The EPA established "benchmark" concentrations include parameters such as total suspended solids (TSS), for which water quality criteria do not exist. Like water quality criteria, benchmark concentrations set forth in the Storm Water Multi-sector permit (reference 6) are not effluent limitations and are not to be adopted as such. These levels are simply target concentrations that industrial dischargers should attempt to achieve through the implementation of an SWPPP.

c. Analytical Results. The highest concentrations were observed in the first samples collected at the beginning of the rain event (initial runoff, first 30 minutes of rain event). For the most part, parameter concentrations tended to decrease after the first 30 minutes of the rain event, indicating that, as expected, the worst storm water quality was from initial runoff (see Table 4.). Parameters typically detected above benchmark concentrations were chemical oxygen demand (COD), nitrite/nitrate-nitrogen (NO_2/NO_3), aluminum, and iron. Total suspended solids are believed to have an influence on metals concentrations.

(1) Chemical Oxygen Demand. Chemical oxygen demand is a typical storm water contaminant found in the runoff from vehicle maintenance areas and parking lots or roads with evident petroleum, oil, or lubricant (POL) stains. At the time of the study, there was no evidence of POL stains on the roads and parking lots. Chemical oxygen demand concentrations tended to be above benchmark concentrations during the initial runoff and fell below the benchmark criteria as the rain event continued.

(2) Nitrite/Nitrate-Nitrogen. Nitrite/nitrate-nitrogen, not usually detected in storm water runoff in high concentrations, was likely due to run-on from the surrounding nitrogen-rich farm land.

Table 4. Analytical Results Compared to EPA Fresh Water Criterion and EPA Benchmark Concentrations. Criteria is based on a recieving water Hardness of 50 mg/L.

Parameter Analyzed	Analytical Results								EPA Fresh Water Criterion [1]		EPA Benchmark Concentration [2] (mg/L)
	Outfall 001		Outfall 002		Outfall 003		Outfall 004		Continuous Concentration (Chronic) (mg/L)	Maximum Concentration (Acute) (mg/L)	
	Grab (mg/L)	Comp. (mg/L)	Grab (mg/L)	Comp. (mg/L)	Grab (mg/L)	Comp. (mg/L)	Grab (mg/L)	Comp. (mg/L)			
↓ STATE REGULATED MONITORING ↓											
Oil & Grease	1.5	--	36	--	5.7	--	2.7	--	--	--	15
BOD_5	9.6	<2.3	11	<2.3	19	2.4	<2.3	<2.3	--	--	30
COD	170 §§	29	140 §§	<25	150 §§	31	<25	<25	--	--	120
TSS	400 §§	120 §§	20	22	4.5	34	29	44	--	--	100
TKN	3.5	1.1	3.6	0.8	1.9	0.9	0.56	0.7	--	--	19 ‡
NO_2/NO_3	1.5 §§	1.7 §§	2.2 §§	1.5 §§	1.2 §§	1.2 §§	0.47	0.97 §§	--	--	0.68
PO_4	0.54	0.18	0.11	0.13	0.04	0.07	0.10	0.10	--	--	2
pH (min, max) s.u.	7.0	7.6	7.0	7.5	6.7	7.7	7.3	7.7	--	--	6.0 - 9.0 s.u.
↓ TOTAL METALS ↓											
Aluminum	7.3 §§	2.3 §§	0.45	0.52	<0.25	0.76 §§	0.77 §§	1.2 §§	--	--	0.75
Antimony (H)	0.17	0.34	<0.15	0.31	0.15	0.19	<0.15	<0.15	--	--	0.636
Arsenic (CRL)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.19	0.36	0.1685
Boron	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	0.058	--	--	--
Chromium, total	0.025	<0.020	<0.02	<0.02	<0.02	<0.02	0.32	0.21	--	--	--
Copper (T&O) †	0.029	0.015	0.026	0.031	<0.01	0.026	<0.01	0.011	0.012	0.018	0.0636
Iron	15 §§	4.2 §§	0.61	0.97	0.39	1.2 §§	1.3 §§	1.8 §§	--	--	1.0
Lead (H) †	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.0032	0.082	0.0816
Manganese	0.65	0.17	0.074	0.110	0.29	0.066	0.22	0.10	--	--	1.0
Silver †	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	0.0041	0.0318
Tin	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--	--	--
Titanium	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--	--	--
Zinc (T&O) †	0.19 §	0.1	0.086	0.071	0.06	0.094	0.065	0.051	0.11	0.12	0.117
Zirconium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--	--
↓ MISCELLANEOUS ↓											
Fluoride	<0.2	0.2	<0.2	<0.2	0.21	<0.2	0.58	0.36	--	--	1.8
Sulfate	19	66	15	40	61	23	90	25	--	--	--

1 Reference 5. (Water Quality Criteria)

2 Reference 6. (Benchmark Criteria)

† Based on Hardness equation, (values given at 50 mg/L hardness).

‡ This value is for ammonia nitrogen. Total Kjeldahl nitrogen (TKN) is made up of ammonia and organic nitrogen.

§ Exceeds EPA Water Quality Criteria.

§§ Exceeds Benchmark Concentrations.

(3) Metals. Aluminum and iron detected in the storm water runoff are presumably a result of entrained solids as there was a direct correlation with TSS concentrations. Analytical results showed that when TSS decreased, aluminum and iron decreased; likewise, as TSS increased, aluminum and iron increased. Aluminum and iron are common, naturally occurring, metals prevalent in many soils; therefore, the specific source could have been the native soil or solids and dissolved particles washed off the ore piles. Additional data and site information would be required to determine if ore piles contribute to the aluminum and iron concentration in the runoff. Aluminum and iron are not considered priority toxic pollutants or an immediate threat to human health or the environment. Nevertheless, the EPA has developed benchmark storm water concentrations for these specific parameters to help protect aquatic life resources, to protect designated water uses, and to control pollution of nonpoint source discharges.

(4) Total Suspended Solids. Total suspended solids are typically a significant problem in storm water runoff; however, high TSS concentrations were only found at Outfall 001. The control of TSS throughout the majority of the facility is likely due to the well maintained vegetative cover around storage areas and in storm water channels (ditches).

6. SUMMARY.

a. Data from this report and the information gathered during the onsite evaluation will be used to develop an SWPPP, to be forwarded under separate cover. Site-specific recommendations and best management practices will be included as part of that comprehensive plan.

b. The site visit and the storm water characterization revealed the following:

(1) The facility did an excellent job of minimizing storm water pollution through good housekeeping, preventive maintenance, and frequent inspections.

(2) A few parameters were detected above benchmark concentrations at nearly all the outfalls. Parameters such as aluminum and iron are typically present in storm water runoff because of the native soil composition. High COD concentrations are typically associated with runoff from vehicle maintenance areas and parking lots or roads with evident petroleum, oil, or lubricant stains.

(3) Nitrite/nitrate-nitrogen, detected at every outfall, is most likely due to run-on from the surrounding nitrogen-rich farm land.

(4) Aluminum, iron, zinc, and TSS were detected above benchmark concentrations at Outfall 001. Aluminum and iron detected in the storm water runoff are presumed to be a direct result of solids in the runoff.

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APPENDIX A

REFERENCES

1. Indiana NPDES General Permit Rule Program, 327 Indiana Administrative Code (IAC) 15, August 31, 1992.

2. Title 40, Code of Federal Regulations (CFR), 1995 rev, Part 122, The National Pollutant Discharge Elimination System (NPDES), Storm Water.

3. Title 40, CFR, 1995 rev, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.

4. USAEHA Technical Guide No. 155, February 1993, Environmental Sampling Guide.

5. EPA-823-B-94-005a, Water Quality Standards Handbook, Second Edition, August 1994.

6. Volume 60, Number 189, Federal, Final National Pollutant Discharge Elimination System Storm Water Multi-Sector General Permit for Industrial Activities; Notice, September 29, 1995.

APPENDIX B

PERSONNEL CONTACTED/STUDY PERSONNEL

1. PERSONNEL CONTACTED.

a. Mr. Kevin Reilly, Industrial Hygienist, Defense National Stockpile Operations.

b. Mr. Fred Brooks, Depot Manager, New Haven National Stockpile Center.

2. PROJECT PERSONNEL. The following personnel from USACHPPM, located at Aberdeen Proving Ground, Maryland, conducted the New Haven DNSC Storm Water Characterization Study.

a. Mr. Paul Rankin, Environmental Engineer, Project Officer.

b. Mr. Brian Pickard, Environmental Engineer.

c. Mr. Richard Gordon, Engineering Technician.

d. Mr. Tom Kahoe, Engineering Technician.

APPENDIX C

SITE MAPS

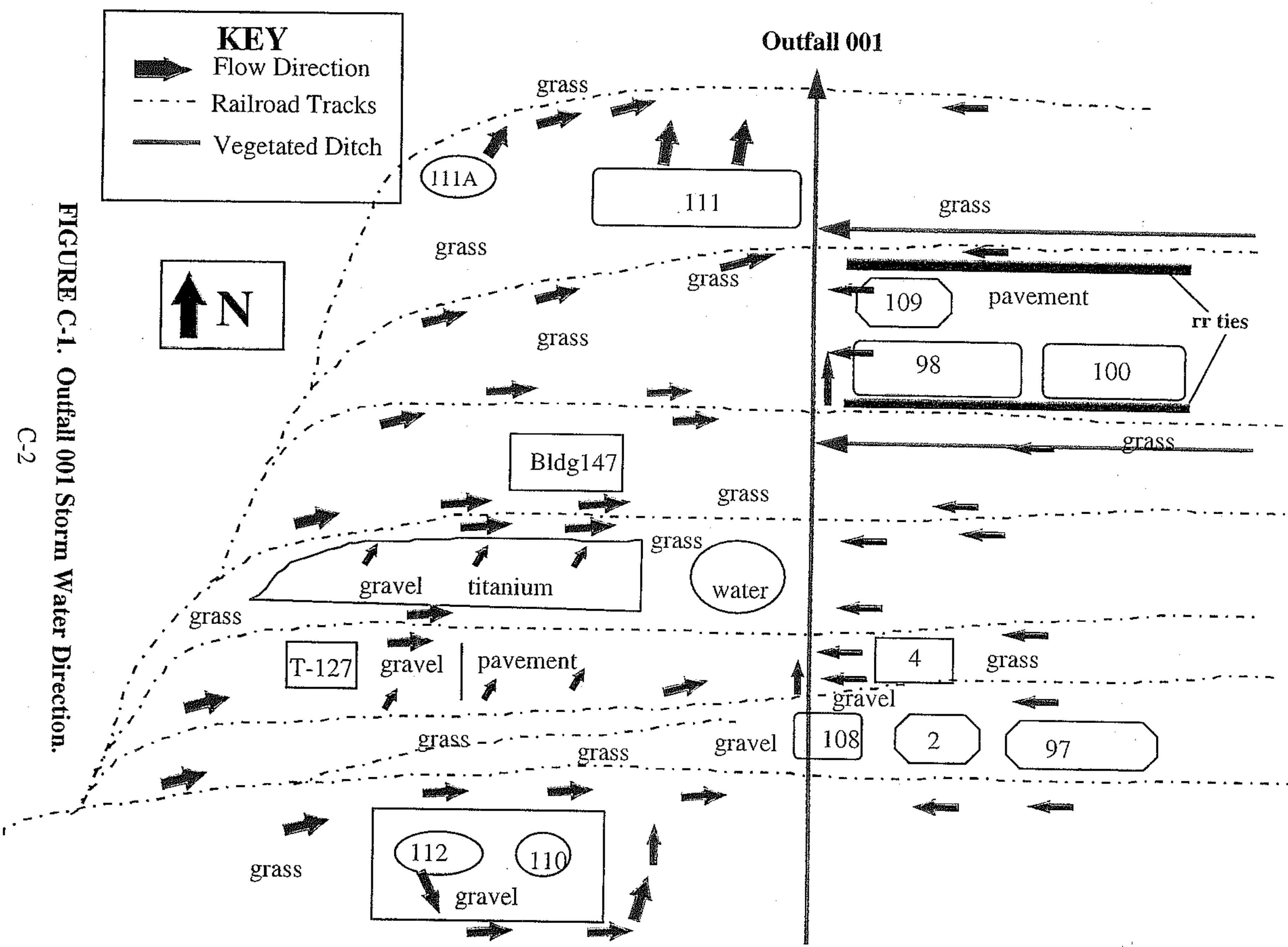

FIGURE C-1. Outfall 001 Storm Water Direction.

OUTFALL 001. Storage Piles.

ALUMINUM OXIDE. Pile 2.

RAILROAD TIES /CONCRETE BLOCKS. Pile 4.

FLUORSPAR. Piles 97, 98, &100.

FERROCHROME. Pile 108.

FERROMANGANESE. Piles 109 & 110.

ZIRCONIUM. Pile 111.

ZIRCONIUM ORE. Pile 111A.

FERROCHROME. Pile 112.

ALUMINUM OXIDE. Pile 127.

FIGURE C-1. Outfall 001 Storm Water Direction. (Continued)

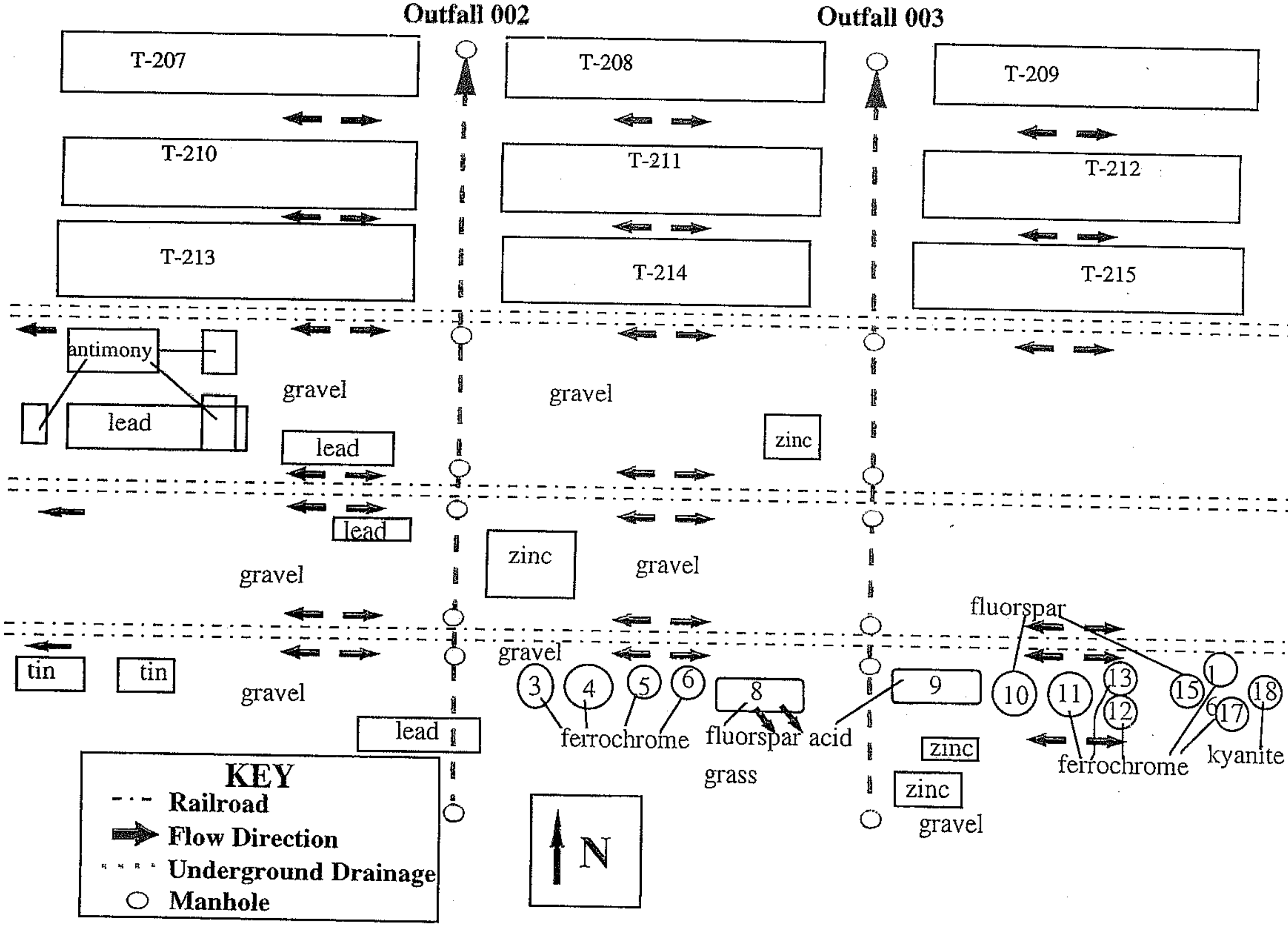

FIGURE C-2. Outfall 002 & 003 Storm Water Flow Direction.

Outfall 002 & 003. Storage Piles

FERROCHROME. Piles 3, 4, 5, 6, 11, 12, & 13.

FLUORSPAR. Piles 10 & 15.

FLUORSPAR ACID. Piles 8 & 9.

KYANITE. Pile 18.

FIGURE C-2. Outfall 002 & 003 Storm Water Direction. (Continued)

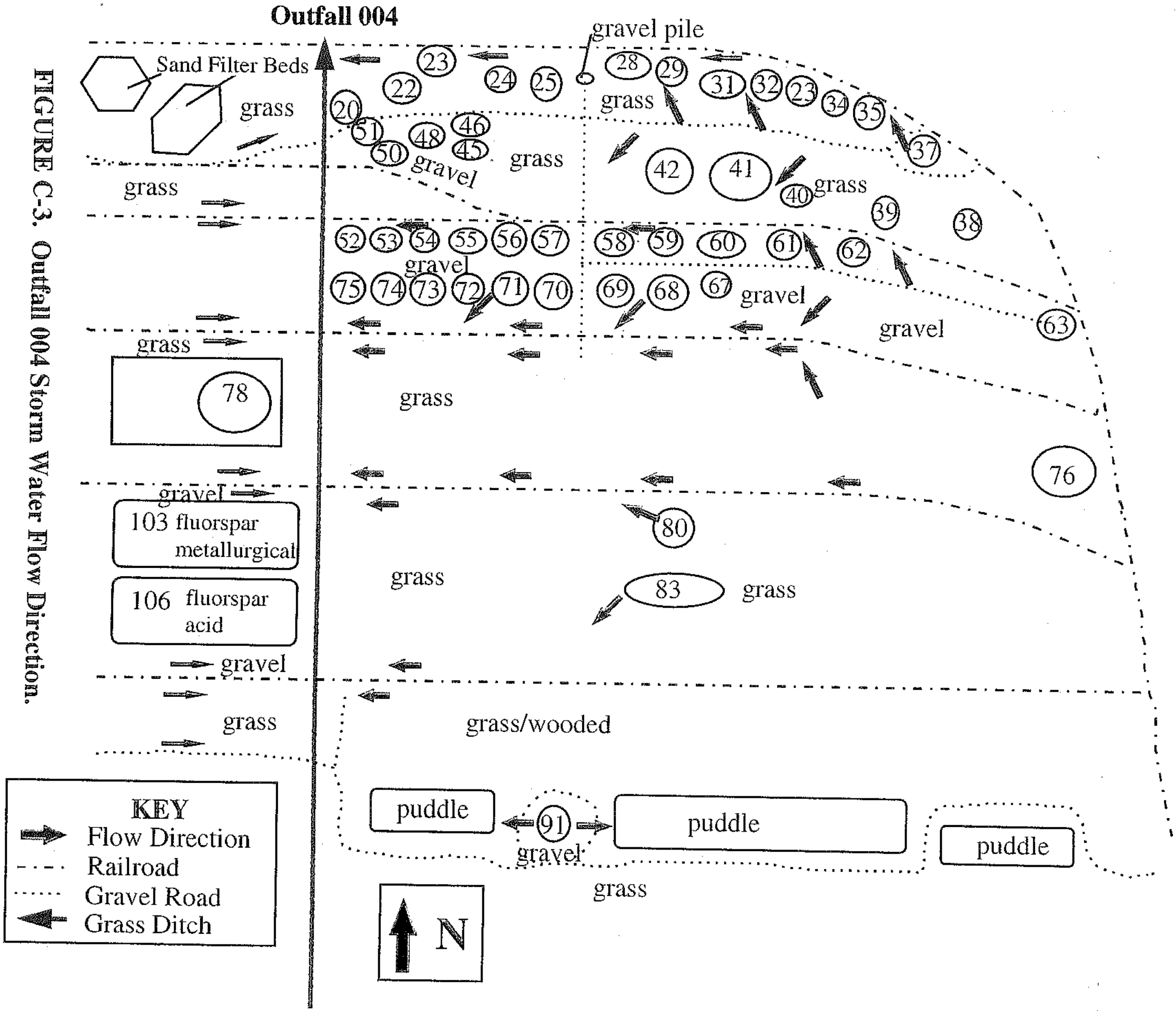

FIGURE C-3. Outfall 004 Storm Water Flow Direction.

Outfall 004. Storage Piles

MANGANESE. Piles 20, 22, 23, 24, 25, 28, 29, 31, 32, 23, 34, 35, 37, 38, 39, 40, 41, 42, 45, 46, 48, 50, & 51.

FERROCHROME. Piles 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 67, 68, 69, 70, 71, 72, 73, 74, & 75.

FERROMANGANESE. Piles 76, 80, & 83.

ALUMINUM OXIDE. Pile 78.

FLUORSPAR. Pile 103.

FLUORSPAR ACID. Pile 91 & 106.

FIGURE C-3. Outfall 004 Storm Water Direction. (Continued)