FINAL ALTERNATIVES ARRAY DOCUMENT

STOUGHTON CITY LANDFILL

STOUGHTON, WISCONSIN

ENSR

SUBMITTED BY:

STOUGHTON CITY LANDFILL STEERING COMMITTEE

REVISION NO. 1

AUGUST 14, 1990

PREPARED BY:

ENSR CONSULTING AND ENGINEERING

740 PASQUINELLI DRIVE

WESTMONT, ILLINOIS 60559

ENSR

Formerly ERT

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August 14, 1990

ENSR Project No: 6885-002-220

Mr. Michael A. Valentino
Remedial Project Manager
U.S. Environmental Protection Agency
Region V (Mail Code: 5HS-11)
230 South Dearborn Street
Chicago, Illinois 60604

SUBJECT: Transmittal of Final Alternatives Array Document (AAD) (Revision 1) for the Stoughton City Landfill RI/FS

Dear Mr. Valentino:

At the direction of the Stoughton City Landfill Steering Committee, we are providing you with 9 copies of the Final AAD for the subject site. As you know, the Draft AAD was prepared by ERM-North Central. The Final AAD has been prepared to address agency review comments on the Draft AAD, including those of U.S. EPA, dated January 10, 1990, and those of WDNR, dated January 12, 1990. The Final AAD uses data and information contained in Revision 2 of the Draft RI Report, submitted under separate cover.

If you have any questions, please do not hesitate to contact me.

Sincerely,

for Louis H. Meschede
Project Manager
Senior Project Hydrogeologist

LHM/js

Enclosure
Reference No. 90-08-G756
cc: Ms. Robin Schmidt/WDNR (3 copies)
Dr. Briand C. Wu (1 copy)
Mr. Robert P. Kardasz (1 copy)
Mr. Michael Doran (1 copy)
Mr. M. Strimbu (1 copy)
Mr. Tim Wright, Esq. (w/o enclosure)

FINAL ALTERNATIVES ARRAY DOCUMENT

STOUGHTON CITY LANDFILL

STOUGHTON, WISCONSIN

SUBMITTED BY:

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WESTMONT, ILLINOIS 60559

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1.0 INTRODUCTION

1.1 Purpose and Organization of Report

The purpose of the Alternatives Array Document (AAD) is to present the analyses and evaluations used to develop and screen remedial alternatives for the Stoughton City Landfill site. The AAD is based on information and data presented in the Draft Remedial Investigation (RI) Report dated August 10, 1990 (Revision 2).

The process used to develop remedial alternatives and the organization of the AAD is consistent with that suggested in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (U.S. EPA, 1988). Figure 1-1 summarizes the remedial alternatives development process and report organization.

1.2 Background Information

1.2.1 Site Description

The Stoughton City Landfill site is located in the northeast portion of Stoughton, Dane County, Wisconsin, approximately 13 miles southeast of Madison. The property containing the landfill site encompasses approximately 27 acres and occupies portions of the W 1/2 of the SW 1/4, and the SW 1/4 of the NW 1/4 of Section 4, T.5N., R.11E. (Figure 1-2). Although the landfill property originally occupied approximately 40 acres, landfilling has occurred on only about 15 acres of the property. Since 1982, land exchanges between the City and the owner of an adjacent property have modified the original site boundaries (Figure 1-3).

Figures 1-4 and 1-5 show existing site conditions and topography, respectively. A wetland area that existed in the southeast portion of the current property boundary was the initial area of waste disposal. Wetlands occur adjacent to the southeast portion of the site, in the north portion of the site, and west of the site along the Yahara River. Surface water runoff over most of the northern portion of the property flows to the drainage ditch in the north-central portion of the site. This drainage ditch originates east of the site and also receives flow from the wetland adjacent to the southeast portion of the property and land east of County Highway N.

Surficial deposits in the vicinity of the site include ice-contact stratified deposits and lacustrine plain sediments (Mickelson and McCartney, 1979). Ice-contact stratified deposits generally include significant sand and gravel deposits and land forms such as kames and eskers. These

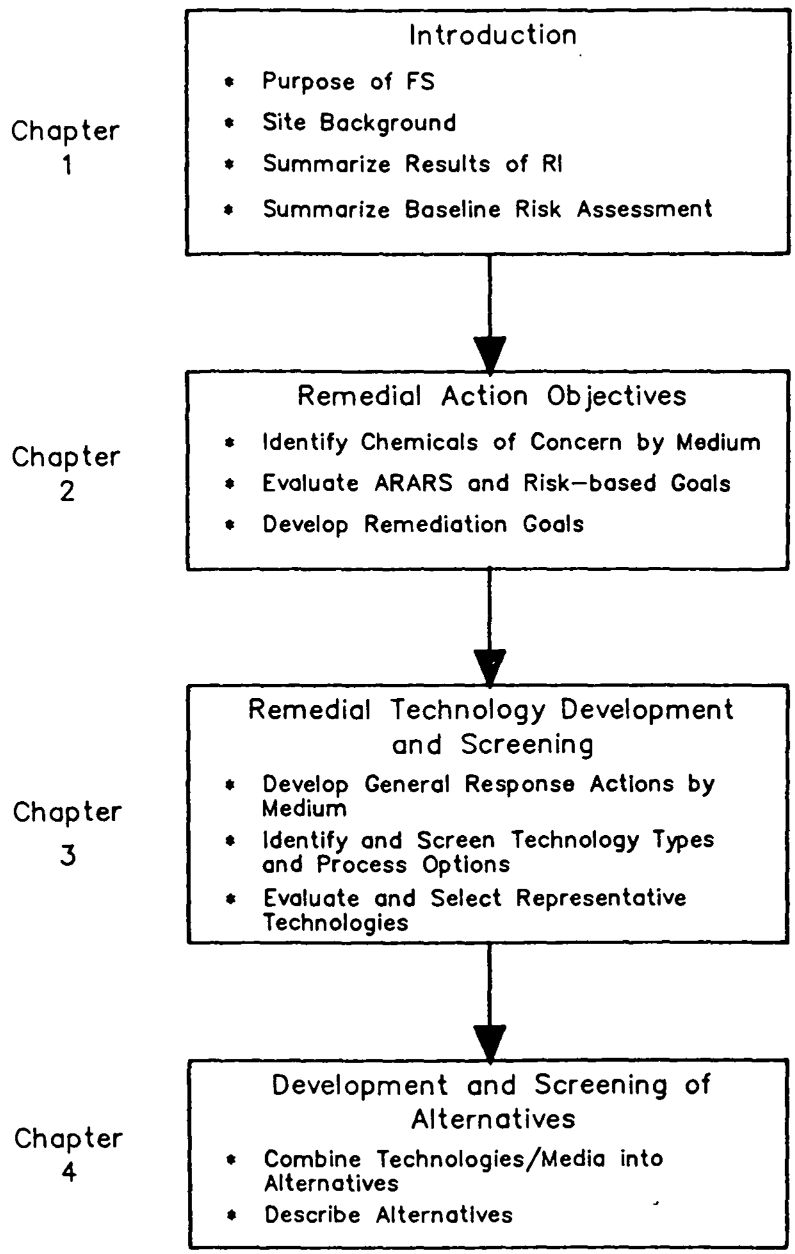

FIGURE 1-1

ENSR™
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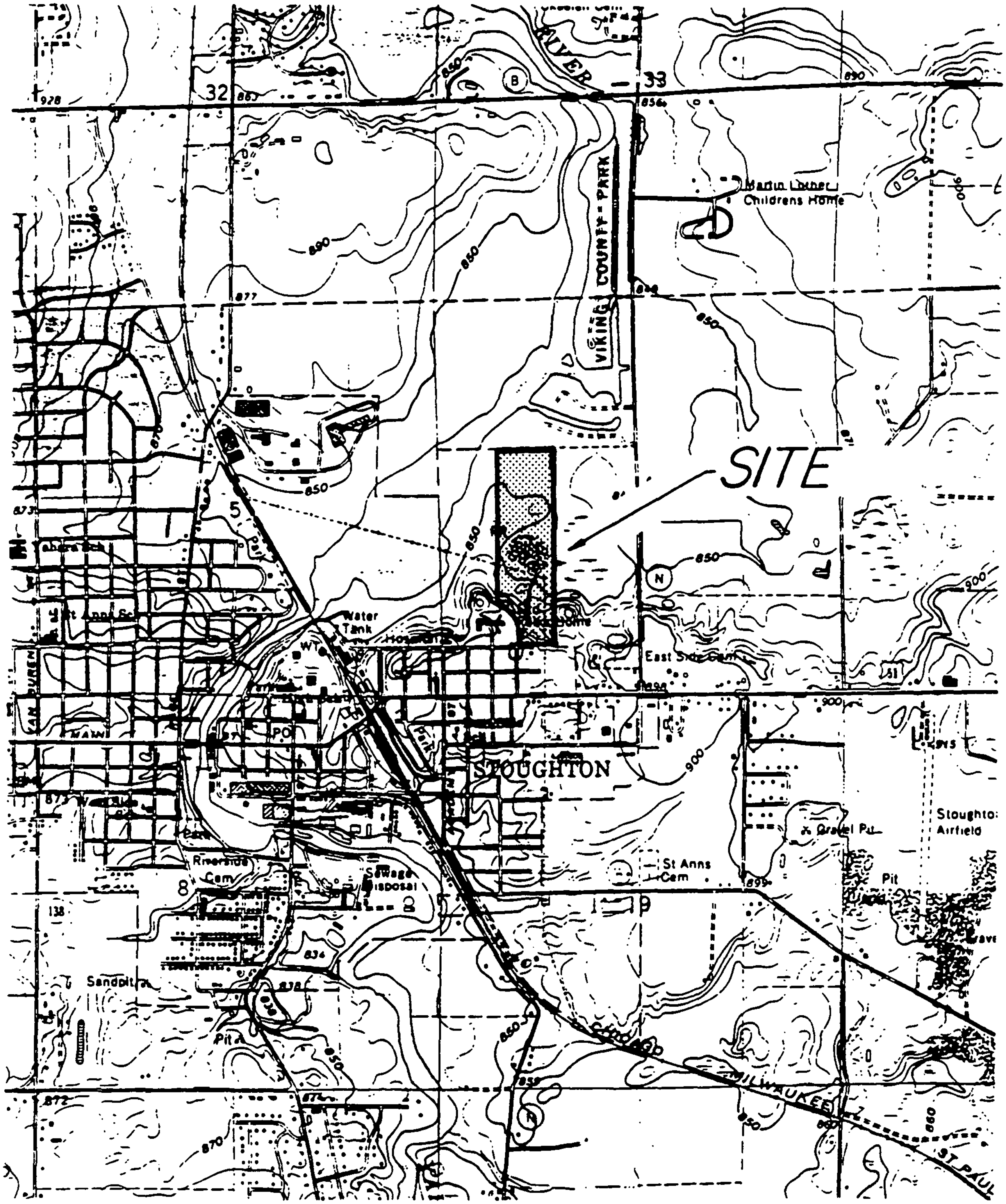
REMEDIAL ALTERNATIVE DEVELOPMENT PROCESS
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

DRAWN:	EDH	DATE:	3/1/90	PROJECT NUMBER:	REV.
APPV'D:	X	REVISED:	X	6885-002	0

FIG1-1



APPROXIMATE SCALE (ft)

1000 0 1000 2000

Ref.: USGS, 7.5-MINUTE STOUGHTON QUADRANGLE, DANE CO., WISCONSIN

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FIGURE I-2

SITE LOCATION MAP

STOUGHTON CITY LANDFILL

STOUGHTON, WISCONSIN

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APPV'D:	REVISED:	DRAWING NUMBER:

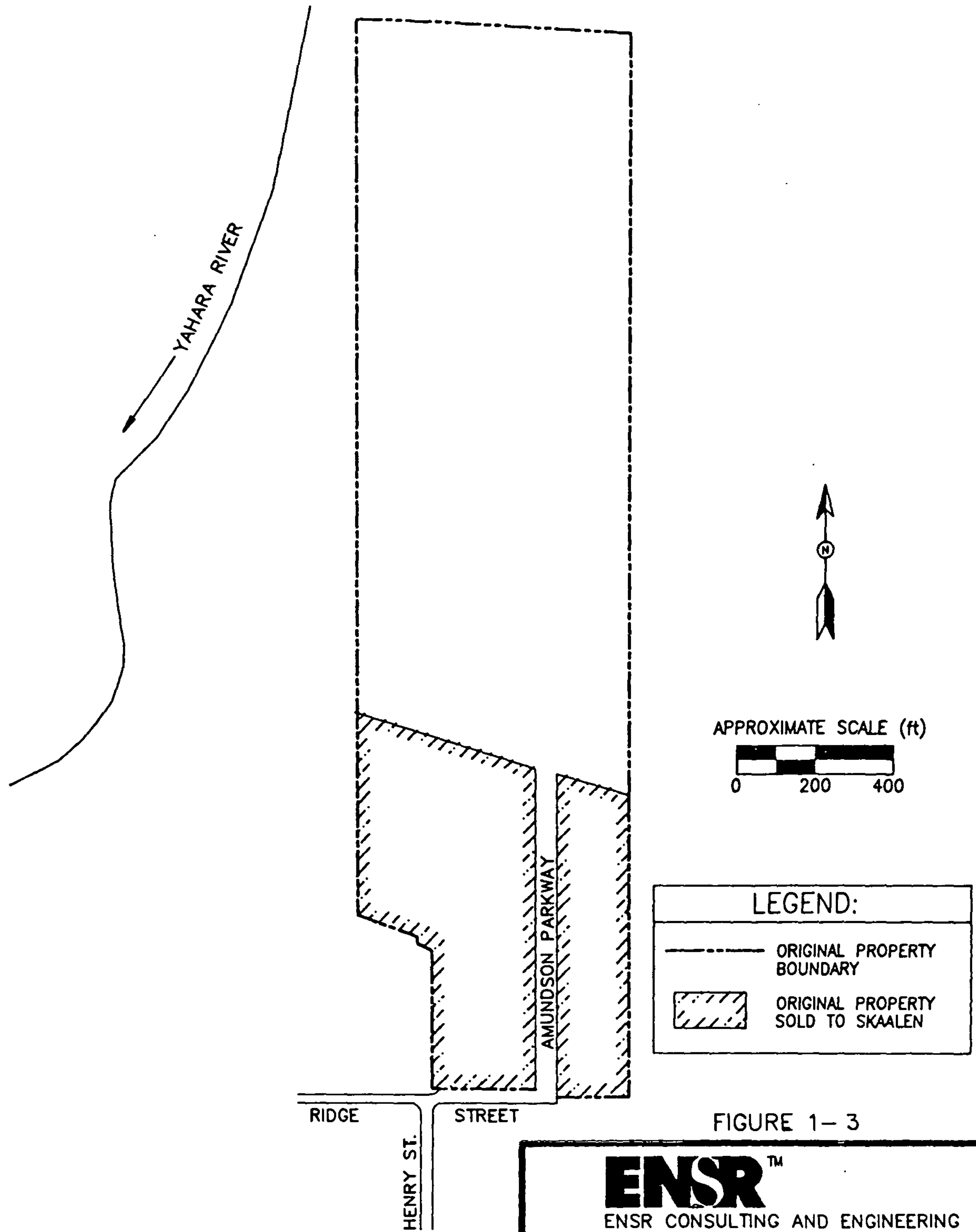

FIGURE 1– 3

ENSR™
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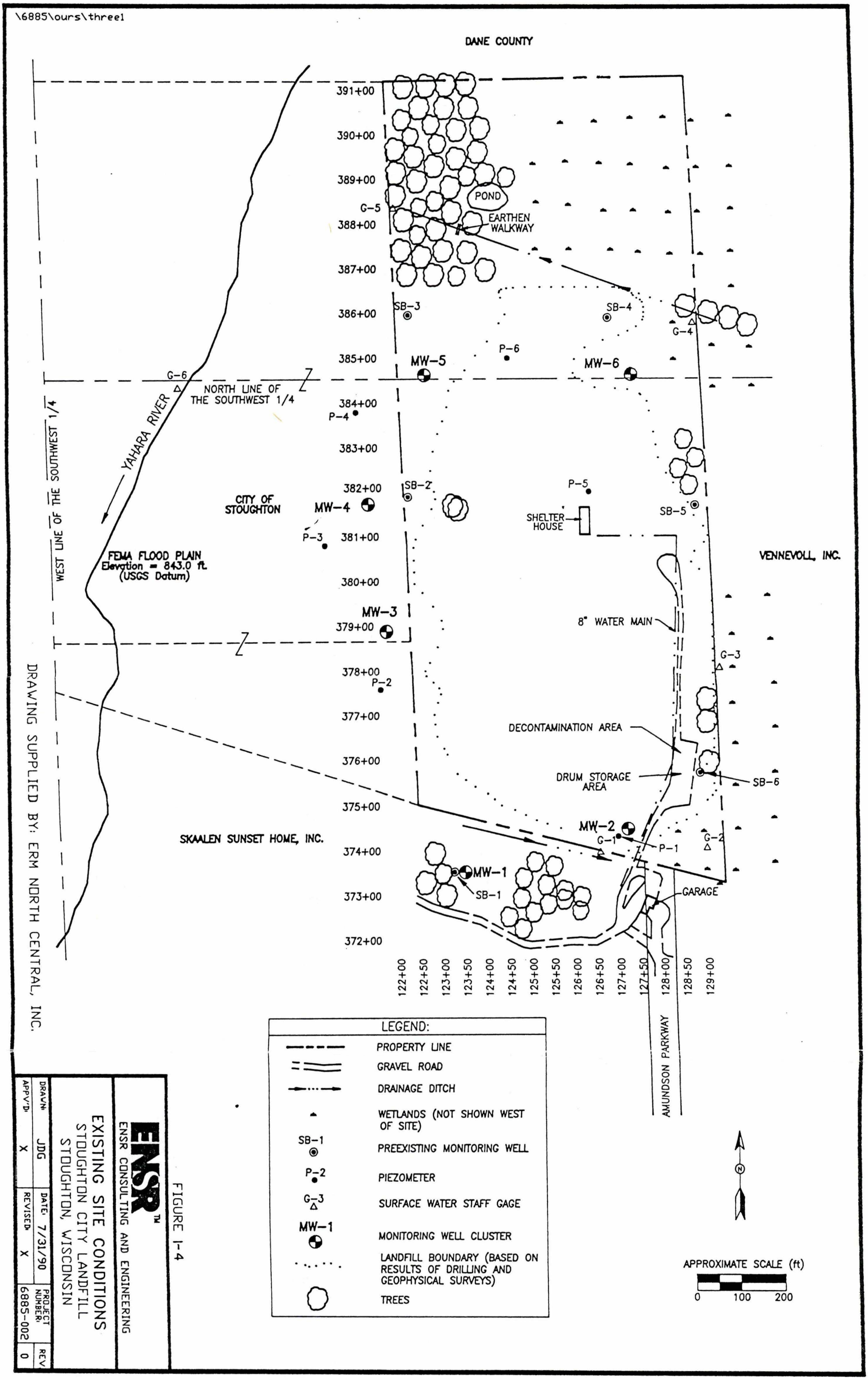
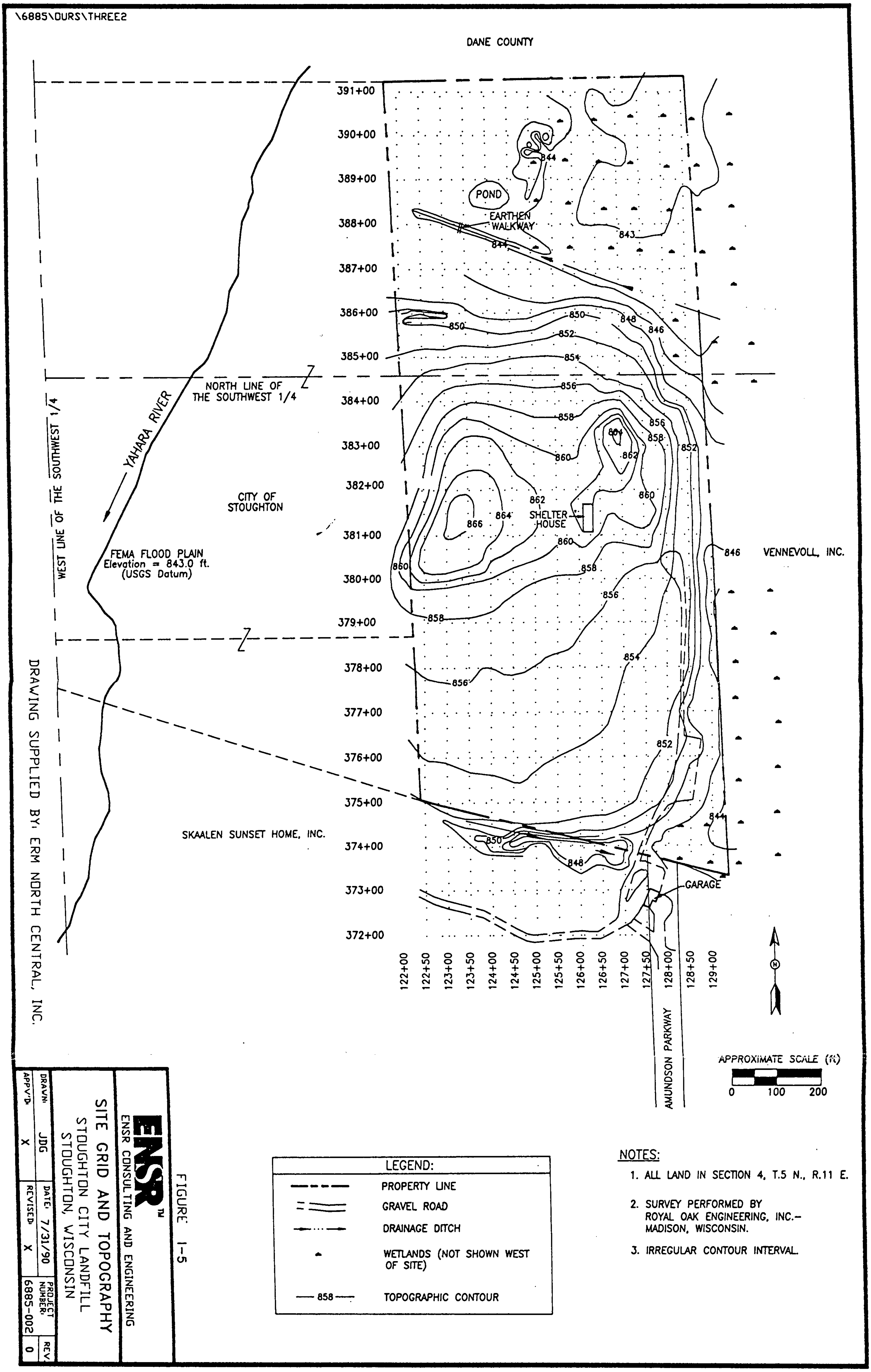
ORIGINAL PROPERTY BOUNDARY
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

DRAWN:	EDH	DATE:	3/5/90	PROJECT NUMBER:	REV.
APPV'D:	X	REVISED:	X	6885–002	0

FIG1–3



\6885\ours\three1
DANE COUNTY
391+00
390+00
389+00
388+00
387+00
386+00
385+00
384+00
383+00
382+00
381+00
380+00
379+00
378+00
377+00
376+00
375+00
374+00
373+00
372+00
POND
EARTHEN WALKWAY
G-5
SB-3
SB-4
G-4
P-6
MW-5
MW-6
G-6
NORTH LINE OF THE SOUTHWEST 1/4
P-4
YAHARA RIVER
WEST LINE OF THE SOUTHWEST 1/4
CITY OF STOUGHTON
MW-4
SB-2
P-5
SHELTER HOUSE
SB-5
P-3
VENNEVOLL, INC.
FEMA FLOOD PLAIN
Elevation = 843.0 ft.
(USGS Datum)
MW-3
8" WATER MAIN
G-3
P-2
DECONTAMINATION AREA
DRUM STORAGE AREA
SB-6
SKAALEN SUNSET HOME, INC.
MW-2
G-1
P-1
G-2
MW-1
SB-1
GARAGE
122+00
122+50
123+00
123+50
124+00
124+50
125+00
125+50
126+00
126+50
127+00
127+50
128+00
128+50
129+00
AMUNDSON PARKWAY
DRAWING SUPPLIED BY: ERM NORTH CENTRAL, INC.
LEGEND:
PROPERTY LINE
GRAVEL ROAD
DRAINAGE DITCH
WETLANDS (NOT SHOWN WEST OF SITE)
SB-1
PREEXISTING MONITORING WELL
P-2
PIEZOMETER
G-3
SURFACE WATER STAFF GAGE
MW-1
MONITORING WELL CLUSTER
LANDFILL BOUNDARY (BASED ON RESULTS OF DRILLING AND GEOPHYSICAL SURVEYS)
TREES
N
APPROXIMATE SCALE (ft)
0
100
200
FIGURE 1-4
ENSR
ENSR CONSULTING AND ENGINEERING
EXISTING SITE CONDITIONS
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN
DRAWN: JDG
DATE: 7/31/90
PROJECT NUMBER: 6885-002
REV 0
APPV'D: X
REVISED: X


\6885\DURS\THREE2
DANE COUNTY
391+00
390+00
389+00
388+00
387+00
386+00
385+00
384+00
383+00
382+00
381+00
380+00
379+00
378+00
377+00
376+00
375+00
374+00
373+00
372+00
POND
EARTHEN WALKWAY
NORTH LINE OF THE SOUTHWEST 1/4
YAHARA RIVER
WEST LINE OF THE SOUTHWEST 1/4
CITY OF STOUGHTON
SHELTER HOUSE
FEMA FLOOD PLAIN
Elevation = 843.0 ft.
(USGS Datum)
VENNEVOLL, INC.
SKAALEN SUNSET HOME, INC.
GARAGE
DRAWING SUPPLIED BY: ERM NORTH CENTRAL, INC.
122+00
122+50
123+00
123+50
124+00
124+50
125+00
125+50
126+00
126+50
127+00
127+50
128+00
128+50
129+00
AMUNDSON PARKWAY
APPROXIMATE SCALE (ft)
0
100
200
LEGEND:
PROPERTY LINE
GRAVEL ROAD
DRAINAGE DITCH
WETLANDS (NOT SHOWN WEST OF SITE)
858 TOPOGRAPHIC CONTOUR
NOTES:
1. ALL LAND IN SECTION 4, T.5 N., R.11 E.
2. SURVEY PERFORMED BY ROYAL OAK ENGINEERING, INC.– MADISON, WISCONSIN.
3. IRREGULAR CONTOUR INTERVAL.
FIGURE 1-5
ENSR
ENSR CONSULTING AND ENGINEERING
SITE GRID AND TOPOGRAPHY
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN
DRAWN: JDG
DATE: 7/31/90
PROJECT NUMBER: 6885-002
REV. 0
APPV'D: X
REVISED: X

deposits occupy higher ground within, and south of the landfill. Lacustrine plain or glacial lake-bottom sediments are generally composed of fine-grained silt and clay. Some sand is present near former shorelines and stream inlets. These areas are often flat, poorly drained, and show evidence of peat accumulation. Lacustrine plain deposits occupy the southeast portion of the current property boundary, that was initially developed for waste disposal, and the low-lying ground adjacent to the east, north, and west portions of the site. Lacustrine plain sediments are generally overlain by younger marsh deposits.

Surficial deposits in the vicinity of the site are underlain by glacial outwash that was deposited in the preglacial Yahara River Valley. Approximately 150 to 250 feet of unconsolidated glacial sediments are reported to overlie Cambrian sandstone bedrock in the vicinity of the site (Cline 1965)[1]. These unconsolidated sediments consist mostly of stratified and sorted sand and gravel. Some of the outwash in the eastern two-thirds of the county is reported by Cline to contain boulders.

1.2.2 Site History

The City of Stoughton purchased the original 40-acre site in July 1952, and annexed it in September 1952, when landfill operation began at the site. Between 1952 and 1969, the site was operated as an uncontrolled dump site. During this time, refuse was usually burned or covered by dirt. In 1969, the site began operation as a State-licensed landfill. In 1977, the Wisconsin Department of Natural Resources (WDNR) required that the site be closed according to State regulations. Closure activities included construction of a trash transfer station, placement of cover material borrowed from the northwest portion of the site and from agricultural areas, application of topsoil also derived from an agricultural area, and seeding. From 1978 to 1982, only brick, rubble, and similar construction materials were accepted at the site while closure work was performed. The landfill was officially closed in 1982.

On November 17, 1983, WDNR sampled monitoring wells at the Stoughton City Landfill site. The results showed elevated levels of volatile organic compounds (VOCs) in two of the six wells sampled. During subsequent sampling of the monitoring wells by the City of Stoughton, additional VOCs were detected. The site was added to the U.S. Environmental Protection Agency (U.S. EPA) National Priorities List (NPL) in June 1986. In March 1988, an "Administrative Order by Consent" (Consent Order) was signed by representatives of U.S. EPA Region V, WDNR, the City of Stoughton, and Uniroyal Plastics Company, Inc., with an effective date of May 2, 1988.

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[1] Cline D.R., 1965, "Geology and Groundwater Resources of Dane County, Wisconsin," GSA Water Supply Paper 1779-U.

The Stoughton City Landfill is currently an inactive facility. Vehicular access to the site is controlled by a set of gates that are kept locked at all times. In addition, snow-fencing was installed along the southern property boundary upon initiation of the RI. Warning signs were placed along the snow-fencing and on signposts installed on the west, north, and east property boundaries.

1.2.3 Nature and Extent of Contamination

The nature and extent of contamination at the Stoughton City Landfill were determined through source characterization and sampling of potentially affected media. Source characterization involved an historical waste stream study, a geophysical investigation, a soil gas survey, and waste sampling. Potentially affected media sampled included surface water, sediment, soil, groundwater, and ambient air. The results of these tasks are discussed below. Table 1-1 summarizes the results of waste and environmental media sample analyses performed as part of the RI. Figures 1-6 through 1-8 show sampling locations for waste and soil, surface water/sediment, and groundwater, respectively.

1.2.3.1 Source Characterization

Common municipal waste and both dry and liquid waste were disposed at the Stoughton City Landfill. Dry waste included sludge materials, empty rejected metal spray containers (used for storing multi-purpose lubricants), and used appliances. Some sludge materials contained 2-butanone (methyl ethyl ketone), xylene mixtures, and small amounts of tetrahydrofuran and toluene. Combustible dry wastes were commonly burned on-site until about 1974. Liquid wastes, including 2-butanone, acetone, tetrahydrofuran, toluene, and xylene mixtures, were disposed at the site from 1954 until 1962. During this period, the liquid wastes were commonly poured over garbage and burned. It was also reported that some liquid wastes were poured down holes drilled to test auger drilling equipment in the west-central portion of the landfill.

The boundaries of the landfill were defined using geophysical surveys and information obtained from a review of historical aerial photographs. The southern landfill boundary was modified based on drilling performed later in the RI. Figure 1-4 shows the landfill boundary defined as part of the RI.

A variety of VOCs were measured in the soil gas survey conducted across the landfill. Dichlorodifluoromethane was detected at greatest concentrations and was most widely distributed across the landfill. Other VOCs, including trans-1,2-dichloroethene, trichloroethene, toluene, tetrahydrofuran, toluene, benzene, and total xylenes, were also detected. Many of these

TABLE 1-1

Summary of Results of Waste and Environmental Media Sample Analyses

CHEMICAL	WASTE (ug/kg) (i.e., @ MW2, MW6)		SOIL (ug/kg)		GW (ug/l)	
	Freq*	Detected Range	Freq	Detected Range	Freq	Detected Range
VOLATILE ORGANICS						
Benzene	1/6	2.0J				
2-butanone						
Chloroform	1/6	1.0J				
1,2-dichloroethene (cis and trans)					1/36	8.0
1,2-dichloroethene (trans only)						
Ethyl benzene						
Toluene						
Xylenes (total)					3/36	1.0J
Dichlorodifluoromethane					7/42	16J - 240J
Trichlorofluoromethane					6/42	6.4J - 24J
Tetrahydrofuran					6/44	27 - 660J
Tentatively identified compounds:						
Dichloromethane					1/30	38J
SEMIVOLATILE ORGANICS						
Benzoic acid					1/36	2.0J
Benzyl alcohol						
Bis(2-ethylhexyl)phthalate	4/6	95J - 600000J			3/36	2.0J - 44J
Butyl benzyl phthalate	1/6	230J				
Di-n-butyl phthalate	1/6	39J				
Di-n-octyl phthalate						
Acenapthene	1/6	72J				
Acenapthylene	1/6	88J				
2-methyl napthalene	1/6	52J				
Napthalene	1/6	180J				
Pentachlorophenol					1/36	3.0J
Anthracene	1/6	210J				
Benzo(a)anthracene	3/5	46J - 480				
Benzo(b)fluoranthene (coelutes w/ Benzo(k)fluoranthene)	4/6	120J - 730J				
Benzo(g,h,i)perylene	4/6	54J - 210J				
Benzo(a)pyrene	4/6	72J - 370J				
Chrysene	4/6	63J - 340J				
Dibenzo(a,h)anthracene	1/6	71J				
Fluoranthene	4/6	53J - 700				
Fluorene	1/6	160J				
Ideno(1,2,3-cd)pyrene	4/6	43J - 180J				
Phenanthrene	2/6	860 - 1800J				
Pyrene	2/6	61J - 570				
Tentatively identified compounds:						
Alkane	1/2	2160J	3/5	250J - 590J		
Carboxylic acids						
Polyaromatic hydrocarbon	2/2	260J - 4310J				
Unknown hydrocarbons					1/30	340J
Adipate						
Aldol condensates					1/30	2J
Benzene derivative	1/2	170J				
N-butyl benzene sulfonamide					1/30	14J
N,N-diethyl, 1,3-methylbenzamide					2/30	18J - 36J
1-(ethyloxy)pentane						
Phosphoric acid derivative	1/2	17,610J				
Phthalate esters	1/2	4,910J				
Sulfur molecule	1/2	450J				
Vitamin E						
PESTICIDES/PCBs						
4,4'-DDD	1/6	270				

TABLE 1-1

Summary of Results of Waste and Environmental Media Sample Analysis

CHEMICAL	SW (ug/l) Freq	SW (ug/l) Detected Range	SEDIMENT (ug/kg) Freq	SEDIMENT (ug/kg) Detected Range	AIR (ppm) Freq	AIR (ppm) Detected Range
VOLATILE ORGANICS						
Benzene						
2-butanone			1/9	8.0J		
Chloroform						
1,2-dichloroethene (cis and trans)						
1,2-dichloroethene (trans only)					1/7	0.06
Ethyl benzene					1/7	0.02
Toluene					1/7	0.04
Xylenes (total)					1/7	0.08
Dichlorodifluoromethane	2/16	1.5J - 3				
Trichlorofluoromethane						
Tetrahydrofuran						
Tentatively identified compounds:						
Dichloromethane						
SEMIVOLATILE ORGANICS						
Benzoic acid			3/9	100J - 2800J(b)		
Benzyl alcohol			1/9	170J		
Bis(2-ethylhexyl)phthalate			7/9	68J - 590J(b)		
Butyl benzyl phthalate						
Di-n-butyl phthalate						
Di-n-octyl phthalate			1/9	58J		
Acenapthene						
Acenapthylene						
2-methyl napthalene						
Napthalene						
Pentachlorophenol						
Anthracene						
Benzo(a)anthracene						
Benzo(b)fluoranthene (coelutes w/ Benzo(k)fluoranthene)			1/9	64J		
Benzo(g,h,i)perylene						
Benzo(a)pyrene						
Chrysene			1/9	66J		
Dibenzo(a,h)anthracene						
Fluoranthene			1/9	110J		
Fluorene						
Ideno(1,2,3-cd)pyrene						
Phenanthrene			1/9	69J		
Pyrene			2/9	72J - 82J		
Tentatively identified compounds:						
Alkane			7/9	580J - 9300J		
Carboxylic acids	1/7	54J	1/9	10600J(b)		
Polyaromatic hydrocarbon			1/9	1300J		
Unknown hydrocarbons			8/9	3880J - 67130J(b)		
Adipate			1/9	470J		
Aldol condensates						
Benzene derivative						
N-butyl benzene sufflonamide						
N,N,-diethyl,1,3-methyl benzamide						
1-(ethyloxy)pentane			1/9	360J		
Phosphoric acid derivative						
Phthalate esters						
Sulfur molecule			1/9	3,900J		
Vitamin E			3/9	970J - 4,100J		
PESTICIDES/PCBs						
4,4'-DDD						

TABLE 1-1

Summary of Results of Waste and Environmental Media Sample Analysis

CHEMICAL	WASTE (mg/kg) [B] (i.e., @ MW2, MW6)		SOIL (mg/kg) [B]		GW (ug/l) [B]	
	Freq	Detected Range	Freq	Detected Range	Freq	Detected Range
INORGANICS						
Aluminum					1/15	131J
Antimony	1/2	15.8J			2/15	33.2J - 33.6J
Arsenic					6/15	1.4J - 5.2J
Barium					3/15	352 - 391
Beryllium	1/2	0.37J				
Cadmium	1/2	27				
Chromium	1/2	40J			1/15	8J
Cobalt						
Copper						
Lead	1/2	460J			1/15	3.6J
Manganese					5/15	873 - 2330
Mercury	1/2	0.62				
Nickel					2/15	19.6J - 20.1J
Selenium					1/5	7.4J
Vanadium						
Zinc						
Calcium	1/2	35,200J	3/7	68,400 - 108,552	3/15	167,000 - 175,000
Magnesium			3/7	38,400 - 39,922	3/15	79,300 - 83,400
Potassium			1/7	611	12/15	17,200 - 156,000
Iron						

TABLE 1-1

Summary of Results of Waste and Environmental Media Sample Analysis

CHEMICAL	SW (ug/l) [B] Freq	SW (ug/l) [B] Detected Range	SEDIMENT (mg/kg) [B] Freq	SEDIMENT (mg/kg) [B] Detected Range
INORGANICS				
Aluminum	6/7	162J - 12,600		
Antimony				
Arsenic	7/7	2.8J - 7.3J		
Barium	4/7	294 - 457		
Beryllium				
Cadmium			4/9	1.6J - 23.3J
Chromium	4/7	6.8J - 16.5		
Cobalt	4/7	5.1J - 16.3J		
Copper	1/7	33.9		
Lead	4/7	15.2J - 68.6J	1/9	172J
Manganese	5/7	792J - 4,480	1/9	746J
Mercury				
Nickel	2/7	42.3J - 51.2J		
Selenium				
Vanadium	4/7	23.3J - 54.2		
Zinc	4/7	127J - 327J		
Calcium	3/7	134,000 - 154,000		
Magnesium	2/7	123,000 - 125,000		
Sodium				
Potassium	7/7	5,440 - 49,100		
Iron	5/7	5,530 - 46,600J		

NOTES: *Frequency based on number of detections for investigative, field duplicate, matrix spike, and matrix spike duplicate sample analyses. Samples not analyzed (NA), flagged as R, or background samples were not included in the frequency determination.

Frequency based on number of detections above quantitation limits for all sampling rounds. Chemicals based on investigative field replicate, matrix spike, and matrix spike duplicate sample analyses.

J - Indicates an estimated value

[B] denotes that values were compared to background; only those in excess of twice background are presented as detections.

(b) denotes compound was also detected in background samples.

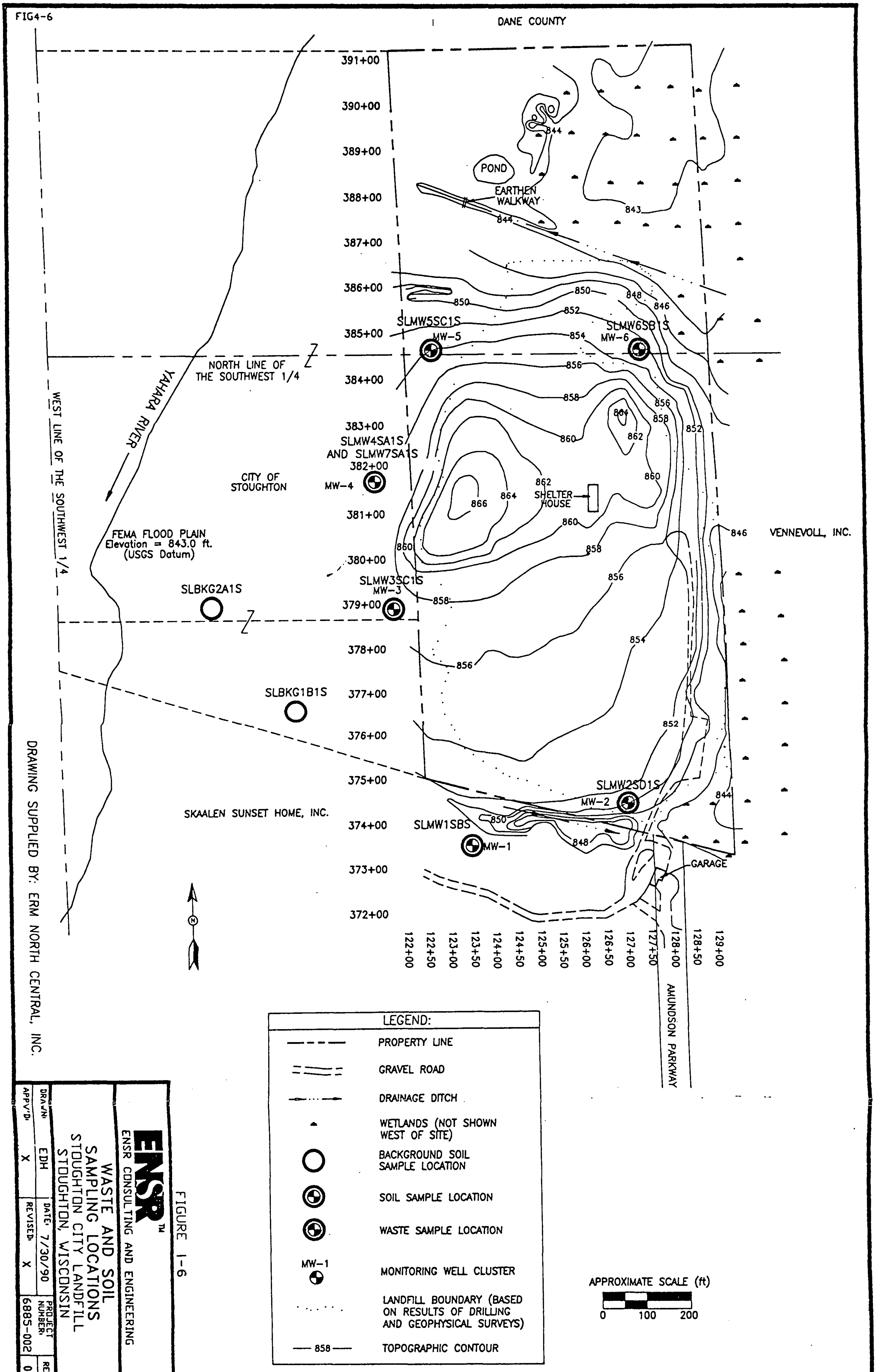
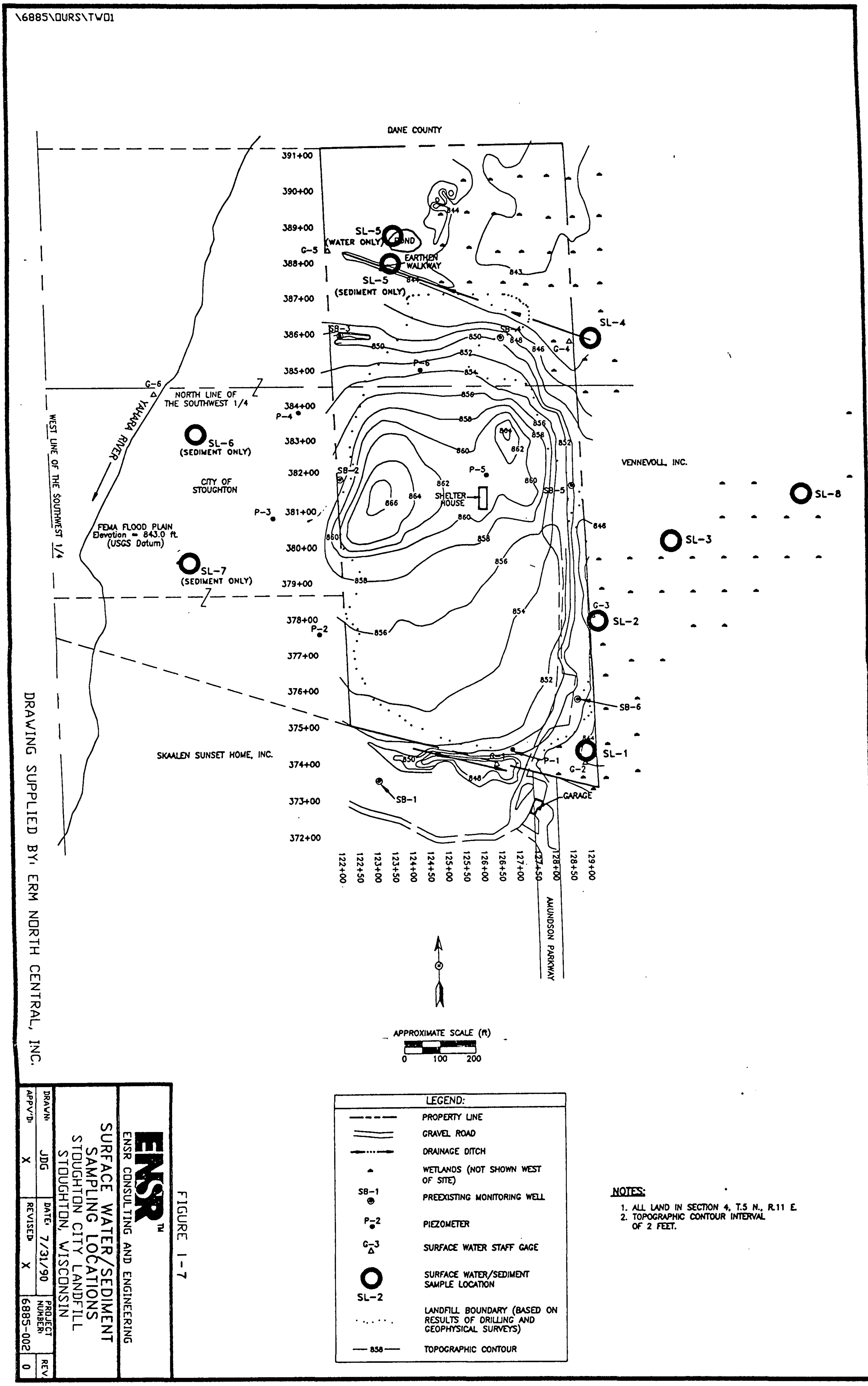


FIGURE 1-6
WASTE AND SOIL SAMPLING LOCATIONS
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN


\6885\DURS\TWO1
DANE COUNTY
VENNEVOLL, INC.
SKAALEN SUNSET HOME, INC.
CITY OF STOUGHTON
YAHARA RIVER
NORTH LINE OF THE SOUTHWEST 1/4
WEST LINE OF THE SOUTHWEST 1/4
FEMA FLOOD PLAIN Elevation = 843.0 ft. (USGS Datum)
SL-5 (WATER ONLY) POND
SL-5 (SEDIMENT ONLY)
EARTHEN WALKWAY
SL-6 (SEDIMENT ONLY)
SL-7 (SEDIMENT ONLY)
SL-1
SL-2
SL-3
SL-4
SL-8
SHELTER HOUSE
GARAGE
AMUNDSON PARKWAY
APPROXIMATE SCALE (ft)
0 100 200
LEGEND:
PROPERTY LINE
GRAVEL ROAD
DRAINAGE DITCH
WETLANDS (NOT SHOWN WEST OF SITE)
SB-1 PREEXISTING MONITORING WELL
P-2 PIEZOMETER
G-3 SURFACE WATER STAFF GAGE
SL-2 SURFACE WATER/SEDIMENT SAMPLE LOCATION
LANDFILL BOUNDARY (BASED ON RESULTS OF DRILLING AND GEOPHYSICAL SURVEYS)
858 TOPOGRAPHIC CONTOUR
NOTES:
1. ALL LAND IN SECTION 4, T.5 N., R.11 E.
2. TOPOGRAPHIC CONTOUR INTERVAL OF 2 FEET.
DRAWING SUPPLIED BY: ERM NORTH CENTRAL, INC.
FIGURE 1-7
ENSR CONSULTING AND ENGINEERING
SURFACE WATER/SEDIMENT SAMPLING LOCATIONS
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN
DRAWN: JDG
DATE: 7/31/90
PROJECT NUMBER: 6885-002
REV 0
APPV'D: X
REVISED: X

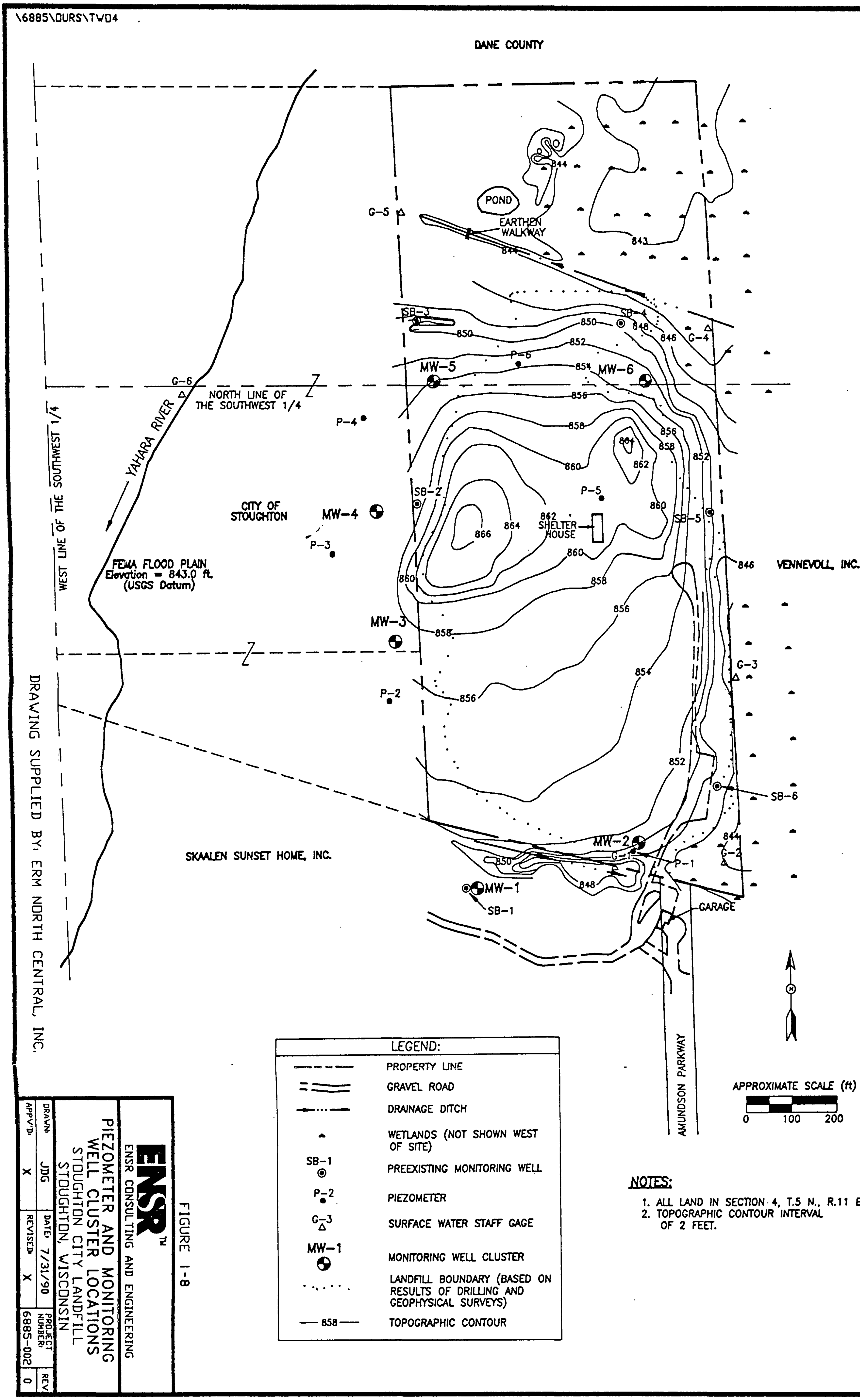


FIGURE 1-8
PIEZOMETER AND MONITORING WELL CLUSTER LOCATIONS
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

constituents were concentrated in the west-central portion of the landfill; however, local, high-concentration areas of the various compounds existed at other locations across the landfill.

Mixed soil and waste were inadvertently encountered in two borings advanced to install monitoring wells on the periphery of the landfill (Figure 1-6). Samples of this material were collected and analyzed. The results of analysis indicated that the primary constituents present at these locations are polycyclic aromatic hydrocarbons (PAHs) and phthalates (Table 1-1). One pesticide compound was also detected.

Refuse was apparently initially deposited in wetlands in the southeast portion of the site, and then later in the extreme north portion of the landfill. In the southeast area, the refuse is saturated to a maximum thickness of approximately 5 feet. The degree of refuse saturation is less in the north portion of the site.

1.2.3.2 Environmental Media Sampling and Analysis

Surface Water

Dichlorodifluoromethane was measured on one sampling occasion in one sample collected from the southeast wetland water body (SL2 on Figure 1-7). Various metal constituents (aluminum, arsenic, barium, calcium, chromium, cobalt, iron, lead, magnesium, potassium, vanadium, and zinc) were detected at concentrations two times greater than background in the southeast wetland water body (SL1, SL2, and SL8). The concentrations of zinc at two locations (SL1 and SL8) within this wetland marginally exceeded chronic toxicity criteria established for the protection of the aquatic life.

Sediment

PAHs, phthalates, and benzoic acid were measured at low concentrations in sediment in some samples collected from the southeast wetland (SL1, SL2, and SL8). Phthalates, benzoic acid, and/or benzyl alcohol were also measured at other sediment sample locations (SL5, SL6, and SL7). Only cadmium (SL1 and SL2) and lead (SL2) were detected in sediment in the southeast wetland at concentrations two times greater than background.

Soil

No organic compounds were detected, and no metal constituents were measured at concentrations significantly above background in soil samples collected while installing monitoring wells around the landfill boundary (Figure 1-6).

Groundwater

A total of three rounds of groundwater sampling and analysis were performed at monitoring well locations shown on Figure 1-8; however, metals were determined only for one sampling round (Round 1) and TCL organics for two sampling rounds (Rounds 1 and 2), as agreed upon with representatives of U.S. EPA and WDNR.

Tetrahydrofuran was measured at MW-3D at concentrations above Wisconsin enforcement standards (50 μg/L) during all three sampling rounds. Tetrahydrofuran was also measured in some sampling rounds at MW-4D and MW-5S above the Wisconsin preventive action limit (PAL) concentration (10 μg/L).

Trichlorofluoromethane was measured in MW-5S and MW-5D during all sampling rounds at concentrations below the Wisconsin PAL (698 μg/L).

Dichlorodifluoromethane was detected in MW-3D, MW-5S, and MW-5D during some sampling rounds. No federal or state groundwater standards exist for dichlorodifluoromethane.

Bis(2-ethylhexyl)phthalate was measured during some sampling rounds at MW-3D and MW-4D at low concentrations. Pentachlorophenol and benzoic acid were detected at very low concentrations in MW-6S and MW-6D, respectively, during one sampling round.

Elevated concentrations of metals were detected in various shallow and deep monitoring wells located in all directions away from the site, excluding the northeast direction. The concentration of arsenic marginally exceeded the PAL of 5 μg/L in MW-2S in one replicate sample. The concentration of barium in MW-2S was also above the PAL. MW-2S is installed in saturated refuse and is not representative of groundwater in the sand and gravel aquifer. The concentration of barium also exceeded the PAL at MW-1S; however, this concentration is not significantly above background. MW-1S is located hydraulically upgradient of the landfill. Selenium also exceeded the PAL in MW-1S. The concentration of chromium exceeded the PAL at MW-4D; however, was well below the MCL. The Wisconsin public welfare groundwater quality standards were exceeded for the following constituents: iron (in MW-2S, MW-3S, MW-4D, and MW-5D) and manganese (all, including the background well). These standards are not health related, but rather are for aesthetics (e.g., color and fixture staining).

Air

Four VOCs were detected at low concentrations at one ambient air sampling point located just north of MW-2 (see Figure 1-4). These VOCs were not detected in a replicate sample at this location.

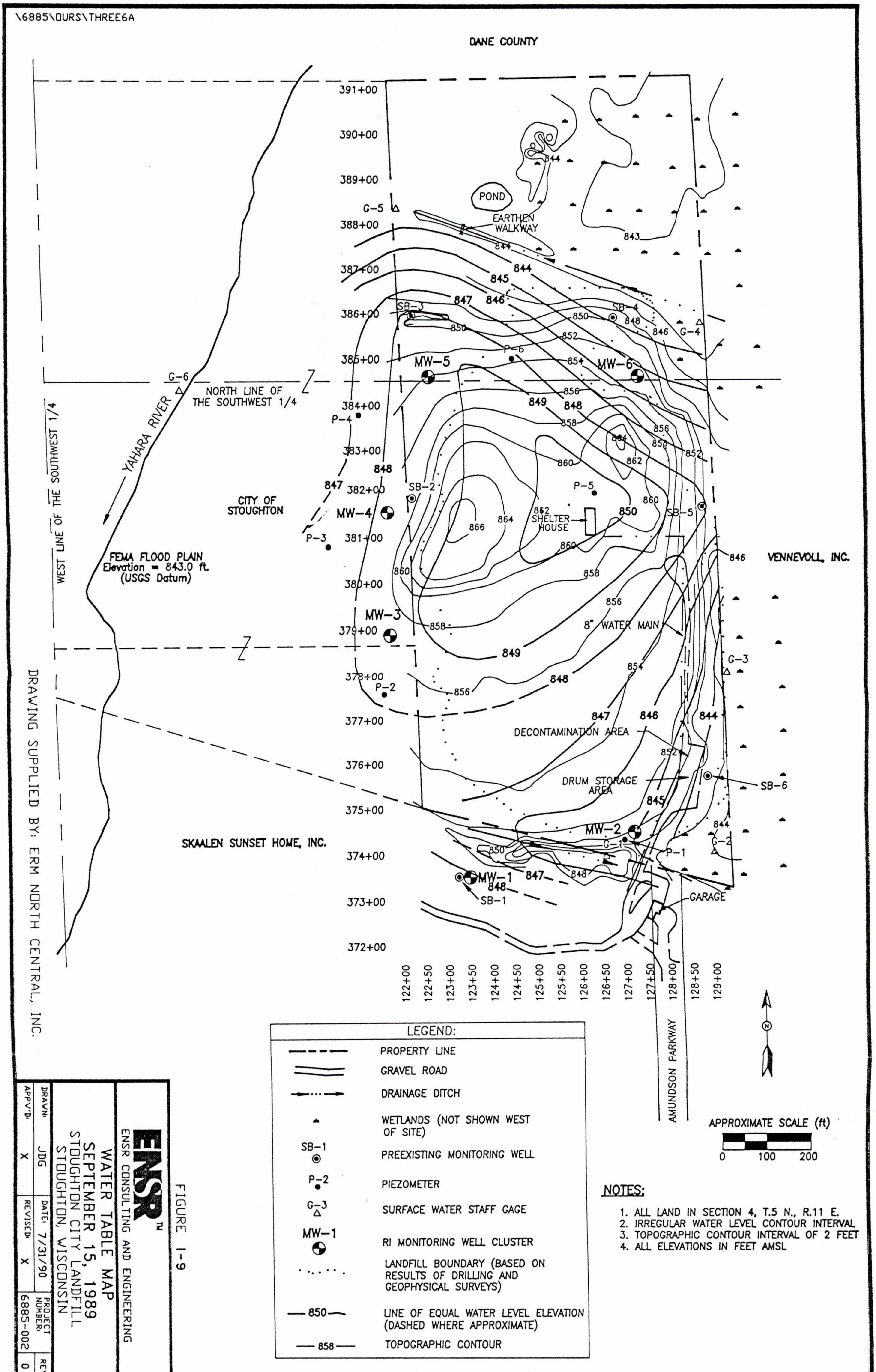
1.2.4 Transport and Fate

All of the VOCs detected in soil gas over the landfill are soluble in water to various degrees and are capable of being dissolved by water that infiltrates the established landfill cover and percolates downward through the refuse to the water table.

Over most of the landfill area, constituents leached from the landfill mass to the water table will migrate in the sand and gravel aquifer. Figure 1-9 shows the water table map prepared using data collected on September 15, 1989. Groundwater migration pathways defined using water table maps and hydrogeologic data generated as part of the RI indicate that groundwater in the sand and gravel aquifer beneath the refuse migrates vertically downward (recharge) in the north-central portion of the landfill, flows laterally away from the landfill toward the north/northeast, southeast, and west, and then discharges through predominantly organic-rich clay, lacustrine plain sediments to the wetlands north/northeast and southeast of the landfill. Although not established as a pathway during the RI, groundwater west of the site presumably discharges through lacustrine plain sediments to the Yahara River. In the southeast and extreme north portions of the landfill, where the refuse is saturated and underlain by predominantly clay lacustrine plain sediments, leachate may migrate in the refuse and discharge directly to the adjacent wetlands.

Environmental fate data indicate that the primary constituents measured in groundwater (tetrahydrofuran, trichlorofluoromethane, and dichlorodifluoromethane) will be highly (tetrahydrofuran) to moderately mobile in groundwater. Nevertheless, these constituents have the potential to be adsorbed onto sediments with high organic content, such as those found in marsh and lacustrine clay sediments that occur adjacent to the site. Similarly, cationic metal constituents detected in groundwater have the potential to be attenuated through the process of cation exchange.

Because the Yahara River is a regional groundwater discharge area, groundwater affected by releases from the landfill that migrates toward the river will likely be diluted by unaffected groundwater discharging to the Yahara River on a regional basis. Organic or inorganic constituents in groundwater discharging through lacustrine clay sediments underlying the river and the adjacent wetlands would likely be removed through sorption or cation exchange.


\6885\OURS\THREE6A
DANE COUNTY
POND
EARTHEN WALKWAY
G-5
G-6
NORTH LINE OF THE SOUTHWEST 1/4
YAHARA RIVER
WEST LINE OF THE SOUTHWEST 1/4
CITY OF STOUGHTON
FEMA FLOOD PLAIN Elevation = 843.0 ft. (USGS Datum)
SKAALEN SUNSET HOME, INC.
VENNEVOLL, INC.
SHELTER HOUSE
8" WATER MAIN
DECONTAMINATION AREA
DRUM STORAGE AREA
GARAGE
AMUNDSON PARKWAY
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
SB-1
SB-2
SB-3
SB-4
SB-5
SB-6
P-1
P-2
P-3
P-4
P-5
P-6
G-1
G-2
G-3
G-4
DRAWING SUPPLIED BY: ERM NORTH CENTRAL, INC.
LEGEND:
PROPERTY LINE
GRAVEL ROAD
DRAINAGE DITCH
WETLANDS (NOT SHOWN WEST OF SITE)
PREEXISTING MONITORING WELL
PIEZOMETER
SURFACE WATER STAFF GAGE
RI MONITORING WELL CLUSTER
LANDFILL BOUNDARY (BASED ON RESULTS OF DRILLING AND GEOPHYSICAL SURVEYS)
LINE OF EQUAL WATER LEVEL ELEVATION (DASHED WHERE APPROXIMATE)
TOPOGRAPHIC CONTOUR
APPROXIMATE SCALE (ft)
0 100 200
NOTES:
1. ALL LAND IN SECTION 4, T.5 N., R.11 E.
2. IRREGULAR WATER LEVEL CONTOUR INTERVAL
3. TOPOGRAPHIC CONTOUR INTERVAL OF 2 FEET
4. ALL ELEVATIONS IN FEET AMSL
FIGURE 1-9
ENSR
ENSR CONSULTING AND ENGINEERING
WATER TABLE MAP
SEPTEMBER 15, 1989
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN
DRAWN: JDG
DATE: 7/31/90
APPV'D: X
REVISED: X
PROJECT NUMBER: 6885-002
REV 0

VOCs that migrate through the refuse to adjacent wetlands would volatilize to the atmosphere under most climatic conditions. Metal constituents released to the southeast wetland water body are apparently diluted by flow in the northwest-trending ditch that transects the north portion of the property. Flow from this ditch to the Yahara River is apparently restricted except under flood conditions.

Lastly, VOCs measured in ambient air at one sampling location, even if attributable to a release from the site, would likely be dispersed quickly and not reach significant concentrations downwind of the site.

1.2.5 Baseline Risk Assessment

A baseline risk assessment was performed to evaluate the potential threat to human health and the environment assuming no remedial action at the Stoughton City Landfill.

The risk assessment was conducted in four steps: 1) hazard identification, 2) exposure assessment, 3) toxicity assessment, and 4) risk characterization. Uncertainty associated with each step was considered, along with the potential effects on the environment.

The following exposure pathways were evaluated during the risk assessment:

- Groundwater: Exposure to contaminants transported in groundwater to *hypothetical* off-site residences located in three directions away from the landfill (existing residences are upgradient and cannot be affected). The exposure routes considered were ingestion and dermal contact.

- Surface Water: Exposure to contaminants in surface water during recreational activities in the southeast wetland water body. The exposure route considered was dermal contact.

- Sediment: Exposure to contaminants in sediment during recreational activities in the southeast wetland area. The exposure routes considered were dermal contact and incidental ingestion.

- Surface Soil: Exposure to contaminants in surface soil during recreational activities and transient visits to the closed landfill. The exposure routes considered were incidental ingestion and dermal contact.

- Surface Solid Waste: Exposure to contaminants in surface solid waste during recreational activities and transient visits to the closed landfill. The exposure routes considered were ingestion and dermal contact.

- Air: Exposure to contaminants in ambient air (vapor) during recreational activities at the closed landfill. The exposure route considered was inhalation.

The potential long-term risk of exposure to chemicals measured along each of these pathways was characterized. Exposure concentration estimates were derived during Step 2 (exposure assessment), and used with the dose-response data developed in Step 3 (toxicity assessment), to calculate a noncarcinogenic Hazard Index (HI), or the lifetime upper-bound cancer risk, as appropriate, for each identified compound. In addition, a site-specific cumulative HI and a cumulative cancer risk were calculated by summing across all exposure routes, media, and compounds.

An acceptable HI value is 1; an individual whose HI value is greater than 1 represents a concern for potential health risks. For excess lifetime cancer risk, values in the range of 1 x 10^{-4} to 1 x 10^{-6} (1 in ten thousand to 1 in one million) are generally of concern.

1.2.5.1 Human Health Exposure Risk

Groundwater

A lifetime HI of 1 for ingestion of groundwater from the sand and gravel aquifer was not exceeded for any individual chemical, nor for any group of chemicals summed at the three exposure points.

Arsenic is calculated to be the largest contributor to excess lifetime cancer risk estimates from drinking groundwater, contributing 7.4E-05 to the west of the landfill and 6.96E-05 to the southeast (average cancer risk from arsenic = 7.2E-05). In addition, bis(2-ethylhexyl)phthalate contributes 3.3E-07 to the west of the landfill.

The summed lifetime HIs for dermal exposures to groundwater are all less than 1E-04 (i.e., less than 0.01% of a composite dermal reference dose [RfD]), indicating little likelihood for adverse health effects. Similarly, an excess lifetime cancer risk from this exposure pathway is calculated to be less than 1E-10 in all three assumed exposure points.

Surface Water

Two carcinogens, arsenic and lead, were measured in surface water. The excess lifetime cancer risk attributed to arsenic is 2.2E-11, less than 2 in one billion. No potency factor has yet been derived for lead, the only other carcinogen detected.

Soil

No chemicals with carcinogenic effects were detected in soil at the site.

Sediment

Potential carcinogenic and noncarcinogenic health risks associated with inadvertent ingestion of and dermal contact with sediments were considered. For dermal exposure to sediments, the excess lifetime cancer risk is 3.21E-9, or approximately 4 in one billion. The lifetime HI for dermal exposure to sediments is 1.35E-2, which does not exceed unity, indicating that adverse noncarcinogenic health effects are not expected to occur. The noncarcinogenic HI for dermal exposure to sediments by a child is 8.52E-03, also well below unity.

For exposure by inadvertent ingestion of sediments, the excess lifetime cancer risk is 1.53E-10, or approximately 2 in one hundred billion. The lifetime HI for the sediment ingestion exposure route is 1.81E-04 and the child HI is 4.61E-04, both well below unity. No adverse noncarcinogenic health effects are expected to occur.

Waste

Potential carcinogenic and noncarcinogenic health risks were estimated for inadvertent ingestion of and dermal contact with waste. The excess lifetime cancer risk for waste ingestion is 5.17E-11, or approximately 6 in one hundred billion. The lifetime HI is 5.84E-08 and the lifetime HI for a child is 1.49E-07. Both HIs are well below unity; no adverse noncarcinogenic health effects are expected to occur.

For dermal exposure to waste at the levels assumed in the text, the excess lifetime cancer risk is 1.11E-9, or approximately 1 in one billion. The lifetime HI is 4.36E-6 and the lifetime HI for a child is 2.76E-06, both well below unity.

Inhalation

Noncarcinogenic health risks associated with the inhalation route of exposure were calculated. The lifetime HI is 4.79E-01 and the lifetime HI for a child is 3.07E-01, both of which are below unity. Exposure through the inhalation pathway is not expected to cause any adverse health effects.

2.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives consist of medium-specific or operable-unit-specific goals for protecting human health and the environment. These goals are both general and site-specific.

General remedial goals are defined by the National Contingency Plan (NCP) and CERCLA (as amended by SARA), and are applicable to all Superfund sites. These goals relate to the statutory requirements for development of the remedy.

Site-specific goals relate to specific media, such as groundwater and soil, and potential exposure routes, and identify target remediation areas and concentrations. Site-specific goals are based on the evaluation of risk to the public health and the environment and on applicable or relevant and appropriate requirements (ARARs). These goals are as specific as possible without limiting the range of alternatives that can be developed for detailed analysis. A detailed evaluation of ARARs used to develop site-specific remedial action objectives for the Stoughton City Landfill site is presented in Appendix A of this report.

General and site-specific remedial action goals are discussed in the following sections.

2.1 General Remedial Action Goals

The NCP states, "The appropriate extent of remedy shall be determined by the lead agency's selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment" (40 CFR 300.68(i)). This is the general goal of all CERCLA feasibility studies.

CERCLA §121 requires selection of a remedial action that is protective of human health and the environment. U.S. EPA's approach to determining protectiveness involves risk assessment, considering both ARARs and to-be-considered (TBCs) materials.

Actual cleanup levels are not specified in feasibility study (FS) documents, although the U.S. EPA is generally concerned with excess lifetime cancer risks exceeding 1×10^{-6} and noncarcinogenic risks that exceed a hazard index of 1. Instead, an acceptable contaminant concentration or range of concentrations for each exposure route is identified as a preliminary goal. Final cleanup levels are established by the U.S. EPA in the record of decision (ROD) following the analysis of the remedial alternatives in the FS and public comment on the U.S. EPA's recommended remedial action.

2.2 Site-Specific Remedial Action Goals

Site-specific goals are based on the results of the baseline risk assessment and on ARARs. The baseline risk assessment was performed as part of the RI (Chapter 6.0 of RI report) and is summarized in Section 1.2.5 of this document. Only chemical-specific ARARs that have been established to regulate releases of specific substances to site media (such as those that exist for groundwater and surface water) are discussed in this section.

The results of the risk assessment showed that the only exposure pathway with excess lifetime cancer risks exceeding 1×10^{-6} was the ingestion of groundwater. This risk is caused by arsenic, present at low concentrations in the sand and gravel aquifer adjacent to the west and southeast portions of the landfill. However, as noted in the baseline risk assessment, this exposure pathway is incomplete; no water supply wells are located downgradient of the site, and groundwater discharges to surface water very near the site. All measured concentrations of arsenic in the sand and gravel aquifer are below the preventive action limit (PAL) established under Wisconsin groundwater standards. Further, potential future use of groundwater in the sand and gravel aquifer is restricted by the Wisconsin Administrative Code (WAC) NR 504.07(8)(b), which prohibits the installation of a water supply well within 1,200 feet of a landfill. No adverse health effects from exposure to noncarcinogens in any site media were identified in the baseline risk assessment, including the ingestion of tetrahydrofuran, the constituent of potential concern measured at highest concentrations in groundwater at the site.

No maximum contaminant levels (MCLs) or maximum contaminant level goals (MCLGs) established under the Safe Drinking Water Act (SDWA) were exceeded in groundwater.

The average concentration of lead (50.2 μg/L) in replicate surface water samples collected at SL2 marginally exceeds the MCL of 50 μg/L. However, this water is classified as marginal surface water (limited aquatic life subcategory) under WAC NR 104.02(3)(b). No other MCLs were exceeded in surface water at the site.

The State of Wisconsin has established public-health-related groundwater standards under WAC NR 140.10, including both enforcement standards and PALs. The PAL is 10% of the enforcement standard concentration for substances that have carcinogenic, mutagenic, or teratogenic properties or interactive effects. For all other substances, the PAL is 20% of the enforcement standard.

Table 2-1 lists information concerning chemicals that exceeded either enforcement standards or PALs in groundwater at the Stoughton City Landfill site. Tetrahydrofuran was the only chemical that exceeded Wisconsin groundwater enforcement standards. This constituent was measured, at concentrations consistently above the enforcement standard, in the lower portion of the sand and gravel aquifer adjacent to the west portion of the site in monitoring well MW-3D. Groundwater in monitoring well MW-4D exceeded the PAL for tetrahydrofuran during one sampling round; however, this constituent was not measured in a field replicate collected at this location, nor was it measured in a previous sampling round. Groundwater at monitoring well MW-5S exceeded the PAL for tetrahydrofuran only on one sampling occasion. As noted previously, no hazardous health effects are anticipated from ingestion of groundwater, even at the maximum concentration measured in groundwater at MW-3D.

The concentration of barium was measured above the PAL in shallow groundwater at monitoring well MW-1S, which is located hydraulically upgradient of the landfill boundary. This concentration is not significantly (greater than 2 times) above background. Selenium was also measured at a concentration that exceeds the PAL in MW-1S.

Chromium was measured in one monitoring well (MW-4D) at a concentration that marginally exceeds the PAL.

Table 2-1 also lists the equivalent concentration that would be required to promote a lifetime hazard HI equal to or greater than one based on the reference dose for the individual chemical. As is evident from this table, no chemicals that exceed Wisconsin groundwater standards at the Stoughton City Landfill Site, including tetrahydrofuran, which was measured at greatest concentrations, exceed the equivalent lifetime HI concentration. At each of the locations where these chemicals were measured, the concentration of other chemicals are sufficiently low that the summed lifetime HI at each of these locations would not exceed the indicator value of one.

TABLE 2-1

Chemicals Exceeding Wisconsin Groundwater Standards at the Stoughton City Landfill Site

Chemical	Maximum Concentration in Groundwater (µg/L)	Wisconsin Groundwater Standard (µg/l) Enforcement Standard	Preventive Action Limit (PAL)	Lifetime Hazard = 1 Concentration (µg/l)
Tetrahydrofuran	660J	50	5	2,380
Barium	293	1,000	200	1,750
Chromium	8J	50	5	175
Selenium	7.4	10	1	105

1 Includes data for chemicals measured in the sand and gravel aquifer.
J Indicates estimated value
NA Not applicable
PAL Preventive Action Limit

Based on the results of the risk assessment and the evaluation of ARARs, two operable units were identified for the site: a solid waste or landfill operable unit and a groundwater operable unit. The solid waste operable unit includes the refuse and soil underlying the refuse within and near the landfill boundary established as part of the RI. The landfill was made a separate operable unit to allow for several alternatives specifically addressing landfill wastes, to be developed. The groundwater operable unit is limited to the vicinity of monitoring well MW-3D, the only location where groundwater in the sand and gravel aquifer consistently exceeded any groundwater standards.

The following remedial action objectives were established for the solid waste and groundwater operable units:

Soil/Solid Waste Operable Unit

- Prevent public from exposure to landfill refuse and potential hazardous substances contained therein; and,

- Control leaching of chemicals of concern from the landfill to groundwater to protect public health and the environment, including protection of aquatic life in the adjacent wetlands.

Groundwater Operable Unit

- Provide remedies that allow eventual achievement of groundwater standards that are applicable or relevant and appropriate for tetrahydrofuran at MW-3D.

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 Introduction

The purpose of this section is to develop a range of remediation technologies that will be assembled into sitewide alternatives. These alternatives will then be analyzed in detail in the Remedial Alternatives Evaluation Technical Memorandum. In Section 3.2, development of general response actions for each medium of interest will be addressed. These include actions such as containment, removal, treatment, and disposal that could be taken to satisfy the remedial action objectives. These general response actions will be defined further in Section 3.3 to identify remedial technology types, and specific technology process options for each remedial technology type. The various technologies identified undergo an initial screening in this section to eliminate those that cannot be implemented at the Stoughton City Landfill because of obvious technical limitations. The technologies that remain after this initial screening will be evaluated in more detail in Section 3.4. This evaluation will identify the most applicable technologies based on effectiveness, implementability, and cost. The assembly of the technologies determined to be most applicable into sitewide alternatives will be discussed in Section 4.0.

3.2 General Response Actions

General response actions were identified for the media of interest at the site to meet the remedial action objectives developed in Section 2.0. It is often necessary to combine two or more of these general response actions when defining alternatives to meet the remedial action objectives. For example, removal of groundwater, followed by treatment and then disposal of the treated water is generally used to address the groundwater cleanup objectives. The general response actions identified for each medium of interest at the Stoughton City Landfill are listed in Table 3-1.

3.3 Technology Development and Initial Screening

Based on general response actions presented in Table 3-1, corresponding technology types and specific technology-based process options were identified. A very broad range of remediation technologies was thus compiled. The technical implementability of each remaining technology type or process option was evaluated based on the types of media and compounds known to be present at the site and on general site conditions. Those technologies determined to be not applicable to the Stoughton City Landfill, based on obvious limitations related to their technical implementability, were deleted. This initial screening process is illustrated in Figures 3-1 and 3-2,

TABLE 3-1

General Remedial Response Actions for the Stoughton City Landfill Site

Operable Unit	General Response Action
Soil/Solid Waste	No Action
	Institutional Controls
	Containment
	Removal
	Treatment
	Disposal
Groundwater	No Action
	Institutional Controls
	Containment
	Removal
	Treatment
	Disposal
	Monitoring

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
NO ACTION	NONE	NONE	No action.	Required for consideration by NCP.
INSTITUTIONAL CONTROLS	ACCESS and USE RESTRICTIONS	DEED RESTRICTIONS	Deed restrictions on development and use in affected areas.	Potentially applicable.
		FENCES	Fences to be installed around affected areas to prevent access and potential contact.	Potentially applicable.
CONTAINMENT	CAP REPAIR	REPAIR EXISTING CAP	Existing cap repaired and extended where necessary.	Potentially applicable.
	SINGLE LAYER CAP	CLAY	Single layer of compacted clay placed over affected areas.	Potentially applicable.
		SPRAYED ASPHALT (shaded)	Sprayed asphalt placed over affected areas.	Not applicable. Asphalt not likely to maintain structural integrity over time.
		PAVED ASPHALT (shaded)	Affected areas paved over with asphalt.	Not applicable. Asphalt not likely to maintain structural integrity over time.
		CONCRETE CAP (shaded)	Concrete slab placed over affected areas.	Not applicable. Cracking of concrete over time likely.
	MULTILAYER CAP	CLAY CAP	Layers of clay and other natrual materials placed over affected areas.	Potentially applicable.
		SYNTHETIC GEOMEMBRANE	Synthetic geomembrane cover placed over affected areas.	Potentially applicable.
		CLAY GEOMEMBRANE	Clay and geomembrane cover placed in layers over affected area.	Potentially applicable.
	HORIZONTAL BARRIERS (shaded)	GROUT INJECTION (shaded)	Pressure injection of grout below waste to prevent leaching to groundwater.	Not applicable. Technology not well–demonstrated.
		LINERS (shaded)	Placement of natural or synthetic liners below waste to prevent leaching to groundwater.	Not applicable. Not feasible to remove all waste to install liner.
	SURFACE CONTROLS	GRADING	Reshaping of surface to manage surface water infiltration, runoff, and to control erosion. Usually done in conjunction with capping.	Potentially applicable.
		SOIL STABILIZATION (shaded)	Chemical stabilization of soil.	Not applicable. Not likely to be effective over time.
		REVEGETATION	Planting and maintaining vegetation on surface to control erosion. Usually done after capping and grading.	Potentially applicable.
		DIVERSION AND COLLECTION SYSTEMS	Construction of dikes, channels, and other structures to control stormwater drainage and erosion. Usually done in conjunction with capping.	Potentially applicable.

FIGURE 3–1 (SHT. 1 OF 2)

SOIL/SOLID WASTE OPERABLE UNIT INITIAL TECHNOLOGY SCREENING

STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

(shaded box) TECHNOLOGY NOT CARRIED FORWARD

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
REMOVAL	EXCAVATION		Excavation of all waste and affected soils followed by disposal or treatment.	Not applicable. Not feasible to excavate all waste and soils from site.
TREATMENT	EXCAVATION WITH TREATMENT	LOW TEMPERATURE VOLATILIZATION	Organic compounds are volatilized from excavated soils and waste by heat, then destroyed or treated.	Not applicable. Not feasible to excavate all soils and waste from site.
		INCINERATION	Excavated soils and waste are fed to a high temperature incinerator to destroy organic compounds.	Not applicable. Not feasible to excavate all soils and waste from site.
		SOLVENT EXTRACTION	Excavated soils and waste are fed to a solvent extraction system to remove compounds.	Not applicable. Not feasible to excavate all soils and waste from site.
	IN SITU TREATMENT	SOIL FLUSHING	Water or other solution flushed through soils and waste to mobilize compounds of interest. The flushing fluid is then collected and treated.	Not applicable. Not possible to effectively flush heterogeneous subsurface at landfill. not all compounds present can be treated using this method
		CHEMICAL OXIDATION	Oxidizing agents in solution flushed through soils and waste to treat compounds of interest.	Not applicable. Not possible to effectively flush heterogeneous subsurface at landfill. Not all compounds present can be treated using this method.
		CHEMICAL REDUCTION	Reducing agents in solution flushed through soils and waste to treat compounds of interest.	Not applicable. Not possible to effectively flush heterogeneous subsurface at landfill. Not all compounds present can be treated using this method.
		BIOREMEDIATION	Subsurface conditions are enhanced through injection of oxygen and nutrients to stimulate microorganisms to destroy compounds of interest.	Not applicable. Not possible to effectively inject nutrient solutions into heterogeneous subsurface at landfill. Not all compounds present can be treated using this method.
		VITRIFICATION	Wastes are converted into a solid glassy material using very high temperatures.	Not applicable. Technology still in developmental stage.
		SOIL VAPOR EXTRACTION	Volatile organic compounds are removed from subsurface by blowing air through perforated piping installed in the soils and waste. Compounds are collected and treated.	Not applicable. Not feasible to extract all chemicals of concern in landfill. Not applicable for inorganic compounds.
		METHANE RECOVERY	Vents installed to allow escape of methane, produced in waste material.	Not applicable. Landfill probably no longer producing methane of any appreciable quantity.
DISPOSAL	EXCAVATION WITH DISPOSAL IN LANDFILL	ONSITE RCRA LANDFILL	Excavated soils and waste are disposed of in a RCRA landfill constructed on site.	Not applicable. Not feasible to excavate all soils and waste from site. Site not likely to be approved for a RCRA landfill.
		OFFSITE RCRA LANDFILL	Excavated soils and waste are disposed of in an approved off-site RCRA landfill.	Not applicable. Not feasible to excavate all soils and waste from site.

FIGURE 3-1 (SHT. 2 OF 2)
SOIL/SOLID WASTE OPERABLE UNIT
INITIAL TECHNOLOGY SCREENING
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

[shaded box] TECHNOLOGY NOT CARRIED FORWARD

C:\6885\68850002

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
NO ACTION	NONE	NONE	No action.	Required for consideration by NCP.
INSTITUTIONAL CONTROLS	ACCESS and USE RESTRICTIONS	DEED RESTRICTIONS	Property deeds in the affected area would include restrictions on wells.	Potentially applicable.
CONTAINMENT	VERTICAL BARRIERS	SLURRY WALL	Vertical trench excavated under a slurry around affected areas and backfilled with a soil/bentonite mixture to form a barrier to groundwater flow.	Not applicable. Bedrock too deep to anchor slurry wall into. Effectiveness of floating slurry wall unpredictable.
		GROUT CURTAINS	Pressure injection of grout in a regular pattern of drilled holes around the affected area, to form a barrier to groundwater flow.	Not applicable. Grouting generally used as a groundwater barrier in rock, not as effective in unconsolidated deposits.
		SHEET PILING	Wood, steel, or preformed concrete sheet piles driven into ground around the affected area to form a barrier to groundwater flow.	Not applicable. Barrier integrity is unpredictable in containing groundwater. Bedrock too deep for effective groundwater containment.
		HYDRAULIC BARRIERS	Pumping wells used to control groundwater flow and prevent migration of compounds off-site.	Potentially applicable.
REMOVAL	GROUNDWATER REMOVAL	RECOVERY WELLS	Groundwater pumping wells used to control groundwater movement and remove groundwater to the surface for treatment.	Potentially applicable.
		SUBSURFACE DRAINS	Gravel-filled trenches and perforated piping installed in the subsurface to control groundwater movement and remove groundwater to the surface for treatment.	Potentially applicable.

FIGURE 3-2 (SHT. 1 OF 3)

GROUNDWATER OPERABLE UNIT
INITIAL TECHNOLOGY SCREENING
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

TECHNOLOGY NOT CARRIED FORWARD

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GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
TREATMENT	PHYSICAL TREATMENT	LIQUID / LIQUID EXTRACTION	Solvent added to remove one liquid from a mixture of liquids. Removed liquid then undergoes treatment.	Not applicable. Difficult to separate compounds completely. Not a well demonstrated technology for groundwater cleanup.
		SUPERCRITICAL EXTRACTION	At certain combinations of temperature and pressure, fluids reach their critical point and their solvent properties are enhanced significantly, making extraction more efficient.	Not applicable. Not a well demonstrated technology for groundwater cleanup.
		ION EXCHANGE	Ion exchange resins used to remove ions from groundwater by exchanging harmless ions in the resin for the ions of concern in the groundwater.	Not applicable. Not effective in removing tetrahydrofuran.
		CARBON ADSORPTION	Organic compounds adsorbed onto activated carbon by passing groundwater through a packed carbon bed.	Potentially applicable.
		REVERSE OSMOSIS	High pressure used to force groundwater through a membrane which is not permeable to the compounds of interest.	Not applicable. Process very sensitive to groundwater chemistry. Would likely require significant pretreatment.
		AIR STRIPPING	Groundwater mixed with air in a tower, volatile compounds of interest are removed by the air then treated.	Not applicable. Not effective in removing tetrahydrofuran.
		STEAM STRIPPING	Similar to air stripping, but able to additionally remove less volatile compounds through the use of steam.	Potentially applicable.
	CHEMICAL TREATMENT	PRECIPITATION	Inorganic chemicals dissolved in groundwater are transformed to solids by changing the chemistry of the water. Solids are then removed.	Not applicable. Not effective in removing tetrahydrofuran.
		CHEMICAL OXIDATION	Oxidizing agents added to groundwater to make the compounds of interest less hazardous.	Potentially applicable.
		CHEMICAL REDUCTION	Reducing agents added to groundwater to make the compounds of interest less hazardous.	Not applicable to compounds at site.
		ULTRAVIOLET PHOTOLYSIS	Ultraviolet light used to destroy or detoxify compounds in groundwater.	Not applicable. Not a well demonstrated technology for groundwater cleanup.

CONTINUED ON SHT. 3 of 3

FIGURE 3–2 (SHT. 2 OF 3)
GROUNDWATER OPERABLE UNIT INITIAL TECHNOLOGY SCREENING
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

[shaded box] TECHNOLOGY NOT CARRIED FORWARD

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GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
TREATMENT	BIOLOGICAL TREATMENT	AEROBIC PROCESSES	Degradation of organic compounds in groundwater by microorganisms under aerobic conditions.	Not applicable. Concentrations of existing compounds too low to be effective.
		ANAEROBIC PROCESSES	Degradation of organic compounds in groundwater by microorganisms under anaerobic conditions.	Not applicable. Concentrations of existing compounds too low to be effective.
		LAND TREATMENT	Groundwater applied to land surface where compounds are degraded by microorganisms.	Not applicable. Concentrations of existing compounds too low to be effective.
	THERMAL TREATMENT	LOW TEMPERATURE VOLATILIZATION	Heat used to volatilize compounds to remove them from groundwater.	Not applicable. Generally not used for treating groundwater.
		INCINERATION	Compounds destroyed in an incinerator. Could be used as a final step after removal by other methods.	Not applicable. Prohibitively expensive to incinerate groundwater.
	IN-SITU TREATMENT	BIOREMEDIATION	Subsurface conditions enhanced by addition of oxygen and/or nutrients to promote growth of microorganisms which degrade compounds of interest.	Potentially applicable.
		CHEMICAL OXIDATION	Oxidizing agents injected into subsurface to detoxify or destroy compounds of interest.	Not applicable. Site conditions not amenable to in-situ treatment.
		CHEMICAL REDUCTION	Reducing agents injected into subsurface to detoxify or destroy compounds of interest.	Not applicable. Site conditions not amenable to in-situ treatment.
		PRECIPITATION	Chemistry of groundwater altered to precipitate and immobilize inorganic compounds.	Not applicable. Site conditions not amenable to in-situ treatment.
DISPOSAL	DISCHARGE TO SURFACE WATER		Treated groundwater discharged to Yahara River.	Potentially applicable.
	REINJECTION		Treated groundwater reinjected to subsurface on-site.	Not applicable. Injection into groundwater prohibited by WDNR regulations.
	DISCHARGE TO POTW		Treated groundwater discharged to local POTW.	Potentially applicable.
MONITORING	GROUNDWATER MONITORING		Samples from groundwater monitoring wells collected and analyzed to track any migration of compounds of interest.	Potentially applicable.

CONTINUED FROM SHT. 2 of 3

FIGURE 3-2 (SHT. 3 OF 3)

GROUNDWATER OPERABLE UNIT
INITIAL TECHNOLOGY SCREENING
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

[shaded box] TECHNOLOGY NOT CARRIED FORWARD

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respectively, for the solid waste and groundwater operable units. Technologies that were not screened out in this step are identified in Table 3-2. These technology types and associated process options were carried forward in the Feasibility Study (FS) process for more detailed evaluation and further screening, as described in Section 3.4.

3.4 Evaluation and Screening of Technologies

Based on the development and initial screening discussed in Section 3.3, the technologies listed in Table 3-2 were carried forward for further evaluation. Each technology process option was evaluated using three main criteria: effectiveness, implementability, and cost. In general, at this stage of the FS, the evaluation is still focused on the effectiveness of the process option, with less emphasis on the other two criteria. In addition, technology process options are evaluated with respect to satisfying the general response action under which they were developed, as opposed to the site as a whole.

These three main evaluation criteria can be broken down into more detailed components. The effectiveness criterion includes consideration of the ability of the technology to meet the remedial action objectives and its ability to handle the volumes or areas of media. The potential impacts to human health and the environment during construction and implementation must be considered as well. The level of development of the technology, and how reliable it is in relation to the Stoughton City Landfill in particular, is also factored into the evaluation.

The implementability criterion in this stage of the FS, unlike in the initial screening, takes into consideration administrative, as well as technical, feasibility. Therefore, in addition to considering the ability to construct and operate the technology, issues such as permitting requirements, available off-site treatment, storage and disposal facilities, and availability of equipment and skilled workers are also evaluated.

The cost evaluation of the technology process options is preliminary; only relative cost comparisons are used. Capital and operation and maintenance (O&M) costs are evaluated based on engineering judgment only. The evaluation is made based on the technology having relatively high, low, or medium capital and O&M costs in relation to other technology process options in the same technology type.

The technology evaluation and screening criteria are summarized for each technology process option listed in Table 3-2. These summaries are presented in tabular form in Tables 3-3A through 3-3K for the soil/solid waste operable unit and in Tables 3-4A through 3-4N for the groundwater operable unit. A list of the summary tables is provided on page 3-10.

TABLE 3-2

Technologies Surviving Initial Screening

General Response Action	Remedial Technology	Process Option
	SOIL/SOLID WASTE OPERABLE UNIT	
No Action	None	None
Institutional Controls	Access and Use Restrictions	Deed Restrictions Fences
Containment	Cap Repair	Cap Repair
	Single Layer Cap	Clay Cap
	Multilayer Cap	Clay Cap
		Synthetic Geomembrane Clay/Geomembrane
	Surface Controls	Grading Revegetation Diversion and Collection Systems
	GROUNDWATER OPERABLE UNIT	
No Action	None	None
Institutional Restrictions	Access and Use Restrictions	Deed Restrictions
Containment	Vertical Barriers	Hydraulic Barriers
Removal	Groundwater Removal	Recovery Wells Subsurface Drains
Treatment	Physical Treatment	Carbon Adsorption Steam Stripping
	Chemical Treatment	Chemical Oxidation
	In-Situ Treatment	Bioremediation
Disposal	Discharge to Surface Water	Discharge to Yahara River
	Discharge to Publicly Owned Treatment Works (POTW)	Discharge to POTW
Monitoring	Groundwater Monitoring	Groundwater Monitoring

TABLE 3-3A

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: NO ACTION

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Will not meet remedial action goals.

1.2) Ability to handle areas or volumes of media: N/A*

1.3) Potential impacts to human health and the environment during construction and implementation: N/A

1.4) Level of development and reliability of process: N/A

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): N/A

2.2) Ability to operate: N/A

2.3) Permitting needs: N/A

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: N/A

3) COST

3.1) Capital cost: None.

3.2) Operating cost: None.

*N/A - not applicable.

TABLE 3-3B

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: DEED RESTRICTIONS

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet remedial action goals by preventing direct contact with soils and waste.

1.2) Ability to handle areas or volumes of media: Deed restrictions would apply to the area encompassed by the landfill boundaries.

1.3) Potential impacts to human health and the environment during construction and implementation: N/A

1.4) Level of development and reliability of process: N/A

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): N/A

2.2) Ability to operate: N/A

2.3) Permitting needs: N/A

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: N/A

3) COST

3.1) Capital cost: Low. May include legal and administrative fees. May also include miscellaneous capital costs due to loss of use of property.

3.2) Operating cost: None.

TABLE 3-3C

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: FENCES

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet remediation goal of preventing direct contact with the soil and waste.

1.2) Ability to handle areas or volumes of media: Area encompassed by the landfill boundaries could be fenced.

1.3) Potential impacts to human health and the environment during construction and implementation: Minimal impacts would be expected during installation of the fencing.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): Very simple to construct.

2.2) Ability to operate: N/A

2.3) Permitting needs: None.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both readily available.

3) COST

3.1) Capital cost: Relatively low.

3.2) Operating cost: Relatively low.

TABLE 3-3D

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: CAP REPAIR

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet the remediation goal of preventing direct contact with the soils and waste; however, would not likely meet remediation goal of controlling the leaching of chemicals of concern from the landfill to the groundwater.

1.2) Ability to handle areas or volumes of media: Repairing the cap that was previously approved can address all of the waste and affected soils on-site.

1.3) Potential impacts to human health and the environment during construction and implementation: Minimal impacts expected. Current cap would remain in place, minimizing potential for contact with waste. Repairing edges of cap could affect surrounding wetlands.

1.4) Level of development and reliability of process: Capping of solid waste landfills is a relatively common process. The current condition of the cap is unknown, making the reliability of a repaired cap uncertain.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major difficulties anticipated in repairing the cap, although an extension of the cap into the wetlands would be difficult to construct.

2.2) Ability to operate: Repaired cap would require minimal maintenance.

2.3) Permitting needs: Permit may be required to fill in wetlands.

2.4) Availability of treatment, storage and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Relatively low.

3.2) Operating cost: Relatively low.

TABLE 3-3E

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: SINGLE LAYER CLAY CAP

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet the remediation goal of preventing direct contact with the soils and waste.

1.2) Ability to handle areas or volumes of media: Entire area encompassed by the landfill boundaries could be capped.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal, because the clay would be placed over the cap already in place, and waste and affected soils would not be disturbed. Capping the edges of the landfill could affect the surrounding wetlands.

1.4) Level of development and reliability of process: Capping with clay is a common process, and would be reliable.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated, although an extension of the cap into adjacent wetlands would be difficult to construct.

2.2) Ability to operate: Capped site would require minimal maintenance.

2.3) Permitting needs: Permit may be required to fill in wetlands.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Relatively low.

TABLE 3-3F

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: MULTILAYER CLAY CAP

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet the remediation goal of preventing direct contact with the waste and soils. Would meet current Wisconsin regulations for capping solid waste sites.

1.2) Ability to handle areas or volumes of media: Entire area encompassed by landfill boundaries could be capped.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal, because the clay would be placed over the cap already in place, and the waste and affected soils would not be disturbed. Capping the edges of the landfill could affect the surrounding wetlands.

1.4) Level of development and reliability of process: Capping with clay and other natural materials is a common process. This type of cap would be reliable.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated, although an extension of the cap into adjacent wetlands would be difficult to construct.

2.2) Ability to operate: Capped site would require minimal maintenance.

2.3) Permitting needs: Permit may be required to fill in wetlands.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both readily available.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Relatively low.

TABLE 3-3G

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: MULTILAYER GEOMEMBRANE CAP

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet the remediation goal of preventing direct contact with waste and soils. Would meet Wisconsin regulations for capping solid waste sites, although use of geomembrane in place of clay layer would require WDNR approval.

1.2) Ability to handle areas or volumes of media: Entire area encompassed by landfill boundaries could be capped.

1.3) Potential impacts to human health and the environment during construction and implementation: Impact would be minimal, as the cap would be placed over the cap already in place, and the waste and affected soils would not be disturbed. Capping the edges of the landfill could affect the surrounding wetlands.

1.4) Level of development and reliability of process: Geomembrane caps, while not as common as clay caps, have been used extensively to cap waste sites, and are considered reliable.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated, although an extension of the cap into the adjacent wetlands would be difficult to construct.

2.2) Ability to operate: Capped site would required minimal maintenance.

2.3) Permitting needs: Permit may be required to fill in wetlands.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both readily available.

3) COST

3.1) Capital cost: Relatively high.

3.2) Operating cost: Relatively low.

TABLE 3-3H

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: MULTILAYER CLAY/GEOMEMBRANE CAP

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet the remediation goal of preventing direct contact with waste and soils. This type of cap would meet Wisconsin regulations for capping of hazardous waste sites.

1.2) Ability to handle areas or volumes of media: Entire area encompassed by landfill boundaries could be capped.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal, because the cap would be placed over the cap already in place, and the waste and affected soils would not be disturbed. Capping the edges of the landfill could affect the surrounding wetlands.

1.4) Level of development and reliability of process: Geomembrane/clay caps, while not as common as clay caps, have been used extensively to cap waste sites, and are considered reliable.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated, although an extension of the cap into the adjacent wetlands would be difficult to construct.

2.2) Ability to operate: Capped site would require minimal maintenance.

2.3) Permitting needs: Permit may be required to fill in wetlands.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Relatively high.

3.2) Operating cost: Relatively low.

TABLE 3-3I

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: SURFACE GRADING

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would not meet remedial action goals by itself, but would be implemented in conjunction with capping or cap repair of the site.

1.2) Ability to handle areas or volumes of media: Could be implemented over the entire site.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal; excavation into solid waste is not anticipated.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated.

2.2) Ability to operate: N/A.

2.3) Permitting needs: No permit required.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both readily available.

3) COST

3.1) Capital cost: Relatively low.

3.2) Operating cost: Relatively low.

TABLE 3-3J

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: SURFACE REVEGETATION

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would not meet remedial action goals by itself, but would be implemented in conjunction with capping or cap repair at the site.

1.2) Ability to handle areas or volumes of media: Could be implemented over entire site.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated.

2.2) Ability to operate: Maintenance would be minimal.

2.3) Permitting needs: No permit required.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both readily available.

3) COST

3.1) Capital cost: Relatively low.

3.2) Operating cost: Relatively low.

TABLE 3-3K

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: SOIL/SOLID WASTE

Technology: SURFACE DIVERSION AND COLLECTION SYSTEMS

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would not meet remedial action goals by itself, but would be implemented in conjunction with capping or cap repair at the site.

1.2) Ability to handle areas or volumes of media: Could be implemented where needed on-site.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated. Enhancement of existing surface water drainage features is likely to be extent of this action.

2.2) Ability to operate: Maintenance would be minimal.

2.3) Permitting needs: No permit required.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both readily available.

3) COST

3.1) Capital cost: Relatively low.

3.2) Operating cost: Relatively low.

TABLE 3-4A

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: NO ACTION

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Not likely to meet remedial action goals.

1.2) Ability to handle areas or volumes of media: N/A

1.3) Potential impacts to human health and the environment during construction and implementation: N/A

1.4) Level of development and reliability of process: N/A

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): N/A

2.2) Ability to operate: N/A

2.3) Permitting needs: N/A

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: N/A

3) COST

3.1) Capital cost: None.

3.2) Operating cost: Relatively low (groundwater monitoring).

TABLE 3-4B

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: DEED RESTRICTIONS

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: May meet the remedial action goal of preventing direct contact with groundwater.

1.2) Ability to handle areas or volumes of media: Would apply to affected areas.

1.3) Potential impacts to human health and the environment during construction and implementation: N/A

1.4) Level of development and reliability of process: N/A

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): N/A

2.2) Ability to operate: N/A

2.3) Permitting needs: N/A

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: N/A

3) COST

3.1) Capital cost: Low. May include administrative and legal fees.

3.2) Operating cost: None.

TABLE 3-4C

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: HYDRAULIC BARRIERS

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: May meet the remedial action goal of preventing direct contact with groundwater by preventing its migration off-site.

1.2) Ability to handle areas or volumes of media: May be possible to provide a barrier to groundwater flow from the west side of the site, where compounds of concern were detected in groundwater.

1.3) Potential impacts to human health and the environment during construction and implementation: Would be a potential for contact with the compounds of concern during well installation.

1.4) Level of development and reliability of process: Hydraulic barriers have been demonstrated to be effective. Reliability depends on ability to maintain an artificial gradient on the groundwater surface.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated.

2.2) Ability to operate: Wells would require regular maintenance. Regular monitoring would also be required to ensure that the desired groundwater flow conditions are maintained.

2.3) Permitting needs: Permit required from WDNR.

2.4) Availability of treatment, storage, and disposal services: Would be implemented as part of a groundwater recovery and on-site treatment program.

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Medium.

TABLE 3-4D

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: GROUNDWATER RECOVERY WELLS

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: This process would not likely meet remedial action goals by itself, but when combined with groundwater treatment, would meet the groundwater treatment goals.

1.2) Ability to handle areas or volumes of media: Would be possible to implement over western boundary of site, where compounds of concern were detected in groundwater.

1.3) Potential impacts to human health and the environment during construction and implementation: Some potential for direct contact with compounds of concern is possible during well installation.

1.4) Level of development and reliability of process: Common technology would be used.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated.

2.2) Ability to operate: Would require regular maintenance of wells and pumps.

2.3) Permitting needs: Permit required from WDNR.

2.4) Availability of treatment, storage, and disposal services: Groundwater removed would be treated on-site.

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Medium.

TABLE 3-4E

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: SUBSURFACE DRAINS

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: This process would not likely meet remedial action goals by itself, but when combined with groundwater treatment, would meet the goals.

1.2) Ability to handle areas or volumes of media: May be effective over western edge of site, where compounds of interest were detected in groundwater.

1.3) Potential impacts to human health and the environment during construction and implementation: Direct contact with wastes could occur during excavation and installation of drains. Release of volatile compounds to the environment is also possible.

1.4) Level of development and reliability of process: Common technology. Could be more reliable over time than recovery wells.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): Major difficulties involved in excavating a trench to the depth necessary to capture compounds of concern in groundwater.

2.2) Ability to operate: Would require some maintenance, but less than a recovery well system.

2.3) Permitting needs: Permit required.

2.4) Availability of treatment, storage, and disposal services: Groundwater removed would be treated on-site.

2.5) Availability of equipment and skilled workers: Both would be available.

3) COST

3.1) Capital cost: Relatively high.

3.2) Operating cost: Relatively low.

TABLE 3-4F

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: CARBON ADSORPTION

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Likely to meet remedial action goals for removal of organics.

1.2) Ability to handle areas or volumes of media: Would be able to handle volume of groundwater to be treated and concentrations of organics.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal.

1.4) Level of development and reliability of process: Common technology. Suitable for removing a wide range of organics from groundwater over a broad range of concentrations. Expected to be reliable.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): Prepackaged treatment units are commercially available. No major problems anticipated.

2.2) Ability to operate: Would require a part-time operator and periodic maintenance. Pretreatment to remove suspended solids may be required.

2.3) Permitting needs: Permit required.

2.4) Availability of treatment, storage, and disposal services: Carbon regeneration and destruction of adsorbed compounds would be conducted at an off-site facility.

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Relatively high.

3.2) Operating cost: Medium.

TABLE 3-4G

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: STEAM STRIPPING

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would likely meet remedial action goals for all organics present except tetrahydrofuran. Steam stripper effluent would require further treatment, such as carbon adsorption.

1.2) Ability to handle areas or volumes of media: Could handle volume of groundwater to be treated.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): Prepackaged units available commercially from vendors. No major problems anticipated.

2.2) Ability to operate: Would require a full-time operator.

2.3) Permitting needs: May require an air pollution permit.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Relatively high.

TABLE 3-4H

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: CHEMICAL OXIDATION

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Would meet remedial action goals for some organics.

1.2) Ability to handle areas or volumes of media: Could handle volume of groundwater to be treated.

1.3) Potential impacts to human health and the environment during construction and implementation: Potential for contact with or release of chemical reactants.

1.4) Level of development and reliability of process: Chemical oxidation not as commonly used for groundwater treatment as other methods. Reliability uncertain.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated.

2.2) Ability to operate: Would require a full-time operator. Could be complicated to operate because of the variety of compounds to be treated and the various reactants necessary.

2.3) Permitting needs: Permit required.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Would require specially trained workers. Common equipment used.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Relatively high.

TABLE 3-4I

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: IN-SITU BIOREMEDIATION

1) EFFECTIVENESS

1.1) **Ability to meet cleanup objectives**: Would likely meet groundwater cleanup objectives, although rate of treatment is relatively slow.

1.2) **Ability to handle areas or volumes of media:** Would be able to handle volume of groundwater to be treated and concentration range of tetrahydrofuran.

1.3) **Potential impacts to human health and the environment during construction and implementation:** Impacts would be minimal. Some potential exposure to constituents of interest during installation of delivery and extraction wells.

1.4) **Level of development and reliability of process**: Technology has not been widely used but is expected to be reliable. A biodegradation treatability study would be required to predict reliability at the Stoughton City Landfill site.

2) IMPLEMENTABILITY

2.1) **Ability to construct (process and site constraints):** No major problems anticipated. Wells for nutrient delivery may need to be closely spaced in high permeability soils.

2.2) **Ability to operate**: System would require that a groundwater monitoring program be implemented to assess progress of bioremediation and changes in subsurface conditions.

2.3) **Permitting needs:** Permits may be required for injection wells.

2.4) **Availability of treatment, storage, and disposal services:** N/A.

2.5) **Availability of equipment and skilled workers:** Both are readily available.

3) COST

3.1) **Initial cost:** Medium

3.2) **Operating cost:** Low.

TABLE 3-4J

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: DISCHARGE TO YAHARA RIVER

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Treated groundwater would likely meet remedial action goals for discharge to surface water.

1.2) Ability to handle areas or volumes of media: No problems anticipated.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated.

2.2) Ability to operate: No major problems anticipated. Would likely require sampling and analysis of treated water on a periodic basis.

2.3) Permitting needs: Would require Wisconsin Pollutant Discharge Elimination System (WPDES) permit.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Relatively low.

3.2) Operating cost: Medium.

TABLE 3-4K

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: DISCHARGE TO POTW

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Treated groundwater would likely meet remedial action goals for discharge to POTW.

1.2) Ability to handle areas or volumes of media: City of Stoughton POTW would not likely be able to handle flow volume due to hydraulic capacity limitations.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major problems anticipated.

2.2) Ability to operate: POTW not likely to accept discharge of treated groundwater due to potentially negative impacts upon the future POTW customer base. Would likely require sampling and analysis of treated water on a periodic basis.

2.3) Permitting needs: User permit likey to be required.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both are readily available.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Medium. Includes cost for monitoring discharge to POTW.

TABLE 3-4L

REMEDIATION TECHNOLOGY SCREENING SUMMARY

Medium: GROUNDWATER

Technology: GROUNDWATER MONITORING

1) EFFECTIVENESS

1.1) Ability to meet remedial action objectives: Not likely to meet remedial action goals. Would be implemented as part of all alternatives.

1.2) Ability to handle areas or volumes of media: All wells could be monitored.

1.3) Potential impacts to human health and the environment during construction and implementation: Impacts would be minimal.

1.4) Level of development and reliability of process: Common technology.

2) IMPLEMENTABILITY

2.1) Ability to construct (process and site constraints): No major difficulties anticipated.

2.2) Ability to operate: No major difficulties anticipated.

2.3) Permitting needs: No permit would be required.

2.4) Availability of treatment, storage, and disposal services: N/A

2.5) Availability of equipment and skilled workers: Both readily available.

3) COST

3.1) Capital cost: Medium.

3.2) Operating cost: Medium.

Based on the evaluation of the technology process options in the screening summary tables, the technologies determined to be most applicable to the Stoughton City Landfill were selected. Figures 3-3 and 3-4 summarize this evaluation and screening process. These figures indicate which technology process options were eliminated as a result of this step and include a summary of the major screening issues from the screening criteria sheets. Technology process options selected for assembly into sitewide alternatives (discussed in Section 4.0) are indicated in the far right column of these figures.

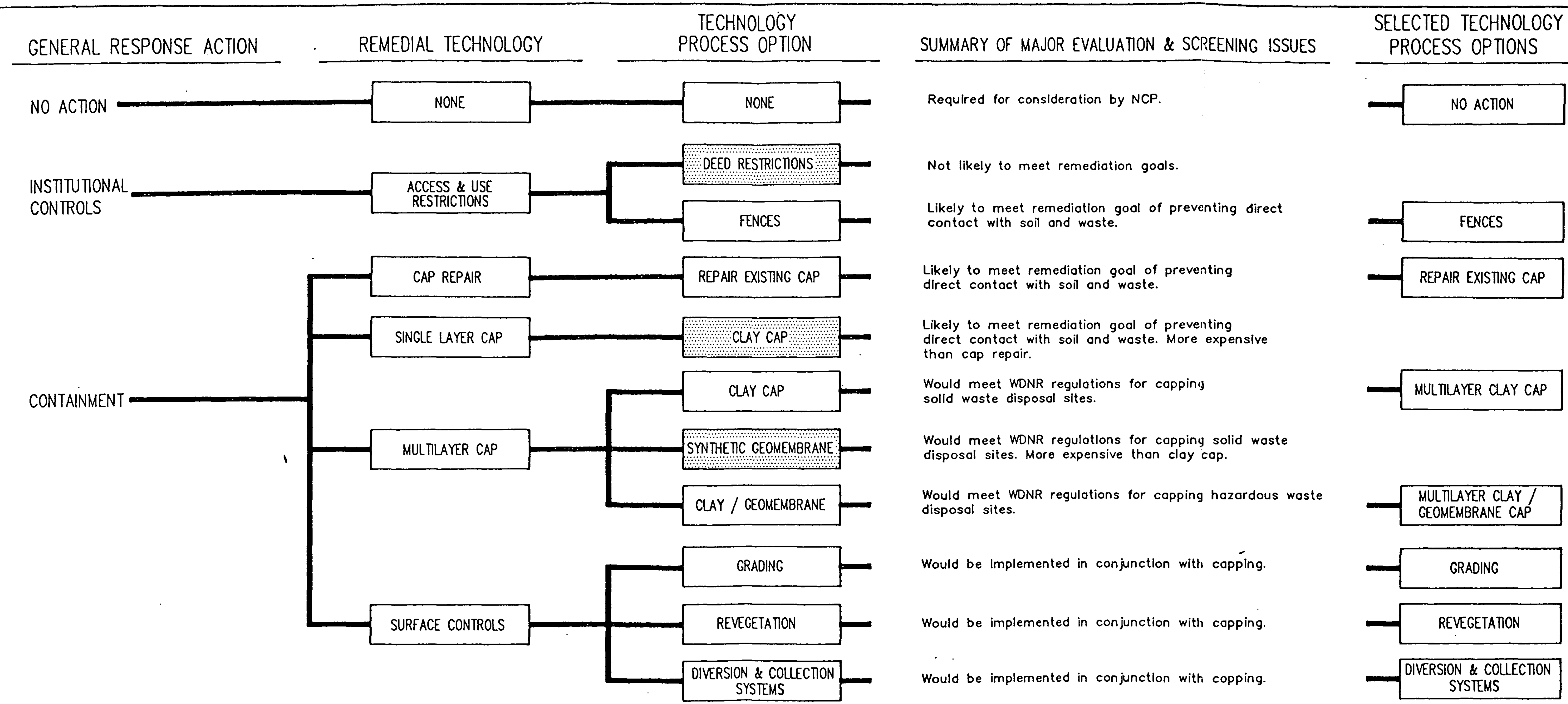
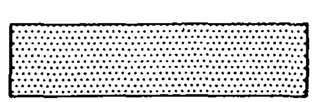


FIGURE 3-3

SOIL / SOLID WASTE OPERABLE UNIT
TECHNOLOGY EVALUATION AND SCREENING
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN


TECHNOLOGY NOT CARRIED FORWARD

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GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	TECHNOLOGY PROCESS OPTION	SUMMARY OF MAJOR EVALUATION AND SCREENING ISSUES	SELECTED TECHNOLOGY PROCESS OPTIONS
NO ACTION	NONE	NONE	Required for consideration by NCP.	NO ACTION
INSTITUTIONAL CONTROLS	ACCESS & USE RESTRICTIONS	DEED RESTRICTIONS	Likely to meet remedial action goal.	DEED RESTRICTIONS
CONTAINMENT	VERTICAL BARRIERS	HYDRAULIC BARRIERS	May meet remediation goal of preventing contact with groundwater. Could be implemented as part of goundwater recovery system.	HYDRAULIC BARRIERS
REMOVAL	GROUNDWATER REMOVAL	RECOVERY WELLS	Likely to be effective in recovering groundwater for treatment.	RECOVERY WELLS
		SUBSURFACE DRAINS	Major difficulties involved in excavating trenches to the depth necessary to capture groundwater containing compounds of interest.	
TREATMENT	PHYSICAL TREATMENT	CARBON ADSORPTION	Likely to meet remediation goals for removal of organics from groundwater, including tetrahydrofuran.	CARBON ADSORPTION
		STEAM STRIPPING	Likely to meet remediation goals for removal of organics except tetrahydrofuran. More expensive than air stripping.	STEAM STRIPPING
	CHEMICAL TREATMENT	CHEMICAL OXIDATION	Not likely to meet remediation goals for all organics in groundwater.	
	IN-SITU TREATMENT	BIOREMEDIATION	Likely to meet remediation goal for removal of tetrahydrofuran.	BIOREMEDIATION
DISPOSAL	DISCHARGE TO SURFACE WATER		Treated water likely to meet remediation goals for discharge to surface water.	DISCHARGE TO YAHARA RIVER
	DISCHARGE TO P O T W		Treated water likely to meet remediation goals for discharge to POTW. Likely to be more expensive than discharge to surface water. POTWs are not usually amendable to superfund effluent. Hydraulic capacity of POTW is limited.	DISCHARGE TO POTW
MONITORING	GROUNDWATER MONITORING		Would be implemented as part of every alternative.	GROUNDWATER MONITORING

TECHNOLOGY NOT CARRIED FORWARD

FIGURE 3-4

GROUNDWATER OPERABLE UNIT

TECHNOLOGY EVALUATION AND SCREENING

STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

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4.0 DEVELOPMENT OF ALTERNATIVES

4.1 Introduction

In this section, technology process options determined (during the screening process described in Section 3.0) to be most applicable to the Stoughton City Landfill site are assembled into sitewide alternatives. Because only a few media are of concern at the site, alternatives for the entire site, rather than alternatives for each medium of interest, have been developed.

The technology process options that survived screening and evaluation discussed in Section 3.0 were assembled into sitewide remediation alternatives. The alternatives cover a range of actions for site remediation. Figure 4-1 is a matrix that shows which technology process options were combined to form the six sitewide alternatives. The rationale for developing each alternative is discussed below, in Section 4.2, followed by a detailed description of each alternative in Section 4.3.

4.2 Development of Sitewide Alternatives

4.2.1 Alternative 1: No Action

The NCP requires that the no action alternative be considered. Semi-annual groundwater monitoring, currently required by WDNR as part of landfill closure, would be expanded under this alternative to include additional organic and inorganic parameters. The purpose of additional monitoring is to evaluate the potential migration of chemicals of concern in groundwater.

4.2.2 Alternative 2: Cap Repair, Fencing, and Groundwater Use Deed Restrictions

This alternative includes access restriction by fencing, repair of the existing cap, and groundwater monitoring. Compared with installing a new cap, repair of the existing cap could be the least expensive way of preventing direct contact with the soil and solid waste. Fencing around the capped area would prevent access, further reducing the possibility of contact with the soil and solid waste. Grading, revegetation, and surface water diversion would be implemented in areas of cap repair. Also, groundwater use deed restrictions would be implemented to prevent the installation of wells in the affected area.

FIG4-1

GENERAL RESPONSE ACTIONS			1 NO ACTION	2 LIMITED ACTION	3 SOURCE CONTAINMENT	4 SOURCE CONTAINMENT	5 SOURCE CONTAINMENT WITH GW COLLECTION & TREATMENT	6 SOURCE CONTAINMENT WITH GW COLLECTION & TREATMENT	7 SOURCE CONTAINMENT WITH GW IN-SITU TREATMENT	8 SOURCE CONTAINMENT WITH GW IN-SITU TREATMENT
MEDIUM	TECHNOLOGY TYPE	AREA OR VOLUME								
SOIL/SOLID WASTE	ACCESS RESTRICTIONS	AFFECTED AREAS		*	*	*	*	*	*	*
	CAP REPAIR	LANDFILL BOUNDARY		*						
	CAPPING-SUBTITLE D	LANDFILL BOUNDARY			*		*		*	
	CAPPING-SUBTITLE C	LANDFILL BOUNDARY				*		*		*
	SURFACE CONTROLS	LANDFILL BOUNDARY		*	*	*	*	*	*	*
GROUND-WATER	GROUNDWATER MONITORING	ALL MONITORING WELLS TWICE/YEAR	*	*	*	*	*	*	*	*
	DEED RESTRICTIONS	AFFECTED AREAS		*						
	GROUNDWATER COLLECTION WITH WELLS	WEST BORDER OF LANDFILL					*	*		
	GROUNDWATER TREATMENT ON-SITE	ALL RECOVERED GROUNDWATER					*	*		
	DISPOSAL OF TREATED GROUNDWATER	ALL TREATED GROUNDWATER					*	*		
	IN-SITU REMEDIATION OF GROUNDWATER	AFFECTED GROUNDWATER							*	*

FIGURE 4-1

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ASSEMBLY OF SITE-WIDE ALTERNATIVES

STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

DRAWN: HWW	DATE: 8/14/90	PROJECT NUMBER:	REV.
APPV'D: X	REVISED: X	6885-002	0

4.2.3 Alternative 3: Subtitle D Cap

This alternative consists of placing a multi-layer cap over the entire landfill, fencing of the capped area to restrict access and groundwater monitoring. The cap, which would consist of layers of clay and other natural materials, would meet the requirements for capping solid waste disposal sites. This cap would comply with both federal guidelines under 40 CFR Subtitle D, and Wisconsin State regulations, under NR 500. A single layer clay cap, which would not meet these state requirements, was not considered. A geomembrane could be used as an alternative to the clay layer, but would require approval by WDNR. Because a clay layer would be less costly than a geomembrane, the multi-layer clay cap was included in this alternative. Surface grading, revegetation, and surface water diversion would also be implemented as part of the cap installation.

4.2.4 Alternative 4: Subtitle C Cap

This alternative is the same as Alternative 3, except that a multi-layer clay and geomembrane cap would be installed over the entire landfill. This cap would meet the requirements for capping hazardous waste disposal sites, under both the federal regulations, (40 CFR Subtitle C), and Wisconsin State regulations (NR 181). Access restriction and groundwater monitoring would be included as part of this alternative. Surface grading, revegetation, and surface water diversion would be implemented as part of the cap installation.

4.2.5 Alternative 5: Subtitle D Cap with Groundwater Collection and Treatment

This alternative consists of capping the entire landfill according to guidelines and regulations for solid waste disposal sites, plus groundwater collection and treatment, access restriction by fencing and groundwater monitoring. Surface grading, revegetation, and surface water diversion would be implemented as part of the cap installation.

Groundwater recovery wells would be used to pump groundwater from a limited area of the site to the surface for treatment. By controlling groundwater flow, this series of wells would also act as a vertical barrier to groundwater flow. The groundwater would be treated to remove tetrahydrofuran.

The treated groundwater would be discharged to the Yahara River. Because the river is located adjacent to the site, it represents a less expensive discharge option.

4.2.6 Alternative 6: Subtitle C Cap with Groundwater Collection and Treatment

This alternative is the same as Alternative 5, except that a multi-layer clay and geomembrane cap would be installed over the entire landfill. This cap would meet the requirements for capping hazardous waste disposal sites under both federal regulations (40 CFR Subtitle C), and Wisconsin State regulations (NR 181). Access restriction and groundwater monitoring would be included as part of this alternative. Surface grading, revegetation, and surface water diversion would be implemented as part of the cap installation.

Groundwater recovery wells would be used to pump groundwater from a limited area of the site to the surface for treatment, and also to serve as a hydraulic barrier to groundwater flow. The groundwater would be treated by carbon adsorption to remove tetrahydrofuran. The treated groundwater would be discharged to the Yahara River.

4.2.7 Alternative 7: Subtitle D Cap with In-Situ Bioremediation of Groundwater

This alternative is the same as Alternative 5, except that in-situ bioremediation would be implemented for the treatment of groundwater instead of groundwater extraction and carbon treatment.

This alternative consist of capping the entire landfill according to guidance and regulations for solid waste disposal sites in the State of Wisconsin. Surface grading, revegetation, and surface water diversion would be implemented as part of the cap installation as well as access restrictions by fencing and groundwater monitoring.

The in-situ groundwater treatment system would consists of a series of wells installed hydraulically downgradient of the site. These wells, consisting of slotted PVC piping, would be used to oxygenate the groundwater by injecting fine air bubbles or hydrogen peroxide to stimulate natural biodegradation. The oxygenated water would create a bioactive zone in the subsurface through which groundwater containing tetrahydrofuran would flow. It is anticipated that biodegradation of the tetrahydrofuran will occur in the bioactive zone and that under natural aquifer flow conditions, remediation of the tetrahydrofuran can be accomplished.

TABLE 4-1

Groundwater Monitoring Analytical Parameters for Remedial Action Alternatives at the Stoughton City Landfill

EXISTING PARAMETERS
Chemical Oxygen Demand (COD)
Hardness
Alkalinity
Chloride
Dissolved Iron
Field Conductivity
Field pH
Groundwater Elevation
ADDITIONAL PARAMETERS
TCL Volatile and Semivolatile Organics
TCL Inorganic
Tetrahydrofuran
Dichlorodifluoromethane
Trichlorofluoromethane

4.2.8 Alternative 8: Subtitle C Cap with In-Situ Bioremediation of Groundwater

This alternative is similar to Alternative 7 except a subtitle C hazardous waste cap is installed over the entire site as a means of source control.

4.3 Detailed Description of Sitewide Alternatives

4.3.1 Alternative 1: No Action

The no action alternative includes no further activities at the site other than an increased level of groundwater monitoring. The monitoring wells present at the site before the RI (SB-1 through SB-6 on Figure 1-4) are currently monitored semiannually (March and September) for the parameters listed in Table 4-1. The City of Stoughton would likely petition WDNR to allow monitoring for these parameters in the monitoring wells installed as part of the RI rather than those that were present at the site prior to the RI. The groundwater samples collected from these wells would be analyzed for the current parameters and additional compounds listed in Table 4-1. This groundwater monitoring program would be implemented as part of all six alternatives.

4.3.2 Alternative 2: Cap Repair, Fencing, and Groundwater Use Deed Restrictions

This alternative would combine repair of the existing cap with fencing of the landfill boundary to restrict access, and deed restrictions to prevent the installation of wells in the affected area. These actions would reduce the potential for exposure to soils and solid waste in the landfill. The repaired cap would also reduce the amount of precipitation infiltration through the landfill.

The condition of the existing cap has not been systematically investigated. Areas were observed, however, where waste was visible because of incomplete capping or erosion of the cap. Animal holes and other damage to the cap were also observed.

Prior to repair, the cap would have to be investigated to assess its overall condition. Soil borings, to determine the thickness and materials used in construction of the cap, would be required as part of this investigation. Areas around the edges of the cap where erosion and exposed waste were observed would also be documented, as would depressions, cracks, and animal holes.

After assessment of its condition, the cap would be repaired to ensure that all areas where waste disposal occurred were covered with 2 feet of compacted clay and 6 inches of topsoil. Figure

4-2 shows the areal extent of this cap. Regrading in some areas using imported fill may be required. Sections of the existing cap disturbed during cap repair would also be revegetated.

Fencing would be installed around the capped area to prevent access, further minimizing the potential for contact with soils and waste in the landfill. Cyclone fencing, with a locking gate at the landfill entrance, would be used. By restricting access, wear on the cap could also be reduced.

Groundwater use in the area would be prevented by issuing deed restrictions on the use and placement of wells in the affected area.

The boundaries of the actual landfill areas were defined by geophysical surveys in the RI. On the east boundary of the landfill, the waste disposal area extends to the property boundary. When repairing the cap to ensure that all former waste disposal areas are covered, it may be necessary to extend the cap past the landfill property boundaries. In addition, in order to fence all areas where the cap was repaired, it may be necessary to install fencing outside the landfill property line. This could have an impact on the adjacent wetlands and existing and planned development on property not owned by the City of Stoughton, especially to the south of the site. These issues need to be considered in implementing this alternative, as well as Alternatives 3 through 6.

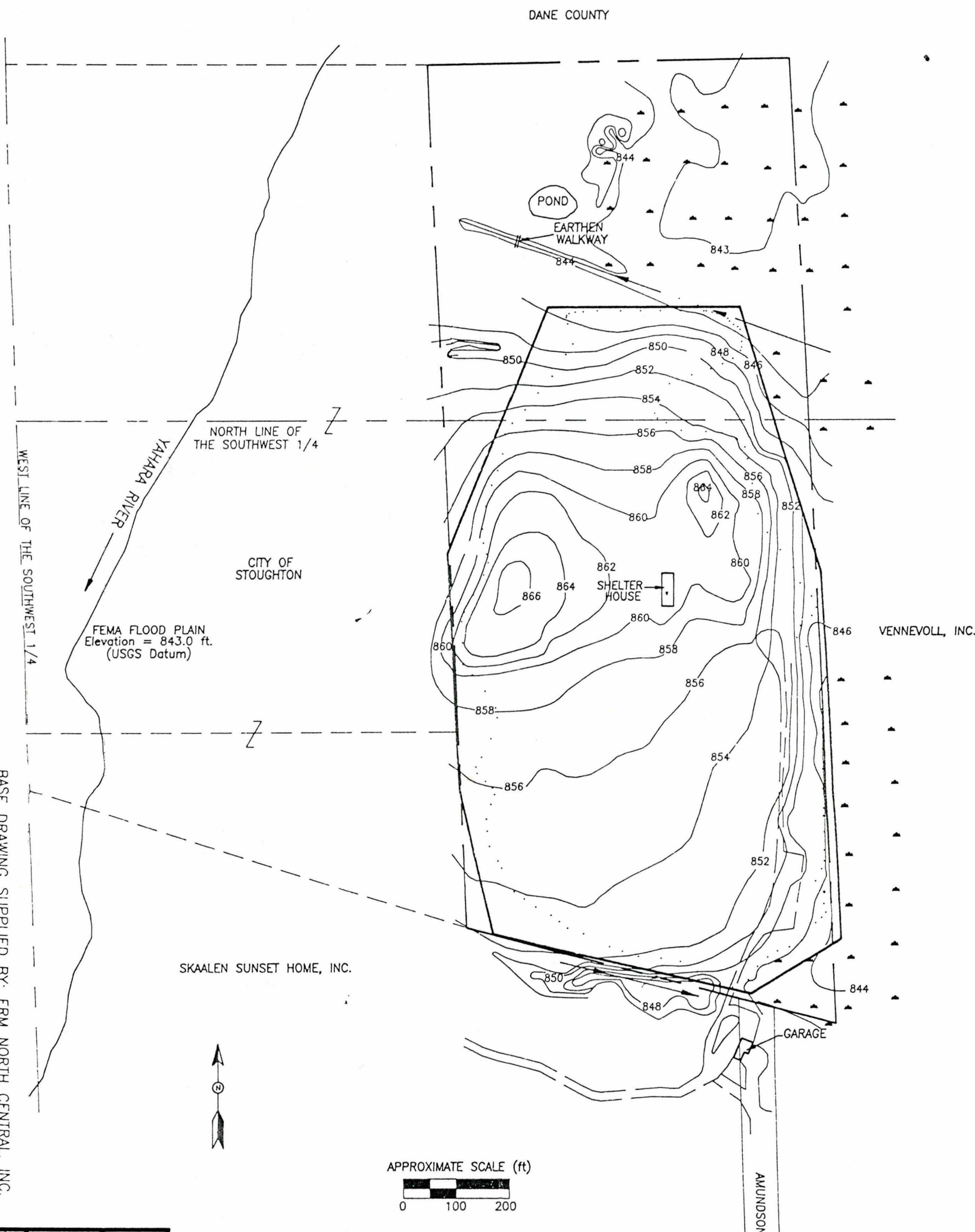
4.3.3 Alternative 3: Subtitle D Cap

This alternative would include placing a new multi-layer clay cap over the entire landfill area. This cap would meet the requirements for the Wisconsin NR 504 regulations concerning cover systems for solid waste disposal facilities. Regrading of certain parts of the landfill using imported fill would be required.

After preparing the surface, a multi-layer clay cap would be installed. The areal extent of the cap would be the same as for the repaired cap described in Alternative 2, and shown in Figure 4-2. The cap to be installed, as depicted in Figure 4-3, would consist of a 0.5-foot grading layer, a 2-foot clay barrier layer, a 1.5-foot cover layer, and a vegetated 0.5-foot topsoil layer. The grading layer would be constructed from the existing cap. The clay barrier layer is required to have a compacted permeability of 1×10^{-7} cm/sec or less.

The landfill boundary would be fenced to restrict access. The same fencing layout and specifications as described for Alternative 2 would be used. Groundwater monitoring, as described for Alternative 1, would also be implemented as part of this alternative.

FIG4-2



BASE DRAWING SUPPLIED BY: ERM NORTH CENTRAL, INC.

LEGEND:

— — —	PROPERTY LINE
═══	GRAVEL ROAD
—•—··—▸	DRAINAGE DITCH
▲	WETLANDS (NOT SHOWN WEST OF SITE)
———	BOUNDARY OF AREA TO BE CAPPED
· · · · ·	LANDFILL BOUNDARY (BASED ON RESULTS OF DRILLING AND GEOPHYSICAL SURVEYS)
— 858 —	TOPOGRAPHIC CONTOUR

NOTES:

1. ALL LAND IN SECTION 4, T.5 N., R.11 E.
2. TOPOGRAPHIC CONTOUR INTERVAL OF 2 FEET.

FIGURE 4-2

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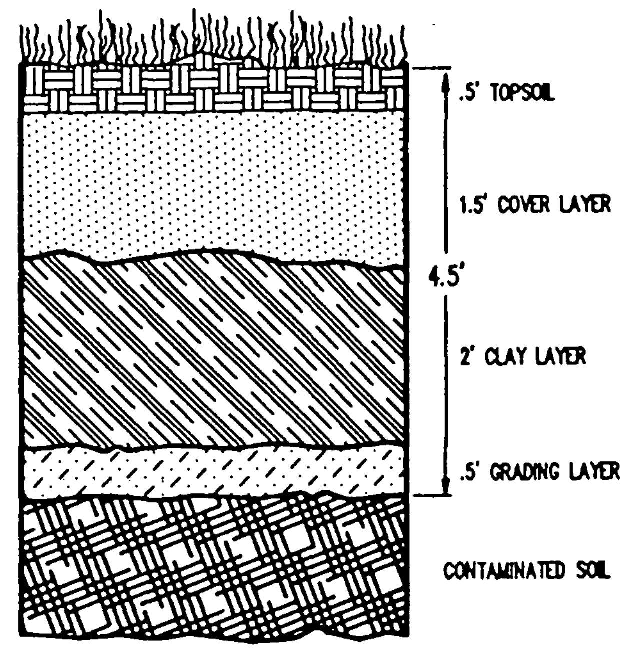
BOUNDARY OF AREA TO BE CAPPED
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

DRAWN: EDH	DATE: 3/15/90	PROJECT NUMBER: 6885-002	REV: 1
APP'V'D: X	REVISED: 8/8/90		



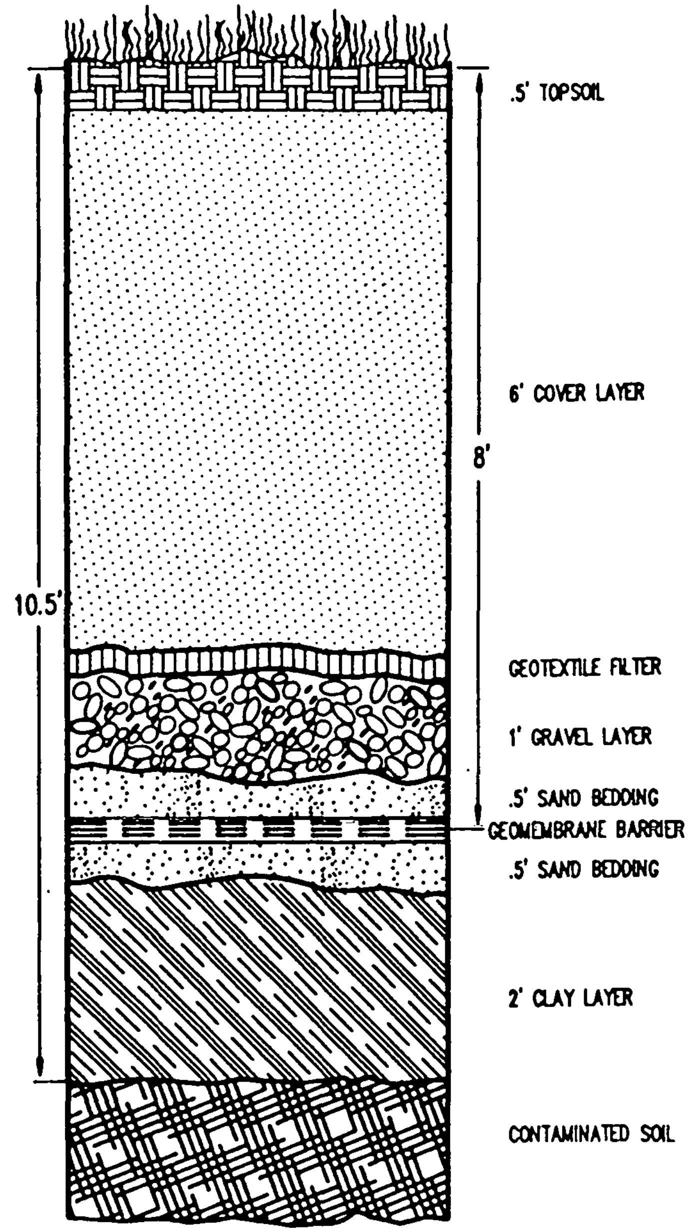


FIGURE 4-3

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MULTILAYER CAP SECTIONS
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

DRAWN:	JDG	DATE:	2/27/90	PROJECT NUMBER:		REV.
APPV'D:	X	REVISED:	X	6885-002		0

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4.3.4 Alternative 4: Subtitle C Cap

This alternative consists of placing a new multi-layer clay and geomembrane cap over the entire landfill area. This cap would meet the requirements in Wisconsin NR 181 regulations for cover systems for hazardous waste disposal sites. Regrading of sections of the landfill surface using imported fill would be required to meet the slope requirements.

After preparing the surface, a multi-layer clay and geomembrane cap would be installed. The areal extent of the cap would be the same as for the repaired cap described for Alternative 2. The cap would consist of a 2-foot clay liner, a geomembrane barrier with 0.5 feet of sand bedding above and below, a 1-foot gravel drainage layer, a geotextile filter, 6 feet of cover, and 0.5 feet of topsoil. The top cover would be vegetated with persistent species, and have a minimum slope of 3% to 5% and a maximum slope of 25%. The geomembrane barrier must be at least 1 foot below the maximum recorded depth of frost penetration, which is reportedly 7 feet in this area.

The landfill boundary would be fenced to restrict access. The same fencing layout and specifications as described for Alternative 2 would be used. Groundwater monitoring, as described for Alternative 1, would also be implemented as part of this alternative.

4.3.5 Alternative 5: Subtitle D Cap with Groundwater Collection and Treatment

This alternative consists of placing a multi-layer clay cap over the entire site; pumping of groundwater from a limited area of the site to the surface using recovery wells; treatment of the groundwater by carbon adsorption and discharge of the treated water to the Yahara River. Fencing to restrict access and groundwater monitoring would also be included.

The cap would meet the requirements of Wisconsin NR 504 regulations for cover systems for solid waste disposal facilities. The details of construction and related issues would be the same as those discussed for Alternative 3.

Groundwater recovery wells would be installed along the western boundary of the landfill, where compounds of concern were detected in groundwater. The exact number of wells, and their locations, depths, and pumping rates, would be determined based on additional treatability studies. The wells would pump groundwater to collection piping, which would direct the water to the on-site treatment facility.

The groundwater treatment facility would likely be located on the south end of the landfill, in the lowest area that would still allow easy access for setup, operation and maintenance, and removal.

Carbon adsorption would be used to remove tetrahydrofuran from the groundwater. Carbon adsorption is a physical process in which compounds are transferred from the liquid to the surface of the carbon. The compounds accumulate on the carbon until the carbon is loaded, and then they are removed or destroyed. Carbon adsorption is typically carried out in fixed beds of carbon. Water enters the top of the unit, flows through the carbon, and exits at the bottom. Figure 4-4 shows a typical carbon adsorption system. The carbon loaded with tetrahydrofuran and other compounds would require regeneration, with treatment of the removed compounds. The treated water exiting the carbon system would be discharged via piping to the Yahara River.

4.3.6 Alternative 6: Subtitle C Cap with Groundwater Collection and Treatment

This alternative includes placement of a multi-layer clay and geomembrane cap over the entire landfill; pumping groundwater from a limited area of the site to the surface using recovery wells; treating the groundwater with carbon adsorption, and discharging the treated water to the Yahara River. Fencing to restrict access and groundwater monitoring would also be included.

The cap would meet the requirements for cover systems for hazardous waste disposal sites and comply with federal regulations, under 40 CFR Subtitle C, and Wisconsin State regulations, under NR 181. The details of the cap construction and related issues would be the same as those discussed for Alternative 4.

Groundwater recovery wells would be installed along the western boundary of the landfill, as described for Alternative 5. An on-site treatment system consisting of carbon adsorption to remove tetrahydrofuran would be installed. Treated water would be discharged to the Yahara River. Details of the treatment system would be the same as for Alternative 5.

4.3.7 Alternative 7: Subtitle D Cap with In-Situ Treatment of Groundwater

This alternative includes placement of a multi-layer clay cap (subtitle D) over the entire landfill and in-situ treatment of groundwater using bioremediation. Fencing to restrict access and groundwater monitoring would also be included. The cap would meet the requirements of Wisconsin NR 504 regulations for cover system for solid waste disposal facilities. The details of construction and related issues would be the same as those discussed for Alternative 3.

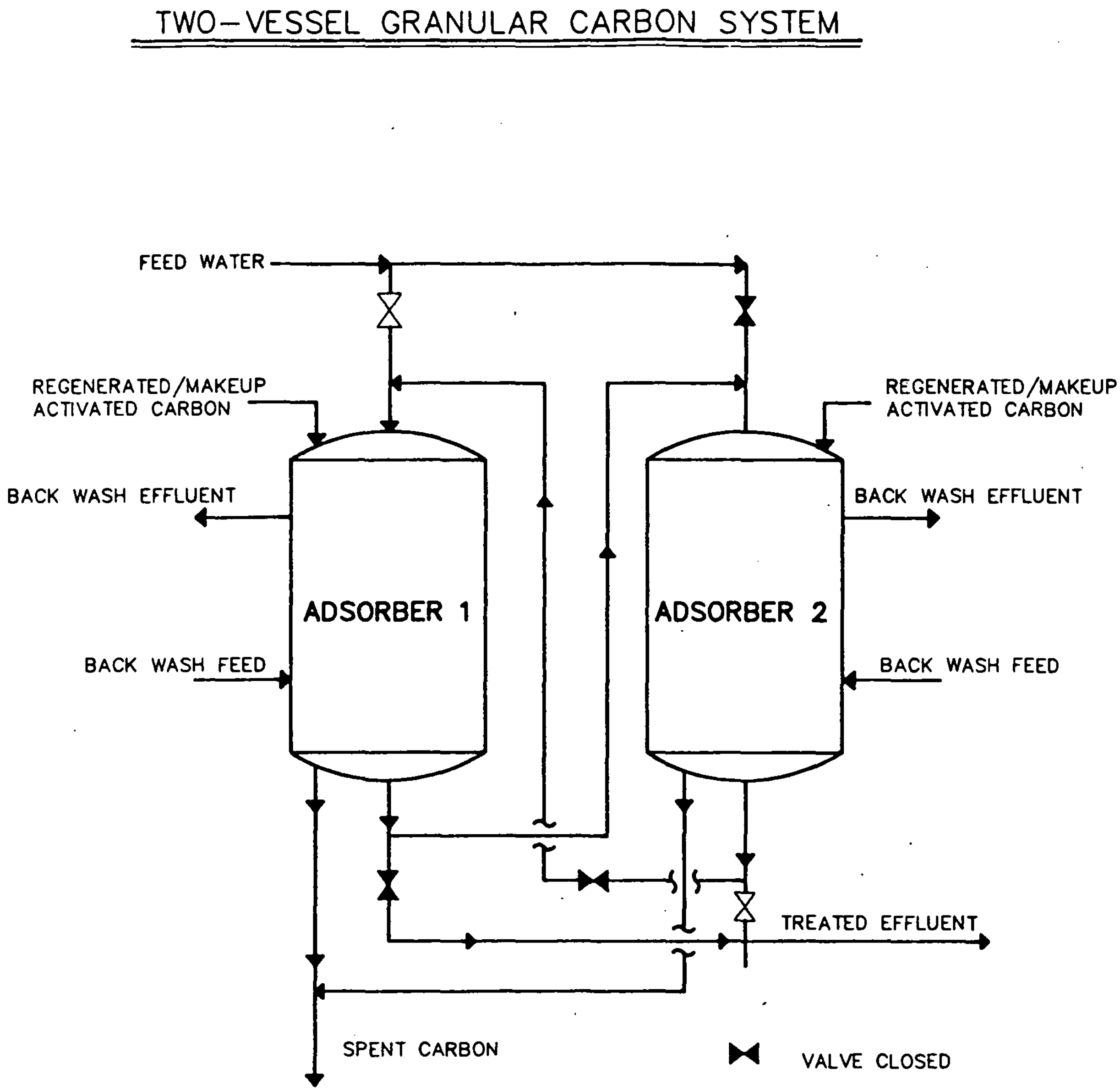

FIGURE 4-4

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TYPICAL CARBON ADSORPTION TREATMENT SYSTEM
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

DRAWN: JDG	DATE: 3/15/90	PROJECT NUMBER:	REV.
APPV'D: X	REVISED: X	6885-002	0

SOURCE: USEPA, 1985

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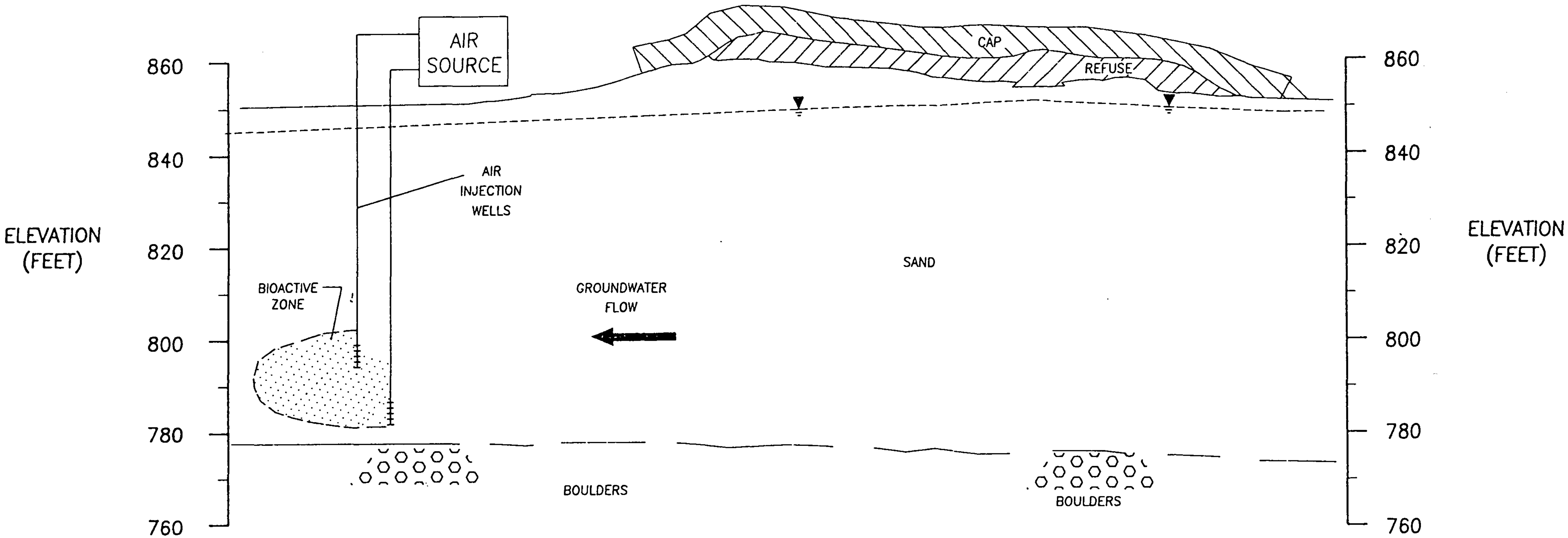
The in-situ bioremediation system would consist of a series of PVC wells used for the aeration or oxygenation of the subsurface water. The system would include the use of fine bubble diffusers located in the wells to provide a source of oxygen to water flowing through the wells. The oxygenated water is expected to flow into the aquifer, creating a zone of bioactivity whereby naturally occurring microorganisms will be stimulated through the increased concentrations of oxygen. Alternatively, hydrogen peroxide may be utilized as an oxygen source. Treatability testing is required to determine which system would be most effective. Figure 4-5 presents a conceptual cross-section of the bioremediation system.

4.3.8 Alternative 8: Subtitle C Cap with In-Situ Treatment of Groundwater

This alternative includes placement of a multi-layer clay and geomembrane cap over the entire landfill and texting groundwater with in-situ bioremediation. Fencing to restrict access and groundwater monitoring would also be included.

The cap would meet the requirements for cover systems for hazardous waste disposal sites and comply with federal regulations, under 40 CFR Subtitle C, and Wisconsin State regulations under NR 181. The details of the cap construction and related issues would be the same as those discussed for Alternative 4. Details for the in-situ bioremediation of groundwater would be the same as discussed for Alternative 7 (Section 4.3.7).



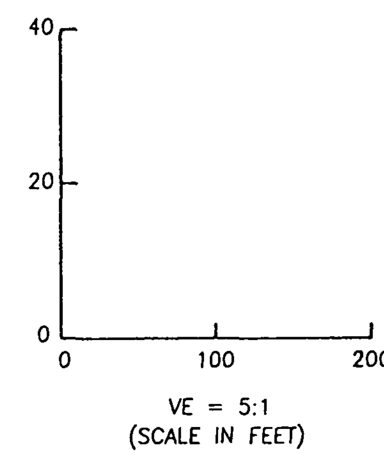
LEGEND

▼ WATER TABLE ELEVATION ON 9/15/89.

REFUSE

NOTES:

- ALL ELEVATIONS ARE IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM



BASE DRAWING SUPPLIED BY: ERM NORTH CENTRAL, INC.

FIGURE 4-5

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CONCEPTUAL CROSS-SECTION OF THE BIOREMEDIATION SYSTEM
STOUGHTON CITY LANDFILL
STOUGHTON, WISCONSIN

DRAWN: EDH	DATE: 8/14/90	PROJECT NUMBER:	REV:
APPV'D: X	REVISED: X	6885-002	0

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APPENDIX A

EVALUATION OF ARARs

1.0 Applicable or Relevant and Appropriate Requirements (ARARs)

CERCLA Section 121 requires that remedial actions comply with the requirements of all federal and state environmental regulations. Those pertinent regulations are referred to as Applicable or Relevant and Appropriate Requirements (ARARs).

Applicable requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance at a CERCLA site.

For a requirement to be applicable, the remedial action or the circumstances at the site must satisfy all of the jurisdictional prerequisites of that requirement. For example, the minimum technology requirements for landfills under RCRA would be applicable only if a new hazardous waste landfill (or an expansion of an existing landfill) were to be built on a CERCLA site.

Relevant and appropriate requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. For example, while RCRA regulations are not applicable to closing in place hazardous waste that was disposed of before 1980, RCRA regulations for closure with waste in place may be deemed relevant and appropriate. In some circumstances, a requirement may be relevant to the particular site-specific situation but will not be appropriate because of differences in the purpose of the requirement, the duration of the regulated activity, or the physical size or characteristic of the situation it is intended to address. For example, maximum contaminant levels (MCLs) under the Safe Drinking Water Act (SDWA) may not be appropriate to use for groundwater that has no potential as drinking water.

Also, only those requirements that are determined to be both relevant and appropriate must be complied with.

A requirement that is judged to be relevant and appropriate must be complied with to the same degree as if it were applicable. Relevant and appropriate requirements that are more stringent and applicable requirements take precedence. There is more discretion in the determination of relevant and appropriate requirements than in the determination of applicable requirements. It is possible for only a part of a requirement to be relevant and appropriate.

Another factor in determining which requirements must be complied with is whether the requirement is substantive or administrative. On-site CERCLA response actions must comply with substantive requirements but not with administrative requirements. Substantive requirements are those that pertain directly to actions or conditions in the environment. Administrative requirements are those mechanisms that facilitate the implementation of the substantive requirements of a statue or regulation. In general, administrative requirements prescribe methods and procedures, such as fees, permitting, inspection, and reporting requirements by which substantive requirements are made effective for purposes of a particular environmental or public health program. In other words, on-site CERCLA response action must meet the intent of the law but need not conform with all the applicable administrative rules. Only those requirements that are determined to be both relevant and appropriate must be complied with.

In addition to the legally binding requirements established as ARARs, many federal and state programs have developed criteria, advisories, guidelines, or proposed standards that may provide useful information or recommend procedures if no ARARs address a particular situation or if existing ARARs do not provide protection. In such situations, these "to be considered" (TBCs) criteria or guidelines should be used to set remedial action levels. Examples of criteria to be considered are reference doses (RfDs) and slope factors ingestion of noncarcinogenic and carcinogenic compounds, respectively, for the risk assessment.

1.1 Application and Use of ARARs

ARARs apply to actions or conditions located on-site and off-site. On-site actions implemented under CERCLA are exempted from having to meet administrative requirements of federal and state regulations such as permit as long as the substantive requirements of the ARARs are met. Off-site actions are subject to the full requirements of the applicable standards or regulations, including all administrative and procedural requirements.

ARARs will define the cleanup goals when they set an acceptable level with respect to site-specific factors. For example, MCLs under the Safe Drinking Water Act are normally acceptable levels for specific contaminants. However, cleanup goals form some substances may have to be based on nonpromulgated criteria and advisories (for example, health advisories such as reference doses (RfD)) rather than on ARARs because ARARs do not exist for those substances or because an ARAR alone would not be sufficiently protective in the given circumstances, e.g., where additive effects from several chemicals are involved. In these situations, the cleanup requirements, in order to meet the cleanup goals, will not be based on ARARs alone but also on TBCs. Similarly, State of Wisconsin criteria, advisories, and guidance should also be considered.

1.2 Classification and Determination of ARARs

Based on the CERCLA statutory requirements, the remedial alternatives developed in this FS will be analyzed for compliance with federal and state ARARs. This process involves the initial determination of potential requirements, the evaluation of the potential requirements for applicability or relevance and appropriateness, and finally, a determination of the ability of thee remedial alternatives to achieve the ARARs.

Three classifications or requirements are defined in the ARAR determination process and are summarized below: chemical specific, location specific, and action specific.

CHEMICAL SPECIFIC ARARs

Chemical-specific ARARs include those laws and regulations governing the release of materials possessing certain chemical or physical characteristics, or containing specific chemical compounds. These requirements generally set health or risk-based concentration limits or discharge limitations after treatment in various environmental media for specific hazardous substances. Examples include drinking water standards and ambient air quality standards. If, in a specific situation, a chemical is subjected to more than one discharge or exposure limit, the more stringent of the requirements should generally be applied.

LOCATION SPECIFIC ARARs

A site's location is a fundamental determinant of its impact on human health and the environment. Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats. An example of a location-specific requirement is the substantive DWA §4040 prohibitions of the unrestricted discharge of dredged or fill material into wetlands.

ACTION SPECIFIC ARARs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, very different requirements can come into play. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be achieved.

Potential ARARs for the Stoughton Landfill site are summarized in Tables A-1 through A-4. Summary tables organize the potential ARARs with respect to each of these three classifications. "To be considered" criteria are also included. The potential ARARs important in setting site-specific remedial goals and development of remedial actions are discussed below. The evaluation of ARARs relative to each developed remedial action is presented in Chapter 5 of the FS.

1.2.1 Chemical Specific ARARs for the Stoughton City Landfill Site

Chemical-specific ARARs for the Stoughton site include those Federal and State of Wisconsin laws and requirements that regulate the release to the environment of specific substances having certain chemical or physical characteristics or materials containing specified chemical compounds. They are important in determining the extent of remediation of the operable units

TABLE A-1

Potential Contaminant-Specific ARARs
Stoughton City Landfill Site

Citation	Description	Potential ARAR Status	Comment and Analysis
Federal Contaminant-Specific ARARs			
Safe Drinking Water Act (40 U.S.C. Sect. 300)	(See below for specific citations)		
National Primary Drinking Water Standards (40 C.F.R. Part 141)	Establishes health-based standards for public water systems (maximum contaminant levels).	Relevant and Appropriate	The MCLs are relevant and appropriate for the groundwater quality.
National Secondary Drinking Water Standards (40 C.F.R. Part 143)	Establishes welfare-based standards for public water systems (secondary maximum contaminant levels).	Relevant and Appropriate	Secondary MCLs are relevant and appropriate for groundwater quality.
Maximum Contaminant level Goals (Pub. L. No. 99-339.100 Stat. 642 (1986)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects, with an adequate margin of safety.	Relevant and Appropriate	Proposed MCLGs for organic contaminants should be treated as "other criteria, advisories, and guidance." MCLs take precedence.
Clean Water Act (33 U.S.C. Sect. 1251-1376)	(See below for specific citations)		
Water Quality Criteria (40 C.F.R. Part 131 Quality Criteria for water, 1976, 1980, 1986)	Sets criteria for water quality based on toxicity to aquatic organisms and human health.	Applicable	WQCs are relevant and appropriate for groundwater and surface water quality. MCLs take precedence unless WQCs are more stringent (according to the U.S. Fish and Wildlife Service). If NPDES is needed for treated effluent discharge. WQCs must be adhered to.
Toxic Pollutant Effluent Standards (40 C.F.R. Part 129)	Establishes effluent standards or prohibitions for certain toxic pollutants: aldrin/dieldrin, DOT, endrin, toxaphen, benzidine, PCBs.	Not ARAR	These pollutant are not present on the site at levels above CLP detection limits.
National Ambient Air Quality Standards/ NESHAPSINSPS/BACT/ PSD/LAER (40 C.F.R. 60.1-.17,) (.50-54, .150-.154, .480-.489) (40 C.F.R. 53.1-.33) (40 C.F.R. 61.01-.18,) (.50-.112, .240-247)	Treatment technology standard for emissions to air. - Incinerators - Surface Impoundments - Waste Piles - Landfills - Fugitive Emissions - Excavation - Grading	Applicable	Air stripping and incineration alternatives if developed would involve emissions governed by these standards, and the requirements are applicable. Also fugitive emissions from excavation, soil placement during landfill capping.
Resource Conservation and Recovery Act (as amended by (HSWA) (42 U.S.C. 6901)	(See below for specific citation)		
Groundwater Monitoring and Response Requirements (40 C.F.R. 264,94)	Standards for 14 toxic compounds to be monitored in the groundwater at RCRA facilities.	Relevant and Appropriate	Although the site is not a RCRA facility, RCRA listed wastes have been detected at the site.

TABLE A-1

Potential Contaminant-Specific ARARs
Stoughton City Landfill Site

Citation	Description	Potential ARAR Status	Comment and Analysis
Identification and Listing of Hazardous Waste (40 C.F.R. Part 261)	Defines those solid waste which are subject to regulation as hazardous waste under 40 C.F.R. Parts 262-265 and Parts 124, 270, and 271.	Relevant and Appropriate	Listed contaminants have been identified at the site.
Land Disposal (40 C.F.R. Part 268)	Established a timetable for restriction of burial of wastes and other hazardous materials.	Not ARAR	No excavation and disposal of hazardous waste or debris will take place.
Clean Air Act (42 U.S.C. Sect. 7401-7642)	Established National Ambient Air Quality Standards for particulate matter.		
National Primary and Secondary Ambient Air Quality Standards (40 C.F.R. Part 50)	Established standards to ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	Applicable	During excavation and grading, fugitive dust emission must not exceed NAAQS requirements for particulate matter.
Health Effects Assessments (HEAs) Proposed Health Effects Assessment (ECAO, U.S. EPA, 1985)	Health effects assessments for the protection of human health.	TBC	Certain contaminants may exceed HEAs.
Reference Doses (RFDs) (Integrated Risk Information System (IRIS) U.S. EPA On-Line Database)	Establishes recommended maximum intake concentrations of contaminants for protection of human health. RfDs are used to calculate the Hazard Index for chrome exposure to non-carcinogenic chemicals.	TBC	To be considered when established standards for water and air exposure is less stringent. Accounts for combined effect.
Slope Factors (Integrated Risk Information System (IRIS) U.S. EPA On-Line Database)	Slope factors are used to calculate the Excess Lifetime Cancer Risk	TBC	To be considered when established standards for water and air exposure is less stringent. Accounts for combined effect.

TABLE A-2

Potential Federal Location-Specific ARARs
Stoughton City Landfill

Citation	Location-Specific Requirement	Potential ARAR Status	Comment and Analysis
Executive Order I1988, Protection of Floodplains, (40 CFR 6, Appendix A)	Action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.	Applicable	The site has the potential for flooding.
National Archaeological and Historical Preservation Act (16 U.S.C. Section 469); 36 CFR Part 65	Action to recover and preserve artifacts	Not ARAR	There are no known archeological or historical artifacts on the site.
National Historical Preservation Act Section 106 (16 USC 470, et seq.); 36 CFR Part 800	Action to preserve historic properties; planning of action to minimize harm to National Historic Landmarks	Not ARAR	The Stoughton site is not included in the National Register of Historic Places.
Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR Part 200, 50 CFR, Part 402	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior	Unlikely ARAR	No endangered species are know to exist at the site. No evidence of unique habitat is present.
Executive Order I1990, Protection of Wetlands, (40 CFR 6, Appendix A)	Action to minimize the destruction, loss, or degradation of wetlands	Applicable	Wetland areas exist on site and north and east of the site.
Clean Water Act Section 404; 40 CFR Parts 230, 231	Action to prohibit discharge of dredged or fill material into wetland without permit	Applicable	Wetland areas exist onsite and north and east of the site.
Wilderness Act (16 USC 1131 et seq.); 50 CFR 35.1 et seq.	Area must be administered in such a manner as well leave it unimpaired as wilderness and to preserve its wilderness character	Not ARAR	The Stoughton site has not been designated as a Federal Wilderness Area.
16 USC 668 dd et seq.; 50 CFR Part 27	Only action allowed under the provisions of 16 USC Section 668 dd(c) may be undertaken in areas that are part of the National Wildlife Refuge System	Not ARAR	The Stoughton site has not been designated as a National Wildlife Refuge.
Fish and Wildlife Coordination Act (16 U.S.CC. 661 et seq.); 40 CFR 6.302	Action to protect fish or wildlife	Not ARAR	No modifications to the Yahara River are planned.
Scenic Rivers Act (16 U.S.C. 1271 et seq. Section 7(a); 40 CFR 6.302(e)	Avoid taking or assisting in action that will have direct adverse effect on scenic river	Not ARAR	The Yahara River is designated for recreational use and is not classified as a Scenic River.
Coastal Zone Management Act (16 U.S.C. Section 1451 et seq.)	Conduct activities in manner consistent with approved State management programs	Not ARAR	The Stoughton City Landfill site is an inland area with no direct access to coastal areas.
Clean Water Act Section 404 40 CFR 125 Subpart M; Marine Protection Resources and Sanctuary Act, Section 103	Action to dispose of dredge and fill material into ocean waters is prohibited without a permit	Not ARAR	Dredge disposal in not an alternative for this site.
RCRA -- 40 CFR 264.18(a)	New treatment, storage, or disposal of hazardous waste prohibited	Not ARAR	There is no evidence of a potentially active fault within 61 meters of the site.
RCRA -- 40 CFR 264.18(b)	Facility must be designed, constructed, operated, and maintained to avoid washout	Relevant and Appropriate	Part of the property lies inside the mapped 100-year floodplain. The landfill does not.
RCRA -- 40 CFR 264.18(c)	Placement of noncontainerized or bulk liquid hazardous waste prohibited	Not ARAR	The site does not contain any salt dome formations, underground mines, or caves used for waste disposal. No such disposal is planned for site wastes.

TABLE A-3

Potential Federal Action-Specific ARARs
Stoughton City Landfill Site

Federal Regulations	Requirement	Potential ARAR Status	Comment and Analysis
Clean Air Act			
Section 101	Calls for development and implementation of regional air pollution control programs	Applicable	Section 101 of the Clean Air Act delegates primary responsibility for regional air quality management to the states. The rules for implementation of regional air quality plans are contained in 40 CFR 52. Regulations promulgated under the Clean Air Act may apply to possible actions at the site that generate air emissions but are most applicable to stationary sources such as air strippers.
Federal Water Pollution Control Act as Amended by the Clean Water Act of 1977			
Section 208(b)	The proposed action must be consistent with regional water quality management plans as developed under Section 208 of Clean Water Act.	Applicable	Substantive requirements adopted by the state pursuant to Section 208 of the Clean Water Act would be applicable to direct discharge of treatment system effluent or other discharge to surface water.
U.S. EPA Regulations on Approval and Promulgation of Implementation Plans			
40 CFR 52	Requires the filling of a notice with the state regarding intent to install a new stationary source of air pollution.	Applicable	40 CFR 52 concerns the installation of stationary sources of air emissions. At the site such actions may include air stripping. Provisions enforceable by the state follow federal Prevention of Significant Deterioration (PSD) program with modifications to conform with regional and local ambient air quality standards. A CERCLA response action is not required to obtain permits under the PSD program but must comply with the substantive requirements of a PSD review.
40 CFR 51	Requires for filing of State Implementation Plans (SIP)	Applicable	
U.S. EPA Regulations on National Emission Standards for Hazardous Air Pollutants			
40 CFR 61	Requires limiting ambient hydrogen sulfide emission to less than 0.10 ppm. The regulation also includes emission standards for mercury. Vinyl chloride, benzene, asbestos, berylium, inorganic arsenic, and radionuclides--all of which are designated hazardous air pollutants.	Not ARAR	Emissions from air strippers must meet emission standards. Selected alternatives will not generate hazardous air pollutants.
U.S. EPA National Pollutant Discharge Elimination System (NPDES) Permit Regulations			
40 CFR 122.44	Federally approved state water quality standards. These may be in addition to or more stringent than federal water quality standards	Applicable	All substantive requirements under the cited sections of 40 CFR 122 would be applicable to the direct discharge of effluents to an onsite or offsite surface water body. Administrative requirements, such as permitting and reporting procedures would be applicable only for effluents discharged to an offsite location (such as a discharge into a stream flowing offsite). Therefore at the Stoughton site these requirements would be applicable to proposed discharges into the Yahara River.
40 CFR 122.44(a)	Requires the use of the Best Available Technology (BAT) for toxic & non-conventional wastewaters or the Best Conventional Technology (BCT) for conventional pollutants. The nature of the wastewater and the technology-based limitations will be determined by the state on a case-by-case basis.	Applicable	

TABLE A-3

Potential Federal Action-Specific ARARs
Stoughton City Landfill Site

Federal Regulations	Requirement	Potential ARAR Status	Comment and Analysis
40 CFR 122.44(e)	Discharge limits must be established for toxics to be discharged at concentrations exceeding levels achievable by the technology-based (BAT/BCT) standards. The discharge limitations would be evaluated on a case-by-case basis depending on the proposed treatment system and the receiving water.	Applicable	
40 CFR 122.44(l)	Requires monitoring of discharges to ensure compliance. Monitor programs shall include data on the mass, volume, and frequency of all discharge events.	Applicable	Administrative requirement applicable only for discharges to offsite surface water.
40 CFR 122.21	Permit application must include a detailed description of the proposed action including a listing of all required environmental permits.	Applicable	Administrative requirement applicable only for discharges to offsite waters.
U.S. EPA Regulations on Criteria for the NPDES			
40 CFR 125.100	The site operator shall develop a best management practice (BMP) program and shall incorporate it into the operations plan or the NPDES permit application if required.	Applicable	Substantive requirements of 40 CFR 125 would be applicable to the direct discharge of treatment system effluent to an onsite or offsite surface water body. The permitting requirements would be applicable only if the effluent is discharged to offsite surface waters.
U.S. EPA Procedures for Approving State Water Quality Standards			
40 CFR 131	States are granted enforcement jurisdiction over direct discharges and may adopt reasonable standards to protect or enhance the uses and qualities of surface water bodies in the states.	Applicable	Applicable to direct discharge of treatment system effluent or other process waters. Such a discharge into the Yahara River would activate the administrative requirements of this rule because it would affect offsite surface waters.
U.S. EPA Regulations on Test Procedures for the Analysis of [Water] Pollutants			
40 CFR 136.1-136.4	These sections require adherence to sample preservation procedures including container materials and sample holding times.	Applicable	Applicable to direct discharge of treatment system effluent.
Permit Regulations for the Underground Injection Control (UIC) Program			
40 CFR 144-147	Provides for protection of underground sources of drinking water.	Not ARAR	Deep well injection of site wastewaters is not expected to be a feasible action at the Stoughton City Landfill site.
U.S. EPA Interim Regulations on Discharge of Dredged or Fill Material into Navigable Waters			
40 CFR 230	Dredge and fill requirements	Not ARAR	Dredging of the Yahara River is not an alternative at the Stoughton City Landfill site.
U.S. EPA Regulations for Identifying Hazardous Waste			
40 CFR 261	Identifies those wastes subject to regulation as hazardous wastes.	Not ARAR	No waste, hazardous, or otherwise will be transported from the Stoughton City Landfill site and disposed in a RCRA facility.

TABLE A-3

Potential Federal Action-Specific ARARs
Stoughton City Landfill Site

Federal Regulations	Requirement	Potential ARAR Status	Comment and Analysis
U.S. EPA Regulations for Owners and Operators of Permitted Hazardous Waste Facilities			
Subpart G--Closure Requirements			
40 CFR 264.111	Closure performance standards specify that site closure must be completed in a manner that ensures protection against contaminant migration and complies with other specific closure-related sections of 40 CFR 264.	Applicable to hazardous wastes left onsite	40 CFR 264.111 and 40 CFR 264.117 concern site closure requirements including operation and maintenance, site monitoring, record-keeping, and site use. The closure requirements would be applicable when under a proposed action hazardous wastes are left in place.
40 CFR 264.117(c)	Post-closure use of the site must and compromise the integrity of covers liners or other containment or monitoring components used to minimize long-term site hazards.		
Subpart I -- Storage Containers			
40 CFR 264.171 through 264.178	Regulations cited under 40 CFR 264.171 to 264.178 (Subpart I) concern permanent onsite storage of hazardous wastes or temporary storage phases used during various cleanup actions such as removal or incineration.	Not ARAR	The storage regulations would only be applicable to storage of hazardous wastes but may be relevant and appropriate to storage of certain non-hazardous wastes or storage system effluents if these materials present risks similar to those associated with hazardous wastes.
Subpart J -- Tank Storage			
40 CFR 264.191 through 264.198	Regulations under 40 CFR 264.191 to 264.198 (Subpart J) apply to tank storage of hazardous materials.	Not ARAR	No tank storage of hazardous materials will take place on-site.
Subpart K -- Surface Impoundments			
40 CFR 264.221 through 264.228	Rules under 40 CFR 264.221 to 264.231 (Subpart K) concern hazardous waste containment using new or existing onsite surface impoundments.	Not ARAR	No new surface impoundments are expected to be constructed.
Subpart M--Land Treatment			
40 CFR 264.271	Regulations cited under 40 CFR 264.272 to 264.283 (Subpart M) pertain to land treatment of hazardous wastes.	Unlikely ARAR	Land treatment of wastes is an unlikely alternative.

TABLE A-3

Potential Federal Action-Specific ARARs
Stoughton City Landfill Site

Federal Regulations	Requirement	Potential ARAR Status	Comment and Analysis
Subpart L--Waste Piles			
40 CFR 264.251	For design and use of waste piles requires liner with a leachate collection and removal system. Also requires a run-on/run-off design that will ensure the stability of waste piles in the event of a 25-year store.	Not ARAR	No waste piles are onsite and no new ones are anticipated.
40 CFR 264.258	Requirements for closure of waste piles specify that wastes must be stabilized to support as above cover requires removal or decontamination of hazardous waste residues from containment system components.	As above	
Subpart O--Incinerators			
40 CFR 264.340 through 264.351	Requirements for hazardous waste incinerator	Not ARAR	No incinerators are anticipated at the Stoughton City Landfill site.
Subpart N--Landfills			
40 CFR 264.301 through 264.314	Rules cited under 40 CFR 264.301 to 264.314 (Subpart N) pertain to design construction operation and maintenance of a new hazardous waste landfill.	Unlikely ARAR	The rules under 40 CFR 264.301 to 314 may apply to construction of a new onsite landfill for contaminated soils, sediments, or incinerator residues. It is unlikely that a new landfill will be constructed at this site.
Subpart X--Miscellaneous Treatment			
40 CFR 264 Subpart X	Standards for environmental performance of miscellaneous treatment units.	Applicable to hazardous wastes. Relevant & appropriate for non-hazardous wastes.	Miscellaneous treatment units may include temporary waste holding units or effluent pretreatment units but do not include incinerators, landfills, containers, underground injection wells, wastewater pretreatment units, or similar methods for which specific management rules have been promulgated under other subparts of 40 CFR 264. At the Stoughton site, the rules of Subpart X may apply to use of onsite physical, chemical, or biological treatment technologies.
U.S. EPA Interim Status Standards for Owners and Operators of Hazardous Waste Facilities			
40 CFR 265	Regulations for interim hazardous waste facilities in operation both before and after November 19, 1980.	Not ARAR	The site did not have interim status. Regulations under 40 CFR 265 are not considered applicable to a CERCLA site because the performance standards under 40 CFR 264 are more stringent.
U.S. EPA Regulations on Land Disposal Restrictions			
40 CFR 268 Subpart C	The land disposal restrictions under this subpart prohibit land-based disposal of certain solvent-containing wastes dioxin-containing wastes and listed wastes.	Not ARAR	No hazardous or nonhazardous waste will be disposed off-site in a RCRA facility.
40 CFR 268 Subpart D	Some hazardous wastes restricted from land disposal in Subpart C may be land-disposed providing they are listed adequately treated in accordance with this subpart.	Not ARAR	No hazardous or nonhazardous waste will be disposed off-site in a RCRA facility.

TABLE A-3

Potential Federal Action-Specific ARARs
Stoughton City Landfill Site

Federal Regulations	Requirement	Potential ARAR Status	Comment and Analysis
U.S. EPA Pretreatment Standards			
40 CFR 403.5	If wastes are discharged to a publicly owned treatment works facility (POTW) the treatment process must not allow waste to pass through untreated or result in contaminated sewage sludge.	Not ARAR	Treatment system effluent from Stoughton site is unlikely to be discharged to a POTW.
U.S. EPA Disposal Requirements for PCBs (Per Toxic Substances Control Act)			
40 CFR 761	Rules under 40 CFR 761 apply to disposal of PCBs. Generally, these regulations require that whenever disposal of PCBs is undertaken, they must be incinerated unless the concentrations are less than 50 ppm. The only possible exception (if PCB concentrations are between 50 and 500 ppm) would be an EPA-approved landfill for PCBs. The rules of this section also contain performance standards for incineration of PCBs.	Unlikely ARAR	The substantive rules of 40 CFR 761 would only be applicable to proposed actions at the Stoughton site if concentrated PCBs (50 ppm or greater) were found in onsite soils. Available data indicate that PCBs have not been detected.

TABLE A-4

Potential State of Wisconsin ARARs
Stoughton City Landfill Site

Citation	Location-Specific Requirement	Potential ARAR Status	Comment and Analysis
NR 102--Water Quality Standards for Wisconsin Surface Waters	Specifies water quality standards for use classifications. Dissolved oxygen must not be lowered below 5 mg/l and pH must be maintained with 6 to 9 units. See NR 102 for additional standards.	Applicable	Actions involving groundwater discharges to the Yahara River must meet water quality standards.
NR 104--Intrastate Water uses and Designated Standards	Designates use classifications for surface waters	Applicable	Designates the Yahara River for recreational use. Actions involving discharges to or alterations of the Yahara River must not preclude these uses.
NR 105--Surface Water Quality Criteria for Toxic and Organoleptic Substances	Specifies water quality criteria for toxic and organoleptic substances for protection of human health and welfare and aquatic life.	Applicable	Water quality criteria are used by WDNR in setting WPDES discharge limits for toxics.
NR 106-Procedures for Calculating Water Quality Based Effluent Limitations for Toxic and Organoleptic Substances Discharged to Surface Waters	Specifies procedures for how effluent limitations are to be calculated for toxic and organoleptic substances.	Applicable	WDNR will use procedures to establish water quality based discharge limits for toxics. Biological toxicity tests may be required for the discharge.
NR 112--Well Construction and Pump Installation	Specifies construction standards for well and pump installations and abandonment of wells.	Applicable	Construction of monitoring wells must conforms to standards specified.
NR 116--Wisconsin's Flood Plain Management Program	Requires and establishes standards for municipal flood plain zoning ordinances	Relevant and Appropriate	Actions involving construction of facilities or alterations of the flood plain must meet the standards of the municipal flood plain ordinance. NR 116 defines the requirements of the municipal ordinance.
NR 140--Groundwater Quality	Specifies groundwater quality preventative action limits and enforcement standards. Notification requirements and potential response actions when standards are exceeded are listed.	Relevant and Appropriate	One or more response actions listed in NR 140 would be required if enforcement standards are exceeded at the point of standards application.
NR 181--Hazardous Waste Management	Establishes requirements for the identification of hazardous waste and standards for the storage, transport, and disposal of hazardous waste. Generally parallels RCRA part 264 requirements (see Federal ARARs table).	Applicable	See Federal ARARs, 40 CFR Part 261 through 264.
NR 181.45--Prohibited Activities	Prohibits underground injection of hazardous waste, land treatment of hazardous waste, and use of hazardous waste in mixtures for dust suppression.	Not ARAR	No underground injection of hazardous waste is anticipated. No hazardous waste placement is anticipated.
NR 200--Application for Discharge Permit	Discharge permit is required for discharges to surface waters and to land areas where water may percolate to groundwater.	Applicable	WPDES permit will be required for discharge to the Yahara River.
NR 211--General Pretreatment Requirements	Prohibits discharges to POTWs which pass through or interfere with the operation or performance of the POTW and thereby cause a POTW to violate its WPDES permit.	Not ARAR	No discharge to POTW's expected.
NR 2114--Land Application and Disposal of Liquid Industrial Wastes and Byproducts	Requires land disposal systems to meet design and construction criteria and requires plans and specification to be approved by WDNR. Effluent limitations and groundwater monitoring requirements are also specified.	Applicable	If groundwater is not considered a hazardous waste, NR 214 would be applicable to land application of treated or untreated groundwater.

TABLE A-4

Potential State of Wisconsin ARARs
Stoughton City Landfill Site

Citation	Location-Specific Requirement	Potential ARAR Status	Comment and Analysis
NR 220–Categories and Classes of Point Sources and Effluent Limitations	Requires WDNR to establish effluent limits for uncategorized point sources and to base those limits on best practicable control technology currently available or best available control technology economically achievable.	Applicable	The substantive requirements of obtaining a WPDES permit would be necessary.
CH147.States–Pollution Discharge Elimination	Requires point source discharges to obtain a permit from WDNR.	Applicable	Substantive requirements in obtaining a permit would have to be met. The actual permit, however, would not have to be obtained for onsite discharges.
NR 440–Standards of Performance for New Stationary Sources	Specifies standards of performance for new stationary sources, specifies monitoring requirements and requires review of plans.	Applicable	Applicable to onsite air stripper.
NR 445–Control of Hazardous Pollutants	Specifies emission limits and control requirements for air contaminant sources emitting hazardous pollutants.	Applicable	Emissions from alternatives such as air strippers that may emit hazardous air pollutants must meet NR 445 requirements.
NR 445.04–Emission Limits for New or Modified Sources	Specifies air concentrations not to be exceeded off the source's property in terms of 24-hour and 1-hour averages. Requires lower achievable emission rates and best available control technology for air contaminants without acceptable ambient concentrations.	Not ARAR	Emissions from air strippers resulting in exceedance of the 24-hour and 1-hour average limits would require treatment. Alternatives do not contain the use of air strippers.
NR 504–Landfill Location, Performance, and Design Criteria	Specifies locational criteria, performance standards, and minimum design requirements for solid waste disposal facilities.	Portions Relevant and Appropriate	Although NR 504 does not pertain to inactive landfills, requirements for gas control, if necessary, and final cover may be considered relevant and appropriate. These include passive gas venting trenches and gas monitoring at the facility perimeter. Final cover requirements include 2-foot clay layer (or approved geomembrane), a 1.5 to 2.5-foot cover layer, 6 inches of topsoil, and revegetation.
NR 506.08–Landfill Operational Criteria–Closure Requirements	Specific closure requirements for landfills including notification, establishment of 2 feet of soil cover and revegetation and hazardous air contaminant control for facilities over 500,000 CY.	Relevant and Appropriate	Closure according to NR 506.08 already has occurred. At a minimum reconstruction of the cover according to NR 506.08 is necessary if excavations through the cover occur. The landfill is below the 500,000 CY minimum for hazardous air contaminant control requirement.
NR 508–Landfill Monitoring, Remedial Actions and In-field Conditions Reports	Specifies monitoring requirements for groundwater, vadose zone, leachate, gas, surface water and air. Also specifies the design management zone as 300 feet from the waste boundary.	Portions Applicable	Monitoring requirements at existing facilities area at the discretion of WDNR. The landfill currently is monitoring groundwater per WDNR requirements.
NR 514–Plan of Operation and Closure Plans for Landfills	Requires plan of operation and closure plans.	Not ARAR	Landfill has already been closed. Submittal of additional closure plans per NR 514 would not be necessary.

at the Stoughton City Landfill site as well as determining the residual levels of contaminants allowable after treatment.

1.2.1.1 Landfill Operable Unit

Chemical specific ARARs do not exist for the operable unit, or for soils in general. However, the RA evaluated TBCs for exposure to site soil, sediment and landfill waste. Exposure to chemicals through these pathways using several possible scenarios do not indicate an excess lifetime cancer risk above 1×10^{-6} or a lifetime hazard index in exceedance of unit (1). As a result, target concentrations for soils and the landfill waste itself based upon TBCs are not included as site-specific goals.

1.2.1.2 Groundwater Operable Unit

FEDERAL ARARs

Chemical specific ARARs for groundwater include, but are not limited to the following standards and criteria:

- Maximum Contaminant Levels (MCLs)
- Maximum Contaminant Level Goals (MCLGs)
- Secondary Maximum Contaminant Levels
- Federal Water Quality Criteria (FWQC)
- Office of Drinking Water Health Advisories

Chemical ARARs for compounds detected in the Groundwater and surface water at the Stoughton site is presented in Table A-5.

Maximum contaminant levels (MCLs) are enforceable drinking water standards established by U.S. EPA under the Safe Drinking Water Act that represent the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. An MCL is required to be set as close as feasible to the respective maximum contaminant limit goal (MCLG), taking into consideration the best technology, treatment techniques, and other factors (including costs), MCLs are listed at 40 CFR 141.61.

For cleaning up groundwater or surface water that is or may be used for drinking, the MCLs set under the Safe Drinking Water Act are generally the applicable or relevant and appropriate standard. MCLs are applicable where the water will be provided directly to 25 or more people or will be supplied to 15 or more service connections. When MCLs are applicable, they should at least be met at the tap. MCLs are relevant and appropriate in other cases where surface water or groundwater is or may be directly used for drinking water, an in such cases, the MCLs should be met in the surface water or groundwater itself.

TABLE A-5

U.S. EPA Drinking Water Standards Criteria Guidelines (Groundwater)

	(a) Maximum Contaminant Level (MCL)		(b) Maximum Contaminant Level Goal (MCLG)		(c) Secondary Maxmum Contaminant Level		(d) Federal Ambient Water Quality Criteria (FAWQC) Water Only			(e) Office of Drinking Water Lifetime Health Advisories
	Final	Proposed	Final	Proposed	Final	Proposed	Toxicity Protection	1×10^{-6} Cancer Risk	Organoleptic Criterion	
VOLATILE ORGANICS										
1,2-Dichloroethene (cis)		70		70						70
1,2-Dichloroethene (trans)		100		100						70
Xylenes (total)		10,000		10,000		20				400
Dichlorodifluoromethane										
Trichlorofluoromethane										
Tetrahydrofuran										
SEMIVOLATILE ORGANICS										
Benzoic acid	-	-	-	-	-	-	-	-	-	-
Bix(2-ethylhexyl)phthalate							21,000	2.5		
Pentachlorophenol				220			1,010		30	220
INORGANICS										
Aluminum						50				
Antimony							146			
Arsenic	50			50				0.0025		50
Barium	1,000	5,000		5,000						1,500
Chromium							50			
Cobalt					300				1,000	20
Copper		1,300		1,300	1,000		50			
Lead	50	5		20						150
Manganese							15.4			
Nickel					50					
Selenium	10									
Vanadium		50		50			5,000			
Zinc										

(a) Maximum Contaminant Levels (MCLs) - MCLs are listed at 40 CFR 141.61 for organic contaminants and 40 CFR 141.62 for inorganic contaminants. Proposed MCLs issued on May 22, 1989 (54 FR 22-62) except lead and copper which were issued August 24, 1988 (53 FR 32259).

(b) Maximum Contaminant Level Goal (MCLGs) were previously named RMCLs. MCLGs are listed at 40 CFR 141.50 for organic chemicals and 40 CFR 141.50 for organic chemicals and 40 CFR 141.51 for inorganic chemicals. Proposed MCLGs issued on May 22, 1989 (54 FR 22062) except lead and copper which were issed August 24, 1989 (53 FR 32259).

(c) Secondary Maximum Contaminant Levels (SMCLs) - They are based on odor, aestheics, and appearence. They are listed at 40 CFR 143. Proposed SMCLs issued on May 22, 1989 (54 FR 20062).

(d) Federal Ambient Water Quality Criteria (FAWQC) - The criteria presented are for protection against carcinogenic health effects, noncarcinogenic health effects, and organoleptic effects. The water only criteria are not published FAWQC but criteria modified for the application to groundwater contamination situations at Superfund sites. These values were published in the "Superfund Public Health Evaluation Manual" (U.S. EPA 1986).

(e) Lifetime health advisories describe concentrations of drinking water contaminants at which health effects would not be anticipated to occur over a lifetime expousre, accounting for other sources of expousre. No lifetime health advisories are issued for carcinogens. A "NRC" is indicated where health advisories have been issued for the chemical for less than lifetime expousres.

The FWQC without modification are not appropriate for exposures through groundwater or other situations where exposure is through drinking water consumption alone. The FWQC values, however, can be adjusted to reflect only exposure from drinking the water.

FWQC for Aquatic Life Protection The FWQC for the protection of aquatic life present two sets of values, one based on the protection of aquatic life from acute exposure and the other from chronic exposures. Where insufficient data exists to set a criterion, the lowest reported acute or chronic-effects level published in the literature were provided.

Office of Drinking Water Health Advisories are nonenforceable guidelines that present the U.S. EPA Office of Water's most recent assessment of concentrations of contaminants in drinking water at which adverse effects (noncarcinogenic end points of toxicity) would not be anticipated to occur. A margin of safety is included to protect sensitive members of the population. These values are subject to change as new health effects information becomes available. They are specified for 1-day, 10-day, longer term (90 days to 1 year), and lifetime exposure periods. The lifetime health advisories are not developed for carcinogens.

STATE OF WISCONSIN ARARs

The State of Wisconsin has chemical-specific standards for groundwater listed in NR 140 of the Wisconsin Administrative Code. Table A-6 presents the enforcement standards and preventative action limits.

Chapter NR 140 requires that corrective action be taken if enforcement standards or preventative action limits are exceeded at a point of standards application. In general, corrective actions may be more extensive if enforcement standards are exceeded.

The point of standards application is one of the following locations:

- Any point of present groundwater use
- Any point beyond the boundary of the property on which the facility, practice, or activity is located
- Any point within the property boundaries beyond the three-dimensional design management zone if one is established by the department at each facility, practice, or activity

The WDNR must designate a design management zone for the site before the point of standards application can be determined. The design management zone for solid waste disposal facilities is the area within a vertical plane located within 300 feet (NR 140.22) of the facility boundary.

TABLE A-6

Wisconsin Groundwater Standards[A]

Chemical[B]	Enforcement Standard (µg/L)	Preventative Action Limit (µg/L)
VOLATILE ORGANICS		
1,2-Dichloroethene (cis)	100	10
1,2-Dichloroethene (trans)	100	20
Xylenes (total)	620	124
Dichlorodifluoromethane	-	-
Trichlorofluoromethane	3,490	698
Tetrahydrofuran	50	10
SEMIVOLATILE ORGANICS		
Benzoic acid	-	-
Bis(2-ethylhexyl)phthalate	-	-
Pentachlorophenol	-	-
INORGANICS		
Aluminum	-	-
Antimony	-	-
Arsenic	50	5
Barium	1000	200
Chromium	50	5
Cobalt	-	-
Copper*	1000	500
Lead	50	5
Manganese*	50	25
Nickel	-	-
Selenium	10	1
Vanadium	-	-
Zinc*	5000	2500

A Wisconsin Groundwater Standards – NR 140. Standards are public health standards except where noted with an asterisk, which are public welfare standards.

B There are no Wisconsin Groundwater Standards for all the chemicals detected in the groundwater (or surface water).

\- Not established.

1.2.1.3 Surface Water

Chemical-specific ARARs for the protection of aquatic life from exposure to contaminants in the Yahara River are important at the Stoughton City Landfill site because the river receives the groundwater discharge from the site and nearly all remedial alternatives would discharge treated groundwater to the river. Potential ARARs for protection of human health from ingestion of aquatic organisms and water during recreational use are not included since this exposure pathway was not a concern in the risk assessment. Wisconsin surface water quality criteria and standards are dependent on the water use designation of the river. The Yahara River is classified for warm water sport fish communities.

Potential ARARs for protection of aquatic life are listed in Table A-7 and A-8. These standards are expressed according to acute and chronic toxicity levels. Table A-7 lists Wisconsin water quality criteria for warm water sport fish. Table A-8 lists the CWA FWQC for aquatic life protection.

1.2.2 Location-Specific ARARs

Location-specific ARARs are those requirements that relate to the geographical position of the site. There are several location-specific ARARs applicable for remedial action to the Stoughton City Landfill site. Areas surrounding the landfill are located within the 100-year flood plain; therefore, the requirements of RCRA 40 CFR 2645.18(b) and Executive Order 11988, Protection of Flood Plains, may be applicable or relevant and appropriate to actions on the site. These regulations would affect the siting of treatment systems.

Alternatives including upgrading of the cap could affect the wetlands surrounding of the site. Potential ARARs regarding these wetlands include Executive Order 11990 which requires that actions at the site be conducted in a manner that minimizes the destruction, loss, or degradation of wetlands. Many of these ARARs require special considerations such as protection from erosion during flood events to be included in the development, and later the design, or remedial actions.

1.2.3 Action-Specific ARARs

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances. Several of the more important action-specific ARARs that may affect the development and conceptual design of alternatives are discussed below.

<u>Identification of Hazardous Waste</u> The definition of the waste disposed at the landfill is important in determining the status of RCRA requirements. Since the waste disposed at the Stoughton City Landfill site was generated and managed before the effective date of RCRA, November 1980, RCRA is not applicable to the site unless wastes are excavated or "managed." RCRA requirements may be relevant and appropriate if wastes disposed before November 1980 are defined as RCRA hazardous waste or are sufficiently similar to RCRA hazardous waste. Based

TABLE A-7

Wisconsin Ambient Water Quality Criteria for Aquatic Life Protection

Chemical	Highest Detected in Groundwater (µg/L)	Highest Detected in Surface Water (µg/L)	WISCONSIN WATER QUALITY CRITERIA (a) Acute Toxicity Criteria (b) (µg/L)	Chronic Toxicity Criteria (c) (µg/L)
VOLATILE ORGANICS				
1,2-Dichloroethene (cis and trans)	8.0	-	-	-
Xylenes (total)	1.0J	-	-	-
Dichlorodifluoromethane	240J	3.0	-	-
Trichlorofluoromethane	24J	-	-	-
Tetrahydrofuran	660J	-	-	-
SEMIVOLATILE ORGANICS				
Benzoic Acid	2.0J	-	-	-
Bis (2-ethylhexyl) phthalate	44J	-	-	-
Pentachlorophenol (d)	4.0J	-	6.23	4.73
INORGANICS				
Aluminum	131J	12,600	-	-
Antimony	33.6J	-	-	-
Arsenic	5.2J	7.3J	363.8	153
Barium	391	457	-	-
Chromium (e)	8.0J	16.5	14.2	9.74
Cobalt	-	16.3J	-	-
Copper*	-	33.9	31.9	22.1
Lead*	3.65	68.6J	408.6	24.4
Manganese	2,330J	4,480		
Nickel	20.1J	51.2J	1963.8	118.9
Selenium	7.4J	-	58.0	7.07
Vanadium	-	54.2	-	-
Zinc*	-	327J	185.8	89.2

* Criterion is dependent on the hardness of the water. Hardness >200 mg/L.

(a) Wisconsin water quality criteria for protection of freshwater aquatic life (warm water sportfish classification). From Wisconsin Administrative Code NR105.

(b) Acute toxicity criteria.

(c) Chronic toxicity criteria.

(d) Criterion is dependent upon the pH of the water. Assumed pH of 6.5.

(e) Criterion listed is applicable to the "total recoverable" form of the more toxic hexavalent chromium (VI)

TABLE A-8

Federal Ambient Water Quality Criteria for Aquatic Life Protection

Chemical	Highest Detected in Groundwater (µg/L)	Highest Detected in Surface Water (µg/L)	FEDERAL WATER QUALITY CRITERIA		LOWEST REPORTED EFFECTS LEVEL	
			Acute Criteria (µg/L)	Chronic Criteria (µg/L)	Acute (µg/L)	Chronic (µg/L)
<u>VOLATILE ORGANICS</u>						
1,2-Dichloroethene (total)	8.0	-	-	-	11,600	-
Xylenes (total)	1.0J	-	-	-	-	-
Dichlorodifluoromethane	240J	3.0	-	-	11,000	-
Trichlorofluoromethane	24J	-	-	-	11,000	-
Tetrahydrofuran	660J	-	-	-	-	-
<u>SEMIVOLATILE ORGANICS</u>						
Benzoic Acid	2.0J	-	-	-	-	-
Bis (2-ethylhexyl) phthalate	44J	-	-	-	-	-
Pentachlorophenol	4.0J	-	-	-	55	3.2
<u>INORGANICS</u>						
Aluminum	131J	12,60	-	-	-	-
Antimony	33.6J	-	-	-	9,000	1,600
Arsenic	5.2J	7.3J	360	190	3,243	812
Barium	391	457	-	-	5,000	-
Chromium	8.0J	16.5	16	11	-	-
Cobalt	-	16.3J	-	-	-	-
Copper*	-	33.9	34	21	-	-
Manganese	2,320J	4,480	-	-	-	-
Nickel*	20.1J	51.2J	3,124	162	-	-
Selenium	7.4J	-	20	5.0	-	-
Vanadium	-	54.2	-	-	-	-
Zinc*	-	327J	211	191	-	-
Lead*	3.6J	68.6J	197	7.7	-	-

* Criterion is dependent on the hardness of water. Assumed hardness 200 mg/L.

J Estimated value.

on a review of the site history, potential RCRA hazardous wastes may have been disposed at the site. Soils contaminated as a result of disposal of these wastes would also be classified as a RCRA hazardous waste as a result of the mixture rule (40 CFR 261.3(c)(2)(1)).

Landfill Closure Cover Requirements As discussed above, RCRA requirements are not applicable but may be considered relevant and appropriate to remedial alternatives not involving excavation or management of soil or solid wastes. The more significant RCRA requirements include construction of a cover having a permeability less than or equal to the permeability of the underlying natural subsoils present. The intent of several of the remedial alternatives is to repair or improve upon the existing cover.

The Wisconsin Administrative Code NR 504 has more stringent requirements for new landfills or expansions of existing landfills. Though not applicable these may be considered relevant and appropriate. Portions of these requirements include a 2-foot clay layer with a 1.5- to 2.5-foot cover layer and 0.5 foot of topsoil on the surface.

Groundwater Treatment Requirements Several remedial alternatives are likely to include collection and treatment of contaminated groundwater. Because off-site discharge will likely be to the Yahara River, WPDES permit requirements and discharge limits are necessary. At a minimum, Wisconsin Administration Code NR 220 requires best available control technology for treatment before discharge. Specific discharge limits from WDNR will not be available until after the final FS is submitted. A discussion of potential treatment requirements and discharge limits is presented in the Chapter 5 discussions of specific alternatives since the discharge limits are a function of the discharge flow rate.