

PROJECT Hardee Co Landfill PROJ. NO. HA86073-6E PAGE 1 OF 9
SUBJECT _____ DATE Apr 87
DETAIL _____ COMPUTED BY LAP CHECKED BY _____

APR 01 1987

DESIGN CALCULATIONS
LEACHATE COLLECTION AND
SPRAY IRRIGATION SYSTEM
SOUTH WEST DISTRICT
JANNA

Collection

Use 8" Corrugated slotted polyethylene pipe
with 0.2% slope and manholes
every 400 ft (±)

Irrigation

From Ardaman & Associates Jan 16 '87 report:

Required Area = 235,224 SQ FT

Application Rate = 1.0 - 1.5 inch/hr

Use 12 sprinklers

Rainbird 85EWPSH with 3/8" nozzle

60 psi 79' radius 30.8 GPM

$$\frac{30.8 \text{ GPM} \times 12}{244} = 1.5 \text{ in/hr}$$

BRILEY, WILD & ASSOCIATES, INC.

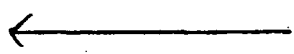
BRILEY, WILD & ASSOCIATES, INC.

PROJECT _____ PROJ. NO. _____ PAGE 2 OF 9
 SUBJECT _____ DATE Mar 87
 DETAIL _____ COMPUTED BY LAP CHECKED BY _____

HARDEE COUNTY LANDFILL
 SPRAY FIELD

REQUIRED AREA: 235,224 SQ FT
 MAXIMUM APPLICATION RATE: 0.1 in/hr

NUMBER SPRINKLERS	RADIUS FT	AREA SQ FT	GPM/ SPRINKLER
1	274	235,224	244.0
2	193	235,224	122.0
3	158	235,224	81.3
4	137	235,224	61.0
5	122	235,224	48.8
6	112	235,224	40.7
7	103	235,224	34.9
8	97	235,224	30.5
9	91	235,224	27.1
10	87	235,224	24.4
11	83	235,224	22.2
12	79	235,224	20.3
13	76	235,224	18.8
14	73	235,224	17.4
15	71	235,224	16.3
16	68	235,224	15.3
17	66	235,224	14.4
18	64	235,224	13.6
19	63	235,224	12.8
20	61	235,224	12.2
21	60	235,224	11.6
22	58	235,224	11.1
23	57	235,224	10.6
24	56	235,224	10.2
25	55	235,224	9.8
26	54	235,224	9.4
27	53	235,224	9.0
28	52	235,224	8.7
29	51	235,224	8.4
30	50	235,224	8.1



BRILEY, WILD & ASSOCIATES, INC.

PROJECT _____ PROJ. NO. _____ PAGE 3 OF 9
 SUBJECT _____ DATE Mar 87
 DETAIL _____ COMPUTED BY LAP CHECKED BY _____

HARDEE COUNTY LANDFILL
 SPRAY FIELD

12 SPRINKLERS @ 30.8 GPM EACH

NUMBER SPRINKLRS	FLOW GPM	PIPE INCH	VELOCITY FPS	
1	30.8	1.5	5.6	
1	30.8	2.0	3.1	←
1	30.8	2.5	2.0	
1	30.8	3.0	1.4	
2	61.6	2.5	4.0	
2	61.6	3.0	2.8	←
2	61.6	4.0	1.6	
3	92.4	3.0	4.2	
3	92.4	4.0	2.4	←
3	92.4	6.0	1.0	
4	123.2	3.0	5.6	
4	123.2	4.0	3.1	←
4	123.2	6.0	1.4	
5	154.0	4.0	3.9	←
5	154.0	6.0	1.7	
6	184.8	4.0	4.7	
6	184.8	6.0	2.1	←
6	184.8	8.0	1.2	
12	369.6	6.0	4.2	←
12	369.6	8.0	2.4	

BRILEY, WILD & ASSOCIATES, INC.

PROJECT _____ PROJ. NO. _____ PAGE 4 OF 9
 SUBJECT _____ DATE Mar 87
 DETAIL _____ COMPUTED BY LAP CHECKED BY _____

$$\text{Pump Head} = \text{Static Head} + \text{Losses to Spray Field} \\ + \text{losses in Spray Field} + \text{losses at nozzle}$$

Static Head

High point of leachate collection system = NW corner

$$\begin{aligned} \text{Ground elev} &= 84-85 \\ \text{Invert} &= 80.0 \end{aligned}$$

At 0.2% invert at west end of dewatering ditch = 78.4

invert at east end = 77.4

Set high water level at 77.4

Ardaman report says 3.2 ft of storage required

$$\begin{array}{r} 77.4 \\ - 3.2 \\ \hline 74.2 \end{array}$$

To pump out ditch set low water level = 72.0

$$\text{Static Head} = 86.0 - 72.0 = \boxed{14.0 \text{ Ft}}$$

Losses to spray field

$$\text{use } 6'' \text{ pipe } v = 4.2 \text{ FPS } \boxed{\text{Head} = 3.38 \text{ Ft}}$$

$$\text{Head at Nozzle} = 60 \text{ PSI} = \boxed{138.4 \text{ Ft}}$$

BRILEY, WILD & ASSOCIATES, INC.

BRILEY, WILD & ASSOCIATES, INC.

PROJECT _____ PROJ. NO. _____ PAGE 5 OF 9
 SUBJECT _____ DATE Mar 87
 DETAIL _____ COMPUTED BY LAP CHECKED BY _____

HARDEE COUNTY LANDFILL
 SPRAY FIELD

HEAD LOSS WITH 160PSI (SDR26) PLASTIC PIPE C=150

LENGTH FT	DIAM IN	FLOW GPM	HL/ 100	HEAD LOSS FEET
70	2	30.8	1.36	0.95
70	2	33.0	1.55	1.08
70	2	35.7	1.79	1.25
70	2	38.3	2.04	1.43
70	2	40.7	2.28	1.60
80	2	30.8	1.36	1.09
80	2	33.0	1.55	1.24
80	2	35.7	1.79	1.43
80	2	38.3	2.04	1.63
80	2	40.7	2.28	1.83
80	3	61.6	0.73	0.58
80	3	66.0	0.83	0.66
80	3	71.4	0.96	0.77
80	3	76.6	1.09	0.87
80	3	81.4	1.22	0.98
160	4	92.4	0.44	0.70
160	4	99.0	0.50	0.79
160	4	107.1	0.57	0.92
160	4	114.9	0.65	1.04
160	4	122.1	0.73	1.17
80	4	123.2	0.74	0.59
80	4	132.0	0.84	0.67
80	4	142.8	0.97	0.78
80	4	153.2	1.11	0.89
80	4	162.8	1.24	0.99
80	4	154.0	1.12	0.90
80	4	165.0	1.27	1.02
80	4	178.5	1.47	1.18
80	4	191.5	1.68	1.34
80	4	203.5	1.88	1.50
280	6	184.8	0.23	0.66
280	6	198.0	0.27	0.75
280	6	214.2	0.31	0.86
280	6	229.8	0.35	0.98
280	6	244.2	0.39	1.10
400	8	369.6	0.23	0.91
400	8	396.0	0.26	1.03
400	8	428.4	0.30	1.20
400	8	459.6	0.34	1.36
400	8	488.4	0.38	1.52
400	6	369.6	0.84	3.38
400	6	396.0	0.96	3.84
400	6	428.4	1.11	4.44
400	6	459.6	1.26	5.05
400	6	488.4	1.41	5.66

280	6	184.8	0.23	0.66
280	6	198.0	0.27	0.75
280	6	214.2	0.31	0.86
280	6	229.8	0.35	0.98
280	6	244.2	0.39	1.10
400	8	369.6	0.23	0.91
400	8	396.0	0.26	1.03
400	8	428.4	0.30	1.20
400	8	459.6	0.34	1.36
400	8	488.4	0.38	1.52
400	6	369.6	0.84	3.38
400	6	396.0	0.96	3.84
400	6	428.4	1.11	4.44
400	6	459.6	1.26	5.05
400	6	488.4	1.41	5.66
210	2	30.8	1.36	2.86
210	2	33.0	1.55	3.25
210	2	35.7	1.79	3.76
210	2	38.3	2.04	4.29
210	2	40.7	2.28	4.80
80	4	92.4	0.44	0.35
80	4	99.0	0.50	0.40
80	4	107.1	0.57	0.46
80	4	114.9	0.65	0.52
80	4	122.1	0.73	0.58
80	4	154.0	1.12	0.90
80	4	165.0	1.27	1.02
80	4	178.5	1.47	1.18
80	4	191.5	1.68	1.34
80	4	203.5	1.88	1.50
80	4	184.8	1.57	1.26
80	4	198.0	1.78	1.43
80	4	214.2	2.06	1.65
80	4	229.8	2.35	1.88
80	4	244.2	2.63	2.10

BRILEY, WILD & ASSOCIATES, INC.

PROJECT _____ PROJ NO _____ PAGE 6 OF 9
 SUBJECT _____ DATE Mar 87
 DETAIL _____ COMPUTED BY LAP CHECKED BY _____

HARDEE COUNTY LANDFILL
 SPRAY IRRIGATION SYSTEM

MINOR LOSSES FROM PUMP STATION TO FARTHEST SPRINKLER

Fitting	Size in	Flow GPM	Velocity Head	Loss in VH	Head Loss Feet
90 el	6	369.6	0.2739	0.90	0.247
Control valve	6	369.6	0.2739	1.00	0.274
Check valve	6	369.6	0.2739	2.50	0.685
45 el	6	369.6	0.2739	0.40	0.110
Wye	6	369.6	0.2739	0.40	0.110
90 el	6	369.6	0.2739	0.90	0.247
Tee	6	369.6	0.2739	0.60	0.164
Gate valve	6	184.8	0.0685	1.00	0.069
Tee	6X4	184.8	0.2362	1.80	0.425
Tee	4	154.0	0.2362	0.60	0.142
Tee	4	123.2	0.1492	0.60	0.090
Tee	4	92.4	0.0894	0.60	0.054
Tee	4X2	61.6	0.1492	0.60	0.090
Tee	2	30.8	0.1492	0.60	0.090
Gate valve	2	30.8	0.1492	1.00	0.149

TOTAL MINOR HEAD LOSSES

2.942

BRILEY, WILD & ASSOCIATES, INC.

PROJECT _____ PROJ. NO. _____ PAGE 7 OF 9
 SUBJECT _____ DATE Mar 87
 DETAIL _____ COMPUTED BY LAP CHECKED BY _____

BRILEY, WILD & ASSOCIATES, INC.

Nozzle Flow GPM	TOTAL FLOW GPM	HEAD AT NOZZLE FT	PIPE FRICTION FT	FORCE MAJN LOSSES FT	MINOR LOSSES FT	STATIC HEAD FT	TOTAL HEAD FT	TOTAL HEAD / BOWL FT
30.8	369.6	138.0	5.37	3.38	2.94	14	163.69	54.56
33.3	399.6	161.0	6.10	3.84	3.44	14	188.38	62.79
35.7	428.4	184.0	7.05	4.44	3.95	14	213.44	71.15
38.3	459.6	207.0	8.03	5.05	4.55	14	238.63	79.54
40.7	488.4	230.0	8.98	5.66	5.13	14	263.77	87.92

BRILEY, WILD & ASSOCIATES, INC.

PROJECT _____ PROJ. NO. _____ PAGE 8 OF 9
SUBJECT _____ DATE Mar 87
DETAIL _____ COMPUTED BY LAP CHECKED BY _____

Use 1 pump @ 370 GPM @ 163 ft

Provide space for second pump, if required, and connection for portable pump for emergency operation

Assume irrigation based on growth needs of cover crop, based on Ardaman report.

BRILEY, WILD & ASSOCIATES, INC.

PROJECTED PUMP RUNNING TIMES FOR IRRIGATION

	Monthly Irrigation Requirement In Inches	Monthly Irrigation In Gallons	Pump Operating Hours per Month	Water Level in Ditch
JANUARY	1.04	152,500	6.9	
FEBRUARY	0.73	107,000	4.8	
MARCH	1.71	250,800	11.3	77.4
APRIL	3.61	529,400	23.8	
MAY	5.85	857,900	38.6	
JUNE	3.55	520,600	23.5	
JULY	3.37	494,200	22.3	74.2
AUGUST	3.01	441,400	19.9	
SEPTEMBER	2.11	309,400	13.9	
OCTOBER	3.01	441,400	19.9	
NOVEMBER	2.63	385,700	17.4	
DECEMBER	1.23	180,400	8.1	
TOTAL	31.85	4,670,700	210.4	



Ardaman & Associates, Inc.

36075

Consultants in Soils, Hydrogeology,
Foundations and Materials Testing

January 16, 1987
File Number 86-166

Briley, Wild & Associates, Inc.
1042 U.S. Highway 1, North
Ormond Beach, Florida 32074

Attention: Mr. John Cumming, P.E.

Subject: Analyses and Recommendations, Hardee County Regional Sanitary
Landfill, Leachate Collection and Disposal System, Hardee
County, Florida

Gentlemen:

As requested and authorized by Mr. Cumming, we have completed a geotechnical evaluation of the proposed leachate collection and disposal system for the Hardee County Regional Landfill site. This report summarizes the results of our analyses and recommendations.

Our scope of work included performing 4 Standard Penetration Test (SPT) borings, installing 3 piezometers and performing in situ permeability tests, performing water balance analyses to determine leachate quantities, providing design recommendations for the leachate collection system, and determining the requirements for leachate storage and disposal areas.

The results of our field and laboratory programs have indicated that the subject site is underlain by an average 12-foot thick surficial aquifer consisting mainly of fine sand to slightly clayey fine sand (see Figures 1 and 2). These results are in general agreement with the site soil conditions reported by Envisors, Inc. in 1982. According to Envisors, Inc. (1982), the surficial aquifer is separated from the deeper Floridan aquifer by a continuous confining clay layer which varies in thickness from 14 feet to 35 feet with an average thickness of about 25 feet. Based upon the results of our field and laboratory programs and that presented by Envisors, Inc., a surficial aquifer permeability of 1.4 feet/day was used in the analyses. A confining bed permeability of 2.83×10^{-4} feet/day (10^{-7} cm/sec) was conservatively used in the analyses.

Water Balance

Water balance analyses were performed utilizing the "Hydrologic Evaluation of Landfill Performance (HELP)" computer model developed by the U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi. This program models on a daily basis the effects of all of the hydrologic processes, including precipitation, surface storage, runoff, infiltration, percolation, evapotranspiration, soil moisture storage, and lateral drainage, that enter the water balance equation. Daily rainfall and temperature data from 1974 to 1978 for West Palm Beach, Florida (default data in the model) were used in the

analyses. These data appeared to be closer to reported average values at the site than the 1974-78 data for Tampa. It is our opinion that the West Palm Beach data are sufficiently representative of site conditions to be used in the water balance calculations required for this project.

The conceptual hydrologic cycle in the landfill area is illustrated in Figure 3. Table 1 presents a summary of water balance analyses for the various design conditions. As can be seen, the maximum amount of leachate will be generated when the refuse is at the original ground surface elevation with 12 inches of intermediate cover. For the purpose of disposal area design, we recommend a leachate generation rate of 11.9 inches per year. For an 11-acre landfill, this rate corresponds to 0.03 acre-feet per day.

Spray Irrigation

Based upon a percolation rate of 3.9 in/year (see Table 1), approximately 10 acres of land south of the dewatering ditch is estimated to contribute lateral seepage to the dewatering ditch (i.e., approximately 10 acres of land immediately south of the dewatering ditch is available for spray irrigation of leachate). Using a gross irrigation rate of 31.8 inches per year (for pasture grasses) as recommended by the SCS for the Tampa area, the area required for irrigation is calculated to be about 5.4 acres as follows:

Inflow to = (10 acres x 3.9 in + 11 acres x 11.9 in)/year
Dewatering Ditch = 170 acre-in per year

Area required = 170 acre-in per year/31.8 in per year
 = 5.34 acres which is less than the 10 acres available

We recommend using either coastal bermudagrass or pangolagrass as a summer crop (March to November) and overseeding the summer crop with ryegrass for winter production (December to April). The estimated monthly gross irrigation requirement is as follows:

<u>Month</u>	<u>Inches</u>
January	1.04
February	0.73
March	1.71
April	3.61
May	5.85
June	3.55
July	3.37
August	3.01
September	2.11
October	3.01
November	2.63
December	1.23

The following design criteria for the irrigation system are provided:

- Maximum application rate is 0.1 inch per hour
- Maximum liquid loading is 1 to 2 inches per week
- Effluent is applied once every 7 days
- In the winter months, the application rate may be as low as 0.2 inch/week
- In the summer months, the application rate may be over 1 inch/week
- The average application rate should not exceed 0.61 inches per week on an average annual basis.

Leachate Storage Area

The existing 800-ft long dewatering ditch has top and bottom widths of 100 feet and 50 feet, respectively. The average depth to the ditch bottom is approximately 11.4 feet. The maximum storage available in the ditch is 14 acre-feet.

Using average monthly water balance calculations with the monthly distribution of leachate production calculated by the HELP model and the monthly gross irrigation requirement as recommended by the SCS, the maximum storage required is approximately 3.1 acre-feet which corresponds to 3.2 feet of leachate in the ditch. The maximum storage is expected to occur in the month of March. The monthly water balance calculations are provided in Table 2.

Leachate Collection System


We recommend a peripheral leachate collection underdrain on the west, north and east sides of the landfill. The underdrains should be a minimum 4 feet below natural ground and should slope toward the dewatering ditch. Figure 4 illustrates two alternative leachate collection underdrain design concepts.

Side Liner

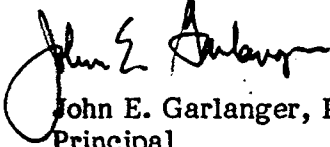
In the previous sections, it was shown that 5.4 acres of sprayfield is required to dispose of the leachate generated from the landfill. Using a rectangular spray irrigation plot (adjacent to the dewatering ditch) with a length of 700 feet parallel to the ditch, a 335-foot extension of the side liner will be required to force all seepage to the ditch. We recommend extending the east and west wall side liners to a minimum distance of 400 feet south from the south edge of the ditch.

We trust that this report meets your immediate requirements. The final report including the results of our field and laboratory programs will be forthcoming. If you have any questions regarding this report, please do not hesitate to contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.



Rajendra K. Shrestha, P.E.
Project Engineer



John E. Garlanger, Ph.D., P.E.
Principal
Florida Registration No. 19782

RKS:ed

cc: J. R. Prestridge (Hardee County)

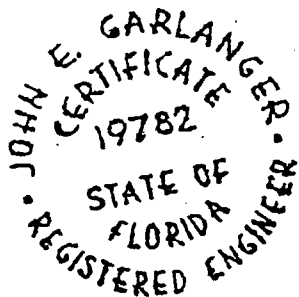


Table 1

SUMMARY OF WATER BALANCE ANALYSES

	<u>Thickness of Cover (inches)</u>	<u>Surface Condition</u>	<u>SCS Curve No. Used</u>	<u>Annual Rainfall (inches)</u>	<u>Annual Runoff (inches)</u>	<u>Annual ET (inches)</u>	<u>Annual Percolation (inches)</u>	<u>Annual Recharge (inches)</u>
Worst Case: Landfill refuse at original ground surface elevation	12	Bare	80 (85.6)*	56.9 56.9	5.3 (8.4)	32.4 (32.0)	11.9 (9.7)	1.6 (1.6)
Final Cover Scenario**	24	Good Grass	73	56.9	4.3	37.5	8.3	1.6
Proposed sprayfield area south of dewatering ditch	Natural Ground	Poor Grass	85	56.9	11.8	33.4	3.9	1.6

NOTES

- ET Evapotranspiration
- * Curve number generated by the HELP model
- ** Permeability of cover = 0.28 feet/day
- The analyses for the landfill consider a peripheral leachate collection underdrain around landfill boundary.

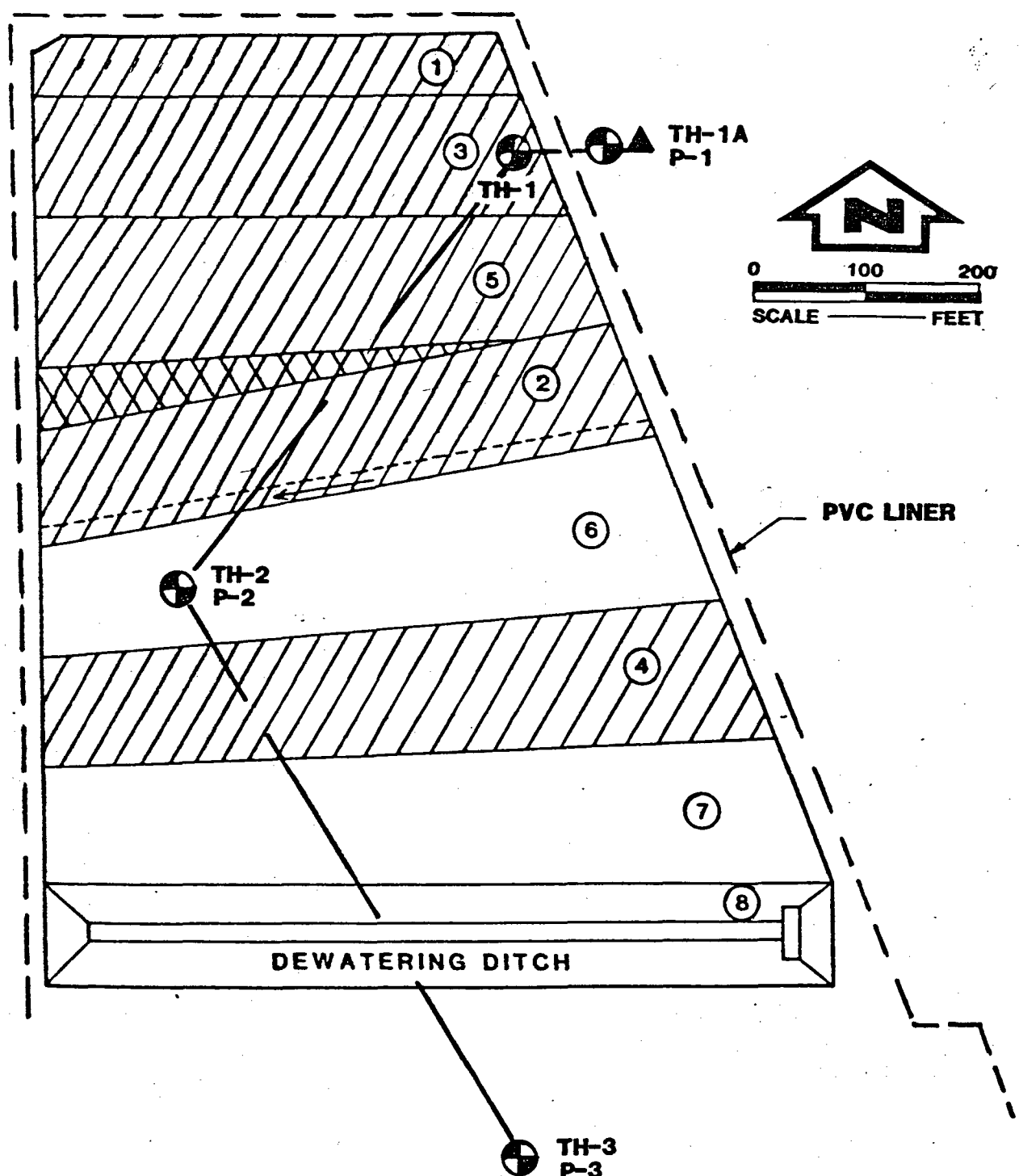
Table 2

MAXIMUM STORAGE REQUIREMENT






Month	Wauchula PPT	WPB PPT (in)	① Leachate (in)	② Leachate Volume (acre-in) ①x11 ac.	③ Spray Irrigation (in) (USDA)	④ Volume Irrigation (acre-in) ③x5.5 ac.	⑤ Drainage to Ditch (in)	⑥ Volume Drain (acre-in) ⑤x10 ac.	⑦ Change in Storage (acre-in) ②+⑥-④	Cumulative Storage (acre-in)
Jan	2.40	3.33	0.922	10.142	1.04	5.72	.295	2.95	7.37	27.46
Feb	3.01	1.81	0.769	8.459	0.73	4.02	.265	2.65	7.09	34.55
Mar	3.02	1.70	0.820	9.020	1.71	9.41	.290	2.90	2.51	37.06
Apr	2.46	1.16	0.723	7.953	3.61	19.86	.269	2.69	-9.22	27.84
May	4.94	8.66	0.765	8.415	5.85	32.18	.297	2.97	-20.80	7.04
Jun	8.33	6.28	0.928	10.208	3.55	19.53	.305	3.05	-6.27	0.77
Jul	8.50	5.22	0.997	10.967	3.37	18.54	.330	3.30	-4.27	0
Aug	6.87	5.13	0.972	10.692	3.01	16.56	.333	3.33	-2.54	0
Sep	7.03	8.73	1.084	11.924	2.11	11.61	.339	3.39	3.70	3.70
Oct	2.88	5.69	1.248	13.728	3.01	16.56	.386	3.86	1.03	4.73
Nov	1.76	5.31	1.275	14.025	2.63	14.47	.378	3.78	3.34	8.07
Dec	1.89	3.90	1.355	14.905	1.23	6.77	.388	3.88	12.02	20.09
Total	53.09	56.92 11.857			31.8		3.874			

NOTES


- PPT (precipitation) used are for W. Palm Beach
- Leachate quantities are 5-yr. average values 74-78
- Naturally occurring drainage to dewatering ditch from approximately 10 acres.
- Spray Area = $(\text{Area LF} \times 11.857 + 10 \times 3.874) / 31.8 = 5.32 \text{ ac}$, say 5.5 acres.



LEGEND

-  COMPLETED CELLS
-  AREA NOT IN ANY CELL DUE TO DRAGLINE LIMITATIONS
-  CELL NUMBERS
-  SPT BORING BY ARDAMAN & ASSOCIATES, INC. IN 1986
-  SPT BORING BY ENVISORS, INC. IN 1982

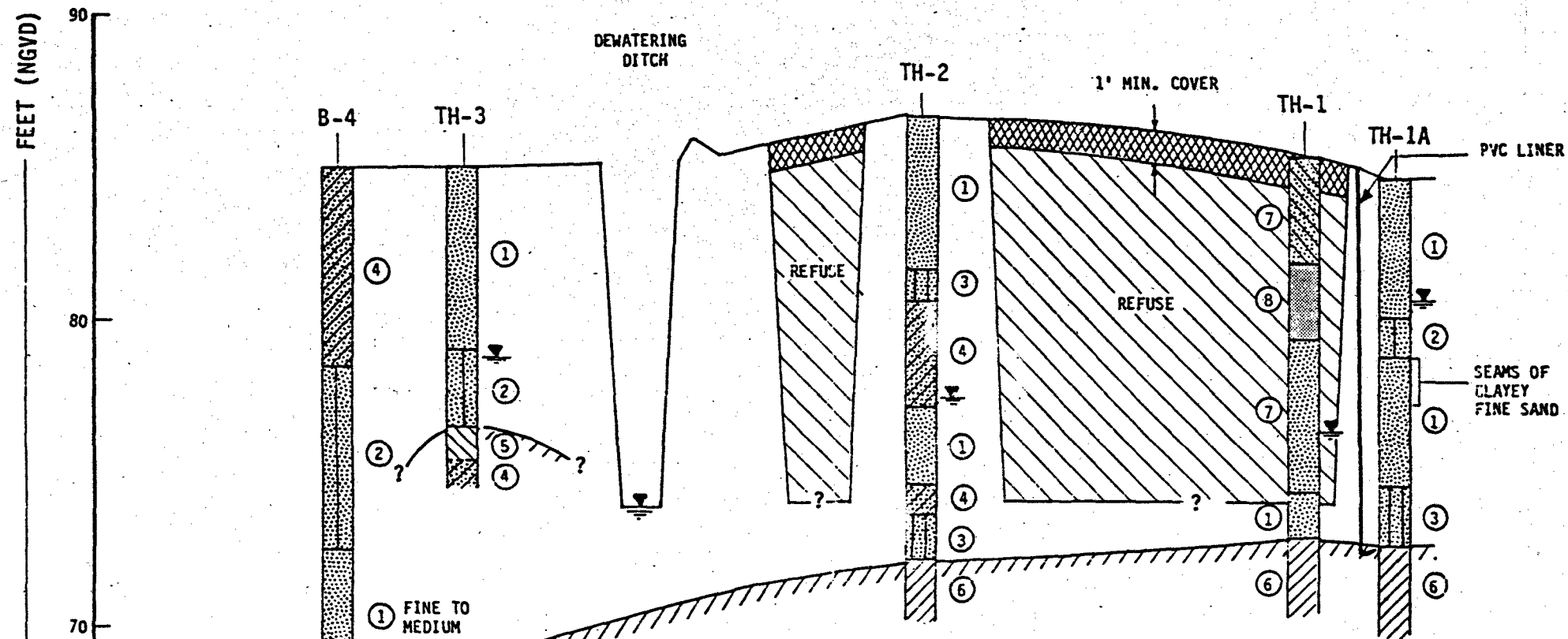
SITE AND BORING LOCATION PLAN

 Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Material Testing	
HARDEE COUNTY REGIONAL SANITARY LANDFILL HARDEE COUNTY, FLORIDA	
DRAWN BY: S.E.F. FILE NO. 86-116	CHECKED BY: PKJ APPROVED BY: <i>John E. Ardaman</i>
DATE: 1/19/87	

73331

FIGURE 1

NORTH-SOUTH CROSS SECTION



LEGEND

- ① FINE SAND
 - ② FINE SAND WITH TRACES OF CEMENTED SAND
 - ③ SLIGHTLY SILTY TO SILTY FINE SAND
 - ④ SLIGHTLY CLAYEY FINE SAND
 - ⑤ CLAYEY FINE SAND
 - ⑥ CLAYEY SAND TO SANDY CLAY WITH TRACES OF PHOSPHATES
 - ⑦ FINE SAND OCCASIONALLY MIXED WITH CLAYEY SAND
 - ⑧ REFUSE
- TH-1 ARDAMAN TESTHOLE
 B-4 ENVISOR, INC. TESTHOLE

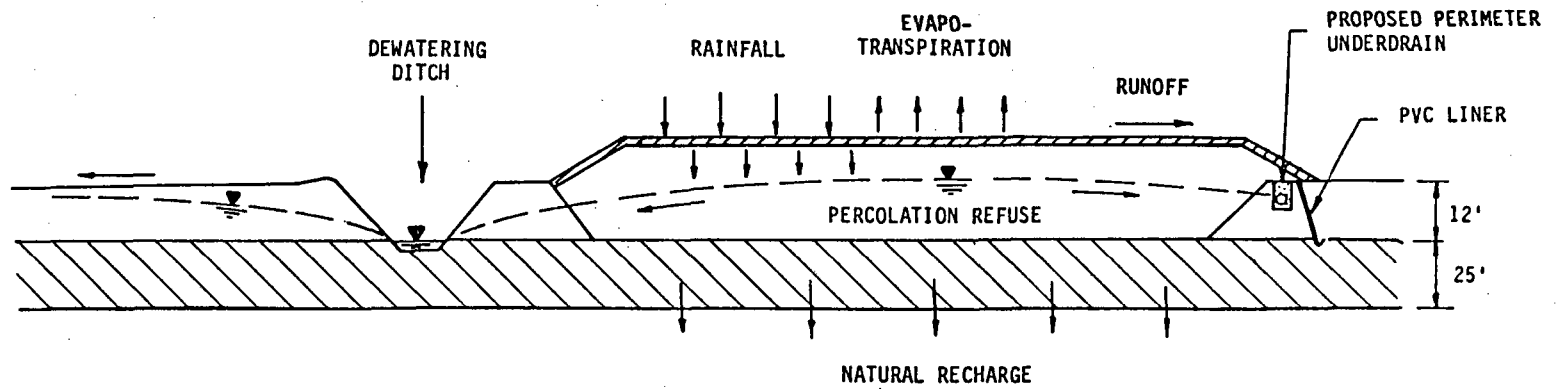
NOTE: SEE FIGURE 1 FOR CROSS-SECTION LOCATION

Ardaman & Associates, Inc.
 Consulting Engineers in Soil Mechanics,
 Foundations, and Materials Testing

**HARDEE COUNTY REGIONAL
 SANITARY LANDFILL
 HARDEE COUNTY, FLORIDA**


DRAWN BY: S.E.F. | CHECKED BY: [Signature] | DATE: 1/19/87
 FILE NO.: 96-116 | APPROVED BY: [Signature]

FIGURE 2

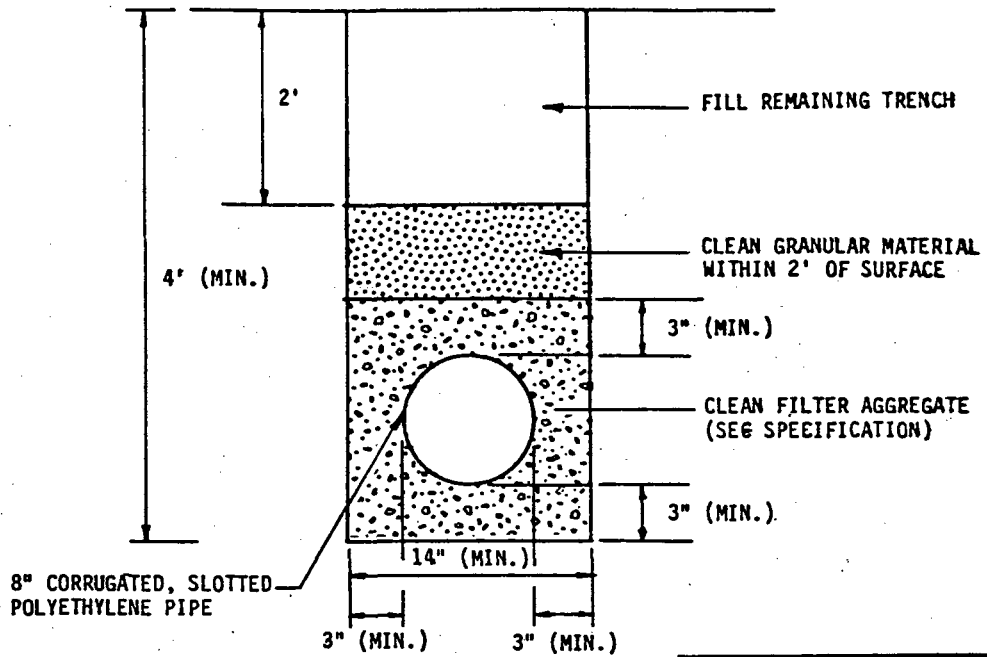


CONCEPTUAL HYDROLOGIC CYCLE

FIGURE 3

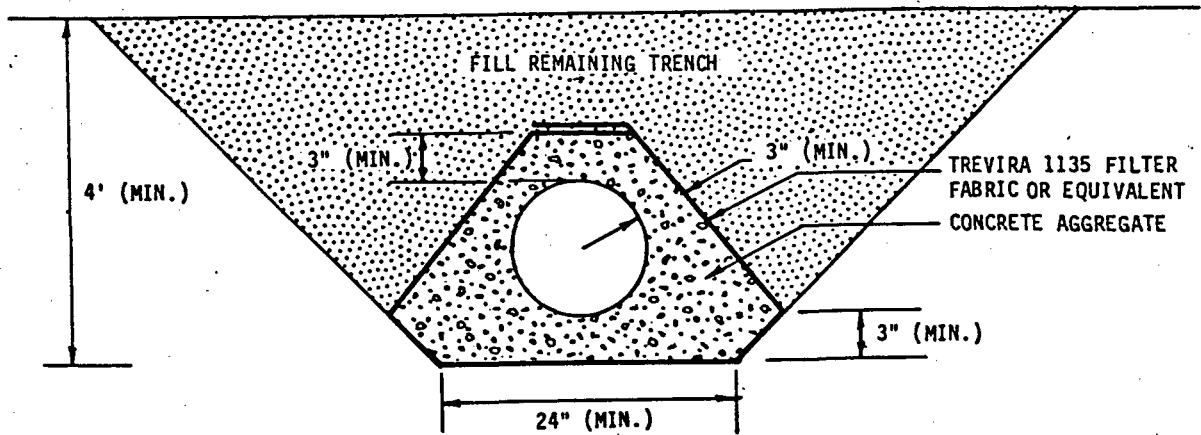
 Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Material Testing	
HARDEE COUNTY REGIONAL SANITARY LANDFILL HARDEE COUNTY, FLORIDA	
DRAWN BY: S. E. F. FILE NO. 86-116	CHECKED BY: RCF DATE: 1/19/87 APPROVED BY: <i>[Signature]</i>

ALTERNATIVE 1



U.S. SIEVE	PERCENT PASSING
3"	MAX. SIZE
3/8"	80-100
NO. 4	60-90
NO. 10	30-70
NO. 20	0-40
NO. 40	0-15

ALTERNATIVE 2



LEACHATE COLLECTION SYSTEM

Ardaman & Associates, Inc.
 Consulting Engineers in Soil Mechanics,
 Foundations, and Material Testing

**HARDEE COUNTY REGIONAL
 SANITARY LANDFILL
 HARDEE COUNTY, FLORIDA**

DRAWN BY: S.E.F. (CHECKED BY: RYS) DATE: 1/19/87
 FILE NO. 86-116 APPROVED BY: *John E. Ardaman*

73331