RMT INC.

RMT, Inc.
Suite 124
1406 East Washington Ave.
Madison, WI 53703-3009
Phone: 608-255-2134
FAX: 608-255-0234

July 13, 1988

Mr. Mark Gordon
Department of Natural Resources
P.O. Box 7921
101 South Webster Street
Madison, WI 53703

Re: Refuse Hideaway Landfill - Proposed Actual Final Grading Plan

Dear Mark:

In response to Condition No. 8 of the June 13, 1988, Modification to the Closure Plan Approval for Refuse Hideaway Landfill, Inc. (RHL), RHL is proposing the final grading plan shown on Figure 1, Appendix A. The development of this plan was based on the following design criteria and information:

1. Maximum slopes are 33 percent and minimum slopes are 3 percent.

2. Cover design criteria are as follows:

   - Grading layer thickness - 6 inches (minimum)
   - Clay capping layer thickness - 24 inches
   - Grading layer thickness - 18 inches
   - Topsoil layer thickness - 6 inches

3. Field surveys were performed by Arnold and O'Sheridan, Inc., on June 9, 13, and 17, 1988.

4. RMT field surveys were performed on June 9, 13, 17, and 21, 1988 to document grading layer thickness.

Details of information collected on the field surveys will be submitted to the Department as part of the Construction Documentation Report.

The proposed final grading plan routes surface water to perimeter ditches as efficiently as possible based on required top of existing grading layer elevations. Additionally, surface water from the northeast is segregated from surface water coming off the landfill. The details of the erosion control features are shown on Figure 2, Appendix A. The computations supporting the drainage system concepts are provided in Appendix B. Redesign of the existing sedimentation basin and design requirements for a retention basin for northeastern surface water flow is also provided in Appendix B. The outlet structure for the sedimentation basin uses a french drain (see detail 5 of 2, Figure 2). This outlet structure may be supplemented by additional over-flow

1181.05 208:SLR:gordon2

control culverts if the existing in-place culverts can be designed to work with the proposed basin outlet structure. If the in-place culverts cannot work with the proposed design, the culverts will be removed and the area restored.

The requirements for erosion control are outlined in Appendix B and presented on Figures 1 and 2, Appendix A. It should be noted that, during site closure construction, areas of the perimeter ditches will be assessed for determination of the best way to control erosion. Due to existing conditions (ie., occasional exposed bedrock in the ditch flowline area), field engineering design of erosion control requirements will be the most effective.

As shown in detail 2 of 3 on Figure 2, closure of the south and west slope areas will consist of the initial removal of approximately two feet of existing soil and then the subsequent placement of the final cover system (excluding the grading layer). Removal of the existing soil on the two slope areas will vary in volume based on what is required for site closure. However, in all cases, a minimum depth of cover over the waste will be six inches.

The limits of clay placement required for site closure will be (at a minimum) to the landfill limits (1986) as shown on Plan Sheet 2 of the In-Field Conditions Report submitted to the Department in January 1988. These limits of waste/limits of final cover system placement are presented on Figure 1, Appendix A. It should be noted that, due to uncontrollable delays such as the soils testing and Town approval required for the borrow source and the approximate doubling of the required area to receive the final cover system (as discussed during Consent Order negotiations), the deadlines stated in the Consent Order for clay capping layer placement (August 15, 1988) and complete cover system placement (September 15, 1988) cannot be met. The following deadlines are provided as a more realistic estimation of completion dates beginning with the top area (approximately 12 acres) of the landfill only. This assumes a clay placement start date of July 25, 1988:

Construction Item	Date
Completion of Clay Capping Layer	September 15, 1988
Final Cover System Completed	October 15, 1988

Closure of the south and west slope areas will take an additional 45 working days for completion of the clay capping layer and an additional 30 working days for completion of the final cover system. RHL will try to coordinate closure of as much of the landfill as possible before the end of the 1988 construction season, but RHL does not want to open up areas of the landfill and not be able to properly close them before the end of the construction season

We hope the Department works with RHL to enable this project to get started so that the delays in the schedule may be minimized. We estimate that the soils testing information and volume computation for the borrow source will be available by July 18, 1988. To date, we have not received Town of Middleton approval of the plan for removing clay from the borrow source. It is our understanding that this approval is necessary before any clay can be moved from the borrow site.

Please call if we can be of any assistance in your review of the enclosed materials or with any other aspects of the site.

Sincerely,

Ed Scaro LB

Ed C. Scaro, P.E.
Senior Project Engineer

Lee A. Bartlett

Lee A. Bartlett, P.E.
Project Manager

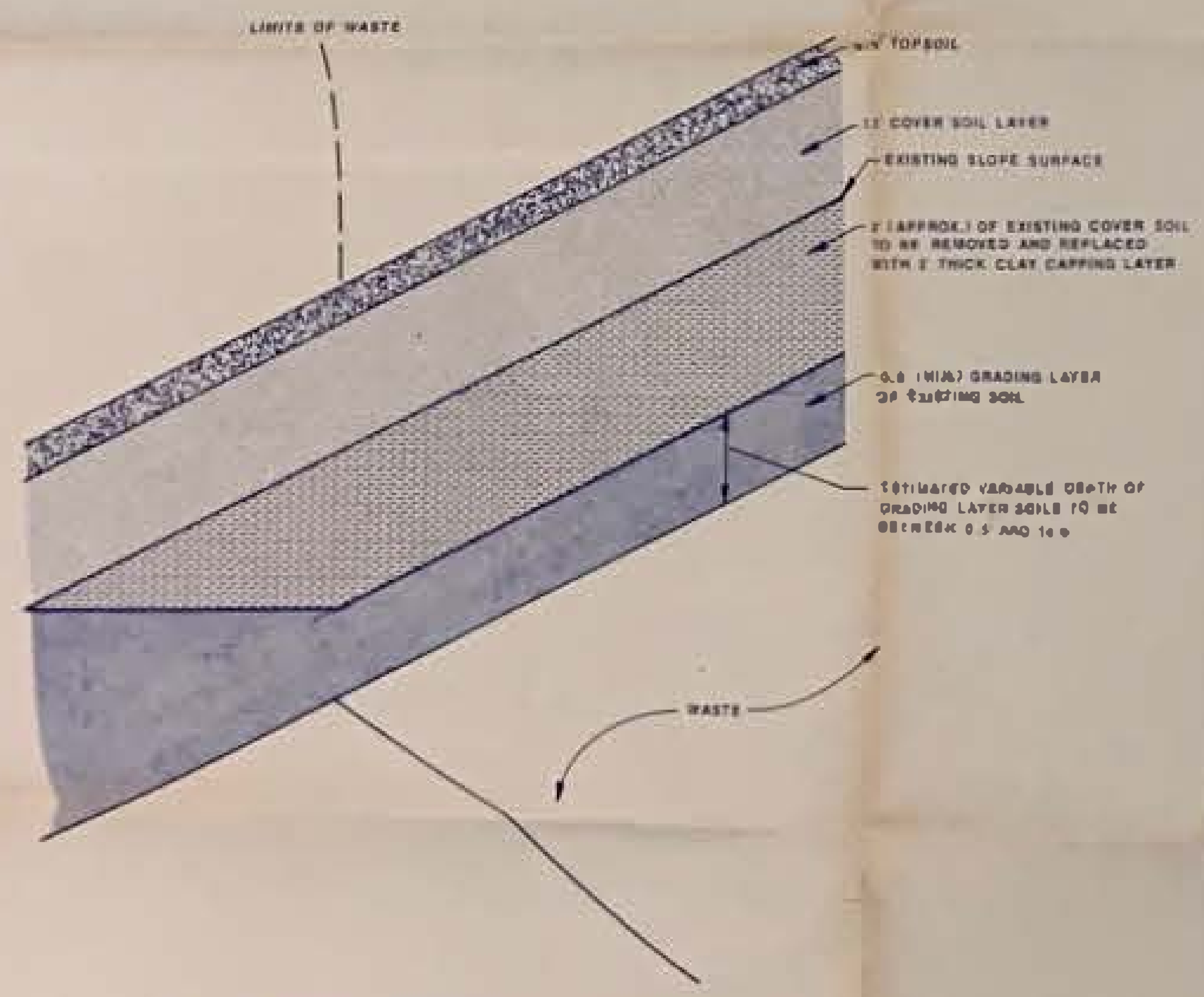
slr

Enclosure

cc: John DeBeck
Tom DeBeck
Kathryn Curtner
Paul Didier
Paul Huebner
Chuck Leveque
Dave Neeb
Bob Selk

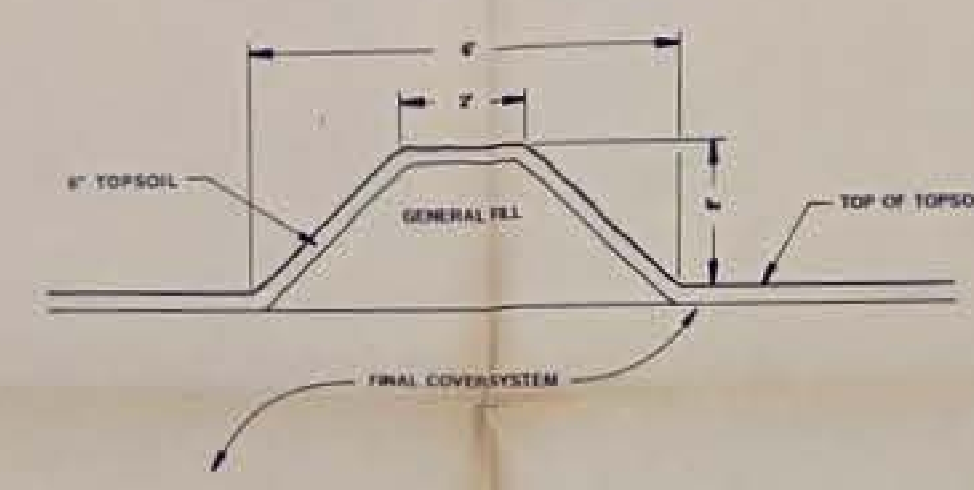
FINAL COVER SYSTEM DETAIL
NOT TO SCALE

(1/2)



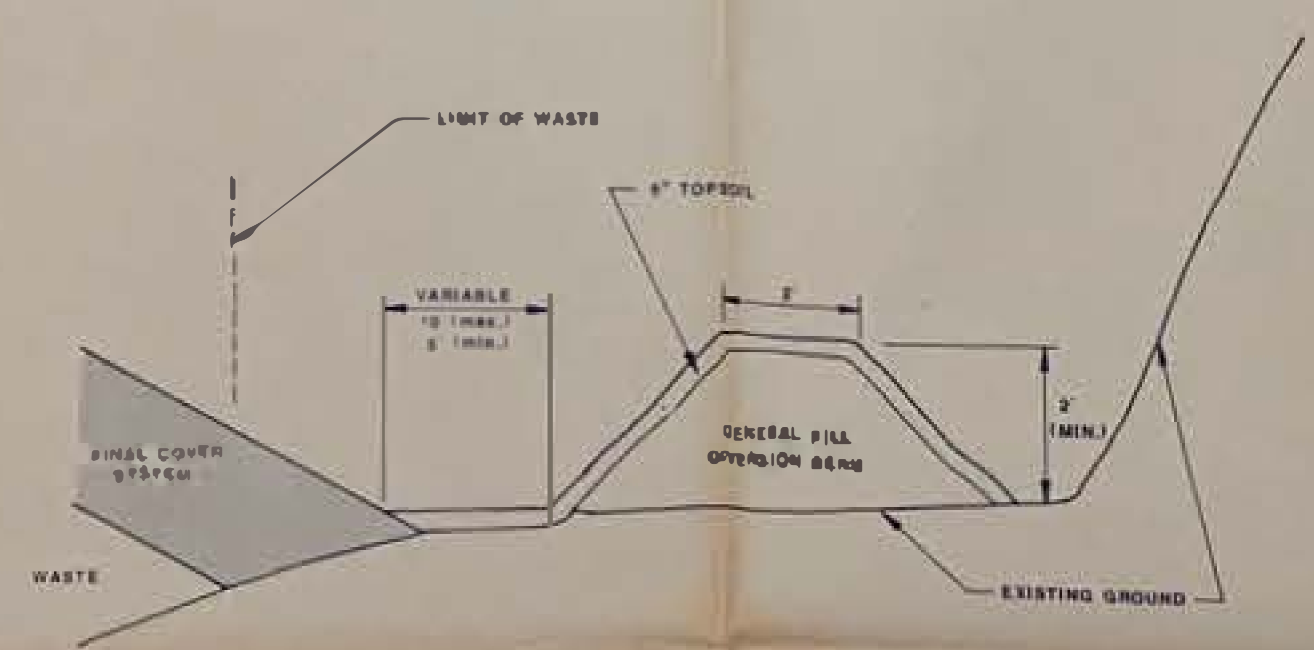
SOUTH AND WEST SLOPE FINAL COVER DETAIL
(NOT TO SCALE)

(2/2)



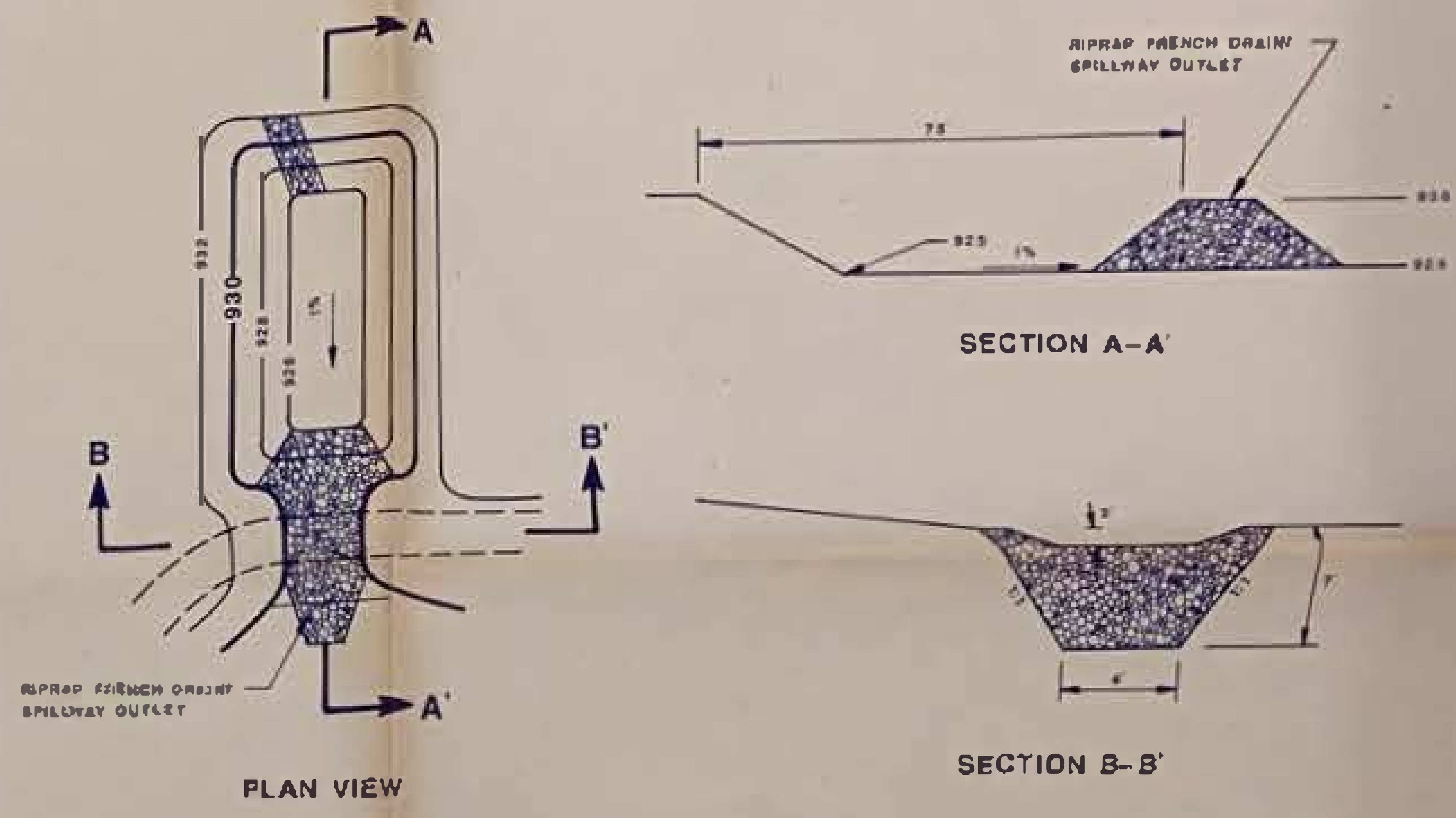
DIVERSION BERM DETAIL
(NOT TO SCALE)

(3/2)



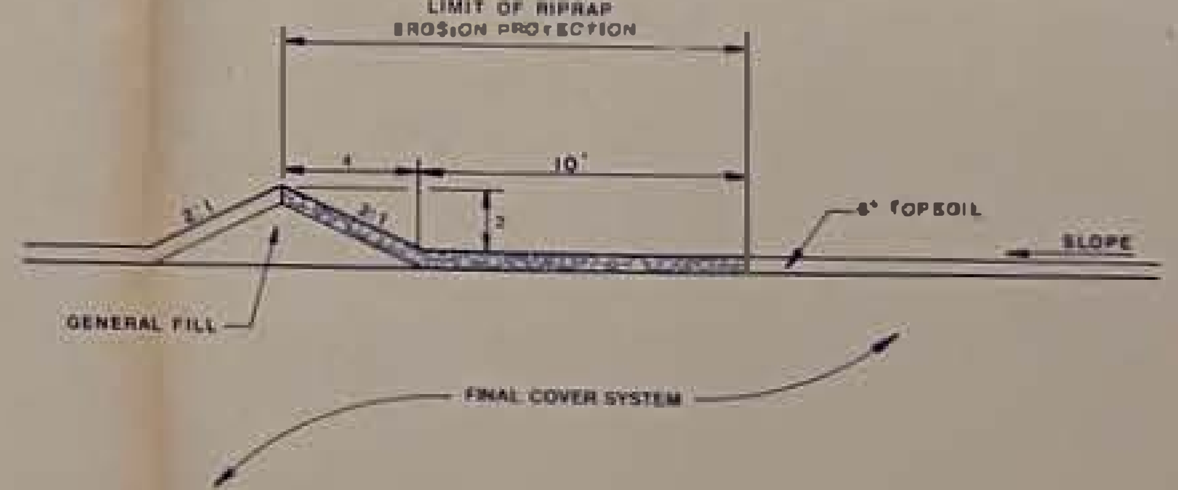
EASTERN PERIMETER DITCHING DETAIL
(NOT TO SCALE)

(4/2)



SEDIMENTATION BASIN DETAIL
(NOT TO SCALE)

(5/2)



SPILLWAY DETAIL
(NOT TO SCALE)

(6/2)

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NOT FOR CONSTRUCTION

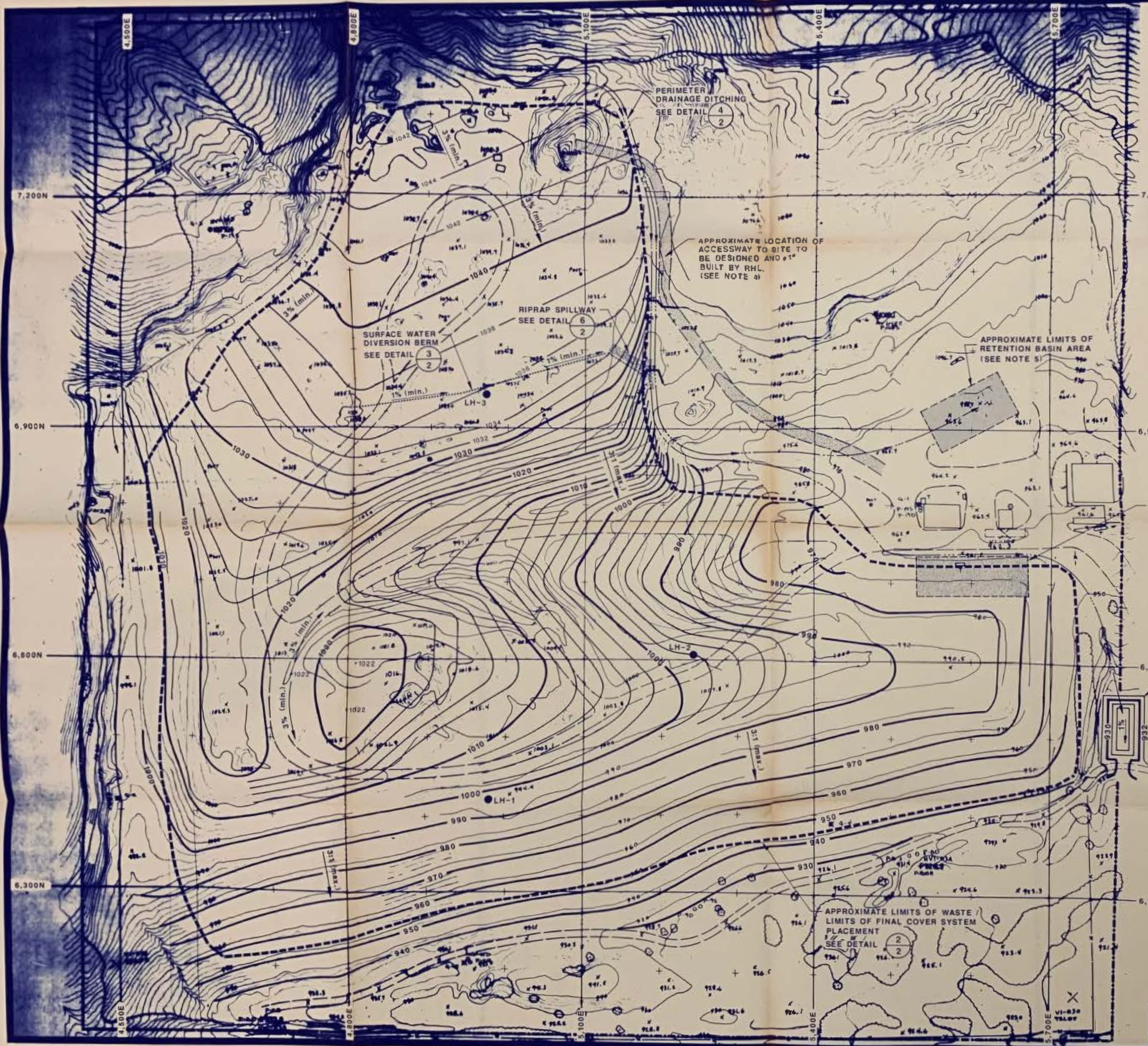
NO.	BY	DATE	REVISION	APPD.
3.				
2.				
1.				

PROJECT: REFUSE HIDEAWAY
SPECIAL CONSENT ORDER SOO-88-02A
SUBMITTAL

SHEET TITLE: DETAILS

DRAWN BY: GOB	SCALE: NO SCALE	PROJ. NO.
CHECKED BY:		DWG. NO.
APPROVED BY:	DATE PRINTED JUL 13 1988	SHEET
DATE: JULY, 1988		Figure 2

RMT INC.



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LEGEND

- APPROXIMATE PROPERTY LINE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING BUILDING
- EXISTING FENCE
- EXISTING 10 CONTOUR
- EXISTING 2 CONTOUR
- EXISTING SPOT ELEVATION
- TREES AND OR BRUSH
- EDGE OF WATER
- WET AREA
- APPROXIMATE LIMITS OF WASTE
- ENGINEERING MODIFICATION GRADE 10 CONTOUR
- ENGINEERING MODIFICATION GRADE 2 CONTOUR
- DETAIL 3 ON FIGURE 2
- DRAINAGE DITCH
- ACCESSWAY
- LH-1 LEACHATE HEAD WELL

NOTES

1. SITE LOCATION: SW1/4 OF THE NW1/4, SECTION 8, T7N, R8E, TOWN OF MIDDLETON, DANE COUNTY, WISCONSIN.
2. TOPOGRAPHIC MAP PREPARED BY ARNOLD AND O'SHERIDAN INC., MADISON, WI, FROM AERIAL SURVEY BY OWEN AYRES AND ASSOCIATES, EAU CLAIRE, WI. DATE OF PHOTOGRAPHY: MAY 5, 1988. TOPOGRAPHY IN SOUTH FILL AREA UPDATED BY GROUND SURVEY BY ARNOLD AND O'SHERIDAN INC., MAY 20, 1988.
3. VERTICAL DATUM IS USGS MEAN SEA LEVEL. CONTOUR INTERVAL IS 2 FEET.
4. ACCESSWAY TO SITE WILL BE DESIGNED AND BUILT BY REFUSE HIDEAWAY LANDFILL (RHL). LOCATION OF ROADWAY IS CONCEPTUAL ONLY. ACTUAL LOCATION WILL BE FINALIZED AS ROADWAY DESIGN IS DEVELOPED AND SITE CLOSURE DESIGN IS FINALIZED.
5. THE RETENTION BASIN AREA WILL BE CONSTRUCTED OVER AREAS OF SANDSTONE WHICH IN THE PAST HAVE DRAINED FREELY. THESE EXISTING LOW AREAS NORTH OF THE EXISTING STRUCTURES WILL BE USED BY RHL TO SHAPE THE BASIN.
6. CLOSURE OF THE SOUTH AND WEST SLOPE AREAS WILL CONSIST OF THE INITIAL REMOVAL OF APPROXIMATELY TWO FEET OF EXISTING SOIL AND THEN THE SUBSEQUENT PLACEMENT OF THE FINAL COVER SYSTEM (EXCLUDING THE GRADING LAYER). REMOVAL OF THE EXISTING SOIL ON THE TWO SLOPE AREAS WILL VARY IN VOLUME BASED ON WHAT IS REQUIRED FOR SITE CLOSURE. HOWEVER, IN ALL CASES, A MINIMUM DEPTH OF COVER OVER THE WASTE WILL BE SIX INCHES.
7. EXISTING DITCHING ON THE NORTH AND WEST SIDES OF THE SITE WILL REMAIN UNDISTURBED OR WILL BE UPGRADED BY REVEGETATION AS REQUIRED TO MINIMIZE SEDIMENT DEPOSITION DOWNSTREAM. TEMPORARY MEANS OF SEDIMENT CONTROL (I.E. SILT FENCING, HAY BALING ETC.) WILL BE USED TO CONTROL SEDIMENT UNTIL THESE AREAS HAVE BEEN STABILIZED.
8. THE EXISTING CULVERTS AT THE SEDIMENTATION BASIN MAY BE USED TO SUPPLEMENT OVER-FLOW CONTROL FOR THE SEDIMENTATION BASIN, IF THE IN-PLACE CULVERTS WORK WITH THE PROPOSED DESIGN.
9. RHL IS PREPARING THE NECESSARY ARRANGEMENTS WITH THE ADJACENT LAND OWNER FOR PERMISSION TO CONSTRUCT THE SEDIMENTATION BASIN. THE AREA IS PRESENTLY PART OF AN EXISTING EASEMENT CURRENTLY USED FOR ACCESS TO THE LANDFILL.

NO.	BY	DATE	REVISION	APP'D
1				
2				
3				

PROJECT: REFUSE HIDEAWAY
SPECIAL CONSENT ORDER SOD-88-02A
SUBMITTAL

SHEET TITLE: PROPOSED ACTUAL FINAL GRADE PLAN

DRAWN BY: PPD	SCALE: 1"=60'	PROJ. NO. 1181.08
CHECKED BY:		DWG. NO.
APPROVED BY:	DATE PRINTED: JUL 13 1988	SHEET OF
DATE: JULY, 1988		Figure 1

RMT

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1406 East Washington Avenue Suite 124 Madison, Wisconsin 53703 (608) 255-2134

PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
REFUSE HIDEAWAY LANDFILL	ECS	7/11/88	GAH	7/11/88	1181.05 208

SITE DRAINAGE ANALYSIS

INDEX

NOTE: TEMPORARY EROSION CONTROL MEASURES (ie. SILT FENCING, HAY BALES, etc.) WILL BE USED AS REQUIRED DURING CONSTRUCTION TO MINIMIZE AREAS OF SEDIMENT DEPOSITION. ALL AREAS WHERE SEDIMENT HAS ACCUMULATED WILL HAVE THE SEDIMENT REMOVED AND THE AREA RESTORED.

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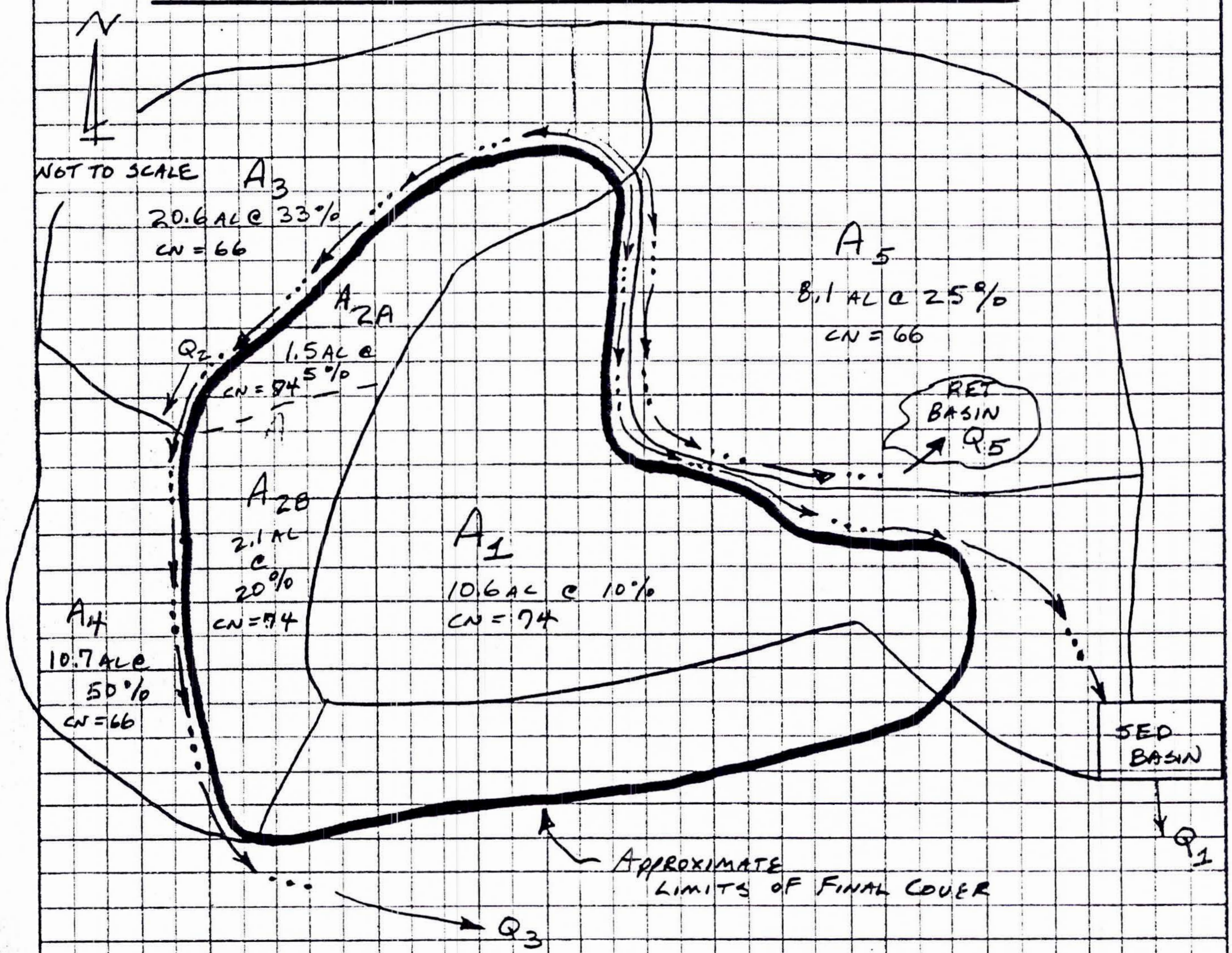
PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT / PROPOSAL NO.
REFUSE HIDEAWAY LANDFILL	By: ECS	Date: 7/8/88	By: GAT	Date: 7/11/88	1181.05

LANDFILL SITE WATERSHED SKETCH



NOTE: AREAS AND SLOPES FOR THE AREAS OUTSIDE THE APPROXIMATE LIMITS OF FINAL COVER were obtained FROM VALUES PREVIOUSLY SUBMITTED TO THE DEPARTMENT, MAY 7, 1987.

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REFUSE HIDEAWAY LANDFILL	By: ECS	Date: 2/8/88	By: GAT	Date: 7/4/88	1181.05

WATERSHED CHARACTERISTICS SUMMARY

WATERSHED	AREA (AC)	RUNOFF CURVE (See p 4 & 5)	Length of Longest Drainage Path (FT)	Ave. Weighted Slope Over Drainage Area (FT/FT)	
A_1	10.6 ✓	74 ✓	1,500 ✓	0.10 ✓	Q_1
$A_{2A} + A_3$	22.1 ✓	67 ✓	1,300 ✓	0.311 ✓	Q_2
$A'_{2A} + A_3 + A_{2B} + A_4$	34.9 ✓	67 ✓	2,100 ✓	0.362 ✓	Q_3
A_5	8.1 ✓	66 ✓	1,360 ✓	0.250 ✓	Q_5

ASSUMPTIONS FOR CALCULATING PEAK FLOW:

1. Hydropak Hydrograph method for determining runoff will be used.

2. SCS Type II 24 hour storm distribution will be used

3. 10 yr - 24 hr storm will be used (4.1 inches see p 6.)

APPENDIX B

SOIL SERIES AND HYDROLOGIC SOIL GROUPS

This appendix provides soil names and their hydrologic classification used in determining soil-cover complexes in chapter 2 of this technical release. The hydrologic parameter, A, B, C, or D, is an indicator of the minimum rate of infiltration obtained for a bare soil after prolonged wetting. By using the hydrologic classification and the associated land use, runoff curve numbers can be computed as shown in chapter 2.

The hydrologic soil groups, as defined by SCS soil scientists, are:

A. (Low runoff potential). Soils having a high infiltration rate even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels.

B. Soils having a moderate infiltration rate when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse texture.

C. Soils having a slow infiltration rate when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine texture.

D. (High runoff potential). Soils having a very slow infiltration rate when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material.

FROM: Urban Hydrology for Small Watersheds. [n.p.]: U.S. Department of Agriculture. Soil Conservation Service Engineering Division, (Technical Release No. 55). 1975, as revised 1981.

Table 2-2.--Runoff curve numbers for selected agricultural, suburban, and urban land use. (Antecedent moisture condition II, and $I_a = 0.2S$)

5/33

LAND USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land[1]: without conservation treatment	72	81	88	91
: with conservation treatment	62	71	78	81
Pasture or range land: poor condition	68	79	86	89
good condition	39	61	74	80
Meadow: good condition	30	58	71	78
Wood or Forest land: thin stand, poor cover, no mulch	45	66	77	83
good cover[2]	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.				
good condition: grass cover on 75% or more of the area	39	61	74	80
fair condition: grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious).	81	88	91	93
Residential:[3]				
Average lot size — Average % Impervious[4]				
1/8 acre or less — 65	77	85	90	92
1/4 acre — 38	61	75	83	87
1/3 acre — 30	57	72	81	86
1/2 acre — 25	54	70	80	85
1 acre — 20	51	68	79	84
Paved parking lots, roofs, driveways, etc.[5]	98	98	98	98
Streets and roads:				
paved with curbs and storm sewers[5]	98	98	98	98
gravel	76	85	89	91
dirt	72	82	87	89

NATURAL GROUND COVER AREAS

AREAS RECEIVING FINAL COVER

1/ For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.

2/ Good cover is protected from grazing and litter and brush cover soil.

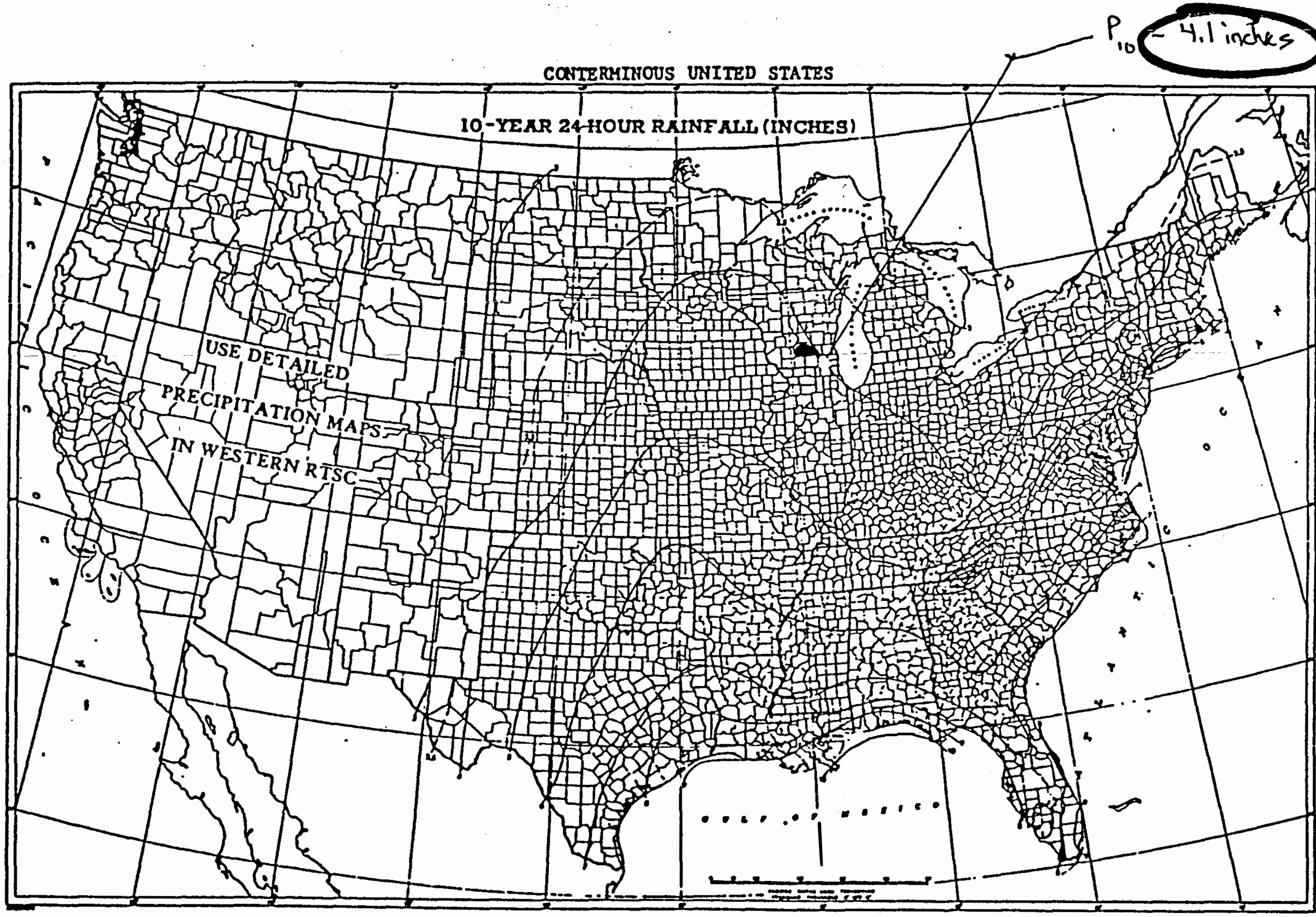
3/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

4/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

5/ In some warmer climates of the country a curve number of 95 may be used.

FROM: Urban Hydrology for Small Watersheds. [n.p.]: U.S. Department of Agriculture. Soil Conservation Service. Engineering Division, (Technical Release No. 55). 1975, as revised 1981.

C-2



Prepared by U. S. Weather Bureau

FROM: Urban Hydrology for Small Watersheds. [n.p.]: U.S. Department of Agriculture. Soil Conservation Service. Engineering Division, (Technical Release No. 55). 1975, as revised 1981.

6/33

F-360

7/33

SUMMARY SHEET FOR HYDROGRAPH INPUT DATA

RMT INC
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1406 East Washington Ave
Madison, WI 53703
Phone 608 255 2134

PREPARED BY:	DATE:	CHECKED BY:	DATE:
ECS	7/8/88	GAT	7/11/88

PROJECT NAME	PROJECT #
REFUSE HIDEAWAY	1181.05

Q1

DRAINAGE AREA (SQ MI)	0.0166
STORM DURATION (HOURS)	24
RUNOFF CURVE NUMBER	74
CURVE NUMBER METHOD USED TO COMPUTE TIME OF CONCENTRATION	
LENGTH OF LONGEST DRAINAGE PATH (FT)	1,500
AVERAGE WEIGHTED SLOPE OVER DRAINAGE AREA (FT/FT)	0.10
TYPE OF STORM	SCS TYPE II
RAINFALL (INCHES)	4.1

8/33

SCS Hydrograph Generation Program

REFUSE HIDEAWAY LANDFILL

DRAINAGE AREA = .0166 SQUARE MILES
TIME OF CONCENTRATION = .2767783 HOURS
RUNOFF CURVE NUMBER = 74
STORM DURATION = 24 HOURS
SCS TYPE 2 STORM
RAINFALL = 4.1 INCHES
RUNOFF = 1.67 INCHES = 1.48 ACRE FEET

VOLUME ADJUSTMENT FACTOR = 1.00

*** MAXIMUM FLOW = 20.14 CFS AT 12.0 HOURS ***

Q1

TIME (HOURS)	CUM. RAINFALL (INCHES)	CUM. RUNOFF (INCHES)	FLOW (CFS)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.09	0.00	0.00
3.00	0.14	0.00	0.00
4.00	0.20	0.00	0.00
5.00	0.26	0.00	0.00
6.00	0.33	0.00	0.00
7.00	0.41	0.00	0.00
8.00	0.49	0.00	0.00
9.00	0.60	0.00	0.00
10.00	0.74	0.00	0.01
11.00	0.96	0.02	0.31
12.00	2.72	0.73	20.14
13.00	3.17	1.01	2.02
14.00	3.36	1.15	1.20
15.00	3.50	1.24	0.94
16.00	3.61	1.32	0.74
17.00	3.70	1.38	0.65
18.00	3.78	1.43	0.58
19.00	3.84	1.48	0.50
20.00	3.90	1.53	0.43
21.00	3.96	1.56	0.40
22.00	4.01	1.60	0.39
23.00	4.05	1.64	0.37
24.00	4.10	1.67	0.36

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PREPARED BY:	DATE:	CHECKED BY:	DATE:
SCS	7/11/88	GAT	7/11/88

PROJECT NAME	PROJECT #
REFUSE HIDEAWAY	1181.05

Q2

DRAINAGE AREA (SQ MI)	0.0345 ✓
STORM DURATION (HOURS)	24
RUNOFF CURVE NUMBER	67
CURVE NUMBER METHOD USED TO COMPUTE TIME OF CONCENTRATION	
LENGTH OF LONGEST DRAINAGE PATH (FT)	1,300
AVERAGE WEIGHTED SLOPE OVER DRAINAGE AREA (FT/FT)	0.311
TYPE OF STORM	SCS TYPE II
RAINFALL (INCHES)	4.1

SCS Hydrograph Generation Program

10/33

REFUSE HIDEAWAY LANDFILL

DRAINAGE AREA = .0345 SQUARE MILES
TIME OF CONCENTRATION = .1693457 HOURS
RUNOFF CURVE NUMBER = 67
STORM DURATION = 24 HOURS
SCS TYPE 2 STORM
RAINFALL = 4.1 INCHES
RUNOFF = 1.21 INCHES = 2.22 ACRE FEET

VOLUME ADJUSTMENT FACTOR = 1.00

*** MAXIMUM FLOW = 35.75 CFS AT 12.0 HOURS ***

Q_2

TIME (HOURS)	CUM. RAINFALL (INCHES)	CUM. RUNOFF (INCHES)	FLOW (CFS)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.09	0.00	0.00
3.00	0.14	0.00	0.00
4.00	0.20	0.00	0.00
5.00	0.26	0.00	0.00
6.00	0.33	0.00	0.00
7.00	0.41	0.00	0.00
8.00	0.49	0.00	0.00
9.00	0.60	0.00	0.00
10.00	0.74	0.00	0.00
11.00	0.96	0.00	0.00
12.00	2.72	0.45	35.75
13.00	3.17	0.67	3.14
14.00	3.36	0.77	1.95
15.00	3.50	0.85	1.58
16.00	3.61	0.91	1.25
17.00	3.70	0.96	1.11
18.00	3.78	1.01	0.99
19.00	3.84	1.05	0.87
20.00	3.90	1.09	0.74
21.00	3.96	1.12	0.70
22.00	4.01	1.15	0.68
23.00	4.05	1.18	0.66
24.00	4.10	1.21	0.63

11/33

SUMMARY SHEET FOR HYDROGRAPH INPUT DATA

RMT INC

Suite 124
1406 East Washington Ave
Madison, WI 53703
Phone. 608 255 2134

PREPARED BY:	DATE:	CHECKED BY:	DATE:
ECS	7-8-88	GAT	7/11/88

PROJECT NAME	PROJECT #
REFUSE HIDEAWAY	1186.05

Q3

DRAINAGE AREA (SQ MI)	0.0545
STORM DURATION (HOURS)	24
RUNOFF CURVE NUMBER	67
CURVE NUMBER METHOD USED TO COMPUTE TIME OF CONCENTRATION	
LENGTH OF LONGEST DRAINAGE PATH (FT)	2,100
AVERAGE WEIGHTED SLOPE OVER DRAINAGE AREA (FT/FT)	0.362
TYPE OF STORM	SCS type II
RAINFALL (INCHES)	4.1

SCS Hydrograph Generation Program

12/3.

REFUSE HIDEAWAY LANDFILL

DRAINAGE AREA = .0545 SQUARE MILES
TIME OF CONCENTRATION = .2303673 HOURS
RUNOFF CURVE NUMBER = 67
STORM DURATION = 24 HOURS
SCS TYPE 2 STORM
RAINFALL = 4.1 INCHES
RUNOFF = 1.21 INCHES = 3.51 ACRE FEET

VOLUME ADJUSTMENT FACTOR = 1.00

*** MAXIMUM FLOW = . 51.48 CFS AT 12.0 HOURS *** Q3

TIME (HOURS)	CUM. RAINFALL (INCHES)	CUM. RUNOFF (INCHES)	FLOW (CFS)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.09	0.00	0.00
3.00	0.14	0.00	0.00
4.00	0.20	0.00	0.00
5.00	0.26	0.00	0.00
6.00	0.33	0.00	0.00
7.00	0.41	0.00	0.00
8.00	0.49	0.00	0.00
9.00	0.60	0.00	0.00
10.00	0.74	0.00	0.00
11.00	0.96	0.00	0.00
12.00	2.72	0.45	51.48
13.00	3.17	0.67	5.14
14.00	3.36	0.77	3.15
15.00	3.50	0.85	2.52
16.00	3.61	0.91	2.00
17.00	3.70	0.96	1.77
18.00	3.78	1.01	1.58
19.00	3.84	1.05	1.38
20.00	3.90	1.09	1.18
21.00	3.96	1.12	1.11
22.00	4.01	1.15	1.08
23.00	4.05	1.18	1.04
24.00	4.10	1.21	1.00

13/33

SUMMARY SHEET FOR HYDROGRAPH INPUT DATA

RMT INC
Suite 124
1406 East Washington Ave
Madison, WI 53703
Phone. 608 255 2134

PREPARED BY:	DATE:	CHECKED BY:	DATE:
SCS	7/8/88	GAT	7/11/88

PROJECT NAME	PROJECT #
REFUSE HIDEAWAY	181.05

Q5

DRAINAGE AREA (SQ MI)	0.0127 ✓
STORM DURATION (HOURS)	24
RUNOFF CURVE NUMBER	66
CURVE NUMBER METHOD USED TO COMPUTE TIME OF CONCENTRATION	
LENGTH OF LONGEST DRAINAGE PATH (FT)	1,360
AVERAGE WEIGHTED SLOPE OVER DRAINAGE AREA (FT/FT)	0.250
TYPE OF STORM	SCS TYPE II
RAINFALL (INCHES)	4.1

SCS Hydrograph Generation Program

14/33

REFUSE HIDEAWAY LANDFILL

DRAINAGE AREA = .0127 SQUARE MILES
TIME OF CONCENTRATION = .2010237 HOURS
RUNOFF CURVE NUMBER = 66
STORM DURATION = 24 HOURS
SCS TYPE 2 STORM
RAINFALL = 4.1 INCHES
RUNOFF = 1.15 INCHES = 0.78 ACRE FEET

VOLUME ADJUSTMENT FACTOR = 0.97

*** MAXIMUM FLOW = 11.83 CFS AT 12.0 HOURS *** Q5

TIME (HOURS)	CUM. RAINFALL (INCHES)	CUM. RUNOFF (INCHES)	FLOW (CFS)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.09	0.00	0.00
3.00	0.14	0.00	0.00
4.00	0.20	0.00	0.00
5.00	0.26	0.00	0.00
6.00	0.33	0.00	0.00
7.00	0.41	0.00	0.00
8.00	0.49	0.00	0.00
9.00	0.60	0.00	0.00
10.00	0.74	0.00	0.00
11.00	0.96	0.00	0.00
12.00	2.72	0.42	11.83
13.00	3.17	0.63	1.12
14.00	3.36	0.73	0.69
15.00	3.50	0.80	0.56
16.00	3.61	0.86	0.44
17.00	3.70	0.91	0.39
18.00	3.78	0.95	0.35
19.00	3.84	0.99	0.31
20.00	3.90	1.03	0.26
21.00	3.96	1.06	0.25
22.00	4.01	1.09	0.24
23.00	4.05	1.12	0.23
24.00	4.10	1.15	0.23

COMPUTATION SHEET

RMT INC.
1406 East Washington Avenue Suite 124 Madison, Wisconsin 53703 (608) 255-2134

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
REFUSE HIDEAWAY LANDFILL	By: ELS	Date: 7/6/88	By: GAT	Date: 7/11/88	1181.05

EXISTING SEDIMENTATION BASIN EVALUATION:

EXISTING BASIN DATA: (see EXISTING BASIN TOPO BELOW)

$Q_{DESIGN} = Q_1 = 20.1$ CFS (PAGE 8) ✓

REQUIRED SIZING = (20.1)(145) = 2914.5 SF (say 3,000 SF) ✓

(see p 17 FOR ASSUMPTIONS)

PROPOSED DESIGN:

TOP OF BERM ELEV = 932.0

OUTLET ELEV = 930.0

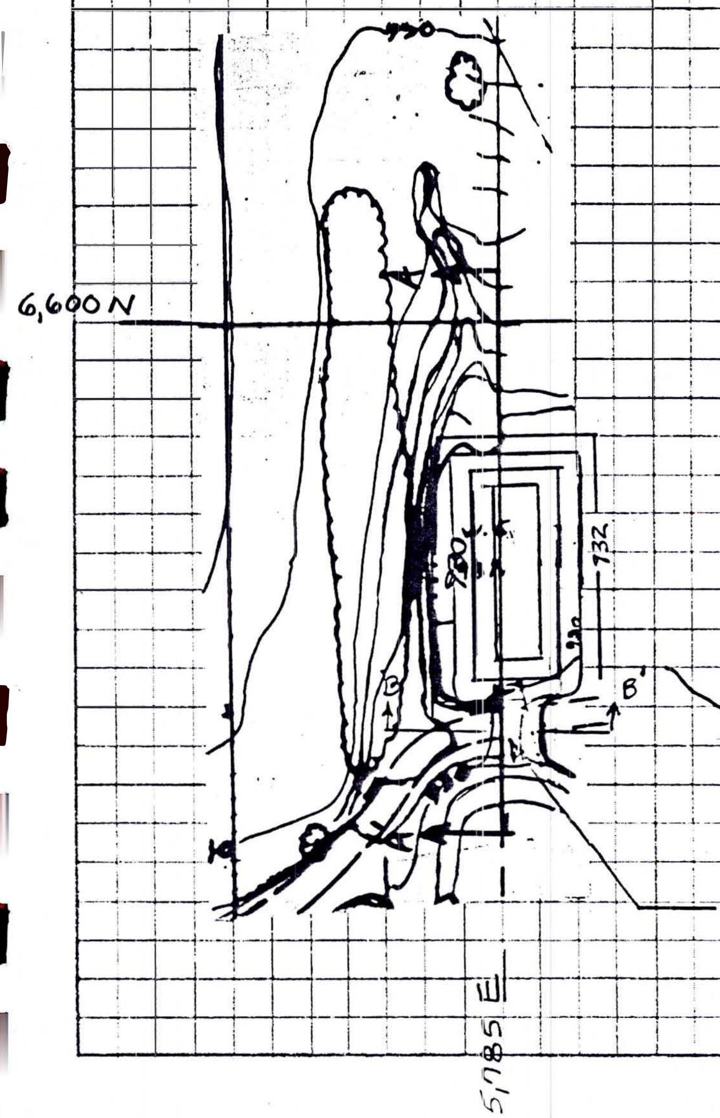
Basin Dimensions:

WIDTH = 40 FT

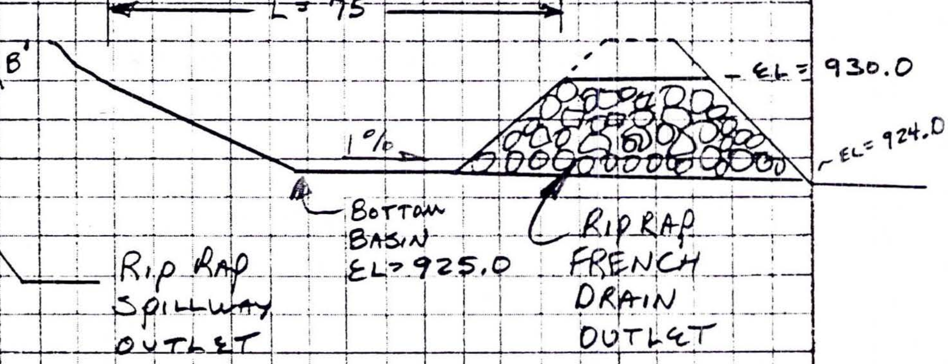
Length = 75 FT

BASE OF BASIN ELEV = 925.0

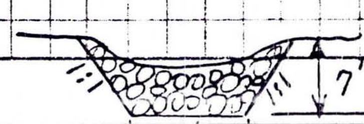
EXISTING BASIN



SECTION A-A'



SECTION B-B'



COMPUTATION SHEET

RMT INC.

1406 East Washington Avenue Suite 124 Madison, Wisconsin 53703 (608) 255-2134

PROJECT / PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
Refuse Hideaway	By: GAT	Date: 7/8/88	By: ECS	Date: 7-11-88	1181.05

Retention Basin Design

Design Flow = 11.83 cfs (See Q_5 Sheet 14) ✓

Design Vol = .78 acre ft = 1260 cy ✓

Surface Area Required : A_s

A_s = 12 cfs (145 SF / cfs) = 1740

L = 60'
W = 30'
(Reccomended : L = 2W)

Vol required = 1260 cy (27 ft³ / cy) = 34020 ft³

Using above A_s depth of basin =

34020 ft³ · 1 / 1740 SF = 19.5' too deep ✓ ✓

Adjust surface Area to give a 5' basin depth

choose 5' depth based on topography

34020 ft³ / 5' deep = 6800 SF = A_s

L = 110' ✓
W = 60' ✓

Proposed design: Basin will be constructed over fractured sandstone - naturally recharging the ground water. No discharge spillway, etc is required. The basin will be shaped to match existing topography attempting to provide the required basin dimensions.

ASSUMPTIONS USED FOR SEDIMENTATION BASIN SIZING

1. The particle settled out is fine sand with a diameter of 40 microns and a settling velocity of 0.21 cm/sec. Figures were taken from Table 23 of APWA, Practices in Detention of Urban Stormwater Runoff, page 116.

2. The pond outflow rate is equal to the estimated peak runoff from the drainage basin.

3. The particle settling velocity is equal to the upflow velocity under the assumed "ideal" conditions.

4. The minimum required surface area for a flow of 1 cfs is equal to 145 square feet.

$$A = \frac{Q}{V_o} = \frac{Q\ max}{V_s}$$

$$A = \frac{1\ cfs}{0.21\ cm/s}$$

$$A = 145\ sf/cfs$$

Q = pond outflow rate
Q_{max} = estimated peak runoff
V_o = upflow velocity
V_s = particle settling velocity
A = minimum required surface area

5. Basin area is shaped to have a length to width ratio of at least 2:1 because this minimizes the "short circuiting" sediment-laden inflow to riser.

6. The depth of the pond is usually assumed to be 5 feet because the sediment generation rate does not warrant a large sediment storage capacity. In addition, deepening a pond has no effect on trapping efficiencies.

COMPUTATION SHEET

RMT INC.
1406 East Washington Avenue Suite 124 Madison, Wisconsin 53703 (608) 255-2134

PROJECT / PROPOSAL NAME	PREPARED	CHECKED	PROJECT/PROPOSAL NO.
REFUSE HIDEAWAY LF	By: ECS Date: 7/8/88 GAT 7/11/88	By: ECS Date: 7-11-88	1181.05

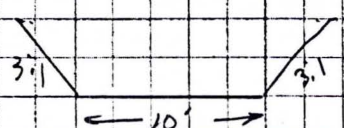
DITCH VELOCITY EROSION CONTROL REQUIREMENTS:

Determine Erosion Control for Ditching in each Area

Assumptions:

1. Use peak flow from Area as design flow for the downstream half of the ditch and assume a peak flow for the upstream half of the ditch. (Realistically, the upstream portion will not be subjected to the estimated peak flow).

2. The ditch design is assumed to be as shown below:



3. Manning coefficient of roughness is assumed to be .03 in all ditches; (except where noted) normal vegetated channel (See page 19).

Q₁

Downstream

Q_1 = 20.1 cfs @ 25% (near sed basin inlet) V = 8.6 fps (see p. 20)
@ 1% V = 3.1 fps (see p 21)
@ 10% V = 6.5 fps (see p 22)

Upstream

Q_1 = 15 cfs @ 25% V = 7.7 fps (see p 23)
@ 3% V = 4.0 fps (see p 24)

Q_2

Downstream

Q_2 = 36 cfs @ 15% V = 9.1 fps (see p 25)
@ 3% V = 5.4 fps (see p 26)

Upstream

Q_2 = 20 cfs @ 1% V = 3.1 fps (see p 27)

COMPUTATION SHEET

RMT INC.
1406 East Washington Avenue Suite 124 Madison, Wisconsin 53703 (608) 255-2134

PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
Refuse Hideaway	GAT	7/11/88	ECS	7/11/88	1181.05

Q_3

Downstream

Q_3 = 51.48 cfs @ 25% V = 10 fps (see p. 28) (existing drainage swale; use n = .04)

@ 10% (discharge pt) V = 4.2 fps (see p 29)

@ 2.6% (existing drainage swale; use n = .04) V = 4.7 fps (see p 30)

Q_5

Downstream

Q_5 = 11.83 cfs @ 1% (most of runoff is sheetflow to basin) V = 2.5 fps (see p 31)

Upstream

Q_5 = 6 cfs @ 18% V = 5.0 fps (see p 32)

@ 3% V = 2.8 fps (see p 33)

Erosion Control Requirements (Refer to attached Computer printouts for ditch vel. etc.)

Q_1 : Use light riprap or an erosion control fabric (Enkamat) at the inlet to the basin.

Ditch slopes which reach 10% may require erosion control fabric. Construct ditches with less than 10% slope.

Q_2 : Use an erosion control fabric along the 25% slope at the discharge into existing drainage swale which leads to Q_3 discharge

Q_3 : Use light riprap or erosion control fabric along the existing drainage swale at the Southwest corner of the site. Velocities range from 7 - 12 fps.

Q_5 : No erosion control necessary

NOTE: CERTAIN AREAS OF DITCH CONSTRUCTION, WHERE EXPOSED ROCK IS ENCOUNTERED, WILL NOT BE TOPSOILED AND SEEDED. THESE AREAS WILL BE LEFT AND THE EXPOSED ROCK USED TO CONTROL EROSION.

18A/33

d) 49 x 1.08 = 53 cfs/inch runoff (Page E-2)

e) 10 year/24 hour storm = 1.76" runoff ✓

(Page 2-3)

53 cfs/inch runoff x 1.76" = 93 cfs

7) Runoff Velocities (based on road ditch slope for road ditch; culvert slope for culvert, etc.)

a) [redacted] this table is based on the fact that you have "D" retardance.

To us this means for a new channel that:

If V is 0-2.9	seed and mulch (punched into soil)*
3-4.9	seed and mulch and jute netting or excelsion blankets
5-7.0	sod**
over 7.0	need mechanical controls

* Can use 6' long sod strips covering the total cross-section at 25' intervals to reduce erosion. However, these are only considered effective up to 2% slopes.

** If sod is used, we need establishment and maintenance plan.

b) We check your velocity according to TP-61.

1. Choose proper chart from pages 14-22; determine hydraulic radius

2. Go to page 29:

   a) find proper hydraulic radius
   b) use proper slope
   c) determine "n"
   d) find what V is

EXAMPLE: Data submitted for triangular channel with 3:1 ss, 0.94' deep, 5% road ditch slope

From Fig. 10 - H-R = .43
From Fig. 17 - (retardance D) - n = .048
From Fig. 17 - V = 4fps

Appendix 6.2C

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT *n* (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150

Normal Vegetated Channel

Vegetated with high dense weeds

DRAFT

OPEN-CHANNEL HYDRAULICS
VEN TE CHOW, PH.D.
1959

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	25.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.22

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	2.35
HYDRAULIC RADIUS (FT), R =	0.21
VELOCITY (FPS), V =	8.64
FLOW (CFS), Q =	20.25

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	1.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.57

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	6.67
HYDRAULIC RADIUS (FT), R =	0.49
VELOCITY (FPS), V =	3.08
FLOW (CFS), Q =	20.57

22/33

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	10.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.29

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	3.15
HYDRAULIC RADIUS (FT), R =	0.27
VELOCITY (FPS), V =	6.48
FLOW (CFS), Q =	20.44

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	25.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.19

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	1.95
HYDRAULIC RADIUS (FT), R =	0.17
VELOCITY (FPS), V =	7.74
FLOW (CFS), Q =	15.12

24/33

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	3.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.35

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	3.81
HYDRAULIC RADIUS (FT), R =	0.31
VELOCITY (FPS), V =	3.95
FLOW (CFS), Q =	15.04

25/33

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) = 10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H = 3.00

COEFFICIENT OF ROUGHNESS (ft^1/6), n = 0.030

SLOPE OF DITCH/SPILLWAY (%) = 15.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D = 0.36

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) = 3.99
HYDRAULIC RADIUS (FT), R = 0.32

VELOCITY (FPS), V = 9.07
FLOW (CFS), Q = 36.17

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	3.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.58

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	6.76
HYDRAULIC RADIUS (FT), R =	0.50
VELOCITY (FPS), V =	5.37
FLOW (CFS), Q =	36.27

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	1.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.56

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	6.54
HYDRAULIC RADIUS (FT), R =	0.48
VELOCITY (FPS), V =	3.05
FLOW (CFS), Q =	19.94

28/33

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.040
SLOPE OF DITCH/SPILLWAY (%) =	25.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.45

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	5.11
HYDRAULIC RADIUS (FT), R =	0.40
VELOCITY (FPS), V =	10.04
FLOW (CFS), Q =	51.30

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) = 10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H = 3.00

COEFFICIENT OF ROUGHNESS (ft^1/6), n = 0.030

SLOPE OF DITCH/SPILLWAY (%) = 1.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D = 0.96

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) = 12.36
HYDRAULIC RADIUS (FT), R = 0.77

VELOCITY (FPS), V = 4.16
FLOW (CFS), Q = 51.42

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.040
SLOPE OF DITCH/SPILLWAY (%) =	2.60

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.86

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	10.82
HYDRAULIC RADIUS (FT), R =	0.70
VELOCITY (FPS), V =	4.73
FLOW (CFS), Q =	51.13

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	1.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.41

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	4.60
HYDRAULIC RADIUS (FT), R =	0.37
VELOCITY (FPS), V =	2.53
FLOW (CFS), Q =	11.66

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	18.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.12

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	1.24
HYDRAULIC RADIUS (FT), R =	0.12
VELOCITY (FPS), V =	4.99
FLOW (CFS), Q =	6.20

ECS 5/85

<<<< MANNING'S EQUATION FOR USE IN DITCH AND SPILLWAY DESIGN >>>>

DATE: 09-Jul-88
USER NAME: GAT
PROJECT NAME: REFUSE HIDEAWAY
PROJECT #: 1181.05

<<< INPUT KNOWN/SELECTED VARIABLES >>>

BOTTOM WIDTH OF DITCH/SPILLWAY (FT) =	10.00
SIDESLOPE OF DITCH/SPILLWAY (H:1), H =	3.00
COEFFICIENT OF ROUGHNESS (ft^1/6), n =	0.030
SLOPE OF DITCH/SPILLWAY (%) =	3.00

<<< INPUT SELECTED VARIABLES >>>

ASSUMED FLOW DEPTH IN DITCH/SPILLWAY (FT), D =	0.20

<<< CALCULATED VALUES >>>

AREA OF FLOW (SF) =	2.12
HYDRAULIC RADIUS (FT), R =	0.19
VELOCITY (FPS), V =	2.82
FLOW (CFS), Q =	5.97