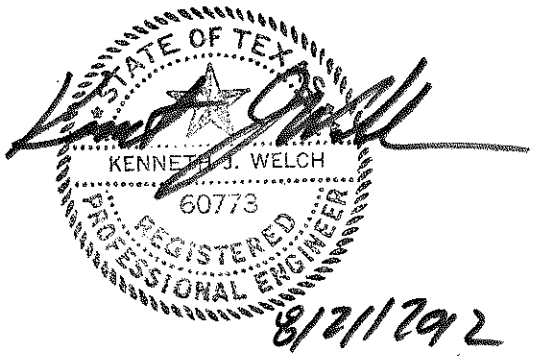
SKYLINE LANDFILL

ATTACHMENT C1

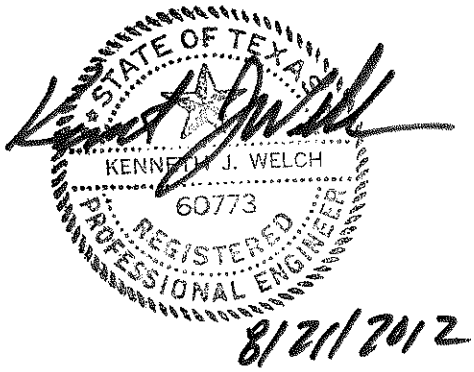
APPENDIX C1-C

POSTDEVELOPMENT HYDROLOGIC CALCULATIONS

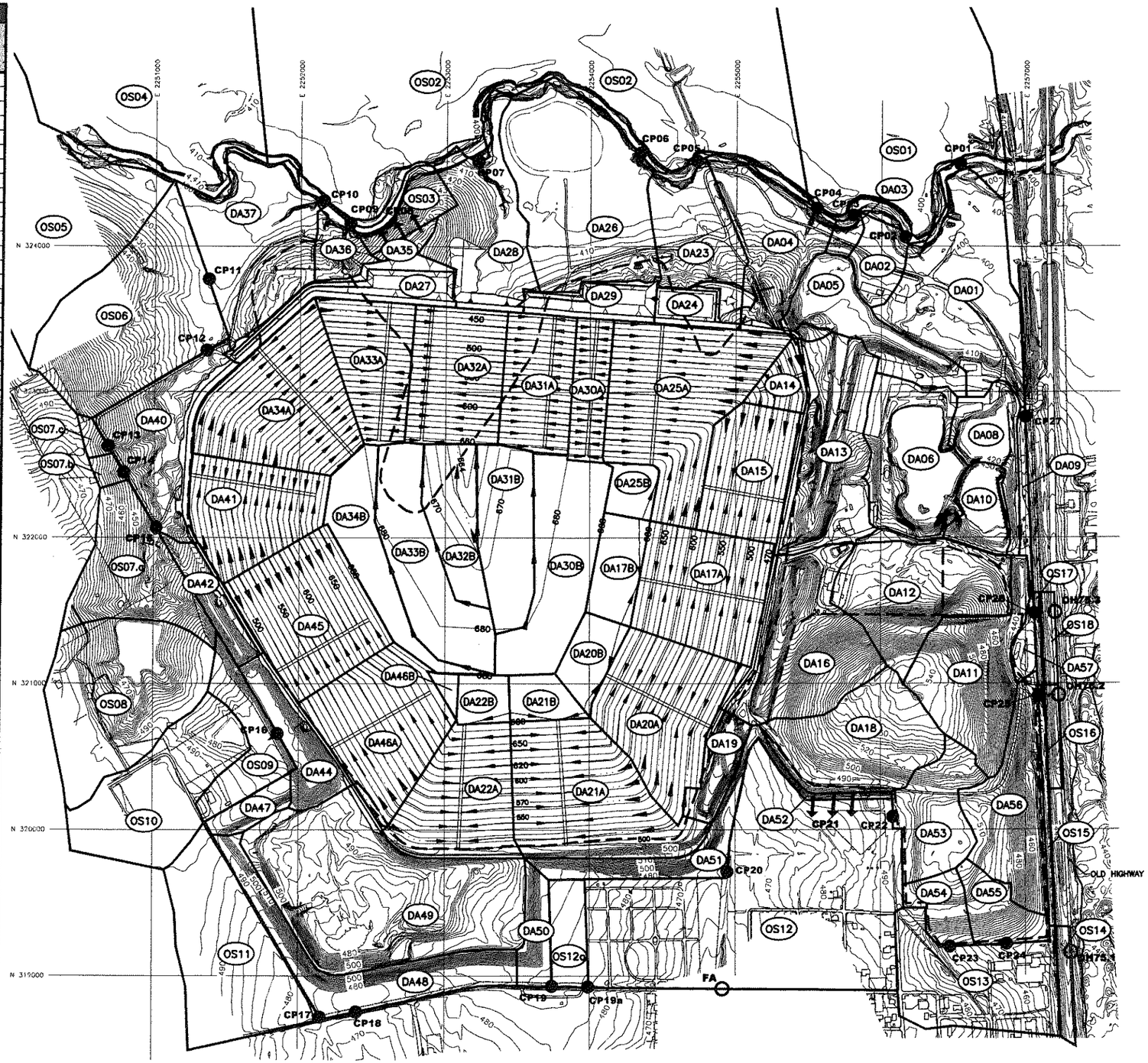


Includes pages C1-C-1 through C1-C-143

CONTENTS



POSTDEVELOPED DRAINAGE AREAS			
WATERSHED NAME	AREA (ac)	25-YEAR FLOW RATE (cfs)	25-YEAR VOLUME (ac-ft)
DA1	21.7	66.1	11.1
DA2	4.0	15.4	1.9
DA3	1.2	5.4	0.6
DA4	12.4	46.9	6.0
DA5	10.3	40.9	5.5
DA6	14.3	63.2	7.6
DA7	0.7	2.5	0.3
DA8	6.4	21.2	3.3
DA9	1.7	5.3	0.8
DA10	4.7	23.5	2.6
DA11	14.5	49.8	7.0
DA12	16.4	61.3	7.9
DA13	17.3	55.5	8.3
DA14	2.8	13.7	1.4
DA15	11.6	54.6	5.9
DA16	18.5	68.0	8.9
DA17.A	16.0	72.4	8.2
DA17.B	5.3	17.0	2.6
DA18	15.4	51.4	7.4
DA19	4.1	14.3	2.0
DA20.A	17.2	77.0	8.8
DA20.B	4.2	13.5	2.1
DA21.A	20.9	91.8	10.7
DA21.B	3.2	10.5	1.6
DA22.A	14.4	63.7	7.4
DA22.B	2.7	8.8	1.3
DA23	11.2	38.8	5.4
DA24	2.8	13.4	1.5
DA25.A	23.6	101.3	12.1
DA25.B	2.7	8.3	1.3
DA26	26.6	80.0	60.0
DA27	7.4	20.5	3.8
DA28	14.8	49.6	7.1
DA29	4.7	12.9	2.5
DA30.A	5.6	27.1	2.9
DA30.B	15.6	40.6	7.7
DA31.A	10.5	48.2	5.4
DA31.B	10.4	28.8	5.1
DA32.A	13.7	62.7	7.0
DA32.B	8.1	23.6	4.0
DA33.A	10.8	50.0	5.5
DA33.B	13.8	33.3	6.8
DA34.A	19.5	89.4	10.0
DA34.B	9.0	22.2	4.4
DA35	1.2	5.5	0.6
DA36	3.3	15.0	1.6
DA37	18.3	53.1	8.8
DA40	13.6	39.0	6.6
DA41	13.4	60.5	6.8
DA42	4.4	15.8	2.1
DA44	6.8	16.4	3.5
DA45	17.5	73.9	8.9
DA46.A	16.6	74.6	8.5
DA46.B	0.8	3.2	0.4
DA47	2.6	9.4	1.3
DA48	12.6	37.4	6.1
DA49	34.8	102.9	16.8
DA50	3.5	14.6	1.7
DA51	7.1	23.2	3.4
DA52	0.7	2.7	0.3
DA53	9.0	29.6	4.4
DA54	3.8	15.1	1.8
DA55	4.8	18.6	2.3
DA56	12.7	41.3	6.1
DA57	1.5	5.1	0.7
OS12a	4.3	13.0	2.1



0 400 800
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LANDFILL FOOTPRINT
- 460 EXISTING 10' GROUND CONTOUR
- 500 PROPOSED 10' FINAL COVER CONTOUR
- DRAINAGE AREA BOUNDARY
- DRAINAGE AREA REACH
- DA18 DRAINAGE AREA DESIGNATION
- COMPARISON POINT-POINT DISCHARGE
- COMPARISON POINT-SHEET FLOW (NON-POINT DISCHARGE)
- OTHER COMPARISON POINT

NOTES:

1. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY. FLOWN MARCH 6, 2011. COORDINATE SYSTEM IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.
2. CONTOURS WITHIN THE LANDFILL FOOTPRINT DEPICT POSTDEVELOPED FINAL CONTOURS.
3. DRAINAGE AREA BOUNDARY NOT SHOWN WHERE COINCIDENTAL WITH PERMIT BOUNDARY.

STATE OF TEXAS
KENNETH J. WELCH
60773
REGISTERED
PROFESSIONAL ENGINEER
8/21/2012

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REVISIONS						
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	08/12	NOD NO. 1 RESPONSE	BBB	FAW	FAW	KJW

POSTDEVELOPED DRAINAGE AREA SUMMARY

WASTE MANAGEMENT OF TEXAS, INC. SKYLINE LANDFILL MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256 TBPG FIRM NO. 50222

DSN. FAW DATE : 04/12
DWN. BBB SCALE : GRAPHIC
CHK. KJW DWG : C1_C_1.dwg

DRAWING C1-C-1

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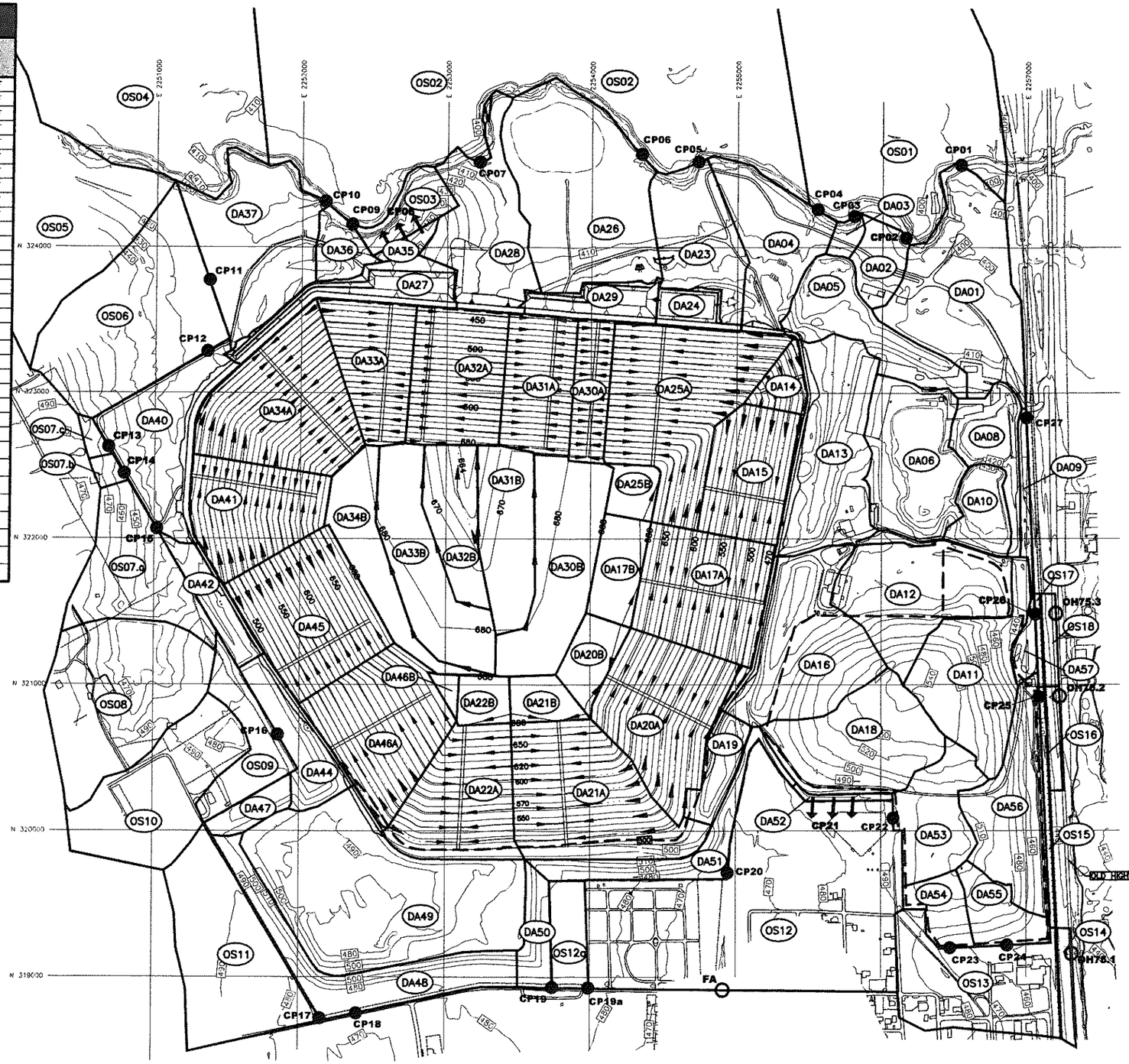
POSTDEVELOPED BOUNDARY ANALYSIS SUMMARY				
BOUNDARY COMPARISON POINT	25-YEAR FLOW RATE (cfs)	25-YEAR VOLUME (ac-ft)	25-YEAR VELOCITY (fps)	TYPE OF FLOW
CP01	66.1	11.1	2.32	RUNOFF
CP02	15.4	1.9	2.46	RUNOFF
CP03	5.4	0.6	1.00	RUNOFF
CP04	465.4	96.7	19.35	RUNOFF
CP05	93.7	20.1	2.02	RUNOFF
CP06	80.0	13.6	1.25	RUNOFF
CP07	204.6	71.9	9.90	RUNOFF
CP08	5.4	0.6	1.62	RUNOFF
CP09	15.0	1.6	8.53	RUNOFF
CP10	278.9	82.9	16.33	RUNOFF
CP11	249.2	74.1	2.79	RUNON
CP12	187.6	61.7	4.39	RUNOFF
CP13	4.2	0.4	3.00	RUNON
CP14	4.2	0.4	2.83	RUNON
CP15	45.2	11.3	2.88	RUNON
CP16	129.3	11.4	13.33	RUNON
CP17	113.0	9.5	9.60	RUNOFF
CP18	124.8	32.4	4.88	RUNOFF
CP19	14.6	1.7	3.36	RUNOFF
CP19a	25.5	3.8	4.11	RUNOFF
CP20	23.2	3.4	1.77	RUNOFF
CP21	2.7	0.3	1.32	RUNOFF
CP22	29.6	5.8	1.09	RUNOFF
CP23	15.1	1.8	4.44	RUNOFF
CP24	18.6	2.3	6.00	RUNOFF
CP25	41.3	6.1	7.96	RUNOFF
CP26	5.1	0.7	2.44	RUNOFF
CP27	0.0	0.0	0.0	RUNOFF
OTHER COMPARISON POINTS				
FA	323.5	37.8		RUNOFF
OH75.1	68.3	11.9		RUNOFF
OH75.2	53.1	8.1		RUNOFF
OH75.3	24.0	2.1		RUNOFF



0 400 800
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL FOOTPRINT
- 460 EXISTING 10' GROUND CONTOUR
- 500 PROPOSED 10' FINAL COVER CONTOUR
- DRAINAGE AREA BOUNDARY
- DRAINAGE AREA REACH
- DA18 DRAINAGE AREA DESIGNATION
- COMPARISON POINT-POINT DISCHARGE
- COMPARISON POINT-SHEET FLOW (NON-POINT DISCHARGE)
- OTHER COMPARISON POINT

NOTES:

1. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY. FLOWN MARCH 6, 2011. COORDINATE SYSTEM IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.
2. CONTOURS WITHIN THE LANDFILL FOOTPRINT DEPICT POSTDEVELOPED FINAL CONTOURS.
3. DRAINAGE AREA BOUNDARY NOT SHOWN WHERE COINCIDENTAL WITH PERMIT BOUNDARY.
4. DRAINAGE AREAS CONTRIBUTING TO EACH COMPARISON POINT ARE LISTED ON THE TABLE ON PAGE C1-12.

STATE OF TEXAS
KENNETH J. WELCH
60773
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PROFESSIONAL ENGINEER
8/21/2012

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REVISIONS							
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY	
1	08/12	NOD NO. 1 RESPONSE	BBB	FAW	FAW	KJW	

POSTDEVELOPED BOUNDARY ANALYSIS SUMMARY

WASTE MANAGEMENT OF TEXAS, INC. SKYLINE LANDFILL MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144
TBPE FIRM NO. F-256 TBPG FIRM NO. 50222

DSN. FAW	DATE : 04/12	DRAWING	
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CHK. KJW	DWG : C1_C_2.dwg		

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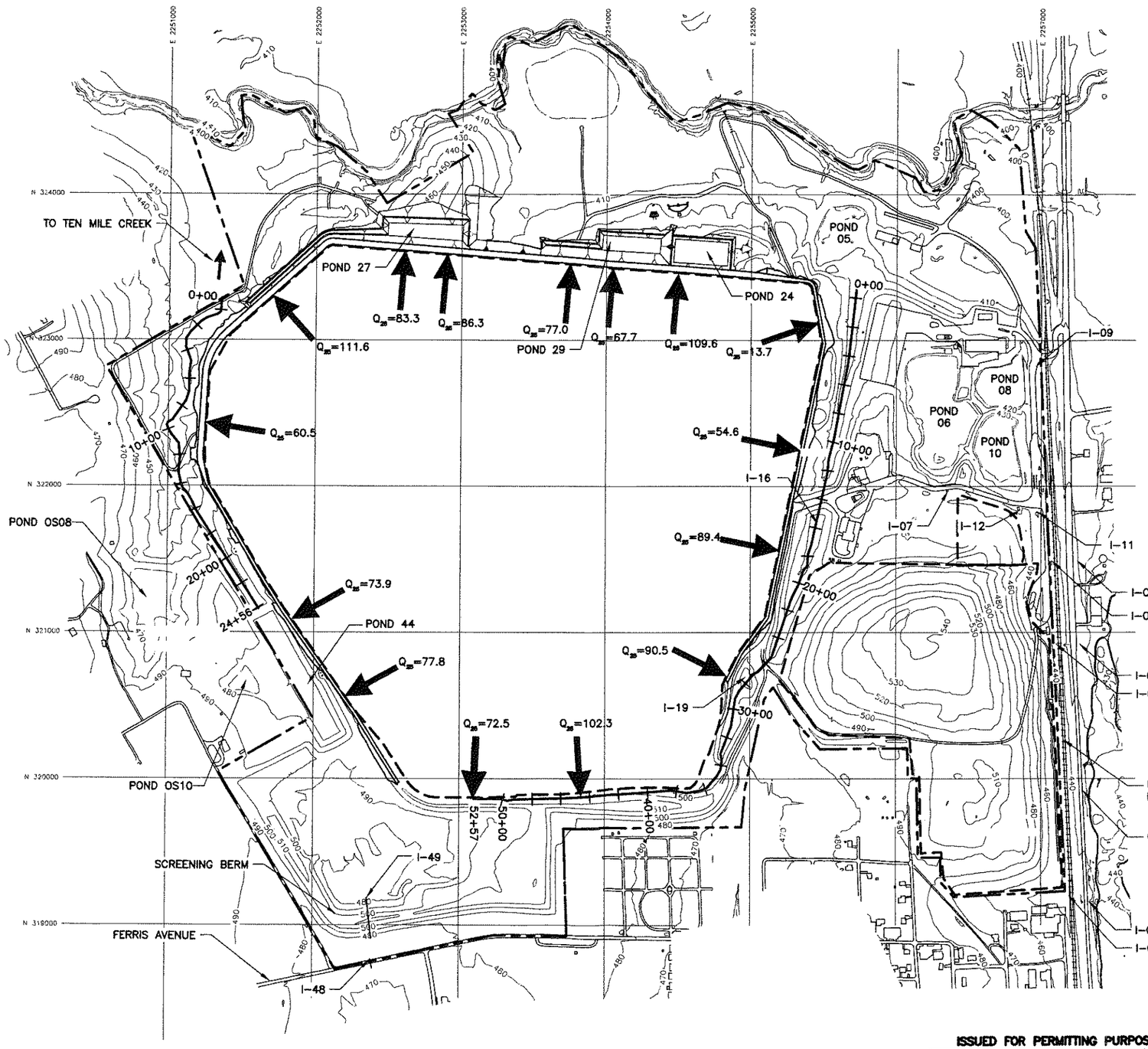

0 400 800
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LANDFILL FOOTPRINT
- 460 EXISTING 10' GROUND CONTOUR

NOTES:

1. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY. FLOWN MARCH 6, 2011. COORDINATE SYSTEM IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.

DRAINAGE STRUCTURE NOTES:

1. POND 24, POND 27, AND POND 29 ARE PROPOSED ONSITE DETENTION PONDS.
2. POND 44 IS AN EXISTING ONSITE DETENTION POND.
3. POND 05, POND 06, POND 08, POND 10, POND 24, AND POND 29 ARE EXISTING ONSITE RETENTION PONDS.
4. POND OS08 AND POND OS10 ARE EXISTING OFFSITE RETENTION PONDS.
5. I-16 AND I-19 ARE EXISTING DRAINAGE CONTROL STRUCTURES WITHIN THE EAST DITCH.
6. I-07, I-09, I-11, I-12, I-48, AND I-49 ARE EXISTING ONSITE DRAINAGE CONTROL STRUCTURES.
7. I-OS13, I-OS14, I-OS15, I-OS16, I-OS17, AND I-OS18 ARE EXISTING OFFSITE DRAINAGE CONTROL STRUCTURES WHICH RECEIVE STORMWATER RUNOFF FROM THE SKYLINE LANDFILL.

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8/21/2012

POSTDEVELOPED DRAINAGE STRUCTURE LOCATION PLAN

WASTE MANAGEMENT OF TEXAS, INC. SKYLINE LANDFILL MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144

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REVISIONS							
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY	
1	08/12	NOD NO. 1 RESPONSE	BBB	FAW	FAW	KJW	

TBPE FIRM NO. F-256 | TBPG FIRM NO. 50222

DSN. FAW | DATE : 04/12
DWN. BBB | SCALE : GRAPHIC
CHK. KJW | DWG : C1_C_3.dwg

DRAWING C1-C-3

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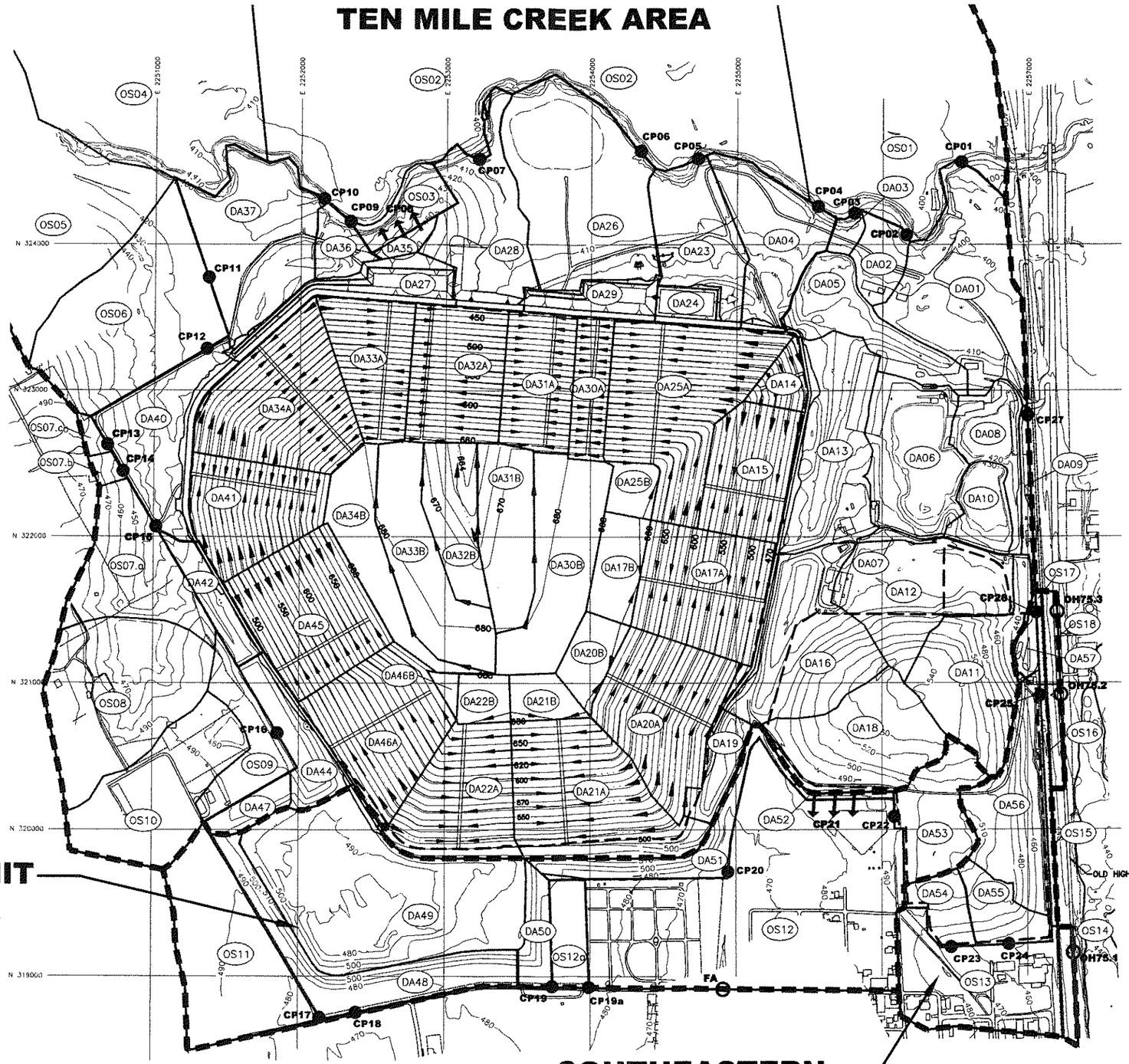
TEN MILE CREEK AREA



SOUTHERN PERMIT BOUNDARY AREA

SOUTHEASTERN PERMIT BOUNDARY AREA

0 400 800
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL FOOTPRINT
- 460 — EXISTING 10' GROUND CONTOUR
- 500 — PROPOSED 10' FINAL COVER CONTOUR
- DRAINAGE AREA BOUNDARY
- MAJOR DRAINAGE DIVIDE BOUNDARY
- (CA01) DRAINAGE AREA DESIGNATION
- ● COMPARISON POINT–POINT DISCHARGE
- ↓↓↓ COMPARISON POINT–SHEET FLOW (NON–POINT DISCHARGE)
- ○ OTHER COMPARISON POINT

NOTES:

1. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY. FLOWN MARCH 6, 2011. COORDINATE SYSTEM IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.

STATE OF TEXAS
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8/21/2012

POSTDEVELOPED MAJOR DRAINAGE DIVIDES

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS ♦ WICHITA FALLS
817-563-1144
TBPE FIRM NO. F-256 TBPG FIRM NO. 50222

ISSUED FOR PERMITTING PURPOSES ONLY

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	08/12	NOD NO. 1 RESPONSE	BBB	FAW	FAW	KJW

DSN. FAW DATE : 04/12
DWN. BBB SCALE : GRAPHIC
CHK. KJW DWG : C1_C_4.dwg

DRAWING C1-C-4

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SKYLINE LANDFILL

ATTACHMENT C1

APPENDIX C1-D

PERIMETER DRAINAGE SYSTEM DESIGN

Includes pages C1-D-1 through C1-D-~~6~~10

CONTENTS

NARRATIVE

30 TAC §§330.303 and 330.305

This appendix presents the design of the Skyline Landfill perimeter drainage channels and detention ponds in accordance with §330.305(a)-(d).

PERIMETER DRAINAGE PLAN

Drawing C1-D-1 – Perimeter Drainage Plan depicts the perimeter drainage channels (ditches), detention ponds, retention ponds, and surface water impoundments at the Skyline Landfill. The only drainage control features proposed by this permit amendment application are detention ponds 24, 27, and 29. Detention pond 44, the East and West Perimeter Ditches, the onsite and offsite retention ponds, and onsite and offsite surface water impoundments are all existing drainage control features.

With the exception of the retention Ponds 6, 8, and 10, which predate the Skyline Landfill, the existing surface water drainage control features were constructed in accordance with current permitted condition. The existing drainage control features have been in-place for several years and are well-established. The characteristics of the existing, current permitted, drainage features were based on as-built drawings, survey data, and field observations.

PERIMETER CHANNEL DESIGN SUMMARY

The minor channels associated with Detention Ponds 27 and 29 are actually included in the storage volume for these detention ponds and do not function as channels. The perimeter drainage plan includes two existing perimeter channels, the East and West Ditches, which are also referred to as the East and West Perimeter Ditches. The existing East and West Ditches were evaluated using HEC-HMS and Manning's Equation. In accordance with §330.305, the perimeter ditches will pass the surface water runoff from 25-year, 24-hour rainfall event. The 25-year hydraulic grade line is shown on the perimeter ditch profiles in Attachment C3 on Drawings C3-18 through C3-21. The perimeter ditches will also pass the surface water runoff from the 100-year, 24-hour rainfall event without overtopping. The peak flow rates at specific stations along the perimeter ditches are directly from HEC-HMS modeling output. Normal depth and velocity calculations are included on pages C1-D-9 and C1-D-10 for the peak flow rates from the 25-year and 100-year, 24-hour rainfall events.

DETENTION POND DESIGN SUMMARY

The detention ponds were designed using HEC-HMS to provide the necessary storage and outlet control to prevent an adverse alteration in the peak stormwater discharge rate off the developed site. The detention ponds were designed to closely match the current

permitted peak discharges for the 25-year, 24-hour storm event. The table below, Detention Pond Summary, provides the 25-year water surface elevation, the perimeter berm elevation for the pond, the freeboard, and the access road elevation. The design parameters for the proposed detention ponds 24, 27, 29 and the existing detention pond 44 are provided on pages C1-C-22 through C1-C-25. The detention pond plans and details are included in Attachment C3.

Detention Pond Summary

Detention Pond	25-Year Water Surface Elevation (feet-msl)	Perimeter Pond Berm Elevation (feet-msl)	Freeboard (feet)	Access Road Elevation (feet-msl)
Pond 24	433.3	436.0	2.7	437.84
Pond 27	423.0	427.0	4.0	432.20
Pond 29	417.5	420.0	2.5	436.31
Pond 44	470.0	480.4	10.4	486.10

RETENTION POND SUMMARY

All of the onsite and offsite retention ponds are existing ponds, are included in the current permitted condition, and their functions does not change in the postdeveloped condition. With the exception of Pond 5, the retention ponds predate the Skyline Landfill. The existing retention ponds were evaluated using HEC-HMS for the 25-year, 24-hour rainfall event. The table below, Retention Pond Summary, provides the 25-year water surface elevation, the perimeter berm elevation for the pond, and the freeboard. The parameters for retention Ponds 5, 6, 8, 10, OS08 and OS10 are provided on pages C1-C-18 through C1-C-27. Retention pond plans and details are included in Attachment C3.

Retention Pond Summary

Retention Pond	25-Year Water Surface Elevation (feet-msl)	Perimeter Pond Berm Elevation (feet-msl)	Freeboard (feet)
Pond 05	414.6	415.0	0.4
Pond 06	426.3	431.0	4.7
Pond 08	420.3	424.0	3.7
Pond 10	429.5	432.0	2.5
Pond OS08	462.5	463.0	0.5
Pond OS10	477.8	478.0	0.2

SURFACE WATER IMPOUNDMENT DESIGN SUMMARY

All of the onsite and offsite surface water impoundments are related to existing drainage control features which are included in the current permitted condition and their functions do not change in the postdeveloped condition. The existing drainage control features were evaluated using HEC-HMS for the 25-year, 24-hour rainfall event. The table below, Surface Water Impoundment Summary, provides the 25-year water surface elevation and the name and approximate elevation of the road which crosses the drainage control structure. The parameters for surface water impoundments I-07, I-09, I-11, I-12, I-16, I-19, I-48, I-49, I-OS13, I-OS14, I-OS15, I-OS16, I-OS17 and I-OS18 are provided on pages C1-C-28 through C1-C-41. The retention pond plans and details are included in Attachment C3.

Surface Water Impoundment Summary

Impoundment	25-Year Water Surface Elevation (feet-msl)	Road Elevation (feet-msl)	Road Description
I-07	453.3	453.5	Landfill Entrance Road
I-09	421.3	421.5	Landfill Entrance Road
I-11	433.4	435.0	Landfill Entrance Road
I-12	437.5	437.0	Landfill Entrance Road
I-16	438.3	458.0	Landfill Access Road
I-19	467.5	476.0	Landfill Perimeter Road
I-48	474.1	474.0	Ferris Avenue
I-49	478.1	510.0	Screening Berm
I-OS13	449.0	451.0	Union Pacific Railroad
I-OS14	443.4	443.0	Old Highway 75
I-OS15	438.8	439.0	Union Pacific Railroad
I-OS16	430.2	430.0	Old Highway 75
I-OS17	432.6	435.0	Union Pacific Railroad
I-OS18	425.2	425.0	Old Highway 75

~~PERIMETER DRAINAGE PLAN~~

~~Drawing C1-D-1 – Perimeter Drainage Plan depicts the perimeter drainage system and detention pond locations for the Skyline Landfill. The plan reflects the perimeter channel design and stationing. The perimeter channel hydraulic analysis is included for the 25-year rainfall event.~~

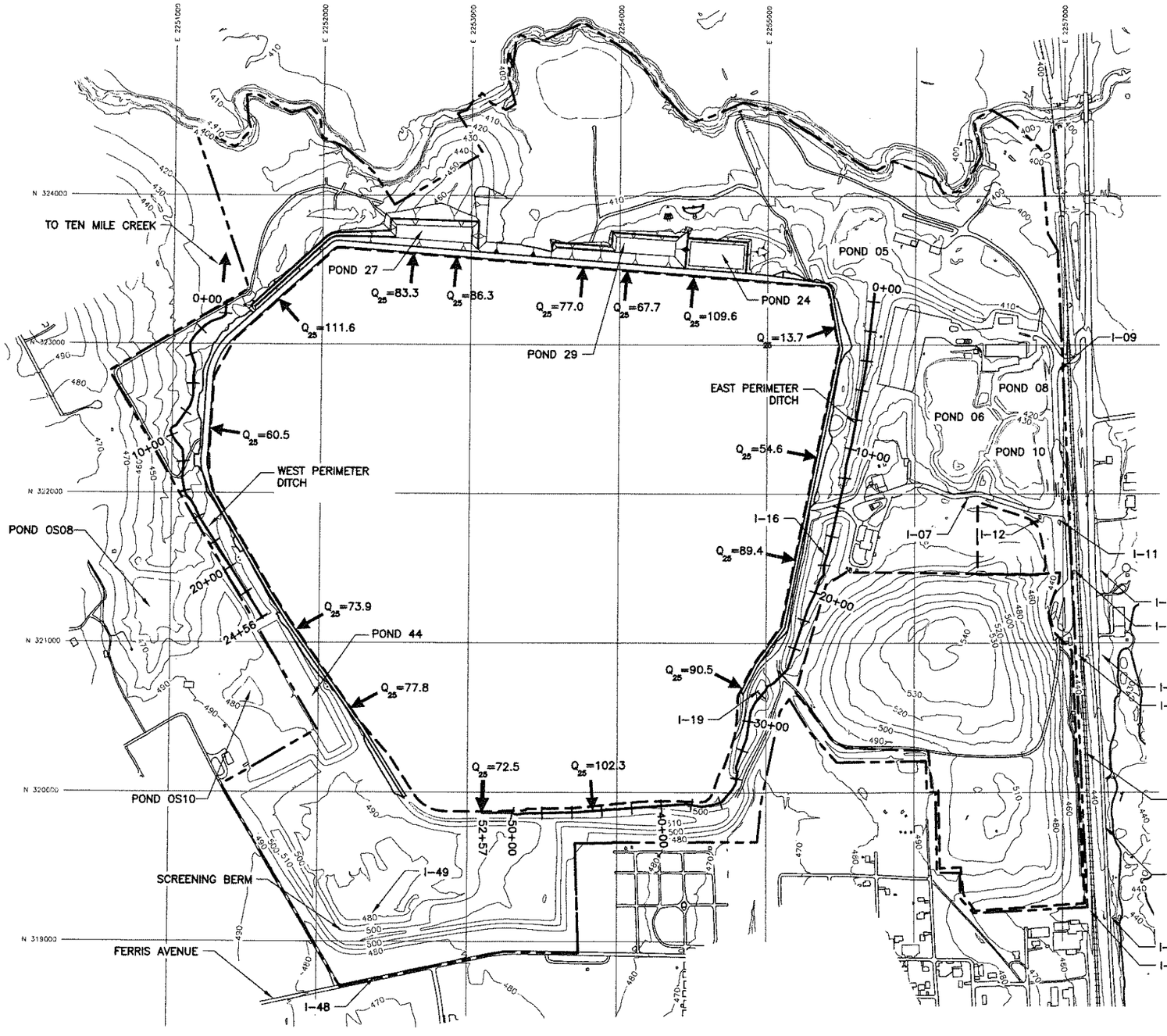
DETENTION POND DESIGN SUMMARY

The detention ponds were designed to provide the necessary storage and outlet control to prevent an adverse alteration in the peak stormwater discharge rate off the developed site. The detention ponds were designed to closely match the current permitted peak discharges for the 25-year, 24-hour storm event. Stormwater storage is provided in earthen ponds with stormwater release controlled by concrete outfall structures. The design parameters for detention ponds 24, 27, 29 and 44 are provided on pages C1-C-22 thorough C1-C-25. The detention pond plans and details are included in Attachment C3.

PERIMETER CHANNEL DESIGN SUMMARY

The perimeter channels are designed for the 24-hour, 25-year event and will pass the 24-hour, 100-year storm event. In several locations along the perimeter channel, the depths are much greater than necessary to convey the predicted stormwater flow rates; however, minimum channel slopes were maintained to help prevent excessive velocity and erosion. The perimeter channel design calculations are included beginning on page C1-D-4. The perimeter channel profile is included in Attachment C3.

PERIMETER DRAINAGE PLANS



0 400 800
SCALE IN FEET

LEGEND

PERMIT BOUNDARY

LANDFILL FOOTPRINT

460 EXISTING 10' GROUND CONTOUR

NOTES:

1. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY. FLOWN MARCH 6, 2011. COORDINATE SYSTEM IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.
2. THE EAST AND WEST PERIMETER DITCHES FLOW TO STATION 0+00.

STATE OF TEXAS
KENNETH J. WELCH
60773
REGISTERED PROFESSIONAL ENGINEER
8/21/2012

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REVISIONS							
1	08/12	NOD NO. 1 RESPONSE	BBB	FAW	FAW	KJW
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

PERIMETER DRAINAGE PLAN

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256 | TBPG FIRM NO. 50222

DSN. FAW | DATE : 04/12
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CHK. KJW | DWG : C1_D_1.dwg

DRAWING C1-D-1

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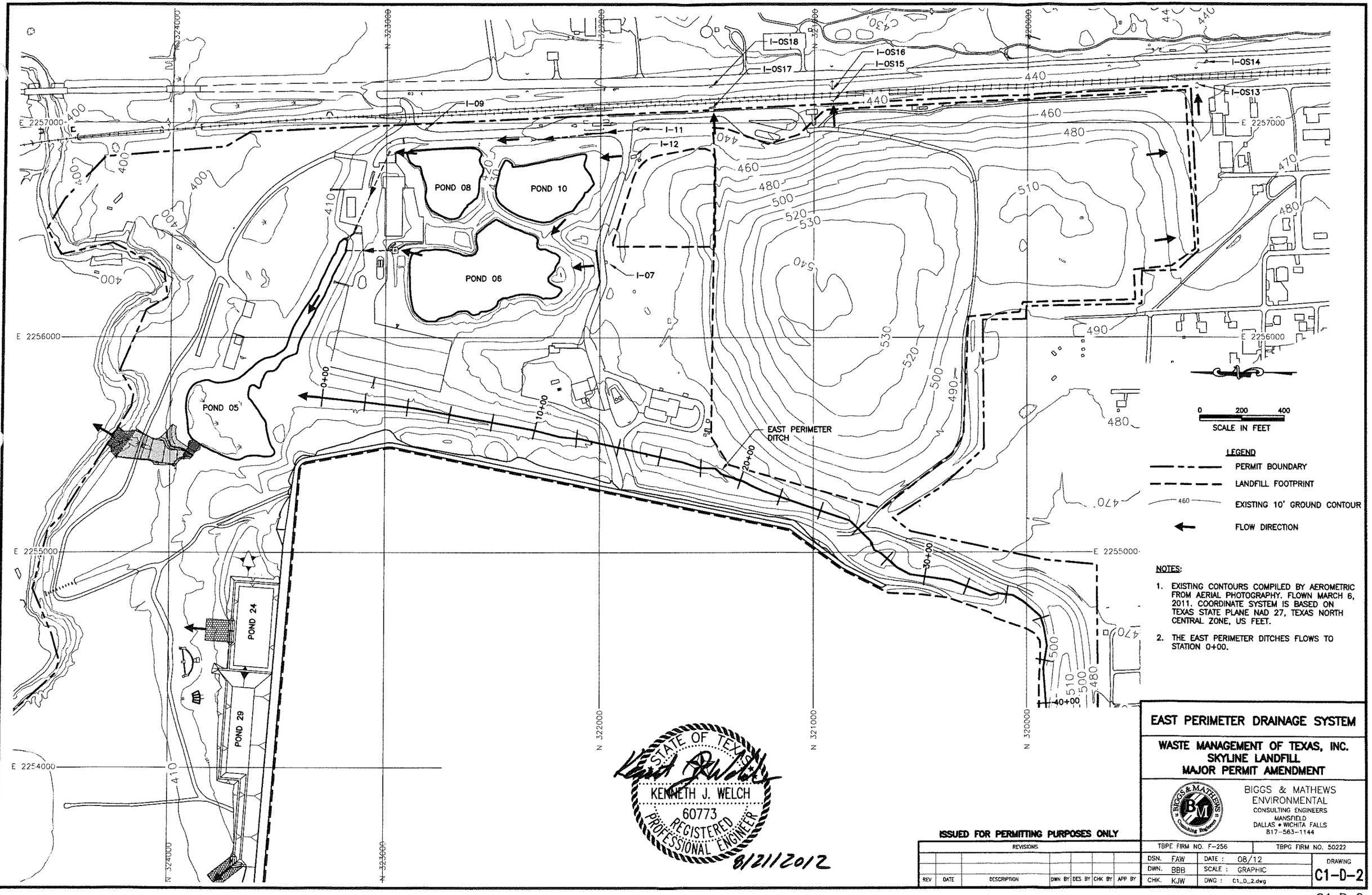

NOTES:

1. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY. FLOWN MARCH 6, 2011. COORDINATE SYSTEM IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.
2. THE EAST PERIMETER DITCHES FLOWS TO STATION 0+00.

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8/21/2012

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REVISIONS						
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

EAST PERIMETER DRAINAGE SYSTEM

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256 | TBPG FIRM NO. 50222

DSN. FAW	DATE : 08/12	DRAWING	C1-D-2
DWN. BBB	SCALE : GRAPHIC		
CHK. KJW	DWG : C1_D_2.dwg		

J:\101\01\120\ATT C\C1_D_2.dwg Layout: Layout1 User: bboles

NOTES:

1. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY. FLOWN MARCH 6, 2011. COORDINATE SYSTEM IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.
2. THE WEST PERIMETER DITCH FLOWS TO STATION 0+00.

STATE OF TEXAS
KENNETH J. WELCH
60773
REGISTERED
PROFESSIONAL ENGINEER
8/21/2012

ISSUED FOR PERMITTING PURPOSES ONLY

REVISIONS						
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

WEST PERIMETER DRAINAGE SYSTEM

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256 | TBPG FIRM NO. 50222

DSN. FAW	DATE : 08/12	DRAWING	C1-D-3
DWN. BBB	SCALE : GRAPHIC		
CHK. KJW	DWG : C1_D_3.dwg		

J:\101\01\120\ATT C\C1_D_3.dwg Layout: Layout1 User: bboles

PERIMETER CHANNEL DESIGN CALCULATIONS

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
Depth and Velocity Calculations for the Perimeter Channels for the 25-Year Peak Runoff

Required: Determine the velocity and depth for the perimeter channels and compare to the permissible non-erodible flow velocity.

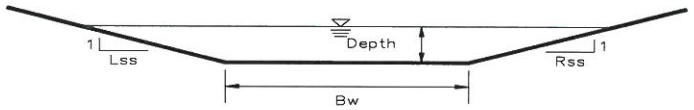
Method: Manning's Equation for flow velocity.

References:
1. Texas Department of Transportation, *Hydraulic Design Manual,* March 2004.

Solution:

Manning's Equation $V = (k/n)(R^{2/3})(S^{1/2})$

V =	Velocity (fps)		
k =	Conversion Factor = 1.5		
n =	Manning's Roughness Coefficient =	0.03	Grass-lined channel
R =	Hydraulic Radius = A/Pw		
A =	Cross-Sectional Area (ft^2)		
Pw =	Wetted Perimeter (ft)		
S =	Channel Slope (ft/ft)		
Bw =	Bottom Width (ft)		



Channel	Channel Station		Q (cfs)	S (ft/ft)	BW (ft)	Lss (H:V)	Rss (H:V)	D (ft)	R (ft)	A (sf)	PW (ft)	V (fps)	Shear Stress (psf)
East	0+00	2+58	392.8	0.008	60	3.4	3.3	1.25	1.17	80.07	68.72	4.91	0.62
East	2+58	11+58	379.6	0.008	30	3.0	3.0	1.81	1.55	64.08	41.44	5.92	0.90
East	11+58	13+19	326.3	0.042	30	5.4	6.3	1.00	0.85	35.72	41.83	9.14	2.61
	Culvert												
East	16+11	18+57	363.5	0.008	40	3.0	5.3	1.49	1.30	68.75	52.74	5.29	0.74
East	18+57	24+19	210.1	0.036	60	3.5	3.7	0.55	0.53	34.07	64.11	6.17	1.23
East	24+19	25+94	210.1	0.004	50	3.4	3.3	1.17	1.09	63.37	58.22	3.32	0.29
	Culvert												
East	28+05	34+30	164.2	0.021	70	3.2	3.2	0.51	0.50	36.47	73.41	4.50	0.67
East	34+30	34+74	164.2	0.286	50	3.2	3.0	0.28	0.28	14.50	51.86	11.33	5.08
East	34+74	38+93	165.2	0.025	40	4.1	3.4	0.67	0.63	28.62	45.23	5.77	1.05
East	38+93	40+94	165.2	0.015	0	4.1	3.3	2.54	1.22	23.80	19.45	6.94	2.37
East	40+94	45+12	165.2	0.009	0	4.1	3.3	2.79	1.35	28.83	21.40	5.73	1.57
East	45+12	52+57	69.5	0.004	0	4.1	3.0	2.39	1.15	20.23	17.63	3.43	0.60
West	0+00	9+77	187.6	0.009	90	5.9	8.0	0.61	0.58	57.30	98.54	3.27	0.34
West	9+77	13+93	153.3	0.019	70	4.3	4.7	0.50	0.49	36.30	74.63	4.22	0.60
West	13+93	17+59	96.8	0.010	0	3.7	13.5	1.62	0.80	22.62	28.17	4.28	1.01
West	17+59	24+56	41.7	0.009	20	3.8	4.3	0.60	0.54	13.43	25.00	3.11	0.34

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
Depth and Velocity Calculations for the Perimeter Channels for the 100-Year Peak Runoff

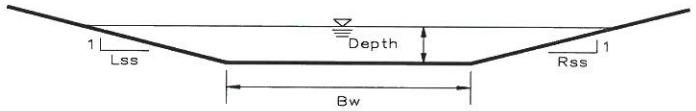
Required: Determine the velocity and depth for the perimeter channels and compare to the permissible non-erodible flow velocity.

Method: Manning's Equation for flow velocity.

References:
1. Texas Department of Transportation, *Hydraulic Design Manual,* March 2004.

Solution: Manning's Equation $V = (k/n)(R^{2/3})(S^{1/2})$

V =	Velocity (fps)		
k =	Conversion Factor = 1.486		
n =	Manning's Roughness Coefficient =	0.03	Grass-lined channel
R =	Hydraulic Radius = A/Pw		
A =	Cross-Sectional Area (ft^2)		
Pw =	Wetted Perimeter (ft)		
S =	Channel Slope (ft/ft)		
Bw =	Bottom Width (ft)		



Channel	Channel Station		Q (cfs)	S (ft/ft)	BW (ft)	Rss (H:V)	Lss (H:V)	D (ft)	R (ft)	A (sf)	PW (ft)	V (fps)	Shear Stress (psf)
East	0+00	2+58	466.1	0.008	60	3.4	3.3	1.38	1.28	89.21	69.65	5.22	0.69
East	2+58	11+58	449.6	0.008	30	3.0	3.0	1.99	1.68	71.72	42.61	6.27	1.00
East	11+58	13+19	383.4	0.042	30	5.4	6.3	1.09	0.93	39.77	42.97	9.64	2.86
	Culvert												
East	16+11	18+57	437.8	0.008	40	3.0	5.3	1.66	1.43	77.70	54.18	5.63	0.83
East	18+57	24+19	243.9	0.036	60	3.5	3.7	0.60	0.58	37.35	64.49	6.53	1.35
East	24+19	25+94	243.9	0.004	50	3.4	3.3	1.28	1.18	69.67	58.97	3.50	0.32
	Culvert												
East	28+05	34+30	206.0	0.021	70	3.2	3.2	0.58	0.57	41.90	73.91	4.92	0.76
East	34+30	34+74	206.0	0.286	50	3.2	3.0	0.33	0.32	16.65	52.13	12.38	5.82
East	34+74	38+93	208.3	0.025	40	4.1	3.4	0.77	0.72	33.11	45.99	6.29	1.20
East	38+93	40+94	208.3	0.015	0	4.1	3.3	2.77	1.33	28.32	21.22	7.35	2.59
East	40+94	45+12	208.3	0.009	0	4.1	3.3	3.04	1.47	34.30	23.35	6.07	1.71
East	45+12	52+57	87.4	0.004	0	4.1	3.0	2.60	1.25	24.03	19.21	3.64	0.65
West	0+00	9+77	261.1	0.009	90	5.9	8.0	0.74	0.70	70.40	100.39	3.71	0.42
West	9+77	13+93	215.2	0.019	70	4.3	4.7	0.61	0.59	44.74	75.67	4.81	0.73
West	13+93	17+59	151.2	0.010	0	3.7	13.5	1.92	0.95	31.61	33.30	4.78	1.20
West	17+59	24+56	46.4	0.009	20	3.8	4.3	0.64	0.57	14.39	25.32	3.22	0.36