ATASCOCITA RECYCLING AND DISPOSAL FACILITY
HARRIS COUNTY, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 1307D

PERMIT AMENDMENT APPLICATION

PART III – FACILITY INVESTIGATION AND DESIGN
ATTACHMENT C2
REGIONAL DRAINAGE AND
FLOOD CONTROL ANALYSIS

Prepared for

Waste Management of Texas, Inc.

September 2010

Alejandro Flores
9/13/10

Prepared by

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CONTENTS

1 INTRODUCTION C2-1
1.1 Purpose C2-1
1.2 Harris County Flood Control District Approval C2-1
1.3 Datum and Benchmark C2-2

2 METHODOLOGY C2-3
2.1 Concepts and Methods C2-3
2.2 Hydrologic and Hydraulic Modeling C2-4
2.2.1 HEC-HMS C2-4
2.2.2 HEC-RAS C2-4

3 CURRENT PERMITTED CONDITION (PRE-PROJECT) C2-5

4 POSTDEVELOPMENT CONDITION (POST-PROJECT) C2-7

5 REGIONAL DRAINAGE PATTERNS AND RECEIVING CHANNELS C2-9

6 100-YEAR FLOODPLAIN C2-11
6.1 FEMA 100-Year Floodplain C2-11

7 CONCLUSIONS C2-13

APPENDIX C2-A
Regional Drainage Summary

APPENDIX C2-B
100-Year Floodplain Maps

APPENDIX C2-C
Documentation of Approved Submittals

9/13/10

Alejandro Flores V

1 INTRODUCTION

30 TAC §§330.63(c) and 330.303-307

1.1 Purpose

The regional drainage and flood control analysis are prepared as part of a permit amendment application for the Atascocita Recycling and Disposal Facility (RDF), consistent with 30 TAC Chapter 330. The purpose of the regional drainage and flood control analysis is to demonstrate that the proposed expansion of the Atascocita RDF will not adversely alter existing or permitted drainage patterns, will not adversely impact the flooding conditions of the receiving channels, and that the proposed waste disposal footprint is not within the 100-year floodplain. These analyses and demonstrations have been prepared consistent with the requirements of §330.63(c) and §§330.301-330.307, and consistent with the requirements of the Harris County Flood Control District (HCFCD).

1.2 Harris County Flood Control District Approval

Dannenbaum Engineering Corporation was contracted by Waste Management of Texas, Inc. (WMTX) to conduct a drainage analysis for the expansion of the Atascocita RDF, located in north central Harris County, Texas. The purpose of the study was to demonstrate to the HCFCD that the proposed expansion of the Atascocita RDF will not adversely impact the flooding conditions of the receiving channels. The HCFCD has jurisdiction over the downstream receiving channels from the Atascocita RDF (Garners Bayou and Williams Gully). The Atascocita RDF – Expansion Drainage Design was approved by the HCFCD on March 5, 2010; a copy of the approval is included in Appendix C2-C.

The HCFCD required the analysis of five conditions: effective, corrected effective, updated, pre-project and post-project. The flood hazard flow rate frequencies of 10 percent, 2 percent, 1 percent, and 0.2 percent events (10-, 50-, 100-, and 500-year frequency events, respectively) were evaluated for the effective, corrected effective, and updated conditions to remain consistent with the effective models from the Federal Emergency Management Agency (FEMA). The flood hazard frequencies for the 10 percent, 4 percent, and 1 percent events (10-, 25-, and 100-year frequency events, respectively) were evaluated for the pre-project (current permitted) and post-project (postdevelopment) condition to comply with the requirements of the HCFCD and the Texas Commission on Environmental Quality (TCEQ). The pre-project (current permitted) and post-project (postdevelopment) conditions are the only conditions required by the TCEQ and are the only conditions discussed in this regional drainage and flood control analysis.

1.3 Datum and Benchmark

Harris County experiences land subsidence, whereby the ground surface sinks due to the withdrawal of groundwater. Datums and benchmarks are used as reference points for ground surface elevations. Adjustments are required in order to combine elevations from differing datums.

The Atascocita RDF site benchmark is described as a brass cap in concrete stamped "2-10-03 Elev. 63.07" and located at North 789,929.71 East 3,189,458.65 (Lat 29° 57' 12" Long 095° 14' 36"). The benchmark is referenced to the City of Houston Benchmark 5666-1212 at State Plane Coordinates N 796,289.72 E 3,187,793.77 North American Datum of 1927 (NAD27) (SCZ) at elevation 73.61 National Geodetic Vertical Datum of 1929 (NGVD29) (1978 Releveling).

Regarding the regional drainage and flood control analysis, the only other datum of interest is that of the current FEMA floodplain elevations and maps. This datum is referenced to the North American Vertical Datum of 1988 (NAVD88) (2001 Releveling). The datum adjustment applied to the site benchmark is based upon floodplain Reference Mark No. 150470 (NAVD88, 2001 adj.), which is 1.23 feet lower than the site (NGVD29, 1978 adj.) datum. Therefore the datum adjustment for this project is:

2001 (FEMA) datum to 1978 (site) datum adjustment = +1.23 feet

All elevations in Attachment C2 reference the FEMA datum.

2 METHODOLOGY

2.1 Concepts and Methods

The hydrologic and hydraulic methods employed in the Atascocita RDF – Expansion Drainage Design, approved by HCFCD on March 5, 2010, are consistent with the TCEQ regulations. The United States Army Corps of Engineers (COE) Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) and River Analysis System (HEC-RAS) computer programs were used to compute peak flow rates and to determine water surface profiles, respectively. Analyses of the peak flow rates, water surface profiles, and drainage design for these conditions proceeded in the following sequence:

1. Stormwater runoff characteristics of the current permitted final cover drainage conditions, contributing areas, and the existing conditions of the expansion area were developed based on TCEQ and HCFCD requirements.

2. Stormwater runoff hydrographs for the current permitted condition were developed using HEC-HMS.

3. Hydraulic models of the current permitted perimeter drainage systems were prepared in HEC-RAS. The stormwater runoff hydrographs were routed through the perimeter drainage systems using unsteady-state HEC-RAS, which produced discharge hydrographs.

4. The discharge hydrographs for the current permitted drainage condition were input into the HCFCD HEC-HMS model for this region. Refer to Drawing C2-A-1 for the delineation of the regional drainage areas for the current permitted condition. The regional HEC-HMS model developed peak flow rates for locations along Garners Bayou and Williams Gully. These peak flow rates were used in the hydraulic models for the current permitted condition.

5. Hydraulic models for the current permitted condition were developed to evaluate water surface elevations along Garners Bayou and Williams Gully, the downstream receiving channels of the Atascocita RDF, using steady-state HEC-RAS v3.0.1. The current permitted hydraulic analysis is summarized on Drawing C2-A-2.

6. Stormwater runoff characteristics of the postdevelopment final cover drainage conditions for the expansion of the Atascocita RDF were developed based on TCEQ and HCFCD requirements.

7. Stormwater runoff hydrographs for the postdevelopment condition were developed using HEC-HMS.

8. Hydraulic models of the postdevelopment perimeter drainage systems were prepared in HEC-RAS. The perimeter drainage system design is described in Part III, Attachment C, Appendix C1-D. The stormwater runoff hydrographs were routed through the perimeter drainage systems using unsteady-state HEC-RAS, which produced discharge hydrographs.

9. The discharge hydrographs for the postdevelopment drainage condition were input into the HCFCD HEC-HMS model for this region. Refer to drawing C2-A-3 for the delineation of the regional drainage areas for the postdevelopment condition. The regional HEC-HMS model developed peak flow rates for locations along Garners Bayou and Williams Gully. These peak flow rates were used in the hydraulic models for the postdeveloped condition.

10. Hydraulic models for the postdevelopment condition were developed to evaluate water surface elevations along Garners Bayou and Williams Gully using steady-state HEC-RAS. The postdevelopment hydraulic analysis is summarized on Drawing C2-A-4.

11. The postdevelopment flood stage analysis was compared to the current permitted flood stage analysis for Garners Bayou and Williams Gully. The comparison is included in tabular form on page C2-A-5.

Hydraulic modeling of the internal drainage systems and diversion channel of the Atascocita RDF was performed in unsteady-state HEC-RAS v3.1.3. The unsteady-state HEC-RAS modeling more accurately represents the complex interactions of the systems, including detention ponds, channel storage, lateral weirs, culverts, and tailwater conditions. Hydrologic modeling in HEC-HMS v3.1.0 was required to develop hydrographs to apply to the unsteady-state HEC-RAS analysis and to calculate the node flow rates along the receiving channels.

2.2 Hydrologic and Hydraulic Modeling

2.2.1 HEC-HMS

HEC-HMS was developed by the COE Hydrologic Engineering Center to simulate the surface runoff response of a watershed. The HEC-HMS model represents a watershed as a network of hydrologic and hydraulic components. The modeling process results in the computation of stream-flow hydrographs at desired locations in the watershed.

2.2.2 HEC-RAS

The COE HEC-RAS program was developed to simulate one-dimensional, steady-state or unsteady-state flow, water surface profile computations of streams and hydraulic structures. The HEC-RAS model represents drainage systems as a full network of reaches representing channels, streams, or river segments that may include confluences and obstructions such as bridges, culverts and weirs. The program uses the energy and momentum equations to determine water surface profiles.

3 CURRENT PERMITTED CONDITION (PRE-PROJECT)

The Atascocita RDF is an existing 503.7-acre, Type I Municipal Solid Waste Disposal Facility located in Harris County.

The Atascocita RDF is located in the Greens Bayou watershed. Stormwater runoff leaving the current permitted permit boundary contributes to Garners Bayou. Stormwater runoff leaving the expansion area contributes to Williams Gully. Garners Bayou and Williams Gully are tributaries within the Greens Bayou watershed.

The current permitted (pre-project) condition is established by the existing permit for the Atascocita RDF (MSW Permit No. 1307C) issued by TCEQ on December 8, 2004. The current permitted condition is defined within MSW Permit No. 1307C in Part III, Attachment 6 – Groundwater and Surface Water Protection Plan and Drainage Plan, and Part III, Attachment 7 – Final Contour Map. The current permitted condition is incorporated into the regional drainage evaluation as the currently permitted Atascocita RDF (P130G1-2) drainage area depicted on Drawing C2-A-1, Current Permitted Regional Drainage Area Map. The current permitted analysis summary is shown on Drawing C2-A-1. Refer to Attachment C1, Appendix C1-B for the current permitted hydrologic and hydraulic analyses of the drainage systems within the permit boundary.

The following current permitted internal drainage conditions were included in the regional drainage analysis to determine the 25-year flood stage along Garners Bayou and Williams Gully.

The current permitted condition of the Atascocita RDF contains two separate drainage systems. The west system conveys flow from the west drainage area including an off-site drainage area, landfill cover area, and other areas within the permit boundary through the west ditch and west tributary into the west pond, which then outfalls through a channel (west outfall) and finally into Garners Bayou via a 78-inch culvert at CP1. The west system, as described, has been constructed consistent with the current permit (MSW Permit No. 1307C).

The east system conveys flow from the landfill cover area through the east ditch and east tributary into the east pond, which then outfalls into the floodplain mitigation channel via a 72-inch culvert. The 72-inch culvert conveys flow from the floodplain mitigation channel to a manhole adjacent to Garners Bayou. A 78-inch culvert conveys flow from the manhole to Garners Bayou at CP2. The east system, as described, has been constructed consistent with the current permit (MSW Permit No. 1307C).

The current permitted condition of the expansion area is undeveloped land. The expansion area generally slopes to the south and east to Williams Gully. Surface water runoff enters the expansion area as sheet flow along the proposed north permit boundary and exits as sheet flow along the south and east permit boundary. An existing

ditch (Harris County Flood Control District [HCFCD] Unit No. P130-02-01) receives runoff from an offsite drainage area (P1300201A) and flows in a north to south direction along the east side of the current permit boundary, exiting the site and continuing to Williams Gully.

4 POSTDEVELOPMENT CONDITION (POST-PROJECT)

After the expansion, the Atascocita RDF will be a 647.1-acre facility. The entire expanded facility will be located in the Greens Bayou watershed. Stormwater runoff leaving the permit boundary contributes to tributaries of Garners Bayou and Williams Gully within the Greens Bayou watershed.

The post-project condition of the internal systems was defined by the postdevelopment configuration. As such, the post-project condition will be compared to the current permitted condition, as modeled in the pre-project condition, to identify any potential impacts resulting from the proposed development. The postdevelopment analysis summary is shown on Drawing C2-A-4. Refer to Attachment C1, Appendix C1-C for the postdevelopment hydrologic and hydraulic analyses of the drainage systems within the permit boundary.

The proposed Atascocita RDF will consist of two separate drainage systems. The west system conveys flow from one off-site drainage area, the landfill cover area, and landfill permit boundary through the west ditch and west tributary into the west detention pond, which then outfalls through a channel (west outfall) and finally into Garners Bayou via a 78-inch culvert at CP1, in the same manner as the current permitted condition. The west system, as described, has been constructed consistent with the current permit, MSW Permit No. 1307C.

The currently permitted east system will be expanded to accommodate surface water runoff from the current permitted east final cover area and the expansion area. The east ditch will be extended to the east around the perimeter of the proposed expansion. A lateral weir along the east ditch will direct a minor portion of the flow into the proposed pond (Williams Pond), located in the southeast corner of the facility along Williams Gully. A proposed outfall will convey flow to Williams Gully via an 18-inch culvert at CP4. The major portion of the flow will continue through the east ditch to the east pond. The east ditch and east tributary flow into the east pond, which then outfalls into the floodplain mitigation channel via a 72-inch culvert. The 72-inch culvert conveys flow from the floodplain mitigation channel to a manhole adjacent to Garners Bayou. A 78-inch culvert conveys flow from the manhole to Garners Bayou at CP2.

The proposed expansion includes the realignment of the existing HCFCD Unit No. P130-02-01 to the east via a diversion channel. In the postdevelopment condition, the diversion channel will redirect the stormwater runoff from along the northern border of the proposed permit boundary to the east to Williams Gully at CP5. To account for the effects of the diversion channel and diversion pond in the postdevelopment condition, CP5 is not located where the diversion channel crosses the permit boundary but rather where the diversion channel discharges into Williams Gully.

The Atascocita RDF landfill expansion (postdevelopment condition), including the internal drainage systems, the diversion channel, and diversion pond, is included in the Atascocita RDF – Expansion Drainage Design approved by the HCFCD on March 5, 2010. A copy of the expansion drainage design approval is included in Appendix C2-C.

5 REGIONAL DRAINAGE PATTERNS AND RECEIVING CHANNELS

30 TAC §330.63(c) and §330.303-307

Consistent with 30 TAC §330.63(c)(1) and §330.305(a), the proposed landfill development will not adversely alter existing or permitted drainage patterns or impact flooding conditions of receiving channels. A summary of the two drainage conditions analyzed is included as Drawing C2-A-2 – Current Permitted Flood Stage Analysis Summary and Drawing C2-A-4 – Postdevelopment Flood Stage Analysis Summary. The current permitted runoff to postdevelopment runoff comparison is also summarized in Appendix C2-A in tabular format on page C2-A-5. A summary of drainage patterns and flows produced by the 25-year storm event, as required by the regulations, are presented on the following attachments.

- Drawing C2-A-1 – Current Permitted Regional Drainage Area Map: This drawing depicts the current permitted Atascocita RDF final development condition and the regional drainage areas used in the current permitted regional drainage analysis.

- Drawing C2-A-3 – Postdevelopment Regional Drainage Area Map: This drawing depicts the proposed Atascocita RDF final development condition and the regional drainage areas used in the postdevelopment regional drainage analysis.

- Drawing C2-A-2 – Current Permitted Flood Stage Analysis Summary: This drawing depicts the locations of the HEC-RAS cross sections where the 25-year flood stage was determined for Garners Bayou and Williams Gully. Each cross section is identified with flow rate, elevation, and velocity in the summary table.

- Drawing C2-A-4 – Postdeveloped Flood Stage Analysis Summary: This drawing depicts the locations of the HEC-RAS cross sections where the 25-year flood stage was determined for Garners Bayou and Williams Gully. Each cross section is identified with flow rate, elevation, and velocity in the summary table.

- Page C2-A-5 – Current Permitted/Postdevelopment 25-Year Flood Stage Analysis Summary: This table compares the current permitted flood stage analysis to the postdevelopment flood stage analysis for Garners Bayou and Williams Gully.

Potential impacts to the regional drainage patterns or receiving channels from the proposed development at the Atascocita RDF will be mitigated with the two existing detention ponds and with the two additional detention ponds.

The proposed development at the Atascocita RDF, including the site expansion and diversion channel, will not adversely affect the receiving channels. Flood stages do not increase for any modeled event. Although negligible flow rate impacts are induced within the receiving channels, Garners Bayou and Williams Gully do not experience increases to flood stages for the modeled events. This drainage analysis meets the TCEQ requirements of 30 TAC Chapter 330, §330.63(c) and §330.305(a) and demonstrates that the existing or permitted drainage patterns will not be adversely altered.

6 100-YEAR FLOODPLAIN

6.1 FEMA 100-Year Floodplain

The Federal Emergency Management Agency (FEMA) has defined the limits of the 100-year floodplain in the vicinity of the landfill as Zone AE; base flood elevations have been determined by FEMA. The limits of the floodplain are depicted on Drawing C2-B-1, which is a drawing compiled from the Flood Insurance Rate Map (FIRM), Community Panel Number 48201C0505L, with an effective date of September 28, 1990, and a most recent revision date of June 18, 2007.

As depicted on Drawing C2-B-1, portions of the permit boundary along Garners Bayou and Williams Gully are located within the FEMA defined 100-year floodplain. Drawing C2-B-1 also shows that a portion of the waste disposal footprint is within the limits of the 100-year floodplain. However the FIRM panel has not been revised to reflect modifications to the floodplain approved after June 18, 2007.

As part of the current permit, the Atascocita RDF has constructed the west pond, east pond, floodplain mitigation channel, and the perimeter berm. The perimeter berm hydraulically disconnects the 100-year floodplain and Phase 5, the future fill area, which is shown in the 100-year floodplain on Drawing C2-B-1. The floodplain mitigation channel provides floodplain storage mitigating the volume of storage removed by the perimeter berm.

A Letter of Map Revision – Fill (LOMR-F) was prepared by Dannenbaum Engineering Corporation to revise the 100-year floodplain to account for the improvements and developments with the 100-year floodplain. The LOMR-F, which officially modifies the 100-year floodplain, was approved by FEMA on September 15, 2009 (see Appendix C2-C).

The FEMA 100-year floodplain for the current permitted condition, incorporating the modification from the LOMR-F approval, is shown on Drawing C2-B-2. The drainage analysis conducted for the Atascocita RDF landfill expansion, approved by HCFCD on March 15, 2010, included an analysis of the 1 percent (100-year) floodplain.

The proposed development of the Atascocita RDF or postdevelopment condition was evaluated to determine any impacts to the 1 percent (100-year) floodplain. As previously discussed, the HCFCD authorized development of the Atascocita RDF, and determined that there are no impacts to the 1 percent (100-year) floodplain as documented in the approval dated March 15, 2010. Refer to Drawing C2-B-3 for the 100-year floodplain for the postdevelopment condition.

The 100-year floodplain is documented on the following drawings:

- Drawing C2-B-1 – Flood Insurance Rate Map (FIRM): This drawing depicts the portions of the permit boundary located within the FEMA 100-year floodplain. Drawing C2-B-1 does not depict the revised limits of the 100-year floodplain per the approved LOMR-F.

- Drawing C2-B-2 – 100-Year Floodplain Map Current Permitted: This drawing depicts the 100-year floodplain and the current permitted landfill configuration. Drawing C2-B-2 depicts the revised limits of the 100-year floodplain per the approved LOMR-F.

- Drawing C2-B-3 – 100-Year Floodplain Map Postdeveloped: This drawing depicts the 100-year floodplain and the postdevelopment landfill configuration. Drawing C2-B-3 depicts the revised limits of the 100-year floodplain per the approved LOMR-F.

Based on the evaluation of the current permitted landfill conditions, no pre-Subtitle D or Subtitle D landfill units are located within the 100-year floodplain. Based on the evaluation of the postdeveloped landfill conditions, no pre-Subtitle D or Subtitle D landfill units are located within the 100-year floodplain and no waste disposal operations will take place within the 100-year floodplain.

Consistent with 30 TAC §330.63(c)(2) and §330.307, for the proposed expansion of the Atascocita RDF, no pre-Subtitle D or Subtitle D landfill units are located within the 100-year floodplain.

7 CONCLUSIONS

The following conclusions summarize the results of the Regional Drainage and Flood Control Analysis Report:

- The proposed expansion of the Atascocita RDF will not adversely alter existing or permitted drainage conditions.
- The proposed expansion of the Atascocita RDF will not adversely impact the receiving channels, Garners Bayou and Williams Gully, or the Greens Bayou watershed.
- The current permitted and postdevelopment landfill footprint is not located within the limits of the FEMA 100-year floodplain. No disposal operations will be conducted within the 100-year floodplain.
- The drainage design criteria and analyses used for these drainage calculations meet the requirements of 30 TAC §330.63(c) and §§330.303-307.

ATASCOCITA RECYCLING AND DISPOSAL FACILITY

ATTACHMENT C2
APPENDIX C2-A

REGIONAL DRAINAGE SUMMARY

Includes pages C2-A-1 through C2-A-5

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CONTENTS

Current Permitted Regional Drainage Area Map C2-A-1

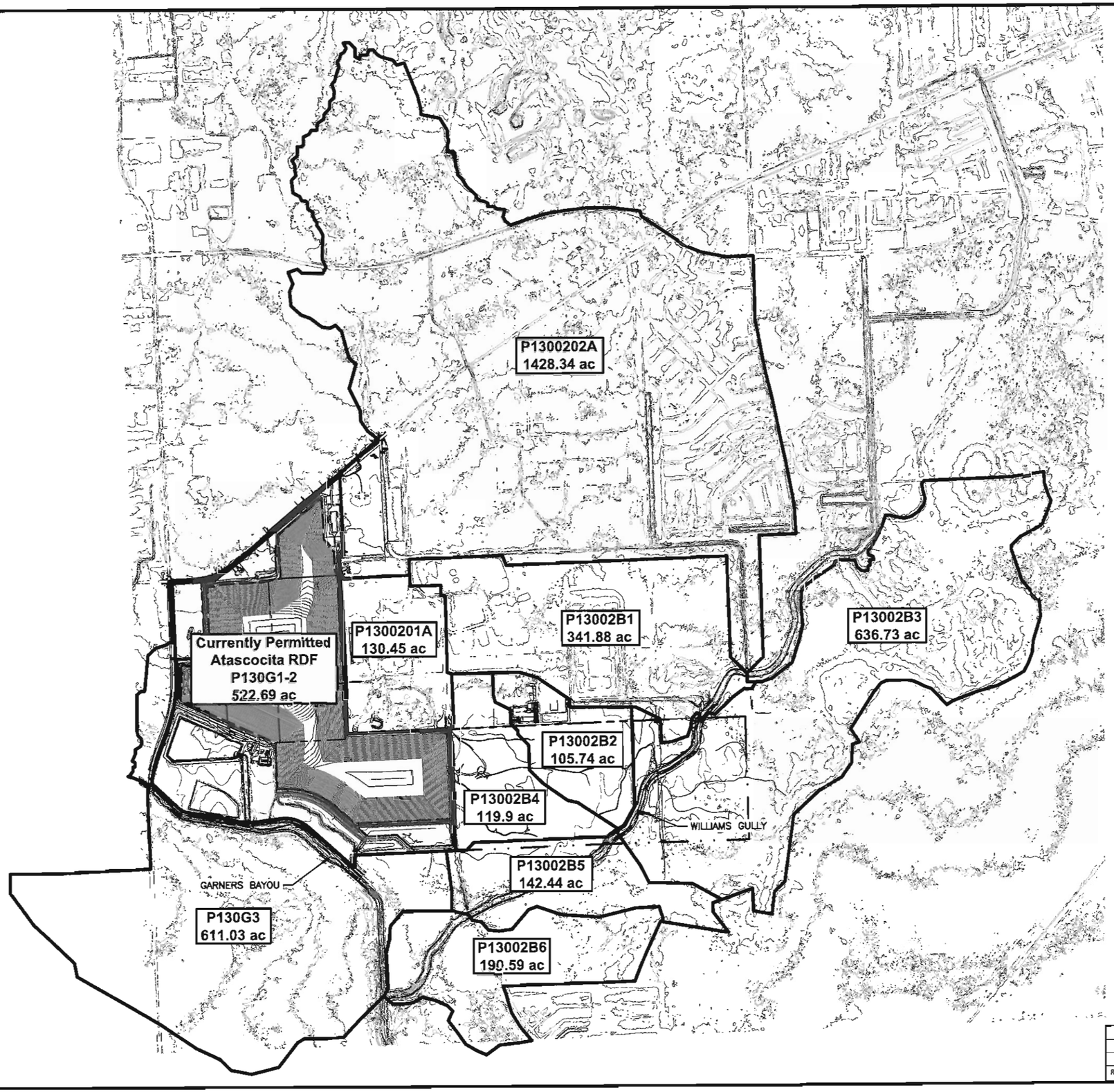
Current Permitted Flood Stage Analysis Summary C2-A-2

Postdevelopment Regional Drainage Area Map C2-A-3

Postdevelopment Flood Stage Analysis Summary C2-A-4

Current Permitted/Postdevelopment 25-Year Flood Stage Analysis Summary Table C2-A-5

alejandro Flores 9/13/10



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SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LANDFILL FOOTPRINT
- 450 EXISTING CONTOUR
- DRAINAGE AREA BOUNDARY
- STREAM

NOTES:

1. CONTOURS AND ELEVATIONS INSIDE THE PERMIT BOUNDARY COMPILED BY DALLAS AERIAL SURVEYS FROM AERIAL SURVEY FLOWN APRIL 13, 2009. CONTOURS OUTSIDE THE PERMIT BOUNDARY TAKEN FROM 2001 LIDAR MAPPING PROVIDED BY DANNENBAUM.
2. CONTOURS WITHIN EXISTING WASTE DISPOSAL FOOTPRINT DEPICT CURRENT PERMITTED FINAL CONTOURS.
3. ONLY DRAINAGE AREAS MODIFIED FOR THIS ANALYSIS ARE DEPICTED ON THIS DRAWING.

Alejandro Flores V
9/13/10

STATE OF TEXAS
A.C. FLORES VARELA
56939
REGISTERED PROFESSIONAL ENGINEER

ISSUED FOR PERMITTING PURPOSES

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

CURRENT PERMITTED REGIONAL DRAINAGE AREA MAP

WASTE MANAGEMENT OF TEXAS, INC.
ATASCOCITA RECYCLING AND DISPOSAL FACILITY
MAJOR PERMIT AMENDMENT

DANNENBAUM
ENGINEERING CORPORATION
T.B.P.E. FIRM REGISTRATION #392
3100 WEST ALABAMA HOUSTON, TX 77098 (713) 520-9570

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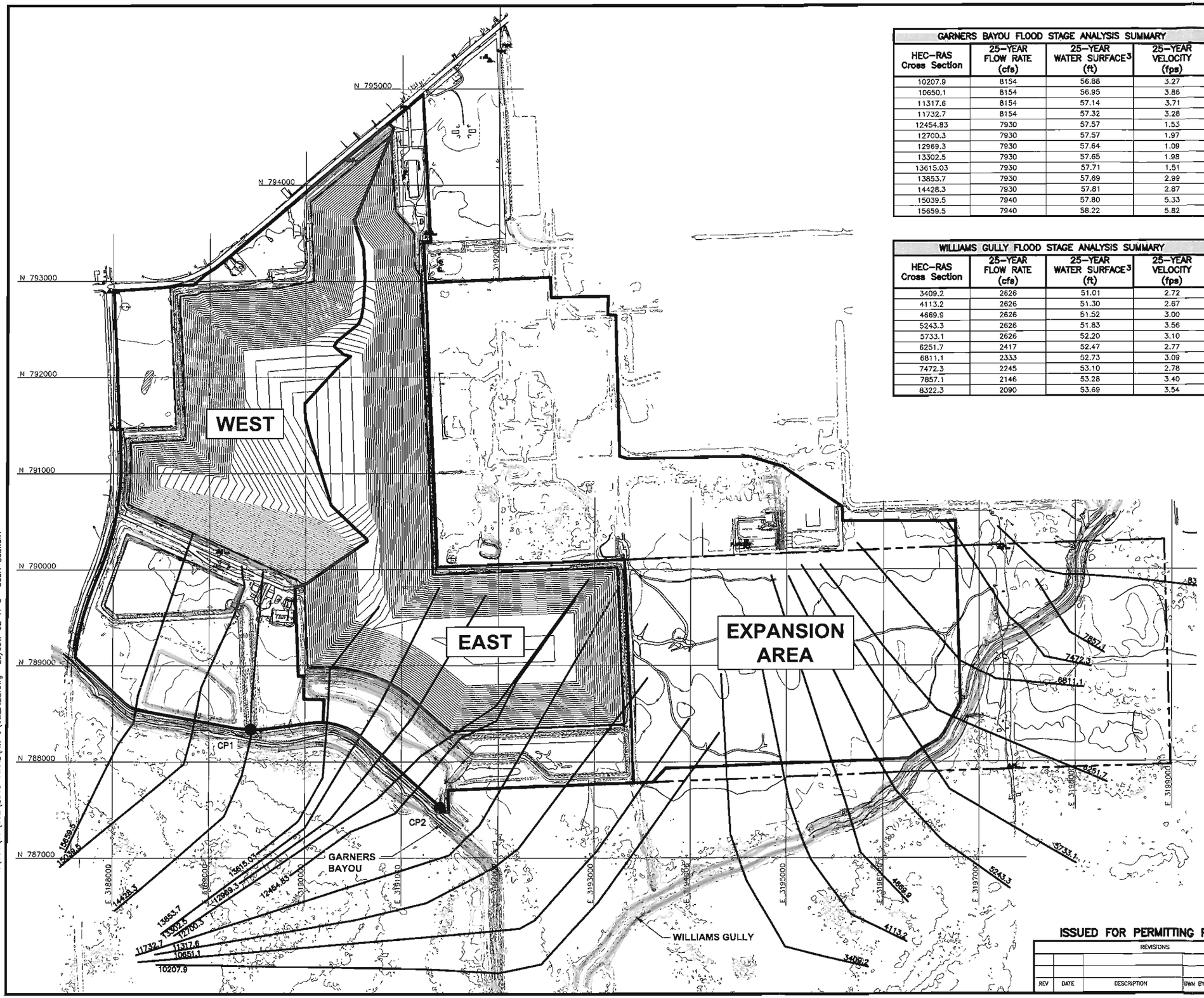

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GARNERS BAYOU FLOOD STAGE ANALYSIS SUMMARY			
HEC-RAS Cross Section	25-YEAR FLOW RATE (cfs)	25-YEAR WATER SURFACE[3] (ft)	25-YEAR VELOCITY (fps)
10207.9	8154	56.88	3.27
10650.1	8154	56.95	3.86
11317.6	8154	57.14	3.71
11732.7	8154	57.32	3.28
12454.83	7930	57.57	1.53
12700.3	7930	57.57	1.97
12969.3	7930	57.64	1.09
13302.5	7930	57.65	1.98
13615.03	7930	57.71	1.51
13853.7	7930	57.69	2.99
14428.3	7930	57.81	2.87
15039.5	7940	57.80	5.33
15659.5	7940	58.22	5.82

WILLIAMS GULLY FLOOD STAGE ANALYSIS SUMMARY			
HEC-RAS Cross Section	25-YEAR FLOW RATE (cfs)	25-YEAR WATER SURFACE[3] (ft)	25-YEAR VELOCITY (fps)
3409.2	2626	51.01	2.72
4113.2	2626	51.30	2.67
4689.9	2626	51.52	3.00
5243.3	2626	51.83	3.56
5733.1	2626	52.20	3.10
6251.7	2417	52.47	2.77
6811.1	2333	52.73	3.09
7472.3	2245	53.10	2.78
7857.1	2146	53.28	3.40
8322.3	2090	53.69	3.54

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SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL FOOTPRINT
- 60 EXISTING CONTOUR
- DRAINAGE AREA BOUNDARY
- DRAINAGE AREA REACH
- STREAM

NOTES:

1. CONTOURS AND ELEVATIONS COMPILED BY DALLAS AERIAL SURVEYS FROM AERIAL SURVEY FLOWN APRIL 13, 2009. CONTOURS OUTSIDE THE PERMIT BOUNDARY TAKEN FROM 2001 LIDAR MAPPING PROVIDED BY DANNENBAUM.
2. CONTOURS WITHIN EXISTING WASTE DISPOSAL FOOTPRINT DEPICT CURRENT PERMITTED FINAL CONTOURS.
3. 25-YEAR WATER SURFACE ELEVATIONS REFERENCE THE FEMA DATUM. SEE PAGE C2-2 FOR DISCUSSION OF THE DATUM.
4. SEE DRAWING C2-A-1 FOR PERMIT BOUNDARY LOCATION.

9/13/10

STATE OF TEXAS
A.C. FLORES VARELA
56939
REGISTERED PROFESSIONAL ENGINEER

Alejandro Flores V.

ISSUED FOR PERMITTING PURPOSES

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

CURRENT PERMITTED FLOOD STAGE ANALYSIS SUMMARY

WASTE MANAGEMENT OF TEXAS, INC.
ATASCOCITA RECYCLING AND DISPOSAL FACILITY
MAJOR PERMIT AMENDMENT

DANNENBAUM
ENGINEERING CORPORATION
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3100 WEST ALABAMA HOUSTON, TX 77098 (713) 520-9570

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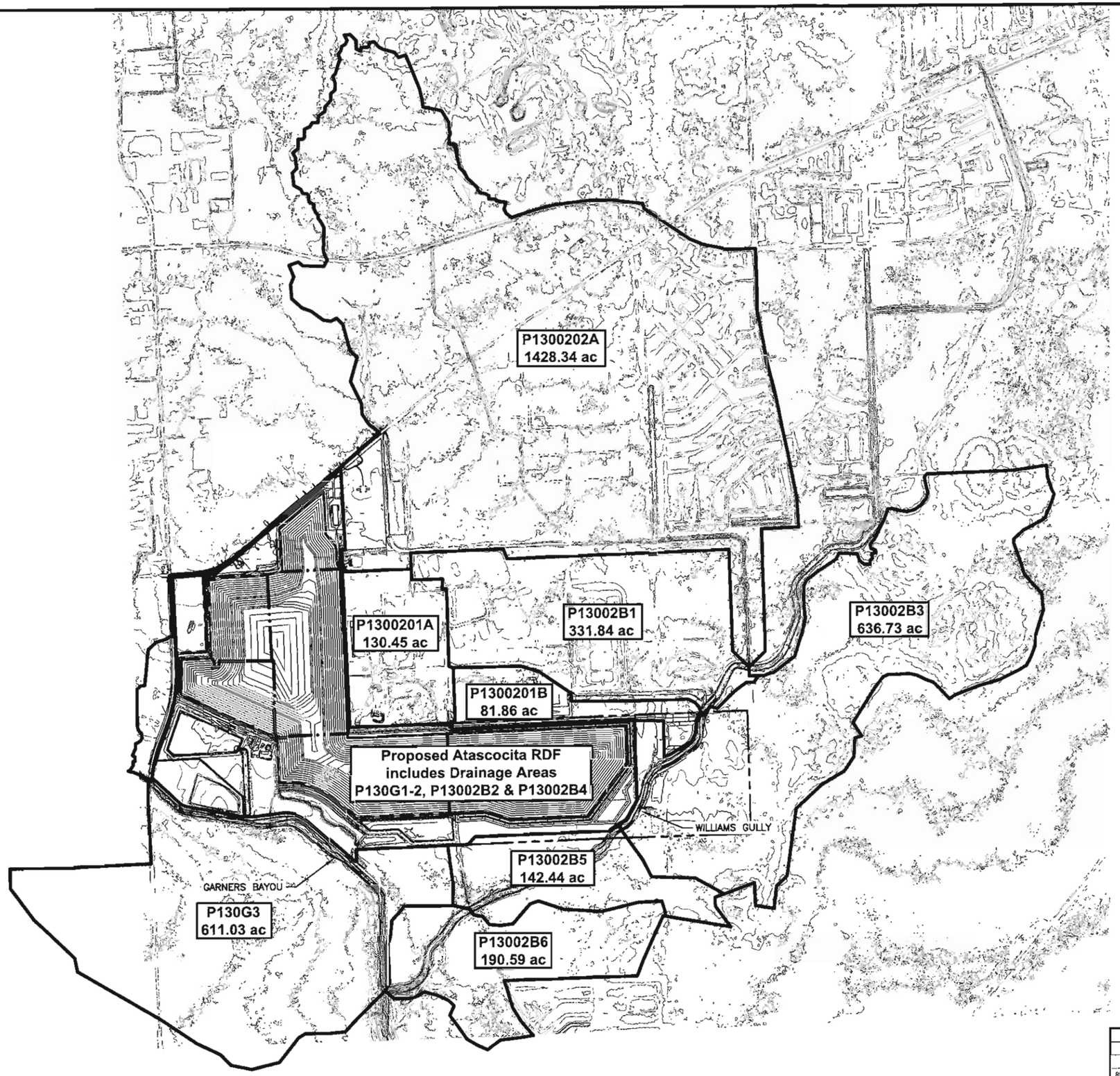

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SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL FOOTPRINT
- 450 EXISTING CONTOUR
- DRAINAGE AREA BOUNDARY
- STREAM

NOTES:

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ISSUED FOR PERMITTING PURPOSES

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

POSTDEVELOPMENT REGIONAL DRAINGE AREA MAP

WASTE MANAGEMENT OF TEXAS, INC.
ATASCOCITA RECYCLING AND DISPOSAL FACILITY
MAJOR PERMIT AMENDMENT

DANNENBAUM
ENGINEERING CORPORATION
T.B.P.E. FIRM REGISTRATION #392
3100 WEST ALABAMA HOUSTON, TX 77098 (713) 520-9570

DSN.	DEC	DATE :	09/10
DWN.	BME	SCALE :	GRAPHIC
CHK.	DEC	DWG :	C2_A_3.dwg

DRAWING C2-A-3

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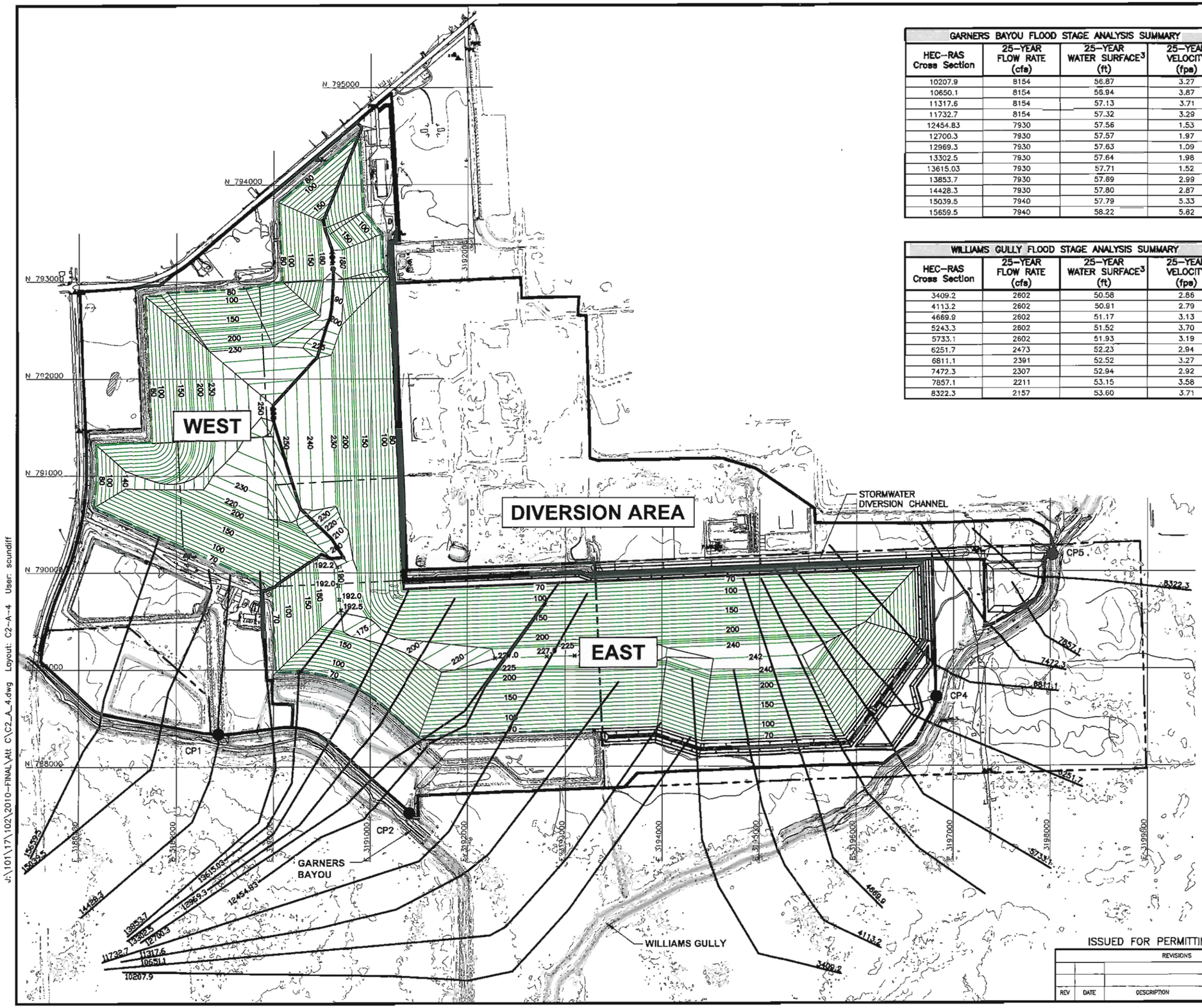

GARNERS BAYOU FLOOD STAGE ANALYSIS SUMMARY			
HEC–RAS Cross Section	25–YEAR FLOW RATE (cfs)	25–YEAR WATER SURFACE[3] (ft)	25–YEAR VELOCITY (fps)
10207.9	8154	56.87	3.27
10650.1	8154	56.94	3.87
11317.6	8154	57.13	3.71
11732.7	8154	57.32	3.29
12454.83	7930	57.56	1.53
12700.3	7930	57.57	1.97
12969.3	7930	57.63	1.09
13302.5	7930	57.64	1.98
13615.03	7930	57.71	1.52
13853.7	7930	57.89	2.99
14428.3	7930	57.80	2.87
15039.5	7940	57.79	5.33
15659.5	7940	58.22	5.82

WILLIAMS GULLY FLOOD STAGE ANALYSIS SUMMARY			
HEC–RAS Cross Section	25–YEAR FLOW RATE (cfs)	25–YEAR WATER SURFACE[3] (ft)	25–YEAR VELOCITY (fps)
3409.2	2602	50.58	2.86
4113.2	2602	50.91	2.79
4669.9	2602	51.17	3.13
5243.3	2602	51.52	3.70
5733.1	2602	51.93	3.19
6251.7	2473	52.23	2.94
6811.1	2391	52.52	3.27
7472.3	2307	52.94	2.92
7857.1	2211	53.15	3.58
8322.3	2157	53.60	3.71

0 400 800
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL FOOTPRINT
- 60 EXISTING CONTOUR
- DRAINAGE AREA BOUNDARY
- DRAINAGE AREA REACH
- STREAM

NOTES:

1. CONTOURS AND ELEVATIONS COMPILED BY DALLAS AERIAL SURVEYS FROM AERIAL SURVEY FLOWN APRIL 13, 2009. CONTOURS OUTSIDE THE PERMIT BOUNDARY TAKEN FROM 2001 LIDAR MAPPING PROVIDED BY DANNENBAUM.
2. CONTOURS WITHIN THE WASTE DISPOSAL FOOTPRINT DEPICT POSTDEVELOPMENT FINAL CONTOURS.
3. 25–YEAR WATER SURFACE ELEVATIONS REFERENCE THE FEMA DATUM. FINAL COVER CONTOUR ELEVATIONS REFERENCE THE SITE DATUM. SEE PAGE C2–2 FOR A DISCUSSION OF THE DATUM.
4. SEE DRAWING C1–A–1 FOR PERMIT BOUNDARY LOCATION.

STATE OF TEXAS
A.C. FLORES VARELA
56939
REGISTERED
PROFESSIONAL ENGINEER

9/13/10

alejandro flores v

ISSUED FOR PERMITTING PURPOSES

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

POSTDEVELOPMENT FLOOD STAGE ANALYSIS SUMMARY

WASTE MANAGEMENT OF TEXAS, INC.
ATASCOCITA RECYCLING AND DISPOSAL FACILITY
MAJOR PERMIT AMENDMENT

DANNENBAUM
ENGINEERING CORPORATION
T.B.P.E. FIRM REGISTRATION #392
3100 WEST ALABAMA HOUSTON, TX 77098 (713) 520-9570

DSN.	DEC	DATE :	09/10
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WASTE MANAGEMENT OF TEXAS, INC.
Atascocita Recycling and Disposal Facility
Current Permitted/Postdevelopment 25-Year Flood Stage Analysis Summary

Garners Bayou 25-Year Flood Stage Analysis Summary

HEC-RAS Cross Section	Current Permitted 25-Year Flow Rate (cfs)	Postdevelopment 25-Year Flow Rate (cfs)	Difference	Current Permitted 25-Year Water Surface* (ft)	Postdevelopment 25-Year Water Surface* (ft)	Difference	Current Permitted 25-Year Velocity (fps)	Postdevelopment 25-Year Velocity (fps)	Difference
10207.9	8154	8154	0	56.88	56.87	-0.01	3.27	3.27	0.00
10650.1	8154	8154	0	56.95	56.94	-0.01	3.86	3.87	0.01
11317.6	8154	8154	0	57.14	57.13	-0.01	3.71	3.71	0.00
11732.7	8154	8154	0	57.32	57.32	0.00	3.28	3.29	0.01
12454.83	7930	7930	0	57.57	57.56	-0.01	1.53	1.53	0.00
12700.3	7930	7930	0	57.57	57.57	0.00	1.97	1.97	0.00
12969.3	7930	7930	0	57.64	57.63	-0.01	1.09	1.09	0.00
13302.5	7930	7930	0	57.65	57.64	-0.01	1.98	1.98	0.00
13615.03	7930	7930	0	57.71	57.71	0.00	1.51	1.52	0.01
13853.7	7930	7930	0	57.69	57.69	0.00	2.99	2.99	0.00
14428.3	7930	7930	0	57.81	57.80	-0.01	2.87	2.87	0.00
15039.5	7940	7940	0	57.80	57.79	-0.01	5.33	5.33	0.00
15659.5	7940	7940	0	58.22	58.22	0.00	5.82	5.82	0.00

Williams Gully 25-Year Flood Stage Analysis Summary

HEC-RAS Cross Section	Current Permitted 25-Year Flow Rate (cfs)	Postdevelopment 25-Year Flow Rate (cfs)	Difference	Current Permitted 25-Year Water Surface* (ft)	Postdevelopment 25-Year Water Surface* (ft)	Difference	Current Permitted 25-Year Velocity (fps)	Postdevelopment 25-Year Velocity (fps)	Difference
3409.2	2626.0	2602	-24	51.01	50.58	-0.43	2.72	2.86	0.14
4113.2	2626.0	2602	-24	51.30	50.91	-0.39	2.67	2.79	0.12
4669.9	2626.0	2602	-24	51.52	51.17	-0.35	3.00	3.13	0.13
5243.3	2626.0	2602	-24	51.83	51.52	-0.31	3.56	3.70	0.14
5733.1	2626.0	2602	-24	52.20	51.93	-0.27	3.10	3.19	0.09
6251.7	2417.0	2473	56	52.47	52.23	-0.24	2.77	2.94	0.17
6811.1	2333.0	2391	58	52.73	52.52	-0.21	3.09	3.27	0.18
7472.3	2245.0	2307	62	53.10	52.91	-0.19	2.78	2.92	0.14
7857.1	2146.0	2211	65	53.28	53.15	-0.13	3.40	3.58	0.18
8322.3	2090.0	2157	67	53.69	53.60	-0.09	3.54	3.71	0.17

*25-year water surface elevations are based on the 2001 FEMA datum. See page C2-2.

ATASCOCITA RECYCLING AND DISPOSAL FACILITY

ATTACHMENT C2
APPENDIX C2-B

100-YEAR FLOODPLAIN MAPS

Alejandro Flores V
9/13/10

Includes pages C2-B-1 through C2-B-3

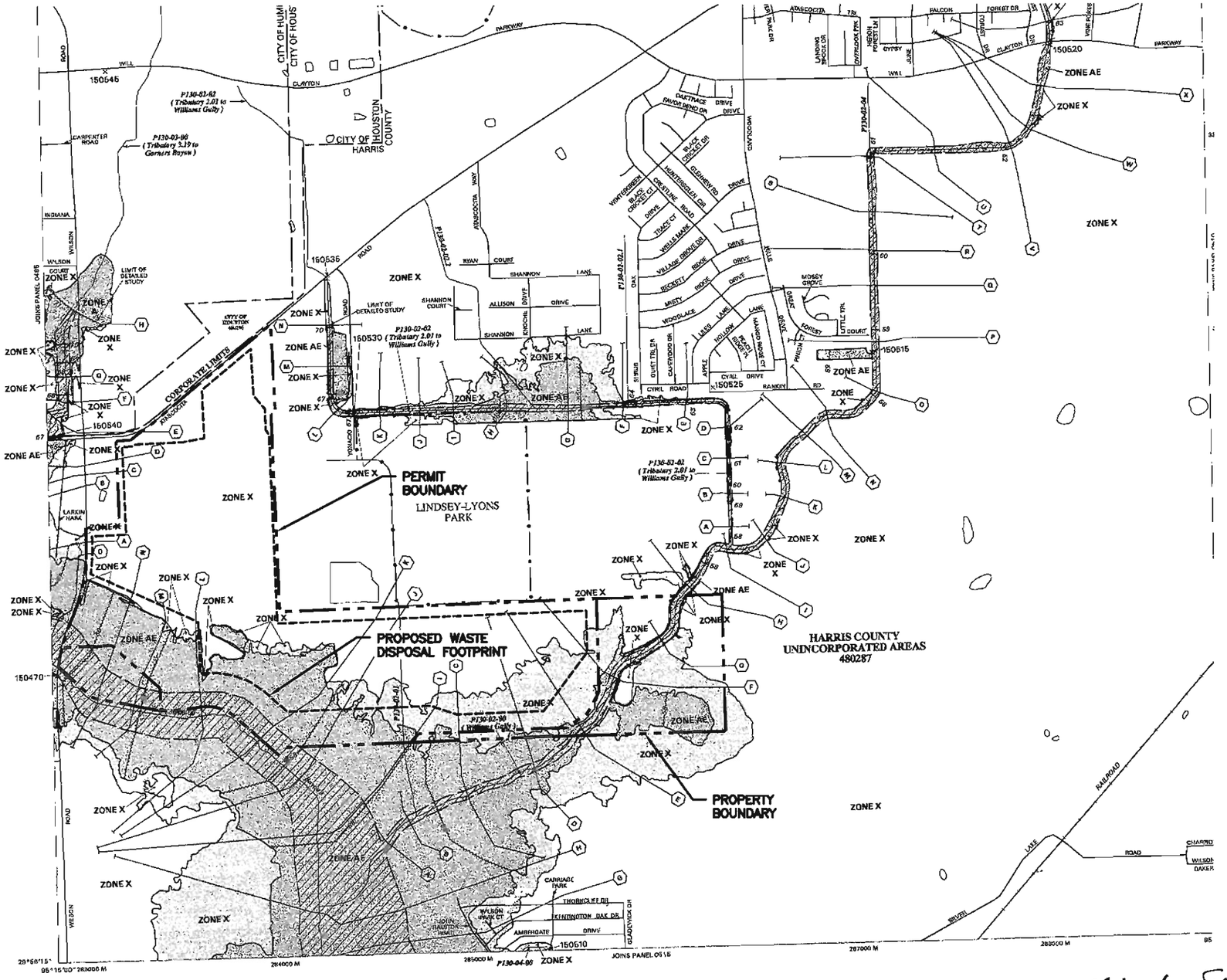
CONTENTS

Flood Insurance Rate Map (FIRM) C2-B-1

100-Year Floodplain Map Current Permitted C2-B-2

100-Year Floodplain Map Postdeveloped C2-B-3

Alejandro Flores V
9/13/10



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equalled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** — Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.
- **ZONE A99** — Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no base flood elevations determined.
- **ZONE V** — Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- (A)—(A) — Cross Section Line
- (23)—(23) — Transect Line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4276000M — 1000-meter Universal Transverse Mercator grid values, zone 15
- 600000 FT — 5000-foot grid ticks
- DX5510 × — Bench mark (see explanation in Notes to Users section of the FIRM panel).
- M1.5 — River Mile

MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
SEPTEMBER 28, 1990

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
SEPTEMBER 30, 1992
NOVEMBER 6, 1995
APRIL 20, 2000
JUNE 18, 2007: to change base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to reflect updated topographic information, and to change floodway.

- LANDFILL PERMIT BOUNDARY
- PROPERTY BOUNDARY

NOTES:
1. THIS MAP HAS BEEN COMPILED FROM FEMA FLOOD INSURANCE RATE MAP (FIRM) OF HARRIS COUNTY, TEXAS AND INCORPORATED AREAS COMMUNITY PANEL NUMBER 48201C0505L, REVISED JUNE 18, 2007.

STATE OF TEXAS
A.C. FLORES VARELA
56939
REGISTERED PROFESSIONAL ENGINEER

alejandro Flores Varela
9/13/10

ISSUED FOR INFORMATIONAL PURPOSES ONLY

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

FLOOD INSURANCE RATE MAP (FIRM)

WASTE MANAGEMENT OF TEXAS, INC.
ATASCOCITA RECYCLING AND DISPOSAL FACILITY
MAJOR PERMIT AMENDMENT

DANNENBAUM
ENGINEERING CORPORATION
T.B.P.E. FIRM REGISTRATION #392
3100 WEST ALABAMA HOUSTON, TX 77098 (713) 520-9570

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DWN. BME	SCALE : GRAPHIC	C2-B-1	
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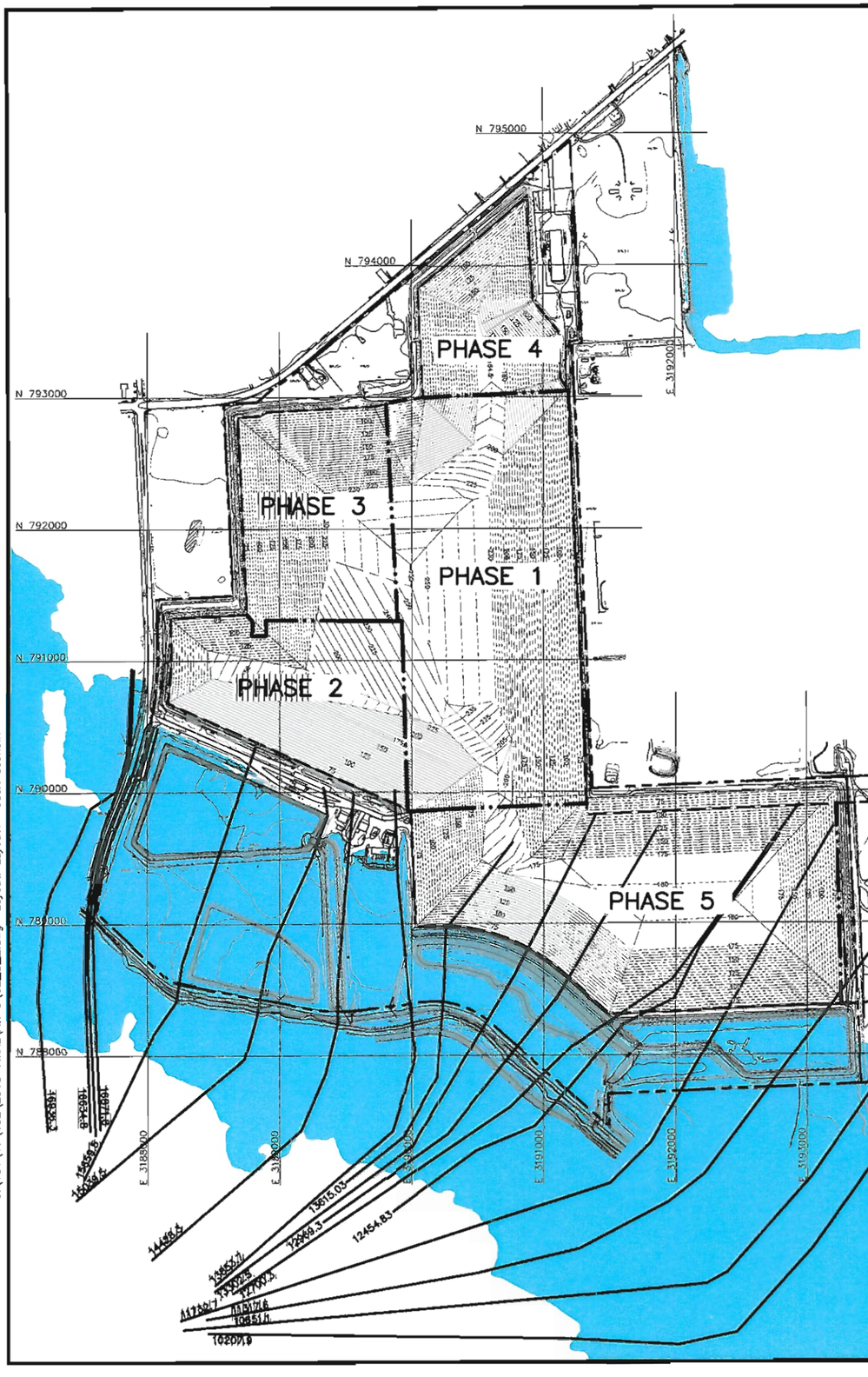

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SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL FOOTPRINT
- PHASE BOUNDARY
- EXISTING CONTOUR (CO)
- N 6753000 STATE PLANE GRID
- 100-YEAR FLOODPLAIN

NOTE:

1. EXISTING CONTOURS AND ELEVATIONS COMPILED BY DALLAS AERIAL SURVEYS FROM AERIAL SURVEY FLOWN APRIL 13, 2009. CONTOURS OUTSIDE THE PERMIT BOUNDARY TAKEN FROM 2001 LIDAR MAPPING PROVIDED BY DANNENBAUM.
2. HEC-RAS CROSS-SECTION STATION IS IN FEET.
3. 100-YEAR FLOODPLAIN PROVIDED BY DANNENBAUM AS APPROVED BY LOMR-F ISSUED BY FEMA ON SEPTEMBER 15, 2009.
4. FINAL COVER CONTOUR ELEVATIONS REFERENCE THE SITE DATUM. SEE PAGE C2-1 FOR A DISCUSSION OF THE DATUM.

Alejandro Flores 9/13/10

STATE OF TEXAS
A.C. FLORES VARELA
56939
REGISTERED PROFESSIONAL ENGINEER

ISSUED FOR PERMITTING PURPOSES ONLY

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

100-YEAR FLOODPLAIN MAP
CURRENT PERMITTED

WASTE MANAGEMENT OF TEXAS, INC.
ATASCOCITA RECYCLING AND DISPOSAL FACILITY
MAJOR PERMIT AMENDMENT

DANNENBAUM
ENGINEERING CORPORATION
T.B.P.E. FIRM REGISTRATION #392
3100 WEST ALABAMA HOUSTON, TX 77098 (713) 520-9570

DSN.	DEC	DATE :	09/10
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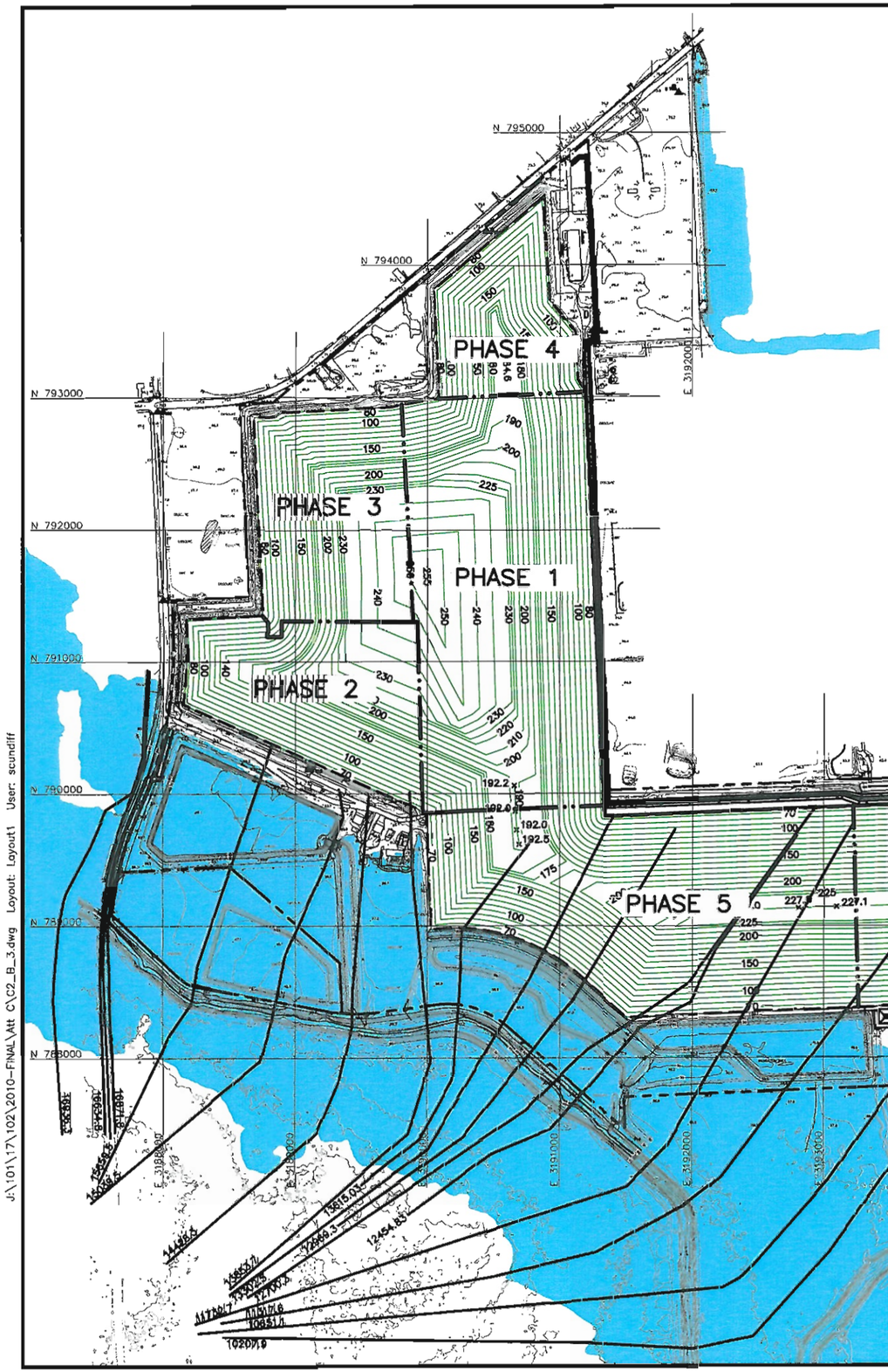

0 500 1000
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL FOOTPRINT
- PHASE BOUNDARY
- EXISTING CONTOUR
- N 6753000 STATE PLANE GRID
- 100–YEAR FLOODPLAIN

NOTE:

1. EXISTING CONTOURS AND ELEVATIONS COMPILED BY DALLAS AERIAL SURVEYS FROM AERIAL SURVEY FLOWN APRIL 13, 2009. CONTOURS OUTSIDE THE PERMIT BOUNDARY TAKEN FROM 2001 LIDAR MAPPING PROVIDED BY DANNENBAUM.
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STATE OF TEXAS
A.C. FLORES VARELA
56939
REGISTERED PROFESSIONAL ENGINEER

9/13/10

Alejandro Flores V.

ISSUED FOR PERMITTING PURPOSES ONLY

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

100–YEAR FLOODPLAIN MAP
POSTDEVELOPED

WASTE MANAGEMENT OF TEXAS, INC.
ATASCOCITA RECYCLING AND DISPOSAL FACILITY
MAJOR PERMIT AMENDMENT

DANNENBAUM
ENGINEERING CORPORATION
T.B.P.E. FIRM REGISTRATION #392
3100 WEST ALABAMA HOUSTON, TX 77098 (713) 520-9570

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ATASCOCITA RECYCLING AND DISPOSAL FACILITY

ATTACHMENT C2
APPENDIX C2-C

DOCUMENTATION OF APPROVED SUBMITTALS

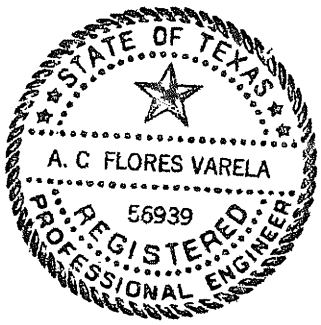
Includes pages C2-C-1 through C2-C-13

Alejandro Flores &
9/13/10

HARRIS COUNTY FLOOD CONTROL DISTRICT APPROVAL OF

ATASCOCITA RDF EXPANSION DRAINAGE DESIGN

PREPARED BY
DANNENBAUM ENGINEERING CORPORATION



alejandro Flores V
9/13/10

HARRIS COUNTY

Public Infrastructure Department
Architecture & Engineering Division

10555 Northwest Frwy., Suite 120
Houston, Texas 77092
(713) 956-3000

March 5, 2010

Mr. A.C. Flores Varela, P.E.
Dannenbaum Engineering Corporation
3100 West Alabama
Houston, TX 77098

SUBJECT: Drainage Analysis for Atascocita Recycling & Disposal Facility Expansion Drainage Design; Units P130-00-00 & 130-02-00: Key Map 376; Pct 2; Project No. 2006351

Dear Mr. Varela:

Harris County and the Harris County Flood Control District (HCFCD) have reviewed the above referenced report. Details of our understanding of the design are given on the attached review memo.

The report includes statements that the project will cause no adverse impact to the receiving waterways in storm events up to and including the 100-year event. The documentation within the report generally supports the conclusions stated by the engineer. Based on the stated conclusions, HCFCD interposes no objection to the referenced report. Please note, this acceptance does not necessarily mean that the entire report, including supporting data and calculations, has been completely checked and verified. However, the report is signed, dated, and sealed by a Professional Engineer licensed to practice in the State of Texas, which therefore conveys the licensed engineer's responsibility and accountability.

If you have any questions or need any additional information, please do not hesitate to contact the reviewers.

Sincerely,

Joshua Stuckey, CFM
Assistant Deputy Director

JS/fr
Attachments

cc: Raymond J. Anderson, HCPID
Dan Mushen, HCPID

MEMORANDUM

Harris County
Flood Control District
9900 Northwest Freeway
Houston, Texas 77092
713 684-4000

DATE: March 5, 2010

TO: Josh Stuckey, CFM
Harris County Permits Division

FROM: Myron M. Harris, P.E.
Watershed Coordination Department

RE: Project No. 2006351
Atascocita Recycling & Disposal Facility Expansion Drainage Design
HCFCD Units P130-00-00, P130-02-00; Key Map 376P; Pct 2

Objective

The referenced report dated December 23, 2009, by Dannenbaum Engineering Corp., has been reviewed pursuant to the HCFCD Policy, Criteria, and Procedure Manual and Section 3.02 of the "Regulations of Harris County, Texas for the Approval and Acceptance of Infrastructure." The goals of the review are to provide technical support to the Harris County Floodplain Administrator and to apply HCFCD policy and criteria where appropriate.

This review addresses issues regarding hydraulic and hydrologic drainage design criteria only. Design criteria regarding the site layout of the proposed development and drainage facilities will be reviewed upon submittal of site plans.

Submitted Report

Atascocita Recycling & Disposal Facility
Expansion Drainage Design
December 12, 2009

Consulting Engineer The Report was prepared by:

Dannenbaum Engineering Corporation
3100 West Alabama
Houston, TX 77098
TBPE No. 392
A.C. Flores Varela, P.E.
TX P.E.# 56939

HCFCD Jurisdiction	The proposed development outfalls directly into HCFCD right-of-way and is located within a watershed where HCFCD detention and impact fee requirements apply.
Project Summary	Dannenbaum Engineering Corp was contracted by Waste Management of Texas, Inc., to conduct a drainage analysis for the expansion of Atascocita Recycling and Disposal Facility, located in the north central part of Harris County, Texas. The proposed project will expand the operations of the existing 503-acre permitted municipal solid facility to a total permitted size of 674 acres. The study has been conducted to demonstrate to the HCFCD that the proposed project will not impact the flooding conditions of the downstream receiving channels (Garner Bayou and Williams Gully). Current on-site drainage is accommodated through two existing drainage systems of which outfalls to Garner Bayou (P130-00-00). Both systems will undergo be modified to service the proposed detention facility.
Report's Findings	The report states, "The proposed development at Atascocita RDF, including the site expansion and diversion channel will not adversely affect the receiving channels. Flood stages do not increase for any modeled event". Also, "The proposed expansion does not induce adverse impacts to the 1% floodplain". Detention Summary Table 6.1 and Table 6.2 are attached.
HCFCD Planning Technical Review Comments	The Planning Department offers the following: The report includes statements that the project will cause no adverse impact to the receiving waterways in storm events up to and including the 100-year event. The documentation within the report generally supports the conclusions stated by the engineer. Based on the stated conclusions, HCFCD interposes no objection to the referenced report. Please note, this acceptance does not necessarily mean that the entire report, including all supporting data and calculations, has been completely checked and verified. However, the report is signed, dated, and sealed by a Professional Engineer licensed to practice in the State of Texas, which therefore conveys the licensed engineer's responsibility and accountability.

HCFCD Criteria

Additional Harris County Flood Control District criteria that you should be aware of include the following:

1. Design plans for the proposed project must be submitted to the Flood Control District for review and signature.

2. All work proposed within existing and future Flood Control District right-of-way must be designed and constructed in accordance with its Policy, Criteria, and Procedure Manual.

3. The owner is responsible for obtaining all necessary federal, state, and local permits. Approval for such permits must be obtained prior to receiving a HCFCD right-of-way permit from Harris County.

Floodplain Information

A portion of the project is located in the regulatory floodplain of Garners Bayou (P130-00-00). A LOMR-F was submitted and approved for this area in July of 2009, (Project No. 2003622).

Environmental Review & Permitting

Harris County Flood Control District's Environmental Department suggests that the U.S. Army Corps of Engineers be contacted to determine if a permit is required for this project. Copies of permits necessary for work within HCFCD rights-of-way should be given to HCFCD at least 48 hours prior to construction.

MMH:td
Attachments: Detention Summary Table 6.1 and Table 6.2

cc: Diane Blackburn, CFM

Memo 3-5-10 P# 2008351 Atascocita Recycling & Disposal Facility Expansion Drainage Design.doc

Table 6.1
Detention Summary
Atascocita Recycling & Disposal Facility Expansion
Internal Systems

Existing West Detention Pond

Detention Basin Drainage Area	264.96	ac
Detention Storage Rate	1.04	ac-ft/ac
Detention Storage Provided	275	ac-ft
Pond Top of Bank	61.00	ft-1978

Storm Frequency	50% 2-yr	10% 10-yr	4% 25-yr	1% 100-yr
Design Water Surface Elevation (ft-1978)	48.48	54.95	57.71	60.24
Freeboard Allowed (ft)	12.52	6.05	3.29	0.76
Existing Outflow (cfs)	104	174	215	238
Maximum Outflow Provided (cfs)	91	176	216	238

Existing East Detention Pond

Detention Storage Provided	219	ac-ft
Pond Top of Bank	60.00	ft-1978

Storm Frequency	50% 2-yr	10% 10-yr	4% 25-yr	1% 100-yr
Design Water Surface Elevation (ft-1978)	48.57	57.02	58.59	59.97
Freeboard Allowed (ft)	11.43	2.98	1.41	0.03
Existing Outflow (cfs)	130	296	350	379
Maximum Outflow Provided (cfs)	138	329	394	421

Proposed Detention Pond

Detention Storage Provided	52	ac-ft
Pond Top of Bank	61.00	ft-1978

Storm Frequency	50% 2-yr	10% 10-yr	4% 25-yr	1% 100-yr
Design Water Surface Elevation (ft-1978)	52.97	56.76	58.55	60.16
Freeboard Allowed (ft)	8.03	4.24	2.45	0.84
Existing Outflow (cfs)	NA	NA	NA	NA
Maximum Outflow Provided (cfs)	17	28	34	41

Combined East System

Total Drainage Area	417.92	ac
Total Detention Storage Provided	271	ac-ft
East System Detention Storage Rate	0.65	ac-ft/ac

Entire Atascocita RDF (without Diversion Channel)

Total Drainage Area	682.88	ac
Total Detention Storage Provided	546	ac-ft
Site Detention Storage Rate	0.80	ac-ft/ac

Table 6.2
Detention Summary
Atascocita Recycling & Disposal Facility Expansion
Diversion Channel

Detention Basin Drainage Area	212.48	ac
Detention Storage Rate	0.41	ac-ft/ac
Detention Storage Provided	88	ac-ft
Pond Top of Bank	61.23	ft-1978

Storm Frequency	50% 2-yr	10% 10-yr	4% 25-yr	1% 100-yr
Design Water Surface Elevation (ft-1978)	47.51	53.3	56.29	59.91
Freeboard Allowed (ft)	13.72	7.93	4.94	1.32
Existing Outflow (cfs)	NA	NA	NA	NA
Maximum Outflow Provided (cfs)	62	126	153	186

Entire Atascocita RDF (with Diversion Channel)

Total Drainage Area	895.36	ac
Total Detention Storage Provided	634	ac-ft
Site Detention Storage Rate	0.71	ac-ft/ac

FEDERAL EMERGENCY MANAGEMENT AGENCY APPROVAL OF

LETTER OF MAP REVISIONS BASED ON FILL (LOMR-F) DETERMINATION DOCUMENT

PREPARED BY
DANNENBAUM ENGINEERING CORPORATION

Federal Emergency Management Agency

Washington, D.C. 20472

September 15, 2009

THE HONORABLE ED EMMETT
COUNTY JUDGE, HARRIS COUNTY
1001 PRESTON STREET
SUITE 911
HOUSTON, TX 77002

CASE NO.: 09-06-2736A
COMMUNITY: HARRIS COUNTY, TEXAS
(UNINCORPORATED AREAS)
COMMUNITY NO.: 480287

DEAR MR. EMMETT:

This is in reference to a request that the Federal Emergency Management Agency (FEMA) determine if the property described in the enclosed document is located within an identified Special Flood Hazard Area, the area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood), on the effective National Flood Insurance Program (NFIP) map. Using the information submitted and the effective NFIP map, our determination is shown on the attached Letter of Map Revision based on Fill (LOMR-F) Determination Document. This determination document provides additional information regarding the effective NFIP map, the legal description of the property and our determination.

Additional documents are enclosed which provide information regarding the subject property and LOMR-Fs. Please see the List of Enclosures below to determine which documents are enclosed. Other attachments specific to this request may be included as referenced in the Determination/Comment document. If you have any questions about this letter or any of the enclosures, please contact the FEMA Map Assistance Center toll free at (877) 336-2627 (877-FEMA MAP) or by letter addressed to the Federal Emergency Management Agency, LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075.

Sincerely,

Kevin C. Long

Kevin C. Long, Acting Chief
Engineering Management Branch
Mitigation Directorate

LIST OF ENCLOSURES:

LOMR-F DETERMINATION DOCUMENT (REMOVAL)

cc: State/Commonwealth NFIP Coordinator
Community Map Repository
Region
Mr. Alejandro C. Flores, P.E.

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION BASED ON FILL DETERMINATION DOCUMENT (REMOVAL)

COMMUNITY AND MAP PANEL INFORMATION		LEGAL PROPERTY DESCRIPTION
COMMUNITY	HARRIS COUNTY, TEXAS (Unincorporated Areas)	Parcels of land, as described in the Special Warranty Deed, recorded as Document No. P430821; described in the Warranty Deed, recorded as Document No. L203614; described in the Substitute Trustee's Deed, recorded as Document No. R087717; described in the Special Warranty Deed, recorded as Document No. P430822; described in the Warranty Deed, recorded as Document No. P028699; described in the Warranty Deed, recorded as Document No. R001722; described in the Deed Without Warranty, recorded as Document No. R157798; described in the Substitute Trustree's Deed, recorded as Document No. R087719; described in
	COMMUNITY NO.: 480287	
AFFECTED MAP PANEL	NUMBER: 48201C0505L	
	DATE: 6/18/2007	
FLOODING SOURCE: P130-00-00 (GARNERS BAYOU)		APPROXIMATE LATITUDE & LONGITUDE OF PROPERTY: 29.952, -95.246 SOURCE OF LAT & LONG: ESRI: FEMA GEOCODE/GOOGLE MAPS DATUM: NAD 83

DETERMINATION

LOT	BLOCK/ SECTION	SUBDIVISION	STREET	OUTCOME WHAT IS REMOVED FROM THE SFHA	FLOOD ZONE	1% ANNUAL CHANCE FLOOD ELEVATION (NAVD 88)	LOWEST ADJACENT GRADE ELEVATION (NAVD 88)	LOWEST LOT ELEVATION (NAVD 88)
--	--	39.48 Acre Tract	3623 Wilson Road	Portion of Property	X (unshaded)	58.8 feet	--	--

Special Flood Hazard Area (SFHA) - The SFHA is an area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood).

ADDITIONAL CONSIDERATIONS (Please refer to the appropriate section on Attachment 1 for the additional considerations listed below.)

LEGAL PROPERTY DESCRIPTION
DETERMINATION TABLE (CONTINUED)
PORTIONS REMAIN IN THE FLOODWAY
FILL RECOMMENDATION
GROUND SUBSIDENCE

This document provides the Federal Emergency Management Agency's determination regarding a request for a Letter of Map Revision based on Fill for the property described above. Using the information submitted and the effective National Flood Insurance Program (NFIP) map, we have determined that the described portion(s) of the property(ies) is/are not located in the SFHA, an area inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood). This document revises the effective NFIP map to remove the subject property from the SFHA located on the effective NFIP map; therefore, the Federal mandatory flood insurance requirement does not apply. However, the lender has the option to continue the flood insurance requirement to protect its financial risk on the loan. A Preferred Risk Policy (PRP) is available for buildings located outside the SFHA. Information about the PRP and how one can apply is enclosed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at (877) 336-2627 (877-FEMA MAP) or by letter addressed to the Federal Emergency Management Agency, LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075.

Kevin C. Long

Kevin C. Long, Acting Chief
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION BASED ON FILL DETERMINATION DOCUMENT (REMOVAL)

ATTACHMENT 1 (ADDITIONAL CONSIDERATIONS)

LEGAL PROPERTY DESCRIPTION (CONTINUED)

described in the Warranty Deed, recorded as Document No. P682281; and described in the Warranty Deed, recorded as Document No. R015622; all deeds recorded in the Office of the County Clerk, Harris County, Texas

Please note: All Elevations in this Determination Document are referenced to the North American Vertical Datum of 1988 (2001 Adjustment)

The portion of properties are more particularly described by the following metes and bounds:

39.48 Acre Tract
COMMENCING at a 5/8 inch iron rod with cap (RPLS 4524) found for the most Southerly Southwest corner of said 136.132 acre tract and from which a ¾ inch iron pipe found for the Southeast corner of said 136.132 acre tract bears N 87°45'28" E, 1926.05 feet and the Southeast corner of said 116.132 acre tract bears S 02°35'52" E, 229.38 feet; thence North 02°35'52" W along the West boundary line of said 136.132 acre tract and the East boundary line of said 116.3526 acre tract a distance of 648.83 feet to the Point of BEGINNING; thence N 48°35'08" W a distance of 422.39 feet to a point of curve; thence in a Northwesterly direction, following a curve to the left; said curve having a radius of 1400.00 feet, a central angle of 46°56'43", a long chord of N 72°03'30" 1115.27 feet; for a arc length of 1147.09 feet to a point of tangent; thence the following courses; N 5°31'51" W, 40.68 feet; N 14°19'07" E, 181.25 feet; N 40°38'00" E, 113.96 feet; S 84°15'54" E, 79.97 feet; S 63°52'02" E, 178.72 feet; N 82°59'38" E, 259.89 feet; N 17°22'46" E, 85.89 feet; N 57°52'20" W, 96.99 feet; N 61°07'45" W, 504.72 feet; N 35°44'02" W, 82.20 feet; N 02°27'19" E, 53.66 feet; N 32°43'19" E, 60.25 feet; S 88°28'32"E, 201.63 feet; S 68°50'09" E, 320.18 feet; S 39°38'28" E, 243.30 feet; S 08°11'21" E, 153.57 feet; N 77°38'28" E, 99.47 feet; N 89°29'36" E, 354.63 feet; S 88°06'52" E, 356.71 feet; N 78°36'24" E, 201.42 feet; N 89°23'30" E, 149.44 feet; N 51°51'03" E, 111.63 feet; N 85°33'35" E, 118.20 feet, S 19°59'35" E, 169.03 feet; S 12°05'35" E, 145.81 feet; S 59°34'15" W, 110.02 feet; S 69°18'23" W, 135.67 feet, S 01°22'34" W, 139.13 feet; S 12°57'47" E, 96.96 feet; S 27°47'18" E, 60.21 feet; S 68°32'24" E, 80.54 feet; S 44°20'19" E, 154.49 feet; S 08°00'34" E, 78.43 feet; S 13°18'44" W, 65.04 feet; S 44°20'58" E, 215.21 feet; N 29°46'03" E, 75.55 feet; N 37°10'13" E, 138.67 feet; N 46°04'31" E, 194.16 feet; S 45°09'29" E, 71.28 feet; S 33°47'23" W, 89.13 feet; S 39°33'17" W, 163.61 feet; S 16°30'48" W, 66.24 feet; S 87°44'13" W, 1020.91 feet; N 63°08'56" W, 86.31 feet; N 48°35'08" W, 61.40 feet to the Point of BEGINNING

0.04 Acre Tract
COMMENCING at a 5/8 inch iron rod with cap (RPLS 4524) found for the most Southerly Southwest corner of said 136.132 acre tract and from which a ¾ inch iron pipe found for the Southeast corner of said 136.132 acre tract bears N 87°45'28" E, 1926.05 feet; thence N 66°57'07" E, a distance of 1590.54 feet to the Southwest corner of this 0.04 acre tract and the Point of BEGINNING; thence N 25°00'22" E, a distance of 33.24 feet to a point for corner; thence N 83°38'56" E, a distance of 30.35 feet to a point for corner; thence S 55°18'56" E, a

This attachment provides additional information regarding this request. If you have any questions about this attachment, please contact the FEMA Map Assistance Center toll free at (877) 336-2627 (877-FEMA MAP) or by letter addressed to the Federal Emergency Management Agency, LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075.

Kevin C. Long

Kevin C. Long, Acting Chief
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION BASED ON FILL
DETERMINATION DOCUMENT (REMOVAL)

ATTACHMENT 1 (ADDITIONAL CONSIDERATIONS)

distance of 52.75 feet to the Southeast corner of this 0.04 acre tract; thence S 87°44'13" W, a distance of 87.65 feet to the Point of BEGINNING

DETERMINATION TABLE (CONTINUED)

LOT	BLOCK/ SECTION	SUBDIVISION	STREET	OUTCOME WHAT IS REMOVED FROM THE SFHA	FLOOD ZONE	1% ANNUAL CHANCE FLOOD ELEVATION (NAVD 88)	LOWEST ADJACENT GRADE ELEVATION (NAVD 88)	LOWEST LOT ELEVATION (NAVD 88)
--	--	0.04 Acre Tract	3623 Wilson Road	Portion of Property	X (unshaded)	58.2 feet	--	--

PORTIONS OF THE PROPERTY REMAIN IN THE FLOODWAY (This Additional Consideration applies to the preceding 2 Properties.)

A portion of this property is located within the Special Flood Hazard Area and the National Flood Insurance Program (NFIP) regulatory floodway for the flooding source indicated on the Determination/Comment Document while the subject of this determination is not. The NFIP regulatory floodway is the area that must remain unobstructed in order to prevent unacceptable increases in base flood elevations. Therefore, no construction may take place in an NFIP regulatory floodway that may cause an increase in the base flood elevation, and any future construction or substantial improvement on the property remains subject to Federal, State/Commonwealth, and local regulations for floodplain management. The NFIP regulatory floodway is provided to the community as a tool to regulate floodplain development. Modifications to the NFIP regulatory floodway must be accepted by both the Federal Emergency Management Agency (FEMA) and the community involved. Appropriate community actions are defined in Paragraph 60.3(d) of the NFIP regulations. Any proposed revision to the NFIP regulatory floodway must be submitted to FEMA by community officials. The community should contact either the Regional Director (for those communities in Regions I-IV, and VI-X), or the Regional Engineer (for those communities in Region V) for guidance on the data which must be submitted for a revision to the NFIP regulatory floodway. Contact information for each regional office can be obtained by calling the FEMA Map Assistance Center toll free at (877) 336-2627 (877-FEMA MAP) or from our web site at http://www.fema.gov/about/regoff.htm.

This attachment provides additional information regarding this request. If you have any questions about this attachment, please contact the FEMA Map Assistance Center toll free at (877) 336-2627 (877-FEMA MAP) or by letter addressed to the Federal Emergency Management Agency, LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075.

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LETTER OF MAP REVISION BASED ON FILL DETERMINATION DOCUMENT (REMOVAL)

ATTACHMENT 1 (ADDITIONAL CONSIDERATIONS)

FILL RECOMMENDATION (This Additional Consideration applies to the preceding 2 Properties.)

The minimum NFIP criteria for removal of the subject area based on fill have been met for this request and the community in which the property is located has certified that the area and any subsequent structure(s) built on the filled area are reasonably safe from flooding. FEMA's Technical Bulletin 10-01 provides guidance for the construction of buildings on land elevated above the base flood elevation through the placement of fill. A copy of Technical Bulletin 10-01 can be obtained by calling the FEMA Map Assistance Center toll free at (877) 336-2627 (877-FEMA MAP) or from our web site at http://www.fema.gov/mit/tb1001.pdf. Although the minimum NFIP standards no longer apply to this area, some communities may have floodplain management regulations that are more restrictive and may continue to enforce some or all of their requirements in areas outside the Special Flood Hazard Area.

GROUND SUBSIDENCE (This Additional Consideration applies to the preceding 2 Properties.)

The location of this request is in an area subject to ground subsidence, the lowering of the ground as a result of natural occurrences such as soil settlement, or artificial occurrences such as the extraction of water or oil from the ground. While the elevations submitted with this request show the subject property is currently above the Base Flood Elevation (BFE), the property may "subside" with the passage of time to the extent that property elevations would be below the BFE and flood insurance may be required.

This attachment provides additional information regarding this request. If you have any questions about this attachment, please contact the FEMA Map Assistance Center toll free at (877) 336-2627 (877-FEMA MAP) or by letter addressed to the Federal Emergency Management Agency, LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075.

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