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## 2011 Regional Storm Debris Management Assessment

Houston-Galveston Area Council (H-GAC)



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## Houston-Galveston Area Council 2011 Regional Storm Debris Management Assessment

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## ACRONYMS

C&D	Construction and Demolition
CDP	Census-Designated Place
СҮ	Cubic Yard
DDMP	Disaster Debris Management Plan
DMS	Debris Management Site
DRSPFA	Debris Removal Services Program Feasibility Analysis
EPA	U.S. Environmental Protection Agency
E-waste	Electronic Waste
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GIS	Geographic Information Systems
H-GAC	Houston-Galveston Area Council
HHW	Household Hazardous Waste
MUD	Municipal Utility District
PA	Public Assistance
PNP	Private Nonprofit
RFP	Request for Proposals
ROW	Right of Way
RSDMA	Regional Storm Debris Management Assessment
SGDM	Strategic Guide to Debris Management
UASI	Urban Area Security Initiative
TCEQ	Texas Commission on Environmental Quality
TDSRS	Temporary Debris Storage and Reduction Site
TxDOT	Texas Department of Transportation

#### Background

In May of 2003, the Houston-Galveston Area Council (H-GAC) conducted a regional storm debris management assessment (RSDMA). The purpose of the 2003 RSDMA was to determine if local governments within the region were prepared to respond to a major debris-generating incident. The purpose of the 2011 RSDMA is to reassess the preparedness of local governments within the region and review the impact H-GAC resources and programs have had in assisting the region with debris management planning. To accomplish this, the project was divided into four phases.

#### Phase 1: Assess the Impact of Houston-Galveston Area Council Resources and Programs

H-GAC resources and programs were reviewed to determine which were the most effective in assisting local governments with debris management planning.

#### Phase 2: Assess the Disaster Preparedness of Local Governments within the Region

The project team worked with H-GAC to develop and distribute a revised 2011 RSDMA Inventory and Existing Plan Survey to assess the debris management planning of local governments within the region.

#### Phase 3: Develop the 2011 Regional Storm Debris Management Assessment Update

The H-GAC 2011 RSDMA was updated to reflect findings and new information related to the region.

# Phase 4: Conduct the 2011 Houston-Galveston Area Council Regional Storm Debris Management Assessment Plan Workshop

The 2011 H-GAC RSDMA Plan Workshop presented the findings and recommendations of the plan and provided a review of debris management planning to help local governments respond to and recover from debris-generating incidents.

#### Key Findings Related to the Houston-Galveston Area Council

- Debris management workshops have been an effective tool to help the region prepare for and respond to debris-generating incidents.
- Access and use of the storm debris publications web site can be increased by evaluating and revising materials available and developing a communication strategy to inform local governments of this resource for debris management planning.
- H-GAC solid waste implementation grants can be used to fund technical studies related to debris management that can help local governments prepare for disasters.

#### Key Findings Related to Local Governments

Local governments in the region have increased debris management planning activities and have grown more experienced in responding to and recovering from debris-generating incidents.

- Local governments in the region are knowledgeable of basic debris management planning and are requesting more advanced debris management training topics.
- Local governments in the region have increased their application of technology for debris management planning.
- Debris estimates may not correspond to observed debris quantities and local governments should plan for and be prepared to respond to greater debris quantities than anticipated based on debris estimation tools.

#### Recommendations to Assist H-GAC in Debris Management Planning

- H-GAC should reexamine and reissue the H-GAC Debris Removal Services Program in 2011 to reflect revised guidance from reimbursement agencies and changes in the debris vendor industry.
- H-GAC should explore the use of webinars or other virtual meeting tools to allow for flexibility and greater attendance of future debris management workshops.
- Because H-GAC continues to lead the region in developing tools and reference materials for local governments, H-GAC should explore developing a smartphone-compatible debris management reference guide.
- H-GAC should investigate reorganizing online reference materials to allow for a more user-friendly interface for those planning for or affected by a debris-generating incident.
- To reduce the amount of storm-generated debris that is disposed of at regional landfills, H-GAC should examine disposal alternatives for storm-generated debris, including markets for wood chips, ash, white goods, household hazardous waste (HHW), and construction and demolition (C&D) debris.

# Recommendations to Assist Regional Local Governments in Debris Management Planning

- Local governments should enhance debris management planning programs by including plan review, update, and exercise activities.
- Local governments should incorporate Federal Highway Administration Emergency Relief (FHWA-ER) Program eligible roads and data into existing road inventory data.
- Local governments with pre-positioned contracts with debris vendors should reexamine their contracts to ensure they meet the current standards specified by local, state, and federal regulations.
- Local governments should explore social media outlets to supplement traditional methods for debris management communications.
- Local governments should review debris management site options for future use following a debris-generating incident.

# Section 1 INTRODUCTION

## 1.1 Background

The mission of the Houston-Galveston Area Council (H-GAC) is to serve as the instrument of local government cooperation. In the spirit of local government cooperation, H-GAC conducted a regional storm debris management assessment (RSDMA) in 2003. The purpose of the RSDMA was to determine if local governments within the region were prepared to respond to a major debris-generating incident.

The assessment revealed that many of the local governments within the region lacked most of the proper capabilities and plans to respond to a major debris-generating incident. Therefore, the 2003 RSDMA provided recommendations on how the local governments and H-GAC could better prepare the region to respond to a debris-generating incident.

Local Governments	H-GAC
<ul> <li>Update or develop a coordinated disaster debris management plan (DDMP).</li> </ul>	Coordinate a meeting between the 13 county emergency management coordinators and project
Designate a debris manager.	team to discuss key findings and recommendations of the 2003 RSDMA.
Create a debris management center.	Coordinate the presentation of debris management
Assign a public information officer.	workshops.
Develop right-of-entry and hold harmless agreements.	Coordinate with the City of Houston for a demonstration of their GIS-based debris
Establish pre-positioned contracts with debris removal and disposal vendors.	management application.
Identify temporary debris management sites (DMS) and conduct baseline studies on each site.	
Identify and train debris contract monitors.	
<ul> <li>Conduct training workshops for debris management staff.</li> </ul>	
Develop a geographic information systems (GIS)- based debris management application capable of forecasting and estimating debris quantities and tracking debris removal activities.	

Table 1-1 Summary of 2003 RSDMA Recommendations

Based on the findings and recommendations of the 2003 RSDMA, H-GAC has strived to become the regional leader in disaster debris management planning, training, resources, and programs. Debris-generating incidents since 2003, such as Hurricane Rita in 2005 and Hurricane Ike in 2008, have tested the preparedness of local governments in the region and demonstrated the value of planning and preparedness efforts.

H-GAC commissioned the 2011 RSDMA update to revisit many of the key elements of the 2003 RSDMA and to analyze the progress the region has made over the last 8 years.

## 1.2 Project Approach

The purpose of the 2011 RSDMA is to reassess the preparedness of local governments within the region and review the impact H-GAC resources and programs have had in assisting the region with debris management planning. To accomplish this, the project was divided into four phases.



## 1.2.1 Phase 1: Assess the Impact of H-GAC Resources and Programs

A critical element in determining how to better prepare for major debris-generating incidents is to assess the impact of previous planning and training efforts. In Phase 1, H-GAC resources and programs were reviewed to determine which were most effective in assisting local governments with debris management planning. Debris management-related resources and programs provided by H-GAC include debris management workshops, storm debris publications, solid waste implementation grants, and debris management programs.

As part of the analysis in Phase 1, an H-GAC Program Assessment Survey was distributed to local governments, state agencies, and private sector stakeholders. The purpose of the survey was to obtain feedback on the debris management resources and programs provided by H-GAC.

# 1.2.2 Phase 2: Assess the Disaster Preparedness of Local Governments within the Region

In Phase 2, the debris management preparedness of local governments was evaluated. The project team worked with H-GAC to develop a list of qualifiers to assess the debris management planning of local governments within the region. The established qualifiers were used to develop a revised 2011 RSDMA Inventory and Existing Plan Survey. During the 2003 RSDMA, an inventory and existing plan survey was distributed to county and city representatives and follow-up on-site meetings were conducted to collect the results.

In the interest of obtaining unbiased information, the 2011 RSDMA Inventory and Existing Plan Survey was distributed electronically and responses were collected anonymously. Survey respondents were asked only to designate the type of organization they represent (county, city, state, federal, or private sector).

### 1.2.3 Phase 3: Develop the 2011 Regional Storm Debris Management Assessment Update

Phase 3 consisted of updating the 2003 RSDMA to reflect findings and new information. The framework of the 2011 RSDMA was revised to include the following sections:

- Assessment of H-GAC resources and programs
- Local government debris management planning assessment
- Impact of a large-scale debris-generating incident
- Key findings
- Recommendations

#### 1.2.4 Phase 4: Conduct the 2011 Houston-Galveston Area Council Regional Storm Debris Management Assessment Plan Workshop

The purpose of the H-GAC RSDMA Plan Workshop was to present the findings and recommendations of the updated plan. The workshop also reviewed best management practices and presented new or revised Federal Emergency Management Agency (FEMA) guidance, policies, and procedures as they relate to debris management.

## Section 2 ASSESSMENT OF HOUSTON-GALVESTON AREA COUNCIL RESOURCES AND PROGRAMS

Over the past eight years, the Houston-Galveston Area Council (H-GAC) has strived to become the regional leader in disaster debris management planning, training, resources, and programs. Consequently, H-GAC has provided the region with workshops, publications, grants, and programs that support debris management planning and disaster preparedness.

## 2.1 Workshops

From 2006 to 2011, H-GAC-sponsored 17 workshops related to debris management planning. The workshops were available to local governments, state agencies, and private sector stakeholders. The workshops provided debris management planning guidance, updates regarding eligibility requirements, and best management practices for response and recovery operations. Presentations and associated workshop materials are maintained on H-GAC's web site and are available to the public. The workshop presentation and associated workshop materials can be accessed at the following locations:

http://www.h-gac.com/community/waste/storm/debris-workshops.aspx

http://www.h-gac.com/community/waste/storm/storm\_debris\_workshop\_resources.aspx

Table 2-1 lists the workshops by topic and includes presentation years. Appendix A includes a complete list of workshop materials maintained on H-GAC's web site.

Торіс	Number of Workshops	Years	
Planning	6	2006, 2007, 2009, 2010, 2010, 2011	
Reduction/disposal	3	2006, 2010, 2010	
Financial	2	2007, 2010	
Contracted services (hauling, monitoring, etc.)	3	2006, 2006, 2008	
Public information	1	2006	
Technology	1	2006	
Mutual aid	1	2010	

Table 2-1 H-GAC Storm Debris Workshops

For the purposes of this plan, the attendance and instructor evaluation forms from the series of six debris management planning workshops conducted in 2010 were reviewed. The average attendance was 62 participants per workshop. Workshop participants included representatives from cities, counties, state agencies, federal agencies, private sector entities, educational

institutions (schools, school districts, and universities), and other agencies (nonprofit organizations, flood control districts, council of governments, etc.).

Type of Organization	Number of Representatives	Percentage of Total Workshop Attendees
City government	52	27.23%
County government	59	30.89%
State agency	11	5.76%
Federal agency	4	2.09%
Private sector stakeholder	44	23.04%
Educational institution	3 1.57%	
Other agency	18	9.42%

Table 2-2 2010 Workshop Attendance

Table 2-2 lists the number of representatives per type of organization. As illustrated in the table, nearly 60 percent of participation came from city and county governments.

Table 2-3 Multiple Workshop Attendees

Type of Organization	Percentage Who Attended Two or More Workshops	Percentage Who Attended Three or More Workshops	Percentage Who Attended Four or More Workshops
City government	40%	29%	12%
County government	47%	29%	22%
State agency	45%	18%	-
Federal agency	-	-	-
Private sector stakeholder	30%	20%	14%
Educational institution	-	-	-
Other agency	61%	44%	39%

Table 2-3 lists the percentages of workshop attendees who were able to attend multiple workshops. In addition to being able to attend multiple workshops, many city and county governments were able to send multiple representatives. Appendix B includes a detailed table of participation for the debris management planning workshops conducted in 2010.

The consensus from the instructor evaluation forms was that participants found the workshops to be very helpful. However, participants felt that the following three areas of debris management planning were not adequately covered in the workshops:

- Guidance related to federal, state, and local agency coordination. Specific examples of coordination include mutual aid agreements, interlocal agreements, and more detail regarding how agencies can work together following a debris-generating incident.
- Information regarding contracted debris removal and monitoring services, such as the importance of pre-positioned contracts, best contract negotiation practices, and sample contract or contract templates.
- Guidance related to collection and disposal of household hazardous waste (HHW), white goods, and electronic waste (e-waste).

## 2.2 Storm Debris Publications

The next resource H-GAC has provided to the region is access to storm debris publications that assist local governments in debris management planning and response. The storm debris publications are maintained on H-GAC's web site and are available to the public at the following location:

http://www.h-gac.com/community/waste/storm/publications.aspx

H-GAC storm debris publications are organized into four sections:

- 2003 Regional Storm Debris Management Assessment Report
- Strategic Guide to Debris Management
- Helpful Information
- FEMA Forms

The storm debris publications web site also includes an electronic copy of the Montgomery County Temporary Debris Storage and Reductions Site (TDSRS) Report. The TDSRS report was completed for Montgomery County and was funded through an H-GAC solid waste implementation grant. The TDSRS report includes valuable information on identifying debris management sites (DMS), developing site operations plans, and applying for applicable permits.

**2003 Regional Storm Debris Management Assessment Report (RSDMA).** The 2003 RSDMA Plan includes helpful debris management planning items such as detailed county and city debris estimation tables, initial temporary debris management site investigation forms and site baseline data checklists, debris management plan development guidance, sample debris management contract scopes of work, and sample mutual aid agreements. These items assist in local government debris management planning and post-incident response.

**Strategic Guide to Debris Management (SGDM).** The SGDM was developed by H-GAC to provide guidance to local governments on developing and implementing a successful debris management plan.

**Helpful Information.** This section includes nine electronic documents that provide guidance on debris management planning and post-incident response operations. These documents relate to procurement and contracts, state and federal roads, and FEMA guidance. The following electronic documents are included in this section:

Pre-Disaster checklist

- Sample contract scopes of work
- Texas Commission on Environmental Quality (TCEQ) Outdoor Burning in Texas
- State procurement policies
- Texas Department of Transportation (TxDOT) and Federal Highway Administration (FHWA) roads
- Federal Emergency Management Agency (FEMA) Debris Management Guide
- FEMA Debris Operations Job Aid
- FEMA Public Assistance Guide
- Applicant workbook

**FEMA Forms.** This section includes FEMA forms related to documenting eligible costs and applying for reimbursement. The following FEMA forms are maintained on H-GAC's web site:

- Applicant's Benefits Calculation Worksheet
- Contract Work Summary Record
- Cost Estimate Continuation Sheet
- Damage Description and Scope of Work Continuation Sheet
- Force Account Equipment Summary Report
- Force Account Labor Summary Record
- Historic Review Assessment for Determination of Effect
- Maps and Sketches Sheet
- Materials Summary Record
- Photo Sheet
- Private Nonprofit (PNP) Facility Questionnaire
- Project Validation Form
- Project Worksheet Instructions
- Rented Equipment Summary Record
- Request for Public Assistance
- Special Consideration Questions
- Validation Worksheet

As part of the 2011 RSDMA Plan, visitor volume for the storm debris publication web site was reviewed. The designated review period was post-Hurricane Ike, from September 2008 through December 2008. As illustrated in Figure 2-1, the visitor volume increased from September to October. After October, visitor traffic gradually decreased.

Figure 2-1 Storm Debris Publications Web Site Visitors



Increased web site traffic from September 2008 to October 2008 may be attributed to two factors. First, there may have been increased traffic due to web site hits from affected local governments conducting Internet searches for guidance related to debris removal. Second, local governments in the H-GAC region may have accessed the storm debris publications web site because they were aware of the resources available on the site.

The decrease in traffic in the months of November and December is consistent with response and recovery operations being successfully underway and FEMA representatives being on the ground to support local government efforts in the region.

## 2.3 Solid Waste Implementation Grants

Each year H-GAC awards solid waste implementation grants to fund projects that will have a direct and measurable effect on reducing the amount of waste that goes into regional landfills. H-GAC solid waste implementation grants are also awarded for solid waste education, community cleanup events, facility improvement, and other solid waste management initiatives. The solid waste grants are open to local government and independent school districts and are categorized as follows:

- Citizens' collection stations and small registered transfer stations
- Education and training
- E-waste collection
- HHW management
- Litter and illegal dumping cleanup and community collection events
- Local enforcement

- Local solid waste management plans
- Source reduction and recycling
- Technical studies

H-GAC awards approximately \$1.4 million in solid waste implementation grants to local governments annually. In 2010, over \$2.1 million in solid waste implementation grants were awarded to eight counties, seven cities, and one independent school district within the region. Examples of projects funded in 2010 include HHW and E-waste education and collection events, enhancements to a permanent HHW facility, enhancements to a compost facility, a 2010 recycling awareness campaign, and environment enforcement and education. Additional information, such as resources for grantees, grants to date, grant application workshops, and grant writing tips, are available on H-GAC's solid waste implementation grant web site:

http://www.h-gac.com/community/waste/grant/default.aspx.

In addition to the efforts described above, the following two technical debris management planning studies were proposed and funded through H-GAC solid waste implementation grants:

**TDSRS Report – Montgomery County, Texas (2008).** This report helped reduce the amount of waste that is directed into regional landfills following a debris-generating incident. Although the report was specifically written for Montgomery County, the document provided guidance on identifying TDSRS locations (also known as DMS), developing site operations plans, and applying for permits that could be used by any of the local governments within the region. Proper use of DMS locations following a debris-generating incident can reduce the amount of storm debris that is directed to regional landfills. DMS locations allow for proper segregation of usable metals recovered from construction and demolition (C&D) debris and the reduction of vegetative debris. Both activities reduce the amount of storm debris that must be disposed of at regional landfills.

**Disaster Debris Management Plan (DDMP) – Brazoria County, Texas (2009).** While this DDMP was developed specifically for Brazoria County, the document provided a template for other local governments in the region to work from to develop their own DDMP. Additionally, many of the appendices included in the DDMP (including sample press releases, a sample right-of-entry agreement, a sample memorandum of agreement, a health and safety strategy, and debris management checklists) can be used by any local government following a debris-generating incident.

Both technical studies are maintained on H-GAC's storm debris publications web site and are available for the public to download.

## 2.4 Programs

One of H-GAC's goals is to simplify the governmental procurement process by establishing competitively priced contracts for goods and services. H-GAC contracts have been obtained through a public competitive procurement process and are available to participating members of HGACBuy. HGACBuy is a government-to-government procurement service that has been assisting governmental entities with procuring products and services for over 30 years.

In January 2008, the H-GAC Debris Removal Services Program Feasibility Analysis was completed. The purpose of the feasibility analysis was to assess the interest of governmental entities and potential vendors in participating in a debris removal services program. Based on the findings of the feasibility analysis, H-GAC decided to pursue the development of a debris removal services program. The decision to pursue the program was based largely on the following:

- H-GAC's ongoing commitment to help end-users reduce costs and streamline procurement processes through their government-to-government procurement services
- FEMA policy statements encouraging local governments to develop pre-positioned debris hauler contracts
- Discussions within FEMA to issue a policy stating that if a local government has taken the necessary steps to be better prepared for debris removal (for example, disposal site identification, pre-positioned contracts, and debris management plan), they would be eligible for a higher federal cost-share

Through a public and competitive procurement process, H-GAC selected the following debris removal vendors to be available through the H-GAC Debris Removal Services Program:

- Ashbritt, Inc.
- Ceres Environmental Services, Inc.
- CrowderGulf
- D&J Enterprises, Inc.
- DRC Emergency Services, Inc.
- Phillips & Jordan, Inc.
- Storm Reconstruction Services, Inc.
- TFR Enterprises, Inc.

Since the inception of the H-GAC Debris Removal Services Program, 29 local governments have used the program to establish pre-positioned debris removal vendors. The H-GAC Debris Removal Services Program is efficient and cost-effective. On average, it takes local government agencies six to eight months to develop and complete the bid/request for proposal (RFP) process. The lengthy procurement process reduces the time each local government has to devote to the research and development of debris services contracts. One of the findings of the procurement program analysis was that, on average, local governments invested \$23,000 to \$30,000 in developing and finalizing their debris removal contracts. The estimation was based on salaries of each participant's employees and the time they spent composing their current contracts. Pre-positioned debris removal contracts are a critical aspect of debris management planning. Local governments in the region may not have the capacity or resources to invest in developing a debris removal services bid/RFP. Consequently, the H-GAC Debris Removal Services Program is a critical resource that can help local governments establish pre-positioned debris removal contracts. Of the 29 local governments that have used the H-GAC Debris Removal Services Program, 26 are from the H-GAC region. Table 2-4 lists the local governments within the H-GAC region that have used the H-GAC Debris Removal Services Program.

Table 2-4
Local Governments within H-GAC Region That Have Participated in the Debris Removal Services
Program

Local Government	Year Contract Established	Households
Chambers County	2008	14,000
City of Jersey Village	2008	3,000
City of Palacios	2008	1,800
City of West University Place	2008	5,300
City of Wharton	2008	3,400
Austin County	2009	9,000
City of Angleton	2009	6,900
City of Clear Lake Shores	2009	550
City of El Campo	2009	3,700
City of Humble	2009	5,100
City of La Marque	2009	5,200
City of Nassau Bay	2009	2,000
City of Piney Point Village	2009	1,394
City of Sealy	2009	2,000
Galveston County Municipal Utility District (MUD) 12	2009	N/A**
Houston Housing Authority	2009	4,000*
League City	2009	24,000
Matagorda County	2009	14,000
City of Bayou Vista	2010	1,019
City of Bellaire	2010	6,400
City of Dayton	2010	1,800
City of Dickinson	2010	7,362
City of Kemah	2010	1,100
City of Pasadena	2010	47,000
City of Shenandoah	2010	1,100
City Katy	2011	4,400

\* Galveston County MUD 12 maintains easements and waterways for utilities.

\*\*Houston Housing Authority manages and owns approximately 4,000 rental units and 19 housing developments.

## 2.5 Houston-Galveston Area Council Programs Assessment Survey

As part of the 2011 RSDMA update, H-GAC distributed the H-GAC Programs Assessment Survey to local governments, state agencies, and private sector stakeholders. The purpose of the

survey was to gather information and feedback on participants' experiences with H-GAC-sponsored resources and programs regarding debris management planning. Thirty-eight representatives of the local governments, state agencies, and private sector stakeholders responded to the survey. Appendix C includes the survey questions and response analysis. The survey analysis is representative of the sample responses received. The sample responses are assumed to be representative of the region. Figure 2-2 summarizes survey participation by type of organization.

Figure 2-2 Survey Participation by Organization



#### 2.5.1 Workshop Feedback

The majority of survey respondents have attended an H-GAC-sponsored debris management planning workshop. Of the survey respondents who have not attended an H-GAC-sponsored debris management planning workshop, the primary reasons for not attending were 1) the respondent did not hear about the workshop, and 2) there was a conflict in workshop dates. The location of workshops did not affect participation in the region because over 80 percent of respondents agreed that workshops should be held at H-GAC headquarters (3555 Timmons Lane, Houston, Texas). This coupled with the fact that the majority of respondents were able to send more than one representative confirms workshops should continue to be held at H-GAC headquarters.

The survey revealed that the strongest influencing factor regarding workshop attendance is the workshop topic. Because H-GAC has sponsored over 17 workshops related to debris management planning, the challenge will be to find new and engaging topics. Based on survey responses, H-GAC should consider topics related to the application of geographic information systems (GIS) for debris management planning (54.5 percent response rate) and hazard mitigation (36.4 percent response rate). Recent advancements in GIS technology and application related to debris management planning and post-incident response may have helped contribute to the high response rate for topics related to GIS.

The survey also confirms that H-GAC-sponsored debris management planning workshops have helped the region prepare for disasters. Fifty-eight percent of respondents used H-GAC-sponsored workshop materials to assist in debris management planning. Figure 2-3 summarizes the workshop materials local governments used for debris management planning.



Figure 2-3 Reference Materials Used to Support Debris Management Planning

When presented with the threat of a viable debris-generating incident, 57 percent of respondents stated that they used reference materials from an H-GAC-sponsored workshop to assist with pre-incident debris management planning activities. Based on the survey, the H-GAC-sponsored debris management workshops and associated workshop materials have helped the region prepare for and respond to disasters.

## 2.5.2 Storm Debris Publications Feedback

The H-GAC Programs Assessment Survey also evaluated H-GAC's storm debris publications web site. The review of web site access statistics (see Figure 2-1) supported the assumption that the storm debris publications may have assisted local governments in the region following Hurricane Ike. However, the analysis of survey data indicates that the majority of respondents to the H-GAC Programs and Assessment Survey do not access the storm debris publications web site during normal conditions. The review of web site access statistics and survey data supports the position that the storm debris publications web site is not accessed regularly during normal conditions, but web site use increases during response conditions.

Additionally, if respondents were to access the web site, the majority also stated they would find FEMA forms more useful than other items, such as the H-GAC RSDMA Plan or the SGDM. Based on the survey responses, H-GAC might want to reassess the resources available on the storm debris publications web site and develop new resources or educate local governments on the benefits of the resources available.

### 2.5.3 Grants Feedback

To assess the impact of H-GAC's solid waste implementation grants, the H-GAC Programs Assessment Survey also polled respondents on their use of grants for debris management planning. The survey revealed that most respondents have not used grants for debris management planning activities. Of the responses, 3.2 percent have used an H-GAC solid waste implementation grant to fund debris management planning activities. The survey also polled respondents on what types of debris management planning activities they would fund using grants. Table 2-5 summarizes the responses. Many of the activities presented in Table 2-5, if completed by local governments, would help reduce the amount of waste that goes into regional landfills following a debris-generating incident. H-GAC might want to consider providing the region with more education on the use of solid waste implementation grants to fund applicable debris management planning activities the amount of storm debris that enters regional landfills.

Description	Percent
Final disposal/recycling analysis	30.8%
Debris estimation and modeling	34.6%
Regional debris management coordination	19.2%
Training	46.2%
Exercises	19.2%
Debris management plan	38.5%
DMS analysis	26.9%
Other	19.2%

Table 2-5 Debris Management Planning Activities

#### 2.5.4 Programs Feedback

The H-GAC Debris Removal Services Program was also assessed using the H-GAC Programs and Assessment Survey. Based on the responses, only 28 percent of respondents have used H-GAC to establish pre-positioned debris removal vendors.

However, respondents who have used H-GAC to procure debris removal vendors stated they did not have problems using the program and found H-GAC staff helpful in responding to questions and concerns.

Additionally, respondents stated that the strongest influencing factors for using H-GAC to procure debris removal vendors were ease of use and timesaving benefits of the program. While the number of respondents who have used H-GAC to procure debris removal vendors was low, this does not undermine the fact that 26 local governments within the region have used H-GAC to procure debris removal vendors. In addition, following Hurricane Ike, five local

governments within the region used debris removal vendors secured through H-GAC to perform debris removal and recovery services.

## 3.1 2011 Inventory and Existing Plan Survey Results

This section covers the results of the 2011 Inventory and Existing Plan Survey. To correspond with the 2003 Regional Storm Debris Management Assessment (RSDMA) Inventory and Existing Plan Survey, the 2011 survey results will be divided into the following sections:

- Organization and coordination
- Resources and training
- Technology

The 2011 RSDMA Inventory and Existing Plan Survey was distributed to select individuals representing local governments, state agencies, and private sector stakeholders who have a known role in debris management planning and response. To increase response rates, the survey was distributed electronically and responses were stored anonymously. Respondents were provided approximately three weeks to complete the survey. During this period, two reminders were sent electronically to recipients. Attempts to reach recipients via phone were also made during the response period.

The survey yielded 26 responses from the region. Of those who responded, 50 percent represented counties, 46.2 percent represented cities, and 3.8 percent represented private sector stakeholders.

The H-GAC region encompasses 12,500 square miles over 13 counties. Four of the 13 counties (Matagorda, Brazoria, Galveston, and Chambers) border the Gulf of Mexico. The inland counties (Wharton, Fort Bend, Harris, and Liberty) are within 90 miles of the coastline, and the upland counties (Colorado, Austin, Waller, Montgomery, and Walker) are the furthest from the coastline but are still within 120 miles. The geographic landscape of the region is diverse and includes urban development, prairies, grasslands, pine forests, and coastal wetlands. The geographic location and diverse landscape of the region make it uniquely susceptible to a number of hazardous incidents that could generate disaster debris. Survey respondents were polled on which debrisgenerating incidents they felt posed the greatest



threat to their community. Every respondent to the question selected a high-wind (tropical system) incident as the type that posed the greatest threat to the region, followed by flooding, storm surge, and tornadoes.



Figure 3-1 Debris-Generating Incident Posing the Greatest Theat to the Community

In 2003, only 57 percent of survey respondents had experienced a debris-generating incident in the last four years (1999–2003). Since 2003, multiple debris-generating incidents, including Hurricane Rita in 2005 and Hurricane Ike in 2008, have tested the preparedness of counties, municipalities, and other governmental agencies within the region. Every respondent to the 2011 Inventory and Existing Plans Survey indicated that their organization was affected by disaster debris caused by Hurricane Ike in 2008.

## 3.1.1 Organization and Coordination

The effects of Hurricane Rita and Hurricane Ike have raised awareness about the importance of debris management planning within the region. The following section assesses the respondents' efforts to establish roles and responsibilities, standard operating procedures, pre-positioned debris contracts, and debris management sites (DMS).

#### **Disaster Debris Management Plans**

Twenty-one respondents indicated whether their organization has a Disaster Debris Management Plan (DDMP) to address disaster debris. **Of those respondents, 85.7 percent indicated that they have developed a DDMP.** A comparison of 2011 survey data to the 2003 Inventory and Existing Plan Survey data shows an increase in the development of DDMP by counties. The 2003 Inventory and Existing Plan Survey reported 15 organizations with a coordinated DDMP, only 2 of the 15 represented counties. However, fifty percent of the 2011 respondents with a

## DDMP represented counties. The 2011 survey data indicates an increase in the number of countywide debris management plans since 2003.

The 2011 survey data also reveals a trend suggesting that plans within the region are being maintained and updated. Most debris plans of the respondents have been updated within the last four years.





\*Eight of the respondents who have a debris management plan did not provide a response.

Since the 2003 RSDMA Plan was developed, the Federal Emergency Management Agency (FEMA) instituted the Public Assistance (PA) Pilot Program from June 1, 2007 through December 31, 2008. The PA Pilot Program provided grants on the basis of estimates for large projects, increased federal share incentive by five percent, allowed retention of salvage value of recyclable debris, and reimbursed regular time salaries and benefits of employees performing debris-related activities. To receive these incentives, jurisdictions were required to have a FEMA-approved DDMP. Fifty-four percent of respondents polled indicated the FEMA PA Pilot Program and incentives influenced their organization's decision to develop a DDMP, and 81 percent indicated that they would develop or update their DDMP and submit it for FEMA approval if the FEMA PA Pilot Program was reinstituted.

Three respondents indicated that they do not have a DDMP. However, two of those respondents indicated that they intend to develop a DDMP in the future.

#### **Designated Debris Manager**

The 2003 Inventory and Existing Plan Survey recommended that each municipality designate a debris manager or a single point of contact on all debris matters. In 2003, more respondents had an assigned debris manager than a DDMP. The 2011 survey results show an inverse of this relationship, where more respondents reported having a DDMP than having an assigned debris manager. The 2011 survey respondents indicated that a debris manager has been designated in 50 percent of the respondents' organizations. The majority of debris managers work within the emergency management department of the organization. Forty-six percent of respondents reported having a debris management organizational chart that specifies roles and responsibilities for debris management operations. Ninety-two percent of the respondents who have an organizational chart also have a DDMP and a designated debris manager.

#### **Debris Management Sites and Landfills**

Similar to the 2003 survey results, about 50 percent of respondents to the 2011 Inventory and Existing Plans Survey indicated having potential DMS locations identified for future use. (DMS locations are the same as temporary debris staging and reduction sites.) Their responses identified approximately 31 DMS locations throughout the region. Respondents also identified approximately 15 named landfills or end-users for the final disposal, recycling, or beneficial use of disaster-related debris. Analysis provided in section 4 reviews DMS locations and landfills used following Hurricane Ike in 2008 and supplies a more comprehensive depiction of the DMS and landfill capabilities of the region.

#### **Public Information Communication**

Establishing a plan for how an organization will communicate with the public after a debris-generating incident is a critical component of debris management planning. Forty-six percent of respondents provided information on what methods they intend to use to disseminate information and what information they intend to broadcast to the public regarding debris removal operations. Most respondents will use print media, radio, and their organization's web site to distribute information to the public. Respondents also reported that debris removal dates and contact information will be broadcast by their organization. Organizations also indicated that they will rely heavily on their organization's phone number, web site, and e-mail to receive feedback related to debris removal operations from the public.

The data provided through the 2011 Inventory and Existing Plan Survey highlights the benefits of establishing a DDMP to address disaster debris management and operations. Table 3-1 lists the percentage of respondents who have a plan to address disaster debris and reported having other critical debris management planning components in place.

Organization has a plan and has	Percentage
A designated debris manager	66%
A debris management organizational chart	61%
Interlocal agreement(s)	61%
Identified Federal Highway Administration Emergency Relief (FHWA-ER) Program eligible roads	50%
Identified potential temporary DMS locations	66%
Pre-positioned contracts for disaster debris clearing, removal, and disposal services	55%
Pre-positioned contracts for disaster debris removal monitoring services	44%
Developed debris removal zones	44%

Table 3-1 Elements of a Debris Management Plan

In most cases, the development of a plan to address disaster debris increases the likelihood an organization will address other critical debris management planning components.

## 3.1.2 Resources and Training

#### Resources

Respondents to the 2011 Inventory and Existing Plan Survey were asked to identify what equipment their organization has to support disaster debris clearance, removal, and disposal operations and to provide the quantity of each item. Seven survey respondents provided the following information. Respondents also indicated that some of the equipment detailed below would be provided by the contracted debris hauler.

Equipment Type	Quantity
Open-top trucks with hauling capacity of 6–12 cubic yards	149
Open-top trucks with hauling capacity of 12–20 cubic yards	16
Open-top trucks with hauling capacity of 20–30 cubic yards	13
Open-top trucks with hauling capacity of more than 30 cubic yards	100
Backhoes	17
Bobcats	8
Front end loaders	17
Gradall	9
Trackhoe	6
Motor Grader	1
Utility Tractor	1

Table 3-2 Reported Equipment Available within the Region

#### Interlocal Agreements and Debris Management Contracts

Established interlocal agreements and pre-positioned contracts are another source for organizations to obtain resources and services to supplement existing capacity.

Many respondents have established interlocal agreements with other organizations for debris clearing, removal, and disposal operations. Sixty-two percent of county respondents and 33.3 percent of city respondents indicated having interlocal agreements. The majority of agreements appear to be between the counties and cities. All reported interlocal agreements with the Texas Department of Transportation (TxDOT) are at the county level.

In 2003, few organizations reported having pre-positioned contracts with local or national contractors to perform debris removal and disposal missions. Of those that reported having contracts, the majority were with local contractors. The 2011 Inventory and Existing Plan Survey results not only showed a higher response rate to having pre-positioned contracts, but contracts were primarily with a regional or national contractor. Forty-six percent of the 2011 survey

respondents indicated that they have pre-positioned contracts for disaster debris clearing, removal, and disposal, and 35 percent of respondents have pre-positioned contracts for disaster debris monitoring. Overall, 35 percent of respondents have pre-positioned contracts for both services. The majority of the disaster debris clearing, removal, disposal, and monitoring services contracts were obtained through competitive procurement and were best described by the respondents as being with a regional or national contractor.





#### Training

Respondents to the 2003 Inventory and Existing Plan Survey expressed a high interest in attending workshops on debris contract monitoring and FEMA documentation. Respondents also felt that H-GAC should sponsor the workshops. Since 2003, H-GAC has sponsored over 17 workshops on a variety of disaster debris management-related topics (see table 2-1), including debris contract monitoring and FEMA documentation. H-GAC is seen as a leader in providing training resources to the region, as 60 percent of 2011 survey respondents who have taken training workshops have done so through H-GAC.

The 2011 respondents also provided feedback regarding which debris management planning topic areas were strongest and weakest within their organization. Most respondents indicated that their organization has a strong understanding of debris management roles and responsibilities and debris removal operations and would be most interested in training related to specialized debris programs, such as household hazardous waste removal and private property debris removal. Reimbursement, disposal, and recycling were also topics of interest for additional training. H-GAC continues to be one of the leading resources to fulfill training needs within the region and they should consider the abovementioned areas when planning future workshops.

## 3.1.3 Technology

Technology resources, specifically geographic information systems (GIS), have significantly enhanced debris management planning since 2003. GIS has been used in debris management planning to define debris removal zones, map debris management sites, and plot the most efficient routes between them. Forty-two percent of respondents indicated that they use GIS for debris planning and mapping services. Fifty-seven percent of those respondents have **developed debris removal zones to assist in debris management planning and debris removal following a disaster.** Debris removal zones can be defined in a variety of ways from district lines and political boundaries (for example, commissioner precincts or council districts) to zip codes and neighborhoods. Seventy-five percent of respondents who have developed debris removal zones also reported that they intend to use political boundaries to track debris removal progress.

Respondents also provided information on the various types of GIS data available to their organization. Floodplain data was reported as the most available data to the majority of respondents with GIS capabilities, followed by applicable political boundaries and recent aerial photography. Respondents also indicated that the most important use of GIS technology to support debris removal operations is the development of maps and reports. Table 3-3 lists the percentage of respondents who have access to various types of common disaster debris management GIS data types.

GIS Data Types	Percentage Available
Street centerline with maintenance responsibility	75%
Applicable political boundaries	88%
Parcel database with ownership information	75%
Address points with structure type information	75%
Critical facilities	75%
FHWA-ER Program eligible roads or a street centerline with functional classification data	25%
Landfill locations	50%
Temporary debris staging and reduction site locations	75%
Recent aerial photography	88%
Floodplain data	100%

Table 3-3 Accessibility to Types of GIS Data

## Section 4 IMPACT OF A LARGE-SCALE DEBRIS-GENERATING INCIDENT

As part of the 2003 Regional Storm Debris Management Assessment (RSDMA) Plan, debris estimates were developed for the region to assist local governments in debris management planning. Because hurricanes pose a significant threat to the region, the scenario of a Category 4 hurricane impacting the area was selected as the basis for developing debris estimates. Since 2003, the area has grown in population and been affected by major debris-generating incidents, the most devastating of which was Hurricane Ike in 2008. While Hurricane Ike did not make landfall as a Category 4 hurricane, the resulting debris quantities and impact of the storm can be compared against the 2003 RSDMA Plan debris estimates to assist in future debris management planning.

## 4.1 Background

On September 13, 2008, Hurricane Ike made landfall over Galveston Island as a strong Category 2 storm. Hurricane Ike had an eye that was 46 miles wide and wind gusts of up to 125 mph. Although at 110 mph the sustained winds from Hurricane Ike were normal for a Category 2 storm, the storm surge was much greater, equaling that of a Category 4 storm. The maximum storm surge was estimated at 17 feet and could have reached up to 20 feet in some areas. Appendix E includes a map of storm surge and high water marks generated by Hurricane Ike. As the storm surge moved across the island, it inundated areas and left little ground vegetation behind. Hurricane Ike generated significant storm surge and expansive hurricane-force winds across the region. Upon landfall, hurricane-force winds extended across the coastal counties from Brazoria County to Orange County and as far inland as Liberty County and Montgomery County. Appendix F includes a map of Hurricane Ike property damage losses nationwide are estimated at \$24.9 billion, making Hurricane Ike the third most expensive hurricane to strike the United States, following Hurricane Andrew in 1992 and Hurricane Katrina in 2005.

## 4.2 Debris Quantities

Due to the geography of the region, the 2003 RSDMA Plan developed debris estimates for the area based on three sub-regional zones identified as coastal counties, inland counties, and upland counties, all of which are identified in table 4-1. For the purposes of the 2011 RSDMA Plan, the same sub-regional zones will be used as the basis for comparing estimates to actual debris quantities caused by Hurricane Ike.

Table 4-1	
Sub-regional Zone	S

Coastal Counties	Inland Counties	Upland Counties
<ul> <li>Brazoria</li> </ul>	Fort Bend	Austin
Chambers	<ul> <li>Harris</li> </ul>	Colorado
<ul> <li>Galveston</li> </ul>	■ Liberty	Montgomery
Matagorda	Wharton	<ul> <li>Walker</li> </ul>
		<ul> <li>Waller</li> </ul>

The 2003 RSDMA debris estimates for the region were based on a Category 4 hurricane directly impacting the region. Coastal counties would experience Category 4 winds and storm surge, inland counties would experience Category 3 winds, and upland counties would experience Category 2 winds. Table 4-2 lists 2003 unincorporated debris estimates by county. Table 4-3 lists 2003 debris estimates by city.

Table 4-2 Unincoporated Debris Estimates by County

Coastal Counties	Cubic Yards
Brazoria	1,970,948
Chambers	370,614
Galveston	708,144
Matagorda	262,663
Total	3,312,369
Inland Counties	Cubic Yards
Fort Bend	1,509,418
Harris	9,074,243
Liberty	496,590
Wharton	187,909
Total	11,268,160
Upland Counties	Cubic Yards
Austin	42,287
Colorado	32,516
Montgomery	704,505
Walker	78,978
Waller	46,520
Total	904,806
Cubic Yard

Coastal Cities	Cubic Yards	Inland Cities
Brazoria County		Fort Bend Cou
Alvin	385,197	Meadows Place
Angleton	321,395	Missouri City
Clute	182,140	Rosenberg
Freeport	166,613	Stafford
Jones Creek	37,622	Sugar Land
Lake Jackson	469,459	Harris County
Pearland	646,109	Baytown
Chambers County	,	Bellaire
Anahuac	40,051	Deer Park
Mont Belvieu	39,339	Galena Park
Galveston County		Houston
Dickinson	301,914	Humble
Friendswood	496,686	Jacinto City
Galveston	1,213,388	Jersey Village
Hitchcock	118,823	Katy
Jamaica Beach	23,501	La Porte
La Marque	258,526	Pasadena
League City	796,905	Seabrook
Santa Fe	772,576	South Houston
Matagorda County	1	Webster
Bay City	341,111	Liberty County
Palacios	81,561	Cleveland
		Dayton
		Liberty
		Wharton Coun
		El Campo

Table 4-3 Debris Estimates by City

Cubic Vards	Unland Cities	Cubic Vards
	Austin County	
41,396	Bellville	11,743
434,092	Sealy	14,885
203,163	Colorado Count	у
148,881	Columbus	12,727
524,629	Eagle Lake	10,280
	Weimar	6,603
601,429	Montgomery Co	unty
153,692	Conroe	105,174
246,752	Walker County	
77,380	Huntsville	118,445
18,548,519	Waller County	
141,060	Brookshire	8,881
75,697	Hempstead	13,403
72,069	Pine Island	2,299
99,499	Prairie View	14,214
278,675	Waller	5,999
1,201,149		
103,628		
116,338		
107,595		
7,303		
54,407		
76,844		
101,261		
93,290		

\*Cities represented in the table are based on 2003 RSDMA data and do not represent all cities within the designated counties.

Wharton

While Hurricane Ike made impact as a strong Category 2 storm, the associated storm surge was closer to that of a Category 4 storm. As a result, many of the coastal communities experienced debris quantities and damages that are normally associated with stronger hurricanes. Table 4-4 summarizes Hurricane Ike debris quantities by county. Table 4-5 summarizes debris quantities by city.

<b>Coastal Counties</b>	Cubic Yards	Inland Counties	Cubic Yards	Upland Counties	Cubic Yards
Brazoria	130,465	Fort Bend	267,325	Austin	-
Chambers	566,346	Harris	2,498,133	Colorado	-
Galveston	2,996,801	Liberty	655,010*	Montgomery	517,877
Matagorda	79,475*	Wharton	-	Walker	22,166*
				Waller	500*
Total	1,636,611		3,311,005		729,791

Table 4-4Hurricane Ike Debris Quantities by County

\* Denotes totals based on estimated quantities developed during Texas Commission on Environmental Quality (TCEQ) site visits

- Denotes no data available or no Hurricane Ike debris

Coastal Cities	Cubic Yards	Inland Cities	Cubic Yards		Upland Cities	Cubic Yards
Brazoria County		Fort Bend County		Austin County		
Alvin	193,195	Meadows Place	9,657		Bellville	-
Angleton	77,558	Missouri City	147,101		Sealy	-
Clute	34,032	Rosenberg	25,445		Colorado Coun	ty
Freeport	16,720	Stafford	25,002		Columbus	-
Manvel	25,170	Sugar Land	189,946		Eagle Lake	-
Pearland	349,226	Harris County			Weimar	-
Chambers County	1	Baytown	817,523		Montgomery County	
Anahuac	39,605	Bellaire	63,414		Conroe	4,642
Mont Belvieu	16,678	Deer Park	47,881		The Woodlands	117,563
Galveston County	,	El Lago	21,103		Panorama Village	15,241
Bayou Vista	41,602	Friendswood	488,169		Walker County	
Clearlake Shores	31,465	Houston	5,469,166		Huntsville	166,000*
Dickinson	216,145	La Porte	64,500*		New Waverly	-
Friendswood	488 169	Pasadena	383 178			

## Table 4-5Hurricane Ike Debris Quantities by City

#### IMPACT OF A LARGE-SCALE DEBRIS-GENERATING INCIDENT

Coastal Cities	Cubic Yards	Inland Cities	Cubic Yards	Upland Cities	Cubic Yards
Galveston	1,753,214	Seabrook	128,040	Waller County	
Jamaica Beach	66,608	South Houston	13,226	Brookshire	7,000*
Kemah	96,211	Webster	13,220	Hempstead	16,880*
La Marque	106,093	Liberty County			
League City	261,351	Cleveland	103,520*		
Santa Fe	120,731	Dayton	83,272		
Texas City	210,404	Liberty	280,000*		
Tiki Island	39,120	Wharton County			
Matagorda Count	y	El Campo	4,800*		
Bay City	-	Wharton	1,620*		

\* Denotes totals based on estimated quantities developed during TCEQ site visits

- Denotes no data available or no Hurricane Ike debris

#### Coastal Counties - Estimated versus Observed Quantities

Of the coastal counties, Galveston County and Chambers County experienced the most debris and damage when comparing debris estimates to observed totals. The high volumes of debris generated in the two counties can be attributed to the large storm surge associated with Hurricane Ike. As the storm surge from Hurricane Ike passed over Galveston Island, debris amassed with the surge water and was pushed into Chambers County. The displacement of debris from Galveston Island is well documented in cases of homes from the island being found in Chambers County following Hurricane Ike. Chambers County estimates that debris from approximately 3,300 homes from Bolivar Peninsula was displaced in the county by Hurricane Ike. As a result, the actual debris quantity experienced by Chambers County was much higher than the amount of debris expected from a Category 4 storm.



Did you know that following Hurricane Ike over 2 million pounds of household hazardous waste (HHW) was collected in the City of Galveston? HHW consists of materials that are ignitable, reactive, toxic, or corrosive. Examples of HHW include paints, cleaners, pesticides, solvents, and gasoline.

Table 4-6
<b>Coastal Counties Estimated Versus Observed</b>

Coastal Counties	Estimated Cubic Yards	Observed Cubic Yards
Brazoria	1,970,948	130,465
Chambers	370,614	566,346
Galveston	708,144	2,996,801
Matagorda	262,663	79,475*
Total	3,312,369	3,773,087

\* Denotes totals based on estimated quantities developed during TCEQ site visits

In comparing the debris quantities of the coastal cities, it is evident that the City of Galveston, the City of Jamaica Beach, the City of Friendswood, and the City of Anahuac incurred the most debris and damage following Hurricane Ike. Although Hurricane Ike made landfall as a strong Category 2, the debris quantities in the aforementioned cities equaled or surpassed the respective debris estimates based on a Category 4 hurricane. The significant damage and volume of debris generated in the coastal cities is attributed to the large storm surge associated with Hurricane Ike.

Coastal Cities	Estimated Cubic Yards	Observed Cubic Yards
Brazoria		
Alvin	385,197	193,195
Angleton	321,395	77,558
Clute	182,140	34,032
Freeport	166,613	16,720
Pearland	646,109	349,226
Chambers		
Anahuac	40,051	39,605
Mont Belvieu	39,339	16,678
Galveston		
Dickinson	301,914	216,145
Friendswood	496,686	488,169
Galveston	1,213,388	1,753,214
Jamaica Beach	23,501	66,608
La Marque	258,526	106,093
League City	796,905	261,351
Santa Fe	772,576	120,731
Matagorda		
Bay City	341,111	-

Table 4-7
Coastal Cities Estimated versus Observed

#### Inland Counties – Estimated versus Observed Quantities

Of the inland counties, Liberty County had the strongest correlation between estimated quantity of debris and observed quantity of debris. The 2003 RSDMA Plan developed debris estimates for inland counties based on a Category 3 storm. As Hurricane Ike moved through the inland counties, the storm weakened from a strong Category 2 to a Category 1. However, maximum sustained winds still approached 100 mph in many inland areas. The high volume of debris in Liberty County may be attributed to the northeast side of Hurricane Ike (also known as the "dirty side" of the hurricane) passing through the county. Based on the historical review of hurricanes

and resulting debris, the northeast side of a hurricane generally causes more damage and results in more debris. Due to the size of Hurricane Ike, the sustained high winds, and the population and tree density of the other inland counties, Fort Bend County and Harris County experienced significant damage. The debris quantities generated in Harris County and Fort Bend County during Hurricane Ike do not strongly correlate with the 2003 RSDMA Plan debris estimates, but the generated volume is still significant based on the Category 2 storm. In unincorporated Harris County alone, Hurricane Ike generated almost 2.5 million cubic yards of debris.

Inland Counties	Estimated Cubic Yards	Observed Cubic Yards
Fort Bend	1,509,418	267,325
Harris	9,074,243	2,498,133
Liberty	496,590	655,010
Wharton	187,909	-
Total	11,268,160	3,420,468

Table 4-8	
Inland Counties Estimated versus	Observed

- Denotes no data available or no Hurricane Ike debris

Based on a review of the actual debris quantities of the inland cities, the City of Baytown, the City of Seabrook, the City of Cleveland, the City of Dayton, and the City of Liberty all incurred equal to or more than the debris estimates based on a Category 3 hurricane. Due to the proximity to the water and the track and associated storm surge of Hurricane Ike, the inland cities of Baytown and Seabrook may have experienced more debris than projected. Likewise, the significant damage and resulting debris in the cities within Liberty County may be attributed to the sustained winds from the northeast side of the hurricane. While the actual debris volume for the City of Houston does not strongly correlate with the estimated debris quantities, it is important to note that over 5.4 million cubic yards of debris was collected and disposed of in response to Hurricane Ike.

Inland Cities	Estimated Cubic Yards	Observed Cubic Yards
Fort Bend		
Meadows Place	41,396	9,657
Missouri City	434,092	147,101
Rosenberg	203,163	25,445
Stafford	148,881	25,002
Sugar Land	524,629	189,946
Harris		
Baytown	601,429	817,523
Bellaire	153,692	63,414
Deer Park	246,752	47,881

Table 4-9Inland Cities Estimated versus Observed

Inland Cities	Estimated Cubic Yards	Observed Cubic Yards
Houston	18,548,519	5,469,166
La Porte	278,675	64,500*
Pasadena	1,201,149	383,178
Seabrook	103,628	128,040
South Houston	116,338	13,226
Webster	107,595	13,220
Liberty		
Cleveland	7,303	103,520*
Dayton	54,407	83,272
Liberty	76,844	280,000*
Wharton		
El Campo	101,261	4,800*
Wharton	93,290	1,620*

\* Denotes totals based on estimated quantities developed during TCEQ site visits

#### Upland Counties - Estimated versus Observed Quantities

The upland counties did not experience as much damage from Hurricane Ike as the other subregional zones. Hurricane Ike made landfall in the region as a strong Category 2 hurricane. The hurricane weakened as it moved through the coastal and inland areas. Of the upland counties, only Montgomery County sustained debris volumes and damages similar to the 2003 RSDMA Plan projected debris volumes. The significant volume of debris generated in the county may be attributed to the dense tree canopy and sustained winds from Hurricane Ike. Appendix F includes the Harris County Appraisal District Hurricane Ike Wind Contours Map, which shows bands of hurricane-force winds impacting Montgomery County. As Hurricane Ike tracked through the region, Montgomery County may have experienced greater wind damage due to the initial bands of hurricane-force winds.

-		
Upland Counties	Estimated Cubic Yards	Observed Cubic Yards
Austin	42,287	-
Colorado	32,516	-
Montgomery	704,505	517,877
Walker	78,978	22,166*
Waller	46,520	500
Total	904,806	540,543

Table 4-10 Upland Counties Estimated versus Observed

\* Denotes totals based on estimated quantities developed during TCEQ site visits

- Denotes no data available or no Hurricane Ike debris

In reviewing the debris quantities of the inland cities, it is evident that the City of Hempstead and the City of Huntsville incurred debris volumes similar to the estimated quantities from the 2003 RSDMA. The 2003 RSDMA Plan debris estimates for the inland cities were based on a Category 2 storm. Some areas in the upland counties may have experienced sustained winds similar to that of a Category 2 storm, but most areas experienced sustained winds similar to that of a Category 1 storm.

Upland Cities	Estimated Cubic Yards	Observed Cubic Yards
Austin		
Bellville	11,743	-
Sealy	14,885	-
Colorado		
Columbus	12,727	-
Eagle Lake	10,280	-
Weimar	6,603	-
Montgomery		
Conroe	105,174	4,642
Walker		
Huntsville	118,445	166,000*
Waller		
Brookshire	8,881	7,000*
Hempstead	13,403	16,880*

Table 4-11 Upland Cities Estimated versus Observed

\* Denotes totals based on estimated quantities developed during TCEQ site visits

## 4.3 Debris Storage, Reduction, and Final Disposal

Temporary debris management sites (DMS), also known as temporary debris storage and reduction sites (TDSRS), are established to store, reduce, segregate, and process debris before being hauled to a final disposal site. The use of DMS locations is critical to minimize the impact on regional landfills and, when possible, divert residual debris to recycling options or beneficial uses. Depending on the relative location of a DMS location to a disaster area, a DMS can also expedite recovery operations by reducing travel time from debris collection areas to the disposal site. Following Hurricane Ike, DMS locations played a vital role in the collection, staging, processing, and final disposal of over 20 million cubic yards of storm-generated debris in the region.

## 4.3.1 Debris Management Sites



collected from unincorporated areas of the county.

In response to Hurricane Ike, over 170 DMS locations were established in the region. Based on TCEQ records, no DMS locations were activated in Austin County or Colorado County. Appendix G includes more detailed information regarding the DMS locations used following Hurricane Ike. Appendix H contains maps of the DMS locations used following Hurricane Ike organized by county. Due to the population density and vegetation

characteristics of the inland counties, more debris was generated in these areas and resulted in more DMS location activations when compared to the other two sub-regional zones. Table 4-12 summarizes the number of activated DMS locations by sub-regional zone and county. The total DMS locations shown for each county is cumulative and includes sites established for city debris removal efforts.

Coastal Counties	DMS	Inland Counties	DMS	Upland Counties	DMS
Brazoria	21	Fort Bend	9	Austin	-
Chambers	19	Harris	57	Colorado	-
Galveston	24	Liberty	18	Montgomery	13
Matagorda	3	Wharton	2	Walker	4
				Waller	4
Totals	67		86		21

 Table 4-12

 Total Debris Management Sites by County

The DMS locations activated and used following Hurricane Ike played a vital role in diverting residual storm debris from regional landfills. The staging of debris allowed for additional debris segregation to remove incidental debris that may have been comingled. Staged debris was then processed and reduced through reduction, burning, and crushing/compacting.

As part of the recovery effort following Hurricane Ike, TCEQ broadened the authority of local governments to burn brush, trees, and other vegetation debris that resulted from Hurricane Ike. The broadened authority was limited to counties affected by Hurricane Ike. The reduction of vegetative debris through burning has a higher reduction ratio than grinding. The resulting ash from burning can also be applied to soil for nutrient enrichment. Table 4-13 identifies the total number of DMS locations that used TCEQ's exception to reduce debris by burning in each county.

County	Number of DMS
Austin	-
Brazoria	14
Chambers	6
Colorado	-
Ft. Bend	-
Galveston	6
Harris	3
Liberty	8
Matagorda	3
Montgomery	3
Walker	-
Waller	1
Wharton	-
Total	44

Table 4-13 DMS by County Reducing Debris by Burning

\*Figures based on TCEQ site evaluation data

## 4.3.2 Proposed Debris Management Sites

As part of the 2011 Inventory and Existing Plans Survey, local governments were asked to provide details on proposed DMS locations that have been identified for use following a debrisgenerating incident. The response rate for proposed DMS locations was low. Thirty-one proposed DMS were extrapolated from survey responses. Table 4-14 summarizes the proposed DMS locations and their estimated sizes.

Proposed DMS	Location	Estimated Acres
Valley Lodge-Simonton Texas	Austin County	6
Old Alvin Landfill	Brazoria County	6
Weems Asphalt Plant, off State Highway 35, East Columbia	Brazoria County	10
Sweeny Fire Field, McKinney Road, Sweeny	Brazoria County	14
McGaughey Property, SH 35 off Mitchell Road	Brazoria County	17
Seabreeze Landfill	Brazoria County	25
Sheriff's Office Complex, County Road 45, Angleton	Brazoria County	29
Weems Oil Field, off SH 36, West Columbia	Brazoria County	47

Table 4-14Proposed Debris Management Sites

Proposed DMS	Location	Estimated Acres
141 Canna Lane, Lake Jackson, Texas	Brazoria County	100
County Road and Bridge Department, Padon Road	Fort Bend County	6
Precinct 2 Stockpile Yard-FM 521	Fort Bend County	6
Bob Lutz Park-Harlem Road	Fort Bend County	8
Kitty Hollow Park-Missouri City	Fort Bend County	15
Stella Road (Fort Bend County Fairgrounds)	Fort Bend County	25
NRG Property, Thompson Highway, Richmond, Texas	Fort Bend County	100
Site 2 at 2759 and Cortez Road	Fort Bend County	100
Gullo Park	Harris County	17
Orwall Extension	Harris County	30
Pagan Construction Sand Pit	Liberty County	30
Precinct 2 Annex-Lake-Magnolia	Montgomery County	7
Arnold Road	Montgomery County	10
Precinct 2 Annex-Magnolia	Montgomery County	15
Charles Taylor Memorial Park	Montgomery County	17
Deanco Dirt Pit	Montgomery County	20
Deanco Recycling Mulch Pit	Montgomery County	35
Montgomery County Fair Grounds	Montgomery County	40
Pitcock DMS	Montgomery County	60
123 Booker Road, Huntsville	Walker County	Not provided
350-A SH75 North, Huntsville	Walker County	Not provided
9368 SH75 South, New Waverly – Precinct 4	Walker County	Not provided
Bates Allen Park-Charlie Roberts Lane, Kendleton, Texas	Wharton County	150

An important aspect of debris management planning is to analyze service areas of DMS locations. The geographic location of DMS locations within a jurisdiction can significantly affect response and recovery efforts. If the distance between DMS locations and affected disaster areas is significant, recovery efforts can be hindered based on the increased haul distances and time. Additionally, longer haul distances from DMS locations to affected disaster areas can create additional costs with mileage-based contracts.

While the survey response rate for proposed DMS locations was low, the data can be used in combination with DMS locations previously used for Hurricane Ike response efforts to evaluate service areas. The counties of Colorado and Austin did not provide proposed DMS locations and did not have any DMS locations activated following Hurricane Ike. Consequently, service areas of DMS locations within the two counties could not be evaluated.

For the counties within the region that provided proposed DMS locations and/or had DMS locations activated following Hurricane Ike, a 15-mile buffer was applied to each DMS location.

The 15-mile buffer represents a 15-mile coverage area between debris collection locations and DMS locations. The 15-mile buffer applies to mileage-based collection contracts and affects recovery operations based on the haul time between debris locations and DMS locations. During the DMS location analysis, each county was evaluated to identify which areas needed additional DMS locations to provide comprehensive coverage of the county. Appendix I contains a map for each county that shows the coverage capability of the proposed DMS locations and previously used Hurricane Ike DMS locations.

#### 4.3.2.1 Debris Management Site Analysis

In general, each county evaluated in the region had either complete coverage or minimal areas that could not be serviced based on a 15-mile buffer. The following counties had minimal areas without coverage based on the proposed and previously used DMS locations:

- Brazoria County: The southeast corner of the unincorporated county does not have adequate coverage based on a 15-mile DMS buffer. The closest DMS location is the Coastal Plains Recycling and Disposal Facility.
- Liberty County: The northeast corner of the unincorporated county does not have adequate coverage based on a 15-mile DMS buffer. The closest DMS location is the Boothe Site DMS.
- Matagorda County: The western most part of the unincorporated county does not have adequate coverage based on a 15-mile DMS buffer. Included in this area are the City of Palacios and the census-designated place (CDP) of Blessing. The closest DMS location is the Matagorda Debris 2 DMS.
- Wharton County: The northern most part of the unincorporated county does not have adequate coverage based on a 15-mile DMS buffer. Included in this area is the City of East Bernard. The closest DMS are the El Campo DMS and the Wharton Transfer Station DMS.

While Brazoria County and Liberty County were identified as having areas without adequate DMS coverage, the areas in question are in the rural areas with less population density. In the case of Matagorda County and Wharton County, the areas identified without adequate DMS coverage include areas with cities and higher population densities. These areas may need to be evaluated and additional DMS locations identified to assist in post-incident debris removal operations.

## 4.3.3 Alternative Final Disposal

Local governments in the region are sensitive to the lifespan of regional landfills. During Hurricane Ike recovery efforts, many communities strived to find alternative final disposal options for processed debris. Examples of alternative final disposal include land application of ash, use of mulch chips as fuel, and beneficial use of ash or mulch. Residual ash or mulch from the processing of debris can be used for beneficial use applications such as soil amendment, road base, erosion control, and moisture control. Table 4-15 summarizes the alternative disposal methods for reduced vegetative debris following Hurricane Ike.

County	Land Application of Ash	Mulch Sold as Fuel	Beneficial Use of Ash or Mulch
Austin	-	-	-
Brazoria	6	-	15
Chambers	3	-	12
Colorado	-	-	-
Ft. Bend	-	-	9
Galveston	3	-	13
Harris	3	5	50
Liberty	8	8	14
Matagorda	3	-	1
Montgomery	3	-	12
Walker	-	-	4
Waller	1	-	4
Wharton	-	-	2
Totals	30	13	136

Table 4-15 Summary of Alternative Final Disposal by County

\*Figures are based on TCEQ site evaluation data and represent the number of DMS locations in each county

The type of debris stream limits the alternative disposal options available. Due to the nature of construction and demolition (C&D) debris, there are limited alternative disposal options. Generally, usable metal is segregated from unusable C&D and hauled to a permitted C&D recycling facility. Vegetative debris that is clean from other incidental materials has alternative disposal options based on the type of processing used to reduce the debris.

Vegetative debris that is processed by burning results in ash. The ash is nutrient rich and if incidental non-vegetative material was removed prior to burning, the residual ash can be applied to land and soil. Many DMS locations used trench burning, and once burning operations ceased, the burn trenches were filled with dirt and the activities recorded in the deed. However, if incidental material was burned with the vegetative debris or ash could not be applied to the land, the residual ash had to be taken to a landfill. Based on TCEQ site evaluation data, 16 of the 44 DMS locations that used reduction by burning hauled residual ash to a landfill.

Vegetative debris that is processed through grinding results in mulch or wood chips. The residual mulch can be used for landscaping, land application, or fuel. While mulch has many end uses, like any commodity, once the market is flooded the demand decreases. Based on a review of the TCEQ site



Did you know that the Living Earth Technology Company (LETCO), in conjunction with the City of Houston, recycled reduced vegetative debris collected in the city? The recycled mulch is marketed as "Living Earth Houston Mulch" and is composed of the vegetative brush and trees collected within the city as a result of Hurricane Ike. evaluation data, 136 of the DMS locations were able to find beneficial uses for the residual mulch. Beneficial uses of mulch include agricultural uses, land stabilization or erosion control, and landfill cover. Of the DMS locations that used reduction by grinding, 13 sites were able to secure end-users that intended to use residual mulch for fuel (typically used for industrial heating or cogeneration plants).

## 4.3.4 Landfill Usage

An analysis of the landfill disposal totals reveals an increase in disposal from 2008 to 2009. The increase in landfill disposal volume for this period can be attributed to Hurricane Ike recovery efforts in the region. While alterative final disposal options helped divert vegetative waste from landfills, C&D debris that resulted from Hurricane Ike was disposed of at landfills.

Additionally, because Hurricane Ike had a strong storm surge, the area experienced a significant volume of C&D debris. Over 7.4 million cubic yards of C&D debris inundated the region. See appendix J for detailed Hurricane Ike debris removal totals for the region. In many cases, the proximity of the disaster area to landfills supported the direct haul of C&D materials from the disaster area to a landfill. While a DMS location would have supported compaction of C&D and segregation of usable metals, the costs associated with operating a C&D DMS location outweighed directly hauling such material to the landfill.

The debris removal operation in the City of Kemah is a good example of when it is more efficient and cost-effective to directly haul C&D debris to a landfill. Due to storm surge, the majority of debris in the City of Kemah consisted of C&D debris. Consequently, C&D debris was directly hauled to the Republic Waste North County Landfill while vegetative debris was brought to a DMS location for processing prior to final disposal.

Appendix K contains graphs of landfill disposal measured in tons by county. The landfill usage graphs for the coastal counties of Galveston and Chambers show significant spikes in disposal for 2009. Additionally, landfills in the south and southeast area of Harris County also show spikes in disposal. See appendix L for landfill data for the Houston-Galveston region from 2006 to 2010.

The review of Houston-Galveston Area Council (H-GAC) resources and programs, regional debris management assessment, and impact of a large-scale debris-generating incident yielded key findings. The key findings have been organized based on their association with H-GAC or local governments within the region. The key findings presented below assisted in the development of recommendations for H-GAC and for local governments within the region.

## 5.1 Key Findings Related to Houston-Galveston Area Council

#### **Debris Management Planning Workshops**

The debris management workshops are an effective resource for helping the region prepare for planning and responding to a debris-generating incident. The 2010 debris management planning workshops sponsored by H-GAC had a strong regional participation rate and a diverse range of participants. The results of the H-GAC Programs Assessment Survey confirmed the key finding that debris management workshops are an effective resource for preparing local governments in the region for a debris-generating incident. Over 70 percent of the survey respondents have attended an H-GAC-sponsored debris management workshops found them to be useful for debris management planning and to provide new information, concepts, and policies. Additionally, 57 percent of respondents stated that when threatened by a debris-generating incident, they used H-GAC-sponsored workshop materials as a reference in pre-incident debris management planning activities.

The survey respondents that stated they have not attended H-GAC-sponsored debris management workshops cited conflict in schedule or lack of awareness of the workshops as their primary reasons for not attending. To increase participation from local governments in the region, H-GAC may need to evaluate and revise communication strategies for broadcasting workshops. Revisions to the workshop communication strategy may include adding additional distribution lists to electronic and mailed invitations, distributing workshop information through the Emergency Management Association of Texas, and listing workshops on the Texas Department of Public Safety online schedule (https://www.preparingtexas.org/).

#### **Debris Management Online Resources**

The H-GAC storm debris publications web site serves as a central repository of information that local governments can use for pre-incident debris management planning or post-incident response. Providing a central repository of debris management information supports H-GAC's objective to be the regional leader in disaster debris management planning, training, resources, and programs. The analysis of H-GAC web site traffic following Hurricane Ike supports the position that local governments accessed the storm debris publications web site for debris

management information following a debris-generating incident. However, most respondents to the H-GAC Programs Assessment Survey indicated that they do not access the web site during normal conditions. The increased use of the storm debris publications web site following a debris-generating incident indicates that the resources made available are beneficial to local governments. Access and use of the web site by local governments during normal conditions can be increased by evaluating and revising the materials available and developing a communication strategy to inform local governments of this resource for debris management planning. A possible communication strategy is to distribute a newsletter to emergency management, public works, and solid waste representatives in the region via e-mail to highlight changes made to the web site, describe available resources and forms, and provide a hyperlink to the storm debris publications web site.

#### **Grant Resources**

H-GAC's solid waste implementation grant funds can be used as a resource to assist local governments in debris management planning. The H-GAC solid waste implementation grant fund is intended to fund projects that will reduce the amount of waste that goes into regional landfills. However, as appendix K shows, many of the regional landfills experienced a spike in disposal following Hurricane Ike. While the debris stream and proximity to landfills contributes to the preference for direct landfill disposal, H-GAC solid waste implementation grants can be used to fund technical studies that may provide better alternatives. Table 5-1 lists debris management planning activities and the results when survey respondents were polled regarding what types of activities they would use grant funds to support.

Description	Percent
Final disposal/recycling analysis	30.8%
Debris estimation and modeling	34.6%
Regional debris management coordination	19.2%
Training	46.2%
Exercises	19.2%
Debris management plan	38.5%
Debris management site analysis	26.9%
Other	19.2%

Table 5-1 Debris Management Planning Activities

## 5.2 Key Findings Related to Local Governments

#### **Increase in Debris Management Planning Activities**

Since 2003, multiple debris-generating incidents, such as Hurricane Rita in 2005 and Hurricane Ike in 2008, have tested the preparedness of counties, municipalities, and other governmental agencies within the region. The region has also grown more experienced in responding to and

recovering from debris-generating incidents. This enhancement in preparedness, response, and recovery was evident in the analysis of the H-GAC Program Assessment Survey and the 2011 Inventory and Existing Plans Survey.

For the last eight years, H-GAC has supported the region in increasing the overall level of preparedness through offering workshops, resources, publications, grants, and programs focused on disaster debris management. Findings from the H-GAC Program Assessment Survey confirm that the training, resources, and programs sponsored by H-GAC have helped the region prepare for disasters. For example, 58 percent of respondents used H-GAC-sponsored workshop materials to assist in debris management planning and, when presented with the threat of a viable debris-generating incident, 57 percent of respondents stated they used reference materials from an H-GAC-sponsored workshop to assist with pre-incident debris management planning activities.

Analysis of the 2011 Inventory and Existing Plan Survey also shows advancement in debris management planning since 2003. The survey data suggests that organizations are building more comprehensive debris management planning programs. For example, most respondents to the 2011 survey who indicated having an established disaster debris management plan (DDMP) also have other critical planning components such as the following:

- A designated debris manager
- A debris management organizational chart
- Interlocal agreement
- Identified Federal Highway Administration Emergency Relief (FHWA-ER) Program eligible roads
- Identified potential temporary debris management sites (DMS)
- Pre-positioned contracts for disaster debris clearing, removal, and disposal services
- Pre-positioned contracts for disaster debris removal monitoring services
- Identified debris removal zones

#### Advanced Debris Management Planning Training

In the 2011 Inventory and Existing Plan Survey, respondents also indicated having a strong understanding of debris management roles and responsibilities and debris removal operations, which are two topics that H-GAC has dedicated a number of resources to educating the region on over the last 8 years. Local governments in the region have also gained more experience based on the debris-generating incidents that have affected the area. Due to increased debris management planning activities as well as relative experience, local governments in the region are requesting training on advanced debris management planning topics. Survey respondents expressed interest in training on more advanced debris management planning topics, such as household hazardous waste removal and private property debris removal, reimbursement, disposal, and recycling. Because H-GAC continues to be one of the leading resources to fulfill training needs within the region, it should consider these topics for future workshops within the region.

#### Increase in Use of Technology for Debris Management Planning

Survey data generated from the 2003 RSDMA indicated that 19 percent of local governments had geographic information systems (GIS) capabilities. Analysis of the 2011 Inventory and Existing Plan Survey indicates an increase in the application of GIS for debris management planning. Forty-two percent of respondents indicated that they use GIS for debris planning and mapping services. Respondents that were using GIS for debris management planning also indicated that data layers for street centerline with maintenance responsibility, parcel and ownership information, DMS locations, and landfills were also maintained. Not only are local governments within the region applying GIS capabilities for zone maps and reporting, but data layers necessary for recovery efforts and more specialized debris removal programs are also being maintained.

#### Debris Estimation Tools May Not Correspond to Observed Debris Quantities

One of the key findings related to local governments in the region was that debris estimation models may not always correspond to observed debris quantities following a debris-generating incident. The analysis performed in Section 4: Impact of a Large-Scale Debris-Generating incident found that storm surge has a significant impact on the debris resulting from a hurricane. While Hurricane Ike impacted the region as a strong Category 2 storm, many of the resulting debris quantities of local governments in the region corresponded to that of a Category 4 storm. Local governments should plan for and be prepared to respond to greater debris quantities than anticipated based on debris estimation tools.

## 6.1 Recommendations to Assist Houston-Galveston Area Council in Debris Management Planning

#### **Recommendation 1: Reissue Debris Removal Services Program**

The H-GAC Debris Removal Services Program has been used by a number of local governments prior to and immediately after a disaster around the state. While the Federal Emergency Management Agency (FEMA), the primary reimbursement source for many local governments after a disaster, has supported the purchasing program, FEMA has also issued several contract/procurement-related guidance documents over the last three years. Reimbursement agencies such as FEMA have displayed a heightened sensitivity related to contracting for debris-related activities.

Also, due to a number of disasters (for example, Hurricanes Ike, Gustav, and Dolly, severe floods, and tornadoes) over the last several years, the experience level of existing or other debris haulers may have changed and thus may not be reflected in the previous qualifications analysis.

H-GAC should reexamine and reissue the Debris Hauler Procurement Program in 2011 to account for these changes over the last four years.

#### **Recommendation 2: Utilize Webinars for Debris Management Workshops**

Due to increased fuel costs and higher demand on local government employees, many individuals who want to attend H-GAC-sponsored debris management workshops may find it increasingly difficult to dedicate a full- or half-day to training. To better meet the needs of those in the region, while still providing valuable information to local governments, H-GAC should explore webinars or other virtual meeting tools for future debris management workshops.

These workshops could be limited to one to two hours and could accommodate those who wish to attend in person or remotely.

#### **Recommendation 3: Develop Mobile Reference Guide**

Over the last several years, the expansion of smartphone technology has grown at a rapid pace. Many local governments have issued departmental staff smartphones that operate on the Android or iOS platforms. As H-GAC continues to lead the region in developing tools and reference materials for local governments, H-GAC should explore developing a debris management-based reference application. The application could provide valuable information on all phases of debris management, including links to other reference guides, best management practices, and contact information for H-GAC staff.

#### **Recommendation 4: Reorganize Web Site Content**

Based on the data collected from the web site traffic following Hurricane Ike, local governments affected by the disaster sought out information on debris management from the H-GAC web site. H-GAC should investigate reorganizing the online reference materials to allow for a more user-friendly interface for those planning for or affected by a debris-generating incident. The web site could include information such as contact information, quick reference materials, and links to other agencies or documents.

#### **Recommendation 5: Examine Disposal Alternatives for Storm-Generated Debris**

Many local governments tasked with removing storm-generated debris sought alternative disposal options in an effort to divert material from the region's landfills. However, due to the abundance of material within the region or lack of information on alternative end markets, some local governments chose to dispose of the debris in landfills.

H-GAC should examine disposal alternatives for storm-generated debris, including markets for wood chips, ash, white goods, household hazardous waste (HHW), and construction and demolition (C&D) debris. The study area could be expanded beyond the H-GAC region to include southeast Texas, Louisiana, or north Texas due to the potential volume of material that could be generated by a disaster.

## 6.2 Recommendations to Assist Regional Local Governments in Debris Management Planning

# Recommendation 1: Enhance Planning Activities by Including Plan Review, Updates, and Exercises

While the majority of local governments within the region have established disaster debris management plans (DDMP), many local governments did not indicate that they regularly reviewed, updated, or exercised their DDMP. The development of a DDMP helps a local government define pre-incident planning and post-incident response. However, debris management planning is a continuous process. Each year funding agencies such as FEMA or the Federal Highway Administration (FHWA) provide new or revised guidance for eligibility, documentation, or reimbursement. The changes or revisions in guidance must be incorporated into a local government's DDMP annually. Additionally, experience gained from responding to or recovering from debris-generating incidents should also be incorporated into DDMPs.

A best practice to ensure plan review, updates, and exercises are being met is to establish an allhazards DDMP training, testing, and exercise program. The major components of the this program should include training all appropriate staff on their DDMP responsibilities; conducting periodic exercises to test and improve the DDMP and procedures, systems, equipment; and instituting a multiyear process to ensure plan updates in response to changing conditions.

#### **Recommendation 2: Incorporate FHWA Road Layers into Road Inventory**

Based on the 2011 Inventory and Existing Plan Survey results, 66.7 percent of local governments in the region have identified FHWA Emergency Relief (ER) Program eligible roads within their jurisdiction. While this is higher than previously reported in 2003, local governments can increase this percentage by requesting the road inventory for their jurisdiction from the Texas Department of Transportation (TxDOT). The road inventory contains the functional classification of roads, which is used to determine which roads are FHWA-ER Program eligible. Appendix M contains the geographic information systems (GIS) layers for FHWA-ER Program eligible roads within Texas. The GIS departments of local governments can integrate the applicable FHWA-ER Program eligible road data into their GIS layers. Because functional classifications of roads can change, local governments should maintain and update FHWA-ER Program eligible roads within their jurisdiction annually.

#### **Recommendation 3: Review Pre-positioned Contracts for Debris Services**

Many local governments within the H-GAC region have retained the services of pre-positioned debris vendors, including debris haulers, monitors, processors, or disposal sites. As FEMA and FHWA continue to provide guidance on contracting procedures, local governments should reexamine their pre-positioned contracts to ensure that they meet the standards specified by local, state, and federal regulations. In September 2010, FEMA released revised guidance for debris contracting, 9580.201 Fact Sheet: Debris Contracting Guidance. The fact sheet contains a checklist of requirements and recommendations for pre-positioned debris vendor contracts.

# Recommendation 4: Explore Social Media Outlets for Debris Management Communications

The analysis of survey data from the 2011 Inventory and Existing Plan Survey supports the finding that the majority of local governments intend to use traditional methods of communication such as radio, print media, or the local government web site to broadcast information to the public following a debris-generating incident. Local governments can leverage social media outlets such as Facebook and Twitter to supplement traditional methods of public communications. The social media outlets will allow local governments to reach an even broader audience, which will facilitate recovery efforts.

#### **Recommendation 5: Review Debris Management Site Options for Future Use**

Local governments in the region should identify, evaluate, and maintain information related to debris management sites (DMS) that can be used following debris-generating incidents. The survey responses from local governments indicate a trend in the region that many local governments have not identified DMS locations for future use. Identifying and maintaining a list of potential DMS locations is essential to debris management planning and post-incident response. Additionally, locations identified as DMS locations need to be evaluated annually. Often, the use of land or conditions may change, which can preclude the site's use as a DMS location.

## Appendix A WORKSHOP MATERIALS

Workshop	Date	Material
Debris Contracting	1/30/2006	Public Assistance Non-competitive Procurement Guide
Debris Contracting	1/30/2006	Public Assistance Documentation Guide
Debris Contracting	1/30/2006	Sample Right-of-Entry Permit
Debris Contracting	1/30/2006	Truck Measurement Aid
Debris Contracting	1/30/2006	Sample Project Worksheet
Debris Contracting	1/30/2006	Example Mutual Aid Agreement and Federal Emergency Management Agency (FEMA) Policy
Debris Contracting	1/30/2006	Example Unit Price Contract for Debris Removal
Debris Contracting	1/30/2006	Conversion Factor Calculation Sheet
Debris Contracting	1/30/2006	Storm Debris Documents Available from Houston- Galveston Area Council (H-GAC)
Debris Contracting	1/30/2006	Personnel Policy
Incineration Options and TDSR Site Selection	2/15/2006	Example Local Cubic Yard Debris Contract
Incineration Options and TDSR Site Selection	2/15/2006	Example Local Bidding Schedule Cubic Yard
Incineration Options and TDSR Site Selection	2/15/2006	Debris Monitoring Field Pocket Guide
Incineration Options and TDSR Site Selection	2/15/2006	Texas Administrative Code, Site Selection Guidance
Incineration Options and TDSR Site Selection	2/15/2006	FEMA Debris Management Timeline
Incineration Options and TDSR Site Selection	2/15/2006	FEMA Debris Management Planning
Incineration Options and TDSR Site Selection	2/15/2006	FEMA Debris Management Eligibility and Documentation
Incineration Options and TDSR Site Selection	2/15/2006	FEMA Debris Management Contracting and Monitoring
Incineration Options and TDSR Site Selection	2/15/2006	Fact Sheet Legal Responsibility
Incineration Options and TDSR Site Selection	2/15/2006	Fact Sheet Hand Loaders, Stump Extraction, Contract Checklist
Incineration Options and TDSR Site Selection	2/15/2006	Texas Commission on Environmental Quality (TCEQ) Burn Approval Letters All Counties
Incineration Options and TDSR Site Selection	2/15/2006	Emergency Debris Management Site Certification Form

## Appendix A

Workshop	Date	Material
Incineration Options and TDSR Site Selection	2/15/2006	TDSR Site Investigation Form
Geographic Information Systems (GIS) and Debris Management	3/15/2006	HAZUS-MH Debris
GIS and Debris Management	3/15/2006	H-GAC GIS Resources
GIS and Debris Management	3/15/2006	Agencies Tackle Massive Gulf Coast Waste Removal Challenge
Community Relations and Special Collection Areas	4/19/2006	Managing Issues and Crisis
Community Relations and Special Collection Areas	4/19/2006	Private Property Policy Listing
Preparing for Hurricane Season	5/17/2006	Public Assistance Process Flowchart
Preparing for Hurricane Season	5/17/2006	Debris Management Plan Example
Preparing for Hurricane Season	5/17/2006	Fact Sheet Emergency Contracting vs. Emergency Work
Preparing for Hurricane Season	5/17/2006	FEMA Policy 9523.14 Debris Removal from Private Property
Preparing for Hurricane Season	5/17/2006	Pre- and Post-Disaster Checklists
Preparing for Hurricane Season	5/17/2006	Equipment Specifications
Debris Monitoring	6/21/2006	Link to FEMA Policy 9500 Series
Debris Monitoring	6/21/2006	Public Assistance Process Flowchart
"The Check is in the Mail?"	6/12/2007	Lake County Demonstration of Legal Responsibility
"The Check is in the Mail?"	6/12/2007	Lake County Groundhog Day Tornadoes
"The Check is in the Mail?"	6/12/2007	FEMA Eligibility Determination
"The Check is in the Mail?"	6/12/2007	Stafford Act Sections
"The Check is in the Mail?"	6/12/2007	Texas Health & Safety Code Chapter 343 Nuisance Abatement
Looking Back and Focusing on the Future	6/26/2007	Truck Certification Sample
Looking Back and Focusing on the Future	6/26/2007	Load Ticket Sample
Looking Back and Focusing on the Future	6/26/2007	Sample Road List
Looking Back and Focusing on the Future	6/26/2007	Question and Answer Exercise
Looking Back and Focusing on the Future	6/26/2007	Pre- and Post-Disaster Checklists
Looking Back and Focusing on the Future	6/26/2007	Public Assistance Pilot Program Fact Sheet
Looking Back and Focusing on the Future	6/26/2007	Example Project Worksheet

Workshop	Date	Material
Looking Back and Focusing on the Future	6/26/2007	Public Assistance Pilot Program Debris Management Plan Outline
Looking Back and Focusing on the Future	6/26/2007	Breakout Activity 1: Identify Internal and External Agencies
Meet the Experts	4/14/2008	Phillips & Jordan, Inc.
Meet the Experts	4/14/2008	DRC Emergency Services, Inc.
Meet the Experts	4/14/2008	CERES Environmental Services, Inc.
Meet the Experts	4/14/2008	Ashbritt, Inc.
Meet the Experts	4/14/2008	TFR Enterprises, Inc.
Meet the Experts	4/14/2008	Houston-Galveston Area Council
Meet the Experts	4/14/2008	CrowderGulf
Meet the Experts	4/14/2008	Storm Reconstruction Services, Inc.
Meet the Experts	4/14/2008	D&J Enterprises, Inc.
Meet the Experts	4/14/2008	Omni-Pinnacle, Inc.
Disaster Resiliency Workshop	4/30/2009	Planning Notes
Disaster Resiliency Workshop	4/30/2009	Response Notes
Disaster Resiliency Workshop	4/30/2009	Recovery Notes
Disaster Resiliency Workshop	4/30/2009	Mitigation Notes
Getting Back to the Basics	1/28/2010	Disaster Timeline
Getting Back to the Basics	1/28/2010	Roles and Responsibilities
Getting Back to the Basics	1/28/2010	GIS Information
Getting Back to the Basics	1/28/2010	Scenario
Getting Back to the Basics	1/28/2010	Debris Operations Checklist
All Hands on Deck	2/25/2010	Federal Agencies Handout
All Hands on Deck	2/25/2010	U.S. Environmental Protection Agency's (EPA) Role in Emergency and Disaster Response
Keep it Between the Lines	3/25/2010	Debris Management Site Checklist
Keep it Between the Lines	3/25/2010	Panel Discussion Questions
Keep it Between the Lines	3/25/2010	Disposal Site Evaluation and Registry
Keep it Between the Lines	3/25/2010	Sample Debris Site Checklist

Workshop	Date	Material
Keep it Between the Lines	3/25/2010	Sample Debris Site Extension Letter
Keep it Between the Lines	3/25/2010	Sample Letter to County Judge
Keep it Between the Lines	3/25/2010	Burn Conditions List
Keep it Between the Lines	3/25/2010	Emergency Disposal Site Evaluation and Registry
Keep it Between the Lines	3/25/2010	Disaster Specific Guidance for Hurricane Ike
Keep it Between the Lines	3/25/2010	Guidance for Hu-Mar Chemicals
Keep it Between the Lines	3/25/2010	Guidance for Public Water System
Keep it Between the Lines	3/25/2010	Managing Storm Debris from Declared Disasters
Reducing Your Disaster Footprint	4/29/2010	EPA Case Study
Reducing Your Disaster Footprint	4/29/2010	Living Earth: Storm Debris, Recycling
Reducing Your Disaster Footprint	4/29/2010	Waste Management: Disposal of Disaster Debris
Sticker Shock	5/27/2010	Federal Aid Construction Contract Provisions
Sticker Shock	5/27/2010	Sample Pricing Matrix
Sticker Shock	5/27/2010	Sample Proposal Evaluation
Sticker Shock	5/27/2010	FEMA Process Flowchart
What if: Planning for Special Debris Operations	6/10/2010	Demolition Checklist
What if: Planning for Special Debris Operations	6/10/2010	Demolition of Private Structures
What if: Planning for Special Debris Operations	6/10/2010	Debris Removal from Waterways
What if: Planning for Special Debris Operations	6/10/2010	Documenting & Validating Hazardous Trees, Limbs, and Stumps
Risk and Vulnerability Assessment Workshop	3/29/2011	Importance of Understanding Risks & Vulnerabilities within the Region
Risk and Vulnerability Assessment Workshop	3/29/2011	Impact of Climate Change on Disasters
Risk and Vulnerability Assessment Workshop	3/29/2011	Impacts of Risks on Economic Recovery
Risk and Vulnerability Assessment Workshop	3/29/2011	Impacts of Risks on Public Health & Safety, Government & Environment
Risk and Vulnerability Assessment Workshop	3/29/2011	Risk Mitigation Opportunities

# Appendix B 2010 WORKSHOP PARTICIPATION

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
City of Alvin	Public Works Department	Purchasing/Warehouse Coordinator	City	×					
City of Alvin	Public Works Department	Street Superintendent	City	×	×			×	
City of Baytown	Planning & Development	Planner	City						×
City of Deer Park	Public Works Department	Sanitation Supervisor	City	×			×		×
City of Deer Park	Public Works Department	Floodplain Administrator	City					×	
City of Eagle Lake	Administration	City Manager	City	×		×			
City of Galveston	Public Works Department		City	×					
City of Galveston	Public Works Department		City	×					
City of Houston	Public Works & Engineering	Geographic Information System (GIS) Analyst	City	×					
City of Houston	Public Works & Engineering		City	Х					
City of Houston	Public Works & Engineering	Right of Way & Fleet Maintenance, Maintenance Manager	City			×		×	×
City of Houston	Houston Parks & Recreation	Grants, Legislation and Development	City						×
City of Houston	Houston Police Department		City			Х			
City of Houston	Houston Police Department	Navigation	City			Х			

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
City of Houston	Solid Waste Management Department	GIS Analyst, Office of Director	City	×					
City of Houston	Houston Department of Health and Human Services	Environmental Investigator	City		×				
City of Houston	Houston Department of Health and Human Services	Bureau of Air Ouality Control, Environmental Investigator	City		×				
City of Houston	Solid Waste Management Department		City	×		×			
City of Houston	Solid Waste Management Department		City	×		×			
City of Houston	Solid Waste Management Department	Senior Staff Analyst	City	×					
City of Huntsville	Public Utilities Department	Solid Waste Division, Solid Waste Services Superintendent	City	×	×	×	×	×	×
City of Huntsville	Public Utilities Department	Director	City		×	×			
City of Huntsville	Fire Department	Assistant Fire Chief and Emergency Management Coordinator	City	×		×	×	×	×
City of Lake Jackson	Public Works Department	Sanitation Foreman	City				Х		
City of League City	Finance Department	Senior Accountant	City					×	
City of Meadows Place	Public Works Department	Director of Public Works	City	Х					
City of Missouri City	Public Works Department	Administrative Assistant	City			×			
City of Missouri City	Public Works Department	Project Manager	City						Х
City of Missouri City	Planning Department	Project Coordinator	City		×		×	×	×

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
City of Missouri City	Fire Department	Fire Chief	City		×				
City of Missouri City	Office of Emergency Management	Chief	City	Х	Х				
City of Pasadena	Health Department	Health Inspector	City		×				
City of Pasadena		Superintendent	City	×					
City of Patton Village	Police Department	Detective, Environmental Enforcement	City						×
City of Pearland	Purchasing Department	Purchasing Officer	City	×	×		Х		×
City of Pearland	Public Works Department	Assistant Director of Public Works	City	Х	×		Х	Х	
City of Pearland	Fire Department	Emergency Management Coordinator	City					×	
City of Piney Point Village	Public Works/Code Enforcement	Code Enforcement Officer	City			Х			
City of Santa Fe	Community Services	Street Foreman	City	Х	Х	×			
City of Santa Fe	Community Services	Street Superintendent	City	Х	Х	×			
City of Seabrook	Public Works Department	Assistant Director of Public Works	City		×	×		×	×
City of Seabrook	Public Works Department	Assistant Director of Public Works	City				Х	×	×
City of Sugar Land	Emergency Management	Emergency Management Coordinator	City		×				
City of Sugar Land	Community & Environmental Services	Director	City	×					
City of Sugar Land	Office of Emergency Management	Emergency Management Coordinator	City		×				
City of Sugar Land	Public Works Department	Environmental Manager	City			Х		×	Х
City of Sweeny	Public Works Department	Director of Public Works	City		×				

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
City of Tomball	Administration	Assistant to City Manager	City						×
City of West Columbia	Administration	City Manager	City				×	×	×
City of West University Place	Public Works Department	Contract Administrator	City	Х	Х				
City of Willis	Public Works Department	Director of Public Works	City					×	
The Woodlands Township	Community Services	Assistant General Manager	City		X	×	×		
Brazoria County	Commissioner Precinct 1	None provided	County	×					
Brazoria County	Engineering Department	GIS Data Technician	County	Х	Х	Х		×	Х
Brazoria County	Engineering Department	GIS Data Technician	County		Х		×	×	Х
Brazoria County	Engineering Department	Engineer in Training	County			Х	×	Х	
Brazoria County	Commissioner Precinct 1	Road & Bridge Foreman	County	Х					
Brazoria County	Engineering Department	Engineer in Training	County		×		×	×	×
Brazoria County	Commissioner Precinct 1	Road Superintendent	County	Х					
Brazoria County	Engineering Department	Environmental Compliance Specialist	County	Х	Х	Х	Х	Х	
Brazoria County	Auditor's Office	Supervisor, Internal Audit	County					×	
Brazoria County	Auditor's Office	Grants Supervisor	County					×	
Chambers County	County Engineer's Office	County Engineer	County	Х	Х				
Chambers County	County Engineer's Office	Engineering Project Manager	County	Х	Х	Х			Х
Chambers County	Chambers County Landfill	Landfill Supervisor	County		Х	Х			

ation	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
	Solid Waste Management	Director of Solid Waste	County		Х				
	Road & Bridge	Manager Drainage and Beaches	County	×					
r	Nuisance Abatement Program	Nuisance Abatement Officer	County	×					×
r	Office of Finance and Administration	Grants Coordinator	County	×					
	Office of Emergency Management	Emergency Management Coordinator	County	×					
T.	District Attorney's Office	Assistant County Attorney	County				×		
	Commissioner Precinct 2	Maintenance Camps, Washburn Tunnel - Safety Director	County	×				Х	
1	Commissioner Precinct 2	Road & Bridge Foreman	County	Х				×	
r	Public Infrastructure Department	Watershed Protection Group, Household Hazardous Waste Program Manager	County				X	X	×
	Public Infrastructure Department	Special Projects	County					Х	
	Public Infrastructure Department	Operations Division, Administrative Assistant	County					Х	
	Public Infrastructure Department	Operations Division, Manager of Special Projects	County	×	×		×	×	×
	Public Infrastructure Department	Architecture & Engineering Division, Chief Environmental Inspector, Storm Water Quality Section, Chief Environmental Inspector	County			×			×
	Commissioner Precinct 2	None Provided	County			×			
· · · · · · · · · · · · · · · · · · ·	Commissioner Precinct 3	Road & Bridge Division, Road & Bridge	County		×	×	Х	Х	×

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
		Coordinator							
Harris County	Commissioner Precinct 1	Road and Bridge Operations Superintendent	County	Х					
Harris County	Public Infrastructure Department	Architecture & Engineering Division, Project Coordinator for Precinct 2	County		×				
Harris County	Public Infrastructure Department	Watershed Protection, Office Manager	County					Х	
Harris County	Public Infrastructure Department	Watershed Protection Group, Water Quality Monitoring	County						×
Harris County	Commissioner Precinct 3	Office of Commissioner Community Aide	County	Х		Х	×	×	Х
Harris County	Commissioner Precinct 2	None provided	County			Х			
Harris County	Public Infrastructure Department	Watershed Protection Group, Manager	County			Х		Х	Х
Harris County	Commissioner Precinct 3	Road & Bridge Division, Administrative Aide	County		×	Х	×	Х	Х
Harris County	Commissioner Precinct 2	Genoa Red Bluff Maintenance Camp	County			Х			
Harris County	Commissioner Precinct 3	Road & Bridge Division, Superintendent	County		×		×	Х	Х
Harris County	Public Infrastructure Department	Operations Division, Manager of Operations	County			Х		×	
Harris County	Public Infrastructure Department	Manager of Capital Projects Section	County		×				
Harris County	Commissioner Precinct 2	Assistant Director of Safety Operations and Emergency Management	County			Х			
Harris County	Public Infrastructure Department	Planning Division, Financial Planner	County					Х	
Harris County	Commissioner Precinct 2	Road and Bridge General Superintendent	County	Х					

p Workshop					×			×					
05-27-10 Worksho	×	×	×			×		×					
04-29-10 Workshop			×		×		×	×		×			×
03-25-10 Workshop			×					Х			×	×	×
02-25-10 Workshop			×					×	×		×	×	×
01-28-10 Workshop				×	×			×					×
Type	County	County	County	County	County	County	County	County	County	County	County	County	County
Title	Operations Division, Finance Manager		Architecture & Engineering Division, Administration Section, Assistant Deputy Director	Architecture & Engineering Division, Administration Section, Assistant Deputy Director	Environmental Public Heatth, Solid Waste Specialist	Compliance Manager, Recovery Team Annex J	Assistant County Attorney	Operations Division, Project Manager	Environmental Health Director	Energy Manager	Environmental Health Division, Chief of OSSF Program	OSSF Complaint Investigator, Field Inspector	Deputy Emergency
Department	Public Infrastructure Department	Commissioner Precinct 3	Public Infrastructure Department	Public Infrastructure Department	Public Health & Environmental Services	Management Services	District Attorney's Office	Public Infrastructure Department	Environmental Health Office	Department of Infrastructure	Environmental Health Services	Environmental Health Services, Environmental Health Division	Office of Emergency
Organization	Harris County	Harris County	Harris County	Harris County	Harris County	Harris County	Harris County	Harris County	Matagorda County	Montgomery County	Montgomery County	Montgomery County	Walker County

Organization	Department	Title	Tvpe	01-28-10	02-25-10	03-25-10	04-29-10	05-27-10	06-10-10
2		Coordinator	5	Workshop	Workshop	Workshop	worksnop	Workshop	Worksnop
Walker County	Commissioner Precinct 4		County		×				
Walker County	Commissioner Precinct 1	Office Manager Road & Bridge	County	×	×				
Walker County	Commissioner Precinct 3	Commissioner	County	×	×				
U.S. Coast Guard	Marine Safety Unit Galveston	ENS, Chief, IMD/MER	Federal		×				
U.S. Coast Guard	Marine Safety Unit Galveston	MSTC	Federal		×				
U.S. Coast Guard	Marine Safety Unit Galveston	MST1	Federal		×				
U.S. Environmental Protection Agency	Region 6		Federal		×				
Bayou Preservation Association, Inc.		Water Ouality Director	Other Agency			×			×
Brazoria County Drainage District #4		Foreman	Other Agency		×				
Brazoria County Drainage District #4			Other Agency		×	×	×	×	
Deep East Texas Council of Governments		Environmental Planner	Other Agency	×					
Friends of the River San Bernard	Public Works Department	Drainage Supervisor	Other Agency	×	×	×	X	×	×
Galveston Bay Foundation		Director of Community Programs	Other Agency	×					
Greater Houston Partnership	Public Policy Division	Manager	Other Agency	×					
Harris County Flood Control District	Infrastructure Division	Manager	Other Agency	×	Х				
Harris County Flood Control District	Infrastructure Division, Maintenance	Maintenance Manager	Other Agency	×	×	×			×

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
	Engineering								
Harris County Flood Control District	Planning Department	Property Management Department Manager	Other Agency	Х	×	Х			
Harris County Flood Control District	Infrastructure Division, Facilities Maintenance Department	Assistant Facilities Maintenance Department Manager	Other Agency	×	×	×	×		×
Historic Houston	Founding Director	Executive Director	Other Agency	Х					
Historic Houston	Salvage Program	Director	Other Agency	×					
Houston Audubon Society		Sanctuary Steward	Other Agency	Х					
Houston-Galveston Area Council	Community & Environmental Planning	Senior Environmental Planner	Other Agency	Х	×	×	×		
Houston-Galveston Area Council	Community & Environmental Planning	Sustainable Development Program Manager	Other Agency	Х	×	×	×		Х
Houston-Galveston Area Council	Community & Environmental Planning	Environmental Planning Assistant	Other Agency	Х	×	×	×		
Velasco Drainage District		Operations Superintendent	Other Agency	Х				Х	
AshBritt, Inc.	Government Relations	Regional Manager	Private	×		×			×
AshBritt, Inc.		Vice President of Marketing	Private		×		Х		
Beck Disaster Recovery, Inc.		Director, Post-Event Programs	Private	×	×	×	×	×	×
Beck Disaster Recovery, Inc.			Private	Х		×	×	×	Х
Brown & Gay Engineers, Inc.			Private						Х
Ceres Environmental Services, Inc.	Texas Environmental Recycling	Branch Manager	Private	Х	×	×			

Organization	Department	Title	Tvpe	01-28-10	02-25-10	03-25-10	04-29-10	05-27-10	06-10-10
Coros Environmontal			5	Workshop	Workshop	Workshop	Workshop	Worksnop	Workshop
Services, Inc.		Project Manager	Private	×					
Ceres Environmental Services, Inc.			Private	×					
Cherry Crushed Concrete, Inc.		Business Development Manager	Private	Х	Х				
Cherry Demolition, Inc.			Private		×				
Cobb, Fendley & Associates, Inc.	Landscape Architecture and Planning	P3 Finance & Development Manager	Private						×
Dannenbaum Engineering Corporation		Emergency Management Project Director	Private	×	×				
Dannenbaum Engineering Corporation		Engineer-in-Training	Private	×	×				
Dannenbaum Engineering Corporation		Senior Project Manager	Private	×	×	×	×		
Dannenbaum Engineering Corporation		Senior Project Manager	Private				×		
Dannenbaum Engineering Corporation			Private	×					
DRC Emergency Services, LLC	Government Affairs	Vice President	Private	×					
DRC Emergency Services, LLC			Private	×	×			×	
Edminster, Hinshaw, Russ and Associates, Inc.		Land Planning Project Manager	Private				×		
Effective Environmental, Inc.		Sales	Private		×	×	×	×	×
Effective Environmental, Inc.		Director of Disaster Management	Private	×					
Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
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Effective Environmental, Inc.			Private	Х					
Golder Associates, Inc.		Associate	Private			×			
Gulf Coast Waste Disposal Authority	Washburn Tunnel Facility	Facility Manager	Private	Х	Х		Х	×	
Gulf Coast Waste Disposal Authority		Senior Accountant	Private					×	
Home Sweet Home CRC, Inc.	Community Redevelopment	Executive Director	Private	×					
Home Sweet Home CRC, Inc.	Board of Directors	Housing Counselor	Private			×			
Home Sweet Home CRC, Inc.	Community Redevelopment		Private	×	×		Х	×	Х
Homeland Security Information Corporation		President	Private		×				
Living Earth		President	Private				Х		
Omni Pinnacle, LLC			Private	Х					
Omni Pinnacle, LLC			Private	X					
Phillips & Jordan, Inc.		Project Manager	Private		×				
Phillips & Jordan, Inc.		Business Development Manager	Private		Х				
Phillips & Jordan, Inc.		Project Manager	Private		×				
R.G. Miller Engineers, Inc.	Site Department	Project Manager	Private						Х
Storm Reconstruction Services, Inc.			Private	×					
Storm Reconstruction Services, Inc.			Private	×					

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
Unified Recovery Group	Texas Area Business Development	Accredited Inspector	Private	×					
URS Corporation	Vice President	School Board Trustee La Porte Independent School District	Private		×				
Vogt Engineering, LP		Principal	Private						×
Waste Management, Inc.	Planning & Project Development	Senior Manager Market Area	Private				×		
Winc Engineering Service Corporation		President	Private				×		
Zarinkelk Engineering Services, Inc.			Private						Х
Lamar Independent School District	Public Works & Engineering	Assistant Director Stormwater Maintenance Branch	School		×				
Rice University	Department of Earth Science	Emeritus Professor Geology and Geophysics	School						Х
Rvi Houston		Principal	School						×
Texas Commission on Environmental Quality	Region 12	Waste Section Manager	State Agency	×		×			
Texas Commission on Environmental Quality	Region 12	None Provided	State Agency			×			
Texas Commission on Environmental Quality	Region 12	Environmental Assessment Team Leader	State Agency		×	×			
Texas Commission on Environmental Quality	Region 12	Office of Public Assistance, Program Specialist	State Agency	×		×	×		
Texas Commission on Environmental Quality	Region 12	None Provided	State Agency	×			×		

Organization	Department	Title	Type	01-28-10 Workshop	02-25-10 Workshop	03-25-10 Workshop	04-29-10 Workshop	05-27-10 Workshop	06-10-10 Workshop
Texas Commission on Environmental Quality	Region 12	None Provided	State Agency	×					
Texas Commission on Environmental Quality	Region 12	Waste Section, Municipal Solid Waste, Program Coordinator	State Agency				×		
Texas Commission on Environmental Quality	Region 12	Waste Section, Environmental Investigator	State Agency	Х					
Texas Department of Public Safety	District S2C, Division of Emergency Management	Regional Liaison Officer	State Agency	Х	×		×		
Texas Department of Transportation		District Transportation Planner	State Agency						Х
Texas Division of Emergency Management		Public Assistance Officer	State Agency					×	

## Appendix C HOUSTON-GALVESTON AREA COUNCIL PROGRAMS ASSESSMENT SURVEY

- 1) Which of the following best describes the organization you represent?
  - a. County (21.6%)
  - b. City (**48.6%**)
  - c. State (13.5%)
  - d. Federal (0%)
  - e. Private sector (13.5%)
  - f. Other (2.7% Response: Emergency and debris management planning specialist)
- 2) Which of the following best describes the location of your organization within the region?
  - a. Coastal (57.1%)
  - b. Inland (42.9)
  - c. Upland (0%)
- 3) How long have you been with your organization?
  - a. Less than a year (2.7%)
  - b. 2-5 years (16.2%)
  - c. 5-10 years (29.7%)
  - d. More than 10 years (**51.4%**)
- 4) What is your role at the organization regarding debris management planning?
  - a. Contractor oversight (13.9%)
  - b. Procurement/contracting (11.1%)
  - c. Field management (25.0%)
  - d. Public safety (police, fire, etc.) (2.8%)
  - e. Finance (**5.6%**)
  - f. Planning (**13.9%**)
  - g. Other (27.8% Responses: GIS manager, city administrator, code enforcement, program specialist, public works)

#### Workshops

- 1) Have you attended a Houston-Galveston Area Council (H-GAC)-sponsored workshop?
  - a. Yes (73.7%)
  - b. No (26.3%)

2) If respondent answered "No" to Question #1

What was the primary reason for not attending?

- a. Workshop topics (0%)
- b. Workshop dates (33.3%)
- c. Workshop locations (0%)
- d. Did not hear about workshops (44.4%)
- e. Other (22.2%)
- 3) How far did you have to travel to attend the H-GAC-sponsored workshop?
  - a. 0–15 miles (25.9%)
  - b. 15–30 miles (**18.5%**)
  - c. 30–60 miles (**33.3%**)
  - d. 60–100 miles (**11.1%**)
  - e. More than 100 (**11.1%**)
- 4) Where should H-GAC-sponsored workshops be held?
  - a. H-GAC headquarters (3555 Timmons Lane Houston, Texas) (81.5%)
  - b. Regionally (7.4%)
  - c. Subregionally (7.4%)
  - d. Other (3.7% Response: Local office)
- 5) How would you <u>best</u> describe your position in the organization when you attended the H-GAC-sponsored workshop?
  - a. Department director (23.1%)
  - b. Organization manager/administration (50%)
  - c. Elected official (**0%**)
  - d. Foreman/operator (0%)
  - e. Emergency management coordinator (3.8%)
  - f. Public safety (police, fire, etc.) (0%)
  - g. Engineer (0%)
  - h. Planner (0%)
  - i. Other (23.1% Responses: Contractor, auditor, debris management, air program liaison, emergency and debris management planning specialist, concerned resident)
- 6) Was your organization able to send more than one representative to an H-GAC-sponsored workshop?
  - a. Yes (77.8%)
  - b. No (22.2%)

7) If respondent answered "Yes" to Question #6:

How many people attended?

- a. 2 (**61.1%**)
- b. 3 (22.2%)
- c. 4 (**5.6%**)
- d. More than 4 (11.1%)
- 8) Did you find the topic of the H-GAC-sponsored workshop useful for debris management planning?
  - a. Yes (95.8%)
  - b. No (4.2%)
- 9) Did the H-GAC-sponsored workshop provide you with new information, concepts, or policies related to debris management?
  - a. Yes (75%)
  - b. No (25%)
- 10) Do you plan to attend future H-GAC workshops?
  - a. Yes (87.5%)
  - b. No (12.5%)
- 11) Which factor is most likely to influence your decision to attend an H-GAC-sponsored workshop?
  - a. Workshop guest speaker (33.3%)
  - b. Workshop topic (95.8%)
  - c. Workshop date (25%)
  - d. Workshop location (12.5%)
  - e. Other (4.2% Response: Time of workshop and traffic conditions)
- 12) Which of the following would you like to see as workshop or training topics in the future?
  - a. Evacuation planning (18.2%)
  - b. Emergency sheltering (9.1%)
  - c. Hazard mitigation (36.4%)
  - d. Exercise planning (27.3%)
  - e. Application of geographic information systems (GIS) for debris management planning (54.5%)
  - f. Other (18.2% Responses: procurement of contracts, recouping costs, abandoned vessels, recycling of green waste)

- 13) Have you used reference materials from an H-GAC-sponsored workshop to assist with debris management planning?
  - a. Yes (58.3%)
  - b. No (41.7%)
- 14) If respondent answered "Yes" to Question #13:

What sample reference materials from H-GAC workshops have you used to support debris management planning?

- a. Debris operations checklist (78.6%)
- b. Debris site checklist (51.1%)
- c. Debris site extension letter (14.3%)
- d. Pricing matrix (28.6%)
- e. Proposal evaluation (42.9%)
- f. Other (please specify) (0%)
- 15) When a viable debris-generating incident threatened your community, did you use any reference materials from an H-GAC-sponsored workshop to assist with pre-incident debris management planning?
  - a. Yes (57.1%)
  - b. No (71%)
  - c. N/A (35.7%)

#### **Storm Debris Publications**

- 1) Have you accessed the storm debris publications that are available on the H-GAC website (<u>http://www.h-gac.com/community/waste/storm/publications.aspx</u>)?
  - a. Yes (15.8%)
  - b. No (84.2%)
- 2) Which section of the storm debris publications website do you find the most useful? Select all that apply.
  - a. Regional Storm Debris Management Assessment Report (0%)
  - b. Strategic Guide to Debris Management (0%)
  - c. Helpful Information (0%)
  - d. FEMA Forms (66.7%)
  - e. None (33.3%)
- **3)** Do you use the storm debris publications website as a reference point in debris management planning and preparation?
  - a. Yes (0%)
  - b. No (100%)

- 4) Have you downloaded materials from the storm debris publications website?
  - a. Yes (0%)
  - b. No (100%)
- 5) Did you use the storm debris publications website as a reference source when a viable debris-generating incident threatened or affected your community?
  - a. Yes (0%)
  - b. No (100%)

#### **Storm Debris Procurement Programs**

- 1) Have you procured storms debris services through H-GAC?
  - a. Yes (28.1%)
  - b. No (50%)
  - c. N/A (21.9%)
- 2) If respondent answers "Yes" to Question #1:

Which services have you procured through H-GAC?

- a. Disaster debris hauling (25%)
- b. Disaster debris monitoring (25%)
- c. Both (50%)
- d. Other (0%)
- **3)** Which factor most influenced your decision to use H-GAC to procure storm debris services?
  - a. Flexibility (25%)
  - b. Ease of use (87.5%)
  - c. Availability of information (25%)
  - d. Time savings (50%)
  - e. Other (12.5% Responses: Quality of monitoring contractor)
- 4) Were H-GAC staff helpful in responding to your questions regarding the procurement of storm debris services?
  - a. Yes (100%)
  - b. No (0%)
- 5) Did you have problems using H-GAC to procure storm debris services?
  - a. Yes, please provide details below (0%)
  - b. No (100%)
- 6) What could be done to improve your experience using H-GAC to procure storm debris services?

**Responses:** Need more comprehensive Request for Proposal information to better select more qualified contractors. Would like to have results/awards info sent to us after we bid, or a notice of possible award date and results.

7) What additional storm debris-related services do you think should be procured through H-GAC?

**Response: marine salvage, emergency logistics, housing and food services, more environmental services** 

#### Grants

- 1) Which of the following grants have you used to fund storm debris management planning?
  - a. Emergency Management Performance Grant (EMPG) (0%)
  - b. H-GAC Solid Waste Implementation Grant (3.2%)
  - c. Urban Areas Security Initiative (UASI) (6.5%)
  - d. Regional Catastrophic Planning (0%)
  - e. None of the above (**80.6%**)
  - f. Other (please specify) (12.9% Responses: unknown to my role in the organization, not applicable to my position)
- 2) If respondent answered "a-d" to Question #1:

Were you awarded the grant?

- a. Yes (66.7%)
- b. No (**33.3%**)
- 3) If respondent answered "e" to Question #1:

Do you intend to apply for a grant to fund a debris management planning project?

- a. Yes (17.9%)
- b. No (**82.1%**)
- 4) Which of the following would you use grant funds to support? Select all that apply.
  - a. Final disposal/recycling analysis (30.8%)
  - b. Debris estimation and modeling (34.6%)
  - c. Regional debris management coordination (19.2%)
  - d. Training (46.2%)
  - e. Exercises (19.2%)
  - f. Debris management plan (38.5%)
  - g. Debris management site analysis (26.9%)
  - h. Other (please specify) (19.2% Responses: Supporting technologies, not applicable to my position, none)

# Appendix D 2011 INVENTORY AND EXISTING PLANS SURVEY AND RESULTS

#### General

- 1) Which of the following best describes the organization you represent?
  - a. County (50%)
  - b. City (46.2%)
  - c. State
  - d. Federal
  - e. Private sector (3.8%)
- 2) Was the organization you represent affected by disaster debris from Hurricane Ike?
  - a. Yes (100%)
  - b. No
- 3) If respondent answered "Yes" to Question #2:

How much disaster debris was collected in your community following Hurricane Ike?

- a. 0–100,000 cubic yards (17.6%)
- b. 100,000–250,000 cubic yards (29.4%)
- c. 250,000–500,000 cubic yards (5.9%)
- d. 500,000–1,000,000 cubic yards (23.5%)
- e. More than 1,000,000 cubic yards (23.5%)
- 4) What was the last type of debris-generating incident to affect your community?
  - a. Storm surge (tropical system)
  - b. High wind (tropical system) (100%)
  - c. Flooding (non-tropical system)
  - d. Tornado
  - e. Ice storm
  - f. Other
- 5) What was the month and year of the most recent debris-generating incident?

Month: \_\_\_\_\_ Year: \_\_\_\_\_

#### **Response: Ike**

- 6) Which of the following debris-generating incidents do you feel poses the greatest threat to your community?
  - a. Storm surge (tropical system) (35%)

- b. High wind (tropical system) (100%)
- c. Flooding (non-tropical system) (35%)
- d. Tornado (35%)
- e. Ice storm (15%)
- f. Other (drought conditions)

#### **Debris Management Planning**

- 1) Does your organization have a plan in place to address disaster debris (for example, disaster debris management plan)?
  - a. Yes (85.7%)
  - b. No (14.3%)

2) If respondent answered "Yes" to Question #1: When was the plan last updated?

- a. 2010 **2**
- b. 2009 **4**
- c. 2008 **1**
- d. 2011 **3**

3) If respondent answered "No" to Question #1:

Does your organization intend on developing a plan to address disaster debris in the future? N=3  $\,$ 

- a. Yes (66.7%)
- b. No (33.3%)
- 4) Did the FEMA PA Pilot Program and incentives influence your organization's decision to develop a plan? The FEMA PA Pilot Program was instituted from June 1, 2007 through December 31, 2008. The FEMA PA Pilot Program provided grants on the basis of estimates for large projects, increased federal share incentive (5%), allowed retention of salvage value of recyclable debris, and reimbursed regular time salaries and benefits of employees performing debris-related activities.
  - a. Yes (53.8%)
  - b. No (46.2%)
- 5) Would you develop or update a plan and submit it for FEMA approval if the PA Pilot Program was reinstituted? The FEMA PA Pilot Program was instituted from June 1, 2007 through December 31, 2008. The PA Pilot Program provided grants on the basis of estimates for large projects, increased federal share incentive (5%), allowed retention of salvage value of recyclable debris, and reimbursed regular time salaries and benefits of employees performing debris-related activities.

- a. Yes (81.3)
- b. No (18.8)

6) Does your organization have a designated debris manager?

- a. Yes (76.5%)
- b. No (23.5%)

7) If respondent answered "Yes" to Question #6:

Which department is your designated debris manager from?

- a. Solid Waste (7.7%)
- b. Public Works (15.4%)
- c. Road and Bridge (23.1%)
- d. Emergency Management (30.8%)
- e. Other, please specify: Debris Management Task Force
- 8) Do you have a debris management organizational chart that specifies roles and responsibilities for debris management operations?
  - a. Yes (75.0%)
  - b. No (25%)
- 9) Does your organization have interlocal agreement(s) with other organizations for debris clearing, removal, and/or disposal operations?
  - a. Yes (76.5%)
  - b. No (23.5%)

10) If respondent answered "Yes" to Question #7:

Which of the following best describes the type of organization(s) with which you have an interlocal agreement(s)? Select all that apply.

- a. City (75%)
- b. County (**41.7%**)
- c. Schools (25%)
- d. University (8.3%)
- e. Nonprofit (16.7%)
- f. Texas Department of Transportation (TxDOT) (33.3%)
- 11) Which disaster-related federal aid programs has your organization applied to for reimbursement of debris-related costs? Select all that apply.
  - a. Federal Emergency Management Agency (FEMA) Public Assistance Program (89.8%)

- b. Federal Highway Administration Emergency Relief (FHWA-ER) Program (52.6%)
- c. Natural Resources Conservation Service (NRCS) (0%)
- d. Community Development Block Grant (CDBG) (10.5%)
- e. Other, please specify:
- 12) Has your organization identified roads within your jurisdiction that may be eligible for FHWA-ER Program funding following a disaster?
  - a. Yes (66.7%)
  - b. No (20.0%)
  - c. N/A (13.3%)
- 13) Has your organization identified potential temporary debris management sites (DMS) for future use?
  - a. Yes (86.7%)
  - b. No (13.3%)
  - c. N/A (0%)

14) If respondent answered "Yes" to Question #11:

Plea	ase	list the address and size (acreage) of each potential I	OMS.
	a.	Address: 2200 S. Friendswood Drive	Size: 22
	b.	Address: 1022 Red Bluff Road	Size: 13.2
	c.	Address: FM 2759 and Cortez Road	Size: 25
	d.	Address: NRG Property, Thompson Highway, Rich	mond, Texas
			Size: 100
	e.	Address: 141 Canna Lane Lake Jackson, Texas	Size: 100
	f.	Address: 350-A SH75 North, Huntsville - Pct. 1	Size: Not listed_
	g.	Address: 10,000 Eiker	Size: 10
	h.	Address: Seabreeze Environmental Landfill, FM 52	3, Angleton
		Size: 25	
	i.	Address: 17825 SH35	Size: 35
	j.	Address: Site 2 at 2759 and Cortez Road	Size: 100
	k.	Address: Fort Bend County Fairgrounds	Size: 30
	1.	Address: 123 Booker Road, Huntsville	Size: Not listed_
	m.	Address: McGaughey Property, SH 35 off Mitchell	Rd Size: 17
	n.	Address: Private Land in Arcola, Texas	Size: 200
	о.	Address: 9368 SH75 South, New Waverly - Pct. 4	
		Size: Not listed_	
	p.	Address: Sheriff's Office Complex, CR 45, Angleto	n_
		Size: 29	
	q.	Address: Bates Allen Park-Charlie Roberts Ln, Ken	dleton Tx
	-	Size: 150	
	r.	Address: County Owned Property in Katy, Texas Si	ize: 10

s.	Address: Old Alvin Landfill	Size: 6
t.	Address: Bob Lutz Park-Harlem Rd	Size: 8
u.	Address: Leased School Property in Needville, T	exas
	Size: 20	
v.	Address: Sweeny Fire Field, McKinney Road, S	weeny_
	Size: 14	
w.	Address: Precinct 2 Stockpile yard-FM 521	Size: 6
x.	Address: Fort Bend County Owned Park in Kend	lleton
	Size: 600	
y.	Address: Weems Asphalt Plant, off SH 35, East	Columbia
	Size: 10	
z.	Address: Valley Lodge-Simonton Texas	Size: 6
aa.	Address: Kitty Hollow Park-Missouri City	Size: 15

- 15) What landfills or end-users have you identified for the final disposal, recycling, or beneficial use of disaster-related debris?
  - a. Name: Hill Sand Company\_
  - b. Name: Coastal (Waste Management) \_\_\_\_\_
  - c. Name: Republic Waste North County Landfill
  - d. Name: USA Waste and Texas Landfill\_\_\_\_\_
  - e. Name: Sprint Waste Disposal Landfill
  - f. Name: Blueridge Landfill \_\_\_\_\_
  - g. Name: Fort Bend Regional Landfill
  - h. Name: BFI \_\_\_\_\_
  - i. Name: Seabreeze Environmental Landfill
  - j. Name: Living Earth locations will process and sell green debris
  - k. Name: Any approved C&D landfill site (determined by incident) \_\_\_\_
  - 1. Name: Hill's Landfill
  - m. Name: Dixie Farm Road Landfill, Pearland, TX \_\_\_\_\_
  - n. Name: Waste Management \_\_\_\_\_
  - o. Name: City of Lake Jackson \_\_\_\_\_
- 16) Do you have current pre-positioned contracts for disaster debris clearing, removal, and disposal services?
  - a. Yes (85.7%)
  - b. No (14.3%)
  - c. N/A (0%)

- 17) If respondent answered "Yes" to Question #16:
  - Which of the following best describes your contractor?
    - a. Local contractor (16.7%)
    - b. Regional or national contractor (83.3%)
    - c. Franchise municipal waste contractor (0%)
    - d. Other (0%)
- 18) If respondent answered "Yes" to Question #16:

How did you obtain your pre-positioned contract for disaster debris clearing, removal, and disposal?

- a. HGACBuy (8.3%)
- b. Cooperative purchase agreement (8.3%)
- c. Competitive procurement (83.3%)
- d. Assigned legal responsibility to County or other jurisdiction (0%)
- e. Other (**0%**)
- 19) If respondent answered "No" to Question #16:

Which of the following best describes why your organization does not have prepositioned contracts for disaster debris clearing, removal, and disposal services?

- a. We have not secured pre-positioned contracts but intend to prior to an incident. (0%)
- b. We intend to clear and remove debris using internal staff and equipment. (0%)
- c. We need more information to make a decision. (0%)
- d. Other, please specify: Not applicable or currently approving new contracts
- 20) Do you have current pre-positioned contracts for disaster debris removal monitoring services?
  - a. Yes (64.3%)
  - b. No (28.6%)
  - c. N/A (7.1%)

21) If respondent answered "Yes" to Question #20:

Which of the following best describes your contractor?

- a. Local contractor (16.7%)
- b. Regional or national contractor (83.3%)
- c. Franchise municipal waste contractor (0%)
- d. Other (0%)

22) If respondent answered "No" to Question #20:

Which of the following best describes why your organization does not have pre-positioned contracts for disaster debris removal monitoring?

- a. We have not secured pre-positioned contracts but intend to prior to an incident. (0%)
- b. We intend to monitor debris removal using internal staff. (33.3%)
- c. We need more information to make a decision. (0%)
- d. Other, please specify: Use H-GAC contract and in the process of approving new contracts

#### Resources

- 1) What equipment does your organization have to support disaster debris clearance, removal, and/or disposal operations?
  - a. Open-top trucks with hauling capacity of 6–12 cubic yards: 149\_\_\_\_\_
  - b. Open-top trucks with hauling capacity of 12–20 cubic yards: 16\_\_\_\_\_
  - c. Open-top trucks with hauling capacity of 20–30 cubic yards: 13\_\_\_\_
  - d. Open-top trucks with hauling capacity of more than 30 cubic yards: 100
  - e. Backhoes: 17\_\_\_\_
  - f. Bobcats: 8\_\_\_\_
  - g. Front end loaders: 17\_\_\_\_
  - h. Other: Excavator, grandall (9), motor grader, utility tractor, trackhoe 6

#### **Public Information**

- 1) Which of the following methods will your organization use to broadcast public information regarding debris removal operations? Check all that apply.
  - a. Print media (**91.7%**)
  - b. Radio (66.7%)
  - c. Television (66.7%)
  - d. E-mail (50%)
  - e. Organization website (66.7%)
  - f. Social media (58.3%)
  - g. Other (16.7%) (Walker County Code Red, Connect CTY)
- 2) What information will your organization broadcast? Check all that apply.
  - a. Proper setout procedures for debris (91.7%)
  - b. Debris removal dates (100%)
  - c. Debris removal progress (66.7%)
  - d. Community debris drop-off locations (58.3%)

- e. Contact information (100%)
- f. Other (0%)
- 3) How will you receive feedback from the public? Check all that apply.
  - a. Organization website (88.3%)
  - b. Organization phone number (100%)
  - c. Special debris/disaster hotline (41.7%)
  - d. E-mail (83.8%)
  - e. Social media (**41.7%**)
  - f. Other (0%)

### Technology

- 1) Does your organization use geographic information systems (GIS) for planning and mapping purposes?
  - a. Yes (Survey prompts Questions 2–9) (91.7%)
  - b. No (Survey continues to Training) (8.3%)
  - c. N/A (Survey continues to Training) (0%)
- 2) Has your organization developed debris removal zones to assist with debris management planning and debris removal following a disaster?
  - a. Yes (72.7%)
  - b. No (18.3%)
  - c. N/A (**9.1%**)
- 3) If respondent answered "Yes" to Question #2:

Which format are the debris removal zone maps stored in?

- a. GIS shapefile (75%)
- b. Geodatabase (25%)
- c. CAD file (12.5%)
- d. Other (37.5%) (Feature Class inside of Special Data Engine (SDE), Data stored at Walker County Planning and Development)
- 4) If you answered "No" to Question #2:

Do you intend to develop debris removal zone maps prior to a disaster?

- a. Yes (0%)
- b. No (100%)
- c. N/A (0%)

- 5) Does your organization plan to use political boundaries (for example, commissioner precincts or council districts) to track debris removal progress?
  - a. Yes (70%)
  - b. No (20%)
  - c. N/A (0%)
- 6) Which of the following GIS data is available for your organization? Select all that apply.
  - a. Street centerline with maintenance responsibility (75%)
  - b. Applicable political boundaries (85%)
  - c. Parcel database with ownership information (75%)
  - d. Address points with structure type information (75%)
  - e. Critical facilities (75%)
  - FHWA-ER eligible roads or a street centerline with functional classification data (25%)
  - g. Landfill locations (50%)
  - h. Temporary debris staging and reduction site (TDSRS) locations (75%)
  - i. Recent aerial photography (87.5%)
  - j. Floodplain data (100%)
- 7) Is GIS data for your organization stored in a centralized location and available for quick retrieval such as an online download site or file transfer protocol (FTP) site?
  - a. Yes (100%)
  - b. No (**0%**)
- 8) Do you have a GIS technician designated to support debris management planning following a disaster?
  - a. Yes (77.8%)
  - b. No (22.2%)
- 9) Which of the following do you feel is the most important use of GIS technology to support debris removal operations?
  - a. Tracking debris removal progress (22.2%)
  - b. Developing maps and reports (66.7%)
  - c. Ensuring debris removal only occurs on organization-maintained roads (11.1%)
  - d. Tracking damages and incident reports (0%)
  - e. Other (**0%**)

### Training

1) Which of the following training courses and/or workshops have you or your staff taken? Check all that apply.

- a. E202 Debris Management Course (Emergency Management Institute [EMI] On-Campus Course) G202 – Debris Management Course (Texas Division of Emergency Management [TDEM] Trainer) (60%)
- b. FEMA IS-632: Introduction to Debris Operations in FEMA's Public Assistance Program (40%)
- c. FHWA-ER (TxDOT) (30%)
- d. H-GAC workshops (60%)
- e. Conference workshops (70%)
- f. Vendor training (40%)
- g. Other (10%)
- 2) Has your organization included aspects of a debris management operation in an exercise (for example, tabletop exercise, functional exercise, or full-scale exercise)?
  - a. Yes (50%)
  - b. No (50%)
- 3) Which area of debris management planning is strongest in your organization and does not require additional training?
  - a. Roles and responsibilities (60%)
  - b. Contracts/procurement (50%)
  - c. Reimbursement (30%)
  - d. Force account labor (30%)
  - e. Debris removal operations (60%)
  - f. Specialized debris programs (household hazardous waste, private property debris removal, etc.) (10%)
  - g. Temporary debris management sites (30%)
  - h. Disposal/recycling of disaster debris (30%)
  - i. Other (20%)
- 4) Which area of debris management planning is weakest in your organization and requires additional training?
  - a. Roles and responsibilities (18.2%)
  - b. Contracts/procurement (36.4%)
  - c. Reimbursement (45.5%)
  - d. Force account labor (27.3%)
  - e. Debris removal operations (9.1%)
  - f. Specialized debris programs (household hazardous waste, private property debris removal, etc.) (54.5%)
  - g. Temporary debris management sites (27.3%)
  - h. Disposal/recycling (36.4%)
  - i. Other (18.2%)

Appendix E STORM SURGE AND HIGH WATER MARKS



# Appendix F HURRICANE IKE WIND CONTOURS



# Appendix G HURRICANE IKE DEBRIS MANAGEMENT SITES

### Brazoria County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Oakwood Shores Subdivision AKA Lone Star Land Developers	FM 288 and FM 2004	Richwood	29.074628	-95.409973	40
Brazoria County Drainage District #5	1022 FM 1462	Rosharon	29.3518	-95.448003	40-100
Oyster Creek #2	End of Jeffers Road, off Farm Road 523	Oyster Creek	28.990578	-95.332789	2-12
Oyster Creek #1 @ RV Ranch	2815 FM 523	Freeport	28.99756	-95.33024	0.5
Lake Jackson - Closed Landfill	141 Canna Lane	Lake Jackson	29.0253	-95.4577	20
Lake Jackson Mulch Site	103 Canna Lane	Lake Jackson	29.0281	-95.45193	5
Seabreeze Landfill	10310 FM 523	Angleton	29.090106	-95.366426	17
Brazoria County Debris 1	CR 645 just east of West Columbia/1/4 mile south of 698 CR 645	West Columbia	29.12296	-95.61666	4
City of Danbury	CR 46 and CR 207 - 450 feet east of 25625 Highway 46	Danbury	29.22603	-95.3568	2
Detention Center	CR 45 (1 mile east of CR 48)/3600 CR 45	Angleton	29.24722	-95.41008	35
Closed Landfill in Alvin	Northeast of CR 38 and 182	Alvin	29.394364	-95.338471	60-100
Dixie Farm Road (Hill Sand)	4649 Dixie Farm Road	Pearland	29.51892	-95.25551	50-100
Slaughter Road Site - AKA Longhorn/Dow Chemical	CR 217, 3/4 mile east of Slaughter Road, 3/4 mile from Brazos River	Freeport	28.96145	-95.384867	40
Brazoria WWTP	1 mile west of FM 521 and CR 797 Intersection	Brazoria	29.0165	-95.5846	2-5
Lake Jackson - Jasmine Hall Parking Lot	100 Narcissus	Lake Jackson	29.036517	-95.416983	0.5
Dunbar Park Pavilion Parking Lot	400 FM 2004	Lake Jackson	29.060833	-95.451683	0.5
Welch Park	2198 East Kiber Road	Angleton	29.1582	-95.40085	1-5
Brazoria County Conservation and Reclamation District #3	6802 Bissell Road	Manvel	29.467367	-95.36795	10
Pearland Veterans Site	3421 Veterans Drive	Pearland	29.530321	-95.289175	30
Stevens Ranch	5146 Blue Lake Road	Holiday Lakes	29.178834	-95.525829	34
Alvin Highway 6	550 West Highway 6	Alvin	29.427455	-95.239837	1-3

#### **Chambers County Hurricane Ike Debris Management Sites**

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Anahuac TDRS Site	805 Airport Road	Anahuac	29.769357	-94.658242	5-7
Smith Point Road – Texas Department of Transportation (TxDOT)	End of Smith Point Road, near intersection with Heartfield Lane	Anahuac	29.52749	-94.7719	5
Smith Point Road Site	Smith Point Road and Heartfield Lane	Smith Point	29.52749	-94.7719	5
Smith Point TDRS Site	806 Plummer Camp Road	Smith Point	29.5294	-94.75967	1-7
Highway 1985 Dump Site	1415 FM Highway 1985	Winnie	29.671387	-94.489422	5
Oak Island	130 West Bayshore Road	Anahuac	29.7037976	-94.684271	1-7
Ben Nelson 562 Site	FM 562, one mile east of Double Bayou	Double Bayou	29.68041	-94.61863	5
Beach City Box Site	5121 Lawrence Road	Beach City	29.76717	-94.83688	6-8
Chambers County Landfill	7505 Highway 65	Winnie	29.79121	-94.52225	10-30
Chambers County Resource and Recovery Center	7508 Highway 65	Winnie	29.79121	-94.52225	640
Winnie TDRS Site	815 Cook Road	Winnie	29.8121	-94.37061	2
Wallisville Box Site	24318 I-10	Wallisville	29.8393	-94.67259	4-8
Mont Belvieu Site	10610 Eagle Drive	Dayton	29.84901	-94.85632	1
Winnie Citizen Collection Station	47414 I-10 East (south side of feeder)	Winnie	29.858588	-94.356934	0.5
Storm Reconstruction Services, Inc. Site	4318 FM 1985	Anahuac	29.6436111	-94.543889	10
Trinity Bay Conservation District Site	4318 FM 1985	Anahuac	29.6436111	-94.543889	10
Holliday TDRS	4318 FM 1985	Anahuac	29.6586111	-94.548611	10
Wayne Morris Farms	9451 FM 87/One Mile Highway 1985	Anahuac	29.772975	-94.681594	5
Oak Island Box Site	308 Box Site Road	Anahuac	29.772975	-94.681594	12

### Fort Bend County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Needville-Padon Road Stockpile	Near Needville- Fairchilds Road	Needville	29.4103813	-95.802995	10
Sprint Landfill	16007 Boss Gaston Road	Richmond	29.6675906	-95.668329	1
Padon Road Stockpile	Padon Road	Needville	29.401864	-95.815092	2

## HURRICANE IKE DEBRIS MANAGEMENT SITES

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Houston Southwest Airport Site	Off Highway 6 East, between Teal Bend Boulevard and McKeever Road	Arcola	29.51599	-95.47835	20-50
Fort Bend County Fairgrounds	4310 Highway 36	Rosenberg	29.52144	-95.81902	11
Sienna Plantation Debris Site	Sienna Parkway/south side of Sienna Parkway and Sienna Springs intersection	Missouri City	29.5313348	-95.534211	5-15
Blue Ridge Landfill	2200 FM 521	Fresno	29.55442	-95.443005	4-6
Missouri City Tower	1919 Scanlin Road near water tower	Missouri City	29.60282	-95.53315	15-30

## Galveston County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Island Entertainment Inc in Galveston (Sea-A-Rama)	9228 Seawall Boulevard/Stewart at 89th Street	Galveston	29.2511	-94.858	11-20
Galveston County Justice Center	600 59th Street (5701 Avenue H)	Galveston	29.2984	-94.8306	10-20
DRC Auto Recovery - Galveston	4300 Port Industrial Boulevard	Galveston	29.302132	-94.818512	22
Beachtown Galveston Corporation/TIRZ 13	406 East Beach Drive	Galveston	29.319722	-94.750055	20
East Lagoon	South of Seawall and east of Boddecker	Galveston	29.3338905	-94.7524985	1
Highlands Bayou Park	I-45, Exit 10 - Bayou Road	La Marque	29.34471	-94.97362	2.5
TxDOT Bolivar Ferry Staging and Segregation Area	Bolivar Peninsula Ferry Landing	Bolivar	29.362943	-94.778561	0.02
Port Bolivar, 25 Highway 87 Site	25 Highway 87	Port Bolivar	29.31457	-94.770564	130
Santa Fe Site	11702 11th Street	Santa Fe	29.37535	-95.07608	2
Santa Fe Junior High School	4132 Warpath Avenue (Avenue T)	Santa Fe	29.38139	-95.1065621	1
Galveston County Landfill	1.5 miles west of intersection of I-45 and FM 2004/3935 Avenue A	Galveston	29.390713	-95.056236	2-5
TxDOT Right-of- Way (ROW) Project	5407 Gulf Freeway	La Marque	29.39079	-95.0258	15-20
Coastal Plains Recycling and Disposal Facility	21000 Highway 6 East	Alvin	29.4330181	-95.2559859	15
Crystal Beach County Annex	946 Noble Carl Drive	Crystal Beach	29.454517	-94.63845	5

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Dickinson Avenue Temp Debris Site (League City Site)	2125 Dickinson Avenue	League City	29.49051	-95.07286	2
Rollover Bay	Highway 87 north side of Rollover Pass	Gilchrist	29.5098322	-94.4998555	5
Galveston Co 33.5 acre pond	Retention pond between Windsong Lane and Narina Way off FM 528	Friendswood	29.494167	-95.209322	2-40
Texas City Site	33rd and 29th Street Intersection/29th across from 16th Street	Texas City	29.4138805	-94.9372313	33
City of Galveston, Storm Drain Removal	516 West 61st	Galveston	29.29111111	-94.83777778	1
Port Bolivar Marine Services	Broadway Avenue and John Wayne Road	Port Bolivar	29.400242	-94.7389152	4
High Island Site	1104 Payton Lane	High Island	29.560782	-94.38425	4
Moorehouse Site	3401 Highway 87	Crystal Beach	29.405605	-94.720339	30
Galveston Island State Park	14901 FM 3005	Galveston	29.2043064	-94.9436889	15
Grasso Site	9th Street and Harborside Drive	Galveston	29.29533	-94.807861	0.5

## Harris County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
City of South Houston - Highway 3	Highway 3 and Nevada	Houston	29.6560228	-95.229053	1-10
Detention Basin A521- 01-00	Near intersection of South Fork Boulevard and South Autumn	Houston	29.57737	-95.20575	10
City of Houston - Ellington Field	12701 SH 3/12815 Old Galveston Road	Houston	29.59118	-95.16193	50
Fuqua Debris Site	3213 Fuqua Street	Houston	29.61349	-95.37384	5
University DMS	Near 1990 Airport Boulevard	Houston	29.64202	-95.39591	150
Sylvan Beach Park - Harris County Debris 22	636 Bayshore Drive - Precinct 2	La Porte	29.65221	-95.01113	1-3
Virginia Ball Park, Fire Department Training Field	1302 Georgia	South Houston	29.65873	-95.24816	1.5-2
City of La Porte Storm Debris site	1901 Avenue H and 16th Street/southwest corner of Spencer Highway and Bay Area Boulevard	La Porte	29.6626	-95.04742	80
City of Houston - Belfort/Harris County Debris 14	288 and West Belfort Street	Houston	29.667	-95.381	20-30

## HURRICANE IKE DEBRIS MANAGEMENT SITES

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
City of South Houston - Avenue A	Avenue A and 6th Street	Houston	29.66749	-95.22553	1-3
Harris County Debris 13	2240 Central Street	Houston	29.70196	-95.26967	3
Green Shadow Landfill	710 Jana Lane	Pasadena	29.7112	-95.14793	30
Champion Landscape Site	1723 Highway 6 South	Houston	29.75155	-95.6443	3-5
City of Baytown - Bayway	300 Bayway Drive/6202 Decker Drive	Baytown	29.7852	-95.0333859	3-10
McCarty Road Landfill	5757 Oates Road Houston, TX 77078	Houston	29.825555	-95.235277	23.2
Gene Green Park - Harris County Debris 20	6500 East Sam Houston Parkway North - Precinct 2	Houston	29.82703	-95.16353	1-3
Harris County Debris 4	15530 Miller Road 1	Channelview	29.83722	-95.14731	10-14
Hawthorne Park Landfill	10332 Tanner Road	Houston	29.852	-95.54881	25
Harris County Debris 8 - Mega Sand	11501 Crosby-Lynchburg Road	Crosby	29.86118	-95.05995	30-50
Harris County Debris 7	18511 Beaumont Highway	Houston	29.8767	-95.11089	4
Whispering Pines Landfill	8101 Little York Road, Houston, TX 77016	Houston	29.878333	-95.269444	20.2-22
Harris County Debris 18	West of Gulf Bank and Ella	Houston	29.88626	-95.43199	20
Harris County Debris 5	8125 Fairbanks-N Houston Road	Houston	29.89971	-95.5256	20-40
Duessen Park - Harris County Debris 17	12303 Sonnier Road - Precinct 1	Houston	29.90198	-95.15554	2-10
Gillespie Road ROW	I-45 South Feeder and Gillespie Road	Houston	29.9275	-95.41474	2-3
Cutten Road Auto Salvage	11615 Cutten Road	Houston	29.95094	-95.52144	2
Atascocita Recycling Disposal Facility	3623 Wilson Road, Humble, TX 77396	Houston	29.958333	-95.25	23
Harris County David Williams Site	21025 FM 2100	Crosby	29.980796	-95.089305	15
East Hardy Road Recycling/Formerly Harris County Debris 3	18708 East Hardy Road	Houston	29.9871	-95.39303	15
Harris County Dirt Cheap Mulch	4460 FM 1960	Humble	29.99924	-95.20761	2
Fritsche Park	10603 Fritsche Cemetery Road	Spring	30.0106	-95.66766	3
Harris County Debris 6	20550 Townsen Boulevard East	Humble	30.01271	-95.25053	15
Harris County - CyFair Sports Assoc Complex	22515 Schiel Road	Cypress	30.02695	-95.77231	50
Private Sand Pit AKA Spring-Cypress Estates, Topsoil Earth	7930 Spring-Cypress Road (at Valka)	Spring	30.04161	-95.54615	74

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Disposal					
Klein Park	4531 Spring Cypress Road	Spring	30.05194	-95.48982	0.75
Kirsch Enterprises	2625 Mills Branch Drive	Kingwood	30.07163	-95.17038	1
John Pundt Park	4129 Spring Creek Drive	Spring	30.08073	-95.38122	1.5
City of Baytown - Marina	2651 South Highway 146	Baytown	29.7129833 3	-94.994	3
City of Baytown - Alexander (Gibson Site)	1800 North Alexander	Baytown	29.742	-94.95165	2
City of Baytown - Ferry Road	3030 Ferry Road	Baytown	29.75735	-94.9234833	30
City of Baytown - San Jacinto	6901 Garth Road	Baytown	29.7966416 7	-94.9873167	3
JD Walker Community Center	7613 Wade Road - Precinct 2	Baytown	29.80695	-95.0204	3
Wade Camp Road Harris County Debris 21	8103 Wade Road - Precinct 2	Baytown	29.8152333 3	-95.0169	1-3
Challenger 7 Park - Harris County Debris 16	2301 West NASA Road 1	Webster	29.51315	-95.1343	1-1.5
Seabrook Site	1022 Red Bluff Road	Seabrook	29.5845333 3	-95.0151167	13.2
Shoreacres TxDOT ROW	East of SH-146 at Shoreacres Boulevard	Shoreacres	29.6198	-95.0331167	10
Harris County Flood Control B509-03-00	~1.25 miles E of Red Bluff/Fairmont Parkway	Houston	29.6503413 9	-95.1003425	5
Living Earth	5626 Crawford Road	Houston	29.8490138 9	-95.5573556	2.5
Harris County Debris 9	1605 Genoa-Red Bluff Road	Pasadena	29.630616	-95.172142	1-4
South Acres Site	6101 Selinsky Road	Houston	29.638937	-95.322577	10
Ben Bowen Early Childhood Education Center	24403 East Lake Houston Parkway	Huffman	30.025009	-95.084358	4.2
City of Baytown - Exxon	6400 Bayway Drive	Baytown	29.757418	-95.033797	0.75
Harris County Debris	6023 Windfern Road	Houston	29.857308	-95.5375549	0.5
Boudreaux ROW	Intersection of Boudreaux Road and Kuykendahl Road	Spring	30.0875	-95.53309	0.05
Tom Bass II Park - Harris County Debris 15	3930 Fellows Road	Houston	29.5932545	-95.3572804	1
Munn St. Site/ Pleasantville	8240 Munn Street and 8300 Buchanan Street	Houston	29.7611864	-95.2781497	0.5

## HURRICANE IKE DEBRIS MANAGEMENT SITES

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
CGG East Orem Site	6739 East Orem Drive	Houston	29.6258022	-95.3109029	0.5

#### Liberty County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
FM 1008 Dayton Site/Sue Daniels Site	1930 FM 1008	Dayton	30.025158	-95.112866	5-10
Chubby Parish Site	2201 Highway 105 East	Liberty	30.247031	-94.719132	2
Billy Byers Site	8711 FM 787 West	Cleveland	30.41167	-94.87714	1-2
East Wastewater Treatment Plant	26508 Highway 321	Cleveland	30.32841	-95.05295	3
Cleveland Site	CR 306 near Cleveland	Cleveland	30.271869	-94.9795016	2
Woodlands Industries	21430 FM 787 Road East	Cleveland	30.35102	-95.0679	8-10
Moss Bluff Road Site	Near 1658 CR 133 North	Liberty	29.958517	-94.7527667	25-30
Old Dirt Pit	CR 609, 1/4 miles south of 1960	Dayton	30.040183	-94.96	2-5
Precinct 4 Barn	1034 County Road 605	Dayton	30.040933	-94.9103333	5
Compost Site AKA 1101 Bowie Street	East of intersection of Bowie and Monta Street	Liberty	30.067683	-94.8031833	20-30
Gun Range	3710 FM 1010	Cleveland	30.27425	-95.0888333	50
Coastal ROW	127 CR 3011	Dayton	30.236583	-94.98075	5
Liberty Site - C&C Lumber	1772 Highway 105 East	Cleveland	30.338271	-95.0662132	20
Carl Melonson Site	770 Highway and CR 182	Raywood	30.04615	-94.6701667	6
Boothe Site	3954 East FM 834	Hull	30.167403	-94.681418	10
Al-Con Construction Services Site	10315 Highway 321	Dayton	30.1486	-94.9279	1-5
County Road 142 Site	CR 142, approximately 1.15 miles west of Highway 563	Liberty	29.98953	-94.745796	15
Liberty County Transfer Station	7981 Highway 834 East	Daisetta	30.12296	-94.641829	15

## Matagorda County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Matagorda Debris 1	22001 FM 457/behind Sargent Volunteer Fire Department	Sargent	28.835633	-95.65863	7
Matagorda Debris 2	399 CR 259 (South Gulf Road)	Matagorda	28.70462	-95.94483	5
Matagorda Debris 3	Corner of FM 457 and CR 142 (Allenhurst Road)	Bay City	28.969967	-95.87425	2

Montgomer	v County	/ Hurricane	Ike Debris	Management	Sites
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Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Spring Temp Debris Site	1130 Pruitt Road	Spring	30.11362	-95.45394	10-12
Marilyn Edgar Park (Hillside Park)	26513 Hillside Drive	Oak Ridge	30.14979	-95.4458	1
CGH Inc Green Waste Site	16685 Firetower Road	Conroe	30.2058	-95.2547	23-30
Nature's Way Resources	101 Sherbrook Circle	Conroe	30.2354611	-95.455468	4
Texas Landscape AKA Deanco	40314 Community Road (right on Superior, left on Stapleton, end of pavement), also listed as 1000 Stapleton Road	Magnolia	30.25753	-95.6459	30-70
Conroe Walker Rd AKA Gateway Enterprises American Business	18395 South Walker Road	Conroe	30.32062	-95.284	0.5
Pagen Sandpit	421 North Fostoria Road	Cleveland	30.3188894	-95.188644	2
Lonestar Parkway Site	1.5 mile West of Highway 149 on Lonestar Parkway	Montgomery	30.39762	-95.71994	15-18
K&K Construction - Pitcock Site	10300 Farrel Road (1/2 mile south of Farrel Road)	Willis	30.39827	-95.4411	70-100
Precast of Houston	11393 Sleepy Hollow Road	Conroe	30.1734306	-95.416039	10
Porter Site/Dirt Cheap Mulch	Owens Road (south end)/near Owens Road and FM1314	Porter	30.1068187	-95.227696	10
Rayford Site	Located down a dirt road off 1000 block of Rayford Road	Spring	30.1276142	-95.426779	5
Letco	20611 Hwy 59	New Caney	30.146735	-95.219172	4

## Walker County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
Huntsville Landfill and Transfer Station	590 I-45 Frontage Road	Huntsville	30.74236	-95.59697	11.5
Precinct 3 Barn Site	2986 A State Highway 19	Huntsville	30.7964242	-95.453591	1-2
2296 Site - Precinct 4 Site	West side FM 2296 between SH 190 and FM 2929	Huntsville	30.6812211	-95.450564	3
Landscapers Pride	146 East on FM 2793	New Waverly	30.5671667	-95.4743	1

### Wharton County Hurricane Ike Debris Management Sites

Site Name	Address/Location	City	Latitude	Longitude	Estimated Acres
El Campo Site	1698 CR 303	El Campo	29.14879	-96.29359	3
Wharton Transfer Station Debris Site	820 South Sheppard	Wharton	29.3077	-96.112667	2

# Appendix H HURRICANE IKE DEBRIS MANAGEMENT SITE MAPS






















## Appendix I DEBRIS MANAGEMENT SITE ANALYSIS MAPS























## Appendix J HURRICANE IKE DEBRIS TOTALS

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Hurricane Ike- 2008	Vegetative	Vegetative Percentage	Construction & Demolition (C&D)	C&D Percentage	Total Cubic Yards	Hazardous Hangers	Hazardous Tree Removals	Hazardous Stumps	White Goods
Galveston County - Unincorporated	223,527	7%	2,773,274	93%	2,996,801	3,341	5,206		16,756
City of Galveston	115,363	7%	1,637,851	63%	1,753,214	2,985	8,627	14	60,649
City of Conroe	4,642	100%		%0	4,642	14	2	1	ı
City of Montgomery	4,829	100%		%0	4,829	ı	1	1	
City of Panorama Village	15,189	100%	52	%0	15,241	1,008	454	12	
City of Patton Village	4,152	%96	195	4%	4,347	,	,	1	
City of Pinehurst	7,571	%66	89	1%	7,660	1	ı	1	
Porter Heights	9,468	100%		%0	9,468	,	,	1	
City of Roman Forest	4,836	100%		%0	4,836	1	1	1	
The Woodlands Township	112,819	%96	4,744	4%	117,563	288	149		
City of Willis	5,328	100%	26	%0	5,354	1	1	1	
City of Woodbranch	5,623	%66	59	1%	5,682	ı	ı	1	
Montgomery County - Unincorporated	509,795	%86	8,025	2%	517,820	2,472	584	2	1
City of Anahuac	32,107	81%	7,498	19%	39,605	940	170	26	123
City of Mont Belvieu	15,435	63%	1,243	7%	16,678	389	102	14	ı
Chambers County - Unincorporated	337,666	90%	228,680	40%	566,346	10,145	2,892	465	3,225
City of Arcola	3,096	%66	44	1%	3,140	1	1	1	I
City of Meadows Place	9,526	%66	132	1%	9,657	1	1	1	I
City of Missouri City	143,649	98%	3,452	2%	147,101	3,582	102	I	I

## HURRICANE IKE DEBRIS TOTALS

Hurricane Ike- 2008	Vegetative	Vegetative Percentage	Construction & Demolition (C&D)	C&D Percentage	Total Cubic Yards	Hazardous Hangers	Hazardous Tree Removals	Hazardous Stumps	White Goods
City of Richmond	12,604	100%	25	%0	12,629	8	3	I	ı
City of Rosenberg	25,411	100%	34	%0	25,445	35	5	1	1
City of Stafford	24,340	%16	661	%£	25,002	38	2	1	ı
Fort Bend County - Unincorporated	256,579	%96	10,746	%†	267,325	4,687	468		
City of Alvin	173,751	%06	19,444	%01	193,195		-	-	
City of Texas City	172,084	82%	38,320	%81	210,404		-	-	
City of Sugarland	177,134	63%	12,812	%L	189,946	6,193	458	-	
City of La Marque	85,615	81%	20,478	%61	106,093	1,630	T	1	291
City of Dickinson	172,706	80%	43,439	%07	216,145	1	-	-	223
City of Santa Fe	112,239	63%	8,492	%L	120,731		-	-	
City of Angleton	63,611	82%	13,946	%81	77,558	1	I	I	
City of Jamaica Beach	318	0%	66,290	100%	66,608	-	I	I	2,737
Village of Tiki Island		%0	39,120	%001	39,120	1	-	-	1,050
City of Bayou Vista		0%	41,602	100%	41,602	-	I	I	2,522
City of Kemah	10,817	11%	85,394	%68	96,211	127	31	1	450
City of Brookside Village	21,031	96%	895	4%	21,926	-	I	I	ı
City of Clear Lake Shores	5,802	18%	25,663	82%	31,465	234	482	I	632
City of Freeport	14,722	88%	1,998	12%	16,720		I	I	ı
City of Manvel	24,448	97%	722	3%	25,170	I	·	I	

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Hurricane Ike- 2008	Vegetative	Vegetative Percentage	Construction & Demolition (C&D)	C&D Percentage	Total Cubic Yards	Hazardous Hangers	Hazardous Tree Removals	Hazardous Stumps	White Goods
City of Clute	30,049	88%	3,983	12%	34,032	I	ı	ı	1
Totals	11,218,572	%6L	7,422,299	21%	18,640,871	333,447	24,701	617	94,310

## Appendix K REGIONAL LANDFILL DISPOSAL GRAPHS











Regional Storm Debris Management Assessment - 2011

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## Appendix L REGIONAL LANDFILL DATA

## 2006 Landfill Data for the H-GAC Region Landfills

	Dormit	Cita Nama	County	Tung	2006 Tons	DamVde	Data	PamTons	DomVrc
			oouny	عالاا			ואמור		
16	0203	Altair Landfill	Colorado	~	14,907	11,408	850	4,848	22
16	0261	McCarty Road Landfill	Harris	-	1,689,666	2,844,499	2,618	3,723,449	2
16	1149	Galveston County Landfill	Galveston	-	315,696	5,702,058	1,865	5,317,169	14
16	1193	Whispering Pines Landfill	Harris	-	79	11,613,345	1,384	8,279,828	19
16	1301	Addicks-Fairbanks Landfill	Harris	4	16,296	1,385,618	1,600	1,108,494	10
16	1307	Atascocita Landfill	Harris	1	1,185,151	29,076,433	1,700	24,714,968	23
15	1403	Casco Landfill	Harris	4	46,898	2,506,166	006	1,127,775	24
16	1502	Chambers County Landfill	Chambers	-	15,121	614,226	850	261,046	11
16	1505	Blue Ridge Landfill	Fort Bend	1	618,516	14,373,278	1,356	9,745,082	14
16	1535	Baytown Landfill	Chambers	-	258,965	12,878,336	1,600	10,302,669	33
16	1539	Seabreeze Environmental Landfill	Brazoria	-					
16	1540	Greenshadow Landfill	Harris	4	93,931	3,973,689	1,640	3,258,425	35
16	1565	Fairbanks Landfill	Harris	4	303,110	341,411	1,900	324,340	L
16	1578	Hardy Road Landfill	Harris	4	256,182	6,997,600	1,200	4,198,560	16
16	1586	WCT/Greenbelt Landfill	Harris	4	170,430	6,087,500	1,200	3,652,500	21
16	1599	Greenhouse Road Landfill	Harris	4	85,848	7,590,243	800	3,036,097	32

COG	Permit	Site Name	County	Type	2006 Tons	RemYds	Rate	RemTons	RemYrs
16	1708	Dixie Farms Road Landfill	Brazoria	4					
16	1721	Coastal Plains Landfill	Galveston	L	534,899	17,983,850	1,500	13,487,888	25
16	1752	Security Landfill	Montgomery	L	422,044	18,292,203	1,600	14,633,762	30
16	1797	Sprint Fort Bend County Landfill	Fort Bend	4	218,878	19,935,225	1,140	11,363,078	52
16	1849	North County Landfill	Galveston	4					
16	1921	Cougar Landfill	Harris	4					
16	2185	Hawthorn Park Landfill	Harris	4	200	3,425,019	1,000	1,712,510	6
16	2240	Ralston Road Landfill	Harris	4	168,225	1,341,900	1,200	805,140	5
16	2270	Fort Bend Regional Landfill	Fort Bend	1	192,224	47,099,617	1,200	28,259,770	147
16	2304	Tall Pines Landfill	Harris	4					

2007	Landfil	I Data for the H-GAC Region Land	dfills						
COG	Permit	Site Name	County	Type	2007 Tons	RemYds	Rate	RemTons	RemYrs
16	0203	Altair Landfill	Colorado	1	14,970	1,200,000	1,200	720,000	48
16	0261	McCarty Road Landfill	Harris	-	1,559,188	155,175	2,062	1,599,959	2
16	1149	Galveston County Landfill	Galveston	-	340,007	5,122,922	1,377	3,527,132	10
16	1193	Whispering Pines Landfill	Harris	-	192,825	11,484,917	1,383	7,941,820	14
16	1301	Addicks-Fairbanks Landfill	Harris	4	45,900	1,282,969	1,400	898,078	20
16	1307	Atascocita Landfill	Harris	-	1,216,170	27,411,290	1,500	20,558,468	19
15	1403	Casco Landfill	Harris	4					
16	1502	Chambers County Landfill	Chambers	-	20,060	567,027	850	240,986	12
16	1505	Blue Ridge Landfill	Fort Bend	-	606,778	13,528,700	1,256	8,496,024	14
16	1535	Baytown Landfill	Chambers	-	239,507	12,668,695	1,600	10,134,956	40
16	1539	Seabreeze Environmental Landfill	Brazoria	-	1,085,566	31,889,890	1,500	23,917,417	21
16	1540	Greenshadow Landfill	Harris	4	94,900	3,843,435	1,400	2,690,405	28
16	1565	Fairbanks Landfill	Harris	4	193,278	4,931	1,900	4,684	0
16	1578	Hardy Road Landfill	Harris	4					
16	1586	WCT/Greenbelt Landfill	Harris	4	157,377	5,728,457	1,200	3,437,074	22
16	1599	Greenhouse Road Landfill	Harris	4	94,931	7,373,550	800	2,949,420	31
16	1708	Dixie Farms Road Landfill	Brazoria	4					
16	1721	Coastal Plains Landfill	Galveston	1	536,710	17,381,021	1,600	13,904,817	26
16	1752	Security Landfill	Montgomery	1	428,825	17,793,015	1,500	13,344,761	30

Regional Storm Debris Management Assessment – 2011

COG	Permit	Site Name	County	Type	2007 Tons	RemYds	Rate	RemTons	RemYrs
16	1797	Sprint Fort Bend County Landfill	Fort Bend	4	248,575	19,499,159	1,140	11,145,521	51
16	1849	North County Landfill	Galveston	4	63,521	1,207,298	1,250	754,561	8
16	1921	Cougar Landfill	Harris	4	182,846	1,654,538	1,500	1,240,904	7
16	2185	Hawthorn Park Landfill	Harris	4	39,974	3,081,250	1,600	2,465,000	30
16	2240	Ralston Road Landfill	Harris	4	196,675	883,678	1,200	530,207	3
16	2270	Fort Bend Regional Landfill	Fort Bend	1	355,643	46,581,689	1,200	27,949,013	79
16	2304	Tall Pines Landfill	Harris	4	266,292	6,532,065	1,200	3,919,239	15

2008	Landfil	II Data for the H-GAC Region Lan	dfills						
COG	Permit	Site Name	County	Type	2008 Tons	RemYds	Rate	RemTons	RemYrs
16	0203	Altair Landfill	Colorado	-	15,690	1,185,258	1,200	711,155	45
16	0261	McCarty Road Landfill	Harris	-	874,745	764,008	2,261	863,711	
16	1149	Galveston County Landfill	Galveston	-	344,554	4,718,227	1,629	3,842,996	11
16	1193	Whispering Pines Landfill	Harris	-	516,665	10,858,745	1,566	8,288,638	16
16	1301	Addicks-Fairbanks Landfill	Harris	4	51,102	1,164,683	1,200	698,810	14
16	1307	Atascocita Landfill	Harris	-	1,098,917	25,887,191	1,480	19,156,521	17
15	1403	Casco Landfill	Harris	4	47,589	2,301,916	006	1,035,862	22
16	1502	Chambers County Landfill	Chambers	-	22,781	513,424	850	218,205	10
16	1505	Blue Ridge Landfill	Fort Bend	<b>-</b>	624,316	12,888,286	1,560	10,052,863	16
16	1535	Baytown Landfill	Chambers	1	258,767	12,534,103	1,440	9,024,554	35
16	1539	Seabreeze Environmental Landfill	Brazoria	-	1,213,000	30,171,302	1,519	22,915,104	19
16	1540	Greenshadow Landfill	Harris	4	103,408	3,711,382	1,560	2,894,878	28
16	1565	Fairbanks Landfill	Harris	4	583	1	1,400		0
16	1578	Hardy Road Landfill	Harris	4					
16	1586	WCT/Greenbelt Landfill	Harris	4	175,722	5,279,595	1,200	3,167,757	18
16	1599	Greenhouse Road Landfill	Harris	4	78,300	7,209,839	800	2,883,935	30
16	1708	Dixie Farms Road Landfill	Brazoria	4	63,363	2,548,284	880	1,121,245	20
16	1721	Coastal Plains Landfill	Galveston	-	627,403	16,757,241	1,540	12,903,076	27
16	1752	Security Landfill	Montgomery	-	417,110	17,061,034	1,380	11,772,113	28

Regional Storm Debris Management Assessment - 2011

COG	Permit	Site Name	County	Type	2008 Tons	RemYds	Rate	RemTons	RemYrs
16	1797	Sprint Fort Bend County Landfill	Fort Bend	4	272,794	19,020,573	1,140	10,841,727	50
16	1849	North County Landfill	Galveston	4	66,798	1,129,251	1,250	705,782	7
16	1921	Cougar Landfill	Harris	4	156,520	1,286,319	1,420	913,286	9
16	2185	Hawthorn Park Landfill	Harris	4	216,966	3,157,788	1,340	2,115,718	10
16	2240	Ralston Road Landfill	Harris	4	210,061	729,543	1,200	437,672	2
16	2270	Fort Bend Regional Landfill	Fort Bend	-	500,255	46,257,338	1,400	32,380,137	65
16	2304	Tall Pines Landfill	Harris	4	333,517	5,819,514	1,200	3,491,708	10

2009	Landfi	I Data for the H-GAC Region Lan	dfills						
COG	Permit	Site Name	County	Type	2009 Tons	RemYds	Rate	RemTons	RemYrs
16	0203	Altair Landfill	Colorado	-	31,228	1,100,203	1,200	660,122	21
16	0261	McCarty Road Landfill	Harris	-	1,448,879	35,033,257	2,451	42,933,256	30
16	1149	Galveston County Landfill	Galveston	1	444,880	6,911,781	1,758	6,075,456	14
16	1193	Whispering Pines Landfill	Harris	1	172,300	10,434,340	1,655	8,634,416	50
16	1301	Addicks-Fairbanks Landfill	Harris	4	46,063	1,094,891	1,320	722,628	16
16	1307	Atascocita Landfill	Harris	-	1,220,386	24,322,594	1,560	18,971,623	16
15	1403	Casco Landfill	Harris	4	67,354	2,152,240	906	968,508	20
16	1502	Chambers County Landfill	Chambers	1	136,355	192,588	850	81,850	-
16	1505	Blue Ridge Landfill	Fort Bend	1	628,618	12,162,272	1,832	11,140,641	18
16	1535	Baytown Landfill	Chambers	-	345,299	12,033,670	1,380	8,303,232	24
16	1539	Seabreeze Environmental Landfill	Brazoria	-	986,272	28,540,384	1,440	20,549,076	29
16	1540	Greenshadow Landfill	Harris	4	170,299	3,493,050	1,560	2,724,579	16
16	1565	Fairbanks Landfill	Harris	4	20	9,526	1,800	8,573	-
16	1586	WCT/Greenbelt Landfill	Harris	4	280,464	4,801,548	1,200	2,880,929	13
16	1599	Greenhouse Road Landfill	Harris	4	87,864	7,010,653	800	2,804,261	31
16	1708	Dixie Farms Road Landfill	Brazoria	4	108,589	2,592,564	880	1,140,728	16
16	1721	Coastal Plains Landfill	Galveston	1	646,665	15,928,183	1,560	12,423,983	19
16	1752	Security Landfill	Montgomery	-	416,501	16,448,533	1,360	11,185,002	27
16	1797	Sprint Fort Bend County Landfill	Fort Bend	4	282,690	18,254,626	1,140	10,559,037	39

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Regional Storm Debris Management Assessment - 2011

COG	Permit	Site Name	County	Type	2009 Tons	RemYds	Rate	RemTons	RemYrs
16	1849	North County Landfill	Galveston	4	334,131	3,665,100	1,250	2,290,687	23
16	1921	Cougar Landfill	Harris	4	166,573	1,048,358	1,400	733,851	2
16	2185	Hawthorn Park Landfill	Harris	4	289,108	2,691,485	1,240	1,668,721	7
16	2240	Ralston Road Landfill	Harris	4	121,190	378,138	1,200	227,071	-
16	2270	Fort Bend Regional Landfill	Fort Bend	1	574,848	45,377,232	1,400	31,764,062	50
16	2304	Tall Pines Landfill	Harris	4	329,535	5,138,266	1,200	3,082,960	6
16	2344	Lone Star Recycling and Disposal	Harris	4	97,047	14,505,906	1,000	7,252,953	38

2010	Landfill	Data for the H-GAC Region Lan	Idtills						
900	Permit	Site Name	County	Type	2010 Tons	RemYds	Rate	RemTons	RemYrs
16	203	Altair Landfill	Colorado	1	37,786	1,032,391	1,200	619,435	16
16	261	McCarty Road Landfill	Harris	-	1,793,086	32,660,674	1,917	31,305,256	18
16	1149	Galveston County Landfill	Galveston	1	258,026	6,585,658	1,557	5,126,935	20
16	1193	Whispering Pines Landfill	Harris	-	48	10,902,505	2,000	10,902,445	10
16	1301	Addicks - Fairbanks Landfill	Harris	4	45,536	1,016,530	1,400	711,571	13
16	1307	Atascocita Landfill	Harris	-	939,804	24,001,233	1,800	21,601,110	21
16	1403	Casco Landfill	Harris	4	30,255	2,085,007	006	938,253	29
16	1502	Chambers County Landfill	Chambers	-	30,755	407,179	1,500	305,384	10
16	1505	Blue Ridae Landfill	Fort Bend	-	516,629	151,185,753	1,371	103,637,834	200
16	1535	Bavtown Landfill	Chambers	-	343,409	11,596,224	1,650	9,566,885	33
16	1539	Seabreeze Environmental Landfill	Brazoria	-	546,014	27,851,067	1,600	22,280,854	36
16	1540	Greenshadow Landfill	Harris	4	91,443	3,339,025	1,600	2,671,220	25
16	1565	Fairbanks Landfill	Harris	4	. 7	9,520	1.400	6,664	·
16	1586	Greenbelt Landfill	Harris	4	162,006	4,323,233	800	1.729.293	1
16	1599	Greenhouse Road Landfill	Harris	4	54,066	6,873,965	790	2,715,216	50

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COG	Permit	Site Name	County	Type	2010 Tons	RemYds	Rate	RemTons	RemYrs
16	1708	Divie Farm Road Landfill	Brazoria	7	34.574	2,513,987	880	1.106.154	16
2	-			-		0.000			2
16	1721	Coastal Plains Landfill	Galveston	1	523,005	15,541,292	1,760	13,676,337	23
16	1752	Security Landfill	Montaomerv	L	372,515	16 090 208	1 600	12 872 166	31
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16	1797	Sprint Fort Bend County Landfill	Fort Bend	4	240,543	18,102,620	1,140	10,318,493	39
16	1849	North County Landfill	Galveston	4	12,305	3,689,866	2,613	4,820,810	50
16	1921	Cougar Landfill	Harris	4	114.201	534.724	1.400	374.307	2
1 L	710E	llaudhara Dark Landfill				000 170 0	1 200	1 000 142	÷
0	C817	Hawinon Park Langini	HallIS	4	109,034	2,201,308	1,000	1,809,040	=
16	2240	Ralston Road Landfill	Harris	4	65,623	373,856	1,000	186,928	ŝ
16	ULCC	Eart Bond Domional Landfill	Eort Bond	٢	567 1 <i>1</i> 6	112 072 V		76 048 25A	07
0	0177	רטון סכווע הכטוטומו במועווו		-	001,140	40,410,720	1,200	20,040,034	47
16	2304	Tall Pines Landfill	Harris	4	223,881	4,731,087	1,000	2,365,544	10
16	2344	Lone Star Recycling and Disposal Facility	Harris	4	102,449	14,301,008	1,000	7,150,504	37

## Appendix M FEDERAL HIGHWAY ADMINISTRATION EMERGENCY RELIEF PROGRAM ELIGIBLE ROAD LAYERS AND DATA

See included data DVD