actions. For example, the Rio Hondo Fire Department help identify the need to map and access the vulnerability to wildfires and identify water sources to fight fires.

Public Meetings

A series of open public workshops were held within many of the participating jurisdictions, which were scheduled specifically for seeking public and stakeholder input. Topics of discussion for the meetings included the purpose of hazard mitigation, discussion of the planning process, and types of hazards, both natural and human-caused. Representatives from area neighborhood associations were invited to participate, as well as residents located in and around the area. In an effort to further engage the public, the Council utilized social media such as Facebook, Twitter, and the local media.

Public meetings were held on the following dates and locations:

- September 22, 2015 in Rio Hondo
- September 22, 2015 in Port Isabel
- March 1, 2016 in San Benito
- March 2, 2016 in South Padre Island
- April 19, 2016 in Laguna Vista

Documentation of public outreach meetings are found in Appendix E.

Public Participation Survey

In addition to the open public meetings, the Council of Cities was able to solicit input from citizens and stakeholders through the use of a public survey, which was designed to obtain data and information from the residents of the Council of Cities planning area. The survey was promoted by local officials and a link was made available for citizens to access the survey by visiting the participating jurisdictions' website. A total of 95 surveys were completed online, the results of which are analyzed in Appendix B. The purpose of the survey was twofold: 1) to solicit public input during the planning process and 2) to help the jurisdiction to identify any potential actions or problem areas. The Council of Cities reviewed and incorporated input from the survey into the Plan as mitigation actions. For example, many citizens mentioned concerns about flooding, proper drainage, and how enforcing certain building codes could help. In response to the public input several hazard mitigation actions were added to the Plan to control flooding, implementing new building codes, and educating residents on how to protect their property.

Section 3: Council Profile

Overview

The Council of Cities includes ten communities that have joined together to develop the Hazard Mitigation Plan. These communities are: Bayview, Indian Lake, Laguna Vista, Los Fresnos, Port Isabel, Primera, Rancho Viejo, Rio Hondo, San Benito, and South Padre Island.

Town of Bayview

The Town of Bayview is considered a Coastal Oasis. According to the United States Census Bureau, the town has a total area of 4.6 square miles, of which 3.9 square miles is land and 0.73 square miles (15.81%) is water.

Section 3: Council Profile

Town of Indian Lake

Indian Lake is off Farm Road 1575 a mile north of State Highway 100 and three miles northwest of Los Fresnos in central Cameron County. The site had scattered farm units and some dwellings were constructed in the mid-1940s. In the 1960s, Indian Lake became a mobile-home community for winter Texans. Indian Lake was incorporated in the mid-1980s and in the early 1990s had 365 lots. The community's residents, primarily from northern states, numbered 500 or 600 in the winter months and 100 the rest of the year. By 2004, homes were being built in Indian Lake and the number of year-round residents was increasing. The community receives its water and mail services from Los Fresnos.[1]

According to the United State Census Bureau, the town has a total area of 0.3 square miles, of which 0.2 square miles of it is land and 0.1 square miles of it (19.23%) is water.

Town of Laguna Vista

Laguna Vista is a friendly and quiet residential community with an affordable cost-of-living and a wide range of recreational options including golf, bay and deep-sea fishing, birding, wind surfing and kiteboarding. Laguna Vista is home to the South Padre Island Golf Club, an 1800-acre gated community of homes, town homes, villas, and casitas, as well as an 18-hole championship golf course.[2]

According to the United States Census Bureau, the town has a total area of 2.2 square miles, all of which is land.

City of Los Fresnos

Located in south-central Cameron County, the city was named for the fresnos (Frazinus berlandieriana) scattered in the woods and along streams. In 1912, Lon Hill, an early land owner, formed a company to develop a canal system which would use the Rio Grande to irrigate land for farming. Railroad construction in the early 1900s began to bring settlers to the area, and by 1915, a post office was established. Because of the fertile, irrigated land, farm products increased, and with the long growing season in the Rio Grande Valley, farming flourished. Today the city is still surrounded by fertile farm/ranch land. Major crops are cotton, sugarcane, grains, oranges, and red grapefruit.[3]

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[1] *https://tshaonline.org/handbook/online/articles/hridj*

[2] *http://lvtexas.com/*

[3] *https://en.wikipedia.org/wiki/Los_Fresnos,_Texas*

According to the United States Census Bureau, Los Fresnos has a total area of 3.1 square miles, of which 2.9 square miles is land and 0.1 square miles (3.98%) is water.

City of Port Isabel

Established as a town after the Mexican War of Independence, Port Isabel became an important cotton-exporting port before the American Civil War. The harbor, town, and lighthouse were all fought over and changed hands during the Civil War. Because of increasing maritime traffic through Brazos Santiago Pass, near the mouth of the Rio Grande on the Gulf of Mexico, the U. S. Department of Treasury constructed there in 1852 an eighty-two-foot-high brick lighthouse tower topped with a stationary white light, which could be seen for fifteen miles. The lighthouse operated with changing equipment and with intermittent interruptions until 1905, after which time it was abandoned for several years. During the American Civil War, the lighthouse served as an observation post for both Union and Confederate forces operating in the vicinity. After lying unused for most of the first half of the twentieth century, the Point Isabel Lighthouse was acquired in 1950 by the Texas State Park Board, subsequently was restored by that agency, and today stands both as a state historical park and as a functioning navigational aid. The Port Isabel Lighthouse is open to the public year round.[4]

According to the United States Census Bureau, Port Isabel has a total area of 13.7 square miles, of which 6.7 square miles is land and 6.9 square miles (50.94%) is water.

Town of Primera

Primera is a town located 3 miles northwest of the center of Harlingen. Primera is in what was formerly known as the “Wilson Tract,” which was a part of the land designated as “Cameron County School Land” in 1882. The tract was listed as Surveys 25, 26, 36 and 37 in 1902 as part of this area development program.

In November of 1908, a retired doctor named Pierre Wilson and Frank Kibbe bought Survey 25 from Hill. He had paid about $1.00 an acre or less. Wilson and Kibbe paid about $13.00 an acre. They immediately hired A.W. Amthor, engineer and surveyor of La Feria, to survey the tract and stake it out in 40-acre blocks, numbering from 1 to 110. The land was put on the market and “Homeseekers” began coming in and buying it. The land was now priced at $150 an acre – in the brush.

Dr. Wilson built a home over to the Northeast on land that was slightly elevated, as a retirement home for his wife and himself, but he did not live very long. His wife had him buried in the corner of the yard.

[4] *http://portisabel-texas.com/blog/lighthouse-history/*

The grave still was there when the Payne family bought the block of land three or four years later. Mrs. Wilson later had his remains moved and reburied upstate where she was then making her home.

The tract of land was given the name Wilson Tract in honor of the old doctor and was called that until the railroad came through early in 1912. The folks of the community could not call the station “Wilson” because there already was a Wilson in Texas. The railroad officials gave the station the name Primera, for it was the “First” stop out of Harlingen heading west. Primera, of course, means first in Spanish.

A two-story brick school had been built in 1915 at the center crossroads, two churches were organized, and buildings were erected. There was also a store a few years later. This was the nucleus of what later grew into a little town. Additions to the school were made in 1926.

A packing shed was later built by the railroad. Cabbage, carrots, tomatoes and other vegetables were shipped from Primera for several years.

Primera was incorporated in April 9, 1955. It has a new city hall, a modern school, Wilson Elementary, part of the Harlingen Public School System, and a branch post office and store.[5]

According to the United States Census Bureau, the town has a total area of 2.6 square miles, all of which is land.

City of Rancho Viejo

The town is named from a ranch in that area named "Rancho Viejo" (Old Ranch). The first settlement in the area developed when José Salvador de la Garza and his wife María Gertudis de la Garza Falcón moved to the site of what is now Rancho Viejo around 1770. There they founded the ranches Espíritu Santo and El Tanque, later known as El Rancho Viejo. This peaceful community is built around stunning tropical waterways – or Resacas – and one of the finest golf courses in the Rio Grande Valley.[6]

According to the United States Census Bureau, the town has a total area of 2.3 square miles, of which 2.1 square miles of it is land and 0.2 square miles of it (7.05%) is water.

City of Rio Hondo

The City of Rio Hondo is 9 miles east of Harlingen and 28 miles north of Brownsville.[7] According to the United States Census Bureau, the city has a total area of 1.8 square miles, of which 1.7 square miles is land and 0.1 square miles (7.09%) is water.

City of San Benito

San Benito was a village with a moderate number of homes, businesses, churches, and public schools several years before they were incorporated in 1911. The original map of the town site was recorded April

[5] http://cityofprimera.com/about/history/
[6] http://www.ranchoviejotexas.com/about-rancho-viejo/
[7] https://en.wikipedia.org/wiki/Rio_Hondo,_Texas

28, 1907. The first school was established in 1907 with 48 pupils and Miss Kate Purvis as the teacher. The post office also opened in 1907. In 1927 the city adopted a commission form of government operating under a home rule charter.

The irrigation district was organized in 1906. As a result of the availability of irrigation water, San Benito and all of the Lower Rio Grande Valley cities came to serve a newly developing agricultural territory.

On April 3, 2007, San Benito celebrated the 100th anniversary of its naming. The post office was named "Diaz" from April to May 1907. The San Benito Museum, Freddy Fender Museum, and Conjunto Music Museum opened in the same building on Nov. 17, 2007.

The original town-site, created in 1911, contained 1,280 acres. Since then, a series of annexations have increased the incorporated area to 4,092.17 acres.

The mild winter climate in this south-most section of Texas has played a dominant role in the growth of San Benito and the other cities of the Lower Rio Grande Valley. Crops grow and flowers bloom year-round. The city has become a hotspot for winter tourists and retired people, providing a substantial percentage of the buying power of this community.[8]

According to the United States Census Bureau, San Benito has a total area of 16.1 square miles, of which 15.8 square miles is land and 0.3 square miles (2.12%) is water.

Town of South Padre Island

South Padre island is well known as a resort town. The town is located on South Padre Island, a barrier island along the Texas Gulf Coast, accessible via a causeway from the town of Port Isabel. South Padre Island is named after José Nicolás Ballí (Padre Ballí), a Catholic priest and settler.

Subsequent to rebuilding from Hurricane Beulah, the island became a popular spring break destination for college students and a resort destination for families. Many multi-story resort hotels and condominiums have been erected along the coastline of the Gulf of Mexico. The Schlitterbahn Beach Waterpark, the second of its kind in Texas, opened in South Padre Island in 2001. South Padre Island is home to many watersport activities, with personal water craft rental, kiteboarding, and dolphin watches being the most popular. Other favorites are horseback riding adventures on the beach and ecological tours that explore Padre Island National Seashore.

Fishing is also popular. Every year, the Texas International Fishing Tournament is held in late summer, with winnings totaling almost a quarter million dollars. Other fishing tournaments include the Ladies Kingfish Tournament, the Hooters Tournament, and the Redfish Rodeo, just to name a few.

[8] *https://en.wikipedia.org/wiki/San_Benito,_Texas*

Section 3: Council Profile

The town of South Padre Island is located at the southern end of South Padre Island, with the town limits extending from the northern edge of Isla Blanca Park in the south to the end of development north of Wharf Street in the north, a distance of 6 miles. The Queen Isabella Causeway is the only road access to the mainland, leading 2.5 miles across Laguna Madre to the city of Port Isabel. Brownsville is 25 miles southwest of South Padre Island.[9]

According to the United States Census Bureau, the town has a total area of 2.3 square miles, of which 2.1 square miles is land and 0.2 square miles (8.44%) is water.

Study Area

Figure 3-1 shows the general location of the communities participating in the Council of Cities located within Cameron County.

[9] *https://en.wikipedia.org/wiki/South_Padre_Island,_Texas*

Figure 3-1. Location within Cameron County

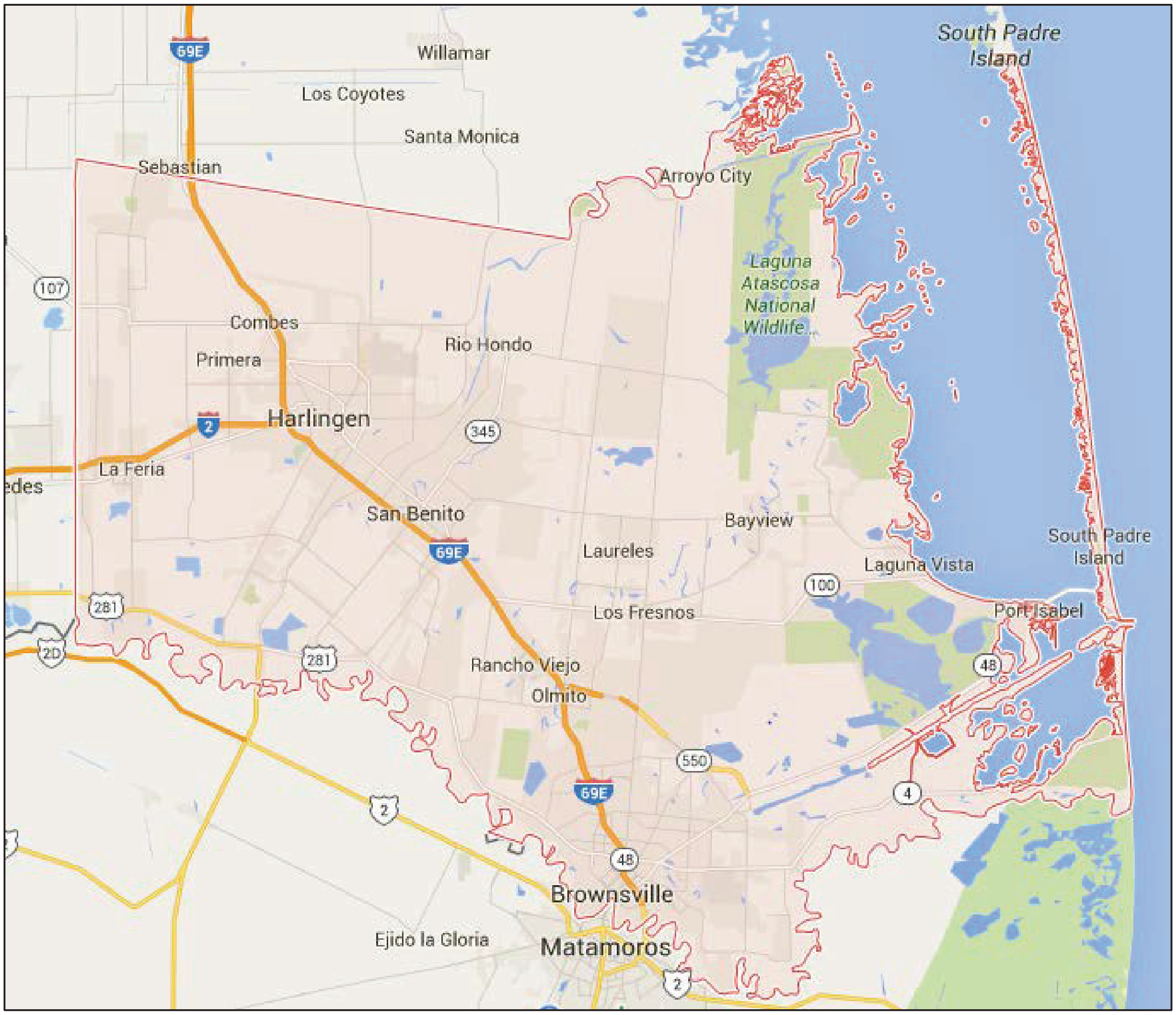
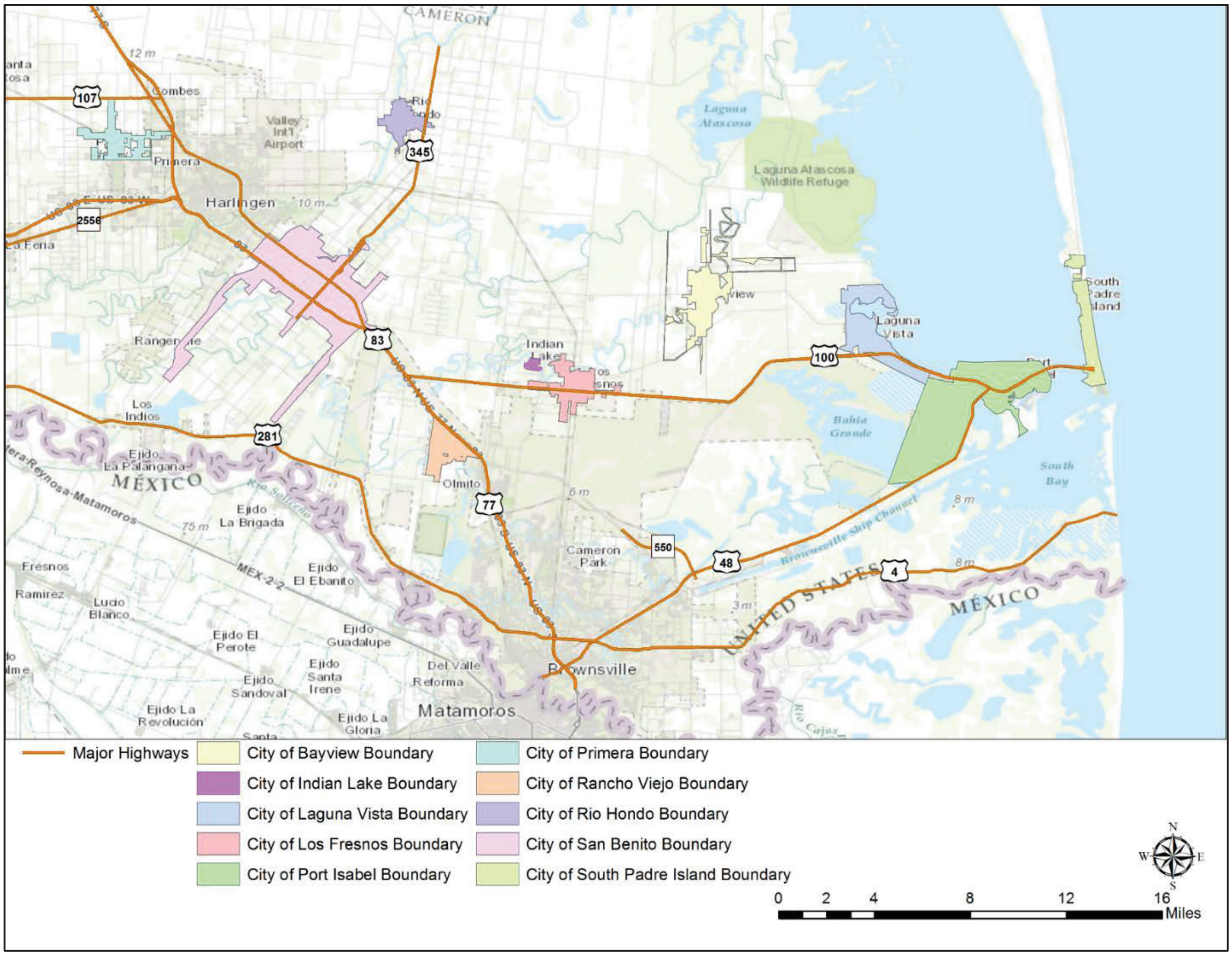


Figure 3-2 shows the Council of Cities Study Area, including the participating cities that are covered in the risk assessment analysis of the plan.

Figure 3-2. Council of Cities Study Area



Provided in Table 3-1 below is a listing of the jurisdictions within the Council of Cities that participated in the Hazard Mitigation Plan.

Table 3-1. Participating Jurisdictions

PARTICIPATING JURISDICTIONS	
City of Bayview	City of Primera
City of Indian Lake	City of Rancho Viejo
City of Laguna Vista	City of Rio Hondo
City of Los Fresnos	City of San Benito
City of Port Isabel	City of South Padre Island

Population and Demographics

In the official Census population count, as of April 1, 2010, the Council of Cities had a population of 50,617 residents. By July 2014, the number had grown to 52,248, and by July 2015, the population was 52,784. Table 3-2 provides the population distribution by city within the Council of Cities.[10]

Between official U.S. Census population counts, the estimate uses a formula based on new residential building permits and household size. It is simply an estimate and there are many variables involved in achieving an accurate estimation of people living in a given area at a given time.

Table 3-2. Population Distribution by Jurisdiction

JURISDICTION	TOTAL 2010 POPULATION	PERCENTAGE	ESTIMATED VULNERABLE OR SENSITIVE POPULATIONS	
			Elderly (Over 65)	Below Poverty Level
City of Bayview	383	0.8%	62	55
City of Indian Lake	640	1.3%	134	193
City of Laguna Vista	3,117	6.2%	610	558
City of Los Fresnos	5,542	10.9%	468	1,718
City of Port Isabel	5,006	9.9%	675	1,742
City of Primera	4,070	8.0%	322	1,266
City of Rancho Viejo	2,437	4.8%	414	312
City of Rio Hondo	2,356	4.6%	329	606
City of San Benito	24,250	47.9%	3,255	9,046
City of South Padre Island	2,816	5.6%	673	651
COUNCIL TOTAL	**50,617**	**100%**	**6,942**	**16,147**

Population Growth

The official 2010 census for the Council of Cities' population is 50,617. The Council of Cities experienced an increase in population between 1980 and 2010 by 76.4%, or 21,920 people. All of the cities exhibited an increase in population between 1980 and 2010, with only the City of Bayview having a slight decrease in population between 1980 and 1990. Table 3-3 provides historic growth rates in the Council of Cities.

[10] http://www.census.gov/quickfacts/table/PST045215/48061,00

Table 3-3. Population for Council of Cities, 1980-2010[11]

JURISDICTIONS	1980	1990	2000	2010	POP CHANGE 1980-2010	PERCENT OF CHANGE	POP CHANGE 2000-2010	PERCENT OF CHANGE
City of Bayview	291	231	323	383	92	31.6%	60	18.6%
City of Indian Lake	-	390	541	640	-	-	99	18.3%
City of Laguna Vista	632	1,166	1,658	3,117	2,485	393.2%	1,459	88.0%
City of Los Fresnos	2,173	2,473	4,512	5,542	3,369	155.0%	1,030	22.8%
City of Port Isabel	3,769	4,467	4,865	5,006	1,237	32.8%	141	2.9%
City of Primera	1,380	2,030	2,723	4,070	2,690	194.9%	1,347	49.5%
City of Rancho Viejo	-	885	1,754	2,437	-	-	683	38.9%
City of Rio Hondo	1,673	1,793	1,942	2,356	683	40.8%	414	21.3%
City of San Benito	17,988	20,125	23,444	24,250	6,262	34.8%	806	3.4%
City of South Padre Island	791	1,677	2,422	2,816	2,025	256.0%	394	16.3%
COUNCIL TOTAL	**28,697**	**35,237**	**44,184**	**50,617**	**21,920**	**76.4%**	**6,433**	**14.6%**

Future Development

To better understand how future growth and development in the Council might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts. This section includes an analysis of the projected population change, the number of permits that have been issued throughout the county, and economic impacts.

Population projections from 2010 to 2040 are listed in Table 3-4, as provided by the Office of the State Demographer, Texas State Data Center, and the Institute for Demographic and Socioeconomic Research. Population projections are based on a 0.5 scenario growth rate, which is 50 percent of the population growth rate that occurred during 2000-2010. This information is only available at the County level, so this data was derived for Cameron County; however, the population projection shows an increase in population density for the County, which would mean overall growth for the Council of Cities.

[11] *Not enough data was available to show the population growth from 1980 for the City of Indian Lake nor the City of Rancho Viejo. Data was analyzed when available.*

Table 3-4. Cameron County Population Projects

County	LAND AREA (SQ MI)	2010		2020		2030		2040	
		Population							
		Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)
Cameron	1,276	406,220	318.4	479,754	376.0	560,637	439.4	641,946	503.1

Economic Impact

Building and maintaining infrastructure depends on the economy; therefore, protecting infrastructure from risk due to natural hazards in the planning area is important to the Council of Cities. Whether it's expanding culverts under a road that washes out during flash flooding, shuttering a fire station, or flood-proofing a wastewater facility, infrastructure must be mitigated from natural hazards in order to continue providing essential utility and emergency response services in a fast-growing planning area.

Major employers in the area are critical to the health of the economy, as well as effective transportation connectivity.

Existing and Future Land Use and Development Trends

Many of the communities located in the Council of Cities are directed by a Comprehensive Land Use Plan or Master Plan that serves as a guide for development. These plans focus on quality of life, housing, community livability, infrastructure and utilities, and transportation.

Building Permits

Building permits indicate what types of buildings are being constructed and their relative uses. Table 3-5 lists the number of residential building permits for all of Cameron County that have been granted between 1996 and 2015, as the data is available on a County level. The data includes all sizes of family homes for reported permits, as well as the construction costs, to show the potential increase in vulnerability of structures to the various hazards reviewed in the risk assessment. The increase in vulnerability can be attributed to the higher construction costs that would be factored into repairing or replacing a structure using current market values. Permits are reported annually in September; data reflects permits for years 2010, 2011, 2012, 2013, 2014, and 2015 to demonstrate growth rates.

Table 3-5. County Residential Building Permits[12]

Cameron County			
Year	Buildings	Units	Construction Cost
1996	1,831	2,532	$130,234,455
2000	2,811	3,111	$194,469,723
2005	3,211	3,694	$300,826,541
2010	1,090	1,258	$179,567,508
2011	1,075	1,136	$109,449,392
2012	1,065	1,154	$112,897,740
2013	1,158	1,263	$122,528,567
2014	1,223	1,417	$138,335,630
2015	1,172	1,285	$143,131,494

[12] http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl

Section 4: Risk Overview

Hazard Identification

This section begins the risk assessment, which also includes hazard descriptions and vulnerability assessments found in Sections 5 through 18. The purpose of this section is to provide background information for the hazard identification process, as well as descriptions for the hazards identified.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the Council of Cities identified eleven natural hazards and three human caused hazards that are to be addressed in the Hazard Mitigation Action Plan, or *the Plan.* These hazards were identified through an extensive process utilizing input from planning team members and a review of the current State of Texas Hazard Mitigation Plan ("State Plan"). Readily available online information from reputable sources such as federal and state agencies were also evaluated to supplement information as needed. Based on this review, ten natural hazards and one quasi-technological hazard (dam failure) were identified as significant, as shown in Table 4-1.

Atmospheric hazards are events or incidents associated with weather generated phenomenon. Atmospheric hazards identified as significant from Table 4-1 include: extreme heat, extreme wind, tornado, hail, hurricane wind, and expansive soils.

Hydrologic hazards are events or incidents associated with water related damage and account for over 75% of Federal disaster declarations in the United States. Hydrologic hazards identified as significant includes flood, coastal erosion and drought. Wildfire is considered "other" since it is neither atmospheric nor hydrologic.

The term, "technological hazards," refers to the origins of incidents that can arise from human activities, such as the construction and maintenance of dams. Incidents are distinct from natural hazards primarily in that they originate from human activity. While the risks presented by natural hazards may be increased or decreased as a result of human activity, they are not inherently human-induced; therefore, dam failure is classified as a quasi-technological hazard, referred to as "technological" in Table 4-1 for purposes of description.

Table 4-1. Hazard Descriptions

HAZARD	DESCRIPTION
ATMOSPHERIC	
Extreme Heat	Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period.
Hail	Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass.
Thunderstorm Wind	Thunderstorm winds can have gusts of 100 mph or more and are often accompanied by hail or rain. Windstorms have a broader path that is several miles wide and can cover several counties.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. The destruction caused by tornadoes ranges from light to catastrophic, depending on the intensity, size, and duration of the storm.
Hurricane/Tropical Storm	A hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph or higher.
Expansive Soils	Expansive soils are soils and soft rock that tend to swell or shrink due to changes in moisture content. Changes in soil volume present a hazard primarily to structures built on top of expansive soils.
HYDROLOGIC	
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality.
Flood	The accumulation of water within a body of water, which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding.
Coastal Erosion	Coastal erosion is a hydrologic hazard defined as the wearing away of land and loss of beach, shoreline, or dune material as a result of natural coastal processes or manmade influences.

HAZARD	DESCRIPTION
OTHER	
Wildfire	A wildfire is an uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all increase the risk to people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems but most are caused by human factors.
TECHNOLOGICAL	
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam.
HUMAN-CAUSED	
Hazardous Materials (Transportation & Fixed-Site)	A hazardous quantity (solid, liquid, or gaseous contaminants) of flammable or poisonous material that would be a danger to life or to the environment if released without precaution.
Terrorism	Incidents involving the application of one or more modes of harmful force to the built environment. These modes may include contamination (chemical, biological, radiological, or nuclear), energy (explosives, arson, electromagnetic waves), or denial of service (sabotage, infrastructure breakdown, and transportation service disruption). Terrorism is categorized as either domestic or international.
Pipeline Failure	Fuel pipeline breach or pipeline failure addresses the rare but serious hazard of an oil or natural gas pipeline that, when breached, has the potential to cause extensive property damage and loss of life.

Hazards that weren't considered significant and were not included in the Plan are located in Table 4-2, along with the evaluation process used for determining the significance of each of these hazards. These natural hazards are not addressed in detail due to their no to minimal level of risk within the Council of Cities planning area. Hazards not identified for inclusion at this time may be addressed during future evaluations and updates.

Table 4-2. Hazard Identification Process

HAZARD	DESCRIPTION
Earthquakes	There are no historic losses reported for earthquakes in the planning area and no future losses are anticipated. Actions to reduce losses are not required at this time as the hazard does not affect any of the jurisdictions. The hazard is not profiled further in the plan as a result. (44 CFR 201.6 (c) (2).

HAZARD	DESCRIPTION
Land Subsidence	There are no historic losses reported for land subsidence in the planning area and no future losses are anticipated. Actions to reduce losses are not required at this time as the hazard does not affect any of the jurisdictions. The hazard is not profiled further in the plan as a result. (44 CFR 201.6 (c) (2).
Lightning	Only one event of lightning resulting in damages has been recorded for the entire planning area in the last twenty-one years. Two single family residences (out of 24,842 housing units in the planning area) were struck by lightning, causing structure fires. The structures were privately insured. The houses were deemed not to be critical infrastructure, nor provide critical services to the planning area and were not a critical asset. Therefore, the planning area has not had any impact due to lightning. In the intent of 44 CFR 201.6(c)(2)(i) & 44 CRF 201.6(c)(2)(iii) the intent is to, “To understand the potential and chronic hazards affecting the planning area in order to identify which hazard risks are most significant (…),”. Based on the intent, it is the participating jurisdictions belief that lightning is not a hazard that is most significant to the jurisdiction. During public outreach this was not a concern of the public population and the myriad of reasons lighting will not be profiled in this plan.
Winter Storm	There are no historic losses reported for winter storms in the planning area and no future losses are anticipated. Actions to reduce losses are not required at this time as the hazard does not affect any of the jurisdictions. The hazard is not profiled further in the plan as a result. (44 CFR 201.6 (c) (2).

Natural Hazards and Climate Change

Climate change is defined as a long-term hazard which can increase or decrease the risk of other weather hazard and also directly endangers property due to sea level rise and biological organisms due to habitat destruction.

While sea level rise is a natural phenomenon and has been occurring for several thousand years, the general scientific consensus is that the rate has increased fourfold in the past 200 years, from .5 millimeters per year to 2 millimeters per year. With a higher sea level, storm surges will be bigger and coastal erosion will accelerate.

All communities along the Texas coast face similar futures, according to some scientists, and Texas is considered one of the more vulnerable states in the U.S. to both abrupt climate changes and to the impact of gradual climate changes.

Mega-droughts can trigger abrupt changes to regional ecosystems and the water cycle, drastically increase extreme summer temperature and fire risk, and reduce availability of the water resources, as Texas experienced during 2011-2012.

Texas also has thousands of miles of coastline that are highly vulnerable to the combined impact of sea-level rise and the potential increase of storm intensity. Paleoclimate records also show that the climate over Texas had large swings between periods of frequent mega-droughts and the periods of mild droughts that Texas is currently experiencing. While the cause of these fluctuations is unclear, it would be wise to anticipate that such change could occur again, and may even be occurring now.

Texas has one of the longest coastlines in America coupled with some of the highest rates of coastal erosion in the nation. Approximately 64% of the Gulf shoreline is considered to contain critical erosion areas, with 235 acres of Texas Gulf shoreline lost to erosion annually. That is equivalent to 178 football fields lost each year. Critical erosion data for 2010 indicates that Cameron County has an annual erosion rate of -2 to -25 feet per year.

Erosion is a serious hazard on the Texas coast. Many homes, highways, and commercial establishments along the coast are threatened by continual shoreline erosion. Several processes contribute to chronic (long-term) or episodic (storm-induced) shoreline erosion. These processes include climate, tides, relative sea-level change, subsidence, tropical storms, and the amount and rate of sediment supply. Coastal erosion affects both Gulf and bay shorelines, resulting in the loss of agricultural, industrial, and residential land, as well as critical infrastructure and wetlands. Erosion is attributable to relative sea level rise and to sediment removal by wave energy exceeding that supplied to the beach by currents. Climatic changes (from wetter to drier) have decreased the volume of sediments carried to the Texas coast by rivers.

Overview of Hazard Analysis

This risk assessment was conducted using two distinct methodologies: HAZUS-MH (FEMA's loss estimation software) and a statistical approach. Each approach provides estimates of potential impact by using a common, systematic framework for evaluation.

The HAZUS-MH risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) were modeled using the HAZUS-MH software to determine the impact (e.g., damages and losses) on the built environment. The HAZUS-MH software was used to estimate losses from flooding.

HAZUS-MH is FEMA's standardized loss estimation software program built upon an integrated geographic information system (GIS) platform. This risk assessment allows HAZUS-MH to produce regional profiles and estimate losses for flooding.

Records retrieved from National Climatic Data Center (NCDC) are reported for the named participating jurisdictions. Remaining records occurring in a named area in a county were considered in the total for County events and maximum recorded magnitude of event.

Section 4: Risk Overview

The risk assessment includes four general parameters that are described for each hazard: frequency of return, approximate annualized losses, a description of general vulnerability, and a statement of the hazard's impact.

Frequency of return was calculated by dividing the number of events in the recorded time period for each hazard by the overall time period that the resource database was recording events. Frequency of return statements are defined in Table 4-3, and impact statements are defined in Table 4-4 below.

Table 4-3. Frequency of Return Statements

PROBABILITY	DESCRIPTION
Highly Likely	Event is probable in the next year
Likely	Event is probable in the next 3 years
Occasional	Event is probable in the next 5 years
Unlikely	Event is probable in the next 10 years

Table 4-4. Impact Statements

POTENTIAL SEVERITY	DESCRIPTION
Substantial	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50% of property destroyed or with major damage.
Major	Injuries and/or illnesses result in permanent disability. Complete shutdown of critical facilities for at least two weeks. More than 25% of property destroyed or with major damage.
Minor	Injuries and/or illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than one week. More than 10% of property destroyed or with major damage.
Limited	Injuries and/or illnesses are treatable with first aid. Minor quality of life lost. Shutdown of critical facilities and services for 24 hours or less. Less than 10% of property destroyed or with major damage.

Each of the hazard profiles includes a description of a general vulnerability assessment. Vulnerability is the total of assets that are subject to damages from a hazard (based on historic recorded damages). Assets in the region were inventoried and defined in hazard zones where appropriate. The total amount of damages (including property and crop damages) for each hazard is divided by the total number of assets (building value totals) in that community in order to find out the percentage of damage that each hazard can cause to the community.

Once loss estimates and vulnerability were known, an impact statement was applied to relate the potential impact of the hazard on the assets within the area of impact.

Hazard Ranking

Table 4-5 portrays the results of the planning area's self-assessment for hazard ranking based on the preliminary results of the risk assessment presented at the Risk Assessment Workshop. This table also takes into account local knowledge regarding frequency of occurrence and the potential impact of each hazard.

Table 4-5. Hazard Risk Ranking

HAZARD	FREQUENCY OF OCCURENCE	POTENTIAL SEVERITY	RANKING
Extreme Wind	Highly Likely	Limited	High
Hurricane Wind	Occasional	Substantial	High
Flood	Highly Likely	Limited	High
Extreme Heat	Likely	Limited	Moderate
Drought	Highly Likely	Limited	Moderate
Tornado	Highly Likely	Limited	Moderate
Hail	Highly Likely	Limited	Moderate
Wildfire	Highly Likely	Limited	Low
Expansive Soils	Highly Likely	Limited	Low
Dam Failure	Unlikely	Substantial	Low
Coastal Erosion	Highly Likely	Limited	Low
Hazardous Materials	Likely	Limited	Low
Pipeline Failure	Highly Likely	Major	Low
Terrorism	Unlikely	Substantial	Low

Section 5: Thunderstorm Wind

Hazard Description

Thunderstorms create extreme wind events which includes straight line winds. Wind, is the horizontal motion of the air past a given point, beginning with differences in air pressures. Pressure that is higher at one place than another sets up a force pushing from the high toward the low pressure; the greater the difference in pressures, the stronger the force. The distance between the area of high pressure and the area of low pressure also determines how fast the moving air is accelerated.

Thunderstorms are created when heat and moisture near the Earth's surface are transported to the upper levels of the atmosphere. By-products of this process are the clouds, precipitation, and wind that become the thunderstorm.

According to the National Weather Service (NWS), a thunderstorm occurs when thunder accompanies rainfall. Radar observers use the intensity of radar echoes to distinguish between rain showers and thunderstorms.

Straight line winds are responsible for most thunderstorm wind damages. One type of straight line wind, the downburst, is a small area of rapidly descending air beneath a thunderstorm. A downburst can cause damage equivalent to a strong tornado and make air travel extremely hazardous.

Straight line winds can have gusts of 100 mph or more, and are often accompanied by hail or rain. Unlike tornadoes, windstorms have a broader path that is several miles wide and can cover several counties. Straight line wind may down trees and power lines, overturn mobile homes, and cause damage to well-built structures.

Location

Thunderstorm wind events can develop in any geographic location, and are considered a common occurrence in Texas. Therefore a thunderstorm wind event could occur at any location within the Council of Cities planning area, as these storms develop randomly and are not confined to any geographic area. It is assumed that the planning area is uniformly exposed to the threat of thunderstorm winds.

Extent

The extent or magnitude of a thunderstorm wind event is measured by the Beaufort Wind Scale. Table 5-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

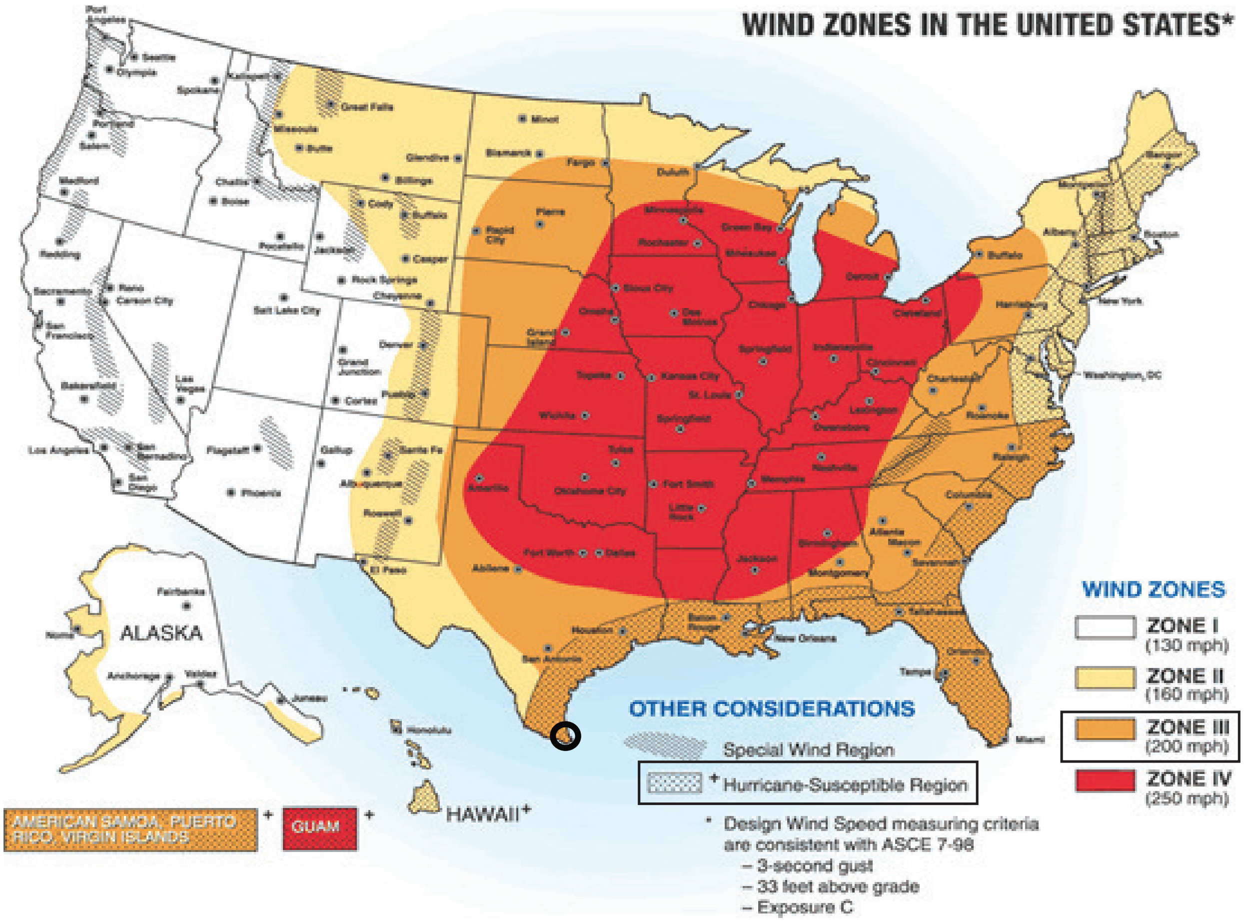
Table 5-1. Beaufort Wind Scale[1]

FORCE	WIND (KNOTS)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	Moderate Breeze	Dust, leaves and loose paper lifted, small tree branches move
5	19-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

The figure 5-1 displays the wind zones as derived from NOAA.

[1] *Source: World Meteorological Organization*

Figure 5-1. Wind Zones in the United States[2]



On average, the planning area experiences two to three thunderstorm wind events every year. The Council of Cities planning area is located within the Zone III, meaning they can experience winds up to 200 mph. The area has experienced a significant wind event, or an event with winds in the range of "Force 12" on the Beaufort Wind Scale with winds above 73 knots.

Historical Occurrences

Tables 5-2, 5-3 and 5-4 depict historical occurrences of thunderstorm wind events for the Council of Cities planning area according to the National Climatic Data Center (NCDC) data. Since January 1955, 147 thunderstorm wind events are known to have impacted Cameron County, based upon NCDC records. Table 5-2 presents information on known historical events impacting the Council of Cities planning area,

[2] *Cameron County is indicated by the circle.*

with resulting damages. It is important to note that high wind events associated with other hazards, such as tornadoes, are not accounted for in this section.

The NCDC is a national data source organized under the National Oceanic and Atmospheric Administration. The NCDC is the largest archive available for climate data; however, it is important to note that the only incidents recorded are those that are reported to the NCDC that have been factored into this risk assessment. In the tables that follow throughout this section, some occurrences seem to appear multiple times in one table. This is due to reports from various locations throughout the County. In addition, property damage estimates are not always available. When this occurs, estimates are not provided. Where an estimate has been provided in a table for losses, the dollar amounts have been altered to indicate the damage in 2015 dollars.

Table 5-2. Historical Thunderstorm Wind Events, With Reported Damages, 1955-2015

MAXIMUM WIND SPEED RECORDED (KNOTS)	NUMBER OF REPORTED EVENTS
0-30	0
31-40	4
41-50	9
51-60	48
61-70	15
71-80	6
81-90	0
91-100	1
Unknown	43

Table 5-3. Historical Thunderstorm Wind Events, 1955-2015[3]

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
Cameron County	3/12/1993	6:05 AM	Unknown	0	0	$82,013	$820
Cameron County	6/13/1994	11:30 AM	Unknown	0	0	$8,028	$803
Cameron County	2/28/1995	3:30 PM	Unknown	0	0	$1,555	$0
Cameron County	2/28/1995	3:40 PM	Unknown	0	0	$9,331	$0
Port Isabel	4/4/1995	8:30 PM	Unknown	0	0	$7,807	$0
South Padre Island	4/4/1995	8:30 PM	Unknown	0	0	$7,807	$0
Cameron County	2/1/1998	4:22 PM	Unknown	0	0	$7,299	$0
Cameron County	11/4/1998	3:15 AM	Unknown	0	0	$110,944	$0
Los Fresnos	5/18/1999	5:15 AM	Unknown	0	0	$2,856	$0
Laguna Vista	5/2/2000	7:20 PM	100 knots	0	0	$6,908,972	$0
South Padre Island	8/19/2003	2:00 AM	50 knots	0	0	$6,441	$0
Cameron County	8/19/2003	2:00 AM	50 knots	0	0	$6,441	$0
Cameron County	2/25/2004	1:30 PM	40 knots	0	0	$37,642	$0
Cameron County	7/20/2005	6:00 AM	55 knots	0	0	$45,510	$0
Port Isabel	10/31/2005	9:23 PM	60 knots	0	0	$12,184	$0
Cameron County	4/29/2006	12:01 AM	60 knots	0	0	$59,014	$0
San Benito	12/23/2006	5:45 PM	52 knots	0	0	$5,091	$0
Cameron County	12/23/2006	5:30 PM	52 knots	0	0	$11,803	$0
Cameron County	2/16/2008	12:00 PM	38 knots	0	0	$1,101	$0
Bayview	3/2/2008	12:00 PM	42 knots	0	0	$550	$0
Cameron County	3/2/2008	12:00 PM	39 knots	0	0	$3,303	$0
Port Isabel	3/17/2008	11:00 AM	41 knots	0	0	$225	$0
Cameron County	3/18/2008	9:00 AM	37 knots	0	0	$1,651	$0

[3] *Only recorded events with fatalities, injuries, and/or damages are listed.*