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October 11, 2018 APTIM Project No: 1021002069

Ms. Irina Afanasyeva, Project Manager
Texas Commission on Environmental Quality (TCEQ)
TCEQ Remediation Division, Superfund Section
12100 Park 35 Circle, Mail Code 136
Austin, Texas 78753

Re: ***Analysis of Brownfields Cleanup Alternatives (ABCA)***
Old Kleberg Hospital
400 East Caesar Avenue
Kingsville, Texas 78363
TCEQ AIRS Contract No.: 582-18-80620
TCEQ Work Order No.: 400-0030

Dear Ms. Afanasyeva:

On behalf of the Texas Commission on Environmental Quality (TCEQ), Aptim Environmental and Infrastructure, Inc. (APTIM) is submitting this Analysis of Brownfields Cleanup Alternatives (ABCA) for the remediation of asbestos containing material (ACM) found in the interior and exterior of the building at the above-referenced site.

I. Introduction & Background

a. Site Location (*address*)

The site is located at 400 East Caesar Avenue in Kingsville, Texas, USA (herein referred to as “the Site”). The Site consists of approximately 3-acres and contains a one two-story structure with a basement, which is known as the Old Kleberg Hospital.

a1. Forecasted Climate Conditions

According to the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information for Texas, the Texas Climate is characterized by hot summers and cold/mild winters. The primary source of moisture is from the Gulf of Mexico, which results in extreme weather events including, hurricanes, tornadoes, droughts, heat waves, cold waves, and intense precipitation (see attached Summary included in *Attachment A*).

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) 48273C0115E, the Site is located within Zone X, which are areas of 0.2% annual chance flood.

The Site receives stormwater discharge from the Site’s building’s roof drains and surrounding properties primarily to the west. The overall topography of the area is relatively flat with a slight slope in an east/southeasterly direction into the street easements of South 9th Street and East

Caesar Avenue. As with any extreme rain event, the Site has potential for erosion; however, due to the vegetative coverage from trees and parking/drive areas, erosion is not likely.

Based on the nature of the Site and its proposed reuse (demolition to vacant lot), changing temperature, precipitation changes, changing ecological zone, and changing groundwater table are not likely to significantly affect the Site.

b. Previous Site Use(s) and any previous cleanup/remediation

According to the City of Kingsville Brownfields Assessment, the Site operated as the Kleberg County Hospital from 1915 to the 1980s; assumed vacant from the 1980s to January 1993; then the Site was purchased by a new owner in January 1993 when the former hospital was utilized as a storage facility and that use was discontinued sometime prior to April 2013; and from April 2013 to present the Site has been condemned by the Kingsville City Commissioners due to safety concerns and set for demolition.

APTIM is not aware of any previous cleanup/remediation activities associated with the Site.

c. Site Assessment Findings (*briefly summarize the environmental investigations that have occurred at the site, including what the Phase I and Phase II assessment reports revealed in terms of contamination present, if applicable*)

According to the City of Kingsville Brownfields Assessment dated June 27, 2017, the Application to Receive a TCEQ Brownfields Site Assessment indicated that a report from Envirotest identified areas of ACM in the interior and exterior of the building, these areas were listed in Table I (Sample Material Summary) and Table II (Sample Number-Homogenous Area) of the report. The complete report was not available for review; therefore, the full contents of the report and the date of the report are unknown except what was presented on Tables I and II.

On August 8, 2017, the TCEQ approved Work Order No.: 323-0121 to conduct a Phase I Environmental Site Assessment (ESA) at the Site. APTIM completed the Phase I ESA on August 31, 2017, and revised it on July 11, 2018. The Phase I ESA revealed no evidence of recognized environmental conditions (RECs), controlled (CRECs), or historical (HRECs) in connection with the Site. APTIM observed the following on-site environmental conditions at the time of the ESA: 1) 'During the time the Site operated as a storage facility (January 1993 to prior 2013), the Site building was densely populated with numerous miscellaneous items, trash, and construction material; therefore, no potential environmental hazards, vaults, sumps, or other containers of hazardous chemicals, petroleum products, or cleaning chemicals were observed other than what was noted in Section 5.5 Interior Observations. If any potential environmental hazards are discovered after removing the miscellaneous items, trash, and construction materials, an environmental professional should be contacted to inspect the hazard.' 2) 'Based on the age of the building, and the fact that there is no evidence that a lead based paint (LBP) survey had been conducted, a potential exists for LBP to be present. APTIM recommends that a LBP survey be conducted, prior to any use/occupancy by children under 6-years of age, renovation, construction, or demolition activities.'

On May 11, 2018, the TCEQ approved Work Order No.: 400-0020 to conduct a Phase II ESA at the Site. APTIM installed ten surface soil borings and collected three soil samples from each boring, which were analyzed for volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), and RCRA 8 metals (metals). In a TCEQ letter dated September 18, 2018, the TCEQ stated that VOC and TPH concentrations were below the Texas Risk Reduction Program (TRRP) Tier I Residential Protective Concentration Levels (PCLs) for ${}^{Tot}Soil_{Comb}$ and ${}^{GW}Soil_{Ing}$. The TCEQ stated that mercury was detected above the soil assessment level in shallow soils (0.5-2 feet) below ground surface; however, mercury was vertically delineated. The TCEQ also stated that lead concentrations exceeded the TRRP Tier I Residential ${}^{GW}Soil_{Ing}$ PCL in two surface soil samples. The sample exhibiting the highest lead concentration was then analyzed for the synthetic precipitation leaching procedure (SPLP) to determine if the lead concentrations would leach into groundwater. The SPLP analysis exhibited a concentration greater than the TRRP Tier I $^{GW}GW_{Ing}$ PCL indicating the potential that lead could migrate into groundwater. The TCEQ concluded that according to TRRP, a groundwater sample would be required to confirm if Site conditions represent a release that is subject to TRRP.

Envirotest performed an asbestos inspection at the Site and completed an Asbestos Inspection Report dated September 26, 2018 for the City of Kingsville. Envirotest collected ninety-six samples of suspect ACM. The following samples contained greater than 1% asbestos: floor tile and mastic adhesive; sheet vinyl flooring; soft ceiling texture; popcorn ceiling texture; black pipe insulation sealant mastic; light fixture heat shield (level 2 skywalk); general adhesive (letters); window and door frame caulk; thermal system pipe insulation and elbows; fire door insulation; sink undercoat; expansion joint caulk; exterior transite panels; and roofing materials (as identified in the Envirotest Inspection Report COR 13 0362). The following materials were observed in a locked mechanical room and were assumed to contain asbestos: thermal system pipe insulation and elbows. Envirotest stated that a Class IV cleanup of the friable ACM debris must be conducted by trained workers supervised by an OSHA designated competent person with air monitoring during the cleanup activities. Envirotest also recommended that all ACM be removed prior to any demolition.

d. Project Goal (*site reuse plan*)

According to the City of Kingsville Brownfields Assessment, the Site's Brownfields Redevelopment Plan identified that the Site would work well with a housing development. With the Site location in the original town site, the housing development would consists of townhomes, duplexes, or smaller homes.

II. Applicable Regulations and Cleanup Standards

a. Clean up Oversight Responsibility (*identify the entity, if any, that will oversee the cleanup, e.g., the state, Licensed Site Professional, other required certified professional*)

Prior to any demolition and/or renovation of the Site, the Site's owner and/or contractor must notify the Texas Department of State Health Services of such activities even if asbestos is not present. Any asbestos related work including sampling or abatement must be conducted by a licensed contractor in the State of Texas. A certified USEPA Asbestos Hazard Emergency Response Act (AHERA) accredited Asbestos Building Inspector in accordance with the Texas Administrative Code Title 25, Part 1 Chapter 295, and Subchapter C must perform the inspection and the individual that performs the inspection must be licensed as an asbestos inspector to conduct asbestos surveys in public buildings.

b. Cleanup Standards for major contaminants (*briefly summarize the standard for cleanup e.g., state standards for residential or industrial reuse*)

The Site's planned abatement activities are to remove all known ACM greater than 1% will be abated/removed and disposed of in accordance with applicable local, state, and federal regulations.

c. Laws & Regulations Applicable to the Cleanup (*briefly summarize any federal, state, and local laws and regulations that apply to the cleanup*)

Laws and regulations that are applicable to the cleanup include TAC Title 25, Part 1 Chapter 295, and Subchapter C, the Texas Department of State Health Services (TDSHS), Occupational Safety and Health Administration (OSHA), National Emission Standards for Hazardous Air Pollutants (NESHAP), Texas Asbestos Health Protection Act (TAHPA), Environmental Protection Agency (EPA), Asbestos Hazard Emergency Response Act

(AHERA), and City of Kingsville by-laws. Any other federal, state, and local laws regarding procurement of contractors to conduct the abatement should be followed.

In addition, all appropriate permits/notifications should be obtained prior to work start-up.

III. Cleanup Alternatives

a. Cleanup Alternatives Considered (*minimum two different alternative plus No Action*)

To address contamination at the Site, five different alternatives were considered, including Alternative #1: No Action; Alternative #2: Encapsulation; Alternative #3 Repair; Alternative #4: Enclosure; and Alternative #5 Removal.

b. Evaluation of Cleanup Alternative (*brief discussion of the effectiveness, implementability and a preliminary cost estimate for each alternative*)

To satisfy EPA requirements, the effectiveness, implementability, and cost of each alternative must be considered prior to selection a recommended cleanup alternative.

Effectiveness

- Alternative #1: No Action is not effective since the redevelopment plan for the Site is to demolish the current structure and rebuild. No Action would be cost effective since no action is being taken to abate or manage the ACM; however, the Site would have no use except to stay in its current condition as a condemned building. The current unsecure conditions of the structure would not control or prevent ACM exposure to the public or environment and therefore the building will need to be secured.
- Alternative #2: Encapsulation is an effective application by applying a thick paint like material on the ACM to prevent ACM from releasing fibers into the air; however, the ACM must be in good condition and any loose or damaged material would need to be removed. Encapsulation would not be the most effective option since the redevelopment plan for the Site is to demolish the current structure and rebuild.
- Alternative #3: Repair would not be effective for the Site. Repairs are usually small projects (three feet or less of material) to an area containing ACM. Depending on the repair project, the ACM is removed and disposed of, the equipment/material is repaired and the ACM is replaced with non-asbestos containing material. The redevelopment plan for the Site is to demolish the current structure and rebuild; therefore, the repair alternative would not be effective.
- Alternative #4: Enclosure is an effective option by creating an air tight barrier around the ACM. All seams must be completely sealed air tight to be effective. Not all ACM identified at the Site could be managed with an enclosure and would need to be in combination with another alternative. The redevelopment plan for the Site is to demolish the current structure and rebuild, therefore, the enclosure alternative would not be the most effective option.
- Alternative #5: Removal (abatement) is the most common practice for controlling ACM and is a permanent solution. Abatement consists of removing the ACM from any location where it is present, properly bagging the ACM, and disposing of it at an approved landfill. Abatement is also a requirement of USEPA and NESHAP regulations for buildings scheduled for demolition. This option may be the most effective option for the Site considering the end goal of land reuse.

Note: An Operations & Maintenance Program would be required for Alternatives #2, #3, and #4.

Implementability

- Alternative #1: No Action is easy to implement since no actions are being conducted except for securing access to the Site’s building interior.

- Alternative #2: Encapsulation is relatively easy to implement; however, any loose ACM, ACM debris, fire damage, and miscellaneous items/debris scattered throughout the building would need to be removed/abated before the encapsulation could be applied. The contractor should apply the encapsulant with a low pressure sprayer and the type of encapsulant to use would depend on the type of ACM it is to be applied. Bridging encapsulants provide a protective coating over the ACM and then harden compared to penetrating encapsulants which soak into the ACM and then harden.
- Alternative #3: Repairing the ACM would not be implemented since it is usually only a small section. For the Site, repairing with no replacement for the entire Site is discussed as Alternative #5 - Removal.
- Alternative #4: An enclosure would be difficult to implement due to any loose ACM, ACM debris, fire damage, and miscellaneous items/debris scattered throughout the building would need to be removed. Additionally, not all ACM identified at the Site could be managed with an enclosure and would need to be in combination with another alternative.
- Alternative #5: Removal would be moderately difficult due to the size of the Site and any material (loose ACM, ACM debris, fire damage, and miscellaneous items/debris) scattered throughout the building; however, a well-planned removal/abatement scope will make implementation more manageable.

Note: Alternatives #2, #4, and #5 are considered Class 1 work and would require a containment be built around the work area to contain the large amounts of fibers that would be released due to the disturbance of the ACM. Additionally, implementability will be more difficult since a portion of the building had been in a fire and those areas would need to be assessed prior to implementation of any work.

<u>Cost</u>

- Alternative #1: No Action would require the installation of a perimeter fence that would cost approximately $54,000.00. This cost does not include regular maintenance for the fence or securing the building.
- Alternative #2: Costs for encapsulation of the ACM is roughly estimated to be $250,000.00 by Coastal Bend Demolition, Inc. (Coastal Bend). This price includes insurance, labor, equipment, materials and supervision. Please note the price does not include oversight or air monitoring.
- Alternative #3: Repairing the ACM is not feasible; therefore, no cost was estimated.
- Alternative #4: Cost for ACM enclosure is roughly estimated to be $250,000.00 by Coastal Bend. This price includes insurance, labor, equipment, materials and supervision. Please note the price does not include oversight or air monitoring.
- Alternative #5: Removal of the ACM as estimated by Coastal Bend is $250,000.00. This price includes insurance, labor, equipment, materials and supervision. Please note that the estimated costs does not include abatement oversight or air monitoring.

c. Recommended Cleanup Alternative

The recommended cleanup alternative is Alternative #5: Removal. Alternatives #1, #2, #3, and #4 do not coincide with the Project Goal’s Redevelopment Plan to demolish the current structure and rebuild for a housing development. Additionally, Alternatives #1, #2, #3, and #4 are temporary methods to manage the ACM in place and would require an Operations & Maintenance (O&M) Program. Removal is the most common way of managing ACM, is a permanent solution, and the recommended course of action due to scheduled demolition. The only exception to removing/abating all ACM would be to leave the non-friable material in place and perform a wet demo, which would include floor tile, gaskets, or roofing materials; however, it would be recommended to abate these materials prior to demolition.

Green and Sustainable Remediation Measures

In order to make the selected Alternative greener or more sustainable, best management practices (BMPs) for the industry should be utilized. Additionally, contractors should propose green techniques to be implemented into their proposals/work plans if approved.

Sincerely,
Aptim Environmental & Infrastructure, Inc.

Valeri A Salinas

Ramsey S. Muallem
Environmental Scientist

Valeri Salinas
Project Manager

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Distribution:
- TCEQ Brownfields Section (1 original)
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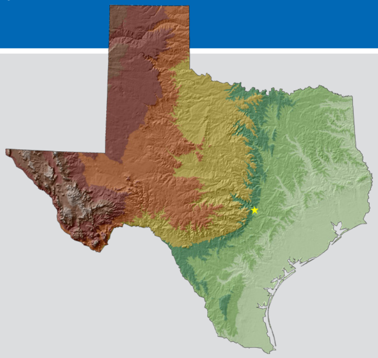
Attachment A
NOAA State Summaries - Texas



TEXAS

KEY MESSAGES

Mean annual temperature has increased by approximately 1°F since the first half of the 20th century. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century, with associated increases in extreme heat events.

Although projected changes in annual precipitation are uncertain, increases in extreme precipitation events are projected. Higher temperatures will increase soil moisture loss during dry spells, increasing the intensity of naturally occurring droughts.

The number of landfalling hurricanes in Texas is highly variable from year to year. As the climate warms, increases in hurricane rainfall rates, storm surge height due to sea level rise, and the intensity of the strongest hurricanes are projected.

The Texas climate is characterized by hot summers and cool to mild winters. Three geographical features largely influence the state's varied climate. The Rocky Mountains block intrusions of moist Pacific air from the west and tend to channel arctic air masses southward during the winter. The relatively flat central North American continent allows easy north and south movement of air masses. The Gulf of Mexico is the primary source of moisture, most readily available to the eastern part of the state. As a result of these factors, the state exhibits large east-west variations in precipitation and is subject to frequent occurrences of a variety of extreme events, including hurricanes, tornadoes, droughts, heat waves, cold waves, and intense precipitation. Increased demand for limited water supplies due to rapid population growth, especially in urban areas, may increase Texas' vulnerability to naturally occurring droughts.

Mean annual temperatures has increased approximately 1°F since the first half of the 20th century (Figure 1). While there is no overall trend in extremely hot days (maximum temperature above 100°F) (Figure 2), the number of very warm nights (minimum temperature below 75°F) was a record high during the latest 2010–2014 period (Figure 3). This was due to very high values during the drought years of 2011 and 2012 when very warm nights were very frequent both along the coast (where they are a common feature of the climate due to warm waters) and in the interior (where they are less common). The urban heat island effect increased these occurrences in city centers. In 2011, Texas recorded its warmest summer on record (since 1895) and broke the record for the statewide-average highest number of days with temperatures of 100°F or more. The Dallas-Fort Worth area endured 40 consecutive days in excess of 100°F, which was the second longest streak on record (1898–2011). The record dry conditions contributed to the higher temperatures.

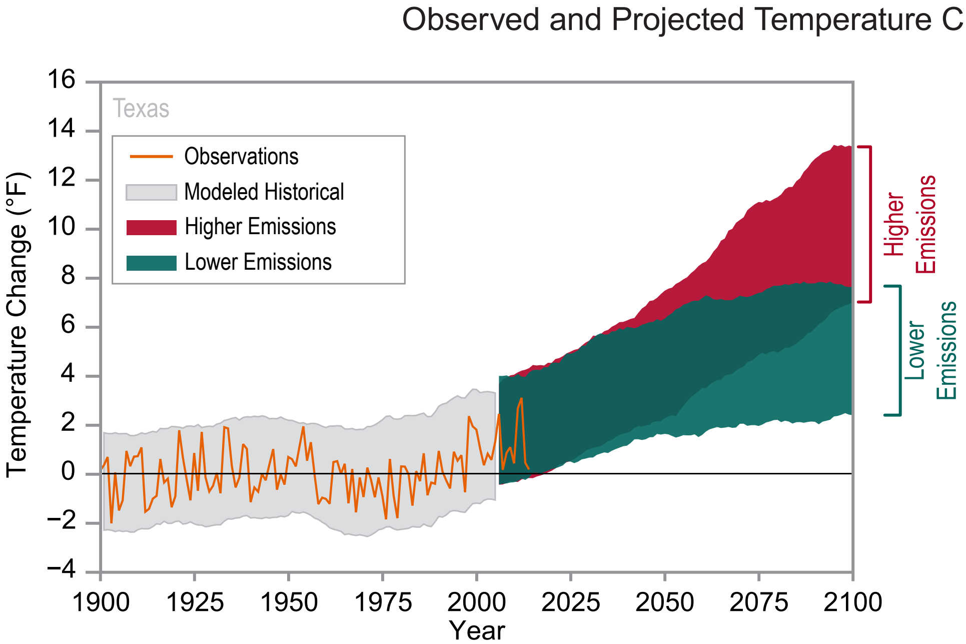


Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for Texas. Observed data are for 1900–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions)[1]. Temperatures in Texas (orange line) have risen about 1°F since the beginning of the 20th century. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during the 21st century. Less warming is expected under a lower emissions future (the coldest years being about as warm as the hottest year in the historical record; green shading) and more warming under a higher emissions future (the hottest years being about 11°F warmer than the hottest year in the historical record; red shading). Source: CICS-NC and NOAA NCEI.

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[1] Technical details on models and projections are provided in an appendix, available online at: https://statesummaries.ncics.org/tx.

Daily minimum temperatures in January typically range from about 20°F in the northern Panhandle to about 50°F near the mouth of the Rio Grande River. The annual number of days of extreme cold (maximum temperatures below 32°F) was well above average in the 1970s and 1980s but since then has fluctuated near the long-term average (Figure 4a).

Average annual precipitation varies from less than 10 inches in the far west to greater than 50 inches in the far east. The driest multi-year periods were in the 1890s, 1950s, and 2000s, and the wettest in the 1940s and mid-1990s (Figure 4b). **The driest 5-year period was 1952–1956 and the wettest was 1990–1994**. In the 1990s and early 2000s, the number of extreme precipitation events was well-above average, but the state has experienced below average rainfall and extreme precipitation events over the last five years (Figure 4c). However, this extended dry period was interrupted in May 2015 with a statewide monthly average rainfall total of 9.05 inches, breaking the previous all-time monthly record by well over two inches (Figure 5a). During one specific late-May episode, the Blanco River at Wimberly (south-central Texas) experienced historic flash and river flooding following a 1- to 2-day rainfall of 4–12 inches (Figure 5b), rising 35 feet in approximately 3 hours.

Texas is consistently ranked in the top 10 states affected by extreme events. In 2011, Texas was hit by eight of the Nation's billion dollar disasters. The three most impactful events were drought, extreme heat, and wildfires. The warmest and the driest summer in the historical record (Figure 6) helped fuel the worst wildfire season since statewide records began (approximately 1990), with nearly 4 million acres burned and $750 million in damages. Since the creation of the United States Drought Monitor Map in 2000, Texas has been completely drought-free for only approximately 8% of the time (2000–2014), and at least half of the state has been under drought conditions for approximately 42% of the time over the same period. Paleoclimatic records indicate that droughts of the severity of 2011 have occurred occasionally in the pat 1000 years (Figure 6). Higher temperatures in combination with drought conditions are likely to increase the severity, frequency, and extent of wildfires in the future posing significant harm to property, human health, and the livelihood of residents.

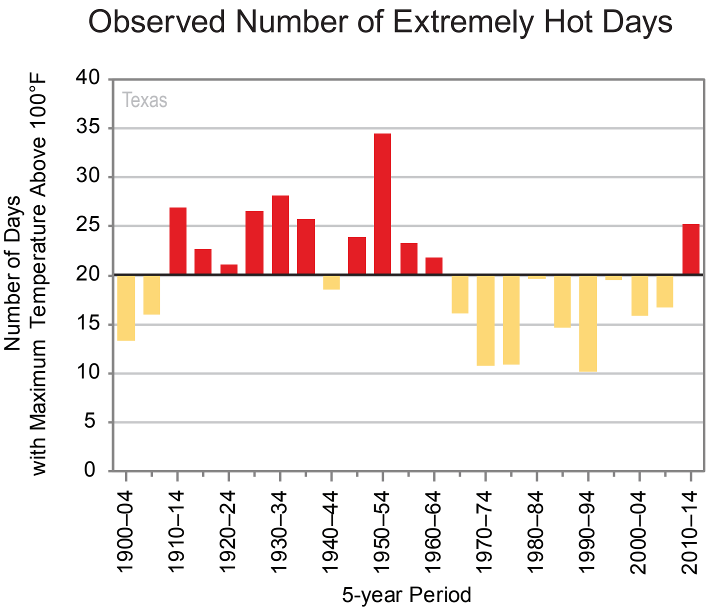


Figure 2: The observed number of extremely hot days (annual number of days with maximum temperature above 100°F) for 1900–2014, averaged over 5-year periods; these values are averages from twenty-six long-term reporting stations. The number of extremely hot days in Texas was mostly above average between 1910 and 1960, below average between the 1960s and early 2000s, and above average again in the last 5 years. The dark horizontal line is the long-term average (1900–2014) of about 20 days per year. Source: CICS-NC and NOAA NCEI.

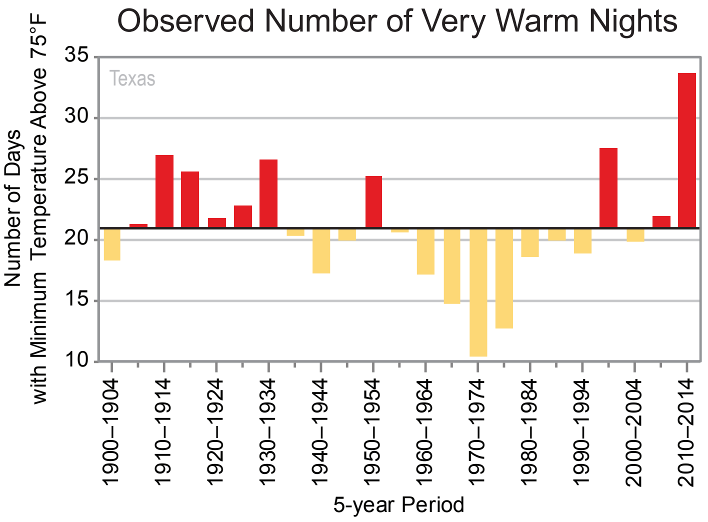
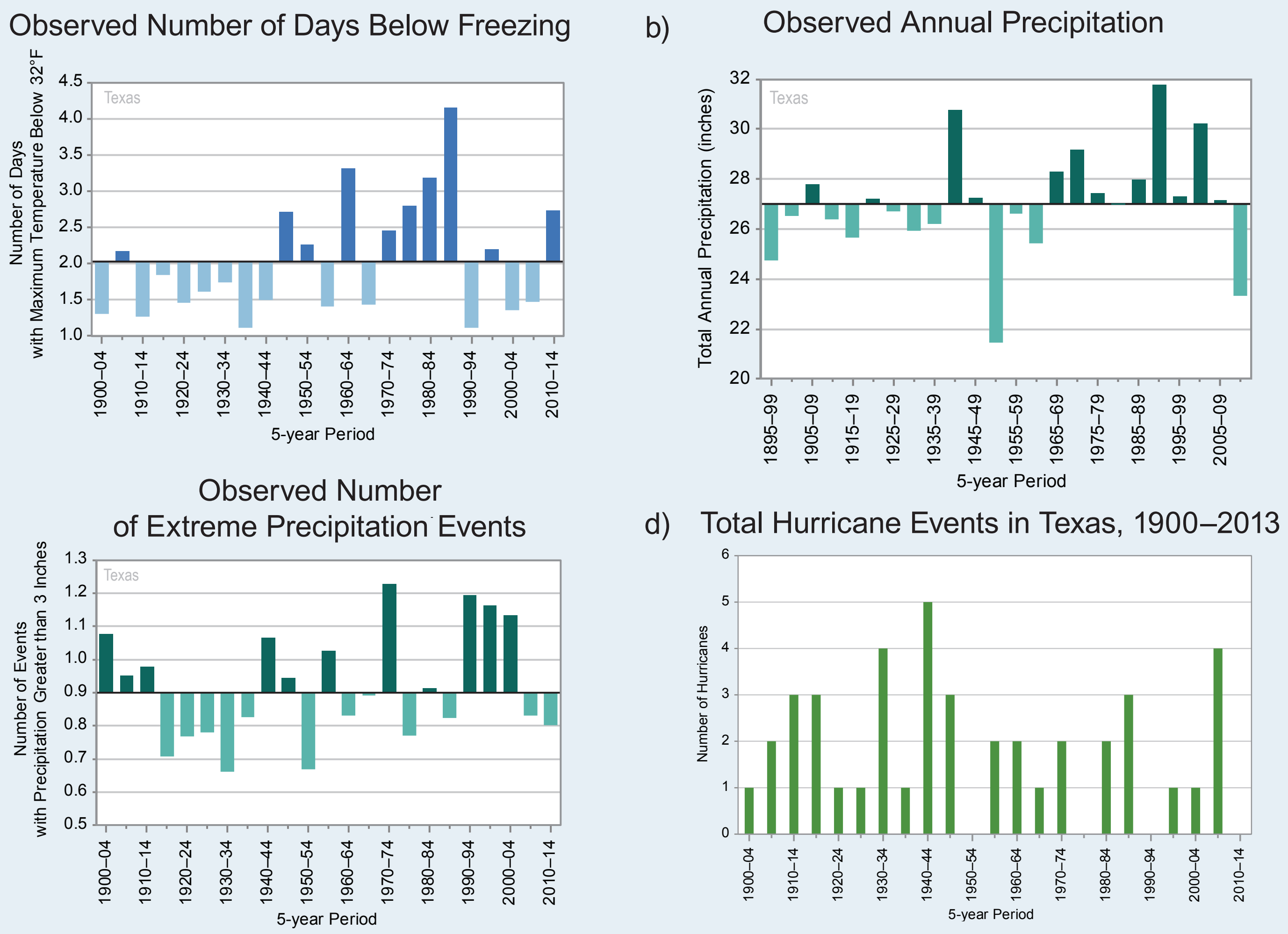


Figure 3: The observed number of very warm nights (number of days with minimum temperature above 75°F) for 1900–2014, averaged over 5-year periods; these values are averages from twenty-six long-term reporting stations. The 1970s saw a record low number of very warm nights. That number increased in the early 21st century, with the record highest number occurring in 2010–2014. The dark horizontal line is the long-term average (1900–2014) of about 21 days per year. Source: CICS-NC and NOAA NCEI.

Over the period of 1900 to 2010, the Texas coastline endured more than 85 tropical storms and hurricanes (about 3 storms every 4 years), with approximately half of them hurricanes (Figure 4d). Since 2000, Texas has experienced 12 named storms, including 5 destructive hurricanes, with Hurricane Rita (Category 3) and Hurricane Ike (Category 2) causing the most significant damage. While Hurricane Rita holds the designation as causing the largest U.S. evacuation in history, Hurricane Ike is the costliest hurricane in Texas history, with an estimated $19.3 billion in damages. Along the southern coast, surges of between 11 and 13 feet typically have return periods of 25 years (Figure 7).



Observed Number of Days Below Freezing

b) Observed Annual Precipitation

Observed Number of Extreme Precipitation Events

d) Total Hurricane Events in Texas, 1900–2013

Figure 4: Observed (a) number of days below freezing (maximum temperature below 32°F), (b) annual precipitation, (c) extreme precipitation events (days with more than 3 inches), and (d) annual number of hurricanes affecting Texas, averaged over 5-year periods. The values in Figures 4a and 4c are averages from twenty-six long-term reporting stations for temperature and thirty-six long-term reporting stations for precipitation. The number of days below freezing was above average in the 1970s and 1980s; since then it has fluctuated near the long-term average. Annual precipitation varies widely between years and has been generally below average during the most recent 5-year period of 2010–2014. The number of extreme precipitation events was well above average during the 1990s and early 2000s and slightly below average since then. There is no long-term trend in the number of hurricanes. Source: CICS-NC and NOAA NCEI.

Over the past 30 years (1985–2014), Texas has averaged 140 tornadoes and 4 tornado fatalities per year. Events can occur all year, though activity typically peaks between April and June.

Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century (Figure 1). Even under a pathway of lower greenhouse gas emissions, average annual temperatures are projected to most likely exceed historical record levels by the middle of the 21st century. However, there is a large range of temperature increases under both pathways, and under the lower pathway, a few projections are only slightly warmer than historical records. Increases in the number of extremely hot days and decreases in the number of extremely cold days are projected to accompany the overall warming. By 2055, an estimated increase of 20–30 days over 95°F is projected under one pathway, with the greatest increase in southwestern Texas.

Future changes in annual average precipitation are uncertain (Figure 8), but an increase in intense rainfall is likely. Furthermore, even if average precipitation does not change, **higher temperatures will increase the rate of soil moisture loss and thus naturally occurring droughts will likely be more intense**. Longer dry spells are also projected.

Increased drought severity combined with increased human demand for surface water will cause changes in streamflow, with extended reductions of freshwater inflow to Texas bays and estuaries. Such reductions in streamflow will cause temporary or permanent changes to bay salinity and oxygen content, with potentially major impacts to bay and estuary ecosystems, such as negatively affecting organism growth, reproduction, and survival.

Future changes in the frequency and severity of tornadoes, hail, and severe thunderstorms are uncertain. However, **hurricane intensity and rainfall are projected to increase for Texas as the climate warms**.

Since 1880, global sea level has risen by about 8 inches.Along the Texas coastline, sea level rise has been measured between 5 and 17 inches per century, causing the loss of an average of 180 acres of coastline per year. **Sea level is projected to rise another 1 to 4 feet by 2100 as a result of both past and future emissions from human activities** (Figure 9). Sea level rise has caused an increase in tidal floods associated with nuisance-level impacts. Nuisance floods are events in which water levels exceed the local threshold (set by NOAA's National Weather Service) for minor impacts. These events can damage infrastructure, cause road closures, and overwhelm storm drains. As sea level has risen along the Texas coastline, the number of tidal flood days has also increased, with the greatest number occurring in 2008 and 2015 (Figure 10). Future sea level rise will increase the frequency of nuisance flooding (Figure 9) and the potential for greater damage from storm surge.

Total Rainfall Amounts in May 2015

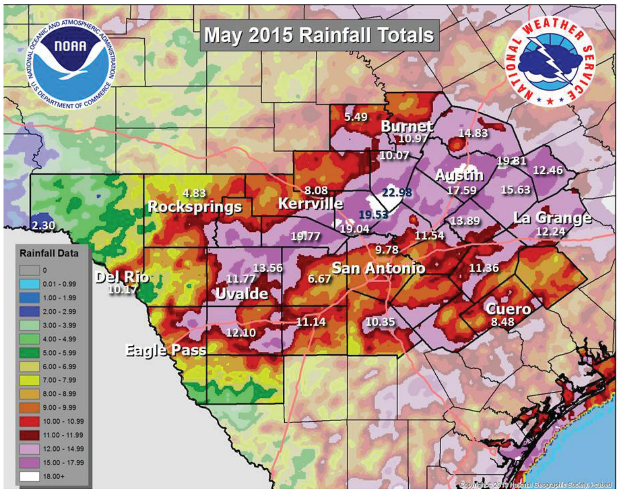


Figure 5: Monthly rainfall totals for May 2015 in south-central Texas. Large areas received more than 10 inches of rainfall and nearly the entire state was 2 to 4 times above normal. In late May 2015, south-central Texas experienced historic flash and river flooding following a 1- to 2-day rainfall of 4–12 inches and locally higher amounts. During this extreme precipitation event, the Blanco River at Wimberly, halfway between Austin and San Antonio, rose 35 feet in about 3 hours. Source: NOAA's National Weather Service.

Texas Palmer Drought Severity Index

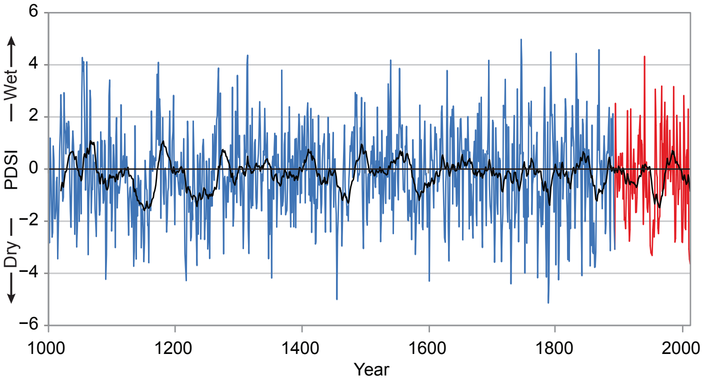


Figure 6: Texas Palmer Drought Severity Index. While periods of drought are common in Texas, the severity of the 2011 drought exceeded that of any previous drought throughout the history of the instrumental record (1895–2013 shown in red). Reconstruction of drought using proxies (blue) indicate droughts of the 2011 severity have occurred occasionally in the past. Source: NOAA NCEI.

Galveston Bay Coastal Surge Return Periods

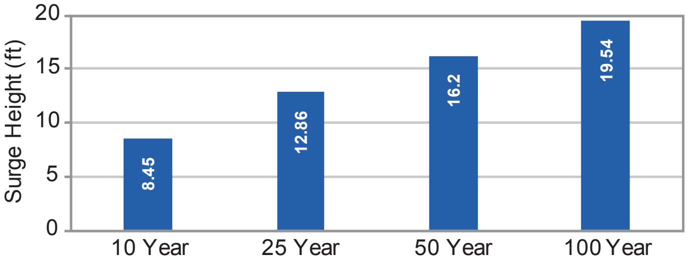


Figure 7: Coastal storm surge levels for 10-year, 25-year, 50-year, and 100-year return periods for (a) Galveston Bay. (Supplied by Luigi Romolo from the SURGEDAT database, Needham and Keim 2012)

Projected Change in Annual Precipitation

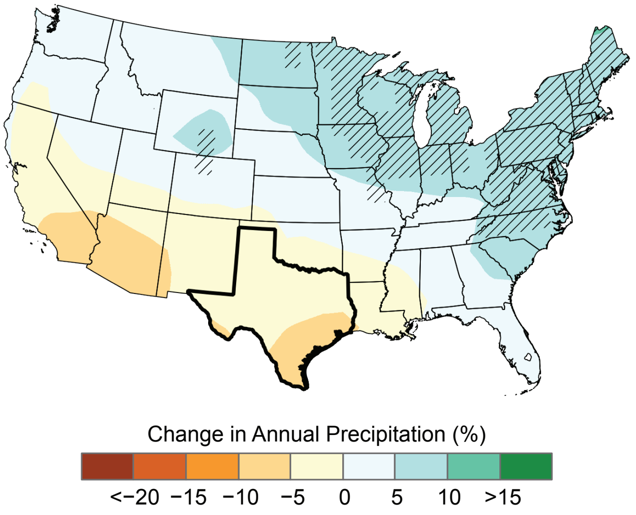


Figure 8: Projected changes (%) in annual precipitation for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. Texas is part of a large area in the southwestern and central United States with projected decreases in annual precipitation, but most models do not indicate that these changes are statistically significant. Source: CICS-NC and NOAA NCEI.

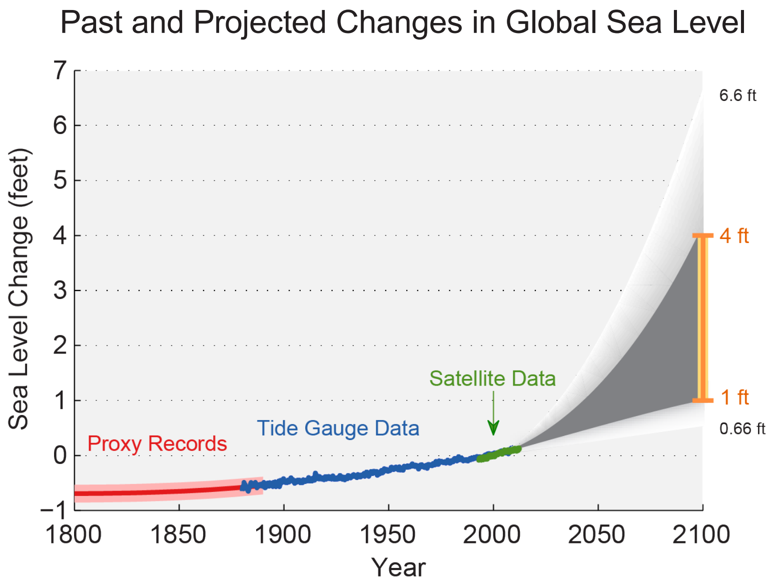


Figure 9: Estimated, observed, and possible future amounts of global sea level rise from 1800 to 2100, relative to the year 2000. The orange line at right shows the most likely range of 1 to 4 feet by 2100 based on an assessment of scientific studies, which falls within a larger possible range of 0.66 feet to 6.6 feet. Source: Melillo et al. 2014 and Parris et al. 2012.

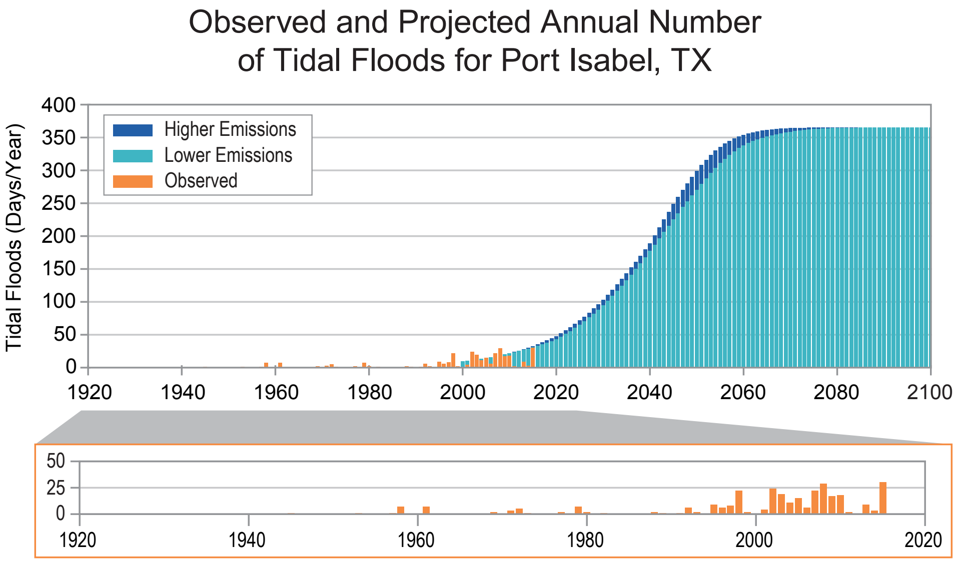


Figure 10: Number of tidal flood days per year for the observed record (orange bars) and projections for two possible futures: lower emissions (light blue) and higher emissions (dark blue) per calendar year for Port Isabel, TX. Sea level rise has caused an increase in tidal floods associated with nuisance-level impacts. Nuisance floods are events in which water levels exceed the local threshold (set by NOAA's National Weather Service) for minor impacts, such as road closures and overwhelmed storm drains. The greatest number of tidal flood days occurred in 2008 and 2015 in Port Isabel. Projected increases are large even under a lower emissions pathway. Near the end of the century, under a higher emissions pathway, some models project tidal flooding nearly every day of the year. To see these and other projections under additional emissions pathways, please see the supplemental material on the State Summaries website (https://statesummaries.ncics.org/tx). Source: NOAA NOS.

Attachment B
FEMA FIRM

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Texas State Plane, Zone South, FIPS 4205. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. This information was compiled from the U.S. Geological Survey, 1989, National Geodetic Survey, 2004, and the Texas Natural Resources Information System, 2010. Additional information was photogrammetrically compiled at a scale of 1:6,000 from National Agriculture Imagery Program aerial photography dated 2004 and 2010.

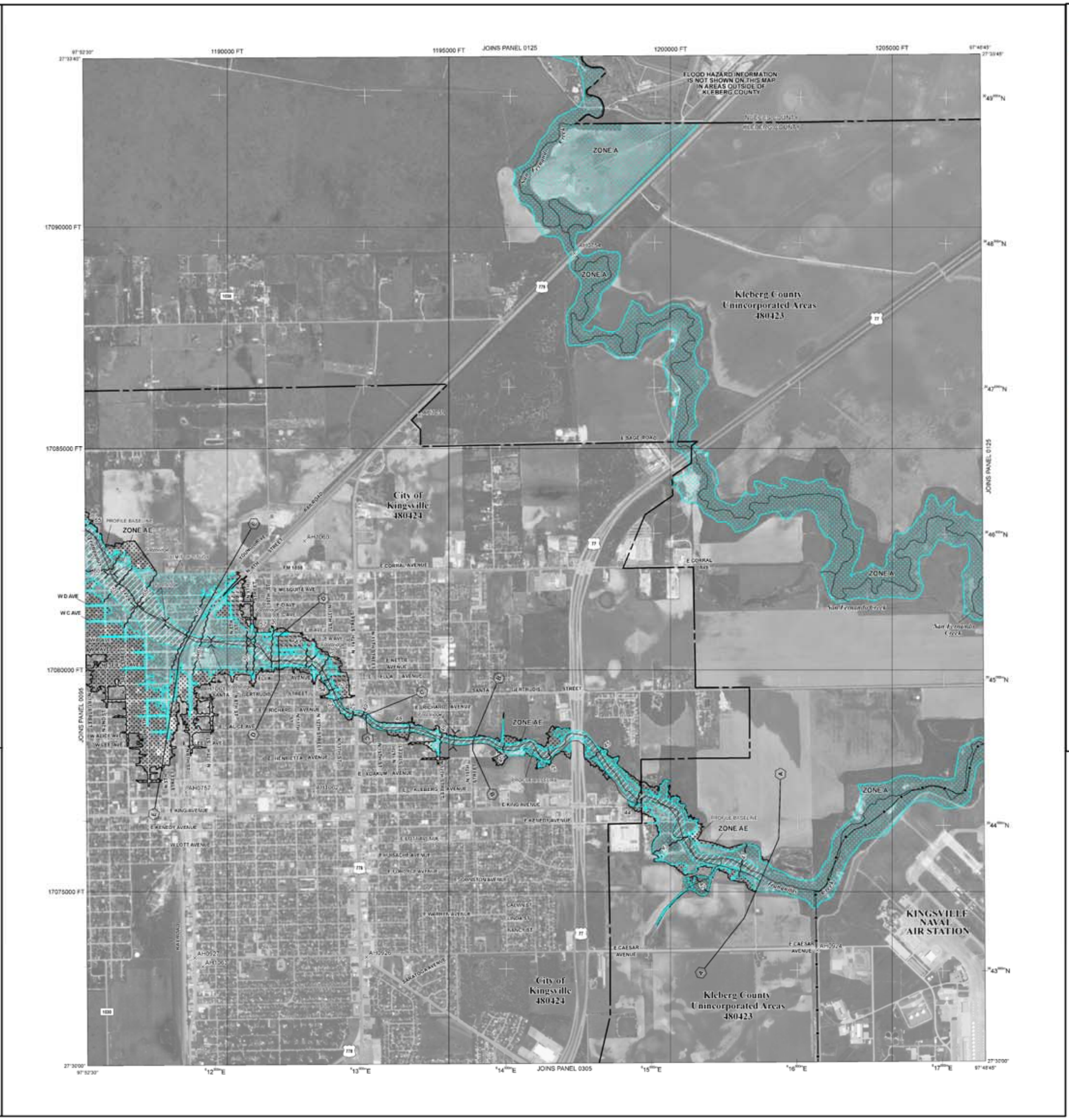
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM, visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have questions about this map, how to order products or the National Flood Insurance Program in general, please call **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

🟦	SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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

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

▨	FLOODWAY AREAS IN ZONE AE

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

▒	OTHER FLOOD AREAS
ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
☐	OTHER AREAS
ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.
▧	COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
▨	OTHERWISE PROTECTED AREAS (OPAs)

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

———	1% annual chance floodplain boundary
———	0.2% annual chance floodplain boundary
— — —	Floodway boundary
— — —	Zone D boundary
••••••••	CBRS and OPA boundary
═══	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
• • • •	Limit of Moderate Wave Action
~~ 513 ~~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

Ⓐ——Ⓐ	Cross section line
㉓- - - -㉓	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
⁴²76ᵐᴺ	1000-meter Universal Transverse Mercator grid values, zone 14N
600000 FT	5000-foot grid values: Texas State Plane coordinate system, South zone (FIPSZONE 4205), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORIES
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

March 17, 2014

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500	0	1000	2000	FEET
300	0	300	600	METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0115E

FIRM
FLOOD INSURANCE RATE MAP

KLEBERG COUNTY,
TEXAS
AND INCORPORATED AREAS

PANEL 115 OF 650
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KINGSVILLE, CITY OF	480424	0115	E
KLEBERG COUNTY	480423	0115	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
48273C0115E

EFFECTIVE DATE
MARCH 17, 2014

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	🟦	Without Base Flood Elevation (BFE) *Zone A, V, A99*
		With BFE or Depth *Zone AE, AO, AH, VE, AR*
	▨	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	🟧	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	▨	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	▨	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	▨	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
	▭	Effective LOMRs
	▭	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	– – –	Channel, Culvert, or Storm Sewer
	ııııııı	Levee, Dike, or Floodwall
OTHER FEATURES	Ⓑ 20.2 / 17.5	Cross Sections with 1% Annual Chance Water Surface Elevation
	⑧ – –	Coastal Transect
	~~ 513 ~~~	Base Flood Elevation Line (BFE)
	═	Limit of Study
	═	Jurisdiction Boundary
	--- ---	Coastal Transect Baseline
	– —	Profile Baseline
	—	Hydrographic Feature
MAP PANELS	☐	Digital Data Available
	☐	No Digital Data Available
	☒	Unmapped

📍 The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/3/2018 at 2:20:47 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.