TexAmericas CENTER®

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QUALIFIED SITES PROGRAM
ALAMO SITE

TexAmericas Center – Texarkana MSA – Hooks, Texas

Qualified Site:

A Certified Site is a commercial or industrial site where the majority of the information (infrastructure, encumbrances, attributes, availabilities, etc.) needed for a development to go to construction has been obtained, organized, prepared and endorsed by an objective third-party assuring a higher level of accuracy of site conditions therefore reducing the unknowns and increasing the speed to development.

A **Qualified Site,** endorsed by TexAmericas Center, is a commercial or industrial tract of land that has undergone the same level of scrutiny as a site certified by an objective third party but has been prepared in-house by a qualified professional.

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1 ABOUT TEXAMERICAS CENTER

TexAmericas Center is one of the largest mixed-use industrial parks in the Americas and has recently been recognized as the 5th ranked industrial park in the nation by *Business Facilities*. TexAmericas Center is a State of Texas-sanctioned Local Redevelopment Authority. This unique organizational structure allows to act like a hybrid of an economic development organization and an industrial real estate development & management company. These characteristics allow it to offer tenants custom real estate solutions and unparalleled speed-to-market.

With the operating capabilities of a municipality and control of its own land use (zoning) regulations and permitting, TexAmericas Center eliminates much of the red tape inherent in traditional real estate processes. Depending on the size and complexity of a development, the plan review and approval may be completed in less than five (5) business days giving businesses a shorter timeline to become operational than may exist in other complexes or municipalities. In addition to permitting expediency and custom real estate solutions, TexAmericas Center offers unique value-added services including: third party logistics, transload activities, on-site rail service, incentive management and build-to-suit and/or build-out-to-suit services.

1.1 MISSION

TexAmericas Center's mission is to bring quality jobs to the greater Texarkana area and diversify the tax base through property redevelopment. The TexAmericas Center Board of Directors has mandated that staff **create 12,000 jobs on the property**. To fulfill this mission, TexAmericas Center redevelops and manages **12,000 acres and 3.5 million square feet** of former military property in centrally located in Northeast Texas. TexAmericas Center is currently home to **48 manufacturing and commercial businesses**. TexAmericas Center and its Partners in Development have invested over **$40 million** in on-site infrastructure upgrades & environmental remediation and are committed to continue investing in our existing tenants, future tenants, and community.

1.2 LAND USE

TexAmericas Center is located outside of any city municipal boundaries and therefore controls its own land use (zoning) regulations and has designated its property for **light and heavy industrial uses.** All land and buildings are governed by TexAmericas Center planning, permitting, and approval processes, which are administered by an on-staff Professional Engineer. Guidelines covering development of the property, including but not limited to, Drainage Guidelines, Land Use Guidelines and Covenants, Codes & Restrictions are available from TexAmericas Center, most being easily accessible on our website, www.TexAmericasCenter.com and more specifically at https://texamericascenter.com/public-information/development-use-guidelines/.

1.3 CONTACT INFORMATION

Additional information about TexAmericas Center and the contents of this report may be obtained through the following:

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1.4 QUALIFIED SITES PROGRAM PURPOSE

The purpose of the TexAmericas Center (TAC) **Qualified Sites Program (QSP)** is to recognize the commercial and industrial sites with known development characteristics and available infrastructure in place that allow for the designation of the property as a **Qualified Site** meaning that the site is **Shovel-Ready** for vertical development.

When a site is designated as a **Qualified Site**, it has undergone a rigorous level of scrutiny to confirm that the site is **adjacent to utilities** typically needed for commercial and/or industrial operations, that site characteristics are **conducive to business activities**, that any **encumbrances** that might impact the property are known and that **key approvals**, documentation, regulations and assessments required for commercial or industrial uses are known and in place.

By having shovel-ready sites available, TAC will be able to better accommodate the needs and desires of prospective businesses. Companies that have immediate space and/or time requirements will have access to a greater amount of information potentially decreasing the chances of risks or constraints that could delay or derail a project.

In addition to designating sites as a Qualified Site, the qualification process will also help TAC identify gaps in information and attributes of its property and develop gap closure recommendations that will increase the inventory of **Qualified Sites**. The QSP

will also help elevate recognition of existing sites that may not be perceived as meeting the needs of business prospects that approach TAC for appropriate locations.

The goal of the QSP is to help developers, real estate professionals, both public and private utility companies and state partners understand and utilize the criteria outlined in this program, to recognize TAC as a nationally recognized industrial park with an inventory of attractive, pre-qualified, speculative sites ready for immediate development by end-users and for these groups to refer prospects to TAC for their business endeavors to take advantage of the location attributes.

Positioning a business prospect on a Qualified Site offers the company the ability to perform at a high standard. The coordination of these efforts may result in the ability of portions of TAC to be branded for a specific application or **Targeted Industry**. Project objectives include:

- Winning more projects;
- Filling identified market gaps;
- Establishing an expectation of high standards for development;
- Creating a high-quality product, a Qualified Site, that does not currently exist in the market;
- Creating an inventory of qualified speculative sites ready for immediate development prior to a prospect's inquiry

It is important to recognize that a principal goal of the program is to identify market gaps in TAC's portfolio of sites. Identifying the deficiencies in information or the availability of infrastructure will help TAC focus its efforts and attention on gaining this insight and prioritizing the extension of infrastructure to underserved properties. In addition, the recognition of sites that have been previously not perceived as having qualifying attributes will be recognized as a Qualified Site and marketed as such.

Creating an inventory of Qualified Sites, defined as being ready for vertical development, before a prospect conducts a site visit will help TAC convert more leads to announcements thus creating jobs, causing more investment and creating more quality commercial and industrial jobs in the region.

TAC reserves the right to amend or terminate the requirements of the QSP at any time.

2 THE ALAMO SITE

2.1 PROPERTY ATTRIBUTES

The property that makes up the TexAmericas Center East campus transferred from the United States of America to Red River Redevelopment Authority (later renamed TexAmericas Center) by Deed Without Warranty on September 1, 2010, and recorded in Volume 5898, Page 1 of the Real Property Records of Bowie County, Texas. A copy of this

document is available from TexAmericas Center, being most easily accessible on our website, www.TexAmericasCenter.com.

The 67-acre Alamo Site is a greenfield development site situated on the TexAmericas Center East Campus (TAC East). The site is situated on the west side of Cass Street at the intersection of Cass Street and Oak Street and is positioned to be a prominent development site near the entry into TAC East. This property is a wooded buffer area separating a former rail transload property from adjacent roadways and other land uses. Vicinity Maps (Figures A-1 to A-5) of TexAmericas Center may be found in Appendix A.

2.2 PROPERTY TERRAIN

The Alamo Site generally slopes from the south to north the northeast with multiple locations where stormwater drains under the rail line along the north property line. The slopes across the property range from 1-2%. A Topographical Exhibit (Figure A-7) of the property can be found in Appendix A.

The site is wooded with a mixture of a variety of species of Pine trees and Oak trees. The site is accessible by vehicle to its boundary on the east property lines and by all-terrain vehicle/4WD from its southern boundary. Additional information regarding the adjacent roads may be found in Section 5.1.1 of this document.

2.3 FLOOD PLAIN

Based on the National Flood Insurance Program Flood Insurance Rate Map for Bowie County Community Panel No. 48037C0310D with an effective date of October 19, 2010, the site is situated in Zone A and Zone X. These zones are defined as follows: A copy of a contour map with floodplain information and a firmette (Figures A-8a & A-8) of the site are included in Appendix A.

Zone A – Special Flood Hazard Area subject to Inundation by the 1% annual chance flood (100 year flood). No Base Flood Elevations determined.

Zone Z – Areas determined to be outside of the 0.2% annual chance (500-year) floodplain.

2.4 GEOLOGICAL INFORMATION

Historical information in the form of a Soil Survey of Bowie County, Texas and on-the-ground investigation of the property are available to give an insight into the soil conditions on the Alamo Site.

2.4.1 Soil Survey of Bowie County, Texas

Based on the *Soil Survey of Bowie County, Texas* prepared by the United States Department of Agriculture Soil Conservation Service in cooperation with the Texas

Agriculture Experiment Station, the majority of the soils located across the property are classified as being part of the Adaton-Muskogee soil complex comprised of:

Annona Loam – Characterized by a fine sandy loam or loamy surfaces over dense clay subsoils.

Blevins Silt Loam – Characterized by loams throughout the soil profile.

Sawyer Silt Loam – Characterized by loams throughout the soil profile.

Thenas Fine Sandy Loam – Characterized as a moderately well to a well-drained soils on flood plains.

Wrightsville – Raino Complex – Characterized as a very deep, poorly drained, very slowly permeable soils formed in silt and clay alluvium.

Excerpts from the Soil Survey are included in Appendix B.

2.4.2 Preliminary Geotechnical Investigation

Geotechnical Investigations have been prepared for sites in the vicinity of the Alamo Site. Testing and analysis were completed by Rone engineering for the TexAmericas Town Center situated east of the Alamo Site in October 2022. In addition, portions of the Alamo site were included in a Preliminary Geotechnical Investigation prepared by ETTL Engineers & Consultants, Inc. in July 2013. A copy of the boring logs for those on the Alamo Site and those closest to the Alamo Site from adjacent testing sites are included in Appendix C.

3 GOVERNMENTAL JURISDICTION

3.1 BOWIE COUNTY, TEXAS

TAC resides inside unincorporated Bowie County, Texas which is governed by a five-member commissioners' court. Four commissioners are voted on by the residents of their respective precincts in the county and presided over by a county judge elected by the residents of Bowie County.

3.2 TEXAMERICAS CENTER (TAC)

TAC is governed by a fifteen-member Board of Directors comprised of individuals appointed by the mayors of the municipalities throughout Bowie County, Texas. The Board of Directors sets policy and leaves the daily operations to staff. The Board of Directors is the final decision maker on all matters related to TAC business, with exception of taxation as TexAmericas Center does not have the right to levy taxes.

All TAC property is **deed restricted to commercial and industrial activity** which makes it suitable and designated for heavy and light industrial construction and operations. TAC

controls its own land use (zoning) and has designated TAC property primarily for **Light and Heavy Industrial** uses. The Alamo Site is located in a **Heavy Industrial District (HI)** based on the Land Use Map adopted by the TexAmericas Center Board of Directors on September 25, 2018. A copy of the Land Use Map (Figure A-9) is included in Appendix A.

TAC has developed ordinances that affect site development of the property. These ordinances are intended to promote the health, safety, moral and general welfare of TAC. A list of these ordinances include:

- Codes, Covenants & Restrictions (CCR's);
- Drainage Guidelines;
- Land Use & Site Design Guidelines;
- Paving Guidelines;
- Road Signage, Striping & Lighting Guidelines;
- Sign Guidelines.

A copy of these are easily accessible on our website, www.TexAmericasCenter.com and more specifically at https://texamericascenter.com/public-information/development-use-guidelines/.

3.3 Fire Protection

The Alamo site falls within the coverage of the Hooks Volunteer Fire Department. **The ISO rating for the Hooks Volunteer Fire Department, at the Alamo Site, is a 6.** A Mutual Aid, Interlocal Agreement exists between the cities of Hooks, New Boston, Leary and Redwater, Texas and Red River Army Depot (RRAD) to provide emergency response services. The **ISO rating for RRAD's Fire and Emergency Services is a 2**.

3.4 Police Protection

Police Protection will be provided by the Bowie County Sheriff's Department. Similar Mutual Aid agreements exist within the adjacent cities for these services also.

4 Environmental & Cultural Impacts

Located amid the Piney Woods, the Texarkana region offers a rare and wonderful bounty of lakes, green space and forestry where hardwoods grow nearly as quickly as softwoods. The region offers picturesque, relaxing and meaningful settings in which to retreat, relax and recharge. An impressive collection of federal, state and local recreational assets are waiting to be explored within a 90-minute drive.

4.1 Environmental Assessment

An environmental evaluation was made of the TAC East Campus (formerly portions of the Lone Star Army Ammunition Plant – LSAAP) and the results were published in the U.S.

Army BRAC 2005 Environmental condition of Property Report Lone Star Army Ammunition Plant Texarkana, TX. Final dated 20 November 2006.

The Environmental Condition of the Property Parcel Map in Figure 5-1 shows the Alamo Site to be designated as 'ECP Category 1', Section 5.2.1 of the report defines ECP Category 1 property as 'Areas where no release or disposal of hazardous substances or petroleum products or their derivatives has occurred, and to which there have been no migration of such substances from adjacent areas.

4.2 WETLANDS

TAC commissioned wetland delineation of the TAC East campus, including the limits of the Alamo Site, in order to determine the impact of wetlands on the property. The delineation reveals that portions of the Alamo Site have wetland characteristics. A formal submittal to the United States of America Corps of Engineers (USACOE)was made for the property and a Jurisdictional Determination (JD)has been provided by the USACOE. The JD indicates that a portion of the property contains jurisdictional wetlands. A copy of the Jurisdictional Determination is included in Appendix D.

4.3 ENDANGERED/THREATENED SPECIES

Texas Parks & Wildlife Department Annotated County Lists of Rare Species, updated March 5, 2021, is included in Appendix E. This is a county-wide list of the species.

In 2000, a planning level survey (PLS) was conducted for vegetative communities and fauna, including an assessment of the potential presence of quality habitat for threatened and endangered species (TES) (Tetra Tech 2002b). The alligator snapping turtle (*Macroclemys temminckii*), a state-listed threatened species, was the only Threatened and Endangered Species (TES) observed at the installations during the Planning Level Survey (PLS). There we no federal-listed threatened or endangered species on the property.

4.4 ARCHAEOLOGICAL/HISTORICAL DESIGNATIONS

Based on the *Phase II Archaeological Investigations at Red River Army Depot and Lone Start Army Ammunition Plant, Bowie County, Texas Final Report* dated February 2012 prepared for the US Army Corps of Engineers (Mobile District) by Earth Science, Inc., there are no locations on the Alamo site that are determined to be of Archaeological or Historical Significance. A copy of the letter from the Texas Historical Commission is enclosed indicating that … "all of the archaeological sites at the installations have been evaluated and none have been determined eligible for inclusion in the NRHP' is included in Appendix F.

4.5 AIR ATTAINMENT STATUS

Based on information provided by the Texas Commission on Environmental Quality and the United States Environmental Protection Agency, Bowie County, Texas appears within acceptable air quality levels according to the National Ambient Air Quality Standards.

5 TRANSPORTATION ASSETS

TAC is positioned to give you access to the greatest domestic market share while still operating in the top-ranked State of Texas. This is because TAC is situated in the Texarkana MSA, **one of the lowest aggregate mile locations in Texas to the geographic and population centers of the US**. This gives tenants at TAC a **500-mile reach of 53.8 million consumers**, which is **10 million more than the Dallas 500-mile reach**. This access comes at a fraction of the transportation costs due to our strategic, central location and robust infrastructure.

5.1 ROAD INFRASTRUCTURE

TAC has excellent interstate access with plans for additional improvements to ease speed of delivery for businesses. **Interstate Highway 30** (I-30) is the closest interstate to the Alamo Site at a distance of **less than 1 mile**. I-30 has **six interchanges** and multiple entry points to TAC on the 15-mile stretch that runs parallel to and less that 1-mile from its north property boundary. TAC Center is approximately **two hours east of Dallas** and **two hours southwest of Little Rock**. Construction is currently underway in Texarkana to widen I-30 to six lanes.

5.1.1 Key Connections

Key connections of TAC road transportation system:

- **Interstate Highway 30** connects to I-20, I-35 & I-45 and more U.S. & State Highways to the west to the DFW Metroplex giving access to the West Coast, Mexico & Canada and east to Little Rock, connecting with I-40 to Oklahoma City, Memphis, Nashville and the eastern seaboard of the United States.
- **Interstate Highway 69/369** (I-69/I-369) connects Canada and the Northeast United States, passing through Texarkana, to Houston and the Texas/Mexico border with multiple connections to additional U.S. & State Highways along the route. I-69 is currently under construction in various stages along its route.
- **U.S. Highway 59** (HWY 59) connects Texarkana to Houston and all Texas ports along the Gulf of Mexico with connections to I-20, Interstate Highway 10 (I-10) and numerous U.S. & State Highways along the route. The existing roadbed of HWY 59 is the proposed route for I-69/I-369 corridor.
- **Interstate Highway 49** (I-49) connects Texarkana to New Orleans with connections to I-10 and I-20 along this route to the south, and Fort Smith and Kansas City to the north with connections to I-40 & I-44 and multiple connections to additional U.S. &

State Highways along the entire route. Plans are in progress to complete the construction of the portion of I-49 between Texarkana and Fort Smith.

- **U.S. Highway 71** (HWY 71) connects Texarkana to Fort Smith, Arkansas and I-40.
- **U.S. Highway 67** (HWY 67) connects Dallas to St. Louis, through Texarkana with multiple connections to interstate, U.S. & State Highways along the route.
- **U.S. Highway 82** (HWY 82) runs immediately adjacent to the north property line of all TexAmericas Center property and connects North and West Texas, to the Atlantic Ocean, and to Los Angeles via I-10 with multiple connections to additional U.S. & State Highways along the route.

5.1.2 Alamo Site Road Adjacency

The Alamo Site is situated at the northwest corner of the intersection of Cass Street and Oak Street on the TAC East campus.

- Cass Street is the main entry into TAC East in downtown Hooks, Texas. Leaving the TAC East campus heading north and crossing HWY 82, Cass Street becomes F.M. 560 through Hooks, Texas. Continuing north on F.M. 560 for approximately half a mile, F.M. 560 intersects I-30 at Exit 206. This intersection is a primary exit from I-30 providing access to TAC East. Cass Street is also a primary north/south corridor through TAC East and is immediately adjacent to the southeast corner boundary of the Alamo Site. Cass Street is currently a two-lane road with a 150' wide right-of-way. Future improvements to Cass Street will add capacity by increasing the pavement width making this a four-lane thoroughfare.
- Oak Street is a primary east/west corridor through TAC East. Oak Street intersects Cass Street approximately a third of a mile south of HWY 82 at the southeast corner of the Alamo Site. Oak Street is currently a two-lane road with a 150' wide right-of-way. Future improvements to Oak Street will add capacity by increasing the pavement width making this a four-lane thoroughfare.

Both Oak Street and Cass Street are Private Roads, owned and maintained by TexAmericas Center. Both roads have asphalt surfaces and are designated truck routes through TAC East with an 80,000-pound capacity.

Exhibits located in Appendix A show the roads adjacent to TexAmericas Center and to the Alamo Site.

5.2 RAIL AND INTERMODAL INFRASTRUCTURE

5.2.1 Area Rail Operators

Texarkana is a major east/west and north/south rail center, with over 125 trains passing through the community per day. The Union Pacific (UP – a Class I Operator), Kansas City Southern (KCS – a Class I Operator), Texas Northeastern (TNER – a Short Line Operator), and TAC Rail (the rail system and power owned and operated by TexAmericas Center on the TAC East Campus) serve TexAmericas Center and the Texarkana market.

5.2.2 Area Intermodal Facilities

The Texarkana/TexAmericas Center market is well-served by inland ports or intermodal facilities. The nearest intermodal operations can be found in:

- **Dallas/Fort Worth, TX** (BNSF, KCS-NS, and UP)
- **Houston, TX** (BNSF and UP)
- **Kansas City, MO-KS** (BNSF, CP, NS, and UP)
- **Memphis, AR-TN** (BNSF, CN, CSX, NS and UP)
- **New Orleans, LA** (CN, NS and UP)
- **St. Louis MO-IL** (BNSF, CN, CSX, NS and UP)
- **San Antonio, TX** (UP)
- **Shreveport/Minden, LA** (KCS-NS)

5.2.3 Alamo Site Rail Adjacency

The TNER collects cars in the UP yard in Texarkana and delivers to TAC via a UP owned line running immediately south of HWY 82 and along the north boundary line of TAC East. The TNER delivers these cars to the siding located at the northwest corner of TAC East. At this point, TAC Rail connects and spots the cars in a 350-car classification yard along the west boundary of TAC East or maneuvers the cars to locations on TAC East at other storage locations or for spotting as needed for tenant activities. A siding currently runs along the north/west boundary of the Alamo Site. Additional switches can be added along this line, if needed, for rail served activities within the Alamo Site.

5.2.4 TAC Rail System

TAC owns approximately 36-miles of rail on TAC East.

The rail on the TAC East campus is predominantly 85# rail. Several crossings adjacent to the Alamo Site have been upgraded recently and the rail at these locations has been upgraded to 115# rail. TAC has received grant funds and is currently working on improvements to several existing crossings and turnouts with the intentions of upgrading the rail through these facilities to 115# rail and performing other maintenance upgrades to better accommodate 286,000# loads.

5.2.5 TAC Transload Facility

A designated transload location is currently operating at TAC East and is located on the acreage immediately east of the Alamo Site on Oak Street. A twelve-car spot is designated and an operator contracts with businesses independently for loading and unloading activities. A variety of commodities can be handled in this facility. TAC will provide contact information for operator if requested.

5.3 AIR INFRASTRUCTURE

TexAmericas Center is a 25-minute drive from **Texarkana Regional Airport (TXK)**, with three daily round trip flights to **Dallas/Fort Worth International Airport (DFW)**. DFW is American Airlines' largest hub and is the third busiest airport in the world, with **over 900 flights daily**

from over 23 airlines with service to **218 non-stop destinations**, both international and domestic. DFW is a 30-minute flight from Texarkana.

Other airports within an approximate two-hour drive from TAC East include:

- **Shreveport Regional Airport (SHV)** – approximately 75 minutes, with non-stop, direct flights to 9 destinations.
    - Destinations include: Dallas/Fort Worth, Los Angeles, Las Vegas, Atlanta, Orlando, Destin, Denver, Charlotte, and Houston
    - Commercial air operations are provided by Allegiant, American, Delta, GLO, and United.
- **Little Rock Municipal Airport (Clinton National Airport)(LIT)** – approximately 2 hours, with non-stop, direct flights to 13 destinations.
    - Major Destinations include: Las Vegas, New York, Washington D.C, Dallas, Houston, Atlanta, Orlando, Charlotte, Miami, St. Louis, Denver, and Chicago.
    - Commercial air operations are provided by Allegiant, American, Delta, Southwest, GLO, and United.

- **Dallas Love Field (DAL)** – approximately 2 hours, with non-stop, direct flights to 71 destinations.
    - Major Destinations include: Chicago, Washington DC, Los Angeles, New York, Atlanta, and Las Vegas
    - Southwest HQ hub

5.4 WATERWAYS AND PORT FACILITIES

TexAmericas Center is **within a five-hour drive of 10 of the 20 busiest ports in the USA**. The **Port of Caddo-Bossier** is approximately 100 miles away in Northwest Louisiana, the closest port to Texarkana and commercially navigable via the Red River. The Red River connects to the Mississippi River, the coastal waterway system, and the central US waterway system. The **Port of Little Rock** is approximately 160 miles northeast of TexAmericas Center on the Arkansas River, while the **Port of Houston** lies 295 miles south on the Gulf of Mexico.

6 UTILITIES

TexAmericas Center is well-served by industrial-grade utilities with excess capacity situated immediately adjacent to the Alamo Site. Below is a brief summary of all utilities. More information can be provided upon request.

6.1 WATER SOURCE INFORMATION

TexAmericas Center's water provider is **Riverbend Water Resource District (RWRD)**, which currently contracts with **Texarkana Water Utilities (TWU)** for provision of water to

TexAmericas Center property. The water sources are two large reservoirs, Millwood Lake in Arkansas, and Lake Wright Patman in Texas.

TWU's current water plant has a design **capacity of 36 MGD.** The average daily use is 16 MGD, leaving an **excess capacity of 20 MGD**. A **30" transmission line** connects Texarkana to New Boston, Texas. This line can deliver over **4 MGD** to Riverbend's water system on TexAmericas Center's property. RWRD pumps currently pull **1.7 MGD** of water from the line, leaving **2.3 MGD of excess capacity** in the transmission line.

6.1.1 Water (potable) Main Adjacency

A 16-inch main is situated along the south property line of the Alamo Site. An 8-inch water main is located in the Cass Street right-of-way on the west side of the road and immediately adjacent to the East boundary of the Alamo Site. Water may be extended into the Alamo Site from either source to provide water for development.

A Water Availability Map (Figure G-1) is located in Appendix G.

6.1.2 Water (non-potable) Main Adjacency

Riverbend Water Resources District will also be the provider of non-potable water on TAC East after the completion of the new regional water treatment plant.

6.1.3 Water System Expansion

RWRD recently announced a **$200 million investment** in a new, **30 MGD regional water system** that will be located on TexAmericas Center property. This state-of-the-art water system will eliminate reliance on TWU, while allowing businesses locating to TexAmericas Center to expand without concerns surrounding water treatment needs and availability. **Raw water** will also be available on both the Central and East campuses. Long term growth planning calls for full plant expansion up to **90 MGD**.

6.1.4 Contact Information

Riverbend Water Resources District (RWRD)
Kyle Dooley, P.E.
Executive Director/Chief Executive Officer
228 Texas Avenue, Suite A
New Boston, Texas 75570
903.831.0091
riverbend@rwrd.org
www.rwrd.org

6.2 SANITARY SEWER

Riverbend Water Resources District is also the provider of sanitary sewer collection and treatment on TAC East.

6.2.1 Sanitary Sewer Main Adjacency

An 18-inch, SDR 26, sanitary sewer main is situated along the north side of Oak Street and currently terminates at the intersection of Cass Street and Oak Street near the Southeast corner of the Alamo Site. This main can be extended under Cass Street and extended as needed to serve the development.

A Sanitary Sewer Availability Map (Figure G-2) is located in Appendix G.

6.2.2 Treatment Facility

The wastewater plant servicing the TAC footprint has an average daily discharge limitation of 1.5 MGD with a daily maximum discharge limitation of 3.0 MGD. Based on the TCEQ permit for the facility, utilizing the daily maximum discharge limitations (3.0 MGD), the daily maximum biological oxygen demand is 250 lbs/day and the daily maximum total suspended solids is 500 lbs/day. The pH has an operating requirement range from greater than 6.0 to less than 9.0 with minimum monitoring requirements of one sample per day.

RWRD is in negations with RRAD to establish a public pretreatment facility for non-food industrial uses which will be at a yet determined site located on TAC East.

6.2.3 Treatment Facility Expandability

The existing wastewater plant serving the TAC footprint is built in a modular fashion with two (2) modules having a 750,000 GPD capacity. The facility is currently constructed with the necessary piping in place to accommodate an additional 750,000 GPD module increasing the treatment capacity to approximately 2.25 MGD.

6.2.4 Contact Information

Riverbend Water Resources District (RWRD)
Kyle Dooley, P.E.
Executive Director/Chief Executive Officer
228 Texas Avenue, Suite A
New Boston, Texas 75570
903.831.0091
riverbend@rwrd.org
www.rwrd.org

6.3 ELECTRICITY

6.3.1 Source Information

TexAmericas Center is served electricity by **AEP/SWEPCO**, one of the lowest cost electricity providers in the USA, with **rates typically 80% of the US average**. Currently **3-Phase, 12kv distribution lines** and **four substations** serve TexAmericas Center property. Each substation is connected to a **69kv transmission line** and has design capacity of **20MW**, with existing excess capacity of approximately **10MW** of power per substation. An additional **138kv line** and **two 345kv lines** are near and adjacent to TexAmericas Center,

making dual feeds/connections and upgrading the substations to provide **up to 350MW** possible.

6.3.2 Substation Locations

Four substations are on or adjacent to TexAmericas center and provide service to the property. The eastern portions of TAC East are served by a substation on Bowie Parkway on its east boundary.

The northwest portion of TAC East is served from a substation situated approximately one quarter mile north of TAC East with a distribution line along the north right-of-way line of HWY 82. A connection has been made to this distribution line and extended south into TAC East. Additional switching equipment has been installed to switch the source of power in the event of an outage of one of the substations.

AEP is in the planning stages of upgrades to substations serving TAC. One item under consideration is the placement of a new substation on TAC EAST that is connected to the 138-kv transmission line.

6.3.3 Electrical Service Adjacency

A 12-kv overhead distribution line is situated on the west side of Cass Street immediately adjacent to the east boundary line of Cass Street.

An Electricity Availability Map (Figure G-3) is located in Appendix G.

6.3.4 Contact Information

AEP/SWEPCO (AEP)
John R. Jones
Customer Account Manager
428 Travis
Shreveport, LA 71101
903.728.5490
jrjones@aep.com
www.aep.com

6.4 NATURAL GAS

6.4.1 Source Information

Navitas Utility Corporation is the gas supplier to TAC East, which contracts through **Enable**. The Enable Interstate transmission pipeline that connects Texas to Arkansas runs adjacent to TexAmericas Center, north of the HWY 82 right-of-way. This Interstate pipeline is a **10-inch, 220 psi** high pressure natural gas line.

A **6-inch lateral** at **220 psi** from the Enable transmission line connects to Navitas' distribution system on TAC East. The existing meter can be upgraded for additional capacity as demand increases. The natural gas line onto TAC East consists of **dual 4-inch gas lines** that deliver **130 MCF per hour** and is expandable to **at least 170 MCF per hour**.

6.4.2 Natural Gas Main Adjacency

A pair of 4-inch gas lines is situated in the south right-of-way of Oak Street and terminates at the intersection of Cass Street and Oak Street near the southeast corner of the Alamo Site. This main can be extended under Cass Street to serve the Alamo Site as needed. These lines will be capable of delivering approximately 130 MCF/hour with the ability to expand to 170 MCF/hour.

A Gas Availability Map (Figure G-4) is located in Appendix G.

6.4.3 System Expandability

The Enable Interstate transmission pipeline can be upgraded substantially to at least **10,000 MCF per hour**. An upgrade like this would include a dedicated pipeline, likely a 12-inch high pressure (input 900 psi) steel line. Cost for this upgrade is $300,000 per mile (2020 estimate), plus $1,000,000 for interstate pipeline system improvements, and $1,000,000 of contingency. This cost includes:

- Development
- Engineering
- Securing ROW
- Procurement
- Installation
- Commission
- Restoration
- Clean up

6.4.4 Contact Information

Navitas Utility Corporation
Thomas Hartline
Executive Director/Chief Executive Officer
3186 D Airway Avenue
Costa Mesa, CA 92626
714.424.4094
thartline@navitasutility.com
www.navitasutility.com

6.5 HIGH SPEED FIBER

6.5.1 Source Information

Conterra Networks (Conterra) provides data center-quality internet service to TexAmericas Center and has extended a **144-strand fiber line** onto or adjacent to all TexAmericas Center campuses. Conterra offers high bandwidth at competitive rates with **100+ gigabyte upload and download speeds** available.

6.5.2 High Speed Fiber Adjacency

Conterra installed a 144-strand fiber line on the east side of Cass Street immediately adjacent to the east boundary line of the Alamo Tract. A splice can be made to this line and fiber extended into the Alamo Site to serve the development as needed.

A Fiber Availability Map (Figure G-5) is located in Appendix G.

6.5.3 Contact Information

Conterra Networks
Stephanie Green
Area Sales Manager
903.908.3052
sgreen@conterra.com
www.Conterra.com

6.5.4 Fiber Assessment Study – TAC Property

CBRE – Network Advisory Services recently performed a Level 2 IT Assessment on TexAmericas Center property. On a scale of 1-5, with 5 being very feasible and 1 being infeasible, **TexAmericas Center ranked a 4** to support hyperscale, corporate, and similar data center applications. The next phase of the study will provide recommendations for upgrades to a 5 rating. The results of both of these assessments can be made available if requested/as completed.

7 INCENTIVES

Governments consider using public funds on a case-by-case basis to help incentivize proposed private economic development projects to strengthen a community's economic viability. Incentives can take a variety of forms such as tax breaks, construction of supporting infrastructure, workforce development programming and other forms of assistance. Jurisdictions may use these incentives to pursue economic goals such as tax base diversification, job creation, or business retention and expansion.

Incentive and business assistance offerings are typically based on the expected, realistic capital investment and job creation projections. A sample of available incentives are below; all can be used as an inducement to secure investment in our region's economy.

7.1 Special Zones

Locating to one of TAC's three campuses offers several incentive options on the federal, state, and local levels. All incentives are competitive and based on established criteria. Available incentives include property purchase price abatement, property tax abatement, favorable lease/purchase arrangements, employee recruitment & training assistance, infrastructure grants and favorable financing. Area partners have a successful history of obtaining financial assistance for qualified projects from both state and federal sources; however, delivery of proposed grants is not guaranteed. Independent

applications must be filed, and an established review and award process is followed. Seven of TAC's distinct incentives include:

7.1.1 Defense Economic Readjustment Zone

As TAC is comprised solely of land formerly operated as a military installation, companies which locate to the TAC footprint become eligible for the Defense Economic Readjustment Zone Program. This program is a tool for business recruitment and job creation in adversely impacted military communities, such as TexAmericas Center. It is designed to aid Texas communities, businesses, and workers impacted by the closure or realignment of military installations and provides local and state regulatory and tax incentives to encourage businesses to locate or expand in these areas.

7.1.2 U.S. Foreign Trade Zone #258

TexAmericas Center manages Foreign Trade Zone #258, a geographic area where goods may be landed, stored, handled, manufactured or reconfigured then re-exported under specific customs regulations, generally not subject to customs duties. Areas designated as Foreign Trade Zones (FTZ) are generally organized around major transportation hubs and areas with many advantages for trade. An FTZ is a defined, physical area within the United States that, for customs entry purposes is treated as if it is outside U.S. borders. Companies may use FTZs for both storage/distribution activities or, after specific authorization by the U.S. FTZ Board, for production.

TAC will engage our consultant, Point Trade Services Inc., to estimate cost savings of operating in FTZ #258 upon request.

Foreign Trade Zones give companies multiple benefits that ultimately streamline operations and impact the bottom line. Some of these benefits include:

- CBP duty and federal excise tax, if applicable, are paid when the merchandise is transferred from the zone for consumption.
- While in the zone, merchandise is not subject to U.S. duty or excise tax. Certain tangible personal property is generally exempt from state and local ad valorem taxes.
- Goods may be exported from the zone free of duty and excise tax.
- CBP security requirements provide protection against theft.
- Merchandise may remain in a zone indefinitely, whether or not subject to duty.
- The rate of duty and tax on the merchandise admitted to a zone may change as a result of operations conducted within the zone. Therefore, the zone user who plans to enter the merchandise for consumption to CBP territory may normally elect to pay either the duty rate applicable on the foreign material placed in the zone or the duty rate applicable on the finished article transferred from the zone whichever is most advantageous.
- Merchandise imported under bond may be admitted to an FTZ for the purpose of satisfying a legal requirement of exporting the merchandise. For instance, merchandise may be admitted into a zone to satisfy any exportation requirement of the Tariff Act of 1930, or any other exportation requirement.

7.1.3 HUBZone

TexAmericas Center is located within a federal HUBZone which offers advantages for federal contracts. A US HUBZone helps small businesses gain preferential consideration with government contracts by limiting some contracts just to HUBZones and giving HUBZone businesses a 10% price evaluation preference in full and open contract negotiations. By law, three percent of all dollars awarded for federal prime contracts are required to go to HUBZone-certified small business concerns. The local Small Business Development Center will assist in preparing company applications for being recognized as HUBZone eligible.

The SBA provides a higher surety bond for HUBZone companies. There is typically a subcontractor participation goal for many large business contracts. HUBZone requirements generally apply to U.S. Government purchases in excess of $3,000.

The Small Business Association regulates and implements the HUBZone Program by doing the following:

- Determining which businesses are eligible to receive HUBZone contracts
- Maintaining a list of qualified HUBZone small businesses that federal agencies can use to locate vendors
- Adjudicates protests of eligibility to receive HUBZone contracts
- Reports to Congress on the program's impact on employment and investment in HUBZone areas.

To qualify for the program, a business must meet the following criteria:

- It must be a small business by SBA standards (https://www.sba.gov/federal-contracting/contracting-guide/size-standards)
- Its principal office must be located in a HUBZone, which includes military facilities closed by the Base Realignment and Closure Act, such as TAC
- At least 35% of its employees must reside in a HUBZone

7.1.4 New Market Tax Credits

TexAmericas Center is designated as an economically distressed community making businesses located on our footprint eligible for New Market Tax Credits (NMTC). The NMTC program attracts capital to eligible communities by providing private investors with a federal tax credit for investments made in businesses or economic development projects located in distressed communities, such as TAC.

Investors in NMTC receive a tax credit equal to 39 percent of the total Qualified Equity Investment made in a Community Development Entity. The credit is realized over a seven-year period: five percent annually for the first three years and six percent in years four through seven.

7.1.5 U.S. Opportunity Zone

A US Opportunity Zone is an economically distressed community where new investments, under certain conditions, may be eligible for preferential tax treatment to spur economic

development in those areas. Qualified Opportunity Zones retain their designation for 10 years.

First, investors can defer tax on any prior gains until December 31, 2026 or such date in which an investment is sold or exchanged, whichever comes first, as long as the gain is reinvested in a Qualified Opportunity Fund.

Second, if the investor holds the investment in the Opportunity Fund for at least ten years, the investor would be eligible for an increase in basis equal to the fair market value of the investment on the date that the investment is sold or exchanged. Investors can defer certain taxes if they invest in an Opportunity Zone within six months of realizing the gain.

Investments in Opportunity Zones realize the following benefits for investment periods of at least:

- Five years with a 10% increase in tax basis
- Seven years with a 15% increase in tax basis

Ten years with an exemption from additional gains beyond what was previously deferred

7.1.6 Texas Enterprise Zone

The Texas Enterprise Zone Program is a state sales and use tax refund program designed to encourage private investment and job creation in economically distressed areas of the state of Texas.

Depending upon capital investment, Texas will refund up to $7,500 for each allocated permanent or retained job.

- For projects with a capital investment below $150 million, qualified businesses may receive up to $1.25 million in state sales and use tax refunds ($2,500 per job with a maximum of 500 jobs created).
- For projects with a capital investment between $150 million and $250 million, qualified businesses may receive up to $2.5 million in state sales and use tax refunds ($5,000 per job with a maximum of 500 jobs created).
- For projects with a capital investment of $250 million or more, qualified businesses may receive up to $3.75 million in state sales and use tax refunds ($7,500 per job for no less than 500 jobs created).

7.1.7 Texas Reinvestment Zone

Designating a specific geographic area as a Texas Enterprise Zone also makes it a Texas Reinvestment Zone, and potentially eligible for tax increment financing, tax abatement and limitations on appraised value. A local property tax exemption may be granted for real and tangible personal property located in the reinvestment zone that was acquired from the federal government by lease or deed. In addition, property in a reinvestment zone is eligible for:

- A tax refund based on the capital investment in the project

- An exemption from state regulation and suspension from local regulation
- Preference for loans from the state
- Refunds and credits on state excise, use, sales and franchise taxes
- Refunds on local sales and use taxes
- The reduction or elimination of local fees.
- Incentives tied to increasing jobs, wages or investment

7.1.8 Pace Program

The Texas Property Assessed Clean Energy (PACE) program provides low-cost, long-term financing for water and energy efficiency upgrades to commercial and industrial properties. PACE improvements add value to the property and reduce utility bills with the upgrades typically paying for themselves with positive cash flow over time. In 2013, the Legislature passed Senate Bill 385 (83R) allowing municipalities and counties to work with commercial lenders and property owners to pursue improvements using property assessments as a secure repayment mechanism. Eligible upgrades are financed over time through a voluntary property tax assessment attached to the property.

Under a PACE arrangement, private property owners evaluate measures that achieve energy savings and obtain financing, repaid as an assessment on the building. The assessment mechanism allows access to low-cost, long-term capital to finance improvements to the property. By eliminating upfront costs, extending financing and simplifying the transfer of repayment obligations to new owners upon sale, PACE overcomes challenges that have hindered building energy efficiency and related projects.

7.2 Recruitment and Training

7.2.1 Skills Development Fund

The Texas state-funded Skills Development Fund is an innovative program providing local customized training opportunities for Texas businesses and workers to increase skill levels and wages of the Texas workforce. Training providers can use grant funds for curriculum development, training materials, instructor certifications and training equipment additions or upgrades. The employer and local community colleges will partner to develop a training plan for the Skills Development project and submit the application jointly.

The Texas Workforce Commission and local Workforce Board will assist to ensure the application requirements are completed. Grants are provided to help companies and labor unions form partnerships with local community colleges and technical schools to provide custom job training. However, the benefit may vary depending on the proposal. If the grant is awarded, the Texas Workforce Commission funding will be provided to the community college to administer the training program for the employer. Total grant

amounts vary depending on the number of employees participating in the program. No money is spent or received by the company.
The Skills Development Fund is only available to Texas employers and will pay up to $1,800 for each new employee and $900 for each incumbent employee participating in the training. Grants are generally capped at $500,000 but exceptions can be approved, and additional funds requested.

7.2.2 On-the-Job Training (OJT) Contracts

On-the-Job Training (OJT) Contracts are available to an employer who hires an eligible Texas resident. OJT Contracts pay up to 50% of an eligible employee's wages during their training period. OJT Contracts are subject to availability and approval of Texas Workforce Solutions.

7.2.3 Come Home to Texarkana Program

The Texarkana region would be delighted to help you and your employees call Texarkana home. Institutions like the Texarkana Chamber of Commerce, the Greater Texarkana Young Professionals (GTYP), Leadership Texarkana, MainStreet Texarkana, Texarkana College, local school districts and others will help key employees discover Texarkana and acclimate to their new surroundings. We will use all our relocation tools to help you and your employees succeed at your new home in Texarkana.

7.3 Tax Abatement Programs

7.3.1 Goods in Transit Tax Abatement

This law exempts goods, principally inventory, that are stored under a contract of bailment by a public warehouse operator at a public warehouse facility, and that is in no way owned or controlled by the owner of the goods. This is provided such property is moved to another location inside or outside Texas within 175 days after the goods were acquired in Texas or imported into Texas. The movement requirement could be satisfied by simply moving the goods to another warehouse across the street.
Certain specific types of goods are presently excluded from this exemption: oil, natural gas, petroleum products, aircraft, dealer's motor vehicle inventory, dealer's vessel and outboard motor inventory, dealer's heavy equipment inventory, or retail manufactured housing inventory. Some owners of goods that presently store them in owned facilities may move their goods into a public warehouse in order to obtain the tax exemption.
Having inventory located in Texas on the lien date (January 1) that is not being manufactured, modified, assembled, or processed and is pre-committed to an out-of-state customer, most likely qualifies a business for a 100% property tax exemption. In some cases, it is possible to qualify part of your inventory for an interstate/foreign commerce exemption and a Freeport Exemption on the remainder, depending on the flow of goods and qualifying thresholds. Furthermore, as this is a statutory exemption, it applies to all taxing jurisdictions, including county, city, school, and special districts.

7.3.2 Freeport Tax Exemption

The Freeport Exemption is a constitutional amendment that exempts certain goods, which the government has dubbed Freeport goods, from property taxes. If a business has inventory in the state of Texas for a short period of time (175 days or less) before transporting it out of state, it may be eligible to claim a business personal property tax exemption on that inventory. Savings will be based on the percentage of tangible property goods that your business moved out of Texas within the 175-day window during the previous year.

The following conditions must also be met:

- Freeport property includes goods, merchandise, ores, and certain aircraft and aircraft parts.
- The inventory must fall under the categories of finished goods, supplies, raw materials or work in process of being assembled, repaired, maintained, stored, processed or fabricated. The exemption does not apply to oil, natural gas, or liquid or gaseous materials that are immediate derivatives of the oil refining or natural gas.
- The Freeport goods that are eligible for this exemption must be transported out of Texas within 175 days of the date that they are acquired, manufactured or brought into the state.
- Goods, known as goods-in-transit that meet the Freeport property requirements may be sold in-state instead of being shipped out of state. However, the property still must meet all the Freeport property requirements, and be transported out of Texas within 175 days after it was first acquired in or imported into the state.

7.3.3 312 Tax Abatement

Chapter 312 of the Texas Tax Code permits local taxing units to enter into agreements with property owners providing for the abatement of ad valorem property taxes, provided that the property owner makes specified improvements or repairs to the property. The code, also known as the Property Redevelopment and Tax Abatement Act, allows the governing bodies of cities, counties and special districts to exempt all or part of the taxable value of new investments for a period not to exceed 10 years.

To be eligible for an abatement, a project must be a new facility or an expansion or modernization of an existing one. Abatement agreements are required to include certain provisions. They must specify the improvements to be made to the property and provide access for city or county employees to verify that the agreements are followed. The agreements must require payment of taxes if a property owner fails to comply with the abatement terms. In addition, annual certificates of compliance must be filed with the applicable taxing units to ensure accountability and visibility for the public.

7.3.4 381 Tax Abatement

Chapter 381 of the Local Government Code allows counties to provide incentives encouraging developers to build in their jurisdictions. A county may administer and

develop a program to make loans and grants of public money to promote state or local economic development and to stimulate, encourage and develop business location and commercial activity in the county. Specifically, it provides for offering loans and grants of city funds or services at little or no cost to promote all types of business development including industrial, commercial and retail projects. Each agreement can be uniquely tailored to address the specific needs of both the local government entity and the business prospect.

7.3.5 Texas Research and Development Tax Credit

Taxpayers in Texas can claim the R&D Tax Credit to offset a portion of their franchise tax or use it towards a sales and use tax exemption on the purchase or lease of depreciable tangible personal property used in qualified research in Texas. Some highlights of the Texas R&D Tax Credit include:

- Qualified Research Expenses (QREs) must be for research conducted within Texas.
- The credit amount is 5% of the excess amount of qualified research expenses in the current period over the base amount (50% of the average of the previous three years).
- The allowable Franchise Tax Credit in any one period, including carryforward amounts, cannot exceed 50% of the franchise tax due for the period.
- Unused credits can be carried forward for up to 20 years.

7.3.6 Pollution Control Equipment Incentive

Property used wholly or partly to prevent, monitor, control or reduce pollution is considered "pollution control property" and is at least partly exempt from ad valorem (property) tax for the life of the asset. To obtain the exemption, the property owner must apply to the Texas Commission on Environmental Quality. The applicant can submit in three different tiers, or levels, of applications for a use and benefit determination.

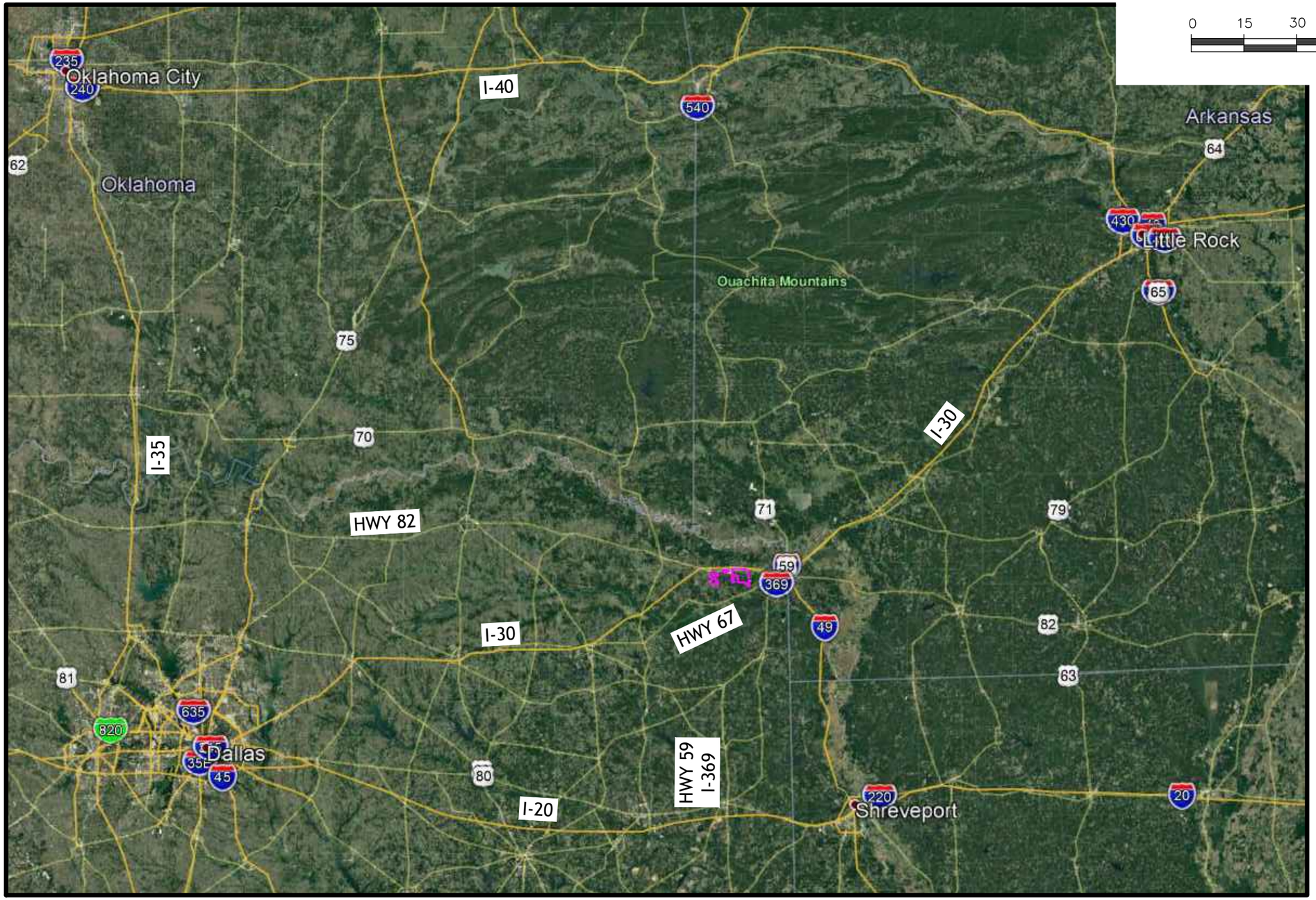
7.3.7 Franchise Tax Exemption and Deduction for Business HQ Relocation

Companies may deduct from apportioned margin relocation costs incurred in relocating their main office or other principal place of business to Texas from another state provided the company (1) did not do business in Texas before the relocation and (2) is not a member of an affiliated group engaged in a unitary business, another member of which is already doing business in Texas.

Deductible relocation costs include (1) costs of relocating computers and peripherals, other business supplies, furniture and inventory; and (2) any other costs related to the relocation that are allowable deductions for federal income tax purposes. The deduction must be taken on the company's initial franchise tax filing.

APPENDIX A

FIGURE A-1



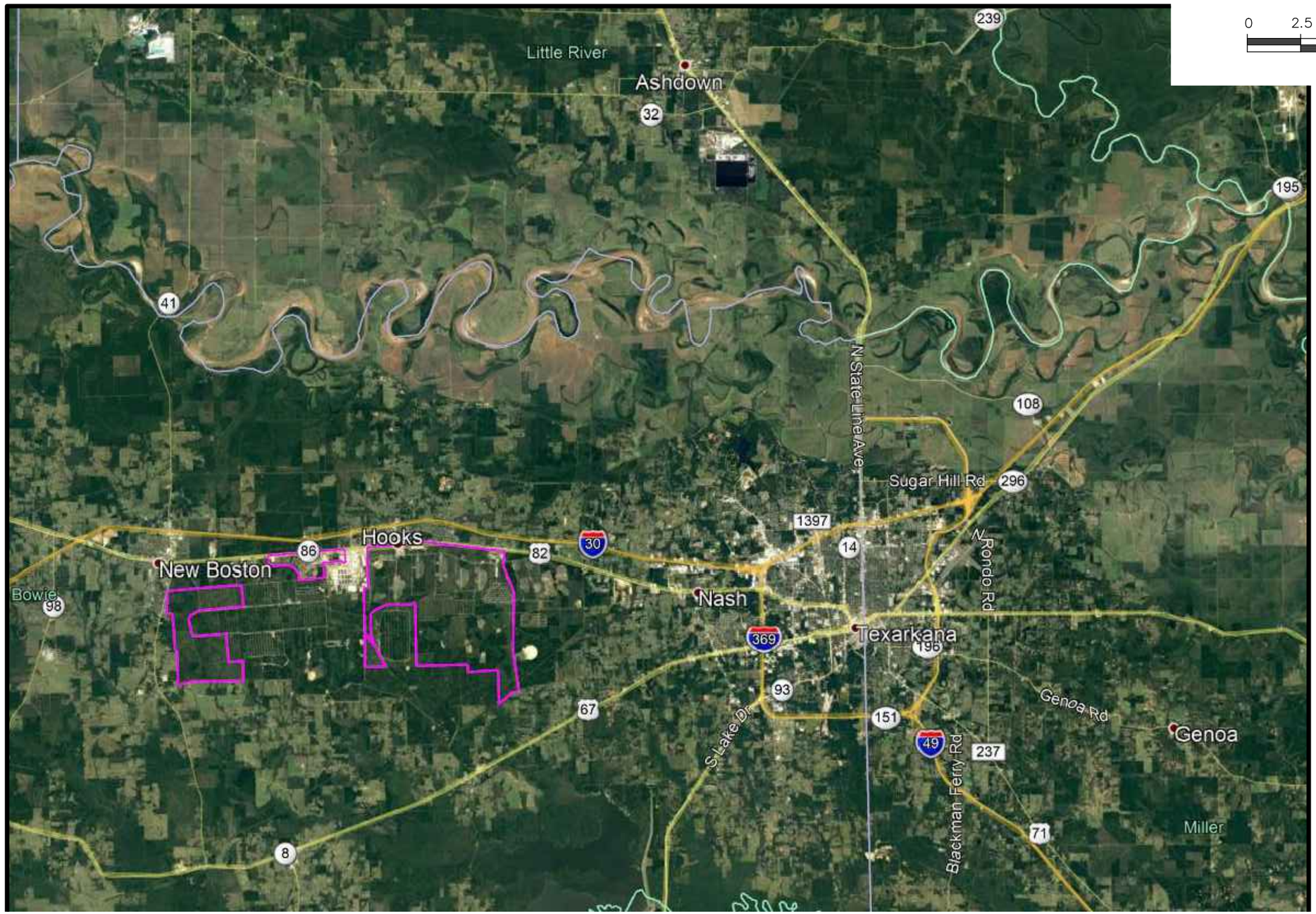
107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

AREA LOCATOR MAP

TexAmericas Center

FIGURE A-2



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TexAmericas CENTER
Texarkana USA

REGIONAL LOCATOR MAP

TexAmericas Center

FIGURE A-3

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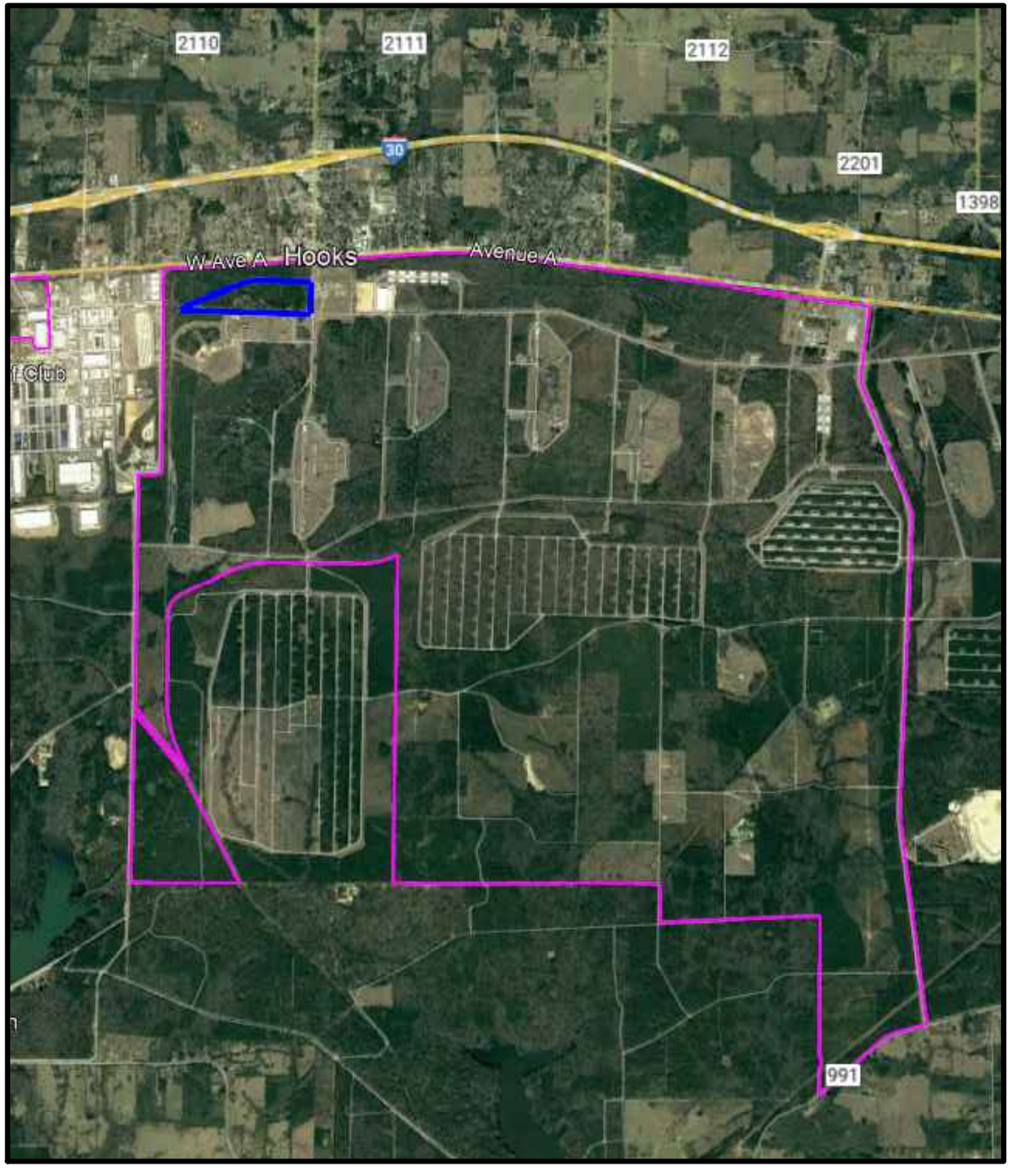
TexAmericas CENTER
Texarkana USA

TEXAMERICAS CENTER - CAMPUS MAP

TexAmericas Center

FIGURE A-4



N

0 15 30 60 90

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TexAmericas CENTER
Texarkana USA

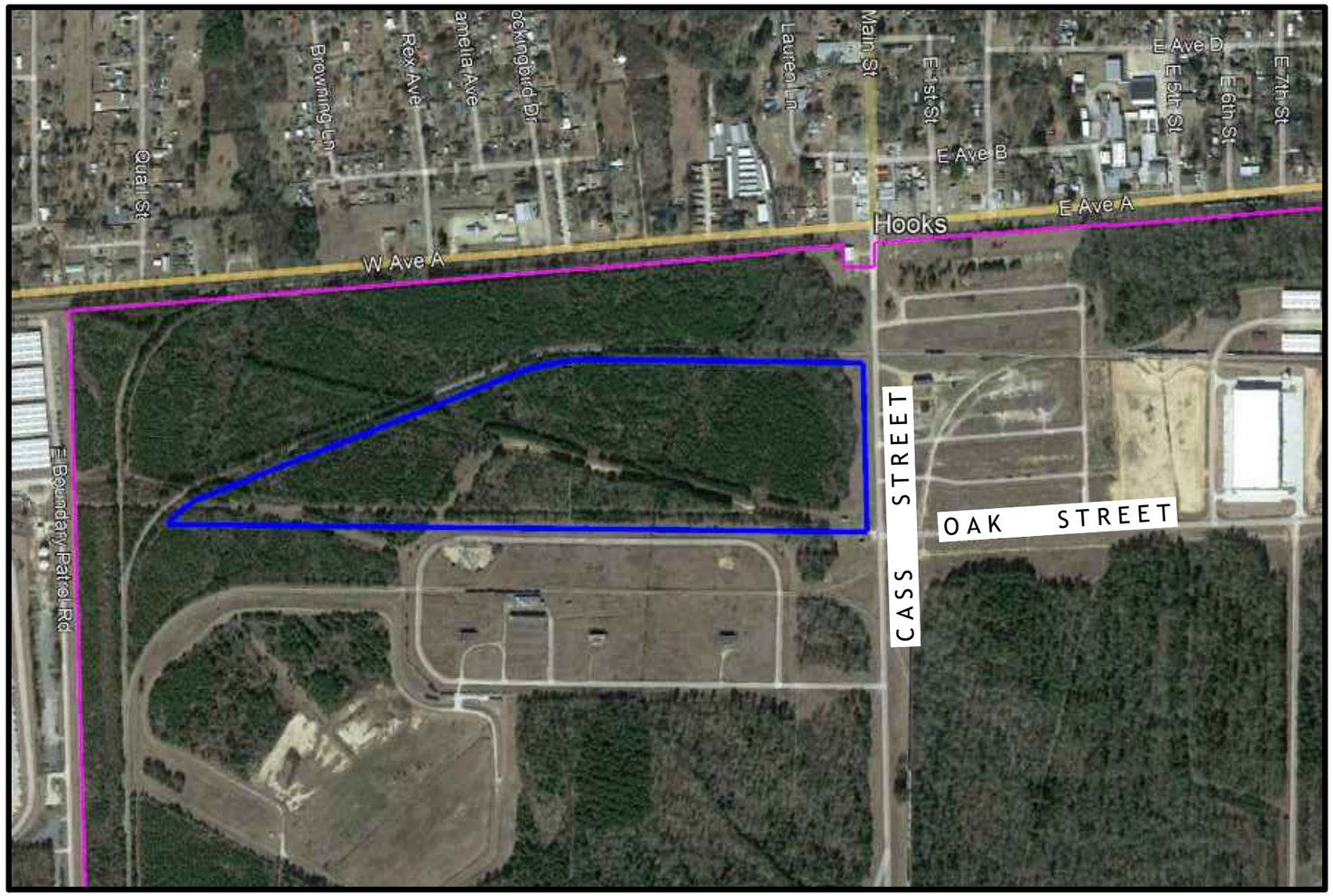
TEXAMERICAS CENTER - EAST CAMPUS

TexAmericas Center

FIGURE A-5

N

0 15 30 60 90



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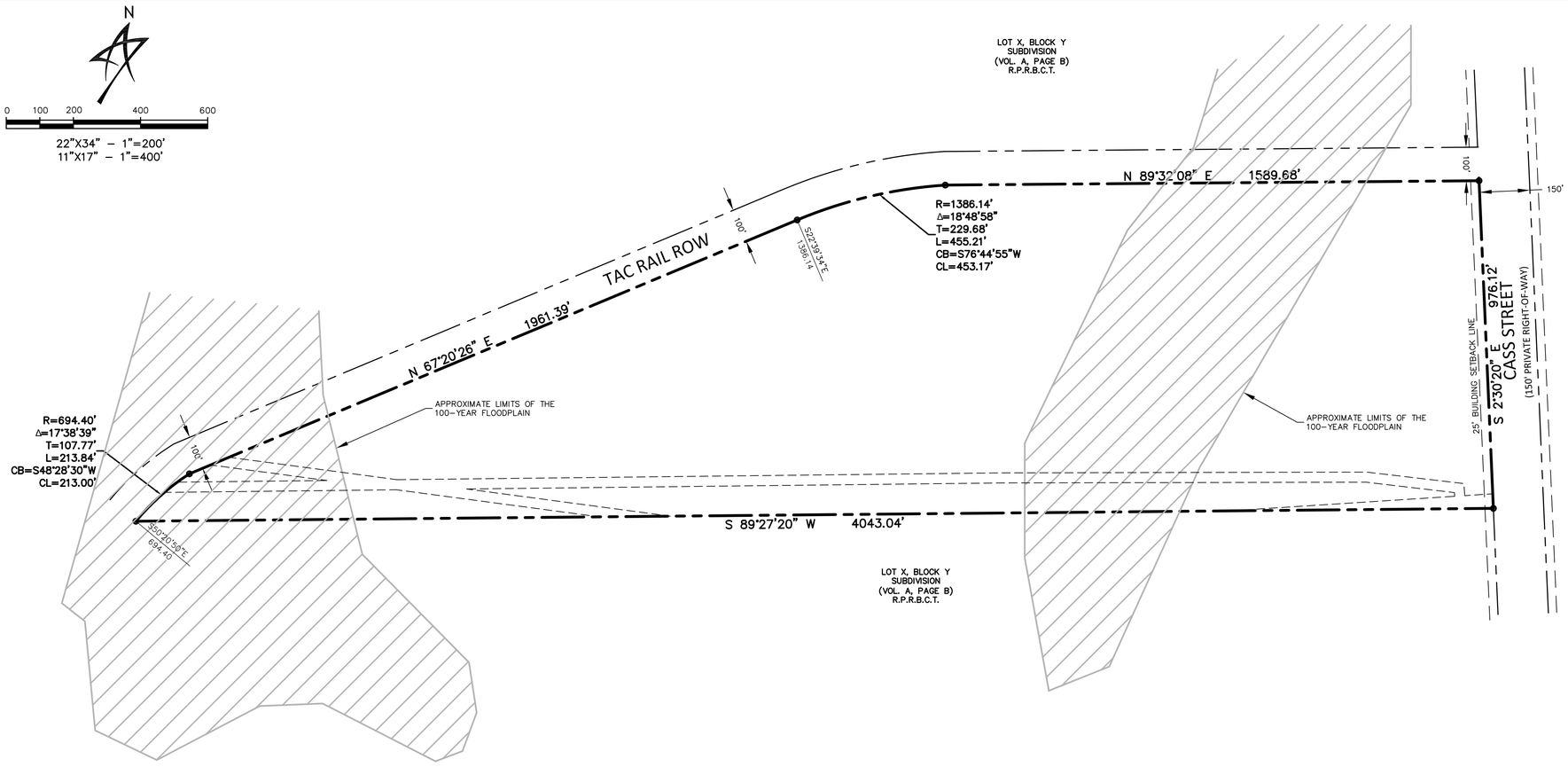
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

ALAMO TRACT - TAC EAST CAMPUS

TexAmericas Center

FIGURE A-6



LEGAL DESCRIPTION
DESCRIPTION, of a ***.** acre tract of land situated in the George Collom Headright Survey, Abstract No. 119, Bowie County Texas; Said tract being a portion of a tract of land conveyed from the United States of Americas to Red River Redevelopment Authority in a Deed without Warranty Recorded in Volume 5898, Page 1 of the Real Property Records of Bowie County, Texas; Said 67.075 acre tract being more completely described as follows:

BEGINNING, at the southeast corner of said 67.075 acre tract; Said point also being in the west right-of-way line of Cass Street (a 150 foot wide right-of-way);

THENCE, South 89 degrees, 27 minutes, 20 seconds West, departing the said west line of Cass Street, a distance of 4,034.04 feet to the southwest corner of said 67.075 acre tract and being in the east line of TAC Rail (a 100 foot wide right-of-way); said point also being at the beginning of a circular curve to the right whose center bears South 50 degrees, 20 minutes, 50 seconds East a distance of 694.40 feet from said point;

THENCE, in a northeasterly direction, along the east line of said TAC Rail ROW and the west line of said 67.075 acre tract and along said curve to the right, through a central angle of 17 degrees, 38 minutes, 39 seconds, an arc distance of 213.84 feet to the end of said curve;

THENCE, North 67 degrees, 20 minutes, 26 seconds East, continuing along the said east line of the TAC RAIL ROW and the west line of said 67.075 acre tract, a distance of 1,961.39 feet to the beginning of a circular curve to the right whose center bears South 22 degrees, 39 minutes, 34 seconds East, a distance of 1,386.14 feet from said point;

THENCE, in an easterly direction, continuing along the south line of said TAC RAIL ROW and along the north line of said 67.075 acre tract, through a central angle of 18 degrees, 48 minutes, 58 seconds, an arc distance of 455.21 feet the the end of said curve;

THENCE, North 89 degrees, 32 minutes, 8 seconds East, continuing along the south line of said TAC RAIL ROW and the north line of said 67.075 acre tract, a distance of 1,589.68 feet to the northeast corner of said 67.075 acre tract; said point also being in the west line of said Cass Street;

THENCE, South 2 degrees, 30 minutes, 20 seconds East, along the east line of said 67.075 acre tract and the west line of said Cass Street, a distance of 976.12 feet to the POINT OF BEGINNING;

CONTAINING 2,921,796.41 square feet or 67.075 acres of land, more or less.

According to the National Flood Insurance Program Flood Insurance Rate Map, Community Panel No. 48037C0310D, effective date October 19, 2010, portions of the herein described tract of land appears to be situated in 'Zone X - Unshaded' and 'Zone A - Shaded'. These area are defined as follows:

Zone X - Unshaded - Areas determined to be outside the 0.2% annual chance floodplain (500-year flood).

Zone A - Shaded - Special Flood Hazard Areas (SFHA) subject to inundation by the 1% annual chance flood (100-year flood, aka base flood) - No Base Flood Elevation Determined

BOUNDARY EXHIBIT
ALAMO TRACT
CASS STREET & OAK STREET
TEXAMERICAS CENTER EAST CAMPUS
GEORGE COLLOM HEADRIGHT SURVEY,
ABSTRACT No. 119, BOWIE COUNTY, TEXAS

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

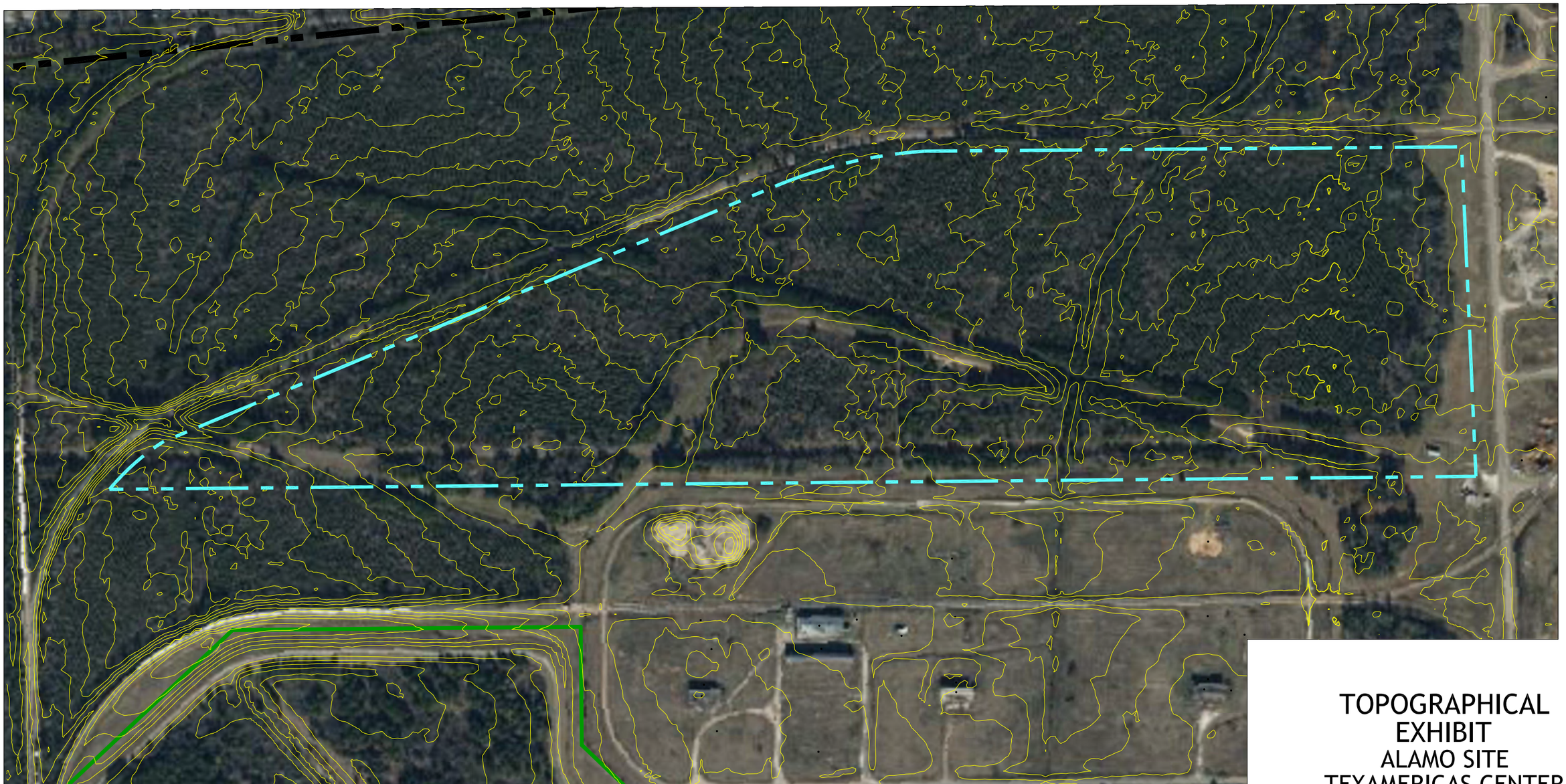
DRAWN: ***	DESIGN: ***	DATE: 10/17/2022	SCALE: ***	JOB #:

FIGURE A-7

N

0 150 300 600 900

11”X17” – 1”=300’



TOPOGRAPHICAL EXHIBIT
ALAMO SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

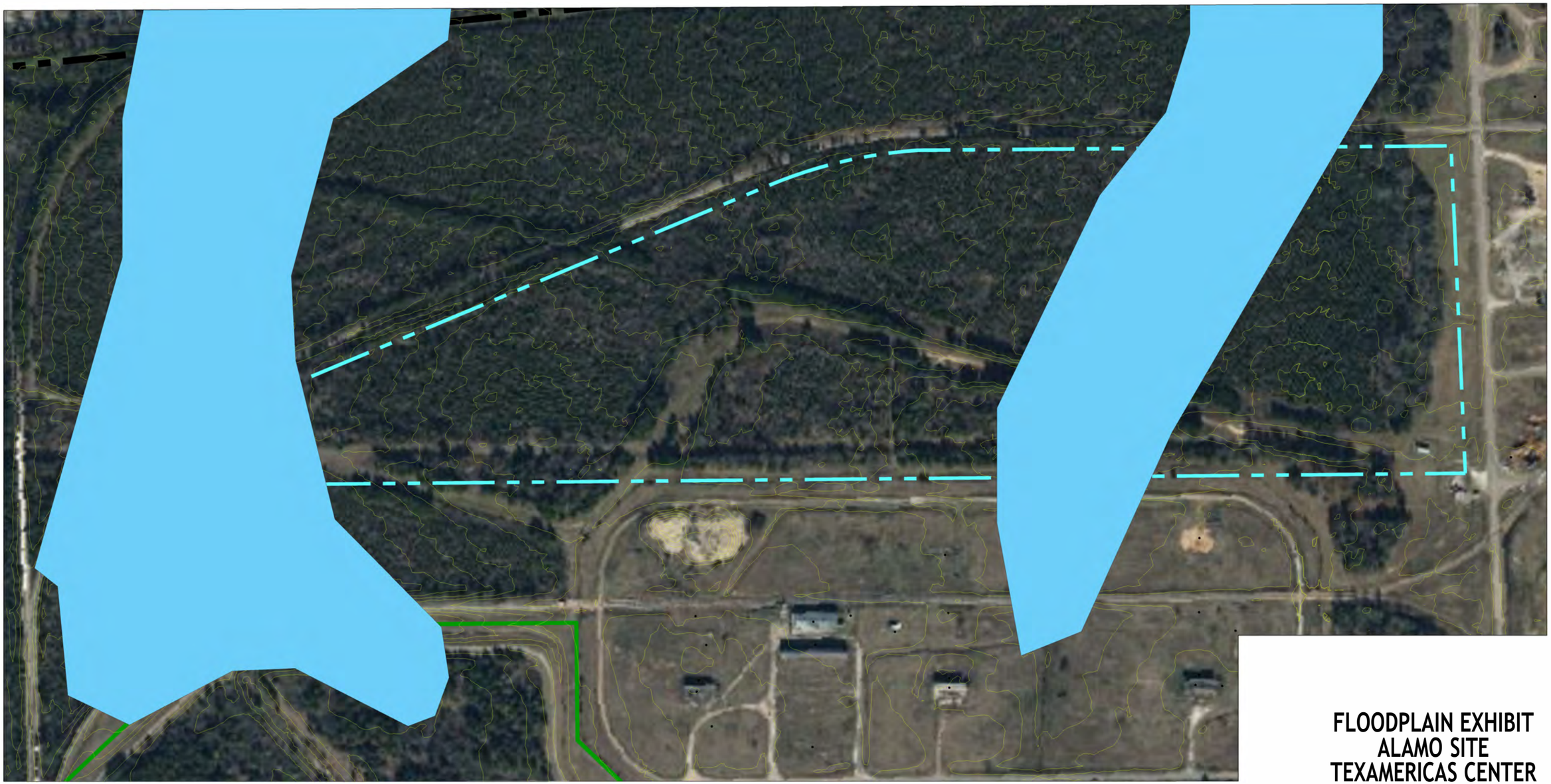
DRAWN: ***	DESIGN: ***	DATE: 10/17/2022	SCALE: ***	JOB #:

FIGURE A-8a

N

0 150 300 600 900

11”X17” – 1”=300’



According to the National Flood Insurance Program Flood Insurance Rate Map, Community Panel No. 48037C0310D, effective date October 19, 2010, portions of the herein described tract of land appears to be situated in 'Zone X - Unshaded' and 'Zone A - Shaded'. These area are defined as follows:

Zone X - Unshaded - Areas determined to be outside the 0.2% annual chance floodplain (500-year flood).

Zone A - Shaded - Special Flood Hazard Areas (SFHA) subject to inundation by the 1% annual chance flood (100-year flood, aka base flood) - No Base Flood Elevation Determined

FLOODPLAIN EXHIBIT
ALAMO SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

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903.223.9841
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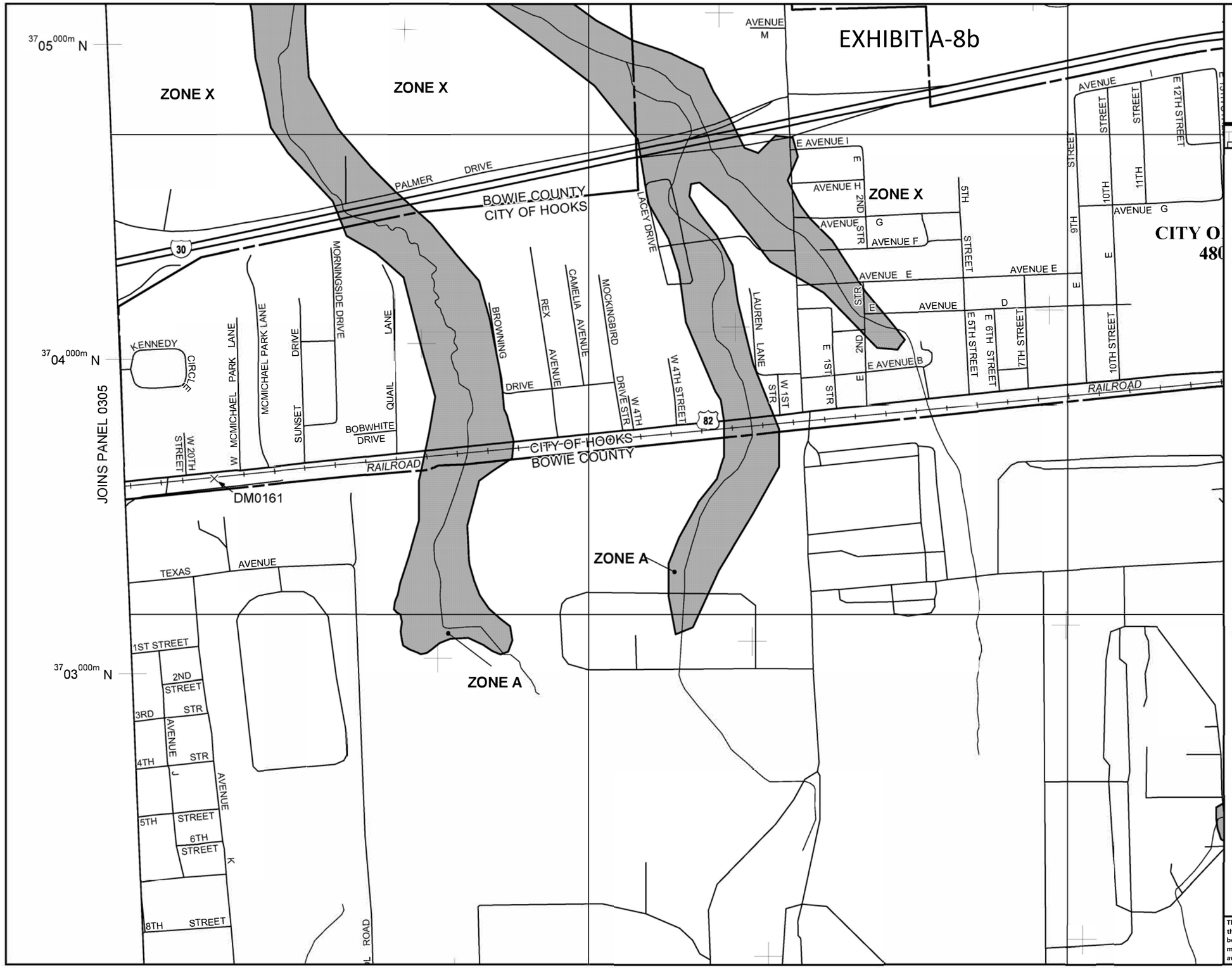
TexAmericas CENTER
Texarkana USA

DRAWN: ***	DESIGN: ***	DATE: 10/17/2022	SCALE: ***	JOB #:

EXHIBIT A-8b



MAP SCALE 1" = 1000'

500 0 1000 2000 FEE

300 0 300 60

PANEL 0310D

FIRM

FLOOD INSURANCE RATE MAP

BOWIE COUNTY, TEXAS AND INCORPORATED AREAS

PANEL 310 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOWIE COUNTY	481194	0310	D
HOOKS,CITY OF	480056	0310	D

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
48037C0310D

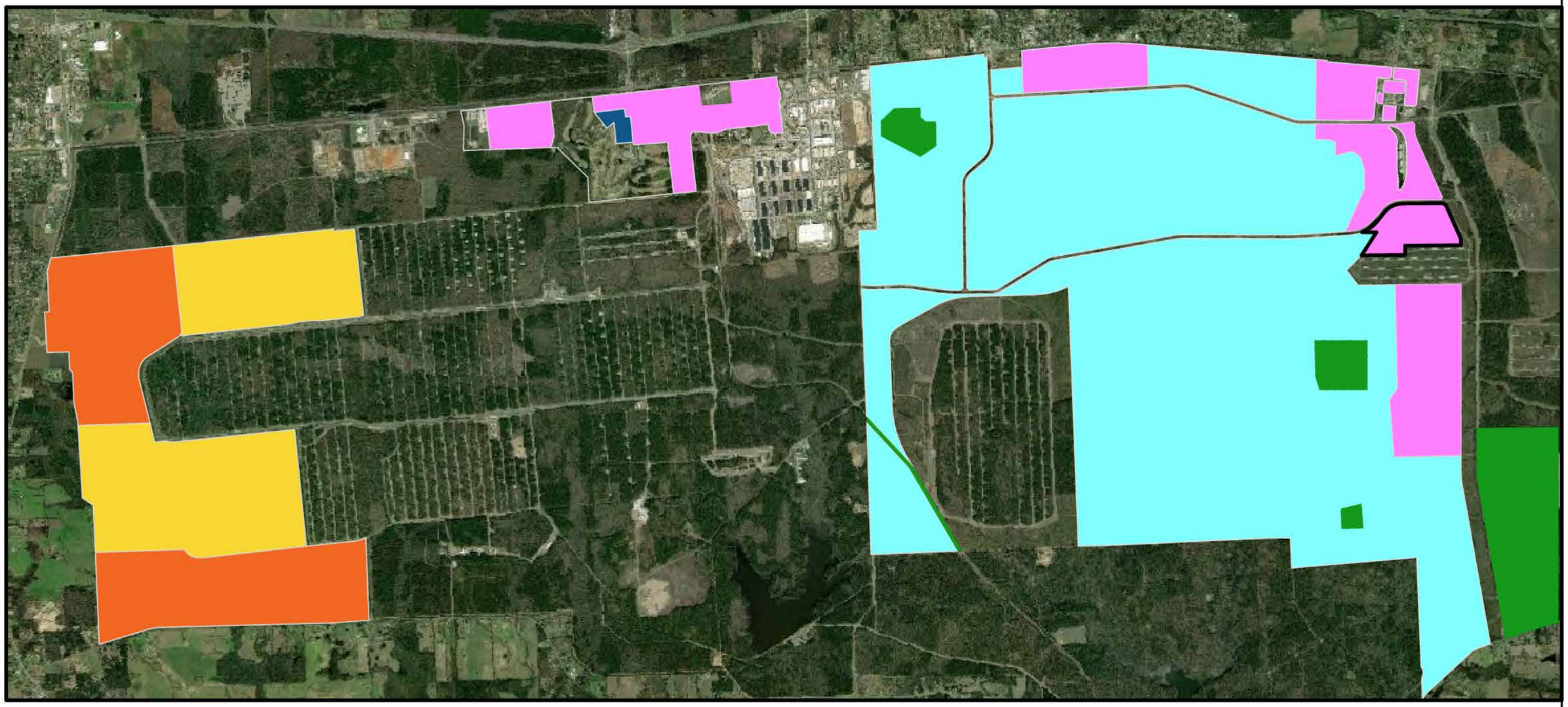
EFFECTIVE DATE
OCTOBER 19, 2010

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FIGURE A-9

N



TECHNOLOGY DISTRICT 1 (T1)
TECHNOLOGY DISTRICT 2 (T2)
RESIDENTIAL DISTRICT (R)
LIGHT INDUSTRIAL DISTRICT (LI)
HEAVY INDUSTRIAL DISTRICT (HI)
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LAND USE MAP

SHEET NO: LUM

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APPENDIX B

Component Text Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the selected area. The component descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit. A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the associated soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas (components) for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The "Map Unit Component Nontechnical Descriptions" report gives a brief, general description of the soil components that occur in a map unit. Descriptions of nonsoil (miscellaneous areas) and minor map unit components may or may not be included. This description is written by the local soil scientists responsible for the respective soil survey area data. A more detailed description can be generated by the "Map Unit Description" report.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Component Text Descriptions

Bowie County, Texas

Map Unit: 1—Adaton-Muskogee complex

Description Category: ES

Adaton: 70 percent

F133BY001TX - Depression Ecological Site Concept Depressions occur on isolated flats of upland and terraces. Their drainage patterns are poor and result in long periods of water retention. Their vegetation more closely resembles bottomlands as opposed to the surrounding uplands. Soil Features The soils consist of very deep, poorly drained, slowly permeable soils. Most of the soils are classified as typic glossaqualfs, but other classifications exist. Soils correlated to this ecological site include: Adaton, Ashford, Catuna, Derly, Goreen, Guyton, Leagueville, Leggett, Merryville, Mollville, Percilla, and Talco. Reference Community Species that can stand excess wetness are found on these sites. Thickets of green ash and mayhaw (Crataegus opaca) are common, oftentimes limiting the growth of the understory grass and forb layer. Other species in the shrub layer include: carolina ash (Fraxinus carolina), common persimmon (Diospyros virginiana), and bottomland post oak (Quercus similis). Ground layer species include: inland sea oats (Chasmanthium latifolium), switchcane (Arundinaria gigantea), sedges (Carex sp.), and rushes (Juncus sp.). Reference Plants List No reference plants list is available. MLRA - 133B Legacy Ecosite ID - F133BY001TX

Description Category: GENSOIL

Adaton: 70 percent

The Adaton component makes up 70 percent of the map unit. Slopes are 0 to 1 percent. This component is on stream terraces on coastal plains. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 3 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. This component is in the F133BY001TX Depression ecological site. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Description Category: ES

Muskogee: 20 percent

F133BY013TX - Terrace Ecological Site Concept The Terrace ecological site has very deep soils on terrace landforms. These sites are located on a higher landform than bottomlands and are not as wet. The sites are situated on a lower landform than the uplands and are not as dry. The sites do not flood or pond. This unique position between the drier uplands and wetter bottomlands creates their plant community. Soil Features Alazan, Attoyac, and Bernaldo are representative soils of the Terraces. The Terraces can have a wide range of textures and depths. The grouping factor is, all are located on the terrace landform position. Besides the previously listed soils, these are correlated as well: Addielou, Annona, Austonio, Bearhead, Besner, Bistineau, Cadeville, Cart, Chireno, Eastham, Elysian, Erno, Forbing, Freestone, Gallime, Garner, Glenmora, Hallsbluff, Keiffer, Landman, Latch, Mckamie, Moten, Multey, Raino, Shatta, Spurger, Timpson, Vesey, Waskom, and Woden. Reference Community Terrace sites are highly variable in their overstory composition. While white oak and loblolly pine are the dominant species, the overstory frequently has southern red oak, (Quercus falcata), sweetgum (Liquidambar styraciflua), and shortleaf pine (Pinus echinata) intermingled. Longleaf pine (Pinus palustris) may occur in the southern portions of the region. White oaks and/or loblolly pine may make up 75 percent of the overstory at any given time. The other hardwood and pine species make up the rest of the overstory. Shrubs are an important component in the ecological site. American beautyberry, yaupon, and possumhaw are dominant. Sassafras (Sassafras albidum), parsley hawthorn (Crataegus marshalii), and farkleberry (Vaccinium arboreum) are common, but seen in lesser densities. The shrub-layer height and densities fluctuate with time since the last fire. Fire prunes their growth back and allows the understory grasses and forbs to stay diverse and abundant. The shrub layer is the main driver between communities 1.1 and 1.2. As the shrubs begin to grow above 4.5 feet and become more dense, the community moves along the pathway from 1.1 to 1.2. The infrequency of fire causes an accumulation of litter throughout the sites and bare ground is uncommon. The most dominant gramanoids are longleaf woodoats, slender woodoats (Chasmanthium laxum), and cypress swamp sedge (Carex joorii). The micro-lows are often colonized by broomsedge bluestem (Andropogon virginicus). Partridgeberry and Carolina elephanstfoot (Elephantopus carolinianus) are highly associated to the site. Reference Plants List white oak, loblolly pine, southern red oak, sweetgum, shortleaf pine, white ash, longleaf pine, blackgum, longleaf woodoats, giant cane, broomsedge bluestem, variable panicgrass, slender woodoats, cypress swamp sedge, eastern poison ivy, partridgeberry, St. Andrew's cross, Carolina elephantsfoot, Missouri violet, slender yellow woodsorrel, ebony spleenwort, resurrection fern, American beautyberry, possumhaw, yaupon, sassafras, muscadine, parsley hawthorn, farkleberry, wax myrtle, American hornbeam, southern arrowwood, sweetgum, white oak, loblolly pine, common persimmon, American holly, blackgum, bitternut hickory, greenbrier, Virginia creeper, Alabama supplejack, crossvine, climbing dogbane MLRA - 133B Legacy Ecosite ID - F133BY013TX

Description Category: GENSOIL

Muskogee: 20 percent

The Muskogee component makes up 20 percent of the map unit. Slopes are 0 to 1 percent. This component is on mounds on stream terraces on coastal plains. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April. Organic matter content in the surface horizon is about 3 percent. This component is in the F133BY013TX Terrace ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Description Category: ES

Wrightsville: 10 percent

F133BY012TX - Wet Terrace Ecological Site Concept The Wet Terrace site has very deep soils on terrace landforms. They are positioned higher than bottomlands and lower that uplands. This landscape position coupled with their slowly permeable, poorly drained soils form their unique plant community. Soil Features The ecological site consist of very deep, poorly drained, very slowly permeable soils formed in silty and clayey alluvium. Soils correlated to this ecological site include: Bodcau, Dubach, Frizzell, Gurdon, Haggerty, Kildare, Mollicy, Muldrow, Rodessa, Thage, Vick, Weston, Wrightsville, and Zenoria. Reference Community Dense shrub layers can be common on the Wet Terraces. Species of flowering dogwood (Cornus florida), green ash, American hornbeam (Carpinus caroliniana), American beautyberry (Callicarpa Americana), winged elm (Ulmus alata), American holly (Ilex opaca), and rusty blackhaw (Viburnum rufidulum). A wide variety of grasses and forbs may be common if the overstory and shrub layer are not restricting light to the understory. Longleaf woodoats (Chasmanthium sessiliflorum), hairy bedstraw (Galium pilosum), greenbriers (Smilax sp.), various sedges (Carex sp.), and rushes (Juncus sp.) Reference Plants List No reference plants list is available. MLRA - 133B Legacy Ecosite ID - F133BY012TX

Description Category: GENSOIL

Wrightsville: 10 percent

Generated brief soil descriptions are created for major soil components. The Wrightsville soil is a minor component.

Map Unit: 4—Annona loam, 1 to 3 percent slopes

Description Category: ES

Annona: 85 percent

R087BY002TX - Claypan Savannah Ecological Site Concept The Claypan Savannah ecological site is characterized by a fine sandy loam or loam surface soil underlain by a dense clay subsoil. This is also the typifying site to which the MLRA derived it's name. The clay subsoil impacts water movement through the soil, which often perches water. Soil Features The soils are deep to very deep and have fine sandy loam or loamy surfaces over dense clay subsoils. The topsoil ranges from 6 to 15 inches deep but averages less than 10 inches. The surface soil takes in water readily but the clay subsoil is very slowly permeable and restricts air movement and root growth. The very slow permeability and shallow topsoil cause the site to be wet in the winter, slow to warm in the spring, and droughty during the growing season. Low to moderate fertility somewhat limits production on this site. Under good management where herbaceous cover and litter are maintained, rills, gullies, pedestals, and soil compaction layers are not present on the site. Soils correlated to this site include: Annona, Lufkin, Raino, and Woodtell. Reference Community The interpretive plant community of this site is the reference plant community. This site is a fire-climax savannah of post oak and blackjack oak trees that shade 15 to 20 percent of the ground. The herbaceous component is tall and midgrasses dominated by little bluestem, Indiangrass, and brownseed paspalum (Paspalum plicatulum), which usually make up 50 to 75 percent of the total annual yield. Purpletop tridens (Tridens flavus), Florida paspalum (Paspalum floridanum), switchgrass, tall dropseed (Sporobolus compositus), and thin paspalum (Paspalum setaceum) also occur. Cool-season forage plants occurring on this site include Canada wildrye (Elymus canadensis), Engelmann's daisy, and sedges (Carex spp.). A variety of shrubs, vines, and forbs occur in this community. Grazing prescriptions that permit acceptable grazing periods and allow adequate rest periods with prescribed fire every three to five years are important in the maintenance of the herbaceous plant community and the savannah landscape structure. Continuous overgrazing or over rest and the absence of fire tend to allow a vegetative shift towards woody species such as eastern persimmon, eastern red cedar, and winged elm. Without corrective measures, this shift will continue to the Shrubland State. Reference Plants List No reference plants list is available. MLRA - 087B Legacy Ecosite ID - R087BY002TX

Description Category: GENSOIL

Annona: 85 percent

The Annona component makes up 85 percent of the map unit. Slopes are 1 to 3 percent. This component is on stream terraces on coastal plains. The parent material consists of clayey alluvium of Quaternary aged derived from mixed sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R087BY002TX Claypan Savannah ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Description Category: ES

Sawyer: 5 percent

F133BY005TX - Loamy Upland Ecological Site Concept The Loamy Uplands have very deep loamy soils greater than 80 inches. The ecological sites produce high amounts of plant biomass because of the loamy growing medium with nonrestrictive soil textures through the soil profiles with adequate water-holding capacity. The sites generally have the most robust plant communities of any adjacent sites. Soil Features The soils of this site are deep and characterized by loams throughout the soil profile, measured to 80 inches. The soils belong to the alfisol and ultisol orders and have well developed horizons. The Bowie series is a representative soil and consists of very deep, well drained, moderately slowly permeable soils that formed in loamy residuum from Southern Coastal Plain marine deposits. The series is classified as a fine-loamy, siliceous, semiactive, thermic Plinthic Paleudult. Not all soils within the ecological site will have the same taxonomic classification, but produce similar vegetative communities. Other soils are included within the ecological site and all are defined by deep fine-loamy and fine-silty control sections. The soils included are well drained or moderately well drained. Soils that are moderately well drained have a general increase in clay in the lower horizons. Besides the Bowie series, the Alto, Beauregard, Blevins, Diboll, Elrose, Eylau, Fuller, Gunter, Keatchie, Keithville, Kullit, Latex, Oakwood, Olla, Penning, Rigolette, Rogan, Ruston, Saffell, Sailes, Sawlit, Sawtown, Sawyer, Scottsville, Smithdale, Ulto, and Warnock are correlated to the Loamy Uplands. Reference Community The Shortleaf Pine/Red Oak Woodland (1.1) is the first community in State 1. Litter accumulation is moderate and understory vegetation is naturally dense. The overstory canopy is dominated by shortleaf pine and red oaks, and are usually in higher densities (total basal area) than the adjacently surrounding upland sites. The overstory canopy can also be interspersed with post oak (Quercus stellata), blackjack oak (Quercus marilandica), white oak (Quercus alba), and black hickory (Carya texana). The sites can be dominated by shortleaf pines, 100 percent canopy cover, but range as low as 60 percent with the oak and hickories comprising the rest of the overstory. Given time to mature, the sites produce tall, straight overstory pines which can reach heights above 100 feet. This community is characterized by a dense ground layer with relatively no bare ground (less than 5 percent). Needleleaf rosette grass (Dichanthelium aciculare) is a highly abundant grass throughout the herbaceous understory. Other grasses seen, though not as dominant are longleaf woodoats (Chasmanthium sessiliflorum), variable panicgrass (Dichanthelium commutatum), and little bluestem (Schizachyrium scoparium). Forbs occupying the site include flowering spurge (Euphorbia corollata), hairy small-leaf ticktrefoil (Desmodium ciliare), and downy milkpea (Galactia volubilis). The shrub layer of the community is very conspicuous, containing numerous American beautyberry (Callicarpa americana) and yaupon (Ilex vomitoria). Reference Plants List shortleaf pine, southern red oak, blackjack oak, post oak, black hickory, needleleaf rosette grass, variable panicgrass, little bluestem, longleaf woodoats, eastern poison ivy, dogfennel, flowering spurge, Nuttall's wild indigo, St. Andrew's cross, hairy small-leaf ticktrefoil, slender yellow woodsorrel, whitemouth dayflower, downy milkpea, nettleleaf noseburn, western brackenfern, American beautyberry, yaupon, sawtooth blackberry, parsley hawthorn, farkleberry, rusty blackhaw, summer grape, Virginia creeper, saw greenbrier, cat greenbrier, laurel greenbrier MLRA - 133B Legacy Ecosite ID - F133BY005TX

Description Category: ES

Alusa: 5 percent

F133BY002TX - Seasonally Wet Upland Ecological Site Concept The Seasonally Wet Upland site is unique by its upland position on the landscape, while also having a seasonally high water table. Clay soils in the subhorizons cause water to stay in the profile for long periods of time, especially from November to May. Not only does the water table affect the plants, but many of the soils are shallow with their depth to bedrock as low as 16 inches. Soil Features The soils consist of shallow to very deep, somewhat poorly to poorly drained soils formed from mudstone residuum. The representative soils are: Alusa, Anacoco, Browndell, Colita, Corrigan, Elmina, Felker, Fetzer, Gomery, Kolin, Libuse, Lummus, Metcalf, Tiak, and Wiergate. They are widely varying taxonomically, from alfisols to ultisols to vertisols. Their unifying factor is their upland position with a fluctuating water table. Many of the soils have restrictions to bedrock, classifying them as shallow. Reference Community The varying degree of water availability and root restriction cause the understory sites to be highly variable. Common understory species include: longleaf woodoats (Chasmanthium sessiliflorum), sedges (Carex sp.), partridgeberry (Mitchella repens), and Texas ironweed (Vernonia texana). Common shrub species include: American beautyberry (Callicarpa americana), parsley hawthorn (Crataegus marshallii), and yaupon (Ilex vomitoria). Reference Plants List No reference plants list is available. MLRA - 133B Legacy Ecosite ID - F133BY002TX

Description Category: ES

Adaton: 5 percent

F133BY001TX - Depression Ecological Site Concept Depressions occur on isolated flats of upland and terraces. Their drainage patterns are poor and result in long periods of water retention. Their vegetation more closely resembles bottomlands as opposed to the surrounding uplands. Soil Features The soils consist of very deep, poorly drained, slowly permeable soils. Most of the soils are classified as typic glossaqualfs, but other classifications exist. Soils correlated to this ecological site include: Adaton, Ashford, Catuna, Derly, Goreen, Guyton, Leagueville, Leggett, Merryville, Mollville, Percilla, and Talco. Reference Community Species that can stand excess wetness are found on these sites. Thickets of green ash and mayhaw (Crataegus opaca) are common, oftentimes limiting the growth of the understory grass and forb layer. Other species in the shrub layer include: carolina ash (Fraxinus carolina), common persimmon (Diospyros virginiana), and bottomland post oak (Quercus similis). Ground layer species include: inland sea oats (Chasmanthium latifolium), switchcane (Arundinaria gigantea), sedges (Carex sp.), and rushes (Juncus sp.). Reference Plants List No reference plants list is available. MLRA - 133B Legacy Ecosite ID - F133BY001TX

Description Category: GENSOIL

Sawyer: 5 percent

Generated brief soil descriptions are created for major soil components. The Sawyer soil is a minor component.

Description Category: GENSOIL

Alusa: 5 percent

Generated brief soil descriptions are created for major soil components. The Alusa soil is a minor component.

Description Category: GENSOIL

Adaton: 5 percent

Generated brief soil descriptions are created for major soil components. The Adaton soil is a minor component.

Map Unit: 8—Blevins silt loam, 1 to 3 percent slopes

Description Category: ES

Blevins: 80 percent

F133BY005TX - Loamy Upland Ecological Site Concept The Loamy Uplands have very deep loamy soils greater than 80 inches. The ecological sites produce high amounts of plant biomass because of the loamy growing medium with nonrestrictive soil textures through the soil profiles with adequate water-holding capacity. The sites generally have the most robust plant communities of any adjacent sites. Soil Features The soils of this site are deep and characterized by loams throughout the soil profile, measured to 80 inches. The soils belong to the alfisol and ultisol orders and have well developed horizons. The Bowie series is a representative soil and consists of very deep, well drained, moderately slowly permeable soils that formed in loamy residuum from Southern Coastal Plain marine deposits. The series is classified as a fine-loamy, siliceous, semiactive, thermic Plinthic Paleudult. Not all soils within the ecological site will have the same taxonomic classification, but produce similar vegetative communities. Other soils are included within the ecological site and all are defined by deep fine-loamy and fine-silty control sections. The soils included are well drained or moderately well drained. Soils that are moderately well drained have a general increase in clay in the lower horizons. Besides the Bowie series, the Alto, Beauregard, Blevins, Diboll, Elrose, Eylau, Fuller, Gunter, Keatchie, Keithville, Kullit, Latex, Oakwood, Olla, Penning, Rigolette, Rogan, Ruston, Saffell, Sailes, Sawlit, Sawtown, Sawyer, Scottsville, Smithdale, Ulto, and Warnock are correlated to the Loamy Uplands. Reference Community The Shortleaf Pine/Red Oak Woodland (1.1) is the first community in State 1. Litter accumulation is moderate and understory vegetation is naturally dense. The overstory canopy is dominated by shortleaf pine and red oaks, and are usually in higher densities (total basal area) than the adjacently surrounding upland sites. The overstory canopy can also be interspersed with post oak (Quercus stellata), blackjack oak (Quercus marilandica), white oak (Quercus alba), and black hickory (Carya texana). The sites can be dominated by shortleaf pines, 100 percent canopy cover, but range as low as 60 percent with the oak and hickories comprising the rest of the overstory. Given time to mature, the sites produce tall, straight overstory pines which can reach heights above 100 feet. This community is characterized by a dense ground layer with relatively no bare ground (less than 5 percent). Needleleaf rosette grass (Dichanthelium aciculare) is a highly abundant grass throughout the herbaceous understory. Other grasses seen, though not as dominant are longleaf woodoats (Chasmanthium sessiliflorum), variable panicgrass (Dichanthelium commutatum), and little bluestem (Schizachyrium scoparium). Forbs occupying the site include flowering spurge (Euphorbia corollata), hairy small-leaf ticktrefoil (Desmodium ciliare), and downy milkpea (Galactia volubilis). The shrub layer of the community is very conspicuous, containing numerous American beautyberry (Callicarpa americana) and yaupon (Ilex vomitoria). Reference Plants List shortleaf pine, southern red oak, blackjack oak, post oak, black hickory, needleleaf rosette grass, variable panicgrass, little bluestem, longleaf woodoats, eastern poison ivy, dogfennel, flowering spurge, Nuttall's wild indigo, St. Andrew's cross, hairy small-leaf ticktrefoil, slender yellow woodsorrel, whitemouth dayflower, downy milkpea, nettleleaf noseburn, western brackenfern, American beautyberry, yaupon, sawtooth blackberry, parsley hawthorn, farkleberry, rusty blackhaw, summer grape, Virginia creeper, saw greenbrier, cat greenbrier, laurel greenbrier MLRA - 133B Legacy Ecosite ID - F133BY005TX

Description Category: GENSOIL

Blevins: 80 percent

The Blevins component makes up 80 percent of the map unit. Slopes are 1 to 3 percent. This component is on interfluves on coastal plains. The parent material consists of loamy residuum weathered from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the F133BY005TX Loamy Upland ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Description Category: ES

Sawyer: 10 percent

F133BY005TX - Loamy Upland Ecological Site Concept The Loamy Uplands have very deep loamy soils greater than 80 inches. The ecological sites produce high amounts of plant biomass because of the loamy growing medium with nonrestrictive soil textures through the soil profiles with adequate water-holding capacity. The sites generally have the most robust plant communities of any adjacent sites. Soil Features The soils of this site are deep and characterized by loams throughout the soil profile, measured to 80 inches. The soils belong to the alfisol and ultisol orders and have well developed horizons. The Bowie series is a representative soil and consists of very deep, well drained, moderately slowly permeable soils that formed in loamy residuum from Southern Coastal Plain marine deposits. The series is classified as a fine-loamy, siliceous, semiactive, thermic Plinthic Paleudult. Not all soils within the ecological site will have the same taxonomic classification, but produce similar vegetative communities. Other soils are included within the ecological site and all are defined by deep fine-loamy and fine-silty control sections. The soils included are well drained or moderately well drained. Soils that are moderately well drained have a general increase in clay in the lower horizons. Besides the Bowie series, the Alto, Beauregard, Blevins, Diboll, Elrose, Eylau, Fuller, Gunter, Keatchie, Keithville, Kullit, Latex, Oakwood, Olla, Penning, Rigolette, Rogan, Ruston, Saffell, Sailes, Sawlit, Sawtown, Sawyer, Scottsville, Smithdale, Ulto, and Warnock are correlated to the Loamy Uplands. Reference Community The Shortleaf Pine/Red Oak Woodland (1.1) is the first community in State 1. Litter accumulation is moderate and understory vegetation is naturally dense. The overstory canopy is dominated by shortleaf pine and red oaks, and are usually in higher densities (total basal area) than the adjacently surrounding upland sites. The overstory canopy can also be interspersed with post oak (Quercus stellata), blackjack oak (Quercus marilandica), white oak (Quercus alba), and black hickory (Carya texana). The sites can be dominated by shortleaf pines, 100 percent canopy cover, but range as low as 60 percent with the oak and hickories comprising the rest of the overstory. Given time to mature, the sites produce tall, straight overstory pines which can reach heights above 100 feet. This community is characterized by a dense ground layer with relatively no bare ground (less than 5 percent). Needleleaf rosette grass (Dichanthelium aciculare) is a highly abundant grass throughout the herbaceous understory. Other grasses seen, though not as dominant are longleaf woodoats (Chasmanthium sessiliflorum), variable panicgrass (Dichanthelium commutatum), and little bluestem (Schizachyrium scoparium). Forbs occupying the site include flowering spurge (Euphorbia corollata), hairy small-leaf ticktrefoil (Desmodium ciliare), and downy milkpea (Galactia volubilis). The shrub layer of the community is very conspicuous, containing numerous American beautyberry (Callicarpa americana) and yaupon (Ilex vomitoria). Reference Plants List shortleaf pine, southern red oak, blackjack oak, post oak, black hickory, needleleaf rosette grass, variable panicgrass, little bluestem, longleaf woodoats, eastern poison ivy, dogfennel, flowering spurge, Nuttall's wild indigo, St. Andrew's cross, hairy small-leaf ticktrefoil, slender yellow woodsorrel, whitemouth dayflower, downy milkpea, nettleleaf noseburn, western brackenfern, American beautyberry, yaupon, sawtooth blackberry, parsley hawthorn, farkleberry, rusty blackhaw, summer grape, Virginia creeper, saw greenbrier, cat greenbrier, laurel greenbrier MLRA - 133B Legacy Ecosite ID - F133BY005TX

Description Category: ES

Rosalie: 10 percent

F133BY006TX - Northern Sandy Loam Upland Ecological Site Concept The Northern Sandy Loam Uplands site has a sandy or loamy surface soil with a gradual increase in clay through the subsurface horizons. The gradual increase in clay content aids in moisture retention, allowing the formation of a well-developed vegetative community. The ecological site has more biomass development than the deep sandy uplands, sometimes located adjacently upslope, and a more open canopy than the adjacent clayey uplands, located downslope. Soil Features The soils of this site are deep and characterized by sands through the A and E profiles. The Bt layer is generally a sandy clay loam occurring between 20 and 40 inches continuing through the lower profiles of the soil. The Briley series is a representative soil and consists of very deep, well drained, moderately permeable soils that formed in sandy and loamy Coastal Plain sediments. The series is classified as a loamy, siliceous, semiactive, thermic Arenic Paleudult. Other soils are included within the ecological site and all are defined by their upper horizons of sands and presence of an argillic between 20 and 40 inches. Besides the Briley series, Darbonne, Larue, Lilbert, Rentzel, Rosalie, Tenaha, Trep, and Wolfpen are correlated to the ecological site. Reference Community Shortleaf pine trees comprise the majority of the overstory. The occurrence in the overstory on any given site is between 75 to 100 percent. Blackjack and post oaks have established on some sites, comprising up to 20 percent of the overall canopy structure. Farkleberry, winged sumac (Rhus copallinum), yaupon (Ilex vomitoria), sassafras (Sassafras albidium), and oak saplings are common in the mid-story layer, increasing in abundance with time since last fire. Both communities are characterized by a diverse ground layer with sometimes large accumulations of plant litter, 15 to 45 percent. Little bluestem and needleleaf rosette grass (Dichanthelium aciculare) are the most abundant grasses seen in the two communities, at times seemingly dominating the entire area. Indicator forbs include Virginia tephrosia (Tephrosia virginiana), St. Andrew's cross (Hypericum hypericoides), Nuttall's wild indigo (Baptistia nuttalliana), and Atlanta pigeonwings (Clitoria mariana). Reference Plants List shortleaf pine, blackjack oak, post oak, southern red oak, black hickory, bluejack oak, little bluestem, needleleaf rosette grass, variable panicgrass, splitbeard bluestem, switchgrass, eastern poison ivy, Texas bullnettle, whitemouth dayflower, shiny goldenrod, Louisiana nerveray, St. Andrew's cross, Nuttall's wild indigo, Atlantic pigeonwings, New Jersey tea, nettleleaf noseburn, Gulf Coast yucca, butterfly milkweed, spotted beebalm, sidebeak pencilflower, sessileleaf ticktrefoil, western brackenfern, American beautyberry, yaupon, sassafras, winged sumac, farkleberry, smallflower pawpaw, blackjack oak, black hickory, post oak, eastern redcedar, shortleaf pine, bluejack oak, summer grape, Virginia creeper, cat greenbrier, muscadine MLRA - 133B Legacy Ecosite ID - F133BY006TX

Description Category: GENSOIL

Rosalie: 10 percent

Generated brief soil descriptions are created for major soil components. The Rosalie soil is a minor component.

Description Category: GENSOIL

Sawyer: 10 percent

Generated brief soil descriptions are created for major soil components. The Sawyer soil is a minor component.

Map Unit: 36—Sawyer silt loam, 0 to 3 percent slopes

Description Category: ES

Sawyer, affr 25-30: 80 percent

F133BY005TX - Loamy Upland Ecological Site Concept The Loamy Uplands have very deep loamy soils greater than 80 inches. The ecological sites produce high amounts of plant biomass because of the loamy growing medium with nonrestrictive soil textures through the soil profiles with adequate water-holding capacity. The sites generally have the most robust plant communities of any adjacent sites. Soil Features The soils of this site are deep and characterized by loams throughout the soil profile, measured to 80 inches. The soils belong to the alfisol and ultisol orders and have well developed horizons. The Bowie series is a representative soil and consists of very deep, well drained, moderately slowly permeable soils that formed in loamy residuum from Southern Coastal Plain marine deposits. The series is classified as a fine-loamy, siliceous, semiactive, thermic Plinthic Paleudult. Not all soils within the ecological site will have the same taxonomic classification, but produce similar vegetative communities. Other soils are included within the ecological site and all are defined by deep fine-loamy and fine-silty control sections. The soils included are well drained or moderately well drained. Soils that are moderately well drained have a general increase in clay in the lower horizons. Besides the Bowie series, the Alto, Beauregard, Blevins, Diboll, Elrose, Eylau, Fuller, Gunter, Keatchie, Keithville, Kullit, Latex, Oakwood, Olla, Penning, Rigolette, Rogan, Ruston, Saffell, Sailes, Sawlit, Sawtown, Sawyer, Scottsville, Smithdale, Ulto, and Warnock are correlated to the Loamy Uplands. Reference Community The Shortleaf Pine/Red Oak Woodland (1.1) is the first community in State 1. Litter accumulation is moderate and understory vegetation is naturally dense. The overstory canopy is dominated by shortleaf pine and red oaks, and are usually in higher densities (total basal area) than the adjacently surrounding upland sites. The overstory canopy can also be interspersed with post oak (Quercus stellata), blackjack oak (Quercus marilandica), white oak (Quercus alba), and black hickory (Carya texana). The sites can be dominated by shortleaf pines, 100 percent canopy cover, but range as low as 60 percent with the oak and hickories comprising the rest of the overstory. Given time to mature, the sites produce tall, straight overstory pines which can reach heights above 100 feet. This community is characterized by a dense ground layer with relatively no bare ground (less than 5 percent). Needleleaf rosette grass (Dichanthelium aciculare) is a highly abundant grass throughout the herbaceous understory. Other grasses seen, though not as dominant are longleaf woodoats (Chasmanthium sessiliflorum), variable panicgrass (Dichanthelium commutatum), and little bluestem (Schizachyrium scoparium). Forbs occupying the site include flowering spurge (Euphorbia corollata), hairy small-leaf ticktrefoil (Desmodium ciliare), and downy milkpea (Galactia volubilis). The shrub layer of the community is very conspicuous, containing numerous American beautyberry (Callicarpa americana) and yaupon (Ilex vomitoria). Reference Plants List shortleaf pine, southern red oak, blackjack oak, post oak, black hickory, needleleaf rosette grass, variable panicgrass, little bluestem, longleaf woodoats, eastern poison ivy, dogfennel, flowering spurge, Nuttall's wild indigo, St. Andrew's cross, hairy small-leaf ticktrefoil, slender yellow woodsorrel, whitemouth dayflower, downy milkpea, nettleleaf noseburn, western brackenfern, American beautyberry, yaupon, sawtooth blackberry, parsley hawthorn, farkleberry, rusty blackhaw, summer grape, Virginia creeper, saw greenbrier, cat greenbrier, laurel greenbrier MLRA - 133B Legacy Ecosite ID - F133BY005TX

Description Category: GENSOIL

Sawyer, affr 25-30: 80 percent

The Sawyer, AFFR 25-30 component makes up 80 percent of the map unit. Slopes are 1 to 3 percent. This component is on marine terraces on coastal plains. The parent material consists of loamy residuum weathered from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F133BY005TX Loamy Upland ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Description Category: ES

Eylau: 10 percent

F133BY005TX - Loamy Upland Ecological Site Concept The Loamy Uplands have very deep loamy soils greater than 80 inches. The ecological sites produce high amounts of plant biomass because of the loamy growing medium with nonrestrictive soil textures through the soil profiles with adequate water-holding capacity. The sites generally have the most robust plant communities of any adjacent sites. Soil Features The soils of this site are deep and characterized by loams throughout the soil profile, measured to 80 inches. The soils belong to the alfisol and ultisol orders and have well developed horizons. The Bowie series is a representative soil and consists of very deep, well drained, moderately slowly permeable soils that formed in loamy residuum from Southern Coastal Plain marine deposits. The series is classified as a fine-loamy, siliceous, semiactive, thermic Plinthic Paleudult. Not all soils within the ecological site will have the same taxonomic classification, but produce similar vegetative communities. Other soils are included within the ecological site and all are defined by deep fine-loamy and fine-silty control sections. The soils included are well drained or moderately well drained. Soils that are moderately well drained have a general increase in clay in the lower horizons. Besides the Bowie series, the Alto, Beauregard, Blevins, Diboll, Elrose, Eylau, Fuller, Gunter, Keatchie, Keithville, Kullit, Latex, Oakwood, Olla, Penning, Rigolette, Rogan, Ruston, Saffell, Sailes, Sawlit, Sawtown, Sawyer, Scottsville, Smithdale, Ulto, and Warnock are correlated to the Loamy Uplands. Reference Community The Shortleaf Pine/Red Oak Woodland (1.1) is the first community in State 1. Litter accumulation is moderate and understory vegetation is naturally dense. The overstory canopy is dominated by shortleaf pine and red oaks, and are usually in higher densities (total basal area) than the adjacently surrounding upland sites. The overstory canopy can also be interspersed with post oak (Quercus stellata), blackjack oak (Quercus marilandica), white oak (Quercus alba), and black hickory (Carya texana). The sites can be dominated by shortleaf pines, 100 percent canopy cover, but range as low as 60 percent with the oak and hickories comprising the rest of the overstory. Given time to mature, the sites produce tall, straight overstory pines which can reach heights above 100 feet. This community is characterized by a dense ground layer with relatively no bare ground (less than 5 percent). Needleleaf rosette grass (Dichanthelium aciculare) is a highly abundant grass throughout the herbaceous understory. Other grasses seen, though not as dominant are longleaf woodoats (Chasmanthium sessiliflorum), variable panicgrass (Dichanthelium commutatum), and little bluestem (Schizachyrium scoparium). Forbs occupying the site include flowering spurge (Euphorbia corollata), hairy small-leaf ticktrefoil (Desmodium ciliare), and downy milkpea (Galactia volubilis). The shrub layer of the community is very conspicuous, containing numerous American beautyberry (Callicarpa americana) and yaupon (Ilex vomitoria). Reference Plants List shortleaf pine, southern red oak, blackjack oak, post oak, black hickory, needleleaf rosette grass, variable panicgrass, little bluestem, longleaf woodoats, eastern poison ivy, dogfennel, flowering spurge, Nuttall's wild indigo, St. Andrew's cross, hairy small-leaf ticktrefoil, slender yellow woodsorrel, whitemouth dayflower, downy milkpea, nettleleaf noseburn, western brackenfern, American beautyberry, yaupon, sawtooth blackberry, parsley hawthorn, farkleberry, rusty blackhaw, summer grape, Virginia creeper, saw greenbrier, cat greenbrier, laurel greenbrier MLRA - 133B Legacy Ecosite ID - F133BY005TX

Description Category: ES

Adaton: 10 percent

F133BY001TX - Depression Ecological Site Concept Depressions occur on isolated flats of upland and terraces. Their drainage patterns are poor and result in long periods of water retention. Their vegetation more closely resembles bottomlands as opposed to the surrounding uplands. Soil Features The soils consist of very deep, poorly drained, slowly permeable soils. Most of the soils are classified as typic glossaqualfs, but other classifications exist. Soils correlated to this ecological site include: Adaton, Ashford, Catuna, Derly, Goreen, Guyton, Leagueville, Leggett, Merryville, Mollville, Percilla, and Talco. Reference Community Species that can stand excess wetness are found on these sites. Thickets of green ash and mayhaw (Crataegus opaca) are common, oftentimes limiting the growth of the understory grass and forb layer. Other species in the shrub layer include: carolina ash (Fraxinus carolina), common persimmon (Diospyros virginiana), and bottomland post oak (Quercus similis). Ground layer species include: inland sea oats (Chasmanthium latifolium), switchcane (Arundinaria gigantea), sedges (Carex sp.), and rushes (Juncus sp.). Reference Plants List No reference plants list is available. MLRA - 133B Legacy Ecosite ID - F133BY001TX

Description Category: GENSOIL

Eylau: 10 percent

Generated brief soil descriptions are created for major soil components. The Eylau soil is a minor component.

Description Category: GENSOIL

Adaton: 10 percent

Generated brief soil descriptions are created for major soil components. The Adaton soil is a minor component.

Map Unit: 42—Thenas fine sandy loam, frequently flooded

Description Category: ES

Thenas: 80 percent

F133BY014TX - Creek Bottomland Ecological Site Concept The ecological site has developed along fast moving water bodies that flood occasionally to frequently. The sites do not pond water and are moderately well to well drained. The plant communities are not typically hydrophitic, but are influenced by the flooding regime. Soil Features Iulus is a representative soil of the Creek Bottomlands. The series consists of very deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in recent alluvium derived from coastal plain sediments. The slope ranges from 0 to 1 percent. Other soils correlated to this ecological site include: Dardanelle, Dela, Garton, Hannahatchee, Idabel, Iuka, Kosse, Koury, Laneville, Lotus, Marietta, Mooreville, Nugent, Ochlockonee, Owentown, and Thenas. Reference Community The Creek Bottomland Communities are highly based on proximity to the stream channel and micro-relief throughout the site. A subtle rise or fall of mere inches can drastically alter the vegetative composition. The Water Oak/ White Oak community (1.1) represents the higher elevation sites, further away from the stream bank in comparison to community 1.2. Plant species occurring in the Water Oak/White Oak community vary from facultative to upland according to the U.S. Army Corps' Wetland Delineation Manual (2010). Understory indicators include; Indian woodoats, longleaf woodoats (Chasmanthium sessiliflorum), partridgeberry, Carolina elephantsfoot (Elephantopus carolinianus), and American beautyberry (Callicarpa americana). Reference Plants List water oak, white oak, sweetgum, loblolly pine, American beech, red maple, southern red oak, shortleaf pine, southern magnolia, blackgum, longleaf woodoats, variable panicgrass, needleleaf rosette grass, Indian woodoats, partridgeberry, eastern poison ivy, hairy bedstraw, Carolina elephantsfoot, St. Andrew's cross, Canadian blacksnakeroot, Canada goldenrod, mayapple, beechdrops, early blue violet, Texas dutchman's pipe, American beautyberry, two-wing silverbell, southern arrowwood, American witchhazel, yaupon, common sweetleaf, farkleberry, Carolina laurelcherry, red maple, sweetgum, American hornbeam, water oak, winged elm, red mulberry, white oak, flowering dogwood, hophornbeam, American beech, muscadine, Virginia creeper, cat greenbrier, roundleaf greenbrier, lanceleaf greenbrier, evening trumpetflower, crossvine MLRA - 133B Legacy Ecosite ID - F133BY014TX

Description Category: GENSOIL

Thenas: 80 percent

The Thenas component makes up 80 percent of the map unit. Slopes are 0 to 1 percent. This component is on flood plains on coastal plains. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F133BY014TX Creek Bottomland ecological site. Nonirrigated land capability classification is 5w. This soil does not meet hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Description Category: ES

Sardis: 20 percent

F133BY017TX - Loamy Bottomland Ecological Site Concept The ecological site has very deep, somewhat poorly drained soils that are frequently flooded. The site is typically flooded for brief to long periods during normal rainfall years. They will stay flooded starting in November and ending in May. The loamy-textured soils combined with the flooding frequency form the plant community. Soil Features Mattex and Manco are two of the representative soils of the Loamy Bottomlands. This ecological site formed from loamy alluvium and is associated with very deep, somewhat poorly drained, slowly permeable loamy entisols on bottomlands. The first gleyed-subsurface horizon usually appears within 8 to 11 inches. The gleying and other redoximorphic features continue through the profile usually past 80 inches. Gleying and redoximorphic features are caused by prolonged inundation. The sites are very flat with slopes from 0 to 1 percent. Other soils correlated to this site include: Amy, Angelina, Bibb, Bleakwood, Dreka, Groom, Guyton, Kanebreak, Mathiston, Mattex, Nahatche, Pophers, Sardis, Marietta, Mooreville, Ochlockonee, and Socagee. Reference Community The Loamy Bottomland system communities are based highly on micro-relief throughout the landscape. A subtle rise or fall of mere inches can drastically alter the vegetative composition. The willow oak community (1.1) represents the middle-relief elevation in comparison to communities 1.2 and 1.3. Plant species occurring in the willow oak community are usually facultative wet according to the U.S. Army Corps' Wetland Delineation Manual (2010). Understory indicators include blunt broom sedge (Carex tribuloides), smallspike false nettle (Boehmeria cylindrical), and American Buckwheat vine (Brunnichia ovata). Reference Plants List willow oak, water oak, overcup oak, laurel oak, swamp chestnut oak, sweetgum, blackgum, American elm, red maple, giant cane, blunt broom sedge, greater bladder sedge, slender woodoats, marsh flatsedge, smallspike false nettle, camphor pluchea, Virginia dayflower, Canada germander, smallflower thoroughwort, smooth hedgenettle, sensitive fern, false indigo bush, St. Peterswort, sweetscent, American snowbell, possumhaw, dwarf palmetto, willow oak, laurel oak, green ash, cherrybark oak, sugarberry, American buckwheat vine, climbing dogbane, climbing hempvine, catbird grape, American wisteria MLRA - 133B Legacy Ecosite ID - F133BY017TX

Description Category: GENSOIL

Sardis: 20 percent

Generated brief soil descriptions are created for major soil components. The Sardis soil is a minor component.

Map Unit: 48—Wrightsville-Raino complex, 0 to 1 percent slopes

Description Category: ES

Wrightsville, affr 30-42: 65 percent

F133BY012TX - Wet Terrace Ecological Site Concept The Wet Terrace site has very deep soils on terrace landforms. They are positioned higher than bottomlands and lower that uplands. This landscape position coupled with their slowly permeable, poorly drained soils form their unique plant community. Soil Features The ecological site consist of very deep, poorly drained, very slowly permeable soils formed in silty and clayey alluvium. Soils correlated to this ecological site include: Bodcau, Dubach, Frizzell, Gurdon, Haggerty, Kildare, Mollicy, Muldrow, Rodessa, Thage, Vick, Weston, Wrightsville, and Zenoria. Reference Community Dense shrub layers can be common on the Wet Terraces. Species of flowering dogwood (Cornus florida), green ash, American hornbeam (Carpinus caroliniana), American beautyberry (Callicarpa Americana), winged elm (Ulmus alata), American holly (Ilex opaca), and rusty blackhaw (Viburnum rufidulum). A wide variety of grasses and forbs may be common if the overstory and shrub layer are not restricting light to the understory. Longleaf woodoats (Chasmanthium sessiliflorum), hairy bedstraw (Galium pilosum), greenbriers (Smilax sp.), various sedges (Carex sp.), and rushes (Juncus sp.) Reference Plants List No reference plants list is available. MLRA - 133B Legacy Ecosite ID - F133BY012TX

Description Category: GENSOIL

Wrightsville, affr 30-42: 65 percent

The Wrightsville, AFFR 30-42 component makes up 65 percent of the map unit. Slopes are 0 to 1 percent. This component is on depressions on stream terraces on coastal plains. The parent material consists of clayey alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F133BY012TX Wet Terrace ecological site. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Description Category: ES

Raino: 25 percent

F133BY013TX - Terrace Ecological Site Concept The Terrace ecological site has very deep soils on terrace landforms. These sites are located on a higher landform than bottomlands and are not as wet. The sites are situated on a lower landform than the uplands and are not as dry. The sites do not flood or pond. This unique position between the drier uplands and wetter bottomlands creates their plant community. Soil Features Alazan, Attoyac, and Bernaldo are representative soils of the Terraces. The Terraces can have a wide range of textures and depths. The grouping factor is, all are located on the terrace landform position. Besides the previously listed soils, these are correlated as well: Addielou, Annona, Austonio, Bearhead, Besner, Bistineau, Cadeville, Cart, Chireno, Eastham, Elysian, Erno, Forbing, Freestone, Gallime, Garner, Glenmora, Hallsbluff, Keiffer, Landman, Latch, Mckamie, Moten, Multey, Raino, Shatta, Spurger, Timpson, Vesey, Waskom, and Woden. Reference Community Terrace sites are highly variable in their overstory composition. While white oak and loblolly pine are the dominant species, the overstory frequently has southern red oak, (Quercus falcata), sweetgum (Liquidambar styraciflua), and shortleaf pine (Pinus echinata) intermingled. Longleaf pine (Pinus palustris) may occur in the southern portions of the region. White oaks and/or loblolly pine may make up 75 percent of the overstory at any given time. The other hardwood and pine species make up the rest of the overstory. Shrubs are an important component in the ecological site. American beautyberry, yaupon, and possumhaw are dominant. Sassafras (Sassafras albidum), parsley hawthorn (Crataegus marshalii), and farkleberry (Vaccinium arboreum) are common, but seen in lesser densities. The shrub-layer height and densities fluctuate with time since the last fire. Fire prunes their growth back and allows the understory grasses and forbs to stay diverse and abundant. The shrub layer is the main driver between communities 1.1 and 1.2. As the shrubs begin to grow above 4.5 feet and become more dense, the community moves along the pathway from 1.1 to 1.2. The infrequency of fire causes an accumulation of litter throughout the sites and bare ground is uncommon. The most dominant gramanoids are longleaf woodoats, slender woodoats (Chasmanthium laxum), and cypress swamp sedge (Carex joorii). The micro-lows are often colonized by broomsedge bluestem (Andropogon virginicus). Partridgeberry and Carolina elephanstfoot (Elephantopus carolinianus) are highly associated to the site. Reference Plants List white oak, loblolly pine, southern red oak, sweetgum, shortleaf pine, white ash, longleaf pine, blackgum, longleaf woodoats, giant cane, broomsedge bluestem, variable panicgrass, slender woodoats, cypress swamp sedge, eastern poison ivy, partridgeberry, St. Andrew's cross, Carolina elephantsfoot, Missouri violet, slender yellow woodsorrel, ebony spleenwort, resurrection fern, American beautyberry, possumhaw, yaupon, sassafras, muscadine, parsley hawthorn, farkleberry, wax myrtle, American hornbeam, southern arrowwood, sweetgum, white oak, loblolly pine, common persimmon, American holly, blackgum, bitternut hickory, greenbrier, Virginia creeper, Alabama supplejack, crossvine, climbing dogbane MLRA - 133B Legacy Ecosite ID - F133BY013TX

Description Category: GENSOIL

Raino: 25 percent

The Raino component makes up 25 percent of the map unit. Slopes are 3 to 10 percent. This component is on mounds on stream terraces on coastal plains. The parent material consists of loamy alluvium of Pleistocene age derived from mixed sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 33 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 1 percent. This component is in the F133BY013TX Terrace ecological site. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Description Category: ES

Derly: 5 percent

R087BY001TX - Depression Ecological Site Concept Depressions occur on isolated flats of upland and terraces. Their drainage patterns are poor and result in long periods of water retention. Their vegetation more closely resembles wetter areas as opposed to the surrounding uplands. Soil Features The Depression site consists of very deep, poorly drained, moderately slowly to very slowly permeable soils. They formed in sandy, loamy, and clayey sediments. The Derly series is correlated to the site with a taxonomic classification of fine, smectitic, thermic Typic Glossaqualf. Leagueville is also correlated to the site with a classification of loamy, siliceous, semiactive, thermic Arenic Paleaquult. Both soils are wet with Derly have more clay content in the soil profile while Leagueville is overall more sandy. Reference Community This reference plant community resembles a wet prairie or wet meadow and contains grass-like species including sedges, flatsedges, and rush. Wax myrtle and eastern baccharis are common shrubs found on the site. Water oak, willow oak, elms, and black willow provide up to a 50 percent canopy and occupy locations influenced by wetness. Water oak occurs on the higher/dryer upslopes while black willow occurs on the lower/wetter position of the site. Willow oak is intermediate between the two. Fire may play a part in the maintenance of the savannah landscape in years of prolonged drought. This site has the potential to produce heavy fine fuel loads but is usually too wet to have fine fuel moisture conditions conducive for burning. Since this site has such favorable moisture regimes, especially during the summer, grazing and browsing by bison, deer, and cattle probably had more influence on the maintenance of the savannah landscape. Due to the wetness of the site, mechanical brush management is rarely a treatment option for this site. The inability to selectively apply broadcast herbicide normally precludes this treatment option, although individual plant treatment with herbicides may be a viable option. Abandonment of the site allows a transitional shift in vegetation towards a shrub-dominated community that, over time, results in a tree/shrub state. The maintenance of the reference plant community seems to require the presence of grazing and browsing animals and periodic fire when conditions permit. Reference Plants List No reference plants list is available. MLRA - 087B Legacy Ecosite ID - R087BY001TX

Description Category: ES

Rodessa: 5 percent

F133BY013TX - Terrace Ecological Site Concept The Terrace ecological site has very deep soils on terrace landforms. These sites are located on a higher landform than bottomlands and are not as wet. The sites are situated on a lower landform than the uplands and are not as dry. The sites do not flood or pond. This unique position between the drier uplands and wetter bottomlands creates their plant community. Soil Features Alazan, Attoyac, and Bernaldo are representative soils of the Terraces. The Terraces can have a wide range of textures and depths. The grouping factor is, all are located on the terrace landform position. Besides the previously listed soils, these are correlated as well: Addielou, Annona, Austonio, Bearhead, Besner, Bistineau, Cadeville, Cart, Chireno, Eastham, Elysian, Erno, Forbing, Freestone, Gallime, Garner, Glenmora, Hallsbluff, Keiffer, Landman, Latch, Mckamie, Moten, Multey, Raino, Shatta, Spurger, Timpson, Vesey, Waskom, and Woden. Reference Community Terrace sites are highly variable in their overstory composition. While white oak and loblolly pine are the dominant species, the overstory frequently has southern red oak, (Quercus falcata), sweetgum (Liquidambar styraciflua), and shortleaf pine (Pinus echinata) intermingled. Longleaf pine (Pinus palustris) may occur in the southern portions of the region. White oaks and/or loblolly pine may make up 75 percent of the overstory at any given time. The other hardwood and pine species make up the rest of the overstory. Shrubs are an important component in the ecological site. American beautyberry, yaupon, and possumhaw are dominant. Sassafras (Sassafras albidum), parsley hawthorn (Crataegus marshalii), and farkleberry (Vaccinium arboreum) are common, but seen in lesser densities. The shrub-layer height and densities fluctuate with time since the last fire. Fire prunes their growth back and allows the understory grasses and forbs to stay diverse and abundant. The shrub layer is the main driver between communities 1.1 and 1.2. As the shrubs begin to grow above 4.5 feet and become more dense, the community moves along the pathway from 1.1 to 1.2. The infrequency of fire causes an accumulation of litter throughout the sites and bare ground is uncommon. The most dominant gramanoids are longleaf woodoats, slender woodoats (Chasmanthium laxum), and cypress swamp sedge (Carex joorii). The micro-lows are often colonized by broomsedge bluestem (Andropogon virginicus). Partridgeberry and Carolina elephanstfoot (Elephantopus carolinianus) are highly associated to the site. Reference Plants List white oak, loblolly pine, southern red oak, sweetgum, shortleaf pine, white ash, longleaf pine, blackgum, longleaf woodoats, giant cane, broomsedge bluestem, variable panicgrass, slender woodoats, cypress swamp sedge, eastern poison ivy, partridgeberry, St. Andrew's cross, Carolina elephantsfoot, Missouri violet, slender yellow woodsorrel, ebony spleenwort, resurrection fern, American beautyberry, possumhaw, yaupon, sassafras, muscadine, parsley hawthorn, farkleberry, wax myrtle, American hornbeam, southern arrowwood, sweetgum, white oak, loblolly pine, common persimmon, American holly, blackgum, bitternut hickory, greenbrier, Virginia creeper, Alabama supplejack, crossvine, climbing dogbane MLRA - 133B Legacy Ecosite ID - F133BY013TX

Description Category: GENSOIL

Derly: 5 percent

Generated brief soil descriptions are created for major soil components. The Derly soil is a minor component.

Description Category: GENSOIL

Rodessa: 5 percent

Generated brief soil descriptions are created for major soil components. The Rodessa soil is a minor component.

Data Source Information

Soil Survey Area: Bowie County, Texas
Survey Area Data: Version 20, Aug 24, 2022

APPENDIX C

RONE ENGINEERING
EST: 1972

GEOTECHNICAL ENGINEERING REPORT
TEXAMERICAS TOWN CENTER
HOOKS, TEXAS

Prepared For:

TexAmericas Center
107 Chapel Lane
New Boston, Texas, 75570

Attn: Mr. Jeff Whitten

October 2022

PROJECT NO. 22-26822

www.roneengineers.com

RONE ENGINEERING
EST: 1972

GEOTECHNICAL ENGINEERING
EARTHWORKS CONTROL
ENVIRONMENTAL CONSULTING
CONSTRUCTION MATERIAL TESTING

October 4, 2022

Mr. Jeff Whitten
TexAmericas Center
107 Chapel Lane
New Boston, Texas, 75570

Re: Geotechnical Engineering Report
TexAmericas Town Center
Hooks, Texas
Rone Report No. 22-26822

Dear Mr. Whitten:

Rone Engineering Services, Ltd. (Rone) is pleased to submit the Geotechnical Engineering Report for the above referenced project. The geotechnical engineering services performed for this study were carried out in general accordance with Rone Proposal No. P-33717-22, dated August 1, 2022.

This report presents engineering analyses and recommendations for site grading, foundations, and pavements with respect to known project and site characteristics. Detailed results of our field exploration and laboratory testing are provided in the appendix of the report.

We appreciate the opportunity to be of service to you on this project. We look forward to providing additional Geotechnical Engineering and Construction Materials Testing services as the project progresses through the final design and construction phases. Please contact us if you have any questions or if we can be of further assistance.

Respectfully submitted,

STATE OF TEXAS
JEREMY PAUL WEHNER
108227
LICENSED
PROFESSIONAL ENGINEER
10.04.2022

Jeremy P. Wehner, P.E.
Senior Geotechnical Engineer

Robert H. Lawrence, P.E.
Senior Geotechnical Engineer

Texas Engineering Firm License No. F-1572

Table 3: Untreated Subgrade Movement Potential

Material	Vadose Zone Depth (feet)	Estimated Swell Pressure (psf)	Untreated Swell Potential (inches)
Fat Clay	12	2,200	3 to 4

5.4 Seismic Site Class

The site class for seismic design is based on several factors that include soil profile (soil or rock), shear wave velocity, density, relative hardness, and strength, averaged over a depth of 100 feet. The borings for this project did not extend to a depth of 100 feet; therefore, we assumed the soil and rock conditions below the depth of the borings to be similar to those encountered at the termination depth of the borings. Based on Section 1613.2.2 of the 2015 International Building Code and Table 20.3-1 of ASCE 7-16, we recommend using **Site Class C (Very Dense Soil and Soft Rock)** for seismic design.

6 FOUNDATION SYSTEM RECOMMENDATIONS

Based on the anticipated loads and the subsurface conditions, we anticipate shallow foundations are suitable to support the proposed structures. Ground modification depths of 8 feet are recommended to limit the PVR's to 1 inch. Ground modification will consist of controlled subgrade recompaction and grade raise fill construction to the pad design grades. Schematic cross-sections of the recommended foundation systems are provided below.

Figure 3: Foundation System Illustration: Slab Foundation

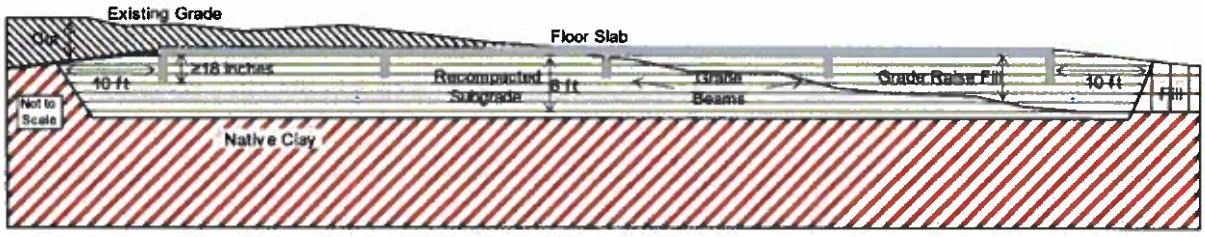
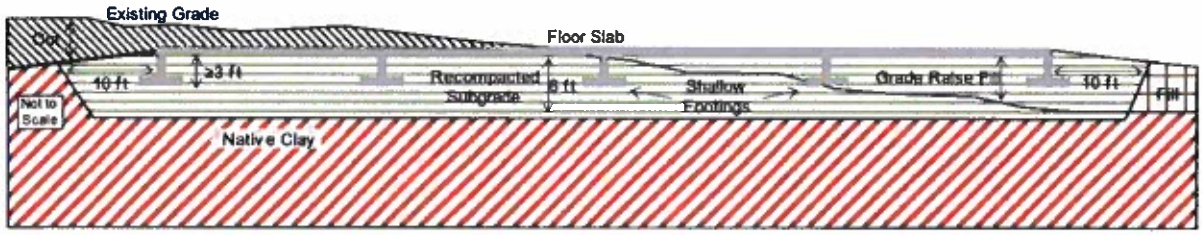


Figure 4: Foundation System Illustration: Shallow Footings



The foundation systems, when designed and constructed properly, should tolerate ground movement up to 1 inch. The subgrade design should result in the following ground stability conditions when constructed as required in this report. The following parameters should be used for design of the structural foundation system.

Table 4: Summary of Ground Improvement Depths for Foundation Design

Material	Thickness from Existing Elevation (feet)	Estimated Swell Pressure (psf)	Swell Potential at Finished Pad (inches)
Imported Fill (if used)	1	Negligible	Negligible
Recompacted Subgrade	8	800	Negligible
Native Soils	8+	4,000	<1

1. Measured from finished grade

6.1 Ground Modification and Subgrade Treatments

Existing grades below the building slab shall be excavated, mixed and recompacted as prescribed below. Subgrade reconstruction is designed to restructure the in-place cohesive soils such that strength and volume change can be controlled. Determination of the compaction energies and compaction efficiencies required for the existing soil property ranges enable this control.

Excavate to an 8-foot depth below the finished pad grade, mix the encountered soils, replace and recompact as specified in this report. This ground modification measure is designed to stabilize and increase strength and control swell potential and swelling pressures of the upper fat clay subgrade.

The subgrade excavation should extend at least 10 feet beyond the building perimeters and/or foundations, whichever distance is further, to allow for adequate edge treatment. The grade raise fill and recompacted subgrades should be constructed to the planned finished grade elevations.

The fully compacted subgrade should be scarified, mixed with lime and pulverized in accordance with Rone Specification 400 (Appendix B) to provide a lime treated pad cap to be used as a working surface during construction. Lime treatment should extend to a depth of at least 6 inches and include at least 6 percent lime by dry weight (27 pounds per square yard). A moisture barrier should also be placed immediately beneath the concrete slab. As an alternative to the lime treated pad cap, an 8-inch layer of crushed limestone, or recycled concrete meeting TxDOT Item 247 (Type A, C or D and Grade 1, 2 or 5) may be used as the building pad cap. The crushed limestone or recycled concrete should not extend beyond the building perimeter.

6.2 Excavation Safety Considerations

All excavations should be sloped, shored, or shielded in accordance with OSHA requirements. It should be noted that in accordance with Texas State Law, the design and maintenance of excavation safety systems is the sole responsibility of the construction contractor. OSHA Standards 29 CFR – 1926 Subpart P, including Appendices A and B, should be referenced for guidance in the design of such systems.

7 SITE PREPARATION FOR CONSTRUCTION

7.1 General

Remove existing foundations, abandoned structures, deleterious materials, site debris, abandoned utilities, and all other manmade features, and relocate utilities as required and in accordance with the plans and specifications.

7.2 Existing Surface Grades

Clear and grub all tree stumps and root systems as required by the work except where trees or shrubs must be maintained according to the design drawings. Except as otherwise specified or indicated in the drawings or specifications, all materials resulting from clearing and grubbing operations shall be properly disposed.

Clear all vegetation and strip the surficial topsoil as required to remove all roots and organic matter from all work areas of the site. Remove any undocumented fill from structural areas. In no case shall any spoil or other unsuitable material resulting from clearing, grubbing and stripping operations be utilized within any fill materials used onsite.

7.3 Excavations

All excavations shall be made to the lines and grades provided in the design documents. The contractor must use his or her own experience when making decisions regarding means, methods and costs to accomplish the proposed construction, specifically including excavation tools, excavation rates and number of trucks.

Dewatering or other groundwater control measures are not anticipated during site grading and building pad preparations. However, perched water could be encountered. Standard sump pits and pumping procedures should be adequate to control seepage on a local basis during excavation.

8 CONSTRUCTION OF SUBGRADE FILLS

Foundation fill elements are critical components of any foundation system. All foundation systems depend on fill elements as a part of the foundation system. Strength and stability of these elements is essential to limit ground movement below foundations.

The fill construction specifications below are designed for the specific engineering requirements for the fills on this project. The specifications provide the construction controls needed to prepare cohesive fills for saturation and best prepare them for drying potential. If these specified controls are not implemented throughout all fill construction, the fills will be vulnerable to potential instability from strength loss and swell conditions with saturation and potential shrinkage conditions from drying. The initiation of shrinkage or swelling usually leads to shrink-swell cycles with moisture variation over time.

The design of these compaction specifications for soil construction includes determination of compacted properties with varying compaction energies and compaction efficiencies. These parameters are provided in this report. These properties enable assessment of ground movement potential associated with the fill elements of each foundation. In most design cases a limited amount of ground movement potential is tolerable.

Though the construction specifications below prepare the cohesive fills for saturation, the environments of these fills must maintain a generally moist environment without excessive drying.

In some cases, equilibrium moisture ranges can be established in the design, and in some cases that cannot be done without certain maintenance requirements after construction. Maintenance requirements that are necessary for any fills on this project are provided in **Section 12 Site Completion and Maintenance.**

8.1 Subgrade Preparation

After site stripping, existing grades and cut grades must be prepared for construction of foundation fills. All cleared and stripped subgrade areas that will underlie foundation construction require ground modification measures as provided for in the following sections.

Existing stripped grades and cut grades at depths of 2 feet or less, shall be scarified to a depth of 8 inches and recompacted at wet-of the optimum moisture content at full compaction in construction, to at least 95 percent of maximum density in construction, as generated by a CAT 563 tamping foot compactor (or approved equivalent). Subgrade comprised of limestone does not require scarification and recompaction. The Geotechnical Engineer of Record will provide the performance of the compactor used as required for this control. Field verification testing will be conducted in accordance with **Section 8.5 Quality Control and Field Verification Testing**. Any areas not compacting to the properties the compactor should be producing indicate a soft or low modulus subgrade. If testing of recompacted surface grades verifies that soft soils underlie any section of the recompacted surface, then those sections must be excavated deeper and recompacted in lifts as required by the Geotechnical Engineer.

8.2 Construction of Subgrade Fills

All foundations and pavements include a structural fill element. These fill elements are critical to ground modification requirements and the strength and stability of each foundation. Fill construction requirements depend on the design purpose and service conditions of each fill. Each fill element must be constructed to achieve the properties required for the long term stability of each foundation. Each completed lift of fill placed shall be kept moist by application of water by use of water truck or similar process to preserve the soil moisture content prior to application of subsequent fill lifts or permanent protective cover.

8.2.1 Project Fills

The fill elements on this project are identified as follows:

- Scarification depths of existing cut grades within the upper 2 feet
- Subgrade reconstruction and grade raise fills for foundations and site paving
- Utility trench backfill
- General fills for site grading and drainage

8.2.2 Fill Material Requirements

The following table provides general property requirements and applications for the cohesive soils that may be used on this project.

Table 5: Fill Materials

Material	Source	Property Ranges	Use
Native Clay	On-Site	NA	Grade Raise Fill Utility Trench Backfill Building and Pavement Subgrade
Imported Fill (optional)	Import	CL: 15 ≤ PI ≤ 35 or Flexible Base Percent silt ≤ 20%	Building Pad Cap

The excavated on-site soils should be well mixed before re-use as fill. The mixing should include the fat and lean clays with any sands and silts encountered. Fill should be free of organics, debris, large rocks (greater than 4 to 6 inches) and all other deleterious material. Mixing should be able to be achieved by excavating and relocating. Additional handling is not anticipated. Clay clods should be broken down with proper moisture and compaction during earthwork operations.

8.2.3 Borrow Selection

Rone can assist the contractor in the selection of borrow sources and compactor pairings in order to reduce moisture amendment needs during construction. With this assistance, permissible soil property limits may also be expanded by matching the compaction energy of specific compactors with the soil and moisture ranges of borrow material.

For improved control and more consistent fill properties, stratified borrow sources approved for use as fill material should be excavated and processed in a manner to produce consistent mixing and increased uniformity of the fill materials. The Geotechnical Engineer of Record can provide additional guidance for this as needed.

8.3 Fill Construction Specifications

All fill should be placed in consistent loose lift thicknesses and compacted fully and uniformly across each lift. The moisture content at the time of compaction should be wet of the optimum moisture content in construction as defined by the field compaction curves provided in this report. Any moisture adjustments that may be required must be achieved before compaction. Each lift should be uniformly compacted with at least the minimum number of passes required for full compaction as provided in the following sections.

The compaction control specifications for soil construction provided below are developed for each fill required on this project based on predetermined compaction performance of compactor and soil combinations relative to design requirements. These controls have been optimized based on source soil and moisture ranges assessed from the site investigation and typical compactor ranges suitable for these fills and fill volumes. The specifications employ Family-of-Curve methods for the curves produced in construction in order to use the compactors performance for control and accommodate soil and moisture variation during construction. REC™ compaction design reports supporting this analysis and process control requirements are attached to this report. The construction specifications and supporting illustrations of the performance, range and limits of construction for each project fill are provided below. At the end of this section, a table is provided as a summary and quick reference of each specification. Information can also be provided on the relative performances of alternative compactors for changes during construction and optimal selection by the contractor.

All completed lifts should be protected by subsequent lifts placed as soon as practical during construction. Completed lifts shall be kept wet to avoid drying where subsequent construction cover is delayed. Completed lifts damaged by desiccation, erosion, construction traffic, or other disturbances shall be scarified and re-compacted according to the process control requirements for that particular fill. Control of lift thickness is critical to achieve full compaction with the required number of compactor passes. Grade stakes or GPS equipment should be utilized by the earthwork contractor to ensure that loose lifts do not exceed the maximum allowable given herein.

8.3.1 Subgrade and Grade Raise for Building Foundations and Pavement Areas

The building pad subgrade should be fully and uniformly compacted to final pad elevation. Moisture levels should be wet of the optimum moisture content during construction as required in

Section 6.1, according to the following process control specifications. The recompacted subgrade should extend at least 8 feet below finished pad elevation.

A CAT 563, or equivalent footed compactor approved by the **Geotechnical Engineer** should be used to compact in 9-inch loose lifts to a minimum dry density of 100.0 pounds per cubic foot (pcf) at wet-of-optimum moisture during construction and to a maximum air content of 6.6 percent. The optimum moisture content and maximum density in construction are determined from the field moisture-density curves (field compaction curves) generated by the compactor for the range of soils used in construction. This family-of-curve range for the specified compactor energy is provided in the **CHARTS** section of the appendix.

The **Compaction Performance and Design Chart 1a** in the appendix provides the performance and design construction range for the specified compactor and the in-situ moisture ranges relative to the design moisture range for construction. This specification range can be refined with more soil information prior to and/or during construction. An illustration of this compaction specification is provided on the **Compaction Control Chart 1b**. The Compaction Control Chart includes the required construction range and minimum number of passes required for full lift compaction. The construction range provided is only valid for full lift compaction using at least the minimum number of passes. Additional control specifications are noted on the chart. It is critical for the strength and stability of the fill that each lift is fully and uniformly compacted using at least the minimum number of passes for the compactor-soil range combination. **Chart 1b** can be used as a separate reference during construction. The REC™ Compaction Design Reports covering the soil ranges at the site are included in the **CHARTS** section of the appendix.

8.3.2 Utility Trench Backfill

Utility trench backfill should consist of on-site clay fully and uniformly compacted in 6-inch loose lifts wet of the optimum moisture contents to an air content not exceeding 6.6 percent. The optimum moisture is determined from representative Standard Proctor curves normalized on the lab line-of-optimums for the soil range used and corrected according to standard dry unit weight relations. The family of curves and construction acceptance range will be provided by the Geotechnical Engineer of Record. Suitable hand-operated compaction equipment should be approved by the Geotechnical Engineer of Record.

The general performance, range and limits of this construction using the recommended compactor is illustrated on **Compaction Performance and Design Chart 2a** in the appendix. This specification is illustrated on **Compaction Control Chart 2b**; however, it should be refined as necessary prior to construction using additional subsurface information.

8.3.3 General Fills for Site Grading and Drainage

Place and compact general site fills for landscape grading and drainage using native clay. Compact in 12 inch loose lifts with the earthmoving equipment onsite. Use visual controls for wet-of-optimum compaction. Surficial topsoil in landscape areas does not require compaction beyond that produced by the equipment used for spreading and grading.

The following summary table is provided for quick reference purposes. The table does not fully encompass or replace the compaction specifications provided for each fill in the sections above.

Table 6: Summary of Compaction Specifications and Quick Reference

Fill	Building Pad and Pavement Subgrade	Utility Trench Backfill Fill	General Site Grading
Material	On-site soils	On-site soils	On-site soils
Compactor Equivalent	CAT 563	Hand operated	NA
Maximum Lift Thickness (inches)	9	6	12
Minimum Number of Passes	8	NA	NA
Max Air Voids (percent)	6.6	6.6	NA
Minimum Dry Density (pcf)	100	96	NA
Minimum Moisture Content (percent)	14.0	16.0	NA
Minimum Unconfined Strength (ksf)	3.0	NA	NA

8.4 Construction Ramps

Construction access ramps into and out of the building pad over excavation do not constitute adequate fill construction and should be considered a temporary provision. Soil access ramps should enter pad excavation from further cutbacks (outside of pad design limits), or ramps may be constructed within the pad design limits, provided they are constructed according to the fill specifications provided in this report. Temporary access ramps built within the pad excavation limits without further cutback should be removed and reconstructed per pad specs.

8.5 Quality Control and Field Verification Testing

Before fill construction, the property ranges of fill materials should be determined using index property testing. During construction, index properties should be obtained periodically and upon

GPS controls during earthwork operation to manage lift thickness and achieve optimal performance from the reconstructed fills.

The Geotechnical Engineer of Record should be retained to provide the controls needed for soil construction, monitor earthwork operations, monitor foundation construction, evaluate materials, and conduct periodic testing during the construction phase of the project. This enables the geotechnical engineer to verify design conditions, manage ground risk, verify compliant construction, adjust design requirements when unanticipated conditions are encountered, assist the builder and represent Owner interests.

9 BUILDING FOUNDATION STRUCTURES

9.1 Slab Foundations

The proposed structures may be supported on ground supported foundations consisting of a conventionally reinforced beam and slab system or a post-tensioned slab foundation system, provided some floor movements can be tolerated. To achieve an estimated PVR of approximately 1 inch, subgrade recompaction should extend at least 8 feet below final grades or to the top of limestone. The foundations should be designed with exterior and interior grade beams adequate to provide sufficient rigidity to the foundation system to tolerate the potential vertical movement of the foundation subgrade.

A net allowable soil bearing pressure of 2,000 psf may be used for design of all grade beams bearing in tested and approved engineered fill. Grade beams should bear at least 18 inches below final grades. The bottom of the beam trenches should be free of any loose or soft material prior to the placement of the concrete. All grade beams and floor slabs should be adequately reinforced for eccentric loading that could occur from potential differential subgrade movement.

Design criteria for the foundation slab have been estimated according to the Post Tensioning Institute (PTI) based on the methods described in their most recent manual for designing slab-on-grade foundation systems. Recommended PTI foundation design criteria for a Thornthwaite Moisture Index (TMI) of zero are tabulated below:

Table 7: PTI Design Criteria

Parameter	Condition	1-Inch PVR
Edge Moisture Variation Distance, e_m (feet)	Center Lift	7.5
	Edge Lift	3.4
Differential Soil Movement, y_m (inches)	Center Lift	0.8
	Edge Lift	1.2

The PTI method incorporates numerous design assumptions associated with derivation of the variables needed to estimate the foundation design criteria. The PTI method of estimating differential soil movement is applicable when site moisture conditions are controlled only by the climate on well-graded building pads (i.e. proper site drainage, properly lined landscaped areas, no utility water leaks or other free water sources). As soil moisture increases, the soils may swell. The PTI design method is intended to provide stiffened foundation systems that can perform well under typical natural changes in soil moisture. The differential foundation movements resulting from seasonal soil moisture variations are typically much lower than movements that occur due to free water sources near or beneath the structure, which are not directly addressed by the PTI design method.

9.2 Shallow Footings

The proposed structure may be supported on shallow, continuous and/or spread footings bearing at least 3 feet below final grade. The minimum recommended widths for shallow foundations are 24 inches for continuous strip footings and 36 inches for isolated column footings. Shallow foundations may be designed using a net allowable bearing capacity of 3,000 psf when founded in properly constructed soils as required in this report. We recommend larger footings at corners where panel loading is higher to help distribute loading and reduce cracking of the continuous perimeter grade beam. We recommend a minimum footing width of 5 feet for this application.

9.3 Shallow Foundation Construction Considerations

The geotechnical engineer or his representative should monitor shallow foundation construction to confirm conditions are as anticipated. Foundation excavations should be dry and free of loose material. We recommend that the final 6 inches of the footing bottom be excavated with a smooth mouthed bucket. Foundation excavations should have the reinforcing steel and concrete placed before the end of the workday, or sooner, to reduce deterioration of the bearing surface. Prolonged exposure or inundation of the bearing surface will negatively impact strength and compressibility characteristics. If delays occur, the excavation should be deepened as necessary

and cleaned to provide a fresh bearing surface. If more than 24 hours of exposure of the bearing surface is anticipated, a "mud-slab" should be used to protect the bearing surface.

9.4 Grade Beam/Tilt Panel Walls

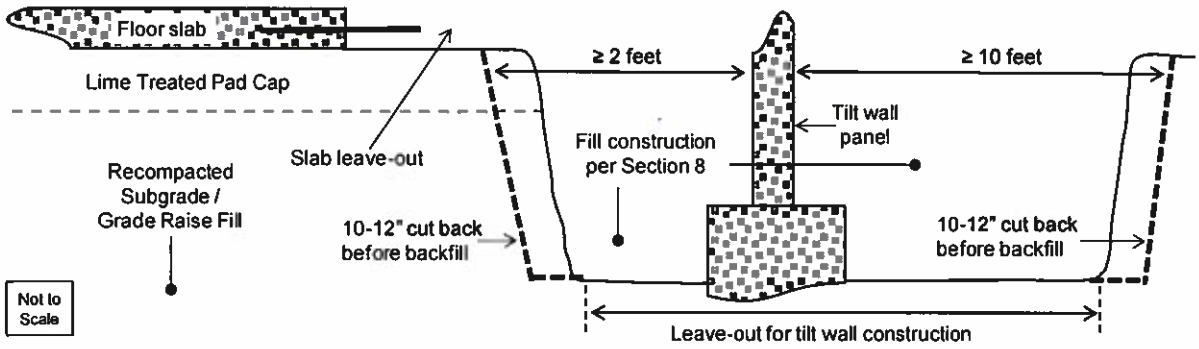
Floor slabs are often connected to the perimeter beams/tilt wall panels. A void is not required provided that subgrade compaction is constructed as required in this report and perimeter foundations are continuous strip footings.

Given that grade-supported floor slabs will be constructed with a potential vertical movement of approximately 1 inch, interior wall connections should be constructed such that the estimated potential movement can be tolerated. If the floor slab is structurally connected to the perimeter wall and/or interior foundations, we recommend that the following tasks be completed:

- Perimeter leave-out backfill should be constructed as outlined in figure below to reduce the potential for differential swell near perimeter walls.
- Subgrade reconstruction should extend at least 10 feet beyond the perimeter of the structure our foundation, whichever is greater, and any adjacent flatwork that is sensitive to movement.
- A saw-cut or physical construction joint should be installed approximately 6 to 8 feet inside the building perimeter to assist in controlling potential hinge cracks that may occur.

To facilitate tilt-wall panel installation, a perimeter "leave-out" can be constructed as illustrated in **Figure 5: Edge Leave-Out Schematic** below. The excavation for the leave-out should extend at least 10 feet outside the building perimeter and 2 feet to the inside.

Figure 5: Edge Leave-Out Schematic



9.5 Grade Supported Slab

The floor slab may be grade-supported, provided that it is designed to tolerate the estimated potential vertical subgrade movement following subgrade recompaction. The fully compacted

subgrade should be scarified, mixed with lime and pulverized in accordance with Rone Specification 400 (Appendix B) to provide a lime treated pad cap to be used as a working surface during construction. Lime treatment should extend to a depth of at least 6 inches and include at least 6 percent lime by dry weight (27 pounds per square yard). A suitable moisture/vapor barrier (e.g., polyethylene sheeting) should be placed over the completed pad before floor slab construction. Excessive moisture migration through the floor slab can negatively affect adhesive flooring and can also create slip hazards and other moisture related issues. The slab designer and slab contractor should refer to ACI 302 for procedures and cautions about the use and placement of a vapor barrier.

10 LATERAL EARTH PRESSURES

Lateral earth pressures will be influenced by structural design, conditions of the wall restraint, methods of construction and/or compaction, the type of materials being retained, and drainage conditions. Walls that will be restrained from movement and rotation (rigid wall) should be designed using at-rest earth-pressures. The equivalent fluid pressures (triangular distribution) provided below may be used for horizontal backfill in a drained condition. To design for a drained condition, the wall must include an adequate drainage system. The provided equivalent fluid pressures do not include a Factor of Safety and do not provide for dynamic pressures on the wall.

Figure 6: Lateral Earth Pressure Diagram

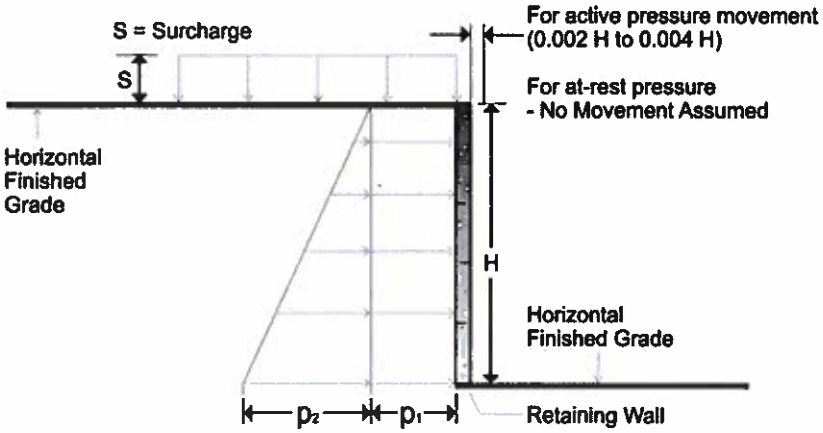


Table 8: Lateral Earth Pressures

Material	Condition	Equivalent Fluid Pressure, pcf	
		Drained	Undrained
Free Draining Granular Soil	At-Rest, k = 0.45	55	90
	Active, k = 0.30	38	81
On-Site Clay Soil	At-Rest, k = 0.79	100	112
	Active, k = 0.67	84	104

Conditions applicable to the table above include:

- A maximum in-situ total unit weight of 125 pcf
- Properly compacted horizontal backfill
- No surcharge loads (construction equipment, pavement, footings, floor slabs, etc.)

The values provided in the table above are for a full "wedge" of material behind the wall, where the backfill extends horizontally 1 to 2 feet away from the bottom of the wall and then slopes upward and away from the wall at a slope of 1H:1V (horizontal to vertical), or flatter, and has a horizontal finished grade. The location and magnitude of permanent surcharge loads (if present) should be determined, and additional pressures generated by these loads should be considered during design. Surcharge loads can be factored using the appropriate earth-pressure coefficient values provided in the table above.

10.1 Wall Drainage

Retaining walls, or below grade walls, should be expected to collect water due to condensation, surface water infiltration, and other means. Drainage should be provided behind all below grade walls to reduce the development of hydrostatic pressure and limit saturation of the backfill and foundation soils. Collector pipes should be placed at or slightly below the bottom level of the wall to prevent the collection of water in the drainage material beneath the collector pipes. Pipes should connect to a sump or gravity drainage system to prevent the accumulation of water behind the walls. Gravity lines should include a backflow preventer to block water from being transmitted into the drainage layer in the event of flooding near the gravity outfall.

The drainage material should consist of free-draining, clean, granular fill. This material should be compatible with ASTM C33, sizes 4 through 9. The drainage layer should extend at least 12 inches from the back face of the wall. A geosynthetic wrap should enclose the granular backfill to reduce the infiltration of fines. The top 2 feet of backfill should consist of clay materials with a

plasticity index of 25 or more, compacted as recommended in the charts based on the zoning location, and extending at least 5 feet beyond the wall excavation to reduce surface water infiltration into the underlying fill.

10.2 Wall Backfill

Free-draining backfill soils should be placed in maximum lifts of 1 foot and lightly consolidated by use of a small hand-operated compactors or other appropriate methods to adequately compact the backfill. Heavy compactors and grading equipment should not be allowed to operate within 15 feet of the crest of the wall to avoid developing excessive additional temporary or long-term lateral soil pressures. If onsite clayey soils are used, these materials should be placed in maximum 6-inch lifts and compacted as recommended in the charts based on the zoning location.

11 PAVEMENT DESIGN

This report includes recommendations for rigid pavements consisting of Portland Cement Concrete (PCC). While some minor differential movement should be anticipated, if the provisions of this report are strictly adhered to in construction, the pavement subgrades can be expected to be relatively stable. To the extent the provisions of this report are not adhered to in construction, risk and magnitude of ground movement can be expected. Design of the proposed pavement sections should factor the performance of the subgrade construction provided for in this report.

11.1 Rigid Pavement Design

For this project, traffic loading and frequency conditions were estimated for various conditions as no specific traffic information was provided. The following information was used in our analysis:

- design life of 20 years
- k-value of 150 pci for modified clay subgrade, and 200 for lime treated soils
- reliability of 90 percent
- initial serviceability, po, of 4.5 and a terminal serviceability, pt, of 2.0 for concrete pavements
- concrete modulus of rupture of 540 psi
- load transfer coefficient of 2.7
- drainage coefficient of 1.0

The pavement thickness determinations were performed in accordance with the "1993 AASHTO Guide for the Design of Pavement Structures" guidelines based on assumed traffic volumes. The minimum pavement sections are presented in the table below. A more precise design can be made with detailed traffic loading information.

Table 9: Minimum Pavement Sections and Allowable Traffic

Traffic Use	Portland Cement Concrete (inches)	Design ESAL for Flexural/Compressive Strength (psi)		
		540/3,500	580/4,000	627/4,500
Parking Areas for Autos and Light Trucks	5	225,000	279,000	355,000
Vehicle Drive Lanes	6	447,000	565,000	724,000
Dumpster Areas / Light Truck Traffic / Fire Lanes [1]	7	1,277,000	1,605,000	2,069,000
Moderate Truck Traffic	8	1,965,000	2,573,000	3,222,000

1. Please refer to local municipal requirements for fire lanes. Use the design criteria which will result in the stronger, more durable pavement section.

The concrete minimum 28-day compressive strength should be selected based on the expected traffic. As a minimum, reinforcing steel should consist of #3 bars spaced at a maximum of 18 inches on center in each direction.

Pavement recommendations are based on the estimated loading conditions and commonly accepted design procedures that should provide satisfactory performance for the design life of the pavement. Concrete pavement should have between 4 and 6 percent entrained air. Hand-placed concrete should have a maximum slump of 5 inches. A sand-leveling course should not be permitted beneath pavements. All steel reinforcement, dowel spacing/diameter and pavement joints should conform to applicable city standards.

Saw cutting should be performed in specified locations to control cracking due to shrinkage. Saw cutting should begin as soon as the concrete has obtained enough strength to keep from raveling, but before cracks can be initiated internally. Saw cut depths generally range from ¼ to ⅓ of the pavement thickness, but should be performed as directed by the civil engineer.

11.2 Pavement Base Course

Lime treatment of the pavement subgrade can enhance the performance of the pavement system, particularly in areas that are subjected to heavy loading during construction. Therefore, we recommend 6 inches of lime treated subgrade beneath concrete pavements that will be subjected to heavy loads during and/or after construction.

At this time, we estimate approximately 8 percent hydrated lime by weight (36 pounds per square yard for a 6 inch thickness) will be required to adequately treat the pavement subgrade, though the actual lime requirement should be determined based on the in-place soil properties and soluble sulfate levels after the pavement subgrade has reached final grade. Lime treatment should be performed in accordance with Rone Specification 400, included in Appendix B. Lime treated subgrade should have a PI between 7 and 20.

Sulfate testing on selected samples during the geotechnical investigation indicated sulfate levels less than 100 ppm. Based on historic elevated sulfate levels in the region, we recommend that additional sulfate testing be performed on the pavement subgrade material once final subgrade elevations are achieved as the movement of soils during cut and fill operations can distribute the sulfates variably across the site. Sulfate levels should be less than 3,000 ppm. Where sulfate levels exceed 3,000 ppm, the double-lime application procedures, and higher quantities of lime may be required.

The treated subgrade should extend a minimum of 2 feet outside the curb line. This will improve the edge support of the pavement and reduce the effects associated with shrinkage during dry periods. Sand or other granular fill should not be used as a leveling course beneath the pavement, as these more porous materials increase water migration beneath the pavement, causing heave and strength loss of the subgrade.

11.3 Pavement Construction and Maintenance Recommendations

The pavement subgrades shall follow the recommendations in **Section 8 Construction of Subgrade Fills**. It is crucial that the moisture and compaction states be maintained until the overlying pavement is placed. If the treated subgrade is allowed to dry prior to the pavement construction, the risk of shrinkage cracks within the pavement surface is increased.

Proper drainage should be provided both during and after construction. The pavement surface should be contoured such that surface water drains off, away from the pavement and into inlets. Water allowed to pond on or adjacent to pavement surfaces will saturate the subgrade soils leading to premature pavement failure. All joints should be adequately sealed. Maintenance should include regular observation to identify and seal cracks. A flexible joint material should be used to seal cracks as they develop.

12 SITE COMPLETION AND MAINTENANCE

12.1 Site Grading and Drainage

The geotechnical design for this project accounts for limited assessment of hydrogeologic conditions and intends to provide for efforts to maintain stable, moist subgrade conditions in a uniform manner after construction. Site grading and drainage plans should support this intention where possible. Site grading and drainage should be efficient in paved areas and less efficient in lawn and landscape areas. Roof runoff should be collected by gutters and downspouts and discharge onto paved areas draining away from the buildings.

12.2 Landscaping and Irrigation

Subgrade moisture levels should be maintained around the building perimeter before and during construction. Irrigated landscaping and lawn areas are recommended with even distribution around the structures. Irrigated areas will serve as supplemental moisture sources surrounding the foundations and pavement areas. Accordingly, regular and uniform irrigation would be required in these areas, particularly during dry and hot weather periods. Above-grade planters may also be considered around the perimeter of the building with regular irrigation to maintain light perimeter infiltration along pavement joints.

13 STUDY CLOSURE

The recommendations contained in this report are based on preliminary site layout plans and should be verified by Rone once final site layout and grading plans are available.

The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of the field exploration and further on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site with little variance beyond that found by the borings. If Rone is not serving a monitoring role during construction as advised, and different subsurface conditions from those encountered in our borings are observed or appear to be present in excavations, Rone must be advised promptly so that these conditions can be evaluated, and our recommendations can be reassessed as may be necessary. If there is a substantial lapse of time between submission of this report and the start of the work at the site, if conditions have changed due either to natural causes or to construction

operations at or adjacent to the site, or if structure locations, structural loads or finish grades are changed, Rone should be promptly informed and retained if necessary if the changed conditions warrant review and reassessment.

It is important that Rone be retained to assist in design reviews or review those portions of the plans and specifications that pertain to earthwork and foundation systems for this particular project to ensure the plans and specifications are consistent with the controls and recommendations provided in this report. It is also advised that Rone provide oversight and monitoring services during construction to ensure that the controls required for design requirements during earthworks construction are provided correctly and implemented effectively. This study has been prepared for the exclusive use of the client and their designated agents for specific application to design and construction of this project. We have exercised a degree of care and skill exceeding that ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. The engineering services and solutions provided herein are considered advanced, and while design and construction controls are improved, no warranty, expressed or implied, can be made or intended.

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EST. 1972

Plate A.3

BORING LOCATION DIAGRAM

TEXAMERICAS TOWN CENTER
SEC'S OF CASE STREET & US HIGHWAY 82 (AVENUE A)
HOOKS, TEXAS

PROJECT NO:	22-26822		
FILE NAME:	2226822.DWG		
DRAWN BY:	CM	DATE:	9-20-2022
REVISED BY:		DATE:	
REVISED BY:		DATE:	
APPROVED BY:	JW	DATE:	9-20-2022

Log	Project No.	TexAmericas Town Center SEC's of Case Street & US Highway 82 Hooks, Texas	RONE ENGINEERING EST: 1972
B-6	22-26822		
Boring Location: See Plate A.3			
Latitude: 33.46510° N	Water Level Observations (feet)	Date: 8-29-22	
Longitude: -94.29007° W	While Drilling: Not Observed At Completion: Not Observed End of Day: Not Measured		

Depth, ft.	Symbol	Sample Type	Elevation, ft.	Stratum Description Approximate Surface Elevation = 389.0 feet	Water Level Observations	SPT or TCP	Penetrometer Reading, tsf	Passing No. 200 Sieve %	Atterberg Limits LL-PL-PI	Moisture Content %	Swell %	Dry Unit Weight, pcf	Unconfined Compression, psf
				SAND LEAN CLAY (CL) - brown, silty, organics			4.5+			11			
							4.5+	64	28-15-13	6			
			385.0	**FAT CLAY (CH)** - light tan, marly									
5							4.5+			10			
							4.50			17			
							4.5+			19			
10				- reddish traces									
							4.5+			20			
15													
							4.5+			20			
20													
							4.5+			32			
25			364.0	Boring Terminated at Approximately 25 Feet									

Material boundaries are approximate; in situ, transitions may be gradual.

Driller: Michael - DAS Logger: Heriberto
Drilling Method: Continuous Flight Augers

Plate A.9

This boring log should not be considered valid if separated from the remainder of the geotechnical report.

Log	Project No.	
B-7	**22-26822**	**TexAmericas Town Center** **SEC's of Case Street & US Highway 82** **Hooks, Texas**
Boring Location **See Plate A.3**		

RONE ENGINEERING EST: 1972

Latitude	Water Level Observations (feet)		Date
33.46440° N	White Drilling	Not Observed	**8-29-22**
Longitude	At Completion	Not Observed	
-94.28958° W	End of Day	Not Measured	

Depth, ft.	Symbol	Sample Type	Elevation, ft.	Stratum Description Approximate Surface Elevation = 390.0 feet	Water Level Observations	SPT or TCP	Penetrometer Reading, tsf	Passing No. 200 Sieve %	Atterberg Limits LL-PL-PI	Moisture Content %	Swell %	Dry Unit Weight, pcf	Unconfined Compression, psf
				LEAN CLAY (CL) - brown, with silt and sand			1.50			16			
							4.5+	70	49-18-31	14			
5				- brown to gray with reddish traces			4.5+			18			
							4.5+			16			
				- gray marly			4.5+			22			
10													
							4.5+	87	49-18-31	18			
15													
							4.5+			28			
20													
							4.5+			12			
25			365.0	Boring Terminated at Approximately 25 Feet									

Material boundaries are approximate; in situ, transitions may be gradual.

Driller: Michael - DAS Logger: Heriberto
Drilling Method: Continuous Flight Augers

Plate A.10

This boring log should not be considered valid if separated from the remainder of the geotechnical report.

Log	Project No.	TexAmericas Town Center SEC's of Case Street & US Highway 82 Hooks, Texas
B-8	22-26822	
Boring Location: See Plate A.3		
Latitude: 33.46454° N	Water Level Observations (feet)	Date: 8-26-22
Longitude: -94.28858° W	While Drilling: Not Observed At Completion: Not Observed End of Day: Not Measured	

RONE ENGINEERING EST: 1972

Depth, ft.	Symbol	Sample Type	Elevation, ft.	Stratum Description Approximate Surface Elevation = 389.0 feet	Water Level Observations	SPT or TCP	Penetrometer Reading, tsf	Passing No. 200 Sieve %	Atterberg Limits LL-PL-PI	Moisture Content %	Swell %	Dry Unit Weight, pcf	Unconfined Compression, psf
				FAT CLAY (CH) - reddish brown			3.50			15			
				- tan to gray, with ferrous oxide staining			2.75	72	57-19-38	19	0.0	131	3,800
5							4.5+			15			
							4.00			16			
							4.5+			20			
10													
							2.25			22			
15													
							1.00			20			
20													
							3.25			16			
25			364.0	Boring Terminated at Approximately 25 Feet									

Material boundaries are approximate; in situ, transitions may be gradual.

Driller: Michael - DAS Logger: Travis
Drilling Method: Continuous Flight Augers

Plate A.11

This boring log should not be considered valid if separated from the remainder of the geotechnical report.

Log	Project No.	TexAmericas Town Center SEC's of Case Street & US Highway 82 Hooks, Texas
B-9	**22-26822**	
Boring Location **See Plate A.3**		
Latitude **33.46453° N**	Water Level Observations (feet)	Date **8-26-22**
	While Drilling: Not Observed	
Longitude **-94.28779° W**	At Completion: Not Observed	
	End of Day: Not Measured	

RONE ENGINEERING EST: 1972

Depth, ft.	Symbol	Sample Type	Elevation, ft.	Stratum Description Approximate Surface Elevation = 386.0 feet	Water Level Observations	SPT or TCP	Penetrometer Reading, tsf	Passing No. 200 Sieve %	Atterberg Limits LL-PL-PI	Moisture Content %	Swell %	Dry Unit Weight, pcf	Unconfined Compression, psf
				FAT CLAY (CH) - brown to reddish brown, with sand, gravel and ferrous oxide staining			0.75	79	62-22-40	22			
				- gray to tan			4.00			18			
5							4.25			19			
							4.5+			19			
							4.00			18			
10													
							2.75	85	56-18-38	20			
15													
							4.00			20			
20													
				- with gravelly layers, trace lignite			4.5+			18			
25			361.0	Boring Terminated at Approximately 25 Feet									

Material boundaries are approximate; in situ, transitions may be gradual.

Driller: Michael - DAS Logger: Travis
Drilling Method: Continuous Flight Augers

Plate A.12

This boring log should not be considered valid if separated from the remainder of the geotechnical report.

Log	Project No.	TexAmericas Town Center SEC's of Case Street & US Highway 82 Hooks, Texas
D-1	22-26822	
Boring Location: See Plate A.3		
Latitude: 33.46573° N	Water Level Observations (feet)	Date: 8-29-22
Longitude: -94.29069° W	While Drilling: Not Observed At Completion: Not Observed End of Day: Not Measured	

RONE ENGINEERING EST: 1972

Depth, ft.	Symbol	Sample Type	Elevation, ft.	Stratum Description Approximate Surface Elevation = 381.0 feet	Water Level Observations	SPT or TCP	Penetrometer Reading, tsf	Passing No. 200 Sieve %	Atterberg Limits LL-PL-PI	Moisture Content %	Swell %	Dry Unit Weight, pcf	Unconfined Compression, psf
				LEAN CLAY (CL) - dark brown to brown, with silt and sand			4.50			10			
							4.5+			10			
5				- with ferrous oxide staining - light gray			4.5+			15			
							4.50			23			
			373.0										
				FAT CLAY (CH) - gray, marly			3.25			19			
10			371.0	Boring Terminated at Approximately 10 Feet									

Material boundaries are approximate, in situ, transitions may be gradual.

Driller: Michael - DAS Logger: Heriberto
Drilling Method: Continuous Flight Augers

Plate A.15

This boring log should not be considered valid if separated from the remainder of the geotechnical report.

ETTL Engineers & Consultants Inc.

GEOTECHNICAL ✱ MATERIALS ✱ ENVIRONMENTAL ✱ DRILLING ✱ LANDFILLS

July 31, 2013

William V. Cork
TexAmericas Center
107 Chapel Lane
New Boston, Texas 75570

SUBJECT: TexAmericas Center – East Parcels 1, 2, 3, 6, 7, 8 & 9
Hooks, Texas
Preliminary Geotechnical Investigation
ETTL Job No. G3972-136

Dear Mr.Cork:

Submitted herein is the report summarizing the results of a preliminary geotechnical investigation conducted at the site of the above referenced project.

If you have any questions concerning this report, or if we can be of further assistance during construction, please contact us. We are available to perform any construction materials testing and inspection services that you may require. Thank you for the opportunity to be of service.

Sincerely,
ETTL Engineers & Consultants Inc.

Russell W. Gibson, P.E.
Project Manager

STATE OF TEXAS
RUSSELL W. GIBSON
104979
LICENSED PROFESSIONAL ENGINEER

ETTL
ENGINEERS & CONSULTANTS
F-3208
July 31, 2013

C. Brandon Quinn, P.E., P.G.
Vice President
Manager of Engineering Services

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July 31, 2013

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w w w . e t t l i n c . c o m

Preliminary Geotechnical Investigation
TexAmericas Center – East Parcels 1, 2, 3, 6, 7, 8 & 9
Hooks, Texas

Submitted to

TexAmericas Center
New Boston, Texas

Prepared by

ETTL Engineers & Consultants Inc.
Tyler, Texas

July 2013

EXECUTIVE SUMMARY

This Executive Summary is provided as a brief synopsis of the specific recommendations and design criteria provided in the attached report. It is not intended as a substitute for a thorough reading of the report in its entirety.

Project Description

The project consists of a preliminary geotechnical investigation for parcels 1, 2, 3, 6, 7, 8 & 9 at bore locations staked by representatives of TexAmericas. **This investigation is very preliminary and not to be used for any final design.**

Site Description

The project site is currently partially developed with large areas heavily forested. According to USGS topography, the elevation varies from approximately 325 to 425. The elevation decreases generally from west to east with drainage ways running south to north at two to three locations.

Depth & Number of Borings

Location	Borings	Depth
Parcel 1 – 223.5 Acres	B-1, B-2, B-3, B-4, B-5	2-20' & 3-10'
Parcel 2 – 136.9 Acres	B-10, B-11, B-12, B-13	2-20' & 2-10'
Parcel 3 – 198.8 Acres	B-6, B-7, B-8, B-9	2-20' & 2-10'
Parcel 6 – 83.5 Acres	B-14, B-15, B-16, B-17	2-20' & 2-10'
Parcel 7 – 2.0 Acres	B-18	1-20'
Parcel 8 – 8.1 Acres	B-19, B-20	1-20' & 1-10'
Parcel 9 – 36.2 Acres	B-21, B-22	2-20'

Soils Encountered

The soils encountered in Parcel 1 generally consisted of loose to medium dense silty sands (SM), silty clayey sands (SC-SM) and silts (ML) overlying interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 42.

The soils in Parcel 2 consisted of surficial loose silts (ML) and clayey sands (SC) overlying soft to medium stiff lean clays (CL) followed by medium stiff to hard fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 61.

In Parcel 3, the soils encountered generally consisted of interlayered soft to very stiff lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from 13 to 35.

The soils in Parcel 6 consisted of interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Very loose to loose silt (ML) and clayey sand (SC) was found at the surface in Boring B-17. Atterberg Plasticity Indices of the tested soils ranged from 16 to 51.

The soils encountered in Parcel 7 consisted of stiff to very stiff fat clays (CH). Atterberg Plasticity Index of the tested soils was 42.

In Parcel 8, the soils encountered consisted of very soft to medium stiff interlayered lean clays (CL) and fat clays (CH) and very loose silt (ML) overlying medium stiff to very stiff fat clay (CH). Atterberg Plasticity Indices of the tested soils ranged from 15 to 44.

The soils encountered in Parcel 9 consisted of medium stiff to hard fat clays (CH). The Atterberg Plasticity Indices of the tested soils ranged from 43 to 61.

Groundwater Depth
No seepage was noted during drilling operations and all borings were dry and open upon completion. The phreatic surface is predicted to be at some depth deeper than 20 feet.

Recommended Foundation Type
Shallow spread footings
Shallow spread footings/ stiffened slab option
Drilled piers

Allowable Gross Bearing Pressure
Spread Footings
Depth listed is below finished subgrade or adjacent exterior grade whichever is deeper.

Parcel	Native Soils		Select Fill	
	Isolated Footings	Strip Footings	Isolated Footings	Strip Footings
Parcel 1	800 psf @ 2 ft.	600 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 2	1000 psf @ 2 ft.	1000 psf @ 2 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 3	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.
Parcel 6	1000 psf @ 2 ft.	500 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 7	3000 psf @ 2 ft.	2500 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 8	800 psf @ 2 ft.	800 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 9	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.

Drilled Piers
Bearing capacity for underreamed piers bearing at the indicated depth below existing grade.

Location	End Bearing Capacity	Depth
Parcel 1	6000 psf	18
Parcel 2	6000 psf	13
Parcel 3	6000 psf	18
Parcel 6	6000 psf	13
Parcel 7	6000 psf	13
Parcel 8	6000 psf	13
Parcel 9	6000 psf	13

Floor System
Flat Slab on prepared subgrade
Stiffened slab on grade - monolithically placed with *shallow footings*
Structurally suspended floor - used with *drilled piers* only

Building Subgrade Preparation
The following *minimum* overexcavation is suggested for the specific option chosen. Limits of overexcavation should extend beyond building and footing lines a distance of 5'. Options are listed in order of increasing risk of damage due to soil movement.

- *Drilled piers with suspended slab* - Grade void space beneath floor to drain.

- *Drilled piers with grade beams and floor slab on prepared subgrade* - Native expansive clay soils are to be removed and replaced with select fill. Overexcavation to the depths below existing grade shown in the table below in order to reduce Potential Vertical Rise (PVR) to 1.0" or less.

- *Shallow spread footings with monolithic flat slab* - Overexcavate to the depths below existing grade shown in the table below in order to reduce the PVR to 1 inch or less.

- *Shallow spread footings with monolithic stiffened slab placed on grade* – None required.

For options where the slab is to be placed on grade, scarify the exposed subgrade, adjust the moisture content, and recompact. Place select fill to finished slab subgrade.

Location	Undercut Depth (ft.)
Parcel 1	3 – 6
Parcel 2	6 – 8
Parcel 3	1 – 3
Parcel 6	6.5 – 7.5
Parcel 7	6
Parcel 8	4 – 7
Parcel 9	7 – 8

Pavement

Cut to proposed subgrade elevation as required and proof roll prior to compaction or treatment. Soft and/or unstable areas should be cut out and replaced with select fill. Scarify exposed subgrade to a depth of 8 inches, adjust the moisture content to optimum -1% to optimum +3% and recompact. If highly plastic soil (PI > 20) is encountered at finished subgrade, it should be cut out to a depth of 18 inches and replaced with select fill. Lime treatment of the subgrade is an alternative to removing and replacing soil.

Table 1 – Pavement Options – Light Duty

Type	Base/Surface Thickness		Subgrade Preparation
Flexible HMAC	2" Surface (Type D)	6" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" HMAC Surface (Type D)	3" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	5" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 2 – Pavement Options – Medium Duty			
Type	**Base/Surface Thickness**		**Subgrade Preparation**
Flexible HMAC	3" Surface (Type C or D)	8" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	4" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	6" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 3 – Pavement Options – Heavy Duty			
Type	**Base/Surface Thickness**		**Subgrade Preparation**
Flexible HMAC	2" Surface (Type C or D)	7" Crushed Stone Base & 2.5" HMAC Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	5.5" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	7" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Notes:

1) Tensar Triax Geogrid placed on subgrade may be substituted for lime treatment of subgrade. Lime treatment or replacement with select fill only needed where expansive clay is encountered within 12" of finished subgrade as determined by a representative of this firm.

2) Increase HMAC thickness by 1" in lieu of lime treated subgrade

3) Increase concrete thickness by 0.5" in lieu of lime treated subgrade.

Construction Considerations

The surficial soils in several areas may become unstable when wet necessitating remediation or removal and replacement to facilitate construction.

1.0 INTRODUCTION

This study was performed at the request and authorization to proceed granted by Nate Hahm with TexAmericas Center of New Boston, Texas in accordance with our proposal dated June 6, 2013. Field operations were conducted June 24 – 26, 2013.

The purpose of this preliminary investigation was to define and evaluate the general subsurface conditions in the area south of US 82 and west of Red River Army Depot near Hooks, Texas. Specifically, the study was planned to determine the following:

- Subsurface stratigraphy within the limits of exploratory borings;
- Classification, strength, expansive properties, and compressibility characteristics of the foundation soils;
- Suitable foundation types and allowable loading; and,
- Construction related problems that may be anticipated by the investigation.

To determine this information a variety of tests were performed on the soil samples. The scope of testing for this report comprised Standard Penetration, Atterberg liquid and plastic limits, Percentage of Fines Passing the No. 200 sieve, Natural Moisture Content, Unconfined Compressive Strength and One-Dimensional Swell. These tests were conducted to classify the soil strata according to a widely used engineering classification system; identify, and provide quantitative data for active (expansive) soils; define strength characteristics relating to allowable bearing values; predict immediate settlement; and assess construction workability of the soils.

The conclusions and recommendations that follow are based on limited information regarding site grading. The boring locations were selected by the client and staked with their assistance. (ETTL did not confirm by survey that the locations indicated on the attached Plan of Borings accurately reflect the location on the ground). This information should be verified prior to design. *Should any portion of it prove incorrect, this firm should be notified in order to assess the need for revisions to this report.*

2.0 PROJECT DESCRIPTION

The project consists of a preliminary geotechnical investigation for parcels 1, 2, 3, 6, 7, 8 & 9 at bore locations staked by representatives of TexAmericas. **This investigation is very preliminary and not to be used for any final design.**

3.0 SITE DESCRIPTION

The project site is currently partially developed with large areas heavily forested. According to USGS topography, the elevation varies from approximately 325 to 425. The elevation decreases generally from west to east with drainage ways running south to north at two to three locations.

4.0 SOIL STRATIGRAPHY AND PROPERTIES

4.1 Site Geology

The Midway Group undivided outcrops at the subject site. The Midway Group is composed of the Wills Point and the Kincaid Formations in Bowie County. The Wills Point Formation is primarily clay. The upper portion of the formation is composed of silt and lignite with some calcareous siltstone

concretions. A thin bed of limestone is located near the middle of the formation and is glauconitic near the base of the formation. The maximum thickness of the Wills Point Formation is approximately 450 feet. The Kincaid Formation is predominately clay with some glauconite and selenite and slightly calcareous. The formation is in part silty and sandy and is locally phosphatic near the base. The maximum thickness of the Kincaid Formation is approximately 150 feet.

4.2 Soil Stratigraphy

The soils encountered in **Parcel 1** generally consisted of loose to medium dense silty sands (SM), silty clayey sands (SC-SM) and silts (ML) overlying interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 42.

The soils in **Parcel 2** consisted of surficial loose silts (ML) and clayey sands (SC) overlying soft to medium stiff lean clays (CL) followed by medium stiff to hard fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 61.

In **Parcel 3**, the soils encountered generally consisted of interlayered soft to very stiff lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from 13 to 35.

The soils in **Parcel 6** consisted of interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Very loose to loose silt (ML) and clayey sand (SC) was found at the surface in Boring B-17. Atterberg Plasticity Indices of the tested soils ranged from 16 to 51.

The soils encountered in **Parcel 7** consisted of stiff to very stiff fat clays (CH). Atterberg Plasticity Index of the tested soils was 42.

In **Parcel 8**, the soils encountered consisted of very soft to medium stiff interlayered lean clays (CL) and fat clays (CH) and very loose silt (ML) overlying medium stiff to very stiff fat clay (CH). Atterberg Plasticity Indices of the tested soils ranged from 15 to 44.

The soils encountered in **Parcel 9** consisted of medium stiff to hard fat clays (CH). The Atterberg Plasticity Indices of the tested soils ranged from 43 to 61.

4.3 Seismic Design Parameters

Based on the 2012 International Building Code section 1613 *Earthquake Loads – Site Ground Motion,* the seismic site class definition should be taken as **Class D**. This classification is based on an average of the blow counts obtained for all borings in this study. This site classification should be confirmed for future projects based specifically on the project site.

A seismic impact zone is an area with a 10 percent or greater probability that the maximum horizontal acceleration in rock, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g in 50 years. Seismic impact maps that represent a 2 percent probability of exceedance in 50 years for 0.2 and 1 second Spectral Response Acceleration can be found in the IBC code. Based on the maps and the site coefficients determined for the appropriate site class, parameters as listed below are recommended by the IBC Code:

Site Coefficients:	$F_a = 1.6$ $F_v = 2.4$
Mapped Acceleration Parameters:	$S_S = 0.140$ g $S_1 = 0.077$ g

Maximum Earthquake Spectral Response Acceleration Parameters: S_{MS} = 0.223 g
S_{M1} = 0.185 g

Design Spectral Response Acceleration Parameters: S_{DS} = 0.149 g
S_{D1} = 0.123 g

4.4 Behavior of Expansive Soils

Expansive soils such as were found at this site, swell when they absorb moisture and shrink as they dry. Structures placed on these soils move up and down with such volume changes of the soil. When expansive soils are covered by an impermeable surface such as a building slab or pavement, seasonal moisture fluctuation at the interior of the covered area tends to be reduced or eliminated due to the lack of exposure to natural wetting and drying conditions (i.e., wind, rain, sun, vegetative, etc.). At the edges of the structure, however, the near surface soils are still subject to seasonal drying and wetting. Where continuously irrigated areas abut a building, the risk of severe shrinkage due to seasonal evaporative drying effects is low, but excess moisture could lead to significant swelling (especially if native clays are dry at the start of construction). Where areas immediately adjacent to the structure are paved both the risk of swelling due to excess moisture and shrinkage due to moisture loss are reduced significantly. A deeper bearing elevation will also reduce the anticipated vertical movements.

Moisture content of the significantly expansive soils we tested varied from dry to moist. Potential for swelling is considered to be moderate to high under conditions at the time of drilling. Potential for shrinkage is also predicted to be moderate to high. As the moisture content of the soil changes from what it was in our samples, the potential for swelling and shrinkage will change accordingly.

One method for quantifying the potential for subgrade movement at any given location is to calculate the Potential Vertical Rise (PVR) (Tex 124 E Modified). This calculation takes into account the inter-relationship between depth, PI, and fluctuations in soil moisture. The maximum potential movement of the existing subgrade, PVR, due to normal climatological fluctuations in soil moisture content is summarized in **Table 4.1** (based on assumed dry conditions and an estimated annual seasonal moisture fluctuation zone of approximately 10 feet). Swell testing indicates a potential heave from 1 inch to as much as 7 inches at current moisture contents.

Table 4.1 - PVR Predictions

Location	PVR (inches)
Parcel 1	1 – 2.75
Parcel 2	3 – 4
Parcel 3	1 – 2.2
Parcel 6	1 – 3.4
Parcel 7	3
Parcel 8	1.75 – 2.2
Parcel 9	4.8 – 5.5

5.0 GROUNDWATER OBSERVATIONS

No seepage was noted during drilling operations and all borings were dry and open upon completion. The phreatic surface is predicted to be at some depth deeper than 20 feet.

It should be noted, however, that seasonal groundwater conditions might vary throughout the year depending upon prevailing climatic conditions. This magnitude of variance will be largely dependent

upon the duration and intensity of precipitation, surface drainage characteristics of the surrounding area, and significant changes in site topography.

6.0 FOUNDATION DESIGN RECOMMENDATIONS

The proposed use is unknown at this time. Given the preliminary nature of this study and the variability of the soils encountered, options for both a shallow foundation system as well as deep foundations are provided below.

Where drilled pier foundations are used, a structurally suspended slab is recommended in order to isolate the structure from subgrade movements.

A system consisting of shallow footings incorporated in a stiffened slab, which is placed on native subgrade or select fill may also be used, but is much less tolerant of significant subgrade volume changes than a structure, which is suspended above the ground (i.e. the risk of structure distress is significantly higher for a ground supported structure). In addition, a stiffened slab on native ground is subject to tilt due to uneven wetting or drying of subgrade soils. Unless the entire structure is surrounded by an impermeable barrier or pavement, uneven wetting due to continuous irrigation on one side of the structure could result in significant heave on that side, tilting the structure. Likewise, uneven drying due to lack of irrigation can also result in tilting.

Some conditions that may affect foundation performance are difficult to account for in standard foundation design procedures. These include vegetative influence (e.g. tree root zones as noted above), unusual climatological conditions, uncontrolled water sources such as plumbing and sprinkler system leaks, and poor drainage conditions. Such sources of moisture change could cause large shrink/swell movements of the expansive clay that will remain beneath the building and lead to significant distress. If it is desired to virtually eliminate the risk of damage from vertical movement due to these conditions, an option incorporating drilled piers with a suspended slab is recommended.

Recommendations and pertinent design parameters for both shallow foundation and deep foundation systems are presented below. With ground supported foundation/floor systems it is *essential* that measures be taken to assure subgrade moisture stability (see section **10.3 Site Design**) in order to enhance the chances of satisfactory structure performance. Proper site design that prevents water from soaking into the subgrade soils around the building is essential to reduce the potential for excessive movement caused by saturation of foundation soils.

6.1 Shallow Spread Footings

Footings should be designed to bear in firm undisturbed native soil or properly compacted select fill. Isolated footings should have a minimum width of 2 feet and strip footings should be at least 12 inches wide. Footings should be proportioned for the allowable gross bearing pressures summarized in **Table 6.1**, below. The footings should bear at the indicated depths below finished slab subgrade or adjacent exterior grade, whichever is deeper. These allowable pressures incorporate a safety factor relative to shear failure of the soil of about 3 and may be increased up to 33% for intermittent loads such as wind. Predicted total settlement for footing widths less than 6 feet is approximately 1 inch or less (total) and 0.5 inch (differential). Detailed testing for the prediction of long-term settlement due to load for these footings is beyond the scope of this investigation.

Table 6.1 – Gross Allowable Bearing Pressures				
Parcel	Native Soils		Select Fill	
	Isolated Footings	Strip Footings	Isolated Footings	Strip Footings
Parcel 1	800 psf @ 2 ft.	600 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 2	1000 psf @ 2 ft.	1000 psf @ 2 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 3	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.
Parcel 6	1000 psf @ 2 ft.	500 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 7	3000 psf @ 2 ft.	2500 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 8	800 psf @ 2 ft.	800 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 9	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.

6.2 Post-Tensioned Slab Design

The information provided below is based on analysis of our field and laboratory test results as well as design procedures given in the Design and Construction of Post-Tensioned Slab-on-Ground - Post-Tensioning Institute Third Edition with 2008 Supplement. We make no warrantee as to the adequacy or applicability of the design procedures given in this manual. These design criteria attempt to account for soil movement due to *normally anticipated climatological fluctuations* and may not entirely accommodate vegetative effects and other unusual situations (noted above). In addition, should the shape factor (SF) of the building slab or foundation exceed 24 as defined by the 2008 manual, PTI recommends limiting the maximum differential movements to 2.0 inches for center lift and 1.0 inch for edge lift. Should the anticipated movements exceed these values, geotechnical approaches should be considered to reduce these predicted movements. Possible methods include, but are not limited to, water injection, lime or chemical injection, removal and replacement with low expansive soil materials or perimeter barriers. Please contact ETTL should evaluation of these methods be necessary. Listed below are parameters for either the post-construction (TMI between -15 and 15) or post-equilibrium case (TMI < -15 or > 15), as recommended by the manual. For the post-construction case, soil moisture fluctuates from very wet to very dry. The post-equilibrium case represents moisture fluctuation from existing to either very wet or very dry.

Table 6.2 – Post Tensioned Slab Design Parameters Thorthwaite Moisture Index (TMI) = 45					
Parcel	Weighted Plasticity Index	Edge Moisture Variation Distance, e_m		Maximum Differential Soil Movement, y_m	
		Center lift (in)	Edge lift (in)	Center lift (in)	Edge Lift (in)
Parcel 1	24	9.0	5.1	0.9	0.1
Parcel 2	39	8.5	5.1	1.3	0.2
Parcel 3	22	8.7	5.1	0.7	0.1
Parcel 6	30	8.7	5.1	0.9	0.1
Parcel 7	42	9.0	5.1	1.6	0.2
Parcel 8	26	8.7	5.1	1.3	0.2
Parcel 9	57	8.0	5.1	2.5	0.4

6.3 Drilled Piers

This foundation system consists of drilled and reinforced concrete piers supporting the entire structure that is suspended above the ground when native clay is not removed from beneath the building.

Drilled piers should be founded in undisturbed native soil and should be proportioned using the gross allowable end bearing pressures summarized in **Table 6.3**, below. The depth indicated is below

existing grade. This value may be increased by 33% when considering intermittent loads such as wind or seismic. Shafts should be underreamed to anchor against uplift from expanding soils. Settlement (due to imposed load only) for piers with a sustained full design load is predicted to be 0.5% to 1% of pier tip diameter. The minimum side slope of underreams should be 60 degrees and the maximum ratio of bell to pier diameter should be 3:1.

The foundation units should contain a minimum amount of reinforcement to resist tensile forces caused by soil heave. An adhesive stress of 1,500 psf applied over the portion of the top 10 feet of the pier perimeter *in contact with unprocessed, native expansive clay* should be used to design the pier for uplift due to expanding soils. A minimum pier size of 18 inches is recommended to facilitate proper concrete placement. Further guidelines for the construction of drilled piers are provided in section **10.0 GENERAL CONSTRUCTION CONSIDERATIONS**. Since moisture migration to the base of a drilled shaft (usually along the shaft perimeter surface) could lead to heave, it is especially important that these construction guidelines be followed in order to reduce the risk of such shaft movement.

Table 6.3 - Drilled Pier Allowable Bearing Pressures		
Location	**End Bearing Capacity**	**Depth (ft.)**
Parcel 1	6000 psf	18
Parcel 2	6000 psf	13
Parcel 3	6000 psf	18
Parcel 6	6000 psf	13
Parcel 7	6000 psf	13
Parcel 8	6000 psf	13
Parcel 9	6000 psf	13

6.3.1 Uplift Resistance of Belled Shafts

For cases where the top of the bell is at least $2.5*d_b$ below the ground surface, ultimate uplift resistance of a belled shaft, Q_u (kips) may be determined by:

$$Q_u = 7.07 * c * (d_b^2 - d_s^2)$$

Where:

c = cohesion (ksf) (avg in the zone from the base of the bell to $2*d_b$ above the base)
d_s = diameter of shaft (ft)
d_b = diameter of bell (ft)

For cases where the top of the bell is shallower than $2.5*d_b$ below the ground surface, the ultimate capacity may be assumed to vary linearly from 0 at the ground surface to Q_u as determined above at $2.5*d_b$.

The ultimate uplift resistance as determined above should be divided by a safety factor (say 2 to 3) and the resultant allowable uplift resistance should be compared to the design uplift load (minus the shaft weight if it is not otherwise accounted for) to verify that the allowable resistance is equal to or greater than the design load (i.e. the uplift load applied at the top of the shaft).

The above procedure is only intended to predict uplift capacity based on the characteristics of the soil surrounding the pier. The designer must verify that the shaft reinforcing (for prevention of detachment of the bell from the shaft) and the thickness of the bell (for prevention of shearing off of the edge of the bell) are also adequate to safely carry the uplift load.

7.0 FLOOR SYSTEMS

The floor system for use with a shallow footing option consists of a flat slab on prepared subgrade or a stiffened slab on grade as detailed above. For the drilled pier system, a structurally suspended floor is preferred. However, a flat slab on grade system can be used provided that most of the surficial expansive clays are removed and replaced with select fill. As noted above, this sort of floor is subject to damage from unusual moisture changing conditions.

A flat slab on a prepared subgrade can be considered where the risk of localized differential movements of approximately 1" is acceptable (1" is what is predicted due to normal climatological factors only, not other possible moisture sources). However, overexcavation to remove some of the expansive clay creates a "bathtub" beneath the structure that can have the potential to collect surface drainage (or moisture from other sources such as plumbing leaks) at its base. This water will soak into the deeper, dry clays over time possibly resulting in excessive heave. The pavement surrounding the buildings (where it actually abuts the building and the joint is maintained in a sealed condition), however, will help to maintain a stable moisture content beneath the building by virtually preventing moisture gain or loss from surface drainage, thus lowering the risk of severe movements. The risk of distress due to shrink/swell movement of the native subgrade (caused by normal climatological moisture fluctuation only) prepared as specified below is considered relatively low. That is, shrink/swell movements of the clay that will remain beneath the building, should they occur, are predicted to be small (1") and, thus, resulting distress is predicted to be relatively low.

Some conditions that may affect floor system performance are difficult to account for in standard design procedures. These include vegetative influence (prior, or subsequent to, construction), unusual climatological conditions, uncontrolled water sources such as plumbing and sprinkler system leaks, and poor drainage conditions. If it is desired to virtually eliminate the risk of damage from vertical movement due to these conditions, an option incorporating drilled piers with a suspended slab is recommended.

7.1 Flat Slab

This floor system consists of a cast-in-place concrete, unstiffened, flat slab on prepared subgrade (according to Section **8.0 BUILDING SUBGRADE PREPARATION**, below) that is either isolated from, or monolithic with footings and grade beams. Provision should be made to account for the fact that a heavily loaded foundation element, which is monolithic with an unloaded slab, may result in significant stress in the transition zone between the unloaded slab and the foundation element. Reinforcing in the slab is used primarily to control shrinkage.

Where a slab is to be placed on grade, we recommend that the subgrade be prepared to reduce the PVR to 1 inch or less. Removal of some of the expansive clay from the zone where the soil moisture tends to fluctuate seasonally is predicted to reduce the potential swelling movement due to normal climatological fluctuation of moisture content of the clay that remains in that zone to less than 1 inch (See **BUILDING SUBGRADE PREPARATION** section **8.0**, below).

Where some or all of the native clay remains beneath a ground supported floor system, it is *essential* that measures be taken to assure subgrade moisture stability (see **Site Design** section **10.3**) in order to enhance the chances of satisfactory structure performance. Provision should be made to account for the possibility of significant differential movement between the main structure and driveways, sidewalks, and any other structure, which are not placed on subgrade prepared as for the building. Proper site design that prevents water from soaking into the subgrade soils around the building and appurtenances (i.e. provides for rapid runoff away from them) is *essential* to reduce the potential for

excessive movement caused by saturation of foundation soils and should help limit differential movement between soil supported elements and the main building.

7.2 Structurally Suspended Slab

The most positive means of eliminating the effects of vertical subgrade movements on the structure is to structurally suspend the entire floor system (including grade beams) as well as all other non-load bearing elements between drilled piers and above the ground. This may be accomplished via the use of void forms upon which a structurally reinforced concrete slab is placed, or may take the form of a structurally framed floor system above a crawl space. Where a "skirt" encloses a crawl space it should be supported on a concrete grade beam that is designed to span between drilled piers and is isolated from the ground with 10" thick void boxes. Any appurtenances attached to the structure such as stairs or decks should also be suspended above a void space and supported on piers. Soil retainers at the edges of voids are recommended to prevent soil from migrating into the void space.

The void space created beneath the floor system should be sealed so that it does not collect surface drainage. Where there is a crawl space created beneath the floor system the floor of the crawl space should be graded so that it does not collect surface drainage. The base of the space should be higher than the surrounding ground to reduce the chances that water will collect in it. Where this is not possible, grading of the space to a drain is recommended. Planting beds adjacent to the structure should be contained in leak proof boxes or a horizontal moisture barrier should be used in conjunction with them in order to protect the building subgrade from water infiltration (from sources such as sprinkler systems). Backfill adjacent to the structure should be properly compacted native clay soil sloped away from the structure at a 5% slope (minimum) to help limit surface infiltration.

Table 7.1 – Comparison of Foundation Options		
Foundation Option	**Advantages**	**Disadvantages**
Drilled Piers (with structurally suspended slab)	Isolated from potential expansive clay movements Minimal subgrade preparation	Expensive.
Drilled Piers (with a monolithic or isolated flat slab on overexcavated subgrade)	Potentially lower cost Risk of damage to pier supported elements very low.	Requires some overexcavation to remove a significant portion of expansive clay. Slab and slab supported elements subject to damage from subgrade movement due to soil moisture change (Risk of significant damage is low and is primarily related to unusual water sources such as plumbing leaks and surface water infiltration)
Shallow spread footings (with a monolithic or isolated flat slab)	Ease of installation Potentially lower cost.	Requires some overexcavation to remove a significant portion of expansive clay. Structure, slab and slab supported elements subject to damage from subgrade movement due to soil moisture change (Risk of significant damage is low and is primarily related to unusual water sources such as plumbing leaks and surface water infiltration)
Stiffened Slab (monolithic with shallow footings)	Ease of installation Lower risk of foundation distress than flat slab for identical subgrade preparation Minimal subgrade preparation	Potentially more expensive than spread footings with a flat slab Subject to damage and/or tilt from subgrade movement due to unusual and/or uneven wetting or drying conditions

8.0 BUILDING SUBGRADE PREPARATION

In order to validate the design assumptions given above regarding allowable foundation loads, and, in order to provide a serviceable floor system (within the limitations stated above), it is imperative that the subgrade of the building be properly prepared. Special subgrade preparation (other than grading for drainage beneath and around the building) is not required for the suspended slab option. The following procedures are recommended as a minimum:

- Remove any surficial vegetation, wood chips and topsoil. Where trees are removed (or have been removed in the last year) from the slab area, the entire root zone should be cut out and

replaced with select fill. Root zones tend to be comprised of highly desiccated soil, which, if left in place, are prone to significant swelling later on, resulting in heaving of the slab. Verify that all stump holes are backfilled with properly compacted select fill.

- The following *minimum* overexcavation is required for the specific option chosen. Limits of overexcavation should extend beyond building and/or footing lines a distance of 5'. Options are listed in order of increasing risk of damage due to foundation movement.
    - *Drilled piers with suspended slab* - Grade void space beneath floor to drain.
    - *Drilled piers with grade beams and floor slab on prepared subgrade* - Native expansive clay soils are to be removed and replaced with select fill. Overexcavate to the depths below existing grade shown in **Table 8.1** below in order to reduce the PVR to 1 inch or less.
    - *Shallow spread footings with monolithic flat slab* - Overexcavate to the depths below existing grade shown in **Table 8.1** below in order to reduce the PVR to 1 inch or less.
    - *Shallow spread footings with monolithic stiffened slab placed on grade* – None required
- Scarify the exposed subgrade to a depth of 8 inches, adjust the moisture content to, and maintain it within a range of optimum to optimum +3% and recompact to a minimum density of 95% of the maximum density defined by ASTM D 698 (Standard Proctor). *Maintain specified moisture content until subgrade is covered with fill or slab.*
- Place select fill to finished slab subgrade. Specifications for the placement of select fill are covered in section **10.4 Select Fill**.

A durable moisture barrier should be provided between the concrete building slab and the underlying soil subgrade. An intact membrane installation with lapped and sealed joints and which is repaired if damaged during construction will help to inhibit moisture migration from the subgrade through the slab.

Table 8.1 – Recommended Undercut Depth

Location	Depth (ft.)
Parcel 1	3 – 6
Parcel 2	6 – 8
Parcel 3	1 – 3
Parcel 6	6.5 – 7.5
Parcel 7	6
Parcel 8	4 – 7
Parcel 9	7 – 8

9.0 PAVEMENT RECOMMENDATIONS

General recommendations for the design of *minimal* pavement structures are provided herein for your information. A more detailed pavement analysis would require additional laboratory tests on bulk samples of the materials to be used in pavement construction and is beyond the scope of this

investigation. A summary of proposed designs is provided in **Table 9.1**, **Table 9.2** and **Table 9.3** below.

9.1 Pavement Subgrade Preparation

As a minimum, strip the native subgrade to remove topsoil and other deleterious materials. Cut to the proposed subgrade elevation as required. After all cutting to finished subgrade has been performed, the exposed soils should be examined and tested by a representative of ETTL to detect areas of expansive clay or other unsuitable soil conditions that need to be cut out and replaced. Tree root zones often contain highly desiccated, highly plastic soil that eventually results in heaving after a period of rewetting. The only way to limit this potential is to remove these zones and replace them with select fill. The heaving effect can be reduced with good pavement drainage and maintenance. If this is not feasible, then future additional pavement maintenance will probably be necessary. Verify that all stump holes as well as areas disturbed by demolition activity, if any, are cut out and backfilled with properly compacted select fill. Positive surface drainage should be provided at all times during construction (especially in low areas) to maintain pavement subgrade in a dry and stable condition.

9.1.1 Unsuitable Subgrade Soil

Where the exposed subgrade is found to consist of soil with a PI>20, cut out the plastic clay to an elevation equal to finished subgrade minus 12", or deeper if necessary to expose stable ground (as determined by proof rolling as specified below). Scarify the exposed soil to a depth of 8", adjust the moisture content to within a range of optimum to optimum +3% and recompact to a minimum density of 95% of ASTM D698 (standard proctor). Lime treatment, in accordance with section **9.1.3 Lime Treated Subgrade**, is an alternative to removal and replacement.

9.1.2 Suitable Subgrade Soil

Where exposed native soil consists of a soil with a PI<20, it should be proof rolled in accordance with TxDOT Item 216 (with the exception of roller size). The use of a fully loaded dump truck is recommended. Areas, which prove unstable should be cut out and replaced as directed by a representative of this firm. Scarify the exposed soil to a depth of 8", adjust the moisture content to within a range of optimum to optimum +3% and recompact to a minimum density of 95% of ASTM D698 (standard proctor).

9.1.3 Lime Treated Subgrade

In areas where the subgrade soils consist of expansive clays (PI>20), lime treatment is recommended. Lime treatment of subgrade should be in accordance with Item 260, "Lime Treatment for Materials Used as Subgrade (Road Mixed)," Texas Department of Transportation *Standard Specifications for Construction of Highways, Streets and Bridges*, 2004 Edition with the following exceptions:

- Under article 260.4 (4), "Application," the rate of lime to be applied can be estimated as 40 pounds per square yard worked into the top 8 inches of finished subgrade. *The actual amount of lime to be used should be based on tests of lime soil mixtures conducted prior to treatment.* Quicklime, if used, must be hydrated before mixing into the soil.

- The modified subgrade should be compacted under article 260.4 (6) (b), "Density Control," except that it shall be compacted to 95% of Standard Proctor Density (ASTM D698) *at a moisture content well above optimum* to allow for the drying action of the lime.

- Curing procedures should be strictly followed. Traffic on the treated subgrade should be kept to a minimum during curing.

- Prior to use by significant traffic, the treated subgrade should be covered with base, concrete or some temporary wearing surface to avoid degradation.

9.1.3.1 Alternatives to Lime Treatment

For the flexible pavement option (only) placing a geogrid (Tensar TX 140, no substitute) on the native subgrade prior to placing base material will serve as a substitute for lime treated subgrade. For the full depth HMAC section, lime treatment of the subgrade may be omitted if the thickness of pavement surface specified is increased by 1". For the rigid pavement option (concrete) increase the recommended thickness by 0.5" where lime treatment is omitted.

9.1.4 Fill Construction

Fill to be placed which is below an elevation of finished subgrade minus 18" may consist of any soil and should be compacted to a minimum density of 95% ASTM D698 (standard proctor) at a moisture content within the range of optimum to optimum + 3%. The top 18" of finished subgrade should consist of a select material with the following properties: a PI $\leq$15, a liquid limit $\leq$35 and a percentage passing the #200 sieve <40%.

9.1.5 Stability of Finished Subgrade

The stability of the finished subgrade should be verified by proof rolling (as specified above) prior to placing base material or surfacing. Unstable areas will need to be cut out and reworked.

9.2 Light-Duty Pavements

9.2.1 Flexible Pavement

The minimum pavement section (and a section commonly used) for light-duty driveways and parking areas consists of 6 inches of crushed stone base with 2 inches of hot mix asphaltic concrete (HMAC). Crushed stone base should comply with Type A, Grade 2, Item 247 of the *Texas Department of Transportation (TxDOT) 2004 Standard Specifications for Construction of Highways, Streets and Bridges*. Compaction of the stone base should be to a minimum of 95 percent of ASTM D 1557 (modified proctor) maximum density at optimum moisture ±3 percent. Asphaltic concrete surfacing should comply with the requirements of Type D, Item 340 of the TxDOT Specifications and should be compacted to a density of 92 to 94 percent of maximum theoretical density.

9.2.2 Full Depth Asphalt

The **minimum** full depth asphalt pavement section consists of 3 inches of hot mixed asphaltic concrete binder course (Type B) with 2 inches of hot mixed asphaltic concrete surfacing (Type D). Asphaltic concrete surfacing should comply with the requirements of Type D, Item 340 of the TxDOT Specifications and the asphaltic concrete binder should comply with the requirements of Type B, Item 340. All HMAC should be compacted to a density of 92 to 94 percent of maximum theoretical density.

9.2.3 Rigid Pavement

The performance of concrete pavement is dependent on many factors including weight and frequency of traffic, subgrade conditions, concrete quality (which itself is dependent on a host of factors), joint type and layout, jointing procedures, and numerous construction practices. A detailed discussion of all of these items is beyond the scope of this report. By way of general guidance, the following recommendations are offered:

- Minimum concrete compressive strength of 3,500 psi at 28 days placed with a water/cement ratio of 0.45 or less. The mix should contain 4% - 6% entrained air for durability.

- Minimum pavement thickness of 5 inches.

- Sawcut or preformed control joints at maximum spacing of 12 feet each way. Layout of joints should form basically square panels. Timing of the cutting of joints is critical to their performance and generally should be within 4 - 18 hours of concrete placement. *Sealing of joints and cracks and maintenance of the seal are critical for satisfactory performance.*

- Adequate site drainage to prevent ponding on or near the pavement.

- Cure concrete via use of liquid membrane curing compound.

- Concrete quality should be controlled and jointing properly executed. Minimum reinforcement should consist of 6 x 6 No. 6 welded wire fabric or No. 3 at 18 inches each way and should not be continuous through control joints.

- All edges of pavement should be thickened to 9 inches (transitioning back to 5 inches over a minimum distance of 3 feet).

- Allow a minimum of 7 days curing time before permitting traffic on the pavement.

The reader is referred to the American Concrete Institute Publication No. ACI 330R, *Guide for Design and Construction of Concrete Parking Lots* for more detailed information.

9.3 Medium-Duty Pavements

9.3.1 Flexible Pavement

For areas that will be subject to trash or delivery truck parking and traffic, the minimum recommended flexible pavement section consists of 8 inches of crushed stone base and 3 inches of asphaltic concrete surfacing. The 3 inches of surfacing may be composed of fine-graded surface course (Type D) or coarse-graded surface course (Type C). Paving materials should be specified as discussed previously.

9.3.2 Full Depth Asphalt

For a medium-duty full depth asphalt section, the minimum recommended section is 6 inches of HMAC paving consisting of 2 inches wearing surfacing (Type D) over 4 inches of asphaltic binder (Type B). Paving materials should be specified as discussed previously.

9.3.3 Rigid Pavement

Recommendations for medium-duty concrete paving are the same as for light duty except that 6 inches of portland cement concrete should be considered the minimum pavement section and the edges should be thickened to 9 inches.

9.4 Heavy-Duty Pavements

9.4.1 Flexible pavement

For areas that will be subject to heavy truck parking and traffic, the *minimum recommended* flexible pavement section consists of 7 inches of crushed stone base and 4.5 inches of asphaltic concrete surfacing. The 4.5 inches of surfacing may be composed of 2 inches of fine-graded surface course (Type D) wearing surfacing overlaying 2.5 inches of coarse-graded surface course (Type C). Paving materials should be specified as discussed previously.

9.4.2 Full Depth Asphalt

For a heavy duty full depth asphalt section, the minimum recommended section is 7.5 inches of HMAC paving consisting of 2 inches of hot mixed asphaltic concrete surfacing (Type C or D) over 5.5 inches of asphaltic concrete base course (Type A or B). Paving materials should be specified as discussed previously.

9.4.3 Rigid pavement

Recommendations for heavy-duty concrete paving are the same as for light duty except that 7 inches of Portland cement concrete should be the minimum pavement section and the edges should be thickened to 9 inches.

Table 9.1 – Pavement Options – Light Duty

Type	Base/Surface Thickness		Subgrade Preparation
Flexible HMAC	2" Surface (Type D)	6" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" HMAC Surface (Type D)	3" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	5" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 9.2 – Pavement Options – Medium Duty

Type	Base/Surface Thickness		Subgrade Preparation
Flexible HMAC	3" Surface (Type C or D)	8" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	4" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	6" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 9.3 – Pavement Options – Heavy Duty			
Type	**Base/Surface Thickness**		**Subgrade Preparation**
Flexible HMAC	2" Surface (Type C or D)	7" Crushed Stone Base & 2.5" HMAC Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	5.5" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	7" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Notes:

1)Tensar Triax Geogrid placed on subgrade may be substituted for lime treatemnt of subgrade. Lime treatment or replacement with select fill only needed where expansive clay is encountered within 12" of finished subgrade as determined by a representative of this firm.

2) Increase HMAC thickness by 1" in lieu of lime treated subgrade

3) Increase concrete thickness by 0.5" in lieu of lime treated subgrade

10.0 GENERAL CONSTRUCTION CONSIDERATIONS

The surficial soils in several areas may become unstable when wet necessitating remediation or removal and replacement to facilitate construction.

10.1 Shallow Footings

All footing excavations should be inspected by qualified personnel to insure that subgrade is composed of firm, undisturbed native soil or properly compacted select fill as recommended in this report. Water and/or loose material in footing excavations should be removed prior to final shaping of the footing excavation and placement of concrete.

10.2 Drilled Piers

Personnel familiar with the installation of drilled foundations should monitor construction of all foundation units. As a minimum, a representative of this firm should be present before and during construction in order to verify the founding stratum and to insure that the base of excavation is firm and undisturbed. Free water and/or loose material at the base of excavations should be removed prior to placement of concrete.

Groundwater observations indicate that shaft tip depth will not be below the water table and that dry method of construction should be feasible. Temporary casing and/or slurry drilling procedures could be required however. In any case, it is recommended that contract documents provide alternates with or without casing and dry or slurry displacement construction procedures.

Concrete should be designed to be highly workable (slump of 7 inches to 9 inches) and should be placed at each drilled pier location as soon as possible after the completion of drilling. Also, to insure proper construction of the drilled piers at this site, close coordination between the drilling and concreting operations is considered to be of primary importance. In no case should a shaft remain open overnight.

Construction documents must specify that all piers should be constructed in accordance with ACI 336.1 "Standard Specification for the Construction of Drilled Piers," latest edition. Only contractors familiar with and competent in the employment of these methods should be considered for the work.

The actual capacity of the completed drilled pier is directly related to the degree of conformance to correct construction procedures.

10.3 Site Design

The following recommendations are derived from years of experience with structures founded on expansive soils and are considered essential to satisfactory structure performance, especially where the floor slab is to be placed on grade:

- Sidewalks should be sloped away from buildings and should not be tied to the structures. The joint between the sidewalk and the foundation should be sealed. Sidewalks should not impound water adjacent to the structure. Potential heave of native ground adjacent to the structure needs to be taken into consideration when constructing the walk so as to avoid a sidewalk which impounds water adjacent to the structure.

- The ground surface around the building as well as paved areas should be sloped away from the building on all sides so that water will drain away from the structure. A minimum slope of 5% is recommended for the area 10 feet wide immediately adjacent to the structure. Drainage swales should have a minimum longitudinal slope of 2%. Roof drainage should be conveyed by an appropriate means for a distance of at least 15 feet from the building before it is allowed to drain into the subgrade. Water should not be allowed to pond near the building after the floor system has been placed.

- Trees should not be closer than their mature height to the structure and shrubbery should not be planted adjacent to the building unless they can be contained in watertight planter boxes and irrigation water can be prevented from seeping into the subgrade around the building. A horizontal moisture barrier (e.g. Mirafi 1212 reinforced polyethylene permanently sealed to the foundation edge at the ground line and sloped away from the building) and placed beneath planting beds is an alternative to planter boxes provided it is maintained in a watertight condition (i.e., joints sealed and punctures repaired). Planting bed edging should not impound water. A root barrier around the entire structure perimeter will provide some added assurance against desiccation of the soil due to roots growing beneath the structure. Periodic root pruning may be required to limit drying of soils beneath foundations due to vegetation. *Over irrigation adjacent to the structure can cause an increase in subsurface moisture contents that could lead to heaving.*

- To help limit surface water infiltration beneath the structure, backfill in the area 10 feet wide adjacent to the structure should be native lean or fat clay soil compacted to a minimum density of 95% of ASTM D 698 (Standard Proctor) at a moisture content of optimum or above. This zone should be at least 2 feet thick. This backfill is not necessary where pavement abuts the structure and the joint is sealed.

- Backfill for utility line ditches should be carefully controlled and should consist of a relatively impermeable material (clayey sand or lean clay), especially in the area beneath and immediately outside of the structure. Old utility lines should be removed from beneath the structure. Fill in new or old utility trenches should be placed to the same specifications as select fill. The top 6 inches under paving should be compacted to a density equal to that specified for the pavement subgrade.

- Utility connections to the building should be flexible to allow for anticipated soil movements that will be different than the anticipated movement of the structure to which they are connected (e.g. where a suspended slab is used).

10.4 Select Fill

Select fill shall consist of homogeneous soils (i.e. not sand with clay lumps) free of organic matter and rocks larger than 6 inches in diameter and possessing an Atterberg PI of 8 to 18, with a liquid limit of 40 or less. Atterberg limits testing of the fill at a rate of 1 test per 500 cubic yards of fill (and as visual changes occur) placed is recommended to verify that fill specifications are met. The material should be placed in the following manner:

- Prepare the subgrade in accordance with the recommendations discussed in a previous section of this report entitled **BUILDING SUBGRADE PREPARATION**. Sites that slope more than about 15% should be benched with 5-foot wide benches prior to placing fill.

- Place subsequent lifts of select fill in thin, loose layers not exceeding nine inches in thickness to the desired rough grade and compact to a minimum of 95% of the maximum density defined by ASTM D 698. Maintain moisture within a range of optimum -1% to optimum +3%. Where the total fill depth exceeds 6 feet beneath any portion of a structure, all fill should be compacted to a minimum of 100% of the maximum density defined by ASTM D 698.

- Conduct in-place field density tests at a rate of one test per 3,000 square feet for every lift with a minimum of 2 tests per lift. **Density testing is essential to assure that the soil, which supports the structure, is properly placed.**

- Prevent excessive loss of moisture during construction.

- For select fill placed above the existing groundline, extend the lateral limits of the fill at least 5 feet beyond the perimeter of the building area, transitioning back to the existing groundline on a 3:1(horizontal/vertical) slope.

11.0 LIMITATIONS

Geotechnical design work is characterized by the presence of a calculated risk that soil and groundwater conditions may not have been fully revealed by the exploratory borings. This risk derives from the practical necessity of basing interpretations and design conclusions on a limited sampling of the subsoil stratigraphy at the project site. The number of borings and spacing is chosen in such a manner as to decrease the possibility of undiscovered anomalies, while considering the nature of loading, size and cost of the project. The recommendations given in this report are based upon the conditions that existed at the boring locations at the time they were drilled. The term "existing groundline" or "existing subgrade" refers to the ground elevations and soil conditions at the time of our field operations.

It is conceivable that soil conditions throughout the site may vary from those observed in the exploratory borings. If such discontinuities do exist, they may not become evident until construction begins or possibly much later. Consequently, careful observations by the geotechnical engineer must be made of the construction as it progresses to help detect significant and obvious deviations of actual conditions throughout the project area from those inferred from the exploratory borings. Should any conditions at variance with those noted in this report be encountered during construction, this office should be notified immediately so that further investigations and supplemental recommendations can be made.

Construction plans and specifications should be submitted to ETTL for review prior to issuance for construction to help verify that the recommendations of this report have been correctly understood and implemented.

This company is not responsible for the conclusions, opinions, or recommendations made by others based on the contents of this report. The recommendations made in this report are applicable only to the proposed scope of work as defined in **SECTION 2.0 PROJECT DESCRIPTION** and may not be used for any other work without the express written consent of ETTL Engineers. The purpose of this study is only as stated elsewhere herein and is not intended to comply with the requirements of 30 TAC 330 Subchapter T regarding testing to determine the presence of a landfill. Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No warranties are either expressed or implied.

USGS Design Maps Detailed Report

2012 International Building Code (33.4526°N, 94.26929°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_s) and 1.3 (to obtain S_1). Maps in the 2012 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(1) [1]	S_s = 0.140 g
From Figure 1613.3.1(2) [2]	S_1 = 0.077 g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_s \le 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_s

For Site Class = D and S_s = 0.140 g, F_a = 1.600

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1-s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.077 g, F_v = 2.400

Equation (16-37): $S_{MS} = F_a S_S = 1.600 \times 0.140 = 0.223$ g

Equation (16-38): $S_{M1} = F_v S_1 = 2.400 \times 0.077 = 0.185$ g

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 0.223 = 0.149$ g

Equation (16-40): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.185 = 0.123$ g

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.149 g, Seismic Design Category = A

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.123 g, Seismic Design Category = B

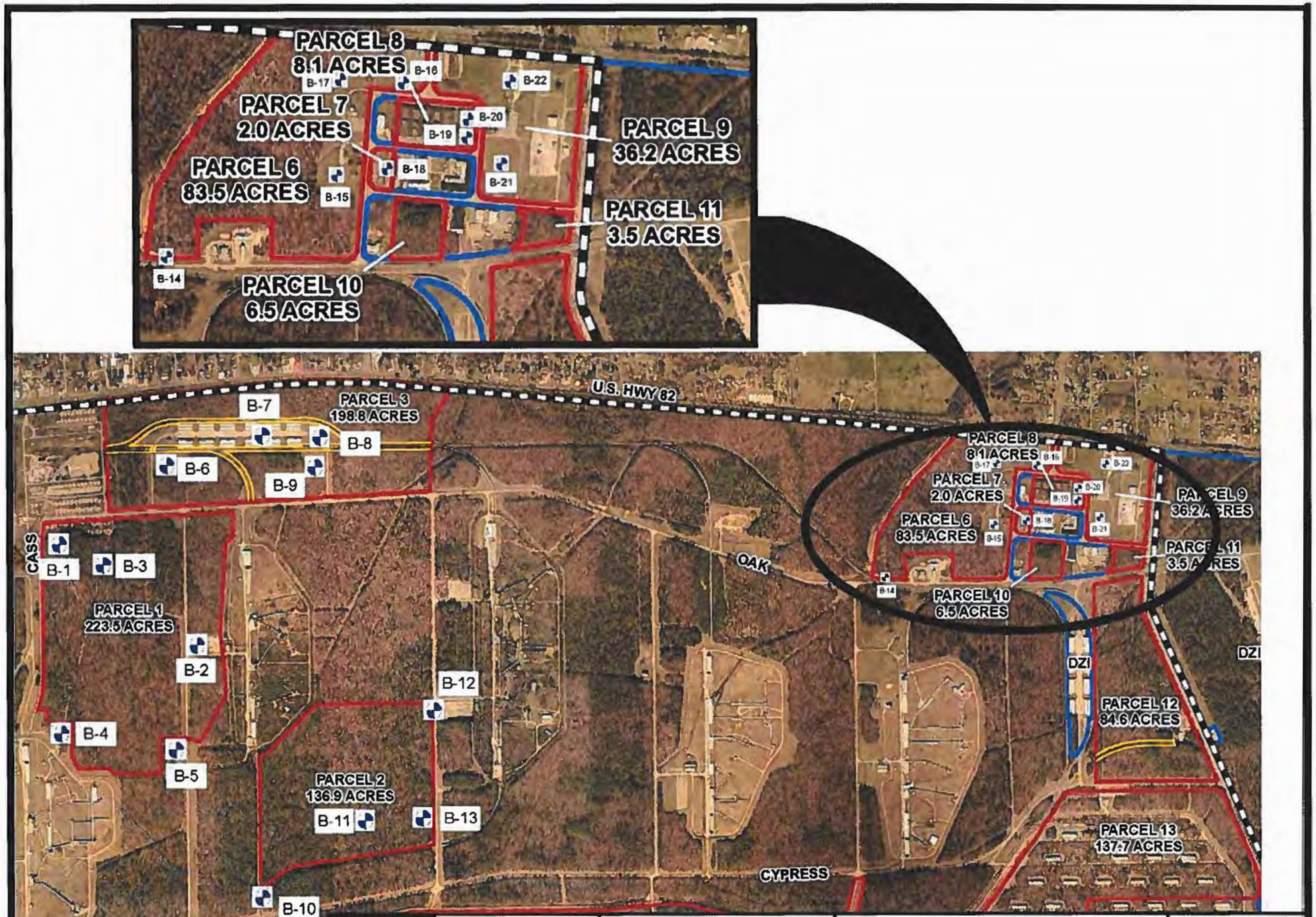
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = B

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 1613.3.1(1)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(1).pdf
2. *Figure 1613.3.1(2)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(2).pdf



ETTL ENGINEERS & CONSULTANTS MAIN OFFICE 1717 East Erwin Tyler, Tx 75702 (903) 595-4421	TexAmericas Center East Parcels 1,2,3,6,7,8&9 Hooks, Texas	PLATE 2 – PLAN OF BORINGS		APPROVED BY:
		JOB No.: G3972-136		DRAWN BY: RWG
		DATE: July 2013	SCALE: N.T.S.	

LOG OF BORING B- 1

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
0		ML	±1' SILT WITH GRAVEL(ML) tan	N=11				6	20	13	7	39	39	17				
		SC SM	SILTY CLAYEY SAND(SC-SM) medium dense; tan															
		CL	LEAN CLAY WITH SAND(CL) medium stiff; red and gray	N=7														
5			--very stiff	N=16				17	42	17	25	74	3	0				
				N=20														
10																		
15			LEAN CLAY(CL) stiff; tan and gray	N=12														
			--very stiff	N=24														
20			Bottom of Boring @ 20'															

BLOW COUNT (20 40 60 80); Qu (tsf) (1 2 3 4); PPR (tsf) (1.0 2.0 3.0 4.0); Torvane (tsf) (1.0 2.0 3.0 4.0)

COMPRESSIVE STRENGTH

Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit; 20 40 60 80)

Water Level — Est. — Measured: — Perched:

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.46064°, W94.28807°

Driller: J. Lewis

Logger: J. Lewis

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MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING B-2

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA
0		SM			±2" ASPHALT	
		GW			SILTY SAND WITH GRAVEL(SM) red	N=5
		CL			WELL GRADED GRAVEL	
					LEAN CLAY(CL) medium stiff; gray	N=7
		CH			FAT CLAY(CH) stiff; tan and gray	
5			Eml			N=9
						N=14
10					Bottom of Boring @ 10'	

FIELD STRENGTH DATA: BLOW COUNT (20 40 60 80); Qu (tsf) (1 2 3 4); PPR (tsf) (1.0 2.0 3.0 4.0); Torvane (tsf) (1.0 2.0 3.0 4.0)

COMPRESSIVE STRENGTH: DRY DENSITY (pcf); COMPRESSIVE STRENGTH (tsf); MOISTURE CONTENT (%)

Natural Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (20 40 60 80)

MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
25	63	21	42	92	1	0				

Water Level — Est.: ▽ Measured: ▼ Perched: ▼

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.45604°, W94.28106°

Driller: J. Lewis

Logger: J. Lewis

LOG OF BORING B- 3

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

PROJECT NO.: G3972-136

DRILL RIG: Truck Rig

BORING TYPE: Flight Auger

DATE 6/26/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
0		GW			±4" WELL GRADED GRAVEL(GW)															
		SM			±6" SILTY SAND(SM) tan	N=13				15	26	14	12	68	6	2				
		CL			SANDY LEAN CLAY(CL) stiff; gray and tan	N=13														
		CH			FAT CLAY(CH) very stiff; red and gray															
5		CL	Eml		SANDY LEAN CLAY(CL) very stiff; tan and gray	P=3.5 P=3.0				16	38	17	21	69	10	3	115	2.1	1250	16
					--stiff	N=12														
10					Bottom of Boring @ 10'															

BLOW COUNT: 20 40 60 80
Qu (tsf): 1 2 3 4
PPR (tsf): 1.0 2.0 3.0 4.0
Torvane (tsf): 1.0 2.0 3.0 4.0

COMPRESSIVE STRENGTH

Natural Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit; 20 40 60 80

Water Level Est. ▽ Measured: ▼ Perched: ▼

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.46009°, W94.28519°

Driller: J. Lewis

Logger: J. Lewis

LOG OF BORING B- 4

ETTL
ENGINEERS &
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MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
0		SM			SILTY SAND(SM) loose; brown	N=6														
		CL			LEAN CLAY WITH SAND(CL) stiff; tan and gray	N=13				19	39	17	22	76	4	2				
5		CH	Eml		FAT CLAY(CH) very stiff; tan and gray	N=24														
					FAT CLAY WITH GRAVEL(CH) very tiff; tan and gray	N=26														
10					Bottom of Boring @ 10'															

BLOW COUNT (20 40 60 80)
Qu (tsf) (1 2 3 4)
PPR (tsf) (1.0 2.0 3.0 4.0)
Torvane (tsf) (1.0 2.0 3.0 4.0)

COMPRESSIVE STRENGTH

Natural Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
20 40 60 80

Water Level Est.: ▽ Measured: ▼ Perched: ▼

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.45281°, W94.28785°

Driller: J. Lewis

Logger: J. Lewis

LOG OF BORING B- 5

ETTL
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MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA
0		SC			CLAYEY SAND WITH GRAVEL(SC) red	N=4
		SM			SILTY SAND(SM) loose; brown	
		ML			SANDY SILT(ML) loose; tan and gray	N=9
5		CL			LEAN CLAY WITH SAND(CL) very stiff; tan	N=26
		CH			FAT CLAY WITH SAND(CH) very stiff; tan and gray	N=27
10						
						N=23
15					--hard	N=34
20					Bottom of Boring @ 20'	

BLOW COUNT (20 40 60 80)
Qu (tsf) (1 2 3 4)
PPR (tsf) (1.0 2.0 3.0 4.0)
Torvane (tsf) (1.0 2.0 3.0 4.0)

DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit; 20 40 60 80)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
				15	NP	NP	NP	62	9	5				
				15	44	18	26	80	1	0				

Water Level Est. Measured: Perched:

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.45186°, W94.28194°

Driller: J. Lewis

Logger: J. Lewis

APPENDIX D

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): November 30, 2021

B. DISTRICT OFFICE, FILE NAME, AND NUMBER: SWT-2020-322 (AJD-2), TexAmericas Center / Red River Army Depot Proposed Commercial Development Bowie County TX

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: Texas County/parish/borough: Bowie County City: near Hooks
Center coordinates of site (lat/long in degree decimal format): Lat. 33.463902 ° **N**,
Long. -94.292308 ° **W**.

Universal Transverse Mercator: N/A
Name of nearest waterbody: Unnamed Tributary to Panther Creek
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Red River.
Name of watershed or Hydrologic Unit Code (HUC): 11140106
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☒ Office (Desk) Determination. Date: November 8, 2021
☒ Field Determination. Date(s): August 19, 2021

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** *"navigable waters of the U.S."* within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **are and are not** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☒ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☒ Non-RPWs that flow directly or indirectly into TNWs
      ☒ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☒ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: 5,360 linear feet: 8 width (ft) and/or acres.
      Wetlands: 59.55 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Pick List**
      Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
   Explain: **The review area has nine wetlands (Wet-A-2, Wet-A-3, Wet-A-4, Wet-A-19, Wet-A-20, Wet-B-5, Wet-B-6,**

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

Wet-B-30, Wet-B-31) which are not connected to the nearest unnamed tributary. These wetlands are isolated based on the lack of physical connection or a commerce nexus.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW
Identify TNW: .

Summarize rationale supporting determination: .

2. Wetland adjacent to TNW
Summarize rationale supporting conclusion that wetland is "adjacent": .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:
Watershed size: 37005 **Pick List**
Drainage area: 160 **acres**
Average annual rainfall: 48 inches
Average annual snowfall: 1 inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☒ Tributary flows through **5** tributaries before entering TNW.

Project waters are **20-25** river miles from TNW.
Project waters are **1 (or less)** river miles from RPW.
Project waters are **5-10** aerial (straight) miles from TNW.
Project waters are **1 (or less)** aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain: No.

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

Identify flow route to TNW[5]: This unnamed tributary (S-1B) to Panther Creek, flows into an unnamed tributary to Panther Creek, which flows into Panther Creek, then into Barkman Creek, then into McKinney Bayou, which flows into the Red River (TNW).
Tributary stream order, if known: The unnamed tributary within the review area is a 1st order stream.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☐ Artificial (man-made). Explain: .
☒ Manipulated (man-altered). Explain: This unnamed tributary has been straightened and placed within a ditch like channel when the U.S Military conducted soil grading work in the 1940's within the review area.

Tributary properties with respect to top of bank (estimate):
Average width: 10 feet
Average depth: 3 feet
Average side slopes: **2:1.**

Primary tributary substrate composition (check all that apply):

☒ Silts	☐ Sands	☐ Concrete
☐ Cobbles	☒ Gravel	☒ Muck
☐ Bedrock	☒ Vegetation. Type/% cover:	
☐ Other. Explain: .		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: The unnamed tributary appears mostly stable within the constructed channel.
Presence of run/riffle/pool complexes. Explain: No.
Tributary geometry: **Relatively straight**
Tributary gradient (approximate average slope): 1-2 %

(c) Flow:
Tributary provides for: **Seasonal flow**
Estimate average number of flow events in review area/year: **20 (or greater)**
Describe flow regime: Based on the drainage area (160 acres) and the stream likely being influenced by groundwater, the stream has been determined to flow in direct response to rain events and have sustained flows during the wettest times of the year (RPW).
Other information on duration and volume: none.

Surface flow is: **Discrete and confined**. Characteristics: The flow within the unnamed tributary is confined within the modified bed/banks. The flow may be discrete when groundwater influence is the primary hydrology source.

Subsurface flow: **Unknown**. Explain findings: N/A.
☐ Dye (or other) test performed: .

Tributary has (check all that apply):
☒ Bed and banks
☒ OHWM[6] (check all indicators that apply):

☒ clear, natural line impressed on the bank	☒ the presence of litter and debris
☐ changes in the character of soil	☒ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☒ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☒ sediment deposition	☒ multiple observed or predicted flow events
☐ water staining	☐ abrupt change in plant community
☐ other (list):	

☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:	☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;
☐ physical markings/characteristics	☐ vegetation lines/changes in vegetation types.

[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.
[6] A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7] Ibid.

☐ tidal gauges
☐ other (list):

(iii) Chemical Characteristics:

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).

Explain: The watercolor is somewhat transparent with a brown color overall, there was no observed surface film or indication of pollutants in the water during my site visit. The drainage area for this waterway is surrounded by pine forests.

Identify specific pollutants, if known: During the site visit, I did not identify any potential sources for pollutants.

(iv) Biological Characteristics. Channel supports (check all that apply):

☒ Riparian corridor. Characteristics (type, average width): This stream has a continuous riparian buffer surrounding it throughout most of the review area except for a 1,000 linear feet segment of the stream where the area is cleared/maintained.

☒ Wetland fringe. Characteristics: Due to the soil grading/modification within the overall review area, wetlands were delineated within the forested areas surrounding this unnamed tributary.

☒ Habitat for:

☐ Federally Listed species. Explain findings: .

☐ Fish/spawn areas. Explain findings: .

☐ Other environmentally-sensitive species. Explain findings: .

☒ Aquatic/wildlife diversity. Explain findings: The unnamed tributary in conjunction with the surrounding mixed wetlands function as wildlife habitat.

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties: There are nine combined wetlands adjacent to the unnamed tributary.

Wetland size: 59.55 acres

Wetland type. Explain: The wetlands are characterized as mostly being scrub shrub wetlands, however, there were almost the same acreage of forested wetlands with less of the overall features being determined as emergent wetlands.

Wetland quality. Explain: These wetlands are likely created when the military conducted soil grading/modifications in the 1940's, resulting in water being impounded for longer than normal. These wetlands are undisturbed and represent moderate quality due to the lack of anthropogenic influence within this military installation.

Project wetlands cross or serve as state boundaries. Explain: No.

(b) General Flow Relationship with Non-TNW:

Flow is: **No Flow** . Explain: These wetlands may have sheet flow which drains into the unnamed tributary during the wettest periods of the year.

Surface flow is**: Overland sheetflow**

Characteristics: Sheet flow is the most likely flow from the wetlands to the unnamed tributary.

Subsurface flow: **Unknown**. Explain findings: N/A.

☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:

☒ Directly abutting

☒ Not directly abutting

☒ Discrete wetland hydrologic connection. Explain: The wetlands which do not have a direct connection are in very close proximity to the unnamed tributary and likely exhibit a discrete surface/subsurface connection.

☒ Ecological connection. Explain.

☐ Separated by berm/barrier. Explain: Several of the delineated wetlands were separated by berm left from historic soil grading/modification.

(d) Proximity (Relationship) to TNW

Project wetlands are **20-25** river miles from TNW.

Project waters are **5-10** aerial (straight) miles from TNW.

Flow is from: **Wetland to navigable waters.**

Estimate approximate location of wetland as within the **50 - 100-year** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: no water was observed during my site visit within any wetland areas; however, the water quality would be similar to water visible in the unnamed tributary.

Identify specific pollutants, if known: N/A.

(iii) Biological Characteristics. Wetland supports (check all that apply):

☒ Riparian buffer. Characteristics (type, average width): The wetlands are primarily represented by scrub shrub, forested, and emergent wetlands, these habitats are large buffers associated with the unnamed tributary.

☒ Vegetation type/percent cover. Explain: The wetlands are primarily scrub shrub and forested, and some are emergent.

☒ Habitat for:

☐ Federally Listed species. Explain findings: .

☐ Fish/spawn areas. Explain findings: .

☐ Other environmentally-sensitive species. Explain findings: .

☒ Aquatic/wildlife diversity. Explain findings: The wetlands likely provide habitat for various wildlife for feeding, bedding, and traveling.

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **9**

Approximately (59.55) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)
Wet-A-1, Yes	6.05	Wet-B-2, Yes	19.69
Wet-A-5, NO	19.54	Wet-B-3, No	0.35
Wet-A-6, No	4.25	Wet-B-4, No	0.07
Wet-A-21, No	1.37		
Wet-A-22, No	19.24		
Wet-B-1, Yes	8.58		

Summarize overall biological, chemical and physical functions being performed: The wetlands adjacent to the unnamed tributary listed above provide various functions. The biological functions include habitat for sleeping, eating, nesting, and traveling. The wetlands provide for both aquatic and terrestrial organisms depending on the time of year. The wetlands provide chemical functions in the form of water quality improvement due to pollutant filtering, and nutrient cycling/transport. The wetlands may aid in slowing down water to reduce peak flood flows within the tributary, as well as provide water table recharge.

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: .

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: The Western region of the review area contains an ephemeral tributary (S-1A), which is depicted on the USGS Topographic Map. The tributary has nine associated wetlands (Wet-A-1, Wet-B-1, Wet-B-2, Wet-A-21, Wet-B-4, Wet-B-3, Wet-A-22, Wet-A-5, Wet-A-6) which are adjacent to the tributary. These wetlands are comprised of scrub shrub, forested, and then some emergent features. This stream has been determined a NRPW based on the limited frequency and duration of flow. This ephemeral stream has a bed/bank and is approximately 7 feet wide and 5 feet deep. This tributary starts within the review area within a roadside ditch and flows into the altered (straightened) channel. These wetland habitats occur along the riparian buffer on both sides of the stream. These aquatic resources likely provide suitable wildlife habitat during the spring rain season. This ephemeral stream along with its wetland habitats may provide some reductions in peak flood flows going into downstream waters. This stream has a riparian corridor throughout most of the site, thus would contribute organics/nutrients to downstream waters. The water quality is likely suitable for supporting aquatic organisms, due to the limited sources of pollutants which could influence this tributary and its downstream waters. Based on the potential for this tributary to provide various ecological benefits when the stream and wetlands contribute flow, these combined features have been determined to have a significant nexus to the Red River (TNW). This NRPW and its wetlands meet the SigNex standard set within the Rapanos Guidance document and is supported within the agent's delineation report as well as this AJD.

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet width (ft), Or, acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: .
   - ☒ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: The intermittent tributary (S-1B) likely exhibits seasonal flow due to the extensive wetland habitats that surround it and its headwater.

   Provide estimates for jurisdictional waters in the review area (check all that apply):
   - ☒ Tributary waters: **660** linear feet **10** width (ft).
   - ☐ Other non-wetland waters: acres.
     Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
   - ☒ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional waters within the review area (check all that apply):
   - ☐ Tributary waters: **4700** linear feet **7** width (ft).
   - ☐ Other non-wetland waters: acres.
     Identify type(s) of waters: **.**

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
   - ☒ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
     - ☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: **.**
     - ☒ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: Wetlands (Wet-A-1, Wet-B-1) are directly abutting the stream within the review area.

   Provide acreage estimates for jurisdictional wetlands in the review area: **14.63** acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
   - ☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

   Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
   - ☒ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional wetlands in the review area: **44.92** acres.

[8]See Footnote # 3.

7. **Impoundments of jurisdictional waters.**[9]
As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]
☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):
☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☒ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
☒ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
☐ Other: (explain, if not covered above): .

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☒ Wetlands: (Wet-B-30; 2.4ac) (Wet-B-31; 2.02ac) (Wet-A-20; 0.14ac) (Wet-A-2; 1.11ac) (Wet-B-6; 0.86ac) (Wet-B-5; 1.43ac) (Wet-A-3; 2.54ac) (Wet-A-4; 0.33ac) acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: TexAmericas Center Delineation Report Dated January 7, 2021.
☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.*

☒ Office concurs with data sheets/delineation report.
☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☒ U.S. Geological Survey Hydrologic Atlas: ORM Data Accessed October 29, 2021.
☒ USGS NHD data.
☒ USGS 8 and 12 digit HUC maps.
☐ U.S. Geological Survey map(s). Cite scale & quad name: Hooks, 1:24,000.
☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
☒ National wetlands inventory map(s). Cite name: ORM Data Accessed October 29, 2021.
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☒ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date):Google Earth Pro Dated March 2019.
or ☒ Other (Name & Date): Site Visit Photos Dated August 19, 2021.
☐ Previous determination(s). File no. and date of response letter: .
☐ Applicable/supporting case law: .
☐ Applicable/supporting scientific literature: .
☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: The review area is approximately 170 acres.


SWT-2020-322
AJD (3) Rapanos
Red box is review area
Blue features are jurisdictional tributaries
Green features are jurisdictional wetlands
Yellow features are non-jurisdictional wetlands
Hooks
(S-1B)
(Wet-B-1)
(Wet-A-1)
(Wet-A-19)
(Wet-B-2)
(Wet-B-30)
(Wet-B-31)
(Wet-A-2)
(Wet-A-20)
(Wet-A-21)
(Wet-B-3)
(Wet-B-4)
(S-1A)
(Wet-A3)
(Wet-A-4)
(Wet-B-6)
(Wet-B-5)
(Wet-A5)
(Wet-A-22)
(Wet-A-6)
Google Earth
N
2000 ft

APPENDIX E

Last Update: 3/5/2021

BOWIE COUNTY

AMPHIBIANS

southern crawfish frog *Lithobates areolatus areolatus*

Terrestrial and aquatic: The terrestial habitat is primarily grassland and can vary from pasture to intact prairie; it can also include small prairies in the middle of large forested areas. Aquatic habitat is any body of water but preferred habitat is ephemeral wetlands.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4T4	State Rank: S3

Strecker's chorus frog *Pseudacris streckeri*

Terrestrial and aquatic: Wooded floodplains and flats, prairies, cultivated fields and marshes. Likes sandy substrates.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

BIRDS

Bachman's sparrow *Peucaea aestivalis*

Open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S1B

bald eagle *Haliaeetus leucocephalus*

Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3B,S3N

Franklin's gull *Leucophaeus pipixcan*

This species is only a spring and fall migrant throughout Texas. It does not breed in or near Texas. Winter records are unusual consisting of one or a few individuals at a given site (especially along the Gulf coastline). During migration, these gulls fly during daylight hours but often come down to wetlands, lake shore, or islands to roost for the night.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2N

interior least tern *Sternula antillarum athalassos*

Sand beaches, flats, bays, inlets, lagoons, islands. Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Federal Status: DL: Delisted	State Status: E	SGCN: Y
Endemic: N	Global Rank: G4T3Q	State Rank: S1B

BOWIE COUNTY

BIRDS

piping plover *Charadrius melodus*

Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on the November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beaches appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e. north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.

Federal Status: LT	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S2N

swallow-tailed kite *Elanoides forficatus*

Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2B

white-faced ibis *Plegadis chihi*

Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4B

wood stork *Mycteria americana*

Prefers to nest in large tracts of baldcypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: SHB,S2N

FISH

blackside darter *Percina maculata*

Restricted to the Red River Basin in the northeast part of the state although specimens have been taken in the lower Trinity and San Jacinto rivers; Often found in clear, gravelly streams.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S1

BOWIE COUNTY

FISH

blackspot shiner *Notropis atrocaudalis*

Occurs from the lower Brazos River to the Sabine River drainage; Red River drainage. Small to moderate size tributary streams in runs and pools over all types of substrates.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

chub shiner *Notropis potteri*

Brazos, Colorado, San Jacinto, and Trinity river basins. Flowing water with silt or sand substrate

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S2

goldeye *Hiodon alosoides*

Restricted to the Red River basin; adults in quiet turbid water of medium to large lowland rivers, small lakes, marshes and muddy shallows connected to them.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

ironcolor shiner *Notropis chalybaeus*

Found only in northeastern streams from the Sabine to the Red River with the exception of an isolated population found in the San Marcos River headwaters. Found primarily in acidic, tannin-stained, non-turbid, sluggish Coastal Plain streams and
rivers of low to moderate gradient. Occurs in aggregation, often at the upstream ends of pools, with a moderate to sluggish current and sand, mud, silt or detritus substrates. Usually associated with aquatic vegetation.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

orangebelly darter *Etheostoma radiosum*

Streams, creeks, and small to moderate-sized rivers in the Red River basin. Riffle areas of gravel-bottoms streams with moderate to high currents.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

paddlefish *Polyodon spathula*

Species occurred in every major river drainage from the Trinity Basin eastward, but its numbers and range had been substantially reduced by the 1950's; recently reintroduced into Big Cypress drainage upstream of Caddo Lake. Prefers large, free-flowing rivers but will frequent impoundments with access to spawning sites.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

Red River shiner *Notropis bairdi*

Red River basin; typically found in turbid waters of broad, shallow channels of main stream, over bottom mostly of silt and shifting sand.

Federal Status:	State Status:	SGCN: Y

BOWIE COUNTY

FISH

Endemic: N | Global Rank: G4 | State Rank: S3

shovelnose sturgeon *Scaphirhynchus platorynchus*

Found only in the Red River below Denison Dam (Lake Texoma). Evidence of the presence of this species in the lower Pecos River, during prehistoric times, strongly suggests that it likely occurred in many Texas rivers. Inhabits flowing water over sandy bottoms or near rocky points or bars.

Federal Status: SAT | State Status: T | SGCN: Y
Endemic: N | Global Rank: G4 | State Rank: S2

silver chub *Macrhybopsis storeriana*

Red River and Brazos River basins. Mainly restricted to large, often silty rivers. Ranges over gravel to silt substrates but found more commonly over silt or mud bottom.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S3

silverband shiner *Notropis shumardi*

In Texas, found from Red River to Lavaca River; Main channel with moderate to swift current velocities and moderate to deep depths; associated with turbid water over silt, sand, and gravel.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S4

taillight shiner *Notropis maculatus*

Restricted to the Sulphur and Cypress drainages in northeast Texas; Quiet, usually vegetated oxbow lakes, ponds, or backwaters.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S1

western creek chubsucker *Erimyzon claviformis*

Eastern Texas streams from the Red River to the San Jacinto drainage. Habitat includes silt-, sand-, and gravel-bottomed pools of clear headwaters, creeks, and small rivers; often near vegetation; occasionally in lakes. Spawning occurs in river mouths or pools, riffles, lake outlets, or upstream creeks. Prefers headwaters, but seldom occurs in springs.

Federal Status: | State Status: T | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S2S3

INSECTS

American bumblebee *Bombus pensylvanicus*

Habitat description is not available at this time.

Federal Status: | State Status: | SGCN: Y
Endemic: | Global Rank: G3G4 | State Rank: SNR

BOWIE COUNTY

MAMMALS

big brown bat *Eptesicus fuscus*

Any wooded areas or woodlands except south Texas. Riparian areas in west Texas.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S5

black bear *Ursus americanus*

Generalist. Historically found throughout Texas. In Chisos, prefers higher elevations where pinyon-oaks predominate; also occasionally sighted in desert scrub of Trans-Pecos (Black Gap Wildlife Management Area) and Edwards Plateau in juniper-oak habitat. For ssp. luteolus, bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Bottomland hardwoods and large tracts of inaccessible forested areas.

Federal Status: State Status: T SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

eastern spotted skunk *Spilogale putorius*

Generalist; open fields prairies, croplands, fence rows, farmyards, forest edges & woodlands. Prefer wooded, brushy areas & tallgrass prairies. S.p. ssp. interrupta found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S1S3

long-tailed weasel *Mustela frenata*

Includes brushlands, fence rows, upland woods and bottomland hardwoods, forest edges & rocky desert scrub. Usually live close to water.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S5

mountain lion *Puma concolor*

Generalist; found in a wide range of habitats statewide. Found most frequently in rugged mountains & riparian zones.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S2S3

southeastern myotis bat *Myotis austroriparius*

Caves are rare in Texas portion of range; buildings, hollow trees are probably important. Historically, lowland pine and hardwood forests with large hollow trees; associated with ecological communities near water. Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S3

swamp rabbit *Sylvilagus aquaticus*

Primarily found in lowland areas near water including: cypress bogs and marshes, floodplains, creeks and rivers.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S5

BOWIE COUNTY

MAMMALS

tricolored bat *Perimyotis subflavus*

Forest, woodland and riparian areas are important. Caves are very important to this species.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G2G3 State Rank: S3S4

woodland vole *Microtus pinetorum*

Include grassy marshes, swamp edges, old-field/pine woodland ecotones, tallgrass fields; generally sandy soils.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

REPTILES

alligator snapping turtle *Macrochelys temminckii*

Aquatic: Perennial water bodies; rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near running water; sometimes enters brackish coastal waters. Females emerge to lay eggs close to the waters edge.

Federal Status: State Status: T SGCN: Y
Endemic: N Global Rank: G3 State Rank: S2

eastern box turtle *Terrapene carolina*

Terrestrial: Eastern box turtles inhabit forests, fields, forest-brush, and forest-field ecotones. In some areas they move seasonally from fields in spring to forest in summer. They commonly enters pools of shallow water in summer. For shelter, they burrow into loose soil, debris, mud, old stump holes, or under leaf litter. They can successfully hibernate in sites that may experience subfreezing temperatures.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

slender glass lizard *Ophisaurus attenuatus*

Terrestrial: Habitats include open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds, often in habitats with sandy soil.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

Texas horned lizard *Phrynosoma cornutum*

Terrestrial: Open habitats with sparse vegetation, including grass, prairie, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.

Federal Status: State Status: T SGCN: Y
Endemic: N Global Rank: G4G5 State Rank: S3

BOWIE COUNTY

REPTILES

timber (canebrake) rattlesnake *Crotalus horridus*

Terrestrial: Swamps, floodplains, upland pine and deciduous woodland, riparian zones, abandoned farmland. Limestone bluffs, sandy soil or black clay. Prefers dense ground cover, i.e. grapevines, palmetto.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S4

PLANTS

Arkansas meadow-rue *Thalictrum arkansanum*

Mostly deciduous forests on alluvial terraces and upper drainages of hardwood slope forests at contacts with calcareous prairies; flowering March-April, withering by midsummer

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G2Q	State Rank: S2

Arkansas oak *Quercus arkansana*

At the Cass County location, it occurs with Quercus stellata, Q. marilandica and Q. incana in a young pine plantation on deep sandy soils; Perennial; Flowering spring

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S1

APPENDIX F

March 23, 2012

Robert Grundborg
Commander's Representative
Department of the Army
Lone Star Army Ammunition Plant
Highway 82 West
Texarkana, TX 756505-9101

Re: Project review under Section 106 of the National Historic Preservation Act of 1966
Final Report: *Phase II Archaeological Investigations at Red River Army Depot and Lone Star Army Ammunition Plant, Bowie County, Texas.* (ARMY)

Dear Mr. Grundborg:

Thank you for allowing us to review the above referenced final report. This letter serves as further comment on the proposed BRAC undertaking at Red River Army Depot (RRAD) and Lone Star Army Ammunition Plant (LSAAP) from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission.

The review staff, led by Bill Martin, has completed its review. After examining the document, we concur with your determination that following archeological sites are ineligible for inclusion in the National Register of Historic Places (NRHP): 41BW276, 41BW278, 41BW497, and 41BW749. It now appears that all of the archeological sites at the installations have been evaluated and none have been determined eligible for inclusion in the NRHP. Therefore, we believe that the plant closure will have no effect on historic properties.

Thank you for your cooperation in this federal review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If we can be of further assistance, please contact Bill Martin at 512/463-5867.**

Sincerely,

William A. Martin

for
Mark Wolfe, State Historic Preservation Officer

MW/wam

cc: Nancy Parrish, COE-FWD

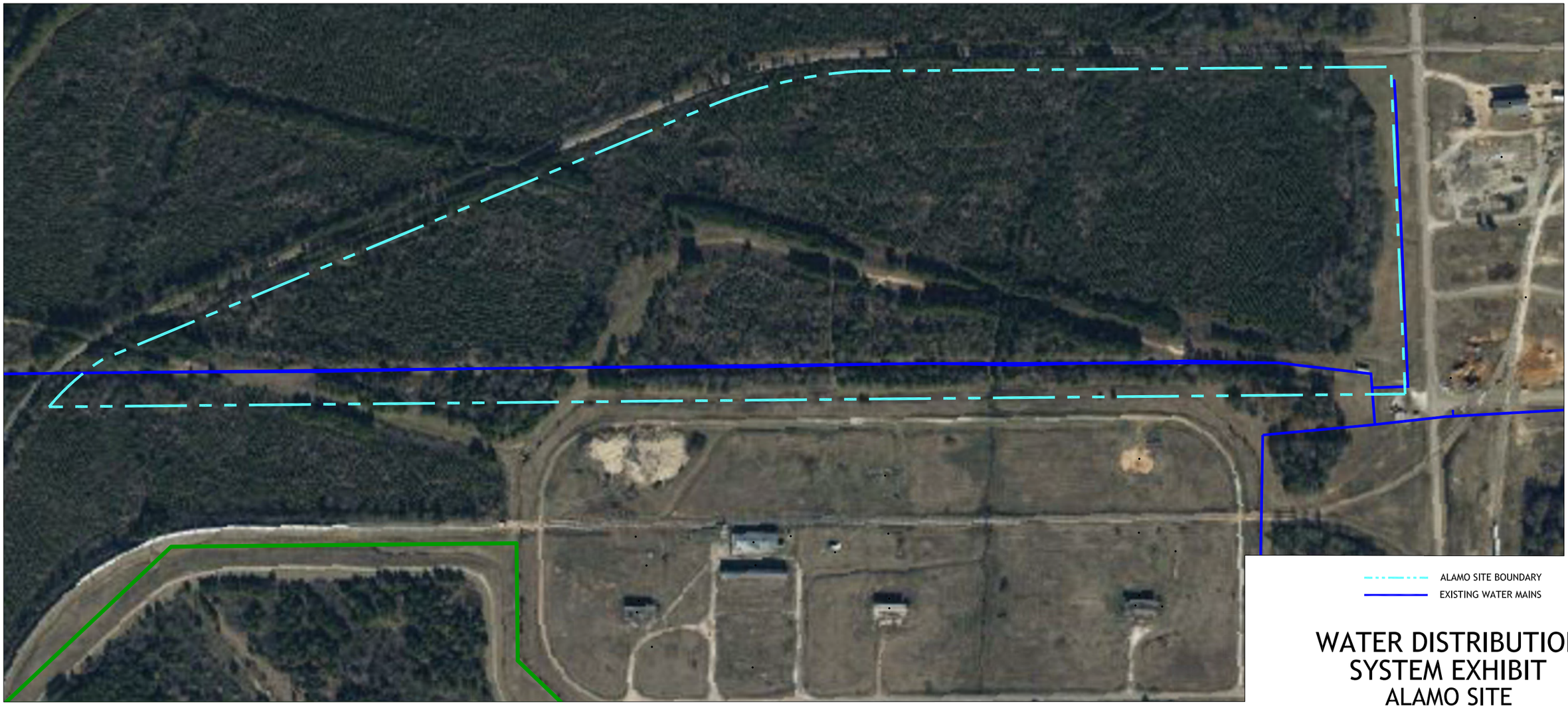
APPENDIX G

FIGURE G-1

N

0 150 300 600 900

11”X17” – 1”=300’



ALAMO SITE BOUNDARY

EXISTING WATER MAINS

WATER DISTRIBUTION SYSTEM EXHIBIT

ALAMO SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

DRAWN: ***	DESIGN: ***	DATE: 10/18/2022	SCALE: ***	JOB #:

FIGURE G-2

N

0 150 300 600 900

11”X17” – 1”=300’

ALAMO SITE BOUNDARY

EXISTING WASTEWATER GRAVITY MAINS

EXISTING WASTEWATER FORCE MAIN

WASTEWATER COLLECTION SYSTEM EXHIBIT

ALAMO SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

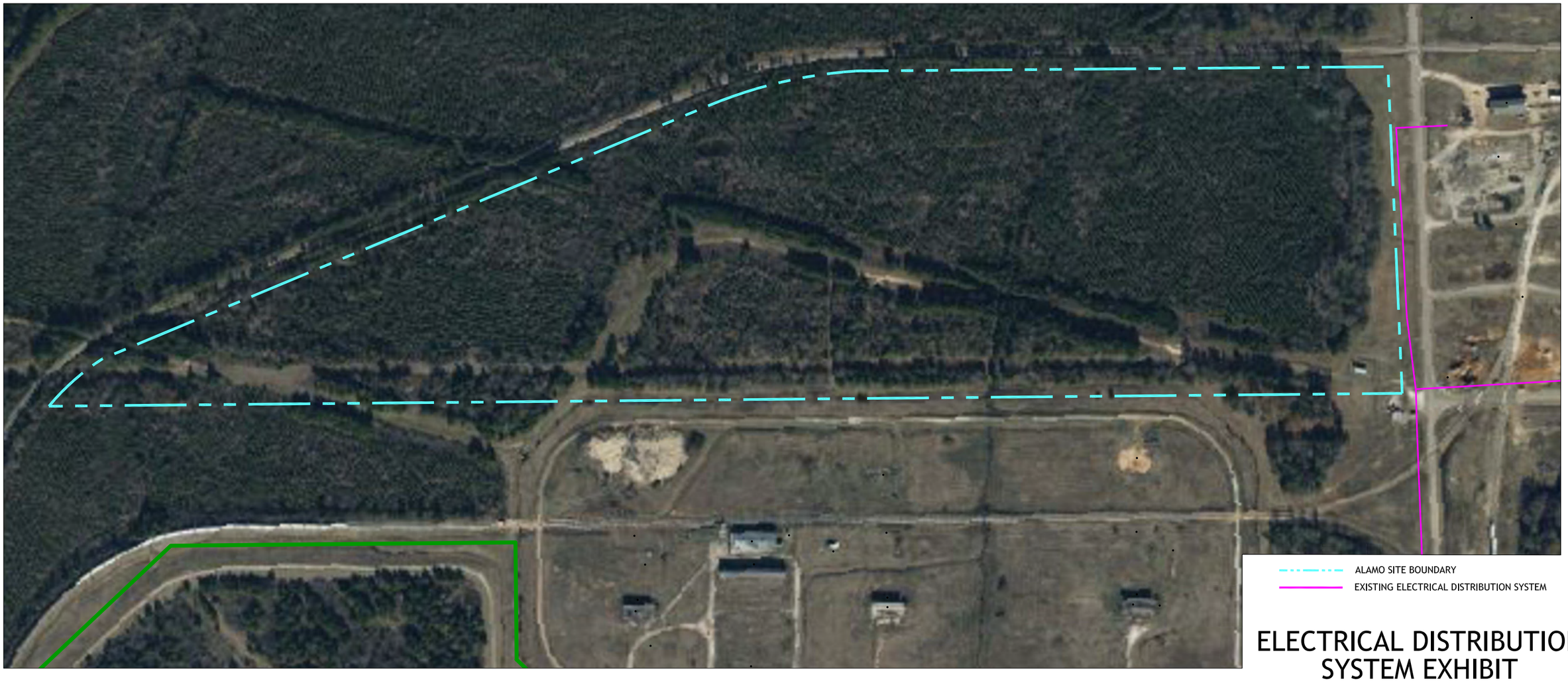
DRAWN: ***	DESIGN: ***	DATE: 10/18/2022	SCALE: ***	JOB #:

FIGURE G-3

N

0 150 300 600 900

11”X17” – 1”=300’



ALAMO SITE BOUNDARY

EXISTING ELECTRICAL DISTRIBUTION SYSTEM

ELECTRICAL DISTRIBUTION SYSTEM EXHIBIT

ALAMO SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

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FIGURE G-4

N

0 150 300 600 900

11”X17” – 1”=300’

ALAMO SITE BOUNDARY

EXISTING NATURAL GAS MAINS

NATURAL GAS DISTRIBUTION SYSTEM EXHIBIT

ALAMO SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

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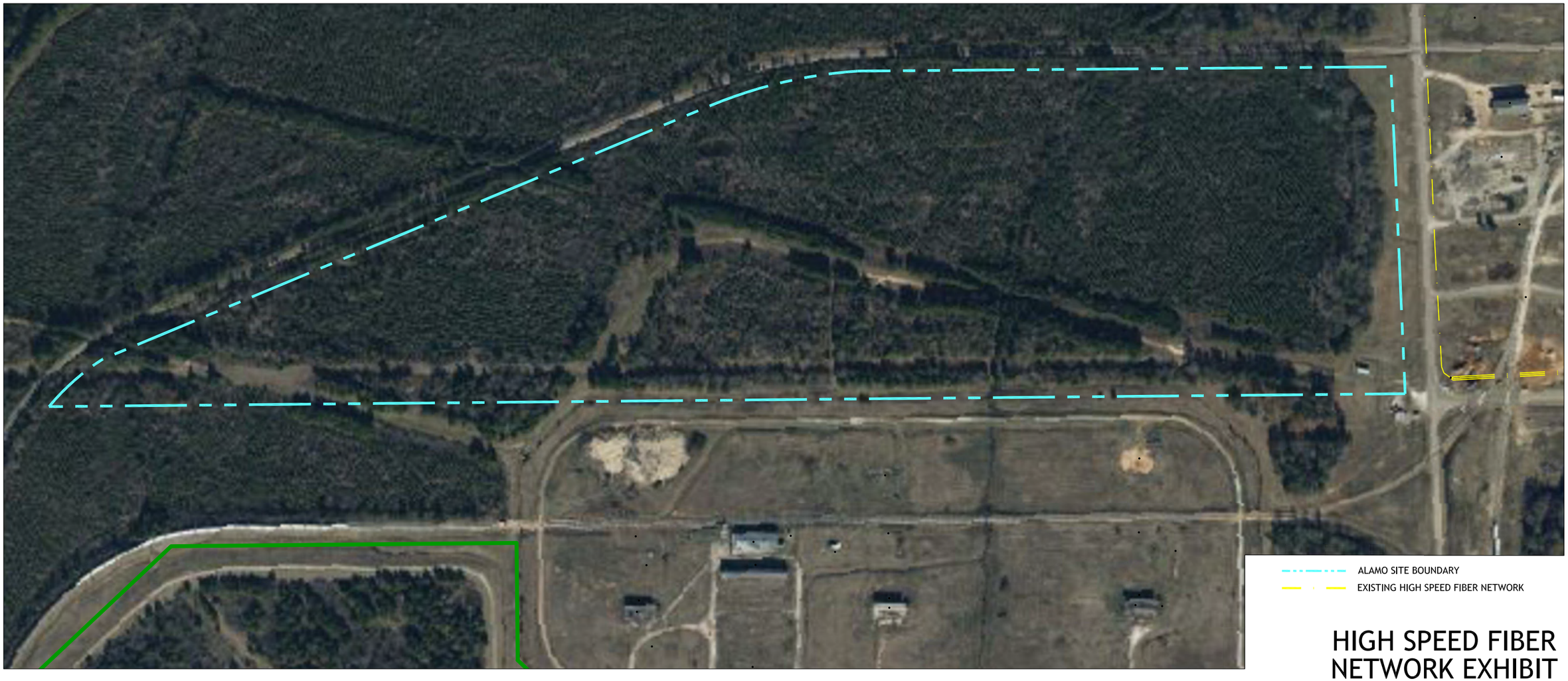
FIGURE G-5

N

0 150 300 600 900

11”X17” – 1”=300’



ALAMO SITE BOUNDARY

EXISTING HIGH SPEED FIBER NETWORK

HIGH SPEED FIBER NETWORK EXHIBIT
ALAMO SITE
TEXAMERICAS CENTER EAST CAMPUS
HOOKS, TEXAS

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
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Texarkana USA

DRAWN: ***	DESIGN: ***	DATE: 10/18/2022	SCALE: ***	JOB #: