PUC DOCKET NO. 50852

COMPLAINT OF JBJQ RANCH FOR	**X**	**PUBLIC UTILITY COMMISSION**
A REVIEW OF THE CONDUCT OF	**X**	
THE ELECTRIC RELIABILITY	**X**	**OF TEXAS**
COUNCIL OF TEXAS, INC. UNDER	**X**	
16 TAC SUBSECTION 22.251	**X**	

2020 JUN -2 PM 12:44

RESPONSE OF JBJQ RANCH TO PUC ORDER NO. 1 ADDRESSING THE COMPLAINTANT'S FILING AND REQUESTING CLARIFICATION FROM THE COMPLAINTANT

TO THE HONORABLE PUBLIC UTILITY COMMISSION:

COMES NOW Complaintant, JBJQ Ranch, and files this Response to Order No. 1 of the Public Utility Commission of Texas (PUC) Requesting Clarification from the Complaintant regarding the review of the conduct of the Electric Reliability Council of Texas (ERCOT) under 16 TAC subsection 22.251.

JBJQ Ranch hereby stipulates that these responses may be treated by the PUC exactly as if they were filed under oath.

I. BACKGROUND

Texas Central Railroad (TCR) is proposing the construction of a High Speed Rail Line (HSR) between Dallas and Houston and a Draft Environmental Impact Statement (DEIS) has been released by the Federal Railroad Administration (FRA). Two separate parcels of land in Leon County that are owned by individuals who operate as JBJQ Ranch, are allegedly in the right of way for the proposed HSR. One tract is 250 acres of land in Leon County commonly known as 12711 CR 408, Normangee, TX 77871 (known as the "Vaughn Place") and the other is 200 acres of land in Leon County commonly known as 11573 CR 408, Normangee, TX 77871 (known as the "Randall Place"). The parcels are about a mile apart and the proposed HSR will be located east of an existing Electric Transmission Line (possibly maintained by Oncor) that is 90 feet from outer cable to outer cable that crosses both parcels. Adjacent and east of the existing Transmission line (on both parcels) are rights-of-way for one pipeline installed around 1975 and a new pipeline installed in 2014 (we believe these lines convey natural gas and petroleum products). County Road 408 runs east to west to the north of the Vaughn Place and there is an existing Atmos Natural Gas Pipeline that crosses under the existing Electric Transmission line and the two pipe lines approximately 2553 feet south of such County Road 408.

II. ARGUMENT: SEPARATE GENERATION AND TRANSMISSION LINES FOR HSR

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The DEIS references "reports and publications" (Reports) that have been compiled for public dissemination by ERCOT. The DEIS has been made available to ERCOT, JBJQ Ranch, numerous agencies and probably thousands of individuals and to date ERCOT has not taken any action to correct the findings the FRA has made from such Reports in the DEIS. I am providing a courtesy copy of the portion of the DEIS relating to **Utilities and Energy** (3.9) contained in the DEIS. The attachment begins at page 3.9.-1 and ends at page 3.9-40 (40 pages). The attachment not only references opinions of ERCOT but it also discusses PUC regulations as well. There are a number of items on such pages to which ERCOT should have taken exception or should have added language for clarification before a Final EIS would have been released by the FRA. JBJQ Ranch has not previously discussed these items with the PUC because until recently a ruling of the district court for Leon County had decided that TCR did not have the right of eminent domain to condemn its needed right of way but recently the Court of Appeals in Corpus Christi ruled that TCR was a railroad and thus has the right of eminent domain.

(A) JBJQ Ranch would hope that the PUC staff would go on line to the "U.S. Department of Transportation, Federal Railroad Administration Website" and access the DEIS referenced above by placing "Dallas to Houston High-Speed Rail, Draft Environmental Impact Statement" in the FRA's search engine to make your own determination as to whether or not the conclusions the FRA/TCR reaches regarding the availability of electricity to power the HSR are correct. We do not mean to interpret the language in DEIS for the PUC but we believe we would be remiss in not commenting on certain sections that cause us concern.

(B) 3.9.3.1 states that utility and energy data are derived in part from "ERCOT statewide data and electrical generation".

(C) 3.9.3.2 states that current electricity consumption rates from ERCOT were compared with the expected consumption of the Build Alternatives.

(D) Figure 3.9-3 states ERCOT manages about 90% of the state's electric load and under "Electrical Demand" the DEIS cites to "The ERCOT 2014 Report on Existing and Potential Electrical System Constraints and Needs". This part of the report states the Houston metropolitan area serves "more than 25% of the entire load in the ERCOT System. In recent years the Houston area has seen persistent electrical load growth but also a lack of new electrical generation development."

In this same section referencing Appendix D and E of "ERCOT's 2014 Regional Transportation Plan Report" it states: ". . . For the year 2014, the annual hourly demand was 58.4 percent of capacity, while the 15-minute demand was 58.3 per cent of capacity. That indicates that sufficient electrical power is generated and supplied the ERCOT system to support the current population of Texas."

(E) Figure 3.9-4 relates to the "2014 Long-Term System Assessment for the ERCOT Region" and a Table 3.9-7 reflects an "Expected Electricity Growth" and this portion of the report suggests a "substantial amount of electrical capacity is forecasted to be added in Texas to accommodate anticipated growth."

(F) Table 3.9-15 relates to the "Projected Build Alternatives Power Demand" for the HSR and reflects the power consumption is estimated to be "467,143 MWh" per year. Such section in part states " . . . ERCOT has established a reserve margin target of 13.75 per cent of peak demand, which means that net added capacity would be targeted to provide 13.75 percent more MWhs than forecasted peak demand." Even if it were not accounted for in a planned or forecasted demand, the daily demand of the Build Alternatives would represent significantly less than the reserve margin considering its percentage of the planned added capacity. . ."

ERCOT, to our knowledge, has not filed any correction to these findings in the DEIS to the FRA. However, ERCOT knows these references to sufficient electrical capacity for the HSR, or any major industrial project, are clearly erroneous. ERCOT's manager, Pete Warnken, in an article from "The Dallas Morning News" dated May 16, 2019 by Jesus Jimenez entitled **"How the Texas power grid braces against rolling blackouts as summer heat looms" stated, "This year, Texas will head into the summer (2019) with a historically low planning reserve.".** Also, in ERCOT's publication entitled "ERCOT Interconnection – Long-Term Transmission Analysis 2012 – 2032 Final Report" dated December 2013, ERCOT admits the Houston Metropolitan Area was a "Net Importer" of electricity (Exhibit 1). We believe the PUC should be concerned with the suppositions the FRA/TCR make in the DEIS regarding items referencing ERCOT in support of such suppositions. We note the article from EDF entitled "The State of the Energy Crunch in Texas" in which it reminds us that the 13.75% reserve margin referenced in the DEIS is inadequate based on expected droughts, made more extreme by climate changes we are beginning to experience. (Exhibit 2) It is hard to believe that ERCOT hasn't even questioned TCR's/FRA's position that the HSR can count on electrical energy from ERCOT's reserve margin. We remind the PUC that the EDF article notes that "when we are in that high demand territory, a single power plant going offline or an unexpected spike in demand can send electric prices from $30/MWh to $3,000 MWh without warning, as was the case in late June 2012." (Exhibit 3)

It is regrettable that landowners, that are forced to sell their land to TCR for the HSR, and residential users against the HSR, may have to experience a rolling blackout to allow a private entity to run its for-profit operation. ERCOT should adopt regulations or propose regulations for the PUC's consideration, that provides, in the future, a for-profit entity like TCR or any entity desiring to use the amount of electrical energy needed by the HSR should be required to produce its own generation and transmission lines needed for its facilities. In the alternative, in the future, any HSR or other for-profit entity coming on line should go dark before any residential user should have to experience a possible blackout.

III. ARGUMENT: IN THE ALTERNATIVE, IF THE TCR IS NOT REQUIRED TO INSTALL ITS OWN TRANSMISSION LINES THEN ERCOT/PUC SHOULD REQUIRE SUCH RELOCATIONS REQUIRED BY TCR TO BE HANDLED IN ONE COMPREHENSIVE CASE

(G) "Utilities" relating to "Electric Utility Modifications" states in part ". . . The utility providers would be responsible for undertaking any potential relocations, pole adjustments and/or new connections.

(H) Table 3.9-10 "Electric Transmission Line Impacts" indicates that **approximately 100 pole realignments may be necessary.** Under "Existing Utility Crossings" it states "Where the Build Alternative would cross underground utilities, realignment may be necessary to provide adequate protection and/or depth. . . Utilities within the Study Area would be either realigned outside the restricted access areas of the HSR ROW or modified (e.g. encased in a pipe sturdy enough to withstand the weight of the HSR system and allow for maintenance access) to avoid conflict.

This section goes on to say "Because of utility realignments and protective actions, construction of the Build Alternatives would result in scheduled and/or accidental interruptions of utility services. . ."

(I) "Fuel" relating to "Crude Oil and Natural Gas" states in part "Oil and gas utilities within the Study Area would be relocated outside the restricted access areas of the HSR ROW or modified (e.g. encased in a pipe sturdy enough to withstand the weight of the HSR system and allow for maintenance access) to avoid conflict.

This section also goes on to say "Because of utility relocations and protective actions, construction of the Build Alternatives would result in scheduled and/or accidental interruptions of oil and gas utility services".

(J) Table 3.9.-16 "Impacts to Oil and Gas Utilities" indicates that approximately **100 pipelines need to be protected.**

ERCOT has not filed any response to the above provisions in the DEIS with the FRA relating to realignments of power poles or encasement of pipelines that may cause disruption in the providing of electricity per its grid and perhaps result in injury to property of electric providers to whom it manages. In high electric demand periods, a loss of a transmission line can have a devastating effect on the ERCOT grid and could result in rolling blackouts. Equally devastating to ERCOT would be the loss of a natural gas pipeline providing fuel to a generation plant located on ERCOT's grid. ERCOT relies heavily on natural gas to fuel generators producing electricity for its grid. In ERCOT's forecasting of future generation in Texas, it relies heavily on the availability of natural gas reserves in Texas. (Figure 3.9-4: ERCOT 2014 Regional Transmission Plan Study Regions). Loss of a few pipelines crossed by the HSR could have a devastating effect on the ERCOT grid. The electrical magnetic fields created by the electrical lines that will serve the HSR can have a devastating effect on the cathodic protection of pipelines adjacent to the HSR and cause their early failure. Additionally, a pipeline company's incorrect analysis of the weight of the soil and aggregate forming the bed for the two sets of rails for the HSR running across an improperly encased pipeline can cause a dangerous rupture of such company's pipeline. "ERCOT's 2013 Mission and Strategic Planning Process" contains a section entitled "Strategic Drivers" and contains a section entitled "Single fuel dependency" that states: **"With a**

high dependency on natural gas, the risk of curtailments or reductions in pipeline capacity present potential impacts to the continue reliability of the grid." (Exhibit 4)

To protect the grid, ERCOT should take appropriate action and/or recommend regulations (e.g. standards for cathodic protection of pipelines and encasement of same, length of separation of electrical transmission and distribution lines from the HSR line and relocated pipelines, and other appropriate safety measures) to the PUC or other appropriate state department(s) for adoption, to regulate the interaction between electric service providers and natural gas pipeline operators with the HSR (or any for-profit entity crossing or relocating pipelines and/or electrical transmission/distribution lines amounting to 100 or more in number) in one comprehensive case rather than have individual electric providers and pipeline companies filing separate cases.

Respectfully submitted,

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CERTIFICATE OF SERVICE

It is hereby certified that a copy of the foregoing has been hand delivered or sent via email or first class United States mail, postage prepaid, to the General Counsel for ERCOT, Chief Counsel for FRA and Counsel for TCR on this the 29th day of May, 2020.

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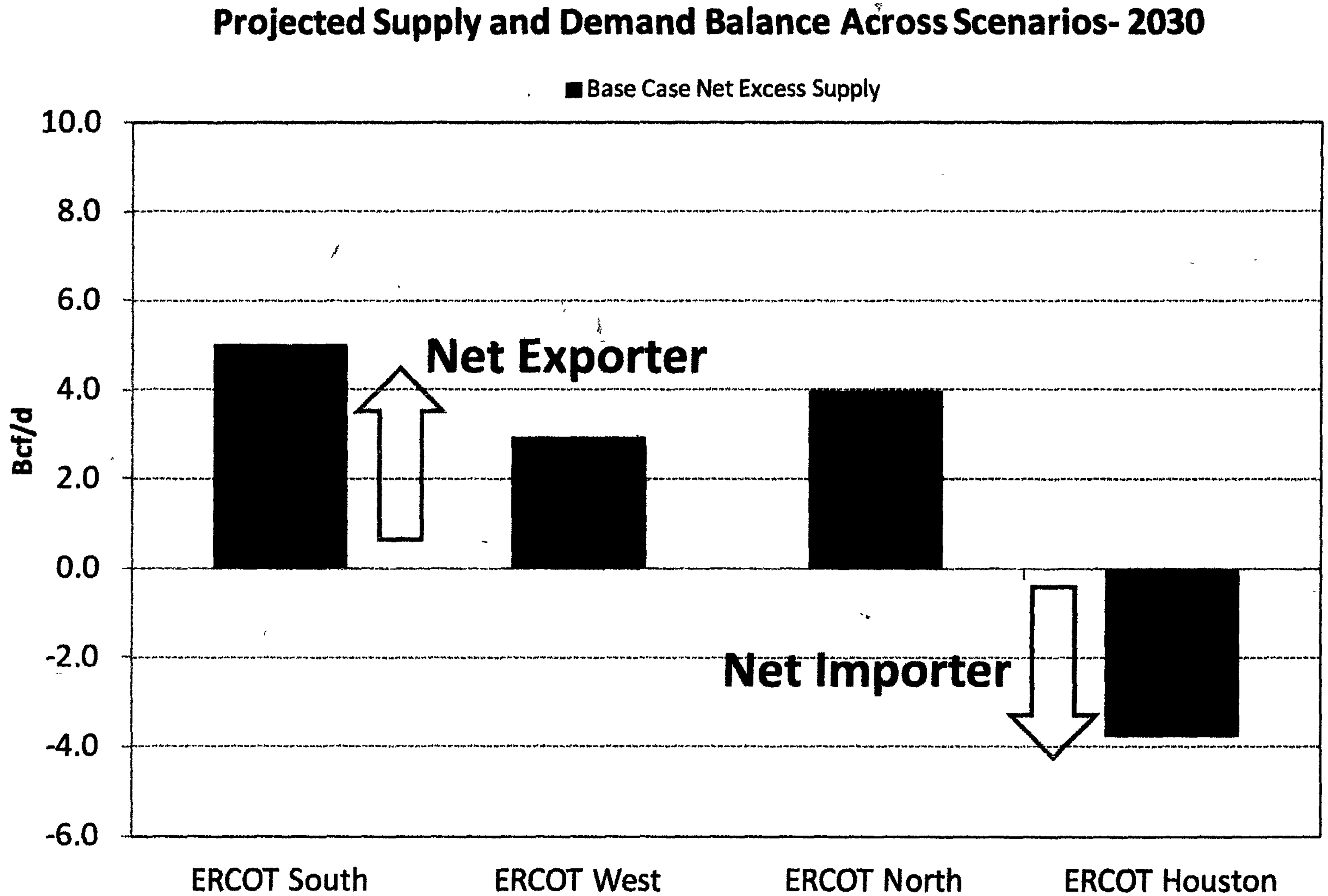
Michael A. Bucek

Exhibit 1

ERCOT HOUSTON IS THE ONLY ZONE WITH NET IMPORT NEEDS



MARKET DESIGN

The Electric Reliability Council of Texas (ERCOT)

The non-profit corporation, ERCOT, is responsible for ensuring the flow of electricity across 40,000 miles of transmission lines to approximately 22 million residents.[2] ERCOT is the independent system operator (ISO) for the state and the decision-making entity that operates under the purview of the Public Utility Commission of Texas (PUC).[3] The ERCOT region encompasses approximately 75 percent of the state, ensuring the ongoing operation of the wholesale electricity market, in addition to transmission planning, sufficient power supply, and transmission congestion management.[4]

An overview of ERCOT's energy-only electricity market

The ERCOT electricity market is energy-only, meaning that both operations and investment are guided solely by energy price signals. The deregulated wholesale market, run by ERCOT, was created in 1995 and has continued to evolve since that time, adopting new technologies and new market opportunities, including the development of a nodal market in late 2010, which increased the system-wide offer cap.[5] In comparison to other U.S. markets, ERCOT is unique in its energy-only market design, as other markets maintain a minimum reserve margin through regulation, defined resource adequacy standards, or capacity payments. Within the energy-only model, reserve margins are the aggregation of private investment decisions based on wholesale prices.[6] The reserve margin set by ERCOT is currently 13.75 percent, a target that is unenforceable through regulation or market structure; it is not mandated. Spot prices in energy-only markets are typically low ($30-$40/MWh) but can spike as high as $4,500/MWH during periods of scarcity; the PUC has taken steps to increase this cap to allow prices to reach as much as $9,000 /MWh. The available generation capacity in the market can be illustrated with a "hockey stick" shaped supply curve (see Figure 1). The energy-only market uses price signals to show resource shortages under the assumption that firms will enter the market when prices are high.

As ERCOT has made clear, the threats to system reliability are of our own making. Market failures caused a lack of proper signals to encourage the building of new power capacity and 2011's record breaking drought, made more extreme by climate change,[7] threatened to shut down more than 11,000 MW[8] of power generation capacity. When it comes to ERCOT and reliability, the issues are complicated, but the solutions are not. It will take real focus and effort to prevent Texas from experiencing the same rolling blackouts experienced during the winter of 2011.

> **Reserve margin**
> Percentage by which available capacity is expected to exceed forecasted peak demand across the region.

The Texas electric market is not being manipulated, it was built that way (and that is not a good thing)

The problem of market abuse surfaced in the summer of 2012 when there was speculation that the violent price fluctuations of June 25 and 26 were the result of market manipulation.[9] This assertion was found to be false by the Independent Market Monitor for ERCOT, contrary to prior reports.[10] Most have greeted this as welcomed news, but the finding could spell rocky years ahead with wild swings in electric prices from day-to-day, which make it difficult for investors, generators and, most importantly, customers to plan ahead.

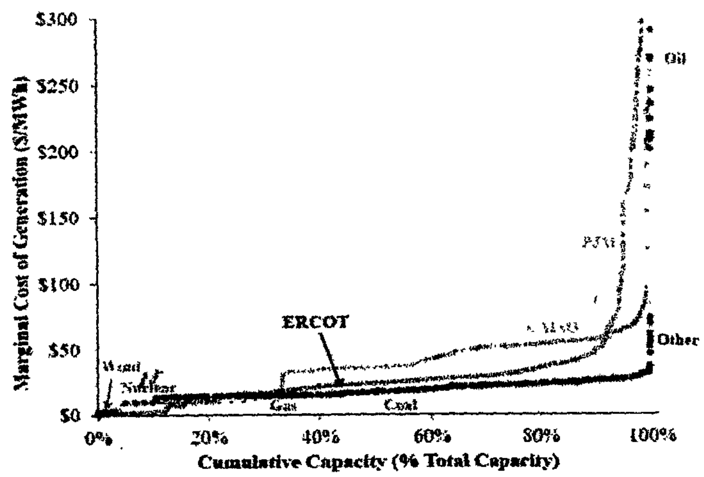
Wild mood swings

If the market is not being manipulated, it is at least feeling a little bipolar: one hot summer day with high demand, prices are up slightly but everything was in working order. The following day, however, a 2 percent uptick in demand

Exhibit 3

combined with an unexpected loss of 1.6 percent of power plant capacity sent prices soaring. The peak price on June 25 hit $438 per megawatt hour (MWh),[11] but on June 26 prices maxed out at $3,000/MWh, meanwhile average prices skyrocketed to 640 percent above the average for June 25.

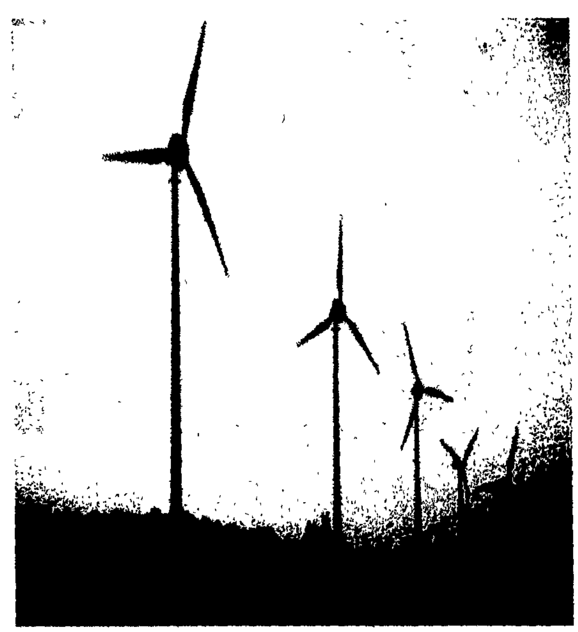
Figure 1: ERCOT Supply Stack vs. Other Markets



Source: The Brattle Group: ERCOT Investment Incentives and Resource Adequacy. June 1, 2012

The cause of these swings is pretty straightforward. This issue was outlined in the June 1, 2012 Brattle Group report entitled *ERCOT Investment Incentives and Resource Adequacy*. This report was commissioned by ERCOT to determine how to best address the resource adequacy issue in Texas. The report states that the ERCOT supply curve does not efficiently reflect current or upcoming scarcity conditions in the market. The supply curve is dominated by low price resources like wind, efficient natural gas power plants, along with nuclear power and some cheaper coal, all of which come in at or under about $30/MWh. But as Figure 1 indicates, when you start approaching the 100 percent peak demand level, there is a sharp "hockey stick" curve upwards in price. This means that when we are in that high demand territory, a single power plant going offline or an unexpected spike in demand can send electric prices from $30/MWh to $3,000/MWh without warning, as was the case in late June 2012. Other regions have a more gradual curve of price increases during scarcity conditions, providing a kind of "warning" to the market that the Brattle Report suggests as part of its suite of recommended market reforms. That gradual curve is important because it allows demand side resources to help stabilize prices and at the same time provide potential investors with the kind of predictable certainty that encourages investment in the Texas electricity market.

In a well-functioning market these price swings would not be so dramatic and unpredictable, pointing to fundamental problems with the electric market in Texas. In extreme situations prices and profits may warrant the support for new investments, but these extremes are so unpredictable that no power company can properly forecast, deterring new investments. As Brattle Group states in the June 1 report "reliance on scarcity prices is unlikely to achieve ERCOT's current reliability objectives." The solutions presented in that report were either to reduce our reliability standards or implement reforms that will lead to reliable electricity supply over the long term without the need for emergency regulatory intervention.



Strategic Drivers

The strategic planning process began with development of key trends and questions for use in a stakeholder and Board facilitation process. The purpose of this process was to ensure the diversity of stakeholder views was utilized in the development of the strategic plan.

Those key trends facing ERCOT:

Resource adequacy

ERCOT plays a key role by providing assessments of future peak demand and commensurate peak available resource volume needed to maintain long-term reliability of the electric grid. Further, ERCOT markets are viewed as a key source of price signals for the value of energy and ancillary services during peak periods. Given its mandate and responsibility, ERCOT must work to anticipate and respond rapidly to changes in market dynamics, rules and processes that are directed toward ensuring resource adequacy with commensurate increased capacity and/or flexible demand resources.

Trends / Changes in fuel prices and installed resource costs

Both the cost to operate and reliability of the ERCOT managed grid will be greatly affected by the cost of fuels such as natural gas (used by most power generators in the ERCOT region). The ability to understand the potential impact of price shifts and major disruptions on both the future cost and reliability can greatly enhance ERCOT's ability to raise awareness and prepare to respond when called upon to address such impacts.

Single fuel dependency

With a high dependency on natural gas, the risk of curtailments or reductions in pipeline capacity present potential impacts to the continued reliability of the grid. In addition, technological advances in alternate resources and the speed of their adoption and integration will continue to impact ERCOT's fuel mix diversity.

Gas / Electric market coordination issues

Increased coordination between natural gas and power industry short-and medium-term planning, with regard to data and information sharing, can improve ERCOT's position to better anticipate potential gas curtailments during extreme load conditions. It may also allow for more economically efficient choices by Market Participants about the use of resources that are exposed to prices across both natural gas and electricity markets.

Increased need for flexible resources

The electric industry is experiencing a shift toward a greater reliance on intermittent supply resources. In addition, consumers are moving toward less predictable load patterns resulting from their own adoption of intermittent technology. To continue to maintain a high level of reliability, ERCOT recognizes the need to analyze the potential positive impacts of further integration of flexible resources into the ERCOT region to provide system operators the necessary tools to manage the balance between supply and demand in a cost-effective and reliable manner.

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3.9 Utilities and Energy

3.9.1 Introduction

The purpose of this section is to identify the major utilities in the Study Area and assess the energy demand of constructing and operating the HSR system. Identification of the major utilities aids in the assessment of potential conflicts with utilities during construction to avoid interruptions to service. The evaluation of major utilities also determines if they can accommodate the energy demands of the HSR system.

3.9.2 Regulatory Context

Federal

FRA's *Procedures for Considering Environmental Impacts* requires the evaluation of the production and consumption of energy. These include assessing impacts of any irreversible or irretrievable commitments of energy resources likely to be involved in the Project and any potential energy conservation, especially those likely to reduce the use of petroleum/gasoline or natural gas. The FRA Procedures do not specifically address utilities such as water, wastewater and energy transmission systems.[1]

State

Public Utility Regulatory Act (Texas Utilities Code, Title 16, Title II)

The purpose of this act is to establish a comprehensive and adequate regulatory system for public utilities to assure rates, operations and services that are just and reasonable to the consumers and to the utilities. The act covers consumer protections, rate setting, measurement and payment, reliability measures and construction and safety standards. This act grants the Texas Public Utility Commission authority to regulate the state's electric and telecommunication utilities, implements respective legislation and offers customer assistance in resolving consumer complaints under the Act.

Texas Local Government Code §§ 214.214

Texas Local Government Code §§ 214.214 codifies the state's compliance with National Fire Protection Association 70 in response to the National Electrical Code. National Fire Protection Association 70 codifies the requirements for safe electrical installations into a single, standardized source. National Fire Protection Association 70 is the benchmark for safe electrical design, installation and inspection to protect people and property from electrical hazards.

Texas Health and Safety Code (Texas Statutes Title 9)

Title 9 Safety, Subtitle A, Chapter 752, Public Safety, establishes regulations for high voltage overhead lines.

[1] FRA. Procedures for Considering Environmental Impacts. Notice of Updated Environmental Assessment Procedures. May 26, 1999.

3.9.3 Methodology

3.9.3.1 Data Collection

The evaluation of the utilities uses a Study Area defined by the boundaries of the LOD, while the Study Area for energy demand is defined by the service area of the energy providers. The utility and energy data are derived from the following sources:

- Platts utility information for aboveground and below ground major utility pipelines/electrical lines as well as electrical providers
- Texas Water Development Board regional plans for water demand
- City of Dallas, City of College Station, City of Navasota and City of Houston water utility for wastewater treatment plant capacity
- U.S. Energy Information Administration data on Texas energy use, electrical generation, crude oil and natural gas, and fuel consumption
- ERCOT statewide data for electrical demand and electrical generation
- RRC data for oil/gas wells

Additionally, municipal long-range plans were reviewed to identify projected needs and specific strategies for utility and energy allocation.

- The 2014 Long Range Water Supply Plan[2] resulted in a list of 14 strategies to provide raw water to the City of Dallas. These strategies range from conservation and reuse to creating new reservoirs. None of these planned reservoirs would be in the vicinity of the Build Alternatives. The Build Alternatives would cross two raw water pipelines - one proposed in Ellis County and the Integrated Pipeline currently under construction in Ellis and Navarro counties. The Integrated Pipeline would bring water from Lake Palestine to Dallas, as well as the Richland Chambers and Cedar Creek reservoirs. The integrated pipeline is being developed in agreement with the Tarrant Regional Water District.
- The Integrated Water Supply Plan[3] is an integration of planning conducted over many years by Tarrant Regional Water District and its customers, and it identifies the new water supplies with the largest potential benefit for water supply reliability. The Integrated Water Supply Plan considers new opportunities, technologies, and strategies for the next 50 years that would maximize reliability and minimize the effect on customer rates.
- The City of Houston Water Conservation Plan[4] (effective September 2014 through May 2019) provides water conservation goals and progress intended to preserve long-term water supplies for the City of Houston and its region
- The North Harris County Water Conservation Plan[5] identifies principles, practices, and standards for conservation and the efficient use of available water supplies and water distribution system capacity
- The Texas Regional Water Plans[6] consists of 16 prioritized water management projects by region that map out how to conserve water supplies, meet future water supply needs and respond to future droughts in the regions

[2] Dallas Water Utilities, "2014 Dallas Long Range Water Supply Plan to 2070 and Beyond," December 2015.
[3] Tarrant Regional Water District, "Integrated Water Supply Plan," 2013.
[4] City of Houston, "Water Conservation Plan," April 2015.
[5] Harris County, "North Harris County Water Conservation Plan," 2013.
[6] Texas Water Development Board, "Texas Regional Water Plans," 2015.

- The 2017 State Water Plan "Water for Texas"[7] is a regional water plan developed every five years for statewide water supply planning. TWDB compiles key information gathered by the regional water planning agencies and provides recommendations to the Texas Legislature for legislative priorities related to the planning and construction of reservoirs and state water plan financing.

The type, size and location of the existing major utilities located within, adjacent or parallel to the LOD were identified by TCRR during conceptual engineering.[8] TCRR used the following criteria to identify the major utilities in the Study Area (see **Appendix F, TCRR Conceptual Engineering Design Report**):

- Water and wastewater – 18-inch diameter and larger
- Storm drain – 36-inch diameter and larger
- Crude oil and natural gas pipelines – 12-inch diameter and larger with high pressure at 500 pounds per square inch
- Electrical transmission lines – 69 kV and above
- Communication and fiber trunk lines – 24-inch and larger
- Oil and gas wells

A 50-foot buffer was added to the oil and gas well locations to account for potential mapping errors in the Texas Railroad Commission data.

TCRR provided water and wastewater demand projections for the stations, TMFs and MOWs. This data was reviewed and compared to capacity in the respective counties in the Study Area.

3.9.3.2 Energy Consumption

Given that energy service provider boundaries cover large areas within central and east Texas, data was collected at a regional and statewide level to define current energy demand and capacity. The construction schedule, provided by TCRR, was used to determine the construction period energy demand. The equipment and workforce schedules were then used to calculate construction-period energy usage.[9] TCRR also provided operational power consumption for train traction energy and energy consumption for stations and other facilities. Train traction power energy consumption was estimated by TCRR using a traction power load flow simulation. Energy demand for station operations and MOWs was estimated by TCRR and was developed using representative square foot energy consumption at similar facilities in Japan. The operational power consumption is summarized in **Table 3.9-13**, and includes power losses from transmission and transformers. Losses were estimated using the ERCOT annual average of 5 percent of power transmitted derived from 1996 to 2013 EIA data, as explained in **Train Operation Emissions** of **Section 3.2.3.2, Air Quality**. The daily power consumption was then multiplied by 365 days per year, the assumed operational schedule, to estimate annual consumption. Current electricity consumption rates from ERCOT were compared with the expected energy consumption of the Build Alternatives.

[7] Texas Water Development board, "2017 State Water Plan "Water for Texas," 2017.

[8] Utilities within the study area are identified in general accordance with recommended practices and procedures described in American Society of Civil Engineers Publication 38-02 (Standard Guideline for the Collection and Depiction of Existing Utility Data)

[9] For the purposes of this analysis, mobilization was assumed to occur from January 2018 to March 2018. Regional building demolition and land grubbing for the embankment, elevated (viaduct), and retained-fill segments was anticipated to begin in March 2018 and conclude in December 2019. The major construction activities were anticipated to occur between 2018 and 2021, with construction of the TMFs, MOWs and stations completed during 2020 and 2021. Demobilization and finishing would occur from September 2021 to December 2021.

Energy is commonly measured in terms of British Thermal Units (BTU) and is the unit of measure used to quantify energy consumption during construction and operation. A BTU is defined as the amount of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit. For transportation activities, energy usage is predominantly influenced by the amount of fuel used. The average BTU content of fuel is the heat value (or energy content) per volume of fuel as determined from tests of fuel samples. For example, a gallon of gasoline produces approximately 114,500 BTU.[10] However, the BTU value of gasoline varies from season to season and from batch to batch. Energy consumption, particularly electricity is commonly measured using the unit of measure of Watts, and consumption over a period of time is typically measured as megawatt-hours (1 million Watts consumed in one hour, or MWh). To compare electric energy consumption to other (e.g. vehicle) energy consumption, the conversion factor of 3,412,141.5 BTUs per MWh was used.

Construction energy (fuel) refers to the one-time energy involved in building the HSR system, typically through the burning of fuel for operating construction equipment and vehicles, as well as delivering construction materials. Construction energy (fuel) was determined based on specific schedule and equipment data estimated by TCRR (see **Appendix F, TCRR Conceptual Engineering Design Report**). These data were used to estimate the anticipated construction energy consumption based on the following assumptions:

- Total equipment working hours from the air quality analysis in **Section 3.2, Air Quality** was used as the basis of construction energy
- Each equipment working hour was assumed to use one-tenth of gallon of fuel as an average for the total length of the Build Alternative
- The total fuel use was then multiplied by 114,500 to calculate the total BTU of construction energy

Operational energy (electricity) refers to the energy consumed during operations. Electrical demand was calculated in terms of megawatts, then converted to BTUs where necessary, and compared to current estimates of peak demand and supply capacity within the electrical grid(s). Operational energy was then compared to the energy (fuel) consumed by the traveling public under the No Build Alternative. This energy is a function of traffic characteristics, such as volume, speed, distance traveled, vehicle mix and thermal value of the fuel being used. The approximate distance from Dallas to Houston is 240 miles, and is the same if a person travels by automobile on IH-45 or flies commercially between the airports in these cities.

To determine the operational benefit of the Build Alternatives on fuel and energy savings, the VMT that would have occurred in the absence of the Build Alternatives was calculated. Using ridership information provided by TCRR[11], it was estimated to be 2,552,520,000 VMT. This is discussed in detail in the air quality **Section 3.2.3.2.2** under the subsection **Reduction in Vehicle Miles Traveled**. Because IH-45 is the principle and practical route used for Dallas-Houston travel, a city center-to-city center distance of 239 miles was assumed for the trip distance, or a round trip total of 478 miles. Because automobile and light truck travel is the predominant mode of passenger transportation between Dallas and Houston, energy (fuel) saved was converted to a BTU equivalent.[12] This information was used along with

[10] EPA 1995. Office of Mobile Sources. Fuel Economy Impact Analysis of Reformulated Gasoline. August.
[11] TCRR, *"Texas Central Partners Texas High Speed Rail Final Draft Conceptual Engineering Report-FDCERv7,"* September 15, 2017.
[12] National Highway Traffic Safety Administration 2009. Corporate Average Fuel Economy Standards for Model Year 2012-2016 Passenger Cars and Light Trucks. http://www.nhtsa.gov/Laws+&+Regulations/CAFE+-+Fuel+Economy/Model+Years+2012-2016:+Final+Rule. Website accessed June 17, 2016.

the 2014 average Corporate Average Fuel Economy (CAFE) standard for passenger vehicles, promulgated by DOT and EPA, to calculate fuel and energy savings shown in **Table 3.9-17**. Energy that would be used during the manufacturing of the train vehicles or with changes in the demand for automobiles or airplanes, are not included in this analysis because the net change in energy use would be relatively small compared to the operational energy consumed by the HSR trains or saved by reducing passenger vehicle use over the long-term.

3.9.4 Affected Environment

3.9.4.1 Utility Crossings

The utilities crossing analysis focuses on major utilities such as large diameter water/wastewater lines, large diameter natural gas pipelines, large diameter petroleum/crude oil pipelines and high voltage electrical transmission lines. Major utilities located within the Study Area are grouped by county, segment and utility owner in **Table 3.9-1**, and shown in **Appendix D, Mineral and Utility Resources Mapbook**.

Table 3.9-1: Summary of Utility Crossings

Type	Number Crossed	Owner
Dallas County Segment 1		
Communication Line (OH)	2	AT&T Texas
Communication Line (UG)	1	AT&T Texas
Electric Transmission	15	ONCOR
Natural Gas	1	Atmos Energy Corp
Natural Gas	1	Gulf South Pipeline Company
Sanitary	15	City of Dallas
Sanitary	1	City of Lancaster
Stormwater	14	City of Dallas
Water	2	City of Dallas
Ellis County Segment 2A		
Communication Line (OH)	1	AT&T Texas
Communication Line (UG)	2	AT&T Texas
Crude Oil	1	Sunoco Pipeline LP
Electric Transmission	8	ONCOR
Natural Gas	3	Energy Transfer Company
Natural Gas	1	EMS USA INC
Natural Gas	3	Atmos Energy Corp
Water	2	Tarrant Regional Water District
Ellis County Segment 2B		
Communication (OH)	1	AT&T Texas
Communication (UG)	2	AT&T Texas

Table 3.9-1: Summary of Utility Crossings		
Type	**Number Crossed**	**Owner**
Crude Oil	1	Sunoco Pipeline LP
Electric Transmission	10	ONCOR
Natural Gas	3	Energy Transfer Company
Natural Gas	1	EMS USA INC
Natural Gas	3	Atmos Energy Corp
Water	2	Tarrant Regional Water District
Navarro County Segment 3A		
Communication Line (UG)	1	AT&T Texas
Crude Oil	1	Sunoco Pipeline LP
Electric Transmission	6	ONCOR
Empty/Unknown	1	Magellan Pipeline Company
Gasoline/Jet Fuel/Diesel	1	Magellan Pipeline Company
Natural Gas	1	Enbridge Pipelines
Natural Gas Liquids	1	ONEOK Arbuckle Pipeline LLC
Natural Gas Liquids	1	Energy Transfer Company
Navarro County Segment 3B		
Crude Oil	1	Sunoco Pipeline LP
Electric Transmission	10	ONCOR
Empty/Unknown	1	Magellan Pipeline Company
Gasoline/Jet Fuel/Diesel	1	Magellan Pipeline Company
Natural Gas	1	Enbridge Pipelines
Natural Gas Liquids	1	ONEOK Arbuckle Pipeline LLC
Natural Gas Liquids	1	Energy Transfer Company
Navarro County Segment 3C		
Crude Oil	2	Sunoco Pipeline LLC
Electric Transmission	6	ONCOR
Empty	1	Magellan Pipeline Company
Gasoline/Jet Fuel/Diesel	1	Magellan Pipeline Company
Natural Gas	1	Enbridge Pipelines
Natural Gas Liquids	1	Energy Transfer Company
Communication (UG)	1	AT&T Texas
Limestone County Segment 4		
Natural Gas	2	Trend Gathering & Treating LLC
Natural Gas	1	Enbridge Pipelines
Freestone County Segment 3A		

Table 3.9-1: Summary of Utility Crossings		
Type	**Number Crossed**	**Owner**
None	--	--
Freestone County Segment 3B		
None	--	--
Freestone County Segment 3C		
Crude Oil	5	Enterprise Crude Pipeline LLC
Crude Oil	2	Sunoco Pipeline LLC
Electric Transmission	4	ONCOR
Gasoline/Jet Fuel/Diesel	1	Magellan Pipeline Company
Liquefied Petroleum Gas	1	ONEOK NGL Pipeline LLC
Natural Gas	2	Anadarko Gathering Company LLC
Natural Gas	2	Atmos Pipeline
Natural Gas	4	Enbridge Pipelines
Natural Gas	2	Energy Transfer Company
Natural Gas	1	Linn Operating Inc
Natural Gas	1	Pinnacle Gas Treating LLC
Natural Gas	1	Trend Gathering & Treating LLC
Natural Gas Liquids	1	ONEOK Arbuckle Pipeline LLC
Freestone County Segment 4		
Communication Line (UG)	1	AT&T Texas
Crude Oil	3	Sunoco Pipeline LP
Electric Transmission	3	ONCOR
Liquefied Petroleum Gas	1	ONEOK NGL Pipeline LLC
Natural Gas	2	Atmos Pipeline
Natural Gas	2	Energy Transfer Company
Natural Gas Liquids	1	DCP Midstream LP
Leon County Segment 3C		
Electric Transmission	2	ONCOR
Gasoline/Jet Fuel/Diesel	1	Magellan Pipeline Company LP
Natural Gas	1	Enbridge Pipelines LP
Natural Gas	1	Energy Transfer Company
Natural Gas Liquids	1	DCP Midstream LP
Leon County Segment 4		
Communication Line (OH)	1	AT&T Texas
Communication Line (UG)	7	AT&T Texas
Electric Transmission	9	ONCOR

Table 3.9-1: Summary of Utility Crossings		
Type	**Number Crossed**	**Owner**
Natural Gas	3	Enbridge Pipelines LP
Natural Gas	2	Trend Gathering & Treating LLC
Natural Gas	1	Energy Transfer Company
Madison County Segment 3C		
Electric Transmission	1	Entergy Texas
Natural Gas	1	Atmos Pipeline
Madison County Segment 4		
Electric Transmission	2	Mid-South Synergy
Natural Gas	1	Atmos Pipeline
Grimes County Segment 3C		
Electric Transmission	1	Mid-South Synergy
Grimes County Segment 4		
Crude Oil *	1	Enterprise Pipelines LP
Grimes County Segment 5		
Crude Oil	1	Magellan Pipeline Company LP
Electric Transmission	3	Entergy Texas
Electric Transmission	2	Unknown
Electric Transmission	2	Centerpoint Energy
Natural Gas	2	Energy Transfer Company
Natural Gas	2	Kinder Morgan Tejas Pipeline LLC
Natural Gas	2	Copano Gulf Coast LLC
Refined Products	1	Sunoco Pipeline LP
Y-Grade Products	2	Enterprise Products Operating LLC
Waller County Segment 5		
Communication Line (UG)*	8	AT&T Texas
Crude Oil	1	Blackhawk Pipeline LP
Electric Transmission	2	CenterPoint Energy
Electric Transmission	1	San Bernard Electric Co-op
Natural Gas	1	Texas Eastern Transmission LP
Harris County Segment 5		
Communication Line (OH)	8	AT&T Texas
Communication Line (UG)*	35	AT&T Texas
Crude Oil	1	Enterprise Crude Pipeline LLC
Crude Oil	2	Magellan Pipeline Company LP
Crude Oil	1	Genesis Pipeline Texas LP

Table 3.9-1: Summary of Utility Crossings

Type	Number Crossed	Owner
Electric Transmission	16	CenterPoint Energy
Natural Gas	1	Netco Pipeline
Natural Gas*	2	Kinder Morgan Tejas Pipeline LLC
Natural Gas	2	Transcontinental Gas PL CO LLC
Natural Gas*	2	Houston Pipeline Company LP
Natural Gas	2	Natural Gas Pipeline Co or America LLC
Natural Gas	1	Gulf South Pipeline Company LP
Natural Gas	2	Tennessee Gas Pipeline CO LLC
Natural Gas	1	Trunkline Gas Company LLC
Natural Gas	1	Southcross Gulf Coast Trans LTD
Natural Gas Liquids	1	Enterprise Products Operating LLC
Sanitary	4	City of Houston
Stormwater	2	City of Houston
Water*	9	City of Houston
Industrial Site Terminal Option Segment 5		
Communication (UG)	1	AT&T Texas
Northwest Mall Terminal Option Segment 5		
Communication (UG)	3	AT&T Texas
Sanitary	1	City of Houston
Segment 5: Northwest Transit Terminal Station Option		
Communication (OH)	1	AT&T Texas
Communication (UG)	12	AT&T Texas
Electric Transmission	2	Centerpoint Energy
Sanitary	2	City of Houston
Stormwater	2	City of Houston
Water	2	City of Houston
Total (All Utilities)	**364**	**–**

Source: AECOM, 2017
Note: OH – Overhead; UG – Underground
* Denotes that the utility will both be crossed and paralleled

The utilities analysis also included those utilities that run parallel to the Study Area. Similarly, they are grouped by county, segment and utility owner in **Table 3.9-2**, and shown in **Appendix D, Mineral and Utility Resources Mapbook**.

Table 3.9-2: Summary of Parallel Utilities		
Type	**Number Parallels**	**Owner**
Dallas County Segment 1		
Sanitary	4	City of Dallas
Stormwater	5	City of Dallas
Water	7	City of Dallas
Ellis County Segment 2A		
Crude Oil	2	Sunoco Pipeline LP
Ellis County Segment 2B		
Electric Transmission	3	ONCOR
Natural Gas	3	Energy Transfer Company
Ellis County Segment 3A		
Electric Transmission	1	ONCOR
Ellis County Segment 3B		
Electric Transmission	2	ONCOR
Ellis County Segment 3C		
Electric Transmission	1	ONCOR
Navarro County Segment 3A		
Electric Transmission	5	ONCOR
Navarro County Segment 3B		
Crude Oil	1	Sunoco Pipeline LP
Electric Transmission	1	ONCOR
Navarro County Segment 3C		
Crude Oil	4	Enterprise Crude Oil LLC
Crude Oil	4	Enterprise Crude Pipeline LLC
Crude Oil	1	Sunoco Pipeline LLC
Electric Transmission	7	ONCOR
Freestone County Segment 3C		
Crude Oil	6	Enterprise Crude Pipeline LLC
Crude Oil	1	Sunoco Pipeline LLC
Electric Transmission	1	ONCOR
Gasoline/Jet Fuel/Diesel	1	Magellan Pipeline Company
Freestone County Segment 4		
Crude Oil	1	Sunoco Pipeline LP
Electric Transmission	5	ONCOR
Natural Gas	2	Energy Transfer Company
Leon County Segment 4		

Table 3.9-2: Summary of Parallel Utilities		
Type	**Number Parallels**	**Owner**
Natural Gas	1	Enbridge Pipelines LP
Natural Gas	1	Trend Gathering & Treating LLC
Madison County Segment 4		
Electric Transmission	7	Centerpoint Energy
Grimes County Segment 4		
Crude Oil*	1	Enterprise Crude Pipeline LLC
Grimes County Segment 5		
Crude Oil	1	Magellan Pipeline Company LP
Electric Transmission	8	Centerpoint Energy
Waller County Segment 5		
Communication Line (UG)*	3	AT&T Texas
Harris County Segment 5		
Communication Line (UG)*	6	AT&T Texas
Natural Gas	2	Atmos
Stormwater	2	City of Houston
Wastewater	1	City of Houston
Water*	3	City of Houston
Northwest Transit Center Terminal Option		
Stormwater	3	City of Houston
Wastewater	2	City of Houston
Water	3	City of Houston
Total (All Utilities)	**122**	–

Source: AECOM, 2017; Note: OH – Overhead; UG – Underground
* Denotes that the utility will be both crossed and paralleled

3.9.4.1.1 Water Demand

According to the 2016 Texas Water Development Board Region C, G and H Water Plans, the counties in the Study Area are forecasted to have growing unmet water demand in the coming years. Shortages were determined by comparing currently connected water supplies (without considering future connection of already developed supplies) with expected demand, as shown in **Table 3.9-3.**[13, 14, 15]

Table 3.9-3: Current and Expected Water Demand and Shortages			
County	**2010/2011 Use [ac-ft/year]**	**2040 Expected Demand [ac-ft/year]**	**2040 Expected Shortage [acre-feet /year]**
Dallas	525,143	674,672	159,703
Ellis	36,349	58,626	14,495

[13] TWDB, "2016 Region C Water Plan for Texas Water Development Board, Volume 1 Main Report," December 2015.
[14] TWDB, "2016 Brazos G Regional Water Plan for Texas Water Development Board," December. 2015.
[15] TWDB, "2016 Region H Water Planning Group for Texas Water Development Board," November 2015.

Navarro	13,991	28,015	17,838
Limestone	32,473	45,404	17,533
Freestone	43,095	35,121	4,431
Leon	5,866	7,481	222
Madison	4,312	5,323	526
Grimes	20,362	41,609	19,053
Waller	29,148	33,130	97
Harris	897,891	1,419,046	272,972

Source: TPWD, 2015
Note: acre-feet is equivalent to 325,851 gallons.

As seen in the table above, potable water demand is anticipated to increase for all 10 counties in the Study Area between year 2010 and 2040. The largest anticipated shortages of potable water are expected in Dallas and Harris counties due to the forecasted population increases in these areas. Relatively minor shortages of potable water are predicted for Leon, Madison and Waller counties.

There are a number of wholesale water providers that could supply water to the stations, TMFs and MOW facilities. The major wholesale providers and their contracted supply through 2020[16, 17, 18, 19, 20] for each of the HSR facilities are listed in **Table 3.9-4**. Water supplies to the urban and suburban communities are almost entirely derived from surface water rights. Rural water supplies are derived from a variety of rivers, lakes, streams, ponds, reservoirs, springs and wells.

Table 3.9-4: Wholesale Water Providers

County	Project Facility (Segment)	Water Provider	Contracted Volume Through 2020 [acre-feet]
Dallas	Dallas Terminal and TMF (1)	Dallas Water Utilities	497,526
Ellis	Bardwell MOW (2A, 2B)	None	n/a
Freestone	Fairfield MOW (3C)	South Freestone WSC	285
Leon	Centerville MOW (3C)	Southeast WSC	180
Freestone	Wortham MOW (4)	Pleasant Grove WSC	157
Leon	Jewett MOW (4)	Concord Robbins WSC	213
Grimes	Brazos Valley Station (4)	Anderson Water Company	12.9
Grimes	Bedias MOW (5)	Wickson Creek SUD	1,710
Waller	Houston MOW (5)	G & W WSC	450
Harris	Houston Terminal and TMF (5)	City of Houston	740,678

Sources: TPWD, 2015; and South Freestone WSC, 2016
Note: acre-feet is equivalent to 325,851 gallons.
WSC – Water Supply Corporation
SUD – Special Utility District

As noted in **Table 3.9-4**, no water supply service would be located near the Bardwell MOW facility, which would be located on Segment 2A or 2B.

3.9.4.1.2 Wastewater Capacity

The HSR system, specifically stations, TMFs and MOW facilities, would produce wastewater in the counties listed in **Table 3.9-5**. The following table summarizes the capacities of the wastewater systems

[16] TWDB, "2016 Region C Water Plan for Texas Water Development Board, Volume 1 Main Report," December 2015.
[17] South Freestone WSC. Personal Communication. 6/21/2016. Permitted groundwater withdrawals.
[18] TWDB, "2016 Region H Water Planning Group for Texas Water Development Board," November 2015.
[19] TWDB, "2016 Brazos G Regional Water Plan for Texas Water Development Board," December. 2015.
[20] Bluebonnet Water Conservation District. Personal Communication. 6/21/2016. Permitted groundwater withdrawals.

in the vicinities of the stations and facilities.[21, 22, 23] Generally, on-site sewage systems (e.g., septic tanks) are used in rural and low-density locations of the Study Area; therefore, there are no wastewater treatment plants in some of the counties in the Study Area.

Table 3.9-5: Wastewater Treatment Capacity

County	Facility (Segment)	Agency	WWTP Name	Capacity
Dallas	Dallas Terminal and TMF (1)	Dallas Water Utilities	Central WWTP	150 MGD
Ellis	Bardwell MOW (2A, 2B)	None	N/A	N/A
Freestone	Fairfield MOW (3C)	None	N/A	N/A
Leon	Centerville MOW (3C)	None	N/A	N/A
Freestone	Wortham MOW (4)	None	N/A	N/A
Leon	Jewett MOW (4)	None	N/A	N/A
Brazos	Brazos Valley Station (4)	City of College Station	Carter's Creek WWTP	9.5 MGD
Brazos	Brazos Valley Station (4)	City of College Station	Lick Creek WWTP	2.0 MGD
Grimes	Bedias MOW (5)	None	N/A	N/A
Waller	Houston MOW (5)	None	N/A	N/A
Harris	Houston Terminal and TMF	City of Houston Public Works	69th Street WWTP	200 MGD

Sources: City of Dallas, 2016; City of College Station, 2016 and City of Houston, 2016
Notes: WWTP – wastewater treatment plant; mgd – million gallons per day; NA – Not Applicable

The wastewater treatment plant that would serve the Dallas Terminal Station option has a capacity of 150 million gallons per day (mgd). The Central Wastewater Treatment Plant has a permit to expand to a future capacity of 200 mgd. The most recent available data indicates that the average annual flow for 2014 was 88 mgd, or approximately 60 percent of existing plant capacity.[24]

As noted in **Table 3.9-5**, due to their location in rural areas, none of the MOW facilities would be in proximity to existing wastewater services.

The closest wastewater treatment plant to the Brazos Valley Station would be in College Station. The two WWTPs in College Station have a capacity of 11.5 mgd. From the most recent available data, the College Station system treats approximately 7 mgd, or 61 percent of the existing plant capacity.[25]

The City of Houston Public Works 69th Street Wastewater Treatment Plant would serve the Houston Terminal Station options; it has a capacity of 200 mgd. Information about average daily flows at individual wastewater treatment plants in Houston is not publically available, but the City of Houston system, whose capacity is 565 mgd, treats a daily average flow of 225 mgd, representing 40 percent of the existing plant capacity.[26]

3.9.4.2 Energy

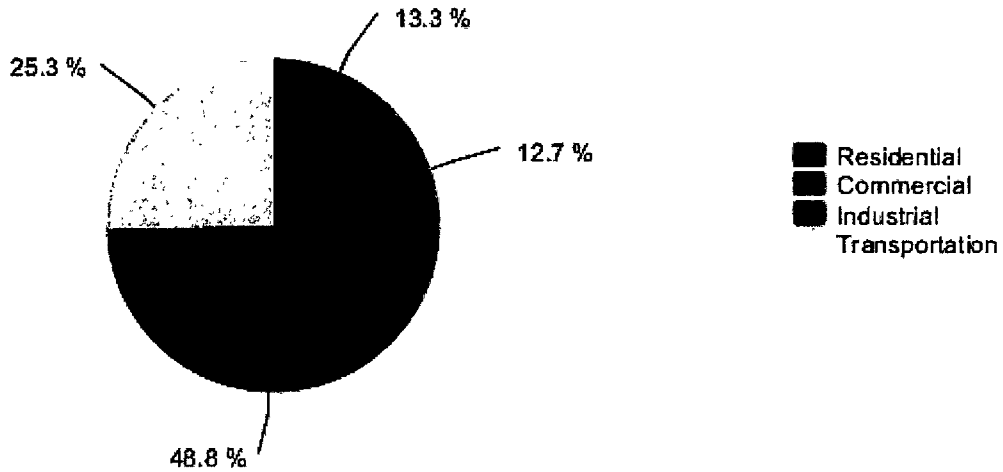
Texas leads the nation in energy production, primarily from crude oil and natural gas, but is also rapidly developing its wind and solar energy resources. Texas also leads the nation in energy consumption, accounting for more than one-eighth of the U.S. total. The state's industrial sector accounts for the

[21] City of Dallas, "City of Dallas Water Conservation Plan 2014. "https://savedallaswater.com/pdf/wcp.pdf. Website accessed March 6, 2016
[22] City of College Station Wastewater (Sewer) Services. http://www.cstx.gov/index.aspx?page=818 . Website accessed March 23, 2016.
[23] City of Houston 2016. Wastewater Facilities & Maintenance Section. 69th Street Wastewater Treatment Plant details. https://www.publicworks.houstontx.gov/pud/wwtms.html. Website accessed February 22, 2016
[24] NCTCOG 2015. North Central Texas Water Quality Management Plan Update. May.
[25] City of College Station, Wastewater (Sewer) Services, http://www.cstx.gov/index.aspx?page=818. Website accessed October 2016.
[26] City of Houston 2016. Wastewater Facilities & Maintenance Section. https://www.publicworks.houstontx.gov/pud/wwtms.html. Website accessed February 22, 2016.

largest share of energy use, due the number and size of petroleum refining and chemical manufacturing facilities. The transportation sector accounts for the second largest share of energy use, due in part because of the distances across the state and large number of registered vehicles. Because of its varied climate, heating and cooling needs are also high in Texas.[27] **Figure 3.9-1** illustrates Texas's energy use by sector in 2013.

[27] EIA 2016a. U.S. Energy Information Administration. Independent Statistics & Analysis. Texas Summary. https://www.eia.gov/state/print.cfm?sid=TX. Website accessed April 25, 2016.

Figure 3.9-1: Texas Energy Consumption by End Use in 2013



Source: EIA, 2016

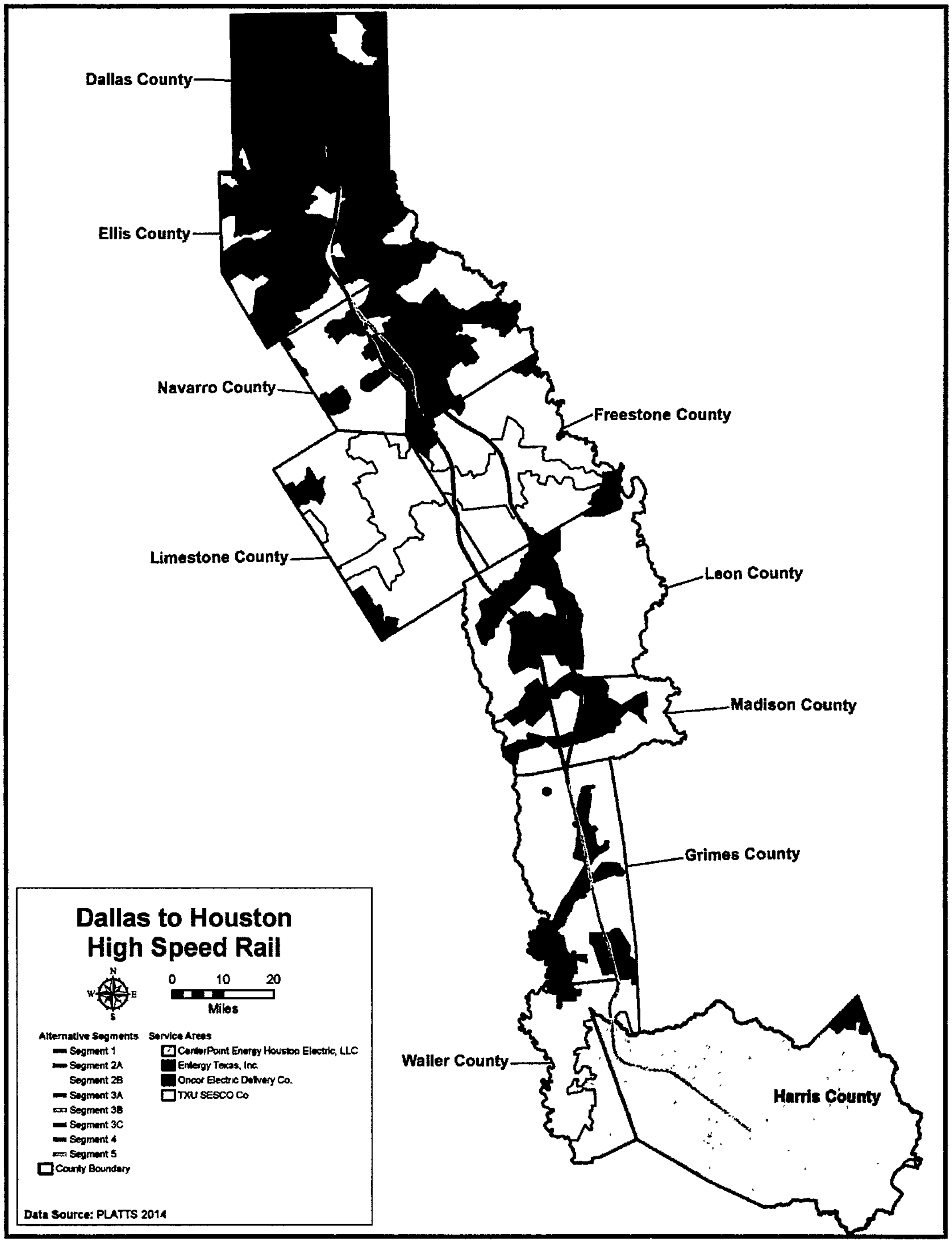
3.9.4.2.1 *Electricity*

Electrical Providers

As seen on **Figure 3.9-2**, the Study Area is served by four major utility service providers—Oncor Electric Delivery, TXU Sesco, Entergy Texas and CenterPoint Energy. Oncor Electric Delivery is Texas' largest distribution and transmission system, delivering power to more than 3.2 million homes and businesses and operating approximately 120,000 miles of transmission and distribution lines.[28] Oncor Electric's service territory in the study area includes Dallas, Ellis, Navarro, Freestone, Limestone, and Leon counties.

[28] Energy Future Holdings 2016. Oncor Electric Delivery overview. https://www.energyfutureholdings.com/about-us/. Website accessed June 9, 2016.

Figure 3.9-2: Major Electric Utility Providers



Source: AECOM, 2017

TXU SESCO delivers electricity across Texas to 1.7 million residential and business customers.[29] TXU SESCO's service area is comparable to Oncor Electric, but is limited to Freestone and Limestone counties in the Study Area.

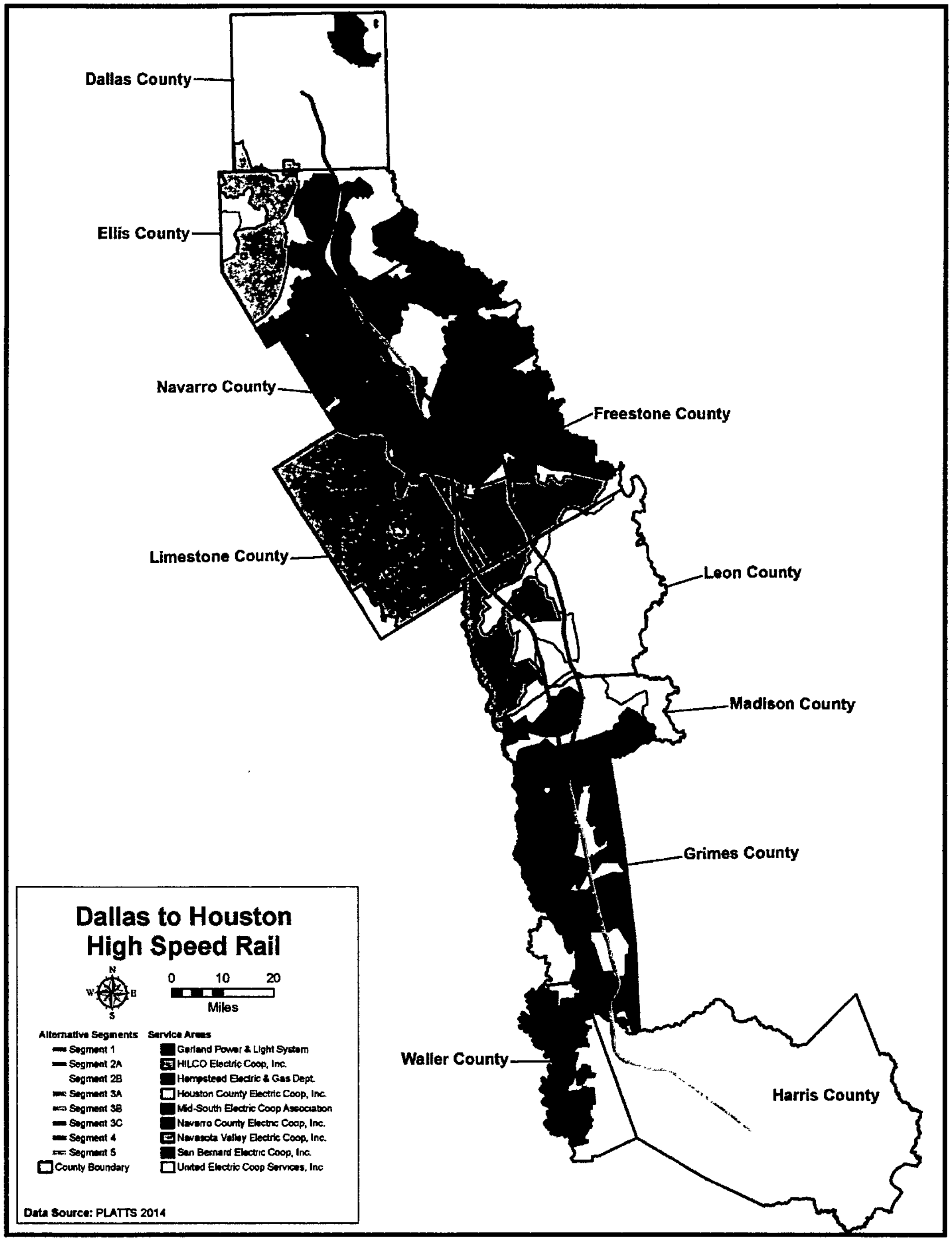
Entergy Texas delivers electricity to 434,000 customers across 27 counties and 15,320 square miles in central and eastern Texas.[30] Entergy Texas' service area is smaller than Oncor Electric, and includes Limestone, Leon, Madison, Grimes, Waller and Harris counties in the Study Area.

CenterPoint Energy's service area is much smaller than Oncor Electric. CenterPoint Energy delivers energy for 85 electric retailers in a 5,000 square-mile area serving more than 2.3 million customers in the Houston metropolitan area.[31] CenterPoint Energy's service territory in the Study Area is Harris County.

In addition to the four major utility service providers, there are nine smaller service providers across the Study Area, as seen on **Figure 3.9-3**. These include Garland Power & Light System, HILCO Electric Coop, Inc., Hempstead Electric & Gas Department, Houston County Electric Coop, Inc., Mid-South Electric Coop Association, Navarro County Electric Coop, Inc., Navasota Valley Electric Coop, Inc., San Bernard Electric Coop, Inc. and United Electric Coop Services, Inc. Many of these smaller service providers are members of the Brazos Electric Cooperative. Brazos Electric Cooperative is Texas' largest generation and transmission cooperative whose members' service territory extends across 68 counties from the Texas Panhandle to Houston. Brazos Electric is the wholesale power supplier for its 16 member-owner distribution cooperatives and one municipal system.[32]

[29] Energy Future Holdings 2016. TXU SESCO overview. https://www.energyfutureholdings.com/about-us/. Website accessed June 9, 2016.
[30] Entergy Texas 2016. Entergy overview. http://www.entergy-texas.com/about_entergy/. Website accessed June 9, 2016.
[31] CenterPoint 2016. CenterPoint Energy Overview. http://www.centerpointenergy.com/en-us/residential/services/electric-utility?sa=ho. Website accessed April 19, 2016.
[32] Brazos Electric 2016. Brazos Valley Electric Cooperative Overview. http://www.brazoselectric.com/. Website accessed April 19, 2016.

Figure 3.9-3: Smaller Electric Utility Providers



Source: AECOM, 2017

ERCOT manages about 90 percent of the state's electric load, connecting more than 43,000 miles of transmission lines and 550 generation units. ERCOT is subject to oversight by the Texas Public Utility Commission and the Texas Legislature. ERCOT's members include consumers, cooperatives, generators, power marketers, retail electric providers, major electric utilities (transmission and distribution providers), and municipal-owned electric utilities.[33]

Electrical Demand

The ERCOT 2014 *Report on Existing and Potential Electric System Constraints and Needs* analyzed existing and potential constraints in the electrical transmission system for Texas consumers. The DFW Metroplex is a major load center in Texas and experiences persistent electrical load growth. Demand in all customer classes has been steadily increasing over the last 10 years. Four electrical transmission line actions have been identified to address the growth. The Houston metropolitan area is the other major load center in Texas, serving more than 25 percent of the entire load in the ERCOT System. In recent years the Houston area has seen persistent electrical load growth but also a lack of new electrical generation development. Demand in all customer classes has been increasing since 2009, and the rate of growth for commercial and residential classes has been increasing since 2010. On the other hand, only 1,800 megawatts (MW) of new generation has been added in the Houston area over the last 10 years (2004-2013), while 3,800 MW of older generation was retired over the same time period.[34]

The ERCOT *2014 Regional Transmission Plan Report Appendix D and E* examined current net system load factors based on hourly demand and net system load factors based on 15-minute demand. For the year 2014, the annual hourly demand was 58.4 percent of capacity, while the 15-minute demand was 58.3 percent of capacity. This indicates that sufficient electrical power is generated and supplied in the ERCOT system to support the current population of Texas.

The ERCOT *2014 Regional Transmission Plan Report* addresses region-wide reliability and economic transmission needs for years 2015 through 2020. ERCOT's transmission system is divided into eight different weather zones to represent the different climate-related weather patterns observed in the ERCOT Region (see **Figure 3.9-4**). The ERCOT weather zones in the Study Area include north central, east and coast. ERCOT used two demand forecast sources for electric reliability. The first demand forecast used annual electric load data, while the second demand forecast used the ERCOT-developed 90th percentile weather zone electrical load data.[35] Both forecasts assumed that summer peak is deemed to be critical due to the high air conditioner load that exists during summer afternoons in Texas. **Table 3.9-6** shows the results of the 90th percentile weather zone electrical load data forecast, which shows steady growth in the north central, east, and coast areas from 2015 through 2020.[36]

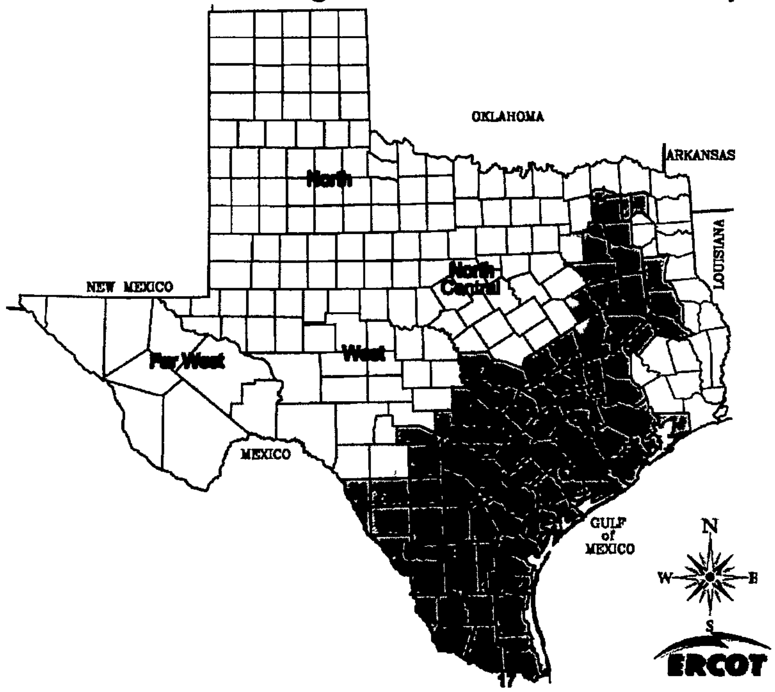
Table 3.9-6: ERCOT 90th Percentile Weather Zone Load Forecast (MW)

Year	Coast	East	Far West	North	North Central	South Central	South	West	ERCOT Non-Coincidental Peak
2015	2,3048	2,343	2,589	1,589	25,917	11,882	6,346	1,945	75,659
2017	2,3419	2,356	2,824	1,570	26,629	12,049	6,721	1,983	77,553
2019	2,3853	2,369	3,056	1,551	27,322	12,210	7,087	2,022	79,470
2020	2,4054	2,376	3,172	1,541	27,664	12,289	7,271	2,041	80,408

Source: ERCOT 2014
Note: MW – megawatts

[33] ERCOT 2016. ERCOT Overview. http://www.ercot.com/about. Website accessed April 19, 2016.
[34] ERCOT 2014. Report on Existing and Potential Electric System Constraints and Needs. December.
[35] ERCOT uses a 90th percentile or 90/10 forecast (as opposed to a 50/50 forecast based on average weather conditions) in order to achieve a transmission system that is sufficient to meet future loads 9 out of 10 years. The ERCOT 90/10 load forecast is developed using the ERCOT Long-Term Hourly Peak Demand and Energy Forecast with a 90th percentile temperature assumption.
[36] ERCOT 2014. Long-Term System Assessment for the ERCOT Region. December.

Figure 3.9-4: ERCOT 2014 Regional Transmission Plan Study Regions



Source: ERCOT 2014

The 2014 *Long-Term System Assessment for the ERCOT Region* studied the short-term need for increased transmission and generation capacity throughout Texas. It provides a long-term view of system reliability needs. Most of the short-term needs for electrical system improvements to the high voltage system noted in this analysis were located in and around the DFW Metroplex. Short-term electrical system improvements are also anticipated in the Houston metropolitan area due to high industrial growth. As seen in **Table 3.9-7,** a substantial amount of electrical capacity is forecasted to be added in Texas to accommodate anticipated growth. In contrast, a much smaller amount of equipment retirements is forecasted over the same 11-year period.[37] The net added capacity, which subtracts the retired capacity, provides a peak capacity of 20,410 MW that would provide an additional 489,840 megawatt hours (MWh) daily, or 178,791,600 MWh annually, under constant generation.

Table 3.9-7: Expected Electricity Growth

	2018	2021	2024	2027	2029
Annual Capacity Additions (MW)	1,350	5,790	4,780	5,940	3,500
Cumulative Capacity Additions (MW)	1,350	7,140	11,920	17,860	21,360
Equipment Retirements (MW)	955	2,086	2,379	2,453	950
Net Added Capacity	395	5,054	9,541	15,407	20,410

Source: ERCOT, 2014

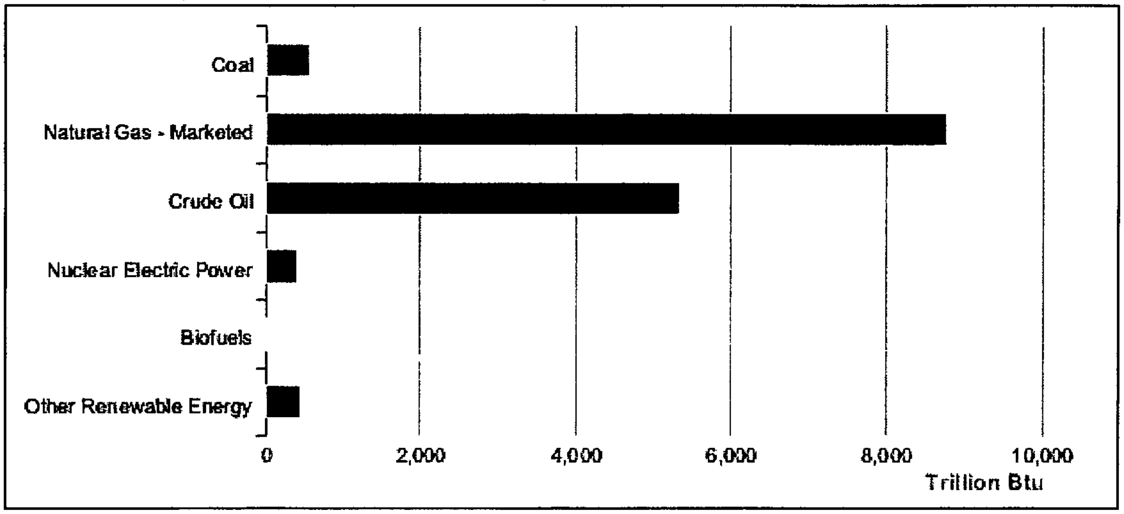
Electric Generation

Texas produces more electricity than any other state, and generates almost twice as much as the second highest-producing state. More than two-thirds of the electricity is generated by independent power

[37] ERCOT, "Long-Term System Assessment for the ERCOT Region," December 2014

producers and industrial generators. **Figure 3.9-5** illustrates Texas' electricity generation estimates by type in 2013.

Figure 3.9-5: Texas Electricity Generation Estimates in 2013



Source: EIA, 2016

3.9.4.2.2 *Fuel*

Crude Oil and Natural Gas

Texas leads the nation in crude oil reserves and production, and the state has almost one-third of all reserves in the U.S. Although crude oil reserves can be found in several geologic basins throughout Texas, including in the Study Area, the largest oil fields are found in west Texas. In 2014, crude oil production exceeded 3.1 million barrels per day. Texas also leads the nation in crude oil refining capacity, with 27 refineries that can process more than 5.1 million barrels of oil per day. Additionally, Texas leads the nation in total oil consumption and in 2014 was fifth in per capita consumption.[38]

Similar to crude oil, Texas leads the nation in natural gas production, and the state has more than one-fourth of all reserves in the U.S. Similar to crude oil, natural gas can be found in several geologic basins throughout Texas, including in the Study Area, but the largest natural gas fields are found in north and south Texas. In 2014, natural gas production reached 7.95 trillion cubic feet. As discussed in **Section 3.9.4** above, there are numerous natural gas pipelines in the Study Area. Texas exports natural gas to markets across the U.S. and Mexico via intrastate and interstate pipelines. Additionally, Texas leads the nation in natural gas consumption, accounting for about one-seventh of total usage in the U.S. The amount of natural gas used for electrical generation in Texas is greater than in any other state and is more than one-sixth of the U.S. total.[39]

Of the 10 counties in the Study Area, only Dallas, Ellis and Waller counties do not have oil and gas activities within or adjacent to the Study Area. Much the rural property between the cities of Dallas and Houston is leased to oil and gas companies for exploration and extraction. Numerous oil and gas wells,

[38] EIA 2016a. U.S. Energy Information Administration. Independent Statistics & Analysis. Texas Summary. https://www.eia.gov/state/print.cfm?sid=TX. Website accessed April 25, 2016.

[39] EIA 2016a. U.S. Energy Information Administration. Independent Statistics & Analysis. Texas Summary. https://www.eia.gov/state/print.cfm?sid=TX. Website accessed April 25, 2016.

and their associated well pads and access roads, were identified within and adjacent to the Study Area, as listed in **Table 3.9-8**. As described in **Section 3.9.3, Methodology**, a 50-foot buffer was added to account for potential mapping errors in the Texas Railroad Commission data.

Table 3.9-8: Oil and Gas Wells within the Study Area

County/Segment	# Vertical Wells in LOD	# Vertical Wells in 50 foot Buffer	# Horizontal Wells in LOD	Total Horizontal Length in LOD
Navarro County				
Segment 3A	2	-	2	7.3
Segment 3B	-	1	-	0
Segment 3C	5	-	-	0
Freestone County				
Segment 3A	-	-	-	-
Segment 3B	-	-	-	-
Segment 3C	3	3	1	675.9
Segment 4	-	-	-	-
Limestone County				
Segment 4	7	4	2	692.5
Leon County				
Segment 3C	2	1	-	851.9
Segment 4	8	1	3	317.6
Madison County				
Segment 3C	1	2	1	502.6
Segment 4	3	1	3	69.3
Grimes County				
Segment 3C	-	-	-	68.2
Segment 4	-	-	-	44.0
Segment 5	3	2	4	1214.8
Harris County				
Segment 5	3	-	1	46.3
Segment 5 Northwest Transit Center	1	-	-	-
Total	**38**	**15**	**22**	**4,490.4**

Source: AECOM, 2017;
Note: No oil/gas wells are located in Dallas, Ellis or Waller counties

Fuel Consumption

The *State Transportation Statistics 2015*, which is published by the USDOT Bureau of Transportation Statistics, presents a statistical profile of transportation across a wide variety of characteristics. A summary of each state's transportation infrastructure, safety, freight movement, passenger travel, VMT, economy and finance, as well as energy and the environment, is presented. Fuel consumption rates for vehicle and airline passengers in Texas are shown in **Table 3.9-9**.[40]

Table 3.9-9: Transportation Energy Consumption by Source for 2013

	Distillate Fuel (diesel)	Jet Fuel	Motor Gasoline*	Residential Fuel	Other**	Total Petroleum	Per Capita
Texas	749.2	386.7	1,498.4	118.3	15.4	2,767.9	104.4
U.S.	5,909.6	2,968.6	16,034.9	581.2	197.3	25,691.4	81.2

Source: U.S.DOT, 2015
Notes: All data is in trillion British thermal units, except for per capita data which is in million British thermal units.

[40] U.S.DOT, Bureau of Transportation Statistics, "State Transportation Statistics 2015," 2015

Table 3.9-9: Transportation Energy Consumption by Source for 2013							
	Distillate Fuel (diesel)	Jet Fuel	Motor Gasoline*	Residential Fuel	Other**	Total Petroleum	Per Capita

* Includes ethanol blended into motor gasoline.
** "Other" category is the sum of aviation gasoline, liquefied petroleum gas, and lubricants.

Automobile and light truck travel is the predominant mode of passenger transportation in the Study Area. Additionally, the Study Area is a major corridor for the movement of goods and services by truck and freight rail between the cities of Dallas and Houston. Generally, the demand for fuel consumption for transportation mirrors the growth of the state's population and economic output. Therefore, as Texas has grown, so has its use of fuel.

3.9.5 Environmental Consequences

3.9.5.1 No Build Alternative

Under the No Build Alternative, the HSR system would not be built. There would be no direct impacts to existing utilities because no construction activities would take place. There would be no additional service demand placed on these utilities. However, economic and population growth would continue, resulting in additional demand for fuel. Fuel consumption from vehicular and aviation travel between Dallas and Houston would increase in response to anticipated population growth and, therefore, no fuel savings would occur.

3.9.5.2 Build Alternatives

3.9.5.2.1 Utilities

Electric Utility Modifications

Table 3.9-10 illustrates three types of electrical utility modifications that would be required, including new connections to HSR facilities and vertical adjustments to existing pole lines. TCRR identified potential locations for these modifications for the Build Alternatives (see **Appendix F, TCRR Conceptual Engineering Design Report**). However, the utility provider would have ultimate decision-making authority over the size and location of the improvement. For example, the provider could choose to combine the needs of the HSR system with other planned or authorized projects. Due to the unknown location of these modifications, an environmental assessment of these areas is not included at the project-level. These potential impacts are discussed at the cumulative-level in **Chapter 4.0, Indirect and Cumulative Impacts**.

TCRR would be responsible for obtaining the necessary authorization from each provider to provide service to the HSR system. This authorization process would also include the environmental clearance of the modified area, if not already assessed in this EIS. TCRR would communicate its intent to electrical utility providers regarding the potential electrical transmission line realignments identified in the table above, conduct coordination to identify opportunities to avoid conflicts and agreements would be completed before construction of the Build Alternatives could begin. The utility providers would be responsible for undertaking any potential relocations, pole adjustments and/or new connections. The effects of any new electrical utility connections cannot be determined at this time due the speculative nature of their location and length. The location of these modifications would be determined by the utility provider. The utility provider may choose to include these modifications into any existing plans to modify their system infrastructure. As the owner of the utility, the provider would manage and lead the environmental process associated with the modifications to provide the connections to TCRR's infrastructure. This process includes a routing analysis that requires environmental impact assessment, as well as a public involvement process, and is coordinated through the Texas Public Utility Commission. These potential actions by the utility providers are discussed further in **Chapter 4.0, Indirect and Cumulative Impacts**.

Table 3.9-10 shows the number and type of the anticipated electrical transmission line realignments. The nine electric transmission lines that are noted in the No Impact column of the table would be parallel to the Build Alternatives, but would not require realignment or modifications.

Table 3.9-10: Electric Transmission Line Impacts

County/Segment	Pole Realignment	No Impact	TPSS Connections
Dallas County			
Segment 1	15	--	1
Ellis County			
Segment 2A	8	--	1
Segment 2B	13	--	1
Segment 3A	1	--	-
Segment 3B	2	--	-
Navarro County			
Segment 3A	10	1	2
Segment 3B	11	--	1
Segment 3C	11	2	2
Freestone County			
Segment 3A	--	--	-
Segment 3B	--	--	-
Segment 3C	5		2
Segment 4	6	2	1
Leon County			
Segment 3C	2	--	1
Segment 4	9	--	2
Madison County			
Segment 3C	1	--	1
Segment 4	7	2	-
Grimes County			
Segment 3C	1	--	-
Segment 5	13	2	2
Waller County			
Segment 5	3	--	-
Harris County			
Segment 5	16	--	-
Harris County -Segment 5: Industrial Site Terminal Option	--	--	-
Harris County- Segment 5: Northwest Mall Terminal Option	--	--	--
Harris County- Segment 5: Northwest Transit Center Terminal Option	2	--	-
Total	**136**	**9**	**17**

Source: AECOM, 2017

Build Alternatives C and F would require ten new electrical connections required at the TPSSs, and Build Alternatives B and E would require the least amount of new connections, with eight each. Pole adjustments, or raising the transmission line, could be required under all Build Alternative to accommodate vertical clearances for the HSR ROW. Estimates of pole adjustments range from 75 under Build Alternative C to 95 under Build Alternative E.

Existing Utility Crossings

While overhead utilities lines are visible and can be verified prior to construction activities, below ground utility exploration would need to be performed by the TCRR and/or its construction contractor prior to the start of construction to determine the exact locations and depths. Additionally, abandoned or unknown utility lines could be discovered during construction activities. For the purposes of this analysis, all utility conflicts would require utility realignment or protective action. Protective actions include activities during construction (e.g., shoring) and/or operations (e.g., encasement).

Where the Build Alternatives would cross underground utilities, realignment may be necessary to provide adequate protection and/or depth. Where the Build Alternatives would cross overhead utilities, realignment or reconstruction would be expected to provide the required vertical clearance over the HSR system to accommodate utility infrastructure. Utilities within the Study Area would be either realigned outside the restricted access areas of the HSR ROW or modified (e.g., encased in a pipe sturdy enough to withstand the weight of the HSR system and allow for maintenance access) to avoid conflict.

Because of utility realignments and protective actions, construction of the Build Alternatives would result in scheduled and/or accidental interruptions of utility services. Final design and phasing of construction activities would minimize interruptions.

Realignment of a utility may also necessitate additional land or easement acquisition, temporary facilities during realignment and reimbursement or penalties for disruption of service. The final utility crossing decisions would be determined on a case-by-case basis between TCRR and the utility provider during final design. Utility realignment and/or protection methods, for construction or post-construction purposes, typically would not negatively impact the effectiveness of the utility infrastructure. Therefore, construction conflicts with utility crossings would be not significant.

Tables 3.9-11 through **3.9-13** summarize the potential utility crossings by type (e.g., water, wastewater and communication underground) and proposed rail configuration (e.g., below grade, on embankment or viaduct), as well as how they would be impacted by the Build Alternatives (e.g., relocated, protected or not impacted). Underground utilities, such as water/wastewater infrastructure, could conflict with construction of the Build Alternatives, particularly where the track would be below grade or is built directly over the utility. Embankment and viaduct construction may avoid some conflicts with underground utilities because piers could be spaced around the underground utility. Overhead utilities could conflict where the Build Alternatives would be on viaduct and there is not sufficient vertical clearance for the HSR system infrastructure beneath the overhead utility.

Table 3.9-11: Impacts to Existing Water Utilities

Type	Relocate	Protect	No Impact
Dallas County – Segment 1			
Water	--	--	9
Stormwater	--	--	19
Ellis County – Segment 2A			

Water	--	2	--
Ellis County – Segment 2B			
Water	--	2	--
Harris County – Segment 5			
Water	3	6	6
Stormwater	--	2	2
Harris County – Segment 5: Northwest Transit Center Terminal Option			
Water	--	4	1
Stormwater		4	1
Total	**3**	**20**	**38**

Source: AECOM, 2017

Table 3.9-12: Impacts to Wastewater Utilities

Type	Relocate	Protect	No Impact
Dallas County – Segment 1			
Sanitary	1	1	18
Harris County – Segment 5			
Sanitary	--	4	--
Wastewater	--	1	--
Harris County- Segment 5: Northwest Transit Center Terminal Option			
Wastewater	--	2	--
Total	**1**	**8**	**18**

Source: AECOM, 2017

Table 3.9-13: Impacts to Communication Lines

Type	Relocate	Protect	No Impact
Dallas County – Segment 1			
Communication	--	1	2
Ellis County – Segment 2A			
Communication	--	--	3
Ellis County- Segment 2B			
Communication	--	--	3
Navarro County – Segment 3A			
Communication	1	--	--
Navarro County- Segment 3C			
Communication	1	--	--
Freestone County – Segment 4			
Communication	--	--	1
Leon County – Segment 4			
Communication	--	--	8
Waller County – Segment 5			
Communication	1	2	10
Harris County – Segment 5			
Communication	35	1	14
Harris County - Segment 5: Industrial Site Terminal Option			

Communication	1	--	--
Harris County - Segment 5- Northwest Mall Terminal Option			
Communication	3	--	--
Harris County - Segment 5- Northwest Transit Center Terminal Option			
Communication	13	--	--
Total	**55**	**4**	**41**

Source: AECOM, 2017

As seen in **Tables 3.9-11** and **3.9-12**, potential impacts to water and wastewater utilities would primarily occur in Dallas and Harris counties. As seen in **Table 3.9-13**, potential impacts to communication lines would primarily occur in Harris County. The majority of the impacts to water, wastewater and communication lines would be in the urban counties like Dallas and Harris, which include common segments of all the Build Alternatives.

Water Demand

Construction activities would involve the use of water to prepare concrete, increase the water content of soil for dust control and re-seed temporarily disturbed areas at the completion of construction. It is anticipated that non-potable water would be used for the construction activities. Potable and non-potable water for construction would likely be supplied from existing surface or groundwater supply systems in the Study Area, and would be trucked throughout the Study Area, as needed. Since the Build Alternatives would be essentially the same length, no difference in construction-period water demand would be anticipated between the Build Alternatives. Construction-period water demand would not be anticipated to require construction or expansion of a water treatment facility, or expanded water entitlements. Therefore, construction-period water demand would not be significant.

Operation of the Build Alternatives would primarily use water at the stations, TMFs and MOW facilities. Trains would be equipped with restrooms for passenger use that would provide a small amount of potable water from a closed system. This water would be collected at the MOW facilities. TCRR provided estimates of daily and yearly water demand for the stations, TMFs and MOW facilities, as shown in **Table 3.9-14**. The total daily water demand for the Build Alternatives would be approximately 275,000 gallons/day or 100,595,460 gallons/year. The contracted water supply volume of the relevant providers listed in **Table 3.9-4** could meet the anticipated operational demand.

Table 3.9-14 Projected Build Alternatives Water Demand

Facility	Demand (gallons per day)	Demand (acre-feet per day)	Demand (gallons per year)	Demand (acre-feet per year)
Dallas Terminal	90,900	0.28	33,178,500	101.9
Brazos Valley Station	29,654	0.091	10,823,710	33.2
Houston Terminal	93,060	0.29	33,966,900	104.3
TMFs (two)	61,440	0.18	22,425,600	68.8
MOW Facilities (seven)	550	0.002	200,750	0.6
Total	**275,604**	**0.84**	**100,595,460**	**307.7**

Source: TCRR, 2016
Note: acre-feet is equivalent to 325,851 gallons.

Station water demand would be associated with restrooms, maintenance/cleaning, restaurant/food service and car rental/car wash services. At the MOW facilities, water demand would be associated with train washing, associated maintenance activities, train water supply and routine employee usage for consumption and restrooms. As shown in **Table 3.9-14**, very little water would be required at the MOWs (no more than 550 gpd). Due to the distance of the MOWs to the water supply providers in the rural areas, it would be cost prohibitive to construct tie-ins to these providers. Drilling local water wells to meet water needs would be more cost effective in these more rural locations. The Prairielands Groundwater Conservation District is the regulating entity for groundwater wells in Ellis County.

The Dallas Terminal Station option, TMF and MOW facility would be located in the City of Dallas and would generate an estimated water demand of 136.8 acre-feet per year. Water for these facilities would be provided by Dallas Water Utilities. The 136.8 acre-feet per year would be well within the service capabilities of the Dallas Water Utilities, and represents less than 0.03 percent of the Dallas Water Utilities contracted volume of 497,526 acre-feet per year. TCRR would coordinate with Dallas Water Utilities to complete a "Development Impact Report"[41] prior to construction to more accurately determine the needs of the Dallas area facilities.

The Brazos Valley Station would generate an estimated water demand of 33.2 acre-feet per year. This station lies in the certificated service area of Anderson Water Company, which has a permitted capacity of 12.9 acre-feet per year. The demand estimated for the Brazos Valley Station exceeds the annual water usage of the Anderson Water Company. Capacity expansion would be required to accommodate the demand of the Build Alternatives. TCRR would coordinate with the Anderson Water Company to complete a development review prior to construction to more accurately determine the new infrastructure needs to support Additionally, the Anderson Water Company would require a permit amendment with the Bluebonnet Groundwater Conservation District for additional contracted water rights.

In lieu of capacity expansion at Anderson Water Company, the service areas of the Wickson Creek SUD is located less than one-half mile to the north, south or west of the Brazos Valley Station site. A six-inch water line currently exists along County Road 226. The Wickson Creek SUD has 1,710 acre-feet per year under contract through 2020.[42] The estimated demand for water at the Brazos Valley Station would represent approximately 1.9 percent of contracted capacity of the Wickson Creek SUD. TCRR would need to tie-in to the existing six-inch water line in order to access the Wickson Creek SUD.

The Houston Terminal Station options and Houston TMF would generate an estimated water demand of 138.7 acre-feet per year. Water for these facilities would be provided by the City of Houston. The 138.7 acre-feet per year would be within the service capabilities of the City of Houston, and would represent less than 0.2 percent of the city's contracted volume of 740,678 acre-feet per year. TCRR would coordinate with the City of Houston to complete a development review prior to construction to more accurately determine the needs of the Houston facilities.

Operations water demand would not be anticipated to exceed the capacity of the City of Dallas Utilities or City of Houston; however, the water demand for the Brazos Valley Station would require new infrastructure from either Anderson Water Company or Wickson Creek SUD. Water for operation at the MOWs would come from local water wells. Therefore, the impact to water demand during operations would not be significant.

[41] City of Dallas, "Development Design Procedure and Policy Manual," October 2015.
[42] HDR, Inc. and Freese and Nichols, Inc. 2015. 2016 Brazos G Regional Water Plan for Texas Water Development Board, Volume 1, Table 3.1-3. December.

Wastewater Capacity

Since the Build Alternatives would be essentially the same length, no difference in the quantity of construction-period wastewater would be anticipated. Wastewater generated during the construction-period that would not be connected to an existing wastewater treatment system would be trucked to a treatment plant for proper disposal. Wastewater generated during the construction-period that would be connected to an existing wastewater treatment system would be treated by existing plants in the Study Area.

Operation of the Build Alternatives would generate wastewater at the stations, TMFs and MOW facilities. Trains would be equipped with restrooms for passenger use that would collect wastewater in a closed system. This wastewater would be collected at the MOW facilities or TMFs.

Station wastewater would be generated by restrooms, maintenance/cleaning, restaurant/food service and car rental/car wash services. The Dallas Terminal Station option, TMF and MOW facility would be located within the City of Dallas and would generate an estimated wastewater demand of 122,170 gallons per day, or 0.12 mgd. Wastewater from the Dallas Terminal Station option would be directed to the Central Wastewater Treatment Plant, operated by the City of Dallas, which currently has a capacity of 150 mgd. The wastewater generated by the Build Alternatives would be well within the Central Wastewater Treatment Plant's capacity, representing 0.08 percent of its capacity.

The Brazos Valley Station would generate an estimated wastewater demand of 29,654 gallons per day, or 0.03 mgd. Wastewater from the Brazos Valley Station could be directed to Carter's Creek Wastewater Treatment Plant, operated by the City of College Station, which has a capacity of 9.5 MGD. However, Carter's Creek Wastewater Treatment Plan is almost 20 miles east of the station and would require an extension of service. Therefore, TCRR would construct an on-site water treatment system. This facility would be classified as a Large Capacity On-Site Sewage System, and be regulated by the TCEQ as a Class V Injection Well.[43] Prior to construction, TCRR would be required to submit an application and the final design of the Class V injection well to the TCEQ Underground Injection Control Program for approval.

The Houston Terminal Station options and TMF would generate an estimated wastewater demand of 124,330 gallons per day, or 0.12 mgd. Wastewater from the Houston Terminal Station options would be directed to the 69th Street Wastewater Treatment Plant, operated by the City of Houston, which has a capacity of 200 mgd. The wastewater generated by the Build Alternatives would be well within the 69th Street Wastewater Treatment Plant's capacity, representing 0.06 percent of its capacity.

At the MOW facilities, wastewater demand would be generated by train washing, maintenance activities and routine employee usage for consumption and restrooms. The six additional MOW facility options (excluding the Dallas MOW discussed above) would each generate an estimated 550 gallons of wastewater per day. All of the proposed MOW locations would be located outside established wastewater service areas. The Bardwell MOW Facility would be located approximately 6 miles northeast of the wastewater service area of the Avalon Water and Sewer Service Corporation. The Fairfield MOW Facility would be located approximately 1.25 miles south of the wastewater service area of the City of Fairfield. The Centerville MOW Facility would be located approximately 18 miles southeast of the wastewater service area of the City of Buffalo. The Wortham MOW Facility would be located approximately 9 miles northeast of the wastewater service area of the City of Mexia. The Jewett MOW Facility would be located approximately 13 miles southwest of the wastewater service area of the City of

[43] Texas Administrative Code, Title 30 Environmental Quality, Chapter 331 Underground Injection Control.

Buffalo. The Bedias MOW Facility would be located approximately 15 miles southwest of the wastewater service area of the City of Madisonville. The Houston MOW Facility in Waller County would be located approximately 7 miles north of the wastewater service area of the City of Waller.

It would be cost prohibitive to extend service to these facilities. Therefore, TCRR would construct and operate on-site treatment (septic) as part of the Build Alternatives. TCEQ has granted authority to Texas counties to manage regulations regarding permits and enforcement of on-site sewage facilities.[44] Prior to the construction of an on-site septic system for each of the MOWs, TCRR would file on-site sewage facilities applications, which once approved, would be given to a licensed sceptic installer. An extension of service would result in a significant impact, requiring additional construction and infrastructure.

Wastewater generated during operation would be treated at existing Wastewater Treatment Plants where accessible, and at on-site treatment facilities constructed as part of the Build Alternatives. Operations period wastewater demand would not exceed the capacity of the City of Dallas or the City of Houston; however, on-site wastewater services would need to be constructed to serve the Brazos Valley Station and the MOWs. These on-site facilities would be constructed in accordance with applicable state and local regulations. Therefore, operations period wastewater demand would not be a significant impact.

3.9.5.2.2 Energy

Electricity

Electricity demand during construction of the Build Alternatives would be limited to power requirements (primarily lighting and power tools) at laydown areas and facilities construction sites. Construction power usage would not require significant additional capacity, or result in a significant peak electric demand or base-period electric demand. Given the linear nature of the Build Alternatives, construction energy (electricity) needs would be spread throughout the Study Area with concentrations in the cities of Dallas and Houston near the stations and TMFs. As discussed in **Section 3.9.4.2**, the 2014 annual hourly electric demand on the ERCOT system was 58.4 percent of capacity and the 15-minute electric demand was 58.3 percent of capacity, which indicates there would be sufficient capacity to cover the construction energy (electricity) needs of the Build Alternatives. Therefore, the construction impact would be not significant.

Operational energy consumption would include the electricity needed to power the HSR trains, stations, TMFs and MOW facilities. The Build Alternatives would obtain electricity from the major electrical service providers in the Study Area. Due to the size and expected electrical demand of the Build Alternatives, it is likely that statewide electricity reserves and electrical transmission capacity would be affected. The Build Alternatives would obtain electricity from the statewide grid, managed by ERCOT, resulting in an overall effect on statewide energy use. Power consumption for the operation of the HSR was estimated using the methods described in **Section 3.9.3.2**. As shown in **Table 3.9-15,** the total energy (electrical) demand of the Build Alternatives is estimated to be 467,143 MWh per year, or 1,593,959 Million BTUs (MMBTUs) per year, including power losses from transmission and transformers.

[44] Texas Administrative Code, Title 30 Environmental Quality, Chapter 285 On-site Sewage Facilities.

Table 3.9-15 Projected Build Alternatives Power Demand

Facility	Power Consumption (MWh per day)	Power Consumption (MMBTU per day)	Power Consumption (MWh per year)	Power Consumption (MMBTU per year)
HSR Trains (80 per day)	680.0	2,320	248,200	846,894
Dallas Terminal Station	101.9	348	37,194	126,909
Brazos Valley Station	29.5	101	10,768	36,740
Houston Terminal Station	107.5	367	39,238	133,884
TMFs (two) and accompanying MOWs	129.3	441	47,195	161,034
MOW Facilities (five)	34.4	117	12,556	42,843
Switching and Substations	109.8	375	40,077	136,748
Signaling and Communication Houses (twenty)	26.5	90	9,673	33,004
Total	1,218.9	4,159	444,899	1,518,057
Power Losses at 5%	60.9	208	22,245	75,903
Total plus Losses	**1,279.8**	**4,367**	**467,143**	**1,593,959**

Source: AECOM, 2016.
Note: MWh – megawatt hours
MMBTU – Millions of British Thermal Units

The TPSS would provide the electric power to the trains and would be composed of the following components: 138kV electrical transmission line connections, TPSS substations, sectioning posts, sub-sectioning posts, auto transformer posts and a 25kV 60 cycle overhead catenary system. Therefore, the energy (electricity) required for propulsion of the HSR trains between Dallas and Houston is estimated at 248,200 MWh per year, or 846,894 MMBTUs per year.

Stations would require energy (electricity) to power the public areas (e.g., restrooms, concourses, restaurants, parking), ticketed passenger spaces (e.g., restaurants, restrooms, secured concourses), facilities to service the train (e.g., custodial equipment, loading dock and yard, kitchen areas, employee service corridors), security spaces (e.g., control rooms, security offices) and staff welfare areas (e.g., employee parking, lockers, offices, break rooms). The Dallas Terminal Station and the Houston Terminal Station are estimated to use 37,194 MWh per year and 39,238 MWh per year, respectively, or collectively, 126,909 MWh per year, or 260,793 MMBTUs per year. The Brazos Valley Station would be smaller and estimated to use 10,768 MWh per year or 36,740 MMBTUs per year.

TMF and MOW facilities would require energy (electricity) to power the train storage areas, inspection and overhaul shops, train wash areas, stabling tracks, administrative offices and staff welfare areas (e.g., employee parking, lockers, offices, break rooms). Combined, the TMF facilities are estimated to use 47,195 MWh per year, or 161,034 MMBTUs per year. Combined, the seven MOW facilities are estimated to use 12,556 MWh per year, or 42,843 MMBTUs per year. Switching and substations, which regulate and switch power on and off to trains traveling long the high speed track, are estimated to use 40,077 MWh per year or 136,748 MMBTUs per year. Signaling houses that relay operational monitoring data from power, control and security systems, would consist of approximately 20 main, intermediate, and sub signal houses distributed along the length of each Build Alternative, and would require approximately 9,673 MWh per year or 33,004 MMBTUs.

As Texas grows, so would its demand for energy (electricity). As shown in **Table 3.9-6**, the electrical load in the state is projected by ERCOT to increase between years 2015 and 2020. To accommodate the future electricity demand, ERCOT is expecting additions to the system to be developed through the year 2029, as shown in **Table 3.9-7**. The net added capacity would provide an additional 489,840 MWh of daily generation. The daily HSR power consumption of 1,279.80 MWh, as shown in **Table 3.9-14,** would represent 0.26 percent of this net added capacity. By contrast, ERCOT has established a reserve margin target of 13.75 percent of peak demand, which means that net added capacity would be targeted to provide 13.75 percent more MWhs than forecasted peak demand.[45] Even if it were not accounted for in planned or forecasted demand, the daily demand of the Build Alternatives would represent significantly less than the reserve margin considering its percentage of the planned added capacity. Current near-term reserve margin forecasts for 2017 to 2026 using more certain ("firm") load forecasts range from 15.9 percent to 25.4 percent of reserve margin.[46]

However, as part of the pre-construction design, planning and permitting process, TCRR would coordinate with and plan the HSR demand with power service providers, and this demand would have to be known and planned for within ERCOT. TCRR would coordinate with CenterPoint, Entergy, Mid-South Synergy, Oncor and San Bernard to complete development reviews prior to construction to more accurately determine the electricity needs of the Build Alternatives and available power supplies. Therefore, the Build Alternatives would not be a significant impact on energy (electricity) supply.

3.9.5.2.3 Fuel

Crude Oil and Natural Gas

Table 3.9-16 summarizes oil and gas utility crossings and how they would be impacted by the Build Alternatives (i.e., relocated, protected or not impacted). Oil and gas utilities within the Study Area would be either relocated outside the restricted access areas of the HSR ROW, or modified (e.g., encased in a pipe sturdy enough to withstand the weight of the HSR system and allow for maintenance access), to avoid conflict. Because of utility relocations and protective actions, construction of the Build Alternatives would result in scheduled and/or accidental interruptions of oil and gas utility services. Final design and phasing of construction activities would minimize interruptions.

Relocation of a utility may also necessitate additional land or easement acquisition, temporary facilities during relocation, and reimbursement or penalties for disruption of service. The final oil and gas utility crossing decisions would be determined on a case-by-case basis between TCRR and the utility provider during final design. Oil and gas utility relocation and/or protection methods, for construction or post-construction purposes, typically would not negatively impact the effectiveness of the utility infrastructure. Therefore, construction conflicts with oil and gas utility crossings would be not significant.

Table 3.9-16: Impacts to Oil and Gas Utilities

Type	Relocate	Protect	No Impact
Dallas County – Segment 1			
Natural Gas	--	2	--
Ellis County – Segment 2A			
Crude Oil	--	3	--
Natural Gas	--	7	--
Ellis County – Segment 2B			
Crude Oil	--	1	--

[45] ERCOT. Resource Adequacy. 2016. http://www.ercot.com/gridinfo/resource. Accessed 9/7/2016.
[46] ERCOT. Summer Summary. *Report on the Capacity, Demand and Reserves (CDR) in the ERCOT Region, 2017-2026*. Capacity, Demand and Reserves Report. May 3, 2016. http://www.ercot.com/content/wcm/lists/96607/CapacityDemandandReserveReport_May2016.xlsx. Accessed 9/7/2016.

Table 3.9-16: Impacts to Oil and Gas Utilities			
Type	**Relocate**	**Protect**	**No Impact**
Natural Gas	--	10	--
Navarro County – Segment 3A			
Crude Oil	--	1	--
Empty	--	1	--
Gasoline/Jet Fuel/Diesel	--	1	--
Natural Gas	--	1	--
Natural Gas Liquids	--	2	--
Navarro County – Segment 3B			
Crude Oil	--	2	--
Empty	--	1	--
Gasoline/Jet Fuel/Diesel	--	1	--
Natural Gas	--	1	--
Natural Gas Liquids	--	2	--
Navarro County – Segment 3C			
Crude Oil	--	8	3
Empty	--	1	--
Gasoline/Jet Fuel/Diesel	--	1	--
Natural Gas	--	1	--
Freestone County – Segment 3C			
Crude Oil	3	10	1
Gasoline/Jet Fuel/Diesel	--	1	1
Liquefied Petroleum Gas	--	1	--
Natural Gas	--	13	--
Natural Gas Liquids	--	1	--
Freestone County – Segment 4			
Crude Oil	--	4	--
Liquefied Petroleum Gas	--	1	--
Natural Gas	--	6	--
Natural Gas Liquids	--	1	--
Limestone County – Segment 4			
Natural Gas	--	3	--
Leon County – Segment 3C			
Gasoline/Jet Fuel/Diesel	--	1	--
Natural Gas	--	2	--
Natural Gas Liquids	--	1	--
Leon County – Segment 4			
Natural Gas	--	8	--
Madison County – Segment 3C			
Natural Gas	--	1	--
Madison County – Segment 4			
Natural Gas	--	1	--
Grimes County – Segment 5			
Crude Oil	--	1	1
Natural Gas	--	6	--
Refined Products	--	1	--
Y Grade Products	--	1	--
Y Grade NGL	--	1	--
Waller County – Segment 5			
Crude Oil	--	1	--
Natural Gas	--	1	--
Harris County – Segment 5			

Table 3.9-16: Impacts to Oil and Gas Utilities

Type	Relocate	Protect	No Impact
Crude Oil	--	3	--
Natural Gas	2	16	--
Natural Gas Liquids	--	1	--
Total	**5**	**134**	**6**

Source: AECOM, 2017

Construction of the Build Alternatives would affect oil and gas wells, their associated access roads and drilling well pads located within the LOD. Conflicts with oil and gas wells would result in the abandonment of the wells. Well abandonment would include removal of all oil and gas equipment, well plugging to prevent fluid migration between subsurface zones (to protect aquifers and minerals), placement of a permanent abandonment marker and restoration of surface terrain to pre-development vegetative conditions. The State of Texas requires inactive wells to be plugged within one year of operations ceasing.

Table 3.9-17: Surface Wells Within the LOD

	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F
Surface Well Count	34	31	24	34	31	24

Source: TCRR, 2016

TCRR would communicate its intent to oil and gas owners, conduct coordination to identify opportunities to avoid conflicts and agreements would be completed before construction begins with concurrence from the Texas Railroad Commission. TCRR would follow federal and state[47] requirements for the abandonment of oil and gas wells prior to the construction of the Build Alternatives. Therefore, there would be no construction conflicts with oil and gas wells. The impact of well abandonment or relocation is also discussed under parcel acquisition in **Section 3.13.6.2.5, Land Use**.

The LOD of the Build Alternatives would impact current access drives to operating oil and gas wells, indirectly impacting these facilities. Therefore, TCRR would construct new access drives as part of the Build Alternatives to maintain connectivity to the oil and gas wells. The affect would mainly be associated with minor inconveniences of increased travel times due to access diversions for oil and gas operators. This would not impact the operation of these oil and gas wells.

Fuel and Energy Consumption

During the construction period, fuel would be consumed to produce and transport materials needed to construct the Build Alternatives. Operating and maintaining construction equipment would also consume fuel. Per **Section 3.9.3.2**, fuel consumption was calculated and is summarized in **Table 3.9-18**. For conservative purposes, Build Alternative A power consumption was used, as it is estimated to have the highest power consumption amongst the Build Alternatives, although the difference with the alternative estimated to consume the least power (Alternative E) is negligible at one percent. As discussed in **Section 3.2.3.2.1, Air Quality**, the energy consumption estimate during construction of the Build Alternatives would be approximately 57,331 MMBTUs).

[47] Texas Natural Resources Code, Title 3. Oil and Gas, Subtitle B, Conservation and Regulation of Oil and Gas, Chapter 91, Subchapter D Prevention of Pollution.

Table 3.9-18: Construction Fuel Consumption Estimate			
Facility	**Total Working Hours**	**Total Fuel Used (gallons)**	**Total MMBTU of Energy Consumed**
Rail Line	1,054,996	210,999	24,159.40
Dallas Terminal	229,593	45,919	5,257.70
Brazos Valley Station	75,765	15,153	1,735.00
Houston Terminal	229,593	45,919	5,257.70
Heavy Maintenance Facility	183,674	36,735	4,206.10
Light Maintenance Facility	183,674	36,735	4,206.10
MOW Facilities	546,273	109,255	12,509.60
Total Hours/Fuel Used	2,503,568	500,714	-
Total BTU of Energy	-	-	**57,331.70**

Source: AECOM, 2016
Notes: Total equipment working hours from the air quality analysis in Section 3.2, Air Quality was used as the basis of construction energy
One gallon of gasoline produces approximately 114,500 BTUs

Since the Build Alternatives would use electricity to power the trains, stations and other HSR facilities, changes in operational fuel consumption would primarily be from changes in passenger vehicle travel, which would decrease as HSR use replaces trips made by passenger vehicles between Dallas and Houston. Therefore, HSR operations would represent an increase in energy consumption, and passenger vehicle travel would represent a decrease in energy consumption. Energy savings was based on specific vehicle travel data used in **Section 3.2.3.2, Air Quality**. **Table 3.9-19** provides the estimated fuel consumption savings.

Table 3.9-19: Annual Operation Energy Savings Estimate

Passenger Vehicle Travel Energy Saved							
Auto Trip	**Round Trip Distance (miles)**	**Total Cars/Year (000s)**	**VMT (Million)**	**2014 CAFE Standard (miles per gallon)**	**Gallons of Gas Used in One Round Trip**	**Total Fuel Saved (000s) [gallons]**	**Total Annual MMBTU of Energy Saved**
Dallas to Houston	478	5,340	2,553	31.3	15.3	81,550	9,337,561
HSR Operation Energy Consumption							
Total Annual Energy Consumed (MMBTU)							1,593,959
Net Energy Saved (MMBTU) [Energy Saved – Energy Consumed]							**7,743,602**

Source: NHTSA, 2009 and AECOM, 2016
Notes: BTU – British

The fuel consumption savings estimated for the Build Alternatives by reducing passenger vehicle travel would be approximately 81.5 million gallons of gasoline, or 9,337,561 MMBTUs annually. This data does not include passengers traveling by air. By comparison, the annual operation of the HSR would consume approximately 1,593,959 MMBTUs, resulting in a net savings in energy of 7,743,602 MMBTUs. Because the Build Alternatives would save more energy annually (7,743,602 MMBTUs) than it would take to construct the HSR system (57,331 MMBTUs one-time expenditure), the long-term impact on energy consumption would be beneficial.

3.9.6 Avoidance, Minimization and Mitigation

Design features were employed to avoid and minimize impacts to the natural, social, physical and cultural environment. Within the Build Alternatives, 53 percent of the LOD, on average, would be located adjacent to existing road, rail or utility infrastructure. Adjacency to existing utility infrastructure offers direct connections to the electric grid, which would minimize impacts resulting from new transmission lines connections. Other design features include maximizing the use of viaduct to minimize impacts to parallel utilities and potentially avoid impacts to utilities crossing the LOD. Approximately 60 percent of the Build Alternatives would be on viaduct. Pier locations would be adjusted to avoid direct impacts to utilities.

3.9.6.1 Compliance Measures

The following Compliance Measures (CM) would be required for Build Alternatives A through F:

EU-CM#1: Development Impact Report. During final design, TCRR shall coordinate with the City of Dallas and complete a Development Impact Report prior to construction to determine the utility needs of the Dallas Terminal Station and TMF. This assessment would take into account the size and purpose of the station and ancillary facilities to determine the appropriate infrastructure needs (e.g., the size of water or wastewater lines) and how best to connect to existing City of Dallas/Dallas Water Utilities systems.

EU-CM#2: Accommodate Bardwell MOW Water Demand. TCRR or its contractor shall drill local water wells in Ellis County to meet the water demand (550 gpd) needs of the Bardwell MOW facility. This would be coordinated with the Prairielands Groundwater Conservation District.

EU-CM#3: Accommodate Brazos Valley Station Water Demand. Prior to construction, TCRR shall evaluate options to provide the estimated 33.2 annual acre/feet of water demand at the Brazos Valley Station. One option could include adding capacity to Anderson Water Company, which would require a permit amendment with the Bluebonnet Groundwater Conservation District. This option would likely require a development review prior to construction to more accurately determine the needs of the Brazos Valley Station. Another option would include partnering with the neighboring Wickson Creek SUD, which does have capacity.

EU-CM#4: Accommodate Brazos Valley Station Wastewater Demand. Prior to construction, TCRR shall evaluate options to accommodate the 0.03 mgd of wastewater that would be generated at the station. One option would include a connection to the Carter's Creek WWTP (approximately 20 miles east of the station. Another option would be to develop a large capacity onsite sewage system, which would be regulated by TCEQ as a Class V Injection Well.

EU-CM#5: TCEQ Permits. Contingent upon **EU-CM#4**, during final design, TCRR shall coordinate with TCEQ for applicable state permits pertaining to the development of Class V injection wells at the Brazos Valley Station.

EU-CM#6: Wastewater Capacity Reservation Application. During final design, TCRR shall coordinate with the City of Houston to complete a Wastewater Capacity Reservation Application prior to construction to more accurately determine the needs of the Houston Terminal Station and TMF.

EU-CM#7: Abandonment of Oil and Gas Wells. During final design, TCRR shall close and abandon all oil and gas wells within the LOD of the Build Alternatives. The abandonment of wells would be conducted in accordance with the Railroad Commission of Texas Statewide Rule 14, Plugging, Revised.

EU-CM#8: Relocation of Oil and Gas Well Permit. During final design, TCRR shall file a drilling permit and/or amend an existing permit with the Railroad Commission of Texas Statewide Rule 13 to relocate an oil and gas well head outside of the LOD of the Build Alternatives.

See also **WQ-CM#2: TPDES General Construction Permit** discussed in **Section 3.3.6.1, Water Quality,** and**WQ-CM#3: Stormwater Management/Stormwater Pollution Prevention Plan** discussed in **Section 3.3.6.1, Water Quality**.

3.9.6.2 Mitigation Measures

The following Mitigation Measures (MM) would be implemented for Build Alternatives A through F:

EU-MM#1: Identification of Utilities. During final design, TCRR shall perform below ground utility exploration to verify exact locations and depths of known subsurface utilities. This data may inform or modify TCRR's approach to the protection and/or relocation of these utilities.

EU-MM#2: Relocation of Major Utilities. During final design and construction, TCRR shall resolve conflicts with each major utility provider (water, wastewater, oil and gas, electric transmission, etc.). As of the publication of the Draft EIS, the Build Alternatives collectively impact more than 400 major utilities, which are owned by 35 different providers. Where utilities must be relocated, TCRR or its contractor shall coordinate multiple relocations of the same type to combine relocations, where possible. Because of utility relocations, construction of the Build Alternatives would result in scheduled and/or accidental interruptions of utility services. TCRR shall coordinate with the utility provider during final design and phasing of construction activities to minimize interruptions during the relocation process.

EU-MM#3: Protection and Encasement of Major Utilities. During final design and construction, TCRR shall resolve conflicts with each major utility provider (water, wastewater, oil and gas, electric transmission, etc.). As of the publication of the Draft EIS, the Build Alternatives collectively impact more than 400 major utilities, which are owned by 35 different providers. Where utilities must be protected or extended, TCRR or its contractor shall protect or encase utilities in place rather than relocate, as often as practicable. Protective actions include activities during construction (e.g., shoring) and/or operations (e.g., encasement). Due to utility protection and encasement, construction of the Build Alternatives would result in scheduled and/or accidental interruptions of utility services. TCRR shall coordinate with the utility provider during final design and phasing of construction activities to minimize interruptions during the protection or encasement process.

EU-MM#4: *Relocation of Minor Utilities.* During final design and construction, TCRR shall coordinate with the respective utility providers to resolve conflicts with minor utilities (fiber optic, telecommunications, etc.) to avoid service interruptions.

EU-MM#5: Electric Utility Provider Coordination. During final design, TCRR shall coordinate with utility providers such as Oncor and CenterPoint to provide connections to the electric grid. The modifications required to make these connections include relocating existing lines, connecting new lines and vertically adjusting existing poles. The location of these modifications would be determined by the utility provider. The utility provider may choose to include these modifications into existing plans to support the operation of their system. As the owner of the utility, the provider would manage and lead the environmental process associated with the modifications to provide the connections to TCRR's infrastructure. This coordination shall also include TCRR working with the utility provider to notify utility customers via phone, email, mail, newspaper and/or other means at least two weeks in advance of scheduled outages, unless there is an emergency. These disruptions, when possible, shall be scheduled during off-business hours and never exceed a 24-hour period except under unusual circumstances, where feasible.

EU-MM#6: Discovery of Unidentified Utility. During construction, TCRR and/or its construction contractor shall cease construction in the area should a utility line be discovered that was not previously identified. Coordination with the utility owner shall be initiated.

EU-MM#7: Implementation of Water Saving Devices. During construction, TCRR shall install water saving devices and/or strategies at all facilities. These may include water efficient fixtures in restrooms and kitchens in the stations, TMFs and MOWs.

EU-MM#8: Landscape Plan. During final design, TCRR shall develop a landscape plan to be reviewed and approved by FRA that uses drought resistant or native vegetation that would require less water for landscaping at the station, TMFs and MOWs. During construction, TCRR and/or its construction contractor shall implement the landscape plan.

3.9.7 Build Alternatives Comparison

The summary of utilities and energy impacts is shown in **Table 3.9-20**. All of the Build Alternatives would require coordination with electric utility providers to relocate or adjust existing overhead transmission lines. Build Alternatives C and F would require fewer electrical relocations and pole adjustments compared to Build Alternatives A, B, D and E. Additionally, all of the Build Alternatives would require the abandonment of active oil and gas wells; however, Build Alternatives C and F would impact fewer wells.

There would be no discernable difference between the Build Alternatives for water use and wastewater generation. Additionally, there would be no discernable difference between the Build Alternatives for the energy required to operate the HSR system, as well as the anticipated energy saved as a result of the Project.

Table 3.9-20: Comparison of Utility Impacts by Build Alternative

	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F
New Electric TPSS Connections	9	8	10	9	8	10
Electric Utility Pole Adjustments	88	90	75	93	95	80
Total Electric Connections	109	108	88	114	113	94
Abandoned Oil and Gas Wells	34	31	24	34	31	24

Source: AECOM, 2017

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