DRAFT

BIOLOGICAL ASSESSMENT OF EFFECTS ON THREATENED AND ENDANGERED SPECIES

THOMAS C. FERGUSON PLANT UPGRADE

PREPARED FOR

LCRA
ENERGY • WATER • COMMUNITY SERVICES

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EXECUTIVE SUMMARY

Pursuant to the Clean Air Act (CAA), the Lower Colorado River Authority (LCRA) is seeking a permit under the Environmental Protection Agency's (EPA) Prevention of Significant Deterioration (PSD) Program to replace the currently operating 440-megawatt natural gas-fired Thomas C. Ferguson Power Plant with a new 550- to 600-megawatt combined-cycle power plant at the same location. The new power plant would be more efficient, reliable, and have improved environmental controls. The proposed project is located approximately 5.5 miles west of Marble Falls, Texas, on the south shore of Lake Lyndon B. Johnson (Lake LBJ) in Llano County. **Figure 1** shows the location of the proposed project, and **Figure 2** shows the area where the proposed power plant would be constructed.

EPA's issuance of a permit may trigger Section 7 of the federal Endangered Species Act (ESA). Section 7 of the ESA requires that, through consultation (or conferencing for proposed species) with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species or result in the destruction or adverse modification of designated critical habitat. This Biological Assessment (BA) provides the results of an assessment of the potential effects of the proposed action on species that are protected under the ESA.

Based on a review of the USFWS and Texas Parks and Wildlife Department's current lists of threatened and endangered species, eight species that are listed as endangered under the ESA are considered to be of potential occurrence in the project Action Area. The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 C.F.R. 402.02). **Figure 3** shows the Action Area used for this BA. The federally listed species that may occur in the Action Area include:

- Black-capped vireo (*Vireo atricapilla*)
- Golden-cheeked warbler (*Dendroica chrysoparia* [recently changed to *Setophaga chrysoparia*])
- Interior least tern (*Sterna antillarum athalassos*)
- Whooping crane (*Grus americana*)
- Gray wolf (*Canis lupus*)
- Red wolf (*Canis rufus*)
- Concho water snake (*Nerodia paucimaculata*)
- Bee Creek Cave harvestman (*Texella reddelli*)

In addition, the bald eagle (*Haliaeetus leucocephalus*), which is no longer protected under the ESA but is protected under the Bald and Golden Eagle Protection Act (BGEPA), is considered of potential occurrence in the project Action Area.

The primary objective of this BA is to evaluate the potential effects of the proposed action on species that are federally listed under the ESA. Based on the results of this BA, it has been determined that the proposed action would have **no effect** on any of the federally listed threatened or endangered species identified above for the following reasons.

The proposed Thomas C. Ferguson Power Plant Upgrade would have **no effect** on any of the federally listed species of potential occurrence in the Action Area for the following reasons:

1. No suitable habitat for any federally listed threatened or endangered species was identified in the proposed construction site or within the Action Area.

2. No suitable habitat for a federally listed threatened or endangered species was identified within the receiving waters (Lake LBJ) in the Action Area, and no known occurrences of any federally listed threatened or endangered species are documented in the receiving water.

3. In the remote scenario that a federally threatened or endangered species does occupy the Action Area or migrates through the Action Area, there is no evidence that any listed species of potential occurrence in the Action Area is specifically susceptible to emissions from a natural gas-fired power plant.

The table below summarizes the effect determinations for each federally listed species, along with the rationale for the determination.

Anticipated Effects on Federally Listed Species of Potential Occurrence in the Action Area

Species Common Name *(Scientific Name)*	**Federal Status[2]**	**Effect Determination**	**Rationale**
Black-capped Vireo (*Vireo atricapilla*)	E	No Effect	No suitable habitat is present in the project Action Area.
Golden-cheeked Warbler (*Dendroica chrysoparia*)	E	No Effect	No suitable habitat is present in the project Action Area.
Interior Least Tern[1] (*Sterna antillarum athalassos*)	E	No Effect	No suitable habitat is present in the project Action Area.
Whooping Crane (*Grus americana*)	E, EXPN	No Effect	No suitable habitat is present in the project Action Area.
Gray Wolf[1] (*Canis lupus*)	E	No Effect	This species has been extirpated from Texas.
Red Wolf[1] (*Canis rufus*)	E	No Effect	This species has been extirpated from Texas.
Concho Water Snake[1] (*Nerodia paucimaculata*)	T-PDL	No Effect	No suitable habitat is present in the project Action Area.
Bee Creek Cave Harvestman (*Texella reddelli*)	E	No Effect	No suitable habitat is present in the project Action Area.

In addition, the bald eagle is not known to occur in the Action Area and is not expected to be impacted by the proposed project; therefore, the proposed project is expected to be in compliance with the BGEPA.

1.0 INTRODUCTION

Pursuant to the Clean Air Act (CAA), the Lower Colorado River Authority (LCRA) is seeking a permit under the Environmental Protection Agency's (EPA) Prevention of Significant Deterioration (PSD) Program to replace the currently operating 440-megawatt natural gas-fired Thomas C. Ferguson Power Plant with a new 550- to 600-megawatt combined-cycle power plant at the same location. **Figure 1** shows the location of the proposed project, and **Figure 2** shows the area where the proposed power plant would be constructed. The new power plant would be more efficient, reliable, and have improved environmental controls. EPA's issuance of such a permit may trigger Section 7 of the federal Endangered Species Act (ESA). Section 7 of the ESA requires that, through consultation (or conferencing for proposed species) with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species or result in the destruction or adverse modification of designated critical habitat.

This Biological Assessment (BA) provides the results of an assessment of the potential effects of the proposed action on federally listed threatened and endangered species that are protected under the ESA. In addition, the Bald and Golden Eagle Protection Act (BGEPA) and State of Texas threatened and endangered species regulations are addressed for informational purposes. This BA is based on a review of the proposed project and pertinent literature, as well as detailed field investigations to evaluate the project site and surrounding area to determine whether suitable habitat exists for protected species within the Action Area (i.e., the area of potential impacts). The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 C.F.R. 402.02). **Figure 3** in **Section 2.0** shows the Action Area used for this BA.

This report includes a project description; a discussion of pertinent protected species regulations; a description of the methods for determining the Action Area; a list of federally and state-listed threatened and endangered species of potential occurrence in the Action Area; a description of the methods utilized in determining the potential for protected species to occur in the Action Area; a discussion of the baseline environmental conditions in the Action Area; and an assessment of potential effects to protected species.

1.1 Project Description

LCRA plans to replace the currently operating 440-megawatt, natural gas-fired Thomas C. Ferguson Power Plant (Ferguson Power Plant) with a new 550- to 600-megawatt, combined-cycle power plant that would be more efficient, reliable, and have improved environmental controls. LCRA began a year-long evaluation in April 2010 to decide whether replacing Ferguson was a financially and technically feasible option. The project is located approximately 5.5 miles west of Marble Falls, Texas, on the south shore of Lake Lyndon B. Johnson (Lake LBJ) (**Figure 1**).

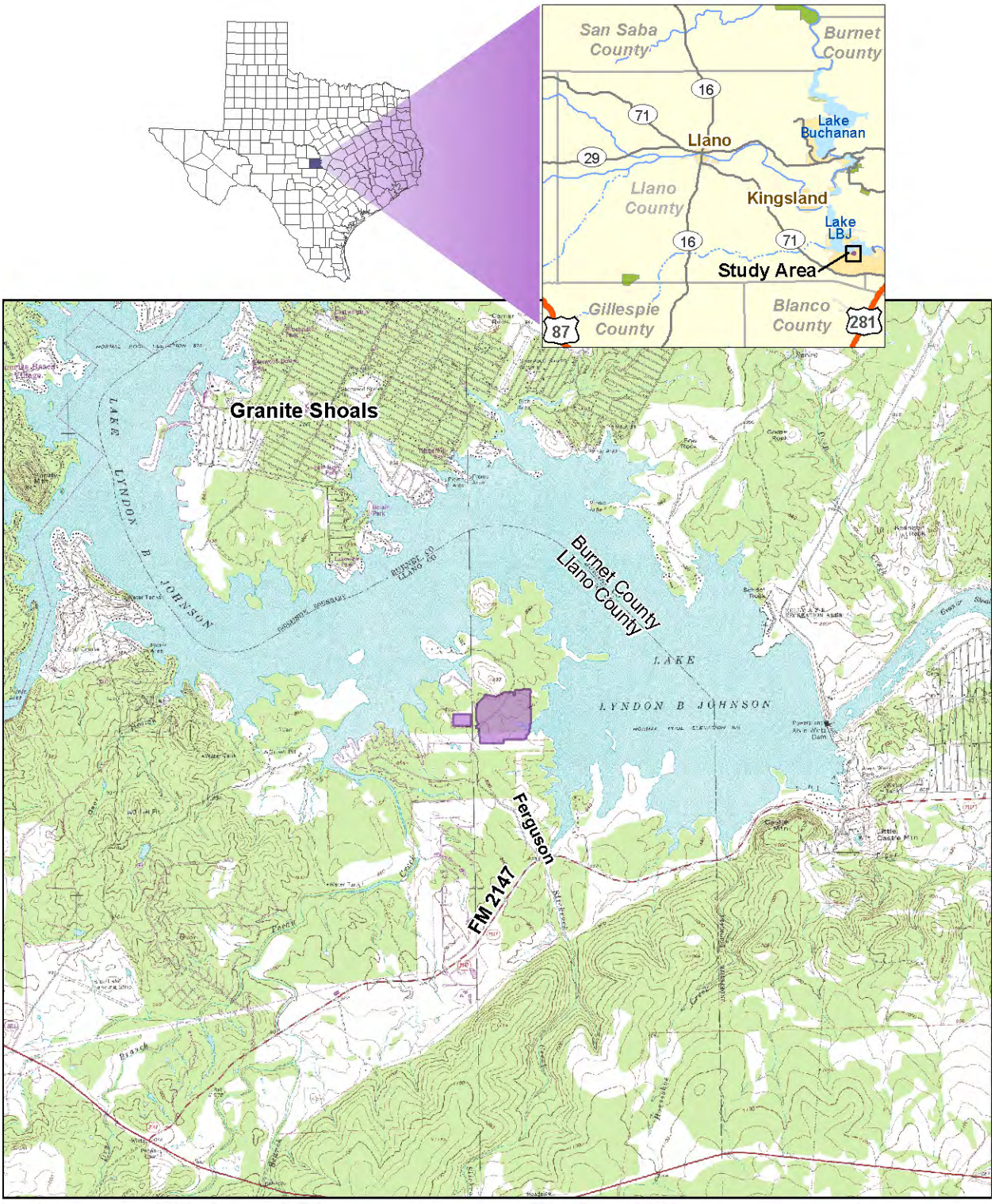

Figure 1
Project Location
LCRA Thomas C . Ferguson
Power Plant Replacement

Throughout this document, the term "Project Site" is used to describe the physical boundary of the property owned by LCRA on which the existing plant is located and the proposed plant would be constructed.

Replacing the 37-year-old Ferguson Power Plant would help LCRA manage wholesale power costs over the long-term because a new, combined-cycle generation facility would burn less fuel (natural gas) and produce fewer emissions per kilowatt-hour. The existing Ferguson Power Plant steam electric generating unit, including the boiler and turbine/generator set, would be retired following completion of the new facility. In addition, LCRA has already removed three 1.8 million gallon fuel oil tanks that it has maintained on-site for use in periods when natural gas is curtailed or increases significantly in price. While the Ferguson Power Plant already has environmental protection measures in place, this action has eliminated the risks associated with storing fuel oil on-site. If the LCRA Board approves moving forward with the proposed project, LCRA expects that a three-year construction phase could take place from late 2011 to 2014.

1.2 Wastewater Discharges

The proposed plant would have a greater generating capacity compared to the existing plant. However, the new plant would be more efficient and would use less water. The existing Ferguson Power Plant is authorized under Texas Pollutant Discharge Elimination System (TPDES) Permit WQ0001369000 to discharge once-through cooling water, auxiliary cooling water, storm water, and low volume waste sources. The discharge route is directly to Lake LBJ, Segment No. 1406 of the Colorado River Basin. The designated uses for Segment No. 1406 are high quality life use, contact recreation, and public water supply. Segment No. 1406 is not currently listed on the State's inventory of impaired and threatened waters (Texas 2008 Clean Water Act Section 303(d) list). The TPDES permit is currently being renewed. The wastewater discharges associated with the replacement facility would be similar in nature to those discharged from the existing plant; however, the replacement facility would use and discharge less water. Accordingly, no additional impacts associated with wastewater discharges would occur as a result of the proposed project.

1.3 Definition of Study Areas

Three different study areas are referenced throughout this BA. For clarity, each is defined below, with references to maps that illustrate the boundaries of each study area.

- Project Site – The physical boundary of the property owned by LCRA on which the existing Ferguson Power Plant is located and the proposed power plant would be constructed. **Figure 2** shows the boundary of the Project Site.

Figure 2
LCRA
Thomas C. Ferguson
Power Plant Replacement
Project Site

Project Site

N
W E
S

Scale 1:6,000

0 250 500 1,000
Feet

Base Map: 2010 NAIP Aerial Imagery

- Action Area – The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 C.F.R. 402.02). The analysis of species or designated critical habitat likely to be affected by the proposed action is focused on impacts within the project's Action Area. **Figure 3** in **Section 2.0** shows the boundaries of the Action Area used in this BA. **Section 2.0** discusses how the Action Area was determined.

- Pedestrian Survey Area – The Pedestrian Survey Area includes portions of the Action Area consisting of undeveloped lands located immediately adjacent to the power plant site and owned by LCRA, where intensive pedestrian survey was required to evaluate potential habitat for protected species. **Figure 4** in **Section 4.1.2** shows the boundaries of the Pedestrian Survey Area.

1.4 Protected Species Regulations

A brief overview of the protected species regulations is presented below to provide the context for the evaluation of regulatory compliance issues. The regulations discussed below include the Federal ESA (**Section 1.4.1**), the BGEPA (**Section 1.4.2**), and the State of Texas Endangered Species Regulations (**Section 1.4.3**). As noted above, the primary objective of this BA is to evaluate the effects of the proposed action on species that are federally listed under the ESA. The BGEPA and State of Texas endangered species regulations are also addressed for informational purposes.

1.4.1 Federal Endangered Species Act

The ESA prohibits the "take" of fish and wildlife species listed as endangered.[1] "Take" is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." 16 U.S.C. §1532. "Harm" is further defined by regulation to include significant habitat modification where such modification results in death or injury to a member of a listed species, including by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering (50 C.F.R. 17.3). 50 C.F.R. 402.12(c) requires the action agency to request a species list from USFWS or provide such a list to USFWS for concurrence.

Section 7 of the ESA requires that federal agencies ensure that any activity an agency funds, authorizes, or carries out does not jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat (16 U.S.C. §1536). ESA implementing regulations found at 50 C.F.R. 402 require federal agencies to prepare a BA to determine whether a proposed action may affect a listed species. Where an agency determines that a proposed action will have no effect on a listed species, consultation with the USFWS is not required. Where a federal agency determines that a proposed action "may affect" or is "likely to adversely affect" a listed species, consultation with USFWS is required.

Where an action agency determines in its BA that a proposed action "may affect, but is not likely to adversely affect" a listed species, and USFWS concurs in writing with such determination, consultation

[1] By regulation, USFWS has extended the "take" prohibition to most wildlife species listed as threatened.

with USFWS is complete. This is known as "informal" consultation. Where, however, the action agency determines that a proposed action is likely to adversely affect a listed species or where USFWS does not concur with an action agency's "not likely to adversely affect" determination, then "formal" consultation between the action agency and USFWS is required. Formal consultation culminates with USFWS issuing its biological opinion as to whether the action, as proposed, will jeopardize the continued existence of the listed species at issue. Where USFWS determines that the proposed action will not jeopardize a listed species, USFWS will include in its biological opinion an incidental take statement, which authorizes take that could occur in connection with the proposed action. Where USFWS determines that a proposed action will jeopardize a listed species, USFWS will provide in its biological opinion reasonable and prudent alternatives to the proposed action which, in the opinion of USFWS, will avoid jeopardy. Reasonable and prudent alternatives must be within the scope of the action agency's authority, must be economically and technically feasible, and must be able to be implemented in a manner consistent with the intended purpose of the action (50 C.F.R. 402).

1.4.2 Bald and Golden Eagle Protection Act

The BGEPA provides that, unless otherwise permitted, no person "shall knowingly, or with wanton disregard for the consequences of his act take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or in any manner, any bald eagle…or golden eagle…" 16 U.S.C. §668 et seq. "Take" is defined as "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Id. In September 2009, USFWS provided for limited "incidental" take of bald and golden eagles, provided certain requirements are met.

1.4.3 State of Texas Endangered Species Regulations

Endangered species legislation was passed in Texas in 1973 and amended in 1981, 1985, and 1987 (Texas Parks and Wildlife Department [TPWD] 1991). Subsequently, the 1975 and 1981 revisions to the TPWD code established a state regulatory vehicle for the management and protection of threatened and endangered species. Chapters 67 and 68 (1975 revisions) of the code authorize the TPWD to formulate lists of threatened and endangered fish and wildlife species and to regulate the taking or possession of the species. A 1981 revision (and 1985 amendment) to the code provides authority for the TPWD to designate plant species as threatened or endangered and to prohibit commercial collection or sale of these species without permits. The Texas Natural Diversity Database (TXNDD), which is part of the TPWD's Texas Wildlife Science Research and Diversity Program, catalogs, monitors, and provides information on rare species and communities of concern whether federally or state listed.

The ensuing TPWD regulations are Sections 65.171–65.177, 65.181–65.184, and 69.01–69.14 of the Texas Administrative Code (Chapters 67, 68, and 88 of the TPWD Code, respectively). These sections regulate the taking, possessing, transporting, exporting, processing, selling/offering for sale, or shipping of endangered or threatened species of fish, wildlife, and plants. Neither specific criteria for the listing of plant and animal species nor protection from indirect take (i.e., destruction of habitat or unfavorable management practices) is found in either of the above mentioned statutes or regulations (TPWD 1991). Based on this information, unlike the federally listed species, there is no protection of habitat afforded to species that are state-listed only.

2.0 DISCUSSION AND IDENTIFICATION OF THE ACTION AREA

For this BA, the Action Area was determined by identifying the maximum area in which the proposed action may result in direct and indirect impacts. The actual preparation of the Project Site and construction of the proposed power plant could cause both direct and indirect impacts depending on whether suitable habitat for a rare species is present and whether the species is occupying the site. In addition, the construction and operation of the proposed power plant could result in indirect impacts to areas outside the Project Site. Indirect impacts to surrounding areas may include noise, lighting, dust, erosion, stream sedimentation, air emissions, and physical disturbances associated with construction activities. For this BA, it was determined that air emissions from the proposed power plant have the potential to impact the largest area surrounding the Project Site. Therefore, the boundaries of the Action Area were determined based on air emission dispersion modeling (see **Section 2.2** and **Appendix 1**).

Through air dispersion modeling efforts, the Action Area was determined to extend up to 2.1 miles (3.3 kilometers) from the Project Site (see **Figure 3**). The potential effects to threatened and endangered species and designated critical habitat were evaluated within the identified Action Area.

The following sections provide additional information on how the Action Area is defined (**Section 2.1**) and describe the methodology used to delineate the Action Area for this BA (**Section 2.2**).

2.1 Action Area Defined

The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 C.F.R. 402.02). The analysis of species or designated critical habitat likely to be affected by the proposed action is focused on impacts within the project's Action Area.

The analysis of effects (presented in **Section 4.0**) compares the conditions within the Action Area with the proposed action in place against the conditions of the environmental baseline, which is defined as "the past and present impacts of all Federal, State, or private actions and other human activities in an Action Area, the anticipated impacts of all proposed Federal projects in an Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in progress" (50 C.F.R. 402.02). This approach isolates the incremental effects of the proposed action on species or designated critical habitat to determine whether and to what extent the proposed action might contribute to jeopardizing the continued existence of a species or adversely modifying critical habitat.

The proposed action is the EPA's approval of regulated air pollutant emissions from the replacement facility at the Ferguson Power Plant, which when completed will coincide with decommissioning of the existing facility. Emissions from the existing facility are one of the "present impacts of all…private actions" and thus are to be included in the environmental baseline. (See Consultation Handbook 4-27 providing an example of adding a second turbine to a hydropower dam to increase power generation and explaining that the pre-existing dam and turbines are to be included in the environmental baseline). The

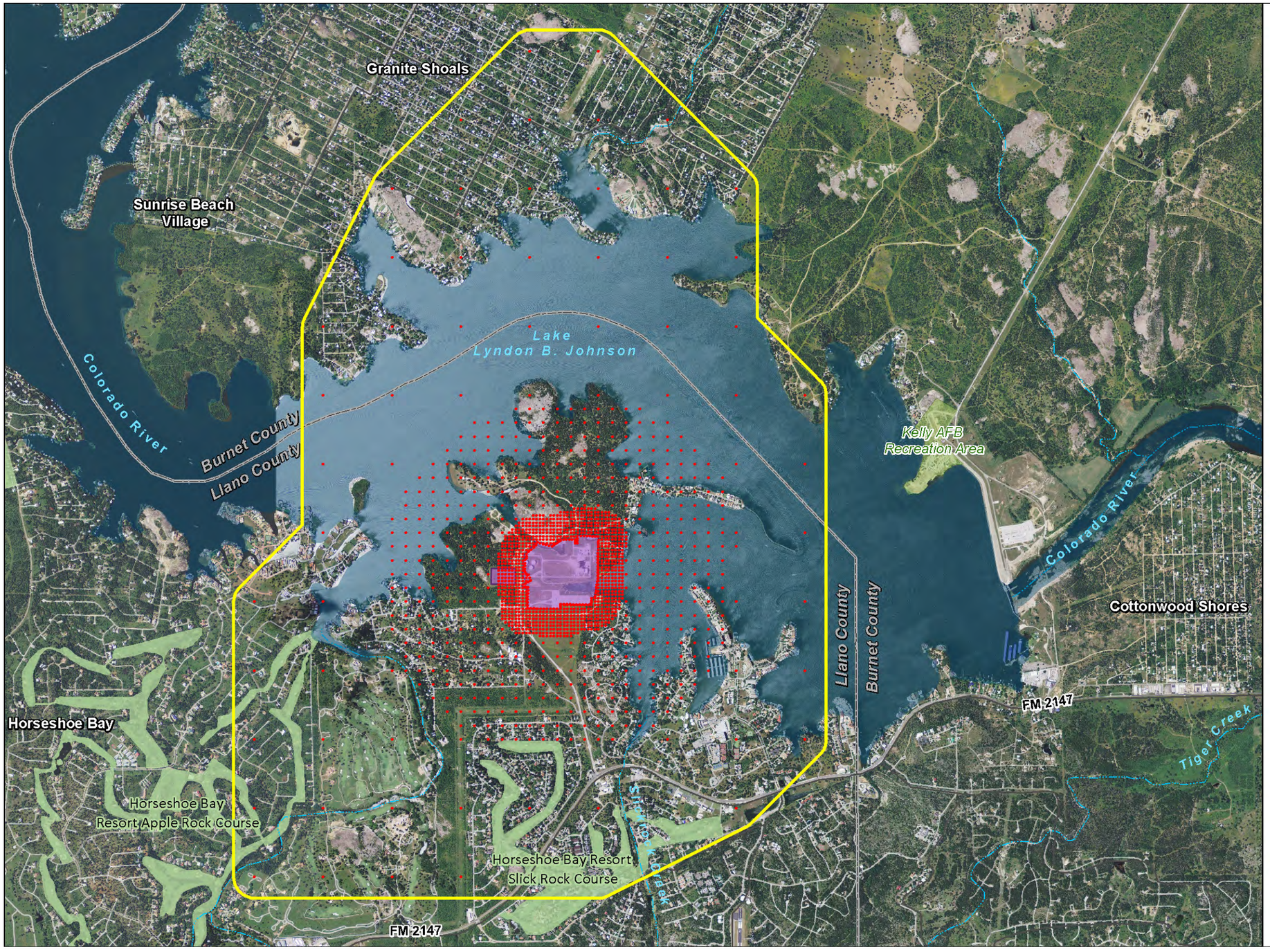

Figure 3
LCRA
Thomas C. Ferguson
Power Plant Replacement
Action Area

- Receptor Where Particulate Matter ($PM_{2.5}$) are Above Significant Impact Level (SIL)
- Action Area
- Project Site
- River or Stream
- Park/Recreational Area
- County Boundary

N
W E
S

Scale 1:30,000

0 1,250 2,500 5,000

Feet

Base Map: 2010 NAIP Aerial Imagery

proposed action would eliminate those emissions, however, and replace them with emissions from the new replacement facility. The effects of the proposed action, therefore, are appropriately measured by examining the difference in emissions between the environmental baseline that includes the existing facility and the scenario in which that facility, and its emissions, are replaced by the proposed new facility.

After comparing the environmental baseline emissions profile against the proposed action's emissions profile, any area affected by emissions in excess of the baseline is considered an "area to be affected directly or indirectly by the Federal action." The aggregate of all such areas defines the Action Area for the proposed action, and the outermost extent of the additional emissions provides the delineation boundary for the Action Area.

The Action Area, as identified on **Figure 3**, extends up to 2.1 miles (3.3 kilometers) from the Project Site (centered on one turbine stack) and includes portions of Llano and Burnet Counties. The following discussion explains how this Action Area delineation method was implemented for the proposed action.

2.2 Action Area Delineation Methodology

The Action Area was established using air emission dispersion modeling in such a manner as to ensure that any potential impact from emissions beyond the defined boundary of the Action Area would, by regulatory definitions, be *de minimis* or trivial. Accordingly, it would not be plausible that the project would have any effect on listed species or associated habitat beyond the Action Area, should any be present.

The boundary of the Action Area was conservatively delineated by applying EPA "significant impact levels" or SILs. A SIL is established for each National Ambient Air Quality Standard (NAAQS), yet at a concentration significantly less than the corresponding NAAQS. By establishing such a *de minimis* threshold, EPA can ascertain when a potential impact is considered to be so low as to be trivial or insignificant.

In the way of background, the CAA requires the EPA to set NAAQS for pollutants considered harmful to human health and the environment. The CAA established two types of NAAQS, **Primary** and **Secondary standards**. **Primary standards** set limits to protect public health, with an adequate margin of safety, where "public health" is defined to include the health of "sensitive" populations such as asthmatics, children, and the elderly. **Secondary standards** set limits to protect public welfare. "Public welfare" includes effects on soils, water, crops, wildlife, weather, economic values, and personal comfort and well-being. The EPA has set NAAQS for the following seven principal pollutants, also called criteria pollutants: carbon monoxide, lead, nitrogen oxides, particulate matter smaller than 10 microns, particulate matter smaller than 2.5 microns, ozone, and sulfur dioxide.

Under the CAA, before a large new source of air pollution can begin construction in an area that is in compliance with or attaining the NAAQS (such as Llano County, the site of the proposed new combined-cycle power plant), it must obtain a permit under the Prevention of Significant Deterioration (PSD) program. In order to receive a PSD permit, the applicant must demonstrate that not only will it meet the

NAAQS but it will also comply with ambient air quality standards designed to prevent the deterioration of air quality (the PSD increments). An increment is a measure of how much of a pollutant can be added to the ambient air before air quality will significantly deteriorate.

As part of the ambient air quality impacts analysis conducted during PSD permitting, sources employ a dispersion model to determine the potential impact the source will have on air quality. To assess whether the potential impact is significant, EPA has established the aforementioned SILs for each NAAQS. In addition to establishing when an impact is *de minimis*, the SILs are also used to determine when a proposed source's ambient impacts warrant a comprehensive (cumulative) source impacts analysis, the size of the impact area within which the air quality analysis is to be completed, and whether the increase in emissions from a proposed new source or modification is considered to cause or contribute to a modeled violation of any NAAQS.

As required, air dispersion modeling was conducted in support of the PSD permit application for the Thomas C. Ferguson Plant Upgrade. In addition to concluding that the replacement plant would not cause or contribute to a violation of any NAAQS, the air dispersion modeling was used to define the Action Area for use in the evaluation of potential effects to threatened and endangered species (**Appendix 1**). It is important to note that the Action Area is not defined by compliance with the NAAQS or the PSD increment, but rather the SIL, which is but a small fraction of the Secondary NAAQS (see **Table 1**).

The proposed increases in emissions above the baseline conditions were modeled to determine whether the resulting off-property concentrations of criteria pollutants are greater than the *de minimis* SILs. Consistent with PSD modeling criteria, for pollutants with PSD-significant emissions (PM_{10} and $PM_{2.5}$), the difference between the proposed allowable emission rates associated with the replacement unit and current actual emission rates from the existing source were modeled. For pollutants that are not PSD-significant (NO_2 and SO_2), the difference between the proposed allowable emission rates and the current allowable emission rates were modeled for each source.

Since the Secondary NAAQS are designed to protect public welfare, they along with the respective SILs, were utilized to define the Action Area. The results of the Action Area modeling analysis as well as the Secondary NAAQS standards and associated SILs are summarized in **Table 1**. Again, it is important to note that the SILs are significantly less than the corresponding Primary and Secondary NAAQS and, as such, ensure a very conservative approach to defining the Action Area.

Table 1 Area of Interest Analysis, Final Results

Pollutant	Averaging Period	SIL	Secondary NAAQS	Modeling Results	
				Maximum Predicted Concentration	Action Area, Maximum Distance*
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(Km)
NO_2	Annual	1	100	0.06	0
SO_2	3-Hour	25	1,300	25.7	0.3
PM_{10}	24-Hour	5	150	17.3	1.4
$PM_{2.5}$	24-Hour	1.2	35	13.3	3.3
	Annual	0.3	15	1.07	1.2

* Distance where predicted (or modeled) concentrations become *de minimis* (less than the SIL).

The reported NO_2, SO_2, and PM_{10} concentrations correspond to the highest predicted concentration from any receptor over a 5-year period. The reported $PM_{2.5}$ concentrations correspond to the highest of the 5-year average concentration from any receptor.

The $PM_{2.5}$ 24-hour results establish a potential impact area that extends the greatest distance, 3.3 kilometers, from the source. Therefore, the modeling results for this pollutant were conservatively utilized to define the Action Area, which corresponds to the area with predicted 24-hour $PM_{2.5}$ concentrations greater than the SIL. In the case of 24-hour $PM_{2.5}$, the SIL is merely 3.4 percent of the respective Secondary NAAQS, demonstrating that any impact outside of the Action Area truly is insignificant. The modeling receptors (red dots) with predicted concentrations greater than the SIL are illustrated in **Figure 3**. The potential impact areas associated with the other pollutants are also provided as **Figures 13-1** through **13-4** in **Appendix 1**. Any impact on air quality outside of the defined Action Area can be considered trivial and, therefore, the BA does not evaluate impacts beyond the Action Area. **Table 13-1** in **Appendix 1** also lists the distances where the predicted concentrations become *de minimis,* i.e., the ambient impact is less than the SIL.

The Action Area, which extends up to 2.1 miles (3.3 kilometers) from the Project Site (centered on one turbine stack), includes portions of Llano and Burnet Counties (**Figure 3**).

2.3 Additional Air Quality Modeling

In addition to the criteria pollutants list above, the emissions of sulfuric acid mist and the hazardous air pollutants listed in Chapter 3 of EPA publication AP 42, *Compilation of Air Pollutant Emission Factors*, were modeled. The ambient air impact of sulfuric acid mist emissions was compared to the Texas Commission on Environmental Quality (TCEQ) Property Line Standard, and the AP 42 listed pollutant impacts were compared to TCEQ Effects Screening Levels (ESLs). ESLs are not ambient air standards, but rather are screening levels used in TCEQ's air permitting process to evaluate air dispersion modeling's predicted impacts.

As described by TCEQ, ESLs are "used to evaluate the potential for effects to occur as a result of exposure to concentrations of constituents in the air. ESLs are based on data concerning health effects, the potential for odors to be a nuisance, and effects on vegetation." Accordingly, if predicted concentrations of a constituent "**do not exceed** the screening level, **adverse health or welfare effects are not expected**."

A comparison of the modeled impacts of sulfuric acid mist and the hazardous air pollutants listed in AP 42 to TCEQ established standards is shown in **Table 2** below. Based on these modeling results, the maximum predicted concentration for all of the modeled constituents is well below the respective ESL and, in the case of sulfuric acid mist, the Property Line Standard. Accordingly, no adverse welfare impacts are expected to occur within the Project Site or the Action Area as the result of these constituents.

Table 2 Impacts from Non-Criteria Pollutants, LCRA – Thomas C. Ferguson Power Plant

Pollutant	Averaging Period	Maximum Predicted Concentration (µg/m^3)	State Property Line Standard (µg/m^3)	% of Standard
Sulfuric Acid Mist	1-hour 24-Hour	14.3 5.54	50 15	28.6% 36.9%

Pollutant	Averaging Period	Maximum Predicted Concentration (µg/m^3)	TCEQ ESL (µg/m^3)	% of Standard
Ammonium Sulfate	1-hour Annual	19.3 0.053	50 5	38.6% 1.1%
Ammonia	1-hour Annual	30.4 0.56	170 17	17.9% 3.3%
1,3-Butadiene	1-hour Annual	0.00086 0.00002	510 9.9	<0.1% <0.1%
Acetaldehyde	1-hour Annual	0.07979 0.00219	90 45	<0.1% <0.1%
Acrolein	1-hour Annual	0.01277 0.00035	3.2 0.15	0.4% 0.2%
Benzene	1-hour Annual	0.02394 0.00066	170 4.5	<0.1% <0.1%
Ethylbenzene	1-hour Annual	0.06383 0.00175	740 570	<0.1% <0.1%
Formaldehyde	1-hour Annual	0.40292 0.01106	15 3.3	2.7% 0.3%
Naphthalene	1-hour Annual	0.00259 0.00007	440 50	<0.1% <0.1%
PAH	1-hour Annual	0.00439 0.00012	0.5 0.05	0.9% 0.2%
Propylene Oxide	1-hour Annual	0.05785 0.00159	70 7	<0.1% <0.1%
Toluene	1-hour Annual	0.25931 0.00712	640 1200	<0.1% <0.1%
Xylenes	1-hour Annual	0.12766 0.00350	350 180	<0.1% <0.1%

3.0 FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES, DESIGNATED CRITICAL HABITAT, AND OTHER PROTECTED SPECIES OF POTENTIAL OCCURRENCE IN THE ACTION AREA

The proposed project is located in Llano County, but the Action Area extends to the north into Burnet County (**Figure 3**). The current list of federally and state-listed threatened and endangered species that potentially occur in Llano and Burnet Counties is presented in **Table 3**. The list provided in **Table 3** is a comprehensive list of threatened and endangered species that may occur in Llano and Burnet Counties and was generated by compiling (1) the USFWS Southwest Region Ecological Services list for these counties (USFWS 2011) and the TPWD's annotated lists for these counties (TPWD 2011a). It is important to note that the TPWD's county lists include several species that are federally listed under the ESA but are not considered by the USFWS as potentially occurring in Llano and Burnet Counties (e.g., interior least tern, gray wolf, red wolf, and Concho water snake). However, to address potential concerns from both agencies, all federally listed species identified in both agency lists are discussed below. In addition, although state-listed species are not protected under the ESA, potential impacts to these species were considered in this assessment.

Table 3 Federally and State-Listed Species of Potential Occurrence in Llano and Burnet Counties

Species Common Name ***(Scientific Name)***	**USFWS Southwest Region County-by-County List**	**TPWD Annotated County List of Rare Species**	
		Federal Status	**State Status**
Federally Listed Threatened, Endangered, and Candidate Species			
Black-capped Vireo (*Vireo atricapilla*)	E	LE	E
Golden-cheeked Warbler (*Dendroica chrysoparia*)	E	LE	E
Interior Least Tern[1] (*Sterna antillarum athalassos*)	NL	LE	T
Whooping Crane (*Grus americana*)	E, EXPN	LE	E
Gray Wolf[1] (*Canis lupus*)	NL	LE	E
Red Wolf[1] (*Canis rufus*)	NL	LE	E
Concho Water Snake[1] (*Nerodia paucimaculata*)	NL	LT-PDL	*
Bee Creek Cave Harvestman (*Texella reddelli*)	E	LE	*
State-listed Threatened and Endangered Species			
American Peregrine Falcon (*Falco peregrinus anatum*)	NL	DL	T
Bald Eagle (*Haliaeetus leucocephalus*)	DM, BGEPA	DL	T
Zone-tailed Hawk (*Buteo albonotatus*)	NL	*	T
Texas Horned Lizard (*Phrynosoma cornutum*)	NL	*	T
False Spike Mussel (*Quadrula mitchelli*)	NL	*	T
Smooth Pimpleback (*Quadrula houstonensis*)	NL	*	T

Table 3 Federally and State-Listed Species of Potential Occurrence in Llano and Burnet Counties

Species Common Name *(Scientific Name)*	USFWS Southwest Region County-by-County List	TPWD Annotated County List of Rare Species	
		Federal Status	State Status
Texas Fatmucket (*Lampsilis bracteata*)	NL	*	T
Texas Fawnsfoot (*Truncilla macrodon*)	NL	*	T
Texas Pimpleback (*Quadrula petrina*)	NL	*	T

[1] The interior least tern, gray wolf, red wolf, and Concho water snake are federally protected under the ESA, but the USFWS does not consider them to occur in Llano or Burnet County. These species are addressed in this assessment because they are included on the TPWD's lists for the counties.

USFWS 2011 (E = endangered; DM = delisted, monitoring; EXPN = Experimental Population, Non Essential (where introduced into suitable habitats outside of the range of the Aransas Wood Buffalo population); NL = not included on USFWS county list) http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm

TPWD 2011a (E = endangered, LE = listed endangered, C = candidate, DL = delisted, PDL = Proposed Delisted, T = threatened, and * = no regulatory status) http://gis2.tpwd.state.tx.us/ReportServer

The following sections describe the listed species and their habitat requirements. Section 3.1 discusses federally listed species and designated critical habitat and Section 3.2 discusses species that are state-listed only.

3.1 Federally Listed Threatened and Endangered Species and Designated Critical Habitat

The following paragraphs address the federally listed threatened and endangered species of potential occurrence in the Action Area according to current lists from the USFWS and TPWD for Burnet and Llano Counties.

3.1.1 Black-capped Vireo (Federal Endangered)

The black-capped vireo (*Vireo atricapilla*) (BCVI) is a small, insectivorous songbird. Mature males are olive green above and white below with faint greenish-yellow flanks. The crown and upper half of the head is black with a partial white eye-ring. The iris is brownish-red, and the bill is black. The plumage of female BCVIs is duller than the males. Females have a dark slate gray head (USFWS 1991). BCVIs arrive in Texas from mid-March to mid-April and arrive in Oklahoma approximately ten (10) days later. They nest from Oklahoma south through central Texas to the Edwards Plateau and south and west to central Coahuila, Mexico. A pair will most often be monogamous for the breeding season, selecting a nest site together. The female completes nest construction in two to three days. BCVIs suspend their nests in the forks of shrubs in dense underbrush, from 1 to 6 feet (0.3 to 0.9 meter) above the ground. Most nests are found around 3.3 feet (1 meter) above the ground. Three to four eggs are usually laid in the first nesting attempt, but later clutches may only contain two to three eggs. The first egg is usually laid one day after nest completion, with one egg being laid each subsequent day. Incubation takes 14 to 17 days and is shared by both the male and female. BCVI chicks are fed by both adults as well and leave the nest 10 to 12 days after hatching (Campbell 2003).

BCVI habitat is thought to have been created by natural disturbances (e.g., fires) in areas with rocky substrates and shallow soils, which generates successional habitat (Koloszar et al. 2000). Although BCVI

habitat throughout Texas is quite variable with respect to plant species, soils, and rainfall, all habitat types have a similar overall appearance. BCVIs typically inhabit shrublands and open woodlands with a distinctive patchy structure. The shrub vegetation generally extends from the ground to about 6 feet (1.8 meters) above the ground and covers about 30 to 60 percent of the total area. Open grassland separates the clumps of shrubs. In the eastern portion of the BCVI's range, the shrub layer is often combined with an open, sparse to moderate tree canopy. In the Edwards Plateau and Cross Timbers regions, common plants in BCVI habitat include Texas red oak (*Quercus buckleyi*), Lacey oak (*Q. glaucoides*), white shin oak (*Q. sinuata* var. *breviloba*), Durand oak (*Q. durandii*), Plateau live oak (*Q. virginiana* var. *fusiformis*), Texas mountain laurel (*Sophora secundiflora*), evergreen sumac (*Rhus virens*), skunkbush sumac (*R. aromatica*), flameleaf sumac (*R. copallinum*), Texas redbud (*Cercis canadensis*), Texas persimmon (*Diospyros texana*), honey mesquite (*Prosopis glandulosa*), and agarita (*Berberis trifoliata*). Densities of Ashe juniper are usually low. In the western Edwards Plateau and Trans-Pecos regions, BCVIs are often found in canyon bottoms and slopes containing plants such as sandpaper oak (*Quercus pungens*), white shin oak, Texas kidneywood (*Eysenhardtia texana*), Mexican walnut (*Juglans microcarpa*), fragrant ash (*Fraxinus cuspidata*), mountain laurel, and guajillo (*Acacia berlandieri*).

Threats to the BCVI include habitat loss and degradation due to development, habitat succession, poor grazing practices, brown-headed cowbird (*Molothrus ater*) nest parasitism, and low reproductive success. Throughout the Texas Hill Country, much of the BCVI's habitat has been destroyed or degraded by residential and commercial development, grazing practices, and fire suppression (USFWS 1991, 2007a). BCVIs may live for more than five (5) years and usually return year after year to the same territory. The birds begin to migrate to wintering grounds on Mexico's western coast in July and are gone from Texas by mid-September (Campbell 2003).

3.1.2 Golden-cheeked Warbler (Federal Endangered)

The golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) is a small, insectivorous songbird, 4.5 to 5 inches long, with a wingspan of about 7.9 inches. The male has a black back, throat, and cap, and yellow cheeks with a black stripe through the eye. Females are similar but less colorful. The lower breast and belly of both sexes are white with black streaks on the flanks (USFWS 1992). The GCWA nests in the juniper-oak woodlands of the Texas Hill Country and winters in the pine-oak woodlands of southern Mexico, Guatemala, Honduras, and Nicaragua. Its entire nesting range is confined to 33 counties in central Texas. Typical nesting habitat consists of tall, dense, mature stands of Ashe juniper mixed with deciduous trees such as Texas red oak, Lacey oak, white shin oak, plateau live oak, post oak (*Quercus stellata*), Texas ash (*Fraxinus texensis*), cedar elm (*Ulmus crassifolia*), Texas sugarberry (*Celtis laevigata*), bigtooth maple (*Acer grandidentatum*), American sycamore (*Platanus occidentalis*), Arizona walnut (*Juglans major*), escarpment cherry (*Prunus serotina*), and pecan (*Carya illinoinensis*). This type of woodland is often found in relatively moist areas such as steep-sided canyons and slopes. Although the composition of woody vegetation may vary from place to place, mature Ashe juniper (*Juniperus ashei*), which is necessary for nest construction, is always present.

Male GCWAs arrive in central Texas in early March and begin to establish breeding territories, which they defend against other males by singing from visible perches within their territories. The females arrive

a few days later but are more difficult to detect in the dense woodland habitat. Usually three or four eggs are laid in nests averaging 16.4 feet above ground. Eggs are generally incubated in April and, unless there is a second nesting attempt, nestlings fledge in May to early June. Migration south to the wintering grounds occurs in July and early August.

Most studies report GCWA territory sizes ranging from 0.09 to 0.21 pair per acre (Ladd 1985). Wahl et al. (1990) reported that density estimates ranged from 0 to 0.26 pair per acre with a median of 0.06 pair per acre among several sites throughout the GCWA's range. Pulich (1976) reported warbler densities in excellent, average, and marginal habitats as 0.05, 0.02, and 0.01 pair per acre, respectively.

The primary threats to the GCWA are habitat loss and urban encroachment. Other factors include the loss of deciduous oaks (which are used for foraging) to oak wilt, nest parasitism by brown-headed cowbirds, and predation and competition by blue jays (*Cyanocitta cristata*) and other urban-tolerant birds (USFWS 1992).

3.1.3 Interior Least Tern (Federal Endangered)

The interior least tern (*Sterna antillarum athalassos*) is a migratory bird that breeds along inland river systems in the United States and winters in Central and South America (Campbell 2003). This smallest of North American terns is a colonial nesting shorebird adapted to lacustrine and riverine sandbar and gravel beach habitats of relatively large drainage systems for inland breeding sites. In Texas, interior least terns are found at three reservoirs along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River (Texas/Oklahoma boundary) into Arkansas (http://www.tpwd.state.tx.us/huntwild/wild/species/leasttern.

3.1.4 Whooping Crane (Federal Endangered)

The whooping crane (*Grus americana*) is North America's tallest bird, with a standing height of 5 feet or more. It is also one of North America's rarest avian species. The whooping crane was listed as endangered by the USFWS in 1970 and by the Canadian Committee on the Status of Endangered Wildlife in 1978 (USFWS 2007b). In 1955, only 21 birds wintered in the U.S. and, as of 2008, approximately 500 individuals existed in three wild and nine captive populations. The only self-sustaining flock is the Aransas-Wood Buffalo population (AWBP), which includes approximately 266 individuals (USFWS and Wind Energy Industry 2008). The main factors leading to the decline of whooping cranes in the late 1800s and early 1900s were habitat destruction and unregulated hunting (USFWS 2007b).

Critical habitat has been designated at five sites in four U.S. states (and is proposed in Canada). These include the wintering grounds at and adjacent to the Aransas National Wildlife Refuge (NWR) in Texas, and four stopover aquatic habitats on public lands in Kansas, Nebraska, and Oklahoma (USFWS 2007b). The AWBP of the whooping crane breeds in Wood Buffalo National Park in southern Northwest Territories and northern Alberta provinces in Canada and winters at the Aransas NWR and Matagorda and St. Joseph's Islands in Aransas, Calhoun, and Matagorda Counties, Texas. The whooping crane typically migrates through the Great Plains in the U.S. states of Texas, Oklahoma, Kansas, Nebraska,

South Dakota, and North Dakota, as well as the Canadian Provinces of Saskatchewan, Alberta and eastern Manitoba. Within Texas, their normal migration corridor stretches from the panhandle eastward to the east-central portion of the state. During their 2,500-mile migration, whooping cranes generally make 12 to 15 stops, during which they use a variety of habitats that are generally isolated from human activity (USFWS 2007b, USFWS and Wind Energy Industry 2008). These stopover areas include croplands, grasslands, and wetlands for feeding sites and wetlands and other aquatic features for roosting sites.

The whooping crane diet during migration consists of frogs, fish, crayfish, insects, plant tubers, and grains. The largest amount of time feeding appears to be in agricultural fields. Stopover sites are most frequently found where suitable feeding and roosting habitats are found in close proximity to one another (USFWS 2007b).

As with many avian migrants in the northern hemisphere, spring migration takes less time than the return trip in the fall. Whooping cranes have no known staging area for spring migration, but they do stage in southern Saskatchewan for up to several weeks in the fall prior to returning to the Texas coast. Sixty to 80 percent of the documented mortalities of the species from 1950 to 1986 occurred during migration. Most of the carcasses were not found, and causes of the mortality remain a mystery. The primary known cause of mortality during migration is collision with power lines, and, to a lesser extent, accidental and purposeful shooting (USFWS 2007b, USFWS and Wind Energy Industry 2008).

3.1.5 Gray Wolf (Federal Endangered)

Gray wolves (*Canis lupus*) historically ranged throughout North America, including the western two-thirds of Texas, and occupied a variety of habitats including forests, woodlands, brushlands, grasslands, and tundra. The species declined rapidly in the late 1800s and early 1900s due to predator control (TPWD 2011b, Schmidly 2004) and was limited to a small area of northern Minnesota by the early 1980s. The last authenticated reports of gray wolves in Texas are two skulls donated to Sul Ross University that were collected in 1970 in Brewster County and the junction of Brewster, Pecos, and Terrell Counties (Schmidly 2004). Since then, gray wolves have been reintroduced in Wyoming and Idaho, as well as Arizona and New Mexico (Mexican subspecies). In addition, the species has re-established in Montana by expanding southward from Canada.

3.1.6 Red Wolf (Federal Endangered)

The red wolf (*Canis rufus*) historically ranged throughout the southeastern U.S., from the Atlantic coast to central Texas, and from the Gulf Coast to central Missouri and southern Illinois. Between 1900 and 1920, red wolves were extirpated from most of the eastern portion of their range. A small number persisted in the wild in southeastern Texas and southwestern Louisiana until the late 1970s; however, by 1980, the species was declared extinct in the wild. Since then, experimental populations have been reintroduced in North Carolina and Tennessee (NatureServe 2011).

3.1.7 Concho Water Snake (Federal Threatened – Proposed Delisted)

The Concho water snake (*Nerodia paucimaculata*) is a small snake (up to 0.9 meter in length) with large, dark reddish-brown bands covering its body. Endemic to Texas, this species is found in the Concho River

and the Colorado River basins of the Rolling Plains from E. V. Spence Reservoir to Colorado Bend State Park. It is also found on artificial shoreline habitat of three reservoirs in the area (E.V. Spence Reservoir, Lake Ballinger, and O.H. Ivie Reservoir). The Concho water snake predominately lives in free-flowing streams over rocks and shallow riffles, using rock debris and crevices for cover and feeding on various fish species (TPWD 2011c).

On July 8, 2008, the Service published a proposed rule to remove the Concho water snake from the list of threatened species. This proposed rule was based on the best available scientific and commercial data, including new information, indicating that the Concho water snake has recovered because threats have been eliminated or reduced to the point that the species no longer meets the definition of threatened or endangered under the Act. The Service is in the process of making a final determination on whether or not to delist the Concho water snake (http://www.fws.gov/southwest/es/Documents/R2ES/CWS_Q&A_dPDMP_8-27-09_final.pdf).

In September 2009, the USFWS published a Draft Post Delisting Monitoring Plan for the Concho Water Snake. The Concho water snake is currently found on the Colorado River from E.V. Spence Reservoir to Colorado Bend State Park, including Ballinger Municipal Lake and O.H. Ivie Reservoir, and on the Concho River from the City of San Angelo to its confluence with the Colorado River at O.H. Ivie Reservoir. Counties of known occurrence include Brown, Coke, Coleman, Concho, Lampasas, McCulloch, Mills, Runnels, San Saba, and Tom Green (http://www.fws.gov/southwest/es/Documents/R2ES/CWS_Q&A_dPDMP_8-27-09_final.pdf).

3.1.8 Bee Creek Cave Harvestman (Federal Endangered)

The Bee Creek Cave harvestman (*Texella reddelli*) is an eyeless light brown spider that inhabits caves, sinkholes, and other karst features associated with the Balcones Fault Zone of the Edwards Plateau (NatureServe 2011). According to a 2009 review by the USFWS, the species is confirmed in eight known caves in Travis County, Texas. These caves are within the Jollyville Plateau, Rollingwood, and McNeil/Round Rock Karst Faunal Regions (http://www.fws.gov/ecos/ajax/docs/five_year_review/doc3015.pdf).

3.1.9 Designated Federal Critical Habitat

There is no designated critical habitat for any federally listed threatened and endangered species in Burnet or Llano Counties (http://criticalhabitat.fws.gov/crithab/).

3.2 State-Listed Threatened and Endangered Species

3.2.1 American Peregrine Falcon

The American peregrine falcon (*Falco peregrinus americanus*) was federally delisted in 1999. Currently, the American peregrine falcon is monitored by the USFWS and other organizations, and will continue to be monitored until 2015. The American peregrine falcon is primarily a migrant through Texas, although it has been known to nest in suitable habitat in the Trans-Pecos region, Big Bend National Park, and in the Guadalupe Mountains (TPWD 2011d).

3.2.2 Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is afforded federal protection under the BGEPA and is being monitored by the USFWS since it was officially delisted in August 2007. Since it was federally listed as endangered in 1978, the bald eagle population has steadily increased throughout the lower 48 states. This increase has been attributed directly to the banning of DDT and other organochlorines along with habitat protection and enhancement measures (USFWS 1994). The desert bald eagle was then relisted as "threatened" on March 6, 2008. However, this relisting only pertains to the Sonoran Desert population in central Arizona and does not affect the rest of the U.S., including Texas.

The bald eagle ranges over much of the U.S. and Canada. This eagle is primarily a fishing species that prefers habitats associated with large bodies of water. Wintering and nesting activities occur mainly near large freshwater impoundments or rivers with standing timber located in or around the water (Mabie 1989). In Texas, the nesting period usually extends from October 1 to May 15. Most nests in Texas occur on major rivers and reservoirs in the eastern portions of the state and coastal regions. Bald eagles are known to utilize numerous reservoirs in Texas, including Lake Buchanan located approximately 13 miles northwest of the Project Site, for wintering sites (http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_0013_bald_eagle.pdf). Recently, a handful of bald eagle nests have been documented on the Colorado and Llano Rivers. At least two bald eagle nests are known between Lake Buchanan and the Llano River (exact locations not disclosed), which is at least 8 miles northwest of the Project Site (Brent Ortego, TPWD Bald Eagle Specialist, personal communication to Mark Kainer May 2011). The status of these two nests was not provided. Another active bald eagle nest is documented approximately 20 miles northwest of the Project Site on the Llano River.

3.2.3 Zone-tailed Hawk

Zone-tailed hawks (*Buteo albonotatus*) prefer arid open country, and especially open deciduous or pine-oak woodland, and mesas and mountain country, often near watercourses. Other areas include wooded canyons and tree-lined rivers along middle slopes of desert mountains, and open country with scattered trees or thickets, especially near marshes or streams. Zone-tailed hawks nest in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas and mature conifers in high mountain regions, often close to cliff or steep hillsides (Snyder and Glinski 1988).

3.2.4 Texas Horned Lizard

The Texas horned lizard (*Phrynosoma cornutum*) is a broad and flattened lizard with conspicuous elongated scales that form spines on their head, neck, and back and is unique in having a black-bordered white line extending down the middle of the back and brown stripes radiating from the eyes (Sherbrooke 2003). The Texas horned lizard inhabits the Southern Great Plains, east of the Rocky Mountains. Their preferred habitat includes arid and semi-arid open areas with scattered vegetation composed of bunchgrass along with scattered cacti, yucca, mesquite, acacia, juniper, or other woody shrubs and small trees on a variety of soil types with some loose soil to bury themselves in (Sherbrooke 2003). The Texas horned lizard once inhabited much of Texas (Dixon 2000), but has disappeared from large portions of their former range in eastern and central Texas. These declines are attributed to the pet trade, habitat loss

and modification, the spread of non-native fire ants and the subsequent loss of harvester ants (which comprise up to 69 percent of the horned lizard diet), and broad-scale application of pesticides (Stebbins 2003).

3.2.5 Five State-Threatened Mussels

Five state-threatened freshwater mussels are of potential occurrence in Burnet and Llano Counties. These include the false spike mussel (*Quadrula mitchelli*), smooth pimpleback (*Q. houstonensis*), Texas pimpleback (*Q. petrina*), Texas fawnsfoot (*Truncilla macrodon*), and Texas fatmucket (*Lampsilis braceata*). All of these occupy the Colorado River Basin and could occur in Lake LBJ or the Colorado or Llano River. Little is known regarding the ecological requirements of these species, but all have experienced sharp population declines in recent decades. The Texas fawnsfoot does not tolerate impoundments, but the smooth pimpleback is known to occur in moderate-sized reservoirs. There are no documented occurrences of any of these species in the Action Area (TXNDD 2011).

In June 2007, the USFWS received a petition to list the Texas fatmucket as threatened or endangered under the federal ESA. In October 2008, the USFWS received a petition to list six additional mussels, including the smooth pimpleback, Texas pimpleback, and Texas fawnsfoot, as either threatened or endangered. The USFWS found the listings may be warranted and initiated a 12-month status review to make that determination (Federal Register 2009). These species are currently under review.

4.0 ENVIRONMENTAL BASELINE AND EFFECTS ANALYSIS

The environmental baseline represents the current condition of the project area including past and present impacts or activities in the Action Area, the anticipated impacts of all proposed federal projects that have already undergone Section 7 consultation, and the impacts of state and private actions that are contemporaneous with the consultation in process. This discussion also provides the current status of the species and their habitats in the Action Area in order to provide a context to assess the effects of the proposed action. **Section 4.1** identifies the methods used to identify the environmental baseline, and **Section 4.2** presents the results.

4.1 Methods

This BA is based on 1) a description of the proposed project; 2) pertinent ecological and physiographic information; 3) air modeling efforts to identify the logical Action Area; 4) field investigations to determine whether suitable habitat for protected species exists in the Project Site and Action Area; and 5) a detailed literature review to identify publications that focused on the impacts of air emissions on the protected species of potential occurrence within a 15-mile radius of the project area. The following describes the methods used in the literature review (**Section 4.1.1**) and for the habitat assessments conducted in the Project Site and Action Area (**Section 4.1.2**).

4.1.1 Literature Review

The literature review conducted for this BA included:

1. Current USFWS and TPWD lists of threatened and endangered species of potential occurrence in Llano and Burnet Counties;

2. A review of the TXNDD of documented rare species and resource occurrences within 15 miles of the Project Site (TXNDD 2011) (Note: The TXNDD database query of 15 miles from the Project Site was used to help determine trends in rare species occurrences in the region for context and does not in any way represent the Action Area, which extends up to 2.1 miles from the Project Site); and

3. A review of pertinent literature and current information on potential impacts of air emissions on general wildlife, threatened and endangered species of potential occurrence in the Action Area, and designated critical habitat (http://criticalhabitat.fws.gov/crithab/).

The purpose of the literature review identified in number 3 above was to evaluate whether any listed species of potential occurrence in the Action Area is known to have a susceptibility to air emissions impacts from a natural gas-fired power plant. This literature review was conducted by searching the University of Texas at Austin library, as well as online journal databases such as JSTOR and BioOne, to identify literature discussing the potential impacts of natural gas air emissions on federally listed threatened and endangered species within a 15-mile radius of the Project Site. The search was conducted in a three-step process.

The first step was to collect a broad scope of articles that referenced air emissions impacts on wildlife. Search terms such as "emissions" and "natural gas emissions" were entered into the online journal databases, as well as the University of Texas library search option. The second step narrowed the search topics down to air emissions and threatened and endangered species. The third and final step narrowed the search topics down even further to include the specific threatened and endangered species with the potential to occur within 15 miles of the Project Site, as identified by the USFWS and TPWD lists: black-capped vireo, golden-cheeked warbler, interior least tern, whooping crane, red wolf, gray wolf, Concho water snake, Bee Creek Cave harvestman, and bald eagle.

4.1.2 Habitat Assessment Methods

A four-step approach was utilized in the habitat assessment conducted for this project.

Step 1 – Existing Data

The initial step in the habitat assessment was to identify the species of potential occurrence in the project area, review known occurrences and habitat requirements of each of these species, and determine baseline conditions in the Action Area relative to the species' habitat requirements.

Step 2 – Remote Sensing Assessment

A remote sensing analysis was conducted based on a review of a number of sources including color infra-red and black and white aerial photography, National Resources Conservation Service (NRCS) soil surveys, USFWS National Wetlands Inventory Maps, and U.S. Geological Survey topographic maps. This assessment included identifying the signature of vegetation communities that would possibly be considered suitable habitat for the listed species. It included identifying residential and commercial developments, granite outcrops, potential wetlands and open water, and various vegetation types.

Step 3 – Ground Verification of Vegetation Community Signatures

The vegetation communities identified in Step 2 were ground-verified, the signatures were clarified by a qualified biologist, and a refined potential habitat map was developed. Based on this step, limited areas located immediately adjacent to the Project Site and owned by LCRA were identified as the only areas within the Action Area that had any potential to be habitat for any of the federally listed species, specifically the GCWA and BCVI. Based on this analysis, it was determined that a more detailed pedestrian survey and, where necessary, quantitative sampling would be conducted to assess whether these areas had any potential to be considered suitable habitat for the GCWA or BCVI. The locations of the Pedestrian Survey Areas are identified on **Figure 4**.

Step 4 – Pedestrian Surveys and Quantitative Sampling

Pedestrian surveys were used to evaluate suitability of habitats for the GCWA and BCVI within the areas of potential habitat identified in Steps 1 through 3 above. **Figure 4** shows the Project Site and the area covered by pedestrian survey relative to the entire Action Area. Three separate pedestrian field

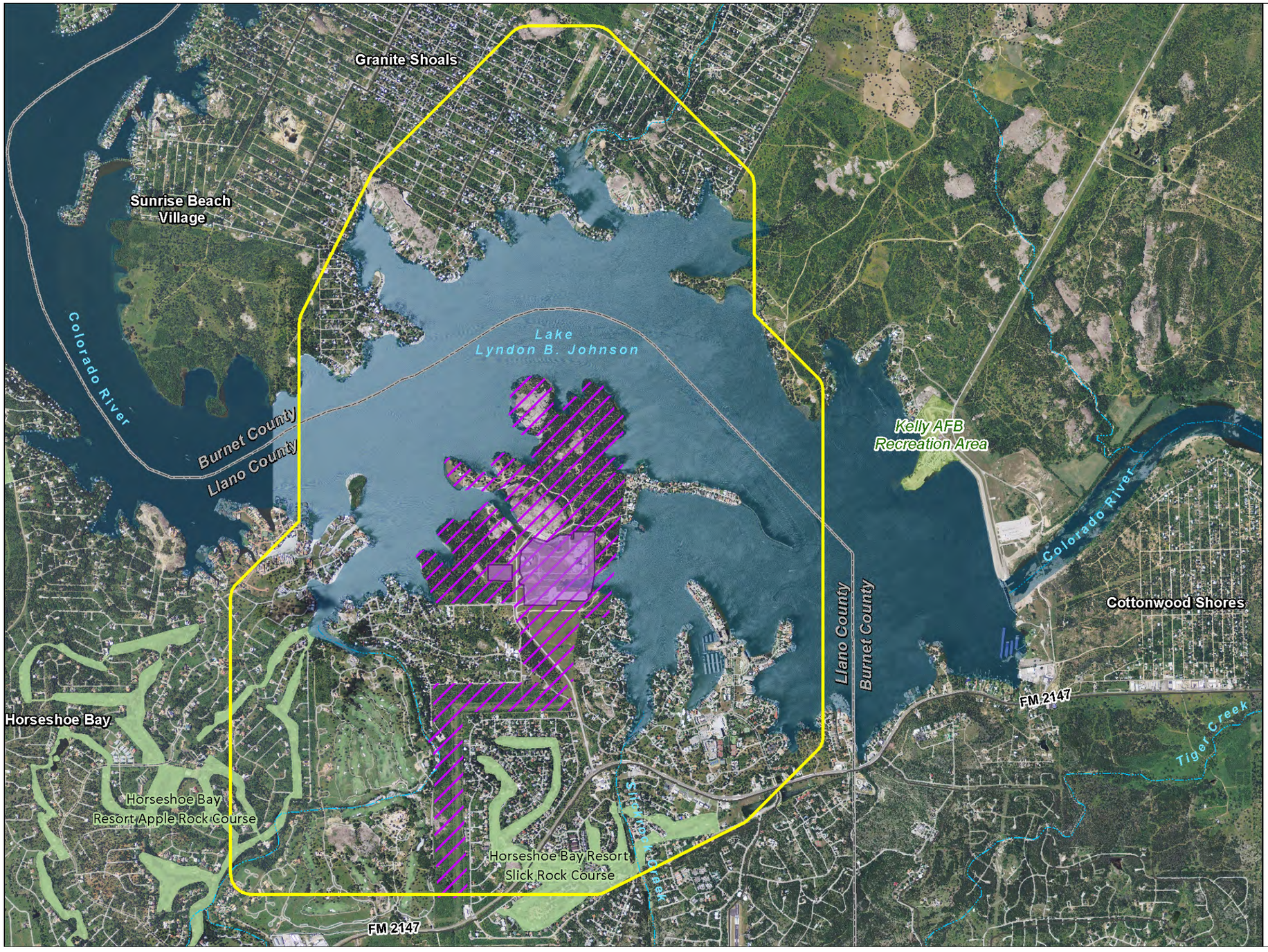

Figure 4
LCRA
Thomas C. Ferguson
Power Plant Replacement
Pedestrian Survey Area

- Action Area
- Project Site
- Pedestrian Survey Area
- River or Stream
- Park/Recreational Area
- County Boundary

N
W E
S

Scale 1:30,000

0 1,250 2,500 5,000

Feet

Base Map: 2010 NAIP Aerial Imagery

investigations were conducted in the spring and summer of 2011 to assess the suitability of these natural areas for federally listed threatened and endangered species.

The first field investigation, conducted on April 28, 2011 by Mark Kainer, endangered species biologist from Blanton & Associates, Inc. (B&A) and Wendy Schreiber, LCRA environmental specialist, consisted of a pedestrian survey of the tracts to collect vegetation data pertinent to an assessment of habitat suitability for listed species, including ocular estimates of average canopy coverage, age of Ashe junipers, canopy height, the percentage of Ashe juniper, and canopy species distribution and diversity.

The second pedestrian investigation was conducted on July 26, 2011 by two qualified biologists from B&A to further define the various vegetation communities and physical features of the two undeveloped LCRA blocks located within the Pedestrian Survey Area (**Figure 4**). As a result of this effort, the Project Team decided to conduct quantitative sampling to further evaluate pertinent woody species composition in these two tracts relative to the habitat requirements of the GCWA.

The third site visit was conducted on August 2, 2011 to collect quantitative samples to further refine the GCWA habitat assessment. The Point-Center-Quarter (PCQ) vegetation sampling method was utilized to collect pertinent quantitative data on the canopy. The PCQ method is designed to collect data to estimate characteristics of density, dominance (a measure of aerial cover), and frequency (a measure of distribution) for each canopy or shrub species encountered. The method also allows for calculations of relative density, dominance, and frequency for each species to help characterize the vegetation community in relation to all species present. Two representative transects were placed within each of these tracts, and samples were taken at 150 foot intervals along these transects. At each sampling point, the closest tree 5 inches or greater in diameter at breast height (dbh) (determined to be the minimum size of canopy trees) was identified, and the following data were collected in each cardinal direction: 1) species; 2) distance from the sampling point; 3) dbh, and 4) height of the tree. In addition, other pertinent information such as average canopy coverage and height, size of Ashe juniper, and relative species diversity were estimated and documented at each point. The western tract, which encompasses approximately 44.9 acres, included 18 sample points along two transects; the eastern Baird Ranch tract, which encompassed approximately 139.9 acres, included 33 sample points along two transects (**Figure 5**).

The transects ranged from 1,250 to 2,750 feet in length. The location of the transects and the associated sample points are identified on **Figure 5**.

4.2 Results

This section provides the results of the investigations performed in order to evaluate the potential for the proposed action to affect threatened and endangered species. **Section 4.2.1** provides the results of the literature review, **Section 4.2.2** provides the results of habitat assessments conducted in the Project Site and Action Area, **Section 4.2.3** discusses the results of the investigations for each of the federally listed species of potential occurrence in the Action Area, and Section **4.2.4** discusses the results of the investigations for state-listed species.

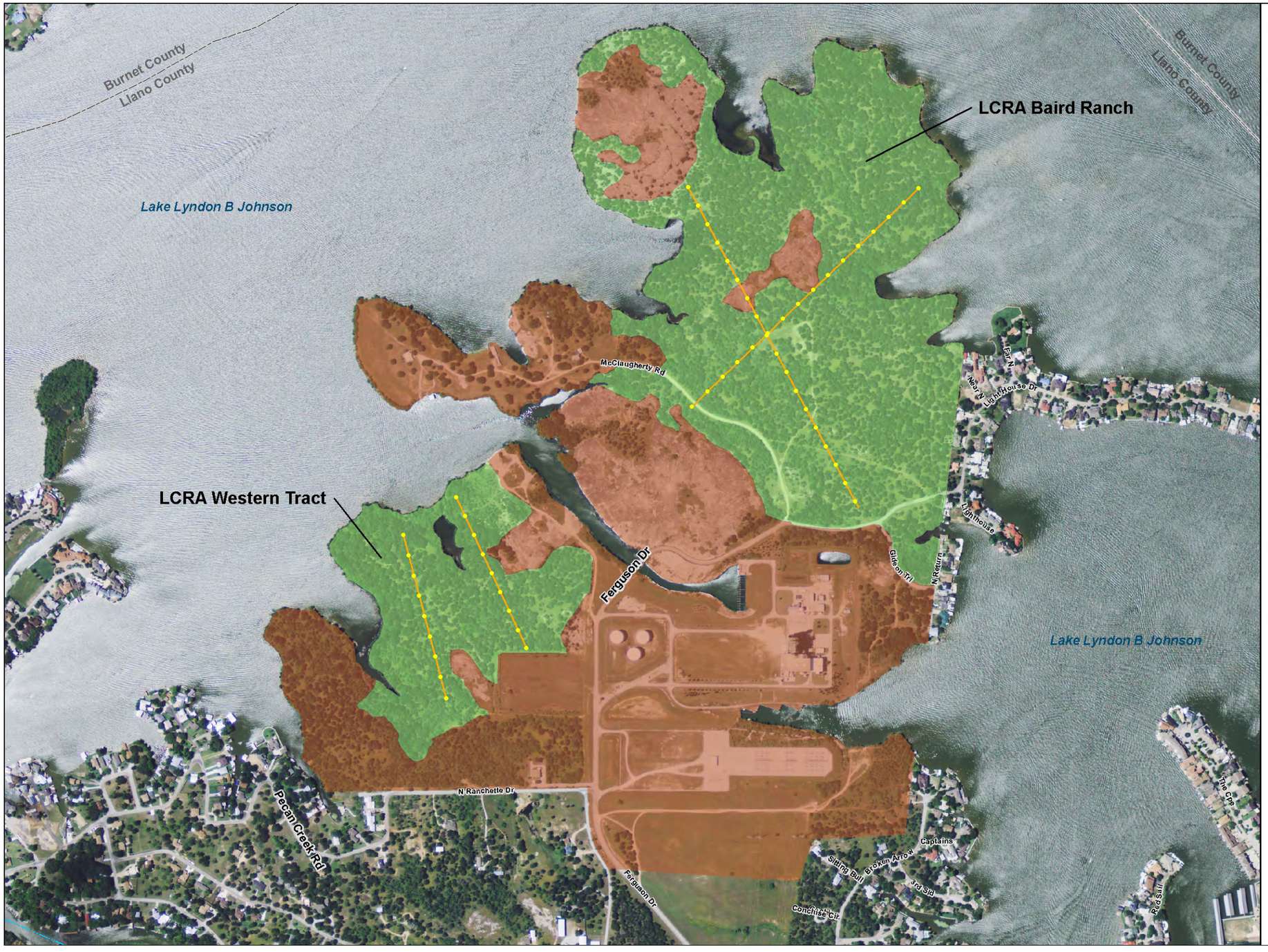

Figure 5
LCRA
Thomas C. Ferguson
Power Plant Replacement
GCWA Habitat
Assessment Area

Point Center Quarter Transect (150' Interval Survey Points)

Quantitative Sample Area

Areas Determined Not Suitable for the GCWA Without Quantitative Samples

N
W E
S

Scale 1:9,000

0 375 750 1,500
Feet

Base Map: 2010 NAIP Aerial Imagery

4.2.1 Results of Literature Review

4.2.1.1 Review of Species Lists and Known Occurrences

The list of threatened and endangered species of potential occurrence in Llano and Burnet Counties, as compiled from the most current USFWS and TPWD lists for the counties, is provided in **Table 3** in **Section 3.0**. Based on an April 2011 query of the TXNDD, the known occurrences of federally listed threatened and endangered species within 15 miles of the Project Site include only the GCWA and BCVI (TXNDD 2011). None of these records are within the Action Area for the proposed action, and the nearest record is over 4 miles from the Action Area. The BCVI was reported in four general locations during the period from 1988-1997. However, the majority of these are single observations of individual or pairs that were not found in subsequent years despite additional searches. No persistent populations of the BCVI are known within 15 miles of the project site (TXNDD 2011). The GCWA observations are all found in association with Oak-Juniper and Juniper-Mixed Deciduous woodlands along bluffs, canyons, and ravines of drainages. The reports do not provide any follow-up data for the GCWA observations, but based on the descriptions of the observations where several pairs and territories were identified, these could be persistent populations. **Table 4** provides a summary of the data provided in the TXNDD element of occurrence reports for federally listed threatened and endangered species within 15 miles of the Project Site.

Table 4 Summary of Federally Threatened and Endangered Species Occurrences from the Texas Natural Diversity Database Query within 15 Miles of the Project Site (4/29/11)

Species	TXNDD ID #	Observation Date	Distance and Direction from Project Site	Within Action Area?	Notes
BCVI	7297	8/29/97	13.6 miles SW	No	John Maresh heard one BCVI. Went back in subsequent years, and no additional BCVIs or population found.
BCVI	1226	5/29/92	6.4 miles NE	No	LCRA biologists observed and heard a pair of BCVIs on the Schifflet Resource Area (LCRA). Went back in subsequent years, and no additional BCVIs or population found.
BCVI	5102	Spring and Summer 1993	9.7 miles N	No	TPWD survey on Longhorn Caverns State Park observed Male BCVI. No follow-up data provided.
BCVI	6385	1988	13.7 miles SW	No	Various biologists observed up to eight BCVI males on Althaus Rd-Blanco County in “past years” (No dates provided). Only one pair found in 1998.
BCVI	662	5/29/92	11.4 miles E	No	LCRA biologists observed a pair of BCVIs on the Schaffer Bend Resource Area (LCRA). Went back in subsequent years, and no additional BCVIs or population found.
GCWA	7449	Spring 1993-1994	10.5 miles ESE	No	LCRA biologists observed several pairs of GCWAs around Bluffs on Double Horn Creek and its tributaries in the Double Horn Resource Area (LCRA) from 1993-1994.
GCWA	573	4/28/85	8.5 miles NNE	No	TPWD survey on Longhorn Caverns State Park observed numerous GCWA pairs from 1988-1995 in Oak-Juniper Woodlands along ravines of Williams Creek and tributaries.
GCWA	574	Spring 2000-2003	11.7 miles NNE	No	SWCA Consultant report to USFWS: four to five GCWAs observed in Oak-Juniper Woodlands along Peters Creek.

In addition to the TXNDD records, the literature review identified an LCRA document entitled *Rare, Threatened and Endangered Species on LCRA Lands Survey Findings and Analysis* (LCRA 1995). In this study, LCRA biologists conducted a habitat assessment for rare species on all their properties, including the Project Site and undeveloped areas surrounding the Project Site. This report is discussed in **Sections 4.2.3.1** and **4.2.3.2**.

4.2.1.2 Results of Literature Review for Air Emissions Impacts on Threatened and Endangered Species

During the first step of the detailed literature search for air emissions impacts on threatened and endangered species, over 15,000 journal articles were identified that referenced emissions. These articles covered effects of emissions on wildlife including mercury contamination as a result of coal-fired power plants, and effects of sulfur gas emissions as well as nitrogen emissions as a result of natural gas refineries.

The second step of the search refined the number of journal articles to just over 7,000. Examples of articles from this search included the effects of mercury contamination (from coal fired power plants) on an endangered crane in Japan.

The final step of the search resulted in less than 200 articles that referenced anywhere in the article the word "emissions" and any of the federally threatened species with the potential to occur within 15 miles of the proposed project. Of those 200 articles, none discussed the impact of natural gas emissions on the threatened and endangered species located within the proposed project area. As noted above, the literature review did not result in any publication that identified impacts of air emissions to any of the listed species addressed in this BA.

4.2.2 Habitat Assessments

This section provides the results of the habitat assessments that were conducted within the Project Site and Action Area. To provide a context for the evaluation of this environmental baseline information, a regional description is provided below, followed by a description of habitats present in the Project Site, Action Area, and Pedestrian Survey Area. Each of these areas is defined below, with references to maps that illustrate the boundaries of each area.

- Project Site – The physical boundary of the property owned by LCRA on which the existing Ferguson plant is located and the proposed power plant would be constructed (**Figure 2**).

- Action Area –The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 C.F.R. 402.02) (**Figure 3**). The analysis of species or designated critical habitat likely to be affected by the proposed action is focused on impacts within the project's Action Area.

- Pedestrian Survey Area – The Pedestrian Survey Area (**Figure 4**) includes portions of the Action Area consisting of undeveloped lands located immediately adjacent to the power plant site and owned

by LCRA, where intensive pedestrian survey was required to evaluate potential habitat for protected species.

4.2.2.1 Regional Description

The Project Site is situated in the Edwards Plateau Physiographic Region just north and west of the canyonlands of the Balcones Escarpment and within the southeastern portion of the Llano Uplift (Jordan et al., 1984). The Edwards Plateau is characterized by rolling limestone hills with level valleys. The surface geology of the Action Area consists of Town Mountain Granite (BEG 1981). Numerous circular outcrops of granite occur in the Action Area, including a large outcrop adjacent to the Project Site. The soils of the Project Site and much of the Action Area are mapped as the Lou-Voca-Keese Association, which are well drained gravelly and sandy loams derived from granite (USDA 2000). The soils of the Project Site are mapped as very gravelly coarse sandy loam. Other soil types in the Action Area include the Voca Association, gently undulating gravelly sandy loam, Keese Rock Outcrop, and Ligon cobbly fine sandy loam (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

The Project Site was mapped by the TPWD as Live Oak-Mesquite-Ashe Juniper Parks, and the surrounding Action Area was mapped as a complex of Live Oak-Ashe Juniper Parks, Live Oak-Mesquite-Ashe Juniper Parks, and Live Oak-Mesquite Parks (McMahan et al. 1984). Common species in these vegetation types include plateau live oak, post oak, honey mesquite, Ashe juniper, cedar elm, flame-leaf sumac, and Texas persimmon.

4.2.2.2 Project Site

The Project Site is a managed area consisting of the existing power plant facility and developed areas adjacent to the power plant. The Project Site is largely devoid of natural woody vegetation. With the exception of the cooling-water discharge channel, it consists primarily of native and introduced grasses that are maintained by mowing. Woody vegetation on the Project Site includes ornamental trees planted in rows for landscaping purposes. Examples of ornamental woody vegetation on the Project Site include live oak, redbud, bald cypress (*Taxodium distichum*), junipers (*Juniperus* spp.), pine (*Pinus* sp.), and Bradford pear (*Pyrus calleryana*). Common grasses and forbs of the Project Site include common bermudagrass (*Cynodon dactylon*), King ranch bluestem (*Bothriochloa ischaemum*), buffalograss (*Buchloe dactyloides*), white tridens (*Tridens albescens*), silverleaf nightshade (*Solanum elaeagnifolium*), and prairie coneflower (*Ratibida columnifera*). Additional photographs of the Project Site are provided in **Appendix 2**.

4.2.2.3 Action Area

As shown in **Figure 3,** most of the Action Area consists of residential developments, roads, golf courses, and Lake LBJ. Two tracts of undeveloped LCRA lands surrounding the Project Site contain woodlands that were evaluated through pedestrian survey. These tracts are discussed separately in **Section 4.2.2.4** below. With the exception of these areas, natural vegetation within the Action Area is limited to a few small, scattered patches. Based on the field investigations, these areas include grasslands and shrublands. The shrublands are dominated by honey mesquite, prickly pear, and Texas persimmon, with scattered whitebrush (*Aloysia gratissima*), post oak, and agarita. Additional photographs of the Action Area are provided in **Appendix 2**.

4.2.2.4 Pedestrian Survey Area

As discussed in **Section 4.1.2**, the undeveloped LCRA lands surrounding the Project Site within the Action Area were evaluated by pedestrian survey (**Figure 4**). The two relatively larger blocks located on peninsulas just north and west of the existing facility consist of woodlands and savanna dominated by Ashe juniper, post oak, and honey mesquite. Other common species generally occurring on edges of woodland openings include Texas persimmon, whitebrush, prickly pear (*Opuntia* spp.), tasajillo (*O. leptocaulis*), Spanish dagger (*Yucca treculeana*), and agarita. Typical herbaceous species in these blocks include frostweed (*Verbesina virginica*), cedar sedge (*Carex planostachys*), little bluestem (*Schizachyrium scoparium*), King Ranch bluestem, buffalograss, three-awn (*Aristida* sp.), and side-oats grama (*Bouteloua curtipendula*). These blocks are very low in woody canopy species diversity, and are somewhat open with the exception of the margin surrounding Lake LBJ. The northern tract is identified by LCRA as the Baird Ranch, and the western tract is unnamed. They are separated by an inlet into the Ferguson Power Plant and a relatively large granite outcrop (**Figure 2**).

An existing transmission line corridor that extends from the plant south across FM 2147 was also evaluated by pedestrian survey (**Figure 4**). The corridor consists of the transmission line surrounded by shrublands in two distinct stages of succession. The portion of the corridor associated with the transmission line appears to be maintained by periodic mowing. The corridor is dominated by young (<15 feet tall) honey mesquite with a few scattered Texas persimmon, prickly pear, Texas sugarberry, and typical xeric grasses described above. Additional photographs of the pedestrian survey area are provided in **Appendix 2**.

4.2.3 Federally Listed Threatened and Endangered Species

4.2.3.1 Black-capped Vireo (Federal Endangered)

There are no documented occurrences of the BCVI in the Action Area. The closest known documented occurrence of the BCVI is approximately 6.1 miles northeast of the Project Site (4 miles from the Action Area), and four additional occurrences are documented within 15 miles of the Project Site, primarily to the north and east (TXNDD 2011). The Project Site, which is industrial and manicured by mowing, is not suitable habitat for the BCVI. The undeveloped areas adjacent to the Project Site owned and managed by LCRA consist of woodlands with only a few small open areas. The BCVI does not occupy woodlands. One linear area along the LCRA transmission line corridor south of the Project Site was mapped in the early 1990s by LCRA biologists as a potential area that may be suitable for the BCVI (LCRA 1995). However, no BCVIs have ever been documented at the site. This area was evaluated during the 2011 habitat assessment by pedestrian survey. The transmission line currently consists almost entirely of honey mesquite and does not support the distinctive patchy and diverse vegetation community required for suitable BCVI habitat. Based on ocular estimates of percent shrub cover, portions of the transmission line corridor do support the aerial coverage of 30 to 60 percent required for the BCVI, but the corridor does not support a diverse assemblage of shrubs in a distinctively patchy arrangement necessary for BCVI occupation. The remaining Action Area consists almost entirely of residential developments, roads, golf courses and Lake LBJ. Based on pedestrian surveys of the Project Site and LCRA lands adjacent to the site (**Figure 4**), and vehicular reconnaissance of the remaining Action Area, no suitable habitat for the BCVI was identified in the Action Area. Therefore, the project would have no effect on the BCVI.

4.2.3.2 Golden-cheeked Warbler (Federal Endangered)

The Project Site, which is industrial and largely devoid of native vegetation, does not contain suitable habitat for the GCWA. The remaining portion of the Action Area consists almost entirely of residential developments, roads, golf courses, and Lake LBJ. Based on aerial photo-interpretation and reconnaissance of the Action Area, only two undeveloped areas adjacent to the Project Site that are owned and managed by LCRA consist of open woodlands that required additional investigations (pedestrian survey) to assess their suitability for the GCWA. LCRA biologists evaluated these tracts in the early 1990s and did not identify them as suitable habitat for any threatened or endangered species including the GCWA. To confirm this assessment, three separate field investigations (as described in **Section 4.1.2**) were conducted in the spring and summer of 2011 to assess the suitability of these undeveloped lands for the GCWA.

These two undeveloped areas include primarily Ashe juniper woodlands situated on level terrain with some deciduous species present in small patches. However, several areas within these woodlands support vegetation that is clearly not suitable for the GCWA. Examples include a few areas that have been cleared of most native vegetation and are managed by periodic mowing; a relatively large area in the western tract that supports a shrubland consisting of a mix of mesquite, whitebrush, agarita, prickly pear, tasajillo, and

scattered cedar elm; and a lake shore that supports a narrow band of mixed shrubs, and scattered trees consisting of various introduced and native species including chaste tree (*Vitex* sp.), oleander (*Nerium oleander*), Chinese tallow (*Sapium sebiferum*), chinaberry (*Melia azedarach*), American sycamore, fan palm (*Washingtonia robusta*), Texas sugarberry, and black willow (*Salix nigra*). In addition, relatively large areas of granite outcrops and course gravelly washes that do not support shrubs or trees are also scattered throughout the tracts. The areas identified as clearly unsuitable GCWA habitat are identified on **Figure 5**.

The remaining portions of the two tracts are situated on very course granitic soils that are extremely well-drained. They support a relatively xeric community with prickly pear, hedgehog cactus (*Echinocereus* sp.), and tasajillo dominating the ground cover in many areas. The shrub layer within the woodland patches was very sparse and absent in many areas. The two woodland/savanna tracts have very low canopy species diversity relative to occupied GCWA habitats in the region and relative to descriptions of suitable GCWA habitat (USFWS 1992). In addition, large areas within these tracts consist almost entirely of Ashe juniper of various age classes. The wooded areas in both tracts lack the diverse assemblage of deciduous species in the canopy and shrub layers generally associated with suitable GCWA habitat. These patches are also located on level well-drained floodplains and not in canyons or on slopes where GCWAs generally occur in the region. The patches are also relatively small and isolated from other woodland patches in the region by residential and commercial developments and Lake LBJ. To further determine the suitability of the wooded areas as GCWA habitat, quantitative sampling was conducted to evaluate woody species composition relative to the habitat requirements of the GCWA. **Figure 5** shows the areas where quantitative sampling was conducted. The results of the quantitative sampling efforts are presented in **Tables 5** and **6**.

The PCQ vegetation sampling method is designed to collect data to estimate characteristics of density, dominance (a measure of aerial cover), and frequency (a measure of distribution) for each canopy or shrub species encountered. The method also allows for calculations of relative density, dominance, and frequency for each species to help characterize the vegetation community in relation to all species present. In this case the most important characteristic to help determine habitat suitability for the GCWA is relative dominance because it considers both density and average basal area to determine the relative cover encompassed by each species. **Table 5** summarizes the results of the PCQ samples for the Baird Ranch, and **Table 6** summarizes the results of the PCQ samples for the western tract.

Table 5 Summary of Point-Center-Quarter Results for the Baird Ranch

Canopy Species	Total Number of Individuals	Estimated Density (#trees/acre)	Total Basal Area/Acre (square inches/acre)	Relative Dominance	Percentage of Sample Points the Species Was Documented
Ashe Juniper	108	63.7	35,691	93.52%	100%
Honey Mesquite	14	13.3	1,152	3.02%	30.3%
Texas Persimmon	3	2.0	118	0.31%	9.1%
Post Oak	3	2.7	612	1.60%	9.1%
Live Oak	2	1.5	184	0.48%	6.1%
Cedar Elm	1	1.1	381	1.00%	3.0%
Netleaf Hackberry	1	0.4	25	0.07%	3.0%
Total	**132**	**84.7**	**38,163**	**100.00%**	**NA**

Table 6 Summary of Point-Center-Quarter Results for the Western Tract

Canopy Species	Total Number of Individuals	Estimated Density (trees/acre)	Total Basal Area/Acre (square inches/acre)	Relative Dominance	Percentage of Sample Points the Species Was Documented
Ashe Juniper	59	144.7	55,680	92.64%	100%
Honey Mesquite	7	19.4	3,270	5.44%	27%
Post Oak	6	8.4	1,152	1.92%	22%
Totals	**72**	**172.5**	**60,102**	**100.00%**	**NA**

Based on the results of the PCQ samples, the dominant species on both tracts is Ashe juniper, which accounts for 93 percent relative dominance on both tracts. Honey mesquite is the only other canopy species of significance on the Baird Ranch, accounting for approximately 3 percent of the relative dominance. Honey mesquite was represented by 5.4 percent of the relative dominance on the western tract. Post oak was represented by 1.9 percent of the relative dominance on the western tract. On both tracts honey mesquite occurs primarily on the edges of openings, and many of the individuals are relatively small. Post oak typically occurs in small clumps where soils are deeper on swales associated with inlets. In general if a sample point ended up in woodland cover Ashe juniper was overwhelmingly dominant. If the sample point ended up in one of numerous openings or on the edge of an opening both honey mesquite and juniper were present. The Baird Ranch had a few other canopy species in trace amounts, but these generally occurred on the edges of the lakeshore community or, in the case of Texas persimmon, in openings. If the 5-inch dbh minimum was lowered to 4 inches, Ashe juniper would have been even more dominant because the minimal understory that was present in these blocks consisted almost entirely of young Ashe juniper. Representative photographs of the Baird Ranch and western tract are provided in **Appendix 2**.

In addition, the percentage of sample points in canopy cover less than 35 percent was 45 percent on the Baird Ranch and 66 percent on the western tract. The percentage of sample points with all Ashe juniper was 52 percent on the Baird Ranch and 50 percent on the western tract.

There are no documented occurrences of the GCWA in the Action Area. The closest known documented occurrence of the GCWA is approximately 7.9 miles north of the Project Site (5.8 miles from the Action Area), and two additional occurrences are documented within 15 miles of the Project Site, primarily north of the existing plant (TXNDD 2011). However, these occurrence records are consistently within canyons and slopes of drainage features in upland hilly terrain and not within the floodplains of large drainages. The Action Area consists almost entirely of residential developments, roads, golf courses and Lake LBJ. Based on pedestrian surveys and quantitative sampling of the Project Site and undeveloped LCRA lands adjacent to the Project Site (**Figures 3** and **4**), and reconnaissance and aerial interpretation of the remaining Action Area, no suitable habitat for the GCWA, as described in Campbell (2003) and USFWS (1992), was identified in the Action Area. Therefore, the project would have no effect on the GCWA.

4.2.3.3 Interior Least Tern (Federal Endangered)

No habitat (large gravel bars or gravelly beaches) occur in the Action Area and no interior least terns are documented in the Action Area (TXNDD 2011). The presence of the interior least tern in the Action Area would be considered incidental. Therefore, the project would have no effect on the interior least tern.

4.2.3.4 Whooping Crane (Federal Endangered)

There are no documented occurrences of the whooping crane within the Action Area (TXNDD 2011). In addition, the whooping crane generally migrates east of the Edwards Plateau (http://www.npwrc.usgs.gov/resource/birds/wcdata/tx_fig1.htm). The Project Site does occur on a major aquatic feature, but it is relatively developed, and whooping cranes are not known to utilize Lake LBJ. Even if one or more whooping cranes stopped over at Lake LBJ or another site in the Action Area, it would be considered an incidental and temporary stopover during migration, and the project would not adversely affect the species. Therefore, the project would have no effect on the whooping crane.

4.2.3.5 Gray Wolf (Federal Endangered)

Gray wolves are considered to be extirpated from Texas. Therefore, the project would have no effect on the gray wolf.

4.2.3.6 Red Wolf (Federal Endangered)

Red wolves are extirpated from central Texas. Therefore, the project would have no effect on the red wolf.

4.2.3.7 Concho Water Snake (Proposed Delisted)

The Concho water snake does not occur in the Action Area or in downstream habitats. Therefore, the project would have no effect on the Concho water snake.

4.2.3.8 Bee Creek Cave Harvestman (Federal Endangered)

The Action Area is not within a karst zone, and the Bee Creek Cave harvestman does not occur in Llano or Burnet Counties. Therefore, the project would have no effect on the Bee Creek Cave harvestman.

4.2.3.9 Designated Federal Critical Habitat

There is no designated critical habitat for any federally listed threatened and endangered species in Burnet or Llano Counties (http://criticalhabitat.fws.gov/crithab/). Therefore, the project would not affect any designated critical habitat.

4.2.4 State-Listed Threatened and Endangered Species

4.2.4.1 American Peregrine Falcon

The Action Area does not provide suitable nesting habitat for this species. Therefore, it is expected that any peregrine falcon occurring in the Action Area would be there only temporarily during migration. Therefore, the project is not expected to adversely impact the American peregrine falcon.

4.2.4.2 Bald Eagle

No bald eagles or nests are documented in the Action Area (TXNDD 2011; Brent Ortego, personal communication to Mark Kainer, May 2011), and none were observed during the field visits. Bald eagles are known to utilize Lake Buchanan, which is located approximately 13 miles from the Project Site, and bald eagle nests have been found along the Llano and Colorado Rivers approximately 8 miles from the Project Site. No exceptionally tall trees suitable for nesting bald eagles were observed in the Action Area. Based on existing data and lack of suitable habitat for nesting bald eagles in the Action Area, the project is not expected to impact the bald eagle.

4.2.4.3 Zone-tailed Hawk

The zone-tailed hawk has not been documented in the Action Area (TXNDD 2011), and suitable habitat for this species does not exist in the Action Area. Therefore, the project is not expected to impact the zone-tailed hawk.

4.2.4.4 Texas Horned Lizard

The Action Area provides suitable habitat for the Texas horned lizard, but they have not been documented in the Action Area (TXNDD 2011), and none were observed during the field investigation. It is unlikely the Texas horned lizard would be impacted by the project.

4.2.4.5 Five State-Threatened Mussels

The proposed project is not expected to alter the habitat quality of Lake LBJ or any downstream aquatic habitats. The proposed plant would use less water than the existing plant, and the removal of the fuel-oil

tanks would eliminate the risk of an oil spill. Therefore, the project is not expected to adversely affect these state-threatened mussels.

5.0 EFFECTS DETERMINATION AND SUMMARY

5.1 Effects Determination (Federally Listed Species)

The proposed Thomas C. Ferguson Power Plant Upgrade would have **no effect** on any of the federally listed species of potential occurrence in the Action Area for the following reasons:

1. No suitable habitat for any federally listed threatened or endangered species was identified in the Project Site or within the Action Area surrounding the Project Site.

2. No suitable habitat for a federally listed threatened or endangered species was identified within the receiving waters (Lake LBJ) in the Action Area, and no known occurrences of any federally listed threatened or endangered species are documented in the receiving water (TXNDD 2011).

3. In the remote scenario that a federally threatened or endangered species does occupy the Action Area or migrates through the Action Area, there is no evidence that any listed species of potential occurrence in the Action Area is specifically susceptible to emissions from a natural gas-fired power plant.

In summary, the project is expected to have no effect on any listed species, and the project would be expected to be in compliance with the ESA.

In addition, no bald eagles or eagle nests are documented in the Action Area (TXNDD 2011; Brent Ortego, personal communication to Mark Kainer, May 2011), and none were observed during the field visit. No suitable nesting habitat was identified in the Action Area. Based on existing data and lack of suitable habitat for nesting bald eagles in the Action Area, the project is not expected to impact the bald eagle. Therefore, the project would be expected to be in compliance with the BGEPA.

5.2 Summary of State-listed Species

No suitable habitat for state-listed threatened or endangered species was identified at the Project Site. However, suitable habitat for the Texas horned lizard, a state threatened species, occurs in the Action Area surrounding the Project Site. No horned lizards have been documented in the Action Area, and none were observed during field investigations.

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Appendix 1

Detailed Dispersion Modeling Analysis

BIOLOGICAL ASSESSMENT "ACTION AREA" ANALYSIS IN SUPPORT OF AN APPLICATION FOR TWO COMBINED CYCLE ELECTRIC GENERATING UNITS AT THE THOMAS C. FERGUSON POWER PLANT LLANO COUNTY, TEXAS

SUBMITTED TO:
ENVIRONMENTAL PROTECTION AGENCY
REGION VI
MULTIMEDIA PLANNING AND PERMITTING DIVISION
FOUNTAIN PLACE 12TH FLOOR, SUITE 1200
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SUBMITTED BY:
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JULY 1, 2011

zephyr

CONTENTS

ATTACHMENTS

1.0 PROJECT IDENTIFICATION INFORMATION

This report presents an analysis of the predicted ambient air quality impacts resulting from the construction of two combined cycle electric generating units at the Thomas C. Ferguson Power Plant (Plant). This report is submitted in support of the *Application for an Air Quality Permit For Two Combined Cycle Electric Generating Units at the Thomas C Ferguson Power Plant, Llano Texas; October 29, 2010* with revisions/addenda. This air quality impacts analysis was conducted to determine the area in which to conduct a Biological Assessment. This area will be described as the "Action Area" in this report.

Zephyr Environmental Corporation (Zephyr) has prepared this air quality impacts analysis following written and verbal methodologies and procedures of the Texas Commission on Environmental Quality (TCEQ) and United States Environmental Protection Agency (USEPA).

Applicant:	Lower Colorado River Authority
Facility:	Thomas C. Ferguson Power Plant
Regulated Entity Number:	RN100219468
Permit Application Number:	93938, PSD-TX-1244
Nearest City:	Horseshoe Bay
County in Which Plant Located:	Llano County
Applicant's Modeler:	Zephyr Environmental Corporation

2.0 PROJECT OVERVIEW

The Lower Colorado River Authority (LCRA) owns and operates the Thomas C. Ferguson Power Plant, which is located in Horseshoe Bay, Llano County. LCRA submitted an application for an air quality permit for the construction of two new combined cycle electric generating units to replace the existing steam boiler. Two models of combustion turbines are being considered for this site: the General Electric 7FA.04 and the Siemens SGT6-5000F.

The modeling results have determined that emissions from the proposed facility that could potentially affect animals, crops, and vegetation are trivial or *de minimis* four kilometers from the proposed turbines. The modeling results were used to define the Action Area for the Biological Assessment.

2.1 TYPE OF PERMIT REVIEW

The applicability of federal permitting to the pending permit application is discussed in Section XI.E. of the application. Table 2-1 provides a summary of the proposed project's Prevention of Significant Deterioration (PSD) emission significance.

Table 2-1 PSD Significance Summary

Contaminant	PSD Emission Significant?
Nitrogen Oxides (NO_X)	No
Carbon Monoxide (CO)	Yes
Sulfur Dioxide (SO_2)	No
Particulate Matter (PM)	Yes
Particulate Matter, Diameter < 10 microns (PM_{10})	Yes
Particulate Matter, Diameter < 2.5 microns ($PM_{2.5}$)	Yes
Volatile Organic Compounds (VOC)	Yes
Sulfuric Acid Mist (H_2SO_4)	Yes
Carbon Dioxide Equivalent (CO_{2e})	Yes

2.2 CONSTITUENTS EVALUATED

Modeling was conducted for pollutants and averaging periods that have Secondary National Ambient Air Quality Standards (NAAQS). The following air contaminants were evaluated for the Action Area modeling analysis: NO_2, SO_2, PM_{10} and $PM_{2.5}$.

2.3 MODELING APPROACH

A Biological Assessment for the proposed project was requested in the pending review of the PSD application for a greenhouse gas permit. The project consists of the construction of two combined cycle turbines with ancillary equipment to replace the existing boiler and existing ancillary equipment at the site. Formal guidance regarding the methods to employ to determine the Biological Assessment Action Area was not provided. Therefore, LCRA utilized Prevention of Significant Deterioration (PSD) guidance developed by the EPA and State New Source Review (NSR) guidance developed by the TCEQ to determine an "Action Area" in which to conduct the required Biological Assessment. PSD modeling guidance was followed for pollutants with PSD-significant emission rates. State NSR modeling guidance was followed for pollutants that are not PSD-significant.

Under the PSD program, various standards and guideline levels exist. These standards and guideline levels are summarized in Table 2-1 and are described below.

- NAAQS – The EPA has set NAAQS for six primary pollutants, which are called criteria pollutants. These include nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with diameter less than 10 microns (PM_{10}), particulate matter with diameter less than 2.5 microns ($PM_{2.5}$), ozone (O_3) and lead (Pb).

  The Clean Air Act established two types of NAAQS:
  - Primary NAAQS set limits to protect public health, with an adequate margin of safety. "Public health" is defined to include the health of "sensitive" populations such as asthmatics, children and the elderly.
  - Secondary NAAQS set limits to protect public welfare from any known or anticipated adverse effects associated with the presence of such a pollutant. "Public welfare" includes protection against decreased visibility, damage to animals, crops, vegetation and buildings.

- PSD Increment Consumption Limits – PSD increment is the amount of pollution an area is allowed to increase. These limits prevent the air quality in clean areas from deterioration to the level set by the NAAQS.

- Significant Impact Level (SIL) – A SIL is a *de minimis* threshold value that can be compared with predicted air quality impacts resulting from the increased emissions from projects that apply for a permit to emit a regulated pollutant in an area that meets the NAAQS. The primary purpose of the SIL is to identify a level of ambient air quality impact that is sufficiently low relative to the NAAQS or PSD increments that such impacts can be considered trivial or *de minimis*.

  The SIL is also used to determine when a proposed project's ambient air quality impacts warrant a comprehensive (cumulative) source impacts analysis and to define the size of the impact area within which the air quality analysis is completed. SILs are not regulatory limits but *de minimis* concentrations set by the EPA to values that are much less than the NAAQS.

Table 2-1. Standards and Guideline Levels

Pollutant	Averaging Period	SIL ($\mu g/m^3$)	NAAQS		PSD Increment Consumption Limit ($\mu g/m^3$)
			Primary ($\mu g/m^3$)	Secondary ($\mu g/m^3$)	
NO_2	1-Hour	7.5	188	None	None
	Annual	1	100	100	25
CO	1-Hour	2,000	40,000	None	None
	8-Hour	500	10,000	None	None
SO_2	1-Hour	7.8	196	None	None
	3-Hour	25	None	1,300	512
	24-Hour	5	365	None	91
	Annual	1	80	None	20
PM_{10}	24-Hour	5	150	150	30
	Annual	1	None	None	17
$PM_{2.5}$	24-Hour	1.2	35	35	9
	Annual	0.3	15	15	4

Since the Secondary NAAQS is designed to protect against any known or anticipated adverse effects to soils, water, wildlife, crops, vegetation and against decreased visibility, they were utilized to define the Biological Assessment Action Area. The EPA considers modeled concentrations less than the SIL to be trivial or *de minimis* (i.e., do not affect ambient air quality). Therefore, the Action Area for the Biological Assessment is defined as an area with predicted (modeled) pollutant concentrations that are greater than the SIL. No adverse effects to threatened or endangered species outside of the Action Area are anticipated.

3.0 PLOT PLAN

Plot plans showing the names and locations of emission points relative to the Plant's property boundaries and fenceline are provided as Attachment 1 to this report. Select structures are identified on the figure in Attachment 2. Downwash structures that may affect the dispersion of emissions from modeled sources are listed in the table included as Attachment 3.

4.0 AREA MAPS

An area map showing a 3,000-foot radius around the plant's property boundaries is provided as Attachment 4.

5.0 AIR QUALITY MONITORING DATA

Air quality monitoring data was not required for this analysis.

6.0 MODELING EMISSIONS INVENTORY

The proposed emissions, operating parameters and design parameters for the proposed project are defined and discussed in the air quality permit application with revisions/addenda. The application submitted to the TCEQ includes detailed information regarding the items addressed in this section.

The project consists of the following new emission sources:

- two combined cycle turbines,
- one emergency generator,
- one fire water pump,
- two combustion turbine lube oil vents,
- one steam turbine lube oil vent, and
- piping fugitives.

The Thomas C. Ferguson Power Plant currently includes a steam boiler. This existing boiler and all other existing emission point sources will be shutdown as part of the proposed project.

A copy of the most recent TCEQ Table 1(a) submitted for this application is included in Attachment 5. This table includes the project sources and their exhaust parameters (in English units). The stack parameters for the modeled LCRA sources are summarized in Attachment 6 (in English units and metric units).

In PSD and State NSR modeling demonstrations, the Area of Significant Impacts (AOI) determines if a comprehensive impacts analysis is required and if so, defines the area over which the comprehensive impacts analysis is to be conducted. The methods used to determine the AOI are provided in the EPA's *New Source Review Workshop Manual, Draft October 1990.* "For a proposed modification, the determination includes contemporaneous emissions increases and decreases, with emissions decreases input as negative emissions in the model" (page C.30). For pollutants with PSD-significant emissions, contemporaneous decreases correspond to creditable actual emissions (page A.37). For pollutants that are not PSD-significant, the guidance provided in the TCEQ's *Air Quality Modeling Guidelines, RG-25, February 1999 (AQMG)* was followed and "the difference between the proposed allowable emission rate and the existing allowable emission rate" (Section 3.4, Step 4, page 13) was used for contemporaneous decreases.

The following emissions data are included as attachments:

- A table summarizing the proposed allowable emission rates for project-related sources is included as Attachment 7.
- A table summarizing the current actual emissions for existing sources is included as Attachment 8.

- A table summarizing the current (permitted/authorized) allowable emissions for existing sources is included as Attachment 9.
- For pollutants with PSD-significant emissions, the difference between the proposed allowable emissions and the current actual emissions were included in the preliminary modeling analysis. The preliminary PSD modeling emission rates are summarized in the table included as Attachment 10.
- For pollutants that are not PSD-significant, the difference between the proposed allowable emissions and the current allowable emissions were included in the preliminary modeling analysis. The preliminary State NSR modeling emission rates are summarized in the table included as Attachment 11.

The modeling was conducted utilizing the conservative modeling assumptions described in Section 6.2.

6.1 SOURCE IDENTIFIERS

A table providing an LCRA source cross-reference between the modeling identification numbers and the Emission Point Numbers (EPNs) listed on Table 1(a) is included as Attachment 12.

6.2 STACK PARAMETER JUSTIFICATION

6.2.1 Good Engineering Practice Stack Height

Each source was modeled at its physical release height or at the Building Profile Input Program (BPIP)-calculated good engineering practice height, whichever is lower.

6.2.2 Operating Load Levels

LCRA expects to operate the proposed power plant with each turbine unit capable of operating continuously at full load. LCRA also expects to operate one or both turbine units part of the time at reduced loads.

The short-term emissions included on TCEQ Table 1(a) correspond to the maximum short-term emissions at all loads. The emission calculations included in the application include short-term emissions and exhaust parameters at various load rates. To ensure that the most conservative (worst-case) off-property concentrations are determined, three load levels were included in the impacts analysis as separate modeling scenarios:

- 100% Load – the highest emissions associated with both turbine units operating at 100% load and the lowest exhaust velocities and temperatures associated with those loads.
- 75% Load – the highest emissions associated with both turbine units operating at 75% load and the lowest exhaust velocities and temperatures associated with those loads.

- 50% Load – the highest emissions associated with both turbine units operating at 47.3% to 60% load and the lowest exhaust velocities and temperatures associated with those loads.

6.2.3 Turbine Unit Startup and Shutdown Scenario

The emissions associated with both turbines simultaneously undergoing startup/shutdown operations were modeled along with the exhaust parameters associated with those operations as a separate modeling scenario.

6.2.4 Plant Operating Scenarios

As stated in Section 2.0, two models of combustion turbines are being considered for this site. Separate analyses were conducted using the emissions and exhaust parameters corresponding to each of the two turbine scenarios: General Electric 7FA.04 and Siemens SGT6-5000F. Each of the proposed turbines were modeled at the three load levels discussed in Section 6.2.2 and the Startup/Shutdown scenario discussed in Section 6.2.3.

6.2.5 Maintenance Emissions Scenarios

The emissions associated with Inherently Low Emitting (ILE) maintenance activities were modeled as a separate modeling scenario that included emissions from normal plant operations. It was conservatively assumed that all ILE maintenance activities can occur in any given hour of the day or night.

The emissions from the single EPN representing these emissions on the draft MAERT were split into three individual activities corresponding to that EPN: online turbine washing, filter change out and catalyst handling. Online turbine washing occurs within the turbine during normal operations. Exhaust parameters corresponding to both turbines operating at 100% load were assumed for this maintenance activity. Filter changes occur at the turbine inlet air filter housing. This maintenance activity was modeled as a fugitive pseudo point source 12 feet above ground level. Catalyst change outs occur at the SCR housing. This maintenance activity was modeled as a fugitive pseudo point source 12 feet above ground level.

6.2.6 Continuous Unit Ramping Emissions Scenarios

The emissions associated with periods of continuous unit ramping (load changes) were modeled as a separate modeling scenario. These operations only affect the maximum hourly NO_2 emissions.

The hourly NO_2 emissions represented in the original air permit application corresponded to steady state operations. LCRA has developed and submitted maximum hourly emission rate estimates associated with periods of continuous unit ramping (load changes). These hourly NO_2 emissions are part of each unit's normal operation. The maximum hourly load change

emissions would occur when the units are ramping up. This operation is best represented by rapid load changes from 50% load to 100% load. This could occur within a period of three (3) minutes (approximately). The corresponding exhaust velocity for the hour would correspond to the 100% load scenario.

6.2.7 Emergency Equipment Emissions

The application includes emissions associated with the emergency readiness testing of an emergency generator and a fire water pump. Emissions associated with this testing were included in the modeling analysis. When applicable, the testing emissions of these engines were conservatively modeled with both units operating under normal conditions. The testing of these engines will not be conducted during turbine startup/shutdown periods. Additionally, the testing of these engines will only be conducted during daytime hours.

Detailed operating information was utilized to calculate the maximum short-term emissions associated with the emergency equipment. The short-term emissions rates listed on TCEQ Table 1(a) for the emergency generator and emergency firewater pump correspond to a full hour of operation. The emergency firewater pump will normally be tested for periods of 30-minutes or less. In order to obtain accurate modeling results, the emissions modeled for the testing of the emergency firewater pump reflects the expected length of the testing period. These emissions are summarized on the (metric units) tables included as Attachments 10 and 11.

The EPA memorandum entitled *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour National Ambient Air Quality Standard, Tyler Fox, March 1, 2011*, states that emissions associated with the infrequent testing of the emergency generator and fire water pump are not required to be included in the 1-hour NO_2 and 1-hour SO_2 NAAQS analyses. Both emergency engines are tested no greater than once per week. They are not tested within the same hour. LCRA believes the infrequent testing of these engines meets the criteria of the EPA as intermittent emission sources not required to be included in 1-hour NO_2 and SO_2 modeling analyses. Inclusion of these infrequent emissions leads to overly conservative modeling results.

However, in order to expedite the modeling review, the emissions associated with these intermittent sources were included in all modeling runs. Additionally, the testing emissions were included in all other NAAQS and TCEQ property-line standards modeling.

The emissions associated with emergency equipment operating during an actual emergency were not modeled, per se. The application does not include, and the permit will not authorize, such emissions. However, the modeling scenarios included testing emissions from the emergency generator and fire water pump plus the two turbines - all operating continuously every hour of the year. These scenarios provide conservative estimates for emergency operations.

6.2.8 Fugitive Source Parameters

Emissions associated with the piping fugitives were modeled as an area source with dimensions corresponding to the size of the area that encompasses the emissions generating sources.

6.2.9 NO_X to NO_2 Conversion

Following guidance included in the EPA memorandum entitled *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour National Ambient Air Quality Standard, Tyler Fox, March 1, 2011*; the Tier 2 default NO_X to NO_2 conversion factor of 80 percent was applied to hourly emissions prior to modeling. The Appendix W default NO_X to NO_2 conversion factor of 75 percent was applied to annual emissions prior to modeling.

6.2.10 Front-Half, Back-Half Particulate Matter Emissions

Front-half and back-half particulate matter emissions estimates were modeled for the PM_{10} and $PM_{2.5}$ analyses.

6.2.11 $PM_{2.5}$ Emissions

It was conservatively assumed that the $PM_{2.5}$ emissions are equal to the calculated PM_{10} emissions for this analysis.

6.3 SCALING FACTORS

Scaling factors were not utilized in the modeling analysis.

7.0 MODELS PROPOSED AND MODELING TECHNIQUES

The American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD), Version 11103, was used to perform the dispersion modeling in this air quality impacts analysis. AERMOD is the latest generation of atmospheric dispersion models suitable for industrial sources and is the model preferred by the USEPA for applications such as the Plant's. To facilitate the running of AERMOD, the Oris Solutions LLC's "BEE-Line BEEST for Windows" graphic user interface (Version 9.90) was used.

The following model options were used in the application of the AERMOD modeling:

A. Regulatory default option was enabled.

B. A medium roughness parameter was used based on the results of the analysis described in Section 8.0 of this protocol.

C. Elevated terrain was used for modeling the area around the facility.

D. The proposed emissions were modeled at their actual stack heights. None of the proposed or existing LCRA stacks exceed the calculated Good Engineering Practice (GEP) height or 65 meters, whichever is greater.

E. The profile base elevation was set to the San Angelo meteorological station base elevation of 1899 feet.

Modeling receptors were placed to a distance that clearly identifies the Action Area. The receptor grid spacing is discussed in Section 11 of this report.

Modeling was conducted for pollutants and averaging periods that have Secondary NAAQS. The proposed increases and contemporaneous emission increases and decreases in NO_2, SO_2, PM_{10} and $PM_{2.5}$ emissions were modeled to determine whether the impacts associated with the project are greater than *de minimis* as defined by the EPA SILs. For those pollutants and averaging periods where the modeling results indicate concentrations greater than the SIL, the modeling results were used to define the action area.

PSD and State NSR guidelines were followed regarding the reporting of preliminary impact analysis concentrations. The modeling output includes an ASCII formatted data file containing the maximum predicted concentration at each model receptor and for each modeling scenario (group). If the maximum predicted concentration was equal or greater than the SIL, the modeling results for that pollutant, averaging period and meteorological data set was imported into electronic spreadsheets for further review. Using these electronic spreadsheets, the maximum predicted highest-first-high (H1H) NO_2 and SO_2 for the modeled year of meteorological data was determined for each receptor and modeling scenario. The H1H PM_{10} concentrations for the five (5) modeled years of meteorological data were determined for each receptor and modeling scenario. Additionally, the average $PM_{2.5}$ concentrations for the five (5) modeled years were determined for each receptor and modeling scenario.

The predicted modeling results are provided in Section 13.

8.0 INFORMATION ON URBAN/RURAL CHARACTERISTICS

A determination of the albedo, Bowen ratio, and surface roughness length of the modeling domain must be made before an atmospheric dispersion model can be run. The TCEQ has determined the albedo values and Bowen ratios for each county in Texas. In order to maintain consistency in the modeling of all proposed projects in Texas, the TCEQ has created pre-processed meteorological data sets for the three general roughness lengths that cover each county in Texas. The modeling method preferred by the TCEQ is to choose one of these three roughness lengths based on a review of the modeling domain.

Mr. Keith Zimmermann, formally of the TCEQ, conducted a number of AERMOD training sessions at various locations prior to the implementation of the model. Guidance obtained during these TCEQ training sessions was relied upon on when determining the meteorological data set for this analysis. The *AERMOD Training* document is currently available on the TCEQ website. Zephyr is not aware of any written TCEQ guidance superseding this document.

The TCEQ's *AERMOD Training* document provides a table showing the land types that correspond to the three roughness lengths in the AERMOD training documentation. The land usage within the Plant's modeling domain match the subcategories included within this table's "medium" roughness parameter category. These include suburban areas, small towns, outskirts of towns, agricultural land, open landscapes with scattered shelters, many trees and hedges with few buildings and low vegetation areas. Additionally, the land usage within the modeling domain does not match the subcategory descriptions for the "low" roughness parameter (hedges, open water, long grass, rangeland, 5 cm grass, airports, smooth snow, ice, etc) or "high" roughness parameter (closed canopy forests, city parks, centers of large towns/cities, urban areas, centers of large towns, etc).

Additional guidance from the TCEQ AERMOD training document requires the applicant to keep the roughness parameter analysis simple and to use the medium roughness category for rural/suburban areas.

Additionally, the EPA's AERSURFACE tool was utilized to determine the surface roughness length for this project. A surface roughness of 0.124 meters was obtained. This is within the 0.1 to 1.0 range stated in the referenced TCEQ AERMOD Training document for Category 2 for the TCEQ's "medium surface roughness" meteorological dataset. All AERSURFACE files are included in electronic form on the computer diskettes supplied as Attachment 26 in the report submitted to the TCEQ.

Based on a comparison of the land usage within the modeling domain with the subcategories listed in the TCEQ guidance table, the TCEQ guidance regarding the modeling of rural/suburban areas, and the results of the AERSURFACE analysis; the "medium" roughness parameter meteorological data set was utilized in the modeling analysis.

9.0 BUILDING WAKE EFFECTS

Building downwash effects were included in the modeling based on guidance provided in the *User's Guide to the Building Profile Input Program* (EPA, October 1993). The EPA currently requires that all building downwash be determined using the EPA Building Profile Input Program (BPIPPRM) subroutine. Oris Solutions, LLC's "BEE-Line BEEST for Windows" was used for calculating downwash parameters for this analysis. This program includes downwash software which uses the latest BPIPPRM subroutine (version 04274) in its calculations.

Plot plans showing the location of the structures that could potentially cause downwash effects on LCRA point sources are included as Attachment 2. The dimensions of these downwash structures are summarized on the table included as Attachment 3. The appropriate information regarding these structures was entered into the BPIP-based software program. The downwash parameters were calculated for each point source by the software program and inserted into the AERMOD input files in the appropriate locations and formats.

10.0 TERRAIN

A map included as Attachment 6 shows the topographic features within the projected AOI. The calculation of the required terrain elevation values are described in Section 11.

11.0 RECEPTOR GRIDS

The receptor grids used in the action area impacts analyses followed the guidelines provided by the TCEQ in their *AQMG*. The receptor coverage utilized for these analyses consisted of the following:

- 1,000 meter spaced receptors to a distance of 30 kilometers from the fenceline,
- 500 meter spaced receptors to a distance of 5 kilometers from the fenceline,
- 100 meter spaced receptors to a distance of 1 kilometer from the fenceline,
- 25 meter spaced receptors to a distance of 200 meters from the fenceline, and
- 25 meter spaced receptors along the fenceline.

The NAD83 datum was used for the receptor UTM coordinates. Oris Solutions LLC's "BEE-Line BEEST for Windows" was used to calculate the appropriate domain boundaries. The USEPA AERMAP program was used to calculate (interpolate) the terrain elevations and local terrain maximum using current 7.5-minute United State Geological Survey (USGS) digital elevation model (DEM) data.

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12.0 METEOROLOGICAL DATA

Current TCEQ modeling guidance was followed concerning meteorological data for AERMOD modeling for sources located in Llano County. Pre-processed meteorological data using surface data from the San Angelo meteorological station with upper air data from the Del Rio International Airport meteorological station was utilized. Five years of representative NWS meteorological data was used for pollutants with PSD-significant emissions. One year of representative NWS meteorological data was used for pollutants with emissions that are not PSD-significant. Pre-processed meteorological data was provided by the TCEQ. The provided meteorological data sets include the 1988 Del Rio set that was reprocessed by the TCEQ in 2011.

The TCEQ-developed "medium" surface roughness value was utilized, as discussed in Section 8.

The base elevation for the San Angelo meteorological station is 1,899 feet.

13.0 MODELING RESULTS

The proposed increases and decreases associated with the project were modeled to determine whether the off-property concentrations are greater than the *de minimis* levels (i.e., the SILs). For pollutants with PSD-significant emissions (PM_{10} and $PM_{2.5}$), the difference between the proposed allowable emission rates and current actual emission rates were modeled for each source. For pollutants that are not PSD-significant (NO_2 and SO_2), the difference between the proposed allowable emission rates and the current allowable emission rates were modeled for each source. The results of the Action Area modeling analysis are summarized in Table 13-1.

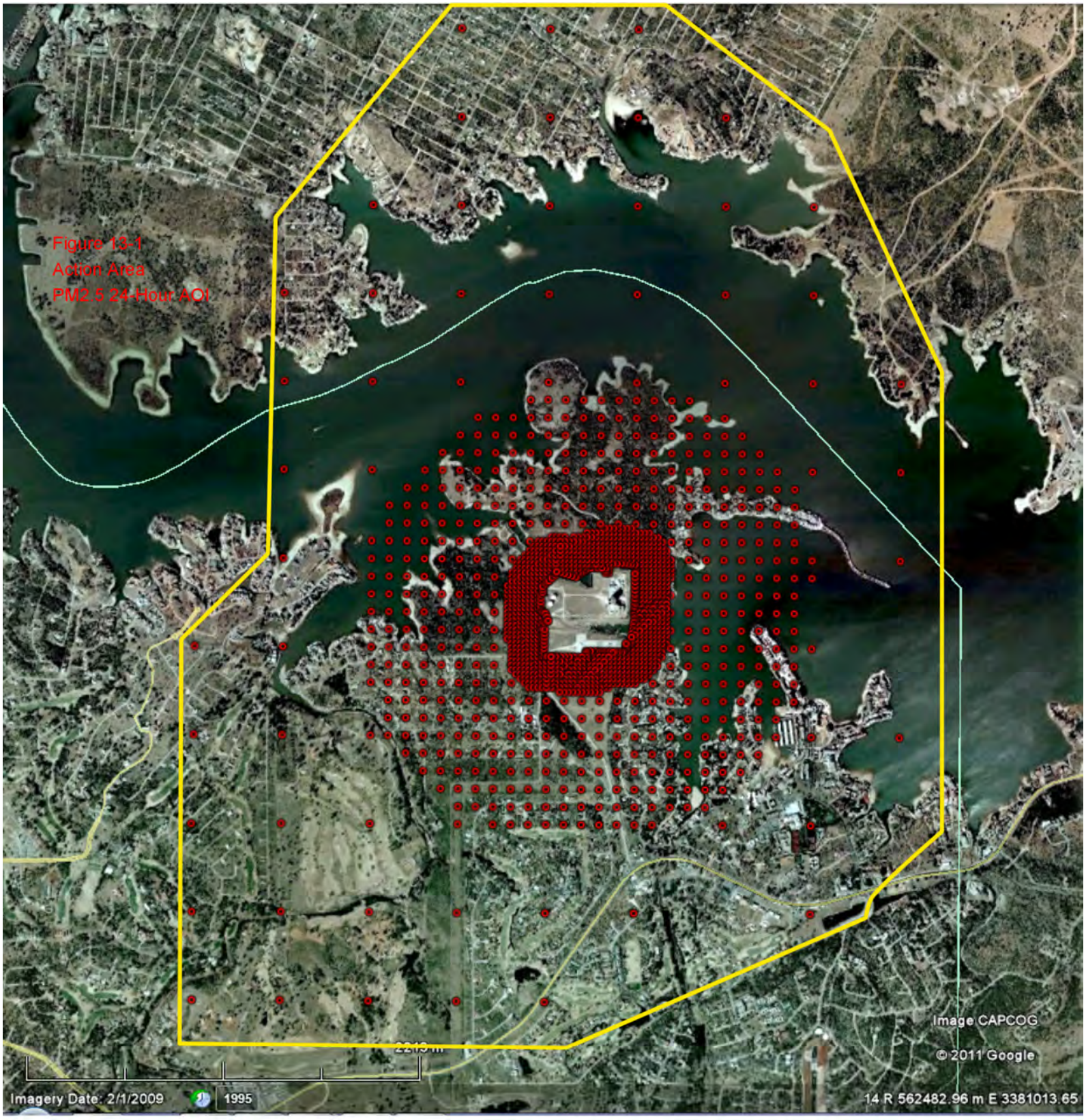
Table 13-1. Action Area Analysis, Final Results

Pollutant	Averaging Period	SIL ($\mu g/m^3$)	Secondary NAAQS ($\mu g/m^3$)	Modeling Results	
				Maximum Predicted Concentration ($\mu g/m^3$)	Action Area, Maximum Distance* (Km)
NO_2	Annual	1	100	0.06	0
SO_2	3-Hour	25	1,300	25.7	0.3
PM_{10}	24-Hour	5	150	17.3	1.4
$PM_{2.5}$	24-Hour	1.2	35	13.3	3.3
	Annual	0.3	15	1.07	1.2

* Distance where predicted (modeled) concentrations become *de minimis* (less than the SIL).

The reported NO_2, SO_2 and PM_{10} concentrations correspond to the highest predicted concentration (H1H) from any receptor over a 5-year period. The reported $PM_{2.5}$ concentrations correspond to the highest of the 5-year average concentration from any receptor.

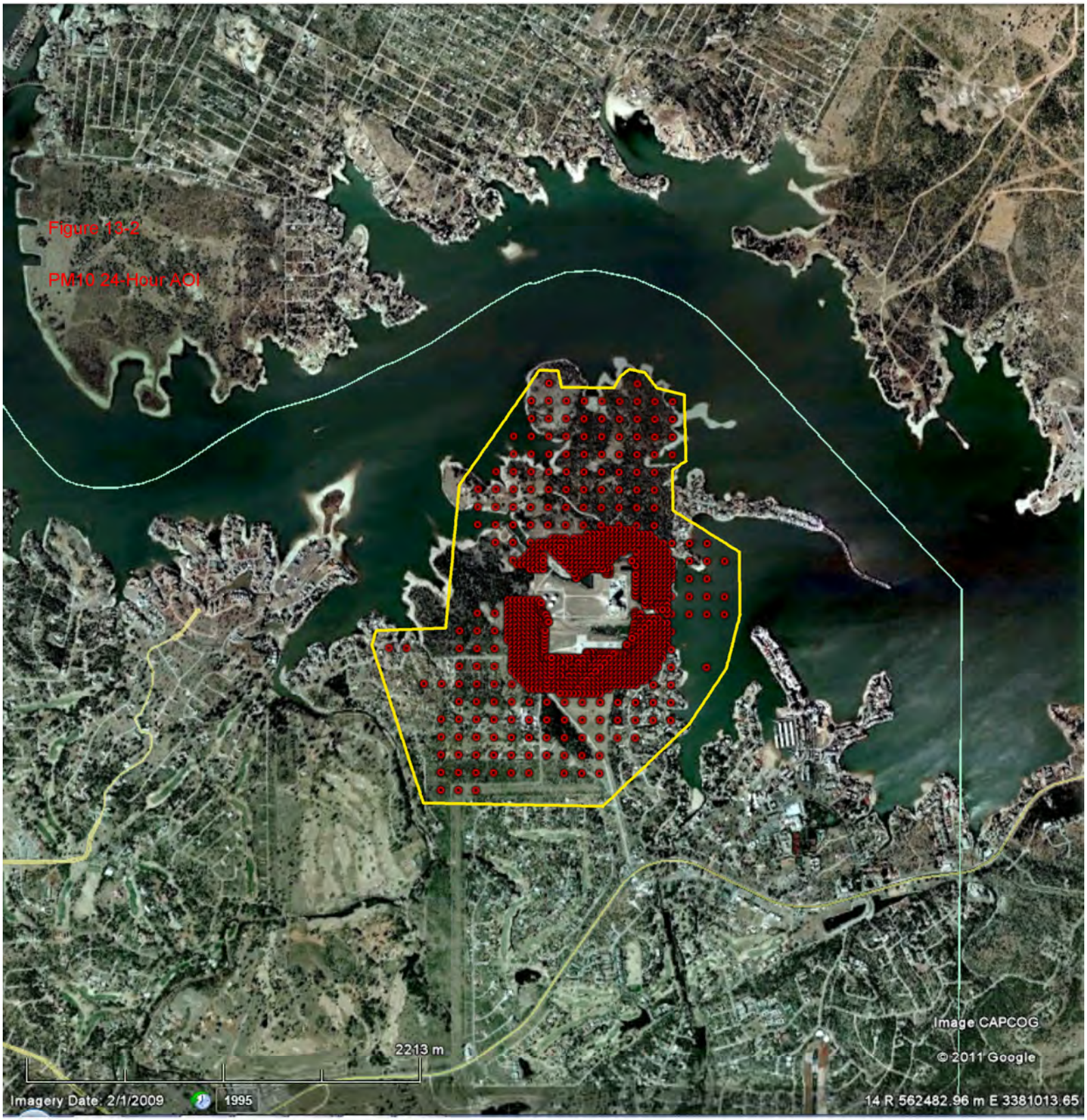
Table 13-1 lists the distances where the predicted concentrations become *de minimis* (ie., do not affect ambient air quality). The $PM_{2.5}$ 24-hour results have the largest distance. Therefore, the modeling results for this pollutant were conservatively utilized to define the Action Area for the Biological Assessment analysis. The Action Area corresponds to the areas with predicted 24-hour $PM_{2.5}$ concentrations greater than the SIL. The modeling receptors with predicted concentrations greater than *de minimis* are illustrated on Figures 13-1 to 13-4 (as red dots). Any impact on air quality outside the defined Action Area can be considered trivial and, therefore, the Biological Assessment does not extend beyond the Action Area.



Action Area

Receptor Where Particulate Matter ($PM_{2.5}$) Is Above Significant Impact Level (SIL)

Figure 13-1
PM2.5 24-Hour AOI



Action Area (If Using PM10)

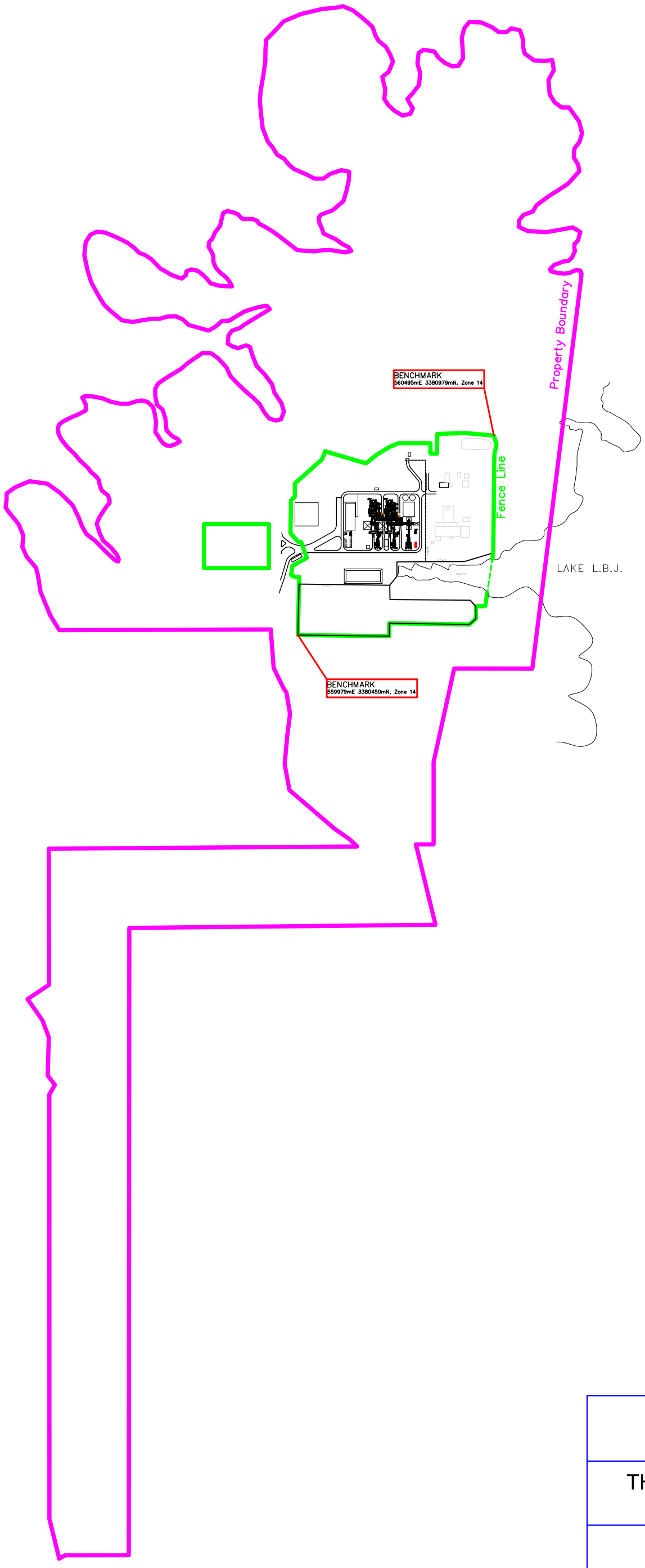
Receptor Where Particulate Matter (PM10) Is Above Significant Impact Level (SIL)

Figure 13-2
PM10 24-Hour AOI

Figure 13-3
PM10 Annual AOI

Figure 13-4
SO2 3-Hour AOI

ATTACHMENT 1
PLOT PLANS



PLOT PLAN

THOMAS C. FERGUSON POWER PLANT

LCRA
ENERGY•WATER•COMMUNITY SERVICES
3700 LAKE AUSTIN BLVD. AUSTIN, TX 78703

File Name: Plot Plan LCRA Ferguson.dwg

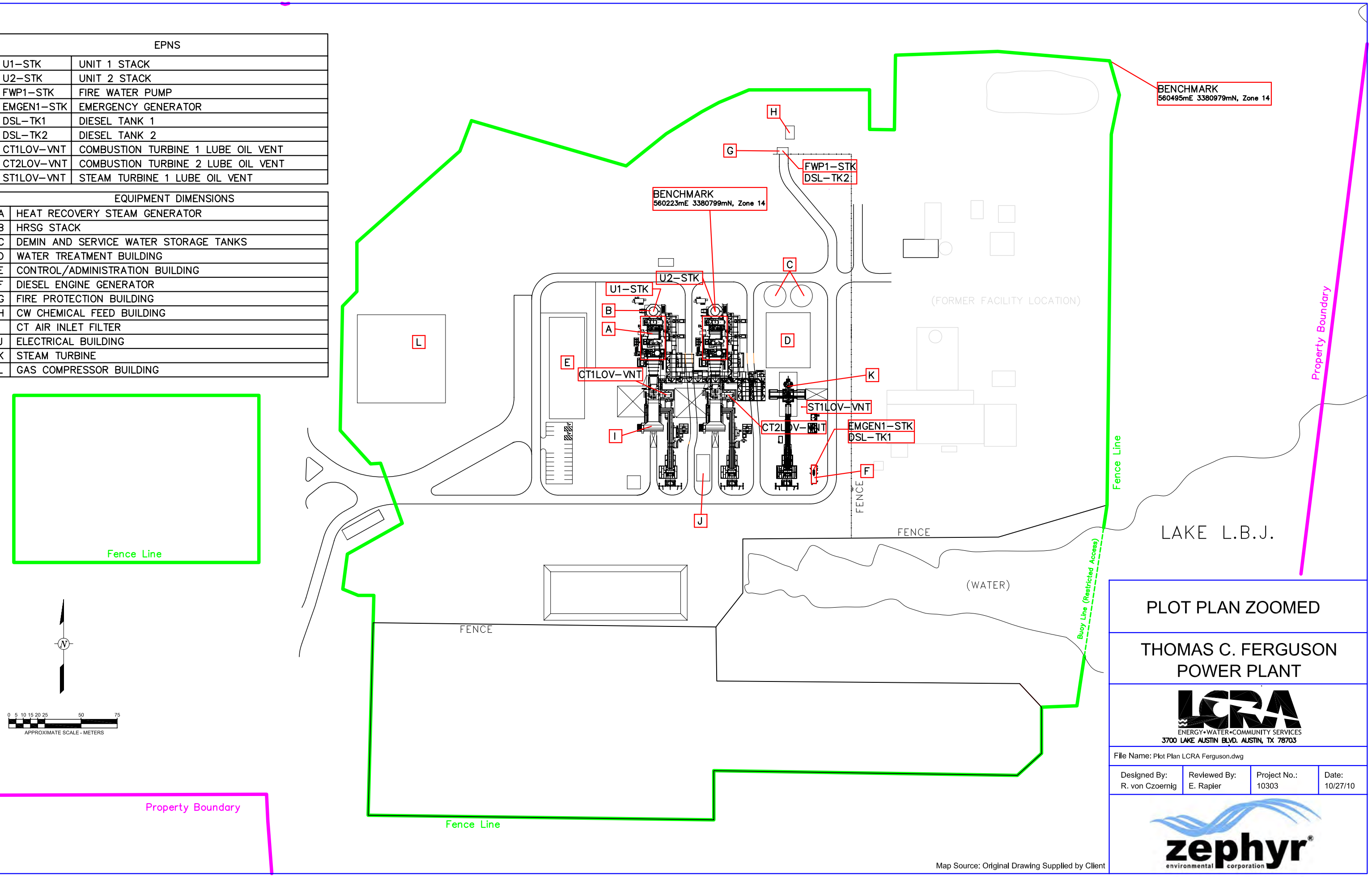
Designed By:	Reviewed By:	Project No.:	Date:
R. von Czoernig	E. Rapier	10303	10/27/10

zephyr environmental corporation

Map Source: Original Drawing Supplied by Client

EPNS	
U1–STK	UNIT 1 STACK
U2–STK	UNIT 2 STACK
FWP1–STK	FIRE WATER PUMP
EMGEN1–STK	EMERGENCY GENERATOR
DSL–TK1	DIESEL TANK 1
DSL–TK2	DIESEL TANK 2
CT1LOV–VNT	COMBUSTION TURBINE 1 LUBE OIL VENT
CT2LOV–VNT	COMBUSTION TURBINE 2 LUBE OIL VENT
ST1LOV–VNT	STEAM TURBINE 1 LUBE OIL VENT

EQUIPMENT DIMENSIONS	
A	HEAT RECOVERY STEAM GENERATOR
B	HRSG STACK
C	DEMIN AND SERVICE WATER STORAGE TANKS
D	WATER TREATMENT BUILDING
E	CONTROL/ADMINISTRATION BUILDING
F	DIESEL ENGINE GENERATOR
G	FIRE PROTECTION BUILDING
H	CW CHEMICAL FEED BUILDING
I	CT AIR INLET FILTER
J	ELECTRICAL BUILDING
K	STEAM TURBINE
L	GAS COMPRESSOR BUILDING



Map Source: Original Drawing Supplied by Client

PLOT PLAN ZOOMED

THOMAS C. FERGUSON POWER PLANT

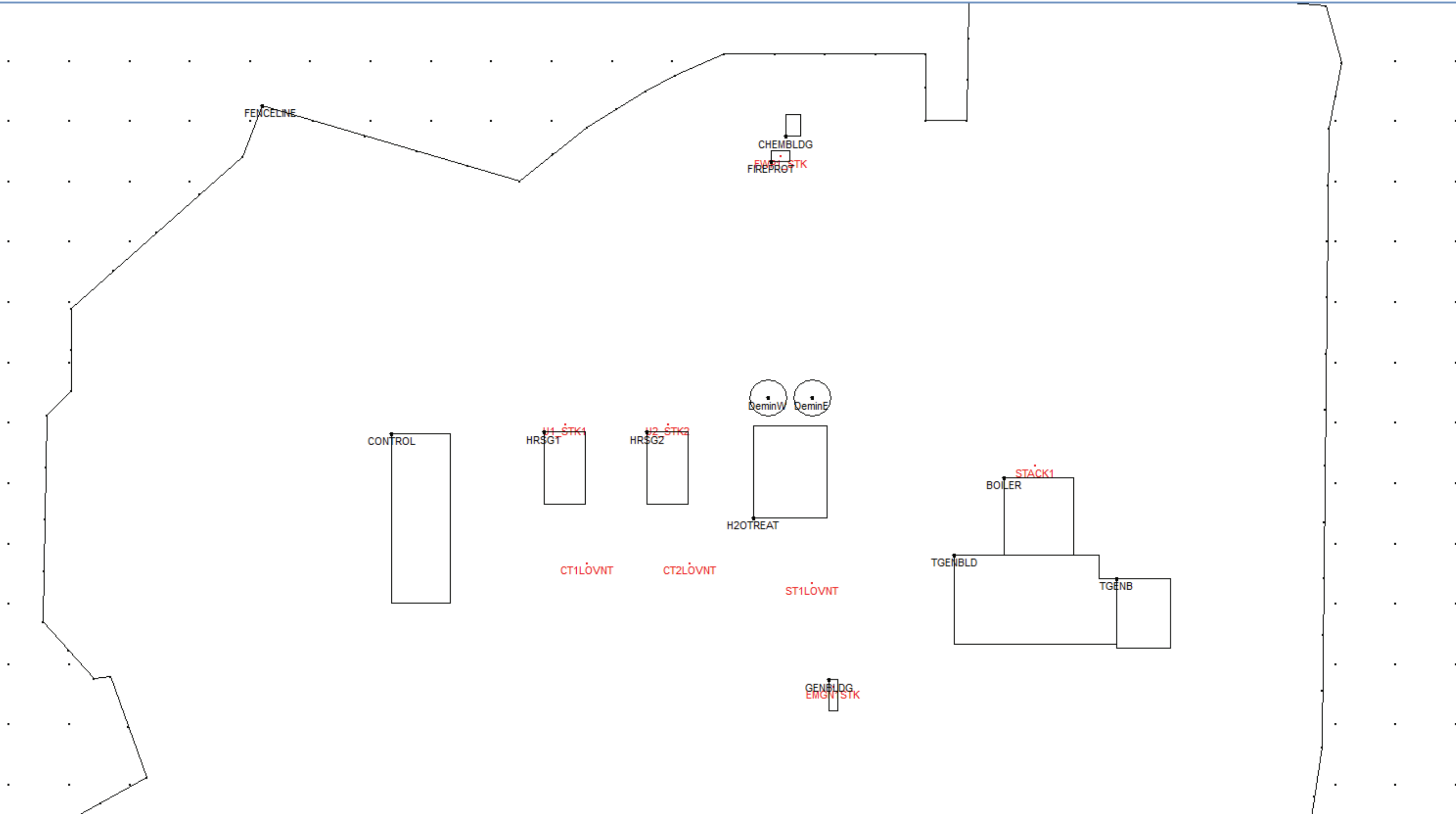
LCRA
ENERGY • WATER • COMMUNITY SERVICES
3700 LAKE AUSTIN BLVD. AUSTIN, TX 78703

File Name: Plot Plan LCRA Ferguson.dwg

Designed By:	Reviewed By:	Project No.:	Date:
R. von Czoernig	E. Rapier	10303	10/27/10

zephyr environmental corporation

ATTACHMENT 2
LOCATION OF POTENTIAL DOWNWASH STRUCTURES

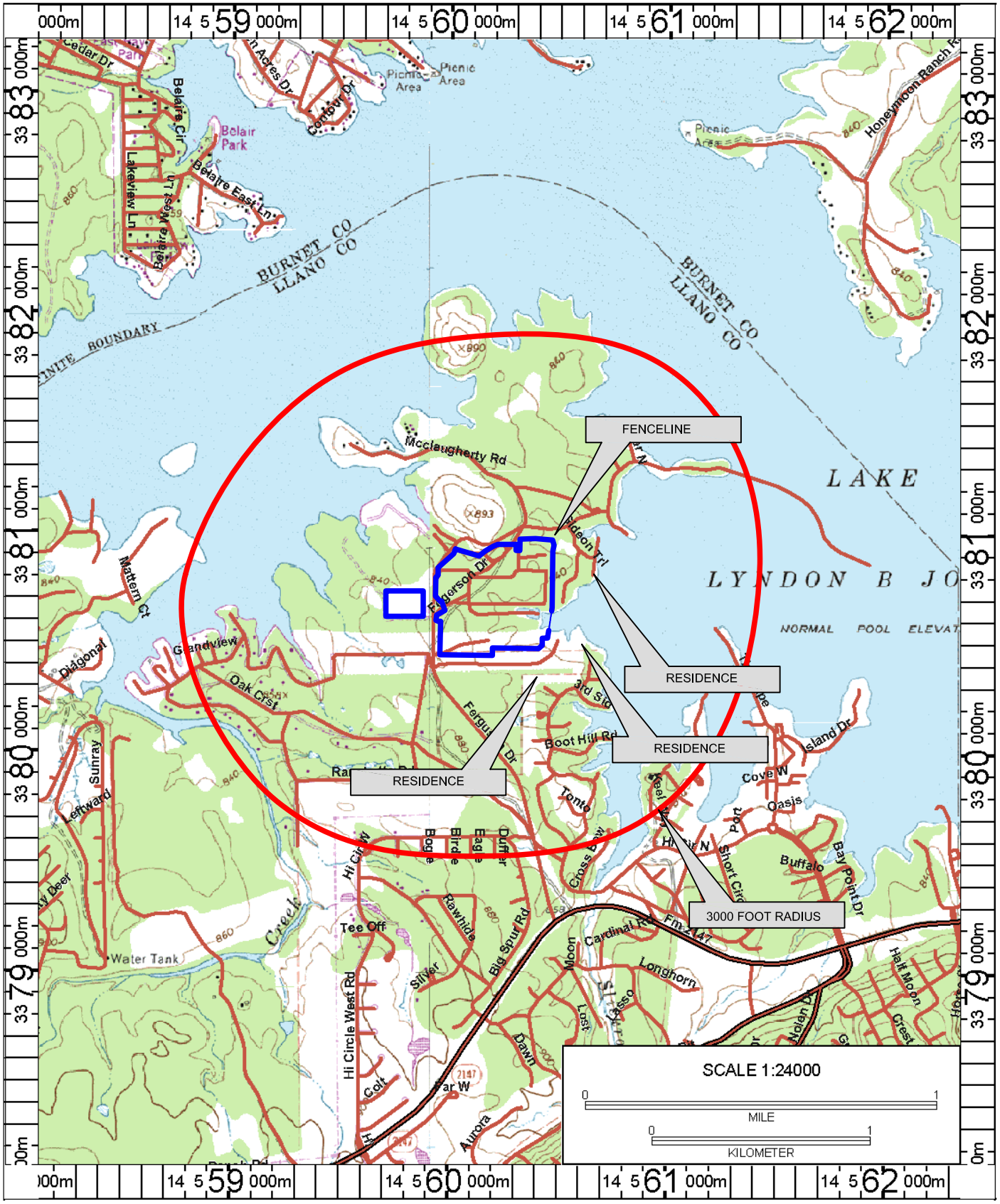

FENCELINE
CHEMBLDG
FIREPROT
EMGN_STK
DeminW
DeminE
CONTROL
U1_STK1
HRSGT
U2_STK2
HRSG2
H2OTREAT
STACK1
BOILER
TGENBLD
TGENB
CT1LOVNT
CT2LOVNT
ST1LOVNT
GENBLDG
EMGN_STK

ATTACHMENT 3
POTENTIAL DOWNWASH STRUCTURES

SUMMARY OF POTENTIAL DOWNWASH STRUCTURES
LCRA THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Structure Description	Modeling ID	Dimensions (approximate)			Base Height (ft)	Modeled Height (ft)
		Width	Length	Diameter		
Buildings	CONTROL	80	230		846	17
	H2OTREAT	100	125		846	32
	GENBLDG	11	42		846	14
	CHEMBLDG	20	30		850	10
	FIREPROT	15	25		850	10
	HRSG1	56	98		846	95
	HRSG2	56	98		846	95
	BOILER	94	105		843.5	160.6
	TGENBLD	120	220		843.5	71.25
	TGENB	73	95		843.5	40
Tanks	DeminW			50.0	846	40
	DeminE			50.0	846	40

ATTACHMENT 4
AREA MAP



Digital USGS 7.5 Minute Topographic Series
–MARBLE FALLS, TX Quadrangle (1967)
–DUNMAN MT, TX Quadrangle (1982)
MAP SOURCE: Terrain Navigator Pro

SITE LOCATION

zephyr environmental corporation

AREA MAP

THOMAS C. FERGUSON POWER PLANT

LCRA ENERGY•WATER•COMMUNITY SERVICES
3700 LAKE AUSTIN BLVD. AUSTIN, TX 78703

File Name: Plot Plan Ferguson.dwg			
Designed By: R. von Czoernig	Reviewed By: E. Rapier	Project No.: 10303	Date: 10/27/10

ATTACHMENT 5
TCEQ TABLE 1(A)

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date: June 24, 2011	**Permit No.: 93938**	**Regulated Entity No.: RN100219468**
Area Name: Thomas C. Ferguson Power Plant		**Customer Reference No.: CN600253637**

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			**2. Component or Air Contaminant Name**	**3. Air Contaminant Emission Rate**	
(A) EPN	**(B) FIN**	**(C) Name**		**(A) Pound Per Hour**	**(B) TPY**
GE 7FA (Option 1)					
U1-STK	U1-STK	Unit 1 Stack	NO_x	18.80	70.36
			NO_x (MSS)	112.0	---
			CO	16.82	141.57
			CO (MSS)	374.0	---
			VOC	4.82	32.79
			VOC (MSS)	70.0	---
			SO_2	27.07	10.86
			PM	33.43	73.10
			PM_{10}	33.43	73.10
			$PM_{2.5}$	33.43	73.10
			H_2SO_4	13.68	5.48

			NH_3	17.89	71.83
			$(NH_4)_2SO_4$	18.43	7.40
U2-STK	U2-STK	Unit 2 Stack	NO_x	18.80	70.36
			NO_x (MSS)	112.0	---
			CO	16.82	141.57
			CO (MSS)	374.0	---
			VOC	4.82	32.79
			VOC (MSS)	70.0	---
			SO_2	27.07	10.86
			PM	33.43	73.10
			PM_{10}	33.43	73.10
			$PM_{2.5}$	33.43	73.10
			H_2SO_4	13.68	5.48
			NH_3	17.89	71.83
			$(NH_4)_2SO_4$	18.43	7.40

Siemens (Option 2)					
U1-STK	U1-STK	Unit 1 Stack	NO_x	34.30	86.44
			NO_x (MSS)	132.0	---
			CO	19.26	390.3
			CO (MSS)	2,295.0	---
			VOC	5.51	93.53
			VOC (MSS)	452.0	---
			SO_2	31.15	12.31
			PM	33.70	63.12
			PM_{10}	33.70	63.12
			$PM_{2.5}$	33.70	63.12
			H_2SO_4	15.74	6.22
			NH_3	20.49	80.94
			$(NH_4)_2SO_4$	21.20	8.37
U2-STK	U2-STK	Unit 2 Stack	NO_x	34.30	86.44
			NO_x (MSS)	132.0	---
			CO	19.26	390.3
			CO (MSS)	2,295.0	---
			VOC	5.51	93.53
			VOC (MSS)	452.0	---
			SO_2	31.15	12.31

			PM	33.70	63.12
			PM_{10}	33.70	63.12
			$PM_{2.5}$	33.70	63.12
			H_2SO_4	15.74	6.22
			NH_3	20.49	80.94
			$(NH_4)_2SO_4$	21.20	8.37
CT1LOV-VNT	CT1LOV-VNT	CT1 Lube Oil Vent	VOC	0.09	0.40
			PM	0.09	0.40
			PM_{10}	0.09	0.40
			$PM_{2.5}$	0.09	0.40
CT2LOV-VNT	CT2LOV-VNT	CT2 Lube Oil Vent	VOC	0.09	0.40
			PM	0.09	0.40
			PM_{10}	0.09	0.40
			$PM_{2.5}$	0.09	0.40
ST1LOV-VNT	ST1LOV-VNT	CT1 Lube Oil Vent	VOC	0.09	0.40
			PM	0.09	0.40
			PM_{10}	0.09	0.40
			$PM_{2.5}$	0.09	0.40
NG-FUG	NG-FUG	Natural Gas Fugitives	VOC	0.03	0.12
NH_3-FUG	NH_3-FUG	Ammonia Fugitives	NH_3	0.12	0.51

EMGEN1-STK	EMGEN1-STK	Emergency Generator	NO_x	16.52	0.83
			CO	9.65	0.48
			VOC	0.89	0.04
			PM	0.55	0.03
			PM_{10}	0.55	0.03
			$PM_{2.5}$	0.55	0.03
			SO_2	<0.01	<0.01
FWP1-STK	FWP1-STK	Fire Water Pump	NO_x	3.81	0.19
			CO	4.12	0.21
			VOC	0.27	0.01
			PM	0.20	0.01
			PM_{10}	0.20	0.01
			$PM_{2.5}$	0.20	0.01
			SO_2	<0.01	<0.01
DSL-TK1	DSL-TK1	Diesel Tank 1	VOC	0.07	<0.01
DSL-TK2	DSL-TK2	Diesel Tank 2	VOC	0.02	<0.01
TURB-MSS	TURB-MSS	ILE Turbine Maintenance Fugitives	PM	0.09	0.02
			PM_{10}	0.09	0.02
			$PM_{2.5}$	<0.01	<0.01
			NH_3	<0.01	<0.01

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Table 1(a) Emission Point Summary

Date:	**10/29/2010**	**Permit No.:**	**TBD**	**Regulated Entity No.:**	**RN100219468**
Area Name:	**Thomas C. Ferguson Power Plant**			**Customer Reference No.:**	**CN600253637**

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA			EMISSION POINT DISCHARGE PARAMETERS										
1. Emission Point			4. UTM Coordinates of Emission Point			Source							
						5. Building Height (ft.)	6. Height Above Ground (ft.)	7. Stack Exit Data			8. Fugitives		
(A) EPN	(B) FIN	(C) NAME	Zone	East (Meters)	North (Meters)			(A) Diameter (ft.)	(B) Velocity (fps)	(C) Temperature (°F)	(A) Length (ft.)	(B) Width (ft.)	(C) Axis Degrees
U1-STK	CTG1	Unit 1 (GE F7FA)	14	560,181	3,380,799		150	19.0	57.0	180			
U2-STK	CTG2	Unit 2 (GE F7FA)	14	560,223	3,380,799		150	19.0	57.0	180			
U1-STK	CTG1	Unit 1 (Siemens SGT6-5000F)	14	560,181	3,380,799		150	19.0	63.9	180			
U2-STK	CTG2	Unit 2 (Siemens SGT6-5000F)	14	560,223	3,380,799		150	19.0	63.9	180			
CT1LOV-VNT	CT1LOV	Combustion Turbine 1 Lube Oil Vent	14	560,190	3,380,742		60	0.003	0.003	115			
CT2LOV-VNT	CT2LOV	Combustion Turbine 2 Lube Oil Vent	14	560,232	3,380,742		60	0.003	0.003	115			
ST1LOV-VNT	ST1LOV	Steam Turbine 1 Lube Oil Vent	14	560,283	3,380,733		4	0.003	0.003	115			
NG-FUG	NG-FUG	Natural Gas Fugitives	14	560,164	3,380,675						84.0	135.0	0.0
NH3-FUG	NH3-FUG	Ammonia Fugitives	14	560,160	3,380,673						90.5	168.0	0.0
EMGEN1-STK	EMGEN1	Emergency Generator	14	560,295	3,380,772		16	0.75	284.5	791			
FWP1-STK	FWP1	Fire Water Pump	14	560,270	3,380,910		16	0.50	294.8	791			
DSL-TK1	DSL-TK1	Diesel Tank 1	14	560,295	3,380,772		6	0.003	0.003	69			
DSL-TK2	DSL-TK2	Diesel Tank 2	14	560,270	3,380,910		5	0.003	0.003	69			

EPN = Emission Point Number
FIN = Facility Identification Number

ATTACHMENT 6
MODELED STACK PARAMETERS

MODELED STACK PARAMETERS - POINT SOURCES
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	UTM NAD83 (m)		Elevation (m)	Height (m)	Temperature (K)	Velocity (m/s)	Diameter (m)
		Easting	Northing					
STACK1	Existing Boiler	560375.5	3380782.1	257.1	56.24	405.37	19.67	6.096
G100_U1	Unit 1 GE, 100% Load	560180.6	3380799.5	257.9	45.72	355.37	18.71	5.791
G100_U2	Unit 2 GE, 100% Load	560223.3	3380799.5	257.9	45.72	355.37	18.71	5.791
G075_U1	Unit 1 GE, 75% Load	560180.6	3380799.5	257.9	45.72	355.37	13.09	5.791
G075_U2	Unit 2 GE, 75% Load	560223.3	3380799.5	257.9	45.72	355.37	13.09	5.791
G050_U1	Unit 1 GE, 50% Load	560180.6	3380799.5	257.9	45.72	355.37	11.24	5.791
G050_U2	Unit 2 GE, 50% Load	560223.3	3380799.5	257.9	45.72	355.37	11.24	5.791
GRAMP_U1	Unit 1 GE, Ramping	560180.6	3380799.5	257.9	45.72	355.37	18.71	5.791
GRAMP_U2	Unit 2 GE, Ramping	560223.3	3380799.5	257.9	45.72	355.37	18.71	5.791
GSUSD_U1	Unit 1 GE, Startup Shutdown	560180.6	3380799.5	257.9	45.72	355.37	9.408	5.791
GSUSD_U2	Unit 2 GE, Startup Shutdown	560223.3	3380799.5	257.9	45.72	355.37	9.408	5.791
S100_U1	Unit 1 Siemens, 100% Load	560180.6	3380799.5	257.9	45.72	355.37	21.27	5.791
S100_U2	Unit 2 Siemens, 100% Load	560223.3	3380799.5	257.9	45.72	355.37	21.27	5.791
S075_U1	Unit 1 Siemens, 75% Load	560180.6	3380799.5	257.9	45.72	355.37	14.82	5.791
S075_U2	Unit 2 Siemens, 75% Load	560223.3	3380799.5	257.9	45.72	355.37	14.82	5.791
S060_U1	Unit 1 Siemens, 60% Load	560180.6	3380799.5	257.9	45.72	355.37	13.19	5.791
S060_U2	Unit 2 Siemens, 60% Load	560223.3	3380799.5	257.9	45.72	355.37	13.19	5.791
SRAMP_U1	Unit 1 Siemens, Ramping	560180.6	3380799.5	257.9	45.72	355.37	21.27	5.791
SRAMP_U2	Unit 2 Siemens, Ramping	560223.3	3380799.5	257.9	45.72	355.37	21.27	5.791
SSUSD_U1	Unit 1 Siemens, Startup Shutdown	560180.6	3380799.5	257.9	45.72	355.37	11.19	5.791
SSUSD_U2	Unit 2 Siemens, Startup Shutdown	560223.3	3380799.5	257.9	45.72	355.37	11.19	5.791
EMGN1STK	Emergency Generator	560291.7	3380690.4	257.9	4.877	694.82	86.72	0.2286
FWP1_STK	Fire Water Pump	560269.9	3380910.4	259.1	3.658	694.82	89.85	0.1524
CT1LOVNT	Combustion Turbine 1 Lube Oil Vent	560189.7	3380741.7	257.9	1.00	0	0.001	0.001
CT2LOVNT	Combustion Turbine 2 Lube Oil Vent	560232.3	3380741.8	257.9	1.00	0	0.001	0.001
ST1LOVNT	Steam Turbine 1 Lube Oil Vent	560283.1	3380733.4	257.9	1.00	0	0.001	0.001
MSSWASH_U1	MSS, Online Turbine 1 Washing	560180.6	3380799.5	257.9	45.72	355.37	18.71	5.791
MSSWASH_U2	MSS, Online Turbine 2 Washing	560223.3	3380799.5	257.9	45.72	355.37	18.71	5.791
MSSFILTER	MSS, Filter Changeout	560180.6	3380715.0	257.9	3.658	0	0.001	0.001
MSSCATALYST	MSS, Catalyst Handling	560180.6	3380796.0	257.9	3.658	0	0.001	0.001

MODELED EXHAUST PARAMETERS - AREA SOURCES
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	UTM NAD83 (m)		Elevation	Height	East Length	North Length	Angle	Vertical Dimension
		Easting	Northing	(m)	(m)	(m)	(m)	(degrees)	(m)
NH3_FUG	Ammonia Fugitives	560170.0	3380762.0	257.9	1.000	64.01	38.10	0	

PHYSICAL EXHAUST PARAMETERS - POINT SOURCES
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	UTM NAD83 (m)		Elevation	Height	Temperature	Velocity	Diameter
		Easting	Northing	(ft)	(ft)	(ºF)	(ft/sec)	(ft)
STACK1	Existing Boiler	560375.5	3380782.1	844	185	270	64.55	20
G100_U1	Unit 1 GE, 100% Load	560180.6	3380799.5	846	150	180	61.40	19
G100_U2	Unit 2 GE, 100% Load	560223.3	3380799.5	846	150	180	61.40	19
G075_U1	Unit 1 GE, 75% Load	560180.6	3380799.5	846	150	180	42.96	19
G075_U2	Unit 2 GE, 75% Load	560223.3	3380799.5	846	150	180	42.96	19
G050_U1	Unit 1 GE, 50% Load	560180.6	3380799.5	846	150	180	36.87	19
G050_U2	Unit 2 GE, 50% Load	560223.3	3380799.5	846	150	180	36.87	19
GRAMP_U1	Unit 1 GE, Ramping	560180.6	3380799.5	846	150	180	61.40	19
GRAMP_U2	Unit 2 GE, Ramping	560223.3	3380799.5	846	150	180	61.40	19
GSUSD_U1	Unit 1 GE, Startup Shutdown	560180.6	3380799.5	846	150	180	30.87	19
GSUSD_U2	Unit 2 GE, Startup Shutdown	560223.3	3380799.5	846	150	180	30.87	19
S100_U1	Unit 1 Siemens, 100% Load	560180.6	3380799.5	846	150	180	69.77	19
S100_U2	Unit 2 Siemens, 100% Load	560223.3	3380799.5	846	150	180	69.77	19
S075_U1	Unit 1 Siemens, 75% Load	560180.6	3380799.5	846	150	180	48.63	19
S075_U2	Unit 2 Siemens, 75% Load	560223.3	3380799.5	846	150	180	48.63	19
S060_U1	Unit 1 Siemens, 60% Load	560180.6	3380799.5	846	150	180	43.26	19
S060_U2	Unit 2 Siemens, 60% Load	560223.3	3380799.5	846	150	180	43.26	19
SRAMP_U1	Unit 1 Siemens, Ramping	560180.6	3380799.5	846	150	180	69.77	19
SRAMP_U2	Unit 2 Siemens, Ramping	560223.3	3380799.5	846	150	180	69.77	19
SSUSD_U1	Unit 1 Siemens, Startup Shutdown	560180.6	3380799.5	846	150	180	36.73	19
SSUSD_U2	Unit 2 Siemens, Startup Shutdown	560223.3	3380799.5	846	150	180	36.73	19
EMGN1STK	Emergency Generator	560291.7	3380690.4	846	16	791	284.5	0.75
FWP1_STK	Fire Water Pump	560269.9	3380910.4	850	12	791	294.8	0.50
CT1LOVNT	Combustion Turbine 1 Lube Oil Vent	560189.7	3380741.7	846				
CT2LOVNT	Combustion Turbine 2 Lube Oil Vent	560232.3	3380741.8	846				
ST1LOVNT	Steam Turbine 1 Lube Oil Vent	560283.1	3380733.4	846				
MSSWASH_U1	MSS, Online Turbine 1 Washing	560180.6	3380799.5	846	150	180	61.40	19
MSSWASH_U2	MSS, Online Turbine 2 Washing	560223.3	3380799.5	846	150	180	61.40	19
MSSFILTER	MSS, Filter Changeout	560180.6	3380715.0	846	12			
MSSCATALYST	MSS, Catalyst Handling	560180.6	3380796.0	846	12			

PHYSICAL EXHAUST PARAMETERS - AREA SOURCES
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	UTM NAD83 (m)		Elevation	Height	East Length	North Length	Angle	Vertical Dimension
		Easting	Northing	(ft)	(ft)	(ft)	(ft)	(degrees)	(ft)
NH3_FUG	Ammonia Fugitives	560170.0	3380762.0	846	3.281	210	125	0	

ATTACHMENT 7
PROPOSED ALLOWABLE EMISSIONS

PROPOSED ALLOWABLE EMISSIONS - PROJECT RELATED
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	NOX		CO		SO2		PM10		PM2.5		H2SO4		(NH4)2SO4		NH3	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
STACK1	Existing Boiler																
G100_U1	Unit 1 GE, 100% Load	13.81	55.44	16.82	67.51	27.07	10.87	33.43	73.10	33.43	73.10	13.68	5.49	18.43	7.40	17.89	71.84
G100_U2	Unit 2 GE, 100% Load	13.81	55.44	16.82	67.51	27.07	10.87	33.43	73.10	33.43	73.10	13.68	5.49	18.43	7.40	17.89	71.84
G075_U1	Unit 1 GE, 75% Load	11.03		13.44		21.83		29.86		29.86		11.03		14.86		14.30	
G075_U2	Unit 2 GE, 75% Load	11.03		13.44		21.83		29.86		29.86		11.03		14.86		14.30	
G050_U1	Unit 1 GE, 50% Load	8.752		11.806		17.496		26.909		26.909		8.839		11.909		11.340	
G050_U2	Unit 2 GE, 50% Load	8.752		11.806		17.496		26.909		26.909		8.839		11.909		11.340	
GRAMP_U1	Unit 1 GE, Ramping	18.80															
GRAMP_U2	Unit 2 GE, Ramping	18.80															
GSUSD_U1	Unit 1 GE, Startup Shutdown	111.6	18.06	374.0	77.92	27.07		33.43		33.43		13.68		18.43		17.89	
GSUSD_U2	Unit 2 GE, Startup Shutdown	111.6	18.06	374.0	77.92	27.07		33.43		33.43		13.68		18.43		17.89	
S100_U1	Unit 1 Siemens, 100% Load	15.81	62.47	19.26	76.07	31.15	12.32	33.70	63.14	33.70	63.14	15.74	6.22	21.20	8.39	20.49	80.94
S100_U2	Unit 2 Siemens, 100% Load	15.81	62.47	19.26	76.07	31.15	12.32	33.70	63.14	33.70	63.14	15.74	6.22	21.20	8.39	20.49	80.94
S075_U1	Unit 1 Siemens, 75% Load	12.52		15.24		24.62		29.26		29.26		12.44		16.76		16.22	
S075_U2	Unit 2 Siemens, 75% Load	12.52		15.24		24.62		29.26		29.26		12.44		16.76		16.22	
S060_U1	Unit 1 Siemens, 60% Load	10.65		12.97		20.97		26.77		26.77		10.59		14.27		13.81	
S060_U2	Unit 2 Siemens, 60% Load	10.65		12.97		20.97		26.77		26.77		10.59		14.27		13.81	
SRAMP_U1	Unit 1 Siemens, Ramping	34.42															
SRAMP_U2	Unit 2 Siemens, Ramping	34.42															
SSUSD_U1	Unit 1 Siemens, Startup Shutdown	132.2	27.54	2,295	318.6	31.15		33.70		33.70		15.74		21.20		20.49	
SSUSD_U2	Unit 2 Siemens, Startup Shutdown	132.2	27.54	2,295	318.6	31.15		33.70		33.70		15.74		21.20		20.49	
EMGN1STK	Emergency Generator	16.52	0.8258	9.645	0.4823	1.626E-04	8.130E-06	0.5511	0.02756	0.5511	0.02756						
FWP1_STK	Fire Water Pump	3.809	0.1904	4.122	0.2061	7.487E-05	3.744E-06	0.2040	0.01020	0.2040	0.01020						
CT1LOVNT	Combustion Turbine 1 Lube Oil Vent							0.09076	0.3975	0.09076	0.3975						
CT2LOVNT	Combustion Turbine 2 Lube Oil Vent							0.09076	0.3975	0.09076	0.3975						
ST1LOVNT	Steam Turbine 1 Lube Oil Vent							0.09076	0.3975	0.09076	0.3975						
MSSWASH_U1	MSS, Online Turbine 1 Washing							0.04613	0.008418	0.04613	0.008418						
MSSWASH_U2	MSS, Online Turbine 2 Washing							0.04613	0.008418	0.04613	0.008418						
MSSFILTER	MSS, Filter Changeout							2.701E-04	6.482E-06	4.090E-05	9.816E-07						
MSSCATALYST	MSS, Catalyst Handling							0.05126	0.002461	0.05126	0.002461					0.01	0.01
NH3_FUG	Ammonia Fugitives															0.1164	0.5097

ATTACHMENT 8
CURRENT ACTUAL EMISSIONS

CURRENT ACTUAL EMISSIONS
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	NOX		CO		SO2		PM		H2SO4		(NH4)2SO4		NH3	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
STACK1	Existing Boiler	199.0	1,538.80	12.49	38.50	0.9794	3.00	11.54	35.90	0.08447	0.37				
G100_U1	Unit 1 GE, 100% Load														
G100_U2	Unit 2 GE, 100% Load														
G075_U1	Unit 1 GE, 75% Load														
G075_U2	Unit 2 GE, 75% Load														
G050_U1	Unit 1 GE, 50% Load														
G050_U2	Unit 2 GE, 50% Load														
GRAMP_U1	Unit 1 GE, Ramping														
GRAMP_U2	Unit 2 GE, Ramping														
GSUSD_U1	Unit 1 GE, Startup Shutdown														
GSUSD_U2	Unit 2 GE, Startup Shutdown														
S100_U1	Unit 1 Siemens, 100% Load														
S100_U2	Unit 2 Siemens, 100% Load														
S075_U1	Unit 1 Siemens, 75% Load														
S075_U2	Unit 2 Siemens, 75% Load														
S060_U1	Unit 1 Siemens, 60% Load														
S060_U2	Unit 2 Siemens, 60% Load														
SRAMP_U1	Unit 1 Siemens, Ramping														
SRAMP_U2	Unit 2 Siemens, Ramping														
SSUSD_U1	Unit 1 Siemens, Startup Shutdown														
SSUSD_U2	Unit 2 Siemens, Startup Shutdown														
EMGN1STK	Emergency Generator														
FWP1_STK	Fire Water Pump														
CT1LOVNT	Combustion Turbine 1 Lube Oil Vent														
CT2LOVNT	Combustion Turbine 2 Lube Oil Vent														
ST1LOVNT	Steam Turbine 1 Lube Oil Vent														
MSSWASH_U1	MSS, Online Turbine 1 Washing														
MSSWASH_U2	MSS, Online Turbine 2 Washing														
MSSFILTER	MSS, Filter Changeout														
MSSCATALYST	MSS, Catalyst Handling														
NH3_FUG	Ammonia Fugitives														

ATTACHMENT 9
CURRENT ALLOWABLE EMISSIONS

CURRENT ALLOWABLES - STANDARD PERMIT 90132, SEPTEMBER 28, 2009
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	NOX		CO		SO2		PM10		H2SO4		(NH4)2SO4		NH3	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
STACK1	Existing Boiler	3,860.8	8,455.20	458.800	1,063.90	1,168.10	426.10	79.200	98.80						
G100_U1	Unit 1 GE, 100% Load														
G100_U2	Unit 2 GE, 100% Load														
G075_U1	Unit 1 GE, 75% Load														
G075_U2	Unit 2 GE, 75% Load														
G050_U1	Unit 1 GE, 50% Load														
G050_U2	Unit 2 GE, 50% Load														
GRAMP_U1	Unit 1 GE, Ramping														
GRAMP_U2	Unit 2 GE, Ramping														
GSUSD_U1	Unit 1 GE, Startup Shutdown														
GSUSD_U2	Unit 2 GE, Startup Shutdown														
S100_U1	Unit 1 Siemens, 100% Load														
S100_U2	Unit 2 Siemens, 100% Load														
S075_U1	Unit 1 Siemens, 75% Load														
S075_U2	Unit 2 Siemens, 75% Load														
S060_U1	Unit 1 Siemens, 60% Load														
S060_U2	Unit 2 Siemens, 60% Load														
SRAMP_U1	Unit 1 Siemens, Ramping														
SRAMP_U2	Unit 2 Siemens, Ramping														
SSUSD_U1	Unit 1 Siemens, Startup Shutdown														
SSUSD_U2	Unit 2 Siemens, Startup Shutdown														
EMGN1STK	Emergency Generator														
FWP1_STK	Fire Water Pump														
CT1LOVNT	Combustion Turbine 1 Lube Oil Vent														
CT2LOVNT	Combustion Turbine 2 Lube Oil Vent														
ST1LOVNT	Steam Turbine 1 Lube Oil Vent														
MSSWASH_U1	MSS, Online Turbine 1 Washing														
MSSWASH_U2	MSS, Online Turbine 2 Washing														
MSSFILTER	MSS, Filter Changeout														
MSSCATALYST	MSS, Catalyst Handling														
NH3_FUG	Ammonia Fugitives														

ATTACHMENT 10
MODELED EMISSIONS, PSD POLLUTANTS

MODELED EMISSION INCREASES - ALLOWABLES MINUS ACTUALS (GRAMS/SEC)
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	CO		PM10	
		ST01	ST08	ST24	ANN
STACK1	Existing Boiler	-1.573	-1.573	-1.454	-1.033
G100_U1	Unit 1 GE, 100% Load	2.119	2.119	4.212	2.103
G100_U2	Unit 2 GE, 100% Load	2.119	2.119	4.212	2.103
G075_U1	Unit 1 GE, 75% Load	1.693	1.693	3.762	0
G075_U2	Unit 2 GE, 75% Load	1.693	1.693	3.762	0
G050_U1	Unit 1 GE, 50% Load	1.488	1.488	3.391	0
G050_U2	Unit 2 GE, 50% Load	1.488	1.488	3.391	0
GRAMP_U1	Unit 1 GE, Ramping	0	0	0	0
GRAMP_U2	Unit 2 GE, Ramping	0	0	0	0
GSUSD_U1	Unit 1 GE, Startup Shutdown	47.12	47.12	4.212	0
GSUSD_U2	Unit 2 GE, Startup Shutdown	47.12	47.12	4.212	0
S100_U1	Unit 1 Siemens, 100% Load	2.426	2.426	4.247	1.816
S100_U2	Unit 2 Siemens, 100% Load	2.426	2.426	4.247	1.816
S075_U1	Unit 1 Siemens, 75% Load	1.920	1.920	3.687	0
S075_U2	Unit 2 Siemens, 75% Load	1.920	1.920	3.687	0
S060_U1	Unit 1 Siemens, 60% Load	1.635	1.635	3.373	0
S060_U2	Unit 2 Siemens, 60% Load	1.635	1.635	3.373	0
SRAMP_U1	Unit 1 Siemens, Ramping	0	0	0	0
SRAMP_U2	Unit 2 Siemens, Ramping	0	0	0	0
SSUSD_U1	Unit 1 Siemens, Startup Shutdown	289.1	289.1	4.247	0
SSUSD_U2	Unit 2 Siemens, Startup Shutdown	289.1	289.1	4.247	0
EMGN1STK	Emergency Generator	1.215	0.1519	0.002894	0.0007927
FWP1_STK	Fire Water Pump	0.2597	0.03246	0.0005356	0.0002935
CT1LOVNT	Combustion Turbine 1 Lube Oil Vent	0	0	0.01144	0.01144
CT2LOVNT	Combustion Turbine 2 Lube Oil Vent	0	0	0.01144	0.01144
ST1LOVNT	Steam Turbine 1 Lube Oil Vent	0	0	0.01144	0.01144
MSSWASH_U1	MSS, Online Turbine 1 Washing	0	0	0.0002422	0.0002422
MSSWASH_U2	MSS, Online Turbine 2 Washing	0	0	0.0002422	0.0002422
MSSFILTER	MSS, Filter Changeout	0	0	1.418E-06	1.865E-07
MSSCATALYST	MSS, Catalyst Handling	0	0	0.0002691	7.079E-05
NH3_FUG	Ammonia Fugitives	0	0	0	0

Note: FWP1_STK values correspond to maximum 30 minutes of testing.

ATTACHMENT 11
MODELED EMISSIONS, STATE NSR POLLUTANTS

MODELED EMISSION INCREASES - ALLOWABLES MINUS ALLOWABLES (GRAMS/SEC)
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

Modeling ID	Description	NO2		SO2			
		ST01	ANN	ST01	ST03	ST24	ANN
STACK1	Existing Boiler	-389.2	-182.4	-147.2	-147.2	-147.2	-12.26
G100_U1	Unit 1 GE, 100% Load	1.392	1.196	3.411	3.411	3.411	0.3128
G100_U2	Unit 2 GE, 100% Load	1.392	1.196	3.411	3.411	3.411	0.3128
G075_U1	Unit 1 GE, 75% Load	1.112	0	2.751	2.751	2.751	0
G075_U2	Unit 2 GE, 75% Load	1.112	0	2.751	2.751	2.751	0
G050_U1	Unit 1 GE, 50% Load	0.8822	0	2.205	2.205	2.205	0
G050_U2	Unit 2 GE, 50% Load	0.8822	0	2.205	2.205	2.205	0
GRAMP_U1	Unit 1 GE, Ramping	1.895	0	0	0	0	0
GRAMP_U2	Unit 2 GE, Ramping	1.895	0	0	0	0	0
GSUSD_U1	Unit 1 GE, Startup Shutdown	11.25	1.707	3.411	3.411	3.411	0
GSUSD_U2	Unit 2 GE, Startup Shutdown	11.25	1.707	3.411	3.411	3.411	0
S100_U1	Unit 1 Siemens, 100% Load	1.594	1.348	3.925	3.925	3.925	0.3545
S100_U2	Unit 2 Siemens, 100% Load	1.594	1.348	3.925	3.925	3.925	0.3545
S075_U1	Unit 1 Siemens, 75% Load	1.262	0	3.102	3.102	3.102	0
S075_U2	Unit 2 Siemens, 75% Load	1.262	0	3.102	3.102	3.102	0
S060_U1	Unit 1 Siemens, 60% Load	1.074	0	2.642	2.642	2.642	0
S060_U2	Unit 2 Siemens, 60% Load	1.074	0	2.642	2.642	2.642	0
SRAMP_U1	Unit 1 Siemens, Ramping	3.470	0	0	0	0	0
SRAMP_U2	Unit 2 Siemens, Ramping	3.470	0	0	0	0	0
SSUSD_U1	Unit 1 Siemens, Startup Shutdown	13.32	2.602	3.925	3.925	3.925	0
SSUSD_U2	Unit 2 Siemens, Startup Shutdown	13.32	2.602	3.925	3.925	3.925	0
EMGN1STK	Emergency Generator	1.665	0.01782	2.049E-05	6.830E-06	8.537E-07	2.339E-07
FWP1_STK	Fire Water Pump	0.1920	0.004109	4.717E-06	1.572E-06	1.965E-07	1.077E-07
CT1LOVNT	Combustion Turbine 1 Lube Oil Vent	0	0	0	0	0	0
CT2LOVNT	Combustion Turbine 2 Lube Oil Vent	0	0	0	0	0	0
ST1LOVNT	Steam Turbine 1 Lube Oil Vent	0	0	0	0	0	0
MSSWASH_U1	MSS, Online Turbine 1 Washing	0	0	0	0	0	0
MSSWASH_U2	MSS, Online Turbine 2 Washing	0	0	0	0	0	0
MSSFILTER	MSS, Filter Changeout	0	0	0	0	0	0
MSSCATALYST	MSS, Catalyst Handling	0	0	0	0	0	0
NH3_FUG	Ammonia Fugitives	0	0	0	0	0	0

Note: FWP1_STK values correspond to maximum 30 minutes of testing.

ATTACHMENT 12
MODELING IDENTIFICATION CROSS REFERENCE

MODELING IDENTIFICATION CROSS REFERENCE
LCRA - THOMAS C. FERGUSON POWER PLANT
LLANO COUNTY, TEXAS

FIN	EPN	Modeling ID	Description
	STACK1	STACK1	Existing Boiler
CTG1	U1-STK	G100_U1	Unit 1 GE, 100% Load
		G075_U1	Unit 1 GE, 75% Load
		G050_U1	Unit 1 GE, 50% Load
		GRAMP_U1	Unit 1 GE, Ramping
		GSUSD_U1	Unit 1 GE, Startup Shutdown
		S100_U1	Unit 1 Siemens, 100% Load
		S075_U1	Unit 1 Siemens, 75% Load
		S060_U1	Unit 1 Siemens, 60% Load
		SRAMP_U1	Unit 1 Siemens, Ramping
		SSUSD_U1	Unit 1 Siemens, Startup Shutdown
CTG2	U2-STK	G100_U2	Unit 2 GE, 100% Load
		G075_U2	Unit 2 GE, 75% Load
		G050_U2	Unit 2 GE, 50% Load
		GRAMP_U2	Unit 2 GE, Ramping
		GSUSD_U2	Unit 2 GE, Startup Shutdown
		S100_U2	Unit 2 Siemens, 100% Load
		S075_U2	Unit 2 Siemens, 75% Load
		S060_U2	Unit 2 Siemens, 60% Load
		SRAMP_U2	Unit 2 Siemens, Ramping
		SSUSD_U2	Unit 2 Siemens, Startup Shutdown
EMGEN1	EMGEN1-STK	EMGN1STK	Emergency Generator
FWP1	FWP1-STK	FWP1_STK	Fire Water Pump
CT1LOV	CT1LOV-VNT	CT1LOVNT	Combustion Turbine 1 Lube Oil Vent
CT2LOV	CT2LOV-VNT	CT2LOVNT	Combustion Turbine 2 Lube Oil Vent
ST1LOV	ST1LOV-VNT	ST1LOVNT	Steam Turbine 1 Lube Oil Vent
TURB-MSS	TURB-MSS	MSSWASH_U1	MSS, Online Turbine 1 Washing
		MSSWASH_U2	MSS, Online Turbine 2 Washing
		MSSFILTER	MSS, Filter Changeout
		MSSCATALYST	MSS, Catalyst Handling
NH3-FUG	NH3-FUG	NH3_FUG	Ammonia Fugitives
NG-FUG	NG-FUG	(Not Applicable)	Natural Gas Fugitives
DSL-TK1	DSL-TK1	(Not Applicable)	Diesel Tank
DSL-TK2	DSL-TK2	(Not Applicable)	Diesel Tank

Appendix 2

Photographs of the Project Site and Action Area

Photo 1 One of Three Fuel Oil Tanks Proposed to be Removed from the Project Site

Photo 2 Wastewater Discharge Facility

Photo 3 View of the Project Site from the Existing Power Plant Facility

Photo 4 View of a Granite Outcrop Adjacent to the Existing Power Plant Facility

Photo 5 View of the Wastewater Discharge Channel from the Existing Power Plant Facility

Photo 6 Undeveloped Woodlands within the Action Area North of the Project Site

Photo 7 Undeveloped Woodlands within the Action Area Northwest of the Project Site

Photo 8 Undeveloped Woodlands within the Action Area Northeast of the Project Site

Photo 9 Undeveloped Shrublands along Transmission Line Corridor within the Action Area South of the Project Site Adjacent to Ferguson Lane

Photo 10 Undeveloped Shrublands along Transmission Line Corridor within the Action Area South of the Project Site Adjacent to Ferguson Lane

Photo 11 Undeveloped Shrublands along Transmission Line Corridor within the Action Area South of the Project Site Adjacent to FM 2471

Photo 12 Developed Residential Area and Golf Course within the Action Area Southwest of the Project Site

Photo 13 Developed Commercial Area within the Action Area Southwest of the Project Site

Photo 14 Developed Residential Area With Larger Lots within the Action Area South of the Project Site

Photo 15 Typical Undeveloped Shrublands within the Action Area Northwest of the Project Site

Photo 16 Typical Undeveloped Shrublands within the Action Area North of the Project Site

Photo 17 Typical Undeveloped Shrublands within the Action Area North of the Project Site

Photo 18 Typical Undeveloped Shrublands within the Action Area South of the Project Site

Photo 19 Typical Undeveloped Shrublands within the Action Area Northwest of the Project Site

Photo 20 Mesquite Shrubland in LCRA's Western Tract Determined to be Unsuitable GCWA Habitat

Photo 21 Typical Opening within the Woodland/Savanna on the Baird Ranch Determined to be Unsuitable GCWA Habitat

Photo 22 Typical Opening within the Woodland/Savanna on the LCRA West Tract Showing Concentration of Honey Mesquite on Edges of Openings, Determined to be Unsuitable GCWA Habitat

Photo 23 Typical “Cedar Break” within the Woodland/Savanna on the Baird Ranch Determined to be Unsuitable GCWA Habitat