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United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-1937, Vol. 2

Draft Environmental Impact Statement for Combined Licenses (COLs) for South Texas Project Electric Generating Station Units 3 and 4

Draft Report for Comment

U.S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001

U.S. Army Corps of Engineers
U.S. Army Engineer District, Galveston
Galveston, TX 77553-1229

US Army Corps

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Abstract

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by STP Nuclear Operating Company (STPNOC) for combined construction permits and operating licenses (combined licenses or COLs). The proposed actions related to the STPNOC application are (1) NRC issuance of COLs for two new nuclear power reactor units at the South Texas Project Electric Generating Station (STP) site in Matagorda County, Texas, and (2) U.S. Army Corps of Engineers (Corps) issuance of a permit to perform certain construction activities on the site. The Corps is participating in preparing this EIS as a cooperating agency and participates collaboratively on the review team.

This EIS includes the review team's analysis that considers and weighs the environmental impacts of building and operating two new nuclear units at the STP site and at alternative sites, and mitigation measures available for reducing or avoiding adverse impacts.

The EIS includes the evaluation of the proposed action's impacts to waters of the United States pursuant to Section 404 of the Federal Water Pollution Control Act (Clean Water Act) and Section 10 of the Rivers and Harbors Appropriation Act of 1899. The Corps will conduct a public interest review in accordance with the guidelines promulgated by the U.S. Environmental Protection Agency under authority of Section 404(b) of the Clean Water Act. The public interest review, which will be addressed in the Corps' permit decision document, will include an alternatives analysis to determine the Least Environmentally Damaging Practicable Alternative.

After considering the environmental aspects of the proposed action, the NRC staff's preliminary recommendation to the Commission is that the COLs be issued as proposed. This recommendation is based on (1) the application, including the Environmental Report (ER), submitted by STPNOC; (2) consultation with Federal, State, Tribal, and local agencies; (3) the review team's independent review; (4) the consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The Corps will issue its Record of Decision based, in part, on this EIS.

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Executive Summary

By letter dated September 20, 2007, the U.S. Nuclear Regulatory Commission (NRC or the Commission) received an application from STP Nuclear Operating Company (STPNOC) for combined construction permits and operating licenses (combined licenses or COLs) for South Texas Project Electric Generating Station (STP) Units 3 and 4, located in Matagorda County, Texas. The review team's evaluation is based on the September 2009 revision to the application, responses to requests for additional information, and supplemental letters.

The proposed actions related to the STP Units 3 and 4 application are (1) NRC issuance of COLs for construction and operation of two new nuclear units at the STP site, and (2) U.S. Army Corps of Engineers (Corps) issuance of a permit pursuant to Section 404 of the Federal Water Pollution Control Act (Clean Water Act) and Section 10 of the Rivers and Harbors Act to perform certain construction activities on the site. The Corps is participating with the NRC in preparing this environmental impact statement (EIS) as a cooperating agency and participates collaboratively on the review team. The reactor specified in the application is a certified U.S. Advanced Boiling Water Reactor design (U.S. ABWR, hereafter referred to as ABWR in this EIS).

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 et seq.) directs that an EIS be prepared for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

The purpose of STPNOC's requested NRC action—issuance of the COLs—is to obtain licenses to construct and operate two new nuclear units. These licenses are necessary but not sufficient for construction and operation of the units. A COL applicant must obtain and maintain the necessary permits from other Federal, State, Tribal, and local agencies and permitting authorities. Therefore, the purpose of the NRC's environmental review of the STPNOC application is to determine if two new nuclear units of the proposed design can be constructed and operated at the STP site without unacceptable adverse impacts on the human environment. The purpose of STPNOC's requested Corps action is to obtain a permit to perform regulated activities that would impact waters of the United States.

Upon acceptance of the STPNOC application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* a Notice of Intent (72 FR 72774) to prepare an EIS and conduct scoping. On February 5, 2008, the NRC held two scoping meetings in Bay City, Texas, to obtain public input on the scope of the environmental review. The staff reviewed the comments received during the scoping process and contacted Federal, State, Tribal, regional, and local agencies to solicit comments.

To gather information and to become familiar with the sites and their environs, the NRC and its contractor Pacific Northwest National Laboratory (PNNL) visited the STP site in February 2008 and the Allens Creeks alternative site in March 2008. In August 2009, the NRC and PNNL visited the Red 2 and Trinity 2 alternative sites. During the site visits, the NRC staff and its contractors met with STPNOC staff, public officials, and the public.

Included in this EIS are (1) the results of the review team's analyses, which consider and weigh the environmental effects of the proposed actions; (2) potential mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the NRC staff's preliminary recommendation regarding the proposed action.

To guide its assessment of the environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the following definitions of the three significance levels – SMALL, MODERATE, and LARGE:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

In preparing this EIS, the review team reviewed the application, including the Environmental Report (ER) submitted by STPNOC; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plan*. In addition, the NRC staff considered the public comments related to the environmental review received during the scoping process. Comments within the scope of the environmental review are included in Appendix D of this EIS.

The NRC staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the COLs be issued as requested. This recommendation is based on (1) the application, including the ER submitted by STPNOC; (2) consultation with other Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The Corps will issue its Record of Decision based, in part, on this EIS.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency (EPA) Notice of Availability of the filing of the draft EIS to allow members of the public and agencies to comment on the results of the environmental review. During this period, the NRC and Corps staff will conduct a public meeting near the STP site to describe the results of the environmental review, respond to questions, and accept public comment. All comments received during the comment period will be addressed in the final EIS.

The NRC staff's evaluation of the site safety and emergency preparedness aspects of the proposed action will be addressed in the NRC's Safety Evaluation Report anticipated to be published in 2011.

Abbreviations/Acronyms

AADT	Average Annual Daily Traffic
ABWR	U.S. Advanced Boiling Water Reactor
ac	acre(s)
ACHP	Advisory Council on Historic Preservation
ADAMS	Agencywide Documents Access and Management System
AEP	American Electric Power
AEP	Archaeology and Ethnography Program
APE	area of potential effect
ALARA	as low as reasonably achievable
ASLB	Atomic Safety and Licensing Board
BEA	Bureau of Economic Analysis
BEIR	Biological Effects of Ionizing Radiation
BGCD	Bluebonnet Groundwater Conservation District
BGS	below ground surface
BMP	best management practice
Btu	British thermal unit(s)
Bq	Becquerel(s)
BWR	boiling water reactor
°C	degree(s) Celsius
CAES	compressed air energy storage
CBC	Christmas Bird Count
CCD	Census County Division
CDC	Centers for Disease Control and Prevention
CDF	core damage frequency
CDR	Capacity, Demand, and Resources Report
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second (water flow)
Ci	curie(s)
cm	centimeter(s)
CMP	Coastal Management Program
CMZ	Coastal Management Zone
CNP	CenterPoint Energy
CO	carbon monoxide
CO_2	carbon dioxide
COL	combined license

CORMIX	Cornell Mixing Zone Expert System
Corps	U.S. Army Corps of Engineers
CPGCD	Coastal Plains Groundwater Conservation District
CPS Energy	City Public Service Board of San Antonio, Texas
CPUE	catch per unit effort
CR	County Road (CR 360, CR 392)
CREZ	Competitive Renewable Energy Zones
CWA	Clean Water Act
CWIS	circulating water intake structure
CWS	circulating water system
CZMA	Coastal Zone Management Act
DBA	Design Basis Accident
dBA	decibel(s) (acoustic)
DC	design certification
DCD	Design Control Document
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSM	demand side management
D/Q	deposition values
DWS	drinking water standards
EA	Environmental Assessment
EAB	Exclusion Area Boundary
ECP	Essential Cooling Pond
EIS	environmental impact statement
EFH	essential fish habitat
ELF	extremely low frequency
EMF	electromagnetic field
EOF	Emergency Operations Facility
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERCOT	Electric Reliability Council of Texas
ESA	U.S. Endangered Species Act of 1973, as amended
ESRP	Environmental Standard Review Plan
°F	degree(s) Fahrenheit
FAA	Federal Aviation Administration
FDA	final design approval
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement

FM	Farm-to-Market
FMP	Fishery Management Plan
fps	feet per second
FR	Federal Register
FSAR	Final Safety Analysis Report
FSER	Final Safety Evaluation Report
ft	foot or feet
ft^2	square feet
ft^3	cubic feet
FWS	U.S. Fish and Wildlife Service
GBq	gigabecquerel
GCC	global climate change
GCRP	U.S. Global Change Research Program
GE	General Electric
GEIS	generic environmental impact statement
GHG	greenhouse gases
GIT	Georgia Institute of Technology
GIWW	Gulf Intracoastal Waterway
gpd	gallon(s) per day
gpm	gallon(s) per minute
GRWMS	gaseous radioactive waste-management system
ha	hectare(s)
HAPC	habitat areas of particular concern
hr	hour(s)
Hg	mercury
Hz	hertz
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IGCC	integrated gasification combined cycle
in.	inch
INEEL	Idaho National Engineering and Environmental Laboratory
IOU	investor owned utility
ISD	Independent School District
ISO	independent system operator
I&S	interest and sinking fund rate
km	kilometer(s)
km^2	square kilometer(s)

kWh	kilowatt-hour(s)
kV	kilovolt(s)
L	liter(s)
lb	pound(s)
LCRA	Lower Colorado River Authority
LCRWPG	Lower Colorado Regional Water Planning Group
LEDPA	least environmentally damaging practicable alternative
LERF	large early release frequency
LLW	low-level waste
LNG	liquefied natural gas
LOS	level of service
LPZ	Low Population Zone
LRF	large release frequency
LST	local standard time
LSWP	LCRA-SAWS Water Project
LTSF	Long-Term Storage Facility
LWA	Limited Work Authorization
LWMS	liquid waste management system
LWR	light water reactor
m	meter(s)
m^3	cubic meter(s)
MACCS2	MELCOR Accident Consequence Code System Version 2
MBq	megabecquerel(s)
MCEDC	Matagorda County Economic Development Corporation
MCEMO	Matagorda County Emergency Management Office
MCR	Main Cooling Reservoir
MDC	Main Drainage Channel
MEI	maximally exposed individual
mg	milligram(s)
MGD	million gallons per day
mg/L	milligram(s) per liter
mi	mile(s)
mi^2	square mile(s)
MIT	Massachusetts Institute of Technology
mL	milliliter(s)
MMS	Minerals Management Service
mo	month
MOU	Memorandum of Understanding
M&O	maintenance and operations

mph	mile(s) per hour
mR	milliroentgen
mrad	millirad(s)
mrem	millirem(s)
µS	microsiemens
MSA	Metropolitan Statistical Area
MSL	mean sea level
mSv	millisievert(s)
MT	metric ton(s) (or tonne[s])
MTU	metric ton(s) of uranium
MUD	municipal utilities district
MW	megawatt(s)
MWd	megawatt-day(s)
MW(e)	megawatt(s) electrical
MW(t)	megawatt(s) thermal

NCI	National Cancer Institute
NCRP	National Council on Radiation Protection & Measurements
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969, as amended
NERC	North American Electric Reliability Corporation
NESC	National Electric Safety Code
NHPA	National Historic Preservation Act of 1966, as amended
NIEHS	National Institute of Environmental Health Sciences
NINA	Nuclear Innovation North America
NMFS	National Marine Fisheries Services
NMM	navigation mile marker
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRG	NRG South Texas LP
NRHP	National Register of Historic Places
NTF	Nuclear Training Facility

ODCM	offsite dose calculation manual
OSF	Onsite Staging Facility
OSGSF	Old Steam Generator Storage Facility
OSHA	Occupational Safety and Health Administration
OW	observation well

PAM	primary amoebic meningoencephalitis
pCi	picocuries
pCi/L	picocuries per liter
PGC	Power Generation Company
PIR	Public Interest Review
PM	particulate matter
$PM_{2.5}$	particulate matter with a diameter of 2.5 microns or less
PM_{10}	particulate matter with a diameter of 10 microns or less
PNNL	Pacific Northwest National Laboratory
ppt	parts per thousand
PSD	prevention of significant deterioration
PUCT	Public Utility Commission of Texas
PWR	pressurized water reactors
RAI	request for additional information
RCRA	Resource Conservation and Recovery Act of 1976, as amended
RCW	Reactor Building Cooling Water
rem	roentgen equivalent man (a special unit of radiation dose)
REMP	radiological environmental monitoring program
RIMS	Regional Input-Output Model System
RMPF	Reservoir Makeup Pumping Facility
RMR	reliability must run
ROD	Record of Decision
ROI	region of interest
ROW	right of way
RSICC	Radiation Safety Information Computational Center
RSW	Reactor Service Water
Ryr	reactor-year
s	second(s)
SACTI	Seasonal and Annual Cooling Tower Impacts
SAMA	severe accident mitigation alternatives
SAMDA	severe accident mitigation design alternatives
SAWS	San Antonio Water System
SCR	selective catalytic reduction
SECPOP 2000	Sector Population, Land Fraction, and Economic Estimation Program
SER	Safety Evaluation Report
SHPO	State Historic Preservation Officer
SO_2	sulphur dioxide
SO_x	sulphur oxide
STP	South Texas Project Electric Generating Station

STPNOC	STP Nuclear Operating Company
Sv	sievert
SWMS	solid waste management system
SWPPP	Stormwater Pollution Prevention Plan
TAC	Texas Administrative Code
TAMUG	Texas A&M University at Galveston
TBEG	Texas Bureau of Economic Geology
TBq	terabecquerel(s)
TCC	Texas Central Company
TCEQ	Texas Commission on Environmental Quality
TCMP	Texas Coastal Management Plan
TDS	total dissolved solids
TDSHS	Texas Department of State Health Services
TEDE	total effective dose equivalent
THC	Texas Historical Commission
TIS	Texas Interconnected System
TLD	thermoluminescent dosimeter
TMDL	total maximum daily load
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TPWP	Texas Prairie Wetlands Project
TRAGIS	Transportation Routing Analysis Geographic Information System
TWC	Texas Water Code
TWDB	Texas Water Development Board
TX	Texas
TXDOT	Texas Department of Transportation
U_3O_8	triuranium octaoxide (“yellowcake”)
UF_6	uranium hexafluoride
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink
UMTRI	University of Michigan Transportation Research Institute
UO_2	uranium oxide
USACE	U.S. Army Corps of Engineers
USC	United States Code
USGS	U.S. Geological Survey
VOC	volatile organic compound
WCS	Waste Control Specialists, LLC

WHO	World Health Organization
WMA	Wildlife Management Area
WSEC	White Stallion Energy Center
WSWTS	West Sanitary Waste Treatment System
WCID	Water Control and Improvement District
χ/Q	dispersion values
yd	yard(s)
yd^3	cubic yard(s)
yr	year(s)

8.0 Need for Power

Chapter 8 of the U.S. Nuclear Regulatory Commission's (NRC) *Environmental Standard Review Plan* (ESRP) (NRC 2000) guides the NRC staff's review and analysis of the need for power from a proposed nuclear power plant. In addition to the ESRP guidance, the NRC addressed need for power in a 2003 response to a petition for rulemaking (68 FR 55910). In the 2003 response, the NRC reviewed whether or not need for power should be considered in NRC environmental impact statements (EISs) prepared in conjunction with applications that could result in construction of a new nuclear power plant. The NRC (68 FR 55910) concluded that:

> The need for power must be addressed in connection with new power plant construction so that the NRC may weigh the likely benefits (e.g., electrical power) against the environmental impacts of constructing and operating a nuclear power reactor. The Commission emphasizes, however, that such an assessment should not involve burdensome attempts to precisely identify future conditions. Rather, it should be sufficient to reasonably characterize the costs and benefits associated with proposed licensing actions.

While the NRC will perform a need for power analysis in its EIS, the NRC also stated in its response to the petition that (1) the NRC does not supplant the states, which have traditionally been responsible for assessing the need for power-generating facilities, for their economic feasibility and for regulating rates and services; and (2) the NRC has acknowledged the primacy of state regulatory decisions regarding future energy options (68 FR 55910).

8.1 Description of Power System

8.1.1 Description of STPNOC

The purpose of proposed Units 3 and 4 at the South Texas Plant Electric Generating Station (STP) site is to provide baseload generation for use by the owners and/or for eventual sale on the wholesale market. As discussed in Chapter 1, it is planned that Unit 3 would be owned by Nuclear Innovation North America (NINA) South Texas 3 LLC and the City of San Antonio, Texas, through the City Public Services Board (CPS Energy), and that Unit 4 would be owned by NINA South Texas 4 LLC and CPS Energy. Both proposed units would be baseload merchant generator plants. NINA South Texas 3 LLC and NINA South Texas 4 LLC intend to sell their share of the power from Units 3 and 4 on the wholesale market. CPS Energy may either use its share of Units 3 and 4 to supply the needs of its service area and/or sell the power on the wholesale market (STPNOC 2009).

The applicant, STP Nuclear Operating Company (STPNOC), stated in its application for combined licenses (COLs) that proposed Units 3 and 4 at the STP site would be unregulated entities. The electric utility industry in the State of Texas was deregulated in 2002. One of the principal owners of proposed Units 3 and 4 (NINA) is a merchant generator that does not have a specific service area. The other principal owner, CPS Energy, is a municipal utility that sells capacity in excess of its own retail service needs in the San Antonio area into the Electric Reliability Council of Texas (ERCOT) wholesale market (STPNOC 2009). Currently, CPS Energy has several wholesale contracts, for which it is seeking renewal, that amount to firm power obligations. In addition, CPS Energy's native retail service area of Bexar County and the San Antonio vicinity also is growing in population and represents additional potential demand. However, in estimating the need for power for proposed Units 3 and 4, STPNOC is relying on ERCOT's forecast of the overall demand for power in the ERCOT region rather than CPS Energy's specific service and contract obligations (STPNOC 2009).

8.1.2 Description of ERCOT

STPNOC has defined the region of interest for evaluating the need for power as the entire area served by ERCOT, the independent system operator (ISO) for the electric grid for most of the State of Texas (Figure 8-1).

Figure 8-1. Map of the ERCOT ISO Service Area (STPNOC 2009)

ERCOT is a membership-based nonprofit corporation formed under 26 USC 501(c)(6) of the Internal Revenue Code. It is governed by a board of directors and subject to oversight by the Public Utility Commission of Texas (PUCT) and the Texas Legislature. ERCOT's members include retail consumers, investor-owned and municipally-owned utilities, rural electric cooperatives, river authorities, independent generators, power marketers, and retail electric providers (ERCOT 2008a). The ERCOT board of directors is made up of independent members, consumers, and representatives from each of ERCOT's electric market segments. The board of directors appoints ERCOT's officers, who direct and manage day-to-day operations (ERCOT 2008b). ERCOT's responsibilities include:

- managing the flow of electric power to approximately 22 million Texas customers, representing 85 percent of the State's electric load,
- scheduling power on an electric grid with 40,000 mi of high-voltage transmission lines and more than 550 generation units,
- managing financial settlements for the Texas competitive wholesale bulk-power market, and
- administering of customer switching for 6.5 million Texans in competitive choice areas (ERCOT 2008c).

As explained in STPNOC's environmental report (ER), the history of the deregulation of the previously regulated electric supply market in the ERCOT region began in 1995, when the Texas Legislature passed Senate Bill 373, introducing wholesale competition into Texas' intrastate market. PUCT adopted rules requiring all transmission system owners to make their transmission systems available for use by others at prices and on terms comparable to each respective owner's use of its system for its own wholesale transactions. In 1999, by terms of Senate Bill 7, choice was further broadened by allowing retail customers of investor owned utilities (IOUs) to choose their electric energy supplier (electric cooperatives and municipally owned utilities such as CPS Energy had the option not to allow their retail customers to join this arrangement and CPS Energy has not allowed this). Formerly, vertically integrated IOUs had to separate their retail energy service activities from regulated utility activities and to unbundle their generation, transmission/ distribution, and retail electric sales functions into separate units, which could be sold off or else operated as independent entities at arm's length from each other. Transmission and distribution entities (including electric cooperatives and integrated municipally owned utilities) are fully regulated by the PUCT and must make their facilities available on an open and non-discriminatory basis. IOUs and independent power producers owning generation assets must be registered as power generation companies with the PUCT and must comply with certain rules that are intended to protect consumers, but they are otherwise unregulated and may sell electricity in private bilateral transactions and at market prices (STPNOC 2009).

As explained in the ER and confirmed in the references below, under deregulation in Texas, utilities no longer perform the comprehensive analysis and planning functions that they once did. The central planning organization under the new Texas market is the ERCOT ISO. State law assigns these obligations to ERCOT, under the oversight of the PUCT. The analyses, reports, system planning processes, and criteria development from ERCOT are the key measures for determining resource needs in the State [see e.g., Texas Utility Code Ann. §§ 39.155(b) and 39.904(k)] (Texas Utilities Code 2009). STPNOC is relying upon several studies performed for or by ERCOT on need for power in ERCOT's capacity as a regional transmission organization. Regional transmission organizations were created as a result of Order No. 2000 issued by the Federal Energy Regulatory Commission (FERC), which encouraged the voluntary formation of such organizations to administer the transmission grid on a regional basis throughout North America (FERC 1999, 2008).

The ERCOT ISO region is also the geographic territory of the Texas Regional Entity (Texas RE) (ERCOT 2008g). Texas RE is one of the eight approved regional entities in North America under the North American Electric Reliability Corporation (NERC). NERC's mission is to ensure the reliability of the bulk power system in North America. NERC develops and enforces reliability standards, monitors the bulk power system, assesses and reports on future transmission and generation adequacy, and offers education and certification programs to utility industry personnel (NERC 2008a). Texas RE is a functionally independent division of ERCOT and is independent of all users, owners, and operators of the bulk power system in the State of Texas. As mandated by the delegation agreement with NERC approved by FERC, Texas RE performs the regional entity functions described in the Energy Policy Act of 2005 for the ERCOT region. Texas RE develops, monitors, assesses, and enforces NERC reliability standards within the ERCOT region. In addition, Texas RE has been authorized by the PUCT and is permitted by NERC to investigate compliance with the ERCOT protocols and operating guides, working with PUCT staff regarding any potential protocol violations (ERCOT 2008g).

The ERCOT region is almost entirely isolated from other NERC regions, electrically speaking. The formation of what is now the ERCOT region dates from the beginning of World War II, when several Texas utilities banded together and interconnected to support the war effort as the Texas Interconnected System (STPNOC 2009). Texas Interconnected System formed ERCOT in 1970 to comply with NERC requirements (ERCOT 2008d). Since the goals of these entities over the years have been to ensure the reliability of the Texas grid rather than to interconnect with the rest of the country, importing electric power into, or exporting electric power out of the ERCOT region effectively is not practicable. As a practical matter this means that electricity demand in the ERCOT region must be served from generation within ERCOT and that power generated in excess of demand within ERCOT cannot effectively reach other markets (STPNOC 2009).

8.1.3 Description of the ERCOT Analytical Process

NRC guidance provides that additional independent review by the NRC may not be needed when need for power analyses prepared by an independent third party such as an affected state, NERC reliability council, or regional transmission organization is sufficiently (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty (NRC 2000). Taken in aggregate, the staff determined that the studies and reports summarized in Section 8.4 satisfy the four tests .

8.1.3.1 Systematic Test

The review team determined ERCOT has a systematic and iterative process for load forecasting and reliability assessment that is updated annually. ERCOT is required by the PUCT to provide extensive studies, issue reports, make recommendations for transmission system needs and resource adequacy, and even make legislative recommendations to further those objectives (STPNOC 2009). The essence of ERCOT is that it is a neutral and independent source of information on electricity issues for policymakers. The development of these reports is subject to a vigorous stakeholder input process.

Membership in ERCOT is open to any entity that meets any of the segment definitions as set forth in the ERCOT bylaws. Members must be in an organization that either operates in the ERCOT region or represents consumers within the ERCOT region. The members are organized by the following market segments: consumers, cooperatives, independent generators, independent power marketers, independent retail electric providers, investor owned utilities, and municipal utilities (ERCOT 2005b, 2008l). ERCOT uses industry best practices and methodological approaches to determine future system reliability and the need for new generating capacity. The forecasts and methods are vetted by ERCOT membership. Moreover, the analyses and actions of ERCOT based on these analyses are overseen by the PUCT.

8.1.3.2 Comprehensive Test

The review team finds that, in aggregate, the ERCOT studies and reports discussed in Section 8.4 are comprehensive. ERCOT (ERCOT 2008e) takes account of trends in customer demand (including the underlying factors of population, income, and employment growth and impacts of both normal and extreme weather conditions. The electricity supply analysis takes into account changes in generation profile and potential generation additions; new generating resources planned for construction in Texas; trends in electric power generation by fuel source; trends in consumption by class of consumer; forecasts of future electricity sales; transmission congestion in Texas; demand side management (DSM), demand response, and distributed generation; and electric reliability assessments. The demand forecasts are fed into the generation and transmission planning process. ERCOT uses industry best practices and methodological approaches to determine system reliability and the need for new generating capacity (ERCOT 2008f, i, j, k). Moreover, the forecasts are subject to a vigorous participatory process.

The model developers recognize that they have not been successful in the past in including electricity prices as valid predictive variables in the electricity demand model (ERCOT 2008e, 2009a):

> In regard to prices, which are considered an important driver for inclusion in a demand equation, it is not clear as to whether or not the wholesale prices that ERCOT collects are really the most relevant for a forecasting application, in terms of being the prices ultimately faced by the consumer. Since the wholesale prices are collected on an hourly basis, and retail prices are better reflected by an average over a longer time period, such as a month, wholesale hourly prices do not capture the correlation with the MWh consumption correctly. Several attempts to include market clearing prices of energy in the forecasting models were made but were unsuccessful. The models obtained showed price to be insignificant or to indicate a nonsensical relationship regarding the direction of the effect of price (wrong sign on the coefficient) and thus should not be included in a long-term demand equation. To make matters more challenging in this respect, an objective and credible forecast of these prices would represent a major accomplishment in itself. Inclusion of a price variable in the forecasting models could potentially provide a means to calculate an unbiased and credible forecast of the price effect on the long-term load response.

However, reportedly, the constraints have been overcome and all future versions of the demand forecast will include the effects of energy prices (PNNL 2009).

8.1.3.3 Subject to Confirmation Test

The review team finds that, in aggregate, the studies and reports discussed in Section 8.4 are subject to confirmation. ERCOT's forecasts are independently prepared. These forecasts are then independently reviewed, confirmed, and consolidated by PUCT and NERC. Both the Long-Term Peak Demand study (ERCOT 2008e) and the Capacity, Demand, and Resources Report (CDR) look at historical information as a check on past forecasting performance and these results are published. For example, in 2008 to validate the forecast model, an out-of-sample prediction was performed by estimating the model with data up to December 2005 and a forecast was produced for January 2006 to December 2006 using the actual temperatures. A forecast for the summer season only was also produced using the actual temperatures. The system peak that occurred on August 17, 2006, was forecasted for the year 2006 with a 0.78 percent error and a 0.45 percent error for the summer alone (ERCOT 2008e). Forecast comparisons for 2008 show a -0.5 percent error for annual energy (with monthly errors from -7.6

percent to plus 6.0 percent). Maximum hourly demand at the August peak had a -1.0 percent error and the forecast for annual peak had a -4.2 percent error (ERCOT 2008c)

Over a longer term, from 1999 to 2006, the ERCOT peak demand and energy consumption forecasts were within ± 5 percent of the actual values (STPNOC 2009). ERCOT publishes its methodology, key input data, forecast errors, methodological uncertainties and limitations, and conclusions.

8.1.3.4 Responsive to Forecasting Uncertainty Test

In preparing its load forecasts and reliability assessments, ERCOT takes account of forecasting uncertainty. It also takes into account of the fact that not all proposed new generating units will be built and that some existing generating units may be taken off line for various reasons.

8.1.3.5 Summary of ERCOT Analytical Process

Based on its review of ERCOT documents, the review team determined that, in aggregate, the ERCOT forecasts and documents are sufficiently (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty to serve the needs of the review team in complying with Section 102 of the National Environmental Policy Act. In keeping with the ESRP (NRC 2000) and the Commission statements at 68 FR 55910, the review team gave particular credence to:

- ERCOT's 2009 long-term demand forecast (ERCOT 2009a),
- ERCOT's 2009 CDR (ERCOT 2009b),
- ERCOT's examination of long-term generation issues associated with wind energy in the 2008 Long-Term System Assessment (ERCOT 2008f), and
- NERC's evaluation of long term system adequacy (NERC 2008b).

8.2 Power Demand

The review team initially relied on the 2007 ERCOT Long-Term Peak Demand and Energy Forecast as its basis for understanding the need for power (ERCOT 2007). Since then, review team also has reviewed the 2008 and 2009 long-term demand studies (ERCOT 2008e, 2009a), ERCOT's 2008 Long Term System Assessment Study (ERCOT 2008f), ERCOT's latest CDR (ERCOT 2009b), and the summary of ERCOT findings from the 2008 studies in NERC's 2008 Long-Term Reliability Assessment as bases for comparison with the STPNOC's need for power assessment (NERC 2008b). ERCOT's demand forecasting model is described in detail in the 2009 demand forecast report and is summarized below (ERCOT 2009a).

The ERCOT long-term load forecast covers a period from 1 to 15 years using a process and tools developed internally by ERCOT. The forecast is used for a variety of operating and planning purposes, the most important of which for the EIS is system planning. The forecasting model is a set of equations that describes the historical load as a function of independent variables, where the coefficients are estimated by multiple regression methods. The long-term forecast was produced with a set of econometric models that use weather and economic and demographic data to capture and project the long-term trends from the past 5 years of historical data. Twelve years of weather data were available from 20 ERCOT weather stations. These weather stations were used to develop weighted hourly weather profiles for each of eight weather zones in the ERCOT region. These data were used in the load shape models. Monthly cooling degree days and heating degree days were used in the monthly energy models. Uncertainty in weather effects (especially that of extreme weather) on load was investigated in a number of ways, including the running of Monte Carlo simulations, to assess the impact of extreme temperatures on the peak demands. Economic and demographic changes can affect the characteristics of electrical demand in the medium- to the long-run. Economic and demographic data at the county level were obtained on a monthly basis from Moody's Economy.com. Three of the key economic and demographic variables that drive the forecast are per capita income, population, and employment. The growth rates in these variables have declined during the last three forecasts, but still show largely the same picture for need for power over the next 10 to 15 years.

Because the proposed Units 3 and 4 at the STP site would be baseload merchant power plants that are expected to operate more than 90 percent of the time to obtain best cost-effectiveness, the most important part of the ERCOT forecast for purposes of the this review is the growth in annual energy demand and the growth in demand at the near-minimum demand hours, since Units 3 and 4 would address this lowest part of the annual load duration curve. ERCOT, on the other hand, needs to emphasize peak load demand because of its institutional responsibility for meeting peak demand and reserve margin. During the period from 1997 to 2007 the compound growth rates for peak demand and annual energy were 2.3 percent per year and 1.5 percent per year, respectively (ERCOT 2009a). Assuming normal weather, ERCOT projects that peak energy demand would increase at a compounded rate of 2.0 percent per year (13,923 MW total) between 2009 and 2019 and that annual energy (average demand) would grow at a compounded growth rate of 2.04 percent per year (7965 average MW total) (ERCOT 2009a). Figure 8-2 shows the ERCOT 2009 peak and annual average load forecasts for the period 2009-2019.

Figure 8-3 shows the 8760-hour load duration curve for the ERCOT region for 2007, the last full year for which data were available. Ninety percent of the hours in the year equals 7884, corresponding to a demand of about 26,000 MW. This is approximately the portion of demand that is addressed by existing nuclear power plants at STP and Comanche Peak (as well as some hydroelectric, coal, and natural gas combined cycle baseload). If minimum annual hourly

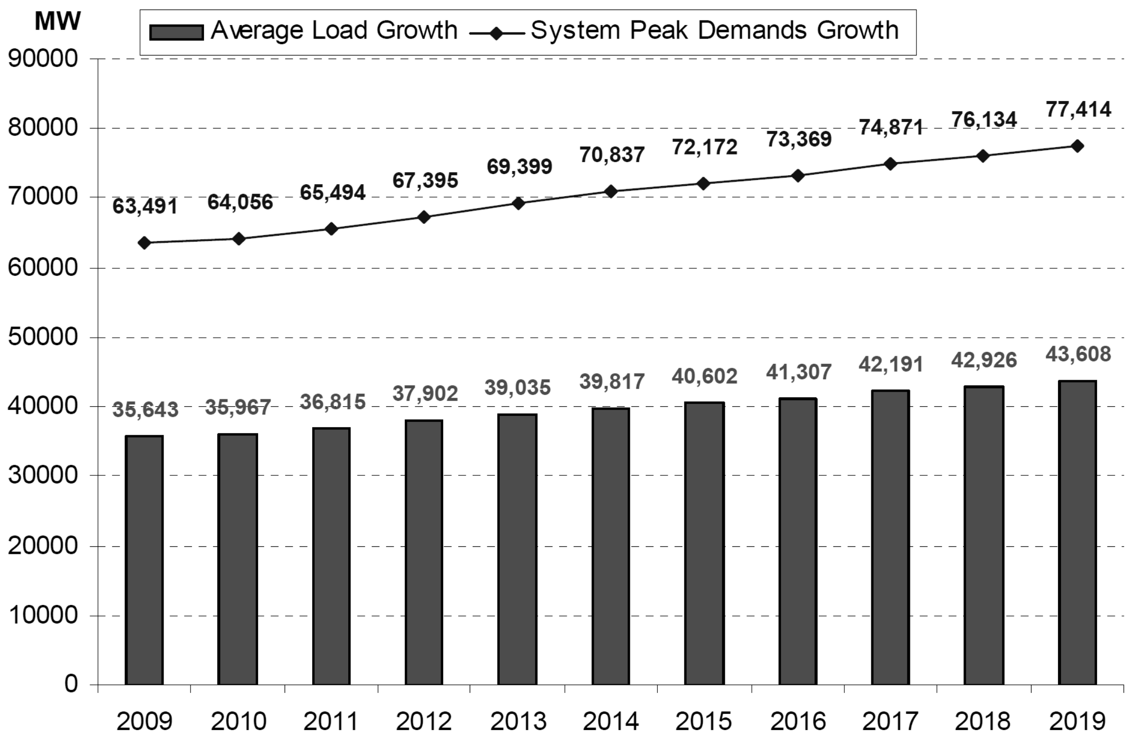

Figure 8-2. Peak Demand and Average Demand in the ERCOT Region 2009-2019 (ERCOT 2009a) (Note: figures are projected totals, not annual growth.)

demand (equal to 21,817 MW in 2007) and 90th percentile hourly demand both grew at approximately the rate of annual average hourly demand in the ERCOT region shown in Figure 8-3, they both would grow by about 27.4 percent by 2019, or by amounts of 5978 MW and 7124 MW, respectively. These increases exceed the increase of high-availability baseload capacity represented by proposed Units 3 and 4 at STP. This simple calculation provides an initial indication that the growth in baseload demand in the ERCOT region would be enough to support additions of two units at both STP and Comanche Peak.

In the 2008 annual NERC report (NERC 2008b) "2008 Long-Term Reliability Assessment 2008-2017, October 2008," it is noted that forecasts of the demand for power declined between the 2007 and 2008 forecasts (after having risen between 2006 and 2007). The decline continued from 2008 to 2009. Figure 8-4 shows the last four summer peak load forecasts compiled by ERCOT. Figure 8-5 shows the difference between annual energy forecasts in 2008 and 2009. The actual 2008 values are below the forecast largely because the peak forecast assumes normal summer weather, and weather was relatively cool on the peak day in 2007.

The NERC report for ERCOT (NERC 2008b) states that the lower 2008 forecast takes into account the slowing of the Texas economy:

- The lower peak demands reflect the expected state of the economy as represented by economic indicators that have been found to drive electricity use in the ERCOT region's eight weather zones, including real per-capita personal income, population, gross domestic product, and various employment measures including non-farm employment and total employment.
- In the long-term, real personal per-capita income is expected to level-off or decline in a slight to medium fashion due to wage rates experiencing modest growth, only slightly faster than inflation, due to lower productivity growth. Texas non-farm employment continues to grow faster than the U.S. rate. The gross domestic product also shows a lower level and growth rate from 2008 to 2018 when compared to last year's forecast.
- Given the net effects of the economic indicators used in the 2008 Long Term Demand Forecast, they indicate slowdown of the economy in the long run. The long-run impact on the forecast due to economic slowdown is projected to start around 2010. Its effects are projected to translate into a 4.50 percent decline in energy and a 3.31 percent decline in peak demand by 2018, when compared to last year's forecast [Note: "last year" refers to the 2007 forecast].

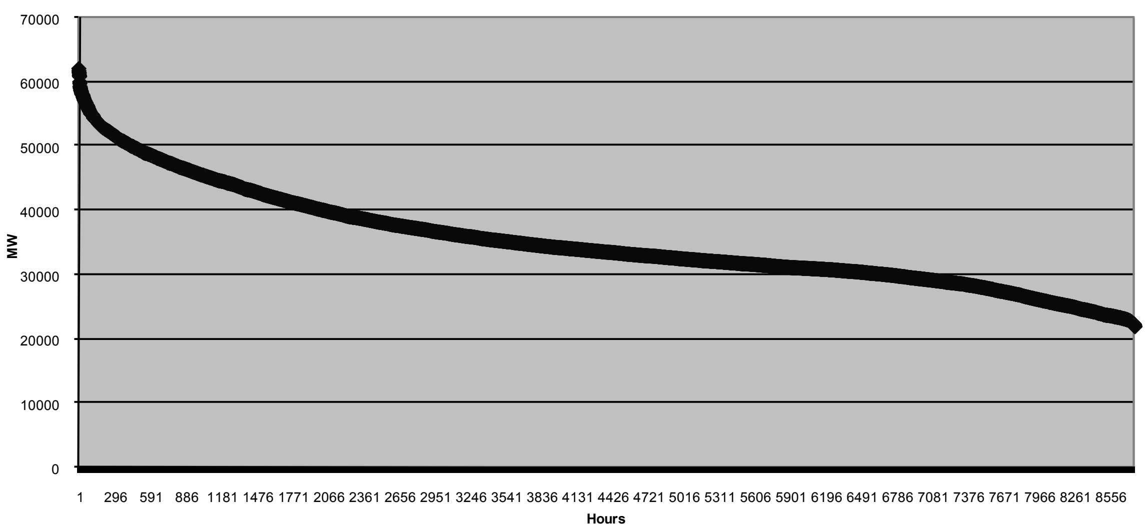

Figure 8-3. ERCOT 2007 Load Duration Curve. (Compiled by review team from ERCOT 2008h)

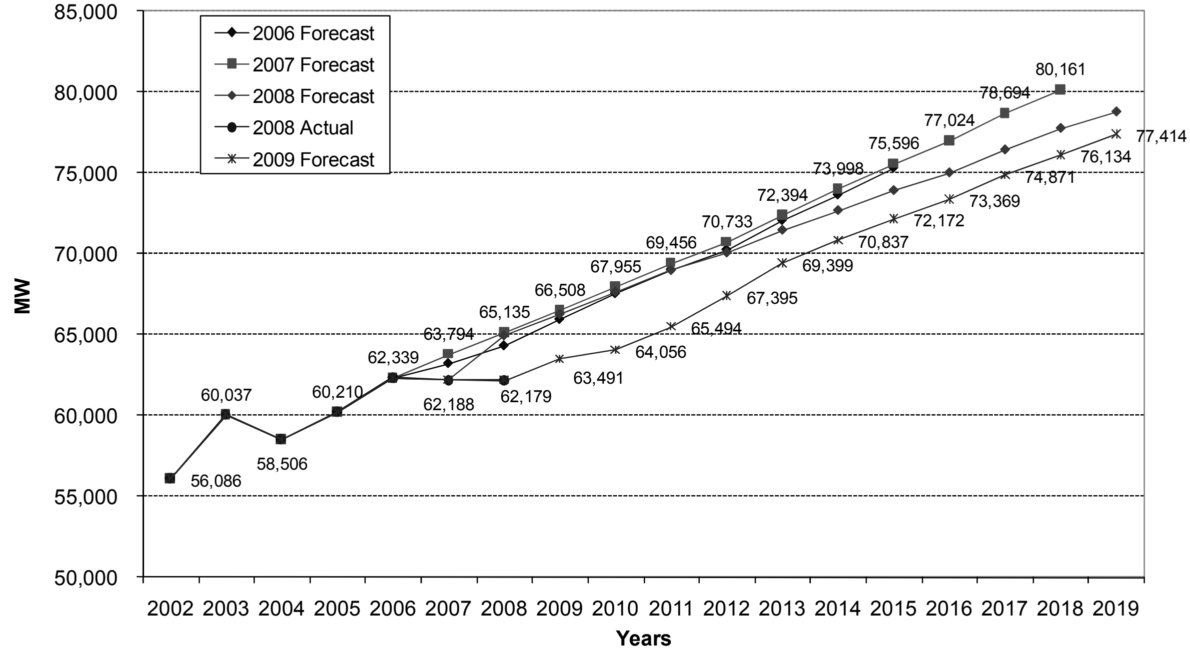

Figure 8-4. ERCOT 2006, 2007, 2008, and 2009 Peak Load Forecasts. (Compiled from 2007, 2008, and 2009 ERCOT Long-Term Demand Forecast reports data by review team from ERCOT 2007; ERCOT 2008e; and ERCOT 2009a)

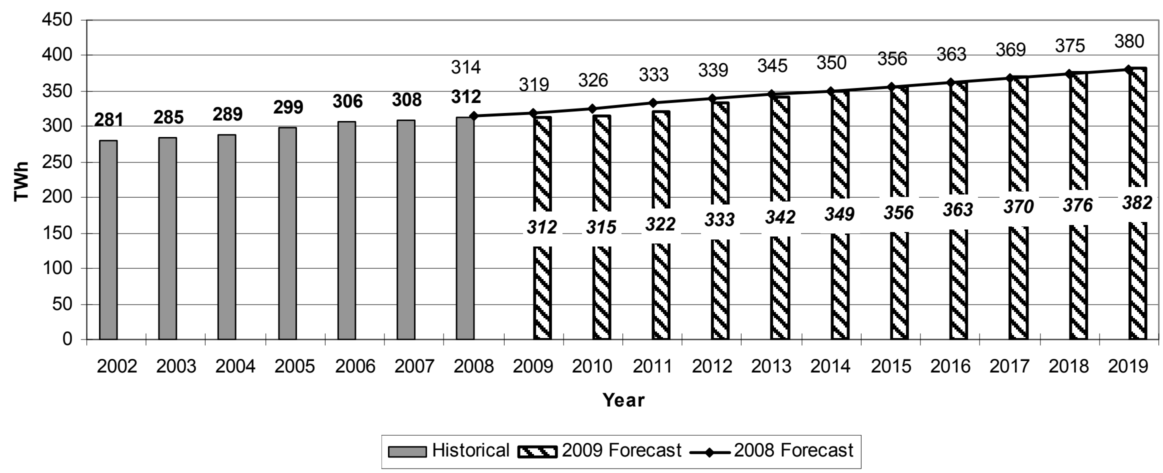

Figure 8-5. ERCOT 2008 and 2009 Energy Demand Forecasts (ERCOT 2009a)

The review team notes that the ERCOT 2009 forecast features still further reduced economic growth in the short term as a result of the 2008-2009 economic downturn. However, some of the decline in underlying long-term economic conditions discussed by NERC between 2007 and 2008 took a more optimistic turn in the ERCOT 2009 forecast. Figure 8-6 through Figure 8-8 show the change in key long-term growth variables used as the primary economic drivers for the 2009 ERCOT forecasts: population, employment, and per-capita income. ERCOT determined population growth rate would be relatively unchanged due to the economic downturn following an initial drop in numbers, but that employment and per-capita income would suffer an initial slump, followed by a faster growth rate than expected in 2008 and which would overtake the 2008 forecasted values by about 2013.

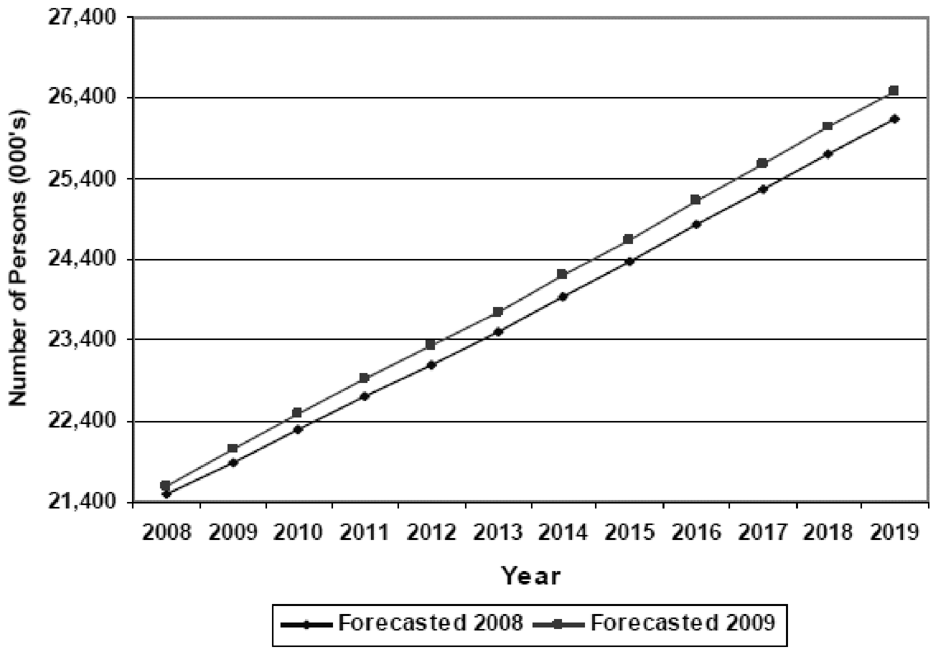

Figure 8-6. Population in the ERCOT Region (ERCOT 2009a)

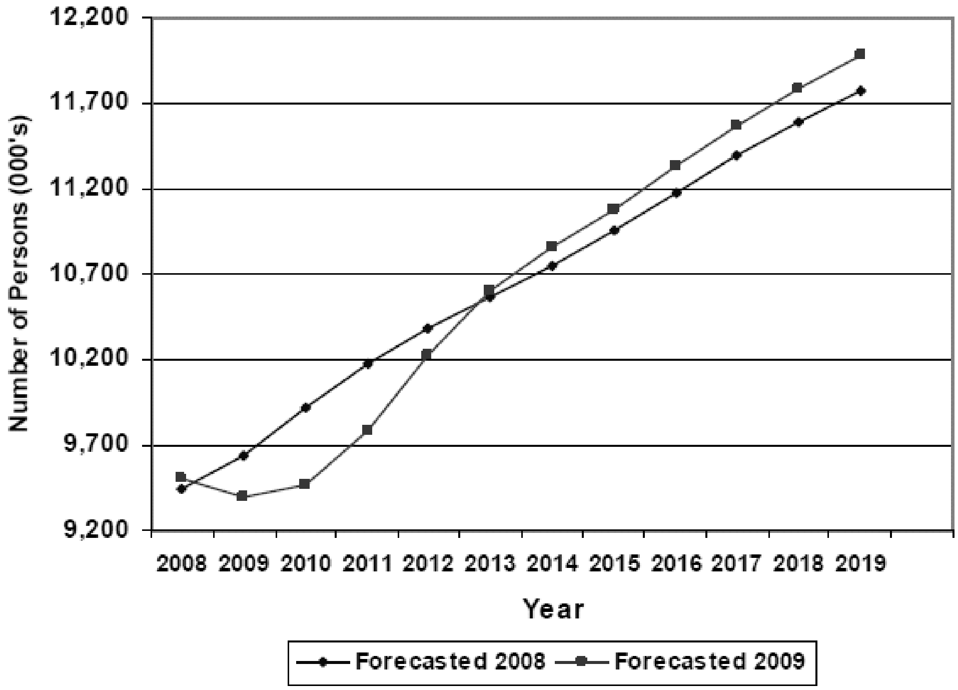

Figure 8-7. Total Non-Farm Employment in the ERCOT Region (ERCOT 2009a)

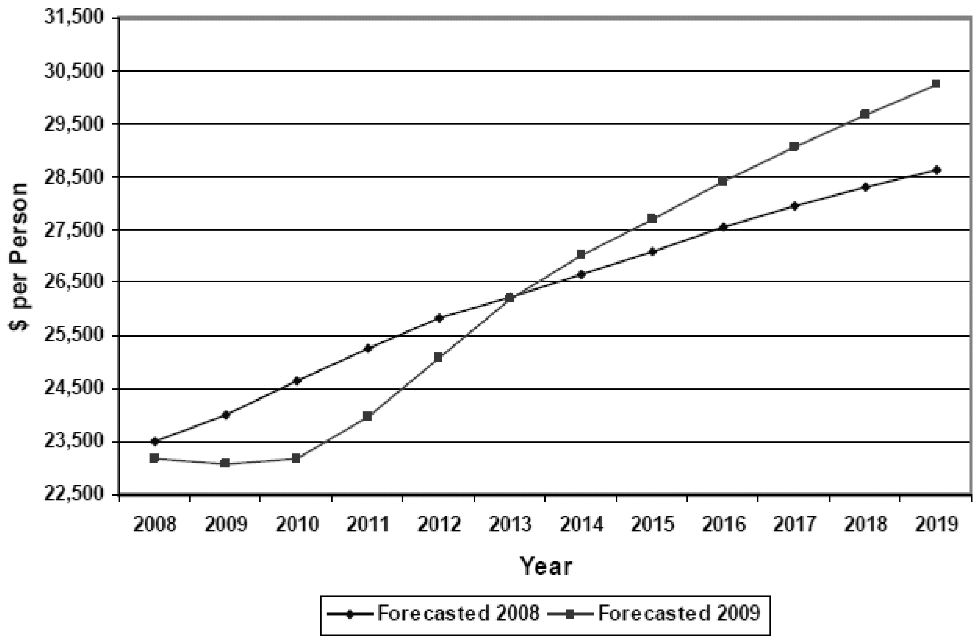

Figure 8-8. Per Capita Income in the ERCOT Region (ERCOT 2009a)

Because it is involved in meeting the maximum demand conditions in its territory, ERCOT pays considerable attention to the summer peak demand and the margin of safety in meeting that peak. The current generation reserve margin requirement for the ERCOT region is 12.5 percent, as approved by the ERCOT Board in August 2002. The following is a brief summary of the methodology for the reserve margin calculation (ERCOT 2005a). The terms used here are defined below.

Firm Load equals:

- long-term forecast model total summer peak demand
- minus loads acting as resources serving as responsive reserve
- minus loads acting as resources serving as non-spinning reserve
- minus balancing up loads.

Available Resources equals:

- installed capacity using the summer net dependable capability pursuant to ERCOT testing requirements (excluding wind generation)
- plus capacity from private networks
- plus effective load carrying capability of wind (determined in a study for ERCOT in 2006 by Global Energy to be 8.7 percent of name plate generation (GED 2007)
- plus reliability must run units under contract
- plus 50 percent of non-synchronous ties
- plus summer net dependable capability of available switchable capacity as reported by the owners
- plus available “mothballed” generation
- plus planned generation with a signed generation interconnection agreement (SGIA) and a Texas Commission on Environmental Quality air permit, if required
- plus effective load carrying capability of planned wind generation with SGIA
- minus retiring units.

Reserve margin is then defined as (Available Resources - Firm Load Forecast/Firm Load Forecast).

In the ERCOT methodology, loads acting as resources are capable of reducing or increasing the need for electrical energy or providing ancillary services such as responsive reserve service or non-spinning reserve service. Loads acting as resources must be registered and qualified by ERCOT, and they will be scheduled by a qualified scheduling entity (STPNOC 2009).

STPNOC discussed the need for power in the context of declining reserve margins in the ERCOT region (STPNOC 2009). As recently as May 2008, forecasted reserve margin in the ERCOT Demand and Reserves report was expected to fall below the required reserve margin of 12.5 percent by 2013. However, the May 2009 update to this report now shows a better capability to meet firm load at least through 2014 (see Table 8-1). ERCOT produces a "top-down" forecast for its major subareas, but does not include separate demand estimates for different end-use sectors. Thus, forecasts do not contain separate forecasts for residential, commercial, and industrial demand.

As shown in Table 8-1, the ERCOT 2009 forecasts take into account DSM programs and efficiency programs. As stated in the 2008 Texas State Energy Plan, DSM can be divided into (1) demand-response programs, which are designed to encourage customers to reduce usage during peak times or to shift that usage to other times; and (2) energy efficiency programs, which provide a reduction in the overall quantity of electricity consumed over the year, but may not necessarily reduce the electricity demanded at the hour of system peak (Governor's Competitiveness Council 2008). Under Texas House Bill 3693 (signed into law in 2007), regulated utilities (transmission and distribution utilities [TDUs]) in ERCOT, and the integrated utilities outside of ERCOT, are required by law to offer DSM programs sufficient to offset 15 percent of the growth in demand by December 31, 2008, and 20 percent of the growth in demand by December 31, 2009 (Governor's Competitiveness Council 2008). Although only regulated utilities are affected inside of ERCOT, success of such programs could affect the overall demand for electricity in the ERCOT region.

Table 8-2 is a less-detailed extension of Table 8-1 to the year 2024 that shows the ERCOT 2009 forecast of demand, reserve margin (ERCOT calculates long-term required resources to meet peak demand plus 12.5 percent). Total resources estimates and the need for baseload power are calculated in Section 8.3. The total resources estimate does not include STP Units 3 and 4 or other units projected for completion after 2014.

Table 8-1. ERCOT Peak Demand and Calculated Reserve Margin, 2009-2014

	2009	2010	2011	2012	2013	2014
Total Summer Peak Demand (MW)	63,491	64,056	65,494	67,394	69,399	70,837
Less: LAARS Serving as Response Reserve and Spinning Reserve, Balancing–Up Loads	1115	1115	1115	1115	1115	1115
Less Energy Efficiency Program (per HB36693)	110	242	242	242	242	242
Firm Load Forecast (MW)	62,266	62,699	64,137	66,037	68,042	69,480
Required Reserve Margin (12.5%)	7783	7837	8017	8255	8505	8685
Required Resources	70,049	70,536	72,154	74,292	76,547	78,165
Estimated Total Resources (MW) (Table 8-3)	72,712	75,314	76,215	77,287	79,122	79,123
Reserve Margin (Resources - Firm Load Forecast)/Firm Load Forecast)	16.8%	20.1%	18.8%	17.0%	16.3%	13.9%

Source: ERCOT 2009b

Table 8-2. ERCOT Calculated Reserve Margin, 2009-2024

	2009	2010	2014	2019	2024
Peak Summer Demand, MW	63,491	64,056	70,837	77,414	82,778
Less: LAAR Spinning and Non Spinning reserve and Balancing-up Loads	1115	1357	1357	1357	1357
Firm Load, MW	62,266	62,699	69,480	76,057	81,421
Plus Reserve Requirements (Peak +12.5%)	7936	8007	8855	9677	10,347
Total Resource Requirements, MW	71,427	72,063	76,692	87,091	93,125
Total Resources, No Retirements	72,712	75,314	79,122	79,123	79,123
Reserve Margin Based on Firm Load	16.8%	20.1%	13.9%	4.0%	-2.8%

Source: Calculated by the review team from tables and figures in ERCOT 2009b.

8.3 Power Supply

ERCOT prepares an annual CDR (ERCOT 2009b) on the supply capacity, demand, and reserves in the ERCOT region. It is developed from data provided by the market participants as part of the annual load data request, the generation asset registrations, and from data collected for the annual U.S. Department of Energy Coordinated Bulk Power Supply Program Report.

The working paper calculates the generation resources reported to be available by market participants (STPNOC 2009).

The CDR considers all of the generation resources in the ERCOT region meeting the list in the previous section. There are several constraints on which resources are listed as available in the CDR.

- Only those new generating resources for which the owners have initiated full transmission interconnection study requests through ERCOT are included as planned generation.
- If an air permit is required for a new generating unit, the unit must have received that permit before it is included as planned generation.
- Some mothballed resources may be counted, but the probability of these resources being able to be returned to service varies by generating technology and declines as the length of time they are mothballed increases (ERCOT 2005b).
- Retiring and retired units are not counted.

Wind Energy in Texas

Large amounts of wind energy have or are about to enter the ERCOT region. In the Interim Order on Reconsideration in Docket 33672 (Interim Order), the PUCT designated five zones as Competitive Renewable Energy Zones (CREZ), primarily for wind power, in the western and Panhandle areas of Texas. By Texas law this amount of power would have to be accepted by the market, if offered to the market, in preference to thermal generation. Installed wind capacity could grow from around 6900 MW to as much as 24,400 MW over the next few years, with a planning value of 18,456 MW in 2018. In response, ERCOT performed a CREZ Transmission Optimization Study (ERCOT 2008j), an extensive study of intrastate transmission bottlenecks that might arise and solutions that might be needed to absorb this new power source.

The wind generation development scenarios used in the CREZ Transmission Optimization Study were also used to evaluate resource needs in the ERCOT system in the December, 2008 Long-Term System Assessment (ERCOT 2008f). The Long-Term System Assessment evaluated the need for other types of generation capacity under the assumption that the projected 2018 load duration curve would be lowered by the maximum possible use of 18,456 MW of wind energy. Figure 8-9 shows that at approximately the 80th percentile (a rule-of-thumb definition of baseload generation) there would still be a demand for up to 30,852 MW of baseload with 18,456 MW of wind generation installed in the system if natural gas prices remained at about $7 per million Btu. However, there would be little need for additional baseload generation beyond current levels (nuclear could still substitute for retiring coal and natural gas, if needed).

Current U.S. Energy Information Administration forecasts of natural gas prices favor a natural gas price to the electricity sector of about $7 per million Btu through much of the next 20 years, as many new resources come on line, even as economic recovery increases demand (EIA 2009). This indicates that the demand in 2018 for baseload capacity (80th percentile of the wind-altered load duration curve) would be close to the 30,852 MW forecast in Figure 8-9. The demand for baseload at the 90th percentile of the wind-altered load duration curve would be about 28,000 MW, an increase of about 2000 MW from current levels. That would not be enough on its own to fully absorb STP Units 3 and 4, but substitution for retiring coal or natural gas-fired plants would still be possible.

ERCOT's 2009 Supply Forecast

Table 8-3 provides ERCOT's May 2009 projection of the generating resources of various types that that would be available to serve the ERCOT region between 2009 and 2024. The 2009-2014 ERCOT projections anticipate substantial development of wind resources during the 2009-2014 period, and the review team adopted the view that these resources would be developed and would meet the State's goal of 18,564 MW of installed wind capacity by 2018. If the State falls short of its goal for wind, the demand for STP Units 3 and 4 would be larger than calculated in this section.

There is uncertainty as to the timing, type, number, and capacity of generating units that may be retired during the forecast period, which affects the need for replacement generating plants. The age of the power plant being considered for retirement is a factor in the decision to retire the plant. Based on ERCOT's May 2009 CDR, Figure 8-10 shows how the summer capacity of generating resources may be affected by the need of some participants to retire older, less efficient, or polluting power plants. Under any retirement scenario, the replacement of such power plants in the ERCOT region further adds to the need for new generating capacity.

The ERCOT forecast of generating resources shown in Table 8-3 begins with installed capacity of existing generating stations. To that is added generating capacity of private networks (connected to the ERCOT grid, but not directly metered by ERCOT), the effective load carrying capability of existing wind generators (at 8.7 percent of installed capacity), and reliability must-run (RMR) units that are required for local grid stability. The remaining group of resources includes (1) 50 percent of so-called "switchable" resources that could either operate in ERCOT or in the Southwest Power Pool; (2) a protected estimate of mothballed resources that could be brought back on line in each year (the actual estimate is an expected value based on detailed computations that involve the age of the unit and the length of time it has been shut down), and (3) planned resources, whose inclusion depends on the phase that each resource is in the required interconnection studies (STPNOC 2009). This resulting estimate is then adjusted downward to account for switchable units known to be unavailable to ERCOT and retiring units. However, because there is also considerable uncertainty concerning whether existing power plants would be retired, the review team calculated available resources both with and without retirements, as shown in Table 8-3.

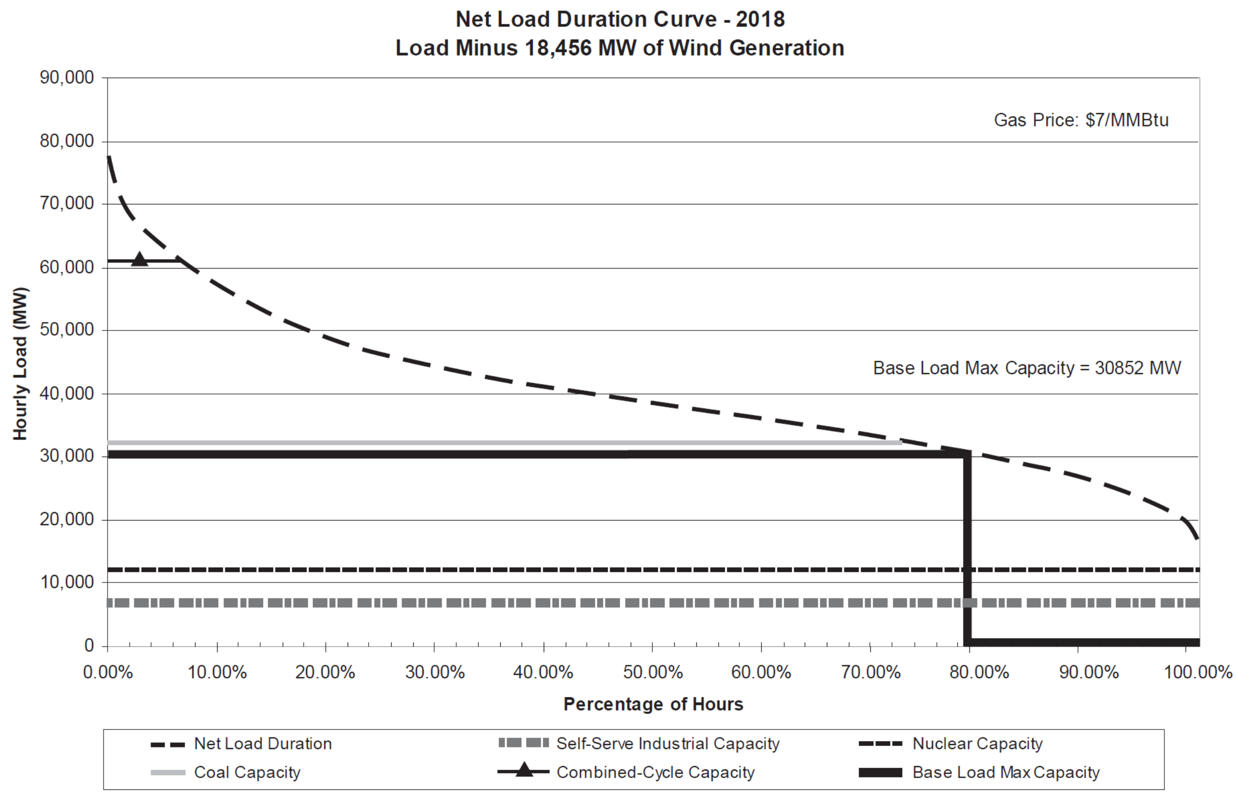

Figure 8-9. ERCOT Net Load Duration Curve in 2018 with 18,456 MW of Wind Generation Capacity (ERCOT 2008f)

1 **Table 8-3**. 2009 ERCOT Forecasted Summer Resources, 2009-2024

	2009	2010	2011	2012	2013	2014	2019	2024
Installed Capacity, MW	63,492	61,800	61,800	61,800	61,800	61,800	61,800	61,800
Capacity from Private Networks, MW	5313	5318	5318	5318	5318	5318	5318	5318
Effective Load-Carrying Capability (ELCC) of Wind Generation, MW	708	708	708	708	708	708	708	708
RMR Units to be under Contract, MW	115	0	0	0	0	0	0	0
Operational Generation, MW	69,628	67,826	67,826	67,826	67,826	67,826	67,826	67,826
50% of Non-Synchronous Ties, MW	553	553	553	553	553	553	553	553
Switchable Units, MW	2848	2848	2848	2848	2848	2848	2848	2848
Available Mothballed Generation , MW	0	401	479	479	479	479	479	479
Planned Units (not wind) with Signed IA and Air Permit, MW	0	3,769	4389	5414	7206	7206	7206	7206
ELCC of Planned Wind Units with Signed IA, MW	0	76	121	168	211	211	1606	1606
Total Resources, MW	73,029	75,472	76,215	77,287	79,122	79,123	80,518	80,518
less Switchable Units Unavailable to ERCOT, MW	317	158	0	0	0	0	0	0
less Retiring Units, MW (None through 2014, Based on >50 yrs after 2014	0	0	0	0	0	0		0
Retirements in Based of age >50 yrs after 2014	0	0	0	0	0	0	9289	25,274
Resources, MW (no retirements)	72,712	75,314	76,215	77,287	79,122	79,123	80,518	80,518
Reserve Margin Above Firm Load, No retirements	16.8%	20.1%	18.8%	17..0%	16.3%	13.9%	5.86%	-1.11%
Resources, MW (with retirements)	72,712	75,314	76,215	77,287	79,122	79,122	71,229	55,244
Reserve Margin Above Firm Load, With retirements	16.8%	20.1%	18.8%	17.0%	16.3%	13.9%	-6.4%	-32.2%

Source: ERCOT 2009b and review team calculations based on the expanded wind resource availability of 18,564 installed MW by 2018, and the >50-year old generation retirement scenarios in Figure 8-10.

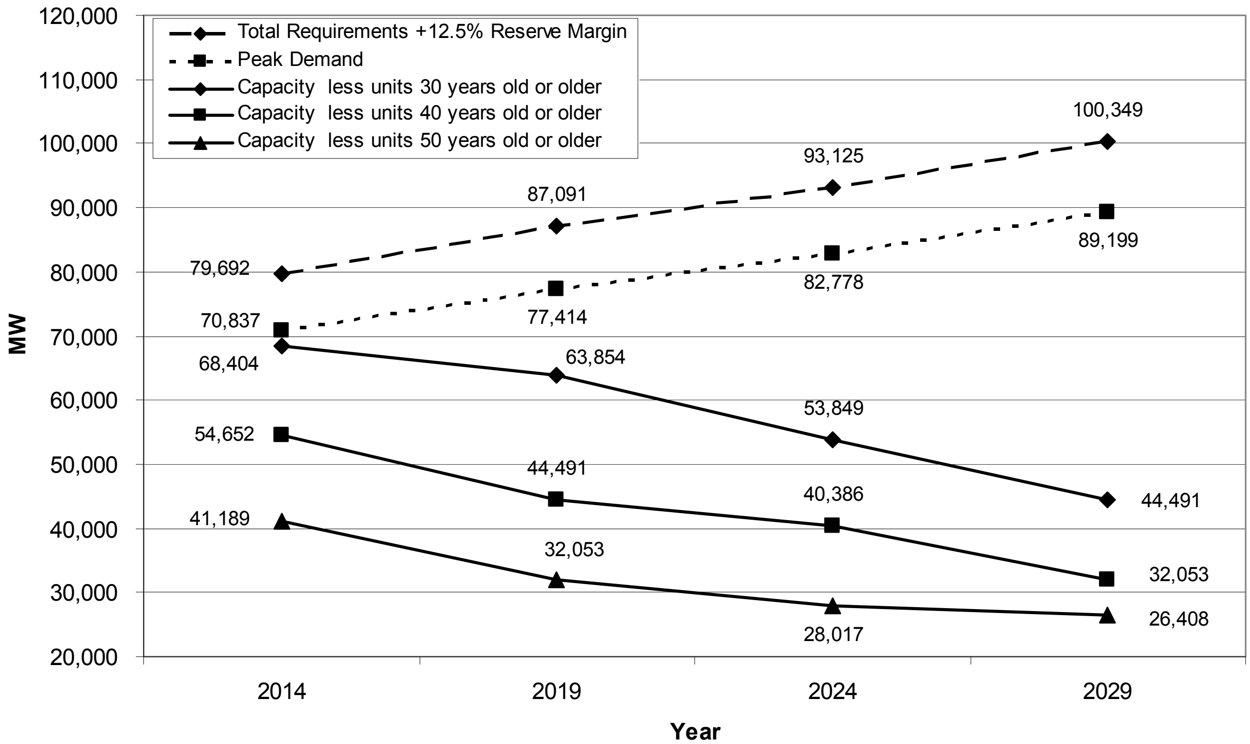

Figure 8-10. Alternative ERCOT Generation Capacity Reduction Scenarios vs. Projected Demand (ERCOT 2009b)

In Table 8-3, the ERCOT forecast shows that by 2014, the amount of summer resources would be about 79,100 MW and 80,500 MW by 2019. Reserve requirements would be met in 2014, but not by 2019. The reserve margin would fall from 13.9 percent in 2014 to 5.9 percent in 2019. With retirements of older power plants after 2014, the demand and supply would be further out of balance, because the resources needed just to meet firm load would be 76,100 MW. The resources available, accounting for wind generation and retirements, would be only 71,200 MW if only power plants older than 50 years old were retired ─ an absolute shortage of 5000 MW and a shortage of 15,900 MW relative to the amount needed to cover the reserve margin. The reserve margin would be below zero. If retirements of power plants increase, the prospective shortage of generation in the 2014-2019 period would grow still larger

STPNOC concluded in its ER (STPNOC 2009), based on the ERCOT 2007 forecasts and before the 2008-2009 economic recession, which the generation shortage in 2016 could be between 20,000 and 50,000 MW. The shortage in Table 8-3 is 15,900 MW, still substantial.

In the ERCOT region, STPNOC estimated about 24.5 percent of current generating capacity is currently considered to be baseload and that this percentage would rise to 30.1 percent by 2012 (STPNOC 2009) In its ER, STPNOC estimated the combined capacity of baseload generation that addresses ERCOT through the year 2012 based on the ERCOT criteria (Table 8-4). The percentage of baseload may be increasing (STPNOC 2009). STP Units 1 and 2 and Comanche Peak Units 1 and 2 would represent 4892 MW of the 22,178 MW of total summer baseload generating capacity needed in the ERCOT region in 2012 (STPNOC 2009). The growth in need for baseload generation in Table 8-4 from 2007 to 2012 is 4557 MW, of which only 2100 MW of new coal and gas had been added to the ERCOT forecast. In the longer term, plant retirements and further increases in demand for power allowed STPNOC (STPNOC 2009) to conclude that:

> Thus, the need for new capacity in ERCOT in 2015-2016 is substantially greater than the new capacity to be provided by STP 3 & 4. As a result, not only will there be a need for power from STP 3 & 4, there will be a need for a substantial amount of other new generating capacity.

Table 8-4. STPNOC Forecasted Summer Capacity, Baseload Generation Units Only

	2007	**2008**	**2009**	**2010**	**2011**	**2012**
Resources, MW	71,812	72,048	71,960	72,394	72,939	73,703
Baseload Generation, MW	17,621	17,621	19,057	19,998	21,378	22,178
Percent of Resources that are Baseload Generation	24.50%	24.50%	26.50%	27.60%	29.30%	30.10%

Source: STPNOC 2009

Table 8-5 shows an estimate made by the review team of the need for baseload power in 2009-2024 with and without retirement of older power plants. For purposes of this estimate it was assumed that baseload power would represent about 27.5 percent of the identified generating needs in Table 8-3. This percentage is midway between today's 24.5 percent and the 30.1 percent calculated by STONOC for the year 2102. Without any retirements, Table 8-5 shows that the demand for new baseload is about 1808 MW, a reflection of much higher planned non-wind resources and wind power penetration into the Texas market than assumed in 2007, combined with lower load growth than assumed by STPNOC in their forecast. With only plants greater than 50 yr old retiring, the demand for new baseload plants not currently in the ERCOT forecast grows to 4362 MW, more than enough for two new nuclear units.

Table 8-5. ERCOT/Review Team Forecasted Summer Capacity, Baseload Generation Units Only[(a)]

	2009	2010	2014	2019	2024
Power Requirements, Including 12.5% Reserves (MW)	71,427	72,063	79,692	87,091	93,125
Current ERCOT Planned New Generation: No Retirements (MW)					
Generating Resources	73,029	75,472	79,123	80,518	80,518
Baseload Needed (27.5%)	19,643	19,817	21,915	23,950	25,609
Baseload Needed After 2009	(353)	(894)	156	1808	3467
Current ERCOT Planned New Generation: Retire Only Plants >50 Yr Old (MW)					
Generating Resources	73,029	75,472	79,123	71,229	55,244
Baseload Needed (27.5%)	19,643	19,817	21,915	23,950	25,609
Baseload Needed After 2009	(353)	(894)	156	4362	10,417

(a) Excludes proposed STP Units 3 and 4

8.4 Assessment of Need for Power

The review team reviewed reports prepared by ERCOT regional ISO in conjunction with its assessment of the need for power from STPNOC's proposed Units 3 and 4 at the STP site. STPNOC relied on the 2007 versions of these reports, which show a slightly higher need for power than the 2008 and 2009 reports; however, all versions provide essentially the same picture. The review team's key findings from the reports are summarized as follows:

- The demand for power at the summer peak and the annual demand for energy in the ERCOT region are both projected to rise over the period 2009 through 2019 at approximately 2.0 percent per year compounded. Total demand would be 77,400 MW at peak in 2019, and including a 12.5 percent reserve requirement, resources would need to be about 87,100 MW in that year. If minimum-hour demand and 90th percentile hourly demand also increases at the 2.0 percent rate, by 2019 the ERCOT region would need an additional 6000 MW to 7100 MW of baseload generation due to load growth alone. This estimate, however, does not account for other supply plans.

- As noted in Section 8.3, retiring generating units were not counted in the 2009 forecast of ERCOT region available resources (they are shown as zero in forecasted resources). Thus, depending on the rate of retirement of older generating units, the ERCOT region may need substantial additional generating capacity by 2019. The analysis in Table 8-3 shows that if only the oldest (greater than 50 years old) are retired after 2014, amount of additional demand for new generation would be about 9300 MW relative to a case with no retirements. About 25 to 30 percent of that growth likely would be baseload generation.

- The 2009 ERCOT resource forecast contains 8137 MW of current installed capacity in 2009 (with 708 MW of average Effective Load Carrying Capability) plus 2425 MW of planned installed capacity (average Effective Load Carrying Capability of 211 MW). However, larger amounts of additional wind generation capacity may be built in the CREZ areas of Texas, ranging up to 24,000 MW installed (average Effective Load Carrying Capability of 2088 MW). Large amounts of wind generation would require major investments in transmission resources and improved system controls to manage wind resources, but they could reduce the demand for power during the off-peak portions of the year and may limit the demand for additional intermediate and baseload thermal generating resources. More modest market penetration of wind energy leaves a market for increased baseload generation. The discussion of the CREZ study in Section 8.3 favors a lower wind penetration rate with up to 18,546 MW installed capacity, given very aggressive wind development, which still leaves room for 10,000 MW of growth in baseload demand by 2018, and 2000 MW of demand growth at the 90^{th} percentile. Because there is uncertainty in the success of very aggressive wind generation and because nuclear plants can substitute for other potential baseload generation, the review team believes there is a need for the amount of electrical generation represented by STP Units 3 and 4.

The State of Texas has funded an ambitious DSM program that is designed to reduce electricity demand by 15 to 20 percent in the service areas of regulated utilities within ERCOT and integrated Texas utilities outside of ERCOT (Governor’s Competitiveness Council 2008). This program is included in the ERCOT forecasts and is part of the 2009 calculation of need for new generating resources.

If the Texas DSM program were completely successful, a 15 to 20 percent reduction in load growth in the regulated portion of the ERCOT region would reduce the need for power, but not eliminate it.

Table 8-6 summarizes the results of the review team’s analysis of the ERCOT electricity demand and supply forecasts that have occurred since STPNOC used the ERCOT 2007 forecasts to estimate unmet need for power from STP Units 3 and 4. The staff reviewed the ERCOT 2008 and 2009 demand forecasts, noted the changes since 2007, and decided that while ERCOT’s short-term forecast of peak summer demand was heavily influenced by the 2008 to 2009 recession, the longer-term estimate of demand is only slightly lower than in the 2007 forecast. A more important issue is that the 2007 supply forecast did not include either the impact of Texas’s energy conservation plan or the full impact of an ambitious program to significantly expand the scope of wind power in Texas. The review team added these elements to the ERCOT 2009 long-term supply forecast. Finally, the review team examined directly the impact of power plant retirements, a factor not specifically included in ERCOT's detailed forecasts. Based on information available in STPNOC's need for power analysis, the review team translated the modified ERCOT 2009 demand and supply forecasts into an estimate of the unmet need for baseload power in ERCOT in the years 2014-2019, which spans the potential completion dates for proposed Units 3 and 4.

Table 8-6. ERCOT/Review Team Forecasted Unmet Need for Baseload Generation Compared with STPNOC Estimated Need for Baseload Power

	Review Team/ERCOT 2009 (2014 and 2019), MW	STPNOC/ERCOT 2007 (2017) MW	Difference (Review Team/STPNOC) (Smallest to Largest)
Estimated Baseload Demand	21,900 to 24,000[(a)]	26,600[(b)]	-4700 to -4500
Estimated Baseload Supply	21,800 to 19,600[(c)]	9900 to 20,100[(d)]	-500 to +11,900
Unmet Net Need for Baseload Power	100 to 4400[(e)]	6500 to 16,700[(f)]	-2100 to -16,600
Proposed Capacity	2740	2740	0

(a) Table 8-35, 2014 and 2019 power requirements times 27.5%.
(b) STPNOC 2009, Figure 8.4-2, 2017 "Total Requirement:, times 30.1%.
(c) Table 8-3, 2014 and 2019 resources with retirements, times 27.5%.
(d) STPNOC 2009, Figure 8.4-2, 2017 "Capacity less units 50 years old or older," "Capacity less units 30 years old or older," times 30.1%..
(e) Difference between demand and supply.
(f) Difference between demand and supply.

Table 8-6 shows that although the demand for baseload power in 2016-2017 has not changed much since the 2007 analysis, the combination of conservation and wind power may have significantly reduced the need for baseload power. However, even though the potential unmet need for power in the review team's alternative estimate is much smaller than STPNOC's estimate, it still shows an unmet need large enough to accommodate proposed Units 3 and 4. In addition, because Units 3 and 4 are merchant plants, they do not need to show an absolute shortage of power. The marketplace would decide whether Units 3 and 4 would be able to compete successfully with other potential suppliers of baseload electricity.

8.4.1 Conclusion

The review team concludes that there is an expected future shortage of baseload power in the ERCOT region that could be at least partially addressed by construction of proposed Units 3 and 4 at the STP site. The review team determined that the STPNOC assessment of its need for power in its ER is not unreasonable. Building of the two new units could address (1) growth in demand for baseload power and (2) replacement of retiring baseload generating units elsewhere in ERCOT. Based on its analysis, the review team concludes that there is a justified need for new baseload generating capacity in the ERCOT region in excess of the planned 2740 MW capacity output of proposed Units 3 and 4 at STP.

8.5 References

68 FR 55910. September 29, 2003. "Nuclear Energy Institute; Denial of Petition for Rulemaking." *Federal Register*. U.S. Nuclear Regulatory Commission.

Electric Reliability Council of Texas (ERCOT). 2005a. "Methodology for Reserve Margin Calculation," Memorandum from Read Comstock, TAC chair to ERCOT Board of Directors, May 10, 2005.

Electric Reliability Council of Texas (ERCOT). 2005b. *Reserve Margin Update - House Committee on Regulated Industries; PowerPoint Presentation*. Electric Reliability Council of Texas.

Electric Reliability Council of Texas (ERCOT). 2007. *2007 ERCOT Planning Long-Term Hourly Peak Demand and Energy Forecast, May 8, 2007*. Accessed at http://www.ercot.com/news/presentations/2007/2007_ERCOT_Planning_Long_Term_Hourly_Demand_Energy_Forecast_.pdf. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008a. *ERCOT Company Profile*. Accessed May 13, 2009 at http://www.ercot.com/about/profile/index.html. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008b. *ERCOT Governance*. Accessed May 13, 2009 at http://www.ercot.com/about/governance/index.html. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008c. *About ERCOT.* Accessed May 13, 2009 at http://www.ercot.com/about/index. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008d. *History of ERCOT*. Accessed May 13, 2009 at http://www.ercot.com/about/profile/history. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008e. *2008 ERCOT Planning Long-Term Hourly Peak Demand and Energy Forecast*. Accessed June 24, 2009 at http://www.ercot.com/content/news/presentations/2008/2008%20Planning%20Long-Term%20Hourly%20Demand%20Energy%20Forecast%20Final.doc. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008f. *ERCOT Long-Term System Assessment December 2008.* Accessed June 24, 2009 at http://www.ercot.com/content/news/presentations/2008/ERCOT_Long-Term_System_Assmt_Dec_2008.pdf. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008g. *Texas Regional Entity*. Accessed May 14, 2009 at http://www.ercot.com/mktrules/compliance/tre/index. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008h. *Hourly Load Data Archives*. Accessed May 14, 2009 at http://www.ercot.com/gridinfo/load/load_hist/. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008i. *ERCOT Capacity, Demand, Reserves Winter Update.* Accessed June 24, 2009 at http://www.ercot.com/content/news/presentations/2009/ERCOT_CDR_update_12-15-08_public.xls. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008j. Competitive Renewable Energy Zones (CREZ) Transmission Optimization Study, ERCOT System Planning, April 2, 2008. Available at http://www.ercot.com/news/presentations/2008/index. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008k. *Report on the Capacity, Demand, and Reserves in the ERCOT Region, System Planning, May 2008.* Available at http://www.ercot.com/content/news/presentations/2008/2008_Capacity,_Demand,_Reserves_Report_FINAL.xls. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2008l. *ERCOT Membership*. Accessed May 14, 2009 at http://www.ercot.com/about/governance/members/. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2009a. *2009 ERCOT Planning Long-Term Hourly Peak Demand and Energy Forecast.* Available at http://www.ercot.com/content/news/presentations/2009/2009_Planning_Long-Term_Hourly_Demand_Energy_Forecast-av2009.pdf. Accession No. ML100600754.

Electric Reliability Council of Texas (ERCOT). 2009b. *Report on the Capacity, Demand, and Reserves in the ERCOT Region, System Planning.* Available at http://www.ercot.com/content/news/presentations/2009/2009%20ERCOT%20Capacity,%20Demand%20and%20Reserves%20Report.pdf. Accession No. ML100600754.

Energy Information Administration (EIA). 2009. *Annual Energy Outlook 2010*, Early Release, Dec 14, 2009. Accessed at http://www.eia.doe.gov/oiaf/aeo/index.html on January 14, 2009. Accession No. ML100600754.

Federal Energy Regulatory Commission (FERC). 1999. “89 FERC 61,285. United States of America Federal Energy Regulatory Commission 18 CFR Part 35 [Docket No. RM99-2-000; Order No. 2000], Regional Transmission Organizations (Issued December 20, 1999).

Federal Energy Regulatory Commission (FERC). 2008. *Regional Transmission Organizations (RTO)/Independent System Operators (ISO)*. Accessed May 14, 2009 at http://www.ferc.gov/industries/electric/indus-act/rto.asp. Accession No. ML100600754.

Global Energy Decisions (GED). 2007. *ERCOT Target Reserve Margin Analysis*. Prepared for Electric Reliability Counsel of Texas (ERCOT). Date submitted January 18, 2007. Sacramento, California.

Governor’s Competitiveness Council. 2008. *2008 Texas State Energy Plan*. Governor’s Competitiveness Council, Austin, Texas.

National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, et seq.

North American Electric Reliability Corporation (NERC). 2008a. *North American Electric Reliability Corporation*. Accessed May 14, 2009 at http://www.nerc.com/. Accession No. ML100600754.

North American Electric Reliability Corporation (NERC) 2008b. *2008 Long-Term Reliability Assessment 2008-2017*. Available at http://www.nerc.com/files/FinalFiled2008LTRA.pdf. Accession No. ML100600754.

Pacific Northwest National Laboratory (PNNL). 2009. Letter from Dave Anderson (PNNL) to Paul Hendrickson and Mike Warwick dated April 22, 2009, “Re: ERCOT Meeting.” Accession No. ML100070666.

South Texas Project Nuclear Operating Company (STPNOC). 2009. *South Texas Project Units 3 and 4 Combined License Application, Part 3, Environmental Report*. Revision 3, Bay City, Texas. Accession No. ML092931600.

Texas Utilities Code. 2009. *Texas Statutes: Utilities Code*. Accessed May 13, 2009 at http://tlo2.tlc.state.tx.us/statutes/ut.toc.htm. Accession No. ML100600754.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Environmental Standard Review Plan—Standard Review Plans for Environmental Reviews for Nuclear Power Plants.* NUREG-1555, NRC, Washington, D.C. Includes 2007 updates.

9.0 Environmental Impacts of Alternatives

This chapter describes alternatives to the proposed U.S. Nuclear Regulatory Commission (NRC) action for a combined license (COL) and the U.S. Army Corps of Engineers (Corps) action for an Individual Permit and discusses the environmental impacts of those alternatives. Section 9.1 discusses the no-action alternative. Section 9.2 addresses alternative energy sources. Section 9.3 reviews the STP Nuclear Operating Company's (STPNOC's) region of interest (ROI), its site selection process, and summarizes and compares the environmental impacts for the proposed and alternative sites. Section 9.4 examines plant design alternatives. Section 9.5 describes onsite alternatives. Section 9.6 lists the references cited in this chapter.

The need to compare the proposed action with alternatives arises from the requirement in Section 102(2)(c)(iii) of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321) that environmental impact statements (EISs) include an analysis of alternatives to the proposed action. The NRC implements this comparison through its regulations in Title 10 of the Code of Federal Regulations (CFR) Part 51 and its Environmental Standard Review Plan (ESRP) (NRC 2000). The environmental impacts of the alternatives are evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – developed using Council on Environmental Quality (CEQ) guidelines (40 CFR 1508.27) and set forth in the footnotes to Table B-1 of 10 CFR 51, Subpart A, Appendix B. The issues evaluated in this chapter are the same as those addressed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[a] with the additional issue of environmental justice. Although NUREG-1437 was developed for NRC's review of renewal of nuclear power plant operating licenses, it provides useful information for this review and is referenced throughout this chapter.

As part of the evaluation of permit applications subject to Section 404 of the Federal Water Pollution Control Act (Clean Water Act), the Corps is required by regulation to apply the criteria set forth in the 404(b)(1) guidelines (33 USC 1344; 40 CFR Part 230). These guidelines establish criteria that must be met for the proposed activities to be permitted pursuant to Section 404.

Section 230.10(a) of the Guidelines (40 CFR 230.10(a)) requires that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." Section 230.10(a)(2) of the Guidelines states that "An alternative is practicable if it is available and capable of being

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(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999 (NRC 1999). Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant which could reasonably be obtained, used, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered." Thus, this analysis is necessary to determine which alternative is the Least Environmentally Damaging Practicable Alternative (LEDPA) that meets the project purpose and need.

Where the activity associated with a discharge is proposed for a special aquatic site (as defined in 40 CFR Part 230, Subpart E), and does not require access or proximity to or siting within these types of areas to fulfill its basic project purpose (i.e., the project is not "water dependent"), practicable alternatives that avoid special aquatic sites are presumed to be available, unless clearly demonstrated otherwise (40 CFR 230.10(a)(3)).

9.1 No-Action Alternative

For purposes of an application for a COL, the no-action alternative refers to a scenario in which the NRC would deny the COL requested by STPNOC which would result in the proposed units not being built. Likewise, the Corps could also take no action or deny the Individual Permit request. Upon such a denial by the NRC, the construction and operation of two new nuclear units at the STP site in accordance with 10 CFR Part 52 would not occur and the predicted environmental impacts associated with the project would not occur. Preconstruction impacts associated with activities not within the definition of construction in 10 CFR 50.10(a) and 51.4 may occur nonetheless. If no other power plants were to be built in lieu of the proposed project or other strategy implemented to take its place, the benefits of the additional electrical capacity and electricity generation to be provided by the project would not occur. If no additional measures (e.g., conservation, importing power, restarting retired power plants, and/or extending the life of existing power plants) were implemented to realize the amount of electrical capacity that would otherwise be required for power in STPNOC's ROI (see Section 9.3.1), then the need for baseload power, discussed in Chapter 8, would not be met. Therefore, the purpose and need of this project would not be satisfied if the no-action alternative was chosen and the need for power was not met by other means.

If other generation sources were installed, either at another site or using a different energy source, the environmental impacts associated with these other sources would eventually occur. As discussed in Chapter 8, there is a demonstrated need for power. It is reasonable to assume that other options to meet the need for power would be pursued. This needed power may be provided and supported through a number of alternatives that are discussed in Section 9.2 and Section 9.3. Therefore, this section does not include a discussion of other energy alternatives that could meet the need for power.

STPNOC's permit request to the Corps covers the dredging of the barge slip along the Colorado River and the placement of culverts across six onsite drainages. If the dredging request were denied, potential alternatives would be constructing a large crane system to offload materials barged up the Colorado River, use of railroad lines to transport materials to the site instead of barge transport, and use of truck transport instead of barge transport. Alternatives to the placement of culverts would be to use current onsite roadways or span the existing drainages (STPNOC 2009d). In the event the Corps denies the permit requests, STPNOC would need to decide if the proposed project could continue or if other alternatives should be pursued.

9.2 Energy Alternatives

The purpose and need for the proposed project identified in Section 1.3 is to provide additional baseload electrical generation capacity for use in the owner's current markets within the Electric Reliability Council of Texas (ERCOT) region and/or for potential sale on the wholesale market. This section examines the potential environmental impacts associated with alternatives to construction of a new baseload nuclear generating facility. Section 9.2.1 discusses energy alternatives not requiring new generating capacity. Section 9.2.2 discusses energy alternatives requiring new generating capacity. Other alternatives are discussed in Section 9.2.3. A combination of alternatives is discussed in Section 9.2.4. Section 9.2.5 compares the environmental impacts from new nuclear, coal-fired and natural gas-fired generating units, and a combination of energy sources at the STP site.

For analysis of energy alternatives, STPNOC assumed a bounding target value of 2700 MW(e) electrical output (STPNOC 2009a). The staff also used this level of output in analyzing energy alternatives.

9.2.1 Alternatives Not Requiring New Generating Capacity

Four alternatives to the proposed action that do not require STPNOC to construct new generating capacity are to:

- purchase the needed electric power from other suppliers
- extend the operating life of existing power plants
- reactivate retired power plants
- implement conservation or demand-side management programs.

Texas produces and consumes more electricity than any other state. Despite large net interstate electricity imports in some areas, the Texas interconnect power grid is largely isolated from the integrated power systems serving the eastern and western United States. In addition, most areas of Texas have little ability to export or import electricity to and from other states

(DOE/EIA 2009a). If power to replace the capacity of the proposed new nuclear units was to be purchased from sources within the United States or from a foreign country, the generating technology likely would be one of those described in NUREG-1437 (e.g., coal, natural gas, or nuclear) (NRC 1996). The description of the environmental impacts of other technologies described in the GEIS for license renewal is representative of the impacts associated with the construction and operation of new generating units at the STP site. The environmental impacts of coal-fired and natural gas-fired plants are discussed in Section 9.2.2.

Under the purchased power alternative, the environmental impacts of power production would still occur but would be located elsewhere within the region, nation, or in another country. If the purchased power alternative were to be implemented, the most significant environmental unknown would be whether or not new transmission line corridors would be required. The construction of new transmission lines could have both environmental and aesthetic consequences, particularly if new transmission line corridors were needed. The review team concludes that the local environmental impacts from purchased power would be SMALL when existing transmission line corridors are used and could range from SMALL to LARGE if acquisition of new corridors is required. The overall environmental impacts of power generation would depend on the generation technology and location of the generation site and, therefore, are unknown. However, as discussed in Section 9.2.5, the review team concluded that from an environmental perspective, none of the viable energy alternatives would be clearly preferable to construction of a new baseload nuclear power generation plant located within STPNOC's ROI.

Nuclear power facilities are initially licensed by the NRC for a period of 40 years. Operating licenses issued by the NRC can be renewed for up to 20 years; NRC regulations do not preclude multiple renewals. The operating license for STP Unit 1 expires in 2027, and the license for STP Unit 2 expires in 2028. STPNOC intends to submit an application to NRC in the fourth quarter of 2010 to renew the operating licenses of STP Units 1 and 2 (NRC 2009a).

The environmental impacts of continued operation of a nuclear power plant are significantly less than construction of a new plant. However, continued operation of STP Units 1 and 2 already is considered in current energy planning.

Older, existing fossil-fueled plants nearing the end of their useful lives, predominately coal-fired and natural gas-fired plants, are likely to need refurbishing to extend plant life for an extensive period (the proposed action assumes a minimum operating period of 40 years) and meet applicable environmental requirements. Given both the costs of refurbishment and the environmental impacts of operating such facilities, the review team concludes that extending the life of older, existing generating plants would not be a reasonable alternative to the proposed action.

Retired generating plants, predominately coal-fired and natural gas-fired plants that potentially could be reactivated, would ordinarily require extensive refurbishment before reactivation. Such vintage plants typically would require refurbishment to meet current environmental requirements that would likely be costly. The environmental impacts of a reactivation scenario would be bounded by the impacts associated with coal-fired and natural gas-fired alternatives (see Section 9.2.2). Given both these costs and the environmental impacts of operating such facilities, the review team concludes that reactivating retired generating plants would not be a reasonable alternative to the proposed action.

Improved energy efficiency and demand management strategies can potentially cost less than construction of new generation and provide a hedge against market, fuel, and environmental risks. NRG Energy, the controlling owner of Nuclear Innovation North America (NINA) and the primary seller of electricity in the ownership group, is a wholesale power generation company (Toshiba will not sell electricity from Units 3 and 4) (STPNOC 2009f). Consequently, it does not directly offer demand-side management or conservation programs.

City Public Service Board of San Antonio (CPS Energy) is a retail electricity provider and offers a variety of energy conservation programs to its customers. It recently introduced a plan to support energy efficiency by treating it as a new fuel source for electrical generation. The plan projects how much the demand for electricity will grow over the next four years and seeks to reduce that amount by 10 percent each year in an effort to reach 40 percent by 2011. Through its Save for Tomorrow Energy Plan, CPS Energy's goal is to achieve a cumulative reduction of approximately 771 MW(e) by 2020 (CPS 2009). To achieve this goal, CPS Energy is committing millions of dollars to customer incentives and rebates for the installation of high energy efficiency appliances, lighting, and insulation (CPS 2009).

Among the energy conservation programs currently offered by CPS Energy to its customers are (STPNOC 2008a):

Commercial Programs:

- lighting retrofit programs
- cool/thermal roof retrofits
- high efficiency chiller and heating, ventilation, and air conditioning retrofits
- efficient electric motors
- window screening and tinting
- incentives for solar water heaters and photovoltaic installations.

Residential Programs:

- rebates for high efficiency heating, ventilation, and air conditioning units

- “peak save” programmable thermostats free to customers that allow cycling of air conditioning compressors in summer months to reduce peak electricity demand
- home efficiency program that offers an array of rebates for attic insulation, duct work, wall insulation, solar powered attic fans, and window treatments
- incentives for solar water heaters and photovoltaic installations.

The need for power discussion in Chapter 8 takes account of conservation and demand-side management programs. The review team concluded in Chapter 8 that there is a justified need for power in the ERCOT region even with the implementation of conservation and demand-side management programs.

Based on the preceding discussion, the review team concludes that the options of purchasing electric power from other suppliers, reactivating retired power plants, extending the operating life of existing power plants, and conservation and demand-side programs are not reasonable alternatives to providing new baseload power generation capacity.

9.2.2 Alternatives Requiring New Generating Capacity

Consistent with the NRC’s evaluation of alternatives to operating license renewal for nuclear power plants, a reasonable set of energy alternatives to building and operating one or more new nuclear units at the STP site should be limited to analysis of discrete power generation sources, a combination of sources, and those power generation technologies that are technically reasonable and commercially viable (NRC 1996). The current mix of baseload power generation options in Texas is one indicator of the feasible choices for power generation technology within the State. In September 2009, natural gas-fired power plants accounted for about 51 percent of the electricity produced in Texas, coal-fired plants about 34 percent, nuclear plants about 10 percent, and renewables (including hydroelectric) about 4 percent (DOE/EIA 2009a).

This section discusses the environmental impacts of energy alternatives to the proposed action that would require STPNOC to construct new generating capacity. The three primary energy sources for generating electric power in the United States are coal, natural gas, and nuclear energy (DOE/EIA 2009b). Coal-fired plants are the primary source of baseload generation in the United States (DOE/EIA 2009b). Natural gas combined-cycle generation plants are often used as intermediate generation sources, but they are also used as baseload generation sources (SSI 2010).

Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an annual energy outlook. In its *Updated Annual Energy Outlook 2009*, EIA’s reference case projects that total electric generating capacity additions between 2007 and 2030 will use the following fuels in the approximate percentages: natural gas (55 percent), renewables (27 percent), coal (14 percent), and nuclear (5 percent) (DOE/EIA 2009c). The EIA projection includes baseload, intermittent, and peaking units and is based on the assumption that providers of new generating capacity would seek to minimize cost while meeting applicable environmental requirements.

The discussion in Section 9.2.2 is limited to a reasonable range of the individual energy alternatives that appear to be viable for new baseload generation: coal-fired and natural gas combined cycle generation. The impacts discussed in Section 9.2.2 are estimates based on present technology. Section 9.2.3 addresses alternative generation technologies that have demonstrated commercial acceptance but may be limited in application, total capacity, or technical feasibility when based on the need to supply reliable, baseload capacity.

The review team assumed that (1) new generation capacity would be located at the STP site for the coal- and natural gas-fired alternatives, (2) the cooling approach planned for proposed Units 3 and 4 (Section 3.2.2.2) would be used for plant cooling, and (3) the existing transmission line corridors serving the STP site would be adequate to serve a new coal- or natural gas-fired plant sited there (Section 3.2.2.3).

9.2.2.1 Coal-Fired Generation

For the coal-fired generation alternative, the review team assumed construction of four supercritical pulverized coal-fired units, each with a net capacity of 675 MW(e). These assumptions are consistent with STPNOC's COL application. Supercritical pulverized coal-fired plants are similar to conventional pulverized coal-fired plants except they operate at slightly higher temperatures and higher pressures, which allows for greater thermal efficiency. Supercritical coal-fired plants are commercially proven and represent an increasing proportion of new coal-fired power plants. A coal-fired plant is assumed to have a capacity factor of 85 percent.

The review team also considered an integrated gasification combined cycle (IGCC) coal-fired plant. IGCC is an emerging technology for generating electricity with coal that combines modern coal gasification technology with both gas turbine and steam turbine power generation. The technology is cleaner than conventional pulverized coal plants because major pollutants can be removed from the gas stream before combustion. The IGCC alternative also generates less solid waste than the pulverized coal-fired alternative. The largest solid waste stream produced by IGCC installations is slag, a black, glassy, sand-like material that is potentially a marketable byproduct. The other large-volume byproduct produced by IGCC plants is sulfur, which is extracted during the gasification process and can be marketed rather than placed in a landfill. IGCC units do not produce ash or scrubber wastes. In spite of the preceding advantages, the review team concludes that, at present, a new IGCC plant is not a reasonable alternative to a 2700 MW(e) nuclear power generation facility for the following reasons: (1) IGCC plants are more expensive than comparable pulverized coal plants (NETL 2007);

(2) the two existing IGCC plants in the United States have considerably smaller capacity, approximately 250 MW(e) each, than the proposed 2700-MW(e) nuclear plant; (3) system reliability of existing IGCC plants has been lower than pulverized coal plants; (4) the existing IGCC plants have had an extended (though ultimately successful) operational testing period (NPCC 2005); and (5) a lack of overall plant performance warranties for IGCC plants has hindered commercial financing (NPCC 2005). For these reasons, IGCC plants are not considered further in this EIS.

The review team assumed that coal and lime (calcium oxide or calcium hydroxide) or limestone (calcium carbonate) for a supercritical pulverized coal-fired plant would be delivered to the plant by train. STPNOC estimates that the plant would consume approximately 11 million tons/yr of pulverized sub-bituminous coal with an ash content of 3.9 percent (STPNOC 2009a). Lime or limestone, used in the scrubbing process for control of sulfur dioxide (SO_2) emissions, is injected as a slurry into the hot effluent combustion gases to remove entrained SO_2. The lime-based scrubbing solution reacts with SO_2 to form calcium sulfite, which precipitates and is removed from the process as sludge. STPNOC estimates that approximately 105,000 tons/yr of limestone would be used for flue gas desulfurization (STPNOC 2009a).

Air Quality

The impacts on air quality from coal-fired generation would vary considerably from those of nuclear generation because of emissions of SO_2, nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), volatile organic compounds (VOCs), and hazardous air pollutants such as mercury and lead. In its environmental report (ER), STPNOC assumed a coal-fired plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. STPNOC estimated that annual emissions for a supercritical pulverized coal-fired generation alternative using sub-bituminous coal would be approximately as follows (STPNOC 2009a):

- SO_2 – 2900 tons/yr
- NO_x – 2000 tons/yr
- CO – 2800 tons/yr
- PM_{10} – 50 tons/yr
- $PM_{2.5}$ – 13 tons/yr
- Mercury – 0.46 tons/yr.

PM_{10} is particulate matter with a diameter equal to or less than 10 microns (40 CFR 50.6). $PM_{2.5}$ is particulate matter with a diameter equal to or less than 2.5 microns (40 CFR 50.7).

Based on data from previous NRC EIS documents, the review team determined the preceding emission estimates are reasonable. A new coal-fired plant at the STP site would also have approximately 27 million tons/yr of unregulated carbon dioxide emissions (STPNOC 2009a) that could affect climate change.

The acid rain requirements of the Clean Air Act capped the nation's SO_2 emissions from power plants. STPNOC would need to obtain sufficient pollution credits either from a set-aside pool or purchases on the open market to cover annual emissions from the plant.

A new coal-fired generation plant at the STP site would likely need a prevention of significant deterioration (PSD) permit and an operating permit from the Texas Commission on Environmental Quality (TCEQ). The plant would need to comply with the new source performance standards for such plants in 40 CFR 60, Subpart Da. The standards establish emission limits for PM and opacity (40 CFR 60.42Da), SO_2 (40 CFR 60.43Da), NO_x (40 CFR 60.44Da), and mercury (40 CFR 60.45Da).

Fugitive dust emissions from construction activities would be mitigated using best management practices (BMPs); such emissions would be temporary (STPNOC 2009a).

The U.S. Environmental Protection Agency(EPA) has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in areas designated as in attainment or unclassified under the Clean Air Act. The STP site is in an area designated as in attainment or unclassified for criteria pollutants (40 CFR 81.344).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future impairment of visibility and remedying existing impairment in mandatory Class I Federal areas when impairment is from air pollution caused by human activities. In addition, the EPA regulations provide that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and confirm no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a new coal-fired power plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. No mandatory Class I Federal areas are within 50 mi of the STP site.

The GEIS for license renewal considers global warming from unregulated carbon dioxide emissions and acid rain from sulfur oxides and nitrogen oxide emissions as a potential impact (NRC 1996). Adverse human health effects, such as cancer and emphysema, have been associated with the byproducts of coal combustion. Overall, the review team concludes that air quality impacts from new coal-fired power generation at the STP site would be MODERATE. The impacts would be clearly noticeable but would not destabilize air quality.

Waste Management

As the NRC has described in NUREG-1437 (NRC 1996) and verified during its preparation of the operating license renewal supplemental EIS analyses, coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction (SCR) catalyst, and scrubber sludge. STPNOC estimated that a coal-fired plant would generate approximately 435,000 tons/yr of ash (STPNOC 2009a). STPNOC estimated that approximately 50 percent of the ash would be recycled (STPNOC 2008a). The coal plant would also generate approximately 124,000 tons/yr of scrubber sludge. STPNOC estimated that landfill disposal of the ash and scrubber sludge over a 40-year plant life would require approximately 141 ac (STPNOC 2009a).

In May 2000, the EPA issued a “Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels” (65 FR 32214). The EPA concluded that some form of national regulation is warranted to address coal combustion waste products because of health concerns. Accordingly, the EPA announced its intention to issue regulations for disposal of coal-combustion waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA). As of November 2009, the EPA is continuing to study the appropriate form of regulation for coal combustion waste products.

Waste impacts on groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use (because of the acreage needed for waste) and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses. Construction-related debris would be generated during plant construction activities, and would be disposed of in approved landfills.

For the reasons stated above, the review team concludes that the impacts from waste generated at a coal-fired plant would be MODERATE. The impacts would be clearly noticeable but would not destabilize any important resource.

Human Health

Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risk from coal and lime/limestone transportation, worker and public risk from disposal of coal-combustion waste, and public risk from inhalation of stack emissions. In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and State agencies, base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. Given the regulatory oversight exercised by the EPA and State agencies, the review team concludes that the human health impacts from radiological doses and inhaled toxins and particulates generated from coal-fired generation would be SMALL.

Other Impacts

Approximately 576 ac would need to be converted to industrial use on the STP site for the powerblock, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge (STPNOC 2009a). Land-use changes would also occur offsite in an undetermined coal mining area to supply coal for the plant. In NUREG-1437, the staff estimated that approximately 22,000 ac would be needed for coal mining and waste disposal to supply a 1000 MW(e) coal-fired power plant over its operating life (59,400 ac for a 2700 MW(e) plant) (NRC 1996). Based upon the amount of land affected for the site, mining, and waste disposal, the review team concludes that land-use impacts would be MODERATE.

The amount of water used and the impacts on water use and quality from constructing and operating a coal-fired plant at the STP site would be comparable to those associated with a new nuclear plant. All discharges would be regulated by the TCEQ through a Texas Pollutant Discharge Elimination System (TPDES) permit. Indirectly, water quality could be affected by acids and mercury from air emissions. However, these emissions are regulated to minimize impacts. In NUREG-1437, the staff determined that some erosion and sedimentation would likely occur during construction of new facilities (NRC 1996). These impacts would be similar to those for a new nuclear plant. Overall, the review team concludes that the water-use and water-quality impacts would be SMALL.

The coal-fired power generation alternative would introduce ecological impacts from construction and new incremental impacts from operations. The impacts would be similar to those of the proposed action at the STP site and along the transmission corridors. The impacts could include terrestrial and aquatic functional loss, habitat fragmentation and/or loss, reduced productivity, and a local reduction in biological diversity. The impacts could occur at the STP site and at the sites used for coal and limestone mining. Some of the impacts would occur in areas that were previously disturbed during the construction of STP Units 1 and 2, thereby limiting potential ecological effects. Stack emissions and disposal of waste products could affect aquatic and terrestrial resources. Additional impacts on threatened and endangered species could result from ash disposal and mining activities if the locations of such activities overlap with habitat for such protected species. Overall, the review team concludes that the ecological impacts would be MODERATE primarily because of potential impacts associated with disposal of ash and the large area of offiste land affected by mining activities.

Socioeconomic impacts would result from the approximately 2400 workers needed to construct the plant and 315 workers to operate it, demands on housing and public services during construction, and the loss of jobs after construction (STPNOC 2009a). Overall, because the scale of activity for coal-fired power generation would be smaller than that for STP 3 and 4 but still significant in Matagorda County, the review team concludes that these impacts would be MODERATE and adverse in Matagorda County and SMALL and adverse elsewhere. STPNOC would pay significant property taxes for the plant to Matagorda County, the Matagorda County Hospital District, Navigation District #1, Drainage District #3, the Palacios Seawall District, and the Palacios Independent School District (STPNOC 2009a). The review team estimates that the taxes would have a LARGE beneficial impact to the tax recipients.

The four coal-fired powerblock units would be up to 200 ft high and visible offsite during daylight hours. The four exhaust stacks would be up to 600 ft high. The stacks and associated emissions would likely be visible in daylight hours for distances greater than 10 mi. The powerblock units and associated stacks would also be visible at night because of outside lighting. The Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 200 ft above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2007). A mitigating factor is that the STP site is currently an industrial site located in a rural area. The visual impacts of a new coal-fired plant could be further mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impacts at night could be mitigated by reduced use of lighting, enhanced use of downfacing-lighting provided the lighting meets FAA requirements, and appropriate use of shielding. Overall, the review team concludes that the aesthetic impacts associated with new coal-fired power generation at the STP site would be SMALL and adverse.

Coal-fired power generation would introduce mechanical sources of noise that would likely be audible offsite. Sources contributing to the noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise impacts associated with rail delivery of coal and lime/limestone would be most significant for residents living in the vicinity of the facility and along the rail route. STPNOC estimated that about 17 unit trains of coal would be needed per week to supply a coal-fired plant (STPNOC 2009a). Although noise from passing trains significantly increases noise levels near the rail corridor, the short duration of the noise reduces the impacts. Nevertheless, given the frequency of train transport and the fact that many people are likely to be within hearing distance of the rail line, the review team concludes that the impacts of noise on residents in the vicinity of the facility and of the rail line would be MODERATE and adverse.

As discussed in Section 2.6, minority and low-income persons are in the population near the STP site. However, the review team concludes that the socioeconomic-related environmental justice impacts on minority and low-income populations associated with a new coal-fired plant located at the STP site would likely be smaller than those associated with proposed Units 3 and

4 because the smaller scale of the building and operating effort. The air quality and noise impacts of a coal-fired power plant in Matagorda County are described above as MODERATE and adverse. Because at least one Asian-Pacific Islander population block group borders the STP site to the west and one small, possibly low-income settlement borders the STP site to the east, there is a potential for a disproportionate and adverse impact on minority and low-income populations. However, the area in the vicinity of the STP site is not a disproportionately minority or low-income area, and the air quality impacts likely would affect all nearby populations roughly equally. Furthermore, as discussed in Section 2.6.3, the review team did not identify any evidence of unique characteristics or practices in the minority and low-income populations that may result in different air quality impacts compared to the general population (STPNOC 2009a; Scott and Niemeyer 2008). Therefore although the review team determined the air quality impact of a coal-fired plant would be noticeable and adverse, the environmental justice impact would be SMALL.

Historic and cultural resource impacts for a new coal-fired plant located at the STP site would be similar to the impacts for a new nuclear plant as discussed in Sections 4.6 and 5.6. A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands that would be acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of the adverse impact from ground-disturbing actions. The studies would likely be needed for all areas of potential disturbance at the plant site; any offsite affected areas, such as mining and waste-disposal sites; and along associated corridors where new construction would occur, such as roads. The review team concludes that the historic and cultural resource impacts would likely be SMALL.

The review team’s characterizations of the construction and operation impacts of new coal-fired power generation at the STP site are summarized in Table 9-1 on the following page.

1 **Table 9-1**. Summary of Environmental Impacts of Coal-Fired Power Generation

Impact Category	Impact	Comment
Land use	MODERATE	Uses approximately 576 ac for the powerblock, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge. Mining activities would have additional impacts to tens of thousands of ac offsite.
Air quality	MODERATE	Emissions would be approximately: SO_2 – 2900 tons/yr NO_x – 2000 tons/yr CO – 2800 tons/yr Hg – 0.46 tons/yr PM_{10} – 50 tons/yr $PM_{2.5}$ – 13 tons/yr CO_2 – 27 million tons/yr
Water use and quality	SMALL	Impacts would be comparable to the impacts for new nuclear generating units located at the STP site.
Ecology	MODERATE	Impacts could include terrestrial and aquatic functional loss, habitat fragmentation and/or loss, reduced productivity, and a local reduction in biological diversity. Impacts could occur at the STP site and vicinity and at the sites used for coal and limestone mining. Disposal of ash could affect the terrestrial and aquatic environments. Additional impacts on threatened and endangered species could result from ash disposal and mining activities.
Waste management	MODERATE	Total waste volume would be approximately 435,000 tons/yr of ash and an additional 124,000 tons/yr of scrubber sludge.
Socioeconomics	LARGE Beneficial to MODERATE Adverse	Impacts related to building the facilities would be noticeable. Local property tax base would benefit mainly during operations. Depending on where the workforce lives, the building-related impacts would be noticeable or minor. Impacts of coal transportation during operation would be noticeable. The plant would have noticeable aesthetic impacts. Some offsite noise impacts would occur.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	SMALL Adverse	There are minority and low-income persons in the local population; air quality and noise impacts to two populations could be noticeable but not disproportionate.

9.2.2.2 Natural Gas-Fired Generation

For the natural gas alternative, the review team assumed construction and operation of a natural gas-fired plant located at the STP site. The review team assumed that the plant would use combined-cycle combustion turbines, which is consistent with STPNOC's ER. The review team used the assumption in the ER of four units with a net capacity of 675 MW(e) per unit (STPNOC 2009a). The natural gas-fired plant is assumed to have an operating life of 40 years. STPNOC estimated that the natural gas-fired plant would use approximately 121 billion standard cubic feet of natural gas per year (STPNOC 2009a).

Air Quality

Natural gas is a relatively clean-burning fuel. When compared to a coal-fired plant, a natural gas-fired plant would release similar types of emissions but in lower quantities. A new natural gas-fired power generation plant would likely need a PSD permit and an operating permit from the TCEQ. A new natural gas-fired combined-cycle plant would also be subject to the new source performance standards in 40 CFR 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_X. The EPA has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P, including a specific requirement for review of any new major stationary source in areas designated as in attainment or unclassified under the Clean Air Act. The STP site is in an area designated as in attainment or unclassified for criteria pollutants (40 CFR 81.344).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future impairment of visibility and remedying existing impairment in mandatory Class I Federal areas when impairment is from air pollution caused by human activities. In addition, the EPA regulations provide that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). If a new natural gas-fired power plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. No mandatory Class I Federal areas are within 50 mi of the STP site.

STPNOC estimated that a natural gas-fired plant equipped with pollution control technology to meet emission limits would have approximately the following emissions (STPNOC 2009a):

- SO_2 – 41 tons/yr
- NO_x – 680 tons/yr
- CO – 141 tons/yr
- $PM_{2.5}$ – 119 tons/yr.

Based on data from previous NRC EIS documents, the review team determined the preceding emission estimates are reasonable. A natural gas-fired power plant would also have approximately 6.9 million tons/yr of unregulated carbon dioxide emissions (STPNOC 2009a) that could affect climate change.

The combustion turbine portion of the combined-cycle plant would be subject to EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR 63) if the site is a major source of hazardous air pollutants. Major sources have the potential to emit 10 tons/yr or more of any single hazardous air pollutant or 25 tons/yr or more of any combination of hazardous air pollutants (40 CFR 63.6085(b)).

The review team assumes fugitive dust emissions from construction activities would be mitigated using BMPs, similar to mitigation discussed in Chapter 4 for proposed Units 3 and 4. Such emissions would be temporary.

The impacts of emissions from a natural gas-fired power generation plant would be clearly noticeable, but would not be sufficient to destabilize air resources. Overall, the review team concludes that air quality impacts resulting from construction and operation of new natural gas-fired power generation at the STP site would be SMALL to MODERATE.

Waste Management

In NUREG-1437, the NRC staff concluded that waste generation from natural gas-fired technology would be minimal (NRC 1996). The only significant waste generated at a natural gas-fired power plant would be spent SCR catalyst, which is used to control NO_x emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent SCR catalyst, waste generation at an operating natural gas-fired plant would be limited largely to typical operations and maintenance waste. Construction-related debris would be generated during construction activities. Overall, the review team concludes that waste impacts from natural gas-fired power generation would be SMALL.

Human Health

Natural gas fired power generation introduces public risk from inhalation of gaseous emissions. The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risk. Regulatory agencies, including the EPA and state agencies, base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. Given the regulatory oversight exercised by the EPA and State agencies, the review team concludes that the human health impacts from natural gas-fired power generation would be SMALL.

Other Impacts

A natural gas-fired generating plant would require approximately 107 ac for the power-block and support facilities (STPNOC 2009a). Construction of a natural gas pipeline from the STP site to the closest natural gas distribution line, located approximately 2 mi northwest of the site, would require approximately 18 ac. Thus, the total land commitment, not including natural gas wells and collection stations, would be approximately 125 ac. A small amount of additional land would also be required for natural gas wells and collection stations. Overall, the review team concludes that the land-use impacts from new natural gas-fired power generation at the STP site would be SMALL.

The amount of water used and the impacts on water use and quality from constructing and operating a natural gas-fired plant at the STP site would be less than the impacts associated with building and operating a new nuclear facility. The impacts on water quality from sedimentation during construction of a natural gas-fired plant were characterized in NUREG-1437 as SMALL (NRC 1996). The NRC staff also noted in NUREG-1437 that the impacts on water quality from operations would be similar to, or less than, the impacts from other generating technologies (NRC 1996). Overall, the review team concludes that impacts on water use and quality would be SMALL.

A natural gas-fired plant at the STP site would have less extensive ecological impacts than a new nuclear facility because less land would be affected. Much of the impact would occur in areas that were previously disturbed during the construction of STP Units 1 and 2. Constructing a new underground gas pipeline to the site would result in permanent loss of some terrestrial and aquatic function and conversion and fragmentation of habitat; however, assuming that the distance required to connect to natural gas distribution systems would be minimal, no important ecological attributes would be noticeably altered. Impacts on threatened and endangered species would be similar to the impacts from a new nuclear facility located at the STP site. Overall, the review team concludes that ecological impacts from a natural gas-fired plant at the STP site would be SMALL.

Socioeconomic impacts would result from the approximately 661 workers needed to build the plant and 91 workers needed to operate it, demands on housing and public services during construction, and the loss of jobs after construction (STPNOC 2009a). Overall, the review team concludes these impacts would be SMALL and adverse for demographics, public services, education, traffic, and housing because of the mitigating influence of the site’s proximity to the surrounding population area and the relatively small number of workers needed to build and operate the plant in comparison to nuclear and coal-fired generation alternatives. The plant owner would pay significant property taxes for the plant to Matagorda County, the Matagorda County Hospital District, Navigation District #1, Drainage District #3, the Palacios Seawall District and the Palacios Independent School District (STPNOC 2009a) and would employ a noticeable but not significant number of workers, especially during the building period. Based on the expected valuation of a natural gas plant, which would be significantly less than for nuclear or coal, the property taxes would be lower for the natural gas option. Considering the population and economic condition of the County, the review team concludes that the taxes and employment would have a MODERATE beneficial impact on the County.

Other socioeconomic impacts related to construction and operation would be SMALL. In most cases, the impacts would not likely be detectable, and certainly would not destabilize any important attribute of the resource involved.

The turbine buildings, four exhaust stacks (approximately 200-ft high) and associated emissions, and the gas pipeline compressors would be visible during daylight hours from offsite. Noise and light from the plant would be detectable offsite. A mitigating factor is the STP site is currently an industrial site located in a rural area. Overall, the review team concludes that the aesthetic impacts associated with new natural gas-fired power generation at the STP site would be SMALL and adverse.

Historic and cultural resource impacts for a new natural gas-fired plant located at the STP site would be similar to the impacts for a new nuclear plant as discussed in Sections 4.6 and 5.6. A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands that would be acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of the adverse impact from ground-disturbing actions. The studies would likely be needed for all areas of potential disturbance at the plant site; any offsite affected areas, such as gas wells, collection stations, and waste disposal sites; and along associated corridors where new construction would occur, such as roads and a new pipeline. The review team concludes that the historic and cultural resource impacts associated with new natural gas-fired power generation at the STP site would be SMALL.

As described in Section 2.6, there are minority and low-income persons in the population around the STP site. However, the review team concludes that the impacts of a natural gas-fired plant at the STP site on minority or low-income populations would likely be much smaller than those associated with STP 3 and 4 because of the smaller scale of the building and operating effort. The air quality impacts of a natural gas-fired power plant in Matagorda County are described as SMALL to MODERATE and adverse. Similar to the situation with a coal-fired power plant at the STP site, there is potential for the Asian-Pacific Islander population block group on the west side of the STP site and the small, possibly low-income settlement on the east to experience a SMALL to MODERATE adverse impact. However, the area in the vicinity of the STP site is not a disproportionately minority or low-income area, and the air quality impacts likely would affect all nearby populations roughly equally. Furthermore, as discussed in Section 2.6.3, the staff did not identify any evidence of unique characteristics or practices in the minority and low-income populations that may result in different air quality impacts compared to the general population (STPNOC 2009a; Scott and Niemeyer 2008). Therefore, although the review team determined the air quality impact of a gas-fired plant could be noticeable and adverse, the environmental justice impact would be SMALL. The review team's characterization of the construction and operational impacts of natural gas-fired power generation at the STP site are summarized in Table 9-2 below.

Table 9-2. Summary of Environmental Impacts of Natural Gas-Fired Power Generation

Impact Category	Impact	Comment
Land use	SMALL	Approximately 125 ac would be needed for the power-block and support systems and connection to a natural gas pipeline.
Air quality	SMALL to MODERATE	Emissions would be approximately: SO_2 – 41 tons/yr NO_x – 680 tons/yr CO – 141 tons/yr $PM_{2.5}$ – 119 tons/yr CO_2 – 6.9 million tons/yr.
Water use and quality	SMALL	Impacts would be somewhat less than the impacts for new nuclear generating units located at the STP site.
Ecology	SMALL	Constructing a new underground gas pipeline to the site would result in some permanent loss of terrestrial and aquatic function and conversion and fragmentation of habitat. Impacts on threatened and endangered species would be similar to the impacts from new nuclear generating units. In forested areas, impacts from pipeline construction would cause conversion of forested areas to herbaceous growth, resulting in net loss of function.
Waste management	SMALL	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions.
Socioeconomics	MODERATE Beneficial to SMALL Adverse	Construction and operations workforces would be relatively small. Addition to property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related beneficial economic impacts would be noticeable, but there likely would not be noticeable adverse impacts on community services or infrastructure because of the relatively small numbers of in-migrants. Impacts during operation would be minor because of the small work-force involved. The plant would have only minor aesthetic impacts.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	SMALL	There are minority and low-income persons in the local population; air quality impacts to two populations could be noticeable but not disproportionate.

9.2.3 Other Alternatives

This section discusses other energy alternatives, the review team's conclusions about the feasibility of each alternative, and the review team's basis for the conclusions. New nuclear units at the STP site would be baseload generation units. Any feasible alternative to the new units would need to generate baseload power. In evaluating other energy technologies, STPNOC used the technologies discussed in the GEIS for license renewal (NRC 1996). The review team reviewed the information submitted by STPNOC in its ER and also conducted an independent review. The review team determined that the other energy alternatives are not reasonable alternatives to two new nuclear units that would provide baseload power.

The review team has not assigned significance levels to the environmental impacts associated with the alternatives discussed in Section 9.2.3 because, in general, the generation alternatives would have to be installed at a location other than the STP site. Any attempt to assign significance levels would require the review team's speculation about the unknown site.

9.2.3.1 Oil-Fired Generation

EIA's reference case in its *Updated Annual Energy Outlook 2009* projects that oil-fired power plants will not account for any new electric power generation capacity in the United States through the year 2030 (DOE/EIA 2009c). Oil-fired generation is more expensive than nuclear, natural gas-fired, or coal-fired generation options. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive. The high cost of oil has resulted in a decline in its use for electricity generation. In Section 8.3.11 of NUREG-1437, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 120 ac of land (NRC 1996). Operation of an oil-fired powerplant would have environmental impacts that would be similar to those of a comparably sized coal-fired plant (see Section 9.2.2.1) (NRC 1996).

For the preceding economic and environmental reasons, the review team concludes that an oil-fired power plant located would not be a reasonable alternative to construction of a 2700 MW(e) nuclear power generation facility that would be operated as a baseload plant within STPNOC's ROI.

9.2.3.2 Wind Power

Texas has significant wind energy resources and leads the Nation in wind-powered generation capacity (DOE/EIA 2009a). The installed wind capacity in Texas as of 2008 was approximately 6234 MW(e) (ERCOT 2008). Wind resource areas in the Texas Panhandle, along the Gulf Coast south of Galveston, and in the mountain passes and ridgetops of the Trans-Pecos region offer some of the greatest wind power potential in the United States. The Horse Hollow Wind

Energy Center in Texas is the largest wind farm in the world with a total capacity of 735 MW(e) spread across approximately 47,000 ac in Taylor and Nolan Counties near Abilene in west-central Texas (TSECO 2008b).

Newer wind turbines typically operate at approximately a 36 percent capacity factor (DOE 2008a). In comparison, the average capacity factor for a nuclear generation plant in 2008 in the United States was 91.5 percent (NEI 2009). Wind turbines generally can serve as an intermittent power supply (NPCC 2005). Section 8.2 notes that the effective load carrying capability of wind is assumed by ERCOT to be 8.7 percent of name plate generation. Wind power, in conjunction with energy storage mechanisms such as pumped hydroelectric or compressed air energy storage (CAES), or another readily dispatchable power source, e.g., hydropower, might serve as a means of providing baseload power.

EIA is not projecting any growth in pumped storage capacity through 2030 (DOE/EIA 2009c). In addition, the review team concludes in Section 9.2.3.4 that the potential for new hydroelectric development in Texas is limited. Therefore, the review team concludes that the use of pumped storage in combination with wind turbines to generate 2700 MW(e) is unlikely in Texas.

A CAES plant consists of motor driven air compressors that use low cost off peak electricity to compress air into an underground storage medium. During high electricity demand periods, the stored energy is recovered by releasing the compressed air through a combustion turbine to generate electricity (NPCC 2009). Only two CAES plants are currently in operation. A 290-MW plant near Bremen, Germany, began operating in 1978, and a 110-MW plant located in McIntosh, Alabama, has been operating since 1991. Both facilities use salt caverns (Succar and Williams 2008). A CAES plant requires suitable geology such as an underground cavern for energy storage. A 268-MW CAES plant coupled to a wind farm, the Iowa Stored Energy Park, has been proposed for construction near Des Moines, Iowa. The facility would use a porous rock storage reservoir for the compressed air (Succar and Williams 2008). To date, nothing approaching the scale of a 2700 MW(e) facility has been contemplated. Therefore, the review team concludes that the use of CAES in combination with wind turbines to generate 2700 MW(e) in Texas is unlikely.

Aerodynamic and mechanical noise from wind turbines would affect wildlife. Collisions with wind turbines would increase bird and bat mortality. However, technological advances allow rotors to turn at lower speeds, reducing the potential for bird and bat strikes.

A significant challenge for new wind power facilities is that wind farms can be built more quickly than transmission lines. It can take a year to build a wind farm, but five years to build the transmission lines needed to send power to cities. Moreover, wind power developers are reluctant to build where transmission lines do not yet exist, and utilities are equally reluctant to install transmission in areas that do not yet have power generators (TSECO 2008c).

Southern Company and the Georgia Institute of Technology (GIT) studied the viability of offshore wind turbines in the southeast (Southern and GIT 2007). Among the conclusions of the study authors were the following: (1) the available wind data indicate that a wind farm located offshore of Georgia would likely have an adequate wind speed to support a project, although offshore project costs run approximately 50 to 100 percent higher than land-based systems; (2) based on current prices for wind turbines, the 20-year levelized cost of electricity produced from an offshore wind farm would be above the current production costs from existing power generation facilities; and (3) the current commercially available offshore wind turbines are not built to withstand major hurricanes above a Category 3 or a 1-min sustained wind speed of 124 mph. The review team believes that the preceding conclusions would generally apply to a wind farm located offshore of Texas.

Although wind power is an important energy resource in Texas, the review team concludes that a wind energy facility at or in the vicinity of the STP site or elsewhere in STPNOC's ROI would not currently be a reasonable alternative to construction of a 2700 MW(e) nuclear power generation facility within STPNOC's ROI that would be operated as a baseload plant.

9.2.3.3 Solar Power

Solar technologies use energy and light from the sun to provide heating and cooling, light, hot water, and electricity for consumers. Solar energy can be converted to electricity using solar thermal technologies or photovoltaics. Solar thermal technologies employ concentrating devices to create temperatures suitable for power production. Concentrating thermal technologies are currently less costly than photovoltaics for bulk power production. They can also be provided with energy storage or auxiliary boilers to allow operation during periods when the sun is not shining (NPCC 2006). The largest operational solar thermal plant is the 310 MW(e) Solar Energy Generating System located on approximately 1500 ac in the Mojave Desert in southern California (NextEra 2009).

Solar radiation is available throughout Texas in sufficient quantity to power distributed solar systems such as solar water heaters and off-grid photovoltaic panels. Large solar power plants would be most cost-effective when sited in areas of west Texas that receive high levels of direct solar radiation (TSECO 2008a).

Solar radiation has a low energy density relative to other common energy sources. Consequently a large total acreage is needed to gather an appreciable amount of energy. Typical solar-to-electric power plants require 5 to 10 ac for every MW of generating capacity (TSECO 2008a). For the target capacity of 2700 MW(e) for proposed Units 3 and 4, land requirements would thus be approximately 13,500 to 27,000 ac. Solar thermal electric technologies also typically require considerable water supplies. While the quantity of water needed per acre of use is similar to or less than that needed for irrigated agriculture, dependability of the water supply is an important issue in the sunny, dry areas of Texas that would be favored for large-scale solar power plants (TSECO 2008a).

For a large solar plant to be practical as a baseload energy source, a means to store large quantities of energy for distribution when the plant is producing less than 2700 MW(e) would be needed. However, the storage possibilities are limited as discussed in Section 9.2.3.2.

Because of the large amount of acreage required for comparable power generation and the limited energy storage availability, the review team concludes that solar energy facilities at or in the vicinity of the STP site would not currently be a reasonable alternative to construction of a 2700 MW(e) nuclear power generation facility within STPNOC's ROI that would be operated as a baseload plant.

9.2.3.4 Hydropower

Most of Texas does not lend itself to large-scale hydroelectric projects. In 2004, hydropower accounted for 0.62 percent of the State's electrical capacity and only 0.34 percent of electricity actually produced. While Texas has some identified potential for additional hydroelectric capacity, the likelihood of development is not high. Reservoirs can face opposition from the public and policy makers, and all new reservoirs being proposed in Texas by water planners are intended for storing water supplies (Texas Comptroller of Public Accounts 2008a).

EIA's reference case in its *Updated Annual Energy Outlook 2009* projects that U.S. electricity production from hydropower plants will remain essentially stable through the year 2030 (DOE/EIA 2009c).

In NUREG-1437, the NRC staff estimated that land requirements for hydroelectric power are 0.4 million ha (1 million ac) per 1000 MW(e) (NRC 1996). For the target capacity of 2700 MW(e) for proposed Units 3 and 4, land requirements would thus be 2.7 million ac. Aquatic organisms could become stranded temporarily when river levels are lowered. Temperature and nutrient stratification in the reservoir and reduced levels of dissolved oxygen could result in hypotoxic or anoxic conditions for aquatic organisms. Aquatic and riparian ecosystems downstream would be affected by a variety of dam-induced conditions, such as changes in sediment transport and deposition patterns, and channel erosion or scouring. Hydropower operations could enhance populations of nonnative aquatic biota and riparian plants.

Because of the relatively low amount of undeveloped hydropower resources in Texas and the large land use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to produce 2700 MW(e), the review team concludes that local hydropower is not a feasible alternative to construction of a new nuclear power generation facility within STPNOC's ROI that would be operated as a baseload plant.

9.2.3.5 Geothermal Energy

Hydrothermal resources, reservoirs of steam or hot water, are available primarily in the western states, Alaska, and Hawaii. However, earth energy can be tapped almost anywhere with geothermal heat pumps and direct-use applications. Other geothermal resources (e.g., hot, dry rock and magma) are awaiting further technology development (DOE 2006).

Texas does not have the sort of readily accessible, high-temperature hydrothermal resource that can be used to generate electricity (Virtus 2008). The resource in the central part of the State can, however, have an impact in low-temperature applications such as space heating or aquaculture. The geopressured-geothermal resource in Texas will become more attractive only in the context of higher energy prices. The potential of hot dry rock in Texas is presently unknown (Virtus 2008).

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, geothermal technology is not widely used as baseload power generation because of the limited geographic availability of the resource and immature status of the technology (NRC 1996). Geothermal systems have a relatively small footprint and minimal emissions (MIT 2006). A study led by the Massachusetts Institute of Technology concluded that a $300-$400 million investment over 15 years would be needed to make early-generation enhanced geothermal system power plant installations competitive in the evolving U.S. electricity supply markets (MIT 2006).

Based on the limited geothermal energy resources currently available in Texas and immature status of the technology, the review team concludes that one or more geothermal energy facilities within STPNOC's ROI would not currently be a reasonable alternative to construction of a 2700 MW(e) nuclear power generation facility within STPNOC's ROI that would be operated as a baseload plant.

9.2.3.6 Wood Waste

In NUREG-1437, the NRC staff determined that a wood-burning facility can provide baseload power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant impediment to the use of wood waste to generate electricity is the high cost of fuel delivery and high construction cost per megawatt of generating capacity. The larger wood-waste power plants are typically only 40 to 50 MW(e) in size. Estimates in NUREG-1437 suggest that the overall level of construction impacts per megawatt of installed capacity would be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-fired plants, wood waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

A 100 MW(e) wood-fired biomass power plant being developed in Sacul, Texas, will use logging residue as its main fuel source, but also could use urban wood waste (Texas Comptroller of Public Accounts 2008b). The plant owner, Southern Power, estimates that the plant will require approximately 1 million tons of biomass per year, which it plans to procure within a 75-mi radius of the project site (Southern 2009). The plant is scheduled to come online in summer 2012.

Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload power plant, the ecological impacts of large-scale timber cutting (for example, soil erosion and loss of wildlife habitat), and the relatively small size of wood generation plants, the review team concludes that wood waste would not be a reasonable alternative in STPNOC's ROI to a 2700 MW(e) nuclear power generation facility operated as a baseload plant.

9.2.3.7 Municipal Solid Waste

Municipal solid-waste combustors incinerate the waste and can use the resultant heat to produce steam, hot water, or electricity. The combustion process reduces the volume of waste and the need for new solid waste landfills. Mass burning technologies are most commonly used in the United States. This group of technologies processes raw municipal solid waste with little or no sizing, shredding, or separation before combustion. More than one-fifth of the U.S. municipal solid waste incinerators use refuse-derived fuel. In contrast to mass burning—where the municipal solid waste is introduced "as is" into the combustion chamber—refuse-derived fuel facilities are equipped to recover recyclables (e.g., metals, cans, and glass) followed by shredding the combustible fraction into fluff for incineration (EPA 2008).

In NUREG-1437, the NRC staff determined that the initial capital cost for municipal solid-waste plants is greater than for comparable steam-turbine technology at wood-waste facilities because of the need for specialized waste-separation and waste-handling equipment for municipal solid waste (NRC 1996).

Municipal solid-waste combustors generate SO_2 and NO_x emissions and an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue gases using fabric filters and/or scrubbers (EPA 2009a).

Currently, approximately 87 waste-to-energy plants are operating in the United States (EPA 2009a). No plants are operating in Texas (Texas Comptroller of Public Accounts 2008c). The 87 plants generate approximately 2500 MW(e), or an average of approximately 29 MW(e) per plant (EPA 2009a). Given the small average output of existing plants, the review team concludes that generating electricity from municipal solid waste would not be a reasonable alternative to a 2700 MW(e) nuclear power generation facility operated as a baseload plant within STPNOC's ROI.

9.2.3.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuel, several other biomass-derived fuels are available for fueling electric generators including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). EIA estimates that wind and biomass will be the largest source of renewable electricity generation among the nonhydropower renewable fuels through the year 2030 (DOE/EIA 2009c). However, in NUREG-1437, the NRC staff determined that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a large baseload generating plant (NRC 1996). The major operating waste from biomass plants would be the fly ash and bottom ash that results from the combustion of the carbonaceous fuels.

Currently, biomass energy accounts for less than 1 percent of electrical power production in Texas (Texas Comptroller of Public Accounts 2008d).

Co-firing biomass with coal is possible when low-cost biomass resources are available. Co-firing is the most economic option for the near future to introduce new biomass power generation. These projects require small capital investments per unit of power generation capacity. Co-firing systems range in size from 1 to 30 MW(e) of biopower capacity (DOE 2008b).

The review team concludes that given the relatively small average output of biomass generation facilities, biomass-derived fuels do not offer a reasonable alternative to a 2700 MW(e) nuclear power generation facility operated as a baseload plant within STPNOC's ROI.

9.2.3.9 Fuel Cells

Fuel cells work without combustion and its associated environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode, and then separating the two by an electrolyte. The only byproducts are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. Higher-temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

During the past three decades, significant efforts have been made to develop more practical and affordable fuel cell designs for stationary power applications, but progress has been slow. The cost of fuel cell power systems must be reduced before they can be competitive with conventional technologies (DOE 2008c).

The review team concludes that, at the present time, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Future gains in cost competitiveness for fuel cells compared to other fuels are speculative.

For the preceding reasons, the review team concludes that a fuel cell energy facility located in STPNOC's ROI would not currently be a reasonable alternative to construction of a 2700 MW(e) nuclear power generation facility operated as a baseload plant.

9.2.4 Combination of Alternatives

Individual alternatives to the construction of one or more new nuclear units at the STP site might not be sufficient on their own to generate STPNOC's target value of 2700 MW(e) because of the limited availability of the resource or lack of cost-effective opportunities. Nevertheless, it is conceivable that a combination of alternatives might be cost effective. There are many possible combinations of alternatives. It would not be reasonable to examine every possible combination of energy alternatives in an EIS. Doing so would be counter to CEQ guidance that an EIS should be analytic rather than encyclopedic, shall be kept concise, and shall be no longer than absolutely necessary to comply with NEPA and CEQ's regulations [40 CFR 1502.2(a), (b)]. Given that STPNOC's objective is for a new baseload generation facility, a fossil energy source, most likely coal or natural gas, would need to be a significant contributor to any reasonable alternative energy combination.

Section 9.2.2.2 assumes the construction of four 675 MW(e) natural gas combined-cycle generating units at the STP site using the existing STP Main Cooling Reservoir (MCR). For a combined alternatives option, the review team assessed the environmental impacts of an assumed combination of three 675 MW(e) natural gas combined-cycle generating units at the STP site, and the following contributions from within STPNOC's ROI: 50 MW(e) of hydropower (including a new reservoir), 250 MW(e) from biomass sources including municipal solid waste, 175 MW(e) from additional conservation and demand-side management programs beyond what is currently planned, and 200 MW(e) from wind power. The demand-side management programs would be implemented by CPS Energy and/or Reliant Energy, a subsidiary of NRG Energy. Wind energy would need to be combined with an energy storage mechanism, such as CAES, to be a base-load resource. The review team believes that the preceding contributions are reasonable and representative for STPNOC's ROI. The contributions reflect the review team's analysis in Section 9.2.

A summary of the review team's characterizations of the environmental impacts associated with the construction and operation of the preceding assumed combination of alternatives is in Table 9-3 on the following page.

Table 9-3. Summary of Environmental Impacts of a Combination of Power Sources

Impact Category	Impact	Comment
Land use	MODERATE	A natural gas-fired plant would have land-use impacts for the powerblock and connection to a natural gas pipeline. Wind, hydro, and biomass facilities and associated transmission lines would have land-use impacts in addition to the land-use impact of the natural gas-fired plant. Both offshore wind development and hydropower plants would potentially impede navigation.
Air quality	SMALL to MODERATE	Emissions from the natural gas-fired plant would be approximately: SO_2 – 31 tons/yr NO_x – 510 tons/yr CO – 106 tons/yr $PM_{2.5}$ – 89 tons/yr CO_2 – 5.2 million tons/yr Municipal solid waste and biomass generation facilities would also have emissions.
Water use and quality	SMALL	Impacts would be somewhat less that the impacts for new nuclear generating units located at the STP site.
Ecology	MODERATE	Wind energy facilities in the Trans-Gulf migratory route could result in increased avian mortality and might also cause increased mortality of migratory and resident bats. Offshore wind power development would also affect avian and aquatic resources. Coastal bird populations could be subject to increased mortality. Hydropower facilities would affect terrestrial and aquatic habitat and species.
Waste management	SMALL to MODERATE	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions and ash from biomass and municipal solid waste sources.
Socioeconomics	MODERATE Beneficial to SMALL Adverse	Construction and operations workforces would be noticeable but not significant. Addition to property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related beneficial economic impacts would be noticeable, but there likely would not be noticeable adverse impacts on community services or infrastructure because of the relatively small numbers of in-migrants. Impacts during operation would be minor because of the small workforce involved. The natural gas-fired and biomass plants and wind turbines would have aesthetic impacts.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.

Table 9-3. (contd)

Impact Category	Impact	Comment
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facilities and infrastructure at the STP site would likely be built on previously disturbed ground.
Environmental justice	SMALL Adverse	There are minority and low-income persons in the local population; air quality impacts to two populations could be noticeable but not disproportionate.

9.2.5 Summary Comparison of Alternatives

Table 9-4 on the following page contains a summary of the review team's environmental impact characterizations for constructing and operating new nuclear, coal-fired, and natural gas-fired combined-cycle generating units at the STP site. The combination of alternatives shown in Table 9-4 assumes siting of natural gas combined-cycle generating units at the STP site and siting of other generating units within STPNOC's ROI.

The review team reviewed the available information on the environmental impacts of power generation alternatives compared to the building new nuclear units at the STP site. Based on this review, the review team concludes that, from an environmental perspective, none of the viable energy alternatives are clearly preferable to building a new baseload nuclear power generation plant at the STP site.

Because of current concerns related to greenhouse gas emissions, it is appropriate to specifically discuss the differences among the alternative energy sources regarding carbon dioxide (CO_2) emissions. The CO_2 emissions for the proposed action and energy generation alternatives are discussed in Sections 5.7.1, 9.2.2.1, 9.2.2.2, and 9.2.4. Table 9-5 on the following page summarizes the CO_2 emission estimates for a 40-year period for the alternatives considered by the review team to be viable for baseload power generation. These estimates are limited to the emissions from power generation and do not include CO_2 emissions for workforce transportation, building fuel-cycle, or decommissioning. Among the viable energy generation alternatives, the CO_2 emissions for nuclear power are a small fraction of the emissions of the other viable energy generation alternatives. Even adding in the transportation emissions for the nuclear plant workforce and fuel cycle emissions would increase the emissions for plant operation over a 40-year period to about 45,000,000 metric tons. This number is still significantly lower than the emissions for the other viable alternatives.

Table 9-4. Summary of Environmental Impacts of Construction and Operation of New Nuclear, Coal-Fired, and Natural Gas-Fired Generating Units, and a Combination of Alternatives

Resource Area	Nuclear	Coal	Natural Gas	Combination of Alternatives
Land use	SMALL	MODERATE	SMALL	MODERATE
Air quality (criteria pollutants)	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water use and quality	SMALL	SMALL	SMALL	SMALL
Ecology	SMALL	MODERATE	SMALL	MODERATE
Waste management	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	LARGE Beneficial to MODERATE Adverse	LARGE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Adverse	MODERATE Beneficial to SMALL Adverse
Human health	SMALL	SMALL	SMALL	SMALL
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL
Environmental justice	SMALL	SMALL	SMALL	SMALL

Table 9-5. Comparison of Carbon Dioxide Emissions for Energy Alternatives

Generation Type	Years	CO_2 Emission (metric tons)
Nuclear Power[(a)]	40	20,000
Coal-Fired Generation[(b)]	40	980,000,000
Natural Gas-Fired Generation[(c)]	40	250,000,000
Combination of Alternatives[(d)]	40	190,000,000

(a) From Appendix I
(b) From Section 9.2.2.1
(c) From Section 9.2.2.2
(d) From Section 9.2.4 (assuming only natural gas generation has significant CO_2 emissions)

The CO_2 emissions associated with generation alternatives such as wind power, solar power, and hydropower would be associated with workforce transportation, construction, and decommissioning of the facilities. Because these generation alternatives do not involve combustion, the review team considers the emissions to be minor and concludes that the emissions would have a minimal cumulative impact. Other energy generation alternatives involving combustion of oil, wood waste, municipal solid waste, or biomass-derived fuels would have CO_2 emissions from combustion as well as from workforce transportation, plant construction, and plant decommissioning. It is likely that the CO_2 emissions from the combustion process for these alternatives would dominate the other CO_2 emissions associated with the generation alternative. It is also likely that the CO_2 emissions from these alternatives would be the same order of magnitude as the emissions for the fossil-fuel alternatives considered in Sections 9.2.2.1, 9.2.2.2, and 9.2.4. However, because the review team determined that these alternatives do not meet the need for baseload power generation, the review team has not evaluated the CO_2 emissions quantitatively.

As discussed in Chapter 8, the review team concludes that the need for additional baseload power generation has been demonstrated. Also, as discussed earlier in this chapter, the review team concludes that the viable alternatives to the proposed action all would involve the use of fossil fuels (coal or natural gas). Consequently, the review team concludes that the proposed action results in the lowest level of emissions of greenhouse gases among the viable alternatives.

9.3 Alternative Sites

9.3.1 Alternative Sites Selection Process

NRC EISs prepared in conjunction with a COL application are to analyze alternatives to the proposed action [10 CFR 51.71(d)]. This section discusses STPNOC's process for selecting its proposed and alternative sites and the review team's evaluation of the process. STPNOC's site selection process was based on guidance in the following documents (STPNOC 2009a): NRC's Environmental Standard Review Plan (ESRP) (NRC 2000), Regulatory Guide 4.7 (NRC 1998), and the Electric Power Research Institute's (EPRI) Siting Guide (EPRI 2002).

NRC's site selection process guidance calls for identification of an ROI followed by successive screening to candidate areas, potential sites, candidate sites, and the proposed site (NRC 2000, ESRP 9.3). STPNOC modified this process somewhat by adding an extra step of screening to primary sites after it had identified potential sites.

The review team raised a number of concerns related to STPNOC's site selection process and associated results submitted by STPNOC in the COL application (through revision 2 of the application) (STPNOC 2009a). The questions were documented in requests for additional information from the NRC dated May 19, 2008 (NRC 2008a), and November 18, 2008 (NRC 2008b). As a result of these information requests, STPNOC revised its siting process and submitted it in Revision 3 to the ER (STPNOC 2009a) and in a separate Siting Report (STPNOC 2009b). The evaluation that follows is based on the revised site selection process documented in ER Revision 3.

9.3.1.1 Selection of Region of Interest

The ROI is the geographic area considered by an applicant in searching for candidate areas and potential sites for a new nuclear power plant (NRC 2000). STPNOC selected the land area included in the ERCOT grid as its ROI (STPNOC 2009a). ERCOT manages the flow of electric power to approximately 20 million Texas customers, which represents approximately 85 percent of the State's electric load and 75 percent of the Texas land area (see Figure 8-1) (ERCOT 2009). ERCOT is further discussed in Section 8.1 of this EIS.

9.3.1.2 Selection of Candidate Areas

Candidate areas are one or more areas within an applicant's ROI that remain after unsuitable areas for a new nuclear power plant (e.g., due to high population, lack of water, fault lines, or distance to transmission lines) have been removed (NRC 2000). To screen the ROI for potential candidate areas, STPNOC used the following screening criteria: geology/seismicity, water availability, population, dedicated lands, and ecology (STPNOC 2009a). STPNOC determined that there are no areas within STPNOC's ROI with predicted peak ground accelerations greater than 0.3 g. Therefore, the related criteria had no effect on site selection. The water availability criterion was the most influential criterion STPNOC used in screening the ROI (STPNOC 2009a). STPNOC looked for rivers where cooling makeup water would not exceed 10 percent of the average flow rate. STPNOC also assumed that water from the Gulf of Mexico would be a viable source of cooling water makeup. Urban population areas and special use lands (e.g., parks) owned by a governmental entity were excluded. Land within a critical habitat for Federally listed endangered species was also excluded. Using its screening criteria, STPNOC selected the following nine candidate areas within its ROI (STPNOC 2009a):

1. The Nueces River below Choke Canyon Reservoir – approximately 85 river mi.
2. The Guadalupe River below New Braunfels and the San Antonio River below Goliad – approximately 320 river mi.
3. The Colorado River below San Saba (just above Lake Buchanan) – approximately 450 river mi.
4. The Brazos River below South Bend (just above Possum Kingdom Lake) and the Little River below the town of Little River – approximately 685 river mi.
5. The Trinity River below Dallas – approximately 200 river mi.
6. The Neches River below Lake Palestine and the Angelina River below Alto – approximately 185 river mi.
7. The Sabine River below Mineola – approximately 60 river mi.
8. The Sulphur River below Talco and the Red River below Burkburnett – approximately 435 river mi.
9. The Gulf Coast – approximately 230 coastal mi.

The candidate areas are shown in Figure 9-1 on the following page.

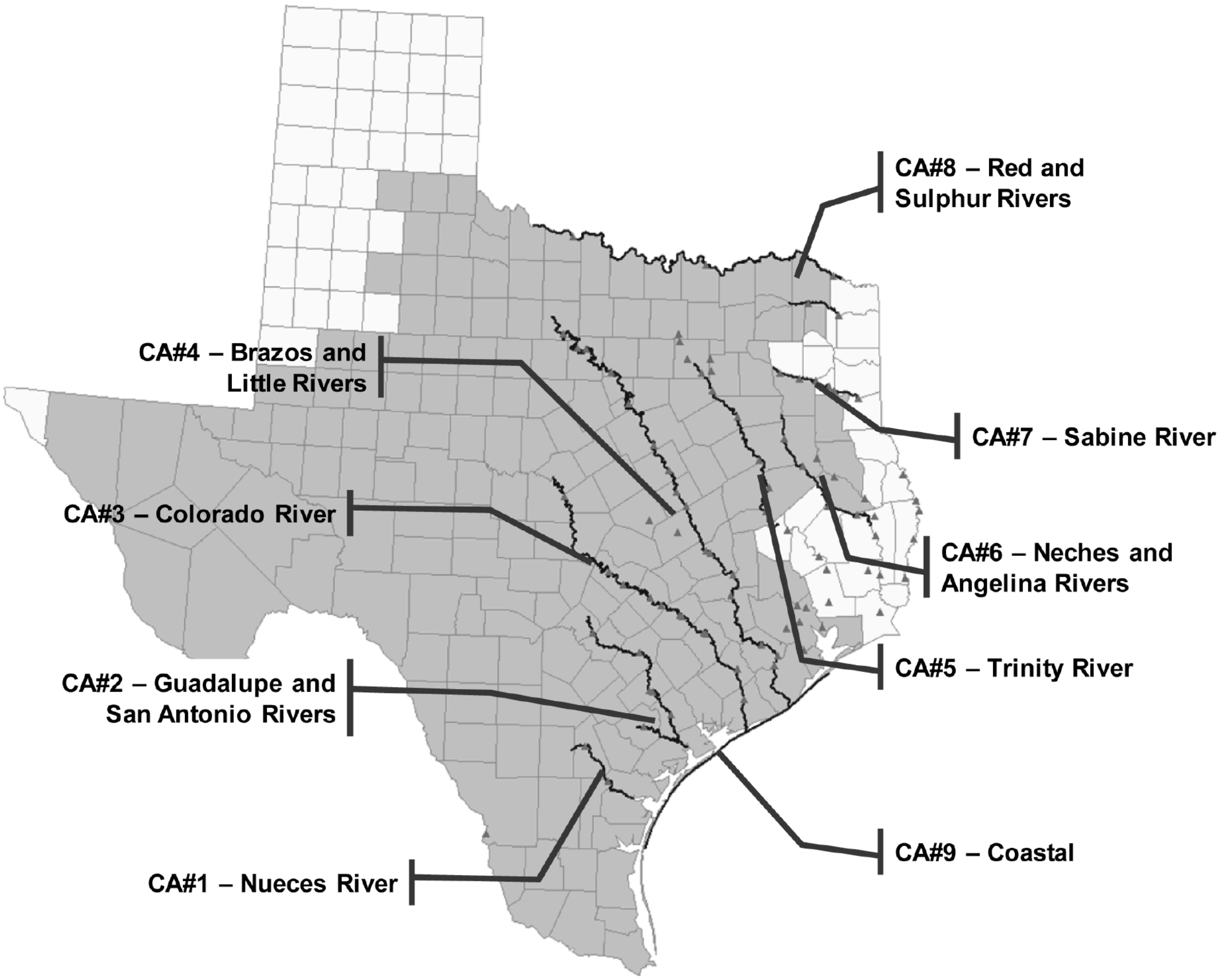


Figure 9-1. Candidate Areas (STPNOC 2009a)

9.3.1.3 Selection of Potential Sites

Potential sites are those sites within a candidate area that have been identified by an applicant for preliminary assessment in establishing candidate sites (NRC 2000). STPNOC applied the following criteria in selecting potential sites (STPNOC 2009a):

- Distance to existing rail lines: The distance to existing rail lines was minimized to the extent possible.
- Distance to existing transmission lines: The distance to existing 345-kV transmission lines was minimized to the extent possible.

- Distances from towns, villages, and developed areas (commercial and residential) were maximized. Developed areas were identified from regional screening, satellite imagery, and county and topographic maps.
- Distance from industrial areas: The distance from industrial areas identifiable from the aerial photographs and topographic maps (e.g., airports and industrial complexes) was maximized except when an existing power plant site was being considered.
- Water availability: STPNOC considered the following factors:
  - Proximity to cooling water supply: Distance to the potential cooling water source was minimized to extent possible.
  - Existing lakes or reservoirs: Whenever possible, lands around existing lakes and reservoirs were evaluated as possible potential sites.
  - Construction of new reservoirs: If existing lakes or reservoirs were not in areas of interest, the topography of the land was qualitatively evaluated for the construction of a new reservoir.
- Topography: The optimal topography was assumed by STPNOC to be: (1) a relatively flat area, (2) above the 100-year floodplain, and (3) adjacent to streams with surrounding topography conducive to the construction of a reservoir. Topographic maps and aerial photographs were qualitatively examined to find areas as close to this ideal as possible.
- Land use: Nominal site areas encompassing a consistent land-use pattern were considered most suitable, with preference to lands that showed no current development but signs of previous disturbance (e.g., recently timbered forest or pasture land). Such patterns were assumed to be associated with fewer landowners (preferred) and less challenges in land acquisition. Land owned by the applicant and known availability of land were not used as criteria.
- Transportation: Access to the potential sites was qualitatively evaluated. Areas around major highways were avoided. Areas within a reasonable distance of state highways were considered.

STPNOC identified 33 potential sites using professional judgment and the preceding criteria. The potential sites are shown in Figure 9-2 on the following page.

9.3.1.4 Selection of Primary Sites

STPNOC screened its 33 potential sites to identify a smaller set of primary sites for more detailed evaluation. Criteria used in the screening included cooling water supply, flooding potential, population, hazardous land uses, ecology, wetlands, heavy haul access, transmission access, and land acquisition. The criteria were derived from a larger set of more detailed criteria in EPRI (2002) (STPNOC 2009a).

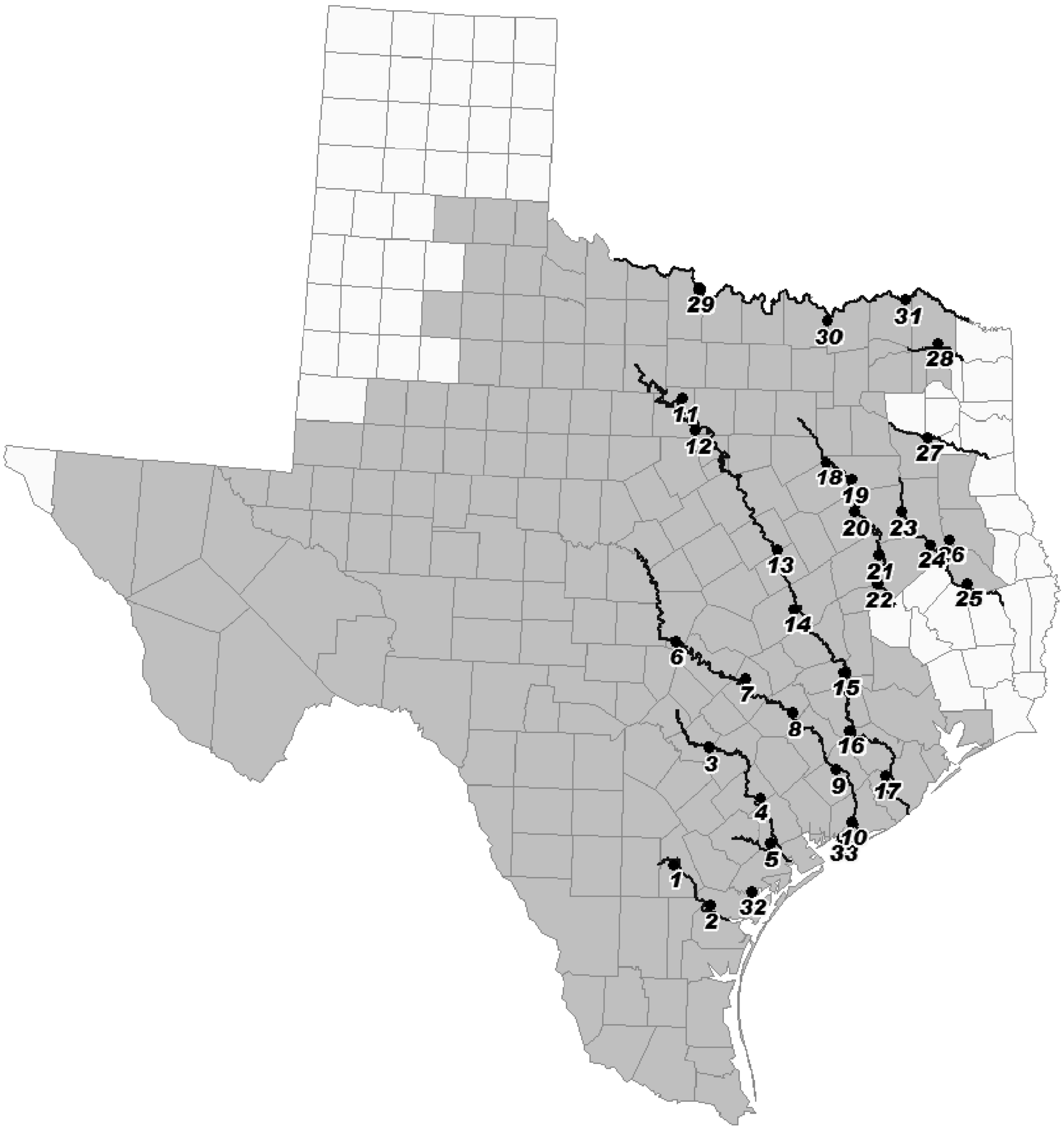


Figure 9-2. Potential Sites (STPNOC 2009a)

STPNOC developed weighting factors reflecting the relative importance of each of the criteria. The factors were developed by a multi-disciplinary committee familiar with the subject area of nuclear power plant site suitability. The committee was comprised of subject matter experts in water use and availability, engineering and licensing, real estate, ecology and environment, transmission, land use, health and safety, geotechnical, socioeconomics, and public relations.

The weighting factors were derived using a methodology consistent with the modified Delphi process specified in EPRI (2002) (STPNOC 2009a).

STPNOC next assigned a rating of 1 to 5 (1 = least suitable; 5 = most suitable) for each criterion at each potential site. STPNOC's information sources for assigning the ratings included publicly available data, information available from STPNOC files and personnel, and large scale satellite photographs. Composite suitability ratings reflecting the overall suitability of each potential site were then developed by multiplying the ratings by the criterion weight factors and summing over all criteria for each potential site (STPNOC 2009a). STPNOC's results are shown in Figure 9-3 below (STPNOC 2009a).

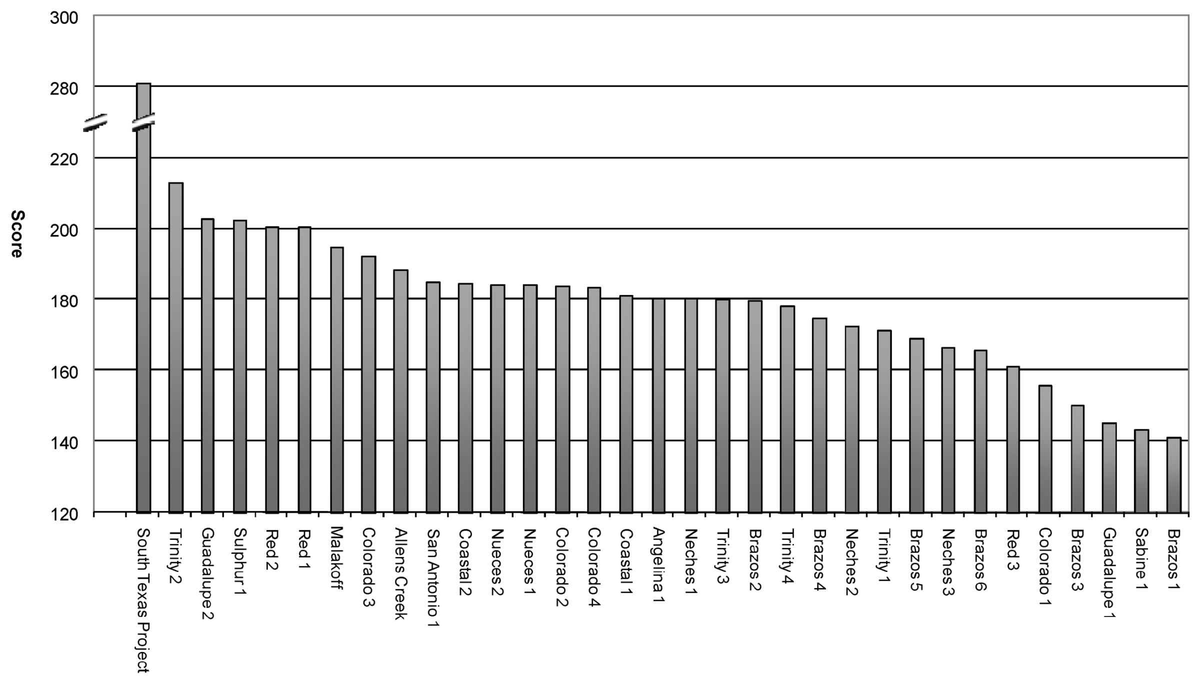
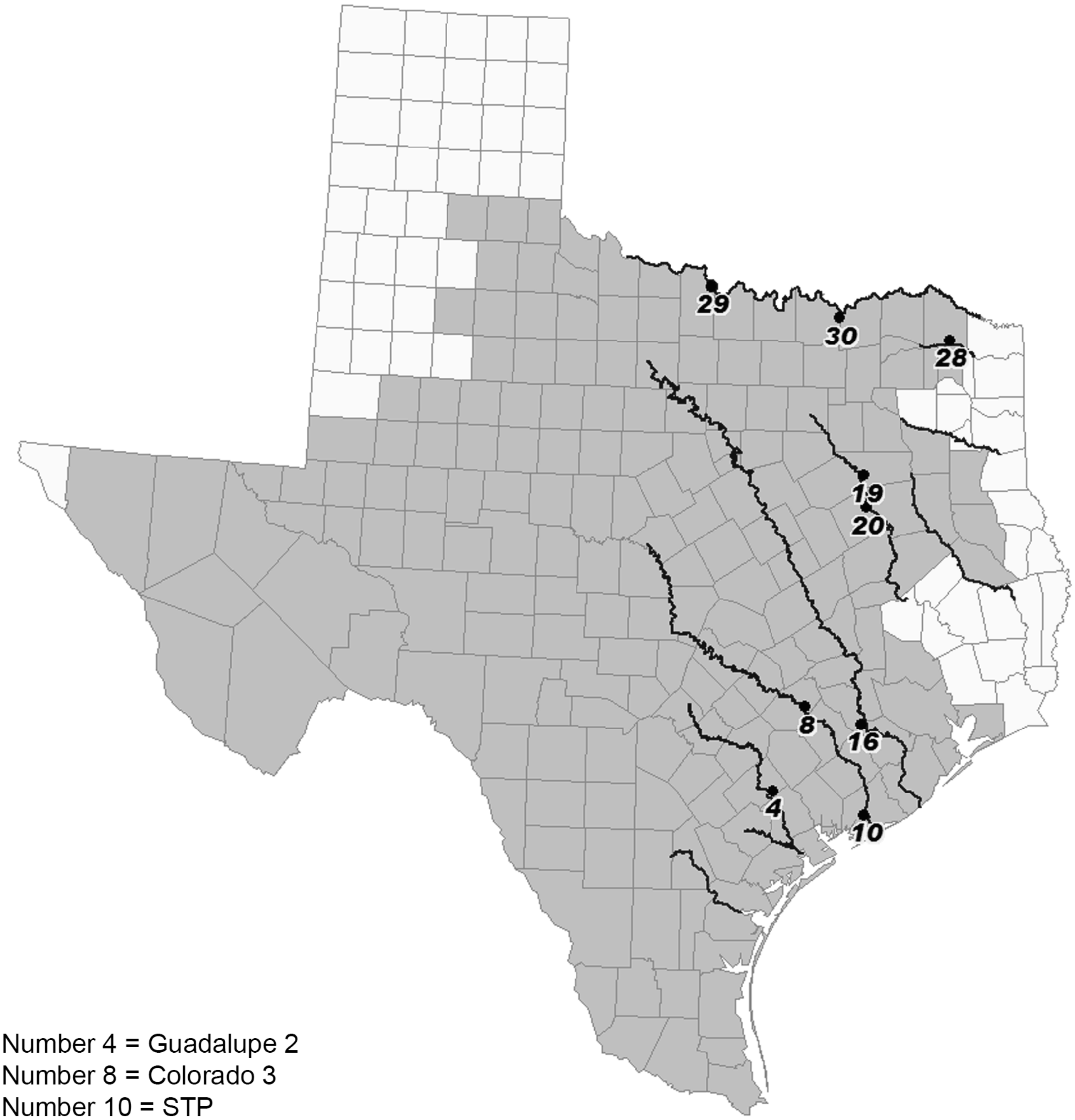


Figure 9-3. Screening Criteria Evaluation Results (STPNOC 2009a)

Based on the results, STPNOC selected the nine highest rated sites as its primary sites for further evaluation. The location of the nine primary sites is shown in Figure 9-4 on the following page.



Site Number 4 = Guadalupe 2
Site Number 8 = Colorado 3
Site Number 10 = STP
Site Number 16 = Allens Creek
Site Number 19 = Malakoff
Site Number 20 = Trinity 2
Site Number 28 = Sulphur 1
Site Number 29 = Red 1
Site Number 30 = Red 2

Figure 9-4. Primary Sites (STPNOC 2009a)

9.3.1.5 Selection of Candidate Sites

STPNOC screened its nine primary sites to identify four candidate sites. Candidate sites are those potential sites within the ROI that are considered in the comparative evaluation of sites to be among the best that can reasonably be found for the siting of a nuclear power plant (NRC 2000).

In selecting candidate sites, STPNOC followed a similar, but more detailed, process to that used to identify primary sites. STPNOC derived more than 30 siting criteria from criteria in EPRI (2002). The criteria are listed in Table 9-6 on the following page (STPNOC 2009b). Weighting Factors were developed using the same process as STPNOC used for the screening of potential sites. The siting criteria and weighting factors used by STPNOC to screen primary sites to candidate sites were not the same as those used to screen potential sites to primary sites.

Each primary site was assigned a rating of 1 to 5 (1 = least suitable; 5 = most suitable) for each of the siting criteria. Similar to the screening of potential sites, STPNOC's information sources for assigning the ratings included publicly available data, information available from STPNOC files and personnel, and large scale satellite photographs. Composite suitability ratings reflecting the overall suitability of each primary site were then developed by multiplying criterion ratings by the criterion weight factors and summing over all criteria for each site. STPNOC's computed composite ratings for the nine primary sites are shown in Table 9-7 (STPNOC 2009a).

To provide additional insights on the environmental preferability of the nine primary sites, two additional indicators were used by STPNOC.

- Environmental Site Rating – This rating consisted of the Health and Safety Criteria (minus the Geology/Seismology criterion), the Environmental Criteria, and the Socioeconomic Criteria. The top sites based on this rating were STP, Red 1, Red 2, Trinity 2, and Allens Creek/Guadalupe 2, with no significant difference between Allens Creek and Guadalupe 2.
- Expanded Environmental Site Rating – This rating consisted of the Environmental Site Rating plus the Railroad Access and Transmission Access criteria, which reflect a rough proxy of environmental impact through measurement of the relative distances required for these support facilities. The top sites based on this rating were STP, Red 2, Trinity 2, and Allens Creek, with no significant difference between Allens Creek, Red 1, and Colorado 3.

Table 9-6. Criteria for Selection of Candidate Sites

Health and Safety	Environmental	Socioeconomic	Engineering and Cost
Accident cause related 1. Geology and seismology 2. Cooling system requirements 3. Flooding potential 4. Nearby hazardous land uses 5. Extreme weather conditions	Construction related effects on aquatic ecology 1. Disruption of important species and habitats 2. Bottom sediment disruption effects	Construction related effects	Health and Safety Related Criteria 1. Water supply 2. Pumping distance 3. Flooding 4. Civil works
Accident effects 1. Population 2. Emergency planning 3. Atmospheric dispersion	Construction related effects on terrestrial ecology 1. Disruption of wetlands and important species and habitats 2. Dewatering effects on adjacent lands	Environmental justice	Transportation and transmission access 1. Railroad 2. Highway 3. Barge 4. Transmission
Operational effects 1. Surface water radionuclide pathway 2. Groundwater radionuclide pathway 3. Air radionuclide pathway 4. Air food ingestion pathway 5. Surface water food indigestion pathway 6. Transportation safety	Operational related effects on aquatic ecology 1. Thermal discharge effects 2. Entrainment and impingement effects 3. Dredging and disposal effects	Land use	Socioeconomic and land use 1. Topography 2. Land rights 3. Labor rates
	Operational related effects on terrestrial ecology 1. Drift effects on surrounding areas		

Source: STPNOC 2009b

Table 9-7. Composite Ratings for the Primary Sites

Site	Composite Rating Score
STP	735.4
Red 2	611.8
Allens Creek	597.5
Colorado 3	595.8
Trinity 2	590.1
Guadalupe 2	586.0
Malakoff	574.1
Red 1	573.2
Sulphur 1	539.9

Source: STPNOC 2009a

STPNOC's evaluation showed that while the Colorado 3 site ranked fourth overall in composite rating, it did not rank as high in the environmentally related criteria ratings. Additionally, the Guadalupe 2 site, ranked sixth in the composite ratings, but did not rank high in the environmentally related criteria. These two sites, along with the three lowest ranked sites, were eliminated by STPNOC from further consideration. Thus, the following sites were identified by STPNOC as its candidate sites:

- STP
- Red 2
- Allens Creek
- Trinity 2.

STPNOC selected the STP site as its proposed site, relying on ESRP 9.3 (NRC 2000), which recognizes that there will be special cases in which the proposed site was not selected on the basis of a systematic site selection process. One example cited in ESRP 9.3 is the siting of a proposed nuclear plant on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review. The proposed site is then compared to alternative sites identified through a systematic process.

9.3.1.6 Evaluation of STPNOC's Site Selection Process

The review team evaluated the methodology used by STPNOC to select its proposed and alternative sites. The ROI selected by STPNOC covers a largely isolated grid system (ERCOT) that encompasses a large and ecologically varied area. Use of such an area is consistent with the guidance in ESRP 9.3 (NRC 2000). STPNOC then established candidate areas based on a group of exclusionary criteria similar to those described in ESRP 9.3. Next STPNOC identified potential sites within the candidate areas based on qualitative criteria, and then narrowed the list of sites using more detailed criteria to identify what it refers to as primary sites. Finally, STPNOC used more specific criteria to evaluate the primary sites and identify the alternative sites. Based on its review of STPNOC's site selection process and the guidance in ESRP 9.3 (NRC 2000), the review team concludes that STPNOC's process for selecting its ROI, candidate areas, potential sites, primary sites, candidate sites, and the proposed STP site was reasonable and did not arbitrarily exclude locations that might be suitable choices for siting two new nuclear generating units to satisfy the need for power identified in Chapter 8.

The three alternative sites examined in detail in Section 9.3 are the Red 2 site in Fannin County, the Allens Creek site in Austin County, and the Trinity 2 site in Freestone County. The review team visited each of the three alternative sites, as well as the proposed site. The review team used information in STPNOC's ER related to the three alternative sites and also independently collected and analyzed reconnaissance-level information for each of the alternative sites using ESRP 9.3 (NRC 2000) as guidance.

In the discussion of the alternative sites that follows, the review team evaluated cumulative impacts of building and operating two new nuclear units at each site for each resource category, considering the impacts of other nearby projects on that resource. Included in the cumulative analysis are past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action. For purposes of this analysis, the past is defined as the time period before receipt of the COL application. The present is defined as the time period from the receipt of the COL application until the start of building proposed Units 3 and 4. The future is defined as the start of building Units 3 and 4 through operation and eventual decommissioning.

Using Chapter 7 as a guide, the specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the alternative site and other actions in the same geographic area were identified. The affected environment that serves as the baseline for the cumulative impacts analysis is described for each alternative site and includes a qualitative discussion of the general effects of past actions. For each resource area, the geographic area over which past, present, and future actions could reasonably contribute to cumulative impacts is defined and described in later sections. The analysis for each resource area at each alternative site concludes with a cumulative impact finding (SMALL, MODERATE, or LARGE). For those cases in which the impact level to a resource was greater than SMALL, the review team also discussed whether building and operating the nuclear units would be a significant contributor to the cumulative impact. In the context of this evaluation, "significant" is defined as a contribution that is important in reaching that impact level determination.

The impacts described in Chapter 6 (e.g., nuclear fuel cycle; decommissioning) would not vary significantly from one site to another. This is true because all of the alternative sites and the proposed site are in low-population areas and because the review team assumes the same reactor design (therefore, the same fuel cycle technology, transportation methods, and decommissioning methods) for all of the sites. As such, these impacts would not differentiate between the sites and would not be useful in the determination of whether an alternative site is environmentally preferable to the proposed site. For this reason, these impacts are not discussed in the evaluation of the alternative sites.

The cumulative impacts are summarized for each resource area at each site in the sections that follow. The level of detail is commensurate with the significance of the impact for each resource area. The findings for each resource area at each alternative site then are compared in Table 9-20 at the end of this section to the cumulative impacts at the proposed site (brought forward from Chapter 7). The results of this comparison are used to determine if any of the alternative sites are environmentally preferable to the proposed site.

9.3.2 Red 2

This section covers the review team's evaluation of the potential environmental impacts of siting a new two-unit nuclear power plant at the Red 2 site in northeastern Texas near the Oklahoma border. The site is located in a rural area of Fannin County 3.7 mi north of Savoy and 12.2 mi southeast of Denison, on the north side of Valley Lake. The Red River, located 3.7 mi to the north of the site, would be the source for water for plant cooling and other plant uses, and construction of a new water storage reservoir would be required. Red 2 is a greenfield site not currently owned by the applicant (STPNOC 2009a).

The following sections include a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the Red 2 site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction and operations and impacts of preconstruction activities. Also included in the assessment are past, present and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Red 2 site. Other actions and projects considered in this cumulative analysis are described in Table 9-8.

Table 9-8. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Cumulative Analysis of the Red 2 Alternative Site

Project Name	Summary of Project	Location (relative to Red 2 site)	Status
Energy Projects			
Valley Power Plant	Three gas-fired generation units with total installed capacity of 1115 MW	About 1.8 mi south of Red 2 site	Operational[(a)]
Pattillo Branch Power Plant	Four new gas-fired turbines with total installed capacity of 1400 MW	Approximately 3 mi south of Red 2 site	Proposed. Air Permit issued June 17, 2009[(b)]
Mining Projects			
Trinity Materials (Hendrix Mine)	Construction sand & gravel mine	About 12 mi northwest of Red 2 site	Operational[(c)]
Parks			
Caddo-LBJ National Grasslands	National grasslands managed by the U.S. Department of Agriculture	About 14 mi northeast of Red 2 site	Development likely limited within this area[(d)]
Other Actions/Projects:			
City of Bells	Sewage treatment facility	About 3 mi southwest of Red 2 site	Operational(e)
City of Denison – Paw Paw wastewater treatment plant	Sewage treatment facility	About 11 mi northwest of Red 2 site	Operational(f)
Lake Ralph Hall	Water storage for municipal use and for recreation	About 30 mi southeast of Red 2 site	Proposed(g)
Lower Bois d'Arc Creek Reservoir	Water storage for municipal use and for recreation	About 20 mi east of Red 2 site	Proposed. Construction is planned to begin in 2015 and take three years to complete(h)

Table 9-8. (contd)

Project Name	Summary of Project	Location (relative to Red 2 site)	Status
Future Urbanization	Construction of housing units and associated commercial buildings; roads (such as the expansion of I-75), bridges, and rail; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region	Construction would occur in the future, as described in state and local land-use planning documents
Various hospitals and industrial facilities that use radioactive materials	Medical and other isotopes	Within 50 mi	Operational in nearby cities and towns

(a) Source: EPA 2009o
(b) Source: TCEQ 2009e
(c) Source: EPA 2009i
(d) Source: USFS 2009
(e) Source: EPA 2009j
(f) Source: EPA 2009k
(g) Source: UTRWD 2010
(h) Source: North Texas Municipal Water District 2009

The STP site is more than 300 mi from the Red 2 site and was therefore not included in this analysis. The only other nuclear power plant currently operating in Texas is Comanche Peak. The Comanche Peak plant is more than 120 mi from the Red 2 site and therefore is also not included in the cumulative impact analysis. The proposed nuclear power plant in Victoria County is approximately the same distance as the STP site and was not included in the cumulative impact analysis.

9.3.2.1 Land Use

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact land use, including other Federal and non-Federal projects listed in. For this analysis, the geographic area of interest for considering cumulative impacts is the 15-mi region surrounding the Red 2 site. This geographic area of interest was selected to include the primary communities (e.g., Denison) that would be affected by the proposed project if it were located at the Red 2 site. Figure 9-5 on the following page shows the location of the Red 2 site and surrounding communities.

The Red 2 site is located in a rural, mostly cleared agricultural area. There is no current zoning applicable to the site. There are several residences in the area and a school is located in

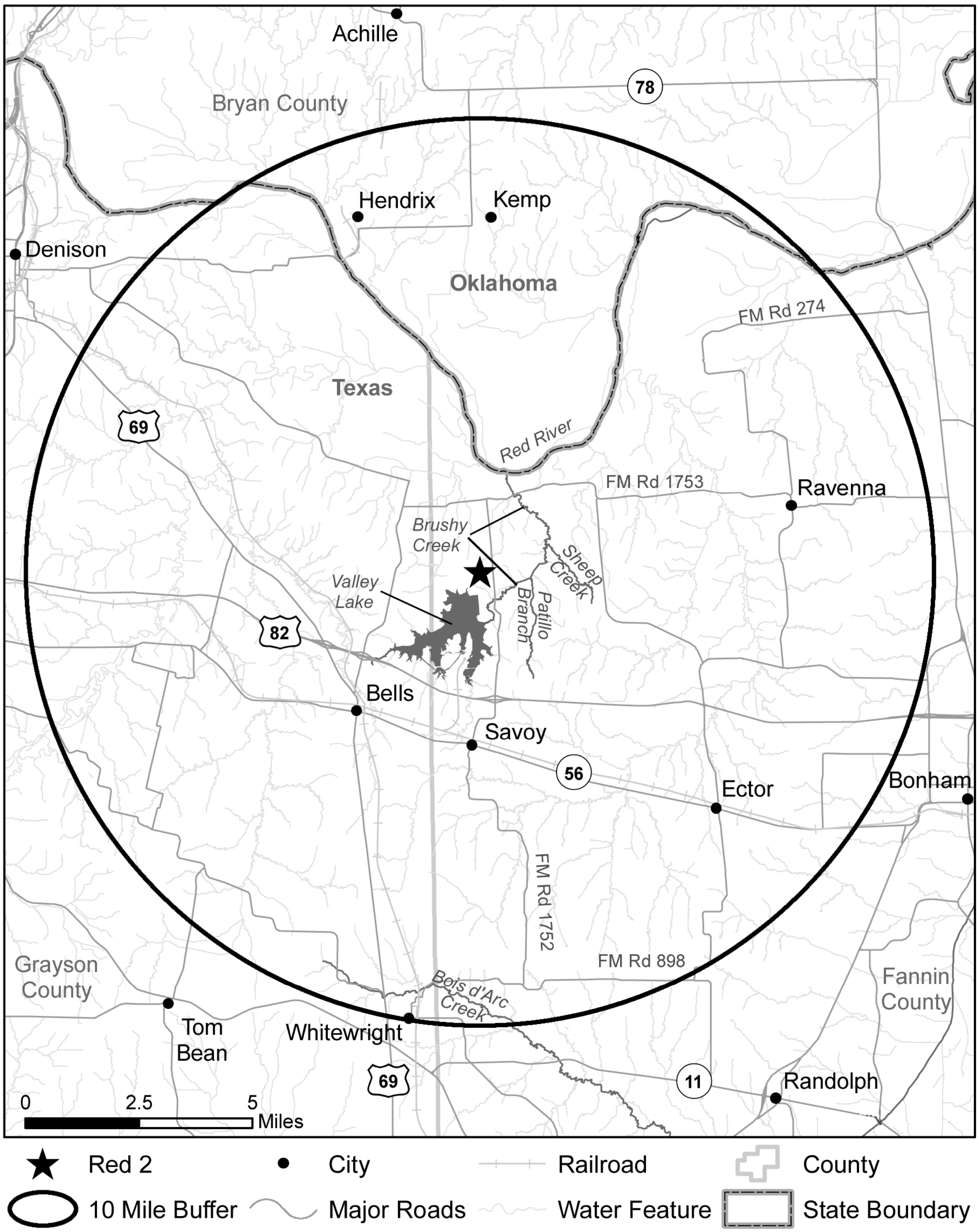


Figure 9-5. Red 2 Alternative Site and 10-mi Radius

Savoy. STPNOC estimates that approximately 47 percent of the site is forested, 51 percent is in cropland, and 2 percent is water resources (STPNOC 2009a). A rail spur is approximately 4 mi from the site (STPNOC 2009a). The Red 2 site is not owned by the applicants and acquisition of the site for a new power plant would involve land purchase from more than one land owner.

The Red 2 site is not in the geographic area covered by the Texas Coastal Management Program (TCMP 2009); therefore, the Coastal Zone Management Act (CZMA) does not apply to this site.

The Red 2 site is located 1.8 mi north of the Valley Power Plant owned by Luminant Power (STPNOC 2009a). The Valley Power Plant is a three-unit, 1115-MW, natural gas-fired plant (Luminant 2009). Cooling water for Valley Power Plant comes from Valley Lake. Valley Lake has a surface area of approximately 1180 ac and is on Brushy Creek, a tributary to the Red River. Construction of Valley Dam, which formed Valley Lake, was completed in 1961 (TSHA 2009a). The Red 2 site is on the north side of Valley Lake.

If new nuclear generating units were built at the Red 2 site, the review team assumes that an onsite water storage reservoir for plant cooling would be built. Water would be diverted from the Red River. The land area affected by building two nuclear generating units at the Red 2 site would be approximately 800 ac for the main power plant site and up to 1700 ac for a new reservoir (STPNOC 2009a). Land-use impacts would also occur as a result of pipeline building to divert water to the plant and/or a reservoir and return discharge water to the Red River and for road and rail access. Most land-use impacts would occur during building, while plant operations would have minimal land-use impacts. The land-use impacts associated with building the plant and the reservoir at the Red 2 site would be noticeable, but not destabilizing.

There are no existing transmission corridors connecting directly to the Red 2 site. However, there are multiple 345-kV transmission lines connecting to the Valley Power Plant (STPNOC 2009a). One or more new transmission corridors would need to be created to connect the Red 2 site to these lines. The corridor(s) would pass through areas that are mostly rural with low population densities. Farmlands that would become part of a corridor could generally continue to be farmed. The land-use impacts of building one or more transmission corridors to serve the Red 2 site would be minimal.

Within the 15-mi geographic area of interest, the reasonably foreseeable future project with the greatest potential to affect cumulative land use would be the Pattillo Branch Power Plant (see Table 9-8). If constructed, the Plant would be located approximately 3 mi south of the Red 2 site. If the Pattillo Branch Power Plant is constructed, one or more new transmission corridors would be needed to connect the plant to the grid.

Future urbanization, the continued operation of the Trinity Materials Hendrix Mine, and global climate change (GCC) (see Table 9-8) could contribute to decreases in open lands, wetlands, and forested areas. Urbanization in the vicinity of the Red 2 site would alter important attributes of land use. Urbanization would reduce natural vegetation and open space, resulting in an overall decline in the extent and connectivity of wetlands, forests, and wildlife habitat. Continued operation of the Trinity Materials Hendrix Mine could include expansion of the mine at some point in the future. Potential expansion of the mine would result in a loss of open lands, forests, and wetlands. GCC could decrease precipitation causing more frequent droughts when combined with increased evaporation in the geographic area of interest for the Red 2 site (Karl et al. 2009). Therefore, a reduced water supply combined with increased temperatures could reduce crop yields and livestock productivity (Karl et al. 2009), which might change portions of agricultural and ranching land uses in the area of interest. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas, to the extent that they are not adversely affected by more droughts. Future urbanization trends and direct changes resulting from GCC could noticeably alter land uses in the geographic area of interest.

Based on the information provided by STPNOC and the review team's independent review, the review team concludes that the cumulative land-use impacts of constructing and operating two new nuclear generating units at the Red 2 site would be MODERATE. This conclusion reflects the substantial amount of land (up to 2500 ac onsite and additional offsite land for roads, a railroad spur, and pipelines) that would be needed for the proposed project, the land-use impacts associated with the proposed Pattillo Branch Power Plant, and the land needed to connect new units at the Red 2 site and the Pattillo Branch Power Plant to the electrical grid, and land use changes from increased urbanization and GCC. Building and operating two new nuclear units at the Red 2 site would be a significant contributor to the MODERATE impact.

9.3.2.2 Water Use and Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact water use and quality, including other Federal and non-Federal projects listed in Table 9-8. Geographic areas of interest are (1) for surface water the drainage basin of the Red River upstream and downstream of the site, and (2) for groundwater the aquifers upgradient and downgradient of the site. These regions are of interest because they represent the water resource potentially affected by the proposed project if it were located at the Red 2 site.

The Red 2 site is located in Fannin County in northeastern Texas near the Oklahoma border, 3.7 mi south of the Red River. The Red 2 site is on the north side of Valley Lake; however, the water of Valley Lake is not available for use. To support operation of the proposed units if they were to be placed at the Red 2 site, a new water storage reservoir on the site would be required.

As stated in Section 2.3.2, water use in Texas is regulated by the Texas Water Code. As established by Texas Water Code, surface water belongs to the State of Texas (Texas Water Code, Chapter 11, Section 11.021). The right to use surface waters of the State of Texas may be acquired in accordance with the provisions of the Texas Water Code, Chapter 11. In Texas, surface water is a commodity. Since the Red River Basin is currently heavily appropriated, future water users in this basin would likely only obtain surface water by purchasing or leasing existing appropriations. Regarding groundwater, Texas law has allowed landowners to pump the water beneath their property without consideration of impacts to adjacent property owners (NRC 2009b). However, Chapter 36 of Texas Water Code authorized groundwater conservation districts to help conserve groundwater supplies and issue groundwater permits. Chapter 36, Section 36.002, Ownership of Groundwater, states that ownership rights are recognized and that nothing in the code shall deprive or divest the landowners of their groundwater ownership rights, except as those rights may be limited or altered by rules promulgated by a district. Thus, groundwater conservation districts with their local constituency offer groundwater management options (NRC 2009b). Existing projects in the State have appropriations to use water for their requirements. The review team expects that future projects, including the proposed units, if they were to be built and operated at the Red 2 site, would operate within the limits of these existing surface water and groundwater appropriations.

As stated in Section 7.2.1, the U.S. Global Change Research Program (GCRP), a Federal Advisory Committee, has compiled the state of knowledge in climate change. This compilation has been considered in the preparation of this EIS. The projections for changes in temperature, precipitation, droughts, and increasing reliance on aquifers within the Red River Basin are similar to those in the Colorado River Basin (Karl et al. 2009). Such changes in climate would result in adaptations to both surface water and groundwater management practices and policies that are unknown at this time.

There are currently 249 water rights owners in the Red River Basin, with total water rights of 456,000 ac-ft/yr that are categorized as industrial, irrigation, or mining users (TCEQ 2009a). According to the TCEQ's water availability maps, unappropriated flows in the Red River Basin for a perpetual water rights permit are available 0 to 25 percent of the time (TCEQ 2009b). The water availability maps do not show the quantity of available water for a new appropriation (TCEQ 2009b).

The average groundwater use in Fannin County from 1980-1999 is approximately 3168 ac-ft/yr and the predicted future groundwater use during 2000-2025 is approximately 2622 ac-ft/yr (Harden and Associates, Inc. 2007). Large water level declines in the Woodbine Aquifer due to heavy pumping in the past have resulted in suppliers switching to surface water and decreased future demand (TWDB 2006a). The estimated managed available groundwater[(a)] for the Woodbine Aquifer in the Fannin County is 2676 ac-ft/yr (Wade 2008).

Building Impacts

The review team assumed that no surface water would be used to build the proposed units at the Red 2 site so there would be no impact on surface water use. This assumption is consistent with the analysis done for the STP site and the other alternative sites.

The impacts on surface water quality from building potential units at the Red 2 alternative site would be limited to stormwater runoff that may enter nearby streams and rivers. Additionally, treated sanitary wastewater may be discharged to these streams and rivers. Building impacts would be limited by the duration of these activities, and therefore, would be temporary. The State of Texas prohibits the unauthorized discharge of waste into or adjacent to water in the state (Texas Water Code, Chapter 26, Section 26.121). The discharge of waste may be authorized under a general or individual permit (Texas Water Code, Chapter 26). These permits may require a stormwater pollution prevention plan (SWPPP) that includes BMPs appropriate for the site (TCEQ 2003; STPNOC 2009a). Implementation of BMPs should minimize impacts to wetlands and surface-water bodies near the Red 2 alternative site. Therefore, the water quality impacts on wetlands and water bodies near the Red 2 alternative site related to building the proposed units would be temporary and minimal.

The review team assumes that the groundwater use for building activities at the Red 2 site would be identical to the proposed groundwater use for the STP site (STPNOC 2009b) because the site would utilize units similar to those proposed for the STP site and the building activities would also be similar. Monthly normalized groundwater use for the STP site ranges up to 491 gpm (792 ac-ft/yr) (Table 3-4 in Chapter 3). STPNOC stated that groundwater would be used for potable and sanitary use, concrete batch plant operation, concrete curing, dust suppression and cleaning, placement of engineered backfill, and piping hydrotests and flushing (STPNOC 2009a).

The Red 2 alternative site is located in the Texas Groundwater Management Area (GMA) 8 and the Red River Groundwater Conservation District (RRGCD). The RRGCD started its operations on September 1, 2009. As of January 2010, the RRGCD has not published any rules or permitting requirements for groundwater use in the district. GMA 8, however, has established a desired future condition[(b)] for average drawdown in Fannin County to not exceed 186 ft from the estimated groundwater elevations in 2000 after 50 years of use (TWDB 2009).

(a) Managed available groundwater is the volume of groundwater available for permitting and withdrawal that would support the desired future conditions established by a groundwater management authority (GMA).

(b) A desired future condition is a metric that specifies the future value of the related aquifer characteristic such as groundwater elevation, groundwater quality, spring flow, and others that may be deemed suitable by a GMA.

If the estimated groundwater demand during building of the proposed units at the Red 2 alternative site were to be obtained using a new groundwater permit, this groundwater use would constitute approximately 30 percent of the managed available groundwater from the Woodbine Aquifer in Fannin County. However, STPNOC stated (STPNOC 2009b) that groundwater from the Trinity Aquifer is also available, that access to groundwater production from existing wells would be sought before requesting new or future groundwater capacity, and that water could be imported primarily for potable uses and thereby reduce groundwater demand.

Since the duration of building activities is approximately five years, the review team considers these impacts to be temporary. A potential plant at the Red 2 alternative site could use a large fraction of the available groundwater resource during that period. Assuming a new groundwater permit were issued and based on the magnitude of this use and the potential for substantial drawdown, the review team concludes that the impact on the groundwater resource associated with the building of the facilities at the Red 2 alternative site would be noticeable but temporary and not sufficient to destabilize the groundwater resource.

During the building of a potential plant at the Red 2 alternative site, impacts to groundwater quality may occur from leaching of spilled effluents into the subsurface and intrusion of lower-quality water of the Red River into the Woodbine Aquifer. STPNOC stated that BMPs would be in place during building activities (STPNOC 2009a). Therefore the review team concludes that any spills would be quickly detected and remediated. The amount of drawdown in the Woodbine Aquifer from groundwater pumping during building should support established desired future conditions. The drawdown could be limited by installing multiple, appropriately-spaced wells. The review team concluded that the drawdown in the Woodbine Aquifer could be managed during building-related groundwater pumping using an appropriately designed well system. In addition, building impacts will be limited by the duration of these activities and, therefore, would be temporary. Because any spills would be quickly remediated, drawdown in the Woodbine Aquifer would be controlled, and the activities would be temporary, the review team concludes that the groundwater-quality impacts from building at the Red 2 site would be minimal.

<u>Operational Impacts</u>

STPNOC estimated that a two-unit plant operated at the Red 2 alternative site using a closed-cycle cooling system that would employ a cooling water reservoir would consume a maximum of 50,000 ac-ft of water per year. STPNOC has proposed the Red River as the source of the cooling water at the Red 2 alternative site. STPNOC currently does not own the necessary water rights. STPNOC proposes to acquire existing Texas Red River water rights that are currently being used for industrial, irrigation, and mining use. Therefore, STPNOC would need to acquire a minimum of 11 percent of these Texas water rights.

According to TCEQ, acquired water rights, as proposed by STPNOC, would have to be aggregated at a single point of diversion which may lead to concerns regarding instream flow to maintain water quality and habitat. The TCEQ staff stated that, under current Texas laws, the acquisition and aggregation process would need to consider the quantity and location of all water rights and the instream flow needs that may be affected by transfer of these water rights (NRC 2009b). Additionally, the waters of the Red River are shared by Texas, Oklahoma, Arkansas, and Louisiana under the Red River Compact (TCEQ 2009c). Because STPNOC has not identified the particular water rights that may be acquired, it is difficult to determine if any are suitable for acquisition. However, the review team expects that the TCEQ permitting process would require STPNOC to acquire water rights in sufficient quantity, at appropriate locations, and of appropriate type within the Red River Basin such that this reallocation of water rights would not adversely affect surface water use and quality in the basin. As such, based on the water rights that would need to be reallocated to accommodate the facility at the Red 2 site, the review team determines that the operational surface water use impact of potential units at the Red 2 alternative sites would be noticeable but not destabilizing.

During the operation of a potential plant at the Red 2 alternative site, impacts to surface water quality could result from stormwater runoff, discharges of treated sanitary and other wastewater, blowdown from service water cooling towers, and periodic discharges from the cooling water reservoir into the receiving water body. As mentioned above, the State of Texas may require STPNOC to obtain a general or individual permit for the discharge of stormwater (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2001; STPNOC 2009a). Any discharges of sanitary and other wastewaters and blowdown or cooling water reservoir discharges would be controlled by the State of Texas under a TPDES permit. The State of Texas limits the quantity and quality of discharges to surface water bodies while accounting for concurrent streamflow and quality conditions within the surface water body. These permit conditions would also account for designated uses of the receiving surface water body. The review team expects that the conditions placed on operations of the proposed units at the Red 2 site would be similar to those currently placed on the existing facilities at the STP site (Section 5.2.3.1). Therefore, the review team concluded that the operational impact on surface water quality of the receiving water body would be minimal because the discharge quantity and quality would be controlled.

The proposed Units 3 and 4 would use approximately 975 gpm (1572 ac-ft/yr) of groundwater during normal operations and approximately 3434 gpm (5538 ac-ft/yr) during maximum demand conditions (STPNOC 2009c). STPNOC stated that the expected groundwater use for Units 3 and 4 are assumed to also apply to alternative sites (STPNOC 2009b). However, for maximum operation demand periods, STPNOC assumes that a temporary increase in the rate of surface water use would be available (STPNOC 2009b).

The review team determined that the proposed groundwater use at the Red 2 alternative site during operations would not be unreasonable because the alternate site would utilize units similar to those proposed for the STP site.

As discussed, the managed available groundwater in Fannin County from the Woodbine Aquifer is 2676 ac-ft/yr. STPNOC estimated normal operational groundwater demand for the two units, if they were to be operated at the Red 2 alternative site and used a new groundwater permit, would constitute approximately 59 percent of the managed available groundwater of the Woodbine Aquifer in Fannin County. However, STPNOC stated (STPNOC 2009b) that groundwater from the Trinity Aquifer is also available, that access to existing groundwater production from current wells would be sought before requesting new or future groundwater capacity, and that water could be imported primarily for potable uses and thereby reduce groundwater demand. The review team concludes that a potential plant at the Red 2 site could use a large fraction of the managed available groundwater resource during operations.

If a new groundwater permit were issued, this level of groundwater use and the potential for substantial drawdown of the Woodbine Aquifer to occur over the operational period of the facility causes the review team to conclude that the impact of operational groundwater use at the Red 2 site would be noticeable. However, based on available information on the aquifer, and the authority of groundwater conservation districts to manage and permit groundwater resources (Texas Water Code, Chapter 36), the impact to the groundwater resource under a groundwater use permit issued by the applicable groundwater conservation district would not destabilize the groundwater resource.

During operation of a potential plant at the Red 2 alternative site, impacts to groundwater quality result from intrusion of lower-quality water of the Red River into the Woodbine Aquifer or from the requirement to draw groundwater from deeper strata of the Woodbine Aquifer. Groundwater quality declines with depth in the Woodbine Aquifer. The amount of drawdown in the Woodbine Aquifer from groundwater pumping during operation should support the established desired future conditions. Based on standard geohydrologic practice, the review team determined that the drawdown could be limited by installing multiple, appropriately-spaced wells. The Red 2 site is located more than 3 mi away from the Red River, and therefore, the review team assumes wells would be located away from the river. The review team concludes that the drawdown in the Woodbine Aquifer could be managed during operation-related groundwater pumping using an appropriately designed well system; however, substantial drawdown would likely occur locally to the well field. The review team concludes that the impacts to groundwater quality local to the well field could range from minimal to noticeable, but would not be sufficient to destabilize the groundwater resource assuming the desired future condition of the aquifer is not violated.

During operation of any potential plant at the Red 2 alternative site, impacts to groundwater quality may occur from leaching of spilled effluents into the subsurface or intentional discharge of effluents to groundwater. However, spills that might affect the quality of groundwater would be prevented or detected and mitigated by BMPs and no intentional discharge of effluents to groundwater should occur. While the implementation of BMPs would preclude or mitigate spills and there should be no intentional discharges to groundwater, because the drawdown in the Woodbine Aquifer would be controlled but perhaps result in noticeable changes in groundwater quality, the review team concludes that the groundwater-quality impacts from operation at the Red 2 site would be minimal to noticeable but not destabilizing.

Cumulative Impacts

In addition to water use and water quality impacts from building and operations activities, cumulative analysis considers past, present, and reasonably foreseeable future actions that impact the same environmental resources. For the cumulative analysis of impacts on surface water, the geographic area of interest for the Red 2 site is considered to be the drainage basin of the Red River upstream and downstream of the site because this is the resource that would be affected by the proposed project. Key actions that have past, present, and future potential impacts to water supply and water quality in the Red River basin include the existing Valley Power Plant, Trinity Materials Hendrix Mine, and sewage treatment facilities. Key actions that could have future potential impacts to water supply and water quality include the planned Pattillo Branch Power Plant, and the Lower Bois d’Arc Creek Reservoir. The Pattillo Branch Power Plant is to be located approximately 1 mi south of the existing Valley Lake. The project would host four natural-gas powered units, with a combined output of approximately 1400 MW.

Cumulative Water Use

The only surface-water-use impacts of building and operating a nuclear power plant at the Red 2 site are the demands occurring during operation. The projected consumptive surface water use of the two units is expected to be about 50,000 ac-ft/yr and would require at least 11 percent of the current held water rights of 456,000 ac-ft/yr in the Red River Basin, which would be a significant fraction of the existing water rights. Past and present water withdrawals, reflected by the water rights held in the Red River Basin, have used the waters of the river. Currently, unappropriated flows in the Red River Basin are available for a perpetual water rights permit only one-quarter of the months during a typical year.

Increases in consumptive use of water in the Red River drainage is anticipated in the future primarily due to population growth (TWDB 2006b). Because the total rated power output of the Pattillo Branch Power Plant is smaller than that of the two proposed units, the increase in the region’s consumptive water use from the Pattillo Branch Power Plant is likely to be smaller than the consumptive use of the two proposed units, if they were to be located at the Red 2 site. The region’s water management strategy includes conservation, reuse, and development of new water supplies, including building the Bois d’Arc reservoir, that would meet and exceed the region’s 2060 water needs if all strategies are implemented (TWDB 2006b). The impacts of the

Pattillo Branch Power Plant on the region's water use would be noticeable but not destabilizing. The impacts of the other projects listed in Table 9-8 would have little to no impact on surface water use.

Groundwater-use impacts of building and operating a nuclear power plant at this site are characterized by the groundwater demand at the STP site, and those use levels are 491 gpm (792 ac-ft/yr) during building, a normal operation demand of 975 gpm, and a maximum operation demand of 3434 gpm (STPNOC 2009c). However, for maximum operation demand periods, STPNOC assumes that a temporary increase in the rate of surface water use would be available for the short duration event. During building and normal operation STPNOC would rely on a balance of (1) a new groundwater permit and associated wells in the Woodbine and Trinity Aquifers, (2) access to existing groundwater production from wells in the vicinity of the plant completed in either the Woodbine or Trinity Aquifers, and (3) use of imported water primarily for potable use onsite that would reduce groundwater demand (STPNOC 2009b). With regard to the groundwater resource available to all past, present, and future projects, the managed available groundwater for the Woodbine Aquifer in Fannin County is 2676 ac-ft/yr, and the predicted future groundwater use through 2025 is 2622 ac-ft/yr. Based on this quantification of the groundwater resource within Fannin County, the review team concludes that past and present projects have fully utilized the Woodbine Aquifer resource.

As indicated above, groundwater would be used during the building and operation of two nuclear units at the Red 2 site. The possibilities exist that STPNOC could (1) use available groundwater from both the Woodbine and Trinity Aquifers, (2) acquire groundwater sufficient to build and operate Red 2 plants from existing permitted groundwater wells, and (3) import water for primarily potable water supplies and thereby reduce groundwater demand (STPNOC 2009e). Assuming that these strategies are implemented, some but not a substantial impact is anticipated to other nearby users of groundwater. However, if only new permits are issued to provide the needed groundwater and new wells are drilled to provide the groundwater, then the review team expects impacts to nearby users of groundwater would be controlled and limited through the permitting process and rules of the groundwater conservation district. As such, impacts to groundwater use would be minimal.

The review team is also aware of the potential for GCC affecting the water resources available for closed-cycle cooling and the impact of reactor operations on water resources for other users. The impact of GCC on regional water resources is not precisely known, however it may result in decreases in precipitation and increases in average temperature (Karl et al. 2009). Such changes could further stress regional water resources. However, the impacts related to GCC would be similar for all the alternative sites.

Historically, the waters of the Red River Basin have been used extensively. The region has a planning, allocation, and development system in place to manage the use of its limited surface water supplies (TWDB 2006a, 2006b). As stated above, operation of the proposed units on the Red 2 site would result in a noticeable but not destabilizing impact to the surface water use in the region. Future projects in the region would also result in noticeable but not destabilizing impacts on surface water use in the region. Therefore, the review team concludes that cumulative impacts to surface water use would be MODERATE. Building and operating the proposed plant at the Red 2 site would be a significant contributor to surface-water-use impacts because of the impacts arising from the acquisition and especially the aggregation of surface-water rights necessary to supply the proposed plant. The review team concludes that cumulative impacts to groundwater use would be MODERATE. Building and operating the proposed plant at the Red 2 site would be a significant contributor to this groundwater-use impact because the implied use of groundwater would exceed the current estimate of managed available groundwater resource by approximately 30 percent for building and 59 percent for operating the proposed plant.

Cumulative Water Quality

Point and nonpoint sources in the river basin have affected the water quality of the Red River. Water quality information presented above for the impacts of building and operating the new units at the Red 2 site would also apply to evaluation of cumulative impacts. The State of Texas may require an applicant to obtain a general or individual permit for discharge of stormwater (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2001, 2003; STPNOC 2009a). The State of Texas would also issue TPDES permits for the discharge of sanitary and other wastewaters, including blowdown from service water cooling towers and cooling water reservoir discharges, before operation of the proposed units at the Red 2 site. Effluent discharges through a TPDES-permitted outfall, such as those from Valley Power Station, Trinity Materials Hendrix Mine, and sewage treatment plants, are required to comply with the Clean Water Act. Such permits are designed to protect water quality. Therefore, the review team concluded that the cumulative impact on surface water quality of the receiving water body would be SMALL. The impacts of other projects listed in Table 9-8 would have little or no impact on surface water quality.

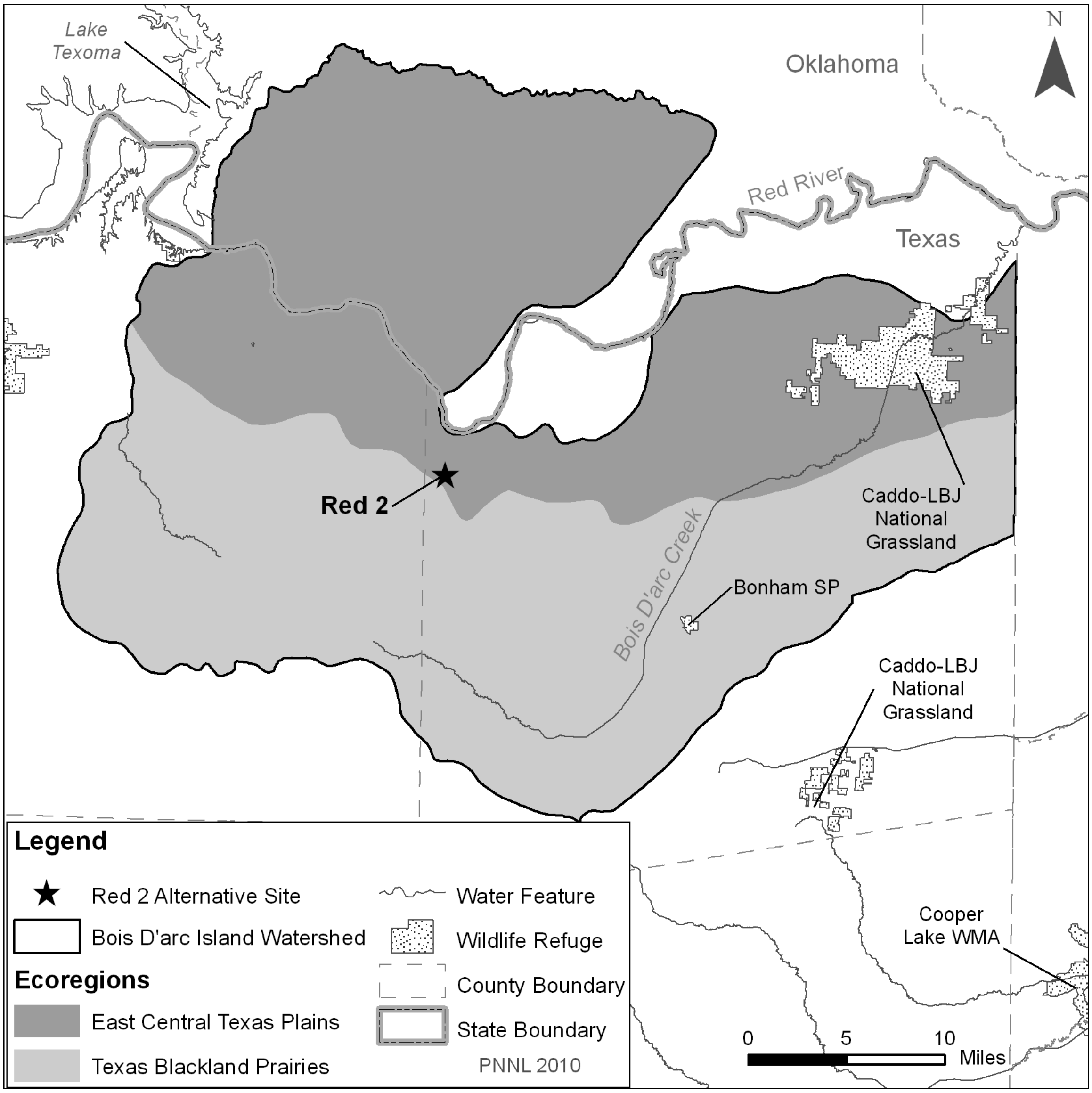
The review team also concludes that with the implementation of BMPs, the impacts of groundwater quality from building two new nuclear units at the Red 2 site would likely be minimal. However, during operation, the production of groundwater from wells under a new permit could result in groundwater-quality impacts ranging from minimal to being altered noticeably because of the degradation in water quality. The individual impacts from other projects listed in Table 9-8 would have little or no impact on regional groundwater quality because of the local nature of groundwater withdrawals and their associated impacts. Therefore, the cumulative impact on groundwater quality would be SMALL to MODERATE. Building and operating the proposed plant at the Red 2 site would be a significant contributor to these water quality impacts.

9.3.2.3 Terrestrial and Wetland Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact terrestrial and wetland resources, including other Federal and non-Federal projects listed in Table 9-8. For the analysis of terrestrial ecological impacts, the geographic area of interest is the intersection of the East Texas Plains and Blackland Prairies ecoregion with the Bois d'Arc Island watershed in Grayson and Fannin Counties (Figure 9-6). This geographic area of interest is expected to encompass the ecologically relevant landscape features and species.

The Red 2 site is a greenfield site located on the northern edge of Valley Lake in Fannin County. The site is in the Blackland Prairies subprovince of the Gulf Coast Plains. The blacklands have a gentle undulating surface that has been cleared of most natural vegetation for the cultivation of crops (UT 1996). The soils of the blacklands are chalks and marls that have weathered to deep, fertile clay soils. Pre-settlement conditions were that of a true prairie grassland community dominated by a diverse assortment of perennial and annual grasses and forbs, with sparsely scattered trees or mottes of oaks (*Quercus* sp.) on the uplands (TPWD 2009a). Forested or wooded areas were restricted to bottomlands along major rivers and streams, ravines, protected areas, or on certain soil types. Trees such as pecan (*Carya illinoinesis*), cedar elm (*Ulmus crassifolia*), cottonwoods (*Populus* spp.), various oaks, and hackberry (*Celtis* sp.) dotted the landscape (TPWD 2009b). The dominant grass was the little bluestem (*Schizachyrium scoparium*). Other grasses included the big bluestem (*Andropogon geradrii*), Indian grass (*Sorghastrum* sp.), eastern gamagrass (*Tripsacum dactyloides*), switchgrass (*Panicum virgatum*), and sideoats grama (*Bouteloua curtipendula*).

Currently, the region surrounding the Red 2 site is mostly rural, with much of the prairie converted to cropland and non-native pasture. In August 2009, NRC staff visited the site and found that the site contained buildings, roads, pastures, and small wooded areas (NRC 2009b). The total acreage for all temporary and permanent impacts is 800 ac for the plant site and 1700 ac for the reservoir. Permanent impacts associated with building two new nuclear units at the Red 2 site would include approximately 150 ac for each unit (300 ac total) and a new 1700-ac reservoir for cooling water for the plant (STPNOC 2009a). While specific habitat acreages have not been determined for the site, Table 9-9 gives approximate acreages by land cover class for areas experiencing permanent impacts. No assessment was made for land cover classes receiving temporary impacts. The acreages for land cover classes receiving permanent impacts are from the ER and were based on evaluation of Google Earth Imagery (STPNOC 2009a).



1

2 **Figure 9-6**. Geographic Area of Analysis of Cumulative Impacts to Terrestrial Resources for
3 the Red 2 Site in Grayson and Fannin Counties

Table 9-9. Estimated Land Cover Classes for Approximately 2000 ac of the 2500 ac Red 2 Site.

Land Cover Class	Plant (ac)	Reservoir (ac)
Forested	80	850
Cleared farmland	220	800
Water resources/freshwater ponds (no high quality forested wetlands identified)	0	50

Source: STPNOC 2009a

Water features at the Red 2 site include a portion of Valley Lake, estimated to be 100 ac, located in the extreme southwestern portion of the site. Numerous freshwater ponds are also scattered throughout the site with an estimated total acreage of 50 ac. In addition, there are a few freshwater, emergent wetland areas totaling less than 1 ac. No high quality forested wetlands have been identified in the immediate site area (STPNOC 2009a).

Ecologically important areas occurring near the Red 2 site include the Caddo-LBJ National Grasslands approximately 15 mi from the site; the grasslands cover more than 16,000 ac (TPWD 2009c). TPWD (2009d) has indicated there is potential for native pasture or native prairie remnants in Fannin County. Additionally two Ecologically Significant River and Stream Segments occur in Fannin County associated with Bois d'Arc Creek and Coffee Mill Creek (TPWD 2010). Portions of the Bois d'Arc Creek include Priority 4 Bottomland Hardwood areas (STPNOC 2009b). The nearby Hagerman National Wildlife Refuge is home to thousands of geese and waterfowl during the winter (STPNOC 2009b).

Important Species

A range of wildlife species potentially occur at the Red 2 site (STPNOC 2009b), including the following recreationally valuable species: the eastern turkey (*Meleagris gallopavo sylvestris*), mourning dove (*Zenaida macroura*), white-tailed deer (*Odocoileus virginianus*), northern bobwhite quail (*Colinus virginianus*), and eastern fox squirrel (*Sciurus niger*) (STPNOC 2009b). All these species are habitat generalists (NatureServe 2009a). Mourning doves use a variety of habitats including croplands and pastures, grasslands, and open hardwood forests. The doves are ground, seed feeders. The eastern fox squirrel is the largest tree squirrel in the western hemisphere (NatureServe 2009a); it is found in open mixed hardwood forests or mixed pine-hardwood associations but is well adapted to disturbed areas. Both the eastern turkey and the bobwhite quail share many of the same habitat characteristics and have been in decline in the Blackland Prairie areas of Texas (TPWD 2009e). Both species are ground nesters and their decline has been linked to a lack of nesting and brood rearing habitat (TPWD 2009e). Turkeys require dense and diverse patches of grasses and forb, with some shrubs and an abundance of insects (TPWD 2009e). Northern bobwhites build their nests at the bases of native bunchgrasses, while brood rearing occurs in areas with enough taller herbaceous cover to provide overhead concealment with bare ground underneath for easy movement (TPWD 2009e). White-tailed deer occur almost entirely in hardwood woodlands, and forage on a wide-variety of plants from grasses and forbs, to fruits and nuts (Davis and Schmidly 1994).

Up to seven bat species living in eastern Texas, can occur in Fannin County (Davis and Schmidly 1994; STPNOC 2009b. Some are mostly year-round residents (i.e., non-migratory), such as the big brown bat (*Eptesicus fuscus*), the eastern pipistrelle (*Pipistrellus subflavus*), and evening bat (*Nycticeius humeralis*). Migratory bats that could occur at the site include the hoary bat (*Lasiurus cinereus*), the silver-haired bat (*Lasionycteris noctivagans*), the eastern red bat (*Lasiurus borealis*), and the Mexican free-tailed bat (*Tadarida brasiliensis*). The Mexican free-tailed bat can be either migratory or non-migratory depending on where it resides; the migratory status of bats occurring in Fannin County is currently unknown (STPNOC 2009b).

The site lies within the Central Flyway of Texas (STPNOC 2009b) – a major migratory corridor for neotropical migrants and other birds. Thousands of migrating birds, especially waterfowl, flying south from cooler regions of the North American continent could potentially rest and feed in this area. Two areas of potential importance to migratory birds in the vicinity of the Red 2 site are the Caddo National Grasslands/Wildlife Management Area, approximately 15 mi from the site, and the Hagerman National Wildlife Refuge located more than 15 mi from the site (STPNOC 2009b). In addition, portions of Bois D'Arc Creek, east of the Red 2 site, include Priority 4 Bottomland Hardwood areas that are considered quality habitat for waterfowl. At the site audit in 2009, the potential for colonial breeding bird rookeries along the pipeline route was noted (NRC 2009b).

No site specific surveys have been conducted for threatened and endangered species at the Red 2 site. The following list for Fannin County (Table 9-10 on the following page) was compiled from the Texas Parks and Wildlife Threatened and Endangered Species by County website (TPWD 2009f) and the U.S. Fish and Wildlife Service Ecological Service T&E species for the Southwest region website (FWS 2009a). Three species are listed as Federally-threatened or endangered in Fannin County (FWS 2009a), and the State lists an additional nine species as endangered or threatened (TPWD 2009f). No critical or sensitive habitats for Federally listed species have been identified in the immediate site area (FWS 2009d).

Table 9-10. Federally and State-listed Threatened and Endangered Species in Fannin County, Texas

Group	Common Name	Scientific Name	Federal Status*	State Status*
Reptiles	Alligator snapping turtle	*Macrochelys temminckii*		T
	Texas horned lizard	*Phrynosoma cornutum*		T
	Timber/canebrake rattlesnake	*Crotalus horridus*		T
Birds	American peregrine falcon	*Falco peregrinus anatum*		T
	Bald eagle	*Haliaeetus leucocephalus*		T
	Eskimo curlew	*Numenius borealis*		E
	Interior least tern	*Sterna antillarum athalassos*	E	E
	Piping plover	*Charadrius melodus*		T
	Whooping crane	*Grus americana*	E	E
	Wood stork	*Mycteria americana*		T
Mammals	Black bear	*Ursus americanus*	T/SA	T
	Red wolf	*Canis rufus*		E

Sources: FWS 2009a; TPWD 2009f
*T-threatened; E-endangered; T/SA-proposed similarity of appearance to a threatened taxon

Alligator snapping turtle

The alligator snapping turtle (*Macrochelys temminckii)* is a State-listed threatened species (TPWD 2009f). It is found in slow-moving, deep water of rivers, sloughs, oxbows, and canals or lakes associated with rivers, and also in swamps, ponds near rivers, and shallow creeks that are tributary to occupied rivers (NatureServe 2009b). It usually occurs in water with mud bottoms and abundant aquatic vegetation; it may migrate several miles along rivers (TPWD 2009g). Turtles are rarely found out of the water except when nesting.

Texas horned lizard

The Texas horned lizard (*Phrynosoma cornutum*) is a State-listed threatened species (TPWD 2009f). It can be found in arid and semiarid habitats in open areas with sparse plant cover (TPWD 2009g). They dig for hibernation, nesting, and insulation purposes, and are commonly associated with loose sand or loamy soils. Populations have declined precipitously in eastern Texas, and their decline may be related to the spread of fire ants, use of insecticide to control fire ants, heavy agricultural use of the land, and other habitat alterations (NatureServe 2009b). Another factor implicated in their decline is over-collecting for the pet and curio trade. This species is particularly vulnerable to the loss of harvester ants, which make up nearly 70 percent of their diet.

Timber/canebrake rattlesnake

The timber rattlesnake (*Crotalus horridus*) is a State-listed threatened species (TPWD 2009f). It prefers moist lowland forests and hilly woodlands or thickets near permanent water sources such as rivers, lakes, ponds, streams, and swamps (TPWD 2009g). The range of the rattlesnake extends from central New England to northern Florida, and west to eastern Texas, where its distribution is spotty (NatureServe 2009b).

American peregrine falcon

The American peregrine falcon (*Falco peregrinus anatum*) is a State-listed threatened species (TPWD 2009f). The bird is a year-round resident and local breeder in west Texas where it nests in tall cliff eyries (TPWD 2009g). This species also migrates across Texas from breeding areas in the United States and Canada to winter along the coast and farther south. The American peregrine falcon occupies a wide range of habitats during migration, including urban areas. Populations are primarily concentrated along coast and barrier islands. The birds are low-altitude migrants, with stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald eagle

Although recently delisted from a status of Federally threatened, the bald eagle (*Haliaeetus leucocephalus*) is State-listed as threatened in Texas and will remain Federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (TPWD 2009f). The species will also continue to be protected under the Endangered Species Act (ESA) through management guidelines that will be in place for the next five years. Most eagles breed in Canada and the northern United States and move south for the winter (NatureServe 2009b). Bald eagles can be year-round residents in areas where water bodies do not freeze. Winter roost sites can vary with proximity to food resources and eagles commonly roost communally in large trees, preferably snags.

Eskimo curlew

The Eskimo curlew (*Numenius borealis*) is a State-listed endangered species (TPWD 2009f). Eskimo curlews historically migrated from breeding grounds in the Arctic tundra through the North American prairies to wintering grounds on the pampas grasslands of Argentina (TPWD 2009g). Fannin county lies in the historic migration path for this species whose numbers currently are estimated to be fewer than 50 (NatureServe 2009b).

Interior least tern

The interior least tern (*Sterna antillarum athalassos*) is Federally and State-listed as endangered (FWS 2009a; TPWD 2009f). The birds breed along inland river systems including the Red River (TPWD 2009g). Interior least terns nest on bare or sparsely vegetated sand, shell, and gravel beaches, islands, and salt flats associated with rivers and reservoirs. The birds prefer open habitat and avoid thick vegetation and narrow beaches. They arrive at breeding areas in early April to early June after wintering along the Central American coast and the northern coast of South America.

Piping plover

The piping plover (*Charadrius melodus*) is State-listed as threatened (TPWD 2009f). This species is Federally listed as threatened in the State of Texas, but is not listed as occurring in Fannin County by FWS (FWS 2009a). Texas is the wintering home for more than 5000 known breeding pairs that have migrated from the Great Lakes regions and southern Canada (TPWD 2009g). They live on sandy beaches and lakeshores along the Gulf coast and could migrate through Fannin County.

Whooping crane

The whooping crane is Federally and State-listed as an endangered species (FWS 2009a; TPWD 2009f). Whooping cranes breed in Canada during the summer months and migrate to the Aransas National Wildlife Refuge along the Texas coastal plain, staying there from November through March (TPWD 2009g). Their winter and migrating habitat includes marshes, shallow lakes, lagoons, salt flats, and grain and stubble fields (NatureServe 2009b). Migration habitat includes sites with good horizontal visibility, water depth of 30 cm or less, and a minimum wetland size of 0.04 ha for roosting.

Wood stork

The wood stork (*Mycteria americana*) is a State-listed threatened species (TPWD 2009f). Nesting has been restricted to Florida, Georgia, and South Carolina. However, they may have formerly bred in Texas (FWS 2009b), but there are no breeding records since 1960 (TPWD 2009g). Wood storks forage in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including saltwater. The birds usually roost communally in tall snags, sometimes in association with other wading birds (i.e., active rookeries). A distinct, non-listed population of wood storks breed in Mexico and then move into Gulf states in search of mud flats and other wetlands, even those associated with forested areas.

Black bear

The black bear (*Ursus americanus*) is on the State endangered species list (TPWD 2009f) due to its similarity to the Louisiana black bear (subspecies *U. americanus luteolus*). The Louisiana black bear is Federally listed as threatened (FWS 2009a); it is not known to be found in Texas, although potential habitat exists in the eastern part of the state including Fannin County. Habitat for the black bear includes bottomland hardwoods and large tracts of inaccessible forested areas (TPWD 2009g).

Red wolf

The red wolf (*Canis rufus*) is State-listed as endangered (TPWD 2009f). Red wolves inhabited brush and forested areas, as well as the coastal prairies (Davis and Schmidly 1994). They formerly ranged throughout eastern Texas, but appear to now be extinct.

Building Impacts

Building impacts would affect up to 2500 ac of land resulting in the permanent loss of terrestrial habitat. Three-hundred ac would be required for permanent structures and facilities, and up to 1700 ac would be required for a new reservoir. Of the 300 ac that would be permanently affected at the plant site, approximately 220 ac are previously cleared land and 80 ac are forested. The reservoir would affect approximately 850 ac of forested land, 800 ac of previously cleared land, 50 ac of ponds and other water resources, and less than 1 ac of emergent wetlands (Table 9-8) (STPNOC 2009a). Only one small freshwater emergent wetland (0.9 ac) was identified within the affected area; this wetland occurs in the area identified for the main power plant area. (STPNOC 2009a) Additional acreage resulting in permanent losses would be associated with transmission lines, pipelines, roads, and railroad access (STPNOC 2009a).

New transmission lines would be needed to connect the Red 2 site with existing transmission lines at the Valley Power Plant, 1.8 mi south. The likely route for new lines would traverse a distance of 5 mi and require a 200-ft-wide corridor, which would affect approximately 120 ac of land (STPNOC 2009a). The land along the theoretical corridor is a mixture of cleared land and forest (STPNOC 2009b). Once at the Valley Power Plant, it is assumed the lines would parallel the existing corridor (with potential need for expansion). Erection of the transmission towers and stringing of the lines would be expected to comply with all applicable laws, regulations, permit requirements, and used of best management practices (STPNOC 2009a). The building of new transmission line corridors would contribute to fragmentation of habitat.

In addition to the transmission lines, a 3.8-mi-long, 75-ft-wide corridor containing the cooling water intake and discharge pipelines between the Red River and new reservoir would be built. A 4.2-mi-long, 50-ft-wide rail corridor and a 2.2-mi-long, 75-ft-wide access road would also be needed. A total of 81 ac of land would be affected for these new corridors (STPNOC 2009a).

The land surrounding the site is predominately cropland and non-native pasture and the review team assumes a large portion of the acreage needed for the road, pipeline, and rail corridors would be previously disturbed.

No site-specific reports on Federally or State-listed species were available for the Red 2 site. As noted above, three Federally-listed and nine State-listed species occur in Fannin County and may potentially occur at the Red 2 site.

Building two new nuclear reactors at the Red 2 site would result in the permanent loss of approximately 2000 ac of terrestrial habitat including more than 900 ac of forested habitat and minimal loss of wetland habitat. However, the reservoir would provide additional waterfowl habitat. Clearing land for the transmission line corridor would increase habitat fragmentation along the 5-mi corridor. Other sources of impacts to terrestrial resources such as noise, increased risk of collision and electrocution, and displacement of wildlife would likely be temporary and result in minimal impacts to the resource. Building the two new units would noticeably alter the available terrestrial habitat.

Operational Impacts

Impacts on terrestrial ecological resources from operation of two new nuclear units at the Red 2 site include those associated with transmission system structures, and maintenance of transmission line corridors. Also, during plant operation, wildlife would be subjected to impacts from increased traffic. An evaluation of specific impacts resulting from building of transmission lines and transmission corridor maintenance cannot be conducted in any detail due to the lack of information, such as the locations of any new corridors that could result from transmission system upgrades. However, in general, impacts associated with transmission line operation consist of bird collisions with transmission lines, electromagnetic field (EMF) effects on flora and fauna, and habitat loss due to corridor maintenance.

Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to low, fast flight and flocking behavior (Brown 1993). Although additional transmission lines would be required for two new nuclear units at Red 2, increases in bird collisions directly attributable to these lines would be minor and would likely not be expected to cause a measurable reduction in local bird populations.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NIEHS 2002). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NIEHS 2002). The magnetic fields from many lines, at a distance of 300 ft are similar to typical background levels in most homes (NIEHS 2002). Thus, impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003).

The impacts associated with corridor maintenance activities are loss of habitat due to cutting and herbicide application, and similar impacts where corridors cross floodplains and wetlands. The maintenance of transmission-line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments. Thus, corridor maintenance would not be expected to increase or contribute to cumulative effects.

The potential effects of operating two new nuclear reactors at the Red 2 site would be primarily associated with maintenance of transmission corridors and increased traffic. Operational impacts to terrestrial resources would be expected to be minimal.

Cumulative Impacts

The impacts of building and operating two units at Red 2 were evaluated by the review team to determine the magnitude of their contribution to regional cumulative impacts on terrestrial ecological resources. The geographic area of interest for cumulative impacts (Figure 9-6) at Red 2 is the intersection of the East Central Texas Plains and Texas Blackland Prairies ecoregions and the Bois d'Arc Island watershed in Fannin and Grayson Counties. Activities related to building include loss of habitat due to clearing for building of the plant, and filling the reservoir. Past actions that have affected terrestrial resources include the construction of the Valley Power Plant approximately 2 mi south of the facility, in which about 300 ac were cleared for the plant; and the construction of the Trinity Materials mine approximately 12 mi from the Red 2 site (Table 9-8). Both of these actions changed the nature of terrestrial habitat, generally through grading, removing and covering the previous terrestrial features.

Present actions that affect terrestrial resources include construction related to the expansion of I-75, 14 mi west of the site (Table 9-8). The project is currently restricted to modifying on and off ramps, and disturbs relatively little area; however, future activity could involve expansion of the road to 6 lanes. At the Caddo-LBJ National Grasslands, habitat restoration work would remove about 200 ac of eastern red cedar (*Juniperus virginiana*) to allow for restoration of the traditional open grassland prairie.

There are several proposed future actions near the Red 2 site (Table 9-8). The first is the proposal to build the Pattillo Branch Power Plant approximately 3 mi south of the Red 2 site. This proposed facility would affect approximately 300 ac of terrestrial resources through land-clearing and construction activities, plus road and transmission corridors. The second proposal is for a reservoir on Bois d’Arc Creek northeast of Bonham Texas, approximately 20 mi east of the Red 2 site (Corps 2009). In addition to flooding 17,000 ac, two pipelines would be constructed for water delivery; one pipeline would be 29 mi from the reservoir, the other 14 mi away. Possible impacts to terrestrial and wetland resources from the power plant and associated transmission line corridors would be habitat loss through removal of habitat components (e.g., trees, grassland, access to soil) and habitat fragmentation. The lake would inundate the Bois d’Arc Creek bottomland hardwoods area, which is designated as a Priority 4 habitat (TWDB 2001). The Bois d’Arc reservoir would convert a large terrestrial habitat to an aquatic habitat; there would be additional loss of terrestrial habitat through construction of pipeline corridors. Also, new transmission lines would add to those associated with the Valley Power Plant and the proposed Pattillo Branch Power Plant (Table 9-8). The increase in the number of transmission towers would not result in a noticeable increase in bird collisions. The proposed Lake Ralph Hall Reservoir (Table 9-8) is outside the geographic area of interest for terrestrial impacts at the Red 2 Site.

The review team is also aware of the potential for GCC affecting the terrestrial resources in the geographic area of interest. The future impact of GCC on plant and wildlife species and their habitats in the geographic area of interest is not precisely known. GCC effects near the Red 2 site could result in regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (Karl et al. 2009). The decrease in precipitation combined with increased temperatures and evaporation could result in more frequent droughts. Such changes in climate could alter and fragment terrestrial habitats (grasslands and wetlands, including prairie potholes) and could result in shifts in species ranges, diversity, and abundance in the geographic area of interest for the Red 2 site (Karl et al. 2009).

The potential cumulative impact to terrestrial resources within the area of interest given the two new reactors at the Red 2 site, the proposed power plant 3 mi south, and the 17,000-ac reservoir 20 mi northeast of the site would noticeably alter terrestrial resources. All these activities would remove or modify terrestrial habitats with the potential to affect important species living or migrating through the area. For the reasons discussed above in Building Impacts and Operational Impacts, the incremental contribution of building and operating the two new reactors at the Red 2 site to the cumulative impacts within the geographic area of interest would be substantial.

Summary

Impacts to terrestrial ecology resources and wetland resources were estimated based in the information provided by STPNOC and the review team's own independent review. Two future activities in the region that would noticeably affect wildlife and wildlife habitat, in addition to the building and operation of two units at the Red 2 site, are the building of the Pattillo Branch Power Plant and the Lower Bois d'Arc Creek reservoir (Table 9-8). After building at the Red 2 site is complete, terrestrial ecological resources in areas that are temporarily disturbed are expected to return to predominantly preconstruction conditions. However, the development of a 1700-ac reservoir would permanently shift resources from terrestrial to aquatic. Additional impacts at the reservoir location and plant site would include the potential for affecting more than 900 ac of forested land, and the potential habitat loss for any protected species that could occur in the area. While there is uncertainty concerning the possible routing of a new transmission corridor, transportation, and pipeline corridors at the Red 2 site, the potential area affected is estimated to be relatively small (i.e., about 200 ac). Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the cumulative impacts within the area of interest on terrestrial plants and animals, including threatened or endangered species, and wildlife habitat in the region would be MODERATE. The creation of the Lower Bois d'Arc Creek reservoir is the primary reason for this impact level. However, the incremental contribution of building and operating the two new reactors at the Red 2 site to the cumulative impacts within the geographic area of interest would be significant.

9.3.2.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact aquatic resources, including other Federal and non-Federal projects listed in Table 9-8. For the analysis of aquatic ecological impacts at the Red 2 site, the geographic area of interest is considered to be all parts of the Red River drainage between the Denison Dam (below Lake Texoma Reservoir) and the confluence of the Red River with the Kiamichi River.

At the Red 2 alternative site, aquatic resources are associated with the Red River, Brushy Creek, and the nearby drainages for Pattillo Branch, Sheep Creek, and Bois d'Arc Creek, as well as Valley Lake (Figure 9-5). The Red 2 site has been cleared for agriculture, and yet still supports numerous springs, intermittent streams, and ponds. The Red River flows through Fannin County downstream of Lake Texoma and is the border between Texas and Oklahoma. Flows in the Red River are maintained by releases from Lake Texoma Dam. While fishing is common in the clear waters of Lake Texoma, recreational fishing is popular in the Red River downstream of the dam (McCord 2009). Texas Water Quality Inventory lists chlorophyll-*a* concentrations at a level of concern in this portion of the river (TCEQ 2008). The reach of the river through Fannin County is not navigable for commercial vessels, but is used for recreational boating activities. In addition, there are numerous, intermittent streams and creeks that flow into the river (McCord 2009; STPNOC 2009a).

Valley Lake is a man-made reservoir on Brushy Creek that is owned and operated by Luminant Power. The lake's water is used for condenser cooling and other uses associated with the natural gas-fueled, Valley Power Plant (STPNOC 2009a). The lake is popular for recreational activities. As stated in Section 9.3.2.2, water from Valley Lake would not be available for cooling new nuclear units located at the Red 2 site (STPNOC 2009a).

Brushy Creek rises east of Valley Lake and flows north for 4 mi through the Red 2 site before emptying into the Red River. The creek crosses flat land surfaced by clay and sandy loams with water-tolerant hardwoods, conifers, and grasses along the banks. The review team could not find any surveys of aquatic resources in Brushy Creek or the other drainages and ponds in the area. Flows in the smaller drainages are assumed to be intermittent and the resources would be dependent on seasonal flows.

Texas Parks and Wildlife Department (TPWD) has designated Bois d'Arc Creek an ecologically significant stream segment, from its confluence with the Red River through the site and upstream to its headwaters in east Grayson County. TPWD notes that the creek has significant habitat value (TPWD 2010).

Within the Red River drainage up and downstream of the Red 2 site there are a number of past, present and potential projects that could affect the aquatic resources (Table 9-8). Past actions include building the Valley Power Plant, excavation of the Trinity Materials (Hendrix Mine), and the wastewater treatment plants for the cities of Belles and Denison. There are two proposed projects in the region that would also affect aquatic resources in vicinity: the gas-powered Pattillo Branch Power Plant and the Lower Bois d'Arc Creek Reservoir (16,641 ac). In addition, the new nuclear units would require building water intake and discharge systems with associated pipelines from the Red River to the new site, inundation of a reservoir, and associated transmission corridors to connect with the existing power grid. Without having the specific plans for locating all facilities at the Red 2 site, the potential for impacts from building and operation of the new units to aquatic biota are likely to be those inhabiting the Red River, Valley Lake, Brushy Creek, springs, intermittent streams, ponds, and the nearby drainages for Bois d'Arc Creek, Sheep Creek, and Pattillo Branch.

Non-Native and Nuisance Species

No non-native or nuisance species have been recorded in the area as a problem. However, there are numerous nuisance aquatic species that TPWD considers to be ubiquitous across waterways in Texas. These species include: hydrilla (*Hydrilla verticillata*), water hyacinth (*Eichhornia crassipes*), and giant salvinia (*Salvinia molesta*). In addition, the Red River basin is known to have the following non-native fish: common carp (*Cyprinus carpio*), grass carp

(*Ctenopharyngodon idella*), blacktail shiner (*Cypinella venusta*), bullhead minnow (*Pimephales vigilax*), rudd (*Scardinius erythrophthalmus*), black buffalo (*Ictiobus niger*), black bullhead (*Ameiurus melas*), Western starhead topminnow (*Fundulus blairae*), redspotted sunfish (*Lepomis miniatus*), tadpole madtom (*Noturus gyrinus*), plains killfish (*Fundulus zebrinus*), yellow perch (*Perca flavescens*), and walleye (*Sander vitreum*)(Thomas et al. 2007; Hassan-Williams and Bonner 2009; TPWD 2009h).

Important Species

The Red River is popular for recreational fishing. The recreational fish species in the Red River and in Valley Lake include: alligator gar (*Atractosteus spatula*), several bass species (spotted bass (*Micropterus punctulatus*), largemouth bass (*M. salmoides*) and other bass hybrids), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), and blue catfish (*I. furcatus*), white crappie (*Pomoxis annularis*), black crappie (*P. nigromaculatus*), golden shiners (*Notemigonus crysoleucas*), emerald shiners (*Notropis atherinoides*), and warmouth (*L. gulosus*). In addition, popular introduced sports fish include: striped bass (*Morone saxatilis*) and walleye. Commercial fishing along the reach of the Red River in Fannin County is limited to collection of bait fish, e.g., the Mississippi silvery minnow (*Hybognathus nuchalis*) (Thomas et al. 2007; Hassan-Williams and Bonner 2009). The centrachids (largemouth and spotted bass, bluegill, crappies, and warmouth) would all be found in lakes, rivers and smaller flowing tributaries. The bass and warmouth are top carnivores, whereas the bluegill and crappies are insectivores. Alligator gar and catfish are top carnivores and are found primarily in larger waterbodies, like rivers and reservoirs. The golden and emerald shiners, cyprinids species, are found in lakes, rivers and smaller flowing tributaries, feeding on various aquatic insects. The Mississippi silvery minnow would only be found in rivers and smaller tributaries where it feeds on soft substrate collecting algae and other organic matter (Thomas et al. 2007; Hassan-Williams and Bonner 2009).

There are no Federally listed aquatic species or designated critical habitat in the vicinity of the Red 2 site. However, TPWD has identified numerous rare and protected aquatic species in Fannin County. The State-listed rare and protected fish species include: Western sand darter (*Ammocrypta clara*), orangebelly darter (*Etheostoma radiosum*), goldeye (*Hiodon alosoides*), and taillight shiner (*Notropis maculates*) (TPWD 2009i). These state rare and protected fish are thought to be in the Red River and its tributaries and could be found in the vicinity of the Red 2 alternative site (Thomas et al. 2007; Hassan-Williams and Bonner 2009). The State-listed threatened fish species include: blue sucker (*Cycleptus elongates*), creek chubsucker (*Erimyzon oblongus*), blackside darter (*Percilla maculata*), paddlefish (*Polyodon spathula*), and shovelnose sturgeon (*Scaphirhynchus platorynchus*) (Table 9-11). Currently, blue suckers and paddlefish are not known to occur in the Red River above the confluence with the Kiamichi River, which is below the site (Thomas et al. 2009; Hassan-Williams and Bonner 2009). At one time, the shovelnose sturgeon was probably found throughout the river systems in Texas, but today, its distribution has been reduced to the Red River below Denison Dam (below Lake Texoma Reservoir). The distribution of the blackside darter is now restricted to the streams and tributaries of the Red River basin, where it feeds on various aquatic insects and crustaceans. The darter is known to migrate from feeding areas in small to medium rivers to spawning areas in small tributaries along riffle areas. The creek chubsucker is found in streams associated with the Red River, where it feeds on aquatic insects, mollusks and crustaceans. They may spawn in shallow areas over a variety of substrates (Thomas et al. 2007; Hassan-Williams and Bonner 2009; TPWD 2009i). There are no specific studies for these State-listed species in the vicinity of the Red 2 alternative site (STPNOC 2009a).

Table 9-11. State-Listed Aquatic Species that are Endangered, Threatened, and Species of Concern for Fannin County

Scientific Name	Common Name	State Status
Fish		
Cycleptus elongates	blue sucker	T
Erimyzon oblongus	creek chubsucker	T
Percilla maculata	Blackside darter	T
Polyodon spathula	paddlefish	T
Scaphirhynchus platorynchus	shovelnose sturgeon	T

Source: State species information provided by TPWD, (TPWD 2009d; 35 Texas Register 249)
T = State Listed Threatened.

The State-listed rare and protected, non-fish species include a number of freshwater mussels: rock pocketbook (*Arcidens confragosus*), Wabash pigtoe (*Fusconaia flava*), plain pocketbook (*Lampsilis cardium*), White heelsplitter (*Lasmigona complanata*), common pimpleback (*Quadrula pustulosa*), pistolgrip (*Tritogonia verrucosa*), and fawnsfoot (*Truncilla donaciformis*). Not much is known about the distribution of these mussels in Fannin County. However, these types of freshwater mussels, known as unioid mussels, are found in various water flows, from fast moving riffles in streams to quiescent ponds. Each species has adapted to a particular flow regime. These unioid mussels have a larval stage called a glochidium. For glochidia to mature to juvenile mussels, they must live as a parasite in the gill tissues of a host fish. An important component to the distribution of freshwater mussels in various water bodies is associated with the relationship between the mussels and the host fish (Strayer 2008). However, for these mussel species the host fish species have not been identified.

Building Impacts

Impacts of building a cooling water reservoir may be significant depending on the siting of the reservoir. At the Red 2 site, the building of a reservoir would flood portions of Brushy Creek (STPNOC 2009a). Impacts from onsite building activities that have the potential to cause erosion and sedimentation to the local water bodies would be controlled or minimized by the implementation of an SWPPP (STPNOC 2009a). During the site visit, observations of the site via public roads indicated that there are streams present that are either perennial or intermittent, and supply water to the major drainages (including Bois d'Arc Creek, Sheep Creek, and Pattillo Branch)(NRC 2009b). There are no known surveys or studies of the aquatic resources within these drainages. Inundation of small flowing streams would affect those aquatic resources that have specific habitat requirements. Fish species that have habitat requirements associated with lotic systems (flowing water) are often replaced with species more suited to lentic environments (standing water) (Linam et al. 2002). Habitat for these lotic species would likely be lost when these water bodies are inundated with the reservoir, including any spawning areas for fish species that are dependent on flowing water, e.g., the blackside darter. Most freshwater mussel species are also adapted to a specific flow regime, and the inundation of stream environments for the reservoir could affect their distribution in the region (STPNOC 2009a; TPWD 2009i). Assuming that aquatic species are ubiquitous in the Red River drainage, and that the habitat types provided by the drainages mentioned above are also represented elsewhere in the Red River drainage, the impacts from the building the cooling water reservoir would not destabilize the aquatic populations of the region.

New cooling water intake and discharge structures in addition to a cooling water reservoir would be required at the Red 2 site (STPNOC 2009a). Building of a new intake and discharge structure in the Red River would likely require dredging, pile driving, and other major alterations to the shoreline and benthic aquatic habitat. These activities would require permits from the Corps and the State of Texas. Building of these structures on the Red River would result in the temporary displacement of aquatic biota within the vicinity of both structures. It is expected that these biota would return to or recolonize the area after construction is complete. Sedimentation due to disturbances of the river bank and bottom during building activities could affect local benthic populations. However, the impacts on aquatic organisms would be temporary and largely mitigable through implementation of an SWPPP and by use of BMPs (e.g., silt screens) (STPNOC 2009a).

Building transportation routes (heavy haul road or railroad spur), transmission corridors, and pipelines for the Red 2 site would also result in the temporary displacement of aquatic biota. Locations for these systems have not been identified. Expansion of existing corridors is expected to result in minor environmental impacts, while building in new corridors could result in more significant impacts. Building these corridors would use BMPs to reduce impacts such that they would be temporary and localized (STPNOC 2009a).

Building the cooling water reservoir for the two new nuclear reactors at the Red 2 site would inundate onsite water bodies and flood a portion of Brushy Creek. The habitat for the aquatic resources would change, and since most species cannot adapt to the reservoir environment, the species would be lost to the site. Thus, the building of the cooling water reservoir would be noticeable but not destabilizing to the aquatic resources. Building the intake and discharge structures on the Red River and in the new reservoir would affect the aquatic communities but the areas would be recolonized after building of these structures was completed. Building of the transportation routes, transmission corridors, and pipelines would result in temporary and localized effects on aquatic communities.

Operation Impacts

To operate two new units at the Red 2 site, water rights for the Red River would have to be acquired. Currently, there are not sufficient water rights aggregated to a single point of diversion to support the water needed for the Red 2 site (Section 9.3.2.2). The Red River water levels and water quality in the vicinity of where an intake structure on the Red River could be located is influenced by releases from Lake Texoma Reservoir. Instream flow studies necessary to maintain aquatic resources have not been evaluated for this reach of the river, and effects on aquatic resources associated with removal of water for the new reservoir are unknown.

Impingement, entrainment, and entrapment of organisms from the Red River and from a constructed reservoir would likely be the most significant impacts to the aquatic population that could occur from operation of two new nuclear units at the Red 2 site. STPNOC states that using a closed-cycle cooling system with a cooling water reservoir would consume a maximum of 50,000 ac-ft of water per year (STPNOC 2009a). While the Red River is considered to be saline and of poor water quality (STPNOC 2009a), the river is known to support populations of aquatic biota that have acclimated and thrived under those conditions (Thomas et al. 2007; Hassan-Williams and Bonner 2009; McCord 2009). EPA's design criteria for 316(b) Phase 1 regulations (66 FR 65256) for intake structures would minimize impacts to aquatic biota in the Red River. The design criteria include: (1) closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities; (2) maximum through-screen velocity of 0.15 m/s (0.5 ft/s) at the cooling water intake; and (3) intake flow of less than or equal to 5 percent of the mean annual flow (STPNOC 2009a). Compliance with these regulations would minimize impingement, entrainment, and entrapment impacts to the aquatic biota.

Operational impacts associated with water quality, physical and thermal characteristics of the discharge cannot be determined without additional detailed analysis. The water quality of a cooling water reservoir could be maintained by addition of water from the Red River. A cooling water reservoir for the Red 2 site would likely evolve in a similar fashion to the MCR at the STP site, where, with time, the reservoir has developed similar aquatic resources to that in the lower Colorado River and acclimated to the discharges of the operating reactor units. Impacts to the Red River would depend on the type of cooling system for the new units, including the volume, frequency, and water characteristics of the discharge. These types of impacts can be addressed and minimized through operational procedures and the permitting process with TCEQ.

Operational impacts to aquatic biota from onsite activities and in the transmission line and pipeline corridors would also be minimal assuming BMPs are used for corridor maintenance.

SWPPPs would ensure that impacts to biota from erosion and sedimentation would be minimal through the use of silt screens and controls for managing stormwater. These controls would be important for habitat quality and survival of benthic biota in the downstream drainages.

Based on operation of the cooling water system (CWS), impacts to aquatic communities in the Red River and reservoir could result from impingement, entrainment, and entrapment as well as thermal, chemical, and physical characteristics of the discharge. STPNOC commits to compliance with State and Federal regulations for operation of intake and discharge structures that would be protective of aquatic resources. Once a community is established in the new reservoir, long-term effects from operation of the CWSs are not expected to noticeably alter aquatic communities in the Red River and reservoir.

Cumulative Impacts

Within all parts of the Red River drainage between the Denison Dam (below Lake Texoma Reservoir) and the confluence of the Red River with the Kiamichi River, the local aquatic resources have adapted to the construction of Valley Lake for the Valley Power Plant, but may be affected by the building of future planned power plants. The aquatic resources of Brushy Creek and the Red River adapted to the construction of Valley Lake and the water needs for the Valley Power Plant. Valley Lake is open to the public for recreational fishing. In 2008, the Pattillo Branch Power Company, LLC, submitted a permit application to TCEQ for construction of a gas-powered electric-generating plant approximately 3 mi south of the Red 2 site (TCEQ 2009a). The construction of this plant would likely have similar impacts to the aquatic biota as those discussed for the building of the Red 2 site. If the proposed Pattillo power plant also includes a reservoir, the cumulative loss of stream and drainage habitat would be greater than the loss of habitat from the Red 2 reservoir. In addition, these actions may affect water flow to Bois d'Arc Creek and degrade the biological function of this water body that is designated as an ecologically significant stream segment.

The Red River below Lake Texoma Reservoir has numerous tributaries, including Brushy Creek and Valley Lake. It is assumed that the proposed new Pattillo Branch Power Plant would divert additional water from the Red River. The Corps and TCEQ would evaluate as part of considering the aggregation of water rights for the proposed Red 2 site if the instream flow in the Red River for the existing Valley Power Plant, the proposed Pattillo Branch Power Plant, and the two new units at Red 2 would be sufficient for protection of aquatic life (NRC 2009b). If instream flows are insufficient for protection of aquatic life, TCEQ could make changes to available water rights, and that could affect the water availability for future power production facilities (NRC 2009b). Of particular concern would be the potential to affect the State-listed species in the area, e.g., the shovelnose sturgeon that now has a distribution limited to the Red River (Thomas et al. 2007; Hassan-Williams and Bonner 2009; TPWD 2009i).

Continued urbanization and agricultural practices could affect aquatic communities in the Red 2 geographic area of interest in the foreseeable future. Expansion of urban areas in the Red River drainage could increase water use, decrease available water for aquatic resources, and increase nonpoint pollution. The effects of continued agricultural practices could result in additional habitat loss and/or degradation due to irrigation using surface waters and groundwater withdrawal, point and non-point source pollution, siltation, and bank erosion.

As mentioned above in the terrestrial section, GCC could result in regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (Karl et al. 2009). The decrease in precipitation combined with elevated water temperatures and evaporation could result in more frequent droughts, which could reduce aquatic habitat. Loss of habitat could cause shifts in species ranges, diversity, and abundance in the geographic area of interest for the Red 2 site (Karl et al. 2009). Specific predictions on potential impacts to aquatic species and their habitat in this region resulting from GCC are inconclusive at this time. Because of the regional nature of climate change, the impacts related to GCC would be similar for all the alternative sites, as they are all in the Great Plains Region.

Based on building and operation of two new nuclear units at the Red 2 alternative site and other projects and influences in the region of influence for aquatic resources, the cumulative impacts would be noticeable but not destabilizing. All these activities would alter the aquatic habitats and potentially change the species composition and diversity in the affected water bodies. The incremental contribution of building and operating the two new reactors at the Red 2 site to the cumulative impacts within the geographic area of interest would be substantial.

Summary

STPNOC has indicated that building of a cooling water reservoir at the Red 2 site would inundate existing water bodies and destroy habitat for aquatic resources that are dependent on flowing water. The review team concludes that the impacts from building two new nuclear units at the Red 2 site would be noticeable but not destabilizing to the aquatic resources. The review team also concludes that the impacts from operation of two new units would be minimal. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the cumulative impacts of building and operating two new reactors on the Red 2 site combined with other past, present, and future activities on most aquatic resources in the Red River drainage would be MODERATE. The incremental contribution of building and operating the two new reactors at the Red 2 site to the cumulative impacts within the geographic area of interest would be significant.

9.3.2.5 Socioeconomics

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact socioeconomics, including other Federal and non-Federal projects listed in Table 9-8. For the analysis of socioeconomic impacts at the Red 2 site, the geographic area of interest is considered to be the 50 mi region centered on the Red 2 site with special consideration of Fannin and Grayson Counties as that is where the review team expects socioeconomic impacts to be the greatest. In evaluating the socioeconomic impacts of site development and operation at the Red 2 site near Savoy in Fannin County, the review team undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources.

Physical Impacts

Many of the physical impacts of building and operation would be similar regardless of the site. Building activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support building activities (e.g., borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions (the latter are discussed under aesthetics and recreation). New units would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed STP site would be controlled in accordance with standard noise protection and abatement procedures. This practice also would be expected to apply to all alternative sites, including the Red 2 site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the alternative site.

The new units at the Red 2 site would likely have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, new units would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce. Based on the information provided by STPNOC and the review team’s independent evaluation, the review team concludes that the physical impacts of building and operating two nuclear units at the Red 2 site would be minimal.

Demography

The Red 2 site is located in Fannin County, 3.7 mi north of the city of Savoy (2008 population 895) and 12.2 mi southeast of Denison (2008 population 24,001), approximately 20 mi east of Sherman (2008 population 38,077) and within 50 mi of the outer edges of the Dallas-Fort Worth

(DFW) Metroplex (2008 population 6,300,006) (USCB 2009a). The Sherman-Denison metropolitan area (located in Grayson County) has an estimated 2008 population of 118,804 (USCB 2009b). After World War II, Fannin County's population declined up until the 1970s when it slowly began to rise again to its current 2008 population of 33,229 (TSHA 2009c).

STPNOC estimated the peak number of building workers would be 5950. Approximately 900 operations workers would also be onsite during the final phase of building activities (STPNOC 2008c). Based on assumptions in Section 4.4 concerning in-migration for Units 3 and 4 in Matagorda County, the review team assumed that 50 percent or 2975 construction workers would in-migrate, with half of these assumed to move to Fannin County and the other half to Grayson County. Collin County and other counties nearer Dallas-Fort Worth would likely see an in-migration of workers as well, but considering the large populations of these counties and the relatively small number of in-migrants they would be easily absorbed with no measurable impact. Eighty percent of in-migrating construction workers would bring a family. All operations workers would in-migrate and all would bring a family. A family size of 3.25 was used for construction workers for a total peak site development related population increase of 8330 (7735 in-migrating workers and family members and 595 workers without family). The average family size of 2.74 for the operating workforce (see Section 5.4) would result in a total in-migrating operations-related population of 2466 (900 operations workers plus family). Therefore, the total expected in-migrating population (site development and operations) at peak building would be 10,796.

Since the assumed in-migrating population during the building period would be less than 5 percent of the total population for Grayson County and 16 percent for Fannin County, the demographic impacts of site development are expected to be much less for Grayson County than for the smaller Fannin County. If the facility is constructed and commences operations, the operational workforce would number about 959 workers, 900 of whom would already be at the site during peak site development and are included in the above analysis, meaning that there would be very little demographic impact during operations in either county. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the demographic impacts of building and operating two nuclear units at the Red 2 site would be noticeable mainly in Fannin County during the building period, because of the relatively significant ratio of in-migrating to resident population.

Taxes and Economy

Tax revenues to the local economies and the State would come in several different forms, as discussed in Sections 4.4 and 5.4. As described in Section 5.4.3.2, STPNOC estimates it would spend $60 million on annual expenditures for goods and services related to the new units of which about 20 percent ($12 million) would be spent locally (STPNOC 2008b). STPNOC estimated if the units were 100 percent taxable, annual franchise taxes for Units 3 would be

$4.7 to $5.4 million and Unit 4 would have payments of $3.9 to $4.7 million per year, which would represent less than 1 percent of the State's annual franchise tax revenues.

Based on the assumptions and methodology detailed in Section 5.4.3.2, the review team estimated that annual property taxes would range from $6.10 million to $13.86 million, which would represent a 73 to 165 percent increase over the 2008 Fannin County taxes levied of $8.4 million. Savoy Independent School District (ISD) may also receive tax benefits from the hypothetical new reactors (STPNOC 2009a).

Economic impacts would be spread across the 50-mi region but would be greatest in Fannin County and to a lesser extent Grayson County. Fannin County per capita income for 2007 was $25,258 and $28,901 for Grayson County. The 2008 unemployment rate for Fannin County and Grayson County was 5.9 percent and 5.3 percent, respectively (Texas Association of Counties 2009a, b) The wages and salaries of the building and operations workforce would stimulate the economy and could result in increases in business activity, particularly in the retail and service sectors. This would have a positive impact on the business community and could provide opportunities for new businesses and increased job opportunities for local residents. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the tax and economic impacts of building and operating two nuclear units at the Red 2 site would be significant.

Transportation and Housing

Primary access to the site is from the south on U.S. Route 82 which runs between Sherman and Bonham. U.S. 82 is four-lanes in Grayson County but narrows to two-lanes before entering Fannin County. Commuters from Denison would use U.S. 69 to its intersection with U.S. 82. Other secondary roads serving the site are Farm-to-Market (FM) 1897, FM 1753 and FM 1752 (provides access to Valley Plant). All three of these roads are two-lanes and in good condition (STPNOC 2009b). The Red 2 site is accessed by a one lane unimproved road not maintained by Texas Department of Transportation (TXDOT) that would need major upgrades and a portion of FM 1752 that would need widening (STPNOC 2009a). The most likely pinch points would be the intersection of U.S. 69 and U.S. 82 and also at FM 1897 and FM 1752. Approximately 4.2 mi of rail would need to be constructed (STPNOC 2009a). The review team expects the transportation impacts from site development of a plant at the Red 2 site could be noticeable and may change traveler behavior, depending on commuter patterns of the workers at the Red 2 site and those at the Valley Power Plant and would warrant mitigation. Operation impacts would be significantly lower than the building phase impacts of traffic due to the much smaller workforce and because roads would have been improved during the building phase.

The U.S. Census Housing Profile for Fannin County estimated a total housing stock of 13,571 units with a rental vacancy rate of 8.5 percent. Approximately 2146 housing units were unoccupied at the time of the survey (USCB 2009b). The U.S. Census Housing Profile for

Grayson County estimated a total housing stock of 51,733 units with a rental vacancy rate of 7.6 percent. Approximately 7103 housing units were unoccupied at the time of the survey (USCB 2009c). The review team expects that the in-migrating workforce could be absorbed into the existing housing stock in Grayson County and the region without a measureable impact, but the impacts to Fannin County could be more significant, given the small number of vacant housing units. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the transportation and housing impacts of building and operating two nuclear units at the Red 2 site would be noticeable.

Public Services and Education

In-migrating construction workers and plant operations staff would likely impact local municipal water, wastewater treatment facilities, and other public services in the region. These impacts would likely be in proportion with the demographic impacts experienced in the region, unless these resources have excess capacity or are particularly strained during building, which would decrease or increase the impact, respectively. For example, the largest water treatment facilities in both Fannin County and Grayson County have water capacity available that is roughly two to five times current average daily consumption (EPA 2009b; TCEQ 2010a), so while Fannin County in particular may have to build considerable distribution infrastructure, neither county is likely to be water capacity limited. The in-migrating workers represent a small portion of the total population of Grayson County and would likely not have a noticeable impact on their public services. In the smaller Fannin County impacts could place a strain on some public services, based on the county's proportionally larger in-migrating workforce population. During operations the impact on public services would likely be minimal.

Fannin County has nine independent school districts with 25 schools, and Grayson County has 13 independent school districts with 69 schools. The 2007-2008 student enrollments for Fannin and Grayson Counties are 5620 students and 21,081 students, respectively (NCES 2009). The review team expects a peak building-related increase of about 2537 students (1269 in each county). The in-migrating students would likely represent a noticeable but not significant impact to schools in Grayson County due to the 6 percent increase in overall students. However, the increase would be a 23 percent increase in the student population in Fannin County, where the review team expects the impact to be significant and potentially destabilizing to this school system. During operation, this impact on schools would be significantly less due to the lower number of in-migrating students. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the public service and education impacts of building and operating two nuclear units at the Red 2 site would be significant.

Aesthetics and Recreation

Recreation in the area includes historic Texas Lakes Trail, Lake Davy Crockett Recreational Area, Caddo Wildlife Management Area (WMA) and Ray Roberts Lake State Park and WMA. These areas offer boat access, picnicking and camping. The Red 2 site is located near Valley Lake which supports the Valley Power Plant. Any recreation that occurs on Valley Lake is private but would be affected by building the nuclear plant (STPNOC 2009a). The building and operation of transmission lines to support the site also would have an aesthetic impact on the region. The NRC review team concludes that the visual impact associated with site development and operation of two tall, relatively isolated nuclear units on this site would have a noticeable impact on the visual aesthetic resources in the area. Impacts on aesthetic resources would not be destabilizing because these resources are already significantly affected by the presence of the nearby Valley Power Plant. The nuclear plant would not adversely affect boating access or access to picnicking or camping sites, therefore, it is expected that there would be minimal impacts on recreation. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the aesthetic and recreation impacts of building and operating two nuclear units at the Red 2 site would be noticeable.

Summary of Project-Related Socioeconomic Impacts

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. In summary, on the basis of information provided by STPNOC and the review team's independent evaluation, the review team concludes that the impacts of the building and operation of two nuclear units at the Red 2 site on socioeconomics would be minimal and adverse for Grayson County and most of the region but could be noticeable but not destabilizing for Fannin County in terms of transportation, housing, and public services and significant and potentially destabilizing for education impacts during the building phase. During operation, these impacts are expected to be minimal. The impacts on aesthetics are expected to be noticeable but not destabilizing. The impacts on the Fannin County economy and tax base during plant development and operation likely would be significant and beneficial.

Cumulative Impacts

For the analysis of socioeconomic impacts at the Red 2 site, the geographic area of interest is considered to be the 50-mi region centered on the Red 2 site with special consideration of Fannin and Grayson Counties as that is where the review team expects socioeconomic impacts to be the greatest. Fannin County has historically had an agricultural based economy centered mainly on cotton but during the late 20th century wheat was the only major crop to increase production as did several other small crops. Stock farming moved from milk cattle to beef cattle and Fannin County also saw an increase in banking and service businesses after World War II. With the opening of the first oilfield in Grayson County in the 1930s the local economy was changed. By 1970, the County was producing 120 million barrels of oil a day and became a manufacturing and trade center in the 1970's and 1980's with 50 percent of the labor force employed in these two sectors (THSA 2009c, d). After World War II Fannin County's population declined up until the 1970s when it slowly began to rise again to its current 2008 population of 33,229 (Handbook of Texas Online 2009).

In addition to assessing the marginal socioeconomic impacts from the building and operations of two additional nuclear units on the Red 2 site, the cumulative impact is also considered. The cumulative analysis considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts on a given region, including other Federal and non-Federal projects and those projects listed in Table 9-8. For the analysis of socioeconomic impacts at the Red 2 site, the geographic area of interest is considered to be the 50-mi region centered on the Red 2 site.

The projects identified in Table 9-8 have or would contribute to the demographics, economic climate, and community infrastructure of the region and generally result in increased urbanization and industrialization. However, many impacts such as those on housing or public services are able to adjust over time, particularly with increased tax revenues. Furthermore, state and county plans along with modeled demographic projections include forecasts of future development and population increases. Because the other projects described in Table 9-8 do not include any significant reasonably foreseeable changes in socioeconomic impacts within 50 mi of the Red 2 site, the review team determined there would not be any significant additional cumulative socioeconomic impacts in the region from those activities. Any economic impacts associated with activities listed in Table 9-8 would have been considered as part of the socioeconomic baseline, except for the Pattillo Branch Power Company natural gas fired power plant near Savoy. The project reportedly would create "100s" of construction jobs and 25 to 30 operations jobs. The project would be completed in 2012. For that reason, Pattillo site employment would be declining just as site employment at Red 2 would be beginning. Because of this timing and Pattillo's relatively small size, the review team does not believe that the Pattillo plant would significantly exacerbate any socioeconomic impacts from the Red 2 site. The Lake Ralph Hall project represents another reasonably foreseeable activity in Fannin County and within 30 mi of the Red 2 site, as is Bois d'Arc Creek Reservoir, located within 20 mi of the Red 2 site. While these projects could impose additional socioeconomic impacts, the planned starting and completion dates and the level of activity for these projects are uncertain. Therefore, the review team concluded that for purposes of this alternative site analysis, the socioeconomic impacts of these projects could not be quantitatively evaluated. However, although the timing of the impacts is not known, the review team expects that the following effects may occur. The review team would expect temporary increases in economic activity, population and traffic during the building period; decreases in existing property tax base which may or may not be offset by values of recreational development and other improvements related to the reservoir. In addition, during reservoir operations, depending on the level of development (and population), there may be increases in the demand for infrastructure and community services. There is a possibility that recreational opportunities would increase.

The review team concludes that the physical impacts of the building and operation of a nuclear plant at the Red 2 site would be SMALL for the entire 50 mi region. Socioeconomic impacts would be SMALL and adverse for Grayson County and most of the region but could be MODERATE and adverse for Fannin County in terms of demographic, transportation, housing, public services, and aesthetics; and LARGE and adverse for education during the building phase. The impacts on the economy and tax base during plant building and operation likely would be beneficial and LARGE in Fannin County but SMALL for the rest of the 50-mi region. Building and operating a new plant at the Red 2 site would make a significant, incremental contribution to these impact levels.

9.3.2.6 Environmental Justice

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact environmental justice, including other Federal and non-Federal projects listed in Table 9-8. The cumulative environmental justice impacts were assessed for the 50-mi region centered on the Red 2 site. In 2000, the 50-mi region around the Red 2 site was characterized as 5.7 percent Black, 1.7 percent American Indian and Alaskan Native, 3.6 percent Asian, 0.04 percent Hawaiian and Other Pacific Islander, 4.1 percent all other races, and 2.3 percent two or more races, 9.2 percent Hispanic or Latino and 6.5 percent low-income (STPNOC 2009a).

The review team identified a total of 631 census block groups within the 50-mi region (which included portions of Oklahoma), 41 of which were classified as minority populations, with one of them in Fannin County and seven of them in Grayson County. None of these populations are within 10 mi of the Red 2 alternative site. The review team also found 19 census block groups classified as low income in the 50-mi region, with none in Fannin County and 2 in Grayson County. None of these populations are within 10 mi of the Red 2 alternative site. See Figure 9-7 and Figure 9-8 for the location of minority or low-income populations within the 50-mi region. Almost all of the potential physical impacts of building and operation would occur within the vicinity of the Red 2 site and Figure 9-7 and Figure 9-8 show no minority or low-income block groups within 10 mi of the Red 2 site. The review team did not locate any minority or low-income populations downstream of the Red 2 site on Brushy Creek or the Red River within 50 mi of the Red 2 site. The review team's analysis did not find any information suggesting that minority or low-income populations in the area were dependent on natural resources that would be adversely affected by a nuclear power plant at the Red 2 site. Finally, the review team did not identify any potential pathways by which any building or operations activity could affect any

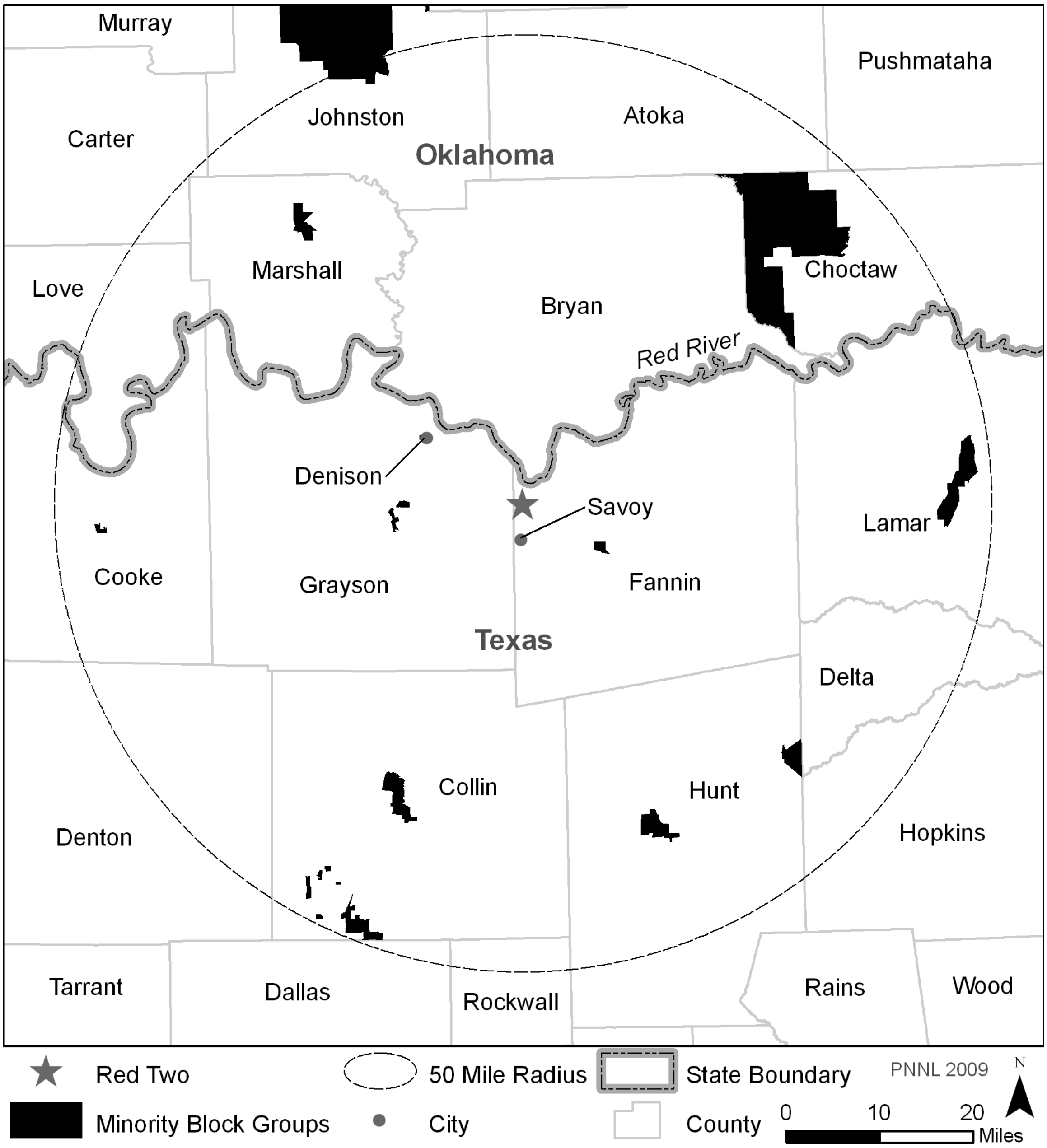


Figure 9-7. Minority Block Groups within 50 mi of the Red 2 Alternative Site

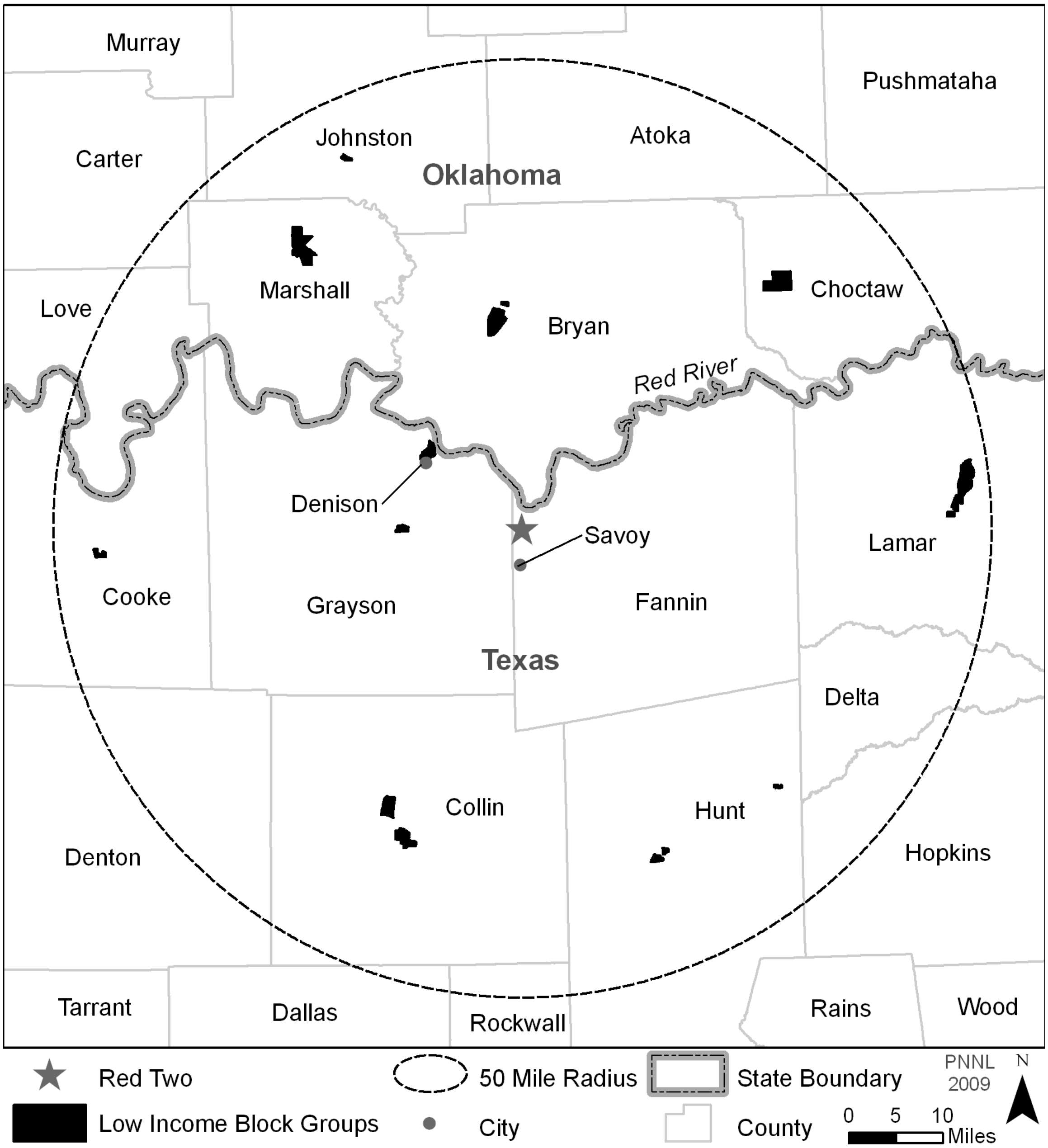


Figure 9-8. Low-Income Block Groups within 50 mi of the Red 2 Alternative Site

minority and low-income populations outside of Fannin and Grayson Counties. The review team determined that for the Red 2 site there would be no disproportionate and adverse impacts on minority or low-income populations from building and operating two nuclear units and therefore the environmental justice impacts can be characterized as minimal and adverse.

The projects identified in Table 9-8 likely did not or will not contribute to environmental justice impacts of the region. Based on information provided by STPNOC and the review team's independent evaluation, the review team concludes that there would likely not be any disproportionate and adverse environmental justice cumulative impacts from building and operating two nuclear units at the Red 2 site and therefore any environmental justice-related impacts would be SMALL and adverse.

9.3.2.7 Historic and Cultural Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact historic and cultural resources, including other Federal and non-Federal projects listed in Table 9-8. For the analysis of cultural impacts at the Red 2 site, the geographic area of interest is considered to be the APE that would be defined for this site. This includes the physical APE, defined as the area directly affected by the site development and operation activities at the site and transmission lines, and the visual APE. The visual APE is defined as an additional 1-mi radius around the physical APE consistent with the discussion in Section 2.7 about the maximum distance from which the structures can be seen.Reconnaissance activities in a cultural resource review have particular meaning. Typically, for example, it includes preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing its EISs, the review team relies upon reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through visits to the site area. To identify the historic and cultural resources at the Red 2 site, the following information was used:

- STPNOC ER (STPNOC 2009a) - including the Texas Historical Commission's Texas Archeological Sites Atlas
- NRC Alternative Sites Visit August 2009

The Red 2 site is a greenfield site located 1.8 mi north of the existing Valley power plant. Historically, the site and vicinity were largely undisturbed and likely contained intact archaeological sites associated with the past 10,000 years of human settlement. Over time, the area has been disturbed by rural development and cleared for agricultural purposes. The physical and visual APEs if the proposed plant were to be sited at the Red 2 site do not appear to have any historic properties likely to be affected by building or operating new units. No archaeological and/or architectural surveys have been conducted at the Red 2 site.

Nine historic properties listed on the National Register of Historic Places are found in Fannin County, Texas, but all are located more than 10 mi away from the site in towns within a protected area (Caddo National Grasslands). Six archaeological sites have been recorded along Valley Lake, within 2 mi of the Red 2 site. In addition, the Virginia Point Cemetery, which is still active, is located 0.75 mi west of the site. Near the cemetery is a Texas Historic Landmark, the Virginia Point Methodist Church, the oldest church in Fannin County (STPNOC 2009a). Neither the cemetery nor the church is listed on the National Register. The project has the potential to affect resources through visual impacts from buildings and transmission lines. Should these two properties be subsequently listed on the National Register, then these impacts may result in significant alterations to the visual landscape within the geographic area of interest.

To accommodate building two new nuclear generating units on the Red 2 site, STPNOC would need to clear approximately 800 ac for the main power plant site and up to 1700 ac for a new reservoir (STPNOC 2009a). In the event that the Red 2 site was chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the State Historic Preservation Officer (SHPO), tribes and interested parties. The results would be used in the site planning process to avoid cultural resources impacts. In the event significant cultural resources were identified by these surveys, the review team assumes that STPNOC would develop protective measures in a manner similar to those for the STP site. These procedures are detailed in STPNOC's Addendum #5 to procedure No OPGP03-ZO-0025 Rev. 12 (Unanticipated Discovery of Cultural Resources) (STPNOC 2008e); the procedure includes notification of Texas Historical Commission.

Section 9.3.2.1 describes the transmission line corridors. There are no existing transmission corridors connecting directly to the Red 2 site. However, there are multiple 345-kV transmission lines connecting to the Valley power plant (STPNOC 2009a). A new transmission corridor would need to be created to connect the Red 2 site to these lines. In the event that the Red 2 site were chosen for the proposed project, the review team assumes that STPNOC would conduct its transmission line-related cultural resource surveys and procedures in a manner similar to that for the STP site described in Section 4.6.

Past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural development and agricultural development and activities associated with these land disturbing activities such as road development. No current or planned projects were identified in Table 9-8 that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest.

Activities associated with building two nuclear units and supporting facilities that can potentially destabilize important attributes of historic and cultural resources include land clearing, excavation, and grading activities. Given STPNOC's site planning process and no known cultural resources at the Red 2 site based on reconnaissance-level information, the impacts to cultural resources due to site development activities would be negligible.

Additionally, visual impacts from transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. Given that there are no known cultural resources where the historic setting and character of the resources are important, the visual impacts would be negligible. The review team assumes that STPNOC would develop procedures and consult with the SHPO similar to the process developed for cultural resource management at the STP site.

Impacts on historic and cultural resources from operation of two new nuclear generating units at the Red 2 site include those associated with the operation of new units and maintenance of transmission lines. The review team assumes that the same procedures currently used by STPNOC would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of the two new units and associated impacts on the cultural resources would be negligible for the physical and visual APEs.

No other activities in Table 9-8 in the geographic area of interest were identified that would significantly affect historic and cultural resources in a manner similar to those associated with the operation of two new units.

Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by the applicant and the review team’s independent evaluation, the review team concludes that the cumulative impacts from building and operating two new nuclear generating units on the Red 2 site (because there are no other projects) would be SMALL. This impact level determination reflects no known cultural resources that could be affected; however, if the Red 2 site was to be developed, then cultural resource surveys may reveal important historic properties that could result in greater cumulative impacts.

9.3.2.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact air quality, including other Federal and non-Federal projects listed in Table 9-8. The geographic area of interest for the Red 2 site is Fannin County, which is in the Metropolitan Dallas-Fort Worth Intrastate Air Quality Control Region (40 CFR 81.39).

The emissions related to building and operating a nuclear power plant at the Red 2 alternative site would be similar to those at the STP site. The air quality attainment status for Fannin

County as set forth in 40 CFR 81.344 reflects the effects of past and present emissions from all pollutant sources in the region. Fannin County is not out of attainment of any National Ambient Air Quality Standard.

The atmospheric emissions related to building and operating a nuclear power plant at the STP site in Matagorda County, Texas, are described in Chapters 4 and 5. The criteria pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of the criteria pollutants at the STP site were evaluated and also determined to be MODERATE principally because of a nearby major source; absent that source, the cumulative impacts would be SMALL.

Reflecting on the projects listed in Table 9-8, the most significant are the Valley Power Plant and the Pattillo Branch Power Plant. Effluents from power plants such these are typically released through stacks and with significant vertical velocity. Other industrial projects listed in Table 9-8 would have de minimis impacts. Given that these projects would be subject to institutional controls, it is unlikely that the air quality in the region would degrade to the extent that the region is in nonattainment of National Ambient Air Quality Standards.

The air quality impact of Red 2 site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. There are no land uses or projects, including the aforementioned sources, that would have emissions during site development that would, in combination with emissions from the Red 2 site, result in degradation of air quality in the region.

Releases from operation of two units at the Red 2 site would be intermittent and made at low levels with little or no vertical velocity. The air quality impacts of the Valley Power Plant are included in the baseline air quality status. The air quality impacts of the Pattillo Branch Power Plant would be similar to the air quality impacts discussed in Section 9.2.2.2, which could be noticeable but not destabilizing. The cumulative impacts from emissions of effluents from the Red 2 site and the aforementioned sources could be noticeable but not destabilizing.

The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in Section 7.5. The impacts of the emissions are not sensitive to location of the source. Consequently, the discussion in Section 7.5 is applicable to a nuclear power plant located at the Red 2 site. The review team concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions of the project at the Red 2 site.

Cumulative impacts to air quality resources are estimated based in the information provided by STPNOC and the review team's independent evaluation. Other past, present and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for greenhouse gas emissions) that could affect air quality resources. The cumulative impacts on criteria pollutants from emissions of effluents from the Red 2 site, other projects, and the Valley Power Plant and the Pattillo Branch Power Plant could be noticeable but not destabilizing, principally as a result of the contribution of these two sources. The national and worldwide cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions from the Red 2 site. The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air quality resources in the geographic areas of interest would be SMALL to MODERATE for criteria pollutants and MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air quality resources from building and operating two units at the Red 2 site would be insignificant for both criteria pollutants and greenhouse gas emissions.

9.3.2.9 Nonradiological Health

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact nonradiological health, including other Federal and non-Federal projects listed in Table 9-8. For the analysis of nonradiological health impacts at the Red 2 alternative site, the geographic area of interest is considered to include projects within a 5-mi radius from the site's center based on the localized nature of the impacts. For impacts associated with transmission lines, the geographic area of interest is the transmission line corridor.

The building activities that have the potential to impact the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to impact the health of members of the public and workers includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site.

Building Impacts

Nonradiological health impacts to construction workers and members of the public from building two new nuclear units at the Red 2 site would be similar to those evaluated in Section 4.8 for the STP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air quality and noise would be complied with during the site preparation and building phase. The incidence of construction worker accidents would not be expected to be different from the incidence of accidents estimated for the STP site. The Red 2 site is located in a rural area and nonradiological health impacts from building would likely be negligible on the surrounding populations.

The ER (STPNOC 2009a) indicated that there may be significant impacts on the transportation network in the vicinity of the Red 2 site and mitigation would be warranted. The impacts in the vicinity of the Red 2 site include traffic associated with the existing Valley Power Plant. Interactions between the traffic destined for the Red 2 site nuclear power plant project and the Valley Power Plant are likely to increase the nonradiological health effects from traffic accidents in the vicinity of the Red 2 site. The additional injuries and fatalities from traffic accidents involving transportation of materials and personnel for building of a new nuclear power plant at the Red 2 site would be similar to those evaluated in Section 4.8.3 for the STP site and would represent a small fraction (less than 5 percent) of the total traffic fatalities in Fannin County.

Past actions in the geographic area of interest that have similarly affected the public and workers from nonradiological resources include the construction of the Valley Power Plant and a wastewater treatment facility for the City of Bells. There are no major current construction projects in the geographic area of interest that would cumulatively impact nonradiological health.

Proposed future actions that would impact nonradiological health in a similar way to development at the Red 2 site would include the proposed Pattillo Branch Power Plant, transmission line development and/or upgrading throughout the designated geographic area of interest, and future urbanization.

Operational Impacts

Nonradiological health impacts from operation of two new nuclear units on occupational health and members of the public at the Red 2 site would be similar to those evaluated in Section 5.8 for the STP site. Occupational health impacts to workers (e.g., falls, electric shock or exposure to other hazards) at the Red 2 site would likely be the same as those evaluated for workers at two new units at the STP site. Exposure to the public from water-borne etiological agents at the Red 2 site would be similar to the types of exposures evaluated in Section 5.8.1, and the operation of the new units at the alternative sites would not likely lead to an increase in water-borne diseases in the vicinity. Noise and EMF exposure would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration (OSHA) regulations. Effects of EMF on human health would be controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria and adherence to the standards for transmission systems regulated by the Public Utility Commission of Texas (PUCT). Nonradiological impacts of traffic associated with the operations workforce would be less than the impacts during building. Mitigation measures taken during building to improve traffic flow would also minimize impacts during operation of a new unit.

The past and present activities in the geographic areas of interest that would have nonradiological impacts to the public or workers similar to those discussed for the Red 2 site include the Valley Power Plant and the wastewater treatment facility for the City of Bells. In the future, these facilities, the proposed Pattillo Branch Power Plant, transmission line systems, and future urbanization would have nonradiological impacts to the public and workers, and these impacts would be similar to those described for the proposed two new units at the Red 2 site.

The review team is also aware of the potential climate changes that could affect human health; a recent compilation of the state of the knowledge in this area (Karl et al. 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature and a decrease in precipitation, which may alter the presence of microorganisms and parasites in any reservoir that would be used. The review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of water-borne diseases.

Summary

Based on the information provided by STPNOC and the review team's independent evaluation, the review team expects that nonradiological health impacts from building and operation of two new units at the Red 2 alternative site would be similar to the impacts evaluated for the STP site. While there are other past, present and future activities in the geographic area of interest that could affect nonradiological health in ways similar to the building and operation of two units at the Red 2 site, the impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes, therefore, that cumulative impacts would be SMALL.

9.3.2.10 Radiological Impacts of Normal Operations

The following impact analysis includes impacts from building activities and operations for two nuclear units at the Red 2 alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that impact radiological health, including other Federal and non-Federal projects listed in Table 9-8. As described in Section 9.3.2, Red 2 is a greenfield site; there are currently no nuclear facilities on the site. The geographic area of interest is the area within a 50-mi radius of the Red 2 site. There are no major facilities that result in regulated exposures to the public or biota within the 50-mi radius of the Red 2 site. However, there are likely to be hospitals and industrial facilities within 50 mi of the Red 2 site that use radioactive materials.

The radiological impacts of building and operating the proposed two advanced boiling water reactor (ABWR) units at the Red 2 site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite that would be well below regulatory limits. These impacts are expected to be similar to those estimated for the STP site. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Red 2 site. This conclusion is based on data from the radiological environmental monitoring programs conducted around currently operating nuclear power plants.

Based on the information provided by STPNOC and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the two proposed ABWRs and other existing and planned projects and actions in the geographic area of interest around the Red 2 site would be SMALL.

9.3.2.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for two nuclear units at the Red 2 alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that impact radiological health from postulated accidents, including other Federal and non-Federal projects and those projects listed in Table 9-8. As described in Section 9.3.2, the Red 2 site is a greenfield site; there are currently no nuclear facilities on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Red 2 site. There are no existing or proposed reactors that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Red 2 Site.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the STP site would be minimal for ABWRs. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria. The ABWR design is independent of site conditions, and the meteorology of the Red 2 and STP sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Red 2 site would be minimal.

Because the meteorology, population distribution, and land use for the Red 2 alternative site are expected to be similar to the proposed STP site, risks from a severe accident for an ABWR reactor located at the Red 2 alternative site are expected to be similar to those analyzed for the proposed STP site. These risks for the proposed STP site are presented in Tables 5-18 and 5-19 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Red 2 alternative site would be SMALL.

9.3.3 Allens Creek

This section covers the review team's evaluation of the potential environmental impacts of siting a new two-unit nuclear power plant at the Allens Creek site in southeastern Texas. The site is located within a rural area of Austin County approximately 4 mi north of Wallis and 7 mi southeast of Sealy. Allens Creek is a greenfield site that was set aside for a nuclear power plant and cooling reservoir in the early 1970s in a proposal by the Houston Power and Lighting Company. Although the project was subsequently cancelled, a Final Environmental Statement for the proposed nuclear power plant was issued by the United States Atomic Energy Commission (AEC 1974). When appropriate, this report is used as a resource in the evaluation of Allens Creek as an alternative site. The majority of the site is currently owned by the City of Houston and the Brazos River Authority (BRA). NRG Energy Inc. still owns 1722 ac of the site which would encompass the location of the power block, related facilities, and switchyard for siting new nuclear units (STPNOC 2009a).

The following sections include a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the Allens Creek site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction and operations and impacts of preconstruction activities. Also included in the assessment are other past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Allens Creek site. Other actions and projects considered in this cumulative impact analysis are described in Table 9-12.

Water for cooling and other plant uses would be from the Allens Creek Reservoir as currently proposed by the BRA. If the BRA reservoir is not constructed, a smaller reservoir at the same location would be constructed as part of the nuclear power plant project. The analysis of cumulative impacts for the Allens Creek site discussed below assumes the Allens Creek Reservoir is constructed by the BRA. Impacts associated with a smaller reservoir would be less than those anticipated for the proposed reservoir and are therefore not considered separately.

Because the STP site is approximately 60 mi from Allens Creek, it is beyond the geographic area of interest for all resource areas with the exception of accidents. The only other nuclear power plant currently operating in Texas is Comanche Peak. The Comanche Peak plant is more than 200 mi from Allens Creek and therefore is also not included in the cumulative impact analysis. The proposed nuclear power plant in Victoria County is approximately 95 mi from Allens Creek and therefore was only considered in the accident analysis.

Table 9-12. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Allens Creek Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
WA Parish Electric Generating Station	Nine-unit, 3653-MW coal- and gas-fired plant	About 30 mi southeast of Allens Creek site	Operational[(a)]
South Texas Project	Two 1265 MW(e) Westinghouse pressurized water reactors	About 60 mi south of Allens Creek site	Operational[(b)] STP plans to submit an application for renewal of the operating licenses for Units 1 and 2 in late 2010. If granted, the operating licenses would be extended for 20 years, or until 2047 for Unit 1 and 2048 for Unit 2.[(c)]
Victoria County Nuclear Station	One or more large-scale power reactors	About 95 mi southwest of Allens Creek site	Proposed. Exelon Generation intends to submit an application to NRC for an Early Site Permit in March 2010.[(d)]
Transportation Projects			
Highway construction	Construction of a 11.9-mi new location, four-lane, controlled access toll road from United States Highway (US) 290 to State Highway (SH) 249 in Harris County, Texas	Approx 40 mi from Allens Creek site	Proposed. Final EIS issued June 2009.[(e)]
Parks and Nature Preserve Facilities			
Texas Independence Trail	Driving route within the Texas Independence Trail region	Throughout the region near site	Development likely limited at specific points along the trail[(f)]
Stephen F. Austin State Historical Park	Activities include picnicking, camping, fishing, hiking, and nature and historical tours	About 10 mi north of Allens Creek site	Development likely limited within this park[(g)]
Attwater Prairie Chicken National Wildlife Refuge	Home to one of the last populations of the critically endangered Attwater's prairie-chicken	Closest parcel of land is 5 mi west of Allens Creek site	Development likely limited within this refuge[(h)]

Table 9-12. (contd)

Project Name	Summary of Project	Location	Status
Brazos Bend State Park	Activities include camping, picnicking, hiking, biking, equestrian, and fishing at six lakes	About 20 mi southeast of Allens Creek site	Development likely limited within this park[i]
Other Actions/Projects			
Allens Creek Reservoir	9500-ac municipal water supply reservoir on Allens Creek proposed by Brazos River Authority	At the Allens Creek site	Proposed. Construction is expected to begin by 2018.[j]
US Steel Tubular Products Inc. – Bellville Operations Division	Line pipe and tubular goods manufacture	About 20 mi northwest of Allens Creek site	Operational[k]
Hudson Products Corporation	Design and manufacture air-cooled heat exchanger equipment to serve the oil, gas and petrochemical processing industries	About 10 mi southeast of Allens Creek site	Operational[l]
Frito Lay – Rosenberg Facility	Food manufacturer	About 20 mi southeast of Allens Creek site	Operational[m]
Acme Brick, San Felipe Plant, Sealy	Brick and structural clay tile manufacture	About 10 mi north-northwest of Allens Creek site	Operational[n]
Waste Water Treatment Plants	Numerous plants	Within 30 mi radius of site	Operational
Future Urbanization	Construction of housing units and associated commercial buildings; roads (such as the I-69 Trans-Texas Corridor project), bridges, and rail; construction of water- and/or wastewater- treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region	Construction would occur in the future, as described in state and local land-use planning documents[o]

Table 9-12. (contd)

Project Name	Summary of Project	Location	Status
Various hospitals and industrial facilities that use radioactive materials	Medical and other isotopes	Within 50 mi	Operational in nearby cities and towns

(a) Source: EPA 2009l
(b) Source: NRC 2009a
(c) Source: NRC 2009a
(d) Source: Exelon 2009
(e) Source: USDOT 2009
(f) Source: STPNOC 2009b
(g) Source: TPWD 2009n
(h) Source: STPNOC 2009b
(i) Source: TPWD 2009o
(j) Source: Brazos River Authority 2010
(k) Source: USS 2009
(l) Source: Hudson 2009
(m) Source: EPA 2009m
(n) Source: EPA 2009n
(o) Source: TxDOT 2009b

9.3.3.1 Land Use

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact land use, including other Federal and non-Federal projects and those projects listed in Table 9-12. For this analysis, the geographic area of interest for considering cumulative impacts is the 10-mi region surrounding the Allens Creek site. This area of interest was selected to include the primary communities (e.g., Sealy) that would be affected by the proposed project if it were located at the Allens Creek site. Figure 9-9 shows the location of the Allens Creek site and surrounding communities.

The Allens Creek site is a greenfield site located in an unincorporated area of Austin County, Texas, 4.4 mi north of Wallis and 7.3 mi southeast of Sealy (STPNOC 2009a). There is no current zoning applicable to the site.

In 1973, Houston Lighting and Power applied to the NRC for construction permits for a new, two-unit nuclear power plant at the site. The application was ultimately withdrawn in 1982 (HMRC 2009). The City of Houston and the Brazos River Authority later acquired the land for a water storage reservoir to be built on Allens Creek, a tributary of the Brazos River. Currently, the Brazos River Authority plans to construct a 9500-ac reservoir at the site to serve the future water needs of the City of Houston and surrounding communities. Construction is expected to begin in 2018 (Brazos 2009). This analysis assumes the reservoir would be a source of cooling water for new nuclear units sited at Allens Creek.

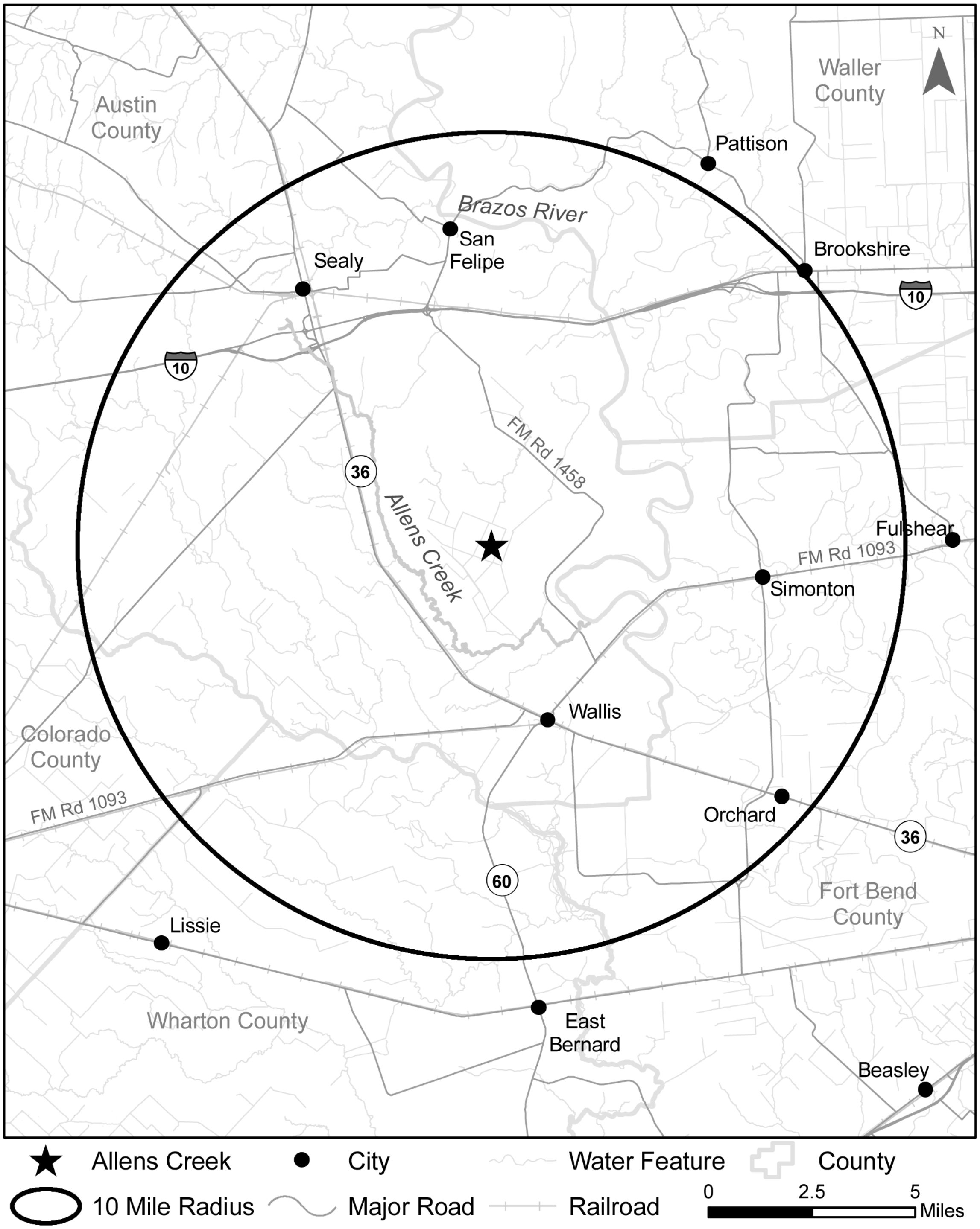


Figure 9-9. Allens Creek Alternative Site and 10-mi Radius

If the Brazos River Authority does not construct the planned reservoir, an alternative reservoir would be needed for plant cooling. Alternatively, water could potentially be withdrawn directly from the Brazos River.

The land area affected by building two nuclear generating units at the Allens Creek site would be approximately 800 ac for the main power plant site and up to 9500 ac for the new, multi-use reservoir (STPNOC 2009a). Land-use impacts would also occur to divert water to the plant and return discharge water to Allens Creek and for road and rail access.

In 1973, the majority of the Allens Creek site was cleared of the native hardwood vegetation, and an extensive system of drainage ditches was constructed which allowed much of the area to be used to farm row crops. Much of the Allens Creek site is open cropland and pasture, but hardwood riparian areas and bluff forests exist along the Brazos River and Allens Creek. Major crops grown in the area include corn, cotton, sorghum, and hay. Uncleared and partially cleared land is used to graze cattle (STPNOC 2009a).

The Allens Creek site is not in the geographic area covered by the TCMP (TCMP 2009); therefore, the CZMA does not apply to this site.

Three new transmission line corridors would likely be needed to connect the Allens Creek site to the three closest 345-kV lines in the area. The Allens Creek site is approximately 20 mi west of the 345-kV connection at the O'Brien Substation, 30 mi northwest of the 345kV line between W.A. Parish power plant and the Hill Substation, and 35 mi northeast of the 345kV line between Holman and Hill substations. The total combined distance for new corridors would be approximately 85 mi. Farmlands that would become part of a corridor could generally continue to be farmed. Based on 85 mi of corridor and a 200-ft corridor width, installation of new transmission corridors would impact approximately 2000 ac (STPNOC 2009a).

Future urbanization in the geographic area of interest and GCC could contribute to decreases in open lands, wetlands, and forested areas. . Urbanization in the vicinity of the Allens Creek site would alter important attributes of land use. Urbanization would reduce natural vegetation and open space, resulting in an overall decline in the extent and connectivity of wetlands, forests, and wildlife habitat. GCC could decrease precipitation, causing more frequent droughts when combined with increased evaporation in the geographic area of interest for the Allens Creek site (Karl et al. 2009). Reduced water supply and increased temperatures could reduce crop yields and livestock productivity (Karl et al. 2009), which might change portions of agricultural and ranching land uses in the area of interest. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas to the extent that they are not adversely affected by droughts. Future urbanization trends and direct changes resulting from GCC could noticeably alter land uses in the geographic area of interest.

Based on the information provided by STPNOC and the review team's independent review, the review team concludes that the cumulative land-use impacts of constructing and operating two new nuclear generating units at the Allens Creek site would be MODERATE. This conclusion reflects the substantial amount of land (800 ac for the main power plant site; up to 9500 ac for the new, multi-use reservoir; and approximately 2000 ac for transmission corridors) that would be needed if the proposed reservoir is built and two new nuclear units were sited at the Allens Creek site, and land use changes from increased urbanization and potential effects of GCC. Building and operating two new nuclear units at the Allens Creek site would be a significant contributor to the MODERATE impact.

9.3.3.2 Water Use and Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact water use and quality including other Federal and non-Federal projects listed in Table 9-12. The Allens Creek site is located in rural Austin County in southeastern Texas. Development of this site for two nuclear units would require the building of a water reservoir on the Allens Creek site supplied with water from the Brazos River.

Geographic areas of interest are the surface water in the drainage basin of the Brazos River upstream and downstream of the proposed intake and outfall structures and the Allens Creek drainage, and for groundwater the aquifers upgradient and downgradient of the site. These regions are of interest because they represent the water resource potentially affected by the proposed project if it were located at the Allens Creek site.

As stated in Section 2.3.2, water use in Texas is regulated by the Texas Water Code. As established by Texas Water Code, surface water belongs to the State of Texas (Texas Water Code, Chapter 11, Section 11.021). The right to use surface waters of the State of Texas can be acquired in accordance with the provisions of the Texas Water Code, Chapter 11. In Texas, surface water is a commodity. Since the Brazos River Basin is currently heavily appropriated, future water users in this basin would likely only obtain surface water by purchasing or leasing existing appropriations. Regarding groundwater, Texas law has allowed landowners to pump the water beneath their property without consideration of impacts to adjacent property owners (NRC 2009b). However, Chapter 36 of Texas Water Code authorized groundwater conservation districts to help conserve groundwater supplies. Chapter 36, Section 36.002, Ownership of Groundwater, states that ownership rights are recognized and that nothing in the code shall deprive or divest the landowners of their groundwater ownership rights, except as those rights may be limited or altered by rules promulgated by a district. Thus, groundwater conservation districts with their local constituency offer groundwater management options (NRC 2009b). Existing projects in the State have appropriations to use water for their requirements. The review team expects that future projects, including the proposed units, if they were to be built and operated at the Allens Creek site, would operate within the limits of these existing surface water and groundwater appropriations.

As stated in Section 7.2.1, the GCRP has compiled the state of knowledge in climate change. This compilation has been considered in the preparation of this EIS. The projections for changes in temperature, precipitation, droughts, and increasing reliance on aquifers within the Brazos River Basin are similar to those in the Colorado River Basin (Karl et al. 2009). Such changes in climate would result in adaptations to both surface water and groundwater management practices and policies that are unknown at this time.

There are currently 1368 water rights owners in the Brazos River Basin, with total water rights of 4,350,000 ac-ft/yr that are categorized as industrial, irrigation, or mining users (TCEQ 2009a). According to TCEQ's water availability maps, unappropriated flows in the Lower Brazos River Basin for a perpetual water rights permit are available 0 to 50 percent of the time in Austin County (TCEQ 2009b). The water availability maps do not show the quantity of available water for a new appropriation (TCEQ 2009b).

The Texas Water Development Board, in the 2007 State Water Plan, has estimated that groundwater supplies of more than 1.6 million ac-ft per year would be available from 2010-2060 in the Gulf Coast Aquifer that is shared by 54 counties and approximately 100,000 ac-ft per year in the Brazos River Alluvium Aquifer that is shared by 13 counties (TWDB 2006a). The Bluebonnet Groundwater Conservation District (BGCD) has estimated the amount of usable groundwater in the district as approximately 107,289 ac-ft per year based on 2001 Region H and Region G Water Plans (BGCD 2004). The estimated groundwater availability of the Gulf Coast and Brazos River Alluvium aquifers within the district are approximately 53,259 and 10,307 ac-ft per year (BGCD 2004). The TWDB reported that wells in the Gulf Coast Aquifer support pumping rates from less than 100 to more than 3000 gpm and those in the Brazos River Alluvium Aquifer support pumping rates of 250 to 500 gpm. The estimated groundwater use within the district is approximately 23,214 ac-ft per year (BGCD 2004).

Building Impacts

The review team assumed that no surface water would be used to build the proposed units at the Allens Creek site so there would be no impact on surface water use. This assumption is consistent with the analysis done for the STP site and the other alternative sites.

The impacts on surface water quality from building potential units at the Allens Creek alternative site would be limited to stormwater runoff that may enter nearby streams and rivers. Additionally, treated sanitary wastewater may be discharged to these streams and rivers. Building impacts would be limited by the duration of these activities, and therefore, would be temporary. The State of Texas prohibits the unauthorized discharge of waste into or adjacent to water in the state (Texas Water Code, Chapter 26, Section 26.121). The discharge of waste may be authorized under a general or individual permit (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2003; STPNOC 2009a). Implementation of BMPs should minimize impacts to wetlands and surface-water bodies near the Allens Creek alternative site. Therefore, the water quality impacts on wetlands and water bodies near the Allens Creek alternative site related to building the proposed new units would be temporary and minimal.

The review team assumes that the groundwater use for building activities at the Allens Creek site would be identical to the proposed groundwater use for the STP site (STPNOC 2009b) because the site would utilize units similar to those proposed for the STP site and the building activities would also be similar. Monthly normalized groundwater use for the STP site ranges up to 491 gpm (792 ac-ft/yr) (see Table 3-4). STPNOC stated that groundwater would be used for potable and sanitary use, concrete batch plant operation, concrete curing, dust suppression and cleaning, placement of engineered backfill, and piping hydrotests and flushing (STPNOC 2009a).

The Allens Creek alternative site is located in Texas GMA 14 and the BGCD. As of January 2010 GMA 14 has not adopted desired future conditions for the Carrizo-Wilcox, Gulf Coast, Brazos River Alluvium, Queen City, Sparta, and Yegua-Jackson aquifers (TWDB 2010c) located within its area. STPNOC has suggested the Gulf Coast and the Brazos River Alluvium aquifers as the potential sources of groundwater. Based on the available information, the review team determined that the groundwater that would be used to build proposed units at the Allens Creek alternative site would be less than 2 percent of the available groundwater from the Gulf Coast and the Brazos River Alluvium aquifers within the BGCD. Based on standard practice, the review team concluded that the drawdown from pumping the aquifers could be minimized during building-related groundwater pumping using an appropriately designed well system. The review team concluded, based on available information, that the impact of groundwater use for building related activities at the Allens Creek site would be minimal.

The review team found that groundwater in the Gulf Coast Aquifer system is reported to be of good quality underlying Austin County (TWDB 2006a). Levels of total dissolved solids (TDS) in the Chicot, Evangeline, and Jasper Aquifers of the Gulf Coast Aquifer system are all shown as less than 1000 mg/L. The review team concludes that wells completed in the Gulf Coast Aquifer system should produce good quality groundwater. During building of any potential units at the Allens Creek alternative site, impacts to groundwater quality may occur from leaching of spilled effluents into the subsurface. BMPs would be in place during building activities and therefore the review team concluded that any spills would be quickly detected and remediated. In addition, impacts would be limited by the duration of these activities, and therefore, would be temporary. Because any spills would be quickly detected and remediated and the activities causing the spill would be temporary, the review team concluded that the groundwater-quality impacts from building at the Allens Creek site would be minimal.

Operational Impacts

STPNOC estimated that a two-unit plant, operated at the Allens Creek alternative site using a closed-cycle cooling system that would employ a cooling water reservoir would consume a maximum of 50,000 ac-ft of water per year. STPNOC identified the Brazos River as the likely source of cooling water at the Allens Creek alternative site. STPNOC currently does not own the necessary water rights. STPNOC would acquire existing Brazos River water rights that are currently being used for industrial, irrigation, and mining use. Based on the total water rights currently issued for the Brazos River Basin, STPNOC would need to acquire a minimum of 1.1 percent of these water rights (STPNOC 2009a).

At the Allens Creek site, the Brazos River Authority (BRA) has plans to create a 9500-ac water supply reservoir. The proposed reservoir would supply water to the City of Houston and a portion of the water would be owned by the BRA. Currently, the building of the reservoir is scheduled to begin in 2018 and to be completed by 2030. STPNOC would need to acquire sufficient water rights in the proposed reservoir and would need the building of the reservoir to begin earlier to support operation of potential units at the Allens Creek alternative site (STPNOC 2009a).

According to TCEQ staff, the water rights for the proposed reservoir at Allens Creek have already been permitted (NRC 2009b). Therefore, the aggregation of these water rights that STPNOC would need to acquire at the potential plant site would not be of concern. However, the review team determined that the reservoir's water rights are currently allocated for municipal use. The acquisition of these water rights for potential plants at the Allens Creek alternative site could displace municipal users. The Allens Creek site is located in Austin County, which is part of Region H. The projected water demand for municipal users in Region H for 2010 is 897,600 ac-ft and is estimated to grow to 1,480,300 ac-ft in 2060 (TWDB 2006a). The needed water supply for municipal users in Region H for 2010 is 69,700 ac-ft and projected to grow to 518,600 ac-ft in 2060. The proposed reservoir at Allens Creek is estimated to supply 97,400 ac-ft. The cooling water demand of approximately 50,000 ac-ft per year for potential units at the Allens Creek alternate site would result in an increased need for municipal uses in Region H. The review team determined, therefore, that the surface water use impacts of operations at the Allens Creek site would be noticeable but not destabilizing.

During the operation of a potential plant at the Allens Creek alternative site, impacts to surface water quality could result from stormwater runoff, discharges of treated sanitary and other wastewater, blowdown from service water cooling towers, and periodic discharges from the cooling water reservoir into the Brazos River. As mentioned above, the State of Texas may require STPNOC to obtain a general or individual permit for the discharge of stormwater (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2001; STPNOC 2009a). Any discharges of sanitary and other wastewaters and cooling water reservoir discharges would be controlled by the State of Texas under a TPDES permit. The State of Texas limits the quantity and quality of discharges to surface water bodies while accounting for concurrent discharge and quality conditions within the surface water body. These permit conditions would also account for designated uses of the receiving surface water body. The review team expects that the conditions placed on operations of any potential plants at the Allens Creek site would be similar to those currently placed on the existing facilities at the STP site (see Section 5.2.3.1). Therefore, the review team concluded that the operational impact on surface water quality of the Brazos River would be minimal because the discharge quantity and quality would be controlled.

The proposed Units 3 and 4 would use approximately 975 gpm (1572 ac-ft/yr) of groundwater during normal operations and approximately 3434 gpm (5538 ac-ft/yr) during maximum demand conditions (STPNOC 2009c). STPNOC stated that the expected groundwater use for Units 3 and 4 are assumed to also apply to alternative sites (STPNOC 2009b). However, for maximum operation demand periods, STPNOC assumes that a temporary increase in the rate of surface water use would be available.

The review team determined that the proposed groundwater use at the Allens Creek alternative site during operations would not be unreasonable because the alternative site would utilize units similar to those proposed for the STP site.

As stated above, GMA 14 has not yet adopted desired future conditions for the Carrizo-Wilcox, Gulf Coast, Brazos River Alluvium, Queen City, Sparta, and Yegua-Jackson aquifers (TWDB 2010c). The BGCD has estimated the amount of usable groundwater in the district as approximately 107,289 ac-ft per year based on 2001 Region H and Region G Water Plans (BGCD, 2004). The estimated groundwater availability of the Gulf Coast and Brazos River Alluvium aquifers within the district are approximately 53,259 and 10,307 ac-ft per year (BGCD, 2004). Based on the available information, the review team determined that the groundwater use for the operation of proposed units at the Allens Creek alternative site would be 2.5 percent of the available groundwater from the Gulf Coast and the Brazos River Alluvium aquifers within the BGCD. During operation of any potential plant at the Allens Creek alternative site, some drawdown of the Brazos River Alluvium and the Gulf Coast Aquifers could be expected. Based on standard hydrogeologic practice, the amount of drawdown in the aquifers from groundwater pumping during operation could be limited by installing multiple, appropriately-spaced wells because groundwater would be withdrawn from a large area resulting in smaller drawdown. Therefore, because groundwater use would be a relatively small fraction of the available groundwater, there is available capacity (BGCD 2004), and drawdown could be controlled, the review team concluded that the impact of operational groundwater use at the Allens Creek site would be minimal.

During the operation of a potential plant at the Allens Creek alternative site, impacts to groundwater quality could result from potential spills. Spills that might affect the quality of groundwater would be prevented and mitigated by BMPs. As noted above, groundwater in the

Gulf Coast Aquifer system underlying Austin County is of good quality (TWDB 2006a). Because spills would be mitigated through BMPs and no intentional discharge to groundwater should occur, the review team concludes that the groundwater-quality impacts from operations at the Allens Creek site would be minimal.

Cumulative Impacts

In addition to water use and water quality impacts from building and operations activities, cumulative analysis considers past, present, and reasonably foreseeable future actions that impact the same environmental resources. For the cumulative analysis of impacts on surface water, the geographic area of interest for the Allens Creek site is considered to be the drainage basin of the Brazos River upstream and downstream of the intake and outfall structures including the Allens Creek drainage because this is the surface water resource that would be affected by the proposed project if it were located at the Allens Creek site. Key actions that have past, present and future potential impacts to water supply and water quality in the Brazos River Basin include the existing WA Parish Electric Generating Station and numerous sewage treatment facilities.

Cumulative Water Use

The only surface-water-use impacts of building and operating a nuclear power plant at this site are the demands occurring during operation. The projected consumptive surface water use of the two units is expected to be about 50,000 ac-ft/yr or less than 1.1 percent of the total water rights of 4,350,000 ac-ft/yr currently held by 1368 water rights owners in the Brazos River Basin. Past and present water withdrawals, reflected by the water rights held in the Brazos River Basin, have used the waters of the river. Currently, unappropriated flows in the Lower Brazos River Basin are available for a perpetual water rights permit less than half of the time during a typical year. The surface water use for the proposed units, if they were to be built at the Allens Creek site, is already granted by TCEQ and held by the City of Houston and the Brazos River Authority. Reasonably foreseeable future actions in the Brazos River Basin, primarily the predicted estimated population growth of 77 percent between 2010 and 2060 (TWDB 2006a), could noticeably alter, but due to water management strategies, not destabilize, the surface water resource. Water management strategies could include conservation, wastewater reuse, system operation of the Brazos River Authority reservoirs, desalination, reservoir augmentation, and new reservoirs, among other strategies (TWDB 2006c). The impacts of other projects listed in Table 9-2 would have little or no impact on surface water use.

Groundwater-use impacts of building and operating a nuclear power plant at this site are characterized by the groundwater demand at the STP site, and those use levels are 491 gpm (792 ac-ft/yr) during building activities, a normal operation demand of 975 gpm (1572 ac-ft/yr), and a maximum operation demand of 3434 gpm (5538 ac-ft/yr) (STPNOC 2009c). However, for maximum operation demand periods, STPNOC assumes that a temporary increase in the rate of surface water use would be available. During building and normal operation of two nuclear units at the Allens Creek site, the possibilities exist that STPNOC could (1) a new groundwater permit and associated wells, (2) access to existing groundwater production from wells in the vicinity of the plant, and (3) use of imported water primarily for potable use onsite (STPNOC 2009b). With regard to the groundwater resource available to all past, present, and future projects, the BGCD (2004) estimates groundwater availability of 63,566 ac-ft/yr and groundwater use of 23,214 ac-ft/yr within the BGCD for the Gulf Coast and Brazos River Alluvium aquifers. The review team concludes there is a net surplus of groundwater available within the BGCD.

The review team is also aware of the potential for GCC affecting the water resources available for closed-cycle cooling and the impact of reactor operations on water resources for other users. The impact of GCC on regional water resources is not precisely known, however it may result in decreases in precipitation and increases in average temperature (Karl et al. 2009). Such changes could further stress regional water resources. However, the impacts related to GCC would be similar for all the alternative sites.

Historically, the waters of the Brazos River Basin have been used extensively. The region has a planning, allocation, and development system in place to manage the use its limited surface water supplies. These efforts are described in the Regional and State Water Plans (TWDB 2006a, 2006b, 2006c). The operation of the proposed units at the Allens Creek site would result in noticeable but not destabilizing impact on surface water use in the region. Future growth would also result in noticeable but not destabilizing impact on surface water use in the region. Therefore, the review team concludes that cumulative impacts to surface water use would be MODERATE. However, building and operating the proposed plant at the Allens Creek site would not be a significant contributor to these water-use impacts because the water rights are already held by the City of Houston and the Brazos River Authority.

As indicated above, groundwater would be used during the building and operation of two nuclear units at the Allens Creek site. Because alternatives are available to supplying the needed groundwater (i.e., new groundwater wells, acquired groundwater permits, and import of potable water), a potential reduction in new groundwater demand, and the available groundwater resource, the review team concludes there would not be a substantial impact to other nearby users of groundwater. As such, the review team concludes that cumulative impacts to groundwater use would be SMALL. The impacts of other projects listed in Table 9-12 would have little or no impact on surface water and groundwater use.

<u>Cumulative Water Quality</u>

Point and nonpoint sources in the river basin have affected the water quality of the Brazos River. Water quality information presented above for the impacts of building and operating the new units at the Allens Creek site would also apply to evaluation of cumulative impacts. The State of Texas may require an applicant to obtain a general or individual permit for discharge of stormwater (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2001, 2003; STPNOC 2009a). The State of Texas would also issue TPDES permits for the discharge of sanitary and other wastewaters, including blowdown from service water cooling towers and cooling water reservoir discharges, before operation of the units at the Allens Creek site. Effluent discharges through TPDES-permitted outfalls, such as those from the WA Parish Electric Generating Station and sewage treatment plants, are required to comply with the Clean Water Act. Such permits are designed to protect water quality. Therefore, the review team concluded that the cumulative impact on surface water quality of the receiving water body would be SMALL. The impacts of other projects listed in Table 9-12 would have little or no impact on surface water quality.

The review team also concludes that with the implementation of BMPs, the impacts of groundwater quality from building and operating two new nuclear units at the Allens Creek site would likely be minimal. The individual impacts from other projects listed in Table 9-8 would have little or no impact on regional groundwater quality because of the local nature of groundwater withdrawals and their associated impacts. Therefore, the cumulative impact on groundwater quality would be SMALL.

9.3.3.3 Terrestrial and Wetland Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact terrestrial and wetland resources, including other Federal and non-Federal projects listed in Table 9-12. For the analysis of terrestrial ecological impacts, the geographic area of interest is considered to be intersection of the Western Gulf Coastal Plains ecoregion with the Lower Brazos and San Bernard watersheds within Austin, Colorado, Wharton, Waller and Fort Bend Counties (Figure 9-10). This area is expected to encompass the ecologically relevant landscape features and species.

Austin County is in the Coastal Prairie subprovince of the Gulf Coastal Plains ecoregion (UT 1996). The Coastal Prairie of Texas is a tallgrass prairie similar to the tallgrass prairie of the Great Plains (TPWD 2009a). Trees are uncommon except along streams and in oak mottes (i.e., groves) (UT 1996). Nearly 1000 plant species have been identified in the Coastal Prairie and it provides habitat for wintering waterfowl and spring neotropical migratory birds (TPWD 2009b). It is home to the Federally endangered Attwater's prairie chicken (*Tympanuchus cupido attwateri*) and is the exclusive wintering ground of the whooping crane (*Grus americana*). Plants in this ecoregion include trees such as oak (*Quercus* spp.), elm (*Ulmus* spp.), mulberry (*Morus* sp.), cedar (*Juniperus* sp.) and pine (*Pinus* spp.); grasses such as bluestem (*Andropogon* sp.) and cordgrass (*Spartina* sp.). Almost all of the coastal prairies have been converted to cropland, rangeland, pasture, or urban uses.

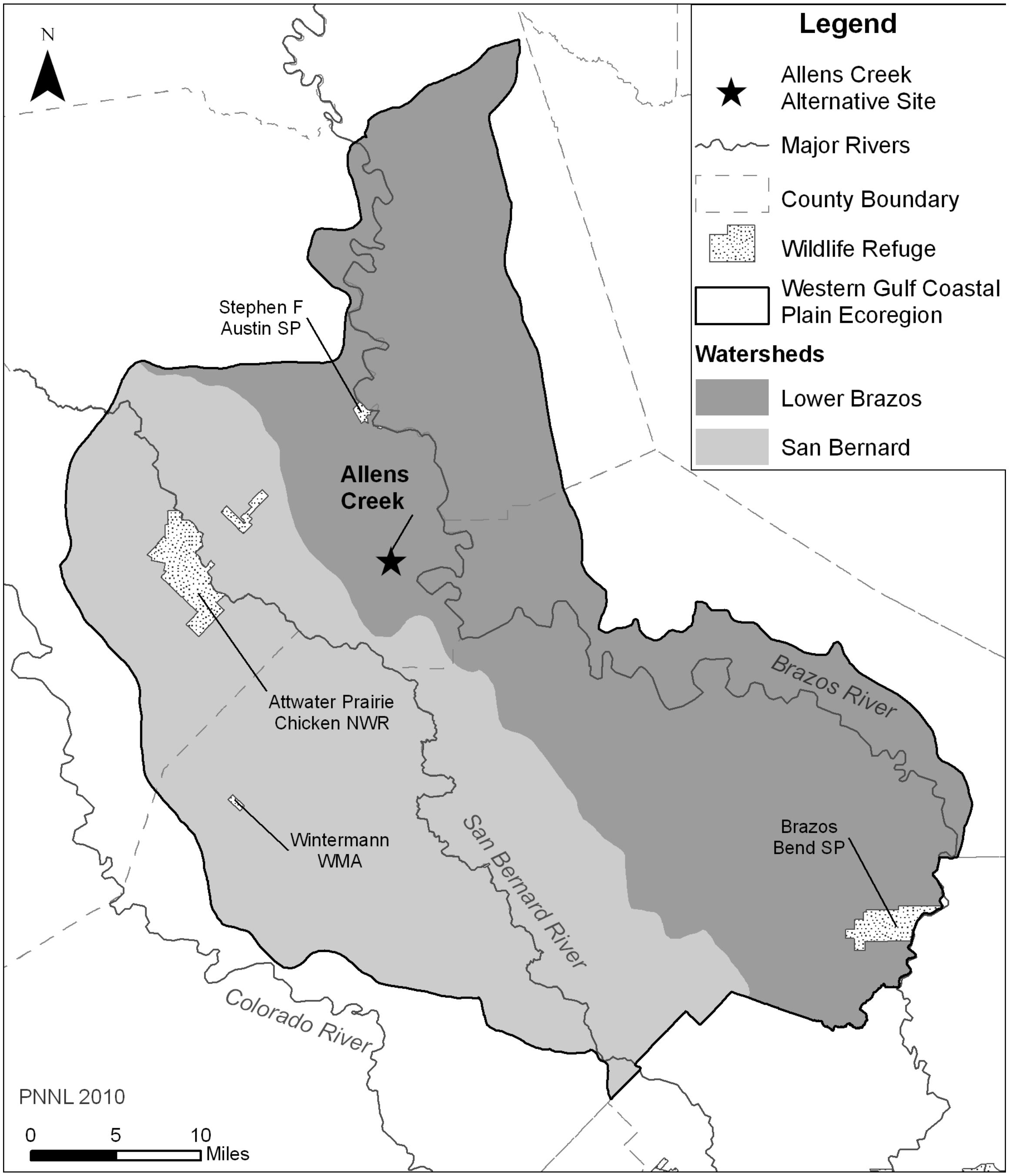


Figure 9-10. Geographic Area for the Analysis of Cumulative Impacts to Terrestrial Resources within the Western Gulf Coast Plains Ecoregion in the Lower Brazos and San Bernard watersheds within Austin, Colorado, Wharton, Waller, and Fort Bend Counties

The terrain at the Allens Creek site varies from rolling hills in the northern, western, and central sections to a nearly level coastal prairie in the south where site is located (STPNOC 2009b). Currently, the site is mostly flat, agricultural land used to farm row crops (primarily cotton, sorghum, corn, and soybeans) and graze cattle. Although much of the site has been disturbed for agriculture, the coastal prairie around the site exhibits wide expanses of open grassland fringed by stands of oak and elm. In 1973, the majority of the site was cleared of native hardwood vegetation, and an extensive system of drainage ditches was constructed to allow the area to be used for farming row crops. Uncleared and partially cleared land was used to graze cattle. The area is prone to flooding and is not considered appropriate for urban development.

The total acreage for all temporary and permanent impacts is 800 ac for the plant site, with 300 ac permanently affected (STPNOC 2009a). The proposed Allens Creek reservoir would be used for cooling water. The City of Houston and the Brazos River Authority acquired part of this site for a proposed 9500-ac reservoir (STPNOC 2009a). For the purposes of this analysis, the review team assumes that the proposed reservoir would be built and functional before the two new nuclear power reactors would be built. General land uses and acreage estimates for areas permanently affected by building are presented in Table 9-13 (STPNOC 2009a). The plant site would be located on the bluff on the western side of the reservoir. No wetlands were identified within the footprint of the Allens Creek alternative site.

Table 9-13. Estimated Acreages by Land Cover Classes for Approximately 300 ac of the 800-ac Allens Creek Site.

Land Cover Class	Plant (ac)[(a)]
Bluff forest	75
Grass	225
Total	300

Source: STPNOC 2009a.
(a) Acreages are for areas permanently affected by building at the site.

Ecologically important areas occurring near the Allens Creek site include the Attwater Prairie Chicken National Wildlife Refuge (NWR) (FWS 2009c) and two Ecologically Significant River and Stream Segments: the Brazos River and Mill Creek (TPWD 2010). The Attwater Prairie Chicken NWR contains one of the largest remnants of coastal prairie habitat in southeast Texas and provides habitat to the critically imperiled prairie chicken (in 1996 there were fewer than 50 birds in the wild) (TPWD 2009g). The ecologically significant segment of the Brazos River extends from the confluence with the Gulf of Mexico upstream to Austin/Waller County and includes riparian conservation areas and rare live oak-water oak-pecan bottomlands (TPWD 2010). Special habitat features associated with Mill Creek include the rare gammagrass-switchgrass (*Tripsacum dactyloides – Panicum virgatum*) bottomland tallgrass prairie (TPWD 2010).

Important Species

Because of changing land-use practices over the years that have reduced upland game species habitat in the Texas Parks and Wildlife Oak-Prairie Wildlife District, the occurrence of game species has been reduced (STPNOC 2009b). This district emcompasses 26 counties in southeastern Texas; Austin County is in the northcentral section (TPWD 2009h). The demise of the small farmer, whose farms in the northern district provided excellent habitat for doves and quail, and the conversion of native pastures to improved grasses to enhance cattle production have combined to greatly reduce the quail population. Dove hunting is still popular in many parts of the Oak-Prairie Wildlife District, although the number of available birds is tied to food supply. There is a hunting season for white-tailed deer and quail in Austin County. Finally, the Oak-Prairie Wildlife District has two species of turkeys: the eastern turkey (stocked in the eastern tier of counties) and the Rio Grand turkey (*Meleagris gallopavo intermedia*), which is found in many western counties. Turkeys are usually found along the major creek and river drainages. Most counties do not support a large number of birds (STPNOC 2009b).

The Allens Creek site is within the Central Flyway of Texas (STPNOC 2009b) and would provide habitat for rest and forage opportunities during migration. There are two birding areas in the vicinity of the Allens Creek site that support migratory birds:

- The Washington-on-the-Brazos State Historic Park (within the southern portion of the Prairies and Pineywoods Wildlife Trail West; more than 20 mi north of Allens Creek in Washington county), where migratory birds have been observed along the Brazos River (vireos, warblers, tanagers, orioles and neotropical migrants including warblers); and
- Chapel Hill/Brazos River Valley Trail (east of SH 36 near Hempstead, between 10 and 15 mi north of the Allens Creek site) (STPNOC 2009b), where "[s]pring and fall migrations release a river of neotropical birds through this area."

Up to 10 bat species living in eastern Texas, can occur in Austin County (Davis and Schmidly, 1994; STPNOC 2009b). Some are mostly year-round residents (i.e., non-migratory), such as the big brown bat (*Eptesicus fuscus*), the eastern pipistrelle (*Pipistrellus subflavus*), evening bat (*Nycticeius humeralis*), and Seminole bat (*Lasiurus seminolus*). Migratory bats that could occur at the site include the hoary bat (*L. cinereus*), the silver-haired bat (*Lasionycteris noctivagans*), the eastern red bat (*Lasiurus borealis*), the big free-tailed bat (*Nyctinomops macrotis*), the northern yellow bat (*L. intermedius*), and the Mexican free-tailed bat (*Tadarida brasiliensis*). The Mexican free-tailed bat can be either migratory or non-migratory depending on where it resides; the migratory status of bats occurring in Austin County is currently unknown (STPNOC 2009b).

No site specific surveys have been conducted for threatened and endangered species at the Allens Creek site or along likely transmission line corridors. The likely transmission line corridors could potentially cross into three adjacent counties: Fort Bend, Colorado, and Wharton. Table 9-14 lists the Federally and State T&E species (FWS 2009a; TPWD 2009f). No areas designated as critical habitat for Federally-listed species exist in Austin County or in the three counties (i.e., Fort Bend, Colorado, and Wharton) where transmission lines may be routed (STPNOC 2009b).

Table 9-14. List of Federal and State Threatened and Endangered Species in Austin, Fort Bend, Colorado, and Wharton Counties, Texas

Group	Common Name	Scientific Name	Federal Status	State Status	County
Plants	Texas prairie dawn-flower	*Hymenoxys texana*	E	E	Fort Bend
Amphibians	Houston toad	*Bufo houstonensis*	E	E	Austin, Fort Bend, Colorado
Reptiles	Alligator snapping turtle	*Macrochelys temminckii*		T	Austin, Fort Bend
	Smooth green snake	*Liochlorophis vernalis*		T	Austin
	Texas horned lizard	*Phrynosoma cornutum*		T	Austin, Fort Bend, Wharton, Colorado
	Timber/Canebrake rattlesnake	*Crotalus horridus*		T	Austin, Fort Bend, Wharton, Colorado
Birds	American Peregrine Falcon	*Falco peregrinus anatum*		T	Austin, Fort Bend, Wharton, Colorado
	Attwater's Greater Prairie-Chicken	*Tympanuchus cupido attwateri*	E	E	Austin, Fort Bend, Wharton, Colorado
	Bald Eagle	*Haliaeetus leucocephalus*		T	Austin, Fort Bend, Wharton, Colorado
	Interior Least Tern	*Sterna antillarum athalassos*		E	Austin, Fort Bend, Wharton, Colorado
	White-faced ibis	*Plegadis chihi*		T	Austin, Fort Bend, Wharton, Colorado
	White-tailed hawk	*Buteo albicaudatus*		T	Austin, Fort Bend, Wharton, Colorado
	Whooping crane	*Grus americana*	E	E	Austin, Fort Bend, Wharton, Colorado
	Wood Stork	*Mycteria americana*		T	Austin, Fort Bend, Wharton, Colorado
Mammals	Louisiana black bear	*Ursus americanus luteolus*	T/SA	T	Austin, Fort Bend, Wharton, Colorado
	Red wolf	*Canis rufus*		E	Austin, Fort Bend, Wharton, Colorado

Sources: FWS 2009a and TPWD 2009f
T = threatened; E = endangered; T/SA = proposed similarity of appearance to a threatened taxon

Texas prairie dawn-flower

The Texas prairie dawn-flower (*Hymenoxys texana)* is a Federally and State-listed endangered species and is found in Fort Bend County (FWS 2009a; TPWD 2009f). The plant is a delicate annual forb found in poorly drained, sparsely vegetated areas at the bases of small mounds in open grassland or in almost barren areas (NatureServe 2009b). They are found in slightly saline soils and are sometimes associated with other Texas Gulf Coast Plain endemics such as Texas windmill-grass (*Chloris texensis*) and Houston machaeranthera (*Machaeranthera aurea*).

Houston toad

The Houston toad (*Bufo houstonensis)* is a Federally and State-listed endangered species and is found in Austin, Fort Bend, and Colorado Counties (FWS 2009a; TPWD 2009f). It lives primarily on land and burrows into sand for protection from cold weather in the winter and from hot, dry conditions in the summer. The toads are found in areas with loose, deep sand supporting woodland savannah and in proximity to still or flowing waters for breeding (TPWD 2009g). The toads have been recorded in Austin County and in the lower Brazos River watershed (NatureServe 2009b).

Alligator snapping turtle

The alligator snapping turtle (*Macrochelys temminckii*) is a State-listed threatened species and is found in Austin and Fort Bend Counties (TPWD 2009f). It is found in slow-moving, deep water of rivers, sloughs, oxbows, and canals or lakes associated with rivers; and also in swamps, ponds near rivers, and shallow creeks that are tributary to occupied rivers (NatureServe 2009b). It usually occurs in water with mud bottoms and abundant aquatic vegetation; it may migrate several miles along rivers (TPWD 2009g). Turtles are rarely found out of the water except when nesting.

Smooth green snake

The smooth green snake (*Liochlorophis vernalis*) is a State-listed threatened species (TPWD 2009f) and is found in Austin County. Habitats include meadows, grassy marshes, moist grassy fields at forest edges, mountain shrublands, stream borders, bogs, open moist woodland, abandoned farmland, and vacant lots (NatureServe 2009b). They have also been found hibernating in abandoned ant mounds. The snake may be extirpated in Austin County, but has recently been recorded in the Lower Brazos River watershed.

Texas horned lizard

The Texas horned lizard (*Phrynosoma cornutum*) is a State-listed threatened species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (TPWD 2009f). It can be found in arid and semiarid habitats in open areas with sparse plant cover (TPWD 2009g). They dig for hibernation, nesting, and insulation purposes, and are commonly associated with loose sand or loamy soils. Populations have declined precipitously in eastern Texas and their decline may be related to the spread of fire ants, use of insecticide to control fire ants, heavy agricultural use of the land and other habitat alterations (NatureServe 2009b). Another factor implicated in their decline is over-collecting for the pet and curio trade. This species is particularly vulnerable to the loss of harvester ants which make up nearly 70 percent of their diet.

Timber/canebrake rattlesnake

The timber rattlesnake (*Crotalus horridus*) is a State-listed threatened species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (TPWD 2009f). It prefers moist lowland forests and hilly woodlands or thickets near permanent water sources such as rivers, lakes, ponds, stream and swamps (TPWD 2009g). Their range extends from central New England to northern Florida, and west to eastern Texas, where its distribution is spotty (NatureServe 2009b).

American peregrine falcon

The American peregrine falcon (*Falco peregrinus anatum*) is a State-listed threatened species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (TPWD 2009f). The bird is a year-round resident and local breeder in west Texas where it nests in tall cliff eyries (TPWD 2009g). The bird also migrates across Texas from breeding areas in United States and Canada to winter along the coast and farther south. The American peregrine falcon occupies a wide range of habitats during migration, including urban areas. Populations are primarily concentrated along coast and barrier islands. The birds are low-altitude migrants, with stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Attwater's Greater Prairie Chicken

The Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*) is a Federally and State-listed endangered species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (FWS 2009a; TPWD 2009f). The prairie chicken lives in the coastal prairie grasslands with tall grasses such as little bluestem, Indian grass, and switchgrass. The birds like a variety of tall and short grasses (TPWD 2009g). About 25 percent of the remaining population of the birds is found on the Attwater Prairie Chicken National Wildlife Refuge (NWR) (NatureServe 2009b) which is approximately 5 mi west of the Allens Creek site (STPNOC 2009b). No information was found on the distance the birds can travel, but they can have home ranges in excess of 2000 ac (NatureServe 2009b) (the refuge covers more than 10,500 ac).

Bald eagle

Although recently delisted from a status of Federally-threatened species, the bald eagle (*Haliaeetus leucocephalus*) is State-listed as threatened in Texas and will remain Federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (TPWD 2009f). The species will also continue to be protected under the ESA through management guildelines that will be in place for the next five years. Most eagles breed in

Canada and the northern United States and move south for the winter (NatureServe 2009b). Bald eagles can be year-round residents in areas where water bodies do not freeze. Winter roost sites can vary with proximity to food resources and eagles commonly roost communally in large trees, preferably snags. The bald eagle is found in Austin, Fort Bend, Colorado, and Wharton Counties.

<u>Interior least tern</u>

The interior least tern (*Sterna antillarum athalassos*) is a State-listed endangered species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (TPWD 2009f). The birds breed along major inland river systems, but it appears restricted to less altered and more natural river segments (TPWD 2009g). Interior least terns nest on bare or sparsely vegetated sand, shell, and gravel beaches, islands, and salt flats associated with rivers and reservoirs. The birds prefer open habitat and avoid thick vegetation and narrow beaches. They arrive at breeding areas in early April to early June after wintering along the Central American coast and the northern coast of South America.

<u>White-faced ibis</u>

The white-faced ibis (*Plegadis chihi*) is a State-listed threatened species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (TPWD 2009f). The white-faced ibis prefers freshwater marshes where they roost on low platforms of dead reed stems or on mud banks (TPWD 2009g). In Texas, they breed and winter along the Gulf coast and may occur as migrants in other parts of the State.

<u>White-tailed hawk</u>

The white-tailed hawk (*Buteo albicaudatus*) is a State-listed threatened species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (TPWD 2009f). In Texas, the white-tailed hawk is found near the coast in coastal prairies, cordgrass flats, and scrub-live oak (NatureServe 2009b). The hawk is resident from coastal Texas to southern South America (Benson and Arnold 2001).

<u>Whooping crane</u>

The whooping crane (*Grus americana*) is a Federally and State-listed endangered species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (FWS 2009a; TPWD 2009f). They breed in Canada during the summer months and migrate to the Aransas National Wildlife Refuge along the Texas coastal plain, staying there from November through March (TPWD 2009g). Their winter and migrating habitat includes marshes, shallow lakes, lagoons, salt flats, and grain and stubble fields (NatureServe 2009b). Migration habitat includes sites with good horizontal visibility, water depth of 30 cm or less, and a minimum wetland size of 0.1 ac for roosting.

Wood stork

The wood stork (*Mycteria americana*) is a State-listed threatened species and is found in Austin, Fort Bend, Colorado, and Wharton Counties (TPWD 2009f). Nesting appears to be limited to Florida, Georgia, and South Carolina. However, they may have formerly bred in Texas (FWS 2009b), but there are no breeding records since 1960 (TPWD 2009g). Wood storks forage in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water. The birds usually roost communally in tall snags, sometimes in association with other wading birds (i.e., active rookeries). A distinct, non-listed population of wood storks breed in Mexico and birds then move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas.

Louisiana black bear

The black bear (*Ursus americanus*) is on the state endangered species list (TPWD 2009f) due to its similarity to the Louisiana black bear (subspecies *U. a. luteolus*). The Louisiana black bear is a Federally and State-listed threatened species; it is not known to be found in Texas, although potential habitat exists in the eastern part of the state. Habitat for the Louisiana black bear is primarily bottomland hardwoods and floodplain forests; it is also found in upland hardwoods, mixed pine/hardwoods, coastal flatwoods, and marshes (TPWD 2009g).

Red wolf

The red wolf (*Canis rufus*) is a State-listed endangered species (TPWD 2009f). Red wolves inhabited brush and forested areas, as well as the coastal prairies (Davis and Schmidly 1994). They formerly ranged throughout eastern Texas, but appear to now be extinct.

Building Impacts

Building two nuclear power units at Allens Creek would affect up to 800 ac of land resulting in the permanent loss of 300 ac of terrestrial habitat. For the purpose of this assessment, the review team assumes that the proposed 9500-ac, multiple-use reservoir would be in place before the two new nuclear power units would be built. To accommodate the building and operation of two nuclear units on the Allens Creek site, STPNOC would need to clear undisturbed terrestrial habitats to tie new power lines with existing lines (STPNOC 2009a). Three new corridors would be required to connect to the three closest 345-kV lines in the area (STPNOC 2009a). The site is approximately 20 mi west of the 345-kV connection at the

O'Brien Substation, which connects to multiple double-circuit lines (in Fort Bend County). The site is 30 mi northwest of a 345-kV line between W.A. Parish power plant and the Hill Substation, which is a triple-circuit line (in Fort Bend County). The site is also 35 mi northeast of a 345-kV line between the Holman and Hill substations (connection could be in either Wharton or Colorado Counties). The total combined distance is 85 mi; based on a 200-ft-width corridor, installation of new lines would affect 2060 ac. Although the most direct route would be used, efforts would be made to avoid natural or man-made areas where important environmental resources are located. This applies particularly to the third potential corridor (i.e., between the Holman and Hill substations) which would run close to the Attwater Prairie Chicken NWR; the corridor would be routed south of FM 3013 to avoid potential conflicts (STPNOC 2009b). Erection of the transmission towers and stringing of the lines would be expected to comply with all applicable laws, regulations, permit requirements, and use of BMPs (STPNOC 2009a).

In addition to transmission corridors, there would be possible impacts associated with the building of pipelines to deliver makeup water from the river to the reservoir. Transportation routes (both road and rail) would also be needed at Allens Creek. Acreage estimates for these activities are: 5 ac for 0.7 mi of rail (50-ft width), 36 ac for 4 mi of pipeline for the cooling water intake and discharge between the plant and new reservoir (75-ft width), and 11 ac for a 1.2-mi access road (75-ft width) (STPNOC 2009a).

No site-specific reports or surveys on Federally or State-listed species were available for the Allens Creek site or for counties affected by transmission line corridors (i.e., Fort Bend, Colorado and Wharton Counties). Federally and State-listed species for Austin, Fort Bend, Wharton, and Colorado Counties are discussed above. At the site visit in 2009, the presence of numerous wetlands and forested areas in the northwest portion of the site was noted; some of these areas contained large, old live oaks (NRC 2009b). In addition, one parcel of the Attwater Prairie Chicken NWR is approximately 5 mi west of the site, while a second parcel is 10 mi west of the site (STPNOC 2009b). The refuge contains one of the largest remnants of coastal prairie habitat and is home to one of the last populations of the critically endangered prairie chicken (FWS 2009c).

Loss of terrestrial habitat and habitat fragmentation associated with building the two new nuclear reactors and the associated new transmission corridors would noticeably alter terrestrial resources. Other sources of impacts to terrestrial resources such as increased traffic, noise, risk of collision and electrocution, and displacement of wildlife would likely be temporary and/or result in minimal impact to the resource. The disturbance footprint for the two new units would be small relative to the disturbance footprint for new transmission corridors.

Operational Impacts

Impacts on terrestrial ecological resources from operation of two new nuclear units at the Allens Creek site include those associated with transmission system structures, and maintenance of transmission line corridors. Also, during plant operation, wildlife would be subjected to impacts from increased traffic. An evaluation of specific impacts resulting from transmission corridor maintenance cannot be conducted in any detail due to the lack of information, such as the locations of any new rights-of-way that could result from transmission system upgrades. However, in general, impacts associated with transmission line operation consist of bird collisions with the lines, EMF effects on flora and fauna, and habitat loss due to corridor maintenance.

Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog, also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to low, fast flight and flocking behavior (Brown 1993). Although additional transmission lines would be required for the two new nuclear units at Allens Creek, increases in bird collisions directly attributable to these lines would be minor and would likely not be expected to cause a measurable reduction in local bird populations.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NIEHS 2002). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NIEHS 2002). The magnetic fields from many lines, at a distance of 300 ft are similar to typical background levels in most homes (NIEHS 2002). Thus, impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003).

The impacts associated with corridor maintenance activities are loss of habitat due to cutting and herbicide application and similar impacts where corridors cross floodplains and wetlands. The maintenance of transmission-line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments. Thus, corridor maintenance would not be expected to increase and contribute to cumulative effects.

The potential effects of operating two new nuclear reactors at the Allens Creek site would be primarily associated with maintenance of transmission corridors and increased traffic. Operational impacts to terrestrial resources would be expected to be minimal.

Cumulative Impacts

The impacts of building and operating two units at the Allens Creek site were evaluated to determine the magnitude of their contribution to regional cumulative impacts on terrestrial ecological resources. Activities related to building and operating at Allens Creek include loss of habitat at the plant site and along the transmission line corridors. The geographic area of interest for cumulative impacts at Allens Creek is the intersection of the Western Gulf Coastal Plains ecoregion with the Brazos and San Bernard watershed within Austin Colorado, Wharton, Waller, and Fort Bend Counties (Figure 9-10). There are a number of past and potential projects that could affect the terrestrial and wetland resources at Allens Creek (Table 9-12). Past actions included building the W.A. Parish Electric Generating Station approximately 30 mi southeast of the site. The generating station occupies about 4650 ac with two multiple-unit stations on the site.

Future activities that potentially could affect terrestrial and wetland resources include road expansion and the development of the Allens Creek reservoir. A four-lane toll road with frontage roads and a 400-ft corridor is proposed to be developed approximately 40 mi from the site. Road expansion and future industrial and urban development would contribute to loss of habitat and fragmentation of existing habitats in the area of interest.

The other future project is building the 9500-ac Allens Creek reservoir for municipal water supplies; the timeline for the reservoir indicates construction would begin in 2018 (Brazos 2010). The reservoir would have a substantial impact to wetland and forest resources. Acreages for the reservoir indicate it would inundate 460 ac of bluff forest, 27 ac of parks, more than 3900 ac of grassland, and more than 2600 ac of bottomland forest, including more than 1700 ac of wetland (STPNOC 2009e). Most of the wetlands were mapped as Brazoria depressional soils with the deepest depressions having a meander pattern, and are probably the remnants of former cutoff channels or oxbow lakes. These depressions are in bottomland forests. The dominant tree in the depressions is weedy hackberry (*Celtis* sp.), with green ash (*Fraxinus pennsylvanica*) in the wetter areas.

The review team is also aware of the potential for GCC affecting the terrestrial resources in the geographic area of interest. The impact of GCC on plant and wildlife species and their habitat in the geographic area of interest is not precisely known. GCC could result in sea level rise and may result in regional increases in the frequency of severe weather, decreases in annual precipitation and increases in average temperature (Karl et al. 2009). Such changes in climate could alter and fragment key terrestrial habitats (grasslands, forests, and wetlands), and could result in shifts in species ranges, diversity, and abundance in the geographic area of interest for the Allens Creek site.

The potential cumulative impact to terrestrial resources within the area of interest given the two new reactors at the Allens Creek site and associated new transmission corridors and the proposed reservoir at the site would noticeably alter terrestrial resources. All these activities would remove or modify terrestrial habitats with the potential to affect important species living or migrating through the area. For the reasons discussed above in Building Impacts and Operational Impacts, the incremental contribution of building and operating the two new reactors at the Allens Creek site and the associated transmission corridors to the cumulative impacts within the geographic area of interest would be significant.

Summary

Impacts to terrestrial and wetland resources were estimated based on information provided by STPNOC and the review teams own independent review. There would be major localized impacts at the reservoir location based on the potential for affecting 3060 ac of forested land, including loss of high quality bottomland hardwood habitat and possible impacts to a number of protected species that could potentially occur in the area. In addition, there is the uncertainty in the possible routing of new transmission line corridors that could affect more than 2000 ac, possibly resulting in substantial impacts to terrestrial resources. Based on the information provided by STPNOC and the review team's assessment, the review team concludes that the cumulative impacts within the area of interest on terrestrial plants and animals, including threatened or endangered species, and wildlife habitat in the region would be MODERATE. The incremental contribution of impacts on terrestrial resources from the building footprint and associated transmission lines would be significant.

9.3.3.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact aquatic resources, including other Federal and non-Federal projects listed in Table 9-12. For the analysis of aquatic ecological impacts at the Allens Creek site, the geographic area of interest is considered to be Allens Creek and the Brazos River drainage, upstream and downstream to the next major tributaries from the confluence of Allens Creek, because this is the area that the aquatic resources could be affected by new nuclear units.

Aquatic resources at the Allens Creek alternative site are associated primarily with the Brazos River and Allens Creek, as well as onsite ponds and drainages (Figure 9-10). The Brazos River would be the major source of water for the proposed 9500-ac, off-channel reservoir at the site. Allens Creek originates southeast of the town of Sealy, and flows south through mostly open country for 9.9 mi before making a strong turn to the east, emptying into the Brazos River after another 3.7 mi (Linam et el. 1994; STPNOC 2009a). The onsite ponds and drainages are mostly associated with wetlands.

The reach of the Brazos River through the Allens Creek site has been designated by TPWD as an ecologically significant stream segment. The characteristics of the reach that are ecologically significant include hydrological functions, riparian conservation and the presence of unique communities within the vicinity of the Allens Creek site (TPWD 2010).

A reservoir at Allens Creek has been part of Texas Water Development Board's plans for some time. In preparation for the reservoir's development, several assessments have been conducted to characterize the fish and macroinvertebrates as well as to evaluate instream flow for the support of aquatic life. Linam et al. (1994) inventoried and assessed the fish in Allens Creek above and through the area proposed to be inundated for construction of a reservoir as well as at and below the confluence of the creek with the Brazos River. Wood et al. (1994) assessed macroinvertebrates at the same sampling stations as Linam et al. (1994) in Allens Creek and the Brazos River. Gelwick and Li (2002) evaluated the mesohabitat use and community structure of the Brazos River for 10 km above and below the confluence with Allens Creek. Osting et al. (2004) prepared an instream flow study for the lower Brazos River using the aforementioned studies as well as others to evaluate impacts to the hydrology and aquatic life from the proposed Allens Creek Reservoir.

Linam et al. (1994) collected fish, habitat characteristics, and physiochemical measurements to characterize the Index of Biotic Integrity (IBI) of the fish community in the region of the Allens Creek alternative site. Forty-four fish species were collected in September and November 1993, from six sites, including four sites in Allens Creek, one at the confluence of Allens Creek with the Brazos River, and another downstream of the confluence. Western mosquitofish was the most abundant fish species at all but two sampling stations in Allens Creek. At the first sampling location within the proposed inundation area for the reservoir, pirate perch (*Aphredoderus sayanus*) slightly outnumbered the mosquitofish in September, whereas longear sunfish (*Lepomis megalotis*) outnumbered the mosquitofish in November. Red shiner (*Cyprinella lutrensis*) was the most abundant species at the confluence of Allens Creek and the Brazos River in November, and dominated both collections at sites within the Brazos River. Bullhead minnow were more numerous than red shiners at the last sampling location within Allens Creek. No one cyprinid species dominated the three upstream stations in Allens Creek, but blacktail shiner was the most numerous cyprinid in most upstream collections. This shift in cyprinid abundance between the lower collection locations on Allens Creek may be related to factors including conductivity, turbidity, and siltation, and perhaps the influence of wastewater discharged from the City of Wallis treatment plant. Linam et al. (1994) speculated that red shiners and bullhead minnows appear better suited than many freshwater fishes (including blacktail shiners) to such physicochemical conditions, providing them an advantage over other cyprinids in the lower reach of Allens Creek and the Brazos River. Biotic integrity of the sampling locations varied over time. The sampling location furthest upstream in Allens Creek was consistently scored as good biotic integrity, while the next sampling station downstream was fair to good integrity class. The lower two sampling locations in Allens Creek had a biotic integrity ranging from excellent to good over the sampling period. At the confluence of Allens Creek and the Brazos River the biotic integrity ranged from good to fair. The Brazos River sampling location ranged from good/excellent to good in biotic integrity. The authors concluded that the species richness in the vicinity of study was comparable to minimally disturbed streams in Texas. They also concluded that the creation of a reservoir and inundation of Allens Creek would likely shift the fish community towards species more suited for lentic rather than lotic habitats.

Wood et al. (1994) sampled at the same locations as Linam et al. (1994) during September and October 1993. Overall, 32 macroinvertebrate taxa were identified from benthic and snag habitats. The most common taxa were insects (78 percent), with the remaining number of organisms divided among Amphipoda (4 percent), Annelida (7 percent), Bivalvia (4 percent), Decapoda (7 percent) and other minor taxa. Benthic habitats were dominated by Annelida (11 percent), Chironomidae (Diptera) (50 percent), *Baetis* spp. (Ephemeroptera) (8 percent), and *Popenaias* sp. (unioid mussel) (6 percent). The dominant taxa for snag habitats were Chironomidae (73 percent), *Hydropsyche* spp. (Tricoptera) (10 percent), *Leptohyphes* spp. (Ephemeroptera) (5 percent), and *Argia* spp. (Odonata) (3 percent). Chironomids were the most numerous organisms collected in both snag and benthic habitats with densities ranging from 9 to more than 1000 organisms per square meter. Snag habitats had the greatest density of macroinvertebrates, with more than 2000 organisms per square meter. Snags and large woody debris in the stream beds created important structural components for macroinvertebrates by increasing the surface area for their food source, and in turn create essential food resources for the fish community. The authors characterized the region as relatively high stress environments for macroinvertebrates due to the rapid fluctuations in water level, temperature, and substrate movement. The results of the macroinvertebrate community assessment indicated a slightly impaired to moderately impaired system and that some level of impact was occurring from the wastewater effluents entering Allens Creek from the Cities of Sealy and Wallis, as well as from agricultural and ranching activity in the watershed. Interestingly, the only bivalve mollusk collected was identified as the unioid mussel genus, *Popenaias*. The only species in Texas of this genus is *P. popeii*, the Texas hornshell. TPWD did not identify this species of freshwater mussel in Austin County. The FWS lists the Texas hornshell as a candidate species, and it is considered a proposed threatened species by TPWD. From 74 to 153 specimens of this species were collected from the upper reach sampled in Allens Creek, and the number of specimens declined in the lower sampling locations along the creek. Additional specimens were collected in the Brazos River sampling location (Wood et al. 1994).

Gelwick and Li (2002) analyzed fish habitat utilization on the basis of visually delineated mesohabitats in the Brazos River above and below its confluence with Allens Creek, and included information about fish habitat at different flow conditions. From September 2001 through August 2002, six collections were completed over a range of river discharges, and 43 species representing 14 families of fish species were collected. Red shiners and bullhead minnows accounted for 67.4 percent and 16.9 percent of the collections, respectively. Other common species (abundances exceeding 1 percent of overall collections) were ghost shiner (*Notropis buchanani*), silverband shiner (*N. shumardi*), striped mullet, and mosquitofish. Notably, three individuals of sharpnose shiner (*Notropis oxyrhynchus*), a candidate species for Federal listing by FWS, were collected in the confluence of Allens Creek and the Brazos River. As did Linam et al. (1994), the authors calculated the IBI for the mesohabitats that were evaluated. Based on seined samples, all the sites in the reach of the Brazos River that was included in the study had IBI metrics of excellent across all six collections over a range of flows, except for a good rating in September 2001. The authors noted that their study reach also scored consistently higher than the scores for seine and electrofishing collections calculated previously in the Brazos River, where that study sampled smaller areas of the river than their study. Overall, the authors found that no significant fish habitat utilization variation in the Brazos River in the vicinity of the Allens Creek alternative site could be explained by visually-classified mesohabitat and that the fish communities were habitat generalists.

Osting et al. (2004) used the available assessments of aquatic communities in Allens Creek and the Brazos River to identify potential impacts from the construction of a reservoir at the Allens Creek site. The analyses focused on hydrology, fish habitat, and the potential for salinity migration in the lower Brazos River. The authors used three different methods to investigate the distribution of fish species within aquatic habitats in the vicinity of the alternative site, and found that two of the analyses indicated fish communities were made up of habitat generalists, and one analysis indicated some degree of habitat specialization. This indicated that fish species relationships related to specialized habitat conditions was strong for some species, and identified fish indicators for habitat evaluations. The resulting hydrodynamic model predicted that Allens Creek Reservoir would not be anticipated to have significant effect on salinity migration in the lower Brazos River estuary.

Within Allens Creek and the Brazos River drainage, upstream and downstream to the next major tributaries from the confluence of Allens Creek, there are a number of past, present and potential projects that could affect the aquatic resources (Table 9-12). Past actions included building and operating the coal- and gas-powered W.A. Parish Electric Generating Station and the wastewater treatment systems for the Cities of Sealy and Wallis. TCEQ, Brazos River Authority and other state agencies have been planning on construction of a reservoir at the Allens Creek site and the water would be available for multiple uses, including power production. The building of new nuclear units, include a water intake and discharge systems with associated pipelines from the Brazos River to the new site, inundation of Allens Creek for development of a reservoir, and associated transmission corridors to connect with the existing power grid. Without having the specific plans for locating all facilities at the Allens Creek site, the potential for impacts from building and operation of the new units to aquatic biota are assumed to be primarily to the organisms inhabiting the Allens Creek and the Brazos River.

Non-Native and Nuisance Species

No non-native or nuisance species have been recorded in the area as a problem. However, there are numerous nuisance aquatic species that TPWD considers to be ubiquitous across waterways in Texas. TPWD works to educate recreational boaters to remove nuisance aquatic plant species across the state and in the area of the Allens Creek site. These species include: hydrilla, waterhyacinth, and giant salvinia. In addition, the Brazos River basin is known to have the following non-native fish introduced to its waters: common carp, grass carp, blacktail shiner, bullhead minnow, rudd, black buffalo, black bullhead, western starhead topminnow, redspotted sunfish, tadpole madtom, plains killfish, yellow perch, and walleye (Thomas et al 2007; Hassan-Williams and Bonner 2009; TPWD 2009h). The introduced bullhead minnow and blacktail shiner have become some of the most abundant species in Allens Creek and at the confluence with the Brazos River (Linam et al. 1994; Gelwick and Li 2002).

Important Species

Osting et al. (2004) reported that TPWD observed very little recreational fishing during creel assessments by TPWD on the Brazos River. Catfish were the most sought after fish in the area, including channel, blue, and flathead catfish. The greatest catch per unit effort (CPUE) in the Brazos River at Simonton (downstream of confluence with Allens Creek) was for channel catfish, followed by flathead catfish and blue catfish. In the vicinity of the Allens Creek site on the Brazos River, recreational boating is limited because steep banks make access difficult and state parks and wildlife management areas that support recreational boating are far away.

There are no Federally listed species in Austin County. However, the FWS considers the sharpnose shiner a candidate for listing (Table 9-15) (TPWD 2009d; FWS 2009a). Gelwick and Li (2002) reported finding three sharpnose shiners at their sampling location in the confluence of Allens Creek and the Brazos River; Linam et al. (1994) did not collect this species almost a decade earlier. TPWD has identified several rare and protected species in Austin County: a mayfly species (*Pseudocentroptiloides morihari)* as well as the freshwater mussels rock pocketbook (*Arcidens confragosus*) and pistolgrip (*Tritogonia verrucosa*). The rare and protected mayfly is a benthic macroinvertebrate, which lives on the bottom of streams until it emerges from the water as a flying adult (TPWD 2009i). In addition, TPDW lists as threatened three species of freshwater, unioid mussels that are found in Austin County: smooth pimpleback (*Quadrula houstonensis*), false spike mussel (*Quincuncina mitchelli*), and Texas fawnsfoot (*Truncilla macrodon*) (Table 9-15) (TPWD 2009i; 35 Texas Register 249). Not much is known about the distribution of these mussels in Austin County, and the only known survey for benthic macroinvertebrates did not collect these species (Wood et al. 1994). However, these types of mussels, known as unioid mussels, are found in various water flows, from fast moving riffles in streams to quiescent ponds. Each species has adapted to a particular flow regime. These unioid mussels have a larval stage called a glochidium. For glochidia to mature to juvenile mussels, they must live as a parasite in the gill tissues of a host fish. An important component to the distribution of freshwater mussels in various water bodies is associated with the relationship between the mussels and the host fish (Strayer 2008).

Table 9-15. Federally and State-Listed Aquatic Species that are Endangered, Threatened, and Species of Concern for Austin County

Scientific Name	Common Name	Federal Status[(a)]	State Status[(b)]
Fish			
Notropis oxyrhynchus	sharpnose shiner	FSC	
Mussel			
Quadrula houstonensis	smooth pimpleback		T
Quincuncina mitchelli	false spike mussel		T
Truncilla macrodon	Texas fawnsfoot		T

(a) Federal status rankings determined by the FWS under the Endangered Species Act, FSC = Federal Species of Concern (FWS 2009a).
(b) State species information provided by TPWD, T = State Listed Threatened (TPWD 2009d; 35 Texas Register 249).

Building Impacts

For the purpose of this assessment, the review team assumes that the proposed 9500-ac, multiple-use reservoir would be in place before the two new nuclear power units would be built. Impacts associated with the building of the reservoir are considered below in the cumulative impacts discussion.

Water intake and discharge structures along the shoreline of the Brazos River would be required for the Allens Creek reservoir at the Allens Creek site (STPNOC 2009a). Building a new intake and discharge in the Brazos River would likely require dredging and other significant alterations to the shoreline aquatic habitat. These activities, which would be unrelated to the building and operating of two nuclear units at the Allens Creek site, would be permitted by the Corps and the construction activities would have to meet all State water quality requirements. Building these structures on the Brazos River would result in the temporary displacement of aquatic biota within the vicinity of both structures. It is expected that the motile aquatic organisms would be displaced temporarily during building, including such fish species as the sharpnose shiner. However, the sessile aquatic biota (e.g., mussels) would be lost during building activities if the river substrate was removed or sedimentation covered the bottom of the river burying the organisms. Organisms like the mussels could possibly recolonize the disturbed river substrate with time. If required by TPWD, State-listed threatened mussels could be surveyed and removed before building activities as a mitigation action. For the most part, the impacts on aquatic organisms would be temporary and largely mitigable through the use of BMPs, e.g., silt screens.

Building transportation routes (heavy haul road and railroad spur), pipelines and transmission lines for the Allens Creek site would result in the temporary displacement of some aquatic biota. Locations for these systems have not been identified. Building new transmission line corridors could result in noticeable impacts; however, effects to the aquatic resources could be minimized by routing the corridor away from water bodies or spanning the water bodies without placement of transmission tower footings in aquatic resource habitats. BMPs would be used while building these corridors to reduce impacts such that they would be temporary and localized (STPNOC 2009a). Depending on whether or not the intake and discharge structure are built in the reservoir before or after filling of the reservoir, some adverse impacts to aquatic biota could occur. Such impacts would be confined in their extent and temporary, and would affect similar species and habitats that would be affected during construction of the intake structure on the Brazos River.

Building the intake and discharge structures on the Brazos River and in the new reservoir would affect the aquatic communities but the areas would be recolonized after building these structures was completed. Building of the transportation routes, transmission corridors, and pipelines would result in temporary and localized effects on aquatic communities.

Operation Impacts

The Brazos River instream flow study determined that the aquatic resources could be maintained with diversion of water to the proposed Allens Creek reservoir (Osting et al. 2004). Water withdrawal and water return to the Brazos River could be managed in such a way that impacts to this ecologically significant stream section could be maintained with minimal impacts to the aquatic resources and associated riparian habitat (STPNOC 2009a).

Impingement, entrainment, and entrapment of organisms from the Brazos River and from the reservoir would likely be the most significant impacts to the aquatic population that could occur from operation of two new nuclear units at the Allens Creek site. EPA's design criteria for 316(b) Phase 1 regulations (66 FR 65256) for intake structures would minimize impacts to aquatic biota in the reservoir. The design criteria include: (1) closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities; (2) maximum through-screen velocity of 0.15 m/s (0.5 ft/s) at the cooling water intake; and (3) intake flow of less than or equal to 5 percent of the mean annual flow (STPNOC 2009a). Compliance with these regulations would minimize impingement, entrainment, and entrapment impacts to the aquatic biota in the reservoir.

Operational impacts associated with water quality, physical, and thermal characteristics of the discharge cannot be determined without additional detailed analysis. The proposed reservoir for the Allens Creek site would likely evolve in a similar fashion to the MCR at the STP site, where, with time, the reservoir has developed similar aquatic resources to that in the lower Colorado River and acclimated to the discharges of the operating reactor units. Impacts to the

Brazos River would depend on the type of cooling system for the new units as well as the volume, frequency, and water characteristics of the discharge. These types of impacts can be addressed and minimized through operational procedures and the permitting process with TCEQ.

Operational impacts to aquatic biota from onsite activities and in the transmission corridors would also be minimal assuming BMPs are used for maintenance of these areas and corridors. SWPPPs would ensure that impacts to biota from erosion and sedimentation would be minimal through the use of silt screens and controls for managing stormwater. These controls would be important for habitat quality and survival of benthic biota in the downstream drainages.

Based on operation of the CWS, impacts to aquatic communities in the Brazos River and reservoir could result from impingement, entrainment, and entrapment as well as thermal, chemical, and physical characteristics of the discharge. STPNOC commits to compliance with State and Federal regulations for operation of intake and discharge structures associated with the nuclear units that would be protective of aquatic resources. Once a community is established in the new reservoir, long-term effects from operation of the CWSs are not expected to noticeably alter aquatic communities in the Brazos River and reservoir.

Cumulative Impacts

Within Allens Creek and the Brazos River drainage, upstream and downstream to the next major tributaries from the confluence of Allens Creek, current and future plans for water usage by municipalities and industries have influenced the aquatic ecology of the region. Included in such plans is the Allens Creek Reservoir to supply water to the City of Houston.

Impacts of building the reservoir at Allens Creek may be significant depending on the siting of the reservoir. The proposed plans are for inundating approximately 7 to 9 mi of Allens Creek to the confluence with the Brazos River. Impacts from onsite building activities that have the potential to cause erosion and sedimentation to the local water bodies would be controlled or minimized by the implementation of an SWPPP (STPNOC 2009a). Habitat for aquatic species, including any spawning areas for fish species that are dependent on flowing water, that are found in Allens Creek and the associated wetlands and drainages would be lost when these water bodies are inundated to create the reservoir. In addition, the snags and large woody debris in the lower reaches of Allens Creek would be less likely to accumulate after building the reservoir, and this habitat was thought to contribute to the high abundance of macroinvertebrates in the creek (Wood et al. 1994). Most freshwater mussel species are adapted to a specific flow regime, and the inundation of Allens Creek could affect the distribution of the organisms in the region (STPNOC 2009a; TPWD 2009i). If habitat for the sharpnose shiner or any of the State-listed mussels is found in the area to be inundated for the creation of the reservoir, the FWS and/or TPWD might require mitigation activities.

Other uses of the reservoir would include cooling for power production and recreation, e.g., fishing and boating. Allens Creek and possibly the proposed reservoir would be influenced mostly by discharges from the wastewater treatment plants for the Cities of Sealy and Wallis as well as agricultural development and ranching activities along the riparian areas (Linam et al. 1994; Wood et al. 1994). The coal- and gas-powered W.A. Parish Electric Generating Station is approximately 40 mi downstream of the Allens Creek site, and uses water from the Brazos River stored in Smithers Lake. Building in and along the shoreline of the Brazos River for the Allens Creek site is not likely to influence the sediment transport and aquatic ecology beyond the geographic area of interest because the activities would be relatively short in duration and BMPs would minimize impacts. In addition, Osting et al. (2004) found that salinity intrusion up the Brazos River is unlikely based on its instream modeling of a reservoir at Allens Creek.

Continued urbanization and agricultural practices could affect aquatic communities in the Allens Creek geographic area of interest in the foreseeable future. Expansion of urban areas in the Brazos River drainage could increase water use, decrease available water for aquatic resources, and increase nonpoint pollution. The effects of continued agricultural practices could result in additional habitat loss and/or degradation due to irrigation using surface waters and groundwater withdrawal, nonpoint source pollution, siltation, and bank erosion.

As mentioned above in the terrestrial section, GCC could result in regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (Karl et al. 2009). The decrease in precipitation combined with elevated water temperatures and evaporation could result in more frequent droughts, which could reduce aquatic habitat. Loss of habitat could cause shifts in species ranges, diversity, and abundance in the geographic area of interest for the Allens Creek site (Karl et al. 2009). Specific predictions on aquatic habitat changes and impacts to aquatic species in this region resulting from GCC are inconclusive at this time. Because of the regional nature of climate change, the impacts related to GCC would be similar for all the alternative sites, as they are all in the Great Plains region.

Based on building and operation of two new nuclear units at the Allens Creek alternative site and other projects and influences in the region of influence for aquatic resources, the cumulative impacts would be noticeable but not destabilizing. All these activities would alter the aquatic habitats and potentially change the species composition and diversity in the affected water bodies.

Summary

The review team concludes that the impacts from building and operating two new nuclear units at the Allens Creek site would be minimal. Building of a multi-use reservoir at Allens Creek would inundate existing water bodies and destroy habitat for aquatic resources that are dependent on flowing water. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the cumulative impacts of building and operating two new reactors on the Allens Creek site combined with other past, present, and future activities on most aquatic resources in the Brazos River drainage would be MODERATE. The incremental contribution of building and operating the two new reactors at the Allens Creek site to the cumulative impacts within the geographic area of interest would not be significant.

9.3.3.5 Socioeconomics

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact socioeconomics, including other Federal and non-Federal projects listed in Table 9-12. For the analysis of socioeconomic impacts at the Allens Creek site, the geographic area of interest is considered to be the 50-mi region centered on the Allens Creek site with special consideration of Austin and Fort Bend Counties as that is where the review team expects socioeconomic impacts to be the greatest. In evaluating the socioeconomic impacts of site development and operation at the Allens Creek site near Wallis and Sealy, in Austin County, the review team undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources. Impacts from both site development and station operation are discussed.

Physical Impacts

Many of the physical impacts of building and operation would be similar regardless of the site. Building activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support building activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions (the latter are covered under aesthetics and recreation). New units would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed STP site would be controlled in accordance with standard noise protection and abatement procedures. This practice also would be expected to apply to all alternative sites, including the Allens Creek site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the alternative site.

The new units at the Allens Creek site would likely have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, new units would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the physical impacts of building and operating two nuclear units at the Allens Creek site would be minimal.

Demography

The Allens Creek site is located in Austin County (2008 population 26,851), 4.4 mi north of the city of Wallis (2007 population 1287) and 7.3 mi southeast of Sealy (2008 population 6190), and within 50 mi of the outer edges of the Houston Metropolitan area (2008 population 5.7 million) (USCB 2009e). Fort Bend County (2008 population 532,141) was one of the fastest growing counties in the United States during recent decades as Houston suburbs have expanded westward into the county.

STPNOC estimated the peak number of construction workers would be 5950. Approximately 900 operations workers would also be onsite during the final phase of building activities (STPNOC 2008c). Based on assumptions in Section 4.4 concerning in-migration for Units 3 and 4 in Matagorda County, the review team assumed that 50 percent or 2975 construction workers would in-migrate, with half of these moving to Austin County and the other half to Fort Bend County. Eighty percent of in-migrating construction workers would bring a family. Harris County, which includes Houston, would likely see an in-migration of workers as well, but considering the large populations of this county and the relatively small number of in-migrants they would be easily absorbed without noticeable impacts. All operations workers would in-migrate and all would bring a family. A family size of 3.25 was used for construction workers for a total peak site development related population increase of 8330 (7735 in-migrating workers and family members and 595 workers without family). An average family size of 2.74 for the operating workforce (see Section 5.4) would result in a total in-migrating operations-related population of 2466 (900 operations workers plus family). Therefore, the total expected in-migrating population (site development and operations) at peak building would be 10,796.

Because the assumed in-migrating population would be about 1 percent of the total population for Fort Bend County, the demographic impacts of building activities are expected to be minimal for this county. However, the impacts would likely be noticeable and significant in the smaller Austin County, where the in-migrating population represents 20 percent of the current population. If the facility is completed and commences operations, the operational workforce would number about 959 workers, 900 of whom would be at the site during building activities and are included in the above analysis. The review team expects that the demographic impact during operation would be minimal for all counties in the region. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the demographic impacts of building and operating two nuclear units at the Allens Creek site would be significant.

Taxes and Economy

As described in Section 5.4.3.2, STPNOC estimates it would spend $60 million annually for goods and services related to the new units, of which about 20 percent ($12 million) would be spent locally (STPNOC 2008b). STPNOC estimated if the units were 100 percent taxable, annual franchise taxes for Unit 3 would be $4.7 to $5.4 million and Unit 4 would have payments of $3.9 to $4.7 million which would represent less than 1 percent of the State's annual franchise tax revenues.

The largest tax impacts would come from property taxes related to the building and operations activities of the two units. The owners of STPNOC would pay taxes to the county, any applicable special districts that exist within the county and the local school district in which the land sits. During the building process, county property tax payments would be based on the cost of building the units and determined in accordance with state law using mutually agreed on appraisal formulas (STPNOC 2009a). During operations property taxes would range from $6.10 million to $13.86 million. Taxes from the nuclear plant would represent a 58 to 131 percent increase over the 2008 Austin County taxes levied of $10.6 million. Development of the Allens Creek site for a nuclear power plant also would require a cooling water source. STPNOC believes that proposed 9500-ac reservoir to the east of the power plant footprint could perform that function. Such a reservoir, if built, could remove approximately 9500 ac from the property tax rolls, with a resulting significant tax loss to Austin County.

Increased property values in the district would increase the tax payments made to Brazos independent school district (ISD), which is a Texas Education Code Chapter 42 "poor district" (TEA 2009) This means the Brazos ISD could keep most if not all of the additional tax revenues generated by the development of a nuclear plant within the district lines. Although the exact amount currently is unknown, the tax payments are likely to represent a substantial beneficial impact for both the small, rural county of Austin County and for Brazos ISD. Brazos ISD's total tax revenue in 2008 was $9.2 million (Global Scholar 2008).

Economic impacts would be spread across the 50-mi region but would be greatest in Austin County. Austin County per capita income for 2007 is $35,580 and $41,779 for Fort Bend County (Texas Association of Counties 2009c, d). The 2008 unemployment rate for Austin County and Fort Bend County was 4.3 percent and 4.5 percent, respectively (Texas Association of Counties 2009c, d). The wages and salaries of the building- and operations-related workforces would stimulate local economies and increase business activity, particularly in the retail and service sectors. This would have a positive and noticeable impact on the business community and could provide opportunities for new businesses and increased job opportunities for local residents. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the tax and economic impacts of building and operating two nuclear units at the Allens Creek site would be significant and beneficial.

Transportation and Housing

Both Austin and Fort Bend Counties have well developed road networks. The local transportation network near the site includes Interstate 10 (I-10), US-90, SH-36, and several FM roads. Primary access to the site is from I-10 which is approximately 6 mi south of the site. Commuters would likely take I-10 to SH 36, a two lane road in good condition, which provides direct access to the site. A new access road would need to be constructed to provide access inside the site. I-10 east and west of Sealy has an annual average daily traffic count (AADT) of 46,000 and 38,000, respectively. The I-10 SH 36 intersection has an AADT of 22,000 but the part of SH 36 between Sealy and Wallis, where direct access to the site would be, is only 5900. The most likely pinch points would be at several intersections on SH 36 between Sealy and Wallis. Provision would have to be made to cross the rail line that closely parallels SH 36 between the highway and the site. Rail traffic is heavy enough on this corridor to possibly require coordination between rail and site vehicular traffic. Less than a mile of rail would need to be constructed (STPNOC 2009a). The review team expects the transportation impacts from building a plant at the Allens Creek site would be significant but not destabilizing on SH 36 and would warrant mitigation. Operation impacts would be minimal due to the much smaller workforce and because roads would have been improved during the site development phase.

Approximately 3875 construction and operations workers could migrate into the region during peak site development. During operations the workforce is expected to be about 959 workers of which 900 are included in the 3875 workers needing housing during peak building activity. U.S. Census Housing Profile for Austin County estimated a total housing stock of 10,822 units with a rental vacancy rate of 11.4 percent. Approximately 1487 housing units were unoccupied at the time of the survey (USCB 2009e). The U.S. Census Housing Profile for Fort Bend County estimated a total housing stock of 148,484 units with a rental vacancy rate of 8.7 percent. Approximately 9209 housing units were unoccupied at the time of the survey (USCB 2009f). Some workers may choose to find other housing such as an apartment while others may in-migrate with their own housing in the form of a travel trailer. The review team expects that the in-migrating workforce would be absorbed easily into the existing housing stock in Fort Bend County and the region without a measurable impact, but if workers concentrate closer to the plant, the impacts could be noticeable but not destabilizing due to the smaller number of housing units available. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the transportation and housing impacts of building and operating two nuclear units at the Allens Creek site would be noticeable.

Public Services and Education

The influx of construction workers and plant operations staff settling in the region could impact local municipal water and water treatment facilities and other public services in the region. These impacts would likely be in proportion with the demographic impacts experienced in the region, unless these resources have excess capacity or are particularly strained during building, which would decrease or increase the impact, respectively. For example, the largest water treatment facilities in Austin County and Fort Bend County have water capacity available that is roughly three to ten times current average daily consumption (EPA 2009b), so while they may have to build considerable distribution infrastructure they are unlikely to be water capacity limited.

The in-migrating workers represent a small portion of the total population of Fort Bend County and would likely have a minimal impact on their public services. In the smaller Austin County the impacts during building could be more noticeable due to a strain on public services from a relatively larger population increase in this county. During operations the impact on public services would diminish to minimal levels throughout the region.

Austin County has 3 independent school districts with 13 schools and Fort Bend County has 6 independent school districts with 174 schools. The 2007-2008 student enrollments for Austin and Fort Bend County are 5641 students and 149,952 students, respectively (NCES 2009). The review team expects a peak building-related increase of about 2537 students (1269 in each county). The in-migrating students would be less than 1 percent of the current student population and would have a minimal impact to schools in Fort Bend County. However, the increase would be a 23 percent increase in the student population in Austin County, where the review team expects the impact would be significant and potentially destabilizing to this school system. The impact from operations-related new students would decline to minimal levels everywhere. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the public service and education impacts of building and operating two nuclear units at the Allens Creek site would be significant.

Aesthetics and Recreation

Recreation in the area includes the historic Texas Independence Trail, the Stephen F. Austin Historical Park, and the Attwater Prairie Chicken National Wildlife Refuge (STPNOC 2009a). Building of the reservoir would impact a 7-mi stretch of the Texas Independence Trail. During building activities, drivers along the Texas Independence Trail would experience modest inconvenience from building activities or by the occasional closure of the road. During operations, drivers would receive minimal impacts from additional cars on the road commuting to the site. The building and operation of the plant itself and transmission lines to support the site would have a noticeable aesthetic impact on the region. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the aesthetic and recreation impacts of building and operating two nuclear units at the Allens Creek site would be noticeable.

Summary of Socioeconomics

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. In summary, on the basis of information provided by STPNOC and the review team's independent evaluation, the review team concludes that the socioeconomic impacts of the building and operation of a new nuclear plant at the Allens Creek site would be minimal and adverse for Fort Bend County and the region but could be noticeable and adverse in terms of transportation, housing, public services, and significant and adverse for demographics and education impacts in Austin County during the building phase. Aesthetic and recreational impacts would be noticeable and adverse. The impacts on the Austin County economy and tax base during plant building and operation likely would be beneficial and significant.

Cumulative Impacts

For the analysis of socioeconomic impacts at the Allens Creek site, the geographic area of interest is the 50-mi region centered on the Allens Creek site with special consideration of Austin and Fort Bend Counties as that is where the review team expects socioeconomic impacts to be the greatest. After World War II and the introduction of irrigation, agriculture supported the local economy in Austin County. Much of the land used for cotton farming was converted to ranchland and livestock production became the chief industry after World War II. Manufacturing in Austin County also increased after World War II due in part to the heavy industry coming out of Houston (TSHA 2009e). Traditionally, Fort Bend County's economy was based on farming and ranching but that has declined over the last several decades. Cotton, sorghum and rice are all still important crops in Fort Bend County however farms produce more cattle than any other commodity. The county also produces numerous minerals and the first oilfields were drilled in the 1920s. The petroleum industry was the most important industry in Fort Bend County in terms of taxes generated until the mid 1970's oil crisis. Due to Houston's westward expansion into Fort Bend County the economy has become much more diverse recently (TSHA 2009f).

In addition to assessing the incremental socioeconomic impacts from the building and operations of two additional nuclear units on the Allens Creek site, the cumulative impacts analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts on a given region, including other Federal and non-Federal projects and those projects listed in Table 9-12. For the analysis of socioeconomic impacts at the Allens Creek site, the geographic area of interest is considered to be the 50-mi region centered on the Allens Creek site.

The projects identified in Table 9-12 have or would contribute to the demographics, economic climate, and community infrastructure of the region and generally result in increased urbanization and industrialization. However, many impacts such as those on housing or public services are able to adjust over time, particularly with increased tax revenues. Furthermore, state and county plans along with modeled demographic projections include forecasts of future development and population increases. Because the projects within the review area identified in Table 9-12 would be consistent with applicable land-use plans and control policies, the review team considers the cumulative socioeconomic impacts from the projects to be manageable with the exception of the Trans-Texas Corridor (TTC). Although the review team was not able to locate information regarding either the timing of the project or the level of employment in the immediate area of Austin County, it is the teams understanding that during construction there would be a large construction population working immediately west of the Allens Creek site. Another branch of the TTC would go through the central part of Fort Bend County (DOT and TxDOT 2007). The highway itself would take a wide swath of land that would be removed from predominately agriculture use in both counties but may attract commercial and industrial development. This is expected to have very significant beneficial consequences for the Austin County economy and tax base but may create short-term burdens on public services. The impacts would be similar in Fort Bend County, but smaller in relative impact because of Fort Bend County's larger population. It is not known whether the long-term balance of socioeconomic effects would be beneficial or adverse. The short- and long-term aesthetic affects would be significant and adverse.

The review team concludes that the cumulative socioeconomic impacts of the building and operation of a new nuclear plant at the Allens Creek site would be MODERATE and adverse for Fort Bend County and the region but could be MODERATE to LARGE and adverse in in Austin County in terms of demographics, transportation, housing, public services, education in Austin County during the building phase. Physical, aesthetic and recreation impacts would be LARGE and adverse. The building and operating the new plants at Allens Creek would make a significant contribution to the aesthetics and recreation impacts. The impacts on the economy and tax base during plant development and operation likely would be beneficial and MODERATE to LARGE in Austin County and MODERATE in Fort Bend County. Building and operating a new plant at the Allens Creek site would make a significant, incremental contribution to these impact levels in Austin County.

9.3.3.6 Environmental Justice

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact environmental justice, including other Federal and non-Federal projects listed in Table 9-

12. The cumulative environmental justice impacts were assessed for the 50-mi region centered on the Allens Creek site. In 2000, the 50-mi region around the Allens Creek site was characterized as 20 percent Black, 0.4 percent American Indian and Alaskan Native, 5.9 percent Asian, 0.05 percent Hawaiian and Other Pacific Islander, 13 percent all other races, and 2.8 percent two or more races, 30.2 percent Hispanic or Latino and 11.6 percent low-income (STPNOC 2009a).

For this analysis of cumulative environmental justice impacts, the geographic area of interest is considered to be the 50-mi region surrounding the Allens Creek site and Freeport area in Brazoria County, which has a minority population and potentially could be affected if the flow regime at the mouth of the Brazos River were to be changed as a result of withdrawing water from the river to supply water for the reservoir at the Allens Creek site. The review team identified 1946 census blocks groups within the 50 mi region, 1065 of which were classified as minority populations (two of them in Austin County and 99 in Fort Bend County). One of these block groups in Austin County (near Sealy) and one block group in Waller County are within 10 mi of the Allens Creek alternative site. The review team identified 164 census block groups classified as low income in the 50-mi region, of which none are in Austin County and one in Fort Bend County. None of these populations are within 10 mi of the Allens Creek alternative site. See Figure 9-11 and Figure 9-12 on the following pages for the location of minority or low-income populations within the 50-mi region. The review team did not locate any minority or low-income populations that were located along Allens Creek. Nor did the review team find any minority or low-income populations in the first 50 miles of the Brazos River downstream from the Allens Creek site or that were engaged in subsistence activity along this river. The review team's analysis did not find any information suggesting that minority or low-income populations in the area were dependent on natural resources that would be adversely affected by a nuclear power plant at the Allens Creek site.

There are significant minority populations in Austin, Wharton, Ft. Bend and Harris Counties. However, physical impacts of building (noise, fugitive dust, air emissions, and air and water emissions) would not disproportionately and adversely affect minority populations because of their distance from the Allens Creek site (at least 5 mi even for the closest minority populations in Waller County just east of Austin County and in the vicinity of Sealy, several miles to the north of the site). The TTC preferred route cuts through Austin County to the immediate west of the Allens Creek site. Another branch of the TTC passes through the central part of Fort Bend County on the general alignment passing just south of East Bernard and Beasley, and just north of Kendleton. The TTC does not appear to pass through minority and low-income census block groups in Austin County but does appear to do so in Fort Bend County (DOT and TxDOT 2007). Much of the TTC corridor in Fort Bend County passes directly through many minority census block groups and because of the preemptive nature of large highways on land use, this branch of the TTC has a strong chance of disproportionately disrupting neighborhood continuity,

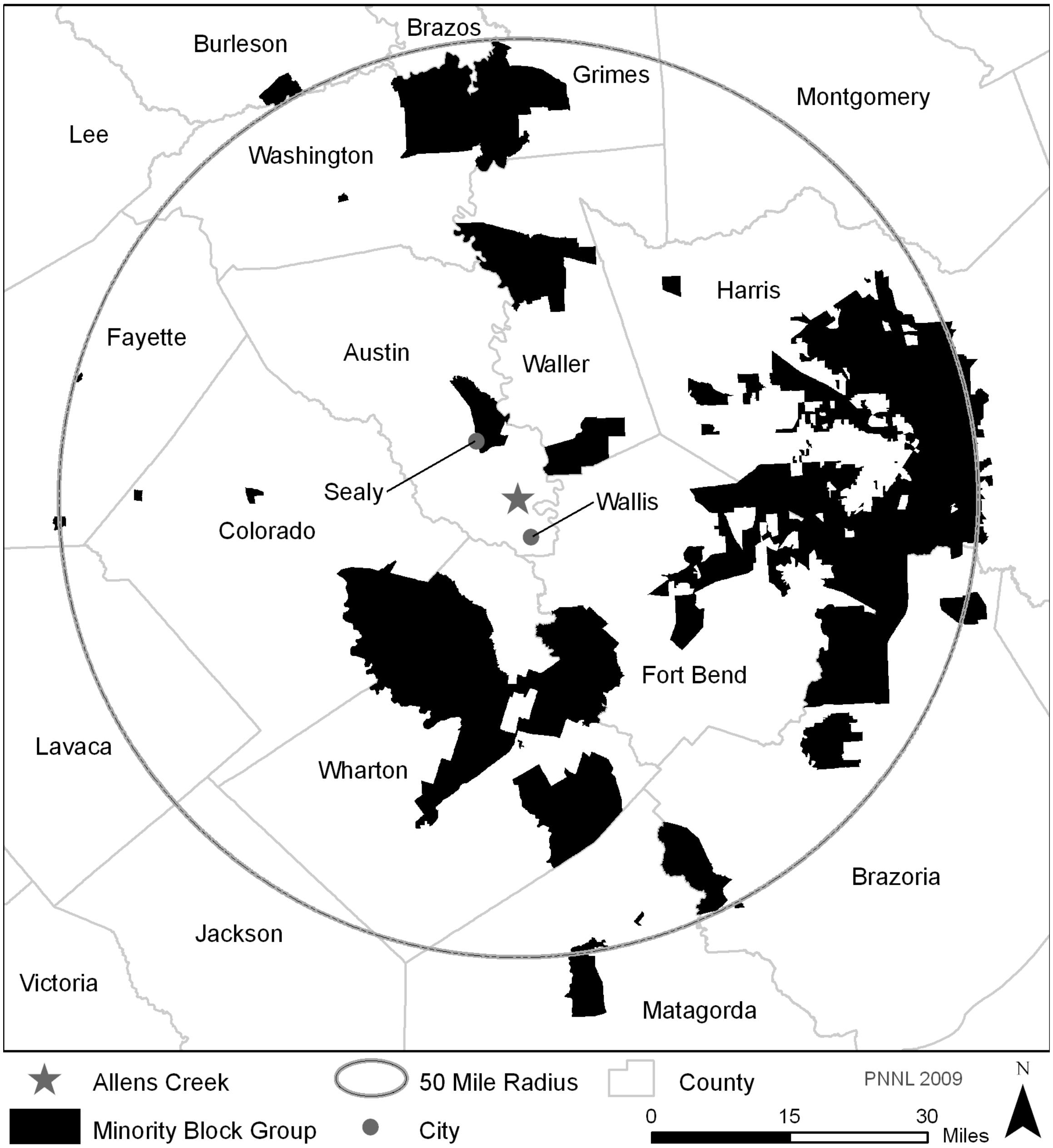


Figure 9-11. Minority Block Groups within 50 mi of the Allens Creek Alternative Site

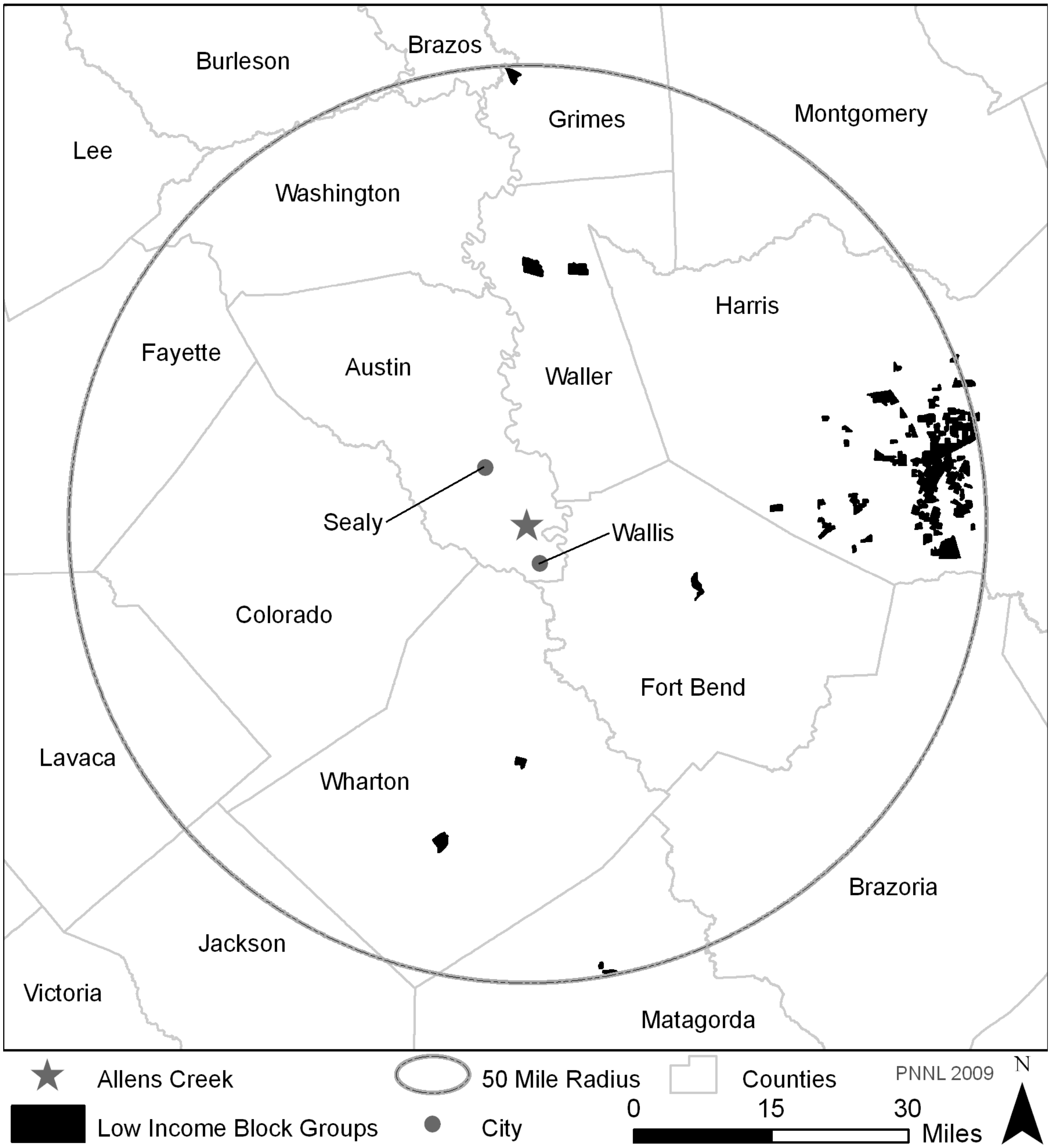


Figure 9-12. Low Income Block Groups Near the Allens Creek Alternative Site

displacing existing local services, and interrupting community interactions in minority communities within the TTC highway corridor. The review team took into account the U.S. Department of Transportation and TxDOT's draft EIS for the Tier 1 I-69 Trans-Texas Corridor Study (DOT and TxDOT 2007). The review team recognizes that a more detailed Tier 2 study will be taking place in the future, that initial estimations of environmental justice impacts could change, and that re-routing and other mitigation would be taken to minimize impacts on minority and low income populations. The impacts of the highway would be significant and potentially destabilizing to affected individuals and communities, but the corridor is broad enough that appropriate routing might avoid or mitigate any disproportionate impact to minority and low-income populations. Depending on the exact routing eventually taken by the TTC highway link through Fort Bend County within the Tier 1 study corridor, disproportionate adverse impacts associated with the TTC to the noted minority census block groups in Fort Bend County could range from minimal to significant and potentially destabilizing. It would noticeably impact the economy, tax base, and public services of both counties and the impact may be quite significant in both counties. Because there are minority populations in the Sealy area, they likely would be adversely affected if crowding in schools and housing occurs in Austin County. However, the review team does not expect that minority and low-income populations in Austin County would be disproportionately affected.

The 9500 ac reservoir for Allens Creek does not appear to infringe on lands occupied by minority populations. There are scattered low income populations in Waller, Ft. Bend, and Warren Counties beyond 15 mi from the Allens Creek alternative site and a somewhat greater concentration in western Harris County more than 30 mi away. There are no identified low income populations in Austin County. Because they are a greater distance from the Allens Creek alternative site than the minority populations, low-income populations are even less likely to experience disproportionate, adverse environmental impacts from the Allens Creek alternative site.

The city of Freeport is at the mouth of the Brazos River, 60 mi downstream from the Allens Creek Site and has a population that is more than 50 percent Hispanic or Latino. Its proportion of low-income persons is about 5 percentage points above the Texas state average. However, any impacts on the Brazos River at Freeport would be short in duration during the building period and negligible during operations. The building and operation of the proposed project at the Allens Creek site is unlikely to have any disproportionate adverse impact on any minority or low-income populations. See Sections 4.5 and 5.5 for more information about environmental justice criteria and impacts. The environmental justice impacts from building and operating two nuclear units at the Allens Creek site would be minimal and adverse.

The cumulative environmental justice impacts in the Allens Creek site area would be SMALL to LARGE and adverse in Fort Bend County and SMALL and adverse elsewhere within the 50-mi region. However, this cumulative rating is based entirely on the impact of the TTC project. Building and operating two nuclear units at the Allens Creek site would not be a significant contributor to these impacts.

9.3.3.7 Historic and Cultural Resources

The following cumulative impact analysis includes building and operating two new nuclear generating units at the Allens Creek site. The analysis also considers other past, present, and reasonably foreseeable future actions that could impact cultural resources, including other Federal and non-Federal projects and those projects listed in Table 9-12. For the analysis of cultural impacts at the Allens Creek site, the geographic area of interest is considered to be the APE that would be defined for this site. This includes the physical APE, defined as the area directly affected by the site development and operation activities at the site and transmission lines, and the visual APE. The visual APE is defined as an additional 1-mi radius around the physical APE consistent with the discussion in Section 2.7 about the maximum distance from which the structures can be seen.

Reconnaissance activities in a cultural resource review have particular meaning. Typically, for example, it includes preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing its EISs, the review team relies upon reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through visits to the site area. To identify the historic and cultural resources at the Allens Creek site, the following information was used:

- STPNOC ER (STPNOC 2009a) - including the Texas Historical Commission's Texas Archeological Sites Atlas;
- NRC Alternative Sites Visit March 2008; and
- Final Environmental Statement – Allens Creek Nuclear Generating Station Units 1 and 2 (AEC 1974).

The Allens Creek site is located in Austin County, Texas. The Allens Creek site is a greenfield site. Historically, the site and vicinity was largely undisturbed and likely contained intact archaeological sites associated with the past 10,000 years of human settlement. Over time, the area has been disturbed by rural development and cleared for agricultural purposes. The majority of the land was cleared of native hardwood vegetation in the 1970's for agricultural purposes. Today, much of the site is farmed and current uses include cropland and pasture land (STPNOC 2009a).

Archaeological and/or architectural surveys conducted at the Allens Creek site were discussed in the 1974 final environmental statement (AEC 1974) for the proposed Allens Creek Nuclear Generating Station. The 1974 environmental statement identified four cemeteries, historic areas, and several significant archaeological sites in the Allens Creek area. Additionally, in that report, the AEC required that the applicant complete an investigation of selected archaeological sites in the vicinity of the plant and cooling reservoir before the start of construction activities that could impact the sites. Subsequently, applicant-sponsored investigations indicate that several mounds with human remains exist in the area. Should the site be developed, then consultation with the THC and Native American tribes would help determine the significance of the mounds and any potential impacts the project would have on cultural resources.

Seven historic properties listed on the National Register of Historic Places are found in Austin County. The closest listed properties to the Allens Creek site are the Church of the Guardian Angel, located in Wallis about 4 mi from the site and an ossuary located in the vicinity of Wallis. A Texas Historic Landmark, the Martin Allen Public House foundation and associated Allen-Johnston cemetery, is about 1 mi from the Allens Creek site (STPNOC 2009a). Neither the Public House nor the cemetery is listed on the National Register. The project has the potential to affect resources through visual impacts from buildings and transmission lines. These impacts may result in significant alterations to the visual landscape within the geographic area of interest.

In the event that the Allens Creek site was chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the SHPO, tribes and interested parties. The results would be used in the site planning process to avoid cultural resources impacts. Because of the known and significant cultural resources that exist in the site area, the review team assumes that STPNOC would develop protective measures in a manner similar to those for the STP site. These procedures are detailed in STPNOC's Addendum #5 to Procedure No. OPGP03-ZO-0025 Rev. 12 (Unanticipated Discovery of Cultural Resources) (STPNOC 2008e); the procedure includes notification of the THC.

Section 9.3.3.1 describes the transmission line corridors. Three new transmission lines would likely be needed to connect to the three closest 345-kV lines in the area (STPNOC 2009a). In the event that the Allens Creek site was chosen for the proposed project, the review team assumes that STPNOC would conduct its transmission line-related cultural resource surveys and procedures in a manner similar to that for the STP site described in Section 4.6.

Past actions in the geographic area of interest that have similarly impacted historic and cultural resources include rural development and agricultural development and activities associated with these land disturbing activities such as road development. Two current or planned projects, the Texas Independence Trail and the Allens Creek Reservoir, were identified in Table 9-12 that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest.

Activities associated with building two nuclear units and supporting facilities that can potentially destabilize important attributes of historic and cultural resources include land clearing, excavation, and grading activities. Given STPNOC's site planning process and known cultural resources at the Allens Creek site, there would be unavoidable impacts to cultural resources due to site development activities.

In addition, visual impacts from transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. Given that there are significant cultural resources where the historic setting and character of the resources are important, the visual impacts would be unavoidable. The review team assumes that STPNOC would develop procedures and consult with the SHPO similar to the process developed for cultural resource management at the STP site.

Impacts on historic and cultural resources from operation of two new nuclear generating units at the Allens Creek site include those associated with the operation of new units and maintenance of transmission lines. The review team assumes that the same procedures currently used by STPNOC would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of the two new units and associated impacts on the cultural resources would be negligible for the physical APE and detectable but not destabilizing for the visual APE.

The two projects that were identified in Table 9-12 that could contribute to the cumulative impacts on cultural resources are the Texas Independence Trail and the Allens Creek Reservoir, a municipal water supply reservoir. The Texas Independent Trail would not significantly affect historic and cultural resources in the geographic area of interest; the impacts would be limited to the visual APE and would be similar to those associated with the operation of two new units. Given the known cultural resources at the Allens Creek site, there would be significant adverse impacts to cultural resources due to site development activities with regard to the Allens Creek Reservoir project.

Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by the applicant and the review team's independent evaluation, the review team concludes that the cumulative impacts from building and operating two new nuclear generating units on the Allens Creek site and from other projects, particularly the planned co-located Allens Creek Reservoir, would be LARGE. The incremental contribution of building and operating the two new units would be a significant contributor to the cumulative impacts determination for the cultural resources known to exist within the geographic area of interest.

9.3.3.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact air quality, including other Federal and non-Federal projects listed in Table 9-12. The atmospheric emissions related to building and operating a nuclear power plant at the STP site in Matagorda County, Texas, are described in Chapters 4 and 5. The criteria pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of the criteria pollutants at the STP site were evaluated and also determined to be MODERATE principally because of a nearby major source; absent that source, the cumulative impacts would be SMALL. The geographic area of interest for the Allens Creek site is Austin County, which is in the Metropolitan Houston-Galveston Intrastate Air Quality Control Region (40 CFR 81.38). The emissions related to building and operating a nuclear power plant at the Allens Creek site would be similar to those at the STP site. The air quality attainment status for Austin County as set forth in 40 CFR 81.344 reflects the effects of past and present emissions from all pollutant sources in the region. Austin County is not out of attainment of any National Ambient Air Quality Standard.

Reflecting on the projects listed in Table 9-12, the most significant is the W.A. Parish Electric Generating Station. Effluents from power plants such as this are typically released through stacks and with significant vertical velocity. Other industrial projects listed in Table 9-12 would have *de minimis* impacts. Given that these projects would be subject to institutional controls, it is unlikely that the air quality in the region would degrade to the extent that the region is in nonattainment of National Ambient Air Quality Standards.

The air quality impact of Allens Creek site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. There are no land uses or projects, including the aforementioned source, that would have emissions during site development that would, in combination with emissions from the Allens Creek site, result in degradation of air quality in the region.

Releases from operation of two units at the Allens Creek site would be intermittent and made at low levels with little or no vertical velocity. The air quality impacts of the aforementioned source are included in the baseline air quality status. The cumulative impacts from emissions of effluents from the Allens Creek site and the aforementioned source would not be noticeable.

The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in Section 7.5. The impacts of the emissions are not sensitive to location of the source. Consequently, the discussion in Section 7.5 is applicable to a nuclear power plant located at the Allens Creek site. The review team concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions of the project at the Allens Creek site.

Cumulative impacts to air quality resources are estimated based in the information provided by STPNOC and the review team's independent evaluation. Other past, present and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for greenhouse gas emissions) that could affect air quality resources. The cumulative impacts on criteria pollutants from emissions of effluents from the Allens Creek site, other projects, and the W.A. Parish Electric Generating Station would not be noticeable. The national and worldwide cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions from the Allens Creek site. The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air quality resources in the geographic areas of interest would be SMALL for criteria pollutants and MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air quality resources from building and operating two units at the Allens Creek site would be insignificant for both criteria pollutants and greenhouse gas emissions.

9.3.3.9 Nonradiological Health

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact nonradiological health, including other Federal and non-Federal projects listed in Table 9-12. The building-related activities that have the potential to impact the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to impact the health of members of the public and workers includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site. For the analysis of nonradiological health impacts at the Allens Creek alternative site, the geographic area of interest is considered to include projects within a 5-mi radius from the site's center based on the localized nature of the impacts. For impacts associated with transmission lines, the geographic area of interest is the transmission line corridor.

Building Impacts

Nonradiological health impacts to construction workers and members of the public from building two new nuclear units at the Allens Creek site would be similar to those evaluated in Section 4.8 for the STP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air quality and noise would be complied with during the site preparation and building phase. The incidence of construction worker accidents would not be expected to be different from the incidence of accidents estimated for STP. The Allens Creek site is located in a rural area and nonradiological health impacts from building would likely be negligible on the surrounding populations. The ER (STPNOC 2009a) indicated that transportation impacts could potentially be significant because the Allens Creek site is located in a rural area. Mitigation would be warranted, including constructing a new access road, and potentially widening existing roadways, installing traffic controls, and other measures designed to reduce traffic congestion. The additional injuries and fatalities from traffic accidents involving transportation of materials and personnel for building a new nuclear power plant at the Allens Creek site would be similar to those evaluated in Section 4.8.3 for the STP site and would represent a small fraction (less than 5 percent) of the total traffic fatalities in Austin County.

There are no past or present actions in the geographic area of interest that would cumulatively impact nonradiological health in a similar way to those discussed for Allens Creek. Proposed future actions would include transmission line development and/or upgrading throughout the designated geographic area of interest, highway improvement projects, and future urbanization. These actions would likely result in nonradiological health impacts similar to those discussed above for the building of the Allens Creek site.

Operational Impacts

Nonradiological health impacts from operation of two new nuclear units on occupational health and members of the public at the Allens Creek site would be similar to those evaluated in Section 5.8 for the STP site. Occupational health impacts to workers (e.g., falls, electric shock or exposure to other hazards) at the Allens Creek site would likely be the same as those evaluated for workers at two new units at the STP site. Exposure to the public from water-borne etiological agents at the Allens Creek site would be similar to the types of exposures evaluated in Section 5.8.1, and the operation of the new units at the Allens Creek site would not likely lead to an increase in water-borne diseases in the vicinity. Noise and EMF exposure would be monitored and controlled in accordance with applicable OSHA regulations. Effects of EMF on human health would be controlled and minimized by conformance with NESC criteria and adherence to the standards for transmission systems regulated by the PUCT. Nonradiological impacts of traffic associated with the operations workforce would be less than the impacts during building. Mitigation measures taken during building to improve traffic flow would also minimize impacts during operation of a new unit.

There are no past or present activities in the geographic areas of interest that would have nonradiological impacts to the public or workers similar to those discussed for the Allens Creek site. Proposed future actions that would impact nonradiological health in a similar way to operation activities at the Allens Creek site would include transmission line systems and future urbanization, which would both occur throughout the designated geographic areas of interest.

The review team is also aware of the potential climate changes that could affect human health; a recent compilation of the state of the knowledge in this area (Karl et al. 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature and decrease in precipitation, which may alter the presence of microorganisms and parasites in any reservoir that would be used. The review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of water-borne diseases.

Summary

Based on the information provided by STPNOC and the review team's independent evaluation, the review team expects that nonradiological health impacts from building and operating two new units at the Allens Creek alternative site would be similar to the impacts evaluated for the STP site. While there are other past, present and future activities in the geographic area of interest that could affect nonradiological health in ways similar to the building and operation of two units at the Allens Creek site, those impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes, therefore, that the cumulative impacts would be SMALL.

9.3.3.10 Radiological Impacts of Normal Operations

The following impact analysis includes impacts from building activities and operations for two nuclear units at the Allens Creek alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions associated with radiological impacts, including other Federal and non-Federal projects listed in Table 9-12. As described in Section 9.3.3, Allens Creek is a greenfield site; there are currently no nuclear facilities on the site. The geographic area of interest is the area within a 50-mi radius of the Allens Creek site. There are no major facilities that result in regulated exposures to the public or biota within the 50-mi radius of the Allens Creek site. However, there are likely to be hospitals and industrial facilities within 50 mi of the Allens Creek site that use radioactive materials.

The radiological impacts of building and operating the proposed two ABWR units at the Allens Creek site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite that would be well below regulatory limits. These impacts are expected to be similar to those estimated for the STP site. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Allens Creek site. This conclusion is based on data from the radiological environmental monitoring programs conducted around currently operating nuclear power plants.

The cumulative radiological impacts from building and operating the two proposed ABWRs and other existing and planned projects and actions in the geographic area of interest around the Allens Creek site would be SMALL.

9.3.3.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for two nuclear units at the Allens Creek alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that impact radiological health from postulated accidents, including other Federal and non-Federal projects and those projects listed in Table 9-12. As described in Section 9.3.3, Allens Creek is a greenfield site; there are currently no nuclear facilities on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Allens Creek site. This includes the reactors at the STP Site. A site near Victoria has been identified as a potential reactor location.

As described in Section 5.11.1, the staff concludes that the environmental consequences of DBAs at the STP site would be minimal for ABWRs. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria. The ABWR design is independent of site conditions, and the meteorology of the Allens Creek and STP sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Allens Creek site would be minimal.

Because the meteorology, population distribution, and land use for the Allens Creek alternative site are expected to be similar to the proposed STP site, risks from a severe accident for an ABWR reactor located at the Allens Creek alternative site are expected to be similar to those analyzed for the proposed STP site. These risks for the proposed STP site are presented in Tables 5-18 and 5-19 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For the existing plants within the geographic area of interest, STP Units 1 and 2, the Commission has determined that the probability-weighted consequences of severe accidents are small (10 CFR 51, Appendix B, Table B-1). It is expected that risks for any new reactors at the Victoria site would be well below risks for current-generation reactors and meet the Commission's safety goals. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Allens Creek alternative site would be SMALL.

9.3.4 Trinity 2

This section covers the review team's evaluation of the potential environmental impacts of siting a new two-unit nuclear power plant at the Trinity 2 site in eastern Texas near the Trinity River.

The site is located in a rural area of Freestone County approximately 10 mi northeast of Fairfield and 2.6 mi east of the existing Big Brown Power Plant. The water source for plant cooling and other plant uses would be the Trinity River and a new reservoir would be constructed. Trinity 2 is a greenfield site not currently owned by the applicant (STPNOC 2009a).

The following sections include a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the Trinity 2 site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction and operations and impacts of preconstruction activities. Also included in the assessment are past, present and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Trinity 2 site. Other actions and projects considered in this cumulative analysis are described in Table 9-16.

The STP site is more than 200 mi from Trinity 2 and was therefore not included in this analysis. The only other nuclear power plant currently operating in Texas is Comanche Peak. The Comanche Peak plant is approximately 100 mi from Trinity 2 and therefore is also not included in the cumulative analysis. The proposed nuclear power plant in Victoria County is approximately the same distance as the STP site and was not included in the following analysis.

Table 9-16. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Cumulative Analysis of the Trinity 2 Alternative Site.

Project Name	Summary of Project	Location (relative to Trinity 2 site)	Status
Energy Projects			
Big Brown Power Plant (BBPP)	Two 575 MW units. Burns lignite coal from local mines, supplemented by sub-bituminous coal delivered by train. Uses water from Lake Fairfield.	Approximately 2.6 mi west of Trinity 2	Operational[(a)]
Freestone Energy Center	1035 MW natural gas plant on 506 ac	Approx 7 mi northwest of Trinity 2	Operational[(b)]
Lakeside Energy Center	Proposed 640 MW natural gas plant	Approx12 mi northwest of Trinity 2 near Richland-Chambers Reservoir	Proposed[(c)]

Table 9-16. (contd)

Project Name	Summary of Project	Location (relative to Trinity 2 site)	Status
Limestone Electric Generating Station	Currently comprised of two lignite/coal-fueled steam units, with a combined 1700 MW capacity. The proposed expansion project would add a third 744 MW unit.	Approx 30 mi south-southwest of Trinity 2 near Jewett, Texas	Units 1 and 2 operational. Unit 3 expected to begin operating in 2012[d]
Mining Projects			
Big Brown Lignite Coal Mine and Expansion	Current mining consists of more than 20,000 ac of land mined in Freestone County. The owner of the Big Brown Mine, Luminant, plans to open the Turlington mine (10,397 ac) adjacent to and south of the existing Big Brown Mine.	Approx 4 mi northwest of Trinity 2	Operational. [e] Turlington mine expected to begin operating in 2011[f]
Streetman Expanded Shale and Clay Plant	Lightweight aggregate production facility	Approx 21 mi west of Trinity 2	Operational.[g]
Transportation Projects			
Highway expansion	Widening of US 79	About 18 mi southeast of Trinity 2	Proposed but currently unfunded[h]
Highway expansion	Widening of US 287	About 10 mi northeast of Trinity 2	Proposed but currently unfunded[i]
Parks and Aquaculture Facilities			
Fairfield Lake State Park	1460 ac outdoor recreation	Approx 4 mi southwest of Trinity 2	Operational[j]
Richland Creek Wildlife Management Area	13,700 ac, created to compensate for habitat losses associated with the construction of Richland-Chambers Reservoir	Approx 10 mi north of Trinity 2	Operational[k]
Big Lake Bottom Wildlife Management Area	2870 ac of the area are accessible and open for public use	Approx 11 mi east-southeast of Trinity 2	Development likely limited within this park[l]

Table 9-16. (contd)

Project Name	Summary of Project	Location (relative to Trinity 2 site)	Status
Gus Engeling Wildlife Management Area	10,958 ac for wildlife management, research, and demonstration area for the Post Oak Savannah Ecoregion. Also used for hunting & other outdoor recreation.	Approx16 mi northeast of Trinity 2	Development likely limited within this park[m]
Other Actions/Projects:			
Tehuacana Reservoir	14,900-ac water supply reservoir	Approx 10 mi west-northwest of Trinity 2	Proposed [n]
Tennessee Colony Reservoir	85,000-ac water supply and flood control reservoir	Adjacent to Trinity 2	Proposed [o]
Coffield Correctional Institution	Prison in operation since 1965, wastewater treatment plant	Approx 8 mi east-southeast of Trinity 2	Operational[p]
Boyd Correctional Institution	Prison in operation since 1992, wastewater treatment plant	Approx. 15 mi west-southwest of Trinity 2	Operational[q]
Nucor Steel	Primary Metal Industries	Approx 34 mi south-southwest of Trinity 2	Operational[r]
Cayuga Independent School District	Waste Water Treatment Plant	Approx 9 mi northeast of Trinity 2	Operational[s]
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water- and/or wastewater- treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region.	Construction would occur in the future, as described in state and local land-use planning documents
Various hospitals and industrial facilities that use radioactive materials	Medical and other isotopes	Within 50 mi	Operational in nearby cities and towns

(a) Source: EPA 2009c
(b) Source: Calpine 2009
(c) Source: TCEQ 2009d
(d) Source: NRG 2009
(e) Source: EPA 2009d
(f) Source: TRC 2010
(g) Source: EPA 2009e
(h) Source: TxDOT 2009a

Table 9-16. (contd)

(i)	Source: TxDOT 2009a
(j)	Source: TPWD 2009j
(k)	Source: TPWD 2009k
(l)	Source: TPWD 2009l
(m)	Source: TPWD 2009m
(n)	Source: TWDB 2010a
(o)	Source: TWDB 2006b
(p)	Source: EPA 2009f
(q)	Source: TDCJ 2009
(r)	Source: EPA 2009g
(s)	Source: EPA 2009h

9.3.4.1 Land Use

The following impact analysis includes impacts from building activities and operations. The analysis also considers past, present, and reasonably foreseeable future actions that impact land use, including other Federal and non-Federal projects and those projects listed in Table 9-16. For this analysis, the geographic area of interest for considering cumulative impacts is the 15-mi region surrounding the Trinity 2 site. This geographic area of interest includes the primary communities (e.g., Fairfield) that would be affected by the proposed project The Trinity 2 site is a greenfield site located in an unincorporated area of Freestone County, Texas, 10.4 mi northeast of Fairfield. STPNOC estimates that approximately 18 percent of the Trinity 2 site is forested, 80 percent is in open land or grass lands, 1 percent is developed, and 1 percent is water resources (STPNOC 2009a). There is no current zoning applicable to the site. The Trinity 2 site is not owned by the applicants. Acquisition of the site for a new power plant would involve land purchase from more than one land owner (STPNOC 2009a).

The Trinity 2 site is not in the geographic area covered by the TCMP (TCMP 2009); therefore, the CZMA does not apply to this site.

The Trinity 2 site is 2.6 mi east of the Big Brown Power Plant owned by Luminant Power (STPNOC 2009a). The Big Brown plant is a two-unit, 1150-MW, coal-fired plant (Luminant 2009). The plant uses lignite coal mined near the plant (see Table 9-16) and also coal from the Powder River Basin in Wyoming. Continued mining operations would be expected to increase the amount of affected land near the Trinity 2 site. Cooling water for the Luminant plant comes from Fairfield Lake. Fairfield Lake has a surface area of approximately 2400 ac and was formed by a dam on Big Brown Creek (TSHA 2009b). Fairfield Lake State Park is located on the southern and southwestern shores of Fairfield Lake.

If new nuclear generating units were built at the Trinity 2 site, the review team assumes that an onsite water storage reservoir for plant cooling would be built and that water would be diverted from the Trinity River. The land area affected by building two nuclear generating units at the

Trinity 2 site would be approximately 800 ac for the main power plant site and up to 1700 ac for a new reservoir to be used for plant cooling (STPNOC 2009a). Land-use impacts would also occur to divert water to the plant and/or a reservoir and return discharge water to the Trinity River and for road and rail access. Most land-use impacts would occur during building, while plant operations would have minimal land-use impacts. The land-use impacts associated with building the plant and the reservoir at the Trinity 2 site would be noticeable, but not destabilizing.

Figure 9-13 shows the location of the Trinity 2 site and surrounding communities. There are no existing transmission corridors connecting directly to the Trinity 2 site. However, there are multiple 345-kV transmission lines connecting to the Big Brown Power Plant (STPNOC 2009a). One or more new transmission corridors would need to be created to connect the Trinity 2 site to these lines. The corridor(s) would pass through areas that are mostly rural with low population densities. Farmlands that would become part of a corridor could generally continue to be farmed. The land-use impacts of building one or more transmission corridors to serve the Trinity 2 site would be minimal.

Within the 15-mi geographic area of interest, four reasonably foreseeable future projects (included in Table 9-16) have the potential to significantly affect cumulative land use. The first project would be the proposed Lakeside Energy Center. The Lakeside Energy Center would be a 640 MW(e) natural gas-fired power plant located on a 35 ac tract of land approximately 12 mi northwest of the Trinity 2 site. Construction and operations workers would likely be drawn from a wide area. If the proposed Lakeside Energy Center is constructed, one or more new transmission corridors would be needed to connect the plant to the grid. The second project would be the proposed Tehuacana Reservoir which would affect approximately 14,900 ac. The third project would be the proposed Tennessee Colony Reservoir which would impact approximately 85,000 ac adjacent to the Trinity 2 site. The fourth project would be the opening of the Turlington Mine to support the Big Brown Power Plant. The planned mine would affect approximately 10,400 ac.

Future urbanization in the geographic area of interest, the continued operation of the Big Brown coal mine, the four proposed projects (see Table 9-16), and GCC could contribute to decreases in open lands, wetlands, and forested areas. Urbanization in the vicinity of the Trinity 2 site would alter important attributes of land use. Urbanization would reduce natural vegetation and open space, resulting in an overall decline in the extent and connectivity of wetlands, forests, and wildlife habitat. Continued operation of the Big Brown coal mine could include expansion of the mine at some point in the future. Potential expansion of the mine would result in a loss of open lands, forests, and wetlands. Construction of the four proposed projects (Lakeside Energy Center and associated transmission lines, the Tehuacana and Tennessee Colony reservoirs, and the Turlington Mine) would all also contribute to loss of open lands, forests, and wetlands. GCC could decrease precipitation, causing more frequent droughts when combined with

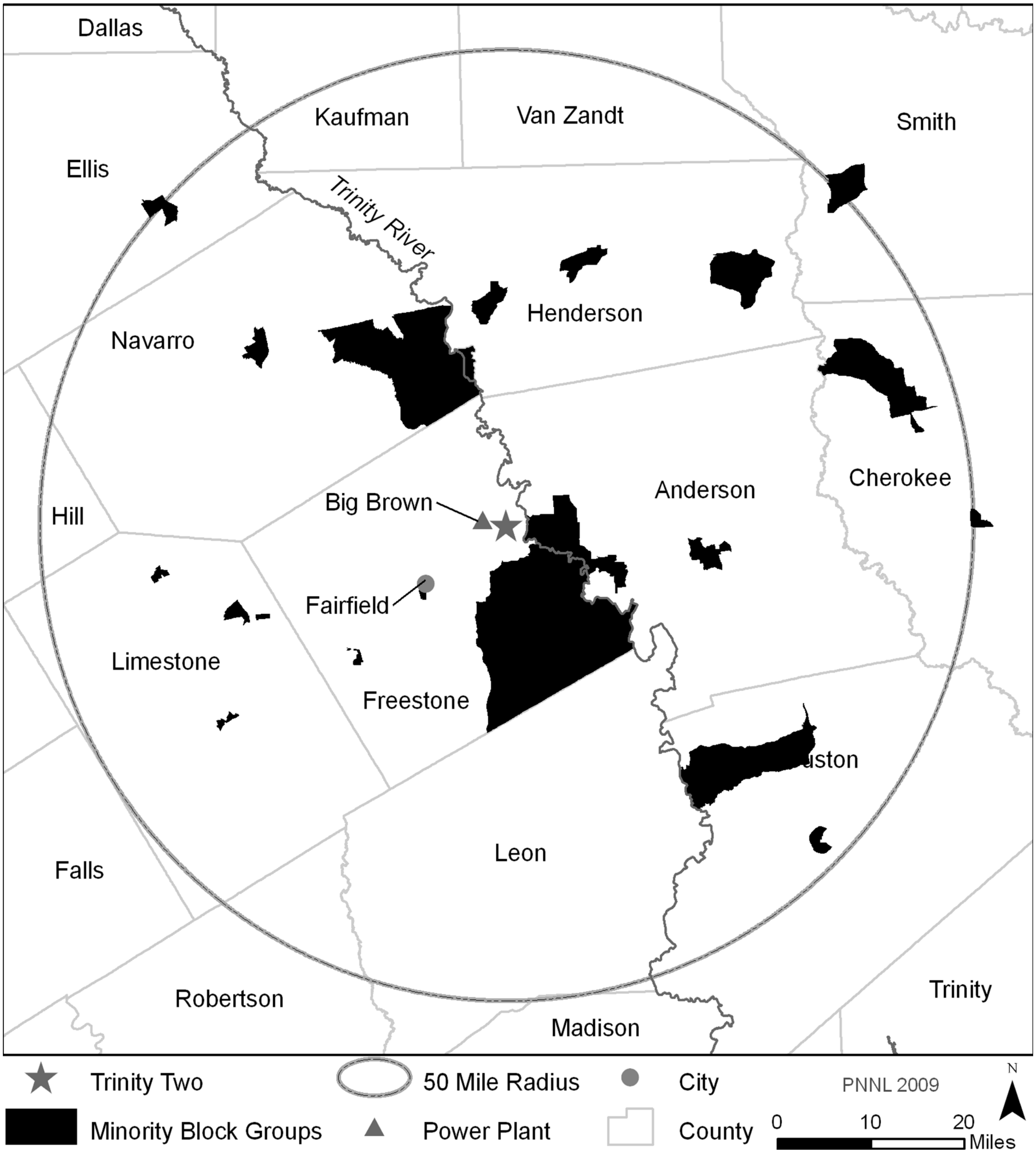


Figure 9-13. Trinity 2 Alternative Site and 10-mi Radius

increased evaporation in the geographic area of interest for the Trinity 2 site (Karl et al. 2009). Reduced water supply and increased temperatures could reduce crop yields and livestock productivity (Karl et al. 2009), which might change portions of agricultural and ranching land uses in the area of interest. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas to the extent that they are not adversely affected by droughts. The proposed two reservoirs (Tehuacana and Tennessee Colony) may help ameliorate some adverse effects of droughts if the reservoirs are in operation soon enough. But these reservoirs would simultaneously cause land-use changes by inundating large tracts of land. Urbanization trends, ongoing and proposed projects, and changes resulting from potential GCC could cause a shift in land use and, therefore, noticeably alter land uses in the geographic area of interest.

Based on the information provided by STPNOC and the review team's independent review, the review team concludes that the cumulative land-use impacts of constructing and operating two new nuclear generating units at the Trinity 2 site would be MODERATE. This conclusion reflects the substantial amount of land (up to 2500 ac onsite and additional offsite land for roads, a railroad spur, and pipelines) that would be needed for the proposed project if it were located at the Trinity 2 site, and the land-use impacts associated with the (1) proposed Lakeside Energy Center, (2) Tehuacana and Tennessee Colony Reservoirs, (3) Turlington Mine, and (4) transmission corridors that would be needed to serve the Trinity 2 and Lakeside Energy Center sites. Increased urbanization and potential effects of GCC could also noticeably contribute to this impact determination. Building and operating two new nuclear units at the Trinity 2 site would be a significant contributor to the MODERATE impact.

9.3.4.2 Water Use and Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact water use and quality, including other Federal and non-Federal projects listed in Table 9-16. The Trinity 2 site is located in rural Freestone County in eastern Texas. Onsite drainages include Tehuacana Creek, Big Brown Creek, and Rock Springs Branch (see Fig 9-13) which all ultimately drain to the Trinity River. Development of this site for two nuclear units would require water from the Trinity River, and the building of a water storage reservoir on the Trinity 2 site.

Geographic areas of interest are (1) for surface water the drainage basin of the Trinity River upstream and downstream of the intake and outfall structures, and the drainage basin of Tehuacana Creek upstream and downstream of the facility, and (2) for groundwater the aquifers upgradient and downgradient of the site. These regions are of interest because they represent the water resource potentially affected by siting the proposed project at the Trinity 2 site.

As stated in Section 2.3.2, water use in Texas is regulated by the Texas Water Code. As established by Texas Water Code, surface water belongs to the State of Texas (Texas Water Code, Chapter 11, Section 11.021). The right to use surface waters of the State of Texas can be acquired in accordance with the provisions of the Texas Water Code, Chapter 11. In Texas, surface water is a commodity. Since the Trinity River Basin is currently heavily appropriated, future water users in this basin would likely only obtain surface water by purchasing or leasing existing appropriations. Regarding groundwater, Texas law has allowed landowners to pump the water beneath their property without consideration of impacts to adjacent property owners (NRC 2009b). However, Chapter 36 of Texas Water Code authorized groundwater conservation districts to help conserve groundwater supplies and issue groundwater use permits. Chapter 36, Section 36.002, Ownership of Groundwater, states that ownership rights are recognized and that nothing in the code shall deprive or divest the landowners of their groundwater ownership rights, except as those rights may be limited or altered by rules promulgated by a district. Thus, groundwater conservation districts with their local constituency offer groundwater management options (NRC 2009b). Existing projects in the State have appropriations to use water for their requirements. The review team expects that future projects, including the proposed units, if they were to be built and operated at the Trinity 2 site, would operate within the limits of these existing surface water and groundwater appropriations.

As stated in Section 7.2.1, the GCRP has compiled the state of knowledge in climate change. This compilation has been considered in the preparation of this EIS. The projections for changes in temperature, precipitation, droughts, and increasing reliance on aquifers within the Trinity River Basin are similar to those in the Colorado River Basin (Karl et al. 2009). Such changes in climate would result in adaptations to both surface water and groundwater management practices and policies that are unknown at this time.

There are currently 475 water rights owners in the Trinity River Basin, with total water rights of 1,169,000 ac-ft/yr that are categorized as industrial, irrigation, or mining users (TCEQ 2009a). According to the TCEQ's water availability maps, unappropriated flows in the Trinity River Basin for a perpetual water rights permit are available 25 to 50 percent of the time (TCEQ 2009b). The water availability maps do not show the quantity of available water for a new appropriation (TCEQ 2009b). The segment of the Trinity River near the Trinity 2 site appears on the State's 303(d) list as an impaired waterbody (TCEQ 2010b).

The Texas Water Development Board, in the 2007 State Water Plan, has estimated that more than 1 million ac-ft of groundwater supplies would be available during 2010-2060 in the Carrizo-Wilcox Aquifer that is shared by 66 counties (TWDB 2006a). The Mid-East Texas Groundwater Conservation District (METGCD) in which Trinity 2 resides, has estimated an average historical use of approximately 2784 ac-ft per year within Freestone County during 1980-2003 (METGCD 2009). The TWDB reported that wells in the Carrizo-Wilcox Aquifer support pumping rates from 500 to 3000 gpm.

Building Impacts

The review team assumed that no surface water would be used to build the units at the Trinity 2 site so there would be no impact on surface water use. This assumption is consistent with the analysis done for the STP site and other alternative sites.

The impacts on surface water quality from building potential units at the Trinity 2 alternative site would be limited to stormwater runoff that may enter nearby streams and rivers. Additionally, treated sanitary wastewater may be discharged to these streams and rivers. Building impacts would be limited by the duration of these activities, and therefore, would be temporary. The State of Texas prohibits the unauthorized discharge of waste into or adjacent to water in the state (Texas Water Code, Chapter 26, Section 26.121). The discharge of waste may be authorized under a general or individual permit (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2003; STPNOC 2009a). Implementation of BMPs should minimize impacts to wetlands and surface-water bodies near the Trinity 2 alternative site. Therefore, the water quality impacts on wetlands and water bodies related to building the proposed units near the Trinity 2 alternative site would be temporary and minimal.

The review team assumes that the groundwater use for building activities at the Trinity 2 site would be identical to the proposed groundwater use for the STP site (STPNOC 2009b). Monthly normalized groundwater use for the STP site ranges up to 491 gpm (792 ac-ft/yr) (see Table 3-4). STPNOC stated that groundwater would be used for potable and sanitary use, concrete batch plant operation, concrete curing, dust suppression and cleaning, placement of engineered backfill, and piping hydrotests and flushing (STPNOC 2009a).

The review team concludes that the potential groundwater use at the Trinity 2 alternative site during building activities would not be unreasonable because the site would utilize units similar to those proposed for the STP site and the building activities would also be similar.

The Trinity 2 alternative site is located in Region C, GMA 12, and the METGCD. As of January 2010, GMA 12 has not adopted desired future conditions for the Carrizo-Wilcox Aquifer (TWDB 2010b) which is the source of groundwater that would be used by STPNOC. The Carrizo-Wilcox Aquifer outcrops in much of Freestone County and therefore receives recharge in the area. Based on the available information, the review team determined that the groundwater that would be used for building the proposed units at the Trinity 2 alternative site would be approximately 28 percent of the average historical groundwater use from the Carrizo-Wilcox Aquifer in Freestone County. While 28 percent appears substantial, it represents 28 percent of prior average annual groundwater use and not of the managed available groundwater resource in the vicinity of the Trinity 2 site. The managed available groundwater resource level will be determined at a future time by the METGCD in cooperation with the TWDB (METGCD 2009).

The METGCD has proposed to develop the Carrizo-Wilcox Aquifer to meet demands within the Freestone County during 2010-2060 (METGCD 2009).

The review team determined, based on available information and groundwater source options that it is possible that there is sufficient groundwater available in the Carrizo-Wilcox aquifer to provide the groundwater needed to build the potential plants at the Trinity 2 alternative site. For example, the METGCD is developing an estimate of the managed available groundwater in the district and may find sufficient groundwater resource to allow expanded use of the aquifer. Based on standard geohydrologic practice, the review team concludes that the drawdown in the Carrizo-Wilcox Aquifer could be managed for groundwater pumping during building activities using an appropriately designed well system. Accordingly, the review team concludes that the impact of groundwater use for building the potential plants at the Trinity 2 site could be minimal. However, if a new groundwater use permit is issued, and the managed available groundwater resource is not sufficient, then the impact would be noticeable but not destabilizing because pumping from the aquifer would be temporary and limited to the building period.

While building the potential plants at the Trinity 2 alternative site, impacts to groundwater quality may occur from leaching of spilled effluents into the subsurface. Within Freestone County, wells completed within the Carrizo-Wilcox Aquifer yield groundwater with TDS levels of less than 500 mg/L (TWDB 2006a). STPNOC stated that BMPs would be in place during building activities and therefore the review team concludes that any spills would be quickly detected and remediated. In addition groundwater impacts would be limited to the duration of these activities, and therefore, would be temporary. Because any spills related to building activities would be quickly remediated under BMPs, and the activities would be temporary, the review team concludes that the groundwater-quality impacts from building at the Trinity 2 site would be minimal.

Operational Impacts

STPNOC estimated that a two-unit plant, operated at the Trinity 2 alternative site using a closed-cycle cooling system that would employ a cooling water reservoir, would consume a maximum of 50,000 ac-ft of water per year. STPNOC has identified the Trinity River as the source of the cooling water at the Trinity 2 alternative site. STPNOC currently does not own the necessary water rights. STPNOC would need to acquire existing Trinity River water rights that are currently being used for industrial, irrigation, and mining use. Therefore, based on the 1,169,000 ac-ft/yr of water rights held on the Trinity River by 475 water right owners, STPNOC would need to acquire a minimum of 4.3 percent of these water rights.

According to TCEQ staff, acquired water rights would have to be aggregated at a single point of diversion which may lead to concerns regarding instream flow to maintain water quality and habitat (NRC 2009b). The TCEQ staff stated that, under current Texas laws, the acquisition and aggregation process would need to consider the quantity and location of all water rights and the instream flow needs that may be affected by transfer of these water rights. Because STPNOC has not identified the particular water rights that may be acquired, it is difficult to determine if any are suitable for acquisition. However, the review team concluded that the TCEQ permitting process would require STPNOC to acquire water rights in sufficient quantity, at appropriate locations, and of appropriate type within the Trinity River Basin such that this reallocation of water rights does not adversely affect surface water use and quality in the basin. As such, based upon the water rights that would need to be reallocated to accommodate the facility at the Trinity 2 site, the review team determined that the operational surface water use impact of the proposed units at the Trinity 2 alternative site would be noticeable but not destabilizing.

During the operation of the proposed plants at the Trinity 2 alternative site, impacts to surface water quality could result from stormwater runoff, discharges of treated sanitary and other wastewater, blowdown from service water cooling towers, and periodic discharges from the cooling water reservoir into the Trinity River. As mentioned above, the State of Texas may require STPNOC to obtain a general or individual permit for the discharge of stormwater (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2001; STPNOC 2009a). Any discharges of sanitary and other wastewaters or cooling water reservoir discharges would be controlled by the State of Texas under a TPDES permit. The State of Texas limits the quantity and quality of discharges to surface water bodies while accounting for concurrent discharge and quality conditions within the surface water body. These permit conditions would also account for designated uses of the receiving surface water body and comply with the Clean Water Act. Such permits are designed to protect water quality. The review team expects that the conditions placed on operations of the proposed plants at the Trinity 2 site would be similar to those currently placed on the existing facilities at the STP site (Section 5.2.3.1). Therefore, the review team concluded that the operational impact on surface water quality of the receiving water body would be minimal because the discharge quantity and quality would be controlled.

The proposed Units 3 and 4 would use approximately 975 gpm (1572 ac-ft/yr) of groundwater during normal operations and approximately 3434 gpm (5538 ac-ft/yr) during maximum demand conditions (STPNOC 2009c). STPNOC stated that the expected groundwater use for Units 3 and 4 are assumed to also apply to alternative sites. However, for maximum operation demand periods, STPNOC assumes that a temporary increase in the rate of surface water use would be available (STPNOC 2009b).

The review team concludes that the potential groundwater use at the Trinity 2 alternative site during operations would not be unreasonable because the alternative site would utilize units similar to those proposed for the STP site.

As stated above, the desired future conditions for the Carrizo-Wilcox Aquifer have not yet been adopted (TWDB 2010b) and the managed available groundwater resource has not yet been determined. However, the Texas Water Development Board, in the 2007 State Water Plan, has estimated that more than 1 million ac-ft/yr of groundwater supplies would be available during 2010-2060 in the Carrizo-Wilcox Aquifer that is shared by 66 counties (TWDB 2006a). The TWDB also reported that wells in the Carrizo-Wilcox Aquifer support pumping rates from 500 to 3000 gpm. The METGCD has determined that average historical use of groundwater in Freestone County between 1984 and 2003 has been approximately 2784 ac-ft per year. The normal operation groundwater use of 975 gpm (1572 ac-ft/yr) represents 56 percent of the county's historical usage.

STPNOC stated that access to groundwater production from existing wells would be sought before requesting new or future groundwater capacity, and that water could be imported primarily for potable water use and thereby reduce groundwater demand (STPNOC 2009b). Thus, less new groundwater may be needed for operations at the Trinity 2 site. However, it is possible that plants operating at the Trinity 2 site would use a large fraction of the available groundwater resource for operations. Based on standard hydrogeologic practice, the review team determined that the amount of drawdown in the Carrizo-Wilcox Aquifer from groundwater pumping during operation could be limited by installing multiple, appropriately-spaced wells because groundwater could be withdrawn from a large area resulting in smaller drawdown. Because of the level of groundwater resource use and the potential for drawdown to occur over the operational period of the facility, the review team concludes that the impact of operational groundwater use at the Trinity 2 site would be noticeable. However, based on available information on the aquifer, and the authority of groundwater conservation districts to manage and permit groundwater resources (Texas Water Code, Chapter 36), the review team expects that the impact to the groundwater resource under a groundwater use permit issued by the applicable groundwater conservation district would not destabilize the groundwater resource.

During the operation of a potential plant at the Trinity 2 alternative site, impacts to groundwater quality could result from potential spills. Spills that might affect the quality of groundwater would be prevented and mitigated by BMPs. During operation of the potential plants at the Trinity 2 alternative site, some drawdown of the Carrizo-Wilcox Aquifer would be expected; however, the aquifer yields fresh groundwater with TDS levels of less than 500 mg/L (TWDB 2003). Because BMPs would be used to mitigate spills and no intentional discharge to groundwater should occur, the review team concludes that the groundwater-quality impacts from operation of two nuclear units at the Trinity 2 site would be minimal.

Cumulative Impacts

In addition to water use and water quality impacts from building and operations activities, cumulative analysis considers past, present, and reasonably foreseeable future actions that impact the same environmental resources. For the cumulative analysis of impacts on surface water, the geographic area of interest for the Trinity 2 site is considered to be the drainage basin of the Trinity River upstream and downstream of intake and discharge structures, and the drainage basin of Tehuacana Creek upstream and downstream of the Trinity 2 site because this is the resource that would be affected by the Trinity 2 project. For groundwater, the geographic areas of interest for cumulative analysis of the Trinity 2 site are aquifers underlying the site upgradient and downgradient of the site.

Water supply in the Trinity River Basin could change with implementation of potential water management strategies (e.g., Lake Tehuacana and Tennessee Colony Lake; Table 9-16). Key actions that have past, present and future potential impacts to water supply and water quality in the Trinity River basin include the existing Big Brown Power Plant, Freestone Energy Center, and Big Brown Lignite Coal Mine and Expansion (Table 9-16). Key actions that would have future potential impacts to water supply and water quality include the planned Lakeside Energy Center, Limestone 3 Coal Plant Expansion Project (Table 9-16), and the cooling water reservoir and/or water storage reservoir required for operation of the Trinity 2 site. The Lakeside Energy Center would use a new 640-MW gas-fired unit that may use water for cooling purposes. Unit 3 at the Limestone site would generate 744 MW and would use dry cooling, which would substantially reduce water consumption.

Cumulative Water Use

The only surface-water-use impacts of building and operating a nuclear power plant at this site are the water demands occurring during operation. The projected consumptive surface water use of the two potential units at the Trinity 2 site is expected to be about 50,000 ac-ft/yr or 4.3 percent of the total basin water rights (i.e., 1,169,000 ac-ft/yr), held by 475 water right owners in the Trinity River Basin. Future potential water use by other actions in the Trinity River Basin (e.g., Lakeside Energy Center and Limestone 3 Coal Plant Expansion Project) would also increase consumptive demand. Because the total rated power output of these power plants is smaller than that of the two proposed units, the review team concludes that the potential water use of these projects would likely be smaller than that for the two proposed nuclear units if they were to be operated at the Trinity 2 site; therefore the combined future water use would likely still be a relatively small fraction of the current water rights in the basin. Therefore, the review team concludes that the impact of these projects on the region's surface water use would be noticeable but not destabilizing.

Increases in consumptive use of water in the Trinity River drainage is anticipated in the future, however, the impacts of the other projects listed in Table 9-16 would have little or no impact on surface water use.

The review team is also aware of the potential for GCC affecting the water resources available for closed-cycle cooling and the impact of reactor operations on water resources for other users. The impact of GCC on regional water resources is not precisely known, however it may result in decreases in precipitation and increases in average temperature (Karl et al. 2009). Such changes could further stress regional water resources. However, the impacts related to GCC would be similar for all the alternative sites

Historically, the waters of the Trinity River Basin have been used extensively. The region has a planning, allocation, and development system in place to manage its limited surface water supplies. These efforts are described in the Regional and State Water Plans (Region C Regional Water Planning Group (RCRWPG) (TWDB 2006a, 2006b). As stated above, operation of the proposed units on the Trinity 2 site would result in a noticeable but not destabilizing impact to the surface water use in the region. Future projects in the region would also result in noticeable but not destabilizing impacts on surface water use in the region. Therefore, the review team concludes that cumulative impacts to surface water use would be MODERATE. Building and operating the proposed plant at the Trinity 2 site would be a significant contributor to these water-use impacts.

Groundwater-use impacts at this site are characterized by the groundwater demand at the STP site, and those use levels are 491 gpm (792 ac-ft/yr) during building, a normal operation demand of 975 gpm (1572 ac-ft/yr), and a maximum operation demand of 3434 gpm (5538 ac-ft/yr) (STPNOC 2009c). However, for maximum operation demand periods, STPNOC assumes that a temporary increase in the rate of surface water use would be available (STPNOC 2009b). During building and normal operation, the possibilities exist that STPNOC could (1) use a new groundwater permit and associated wells in the Carrizo-Wilcox aquifer, (2) acquire existing groundwater production from wells in the vicinity of the plant, and (3) use of imported water primarily for potable use onsite to reduce groundwater-use requirements (STPNOC 2009b). With regard to the groundwater resource used by all other past and present projects, the average use of the Carrizo-Wilcox aquifer in Freestone County is approximately 2784 ac-ft/yr. Normal operation demand for the proposed units, if they were placed at the Trinity 2 site, would represent a 56 percent increase in groundwater use within the Carrizo-Wilcox aquifer in Freestone County. The review team concludes this is a significant increase in use of the groundwater resource for future projects.

As indicated above, groundwater would be used during the building and operation of two nuclear units at the Trinity 2 site. Because of the alternatives available to supply groundwater, (i.e., new, acquired, imported), it is possible that new groundwater demand would be reduced. However, the METGCD is now working with the TWDB to establish the managed available groundwater quantity for the Carrizo-Wilcox aquifer. Accordingly, the review team concludes that based on available information on the aquifer, and the authority of groundwater conservation districts to manage and permit groundwater resources (Texas Water Code, Chapter 36), the impact to the groundwater resource under a groundwater use permit issued by the applicable groundwater conservation district would not destabilize the groundwater resource. Therefore, the review team concludes that cumulative impacts to groundwater use would be MODERATE. Building and operating the proposed units at the Trinity 2 site would be a significant contributor to this groundwater-use impact because the implied use of groundwater would exceed the current estimate of historical groundwater use from the Carrizo-Wilcox Aquifer in Freestone County by approximately 28 percent for building and 56 percent for operating the proposed units. The impacts of other projects listed in Table 9-16 would have little or no impact on groundwater use.

Cumulative Water Quality

Point and nonpoint sources in the river basin have affected the water quality of the Trinity River. The segment of the Trinity River to which the proposed units, if they were to be operated at the Trinity 2 site, would discharge effluent, appears on the State's 303(d) list as an impaired waterbody (TCEQ 2010b). Water quality information presented above for the impacts of building and operating the new units at the Trinity 2 site would also apply to evaluation of cumulative impacts. The State of Texas may require an applicant to obtain a general or individual permit for discharge of stormwater (Texas Water Code, Chapter 26). These permits may require an SWPPP that includes BMPs appropriate for the site (TCEQ 2001, 2003; STPNOC 2009a). The State of Texas would also issue TPDES permits for the discharge of sanitary and other wastewaters including blowdown from service water cooling towers and cooling water reservoir discharges before operation of the units at the Trinity 2 site. Effluent discharges through a TPDES-permitted outfall, such as those from the Big Brown Power Plant, Freestone Energy Center, amd Limestone Electric Generating Station, are required to comply with the Clean Water Act. Such permits are designed to protect water quality. Because historical discharges to the Trinity River have resulted in impairment of the segment near the Trinity 2 site, the review team concludes that the cumulative impact on surface water quality of the receiving water body would be MODERATE. Building and operating the proposed units at the Trinity 2 site would not be a significant contributor to these surface water quality impacts, because industrial and wastewater discharges from the proposed units would comply with TPDES permit limitations. The impacts of other projects listed in Table 9-16 would have little or no impact on surface water quality.

The review team also concludes that with the implementation of BMPs, the impacts to groundwater quality from building and operating two new nuclear units at the Trinity 2 site would likely be minimal. The individual impacts from other projects listed in Table 9-8 would have little or no impact on regional groundwater quality because of the local nature of groundwater withdrawals and their associated impacts. Therefore, the cumulative impact on groundwater quality would be SMALL.

9.3.4.3 Terrestrial and Wetland Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact terrestrial and wetland resources, including other Federal and non-Federal projects listed in Table 9-16. For the analysis of terrestrial ecological impacts at the Trinity 2 site, the geographic area of interest is the intersection of the East Central Plains ecoregion and the Trinity-Lower Tehuacana watershed (Figure 9-14 on the following page). This region is expected to encompass the ecologically relevant landscape features and species.

The Trinity 2 site is a greenfield site located 2.5 mi west and 5 mi south of the Trinity River. The site is in the Blackland Prairies subprovince of the Gulf Coast Plains. The blacklands have a gentle undulating surface that has been cleared of most natural vegetation for the cultivation of crops (UT 1996). The soils of the blacklands are chalks and marls that have weathered to deep, fertile clay soils. Pre-settlement conditions were that of a true prairie grassland community dominated by a diverse assortment of perennial and annual grasses and forbs, with sparsely scattered trees or mottes of oaks (*Quercus* sp.) on the uplands (TPWD 2009a). Forested or wooded areas were restricted to bottomlands along major rivers and streams, ravines, protected areas, or on certain soil types. Trees such as pecan (*Carya illinoinesis*), cedar elm (*Ulmus crassifolia*), cottonwoods (*Populus* sp.), various oaks, and hackberry (*Celtis* sp.) dotted the landscape (TPWD 2009b). The dominant grass was the little bluestem (*Schizachyrium scoparium*); other grasses included the big bluestem (*Andropogon geradrii*), Indian grass (*Sorghastrum* sp.), eastern gamagrass (*Tripsacum dactyloides*), switchgrass (*Panicum virgatum*), and sideoats grama (*Bouteloua curtipendula*).

Currently in the region surrounding the Trinity 2 site, there is a mixture of post oak woods, improved pasture, and rangeland (STPNOC 2009b). There is also a surface lignite mining operation to the west. Onsite drainages include Tehuacana Creek, Big Brown Creek, and Rock Springs Branch. Big Brown Creek is dammed in its middle reaches to form Fairfield Lake; it flows into Tehucana Creek. Big Brown Creek crosses rolling prairie with local shallow depressions, surfaced by clay and sandy loams that support hardwoods, mesquite, conifers, and grasses. The area is used primarily for dryland farming. Tehuacana Creek flows into the Trinity River and passes through terrain similar to Big Brown Creek. The area supports water-tolerant hardwoods, conifers, and grasses (STPNOC 2009a).

The total acreage for all temporary and permanent impacts at the Trinity 2 site is 800 ac for the plant site and 1700 ac for the reservoir. Permanent impacts associated with building two new nuclear units would include approximately 150 ac for each unit (300 ac total) and a new 1700-ac reservoir for cooling water for the plant (STPNOC 2009a). While specific habitat acreages have not been determined for the site, Table 9-17 gives approximate acreages by land cover class for areas expected to receive permanent impacts. No assessment was made for land cover classes expected to receive temporary impacts (STPNOC 2009a).

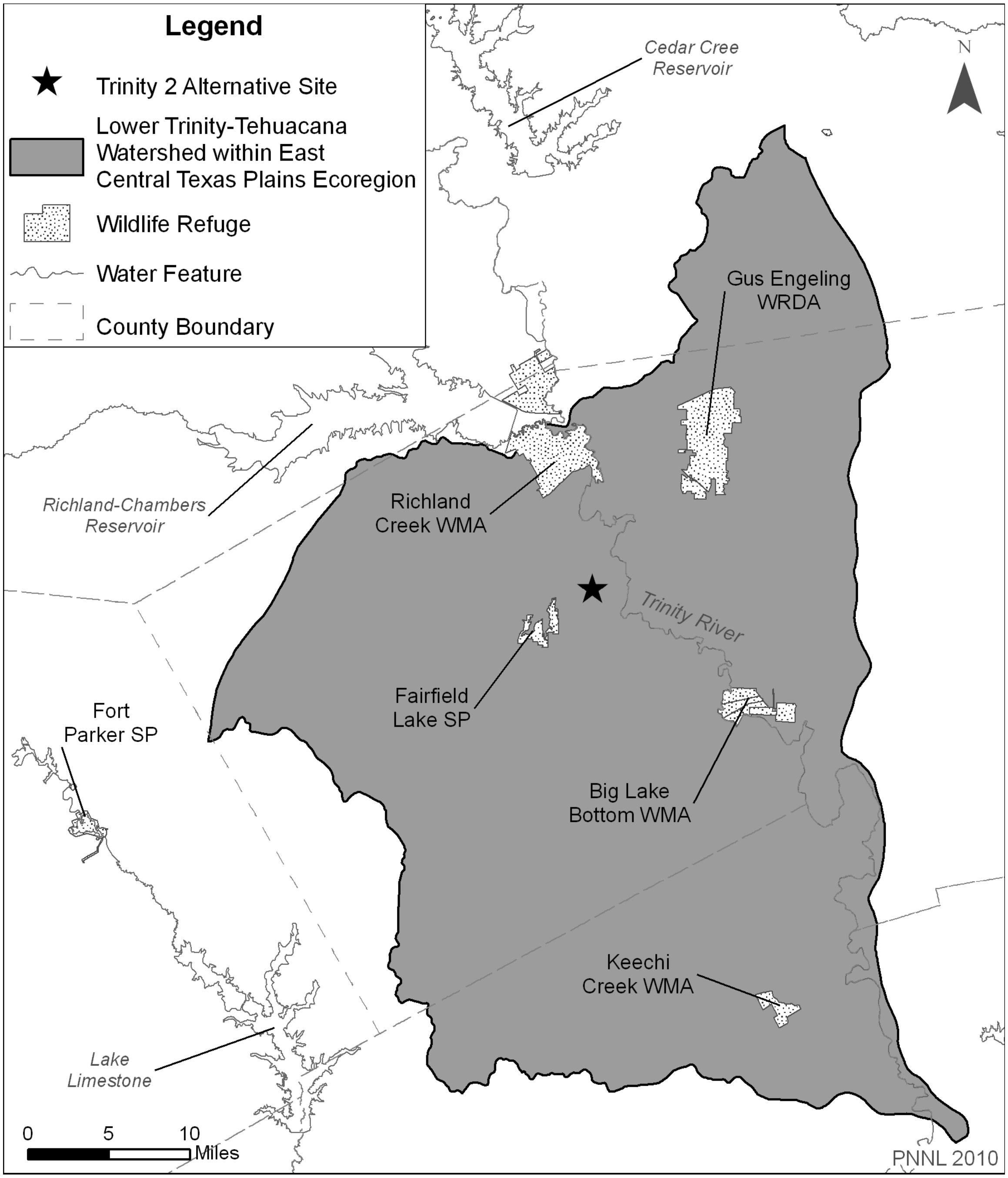


Figure 9-14. Geographic Area of Analysis of Cumulative Impacts to Terrestrial Resources for the Trinity 2 Site in Freestone County

Table 9-17. Estimated Land Cover Classes for Approximately 2000 ac of the 2500-ac Trinity 2 Site.

Land Cover Class	Plant (ac)	Reservoir (ac)
Forested (includes 80 ac of high-quality forested wetlands)	160	190
Open land/grasslands	140	1460
Developed areas (roads, drill pads)		30
Water resources/freshwater ponds		20

Source: STPNOC 2009a
Note: Estimates are for areas receiving permanent impacts and are based on Google Earth Imagery

No digitized wetland maps are available for the site area, so wetland acreage was estimated using United States Geological Survey (USGS) quadrangle maps that encompass the site (i.e., Young (1988) and Yard (1980)) (STPNOC 2009a). Within the 2000- ac area for the Trinity 2 site receiving permanent impacts, wetlands appear to be limited to the northern portion. These wetlands include several high-quality forested wetlands (80 ac total) with several small freshwater ponds (20 ac total). Approximately 15 of the 100 ac appear to be located in the area where the plant would be located; 10 ac of the 15 ac are high quality forested wetlands. The remaining wetland areas fall within the footprint of the reservoir.

There are numerous wildlife areas located near the Trinity 2 site (STPNOC 2009b) including the Fairfield Lake State Park, 4-mi southwest of the site, the Richland Creek WMA approximately 10 mi north of the site, the Gus Engeling WMA, approximately 16 mi northeast of the site, and the Big Lake Bottom WMA 11 mi east-southeast of the site. The woods at the Fairfield Lake State Park include oak, hickory, cedar elm, dogwood, and redbud, and mark the transition zone between pine forests to the east and the prairie grasslands to the north and west (TPWD 2009c). Wildlife found at the park include osprey, bald eagles (November through February), white-tailed deer, raccoons, foxes, beaver, squirrels, and armadillos. The Richland Creek WMA supports a wide variety of bottomland and wetland dependent wildlife and vegetation communities which serves as nesting and brood rearing habitat for many species of neotropical birds (TPWD 2009c). In addition, the area has numerous marshes and sloughs which provide habitat for migrating and wintering waterfowl, wading and shore birds. The Gus Engeling WMA is comprised of 2000 ac of hardwood bottomland floodplain and almost 500 ac of natural watercourse, 350 ac of wetlands, and nearly 300 ac of sphagnum moss bogs (TPWD 2009c). There are two Ecologically Significant River and Stream Segments near the Trinity 2 site: the Trinity River from the Freestone/Anderson/Leon County line upstream to the Anderson/Henderson County line, and Buffalo Creek, from the confluence with Alligator Creek in Freestone County upstream to State Route 164 in Freestone County (TPWD 2010). In addition, drainage in the area feeds Catfish Creek, a tributary of the Trinity River. Eight mi of the creek have been designated as a “Natural National Landmark” by the U.S. Department of Interior (NPS 2009). Currently wildlife in the Gus Engeling WMA comprises nearly 40 species of mammals, 156 species of birds, 54 species of reptiles and amphibians, and 900 plant species.

More than 90 percent of the Big Lake Bottom WMA is bottomland habitat of mature hardwood timber with more than 450 plant species (TPWD 2009c). Wildlife species include white-tailed deer, feral hog, ducks, mourning dove, fox squirrel, gray squirrel, raccoon, skunk, armadillo, coyote, grey fox, plus numerous species of reptiles and migratory birds.

Important Species

A range of recreationally important wildlife species occur at the site (STPNOC 2009b) including white-tailed deer (*Odocoileus virginianus*), mourning dove (*Zenaida macroura*), and northern bobwhite (*Colinus virginianus*) on the uplands, and eastern fox squirrel (*Sciurus niger*) along stream bottoms (STPNOC 2009a). The Tehuacana Creek area, north of the Trinity 2 site, contains excellent deer and wild turkey habitat (STPNOC 2009b). Generally these species are habitat generalists (NatureServe 2009a), although lack of nesting and brood rearing habitats for the turkey and northern bobwhite have led to their decline (TPWD 2009e). The site lies within the Central Flyway of Texas (STPNOC 2009b) and provides habitat for rest and forage opportunities during migration.

Up to seven bat species living in eastern Texas, can occur in Freestone County (Davis and Schmidly 1994; STPNOC 2009b). Some are mostly year-round residents (i.e., non-migratory), such as the big brown bat (*Eptesicus fuscus*), the eastern pipistrelle (*Pipistrellus subflavus*), and evening bat (*Nycticeius humeralis*). Migratory bats that could occur at the site include the hoary bat (*Lasiurus cinereus*), the silver-haired bat (*Lasionycteris noctivagans*), the eastern red bat (*Lasiurus borealis*), and the Mexican free-tailed bat (*Tadarida brasiliensis*). The Mexican free-tailed bat is either migratory or non-migratory depending on where it resides; the migratory status of bats occurring in Freestone County is currently unknown (STPNOC 2009b).

No site-specific surveys have been conducted for threatened and endangered species at the Trinity 2 site. The following list for Freestone County (Table 9-18 on the following page) is from the Texas Parks and Wildlife Threatened and Endangered Species by County website (TPWD 2009c) and the U.S. Fish & Wildlife Service Ecological Service T&E species for the Southwest region website (FWS 2009a). The list includes four species on the Federal-endangered list (FWS 2009a), and an additional ten species on the State-endangered and threatened species list (TPWD 2009f).

Table 9-18. Federally and State-listed Threatened and Endangered Species in Freestone County, Texas

Group	Common Name	Scientific Name	Federal Status	State Status
Plants	Large-fruited sand-verbena	*Abronia macrocarpa*	E	E
	Navasota ladies'-tresses	*Spiranthes parksii*	E	E
Amphibians	Houston toad	*Bufo houstonensis*		E
Reptiles	Alligator snapping turtle	*Macrochelys temminckii*		T
	Texas horned lizard	*Phrynosoma cornutum*		T
	Timber/canebrake rattlesnake	*Crotalus horridus*		T
Birds	American peregrine falcon	*Falco peregrinus anatum*		T
	Bachman's sparrow	*Aimophila aestivalis*		T
	Bald eagle	*Haliaeetus leucocephalus*		T
	Interior least tern	*Sterna antillarum athalassos*	E	E
	Piping plover	*Charadrius melodus*		T
	Whooping crane	*Grus americana*	E	E
	Wood stork	*Mycteria americana*		T
Mammals	Red wolf	*Canis rufus*		E

Sources: FWS 2009a and TPWD 2009f
T = threatened; E = endangered

Large-fruited sand-verbena

Large-fruited sand-verbena (*Abronia macrocarpa*) is a Federally and State-listed endangered species (FWS 2009a; TPWD 2009f). This plant lives in sandy openings in post oak-grassland mosaic vegetation type (NatureServe 2009b). It is sometimes found on actively blowing sand dunes. The species can temporarily dominate bare sand areas during the spring. This plant is distributed in Freestone and two other counties in Texas (TPWD 2009g).

Navasota ladies'-tresses

The orchid, Navasota ladies'-tresses (*Spiranthes parksii*), is a Federally and State-listed endangered species (FWS 2009a; TPWD 2009f). This plant is endemic to the Oak Woodlands and Prairies region of east-central Texas (TPWD 2009g). It occurs primarily in seasonally moist soils along open wooded margins of creeks, drainages, and intermittent tributaries of the Brazos and Navasota rivers. Once thought to be extremely rare, it is now known to be locally common in parts of its range which includes Freestone County.

Houston toad

The Houston toad (*Bufo houstonensis*) is a State-listed endangered species (TPWD 2009f). It lives primarily on land and burrows into sand for protection from cold weather in the winter and from hot, dry conditions in the summer. The toads are found in areas with loose, deep sand supporting woodland savannah and in proximity to still or flowing waters for breeding (TPWD 2009g). The toads have been recorded in Freestone County and in the Trinity River watershed (NatureServe 2009b).

Alligator snapping turtle

The alligator snapping turtle (*Macrochelys temminckii*) is a State-listed threatened species (TPWD 2009f). It is found in slow-moving, deep water of rivers, sloughs, oxbows, and canals or lakes associated with rivers; also swamps, and ponds near rivers, and shallow creeks that are tributary to occupied rivers (NatureServe 2009b). It usually occurs in water with mud bottoms and abundant aquatic vegetation; it may migrate several miles along rivers (TPWD 2009g). Turtles are rarely found out of the water except when nesting. The turtles have been recorded in the Upper and Lower Trinity watersheds (NatureServe 2009b).

Texas horned lizard

The Texas horned lizard (*Phrynosoma cornutum*) is a State-listed threatened species (TPWD 2009f). It can be found in arid and semiarid habitats in open areas with sparse plant cover (TPWD 2009g). They dig for hibernation, nesting, and insulation purposes, and are commonly associated with loose sand or loamy soils. Populations have declined precipitously in eastern Texas and their decline may be related to the spread of fire ants, use of insecticide to control fire ants, heavy agricultural use of the land and other habitat alterations (NatureServe 2009b). Another factor implicated in their decline is over-collecting for pet and curio trade. This species is particularly vulnerable to the loss of harvester ants which make up nearly 70 percent of their diet.

Timber/canebrake rattlesnake

The timber rattlesnake (*Crotalus horridus*) is a State-listed threatened species (TPWD 2009f). It prefers moist lowland forests and hilly woodlands or thickets near permanent water sources such as rivers, lakes, ponds, stream and swamps (TPWD 2009g). Their range extends from central New England to northern Florida, and west to eastern Texas, where their distribution is spotty (NatureServe 2009b).

American peregrine falcon

The American peregrine falcon (*Falco peregrines anatum*) is a State-listed threatened species (TPWD 2009f). The bird is a year-round resident and local breeder in west Texas where it nests in tall cliff eyries (TPWD 2009g). The bird also migrates across Texas from breeding areas in the United States and Canada to winter along the coast and farther south. The American peregrine falcon occupies a wide range of habitats during migration, including urban areas.

Populations are primarily concentrated along coast and barrier islands. The birds are low-altitude migrants, with stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bachman's sparrow

Bachman's sparrow (*Aimophila aestivalis*) is a State-listed threatened species (TPWD 2009f). The sparrow is a permanent resident that occurs only in the far eastern portion of the state (Benson and Arnold 2001). It prefers areas with a high density of herbaceous cover and an open overstory. It historically was found in pineywoods with mature, open pine forests and savannah maintained by frequent fires. Today, with the dramatic decline in this forest type, the sparrow seems to tolerate treeless, grassy areas, abandoned fields or early stages of regenerating clearcuts.

Bald eagle

Although recently delisted as a Federally endangered species, the bald eagle (*Haliaeetus leucocephalus*) is listed as threatened in Texas and will remain Federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (TPWD 2009f). The species will also continue to be protected under the ESA through management guidelines that will be in place for the next five years. Most eagles breed in Canada and the northern United States and move south for the winter (NatureServe 2009b). Bald eagles can be year-round residents in areas where water bodies do not freeze. Winter roost sites can vary with proximity to food resources, and eagles commonly roost communally in large trees, preferably snags.

Interior least tern

The interior least tern (*Sterna antillarum athalassos*) is a Federally and State-listed endangered species (FWS 2009a; TPWD 2009f). The birds breed along major inland river systems but appear to be restricted to less altered and more natural river segments (TPWD 2009g). Interior least terns nest on bare or sparsely vegetated sand, shell, and gravel beaches, islands, and salt flats associated with rivers and reservoirs. The birds prefer open habitat and avoid thick vegetation and narrow beaches. They arrive at breeding areas in early April to early June after wintering along the Central American coast and the northern coast of South America.

Piping plover

The piping plover (*Charadrius melodus*) is a State-listed threatened species (TPWD 2009f). This species is Federally-listed as threatened in the state of Texas, but is not listed as occurring in Freestone County by FWS (FWS 2009a). Texas is the wintering home for more than 5000 known breeding pairs which have migrated from the Great Lakes regions and southern Canada

(TPWD 2009g). They live on sandy beaches and lakeshores along the Gulf coast and could migrate through Freestone County.

Whooping crane

The whooping crane (*Grus americana*) is a Federally and State-listed endangered species (FWS 2009a; TPWD 2009f). They breed in Canada during the summer months and migrate in the fall to the Aransas National Wildlife Refuge along the Texas coastal plain, staying there from November through March (TPWD 2009g). Their winter and migrating habitat includes marshes, shallow lakes, lagoons, salt flats, grain and stubble fields (NatureServe 2009b). Migration habitat includes sites with good horizontal visibility, water depth of 30-cm or less, and a minimum wetland size of 0.04-ha for roosting.

Wood stork

The wood stork (*Mycteria americana*) is a State-listed threatened species (TPWD 2009f). Nesting appears to be restricted to Florida, Georgia, and South Carolina, however they may have formerly bred in Texas (FWS 2009b), but there are no breeding records since 1960 (TPWD 2009g). Wood storks forage in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water. The birds usually roost communally in tall snags, sometimes in association with other wading birds (i.e., active rookeries). A distinct, non-listed population of wood storks breed in Mexico and birds then move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas.

Red wolf

The red wolf (*Canis rufus*) is a State-listed endangered species (TPWD 2009f). Red wolves inhabited brush and forested areas, as well as the coastal prairies (Davis and Schmidly 1994). They formerly ranged throughout eastern Texas, but appear to now be extinct.

Building Impacts

Building two nuclear power units and a reservoir at Trinity 2 would affect up to 2500 ac of land resulting in the permanent loss of 2000 ac of terrestrial habitat. Three-hundred ac would be required for permanent structures, and facilities, and up to 1700 ac would be for a new reservoir. Of the acreage that would be permanently affected, 350 ac would be forested including 80 ac of high quality forested wetlands (Table 9-17) and 1600 ac of open grasslands. In addition, the land required for transmission corridors, water pipelines, road, or rail access is estimated to impact an additional 303 ac. The water storage reservoir would be created off of Tehuacana Creek (STPNOC 2009a), and would flood portions of Tehuacana Creek, Big Brown Creek, and other smaller tributaries in the area (STPNOC 2009a). The project could result in localized, direct, and adverse impacts to wetlands.

To accommodate the building and operation of two nuclear units on the Trinity 2 site, STPNOC would need to clear undisturbed terrestrial habitats to connect existing power lines with new lines (STPNOC 2009a). The terrain along the likely transmission corridor is similar to that of the Trinity 2 site (STPNOC 2009b). The Trinity 2 site is 2.6 mi east of the Big Brown Power Plant and new lines would traverse a distance of 5 mi to connect to multiple 345kV lines. A new corridor would be needed to access these lines. Based on 5 mi and a 200-ft width corridor, installation of new lines would impact 120 ac in Freestone County. Although the most direct route would be used, efforts would be made to avoid natural or man-made areas where important environmental resources are located. No areas designated by the FWS as critical habitat for endangered species exist on the Trinity 2 site or adjacent to associated transmission lines (FWS 2009d). Erection of transmission towers and stringing of new lines would be expected to comply with all applicable laws, regulations, permit requirements, and use of best management practices. (STPNOC 2009a)

In addition to transmission lines, there would be possible impacts associated with the building of pipelines to deliver cooling water to the reservoir/plant site. Transportation corridors (both road and rail) would also be needed at the Trinity 2 site. Acreage estimates for these activities are: 120 ac for 19.5 mi of rail (50-ft width), 36 ac for 4 mi of pipeline for the cooling water intake/ discharge between the Trinity River and new reservoir (75-ft width), and 27 ac for a 3.0-mi access road (75-ft width) (STPNOC 2009a).

There are no published records of Federal or state-listed species were available from the Trinity 2 site (STPNOC 2009a). Federally and State-listed species for Freestone County were discussed above. No critical or sensitive habitats have been identified in the site area although portions of the Trinity River and Tehuacana Creek include Priority Bottomland Hardwood habitat which have high habitat resource value, particularly for waterfowl. The site area, particularly along Tehuacana Creek heading towards Richland-Chambers Reservoir contains excellent deer, wild turkey, and grey squirrel habitat. The Richland Creek WMA is within 7 mi of the site. The WMA was created to compensate for habitat loss associated with the construction of the Richland-Chambers Reservoir; it was developed to provide habitat for indigenous and migratory wildlife species (TPWD 2009c).

Building two new nuclear units at the Trinity 2 site would result in the permanent loss of approximately 2000 ac of terrestrial habitat including 350 ac of forested habitat and 80 ac of wetlands. However, the new reservoir would provide habitat for waterfowl. Clearing land for the transmission line corridor would increase habitat fragmentation along the 5-mi corridor. Other sources of impacts to terrestrial resources such as noise, increased risk of collision and electrocution, and displacement of wildlife would likely be temporary and result in minimal impacts to the resource. Building the two new units would noticeably alter the available terrestrial habitat.

Operational Impacts

Impacts on terrestrial ecological resources from operation of two new nuclear units at the Trinity 2 site would include those associated with transmission system structures, and maintenance of transmission line corridors. Also, during plant operation, wildlife would be subjected to impacts from increased traffic. An evaluation of specific impacts resulting from presence of transmission lines and transmission line corridor maintenance cannot be conducted in any detail due to the lack of information, such as the locations of any new corridors that could result from transmission system upgrades. However, in general, impacts associated with transmission line operation consist of bird collisions with transmission lines, EMF effects on flora and fauna, and habitat loss due to corridor maintenance.

Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to low, fast flight and flocking behavior (Brown 1993). Although additional transmission lines would be required for two new nuclear units at Trinity 2, increases in bird collisions directly attributable to these lines would be minor and these would likely not be expected to cause a measurable reduction in local bird populations. Consequently, the incremental direct mortality posed by the addition of new transmission lines for two new nuclear units would be negligible at Trinity 2.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NIEHS 2002). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NIEHS 2002). The magnetic fields from many lines, at a distance of 300 ft are similar to typical background levels in most homes (NIEHS 2002). Thus, impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003).

The impacts associated with corridor maintenance activities are loss of habitat due to cutting and herbicide application. The maintenance of transmission-line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments. Thus, corridor maintenance would not be expected to increase and contribute to cumulative effects.

The potential effects of operating two new nuclear reactors at the Trinity 2 site would be primarily associated with maintenance of transmission corridors and increased traffic. Operational impacts to terrestrial resources would be expected to be minimal.

Cumulative Impacts

The impacts of building and operating two units at Trinity 2 were evaluated to determine the magnitude of their contribution to regional cumulative impacts on terrestrial ecological resources. The geographic area of interest for cumulative impacts is the intersection of the East Central Texas Plains ecoregion with the Lower Trinity-Tehucana watershed (Figure 9-14). There are a number of past, present, and potential future projects that could affect the terrestrial and wetland resources (Table 9-16). Past actions that have affected terrestrial resources include building the Big Brown Power Plant, approximately 3 mi west of the Trinity 2 site, and the Freestone Energy Center, approximately 7 mi northwest of the site. A third project is the Big Brown Mine, 4 mi northwest of the site. Luminant Mining, LLC, owner of the Big Brown Mine, has mined, leveled, and reclaimed 11,499 ac at the mine site (Gentry 1997).

Projects or actions listed in Table 9-16 that could have future impacts on terrestrial resources include the Lakeside Energy Center, a 640-MW natural gas plant, planned for construction approximately 12 mi northwest of the Trinity 2 site. About 35 ac of terrestrial habitat would be needed for the site (Fairfield 2009). Luminant Mining, LLC is proposing to open the Turlington Mine next to the Big Brown Mine to mine an additional 10,000 ac at their facility 4 mi northwest of Trinity 2 site. There are several planned but currently unfunded highway widening projects within the geographic area of interest. In addition, two reservoirs are planned for the region: the Tehuacana Reservoir (approximately 15,000 ac) and the Tennessee Colony Lake (approximately 85,000 ac); both would inundate substantial areas of terrestrial habitat.

The review team is also aware of the potential for GCC affecting the terrestrial resources in the geographic area of interest. The future impact of GCC on plant and wildlife species and their habitat in the geographic area of interest is not precisely known. GCC effects near the Trinity 2 site could result in regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (Karl et al. 2009). The decrease in precipitation combined with increased temperatures and evaporation could result in more frequent droughts. Such changes in climate could alter and fragment terrestrial habitats (grasslands, forests, and wetlands) and result in shifts in species ranges, diversity, and abundance in the geographic area of interest for the Trinity 2 site (Karl et al. 2009). Because of the regional nature of climate change, the impacts related to GCC would be similar for all the alternative sites, as they are all in the Great Plains Region.

The potential cumulative impact to terrestrial resources within the area of interest given the two new reactors and cooling reservoir at the Trinity 2 site, the proposed Turlington Mine, the building of a new power plant, and the potential construction of two additional reservoirs would noticeably alter terrestrial resources. All these activities would remove or modify terrestrial habitats with the potential to affect important species living or migrating through the area. The incremental contribution of building and operating the two reactors at the Trinity 2 site to the cumulative impacts within the geographic area of interest would be significant.

Summary

Impacts to terrestrial ecology and wetland resources were estimated based on information provided by STPNOC and the review team's own independent review. The review team concludes that there would be a loss of about 10 ac of high-quality forested wetlands associated with building two new nuclear units at the Trinity 2 site. Additional impacts to terrestrial resources would occur at the reservoir location based on the potential for affecting 350 ac of forested land, including high quality bottomland hardwood habitat, wetlands, and to a number of protected species that could potentially occur in the area. Although there is uncertainty concerning the possible routing of a new transmission line corridor, building impacts would probably be minimal given the small distance to existing transmission lines. There are several future activities in the region that would noticeably affect wildlife and wildlife habitat. These activities include the opening of the Turlington Mine, building the Lakeside Energy Center, and development of two large reservoirs (Tennessee Colony and Tehuacana). Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the cumulative impacts within the area of interest on terrestrial plants and animals, including threatened or endangered species, and wildlife habitat in the region would be MODERATE. For the reasons discussed above in Building Impacts and Operational Impacts, the incremental contribution of building and operating two units at Trinity 2 and its associated reservoir to cumulative impacts within the geographic area of interest would be significant.

9.3.4.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact aquatic resources, including other Federal and non-Federal projects listed in Table 9-16. For the analysis of aquatic ecological impacts at the Trinity 2 site, the geographic area of interest is considered to be the Trinity River drainage basin, from the upstream reaches of the Richland Chambers Reservoir to the proposed Tennessee Colony dam site (Region C 2010) because this is the area that the aquatic resources could be affected by new nuclear units.

Aquatic resources of the Trinity 2 site are associated with the Trinity River, Lake Fairfield, and local drainages (Tehuacana Creek, Big Brown Creek, and Rock Springs Branch). (The Trinity River has been significantly influenced by urbanization and growth both upstream (Dallas-Fort Worth) and downstream (Houston). Water conditions in the Trinity River deteriorated to the point where numerous fish kills were common, even as recently as 1985 (USGS 2005). Through efforts to address wastewater discharge and manage water withdrawal, the Trinity

River's aquatic ecology has rebounded in recent years. Surveys of fish in the river have shown the improvement over time. From 1972-74, six surveys for fish were conducted and only four species of fish were identified (smallmouth buffalo [*Ictiobus bubalus*], gizzard shad [*Dorosoma cepedianum*], common carp [*Cyprinus carpio*], and yellow bass [*Morone mississippiensis*]), and no fish were collected in four of the six surveys. TPWD conducted additional surveys in 1987 that indicated species richness was still low but the identification of 11 fish species was an indication of improvements to the aquatic resources. The most recent studies, performed by the USGS from 1993 to 1995, found a cumulative total of 25 fish species, including several game indigenous species. The presence of two darter species (bigscale logperch [*Percina macrolepida]* and slough darter [*Etheostoma gracile]*) suggests that the Trinity River is starting to recover and return to more natural conditions (USGS 2005). Today, the Trinity River in the vicinity of the Trinity 2 site is considered an ecologically significant stream segment based on its biological function, riparian conservation area, and the presence of protected aquatic species (TPWD 2010).

Lake Fairfield supports the Big Brown Power Plant. The lake is an off-channel reservoir, and was formed by the damming of Big Brown Creek. Recreational fishing is popular in the lake and several fishing tournaments take place there every year.

The area for a new reservoir to support the Trinity 2 site is located in the vicinity of Tehuacana Creek, Big Brown Creek, and Rock Springs Branch. No stream surveys for aquatic resources have been identified for Tehuacana Creek, Big Brown Creek, and Rock Springs Branch. Big Brown Creek begins three mi southwest of Fairfield in central Freestone County., and runs northeast 13 mi to the confluence with Tehuacana Creek, which is 4 mi east of Lake Fairfield. Tehuacana Creek flows from outside the town of Tehuacana for 42 mi to the confluence with the Trinity River. Tehuacana Creek and its major tributaries have been reported as having intermittent flow conditions; yet small potholes remain full of water during the drier periods of the year.

Within the Trinity River drainage basin, from the upstream reaches of the Richland Chambers Reservoir to the proposed Tennessee Colony Dam site, there are a number of past, present, and potential projects that could affect the aquatic resources (Table 9-16). Past actions included building the lignite coal-powered Big Brown Power Plant, natural gas-powered Freestone Energy Center, Big Brown Lignite Coal Mine, and the Streetman Expanded Shale and Clay Plant. The Big Brown Lignite Coal Mine has plans to begin expanding its mining activities (Turlington mine). The natural gas-powered Lakeside Energy Center is another proposed power-related project in the region. The Trinity River Authority has proposed additional reservoirs to be constructed off the Trinity River: Tennessee Colony and Tehuacana Reservoirs. In addition, the new nuclear units at the Trinity 2 alternative site would require building water intake and discharge systems with associated pipelines from the Trinity River to the new cooling water reservoir, inundation of existing water features at the Trinity 2 site, and establishing and operation of associated transmission corridors to connect with the existing power grid. Without having the specific plans for locating all facilities at the Trinity 2 site, the potential for impacts from building and operation of the new units to aquatic biota are assumed to be primarily to the organisms inhabiting the Trinity River, Tehuacana Creek, Big Brown Creek, and Rock Springs Branch.

Non-Native and Nuisance Species

No non-native or nuisance species have been recorded in the area as a problem. However, there are numerous nuisance aquatic species that TPWD considers to be ubiquitous across waterways in Texas. TPWD works to educate recreational boaters to remove nuisance aquatic plant species across the state and in the area of the Trinity 2 site. These species include: hydrilla, waterhyacinth, and giant salvinia. In addition, the Trinity River basin is known to have the following non-native fish introduced to its waters: common carp, grass carp, blacktail shiner, bullhead minnow, rudd, black buffalo, black bullhead, Western starhead topminnow, redspotted sunfish, tadpole madtom, plains killfish, yellow perch, red drum (*Sciaenops ocellatus*), tilapia (*Oreochromis aureus*) and walleye (Thomas et al 2007; Hassan-Williams and Bonner 2009; TPWD 2009h).

Important Species

Recreational fishing is popular in the region of the Trinity 2 alternative site, particularly in Lake Fairfield. Access for recreational fishing in the Trinity River in the vicinity is limited because boat access is difficult. In Lake Fairfield, fishing for the following species is popular: alligator gar, largemouth bass, catfish (blue, channel, and flathead), and sunfish (longear [*Lepomis megalotis*], redear [*L. microlophus*], and hybrids) (TPWD 2007; STPNOC 2009a). Recreational and commercially important species for the Trinity River basin include the bluegill, blue catfish, channel catfish, flathead catfish, white crappie, black crappie, striped mullet (*Mugil cephalus*), white mullet (*M. curema*), and warmouth (Thomas et al. 2007; TPWD 2007; Hassan-Williams and Bonner 2009). The centrachids (largemouth bass, bluegill, crappies, sunfishes, and warmouth) typically inhabit lakes, rivers, and smaller flowing tributaries. The bass and warmouth are top carnivores, whereas the bluegill and crappies are insectivores. Alligator gar and catfish are top carnivores and are found primarily in larger waterbodies, like rivers and reservoirs. The striped and white mullet are more commonly found on the coast, and it is unclear if they travel and forage above Lake Livingston, which is below the Trinity 2 site (Thomas et al. 2007; Hassan-Williams and Bonner 2009).

There are no Federally listed aquatic species protected under the ESA in Freestone County. TPWD has identified numerous rare and protected aquatic species in Freestone County. These include several benthic macroinvertebrates that have been determined to be rare and located in the Trinity River basin: Morse's net-spinning caddisfly (*Cheumatopsyche morsei*), Holzenthal's philopotamid caddisfly (*Chimarra holzenthali*), purse casemaker caddisfly (*Hydroptila ouachita*), and another caddisfly (*Phylocentropus harrisi*). These invertebrates live on the bottom of streams (lotic systems) until they emerge from the water as a flying adult. One of the interesting characteristics of caddisflies is that the larvae produce and live inside cases, constructed of material gathered from the stream and held together by silk. Various families of caddisfly have unique cases. As larvae, they eat plants and periphyton. They are important in the food web for streams at all life stages as food for fish and birds. These organisms are not likely to thrive in slow or standing water, such as in a reservoir (Cushing and Allan 2001).

TPWD has also identified a number of rare and protected freshwater mussels in the Trinity River basin: rock pocketbook (*Arcidens confragosus*), Wabash pigtoe (*Fusconaia flava*), creeper (or squawfoot) (*Strophitus undulatus*), pistolgrip (*Tritogonia verrucosa*), fawnsfoot (*Truncilla donaciformis*), and little spectaclecase (*Villosa lienosa*). Not much is known about the distribution of these mussels in the area. However, these types of mussels, known as unioid mussels, are found in various water flows, from fast moving riffles in streams to quiescent ponds. Each species has adapted to a particular flow regime. These unioid mussels have a larval stage called a glochidium. For glochidia to mature to juvenile mussels, they must live as a parasite in the gill tissues of a host fish. An important component to the distribution of freshwater mussels in various water bodies is associated with the relationship between the mussels and the host fish (TPWD 2009d, 2009i).

In addition, TPDW has proposed to list as threatened four species of freshwater, unioid mussels that are found in Freestone County: Texas pigtoe (*Fusconaia askewi*), sandbank pocketbook (*Lampsilis satura*), Louisiana pigtoe (*Pleurobema riddellii*), and Texas heelsplitter (*Potamilus amphichaenus*) (

Table **9-19** on the following page) (TPWD 2009i; 35 Texas Register 249). These unioid mussels have similar life histories to those mentioned above. The Trinity River has one of the two largest populations of the Texas heelsplitter in the State, and has been noted as part of the designation for this reach of the river as an ecologically significant stream segment. The Texas pigtoe and the sandbank pocketbook mussels are being considered for protective status by the FWS (TPWD 2009i).

Table 9-19. Federally and State-Listed Aquatic Species that are Endangered, Threatened, and Species of Concern for Freestone County

Scientific Name	Common Name	State Status
Mussels		
Fusconaia askewi	Texas pigtoe	T
Lampsilis satura	sandbank pocketbook	T
Pleurobema riddellii	Louisiana pigtoe	T
Potamilus amphichaenus	Texas heelsplitter	T

Source: State species information provided by TPWD (TPWD 2009; 35 Texas Register 249).
T = State Listed Threatened

Building Impacts

Impacts of building a cooling water reservoir may be significant depending on the siting of the reservoir. The plans are for inundating portions of Tehuacana and Big Brown Creeks as well as other smaller tributaries in the area. Impacts from onsite building activities that have the potential to cause erosion and sedimentation in the local water bodies would be controlled or minimized by the implementation of an SWPPP (STPNOC 2009a). Inundation of small flowing streams would affect those aquatic resources that have specific habitat requirements. Fish species that have habitat requirements associated with lotic systems (flowing water) are often replaced with species more suited to lentic environments (standing water) (Linam et al. 1994). Habitat for these lotic species found in Tehuacana and Big Brown Creeks, associated wetlands, and drainages would be lost when these water bodies are inundated to create the reservoir, including any spawning areas for fish species that are dependent on flowing water. Most freshwater mussel species are adapted to a specific flow regime, and the inundation of this area could affect the distribution of the organisms in the region (STPNOC 2009a; TPWD 2009i). If habitat for the any of the State-listed mussels is found in the area to be inundated for the creation of the reservoir, TPWD might require mitigation activities (e.g., mussels could be collected and relocated).

Water intake and discharge structures along the shoreline of the Trinity River would be required for the new reservoir at the Trinity 2 site (STPNOC 2009a). Building of a new intake and discharge in the Trinity River would likely require dredging and other significant alterations to the shoreline aquatic habitat. These activities would be permitted by the Corps and would be required to meet all State water quality requirements. Building of these structures on the Trinity River would result in the temporary displacement of aquatic biota within the vicinity of both structures. It is expected that the motile aquatic organisms would be displaced temporarily during building. However, the sessile aquatic biota (e.g., mussels) would be lost during building activities if the river substrate was removed or sedimentation covered the bottom of the river burying the organisms. Organisms like the mussel could possibly recolonize the disturbed river substrate with time. For the most part, the impacts on aquatic organisms would be temporary and largely mitigable through the use of BMPs (e.g., silt screens). If required by TPWD, State-listed mussels could be surveyed and removed before building activities as a mitigation action.

Building transportation routes (heavy haul road and railroad spur), pipeline and transmission lines for the Trinity 2 site would result in the temporary displacement of some aquatic biota. Locations for these systems have not been identified. Expansion of existing corridors is expected to result in small environmental impacts while building new corridors could result in moderate impacts. Development of these corridors would employ BMPs to reduce impacts such that they would be temporary and localized (STPNOC 2009a).

Building the cooling water reservoir for the two new nuclear reactors at the Trinity 2 site would inundate onsite water bodies. The habitat for the aquatic resources would change, and since most species cannot adapt to the reservoir environment, the species would be lost to the site. Thus, the building of the cooling water reservoir would be noticeable but not destabilizing to the aquatic resources. Building the intake and discharge structures on the Trinity River and in the new reservoir would affect the aquatic communities but the areas would be recolonized after building these structures was completed. Building of the transportation routes, transmission corridors, and pipelines would result in temporary and localized effects on aquatic communities.

Operation Impacts

To operate the two new units at Trinity 2, water rights for the Trinity River would have to be acquired. Currently, there are not sufficient water rights aggregated to a single point of diversion (50,000 ac-ft/yr). Instream flow studies necessary to maintain aquatic resources have not been evaluated for this reach of the river, and impacts associated with removal of water for the new reservoir are unknown.

Impingement, entrainment, and entrapment of organisms from the Trinity River and from a constructed reservoir would likely be the most significant impacts to the aquatic population that could occur from operation of two new nuclear units at the Trinity 2 site. STPNOC states that using a closed-cycle cooling system with a cooling water reservoir would consume a maximum of 50,000 ac-ft of water per year (STPNOC 2009a). EPA's design criteria for 316(b) Phase 1 regulations (66 FR 65256) for intake structures would minimize impacts to aquatic biota in the Trinity River. The design criteria include: (1) closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities; (2) maximum through-screen velocity of 0.15 m/s (0.5 ft/s) at the cooling water intake; and (3) intake flow of less than or equal to 5 percent of the mean annual flow. Compliance with these regulations would minimize impingement, entrainment, and entrapment impacts to the aquatic biota.

Operational impacts to aquatic resources associated with water quality, physical and thermal characteristics of the discharge cannot be determined without additional detailed analysis. A cooling water reservoir for the Trinity 2 site would likely evolve in a similar fashion to the MCR at STP, where, with time, the reservoir has developed similar aquatic resources to that in the lower Colorado River and acclimated to the discharges of the operating reactor units. Effects on the aquatic resources in the Trinity River would depend on the type of cooling system as well as volume, frequency, and water characteristics of the discharge. These types of impacts can be addressed and minimized through operational procedures and the permitting process with TCEQ.

Operational impacts to aquatic biota from onsite activities and in the transmission corridors would also be minimal assuming BMPs are used for maintenance of these areas and corridors. SWPPPs would ensure that impacts to biota from erosion and sedimentation would be minimal through the use of silt screens and controls for managing stormwater. These controls would be important for habitat quality and survival of benthic biota in the downstream drainages.

Based on operation of the CWS, impacts to aquatic communities in the Trinity River and reservoir could result from impingement, entrainment, and entrapment as well as thermal, chemical, and physical characteristics of the discharge. STPNOC commits to compliance with State and Federal regulations for operation of intake and discharge structures that would be protective of aquatic resources. Once a community is established in the new reservoir, long-term effects from operation of the CWSs are not expected to noticeably alter aquatic communities in the Trinity River and reservoir.

Cumulative Impacts

In the Trinity River drainage basin, from the upstream reaches of the Richland Chambers Reservoir to the proposed Tennessee Colony Dam site, the aquatic resources have been heavily influenced over the years by urbanization, municipal water use, wastewater treatment, industrial use, and impoundments. Water use and discharge of wastewater from Dallas-Fort Worth area and other municipalities led to significant decline of the water quality as well as fish kills as recently as 1985 (USGS 2005; STPNOC 2009a). Construction of the off-channel Richland Chambers Reservoir and Lake Fairfield (for the Big Brown Power Plant) affected the local aquatic resources during inundation of the areas, and now the aquatic ecology of the local water ways and the reservoir have adapted to the changes in the water flows. Efforts by TCEQ and the municipalities have restored much of the aquatic life to the Trinity River (USGS 2005). Without careful water management of the Trinity River, aquatic resources could be degraded again. Future proposed projects, (e.g., the proposed Turlington Mine next to the existing Big Brown Lignite Coal Mine and the proposed Lakeside Energy Center) would increase water use in the area of interest and affect the aquatic resources in a similar manner to ongoing mining and power production facilities. The Texas Water Development Board and the Trinity River Authority have plans for the construction of additional reservoirs in the Trinity River near the Trinity 2 site. The proposed Tennessee Colony Reservoir would dam the Trinity River downstream of the Trinity 2 site and connect to the existing Richland Chambers Reservoir, the proposed Tehuacana Reservoir, and the existing Lake Fairfield (NRC 2009b). Further evaluations would be needed to determine if the operation of the dam for the Tennessee Colony Reservoir might affect the sharpnose shiner distribution. Building of these reservoirs would have a cumulative loss of stream and drainage habitat that would be substantially greater than the loss of habitat from the building of the cooling reservoir at the Trinity 2 site.

Continued urbanization and agricultural practices could affect aquatic communities in the Trinity 2 geographic area of interest in the foreseeable future. Expansion of urban areas in the Trinity River drainage could increase water use, decrease available water for aquatic resources, and increase nonpoint pollution. The effects of continued agricultural practices could result in additional habitat loss and/or degradation due to irrigation using surface waters and groundwater withdrawal, point and non-point source pollution, siltation, and bank erosion.

As mentioned above in the terrestrial section, GCC could result in regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (Karl et al. 2009). The decrease in precipitation combined with elevated water temperatures and evaporation could result in more frequent droughts, which could reduce aquatic habitat. Loss of habitat could cause shifts in species ranges, diversity, and abundance in the geographic area of interest for the Trinity 2 site (Karl et al. 2009). Specific predictions on aquatic habitat changes in this region resulting from GCC are inconclusive at this time. However, because of the regional nature of climate change, the impacts related to GCC would be similar for all the alternative sites.

Based on building and operation of two new nuclear units at the Trinity 2 alternative site and other projects and influences in the region of influence for aquatic resources, the cumulative impacts would be noticeable and possibly destabilizing. All these activities would alter the aquatic habitats and potentially change the species composition and diversity in the affected water bodies. The incremental contribution of building and operating the two new reactors, including building of a cooling water reservoir, at the Trinity 2 site to the cumulative impacts within the geographic area of interest would be significant.

Summary

STPNOC has indicated that building of the cooling water reservoir at the Trinity 2 site would inundate existing water bodies and destroy habitat for aquatic resources that are dependent on flowing water. The review team concludes that the impacts from building two new nuclear units, including the new cooling water reservoir, at the Trinity 2 site would be noticeable but not destabilizing to the aquatic resources. The review team also concludes that the impacts from operation of two new units would be minimal. In the Trinity River drainage basin, from the upstream reaches of the Richland Chambers Reservoir to the proposed Tennessee Colony Dam site, the aquatic resources have been heavily influenced over the years by urbanization, municipal water use, wastewater treatment, industrial use, and impoundments. Based on the information provided by STPNOC and the review team’s independent evaluation, the review team concludes that the cumulative impacts of building and operating two new reactors on the Trinity 2 site combined with other past, present, and future activities on most aquatic resources in the Trinity River drainage would be MODERATE to LARGE. For the reasons discussed in Building Impacts and Operational Impacts, the incremental contribution of building and operating the two new reactors at the Red 2 site to the cumulative impacts within the geographic area of interest would be significant.

9.3.4.5 Socioeconomics

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact socioeconomics, including other Federal and non-Federal projects listed in Table 9-16.

For the analysis of socioeconomic impacts at the Trinity 2 site, the geographic area of interest is considered to be the 50-mi region centered on the Trinity 2 site with special consideration of Freestone and Anderson Counties as that is where the review team expects socioeconomic impacts to be the greatest. In evaluating the socioeconomic impacts of site development and operation at the Trinity 2 site near Fairfield, in Freestone County, the NRC review team undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources. Impacts from both site development and station operation are discussed.

Physical Impacts

Many of the physical impacts of building and operation would be similar regardless of the site. Building activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support building activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions (the latter of which are treated under aesthetics and recreation below). New units would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise in Freestone County. Highway maps show that practical access to the site from the south, west, and northwest is I-45, then through the town of Fairfield (2000 Census population of 3094) While practical access from the east and northeast may avoid Fairfield, the patterns of access routes likely mean that during the building period several thousand additional cars per day may pass through Fairfield and its eastern outskirts at construction work shift changes, and would have very noticeable impacts on traffic and traffic noise. Any noise coming from the STP site would be controlled in accordance with standard noise protection and abatement procedures. This practice also would be expected to apply to all alternative sites, including the Trinity 2 site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would reduce the noise level generated by the workforce commuting to the alternative site, but there still would likely be very noticeable traffic noise increases in and near Fairfield.

The new units at the Trinity 2 site would likely have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, new units would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the physical impacts of building and operating two nuclear units at the Trinity 2 site would be minimal, except in Freestone County (Fairfield and vicinity), where increases in traffic noise would be very noticeable during the building period.

Demography

The Trinity 2 site is located in Freestone County 10.4 mi northeast of the city of Fairfield (2008 population 3567) and approximately 20 mi west of Palestine (2008 population 18,129), Anderson County (2008 population 56,838 [Texas Association of Counties 2009e, f]). After World War II Freestone County's population declined up until the 1970's when it slowly begin to rise again to its 2008 population of 18,923 (TSHA 2009g).

STPNOC estimated the peak number of construction workers would be 5950. Approximately 900 operations workers would also be onsite during the final phase (i.e., final 10 months) of building activities (STPNOC 2008c). Based on assumptions in Section 4.4 concerning in-migration for Units 3 and 4 in Matagorda County, the review team assumed that 50 percent or 2975 construction workers would in-migrate, with half of these moving to Freestone County and the other half to Anderson County. Eighty percent of in-migrating construction workers would bring a family. Other counties such as Navarro County would likely see an in-migration of workers as well, but considering the larger population of this county and the relatively small number of in-migrants they would be easily absorbed. All operations workers would in-migrate and all would bring a family. A family size of 3.25 was used for construction workers for a total peak site development related population increase of 8330 (7735 in-migrating workers and family members and 595 workers without family). The review team also assumed an average family size of 2.74 for the operating workforce (see Section 5.4), resulting in a total in-migrating operations-related population of 2466 (900 operations workers plus family) at the peak of building activities. Therefore, the total expected in-migrating population at peak building would be 10,796.

Considering that the maximum estimation of in-migrating population would be almost 30 percent of Freestone County's total population and 9 percent of the total population in Anderson County, the demographic impacts of building activities are expected to be significant in both counties and potentially destabilizing for Freestone County. If the facility is constructed and commences operations, the operational workforce would number about 959 workers, 900 of whom would be at the site during peak site development and are included in the above analysis. The review team expects that the demographic impact during operation would be minimal. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the demographic impacts of building would be significant and potentially destabilizing. The demographic impacts of operating two nuclear units at the Trinity 2 site would be minimal.

Taxes and Economy

As discussed in Sections 4.4 and 5.4, in-migrating workers who buy property within the region would pay property taxes to the respective county, workers would also pay both the state and county sales and use tax on all eligible purchases as would STPNOC on all eligible purchases related to the two units. As described in Section 5.4.3.2, STPNOC estimates it would spend $60 million on annual expenditures for goods and services related to the new units of which about 20 percent ($12 million) would be spent locally (STPNOC 2008b). STPNOC estimated if the units were 100 percent taxable, annual franchise taxes for Unit 3 would be $4.7 to $5.4 million and Unit 4 would have payments of $3.9 to $4.7 million, which would represent less than 1 percent of the State's annual franchise tax revenues.

The largest tax impacts would come from property taxes related to the development and operation of the two units. The owners of STPNOC would pay taxes to the county, any applicable special districts that exist within the county and the local school district in which the land sits in. During the building process, county property tax payments would be based on the cost of building the units and determined in accordance with state law using mutually agreed on appraisal formulas (STPNOC 2009a). During operations property taxes would range from $6.10 million to $13.86 million. Taxes from the nuclear plant would represent a 56 to 127 percent increase over the 2008 Freestone County taxes levied of $10.9 million.

An increased appraised value in the district would increase the tax payments made to Fairfield ISD. However, Fairfield ISD is a Chapter 41 "wealthy district," and by State law would have to pass most, if not all, plant-related property taxes to the State of Texas for redistribution (TEA 2009).

Under new legislation, Fairfield ISD and Fairfield County would be allowed to enter into an agreement with the plant owner which would reduce owner's taxes and allow the ISD and County to share in the tax savings. The money the district may receive would not be subject to the state's equalization laws and would not have to be sent back to the State. If such an agreement were reached, the tax payments are likely to represent a significant beneficial impact for both a small, rural county such as Freestone County and for Fairfield ISD.

Economic impacts would be spread across the 50-mi region, but would be greatest in Freestone and Anderson Counties. Per capita income for Freestone County in 2007 is $26,107 and $23,399 for Anderson County. The 2008 unemployment rate for Freestone County and Anderson County was 4.1 percent and 5.7 percent, respectively (Texas Association of Counties 2009e, f). The wages and salaries of the site development and operating workforce would stimulate the local economies and could provide noticeable and significant impacts for new businesses to get started and for increased job opportunities for local residents. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the tax and economic impacts of building and operating two nuclear units at the Trinity 2 site would be significant and beneficial.

Transportation and Housing

The transportation network in the area includes Interstate 45 (I45), US-84, SH-75 and several FM roads. Primary commuter access from the south would be from US-84, I-45, and the west on SH 75 and FM27. Commuters from Palestine and Corsicana could also use US 287 and FM 488. As discussed under physical impacts, the most practical commuting routes to the Trinity 2 site from the north, west, and south converge on the city of Fairfield, resulting in a traffic increase of several thousand cars per day. It is likely that the city of Fairfield would experience a very noticeable increase in traffic as a result. In addition, Freestone County population is projected to grow enough to significantly impact traffic, with lower but noticeable impacts in Anderson County. There are numerous secondary roads near the site, several that lead to the Big Brown Plant. The only roads that lead to the nearby Trinity 2 site are one lane unimproved roads. A new access road would need to be built which would likely be from the west off FM 2570 (STPNOC 2009a). Other major road upgrades would be needed to support site development. The building of a nuclear plant on the Trinity 2 site would have noticeable and significant impacts on the local transportation network.

Approximately 3875 construction and operations workers could migrate into the region during peak building activities. During operations the workforce is expected to be about 959 workers of which 900 are included in the 3875 workers needing housing during peak building activities. The most recent data for Freestone County estimated a total housing stock of 8138 units (USCB 2009g) and 19, 243 for Anderson County, with a rental vacancy rate of 5.6 percent. Approximately 3690 housing units were unoccupied at the time of the survey (USCB 2009h). Some workers may choose to find other housing such as an apartment while others may in-migrate with their own housing in the form of a travel trailer. Given Freestone County's rural nature and small number of overall housing units, the review team expects that the in-migrating workforce of 3875 would cause a noticeable and potentially destabilizing impact on the housing market within the two county socioeconomic impact area and mitigation may be warranted. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the transportation and housing impacts of building and operating two nuclear units at the Trinity 2 site would be noticeable and potentially significant.

Public Services and Education

The influx of construction workers and plant operations staff settling in the region could impact local municipal water and water treatment facilities and other public services in the region. These impacts would likely be in proportion with the demographic impacts experienced in the region, unless these resources have excess capacity or are particularly strained during building, which would decrease or increase the impact, respectively. For example, the largest water treatment facilities in Freestone County and Anderson County have water capacity available that is roughly three to four-and-a-half times current average daily consumption (EPA 2009b, TCEQ 2010a), so while they may have to build considerable distribution infrastructure they are unlikely to be water capacity limited.

The in-migrating workers would likely put a temporary strain on public services during peak site development due to the significant population increases in each county. Therefore, the review team expects site development-related impacts on public services would be noticeable and potentially destabilizing, at least in Freestone County. During operations the impact on public services would be minimal.

Freestone County has 4 independent school districts with 15 schools and Anderson County has 7 independent school districts with 23 schools. The 2007-2008 student enrollments for Freestone and Anderson County are 3667 students and 8539 students, respectively (NCES 2009). The review team expects a peak site development-related increase of about 2537 students (1269 in each county). The in-migrating students would represent a significant increase in students in both counties (35 percent in Freestone County and 15 percent in Anderson County) therefore; the review team expects impacts to educational services would be significant and potentially destabilizing during peak building activities in at least Freestone County and possibly in Anderson County. During operations, this impact would reduce to minimal levels. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the public service and education impacts of building and operating two nuclear units at the Trinity 2 site would be significant.

Aesthetics and Recreation

Recreation in the area includes the Catfish Creek, Gus Engeling WMA, Big Lake Bottom WMA, Richland Creek WMA, Richland Chambers Reservoir and Fairfield Lake State Park. Fairfield Lake State Park is located 2.5 mi southwest of the site and has the most recreational opportunities. During the winter months fishing tournaments are held every weekend. Other activities include picnicking, boat ramps, playgrounds, an amphitheater, hiking, biking, equestrian and bird watching (STPNOC 2009a). The development of transmission lines to support the site would likely follow the Big Brown corridor, and the aesthetics of the site vicinity are already degraded by the existence of the Big Brown plant. The review team concludes that the visual impact associated with building and operating two nuclear units on this site would have a minimal impact on the aesthetics resources in the area. Increased building-related traffic to and from the plant could significantly impact recreation at Fairfield Lake State Park during the building period and would be noticeable in Freestone County; however, the overall impact to recreation elsewhere would be minimal. Based on the information provided by STPNOC and the review team's independent evaluation, the review team concludes that the aesthetic and recreation impacts of building and operating two nuclear units at the Trinity 2 site would be minimal.

Summary of Socioeconomics

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. In summary, on the basis of information provided by STPNOC and the review team's independent evaluation, the review team concludes that the socioeconomic impacts of the building of a new nuclear plant at the Trinity 2 site would be significant and adverse for Anderson County and potentially destabilizing in Freestone County in terms of demographics, transportation, housing, public services, and education. Housing impacts during building would be significant and adverse in Anderson County and probably destabilizing and adverse in Freestone County. These impacts would be minimal and adverse during operations. Physical impacts (with the exception of traffic-related noise in Freestone County) and impacts on aesthetics would be minimal in both counties, but recreation could be noticeably affected during the building period in Freestone County due to access issues at Fairfield State Park. The impacts on the economy and tax base during building and operations likely would be beneficial and significant for Freestone County and beneficial and noticeable in Anderson County. The review team expects all physical and socioeconomic impacts on other areas within the region would be minimal, except in Freestone County where the impacts to recreation could be noticeable during building.

Cumulative Impacts

In addition to assessing the incremental socioeconomic impacts from the building and operations of two additional nuclear units on the Trinity 2 site, the cumulative impact is also considered. The cumulative analysis considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts on a given region, including other Federal and non-Federal projects and those projects listed in Table 9-16. For the analysis of socioeconomic impacts at the Trinity 2 site, the geographic area of interest is considered to be the 50-mi region centered on the Trinity 2 site.

Economic impacts would be spread across the 50-mi region but would be greatest in Freestone and Anderson Counties. After World War II Freestone County's population declined up until the 1970's when it slowly begin to rise again to its current 2008 population of 18,923 (Texas Association of Counties 2009e). Farming began declining before World War II and continued for several decades afterwards. During the 1970s and 1980s farming increased as new businesses also moved into the area. Mining became very important to the area by the late 1980's. Anderson County's economy has been based on manufacturing. Oil and gas discoveries, iron ore deposits, timber regions, and good ranchlands kept the price of farmland high. Another contributor to the local economy has been the three prison units located near Fairfield (TSHS 2009g, h).

Most of the projects identified in Table 9-16 have or would contribute to the impacts on demographics, economic climate, and community infrastructure of the region and generally result in increased urbanization and industrialization. However, many impacts such as those on housing or public services are able to adjust over time, particularly with increased tax revenues. Furthermore, state and county plans along with modeled demographic projections include forecasts of future development and population increases. But several of the proposed energy and mining facilities (for example, the existing Big Brown Mine and the proposed Turlington Mine, which is expected to be operational in 2011) are close to the Trinity 2 site and have substantial workforces. Depending on the timing of these proposed activities, the coincidence of several projects is a potential socioeconomic concern for Freestone County, which could have to deal with significant impacts from building at the Trinity 2 site while also dealing with workers from these other projects. Although the projects identified in Table 9-16 would be consistent with applicable land-use plans and control policies, the review team considers that managing the cumulative socioeconomic impacts from the projects would be possible but could be challenging. Tehuacana Reservoir and Tennessee Colony Reservoir projects represent two reasonably foreseeable activities within close proximity to the Trinity 2 site. While each of those projects could impose additional socioeconomic impacts, the planned starting and completion dates and the level of activity for these projects are all uncertain. Therefore, the review team concluded that for the purposes of this alternative site analysis the socioeconomic impacts of those two projects could not be quantitatively evaluated. However, although the timing of the impacts is not known, the review team expects that the following effects may occur should either reservoir be developed. The review team would expect temporary increases in economic activity, population, and traffic during the construction period; and decreases in the existing property tax base, which may or may not be offset by values of recreational development, and other improvements related to reservoirs. In addition, during reservoir operations, depending on the level of development (and population), there may be increases in the demand for infrastructure and community services. There is a possibility that recreational opportunities would increase.

In summary, on the basis of information provided by STPNOC and the review team's independent evaluation, the review team concludes that the cumulative socioeconomic impacts during the building of a new nuclear plant at the Trinity 2 site would be MODERATE and adverse for Anderson County and LARGE and adverse for Freestone County in terms of demographics, transportation, housing, public services, and education. These impacts would be SMALL and adverse during operations. Cumulative impacts on aesthetics and recreation and physical impacts in Freestone County would be MODERATE and adverse during the building period and SMALL and adverse elsewhere. Impacts on aesthetics would be SMALL. These impacts would all be SMALL and adverse during operations. The cumulative impacts on economy and tax base during building and operations likely would be beneficial and LARGE in Freestone County and beneficial and SMALL to MODERATE in Anderson County. The review team expects all cumulative physical and socioeconomic impacts on other areas within the region would be SMALL. Building and operating a new plant at the Trinity 2 site would make a significant, incremental contribution to these impact levels.

9.3.4.6 Environmental Justice

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact environmental justice, including other Federal and non-Federal projects listed in Table 9-16. The cumulative environmental justice impacts were assessed for the 50-mi region centered on the Trinity 2 site, with allowance made for counties downstream in case offsite surface water-related impacts were identified for any human population. In 2000, the 50 mi region around the Trinity 2 site was characterized as 14.2 percent Black, 0.5 percent American Indian and Alaskan Native, 0.4 percent Asian, 0.07 percent Hawaiian and Other Pacific Islander, 5.6 percent all other races, and 1.3 percent two or more races, 10.2 percent Hispanic or Latino and 12.3 percent low-income (STPNOC 2009a).

The 2000 Census block groups were used for ascertaining minority and low-income populations in the region. There were a total of 282 census blocks groups within the 50-mi region, 41 of which were classified as minority populations (2 of them in Freestone County and 8 of them in Anderson County). One of these populations in Anderson County is within 10 mi of the Trinity 2 alternative site. There are 14 census block groups classified as low income in the 50-mi region, none of which are in Freestone County and 2 in Anderson County. None of these populations is within 10 mi of the Trinity 2 alternative site, but there are minority populations on both sides of the Trinity River downstream from the Trinity 2 site. The review team does not know if they are dependent on the river for water supply or if they are engaged in subsistence activity. See Figure 9-15 and Figure 9-16 for the location of minority or low-income populations within the 50-mi region.

The review team's analysis did not find any information suggesting that minority or low income populations in the area were dependent on natural resources that would be adversely affected by a nuclear power plant at the Trinity 2 alternative site.

Physical impacts during building (noise, fugitive dust, air emissions, traffic) would not disproportionately adversely affect minority populations because of their distance from the Trinity 2 site. However, the operation of the proposed project at the Trinity 2 site may have a disproportionate adverse impact on minority or low-income populations due to impacts on surface water supplies. Surface water-related impacts during operations were described in Section 9.3.4.2 as at least noticeable and adverse because of ambiguity concerning available water rights on the Trinity River and concerns about the water available to downstream users. See Sections 4.5 and 5.5 for more information about environmental justice criteria and impacts.

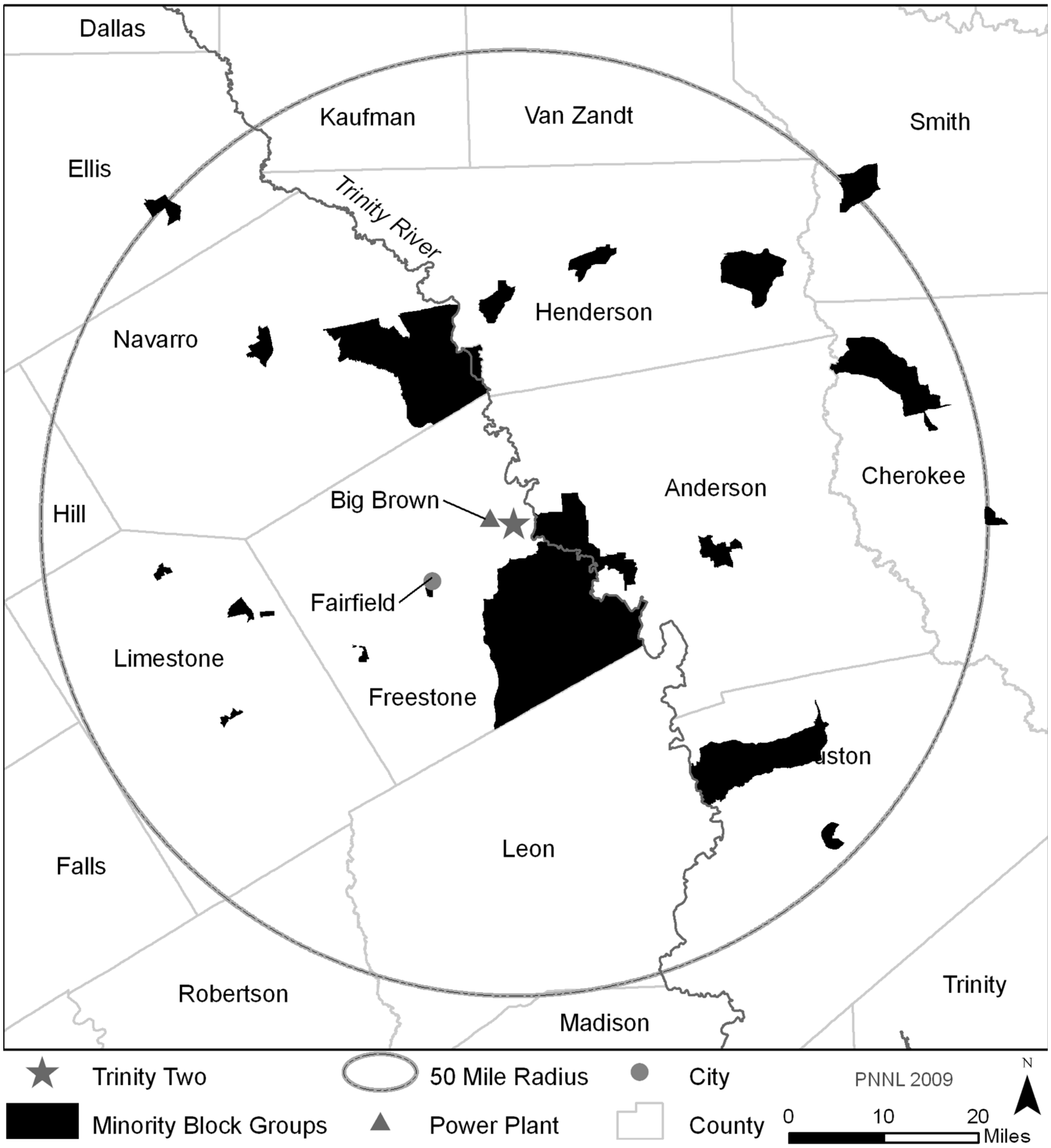
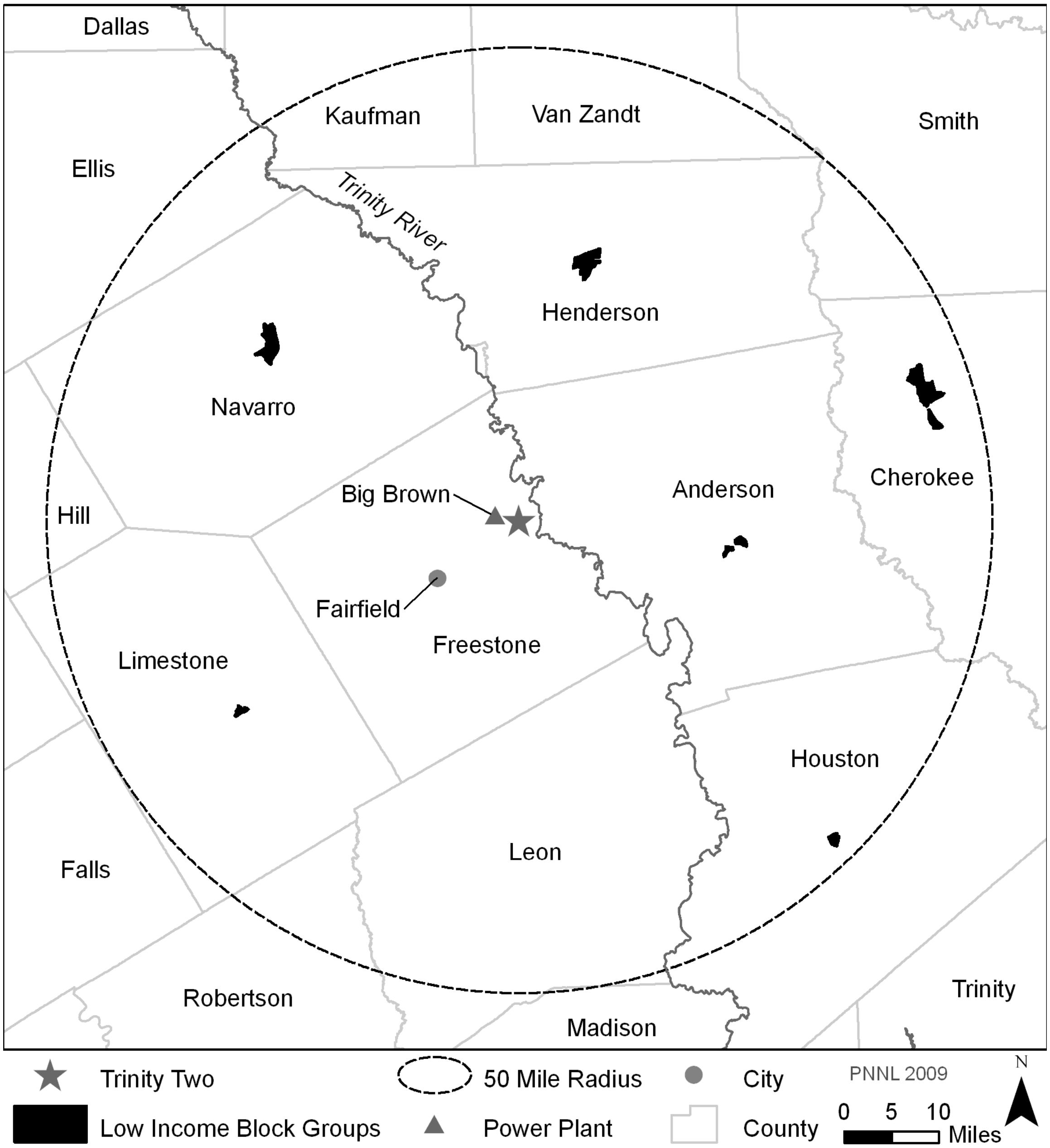


Figure 9-15. Minority Block Groups within 50 mi of the Trinity 2 Alternative Site



1
2 **Figure 9-16**. Low-Income Block Groups within 50 mi of the Trinity 2 Alternative Site

With the possible exception of the Big Brown Power Plant, 2.6 mi west of the Trinity 2 site, the existing projects identified in Table 9-16 are not likely to have disproportionately and adversely affected minority and low-income populations of the region. Neither Big Brown nor its associated mining operations are close to minority or low income populations, but they are significant employers. If additional major construction projects such as the proposed Tehuacana Reservoir and Tennessee Colony reservoir projects commence at the same time as building new nuclear units at the Trinity 2 site, that could cause a greater general rise in rental rates than that due to one project alone, but it is not clear whether any general rent increase would have a disproportionate and adverse impact on rental prices experienced by low-income populations or whether these populations would be uniquely impacted due to their lower household budgets.

Based on information provided on water use by STPNOC and the review team's independent reconnaissance evaluation, MODERATE impacts to surface water resources and aquatic resources are expected in the region of the Trinity 2 site downstream from the site. However, the review team did not find any information suggesting that the minority populations located downstream near the Trinity 2 site had any disproportionate dependence on the Trinity River for water supply and subsistence activities. Accordingly, the review team concludes that the environmental justice impacts from locating the proposed project at the Trinity 2 site would be SMALL and adverse.

9.3.4.7 Historic and Cultural Resources

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact historic and cultural resources, including other Federal and non-Federal projects listed in Table 9-16. For the analysis of cultural impacts at the Trinity 2 site, the geographic area of interest is considered to be the APE that would be defined for this site. This includes the physical APE, defined as the area directly affected by the site development and operation activities at the site and transmission lines, and the visual APE. The visual APE is defined as an additional 1-mi radius around the physical APE consistent with the discussion in Section 2.7 about the maximum distance from which the structures can be seen.

Reconnaissance activities in a cultural resource review have particular meaning. Typically, for example, it includes preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing its EISs, the review team relies upon reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through visits to the site area. To identify the historic and cultural resources at the Trinity 2 site, the following information was used:

- STPNOC ER (STPNOC 2009a) - including the Texas Historical Commission's Texas Archeological Sites Atlas; and
- NRC Alternative Sites Visit August 2009.

The Trinity 2 site is located in Freestone County, Texas, and is a greenfield site. Historically, the site and vicinity were largely undisturbed and likely contained intact archaeological sites associated with the past 10,000 years of human settlement. Over time, the area has been disturbed by rural development and cleared for agricultural purposes. The physical and visual APEs if the proposed plant were to be sited at the Trinity 2 site do not appear to have any historic properties likely to be affected by building or operating new units (STPNOC 2009a). No archaeological and/or architectural surveys have been conducted at the Trinity 2 site.

One historic structure, a railroad depot and office building, listed on the National Register of Historic Places is found in Freestone County. It is located approximately 10 mi away from the site. Eleven archaeological sites have been recorded within a 2-mi radius of the Trinity 2 site, the closest of which is within 0.5 mi, and several cemeteries are located nearby (STPNOC 2009a). None of the cemeteries are listed on the National Register. The project has the potential to affect resources through visual impacts from buildings and transmission lines. Should such properties be subsequently listed on the National Register, then these impacts may result in significant alterations to the visual landscape within the geographic area of interest.

To accommodate building two new nuclear generating units on the Trinity 2 site, STPNOC would need to clear approximately 800 ac for the main power plant site and up to 1700 ac for a new reservoir (STPNOC 2009a). In the event that the Trinity 2 site was chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the SHPO, tribes and interested parties. The results would be used in the site planning process to avoid cultural resources impacts. In the event significant cultural resources were identified by these surveys, the review team assumes that STPNOC would develop protective measures in a manner similar to those for the STP site. These procedures are detailed in STPNOC's Addendum #5 to procedure No. OPGP03-ZO-0025 Rev. 12 (Unanticipated Discovery of Cultural Resources) (STPNOC 2008e); the procedure includes notification of THC.

Section 9.3.4.1 describes the transmission line corridors. There are no existing transmission corridors connecting directly to the Trinity 2 site. However, there are multiple 345-kV transmission lines connecting to the Big Brown Power Plant (STPNOC 2009a). A new transmission corridor would need to be created to connect the Trinity 2 site to these lines. In the event that the Trinity 2 site was chosen for the proposed project, the review team assumes that STPNOC would conduct its transmission line-related cultural resource surveys and procedures in a manner similar to that for the STP site described in Section 4.6.

Past actions in the geographic area of interest that have similarly impacted historic and cultural resources include rural development and agricultural development and activities associated with these land disturbing activities such as road development. Two planned projects, the Tehuacana Reservoir and the Tennessee Colony Reservoir, were identified in Table 9-16 that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest. Activities associated with building two nuclear units and supporting facilities that can potentially destabilize important attributes of historic and cultural resources include land clearing, excavation, and grading activities. Given STPNOC's site planning process and no known cultural resources at the Trinity 2 site based on reconnaissance-level information, the impacts to cultural resources due to site development activities would be negligible.

In addition, visual impacts from transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. Given that there are no known cultural resources where the historic setting and character of the resources are important, the visual impacts would be negligible. The review team assumes that STPNOC would develop procedures and consult with the SHPO similar to the process developed for cultural resource management at the STP site.

Impacts on historic and cultural resources from operation of two new nuclear generating units at the Trinity 2 site include those associated with the operation of new units and maintenance of transmission lines. The review team assumes that the same procedures currently used by STPNOC would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of the two new units and associated impacts on the cultural resources would be negligible for the physical and visual APEs.

No past, present, or future actions in the geographic area of interest were identified that would significantly affect historic and cultural resources in a manner similar to those associated with the operation of two new units.

The two projects that were identified in Table 9-16 that could contribute to the cumulative impacts on cultural resources are the Tehuacana Reservoir and the Tennessee Colony Reservoir. Neither reservoir would significantly affect historic and cultural resources since there are no known resources in the geographic area of interest; the impacts would be limited to the visual APE and would be similar to those associated with the operation of two new units.

Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by the applicant and the review team's independent evaluation, the review team concludes that the cumulative impacts from building and operating two new nuclear generating units on the Trinity 2 site and from other projects particularly the planned adjacent Tennessee Colony Reservoir, would be SMALL. This impact level determination reflects no known cultural resources that could be affected; however, if the

Tennessee Colony Reservoir or the Trinity 2 site were to be developed, then cultural resource surveys may reveal important historic properties that could result in greater cumulative impacts.

9.3.4.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact air quality, including other Federal and non-Federal projects listed in Table 9-16. The atmospheric emissions related to building and operating a nuclear power plant at the STP site in Matagorda County, Texas, are described in Chapters 4 and 5. The criteria pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of the criteria pollutants at the STP site were evaluated and determined to be MODERATE principally because of a nearby major source; absent that source, the cumulative impacts would be SMALL. The geographic area of interest for the Trinity 2 site is Freestone County, which is in the Austin-Waco Intrastate Air Quality Control Region (40 CFR 81.134). The emissions related to building and operating a nuclear power plant at the Trinity 2 site would be similar to those at the STP site. The air quality attainment status for Freestone County as set forth in 40 CFR 81.344 reflects the effects of past and present emissions from all pollutant sources in the region. Freestone County is not out of attainment of any National Ambient Air Quality Standard.

Reflecting on the projects listed in Table 9-16, the most significant are the Big Brown Power Plant, Freestone Energy Center, Lakeside Energy Center, and the Limestone Electric Generating Station. Effluents from power plants such these are typically released through stacks and with significant vertical velocity. Other industrial projects listed in Table 9-16 would have de minimis impacts. Given that these projects would be subject to institutional controls, it is unlikely that the air quality in the region would degrade to the extent that the region would be in nonattainment of National Ambient Air Quality Standards.

The air quality impact of Trinity 2 site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. There are no land uses or projects, including the aforementioned source, that would have emissions during site development that would, in combination with emissions from the Trinity 2 site, result in degradation of air quality in the region.

Releases from operation of two units at the Trinity 2 site would be intermittent and made at low levels with little or no vertical velocity. The air quality impacts of the Big Brown Power Plant, Freestone Energy Center, and Units 1 and 2 of the Limestone Electric Generating Station are included in the baseline air quality status. The air quality impacts of the Lakeside Energy Center would be similar to the air quality impacts discussed in Section 9.2.2.2, and the air quality impacts of Unit 3 of the Limestone Electric Generating Station would be similar to the air quality impacts discussed in Section 9.2.2.1, which could be noticeable but not destabilizing.

The cumulative impacts from emissions of effluents from the Trinity 2 site and the aforementioned sources could be noticeable but not destabilizing.

The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in Section 7.5. The impacts of the emissions are not sensitive to location of the source. Consequently, the discussion in Section 7.5 is applicable to a nuclear power plant located at the Trinity 2 site. The review team concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions of the project at the Trinity 2 site.

Cumulative impacts to air quality resources are estimated based in the information provided by STPNOC and the review team's independent evaluation. Other past, present and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for greenhouse gas emissions) that could affect air quality resources. The cumulative impacts on criteria pollutants from emissions of effluents from the Trinity 2 site, other projects, the Big Brown Power Plant, Freestone Energy Center, Lakeside Energy Center, and the Limestone Electric Generating Station would be noticeable but not destabilizing, principally as a result of the contribution of Unit 3 of the Limestone Electric Generating Station. The national and worldwide cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions from the Trinity 2 site. The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air quality resources in the geographic areas of interest would be MODERATE for criteria pollutants and MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air quality resources from building and operating two units at the Trinity 2 site would be insignificant for both criteria pollutants and greenhouse gas emissions.

9.3.4.9 Nonradiological Health

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that impact nonradiological health, including other Federal and non-Federal projects listed in Table 9-16. The building-related activities that have the potential to impact the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to impact the health of members of the public and workers includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site. For the analysis of nonradiological health impacts at the Trinity 2 alternative site, the geographic area of interest is considered to include projects within a 5 mi radius from the site's center based on the localized nature of the impacts. For impacts associated with transmission lines, the geographic area of interest is the transmission line corridor.

Building Impacts

Nonradiological health impacts to construction workers and members of the public from building two new nuclear units at the Trinity 2 site would be similar to those evaluated in Section 4.8 for the STP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air quality and noise would be complied with during the site preparation and building phase. The incidence of construction worker accidents would not be expected to be different from the incidence of accidents estimated for STP. The Trinity 2 site is located in a rural area and building impacts would likely be negligible on the surrounding populations. The ER (STPNOC 2009a) indicated that there may be significant impacts on the transportation network in the vicinity of the Trinity 2 site and mitigation would be warranted. The impacts in the vicinity of the Trinity 2 site include traffic associated with the Big Brown Power Plant and lignite mine and the Fairfield Lake State Park. Interactions between the traffic destined for the Trinity 2 site during building and these other projects are likely to increase the nonradiological health effects from traffic accidents in the vicinity. The additional injuries and fatalities from traffic accidents involving transportation of materials and personnel for building of a new nuclear power plant at the Trinity 2 site would be similar to those evaluated in Section 4.8.3 for the STP site and would represent a small fraction (less than 5 percent) of the total traffic fatalities in Freestone County.

Past and present actions in the geographic areas of interest that have similarly affected nonradiological resources include the construction and operation of the Big Brown Power Plant and the Big Brown Lignite Coal Mine. Proposed future actions would include transmission line development and/or upgrading throughout the designated geographic area of interest, and future urbanization. These actions would likely result in nonradiological health impacts similar to those discussed above for the building of the Trinity 2 site.

Operational Impacts

Nonradiological health impacts from operation of two new nuclear units on occupational health and members of the public at the Trinity 2 site would be similar to those evaluated in Section 5.8 for the STP site. Occupational health impacts to workers (e.g., falls, electric shock or exposure to other hazards) at the Trinity 2 site would likely be the same as those evaluated for workers at two new units at the STP site. Exposure to the public from water-borne etiological agents at the Trinity site would be similar to the types of exposures evaluated in Section 5.8.1, and the operation of the new units at the Trinity 2 site would not likely lead to an increase in water-borne diseases in the vicinity. Noise and EMF exposure would be monitored and controlled in accordance with applicable OSHA regulations. Effects of EMF on human health would be controlled and minimized by conformance with NESC criteria and adherence to the standards for transmission systems regulated by the PUCT. Nonradiological impacts of traffic associated with the operations workforce would be less than the impacts during building. Mitigation measures taken during building to improve traffic flow would also minimize impacts during operation,

The past and present activities in the geographic areas of interest that would have nonradiological impacts to the public or workers similar to those discussed for the Trinity 2 site include the Big Brown Power Plant and the Big Brown Lignite Coal Mine. Noise from the operation of the Trinity 2 site would not likely be discernable to the public at the Fairfield Lake State Park, which is closest to the Big Brown Power Plant. Proposed future actions that would impact nonradiological health in a similar way to operation activities at the Trinity 2 site would include transmission line systems and future urbanization, which would both occur throughout the designated geographic areas of interest.

The review team is also aware of the potential climate changes that could affect human health; a recent compilation of the state of the knowledge in this area (Karl et al. 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature and a decrease in precipitation, which may alter the presence of microorganisms and parasites in any reservoir that would be used. The review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of water-borne diseases.

Summary

Based on the information provided by STPNOC and the review team's independent evaluation, the review team expects that nonradiological health impacts from building and operating two new units at the Trinity 2 alternative site would be similar to the impacts evaluated for the STP site. While there are past, present and future activities in the geographic area of interest that could affect nonradiological health in ways similar to the building and operation of two units at the Trinity 2 site, those impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes, therefore, that the cumulative impacts would be SMALL.

9.3.4.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts to the public and workers from building activities and operations for two nuclear units at the Trinity 2 alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that impact radiological health, including other Federal and non-Federal projects and those projects listed in Table 9-16. As described in Section 9.3.4, the Trinity 2 site is a greenfield site; there are currently no nuclear facilities on the site. The geographic area of interest is the area within a 50-mi radius of the Trinity 2 site. There are no major facilities that result in regulated exposures to the public or biota within the 50-mi radius of the Trinity 2 site. However, there are likely to be hospitals and industrial facilities within 50 mi of the Trinity 2 site that use radioactive materials.

The radiological impacts of building and operating the proposed two ABWR units at the Trinity 2 site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite that would be well below regulatory limits. These impacts are expected to be similar to those estimated for the STP site. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Trinity 2 site. This conclusion is based on data from the radiological environmental monitoring programs conducted around currently operating nuclear power plants.

Based on the information provided by STPNOC and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the two proposed ABWRs and other existing and planned projects and actions in the geographic area of interest around the Trinity 2 site would be SMALL.

9.3.4.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for two nuclear units at the Trinity 2 alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that impact radiological health from postulated accidents, including other Federal and non-Federal projects and those projects listed in Table 9-16. As described in Section 9.3.4, Trinity 2 is a greenfield site; there are currently no nuclear facilities on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Trinity 2 site. There are no existing or proposed reactors that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Trinity 2 site.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the STP site would be minimal for ABWRs. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria. The ABWR design is independent of site conditions, and the meteorology of the Trinity 2 and STP sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Trinity 2 site would be minimal.

Because the meteorology, population distribution, and land use for the Trinity 2 alternative site are expected to be similar to the proposed STP site, risks from a severe accident for an ABWR reactor located at the Trinity 2 alternative site are expected to be similar to those analyzed for the proposed STP site. These risks for the proposed STP site are presented in Tables 5-18 and 5-19 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Trinity 2 alternative site would be SMALL.

9.3.5 Comparison of the Impacts of the Proposed Action and Alternative Sites

This section summarizes the review team's characterization of the cumulative impacts related to locating a two-unit ABWR nuclear power facility at the proposed STP site and at each alternative site. The three sites selected for detailed review as part of the alternative sites environmental analysis are the Red 2, Allens Creek, and Trinity 2 sites in Texas. Comparisons are made between the proposed and alternative sites to evaluate if one of the alternative sites would be environmentally preferable to the proposed site. The NRC's determination is independent of the Corps' determination of a Least Environmentally Damaging Practicable Alternative pursuant to the Clean Water Act Section 404(b)(1) Guidelines at 40 CFR Part 230. The Corps will conclude its analysis of both off-site and on-site alternatives in its Record of Decision. The Corps onsite alternatives evaluation is discussed in Section 9.5.

The need to compare the proposed site with alternative sites arises from the requirement in Section 102(2)(c)(iii) of NEPA (42 USC 4332) that environmental impact statements include an analysis of alternatives to the proposed action. The NRC criteria to be employed in assessing whether a proposed site is to be rejected in favor of an alternative site is based on whether the alternative site is "obviously superior" or "environmentally preferable" to the site proposed by the applicant (Public Service Company of New Hampshire 1977). An alternative site is "obviously superior" to the proposed site if it is "clearly and substantially" superior to the proposed site (Rochester Gas & Electric Corp. 1978). The standard of obviously superior "...is designed to guarantee that a proposed site will not be rejected in favor of an alternate unless, on the basis of appropriate study, the Commission can be confident that such action is called for (New England Coalition on Nuclear Pollution 1978)."

The "obviously superior" test is appropriate for two reasons. First, the analysis performed by the NRC in evaluating alternative sites is necessarily imprecise. Key factors considered in the alternative site analysis, such as population distribution and density, hydrology, air quality, aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics are difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site must have a wide range of uncertainty. Second, the applicant's proposed site has been analyzed in detail, with the expectation that most adverse environmental impacts associated with the site have been identified. The alternative sites have not undergone a comparable level of detailed study. For these reasons, a proposed site may not be rejected in favor of an alternative site when the alternative site is marginally better than the proposed site, but only when it is obviously superior (Rochester Gas & Electric Corp. 1978). NEPA does not require that a nuclear plant be constructed on the single best site for environmental purposes. Rather, "...all that NEPA requires is that alternative sites be considered and that the effects on the environment of building the plant at the alternative sites be carefully studied and factored into the ultimate decision (New England Coalition on Nuclear Pollution 1978)."

Section 9.3.5.1 reviews the cumulative environmental impacts of building and operating a two-unit nuclear power plant at the proposed STP site. Cumulative impact levels from Chapter 7 (for the proposed STP site), and the three alternative sites (from Sections 9.3.2 through 9.3.4) are listed in Table 9-20. Sections 9.3.5.2 and 9.3.5.3 discuss the cumulative impacts of the proposed project located at the STP site and at the alternative sites as they relate to a determination of environmental preference or obvious superiority.

9.3.5.1 Comparison of Cumulative Impacts at the Proposed and Alternative Sites

The following section summarizes the review team's independent assessment of the proposed and alternative sites. The team characterized the expected cumulative environmental impacts of building and operating new units at the STP site and alternative sites; these impacts are summarized by resource area in Table 9-20 on the following page.

The environmental resource areas listed in the following table have been evaluated using the NRC's three-level standard of impact significance: SMALL, MODERATE, or LARGE. These levels were developed using the CEQ guidelines and set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Full explanations for the specific cumulative impact characterizations are provided in Chapter 7 for the proposed site and in Sections 9.3.2, 9.3.3, and 9.3.4 for the alternative sites. The review team's impact category levels are based on professional judgment, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a COL is underway. The considerations and assumptions were similarly applied at each of the alternative sites to provide a common basis for comparison. In the following discussion, the review team compares the impact levels between the proposed site, and each alternative site.

Table 9-20. Comparison of Cumulative Impacts at the Proposed and Alternative Sites

Resource Area	STP	Red 2	Allens Creek	Trinity 2
Land-Use	MODERATE	MODERATE	MODERATE	MODERATE
Water-Related				
Surface Water Use	MODERATE	MODERATE	MODERATE	MODERATE
Surface Water Quality	MODERATE	SMALL	SMALL	MODERATE
Groundwater Use	SMALL	MODERATE	SMALL	MODERATE
Groundwater Quality	SMALL	SMALL to MODERATE	SMALL	SMALL
Ecology				
Terrestrial Ecosystems	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic Ecosystems	MODERATE	MODERATE	MODERATE	MODERATE to LARGE
Socioeconomic*				
Physical	SMALL	SMALL	LARGE	SMALL to MODERATE
Demography	SMALL to MODERATE	SMALL to MODERATE	MODERATE to LARGE	MODERATE to LARGE
Taxes and Economy	SMALL to LARGE BENEFICIAL	SMALL to LARGE BENEFICIAL	SMALL to LARGE BENEFICIAL	SMALL to LARGE BENEFICIAL
Housing and Transportation	SMALL to MODERATE	SMALL to MODERATE	MODERATE to LARGE	MODERATE to LARGE
Public Services and Education	SMALL to MODERATE	SMALL to LARGE	MODERATE to LARGE	MODERATE to LARGE
Aesthetics and Recreation	SMALL to MODERATE	SMALL to MODERATE	LARGE	SMALL to MODERATE
Environmental Justice	SMALL	SMALL	SMALL to LARGE	SMALL
Historic and Cultural Resources	SMALL	SMALL	LARGE	SMALL
Air Quality	MODERATE	SMALL to MODERATE	SMALL to MODERATE	MODERATE
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL

*ranges indicate differences in counties

9.3.5.2 Environmentally Preferable Sites

As shown in Table 9-20, the cumulative impacts of building and operating two new units at the proposed site and the alternative sites vary across the impact categories. The resource categories for which the impact level at an alternative site is the same as that for the proposed site does not contribute to the alternative site being judged to be environmentally preferable to the proposed site. Therefore, these categories are not discussed further in determining whether an alternate site is environmentally preferable to the proposed site. The categories for which an alternative site has a different impact level than the proposed site are discussed further to determine if an alternative site is environmentally preferable to the proposed site. Where there is a range of impacts for a resource, the upper value of the impacts is used for the comparison. In addition, for those cases in which the cumulative impacts for a resource are greater than SMALL, consideration is given to those cases in which the impacts of the project at the specific site do not make any significant contribution to the cumulative impact level. As shown in Table 9-20, there are some differences in impacts among the sites.

Red 2 Site

The STP site is characterized more favorably than the Red 2 site in Table 9-20 for the following resource areas: groundwater use and quality and public services and education. The Red 2 site is characterized more favorably than the STP site for surface water quality and air quality. For the resource areas for which the STP site is characterized more favorably, building and operating two new nuclear units at the Red 2 site would be a significant contributor to the higher impact level. Therefore, the differences in impacts for these two resource areas are meaningful to the comparison of the sites. For surface water quality, the MODERATE impact at the STP site is based on pre-existing conditions. Building and operating two new nuclear units at the STP would not contribute significantly to surface water quality impacts. For air quality at both sites, the MODERATE impacts are based on the effects of projects other than the nuclear units. Nuclear plants don’t contribute significantly to air quality impacts. So the apparent differences in impacts for these resources are not meaningful in terms of the proposed action.

For land use, surface water use, and terrestrial and aquatic ecosystems, although the two sites have essentially the same cumulative impact levels, the two new nuclear units would not be a significant contributor to the impact level at the STP site. This is because a reservoir already exists at the STP site, and there would be little in-water construction in the Colorado River. The project would be a significant contributor to the MODERATE cumulative impacts to these resources at the Red 2 site because it is a greenfield site with no existing facilities to be shared with new units. A similar situation exists for aesthetics and recreation – the project would not be a significant contributor to the SMALL to MODERATE impacts at the STP site, but it would be at the Red 2 site. Again, these differences favor the STP site.

Based on the results and comparison of the impact characterizations, the review team concludes that the Red 2 site would not be environmentally preferable to the STP site for two new nuclear generating units.

Allens Creek Site

The STP site is characterized more favorably than the Allens Creek site in Table 9-20 for the following resource areas: physical impacts, demography, housing and transportation, public services and education, aesthetics and recreation, environmental justice, and historic and cultural resources. Conversely, the Allens Creek site is characterized by the review team as more favorable than the STP site in Table 9-20 for surface water quality and air quality. For physical and environmental justice impacts, the primary reason for the higher impacts at the Allens Creek site is the proposed Trans-Texas Corridor. Building and operating two new nuclear units at the Allens Creek site would not contribute significantly to the impact levels. For the remainder of the impact areas for which the STP is characterized more favorably, building and operating two new nuclear units at the Allens Creek site is a significant contributor to the higher impact levels, and so the differences in impact levels are meaningful to the comparison of the sites. For surface water quality, the MODERATE impact at the STP site is based on pre-existing conditions. Building and operating two new nuclear units at the STP would not contribute significantly to surface water quality impacts. For air quality at both sites, the MODERATE impacts are based on the effects of projects other than the nuclear units. Nuclear plants don't contribute significantly to air quality impacts. So the apparent differences in impacts for these resources are not meaningful in terms of the proposed action.

For land use and terrestrial ecosystems, although the two sites have essentially the same cumulative impact levels, the two new nuclear units would not be a significant contributor to the impact level at the STP site (i.e., the MODERATE impacts are based on the effects of other projects). This is because a reservoir already exists at the STP site and there would be little in-water construction in the Colorado River. But the project would be a significant contributor to the MODERATE cumulative impacts for these resources at the Allens Creek site because it is a greenfield site with no existing facilties to be shared with new units.

Based on comparison of the impact characterizations in Table 9-20, the review team concludes that the Allens Creek site would not be environmentally preferable to the STP site for two new nuclear generating units.

Trinity 2 Site

The STP site is characterized more favorably than the Trinity 2 site in Table 9-20 for the following resource areas: groundwater use, aquatic ecosystems, physical impacts, demography, housing and transportation, and public services and education. Conversely, the Trinity 2 site is not characterized by the review team as more favorable than the STP site in Table 9-20 for any resource area. For physical impacts, the higher impacts at the Trinity 2 site relate to other projects in the area and the project at the Trinity 2 site would not contribute significantly to the impact level. For all of the other impact areas for which the STP site is characterized more favorably, the differences relate directly to the impacts of the proposed project at the two sites.

For land use, surface water use, and terrestrial ecosystems, although the two sites have essentially the same cumulative impact levels, the two new nuclear units would not be a significant contributor to the impact level at the STP site. This is because a reservoir already exists at the STP site and there would be little in-water construction in the Colorado River. But the project would be a significant contributor to the MODERATE cumulative impacts for these resources at the Trinity 2 site because it is a greenfield site with no existing facilities to be shared with new units.

Based on comparison of the impact characterizations in Table 9-20, the review team concludes that the Trinity 2 site would not be environmentally preferable to the STP site for two new nuclear generating units.

Although there are differences and distinctions between the cumulative environmental impacts of building and operating two new nuclear generating units at the proposed STP site and the alternative sites, the review team concludes that none of these differences is sufficient to determine that any of the alternative sites would be environmentally preferable to the proposed site for building of two new nuclear generating units.

9.3.5.3 Obviously Superior Sites

None of the alternative sites were determined to be environmentally preferable to the proposed STP site. Therefore, the NRC staff concludes that none of the alternative sites would be obviously superior to the STP site. The Corps will conclude its analysis of both offsite and onsite alternatives in its Record of Decision.

9.4 System Design Alternatives

The NRC staff considered a variety of heat dissipation systems and circulating water systems alternatives. While other heat dissipation systems and water systems exist, by far the largest and the most likely to dominate the environmental consequences of operation is the CWS that cools and condenses the steam for the turbine-generator. Other water systems, such as service water system, are much smaller than the CWS. As a result, the review team only considers alternative heat dissipation and water treatment systems for the CWS. The proposed CWS is a closed loop system that uses the existing MCR for heat dissipation (STPNOC 2009a). The proposed system is discussed in detail in Chapter 3.

9.4.1 Heat Dissipation Systems

About two-thirds of the heat from a commercial nuclear reactor is rejected as heat to the environment. The remaining one-third of the reactor's generated heat is converted into electricity. Normal heat sink cooling systems transfer the rejected heat load into the atmosphere and/or nearby water bodies, primarily as latent heat exchange (evaporating water) or sensible heat exchange (warmer air or water). Different heat-dissipation systems rely on different exchange processes. The following sections describe alternative heat dissipation systems considered by the NRC staff for proposed Units 3 and 4 at the STP site.

The impacts associated with the proposed heat dissipation system, a cooling pond or reservoir, are discussed in Sections 4.2, 4.3, 5.2, and 5.3. STPNOC proposes to use the existing MCR as the heat dissipation system for the proposed units. The NRC staff determined in Chapter 4 that the impacts of building the proposed heat dissipation system would be SMALL for both hydrologic and ecological resources. The NRC staff also determined in Chapter 5 that the impacts of operating the proposed heat dissipation system would be SMALL for both hydrologic and ecological resources.

STPNOC considered a range of heat dissipation systems in its ER including a once-through cooling system and several closed-cycle cooling systems. In addition to the closed-cycle MCR selected, STPNOC also considered spray canals, mechanical draft wet cooling towers, natural draft wet cooling towers, a combination wet/dry cooling tower system, fan-assisted natural draft cooling towers and dry cooling towers (STPNOC 2009a). The NRC staff considered these options as well as once-through cooling with a helper tower cooling system that would be used under high receiving water body temperature conditions.

9.4.1.1 Plant Cooling System – Once-Through Operation

Once-through cooling systems withdraw water from the source water body and return virtually the same volume of water to the receiving water body at an elevated temperature. Typically the source water body and the receiving water body are the same body, and the intake and discharge structures are separated to limit recirculation. While there is essentially no consumptive use of water in a once-through heat-dissipation system, the elevated temperature of the receiving water body would result in some induced evaporative loss that decreases the net water supply. The large intake and discharge flows associated with once-through cooling systems require large intake and discharge structures; the high flow rates may result in hydrological alterations in the source/receiving water bodies. In addition, the high flow rates result in higher levels of impingement and entrainment of aquatic organisms. Based on U.S. EPA 316(b) Phase I regulations (66 FR 65255), the NRC staff has determined that once-through cooling systems for new nuclear reactors are unlikely to be permitted in the future, except in rare and unique situations.

The STP site is approximately 10 mi from the Matagorda Bay on the Gulf of Mexico (STPNOC 2009a), the closest body of water that potentially could support once-through cooling. The NRC staff determined that once-through cooling would not be an environmentally preferable alternative because of the magnitude of the impacts of building large intake and discharge structures and associated piping linking these structures with the plant. Furthermore, once-through cooling would require a significant volume of makeup water and could potentially have significant impacts on sensitive aquatic biota of Matagorda Bay.

9.4.1.2 Spray Canals

Spray canal cooling systems circulate water in man-made canals and enhance evaporative cooling by spraying water into the atmosphere. In addition to evaporation, heat transfer from the spray canals to the atmosphere also occurs through black-body radiation and conduction. A spray canal system alternative was evaluated by STPNOC for cooling STP Units 1 and 2 and was found to require an effective canal length of 20,250 ft and a width of 200 ft which would require 150 ac. An additional 680 acres would be required for the intake canal corridor (STPNOC 2009a). The NRC staff independently evaluated the system design requirements and determined that the size and dimensions were calculated consistent with the heat rejection requirements. Since the evaporation from a new spray canal would be greater than the induced evaporation of the existing MCR, the consumptive water use of a spray canal would be greater than the proposed alternative. Because no additional land would need to be disturbed for the proposed alternative and because of increased consumptive use of water in a spray canal the NRC staff concluded that use of a spray canal would not be an environmentally preferable alternative for the STP site.

9.4.1.3 Wet Mechanical Draft Cooling Towers

A wet mechanical draft cooling tower transfers heat to the environment via evaporation and conduction. These towers can be relatively low profile compared to natural draft towers, and rely on large fans to force air through walls of falling water. Drift abatement features in the design limit the amount of water suspended as droplets in the air, which may be deposited on the ground outside the tower. Wet mechanical draft towers often generate visible plumes when the moisture in air from the cooling tower exhaust cools and the moisture condenses.

This alternative would require six towers to be built (three towers for each unit), each containing 12 cells. STPNOC indicates that approximately 70 ac would be required for the towers and an additional 630 ac would be required for the intake canal corridor (STPNOC 2009a). The NRC staff independently evaluated the system design requirements and determined that the size and dimensions were calculated consistent with the heat rejection requirements. Since the evaporation of a wet mechanical draft cooling tower is greater than the induced evaporation of a cooling pond, the consumptive water use of a wet mechanical draft cooling tower is greater than the proposed alternative. Therefore, based on consideration of the land area that would be disturbed and the increase in consumptive water use, the NRC staff concluded that building and operating wet mechanical draft cooling towers would not be an environmentally preferable alternative for the STP site.

9.4.1.4 Wet Natural Draft Cooling Towers

Wet natural draft cooling towers induce airflow up through large (500 ft tall and 400 ft in diameter) towers by cascading warm water downward in the lower portion of the cooling tower. As heat transfers from the water to the air in the tower, the air becomes more buoyant and rises. This buoyant circulation induces more air to enter the tower through its open base. The size of the cooling towers results both in a large visual and land-use footprint. STPNOC indicates that approximately 80 ac would be required for the towers and an additional 630 ac would be required for the intake canal corridor (STPNOC 2009a). The NRC staff independently evaluated the system design requirements and determined that the size and dimensions were calculated consistent with the heat rejection requirements. Since the evaporation of a wet natural draft cooling tower is greater than the induced evaporation of a cooling pond, the consumptive water use of a wet natural draft cooling tower is greater than the proposed alternative. Therefore, based on consideration of the land area that would be disturbed for the tower footprints, the increase in consumptive water use, and the available cooling capacity of the existing cooling reservoir to dissipate heat for two additional units, the NRC staff concluded that building and operating wet natural draft cooling towers would not be an environmentally preferable alternative for the STP site.

9.4.1.5 Dry Cooling Towers

Dry cooling towers would eliminate all water-related impacts from the cooling system operation. No makeup water would be needed, and no blowdown water would be generated. However, dry cooling systems require much larger cooling systems, and result in both a loss in electrical generation efficiency (because the theoretical approach temperature is limited to the dry-bulb temperature and not the lower wet-bulb temperature) and greater parasitic energy losses for the large array of fans involved. This loss in generation efficiency translates into increased fuel cycle impacts. Because the impacts associated with aquatic ecology, water use, and water quality for the proposed cooling system were found to be SMALL (see Chapters 4 and 5), the NRC staff determined that, although dry cooling eliminates water-related impacts, it is not environmentally preferred to the proposed alternative.

9.4.1.6 Combination Wet/Dry Cooling Tower System

A combination mechanical draft wet/dry cooling tower system uses both wet and dry cooling cells to limit consumption of cooling water, often with the added benefit of reducing plume visibility. Water used to cool the turbine generators generally passes first through the dry portion of the cooling tower where heat is removed by drawing air at ambient temperature over tubes through which the water is moving. Cooling water leaving the dry portion of the tower then passes through the wet tower where the water is sprayed into a moving air stream and additional heat is removed through evaporation and sensible heat transfer. When ambient air temperatures are low, the dry portion of these cooling towers may be sufficient to meet cooling needs. The use of the dry portion of the system would result in a loss in generating efficiency that would translate into increased fuel cycle impacts. Although a combination mechanical draft wet/dry cooling tower system could reduce water-related impacts, the NRC staff determined that the impacts associated with aquatic ecology, water use, and water quality for the building and operating the proposed cooling system were SMALL. The NRC staff concluded that building and operating a combination wet/dry cooling tower system would not be an environmentally preferable alternative for the STP site.

9.4.2 Circulating Water Systems

The NRC staff evaluated alternatives to the proposed intakes and discharges for the normal heat sink cooling system, based on the proposed heat dissipation system water requirements. The capacity requirements of the intake and discharge system are defined by the recommended heat dissipation system. For Units 3 and 4, the proposed heat dissipation system is a closed-loop system that uses the existing MCR for heat dissipation.

9.4.2.1 Intake Alternatives

The impacts associated with the proposed intake system, the RMPF, are discussed in Sections 4.2, 4.3, 5.2, and 5.3. STPNOC proposes to use the existing RMPF as the intake system for the proposed units. The review team determined in Chapter 4 that the impacts of building the proposed intake system would be SMALL for both hydrologic and ecological resources. The review team determined in Chapter 5 that the impacts of operating the proposed intake system would be SMALL for both hydrologic and ecological resources.

The existing intake structure, the RMPF, for the STP site was originally designed to support four units. As a result, no additional excavation and building is required to meet the needs of the two proposed units. The existing intake structure would be refurbished with new pumps and traveling screens in the existing structure (STPNOC 2009a). A redesigned intake structure that extends into the river or radial collector wells are alternatives to the current structure for obtaining makeup water for the MCR.

An intake structure that extends into the river has an advantage if other structures on the shoreline would conflict with a shoreline intake or if bathymetry or vegetation considerations make a shoreline intake less desirable. At the STP site, the conditions that would make an offshore intake advantageous do not occur. Offshore intakes with submerged passive screens are also more difficult to maintain. The shoreline option is preferable to an offshore intake because the intake structure is already in place.

A radial collector-well system was considered by the NRC staff because in many cases it reduces the impact on aquatic resources and, when water is being withdrawn from turbid environments can reduce the water treatment needed before its introduction into the cooling system. A radial collector-well system consists of an excavated central concrete caisson with well screens projected laterally outward in a radial pattern (Riegert 2006). Radial collector wells slowly draw surface water through the subsurface layer and, thereby, filter out some sediment that might have required treatment if the water had been directly withdrawn from the surface water body. In general, collecting surface water in this way eliminates most of the direct operational impacts on aquatic ecosystems (e.g., entrainment and impingement) associated with water withdrawal. The NRC staff determined that radial collector wells, which would induce flow through the sediments of the Colorado River into lateral subterranean pipes extending from the shoreline out beneath the reservoir, would require multiple large structures near the shoreline. STPNOC did not consider this alternative water source, but the NRC staff independently determined that a radial collector-well system is not environmentally preferable to the proposed direct withdrawal from the river due to the environmental impacts associated with excavating the caissons, drilling the laterals and building the multiple new shoreline structures, and because the impacts associated with aquatic ecology for the proposed intake have been determined to be SMALL in Chapters 4 and 5.

Because the RMPF already exists, the NRC staff concludes that there would be no alternative intake designs that would be environmentally preferable to the proposed intake design for the STP site.

9.4.2.2 Discharge Alternatives

The impacts associated with the proposed discharge system are discussed in Sections 4.2, 4.3, 5.2, and 5.3. STPNOC proposes to use the existing discharge system as the discharge system for the proposed units. The review team determined in Chapter 4 that the impacts of building the proposed discharge system would be SMALL for both hydrologic and ecological resources. The review team determined in Chapter 5 that the impacts of operating the proposed discharge system would be SMALL for both hydrologic and ecological resources.

The MCR discharges to the Colorado River through the existing discharge structure. This system includes a 1.1-mi-long discharge line that extends downstream along the river bank. Releases to the river would occur through one or more of seven discharge ports (STPNOC 2009a). The review team determined that the impacts of operation of this system would be SMALL and that any other alternative would result in land disturbing and in-water activities. Therefore, the NRC staff concluded that there were no alternative discharge designs that would be environmentally preferable to the proposed discharge design at the STP site.

9.4.2.3 Water Supplies

The impacts associated with the proposed water supply, the Colorado River, are discussed in Sections 4.2, 4.3, 5.2, and 5.3. Since the applicant does not propose to use surface water for building the proposed units, the review team determined in Chapter 4 that the impacts of building the proposed units would be SMALL for both hydrologic and ecological resources. The review team determined in Chapter 5 that the impacts of withdrawing water to operate the proposed units would be SMALL for both hydrologic and ecological resources.

The NRC staff considered alternative sources for the circulating water system including water reuse, groundwater, and surface water, including both freshwater and saltwater.

Water Reuse

Sources of water for reuse can either come from the plant itself or from other local water users. Sanitary waste water treatment plants generally used by communities with modest sized populations are the most ubiquitous source of water for reuse. Agricultural processing, industrial processing, and oilfield production can also provide significant supplies of water for reuse. Additional treatment (e.g., tertiary treatment, chlorination) may be required to provide water of appropriate quality for the specific plant need. Population is very low and there is little industry around the STP site. Consequently, the NRC staff determined that sufficient sources of water for reuse do not exist near the STP site. Therefore, the NRC staff concluded that water reuse would not be a feasible alternative for water supply at the STP site.

Groundwater

STPNOC proposes to use groundwater for the Ultimate Heat Sink (UHS) system during operation, but not the circulating water system. The UHS system discharges to the MCR resulting in approximately 500 gpm of groundwater being made available to make up for evaporative losses from the MCR. The NRC staff did consider groundwater as an alternative water source for the remainder of the makeup water for the circulating water system. Existing groundwater wells at the STP site are limited to a pumping rate of 500 gpm under the Coast Plains Groundwater Conservation District Operating Permit and must be separated by 2500 ft from neighboring Deep Aquifer wells. The review team estimated that withdrawal of the quantities of water needed to supply makeup water to the circulating water system (22,799 gpm for normal operating conditions, 47,489 gpm maximum) would require 95 wells for the maximum demand case. Based on the size of the existing STP site the review team concluded that it is not possible to locate this number of wells on the existing STP site under the rules of the groundwater well operating permit. The review team estimates that if 100 wells were placed in a square grid separated by 2500 ft, it would require more than 18 square mi.

The STPNOC states (STPNOC 2008b) that the Lower Colorado Regional Water Planning Group (LCRWPG) is currently making plans for the conjunctive use of groundwater and surface water to effectively use and preserve available water resources. The planning group advocates the combined use of these two resources in ways that would minimize the use of groundwater when surface water is available and that would manage aquifers for sustainable yield (LCRWPG 2006). The water management plans document an interest in minimizing the use of groundwater rather than utilization. Because it would take an additional 95 wells to meet the maximum demand for makeup water for cooling and water management plans for this region call for minimizing the use of groundwater, the NRC staff determined that groundwater use for CWS makeup water would not be an environmentally preferable alternative for water supply at the STP site.

Surface water

Surface water supplies at the STP site are saltwater from Matagorda Bay, brackish water from the estuarine portion of the Colorado River or fresh water from the Colorado River upstream of the dam at Bay City.

Use of salt water from the Matagorda Bay would require a new intake structure to be built and an 18-mi pipeline to transport the water from the Bay to the STP site to be installed (STPNOC 2009a). To obtain fresh water from the Colorado River upstream of the Fabridam near Bay City would also require a new intake structure and a pipeline to transport the water between the intake and the STP site to be built. The NRC staff determined that, while there is an abundant supply of water from Matagorda Bay and from the Colorado River upstream of the Fabridam, selection of either of these two alternatives would result in environmental impacts in many resource areas due to the construction of intake structures and the associated pipelines. Therefore, the NRC staff concluded that none of the surface water supply alternatives is environmentally preferable for the proposed water source for STP site.

9.4.2.4 Water Treatment

Both inflow and effluent water may require treatment to ensure that it meets plant water needs and effluent water standards. STPNOC proposes to add chemicals to plant water to meet appropriate water quality process needs. The effluent water chemistry is regulated by the TCEQ through the TPDES permitting process. Mechanical treatment may be a viable option for scale and biofilm removal. Other alternatives to manage biofouling, such as UV treatment, are also feasible. These alternatives, while feasible, would not eliminate the need for some chemical treatment. Chemical treatment is a reliable and well-established engineering practice that has been shown to provide minimal impacts in a variety of settings. The NRC staff identified no environmentally preferable alternative to STPNOC's proposed chemical water treatment. The effluents from cooling tower blowdown are specifically regulated in 40 CFR 423 by the EPA to protect the environment. In the State of Texas, this regulatory authority is administered by the TCEQ.

9.4.3 Conclusion

The NRC staff considered alternative systems designs including seven alternative heat dissipation systems and alternative intake, discharge, and water supply systems. As discussed in the above sections, the NRC staff identified no alternative that was environmentally preferable to the proposed plant systems design.

9.5 Corps' Onsite Alternatives Evaluation

A key provision of the 404(b)(1) guidelines is the "practicable alternative test" that requires that "no discharge of fill material shall be permitted if there is a practicable alternative to the proposed fill which would have a less adverse impact on the aquatic ecosystem" [40CFR 230.10(a)]. This is especially true when the proposed project is not water-dependent. The applicant must demonstrate that there are no less-damaging alternatives available and that all onsite impacts to waters of the United States have been avoided to the maximum practicable extent possible. For an alternative to be considered "practicable," it must be available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purpose. STPNOC proposes to construct an off-loading facility and heavy haul roads for oversized equipment associated with the construction and operation of the proposed nuclear power generation facility.

9.5.1 Onsite Alternative 1

Onsite alternative 1 uses a railway system as ingress for large equipment and use of existing roads within the STP facility to offload and transport heavy materials. This alternative would require the construction of 12 mi of rail line, which may cost between $10 and $15 million. Construction of the railway may require up to a 100-ft right-of-way, or 145 ac, which may include impacts to waters, uplands, and public infrastructure such as overhead utility lines, potable water, and sewer lines. Use of existing roads to transport materials after offloading from the railcars would be strictly limited due to safety concerns to human health and risk.

9.5.2 Onsite Alternative 2

Onsite alternative 2 includes barging material up the existing Colorado River Navigation Channel, but not dredging the existing barge terminal. In this alternative, a large crane would be used to offload material from the barges, which could be located within the Colorado River.

The cost of the crane is estimated to be $12 million. Barge traffic staged in the river for offloading may impede commercial and recreational navigation in the river during staging and offloading. Use of upgraded roads to transport materials after offloading from the barge would be strictly limited due to safety concerns to human health and risk. Limited impacts to waters, uplands, or public infrastructure are anticipated by this alternative.

9.5.3 Onsite Alternative 3 (STPNOC's Preferred Alternative)

Onsite alternative 3 uses a combination of barging material up the existing Colorado River Navigation Channel, upgrading existing barge slips to unload heavy equipment and construction of a heavy haul road within the STP facility. The existing barge slips are silted-in and would require dredging and rehabilitation before use. STPNOC has proposed to increase the capacity of the barge slips to accommodate larger barges. Excavation and dredging of material would be conducted utilizing mechanical dredge methods and all materials would be placed in an existing upland dredge material placement area located onsite. Offloading of material would occur within the barge slip, and no impacts to navigation are expected during staging and offloading. A heavy haul road would be constructed from the barge slip to the construction site. The heavy haul road would require six culverted crossings within channelized streams. Properly sized and placed culverts may result in both positive and negative stream impacts. Culverts may disrupt the geomorphology of the stream, but also provide shade for aquatic species. The streams proposed for crossing are channelized and devoid of riparian buffer. The estimated cost of excavation and expansion of the existing barge slip and construction of the heavy haul road is $1 million.

9.6 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

35 Tex. Reg. 249. January 8, 2010. "Threatened and Endangered Nongame Species." *Texas Register*. Texas Parks and Wildlife Department.

40 CFR Part 50. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards."

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

40 CFR Part 63. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

40 CFR Part 230. Code of Federal Regulations, Title 40, *Protection of Environment*, "Section 404(B)(1)Guidelines for Specification of Disposal Sites for Dredged or Fill Materials."

40 CFR Part 423. Code of Federal Regulations, Title 40, *Protection of the Environment*, Part 423, "Steam Electric Power Generating Point Source Category."

40 CFR Parts 1500 - 1518. Code of Federal Regulations, Title 40, *Protection of Environment*, Parts 1500- 1518 "National Environmental Policy Act."

51 FR 30028. August 21, 1986. "Safety Goals for the Operations of Nuclear Power Plants; Policy Statement." *Federal Register*. U.S. Nuclear Regulatory Commission.

65 FR 32214. May 22, 2000. "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels." *Federal Register*. U.S. Environmental Protection Agency.

66 FR 65255. December 18, 2001. "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities. *Federal Register*. U.S. Environmental Protection Agency.

Benson, K.L.P. and K.A. Arnold. 2001. *The Texas Breeding Bird Atlas*. Texas A&M University System, College Station and Corpus Christi, Texas. Accessed October 23, 2009 at http://tbba.cbi.tamucc.edu. Accession No. ML100640755.

Bluebonnet Groundwater Conservation District.(BGCD). 2004. *Groundwater Management Plan of the Bluebonnet Groundwater Conservation District.* Turner Collie & Braden, Inc., for BGCD, Navasota, Texas.

Brazos River Authority (Brazos). 2009. *Allens Creek Reservoir*. Accessed November 12, 2009 at http://www.brazos.org/acrHome.asp. Accession No. ML100640755.

Brazos River Authority (Brazos). 2010. *Allens Creek Reservoir Timeline*. Accessed January 22, 2010 at http://www.brazos.org/generalPdf/acr_Project_Timeline.pdf.

Brown, WM. 1993. *Avian Collisions with Utility Structures: Biological Perspectives*. In Proceedings: Avian Interactions with Utility Structures, International Workshop. EPRI TR-103268.

Calpine. 2009. *Power Plants.* Accessed February 4, 2010 at http://www.calpine.com/power/plant.asp?plant=73. Accession No. ML100640755.

Clean Air Act. 42 USC 7401, et seq.

Coastal Zone Management Act (CZMA). 16 USC 1451, et seq.

CPS Energy (CPS). 2009. "CPS Energy Outlines Its Commitment to Sustainability." Accessed February 17, 2009 at http://windtricity.com/About_CPS_Energy/News_Features/News/012009_sustainability_NR.asp.

Cushing, C.E., and J.D. Allen. 2001. *Streams: Their Ecology and Life*. Academic Press, San Diego, California. Accession No. ML100640755.

Davis, W.B. and D.J. Schmidly. 1994. *The Mammals of Texas*. Accessed October 15, 2009 at http://www.nsrl.ttu.edu/tmot1/Default.htm. Accession No. ML100640755.

Electric Reliability Council of Texas (ERCOT). 2008. *An Update on the ERCOT Market*. Accessed February 19, 2009 at http://www.ercot.com/content/news/presentations/2009/KahnBizComm11-18-08.pdf. Accession No. ML100640755.

Electric Reliability Council of Texas (ERCOT). 2009. "Company Profile." Accessed November 5, 2009, at http://www.ercot.com/about/profile/index.html. Accession No. ML100640755.

Electric Power Research Institute (EPRI). 2002. *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application*. Product ID: 1006878, EPRI, Palo Alto, California.

Endangered Species Act (ESA). 16 USC 1531, et seq.

Erickson, WP, GD Johnson, and DP Young, Jr. 2005. *A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions*. USDA Forest Service General Technical Report, PSW-GTR-191.

Exelon Generation (Exelon). 2009. Letter from Marilyn C. Kray (Exelon Generation Vice President, Project Development) to U.S. Nuclear Regulatory Commission, "Subject: Exelon

Nuclear Texas Holdings, LLC, Victoria County Station, Early Site Permit Application Expected Submission Date, NRC Project Number 0781." October 13, 2009. Accession No. ML092940786.

Fairfield Recorder (Fairfield). 2009. N*ew Gas Power Plant Planned Near Richland-Chambers*. Accessed December 18, 2009 at http://www.thefairfieldrecorder.net/news/2009-02-05/front_page/001.html. Accession No. ML100640755.

Federal Water Pollution Control Act (Clean Water Act). 33 USC 1251, et seq.

Gabbard A. 1993. "Coal Combustion: Nuclear Resource or Danger," *Oak Ridge National Laboratory Review*. Summer/Fall 1993. Oak Ridge National Laboratory, Oak Ridge, Tennessee. Accessed February 23, 2009 at http://www.ornl.gov/ORNLReview/rev26-34/text/colmain.html. Accession No. ML100640755.

Gelwick, F.P., and R.Y. Li. 2002. *Mesohabitat Use and Community Structure of Brazos River Fishes in the Vicinity of the Proposed Allens Creek Reservoir.* Texas Water Development Board Interagency Contract Number 2001-483-376. Texas Parks and Wildlife Department, Austin, Texas.

Gentry, RR. 1997. *An Overview of the Reclamation Program at the Big Brown Lignite Mine. Presented at the 1997 National Meeting of the American Society for Surface Mining and Reclamation, Austin Texas*. Accessed November 20, 2009 at http://www.docstoc.com/docs/15730949/An-Overview-of-the-Reclamation-Program-at-the-Big. Accession No. ML100640755.

Global Scholar. 2008. Schoolfinder - Brazos ISD : Overview & Information. Accessed on January 12, 2009 at http://www.globalscholar.com/schoolfinder/district/16530-brazos-isd/overview-information.aspx. Accession No. ML100640755.

R.W. Harden & Associates, Inc., 2007. Northern Trinity/Woodbine GAM Assessment of Groundwater Use in the Northern Trinity Aquifer due to Urban Growth and Barnett Shale Development. Prepared for the Texas Water Development Board. Austin, Texas. January 2007.

Hassan-Williams, C., and T.H. Bonner. 2009. Texas Freshwater Fishes. Texas State University-San Marcos, Biology Department, Aquatic Station, San Marcos, Texas. Accessed January 25, 2010 at http://nucleus.bio.txstate.edu/~tbonner/txfishes/. Accession No. ML100640755.

Houston Metropolitan Research Center (HMRC). 2009. *Allens Creek Nuclear Generating Plant Collection: An Inventory of Records at the Houston Metropolitan Research Center, Houston*

Public Library. Accessed November 12, 2009 at http://www.lib.utexas.edu/taro/houpub/00043/hpub-00043.html#scopecontent. Accession No. ML100640755.

Hudson Products. 2009. *Company Profile.* Accessed March 4, 2010 at http://www.hudsonproducts.com. Accession No. ML100640755.

Linam, G.W., L.J. Kleinsasser, and K.B. Mayes. 2002. Regionalization of the Index of Biotic Integrity for Texas Streams. River Studies Report No. 17, Texas Parks & Wildlife Department, Resource Protection Division.

Lower Colorado Regional Water Planning Group (LCRWPG). 2006. *Region "K" Water Plan for the Lower Colorado Regional Water Planning Group*. Accessed June 22, 2009 at http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionK. Accession No. ML100640755.

Luminant. 2009. *Power Plants*. Accessed November 12, 2009 at http://www.luminant.com/plants/default.aspx. Accession No. ML100640755.

Massachusetts Institute of Technology (MIT). 2006. *The Future of Geothermal Energy*. Accessed February 25, 2009 at http://geothermal.inel.gov/publications/future_of_geothermal_energy.pdf. Accession No. ML100640755.

McCord, M.W. 2009. *Southwest Paddler: Outdoor Recreation Guide for Texas, Oklahoma, Arkansas, Missouri, New Mexico, Arizona, Colorado and Utah: Red River, Denison Dam to SH 78*. Accessed November 17, 2009 at http://southwestpaddler.com/docs/red3.html.

Mid-East Texas Groundwater Conservation District (METGCD). 2009. Management Plan: Mid-East Texas Groundwater Conservation District; adopted August 13, 2009. METGCD, Centerville, Texas. Accessed at March 4, 2010 at http://mideasttexasgcd/management%20plan.pdf. Accession No. ML100640755.

National Center for Education Statistics (NCES). 2009. Search for Public School Districts. Accessed on November 20, 2009 at http://nces.ed.gov/ccd/districtsearch/index.asp. Accession No. ML100640755.

National Energy Technology Laboratory (NETL). 2007. *Cost and Performance Baseline for Fossil Energy Plants. Volume 1: Bituminous Coal and Natural Gas to Electricity*. DOE/NETL-2007/1281. Accessed February 20, 2009 at http://www.netl.doe.gov/energy-analyses/pubs/Bituminous%20Baseline_Final%20Report.pdf. Accession No. ML100640755.

National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, et seq.

National Park Service (NPS). 2009. *Catfish Creek National Natural Landmark*. Accessed November 20, 2009 http://www.nature.nps.gov/nnl/Registry/USA_Map/States/Texas/NNL/CC/index.cfm. Accession No. ML100640755.

Moulder, J.E.M. 2003. *Powerlines & Cancer FAQS.* Accessed March 8, 2010 at http://www.faqs.org/faqs/medicine/powerlines-cancer-faq/. Accession No. ML100670532.

National Institute of Environmental Health Sciences (NIEHS). 2002. *Electric and Magnetic Fields Associated with the use of Electric Power. Questions and Answers.* Accessed March 5, 2010 at http://www.niehs.nih.gov/health/docs/emf-02.pdf. Accession No. ML100640755.

NRG. 2009. *Repowering NRG. Limestone 3 Expansion.* Accessed February 4, 2010 at http://www.nrgenergy.com/about/repowering/repowering_tx_ls.htm. Accession No. ML100640755.

NatureServe. 2009a. *Species Descriptions for Important Species at Alternative Sites*. Accessed December 21, 2009 at http://www.natureserve.org/explorer/servlet/NatureServe?post_processes=PostReset&loadTemplate=nameSearchSpecies.wmt&Type=Reset. Accession No. ML100640755.

NatureServe. 2009b. *Species Descriptions for Threatened and Endangered Species at Alternative Sites*. Accessed October 26, 2009 at http://www.natureserve.org/explorer/servlet/NatureServe?post_processes=PostReset&loadTemplate=nameSearchSpecies.wmt&Type=Reset. Accession No. ML100640755.

New England Coalition on Nuclear Pollution. 1978. *New England Coalition on Nuclear Pollution v. NRC*. 582 F.2d 87 (1st Circuit 1978).

NextEra Energy Resources (NextEra). 2009. *Solar Electric Generating Systems*. Accessed February 24, 2009 at http://www.nexteraenergyresources.com/content/where/portfolio/pdf/segs.pdf. Accession No. ML100640755.

Nielsen-Gammon, JW. 1995. "The Changing Climate of Texas" In The Impact of Global Warming on Texas, North, G., J. Schmandt, and J. Clarkson (eds). University of Texas Press, Austin, Texas.

Northwest Power and Conservation Council (NPCC). 2005. *The Fifth Northwest Electric Power and Conservation Plan*, Vol. 3. Accessed February 20, 2009 at http://www.nwcouncil.org/energy/powerplan/5/Volume3.pdf. Accession No. ML100640755.

Northwest Power and Conservation Council (NPCC). 2006. *Biennial Assessment of the Fifth Power Plan: Assessment of Other Generating Technologies*. Accessed February 24, 2009 at http://www.nwppc.org/energy/Biennial/BiennialOther%20gen.pdf. Accession No. ML100640755.

Northwest Power and Conservation Council (NPCC). 2009. *Draft Northwest 6th Power Plan*. Accessed September 29, 2009 at http://www.nwppc.org/energy/powerplan/6/default.htm. Accession No. ML100640755.

North Texas Municipal Water District (NTMWD). 2009. *The Lower Bois d'Arc Creek Reservoir.* Accessed February 11, 2010 at http://www.ntmwd.com/bois_dArc.html. Accession No. ML100640755.

Nuclear Energy Institute (NEI). 2009. *U.S. Nuclear Industry Capacity Factors (1971 – 2008)*. Accessed November 24, 2009 at http://www.nei.org/resourcesandstats/graphicsandcharts/performancestatistics/. Accession No. ML100640755.

Osting, T., R. Mathews, and B. Austin. 2004. Analysis of Instream Flows for the Lower Brazos River - Hydrology, Hydraulics, and Fish Habitat Utilization. Final Report, Volume I – Main Report. Texas Water Development Board, Surface Water Resources Division, Austin, Texas.

Public Service Company of New Hampshire. (Seabrook Station, Units 1 and 2) CLI-77-8, 5 NRC 503, 516 (1977).

Riegert, S. 2006. "Reassessing Ranney Wells; The Ins and Outs of Horizontal Collector." *Public Works Magazine*, Published April 15, 2006. Accessed March 4, 2010 at http://www.pwmag.com/industry-news.asp?sectionID=775&articleID=314672. Accession No. ML100640755.

Resource Conservation and Recovery Act (RCRA). 42 USC 6901, et seq.

Rochester Gas & Electric Corp. 1978. (Sterling Power Project Nuclear Unit No. 1), ALAB-502, 8 NRC 383, 397 (1978), affirmed, CLI-80-23, 11 NRC 731 (1980).

Solar Southwest Initiative (SSI). 2010. *Baseload and Dispatchable Power*. Accessed January 7, 2010 at http://www.solarsouthwest.org/node/9. Rochester Gas & Electric Corp. 1978. (Sterling Power Project Nuclear Unit No. 1), ALAB-502, 8 NRC 383, 397 (1978), affirmed, CLI-80-23, 11 NRC 731 (1980).

South Texas Project Nuclear Operating Company (STPNOC). 2008a. Letter from Greg Gibson, STPNOC, to NRC, dated February 28, 2008, “Responses to Environmental Report Site Audit Comments." Accession No. ML080660150.

South Texas Project Nuclear Operating Company (STPNOC). 2008b. Letter from Greg Gibson, STPNOC, to NRC, dated July 15, 2008, ”Response to Requests for Additional Information.” Accession No. ML082040684.

South Texas Project Nuclear Operating Company (STPNOC). 2008c. Letter from Greg Gibson, STPNOC, to NRC, dated July 30, 2008, “Response to Requests for Additional Information." Accession No. ML082140629.

South Texas Project Nuclear Operating Company (STPNOC). 2008d. Letter from Mark McBurnett, STPNOC, to NRC, dated June 9, 2008, “Cultural or Historical Artifact Discovery During Construction." Accession No. ML081640213.

South Texas Project Nuclear Operating Company (STPNOC). 2009a. *South Texas Project Units 3 and 4 Combined License Application, Part 3, Environmental Report*. Revision 3, Bay City, Texas. Accession No. ML092931600.

South Texas Project Nuclear Operating Company (STPNOC). 2009b. Letter from Scott Head, STPNOC, to NRC, dated October 27, 2009, “Response to Request for Additional Information.” Accession No. ML093060175.

South Texas Project Nuclear Operating Company (STPNOC). 2009c. Letter from Scott Head, STPNOC, to NRC, dated November 30, 2009, "Supplemental Response to Request for Additional Information. " Accession No. ML093360350.

South Texas Project Nuclear Operating Company (STPNOC). 2009d. Letter from Scott Head, STPNOC, to NRC, dated September 14, 2009, “Response to Request for Additional Information" Accession No. ML092580491.

South Texas Project Nuclear Operating Company (STPNOC). 2009e. Letter from Scott Head, STPNOC, to NRC, dated November 30, 2009, "Response to Request for Additional Information.” Accession No. ML093370158.

South Texas Project Nuclear Operating Company (STPNOC). 2009f. *South Texas Project Units 3 and 4 Combined License Application, Part 3, Environmental Report*. Revision 3, Bay City, Texas. Accession No. ML092931178.

Southern Company and Georgia Institute of Technology (Southern and GIT). 2007. *Southern Winds: Summary Project Report 2007, A Study of Wind Power Generation Potential off the*

Georgia Coast. Accessed March 5, 2010 at http://www.energy.gatech.edu/research/Summary-Southern-Winds.pdf. Accession No. ML100640755.

Southern Company. 2009. "Southern Company Breaks Ground on Biomass Plant. Accessed January 20, 2010 at http://www.southerncompany.com/news/iframe_pressroom.aspx. Accession No. ML100640755.

Strayer, D.L. 2008. Freshwater Mussel Ecology: A Multifactor Approach to Distribution and Abundance. Freshwater Ecology Series, Vol. 1. University of California Press, Berkley, California.

Succar, S. and R. H. Williams. 2008. "Compressed Air Energy Storage: Theory, Resources, and Applications for Wind Power." Princeton University Energy Systems Analysis Group. Accessed September 30, 2009 at http://www.princeton.edu/~ssuccar/caesReport.html. Accession No. ML100640755.

Texas Association of Counties. 2009a. *Fannin County Profile*. Accessed November 21, 2009 at http://www.txcip.org/tac/census/profile.php?FIPS=48147. Accession No. ML100640755.

Texas Association of Counties. 2009b. *Grayson County Profile*. Accessed November 20, 2009 at http://www.txcip.org/tac/census/profile.php?FIPS=48181. Accession No. ML100640755.

Texas Association of Counties. 2009c. *Austin County Profile*. Accessed November 21, 2009 at http://www.txcip.org/tac/census/profile.php?FIPS=48015. Accession No. ML100640755.

Texas Association of Counties. 2009d. *Fort Bend County Profile*. Accessed November 21, 2009 at http://www.txcip.org/tac/census/profile.php?FIPS=48157. Accession No. ML100640755.

Texas Association of Counties. 2009e *Freestone County Profile*. Accessed November 21, 2009 at http://www.txcip.org/tac/census/profile.php?FIPS=48161. Accession No. ML100640755.

Texas Association of Counties. 2009f *Anderson County Profile*. Accessed November 21, 2009 at: http://www.txcip.org/tac/census/profile.php?FIPS=48001. Accession No. ML100640755.

Texas Coastal Management Program (TCMP) 2009. *Texas Coastal Management Program*. Accessed November 13, 2009 at http://www.glo.state.tx.us/coastal/cmp.html#mapsdata. Accession No. ML100640755.

Texas Commission on Environmental Quality (TCEQ). 2001. Multi-Sector Permit – Permit No. TXR050000. Austin, Texas. August 20, 2001.

Texas Commission on Environmental Quality (TCEQ). 2003. TPDES General Permit No. TXR150000. Austin, Texas. March 5, 2003.

Texas Commission on Environmental Quality (TCEQ). 2008. *Texas Water Quality Inventory: Water bodies with concerns for use for use attainment and screening levels (March 19, 2008). Red River*. Accessed November 18, 2009 at http://www.tceq.state.tx.us/assets/public/compliance/monops/water/08twqi/2008_concerns.pdf. Accession No. ML100640755.

Texas Commission on Environmental Quality (TCEQ). 2009a. *Water Rights Database and Related Files*. Accessed April 13, 2009 at http://www.tceq.state.tx.us/permitting/water_supply/water_rights/wr_databases.html. Accession No. ML100640755.

Texas Commission on Environmental Quality (TCEQ). 2009b. Water Availability Models. Accessed November 15, 2009 at http://www.tceq.state.tx.us/permitting/water_supply/water_rights/wam.html. Accession No. ML100640755.

Texas Commission on Environmental Quality. (TCEQ). 2009c. *Red River Compact Commission*. Accessed November 15, 2009 at http://www.tceq.state.tx.us/permitting/water_supply/water_rights/redriver.html. Accession No. ML100640755.

Texas Commission on Environmental Quality. (TCEQ). 2009d. *Lakeside Operating Permit.* Accessed February 4, 2010 at http://www5.tceq.state.tx.us/airperm/index.cfm?fuseaction=airpermits.project_report&proj_id=143623&addn_num_txt=PSDTX1200. Accession No. ML100640755.

Texas Commission on Environmental Quality. (TCEQ). 2009e. *New Source Review Permits and Authorizations for Calendar Year 2009*. Accessed February 4, 2010 at http://www.tceq.state.tx.us/assets/public/permitting/air/NewSourceReview/Agendas/nsryear2009.htm. Accession No. ML100640755.

Texas Commission on Environmental Quality (TCEQ). 2010a. *List of Texas Utilities (Water or Sewer)*. Accessed on January 15, 2010 at http://www10.tceq.state.tx.us/iwud/util/index.cfm?fuseaction=ListUtilities&COMMAND=LIST. Accession No. ML100640755.

Texas Commission on Environmental Quality (TCEQ). 2010b. Draft 2010 Texas 303(d) List. February 5, 2010. Accessed March 2, 2010 at http://www.tceq.state.tx.us/assets/public/compliance/monops/water/10twqi/2010_303d.pdf. Accession No. ML100630153.

Texas Comptroller of Public Accounts. 2008a. *The Energy Report 2008 - Hydropower*. Accessed March 5, 2010 at http://www.window.state.tx.us/specialrpt/energy/renewable/hydro.php. Accession No. ML100640755.

Texas Comptroller of Public Accounts. 2008b. *The Energy Report 2008 - Wood*. Accessed February 25, 2009 at http://www.window.state.tx.us/specialrpt/energy/renewable/wood.php. Accession No. ML100640755.

Texas Comptroller of Public Accounts. 2008c. *The Energy Report 2008 – Municipal Waste Combustion*. Accessed February 25, 2009 at http://www.window.state.tx.us/specialrpt/energy/renewable/municipal.php. Accession No. ML100640755.

Texas Comptroller of Public Accounts. 2008d. *The Energy Report 2008 – Biomass Overview*. Accessed February 25, 2009 at http://www.window.state.tx.us/specialrpt/energy/renewable/biomass.php. Accession No. ML100640755.

Texas Department of Criminal Justice (TDCJ). 2009. *Correctional Institutions Division – Prison; Boyd.* Accessed February 11, 2010 at http://www.tdcj.state.tx.us/stat/unitdirectory/by.htm. Accession No. ML100640755.

Texas Department of Transportation (TxDOT). 2009a. *TxDOT 2009 Highway Projects*. Accessed March 5, 2010 at http://apps.dot.state.tx.us/apps/project_tracker/projects.htm?view=cnty&dist=Tyler&cnty=Anderson. Accession No. ML100640755.

Texas Department of Transportation (TxDOT). 2009b. *Project Overview Keep Texas Moving.* Accessed March 5, 2010 at http://www.keeptexasmoving.com/index.php/i-69-ttc. Accession No. ML100640755.

Texas Education Agency (TEA). 2009. TEA School Finance Website. Accessed January 22, 2010 at http://ritter.tea.state.tx.us/school.finance/index.html#chapter. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2007. *Fairfield Lake*. Accessed January 10, 2010 at http://www.tpwd.state.tx.us/fishboat/fish/recreational/lakes/fairfield/. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009a. *Wildlife Management by District: Post Oak Savannah and Oak Prairie*. Accessed October 21, 2009 at http://www.tpwd.state.tx.us/landwater/land/habitats. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009b. *Plant Guidance by Ecoregions*. Accessed October 21, 2009 at http://www.tpwd.state.tx.us/huntwild/wild/wildscapes/guidance/plants/ecoregions. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009c. *TPWD Parks and WMA at Alternative Sites*. Accessed November 19, 2009 at http://www.tpwd.state.tx.us/huntwild/hunt/wma/. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009d. Letter from Ross Melinchuk (Deputy Executive Director, Texas Parks and Wildlife Department) to Ray Whited (Chief, U.S. Nuclear Regulatory Commission) dated November 13, 2009, "Proposed alternative sites related to the combined license application for South Texas Project, Units 3 and 4." Accession No. ML093210221.

Texas Parks and Wildlife Department (TPWD). 2009e. *Game Species at Alternative Sites*. Accessed December 21, 2009 at http://www.tpwd.state.tx.us/huntwild/hunt/wma/. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009f. *Endangered and Threatened Species List for Austin, Fannin, Freestone, and Fort Bend Counties*. Accessed October 26, 2009 at http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009g. P*rofiles of Endangered and Threatened Species for Austin, Fannin, Freestone, and Fort Bend Counties*. Accessed October 26, 2009 at http://www.tpwd.state.tx.us/huntwild/wild/species/. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009h. Invasive, Prohibited and Exotic Species. Accessed November 19, 2009 at: http://www.tpwd.state.tx.us/huntwild/wild/species/exotic/. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009i. Rare, Threatened, and Endangered Species of Texas, Fannin, Austin, and Freestone Counties. Texas Parks and Wildlife Department, Austin, Texas. Accessed January 25, 2010 at http://gis.tpwd.state.tx.us/TpwEndangeredSpecies/DesktopDefault.aspx. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009j. *Fairfield Lake State Park.* Accessed February 4, 2010 at www.tpwd.state.tx.us/spdest/findadest/parks/fairfield_lake/. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009k. *Richland Creek WMA.* Accessed February 4, 2010 at http://www.tpwd.state.tx.us/huntwild/hunt/wma/find_a_wma/list/?id=23. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009l. *Big Lake Bottom WMA.* Accessed February 4, 2010 at hhttp://www.tpwd.state.tx.us/huntwild/hunt/wma/find_a_wma/list/?id=1. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009m. *Gus Engeling WMA (GEWMA).* Accessed February 4, 2010 at http://www.tpwd.state.tx.us/huntwild/hunt/wma/find_a_wma/list/?id=10. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009n. *Stephen F. Austin State Park.* Accessed February 4, 2010 at http://www.tpwd.state.tx.us/spdest/findadest/parks/stephen_f_austin_and_san_felipe. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2009o. *Brazos Bend State Park.* Accessed February 4, 2010 at http://www.tpwd.state.tx.us/spdest/findadest/parks/brazos_bend. Accession No. ML100640755.

Texas Parks and Wildlife Department (TPWD). 2010. *Ecologically Significant River and Stream Segments – Regions C and H*. Accessed January 21, 2010 at http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/. Accession No. ML100640755.

Texas Railroad Commission (TRC). 2010. *Surface Mining & Reclamation.* Accessed February 4, 2010 at http://www.rrc.state.tx.us/programs/mining/projects/TurlingtonMine.php. Accession No. ML100640755.

Texas State Energy Conservation Office (TSECO). 2008a. *Texas Solar Energy*. Accessed February 24, 2009 at http://www.seco.cpa.state.tx.us/re_solar.htm.

Texas State Energy Conservation Office (TSECO). 2008b. *Texas Wind Energy*. Accessed February 24, 2009 at http://www.seco.cpa.state.tx.us/re_wind.htm. Accession No. ML100640755.

Texas State Energy Conservation Office (TSECO). 2008c. *Wind Energy Transmission*. Accessed February 24, 2009 at http://www.seco.cpa.state.tx.us/re_wind-transmission.htm. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009a. *Valley Lake*. Accessed November 12, 2009 at: http://www.tshaonline.org/handbook/online/articles/VV/rovnr.html. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009b. *Fairfield Lake*. Accessed November 13, 2009 at http://www.tshaonline.org/handbook/online/articles/FF/rof8.html. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009c. *Handbook of Texas Online - Fannin County*. Accessed on November 18, 2009 at http://www.tshaonline.org/handbook/online/articles/FF/hcf2.html. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009d. *Handbook of Texas Online - Grayson County*. Accessed on November 18, 2009 at http://www.tshaonline.org/handbook/online/articles/GG/hcg9.html. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009e. *Handbook of Texas Online - Austin County*. Accessed on November 18, 2009 at http://www.tshaonline.org/handbook/online/articles/AA/hca8.html. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009f. *Handbook of Texas Online –Fort Bend County*. Accessed on November 18, 2009 at http://www.tshaonline.org/handbook/online/articles/FF/hcf7.html. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009g. *Handbook of Texas Online –Freestone County*. Accessed on November 18, 2009 at http://www.tshaonline.org/handbook/online/articles/AA/hca8.html. Accession No. ML100640755.

Texas State Historical Association (TSHA). 2009h. *Handbook of Texas Online –Anderson County*. Accessed on November 18, 2009 at http://www.tshaonline.org/handbook/online/articles/AA/hca8.html. Accession No. ML100640755.

Thomas, C., T.H. Bonner, and B.G. Whiteside. 2007. *Freshwater Fishes of Texas: A Field Guide*. Texas A&M University Press, College Station, Texas.

Texas Water Development Board (TWDB) 2001. *Region C Water Plan.* Accessed January 13, 2010 at http://www.regioncwater.org/Documents/index.cfm?PageNum_d=1&Category=Water+Plan. Accession No. ML100640755.

Texas Water Development Board (TWDB). 2003. Groundwater Availability Model for the Central Part of the Carrizo-Wilcox Aquifer in Texas. TWDB, Austin, Texas.

Texas Water Development Board (TWDB). 2006a. *Water For Texas 2007*. Accessed January 14, 2010 at: http://www.twdb.state.tx.us/wrpi/swp/swp.htm. Accession No. ML100640755.

Texas Water Development Board (TWDB). 2006b. *2006 Region C Water Plan*. Accessed March 1, 2010 at http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionC/. Accession No. ML100640755.

Texas Water Development Board (TWDB). 2006c. *Regional Water Plan*. Accessed March 1, 2010 at http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionG/. Accession No. ML100640755.

Texas Water Development Board (TWDB). 2009. *Groundwater Management Area 8.* Accessed March 5, 2010 at http://www.twdb.state.tx.us/GwRD/GMA/gma8/gma8home.htm. Accession No. ML100640755.

Texas Water Development Board (TWDB). 2010a. *Potential New Reservoirs for Region C Water Supply. Accessed March 5, 2010 at* http://www.twdb.state.tx.us/rwp/c/PDFs/Regional%20Plan%20Main%20Text/Table_5-3.pdf. Accession No. ML100640755.

Texas Water Development Board (TWDB). 2010b. *Groundwater Management Area 12.* Accessed March 5, 2010 at http://www.state.tx.us/GwRD/GMA/gma12/gma12home.htm. Accession No. ML100640755.

Texas Water Development Board (TWDB). 2010c. *Groundwater Management Area 14.* Accessed March 5, 2010 at http://www.twdb.state.tx.us/GWRD/GMA/gma14/gma14home.htm. Accession No. ML100640755.

Texas Water Code, Title 2, *Water Administration*. Chapter 11, “Water Rights.”

Texas Water Code, Title 2. *Water Administration.* Chapter 26, “Water Quality Control.”

Texas Water Code, Title 2. *Water Administration*. Chapter 36, “Groundwater Conservation Districts.”

United States Steel (USS). 2009. *Bellville Operations Division*. Accessed March 5, 2010 at http://www.ussteel.com/corp/facilities/Bellville.asp. Accession No. ML100640755.

U.S. Army Corps of Engineers (Corps). 2009. Proposed Lower Bois d'Arc Creek Reservoir Scoping Meeting Public Notice Announcement. Application No. SWT-0-14659. U.S. Army Corps of Engineers.

U.S. Atomic Energy Commission (AEC). 1974. Final Environmental Statement Related to the Proposed Allens Creek Nuclear Generating Station, Units 1 and 2. Houston Lighting and Power Company. Docket Nos. 50-466 and 50-467.

U.S. Census Bureau (USCB). *2009a. Population Finder - American FactFinder*. Accessed September 24, 2009 at http://factfinder.census.gov/servlet/SAFFPopulation?_event=Search&geo_id=01000US&_. (Select City). Accession No. ML100640755.

U.S. Census Bureau (USCB). *2009b.*Sherman-Denison, TX Metropolitan Statistical Area. Data Profiles. Selected Social Characteristics in the United States: 2008. Accessed November 21, 2009 at http://factfinder.census.gov. Data Set: 2008 American Community Survey 1-Year Estimates. Survey: American Community Survey.

U.S. Census Bureau (USCB). 2009c. *Fannin County Texas - Selected Housing Characteristics 2006-2008 American Community Survey 3-Year Estimates* Accessed November 21, 2009 at http://factfinder.census.gov Search: 2006-2008 American Community Survey, Data Profiles, Fannin County, Texas.

U.S. Census Bureau (USCB). 2009d. *Grayson County Texas - Selected Housing Characteristics 2006-2008 American Community Survey 3-Year Estimates* Accessed November 21, 2009 at http://factfinder.census.gov Search: 2006-2008 American Community Survey, Data Profiles, Grayson County, Texas.

U.S. Census Bureau (USCB). 2009e. *Austin County Texas - Selected Housing Characteristics 2006-2008 American Community Survey 3-Year Estimates* Accessed November 21, 2009 at http://factfinder.census.gov Search: 2006-2008 American Community Survey, Data Profiles, Austin County, Texas.

U.S. Census Bureau (USCB). 2009f. *Fort Bend County Texas - Selected Housing Characteristics 2006-2008 American Community Survey 3-Year Estimates* Accessed November 21, 2009 at http://factfinder.census.gov Search: 2006-2008 American Community Survey, Data Profiles, Fort Bend County, Texas.

U.S. Census Bureau (USCB). 2009g. *Freestone County Texas - Selected Housing Characteristics 2006-2008 American Community Survey 3-Year Estimates* Accessed November 21, 2009 at http://factfinder.census.gov Search: 2006-2008 American Community Survey, Data Profiles, Freestone County, Texas.

U.S. Census Bureau (USCB). 2009h. *Anderson County Texas - Selected Housing Characteristics 2006-2008 American Community Survey 3-Year Estimates* Accessed November 21, 2009 at http://factfinder.census.gov Search: 2006-2008 American Community Survey, Data Profiles, Anderson County, Texas.

U.S. Census Bureau (USCB). 2009i. P*opulation Estimates Data Sets.* Accessed September 24, 2009 at http://www.census.gov/popest/datasets.html. Accession No. ML100640755.

U.S. Department of Energy (DOE). 2006. *Geothermal FAQs*. Accessed February 25, 2009 at http://www1.eere.energy.gov/geothermal/faqs.html. Accession No. ML100640755.

U.S. Department of Energy (DOE). 2008a. *20% Wind Energy by 2030*. DOE/GO-102008-2567. Accessed February 24, 2009 at http://www1.eere.energy.gov/windandhydro/. Accession No. ML100640755.

U.S. Department of Energy (DOE). 2008b. *State Energy Alternatives: Biomass Energy*. Accessed February 25, 2009 at http://www.eere.energy.gov/states/alternatives/biomass.cfm.

U.S. Department of Energy (DOE). 2008c. *Fuel Cell Technology Challenges*. Accessed February 25, 2009 at http://www1.eere.energy.gov/hydrogenandfuelcells/fuelcells/fc_challenges.html. Accession No. ML100640755.

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2009a. *Texas Quick Facts*. Accessed January 7, 2010 at http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=TX. Accession No. ML100640755.

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2009b. *Electric Power Industry 2007: Year in Review*. Accessed February 19 2009 at http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html. Accession No. ML100640755.

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2009c. *An Updated Annual Energy Outlook 2009 Reference Case Reflecting Provisions of the American Recovery and Reinvestment Act and Recent Changes in the Economic Outlook*. SR/OIAF/2009-03. Accessed July 22, 2009 at http://www.eia.doe.gov/oiaf/servicerpt/stimulus/index.html. Accession No. ML100640755.

U.S. Department of Transportation (USDOT). 2009. *Re-evaluation of the Final Environmental Impact Statement for State Highway 99 Grand Parkway.* Accessed March 5, 2010 at http://www.grandpky.com/downloads/segment_f1/20090605_F-1_FEIS%20Draft_ReEval.pdf. Accession No. ML100640755.

U.S. Department of Transportation and Texas Department of Transportation (DOT and TxDOT). 2007. *I-69/Trans-Texas Corridor Tier One Draft Environmental Impact Statement.* FHWA-TX-EIS-07-02-D. Austin, Texas.

U.S. Environmental Protection Agency (EPA). 2008. *Municipal Solid Waste - Combustion*. Accessed February 25, 2009 at http://www.epa.gov/osw/nonhaz/municipal/combustion.htm. Accession No. ML100640755.

U.S. Environmental Protection Agency (EPA). 2009a. *Municipal Solid Waste*. Accessed February 25, 2009 at http://www.epa.gov/cleanenergy/energy-and-you/affect/municipal-sw.html. Accession No. ML100640755.

U.S. Environmental Protection Agency (EPA). 2009b. U.S. Environmental Protection Agency (EPA). 2009. Safe Drinking Water Information System (SDWIS). Accessed January 15,2010 at http://oaspub.epa.gov/enviro/sdw_form_v2.create_page?state_abbr=TX. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009c. *Big Brown Steam Electric Station.* Accessed March 5, 2010 at http://iaspub.epa.gov/enviro/fii_query_dtl.disp_program_facility?p_registry_id=110000598988. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009d. *Big Brown Lignite Mining Area.* Accessed March 5, 2010 at http://iaspub.epa.gov/enviro/fii_query_dtl.disp_program_facility?p_registry_id=110033229897. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA) 2009e. *TXI Operations LP.* Accessed March 5, 2010 at http://oaspub.epa.gov/enviro/fii_query_dtl.disp_program_facility?pgm_sys_id_in=75859TXPSL2MILE&pgm_sys_acrnm_in=TRIS. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009f. *Coffield Prison Water Discharge Permit.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/pcs_det_reports.pcs_tst?npdesid=TX0031577&npvalue=1&npvalue=2&npvalue=3&npvalue=4&npvalue=5&npvalue=6&rvalue=13&npvalue=7&npvalue=8&npvalue=10&npvalue=11&npvalue=12. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009g. *Nucor Steel – Texas.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/fii_query_dtl.disp_program_facility?pgm_sys_id_in=TXD071378582&pgm_sys_acrnm_in=RCRAINFO. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009h. EPA 2009 Cayuga.

U.S. Environmental Protection Agency. (EPA). 2009i. *Trinity Materials Water Discharge Permits.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/pcs_web.report?PGM_SYS_ID=OK0044172. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009j. *City of Bells Water Discharge Permit.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/pcs_web.report?PGM_SYS_ID=TX0053368. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009k. *EPA 2009 City of Denison Water Discharge Permit.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/pcs_web.report?PGM_SYS_ID=TX0053368. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009l *WA Parish Electric Generating Station Detail Report.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/fii_query_dtl.disp_program_facility?pgm_sys_id_in=TXD097311849&pgm_sys_acrnm_in=RCRAINFO. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009m. *Frito Lay Rosenberg Facility.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/fii_query_dtl.disp_program_facility?pgm_sys_id_in=77471FRTLY3310H&pgm_sys_acrnm_in=TRIS. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009n. *Sealy PLT.* Accessed February 4, 2010 at http://oaspub.epa.gov/enviro/fii_query_dtl.disp_program_facility?pgm_sys_id_in=TXR000017343&pgm_sys_acrnm_in=RCRAINFO. Accession No. ML100640755.

U.S. Environmental Protection Agency. (EPA). 2009o. *EPA 2009 Valley Facility Emissions*. Accessed February 10, 2010 at http://oaspub.epa.gov/enviro/airs_web.report?PGM_SYS_ID=4814700001. Accession No. ML100640755.

U.S. Federal Aviation Administration (FAA). 2007. *Obstruction Marking and Lighting*. Advisory Circular AC 70/7460-1K. Accessed February 23, 2009 at https://oeaaa.faa.gov/oeaaa/external/content/AC70_7460_1K.pdf. Accession No. ML100640755.

U.S. Fish and Wildlife Service (FWS). 2009a. *Endangered and Threatened Species List for Austin, Fannin, Freestone, and Fort Bend Counties*. Accessed October 26, 2009 at http://www.fws.gov/southwest/es/EndangeredSpecies/lists/. Accession No. ML100640755.

U.S. Fish and Wildlife Service (FWS). 2009b. *Profiles of Endangered and Threatened Species for Austin, Fannin, Freestone, and Fort Bend Counties*. Accessed October 22, 2009 at http://ecos.fws.gov/tess_public/. Accession No. ML100640755.

U.S. Fish and Wildlife Service (FWS). 2009c. *Attwater Prairie Chicken National Wildlife Refuge*. Accessed October 21, 2009 at http://fws.gov/southwest/refuges/texas/attwater/index.html. Accession No. ML100640755.

U.S. Fish and Wildlife Service (FWS). 2009d. *Ecological Services; Southwest County-by-County.* Accessed October 26, 2090 at http://www.fws.gov/southwest/es/EndangeredSpecies/lists/default.cfm. Accession No. ML100640755.

U.S. Forest Service. (USFS). 2009. *Caddo-LBJ National Grasslands.* Accessed February 4, 2010 at http://www.fs.fed.us/r8/texas/recreation/caddo_lbj/caddo-lbj_gen_info.shtml. Accession No. ML100640755.

U.S. Geologic Survey (USGS). 2005. Fish-Community Changes Reflect Water-Quality Improvements in the Trinity River Downstream From Dallas. Accessed November 18, 2009 at http://pubs.usgs.gov/circ/circ1171/html/fishcom.htm. Accession No. ML100640755.

Karl, Thomas R., Jerry M. Melillo, and Thomas C. Peterson (eds.). 2009. *Global Climate Change Impacts in the United States*. Cambridge University Press, New York. Accessed February 27, 2010 at http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf. Accession No. ML100580077.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Vol. 1 and 2, Washington, D.C.

U.S. Nuclear Regulatory Commission. 1998. *General Site Suitability Criteria for Nuclear Power Stations*. Regulatory Guide 4.7, Rev. 2.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report."* NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Environmental Standard Review Plan—Review Plans for Environmental Reviews for Nuclear Power Plants.* NUREG-1555, Washington, D.C. Includes 2007 updates.

U.S. Nuclear Regulatory Commission (NRC). 2008a. Letter from Paul Kallan, NRC, to Gregory Gibson, STPNOC, dated May 19, 2008, "Request for Additional Information, Letter Number One Related to the Environmental Report for the South Texas Combined License Application." Accession No. ML081360531.

U.S. Nuclear Regulatory Commission (NRC). 2008b. Letter from Paul Kallan, NRC, to Scott Head, STPNOC, dated November 18, 2008, "Request for Additional Information, Letter Number Two Related to the Environmental Report for the South Texas Combined License Application." Accession No. ML083190269.

U.S. Nuclear Regulatory Commission (NRC). 2009a. Status of License Renewal Applications and Industry Activities. Accessed February 8, 2010 at http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html#future. Accession No. ML100640755.

U.S. Nuclear Regulatory Commission (NRC). 2009b. *Site Audit Summary of South Texas Project Nuclear Operating Company's Revised Alternative Sites Analysis*. November 9, 2009. Accession No. ML092870574.

University of Texas (UT). 1996. P*hysiography of Texas*. Accessed October 21, 2009 at http://www.lib.utexas.edu/geo/physiography.html. Accession No. ML100640755.

Upper Trinity Regional Water District's Diversified Water Portfolio. (UTRWD). 2010. *Lake Ralph Hall.* Accessed March 5, 2010 at http://www.lakeralphhallinfo.com. Accession No. ML100640755.

Virtus Energy (Virtus). 2008. *Texas Renewable Energy Assessment: Geothermal*. Accessed February 25, 2009 at http://www.vera.com/re_b_psdoc_07.htm. Accession No. ML100640755.

Wade, S.C., 2008. GAM Run 08-14mag. Texas Water Development Board, Groundwater Availability Modeling Section. May 6, 2008. Accessed November 15, 2009 at http://www.twdb.state.tx.us/GwRD/GMA/MAG/GMA8_GR08-14mag.pdf. Accession No. ML100640755.

Wood, C.R., T.L. Arsuffi and M.K. Cauble. 1994. *Macroinvertebrate assessment of Allens Creek and the Brazos River, Austin County, Texas*. River Studies Report No. 11, Texas Water Develoment Board Interagency Contract Number 93-483-364. Texas Parks and Wildlife Department, Austin, Texas.

10.0 Conclusions and Recommendations

The U.S. Nuclear Regulatory Commission (NRC or the Commission) received an application from STP Nuclear Operating Company (STPNOC) for combined construction permits and operating licenses (combined licenses or COLs) for South Texas Project Electric Generating Station (STP) Units 3 and 4. The location of the proposed Units 3 and 4 is approximately 2000 ft northwest of the existing STP Units 1 and 2. The STP site and existing facilities are owned by NRG South Texas LP (NRG); City Public Service Board of San Antonio, Texas (CPS Energy); and the City of Austin, Texas. It is planned that STP Unit 3 would be owned by Nuclear Innovation North America (NINA) Texas 3 LLC and CPS Energy, and STP Unit 4 would be owned by NINA Texas 4 LLC and CPS Energy (STPNOC 2009a). STPNOC would be the licensed operator for the proposed Units 3 and 4, as it currently is for the existing Units 1 and 2. In its application, STPNOC specified the certified U.S. Advanced Boiling Water Reactor (ABWR) as the proposed reactor design for Units 3 and 4.

On June 4, 2009, with a subsequent submittal on October 28, 2009, STPNOC submitted a Permit Determination Request to the U.S. Army Corps of Engineers (Corps) Galveston District for activities associated with constructing and operating proposed Units 3 and 4 (STPNOC 2009b). On November 10, 2009, the Corps notified STPNOC that the proposed project would require a U.S. Department of the Army permit pursuant to Section 404 of the Federal Water Pollution Control Act (Clean Water Act) and Section 10 of the Rivers and Harbors Act. The Corps is participating with the NRC in preparing this environmental impact statement (EIS) as a cooperating agency (Corps 2009).

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 et seq.), directs that an EIS is required for major Federal actions that significantly affect the quality of the human environment. Section 102(2)(C) of NEPA requires that an EIS include information about the following:

- the environmental impacts of the proposed action;
- any adverse environmental effects that cannot be avoided should the proposal be implemented;
- alternatives to the proposed action;
- the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- any irreversible and irretrievable commitments of resources that would be involved if the proposed action is implemented.

The NRC has implemented NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. In 10 CFR 51.20, the NRC requires preparation of an EIS for issuance of COLs. Subpart C of 10 CFR Part 52 contains the NRC regulations related to COLs.

The proposed actions related to the Units 3 and 4 application are (1) the NRC issuance of COLs for construction and operation of two new nuclear units at the STP site in Matagorda County, Texas; and (2) the Corps issuance of a permit pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Appropriation Act. The permit application requests authorization to expand an existing barge slip on the Colorado River and to culvert and fill waters of the United States for the purpose of constructing a heavy haul road on the site.

The environmental review described in this EIS was conducted by a team consisting of NRC staff, its contractor's staff, and staff from the Corps. During the course of preparing this EIS, the review team reviewed the Environmental Report (ER) submitted by STPNOC (2009c and supplemental documentation; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plans* (NRC 2000). In addition, the NRC considered the public comments related to the environmental review received during the scoping process. These comments are provided in Appendix D.

Included in this EIS are (1) the results of the review team's preliminary analyses, which consider and weigh the environmental effects of the proposed actions; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the NRC staff's preliminary recommendation regarding the proposed action based on its environmental review. The COL application references a certified reactor design. Where appropriate, this EIS adopts results of the environmental review conducted in support of the design certification application and incorporates those results by reference.

As a cooperating agency, the Corps has participated in the environmental review and EIS preparation. The proposed action includes impacts on waters of the United States. For proposed actions requiring a Section 404 Clean Water Act permit for the discharge of dredged and/or fill material into waters of the United States, regulations promulgated by the U.S. Environmental Protection Agency (EPA) require the Corps to limit its authorization to the least environmentally damaging practicable alternative. The Corps will document its conclusion of the review process, including the requirement for compensatory mitigation, in accordance with 33 CFR Part 332, Compensatory Mitigation for Losses of Aquatic Resources, in its permit-decision document.

Environmental issues are evaluated using the three-level standard of significance – SMALL, MODERATE, or LARGE – developed by the NRC using guidelines from the Council on Environmental Quality (CEQ) (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the following definitions of the three significance levels:

SMALL – Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Mitigation measures were considered for each environmental issue and are discussed in the appropriate sections. During its environmental review, the NRC and Corps review team considered planned activities and actions that STPNOC indicates it and others would likely take should STPNOC receive the COLs. In addition, STPNOC provided estimates of the environmental impacts resulting from the building and operation of two new nuclear units on the proposed site.

10.1 Impacts of the Proposed Action

In a final rule dated October 9, 2007 (72 FR 57416), the Commission limited the definition of “construction” to those activities that fall within its regulatory authority (10 CFR 51.4). Many of the activities required to build a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term “preconstruction.” Preconstruction activities include clearing and grading, excavating, erection of support buildings and transmission lines, and other associated activities. Because the “preconstruction” activities are not part of the NRC action, their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction activities are considered in the context of cumulative impacts. Although the preconstruction activities are not part of the NRC action, they support or are requisite to the NRC action. In addition, certain preconstruction activities require permits from the Corps, as well as other Federal, State, and local agencies.

Chapter 4 describes the relative magnitude of impacts related to preconstruction and construction activities with a summary of impacts in Table 4-7. Impacts associated with operation of the proposed facilities are discussed in Chapter 5 and are summarized in Table 5-21. Chapter 6 describes the impacts associated with the fuel cycle, transportation, and decommissioning. Chapter 7 describes the impacts associated with preconstruction and construction activities and operation of Units 3 and 4 when considered along with the cumulative impacts of other past, present, and reasonably foreseeable future projects in the geographic region around the STP site.

10.2 Unavoidable Adverse Environmental Impacts

Section 102(2)(C)(ii) of NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided should the proposal be implemented. Unavoidable adverse environmental impacts are those potential impacts of the NRC action and the Corps action that cannot be avoided and for which no practical means of mitigation are available.

10.2.1 Unavoidable Adverse Impacts During Construction and Preconstruction

Chapter 4 discusses in detail the potential impacts from construction and preconstruction of the proposed Units 3 and 4 at the STP site and presents mitigation and controls intended to lessen the adverse impacts. Table 10-1 presents the adverse impacts associated with construction and preconstruction activities to each of the resource areas evaluated in this EIS, and the mitigation measures that would reduce the impacts. Those impacts remaining after mitigation is applied are identified in the table as the unavoidable adverse impacts. Unavoidable adverse impacts are the result of both construction and preconstruction activities, unless otherwise noted. The impact determinations in Table 10-1 are for the combined impacts of construction and preconstruction, but the impact determinations for NRC-regulated construction are the same for each resource area.

Table 10-1. Unavoidable Adverse Environmental Impacts from Construction and Preconstruction Activities

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
Land Use	SMALL	Comply with requirements of applicable Federal, State, and local permits.	Approximately 300 ac committed on a long-term basis and 240 ac disturbed on a temporary basis.
Water Use	SMALL	Comply with the requirements of Coastal Plains Groundwater Conservation District (CPGCD) permitting rules.	New groundwater wells would be installed in the Deep Aquifer to supply water for building needs.
Water Quality	SMALL	Implement best management practices (BMPs) and a site-specific Stormwater Pollution Prevention Plan (SWPPP).	Onsite and offsite water bodies would receive stormwater runoff during building phase.
		Comply with Federal and State permits and implementation of BMPs.	Dredging in the Colorado River near the Reservoir Makeup Pumping Facility (RMPF) and barge slip.

Table 10-1. (contd)

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
		Compliance with CPGCD permitting rules and implementation of BMPs.	Inadvertent spills that seep into aquifers and saltwater intrusion.
Ecological (Terrestrial)	SMALL	Implement BMPs and Avian Protection Plans.	Habitat loss and increased risk of collision and direct mortality; temporary wildlife displacement and avoidance due to noise and increased activities.
		Implement BMPs and avoidance.	No temporary or permanent losses of wetlands are expected.
Ecological (Aquatic)	SMALL	Implement BMPs and a site-specific SWPPP.	Habitat loss from dredging and barge slip expansion.
Socioeconomic			
Physical Impacts	SMALL to MODERATE	Alert local governmental agencies concerning needed road repairs.	Minor temporary impacts during building phase.
		Develop and implement a construction traffic management plan during building phase.	Noticeable impacts to traffic in Matagorda County during building phase.
Demography	SMALL to MODERATE	None.	Noticeable demographic impacts in Matagorda County during building phase.
Economic Impacts	SMALL to MODERATE (beneficial)	None.	None.
Community Services and Infrastructure	SMALL TO MODERATE	Add infrastructure and personnel as necessary.	Some temporary shortages of facilities may occur during the building period
		Maintain communication with local government and planning officials so that ample time is given to plan for the influx of population during the building phase. Add modular classrooms, infrastructure, and personnel as necessary, during building phase.	Some temporary infrastructure shortages and crowding in housing and in education facilities during the building period.
Environmental Justice	SMALL	None.	None.

Table 10-1. (contd)

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
Historic and Cultural	SMALL	Formal inadvertent discovery procedures are in place to minimize impacts to potential onsite historic and cultural resources	None.
Air Quality	SMALL	Compliance with Federal, State, and local regulations governing construction activities and construction vehicle emissions. Implementation of a dust control program.	Increased equipment, vehicular, and fugitive dust emissions, but impacts would be temporary.
Nonradiological Health	SMALL	Adherence to permits and authorizations issued by State and local agencies	Temporary public health impacts from exposure to fugitive dust and vehicular emissions, noise, and increased occupational injuries and traffic fatalities during the building phase.
Radiological	SMALL	Doses to construction workers would be maintained below NRC public dose limits.	Small radiological dose to construction workers from operating units that would be less than NRC public dose limits.

The primary unavoidable adverse environmental impacts during building activities would be related to land use and terrestrial habitat loss, as approximately 300 ac would be permanently disturbed and approximately 240 ac would be temporarily disturbed. All building activities for Units 3 and 4, including ground-disturbing activities, would occur within the existing STP site boundary.

No surface water use is proposed during building activities. Several surface-water bodies including the Little Robbins Slough, the Main Cooling Reservoir (MCR), existing Main Drainage Channel, and proposed site drainage channels that flow to the Colorado River and the West Branch of the Colorado River would be affected during building activities. Replacement and placing of new culverts on the site would also affect some onsite sloughs. BMPs would be employed to control runoff to onsite water bodies under a Stormwater Pollution Prevention Plan (SWPPP). The impacts on surface water quality of onsite and offsite water bodies would be temporary. Dredging activities in the Colorado River near the Reservoir Makeup Pumping Facility (RMPF) and the barge slip may result in disturbance of sediments and increased turbidity. The increased turbidity would be localized and temporary.

Groundwater aquifers that would potentially be affected include the Upper and Lower Shallow Aquifers into which the slurry wall, excavation, and fill would penetrate, and the Deep Aquifer in which one or more additional production wells would be installed. Dewatering systems employed during excavation within the powerblock area would depress the water table in the general vicinity; however, the impacts would be localized and temporary.

Ecological impacts from building the proposed units would include loss of terrestrial and aquatic habitats. Terrestrial ecological impacts would include habitat loss during clearing and grading of the proposed site, risk of avian and bat collisions with construction equipment, and direct mortality of species from onsite preconstruction and construction activities. BMPs and avoidance would be used to minimize adverse impacts to wetlands. Aquatic ecological impacts would include habitat loss from activities in the Colorado River and onsite waterbodies. SWPPPs include best management practices to manage loss of aquatic habitat during construction and preconstruction activities.

Socioeconomic impacts of building the proposed units would include an increase in traffic from construction workers, and possible demand pressure on the local housing market and some other public services if workers concentrate in Matagorda County. No unusual resource dependencies on minority and low-income populations in the region were identified. Atmospheric and meteorological impacts include fugitive dust from land disturbing and building activities that can be mitigated by the dust-control plan.

The review team did not identify any cultural resources that would be affected by building the proposed units. STPNOC has agreed to follow procedures if historic or cultural resources are discovered during ground-disturbing activities associated with building the proposed Units 3 and 4. These procedures are detailed in STPNOC's Addendum #5 to Procedures No. OPGP03-ZO-0025 Rev. 12 "Unanticipated Discovery of Cultural Resources" (STPNOC 2008).

Nonradiological health impacts to members of the public from construction, including public and occupational health, noise and transportation of materials, equipment and personal, would be minimal through controls and measures by STPNOC associated with compliance to Federal, State and local regulations, permits and authorizations.

Radiological doses to construction workers at Units 3 and 4 from the adjacent operating units are expected to be well below regulatory limits.

10.2.2 Unavoidable Adverse Impacts During Operation

Chapter 5 provides a detailed discussion of the potential impacts from operation of the proposed Units 3 and 4 at the STP site and presents mitigation and controls intended to lessen the adverse impacts. Table 10-2 presents the adverse impacts associated with operation of the two proposed units to each of the resource areas evaluated in this EIS, and the mitigation measures that would reduce the impacts. Those impacts remaining after mitigation is applied are identified in the table as the unavoidable adverse impacts.

The unavoidable adverse impacts from operation for land use would be minimal and are associated with making land unavailable for other uses until after decommissioning of the two existing and two proposed units.

Water-related impacts during operation would be mitigated through STPNOC's adherence to State permits for water withdrawal and discharge. Remaining adverse impacts to hydrological water-use and water-quality impacts during operation would be minimal and limited to increased water use, potential increases in sedimentation to surface water bodies, potential surface and groundwater contamination from inadvertent spills.

Table 10-2. Unavoidable Adverse Environmental Impacts from Operation

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
Land Use	SMALL	Adherence to local land management plans.	Land would not be available for other use until after decommissioning of the entire STP site, including the proposed two new units.
Water Use	SMALL	Compliance with STPNOC's Texas Commission for Water Quality (TCEQ) water rights permit limits and STPNOC's water delivery contract with Lower Colorado River Authority (LCRA).	Increased surface water use from the Colorado River because of the addition of Units 3 and 4.
		Compliance with CPGCD groundwater permit limits.	Increased groundwater use from the Deep Aquifer because of addition of Units 3 and 4.
Water Quality	SMALL	Implement BMPs and Stormwater Management Plan.	Increased sediment load in stormwater and potential to contaminate surface and groundwater through inadvertent spills.
		Compliance with STPNOC's Texas Pollutant Discharge Elimination System (TPDES) permit	Increased frequency of discharge of MCR waters to the Colorado River

Table 10-2. (contd)

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
Ecological (Terrestrial)	SMALL	Implement BMPs to limit potential impacts from vegetation control, road maintenance, and other corridor activities. Follow Avian Protection Plan.	Transmission line maintenance would prevent forest succession and maintain habitat fragmentation. New structures would represent an incremental increase in the risk of collision for birds and bats. Noise and activities during operation would cause wildlife to avoid certain areas.
Ecological (Aquatic)	SMALL	RMPF already includes design features to mitigate adverse impacts. Use screens at circulating water intake structure.	Cooling water withdrawal would result in impingement, entrainment, and entrapment of some Colorado River species.
		Meet all applicable State and Federal regulatory requirements regarding the discharge of heat.	MCR discharge thermal plume in the Colorado River may affect habitat, behavior, migration, abundance and distribution of some species.
		Meet all applicable State and Federal Clean Water Act and TPDES permit regulations and limitations.	Nonradiological wastewater discharge (e.g., bio-fouling and other process control chemicals) would increase and this may affect aquatic species.
		MCR discharge system design includes features to minimize physical impacts.	MCR discharge into Colorado River may cause physical scouring that would affect aquatic species and habitat in the area.
		Implement BMPs for maintenance and operation activities (e.g., approved herbicide usage and SWPPP).	Maintenance and operation activities (e.g., application of chemicals for vegetation management) along transmission corridor could harm aquatic species.

Table 10-2. (contd)

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
Socioeconomic			
Physical	SMALL	Continue to implement strategies from the building period with consideration of smaller but more permanent impacts	Very minor levels of increased traffic; increased use of schools services, shortages of facilities and personnel for some public services in Matagorda County (but less than during the building period).
Demography	SMALL	None.	Matagorda County's population would grow by 3 to 4% over a few years.
Economic Impacts	SMALL to LARGE (beneficial)	None.	None.
Community Services and Infrastructure	SMALL		Minor impact on traffic from additional workers. Impact would be minimal on housing demand and prices.
Environmental Justice	SMALL	None.	None.
Historic and Cultural	SMALL	Formal inadvertent discovery procedures are in place to minimize impacts to potential onsite historic and cultural resources.	None.
Air Quality	SMALL	Compliance with Federal, State, and local air quality permits and regulations.	Slight increase in certain criteria pollutants and CO_2 due to plant auxiliary combustion equipment (e.g., diesel engines, combustion turbines); plumes and drift deposition from cooling towers; increase fogging from the MCR.
Nonradiological Health	SMALL	State water quality monitoring for bacteria and compliance with TPDES permit for thermal discharges.	MCR discharge thermal plume could encourage growth of etiological agents in Colorado River.

Table 10-2. (contd)

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
		None.	Noise from onsite systems (cooling towers, transformers, loud speakers) would be <65dBA at 400 ft.
		Conformance with Federal codes.	Electrical shock from transmission lines.
		Implementation of existing STP industrial safety program.	Occupational injuries and illnesses.
		Stagger arrival/departure times as well as outage schedule to minimize impacts to transportation routes.	Accidents associated with transportation of operation and outage workers.
Radiological	SMALL	Doses to members of the public would be maintained below NRC and EPA standards; workers' doses would be maintained below NRC limits and As Low As Reasonably Achievable (ALARA); and mitigative actions instituted for members of the public would also ensure doses to biota other than humans would be well below National Council on Radiation and Measurements (NCRP) and International Atomic Energy Agency (IAEA) guidelines.	Small radiation doses to members of the public below NRC and EPA standards; ALARA doses to workers; and biota doses less than NCRP and IAEA guidelines.

Unavoidable adverse impacts to terrestrial resources would include increased risks of bird and bat collisions with structures, wildlife avoidance due to noise, and minimal impacts of salt deposition on vegetation within 660 ft of the mechanical draft cooling towers. Assuming that BMPs are followed, terrestrial impacts during operation would be minor. Aquatic impacts would be minimal during operation because the design of the intake structure on the Colorado River would have minimal effects to aquatic organisms from impingement, entrainment, and entrapment. Aquatic impacts from MCR discharge into the Colorado River would have minimal effects to aquatic organisms; however, as discussed in Section 5.3.2, under certain flow conditions the thermal plume in combination with the water quality of the Colorado River, could create conditions that would have noticeable affects but would not destabilize the on the aquatic community.

Adverse socioeconomic impacts likely would be similar in character to those during the building phase but much smaller due to the smaller project-related population and the fact that much of the mitigation of housing and infrastructure shortages would have occurred in response to the larger impacts during the building period. Socioeconomic impacts would primarily be increased traffic, some damage to roads, an increase in the demand for housing and public services, along with increased employment opportunities and an increase in tax revenue to support the increase in service-demand.

The review team did not identify any cultural resources that would be affected by operation of the proposed units. STPNOC has agreed to follow procedures if historic or cultural resources are discovered during operation activities associated with the proposed Units 3 and 4. These procedures are detailed in STPNOC's Addendum #5 to procedures No. OPGP03-ZO-0025 Rev. 12 "Unanticipated Discovery of Cultural Resources" (STPNOC 2008).

It is expected that air-quality impacts would be negligible and that pollutants emitted during operations would be insignificant. Nonradiological and radiological health impacts would be minimal. Nonradiological health impacts to members of the public from operation, including etiological agents, noise, electromagnetic fields, occupational health and transportation of materials and personal, would be minimal through controls and measures by STPNOC associated with compliance to Federal and State regulations.

Radiological doses to members of the public from operation of proposed Units 3 and 4 would be below NRC and EPA standards. Doses to workers from operation of proposed Units 3 and 4 would also be below NRC limits and would be maintained ALARA. The radiation protection measures designed to maintain doses to members of the public below NRC and EPA standards would also ensure that doses to biota other than humans would be well below NCRP and IAEA guidelines.

10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

Section 102(2)(C)(iv) of NEPA requires that an EIS include information on the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

The local use of the human environment by the proposed project can be summarized in terms of the unavoidable adverse environmental impacts of construction and operation and the irreversible and irretrievable commitments of resources. With the exception of the consumption of depletable resources as a result of plant construction and operation, these uses may be classed as short term. The principal short-term benefit of the plant is represented by the production of electrical energy; and the economic productivity of the site, when used for this purpose, would be extremely large compared to the productivity from agriculture or from other probable uses for the site.

The maximum long-term impact to productivity would result when the plant is not immediately dismantled at the end of the period of plant operation, and consequently the land occupied by the plant structures would not be available for any other use. However, the enhancement of regional productivity resulting from the electrical energy produced by the plant is expected to result in a correspondingly large increase in regional long-term productivity that would not be equaled by any other long-term use of the site. In addition, most long-term impacts resulting from land-use preemption by plant structures can be eliminated by removing these structures or by converting them to other productive uses. Once the plants are shut down, they would be decommissioned according to NRC regulations. Once decommissioning is complete and the NRC license is terminated, the site would be available for other uses.

The review team concludes that the negative aspects of plant construction and operation as they affect the human environment would be outweighed by the positive long-term enhancement of regional productivity through the generation of electrical energy.

10.4 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(C)(v) of NEPA requires that an EIS include information on any irreversible and irretrievable commitments of resources that would occur if the proposed actions are implemented. The term “irreversible commitments of resources” refers to environmental resources that would be irreparably changed by the new units and that could not be restored at some later time to the resource’s state before the relevant activities. “Irretrievable commitments of resources” refers to materials that would be used for or consumed by the new units in such a way that they could not, by practical means, be recycled or restored for other uses. The resources discussed in this section are the environmental resources discussed in Chapters 4, 5, and 6.

10.4.1 Irreversible Commitments of Resources

Irreversible commitments of environmental resources resulting from Units 3 and 4, in addition to the materials used for the nuclear fuel, include:

10.4.1.1 Land Use

Land committed to the disposal of radioactive and nonradioactive wastes is committed to that use and cannot be used for other purposes. The land used for Units 3 and 4 is not irreversibly committed because once Units 3 and 4 cease operations and the plant is decommissioned in accordance with NRC requirements, the land supporting the facilities could be returned to other industrial or nonindustrial uses.

10.4.1.2 Water Use

Approximately 21,600 gpm of cooling water from the MCR would be lost through consumptive use (i.e., evaporation) during operation.

10.4.1.3 Aquatic and Terrestrial Biota

Construction, preconstruction, and operation activities would cause temporary and long-term changes to both the aquatic and terrestrial biota at the plant site and facilities. These activities would change the abundance and distribution of local terrestrial flora and fauna on the STP site; however, enough suitable habitat exists elsewhere in the area that such changes would not result in adverse impacts on the regional populations despite localized permanent loss of habitat associated with the construction footprint for Units 3 and 4. Terrestrial habitats could be restored after decommissioning of the proposed reactors and thus no irretrievable loss of terrestrial habitats would be expected. STPNOC has indicated that no wetlands would be filled or affected, thus no irretrievable loss of wetland habitats would be expected to occur. In addition, no irretrievable loss of resources detectable at the population level would be expected as a result of operations. The review team expects that no irretrievable commitment of resources affecting terrestrial habitats or species would be expected to occur associated with upgrades to the transmission corridor.

Construction, preconstruction, and operation activities would adversely affect the abundance and distribution of the aquatic community, including designated essential fish habitat (EFH), in the Colorado River in the vicinity of the RMPF, barge slip, and discharge structure. The review team expects that these activities would likely have more than minimal, but less than substantial adverse effect on EFH within the Colorado River by loss of forage and/or shelter habitat as well as early life stages of some species (see EFH assessment in Appendix F). The review team expects that no irretrievable commitment of resources affecting habitat or individual species is expected to occur associated with the new transmission corridors. The aquatic habitat and aquatic populations would recover once Units 3 and 4 cease operations and the plant is decommissioned in accordance with NRC requirements.

10.4.1.4 Socioeconomic Resources

The review team expects that no irreversible socioeconomic commitments would be made to socioeconomic resources since they would be reallocated for other purposes once the plant is decommissioned.

10.4.1.5 Air and Water

Dust and other emissions such as vehicle exhaust would be released to the air during construction and preconstruction. During operations, vehicle exhaust emissions would continue and other air pollutants and chemicals including very low concentrations of radioactive gases and particulates would be released from the facility to the air and surface water. Because these releases would conform to applicable Federal and State regulations, their impact to the public health and the environment would be limited. The review team expects no irreversible commitment to air or water resources because all Unit 3 and 4 releases would be made in accordance with duly issued permits.

10.4.2 Irretrievable Commitments of Resources

A study by the U.S. Department of Energy (DOE/EIA 2006) on new reactor construction estimated the following quantities of materials would be required for a single reactor: 12,239 yd^3 of concrete, 3107 tons of rebar, 13,000,000 ft of cable, and 275,000 ft of piping. Therefore, about twice these amounts would be needed for proposed Units 3 and 4 at STP, and considerably more would be required for all the other site structures.

The review team expects that the use of construction materials in the quantities associated with those expected for Units 3 and 4 at the STP site, while irretrievable, would be of small consequence with respect to the availability of such resources.

The main resource that would be irretrievably committed during operation of the new nuclear units would be uranium. The availability of uranium ore and existing stockpiles of highly enriched uranium in the United States and Russia that could be processed into fuel is sufficient (OECD NEA and IAEA 2008), so that the irreversible and irretrievable commitment would be negligible.

10.5 Alternatives to the Proposed Action

Alternatives to the proposed actions are discussed in Chapter 9. Alternatives considered are the no-action alternative, energy production alternatives, system design alternatives, and alternative sites. For the purposes of the Corps' evaluation, onsite alternatives are also addressed in Section 9.5.

The NRC no-action alternative, described in Section 9.1, refers to a scenario in which the NRC would deny the STPNOC's request for the COLs. Upon such a denial by the NRC, the construction and operation of two new nuclear units at the STP site in accordance with 10 CFR Part 52 would not occur and the predicted environmental impacts associated with the project would not occur. If no other power plant were built or electrical power supply strategy implemented to take its place, the electrical capacity to be provided by the project would not become available, and the benefits (electricity generation) associated with the proposed action would not occur and the need for power would not be met.

Alternative energy sources are described in Section 9.2. Alternatives that would not require additional generating capacity are described in Section 9.2.1. Detailed analyses of coal- and natural-gas-fired alternatives are provided in Section 9.2.2. Other energy sources are discussed in Section 9.2.3. A combination of energy alternatives is discussed in Section 9.2.4. The NRC staff concluded that none of the alternative energy options were both (1) consistent with STPNOC's objective of building baseload generation units, and (2) environmentally preferable to the proposed action.

Alternative sites are discussed in Section 9.3. The cumulative impacts of building and operating the proposed facilities at the alternative sites are compared to the impacts at the proposed STP site in Section 9.3.5. Table 9-20 contains the review team's characterization of cumulative impacts at the proposed and alternative sites. Based on this review, the NRC staff concludes that while there are differences in cumulative impacts at the proposed and alternative sites, none of the alternative sites would be environmentally preferable or obviously superior to the proposed STP site. The NRC's determination is independent of the Corps' determination of a Least Environmentally Damaging Practicable Alternative pursuant to Clean Water Act Section 404(b)(1) guidelines. The Corps will conclude its analysis of both offsite and onsite alternatives in its Record of Decisions.

Alternative heat dissipation and circulating water system designs are discussed in Section 9.4. The NRC staff concluded that none of the alternatives considered would be environmentally preferable to the proposed system designs.

10.6 Benefit-Cost Balance

NEPA requires that all agencies of the Federal Government prepare detailed environmental statements on proposed major Federal actions that can significantly affect the quality of the human environment. A principal objective of NEPA is to require each Federal agency to consider, in its decision making process, the environmental impacts of each proposed major action and the available alternative actions. In particular, Section 102 of NEPA requires all Federal agencies to the fullest extent possible:

> "(B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations." (42 USC 4321)

However, neither NEPA nor CEQ requires the costs and benefits of a proposed action be quantified in dollars or any other common metric.

The intent of this section is not to identify and quantify all of the potential societal benefits of the proposed actions and compare these to the potential costs of the proposed actions. Instead, this section will focus on only those benefits and costs of such magnitude or importance that their inclusion in this analysis can inform the decision-making process. This section compiles and compares the pertinent analytical conclusions reached in earlier chapters of this EIS. It gathers all of the expected impacts from building and operations of the proposed Units 3 and 4 and aggregates them into two final categories: the expected costs and the expected benefits. The benefit-cost balancing for the NRC action will be based on a balancing of the benefits and costs of construction and operation.

Although the analysis in this section is conceptually similar to a purely economic benefit-cost analysis, which determines the net present dollar value of a given project, the intent of this section is to identify all potential societal benefits of the proposed actions and compare these to the potential internal (i.e., private) and external (i.e., societal) costs of the proposed actions. The purpose is to generally inform the COL process by gathering and reviewing information that demonstrates the likelihood that the benefits of the proposed actions outweigh the aggregate costs.

General issues related to STPNOC's financial viability and those of its parent organizations are outside NRC's mission and authority and, thus, would not be considered in this EIS. Issues related to the financial qualifications of STPNOC will be addressed in the NRC staff's safety evaluation report. It is not possible to quantify and assign a value to all benefits and costs associated with the proposed action. This analysis, however, attempts to identify, quantify, and provide monetary values for benefits and costs when reasonable estimates are available.

Section 10.6.1 discusses the benefits associated with the proposed action. Section 10.6.2 discusses the costs associated with the proposed action. A summary of benefits is shown in Table 10-3. Section 10.6.3 provides a summary of the impact assessments, bringing previous sections together to establish a general impression of the relative magnitude of the proposed actions' costs and benefits.

10.6.1 Benefits

The most apparent benefit from a power plant is that it generates power and provides thousands of residential, commercial, and industrial consumers with electricity. Maintaining an adequate supply of electricity in any given region has social and economic importance because adequate electricity is the foundation for economic stability and growth and fundamental to maintaining our current standard of living. Because the focus of this EIS is on the proposed expansion of the STP site generating capacity, this section focuses primarily on the relative benefits of the STP option rather than the broader, more generic benefits of electricity supply.

Table 10-3. Summary of Benefits of the Proposed Action

Benefit Category	Description	Monetized Value or Impact Assessment
	Benefits	
Electricity generated	20,000,000 to 22,000,000 MWh (Megawatt hour) per year for the 40-year life of the plant (assuming capacity factors in the range of 85-93 percent).	
Generating capacity	2700 MW (two units at 1350 MW each).	
Fuel diversity and energy security	Nuclear option provides diversity to coal- and natural-gas-fired baseload generation. Reduces exposure to supply and price risk associated with reliance on any single fuel source.	
Tax revenues	Tax payments and service fees in In-lieu-of-taxes increase as STPNOC's investment in building grows and as Units 3 and 4 start generating electricity (see Sections 4.4.3.2 and 5.4.3.2). Franchise tax amount shown is based on STPNOC's estimate of gross margin at 100 percent taxability. Under the proposed settlement between NINA and CPS (NINA 2010, CPS 2010), both units are projected to be about 8 percent owned by non-taxable entities. Property taxes based on STPNOC's estimate of capital cost and a range of 44 percent to 100 percent taxability. Capital cost may be higher, as described in Section 10.6.2.1.	Operations, between $4.7 and $5.4 million (2015) and $8.6-$10.0 million per year (later years) in franchise taxes. $9.5 - $21.5 million per year in property taxes
Local economy	Increased jobs would benefit the area economically and increase the economic diversity of region (see Sections 4.4.3.1 and 5.4.3.1)	1620 total regional employment; $73 million per year regional income
Price Volatility	Would dampen potential for fuel price volatility.	
Electrical Reliability	Would enhance reliability of electricity supply.	

10.6.1.1 Societal Benefits

For the production of electricity to be beneficial to a society, there must be a corresponding demand, or "need for power," in the region. Chapter 8 defines and discusses the need for power in more detail. From a societal perspective, nuclear power offers two primary benefits relative to most other generating systems: long-term price stability and energy security through fuel diversity. These benefits are described in this subsection.

Long-term Price Stability

Because of its relatively low and non-volatile fuel costs, nuclear energy is a dependable generator of electricity that can provide electricity to the consumer at relatively stable prices over a long period of time. Unlike some other energy sources, nuclear energy is generally not subject to unreliable weather or climate conditions, unpredictable cost fluctuations, and is less dependent on foreign suppliers than other energy sources. Nuclear power plants are generally not subject to fuel price volatility like natural gas and oil power plants. In addition, uranium fuel constitutes only 3 percent to 5 percent of the cost of a kilowatt-hour of nuclear-generated electricity. Doubling the price of uranium increases the cost of electricity by about 9 percent; while doubling the price of gas would add about 66 percent to the price of electricity, and doubling the cost of coal would add about 31 percent to the price of electricity (WNA 2010).

Energy Security through Fuel Diversity

Currently, more than 70 percent of the electricity generated in the United States is generated with fossil-based technologies; thus, non-fossil-based generation, such as nuclear generation, is essential to maintaining diversity in the aggregate power-generation fuel mix (DOE/EIA 2006). Nuclear power contributes to the diverse U.S. energy mix, hedging the risk of shortages and price fluctuations for any one power-generation system and reducing the nation's dependence on imported fossil fuels.

A diverse fuel mix helps to protect consumers from contingencies such as fuel shortages or disruptions, price fluctuations, and changes in regulatory practices. ERCOT's 2007 fuel mix for annual generation was made up of approximately 46 percent natural gas, 37 percent coal, 13 percent nuclear, and 4 percent hydroelectric and renewables (ERCOT 2008). Summer capacity is more concentrated in natural-gas fired plants due to the need to address summer peak. Summer capacity percentages are natural gas, 72 percent; coal, 18 percent; nuclear, 7 percent; and hydroelectric and renewables, about 3 percent. Efficiency programs and loads serving as reserves meet about 2 percent of summer peak demand (ERCOT 2009). The effective load–carrying capacity of wind generation is rated by ERCOT at 8.7 percent of nameplate, or about 708 MW total in 2009 (ERCOT 2009). ERCOT is planning a capacity mix that provides the region with a hedge against the risks of future shortages and price fluctuations. The building of STP Units 3 and 4 fits with ERCOT's strategy to continue generating power with a diverse fuel mix.

10.6.1.2 Regional Benefits

Regional benefits of the proposed construction and operation of Units 3 and 4 include enhanced tax revenues, regional productivity, and community impacts.

Tax Revenue Benefits

NINA South Texas 3 LLC and NINA South Texas 4 LLC, STPNOC's taxable entities, would make tax payments and in-lieu-of tax payments to the State of Texas, Matagorda County, Palacios School District, and to other special taxing districts within Matagorda County. Tax payments on existing units are shown in Section 2.5.2.2, and taxes for the proposed Units 3 and 4 are identified in Sections 4.4.3.2 and 5.4.3.2

As the owners of Units 3 and 4 invest in building the power plant, the growing book value of the plant can increase the proportion of STPNOC's property tax payments that the local taxing districts receive. This is on a construction work in progress basis, as power property is amortized, the proportion of tax equivalent payments may decline. The amount of property tax payments received by Matagorda County, some special service districts and the Palacios Independent School District would significantly increase with the construction and operation of STP Units 3 and 4 (see Sections 4.4.3.2 and 5.4.3.2). These impacts are discussed in Sections 4.4 and 5.4 of this document.

In addition to in-lieu-of-tax payments by STPNOC, a variety of taxes would be paid on the wages, earnings, and expenditures that result from the owners of STPNOC's investment in the construction of proposed Units 3 and 4. These various taxes are also described in Sections 4.4 and 5.4 of this document.

Regional Productivity and Community Impacts

The new units would require a net increase in the operating workforce of 656 people who would stimulate the creation of 964 additional indirect jobs (Section 4.5 and 5.5) within the 50-mi region of STP influence, or a total of approximately 1620 new jobs within the region that would be maintained throughout the life of the plant. The economic multiplier effect of the increased spending by the direct and indirect workforce created as a result of two new units would increase the economic activity in the region, most noticeably in Matagorda County (STPNOC 2009a). Sections 4.5.3.1 and 5.5.3.1 provide additional information on the economic impacts of constructing and operating proposed Units 3 and 4 on the STP site.

The NRC staff's interviews in communities surrounding the STP site revealed high perceived benefit to having the jobs, income, and people associated with the nuclear plant in their area (Scott and Niemeyer 2008).

10.6.2 Costs

Internal costs to the proposed owners of Units 3 and 4 as well as external costs to the surrounding region and environment would be incurred during the construction, preconstruction, and operation of two new units at the STP site. A summary of the costs is shown in Table 10-4. Internal costs include all of the costs included in a total capital cost assessment—the direct and indirect cost to physically build the power plant (capital costs), plus the annual costs of operation and maintenance, fuel costs, waste disposal, and decommissioning costs. In accordance with the NRC staff's guidance in NUREG-1555 (NRC 2000), internal costs of the proposed project are presented in monetary terms. External costs include all costs imposed on the environment and region surrounding the plant that are not internalized by the company and may include such things as a loss of regional productivity, environmental degradation, or loss of wildlife habitat. The external costs listed below in Table 10-4 summarize environmental impacts to resources that could result from preconstruction, construction, and operation of the proposed Units 3 and 4. Because Table 10-4 includes costs from preconstruction activities, it overestimates the costs for the proposed NRC action.

Table 10-4. Summary of Costs of Preconstruction, Construction, and Operation

Cost Category	Description	Impact Assessment[(a)]
	Internal Costs[(b)]	
Construction cost	$6.2-$11.1 billion for the two STP units (overnight capital cost – 2008$)[(c)]	
Operating cost	3.8–8.6 cents per kWh (levelized cost of electricity – 2008$) Fuel cost is about 0.7 cents per kWh[(d)]	
Spent fuel management[(e)]	Approximately 0.1 cents per kWh	
Decommissioning[(f)]	Approximately 0.1 to 0.2 cents per kWh	
Material and resources[(g)]	480,000 yds^3 concrete (2 units) 26,000 tons structural steel 18 million linear ft of cable 110,000 linear ft of large bore piping having diameter >2.5 in. 34,000 metric tons of uranium	
Land use	Already utilized plant site of approximately 12,200 ac of which about 300 ac are occupied on a long-term basis by the two new nuclear reactors and associated infrastructure. Rights-of-way maintained for transmission lines (see Sections 4.1 and 5.1).	
	External Costs	
Land use	No new land acquired for new transmission line rights-of-way would be taken out of other productive or beneficial use (see Sections 4.1 and 5.1).	SMALL

Table 10-4. (contd.)

Cost Category	Description	Impact Assessment[(a)]
Air quality impacts	Negligible impacts associated with sulfur dioxide, nitrogen oxide, carbon monoxide, carbon dioxide, and particulate emissions (Sections 4.7 and 5.7).	SMALL
Ecological impacts	Terrestrial habitat loss (approximately 300 ac). STPNOC's adherence to the NPDES permit would likely result in balanced aquatic populations. No threatened or endangered terrestrial or aquatic species likely to be adversely affected (see Sections 4.3 and 5.3). EFH for some species would be adversely affected (more than minimal but less than substantial).	SMALL
Physical Impacts	Traffic noise impacts limited primarily to boundaries of the site and immediate neighborhood. Temporary stress on road/local road network because of congestion during building and potential degradation from building and operation activities (see Sections 4.4.1 and 5.4.1). Because a two unit operating plant already exists onsite, very little marginal impact on aesthetic and recreation from additional reactors (see Sections 4.4.1.4, 4.5.3.4, 5.4.1.4, and 5.4.3.4).	SMALL
Community Services and Infrastructure	Potential short-term strain on some community services and short-term strain on housing in Matagorda County during early stages of 7-year construction period (see Sections 4.5.4.3 and 4.5.4.4).	MODERATE
Health Impacts (Nonradiological and Radiological)	Minor estimated temperature increases would not significantly increase the abundance of thermophilic microorganisms. Radiological doses and nonradiological health hazards to the public and occupational workers would be monitored and controlled in accordance with regulatory limits (see Sections 4.8, 4.9, 5.8, and 5.9).	SMALL

(a) Impact assessments are listed for all impacts evaluated in detail as part of this EIS. The details on impact assessments are found in the indicated sections of this EIS.
(b) Internal costs are those incurred by STPNOC to implement proposed building and operation of the STP site. Note that no impact assessments are provided for these private financial impacts.
(c) \$5.4 billion is based on \$2000/kW(e) in 2003\$ used in STPNOC 2009a, escalated to 2008\$. \$11.1 billion is based on \$4000/kW(e) in 2007\$, estimated in MIT 2009, escalated to 2008\$,
(d) Review team calculation of price per kWh based on MIT (2009).
(e) U.S. used fuel program is funded by a 0.1 cent/kWh levy.
(f) USA experience (WNA 2010).
(g) From STPNOC 2009a and based on referenced plant design, which could change if the plant design is modified.

10.6.2.1 Internal Costs

The most substantial monetary cost associated with nuclear energy is the cost of capital construction. Nuclear power plants have relatively high capital costs for building the plant but low fuel costs relative to alternative power-generation systems. The real prices of key heavy construction commodities, such as cement, steel, and copper, have increased substantially in recent years, which would have a significant impact on nuclear plant capital costs (although it should be noted that these price increases would increase construction costs for non-nuclear power plants as well).[a] Because of the large capital costs for nuclear power, and the relatively long construction period before revenue is returned, servicing the capital costs of a nuclear power plant is a key factor in determining the economic competitiveness of nuclear energy. Construction delays can add significantly to the cost of a plant. Because a power plant does not yield profits during construction, longer construction times mean a longer time before any costs can be offset by revenues. Furthermore the longer it takes to build the plant, the higher would be the interest expenses on borrowed construction funds. In general, because no new nuclear plants have been built in the United States in many years, there is a great deal of uncertainty about the true costs of a new unit, which can affect the cost of capital, further increasing the cost of the proposed project.

Construction Costs

In evaluating monetary costs related to constructing proposed Units 3 and 4, the review team reviewed recent published literature, vendor information, internally generated financial information, and internally generated, site-specific information. The review team also compared recent cost estimates with STPNOC's. The cost estimates reviewed were not based on nuclear plant construction experience in the United States, which is more than 20 years old, but rather on more recent studies and more recent plant construction costs overseas.

Capital costs are costs incurred during construction, including preconstruction, when the actual outlays for equipment and construction and engineering are made. "Overnight capital costs" include engineering, procurement, and construction costs; however, it is presumed that the plant is constructed overnight; thus, interest is not included. STPNOC based its estimates of overnight capital costs for construction and preconstruction on analysis of four comprehensive studies of nuclear plant costs (University of Chicago 2004; MIT 2003; DOE 2004; OECD 2005), in which estimates ranged from $1100 per kW to $2500 per kW (in 2002 dollars). STPNOC estimates that the top end of the overnight cost range increased to around $2000 per kW in 2003 dollars (equivalent to about $2200 per KW in 2008 dollars). On this basis, STPNOC

(a) Although in real terms, the construction costs for large projects remained relatively flat from 1998 to 2002, various construction cost indices from such sources as the Electric Power Research Institute and McGraw Hill estimate real cost escalation for large power plant construction projects to be approximately 4 percent per year since 2002 (through 2007). This is based on actual field data as well as data on commodity costs, labor cost information, and other equipment (USDI/Reclamation 2008).

estimates an overnight capital cost for the two STP units of $5.4 billion in 2003 dollars ($6.1 billion in 2008 dollars) (STPNOC 2009a). In addition to the studies STPNOC used, the review team also considered three other more recent studies: two estimates of construction costs from other applicants and a 2009 update to the 2003 MIT study on the cost of nuclear power (MIT 2009).

- Tennessee Valley Authority estimated its per kW cost of construction for two new proposed AP1000 units at its Bellefonte site in Alabama between $2850 and $3200 per kW (TVA 2008), which if applied to proposed Units 3 and 4 at STP (installed capacity of 2700 MWe), would yield an overnight capital cost of $7.7 to $8.7 billion.
- Southern Nuclear Operating Company estimated the overnight cost of construction for two AP1000 units at its Vogtle site in Georgia between $3200 and $3500 kW (Southern 2008), which if applied to proposed Units 3 and 4 at STP would yield an overnight capital cost of $8.7 billion to $9.5 billion.
- The MIT Update (MIT 2009) estimated the overnight construction cost at $4000 per kW in 2007$ (about $4100 per kW in 2008$) or about $11.1 billion for 2700 MWe in 2008$.

All of these estimates include the cost of both preconstruction and construction activities. Thus, they overestimate the costs of the proposed NRC action and provide a conservative estimate of the costs for the benefit-cost analysis.

Operation Costs

Operation costs are frequently expressed as levelized cost of electricity, which is the lowest price per kilowatt-hour of producing electricity that covers operating costs, annualized capital costs, and a reasonable profit. For nuclear power plants, overnight capital costs typically account for a third of the levelized cost, and interest costs on the overnight costs account for another 25 percent (University of Chicago 2004). STPNOC estimated that the levelized cost for STP would be in the range of $36 to $65 per MWh (3.6 to 6.5 cents per kWh), which is the range estimated by the four studies mentioned above (STPNOC 2009; University of Chicago 2004; MIT 2003; DOE 2004; OECD 2005). In addition, the review team examined the update to the MIT study (MIT 2009) which re-evaluated the overnight levelized cost of electricity at 8.4 cents per kWh (2007$). In 2008 dollars, this yields an overall range of 3.8 to 8.6 cents per kWh. Factors affecting the range include choices for discount rate, construction duration, plant life span, capacity factor, cost of debt and equity, and split between debt and equity financing, depreciation time, tax rates, and premium for uncertainty. Estimates include decommissioning but, because of the effect of discounting a cost that would occur as much as 40 years or more in the future, decommissioning costs have relatively little effect on the levelized cost.

Fuel Costs

STPNOC calculated nuclear fuel cost and decommissioning cost separately using information from a study published jointly by the University of Chicago (2004). In the report, the University of Chicago estimated the average fuel cost for a nuclear generating plant to be $4.35 per MWh, or 0.4 cents per kWh. Based on the recent World Nuclear Association's study (WNA 2010), the review team estimated nuclear fuel costs to be $0.449 cents per kWh (WNA 2010).

Waste Disposal

The back-end costs of nuclear power contribute a very small share of total cost because of both the long lifetime of a nuclear reactor and the fact that provisions for waste-related costs can be accumulated over that time. Spent fuel management costs are estimated to be 0.1 cents per kWh (WNA 2010; DOE 2008). It should be recognized, however, that radioactive nuclear waste poses unique disposal challenges for long-term management. While spent fuel and radioactive nuclear waste are being stored successfully in on-site facilities, the United States has yet to implement final disposition of spent fuel or high-level radioactive waste streams created at various stages of the nuclear fuel cycle.

Decommissioning

NRC has requirements for licensees at 10 CFR 50.75 to provide reasonable assurance that funds would be available for the decommissioning process. Because of the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little effect on the levelized cost of electricity generated by a nuclear power plant. Decommissioning costs are about 9 to 15 percent of the initial capital cost of a nuclear power plant. However, when discounted, they contribute only a few percent to the investment cost and even less to generation cost. In the United States, they account for 0.1 to 0.2 cents per kWh (WNA 2010).

10.6.2.2 External Costs

External costs are social and/or environmental effects that would be caused by the construction of and generation of power by two new reactors at the STP site. This EIS includes the review team's analysis that considers and weighs the environmental impacts of building and operating new nuclear units at the STP site or at alternative sites and mitigation measures available for reducing or avoiding these adverse impacts. It also includes the NRC staff's recommendation to the Commission regarding the proposed action.

Environmental and Social Costs

Chapter 4 describes the impacts of constructing the proposed Units 3 and 4 on the environment with respect to the land, water, ecology, socioeconomics, radiation exposure to construction workers, and measures and controls to limit adverse impacts during building of the proposed new units at the STP site. Chapter 5 examines environmental issues associated with operation of the proposed new nuclear Units 3 and 4 for an initial 40-year period. Potential operational impacts on land use, air quality, water, terrestrial and aquatic ecosystems, socioeconomics, historic and cultural resources, environmental justice, nonradiological and radiological health effects, postulated accidents, and applicable measures and controls that would limit the adverse impacts of station operation during the 40-year operating period are considered. In accordance with 10 CFR Part 51, all impacts identified in Chapters 4 and 5 have been analyzed, and a significance level of potential adverse impacts (i.e., SMALL, MODERATE, or LARGE) has been assigned.

Chapter 6 addresses the environmental impacts from: (1) the uranium fuel cycle and solid waste management, (2) the transportation of radioactive material, and (3) the decommissioning of nuclear units at the STP site. Chapter 9 includes the review team's review of alternative sites and alternative power generation systems.

Unlike generation of electricity from coal and natural gas, normal operation of a nuclear power plant does not result in any emissions of criteria (e.g., oxides of nitrogen or sulfur dioxide,), methyl mercury, or greenhouse gases associated with global warming and climate change. Whereas combustion-based power plants are responsible for at least 70 percent of the sulfur dioxide, at least 21 percent of nitrogen oxides, and 51 percent of the mercury emissions from industrial sources in the United States (EPA 2009), and 40 percent of the carbon dioxide (DOE/EIA 2008). Eighty-two percent of the electric power industry's emissions are from coal-fired plants (DOE/EIA 2008). Chapter 9 analyzes coal- and natural-gas-fired alternatives to the building and operation of proposed STP Units 3 and 4. Air emissions from these alternatives and nuclear power are summarized in Chapters 4, 5 and 9.

As mentioned previously, Table 10-4 summarizes the external costs (i.e., environmental impacts) associated with the preconstruction, construction, and operation of the proposed STP Units 3 and 4. Impacts to land use, air quality, aquatic and terrestrial ecology, housing, transportation, public services, aesthetics and recreation, cultural resources, and radiological and nonradiological health would all be SMALL. Because the overall impact to these resources from the proposed project in its entirety would be SMALL, the NRC portion of the project (i.e., construction as defined in 10 CFR 51.4, and operation of the proposed new units) accordingly would also be SMALL.

10.6.3 Summary of Benefits and Costs

The internal costs to construct additional units appear to be substantial; however, STPNOC's decision to pursue this expansion implies that it has concluded that the internal benefits of the proposed facility (production of 20,000,000 to 22,000,000 MWh per year for the 40-year life of the plant and 2700 MW of baseload capacity) outweigh the internal costs. Although no specific monetary values could reasonably be assigned to the identified societal benefits, it would appear that the potential societal benefits of the proposed Units 3 and 4, including the primary benefit of the generated power and baseload capacity, are substantial. In comparison, the external socio-environmental costs imposed on the region appear to be relatively small.

Table 10-3 includes a summary of both internal and external costs of the proposed activities at the STP site for Units 3 and 4, as well as the identified benefits. The table includes a reference to other sections of this EIS where more detailed analyses and impact assessments are available for specific topics. These assessments are included in the table.

On the basis of the assessments summarized in this EIS, building and operating the proposed Units 3 and 4, with mitigation measures identified by the review team, would have accrued benefits that most likely would outweigh the economic, environmental, and social costs. For the NRC-proposed action (NRC-authorized construction and operation) the accrued benefits would also outweigh the costs of construction and operation of Units 3 and 4.

10.7 Staff Conclusions and Recommendations

The NRC staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the COLs should be issued. The NRC staff's evaluation of the safety and emergency preparedness aspects of the proposed action will be addressed in the staff's safety evaluation report that is anticipated to be published in 2011.

The staff's preliminary recommendation is based on (1) the ER submitted by STPNOC (STPNOC 2009a), (2) consultation with Federal, State, Tribal, and local agencies, (3) the review team's own independent review, (4) the staff's consideration of public scoping comments, and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and in the EIS. In addition, in making its preliminary recommendation, the staff determined that none of the alternative sites assessed is obviously superior to the STP site.

The NRC's determination is independent of the Corps' determination of a Least Environmentally Damaging Practicable Alternative pursuant to Clean Water Act Section 404(b)(1) Guidelines. The Corps will conclude its analysis of both offsite and onsite alternatives in its Record of Decision.

10.8 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

33 CFR Part 332. Code of Federal Regulations, Title 10, *Navigation and Navigable Waters,* Part 332, "Compensatory Mitigation for Losses of Aquatic Resources."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants." *Federal Register*. U.S. Nuclear Regulatory Commission.

CPS Energy (CPS). 2010. February 17, 2010, News Release, "CPS Energy, NINA Reach Agreement." Accession No. ML100670377.

Electric Reliability Council of Texas (ERCOT). 2008. *Report on Existing and Potential Electric System Constraints and Needs December, 2008.* Accessed April 9, 2009 at http://www.ercot.com/news/presentations/2008/index. Accession No. ML100670568

Electric Reliability Council of Texas (ERCOT). 2009. *Report on the Capacity, Demand, and Reserves in the ERCOT Region, System Planning.* Accessed June 24, 2009 at http://www.ercot.com/content/news/presentations/2009/2009%20ERCOT%20Capacity,%20Demand%20and%20Reserves%20Report.pdf. Accession No. ML100600754.

Federal Water Pollution Control Act (Clean Water Act). 33 USC 1251, et seq.

Massachusetts Institute of Technology (MIT). 2003. *The Future of Nuclear Power: An Interdisciplinary MIT Study*. Accessed February 4, 2008 at http://web.mit.edu/nuclearpower/. Accession No. ML100600694.

Massachusetts Institute of Technology (MIT). 2009. *Update of The Future of Nuclear Power: An Interdisciplinary MIT Study*. Accessed July 23, 2009 at http://web.mit.edu/nuclearpower/pdf/nuclearpower-update2009.pdf. Accession No. ML100600695.

National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, et seq.

Nuclear Energy Agency, International Energy Agency, and Organization for Economic Co-operation and Development and (NEA/IEA/OECD). 2005. *Projected Costs of Generating Electricity – 2005 Update*. International Energy Agency, Paris, France.

Nuclear Innovation North America (NINA). 2010. February 17, 2010, News Release, "Nuclear Innovation North American (NINA) Moving Forward with South Texas Project (STP) Expansion." Accession No. ML100670379.

Organization for Economic Co-operation and Development (OECD). 2005. *Nuclear Energy Agency, Organization for Economic Co-operation and Development, and International Energy Agency, Projected Costs of Generating Electricity; 2005 Update. Access March 7, 2010* at http://www.oecdbookshop.org/oecd/display.asp?K=5LH1VDKBQCTB&tag=XNJB98XX4X488918XKCJS5&lang=EN&sort=sort_date/d&sf1=Title&st1=electricity&sf3=SubjectCode&st3=34&st4=not+E4+or+E5+or+5&sf4=SubVersionCode&ds=electricity%3B+Energy%3B+&m=17&dc=58&plang=en. Accession No. ML100600699.

Organization for Economic Co-operation and Development Nuclear Energy Agency and International Atomic Energy Agency (OECD NEA and IAEA). 2008. *Uranium 2007*. 22nd ed., Paris.

Rivers and Harbors Appropriation Act of 1899, as amended. 33 USC 403, et seq.

Scott, M., and M. Niemeyer. 2008. *South Texas Project -- Interviews with the Public; Socioeconomic and Environmental Justice*. Pacific Northwest National Laboratory. Accession No. ML092100141.

South Texas Project Nuclear Operating Company (STPNOC). 2008. Letter from Mark McBurnett, STPNOC, to NRC, dated June 9, 2008, "Cultural or Historical Artifact Discovery During Construction." Accession No. ML081640213.

South Texas Project Nuclear Operating Company (STPNOC). 2009a. *South Texas Project Units 3 and 4 Combined License Application, Part 1, General Financials*. Revision 3, Bay City, Texas. Accession No. ML092931178.

South Texas Project Nuclear Operating Company (STPNOC). 2009b. Letter from S. Head, STPNOC, to U.S. Army Corps of Engineers, dated October 28, 2009, "South Texas Project Units 3 and 4 Permit Determination Request." Accession No. ML093210232.

South Texas Project Nuclear Operating Company (STPNOC). 2009c. *South Texas Project Units 3 and 4 Combined License Application, Part 3, Environmental Report.* Revision 3, Bay City, Texas. Accession No. ML092931600.

Southern Nuclear Operating Company, Inc. (Southern). 2008. *Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Response to NRC Questions from April 23, 2008 Environmental Conference Call*. Letter report from Southern Nuclear Operating Company

(Birmingham, Alabama) to the U. S. Nuclear Regulatory Commission (Washington, D.C.), June 26, 2008. Southern Company, Birmingham, Alabama. Accession No. ML081790598.

Tennessee Valley Authority (TVA). 2008. *Bellefonte Nuclear Plant, Units 3 & 4 COL Application, Part 3, Environmental Report.* Revision 1. Knoxville, TN. Accession No. ML083100558.

U.S. Army Corps of Engineers (Corps). 2009. Letter from Jayson Hudson (Corps) to Scott Head, STPNOC, dated November 10, 2009 in response to STPNOC October 28, 2009 request for a Permit Determination. Accession No. ML093210227.

University of Chicago. 2004. *The Economic Future of Nuclear Power*. University of Chicago, Chicago, Illinois. Accessed June 20, 2009 at http://www.ne.doe.gov/np2010/reports/NuclIndustryStudy-Summary.pdf. Accession No. ML100600700.

U.S. Department of Interior, Bureau of Reclamation (USDI/Reclamation). 2008. *Construction Cost Trends*. U.S. Department of Interior, Washington, D.C. Accessed July 7, 2009 at http://www.usbr.gov/pmts/estimate/cost_trend.html. Accession No. ML100600715.

U.S. Department of U.S. Department of Energy (DOE). 2004. *Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs*. Vol. 2 - MPR-2610, prepared by Dominion Energy, Inc., Bechtel Power Corporation, TLG, Inc., and MPR Associates under Contract DE-AT01-020NE23476, May 27.

Energy (DOE) 2008. *Yucca Mountain Repository*. Accessed May 2008 at http://www.ocrwm.doe.gov/ym_repository/index.shtml#4. Accession No. ML100600704.

U.S. Department of Energy-Energy Information Administration (DOE/EIA). 2006. *Energy Power Annual*. Energy Information Administration, Washington, D.C. Accessed February 4, 2008 at http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html. Accession No. ML100600709.

U.S. Department of Energy/Energy Information Administration (DOE/EIA). 2008. *Emissions of Greenhouse Gases in the United States*. DOE/EIA-0573(2008). Accessed February 3, 2010 at http://www.eia.doe.gov/oiaf/1605/ggrpt/gwp_gases.html. Accession No. ML100580032.

U.S. Environmental Protection Agency (EPA). 2009. *Report on the Environment. A-Z Indicators List*. Accessed on February 3, 2010 at http://cfpub.epa.gov/eroe/index.cfm?fuseaction=list.listByAlpha#E. Accession No. ML100580033.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Environmental Standard Review Plan — Standard Review Plans for Environmental Reviews for Nuclear Power Plants,* NUREG-1555, Vol. 1, Washington, D.C. Includes 2007 updates.

World Nuclear Association (WNA). 2010. *The Economics of Nuclear Power*. Accessed January 27, 2010 at http://www.world-nuclear.org/info/default.aspx?id=410&terms=price. Accession No. ML100600712.

Appendix A

Contributors to the Environmental Impact Statement

Appendix A

Contributors to the Environmental Impact Statement

The overall responsibility for the preparation of this environmental impact statement was assigned to the Office of New Reactors, U.S. Nuclear Regulatory Commission (NRC). The statement was prepared by members of the Office of New Reactors with assistance from other NRC organizations, the U.S. Army Corps of Engineers, and Pacific Northwest National Laboratory.

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Daniel Mussatti	Office of New Reactors	Socioeconomics, Environmental Justice, Need for Power, Benefit Cost
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Rajiv Prasad		Hydrology - Surface Water
Lance Vail		Hydrology
Robert Bryce		Alternative System Design
Janelle Downs		Terrestrial Ecology
Mary Ann Simmons		Terrestrial Ecology – Alternative Sites
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(b) Pacific Northwest National Laboratory is operated by Battelle for the U.S. Department of Energy.
(c) Staff member is no longer with Pacific Northwest National Laboratory

Appendix B

Organizations Contacted

Appendix B

Organizations Contacted

The following Federal, State, regional, Tribal, and local organizations were contacted during the course of the U.S. Nuclear Regulatory Commission staff's independent review of potential environmental impacts from the construction and operation of two new nuclear units, Units 3 and 4, at the South Texas Project Electric Generating Station in Matagorda County, Texas:

Advisory Council on Historic Preservation, Director Office of Federal Agency Programs, Washington, D.C.

Alabama-Coushatta Tribe, Historical Preservation Department, Livingston, Texas

Angleton Independent School District (ISD), Angleton, Texas

Bay City Chamber of Commerce, Bay City, Texas

Bay City Community Development Corporation, Bay City, Texas

Bay City ISD, Bay City, Texas

Bay City Ministerial Alliance, Bay City, Texas

Bay City Salvation Army, Bay City, Texas

Bell Valuation Services, Bay City, Texas

Bluebonnet Groundwater Conservation District, Navasota, Texas

Brazoria County Judge, Angleton, Texas

Brazos River Authority, Waco, Texas

Brazos Valley Groundwater Conservation District, Waco, Texas

Calhoun County Judge, Port Lavaca, Texas

City of Bay City, Mayor, Bay City, Texas

Coastal Plains Groundwater Conservation District, Bay City, Texas

Columbia-Brazoria ISD, West Columbia, Texas

Comanche Nation, Lawton, Oklahoma

Environmental Protection Agency, Regional Office, Dallas, Texas

Frankson and Griffith, Certified Public Accountants, Bay City, Texas

Greater Texoma Utility Authority, Bonham, Texas (now Red River Groundwater Conservation District)

Guadalupe-Blanco River Authority, Seguin, Texas

Jackson County, Edna, Texas

Kiowa Tribe of Oklahoma, Carnegie, Oklahoma

Matagorda County Museum Archives and Collections Department, Bay City, Texas

Mid-East Texas Groundwater Conservation District, Centerville, Texas

Lower Colorado River Authority, Austin, Texas

National Marine Fisheries Service, Galveston Laboratory, Galveston, Texas

National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, Florida

NRG Energy, Inc., Limestone Electric Generating Station, Jewett, Texas

Palacios ISD, Palacios, Texas

State of Texas, Office of the Governor, Austin, Texas

St. Anthony of Padua Church, Palacios, Texas

Tarrant Water District, Fort Worth, Texas

Texas Commission on Environmental Quality, Austin, Texas

Texas General Land Office, Coastal Coordination Council, Austin, Texas

Texas Historical Commission, Austin, Texas

Texas Parks and Wildlife Department, Austin, Texas

Texas State Historic Preservation Officer, Austin, Texas

Texas State Soil and Water Conservation Board, Temple, Texas

Texas Water Development Board, Austin, Texas

Tidehaven ISD, El Maton, Texas

Tonkawa Tribe of Oklahoma, Tonkawa, Oklahoma

Trinity River Authority of Texas Southern Region, Huntsville, Texas

Upper Neches River Municipal Water Authority, Palestine, Texas

U.S. Army Corps of Engineers Galveston District, Galveston, Texas

U.S. Army Corps of Engineers, Fort Worth, Texas

U.S. Congressman Ron Paul’s Office, Galveston, Texas

U.S. Environmental Protection Agency, Temple, Texas

U.S. Fish and Wildlife Service, Ecological Services, Houston, Texas

Van Vleck ISD, Van Vleck, Texas

Appendix C

NRC and Corps Environmental Review Correspondence

Appendix C

NRC and Corps Environmental Review Correspondence

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) or the U.S. Army Corps of Engineers (Corps) and STP Nuclear Operating Company (STPNOC). Also included is other correspondence related to the environmental review of STPNOC's application for combined licenses (COLs) and a Corps permit at the South Texas Project Electric Generating Station (STP) site in Matagorda County, Texas.

All documents, with the exception of those containing proprietary information, are available electronically from the Public Electronic Reading Room found on the Internet at the following web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of the NRC's public documents. The ADAMS accession numbers for each document are included below.

October 16, 2007	Letter to Mr. Mark McBurnett, Vice President, STPNOC, from NRC, regarding Acknowledgement of Receipt of The Combined License Application for South Texas Project, Units 3 and 4, and Associated Federal Register Notice. (Accession No. ML072670515)
November 8, 2007	Letter from Mr. Gregory T. Gibson, Manager, STPNOC, to NRC, regarding Environmental Report Acceptance Review: Outstanding Issues. (Accession No. ML073190645)
November 16, 2007	Letter to Mr. Mark McBurnett, Vice President, STPNOC, from NRC, regarding Acceptance Review of The Combined License Application for South Texas Project (STP), Units 3 and 4. (Accession No. ML073200761)
November 21, 2007	Letter from M.A. McBurnett, STPNOC, to NRC, regarding Supplement to Combined License Application. (Accession No. ML073310616)
November 29, 2007	Letter to Mr. Mark McBurnett, STPNOC, from NRC, regarding the Docketing of The Combined License Application (COL) For South Texas Project (STP), Units 3 and 4. (Accession No. ML073320290)

December 5, 2007	Letter from Mr. Gregory T. Gibson, STPNOC to NRC, Resubmitted Aquatic Ecology Monitoring: Six-Month Interim Report. (Accession No. ML073410357)
December 11, 2007	Letter to Mr. Mark McBurnett, STPNOC, from NRC, regarding the Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Related to Combined Licenses for the South Texas Project Sites, Units 3 and 4. (Accession No. ML073400695)
December 19, 2007	Letter to Mr. Mark McBurnett, STPNOC, from NRC, regarding Federal Register Notice Regarding Opportunity to Petition for Leave to Intervene - South Texas Project Units 3 and 4. (Accession No. ML073390202)
December 21, 2007	Letter to Ms. Martha Johnson, Bay City Public Library, from NRC staff, regarding the Maintenance of Documents at The Bay City Public Library Related to Application by STP Nuclear Operating Company For Combined Licenses for The South Texas Project Site, Units 3 and 4. (Accession No. ML073480284)
January 13, 2008	Email from Mr. Paul Kallan, NRC, to Mr. Greg Gibson, STPNOC, Site Audit Schedule and Preliminary Needs for Site Audit. (Accession No. ML082400729)
January 18, 2008	Notice of Public Meeting to Discuss Environmental Scoping Process for the South Texas Project Site, Units 3 & 4 Combined Licenses (TAC NO. RA2764). (Accession No. ML080020250)
January 25, 2008	Letter to Mr. David Bernhart, Assistant Regional Administrator, National Marine Fisheries Service, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML080020174)
January 25, 2008	Letter to Alabama-Coushatta Tribe, Historical Preservation Department, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML080090115)
January 25, 2008	Letter to Mr. Billy Evans Horse, Chairman of the Kiowa Tribe, Kiowa Tribe of Oklahoma, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML073620378)

January 25, 2008	Letter to Ms. Ruth Toahty, NAGPRA Coordinator, Comanche Nation NAGPRA and Historic Preservation Program, Comanche National Museum, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML073620358)
January 25, 2008	Letter to Mr. Anthony E. Street, Tribal President, Tonkawa Tribe of Oklahoma, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML080090198)
January 25, 2008	Letter to Mr. Don Klima, Director Office of Federal Agency Programs, Advisory Council on Historic Preservation, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML080100669)
January 25, 2008	Letter to Mr. Lawrence Oaks, Executive Director of the Texas SHPO, State Historic Preservation Officer, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML080110216)
January 25, 2008	Letter to Ms. Moni Belton, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service Ecological Services, from Mr. William Burton, NRC, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML080090170)
January 31, 2008	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Submittal of Combined License Application Revision 1. (Accession No. ML080700399)
February 28, 2008	Letter from Mr. Gregory Gibson, STPNOC, to NRC staff, Reponses to Environmental Report Site Audit Comments. (Accession No. ML080660150)
February 08, 2008	Site Audit Summary Report. (Accession No. ML081010440)
February 13, 2008	Notice Withdrawing Hearing Notice Regarding the Application for a Combined Operating License for South Texas Project Units 3 and 4. (Accession No. ML080450208)

April 4, 2008	Letter to Ms. Kathy Boydston, Habitat Assessment Program Manager, Texas Parks and Wildlife Department, from NRC staff, regarding Application for The South Texas Project Site, Units 3 and 4 Combined Licenses. (Accession No. ML080730469)
April 10, 2008	Summary of Public Scoping Meetings to Support Review of the South Texas Plant Combined License Application (TAC NO. MD6691). (Accession No. ML081000171)
May 19, 2008	Letter to Mr. William Burton, NRC, from Mr. Carter Smith, Texas Parks and Wildlife, Proposed application for combined licenses for South Texas Project, Units 3 and 4, Matagorda County. (Accession No. ML090330752)
May 19, 2008	Letter to Mr. Gregory Gibson, STPNOC, from Mr. Paul Kallan, NRC, Request for Additional Information, Letter Number One Related to the Environmental Report for the South Texas Combined License Application. (Accession No. ML081360531)
June 04, 2008	Letter from Mr. Gregory Gibson, STPNOC, to NRC, Cultural or Historical Artifact Discovery During Construction. (Accession No. ML081610296)
June 09, 2008	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Cultural or Historical Artifact Discovery During Construction. (Accession No. ML081640213)
June 17, 2008	Letter from Mr. Gregory Gibson, STPNOC, to NRC, Final Aquatic Ecology Report. (Accession No. ML081750196)
July 02, 2008	Letter from Mr. Gregory Gibson, STPNOC, to NRC, Response to Requests for Additional Information. (Accession No. ML081900569)
July 07, 2008	Letter to Mr. Scott Flanders, NRC, from Mr. Fred Anthamatten, U.S. Army Corps of Engineers, Environmental Impact Statement for the South Texas Project Nuclear Operating Company's Combined License Application. (Accession No. ML082140640)
July 15, 2008	Letter from Mr. Greg Gibson, STPNOC, to NRC, Response to Requests for Additional Information. (Accession No. ML082040684)

July 30, 2008	Letter from Mr. Gregory Gibson, STPNOC, to NRC, Response to Requests for Additional Information. (Accession No. ML082140629)
August 27, 2008	Letter from Mr. Gregory Gibson, STPNOC, to NRC, Response to Requests for Additional Information. (Accession No. ML082420332)
August 29, 2008	Letter to Mr. Fred Anthamatten, U.S. Army Corps of Engineers, from Mr. Scott Flanders, NRC, Request to Cooperate with the Nuclear Regulatory Commission on the Environmental Impact Statement for the South Texas Project Nuclear Operating Company, Units 3 and 4 Combined License Application. (Accession No. ML0823106192)
September 04, 2008	Letter from Mr. Gregory Gibson, STPNOC, to NRC, Completion of NRC Commitment. (Accession No. ML082530234)
September 26, 2008	Letter to Mr. Scott Head, STPNOC, from Mr. William Burton, NRC, Scoping Summary Report Related to the Environmental Scoping Process for the South Texas Project, Units 3 and 4 Combined License Application. (Accession No. ML082260471)
September 24, 2008	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Submittal of Combined License Application Revision 2. (Accession No. ML082830938)
November 18, 2008	Letter to Mr. Scott Head, STPNOC, from Mr. Paul Kallan, NRC, Request for Additional Information, Letter Number Two Related to the Environmental Report for the South Texas Combined License Application. (Accession No. ML083190269)
January 14, 2009	Memorandum from Ms. Jessie Muir, NRC, to Mr. William Burton, NRC, Summary of Teleconferences Held with South Texas Nuclear Operating Company Regarding the Draft Requests for Additional Information. (Accession No. ML090030003)
January 21, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Second Re-submittal of Response to Request for Additional Information. (Accession No. ML090270986)
January 22, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML090270720)

February 03, 2009	Letter from Mr. Scott Head, STPNOC, to Mr. Mark Fisher, TCEQ, Request for State Water Quality Certification of Federally Permitted Activity. (Accession No. ML ML090360530)
February 10, 2009	Letter from Mr. George Wunder, NRC, to Mr. Mark McBurnett, STPNOC, South Texas Project Units 3 and 4 Combined License Application Review Schedule. (Accession No. ML083650198)
February 20, 2009	Federal Register Notice of Order, Hearing, and Opportunity to Petition for Leave to Intervene Docket Nos. 52-012 and 52-013. 74 FR 7934. (Accession No. ML083570595)
February 26, 2009	Summary of the Second Site Audit Related to the Environmental Review of the Combined Operating License Application for South Texas Project Units 3 and 4. (Accession No. ML090350504)
March 03, 2009	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Contracts for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste. (Accession No. ML090640920)
March 16, 2009	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Re-Submittal of Response to Requests for Additional Information. (Accession No. ML090860879)
March 18, 2009	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Update to Aquatic Ecology Monitoring Report Data. (Accession No. ML090830503)
April 07, 2009	Letter from Mr. Kenny Jaynes, U.S. Army Corps of Engineers, to Mr. Gregory Gibson, STPNOC, Jurisdictional Determination, 7,000-Acre Mass Cooling Reservoir (MCR), Wadsworth, Matagorda County, Texas. (Accession No. ML091050501)
April 22, 2009	Letter to Mr. Scott Head, STPNOC, from Ms. Jessie Muir, NRC, Requests for Additional Information, Letter Number Three Related to the Environmental Report for the South Texas Combined License Application. (Accession No. ML090960303)
May 13, 2009	U. S. Army Corps of Engineers to NRC, Preliminary Jurisdictional Determination Form. (Accession No. ML091390115)

May 14, 2009	Letter from Mr. Kenny Jaynes, U.S. Army Corps of Engineers, to Mr. Russell Kiesling, STPNOC, Preliminary Jurisdictional Determination, Wadsworth, Montgomery County, Texas. (Accession Nos. ML091350101; ML091390111)
May 18, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML091410061)
June 04, 2009	Letter from Mr. Scott Head, STPNOC, to Mr. Jayson Hudson, U.S. Army Corps of Engineers, Permit Determination Request. (Accession No. ML092030309)
June 29, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML091830339)
July 08, 2009	Letter from Mr. Casey Cutler, U.S. Army Corps of Engineers, to Mr. Scott Head, STPNOC. (Accession No. ML092030304)
July 30, 2009	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML092150963)
August 10, 2009	Letter from Mr. Jayson Hudson, U.S. Army Corps of Engineers to Ms. Jessie Muir, NRC, Cooperating Agency Scoping Request for South Texas Project Electric Generating Station Units 3 and 4. (Accession No. ML092460137)
August 14, 2009	Letter to Mr. Scott Head, STPNOC, from Ms. Jessie Muir, NRC, Request for Additional Information, Letter Number Four Related to the Environmental Report for the South Texas Combined License Application. (Accession No. ML091620673)
September 14, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML092580491)
September 16, 2009	Letter from Mr. Mark McBurnett, STPNOC, to NRC, Submittal of Combined License Application Revision 3. (Accession No. ML092930393)
September 22, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Second Re-submittal Response to Request for Additional Information. (Accession No. ML092710535)

September 28, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML092740321)
October 01, 2009	Letter from Jessie M. Muir, NRC, to Mr. Scott Head, STPNOC, Request for Additional Information related to Alternative Sites. (Accession No. ML092750384)
October 15, 2009	Letter to Mrs. Moni Belton, USFWS, from Mr. Ryan Whited, NRC, Information Request Regarding Alternative Sites Related to the Combined Licenses Application for South Texas Project, Units 3 and 4. (Accession No. ML092580516)
October 15, 2009	Letter to Mr. Carter Smith, Texas Parks and Wildlife Department, from Mr. Ryan Whited, NRC, Information Request Regarding Alternative Sites Related to the Combined Licenses Application for South Texas Project, Units 3 and 4. (Accession No. ML092580421)
October 27, 2009	Letter from Mr. Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML093060175)
October 28, 2009	Letter from STPNOC to USACE, Permit Determination Request. (Accession No. ML093210232)
November 09, 2009	Site Audit Summary of South Texas Project Nuclear Operating Company's Revised Alternative Sites Analysis. (Accession No. ML092870574)
November 09, 2009	Forthcoming Teleconference with South Texas Project Nuclear Operating Company to Discuss Responses to Request for Additional Information Related to Alternative Sites for the South Texas Project Units 3 and 4 Environmental Reviews. (Accession No. ML093130330
November 10, 2009	Letter from Jayson Hudson, US Army Corps, to Scott Head (STPNOC) dated November 10, 2009 in response to STPNOC October 28, 2009 request for a permit determination. (Accession No. ML093210227)
November 10, 2009	Letter from Scott Head, STPNOC, to NRC, Proposed Revision to Environmental Report. (Accession No. ML093170197)
November 11, 2009	Letter from Scott Head, STPNOC, to NRC, Proposed Revision to Environmental Report. (Accession No. ML093200201)

November 13, 2009	Letter from Kathy Boydston, Texas Parks and Wildlife Division, to Ryan Whited, NRC, Proposed Alternative Sites Related to the Combined License Application for South Texas Project, Units 3 and 4. (Accession No. ML093210221)
November 16, 2009	Letter from Mark McBurnett, STPNOC, to NRC, Request for Limited Work Authorization. (Accession No. ML093230143)
November 23, 2009	Letter from Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML093310296)
November 23, 2009	Letter from Scott Head, STPNOC, to NRC, Supplemental Response to Request for Additional Information. (Accession No. ML093310392)
November 30, 2009	Letter from Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML093370158)
November 30, 2009	Letter from Scott Head, STPNOC, to NRC, Response to Request for Additional Information. (Accession No. ML093380310)
November 30, 2009	Letter from Scott Head, STPNOC, to NRC, Supplemental Response to Request for Additional Information. (Accession No. ML093360350)
December 14, 2009	Summary of November 17, 2009, Public Teleconference Related to the Environmental Review of the South Texas Project Units 3 and 4 Combined Licenses Application. (Accession No. ML093350861)
January 08, 2010	Letter from Michael Johnson, NRC, to Mark McBurnett, STPNOC regarding South Texas Project Nuclear Power Plan Units 3 and 4 Request for a Limited Work Authorization for Installation of Crane Foundation Retaining Walls. (Accession No. ML093350744)
January 20, 2010	Letter to Amy Hanna, Texas Parks and Wildlife Division, from Jessie Muir, NRC, Comments Regarding Alternative Sites Related to the Combined Licenses Application for South Texas Project, Units 3 and 4. (Accession No. ML093450914)
February 2, 2010	Letter from Mark McBurnett, STPNOC, to NRC, Request for Exemption to Authorize Installation of Crane Foundation Retaining Walls. (Accession No. ML100350219)

February 2, 2010	Letter from Charles Maguire, Texas Commission on Environmental Quality, to Ryan Whited, NRC, 401 Water Quality Certification of South Texas Nuclear Project. (Accession No. ML100500926)
February 19, 2010	Letter from Casey Cutler, Department of Army, to Ryan Whited, NRC, regarding Draft Environmental Impact Statement for the Combined Licenses for South Texas Project Generating Station Units 3 and 4. (Accession No. ML100660017).

Appendix D

Scoping Comments and Responses

Appendix D

Scoping Comments and Responses

On December 21, 2007, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process in the *Federal Register* (72 FR 72774). The Notice of Intent notified the public of the staff's intent to prepare an environmental impact statement (EIS) and conduct scoping for the application for combined licenses (COLs) received from STP Nuclear Operating Company (STPNOC) for two new nuclear units identified as South Texas Project Electric Generating Station (STP) Units 3 and 4, to be located at the existing STP site, located approximately 12 mi south-southwest of Bay City, Texas. NRC invited the applicant; Federal, Tribal, State, and local government agencies; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting written suggestions and comments no later than February 18, 2008.

D.1 Overview of the Scoping Process

The scoping process provides an opportunity for public participants to identify issues to be addressed in the EIS and highlight public concerns and issues. The Notice of Intent identified the following objectives of the scoping process:

- Define the proposed action which is to be the subject of the EIS.
- Determine the scope of the EIS and identify significant issues to be analyzed in depth.
- Identify and eliminate from detailed study those issues that are peripheral or that are not significant.
- Identify any environmental assessments and other EISs that are being prepared or will be prepared that are related to, but not part of, the scope of the EIS being considered.
- Identify other environmental review and consultation requirements related to the proposed action.
- Identify parties consulting with the NRC under the NHPA, as set forth in 36 CFR 800.8(c)(1)(i).

- Indicate the relationship between the timing of the preparation of the environmental analyses and the Commission's tentative planning and decision-making schedule.

- Identify any cooperating agencies and, as appropriate, allocate assignments for preparation and schedules for completing the EIS to the NRC and any cooperating agencies.

- Describe how the EIS will be prepared and include any contractor assistance to be used.

Two public scoping meetings were held at the Bay City Civic Center, on Tuesday, February 5, 2008. The scoping meetings began with NRC staff members providing a brief overview of the COL process and the NEPA process. After the NRC's prepared statements, the meeting was open for public comments. Fifty one (51) meeting attendees provided either oral comments or written statements that were recorded and transcribed by a certified court reporter. In addition to the oral and written statements provided at the public scoping meeting, 11 letters and 7 emails were received during the scoping period. Preparation of the draft EIS has taken into account all of the relevant issues raised during the scoping process.

Transcripts for both afternoon and evening scoping meeting can be found in the NRC Agency Document Access and Management System (ADAMS), under accession numbers ML080950499 and ML080950504, respectively. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams/web-based.html (in the Public Electronic Reading Room). (Note: the URL is case-sensitive.) Additional comments received later in letters or emails are also available. A meeting summary memorandum (ML081000171) was issued April 10, 2008.

At the conclusion of the scoping period, the NRC staff reviewed the scoping meeting transcripts and all written material received during the comment period and identified individual comments. These comments were organized according to topic within the proposed EIS or according to the general topic, if outside the scope of the EIS. Once comments were grouped according to subject area, the staff determined the appropriate response for the comment. The staff made a determination on each comment that it was one of the following:

- A comment that was actually a question and introduced no new information.

- A comment that was either related to support or opposition of combined licensing in general (or specifically the STPNOC COLs) or that made a general statement about the COL process. In addition, it provided no new information and did not pertain to 10 CFR Part 52.

- A comment about an environmental issue that
  - provided new information that would require evaluation during the review
  - provided no new information.
- A comment that was outside the scope of the COL, which included, but was not limited to
  - a comment on the safety of the existing units.

Preparation of the EIS has taken into account the relevant issues raised during the scoping process. The comments received on the draft EIS will be considered in the preparation of the final EIS. The final EIS, along with the staff's Safety Evaluation Report (SER), will provide much of the basis for the NRC's decision on whether to grant the STPNOC COLs.

The comments related to this environmental review are included in this appendix. They were extracted from the *South Texas Project Combined License Scoping Summary Report* (Accession No. ML082260454), and are provided for the convenience of those interested specifically in the scoping comments applicable to this environmental review. The comments that are outside the scope of the environmental review for the proposed STP site are not included in this Appendix. The out of scope comments include comments related to:

- Safety
- Emergency Preparedness
- NRC Oversight for operating plants
- Security and Terrorism
- Support or Opposition to the licensing action, licensing process, nuclear power, hearing process or the existing plant

More detail regarding the disposition of general or out of scope comments can be found in the Scoping Summary Report (ML082260454). To maintain consistency with the Scoping Summary Report, the comment source ID and comment number along with the name of the commenter used in that report is retained in this appendix. Any changes that have occurred since the publication of the Scoping Summary Report (e.g., revisions to the EIS outline) are indicated within <new information> angle brackets.

Table D-1 identifies in alphabetical order the individuals providing comments during the scoping period, their affiliation, if given, and the ADAMS accession number that can be used to locate the correspondence. Although all commenters are listed, the comments presented in this appendix are limited to those within the scope of the environmental review. Table D-2 lists the comment categories in alphabetical order and commenter names and comment numbers for each category. The balance of this appendix presents the comments themselves with NRC staff responses organized by topic category.

1 **Table D-1**. Individuals Providing Comments During Scoping Comment Period

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
Acevedo, NK	Self	Meeting Transcript (ML080950499)
Acevedo, NK	Self	Meeting Transcript (ML080950504)
Alvarado, Robert	Self	Meeting Transcript (ML080950499)
Alvarado, Robert	Self	Meeting Transcript (ML080950504)
Bludau, Owen	Matagorda County Economic Development Corporation	Meeting Transcript (ML080950499)
Bludau, Owen	Matagorda County Economic Development Corporation	Meeting Transcript (ML080950504)
Castro, Geoffrey	Citizens League for Environmental Action Now	Meeting Transcript (ML080950499)
Conrad, A.C.	Self	Meeting Transcript (ML080950499)
Corder, John	Self	Meeting Transcript (ML080950504)
Cushing, Lara	Self	Email (ML081140370)
Cushing, Lara	Self	Meeting Transcript (ML080950499)
Dancer, Susan	Matagorda County Coalition for Nuclear Industry Accountability	Meeting Transcript (ML080950499)
Dunham, D.C.	Bay City Community Development Corporation	Meeting Transcript (ML080950499)
Dunham, D.C.	Bay City Community Development Corporation	Meeting Transcript (ML080950504)
Dykes, Ed	Self	Meeting Transcript (ML080950504)
Edwards, Nancy	Self	Letter (ML08064019)
Garcia, Sandra	Self	Meeting Transcript (ML080950499)
Griffith, Mike	Self	Letter (ML080840434)
Gunter, Paul	Beyond Nuclear	Meeting Transcript (ML080950504)
Hadden, Karen	SEED Coalition	Letter (ML080840435)
Hadden, Karen	SEED Coalition	Meeting Transcript (ML080950499)
Hadden, Karen	SEED Coalition	Meeting Transcript (ML080950504)
Head, Bobby	Self	Meeting Transcript (ML080950504)
Hearn, Polly	Self	Letter (ML080840439)
Hefner, James	STP	Meeting Transcript (ML080950499)
Hefner, James	STP	Meeting Transcript (ML080950504)

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Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
Johnson, Matthew	Public Citizen-Texas Office	Email (ML081140369)
Kale, Stephen	Self	Letter (ML080840438)
Kale, Stephen	Self	Meeting Transcript (ML080950504)
Knapik, Richard	Bay City	Meeting Transcript (ML080950499)
Knapik, Richard	Bay City	Meeting Transcript (ML080950504)
Lindsey, Joy	Self	Letter (ML080460530)
Lopez, Diana	Self	Meeting Transcript (ML080950499)
Marceaux, Brent	Self	Meeting Transcript (ML080950504)
Martin, Bruce	Self	Meeting Transcript (ML080950504)
McBurnett, Mark	STPNOC	Meeting Transcript (ML080950499)
McBurnett, Mark	STPNOC	Meeting Transcript (ML080950504)
McCauley, Jimmy	Self	Meeting Transcript (ML080950504)
McCormick, Mr.	Self	Meeting Transcript (ML080950504)
McDonald, Nate	Matagorda County	Letter (ML080840425)
Mitchell, James	Matagora County	Meeting Transcript (ML080950499)
Mitchell, James	Matagora County	Meeting Transcript (ML080950504)
Morton, Joe	Palacios, TX	Meeting Transcript (ML080950499)
Morton, Joe	Palacios, TX	Meeting Transcript (ML080950504)
O'Day, Mike	Self	Meeting Transcript (ML080950499)
O'Day, Mike	Self	Meeting Transcript (ML080950504)
Opella, Ernest	Self	Meeting Transcript (ML080950504)
Payne, Cameron	Self	Email (ML081420662)
Payne, Cameron	Self	Meeting Transcript (ML080950499)
Public Citizen, Texas Office	Public Citizen, Texas Office	Letter (ML080640543)
Reed, Cyrus	Sierra Club, Lone Star Chapter	Email (ML081140366)
Reed, Cyrus	Sierra Club, Lone Star Chapter	Meeting Transcript (ML080950499)
Rendon, Genaro	Self	Meeting Transcript (ML080950499)

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
Rice Herreth, Georgia	Self	Meeting Transcript (ML080950499)
Russell, Nancy	Self	Letter (ML080640196)
Ryan, Timothy	Self	Email (ML081140368)
Scheurich, Venice	Self	Letter (ML080840437)
Schwank, Eleanor	Self	Meeting Transcript (ML080950499)
Shepherd, Joe	STP, Nuclear Operating Company	Meeting Transcript (ML080950499)
Shepherd, Joe	STP, Nuclear Operating Company	Meeting Transcript (ML080950504)
Singleton, Robert	Self	Meeting Transcript (ML080950499)
Singleton, Robert	Self	Meeting Transcript (ML080950504)
Sinkin, Lanny	Self	Email (ML081140364)
Sinkin, Lanny	Self	Email (ML081140367)
Smith, Tom	Public Citizen, Texas Office	Letter (ML080640543)
Smith, Tom	Public Citizen, Texas Office	Meeting Transcript (ML080950499)
Thames, Mitch	Bay City Chamber of Commerce	Meeting Transcript (ML080950499)
Thames, Mitch	Bay City Chamber of Commerce	Meeting Transcript (ML080950504)
Wagner, William	Self	Meeting Transcript (ML080950504)
Williams, Mina	Coastal Bend Sierra Club	Letter (ML080840436)

Table D-2. Comment Categories with Associated Commenters and Comment IDs

Comment Category	Commenter (Comment ID)
Accidents-Design Basis	• Public Citizen, Texas Office (0010-16) • Smith, Tom (0010-16)
Accidents-Severe	• McBurnett, Mark (0008-123) • Payne, Cameron (0005-3) (0005-4) (0005-5) • Reed, Cyrus (0003-45) • Singleton, Robert (0007-121) • Sinkin, Lanny (0002-17) • Williams, Mina (0015-7)
Alternatives-Energy	• Acevedo, NK (0007-89) • Castro, Geoffrey (0007-87) • Cushing, Lara (0007-90) (0007-100) (0018-1) (0018-3) (0018-4) (0018-5) (0018-6) • Dykes, Ed (0008-104) (0008-105) • Edwards, Nancy (0012-6) • Garcia, Sandra (0007-98) • Head, Bobby (0008-31) • Kale, Stephen (0008-29) (0008-30) (0014-4) • Lindsey, Joy (0009-7) • McBurnett, Mark (0007-139) • Reed, Cyrus (0003-2) (0003-5) (0003-11) (0003-15) (0003-16) (0003-18) (0003-19) (0007-44) (0007-58) • Russell, Nancy (0011-1) • Schwank, Eleanor (0007-132) • Shepherd, Joe (0008-127) • Singleton, Robert (0007-118) • Sinkin, Lanny (0002-29) (0002-30) (0002-31) (0002-33) (0002-34) (0002-36) (0004-1) • Smith, Tom (0007-28) • Williams, Mina (0015-8) (0015-9)
Alternatives-Sites	• Reed, Cyrus (0003-20)
Alternatives-System Design	• McBurnett, Mark (0008-122) • Wagner, William (0008-73) (0008-76)
Benefit-Cost Balance	• Cushing, Lara (0007-92) • Edwards, Nancy (0012-3) • Kale, Stephen (0008-28) (0014-3) • Lindsey, Joy (0009-2) • Lopez, Diana (0007-73) • Reed, Cyrus (0003-4) (0003-6) (0003-7) (0003-8) (0003-12) • Sinkin, Lanny (0002-25) • Wagner, William (0008-86) • Williams, Mina (0015-4) (0015-11)

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Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Cumulative Impacts	• Hadden, Karen (0007-32) (0008-54) • Reed, Cyrus (0003-21) (0003-22) • Rendon, Genaro (0007-62) (0007-63) • Wagner, William (0008-67)
Decommissioning	• Sinkin, Lanny (0002-26)
Ecology-Aquatic	• Acevedo, NK (0008-78) • Head, Bobby (0008-32) • Payne, Cameron (0005-6) • Reed, Cyrus (0003-30) (0003-31) (0003-34)
Ecology-Terrestrial	• Head, Bobby (0008-33) (0008-34) • Marceaux, Brent (0008-23) • O'Day, Mike (0008-2) • Public Citizen, Texas Office (0010-17) • Smith, Tom (0007-21) (0010-17)
Environmental Justice	• Smith, Tom (0007-25)
Geology	• Wagner, William (0008-69)
Health-Radiological	• Conrad, A.C. (0007-127) • Dancer, Susan (0007-99) • Hadden, Karen (0008-58) (0008-59) (0008-60) (0008-61) (0008-62) (0008-63) (0008-64) (0008-65) • Hefner, James (0007-115) (0007-116) (0008-90) (0008-91) • McBurnett, Mark (0008-117) • Payne, Cameron (0007-97) • Public Citizen, Texas Office (0010-3) (0010-18) • Reed, Cyrus (0003-46) • Scheurich, Venice (0017-4) • Sinkin, Lanny (0002-18) (0002-20) (0002-21) • Smith, Tom (0007-17) (0010-3) (0010-18) • Wagner, William (0008-80)
Hydrology-Groundwater	• Public Citizen, Texas Office (0010-8) • Scheurich, Venice (0017-2) • Smith, Tom (0007-23) (0010-8)
Hydrology-Surface Water	• Conrad, A.C. (0007-126) • Lopez, Diana (0007-68) • McBurnett, Mark (0007-141) • Public Citizen, Texas Office (0010-4) (0010-5) (0010-6) (0010-7) (0010-9) (0010-10) (0010-11) • Reed, Cyrus (0003-25) (0003-26) (0003-27) (0003-28) (0003-29) (0007-45) (0007-47) (0007-48) (0007-49) • Scheurich, Venice (0017-1) • Schwank, Eleanor (0007-133) (0007-134)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Sinkin, Lanny (0002-6) (0002-11) (0002-12) (0002-13) (0002-14) (0002-15) (0002-16) • Smith, Tom (0007-18) (0010-4) (0010-5) (0010-6) (0010-7) (0010-9) (0010-10) (0010-11) • Wagner, William (0008-77) (0008-79) • Williams, Mina (0015-6)
Land Use-Transmission Lines	• McBurnett, Mark (0008-121)
Meteorology and Air Quality	• Cushing, Lara (0007-93) • Lopez, Diana (0007-81) (0007-82) • O'Day, Mike (0008-6) • Reed, Cyrus (0003-32) (0003-41) • Shepherd, Joe (0007-145) (0008-126) • Singleton, Robert (0007-105) (0007-119) • Sinkin, Lanny (0002-3) (0002-4) (0002-5)
Need for Power	• Kale, Stephen (0008-25) (0008-27) (0014-2) • Lindsey, Joy (0009-3) • McBurnett, Mark (0007-138) • Morton, Joe (0008-19) • Public Citizen, Texas Office (0010-20) (0010-21) (0010-22) • Reed, Cyrus (0003-9) (0003-10) (0003-13) (0003-14) (0003-17) (0007-43) • Smith, Tom (0007-27) (0010-20) (0010-21) (0010-22) • Alvarado, Robert (0007-60) • Conrad, A.C. (0007-128) • Edwards, Nancy (0012-1) • Lindsey, Joy (0009-1) • Lopez, Diana (0007-78) • Ryan, Timothy (0001-1) • Scheurich, Venice (0017-5) • Schwank, Eleanor (0007-135) • Williams, Mina (0015-1) • Hadden, Karen (0008-51) • Reed, Cyrus (0003-3) • Castro, Geoffrey (0007-85) (0007-88) • Edwards, Nancy (0012-2) (0012-4) (0012-7) • Hadden, Karen (0007-30) • Reed, Cyrus (0007-59) • Rendon, Genaro (0007-66) • Singleton, Robert (0007-117) • Sinkin, Lanny (0002-28) • Williams, Mina (0015-3) (0015-10) • Singleton, Robert (0008-106) • Bludau, Owen (0007-76) (0008-101)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• McDonald, Nate (0016-2) • Mitchell, James (0008-12) • Morton, Joe (0008-21) • Public Citizen, Texas Office (0010-12) (0010-13) (0010-14) (0010-15) • Singleton, Robert (0007-122) • Sinkin, Lanny (0002-7) (0002-8) • Smith, Tom (0010-12) (0010-13) (0010-14) (0010-15) • Hadden, Karen (0007-35) • Johnson, Matthew (0006-1) • Kale, Stephen (0008-26) (0014-1) • Reed, Cyrus (0003-24) • Rendon, Genaro (0007-61) • Sinkin, Lanny (0002-32) • Wagner, William (0008-85) • Dancer, Susan (0007-108) • Morton, Joe (0007-15) (0008-22) • Sinkin, Lanny (0002-37) (0002-38) • Corder, John (0008-40) • Dancer, Susan (0007-101) • Hadden, Karen (0007-37) • Lindsey, Joy (0009-5) (0009-6) • Lopez, Diana (0007-80) • McBurnett, Mark (0007-137) (0008-118) (0008-119) (0008-120) • McCauley, Jimmy (0008-87) • McCormick, Mr. (0008-110) • Payne, Cameron (0005-1) (0005-2) (0007-110) (0007-111) (0007-112) (0007-114) • Reed, Cyrus (0003-33) (0003-39) (0003-40) (0007-46) (0007-50) • Rice Herreth, Georgia (0007-130) • Shepherd, Joe (0007-143) (0008-124) • Singleton, Robert (0008-107) (0008-108) • Sinkin, Lanny (0002-2) (0002-9) (0002-10) (0002-19) • Smith, Tom (0007-19) (0007-20) • Wagner, William (0008-66) (0008-68) (0008-70) • Acevedo, NK (0008-71) (0008-83) • Alvarado, Robert (0008-74) • Dancer, Susan (0007-104) • Gunter, Paul (0008-45) (0008-46) • Hadden, Karen (0007-33) • Head, Bobby (0008-36) • McBurnett, Mark (0008-115) (0008-116) • McCormick, Mr. (0008-109) • Mitchell, James (0007-6) (0008-8) (0008-9) (0008-10) (0008-11) • Morton, Joe (0007-13)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Reed, Cyrus (0003-44) (0007-53) (0007-56) • Singleton, Robert (0007-123) • Sinkin, Lanny (0002-23) (0002-35) • Wagner, William (0008-72) (0008-75) (0008-84) • Williams, Mina (0015-5)
Process-ESP-COL	• Acevedo, NK (0008-55) • Hadden, Karen (0007-34) (0007-36) (0007-38) (0007-39) (0007-40) (0008-53) (0008-56) (0008-57) • Reed, Cyrus (0003-1) (0007-42) • Shepherd, Joe (0007-142) • Sinkin, Lanny (0002-1) • Wagner, William (0008-81) (0008-82)
Process-NEPA	• Cushing, Lara (0018-2) • Hadden, Karen (0008-52) (0020-1)
Site Layout and Design	• McBurnett, Mark (0007-136) • Payne, Cameron (0007-113) • Shepherd, Joe (0007-146) (0007-147) (0008-128)
Socioeconomics	• Acevedo, NK (0007-150) • Bludau, Owen (0007-71) (0007-72) (0007-74) (0007-84) (0008-92) (0008-94) (0008-96) (0008-97) (0008-98) (0008-99) (0008-100) • Cushing, Lara (0007-96) • Dancer, Susan (0007-102) (0007-103) (0007-106) (0007-120) • Dunham, D.C. (0007-79) (0008-47) • Head, Bobby (0008-38) (0008-39) • Hearn, Polly (0013-2) • Knapik, Richard (0007-9) (0008-14) • McBurnett, Mark (0008-113) • Morton, Joe (0008-18) • O'Day, Mike (0008-4) • Public Citizen, Texas Office (0010-1) (0010-2) • Rice Herreth, Georgia (0007-129) • Shepherd, Joe (0007-144) (0007-148) (0007-149) (0008-125) (0008-129) • Smith, Tom (0007-16) (0007-29) (0010-1) (0010-2) • Bludau, Owen (0007-69) (0007-77) (0008-93) (0008-102) • Dunham, D.C. (0007-64) (0008-48) • Griffith, Mike (0019-2) • Head, Bobby (0008-35) • Hearn, Polly (0013-3) (0013-4) (0013-5) • Knapik, Richard (0007-8) (0007-11) (0008-15) • Marceaux, Brent (0008-24) • Martin, Bruce (0008-41) • McCormick, Mr. (0008-112) • Mitchell, James (0007-7) (0008-13)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Morton, Joe (0007-14) • Opella, Ernest (0008-88) • Rice Herreth, Georgia (0007-131) • Thames, Mitch (0007-41) (0008-49) • Morton, Joe (0008-17) • Bludau, Owen (0008-95) • O'Day, Mike (0007-2) (0007-3) (0007-4) (0008-1) (0008-3) (0008-5) (0008-7) • Bludau, Owen (0007-70) (0007-75) • Griffith, Mike (0019-1) (0019-3) • Head, Bobby (0008-37) • Hearn, Polly (0013-1) • Knapik, Richard (0007-10) (0008-16) • Martin, Bruce (0008-42) • McDonald, Nate (0016-1) (0016-3) • Morton, Joe (0007-12) (0008-20) • O'Day, Mike (0007-1) (0007-5) • Opella, Ernest (0008-89)
Transportation	• Cushing, Lara (0007-94) • Rendon, Genaro (0007-65) • Smith, Tom (0007-24)
Uranium Fuel Cycle	• Acevedo, NK (0007-95) (0008-44) • Castro, Geoffrey (0007-86) • Cushing, Lara (0007-107) (0007-109) • Dancer, Susan (0007-91) • Dykes, Ed (0008-103) • Edwards, Nancy (0012-5) • Gunter, Paul (0008-43) • Hadden, Karen (0007-31) • Lindsey, Joy (0009-4) • Lopez, Diana (0007-83) • McBurnett, Mark (0007-140) (0008-114) • McCormick, Mr. (0008-111) • Public Citizen, Texas Office (0010-19) (0010-23) • Reed, Cyrus (0003-23) (0003-35) (0003-36) (0003-37) (0003-38) (0003-42) (0003-43) (0007-51) (0007-52) (0007-54) (0007-55) (0007-57) • Rendon, Genaro (0007-67) • Scheurich, Venice (0017-3) • Singleton, Robert (0007-124) (0007-125) • Sinkin, Lanny (0002-22) (0002-24) (0002-27) (0004-2) • Smith, Tom (0007-22) (0007-26) (0010-19) (0010-23) • Williams, Mina (0015-2)

D.2 In-Scope Comments and Responses

The in-scope comment categories are listed in Table D-3 in the order that they are presented in this appendix. In-scope comments and responses are included below the table. Parenthetical numbers shown after each comment refer to the Comment Identification (ID) number (correspondence number-comment number) and the commenter name. Responses have been edited since publication of the Scoping Summary Report to update section references.

Table D-3. Comment Categories in Order as Presented in this Report

Category Number	Category Name
D.2.1	COL Process
D.2.2	Process - NEPA
D.2.3	Site Layout and Design
D.2.4	Land Use - Transmission Lines
D.2.5	Meteorology and Air Quality
D.2.6	Geology
D.2.7	Hydrology - Surface Water
D.2.8	Hydrology - Groundwater
D.2.9	Ecology - Terrestrial
D.2.10	Ecology - Aquatic
D.2.11	Socioeconomics
D.2.12	Environmental Justice
D.2.13	Health - Radiological
D.2.14	Accidents - Design Basis
D.2.15	Accidents - Severe
D.2.16	Uranium Fuel Cycle
D.2.17	Transportation
D.2.18	Decommissioning
D.2.19	Cumulative Impacts
D.2.20	Need for Power
D.2.21	Alternatives - Energy
D.2.22	Alternatives - System Design
D.2.23	Alternatives - Sites
D.2.24	Benefit-Cost Balance

D.2.1 COL Process

Comment: The entire process involved from start to finish of a nuclear project needs to be examined for direct, indirect, secondary, and cumulative impacts, e.g.: Site preparation The extraction of materials to build the plant The transportation of the materials to the plant site The construction process The extraction of materials to produce the equipment to be installed The transportation of that equipment to the site The installation of that equipment The extraction of uranium The milling and enriching of uranium The transportation of enriched uranium to the site The operation of the plant Potential impacts on endangered species (**0002-1** [Sinkin, Lanny])

Response: *With respect to environmental impact analysis, the NRC's COL process is as follows: The NRC regulations governing a COL application require that an applicant for a COL must provide the NRC with an environmental report that meets the requirements of 10 CFR 51.45 and 51.50. As described in 10 CFR 52.17, the contents of an application must focus on the environmental effects of construction and operation of a reactor or reactors that might be built at the proposed site. Additionally, Section 52.18 requires that the NRC prepare an EIS for the application that focuses on the same issues. In its EIS, the NRC staff will review the impacts of the proposed construction and operation of new nuclear units based on the information provided in the application and on information obtained from independent sources. The NRC will document the bases for its conclusions in the EIS and in the COL permit, if approved. The majority of the impacts noted in the comment are evaluated as part of this COL environmental review process. Other issues noted fall outside of the regulatory purveyance of the environmental review.*

Comment: We believe that the decision by the NRC to reverse its decision to accept the application indicates there are serious problems with the process designed by the NRC, and would suggest that until an EIS is completed, the clock on filing for petition to intervene should not begin so that the applicant, NRC and potential petitioners can have the benefit of seeing what an EIS process finds out. (**0003-1** [Reed, Cyrus])

Comment: Since 1992 there has been a consistent effort to constrain citizen input, not to expand it. Right now we've seen -- and this is all too familiar in Texas -- what we're seeing is fast tracking of these permits, and it's unacceptable. We've gone from what should be four and a half years down to three. We've gone from shortened input -- and to be honest, this is -- if this permit moves forward, it is actually illegal. (**0007-36** [Hadden, Karen])

Comment: We have a licensing process moving forward with an EIS not even begun. These are both violations of the statutes and regulations that apply to this process, and I would urge you to halt all further proceedings on the license application until the environmental impact statement is finalized as is required by federal law. (**0007-40** [Hadden, Karen])

Response: *These comments express general opposition to the NRC licensing process for the STP Units 3 and 4 COL, and provide no specific information to the NRC's associated environmental review. These comments also fall outside the scope of 10 CFR 51 and 52 which describe in broad outline the NRC's environmental review process for a COL. Therefore, these* *comments will not be considered further in regards to the NRC EIS for the STP Units 3 and 4 COL.*

Comment: I would also ask that you hold scoping meetings in Houston, which is down wind, as is Dallas/Ft. Worth, from any potential accident, in Austin and San Antonio, where the cities could potentially be partners, and to let more people speak up and be part of this process. (**0007-34** [Hadden, Karen])

Response: *Public meetings are generally held in the community geographically located closest to the proposed project location. Interested parties that are unable to attend the public meetings in person are also afforded the opportunity to submit written comments. This comment expresses opposition to NRC's scoping process, but provides no specific information on the NRC's environmental review of the STP Units 3 and 4 COL application. Therefore, this comment will not be considered further in regards to the NRC DEIS for the STP Units 3 and 4 COL.*

Comment: In the case of a nuclear power plant, the NEPA process is interrelated with the licensing, public participation is through filing petitions to intervene. A key document that could provide information upon which interveners could build contentions, is the final environmental impact statement. Yet the 60 day clock has started on intervention petitions as soon as the NRC accepted the application for docketing, so we now have a deadline of February 25, with no date even set for a draft environmental impact statement. The EIS will not even begin before the final deadline for interveners to file. (**0007-38** [Hadden, Karen])

Comment: And the first concern I would raise is one that's already been mentioned, which is the time factor, that there is a feeling among anyone who analyzes the application and analyzes the environmental report that 60 days simply is not enough time to have a logical and reasonable assessment, particularly when there's new information coming in. I do take note of the issue you raised earlier, which is one can raise contentions later on if new information comes in. (**0007-42** [Reed, Cyrus])

Comment: I spoke to Mr. Barrs earlier and, again, was informed that the safety review is not complete. And even so we as citizens are being asked to have contentions ready in just 20 days. Something tells me that that safety review will not be done during that time. How can we read it, analyze it, get experts, and prepare a case? That is not right. It is not valid. This -- and other reports -- the safety review and the final environmental impact statement should be finished before the licensee procedure goes forward and before citizens have to raise their contentions. (**0008-53** [Hadden, Karen])

Response: *It is the Commission's policy that petitions to intervene in the hearing process be based on the application itself, not the staff's review of the application. These comments express opposition to the NRC's timeline for filing intervention petitions, and provide no specific information to the NRC's environmental review of the STP Units 3 and 4 COL application. Therefore, these comments will not be considered further in regards to the NRC DEIS for the STP Units 3 and 4 COL.*

Comment: The NEPA law prohibits irreversible or irretrievable commitments of resources prior to the completion of the EIS. That involves the work that the NRC does on the permit. So basically what's going on is that we have docketing of a license application for two nuclear reactors that is grossly incomplete, forcing potential interveners to decide on whether to pursue intervention, and to decide on what issue or issues to pursue without a complete application available. (**0007-39** [Hadden, Karen])

Response: *Section 102(2)(C)(v) of NEPA requires that an EIS include information on any irreversible and irretrievable commitments of resources that would occur if the proposed action (approval of the COL) is implemented. Irreversible and irretrievable resource commitments are relevant to the use of nonrenewable resources and the effects that the loss of use of these resources may have on future generations. These issues will be discussed in Chapter 10 of the DEIS. The remainder of this comment expresses opposition to the NRC's timeline for filing intervention petitions for the STP Units 3 and 4 COL, and provides no specific information regarding the associated environmental review.*

Comment: We really are not looking for secrets. Our letter of intent in June was published on the NRC website, was available in the public document room. There were no secrets about our announcement of the new units. (**0007-142** [Shepherd, Joe])

Response: *This comment makes a statement of fact about the Notice of Intent for the STP Units 3 and 4 COL application, but provides no specific information on NRC's associated environmental review. Therefore, this comment will not be considered further in regards to the NRC EIS for the STP Units 3 and 4 COL.*

Comment: There's something called the Design Criteria Document, and that's called the DCD. I started looking at this license application online and I found a whole section that said incorporated by reference in the DCD. It took a long time to find out what was a DCD. And then when I tried to call and get answers I couldn't get them. Tonight I was informed by Mr. Kallan that that document is available. Unfortunately it is available only in Washington, D.C. in the reading room of the Nuclear Regulatory Commission. That is a document that we need. That is the design criteria for the two advanced boiling water reactors that NRG wants to build here. That is a document that we need in our hands to effectively be able to write contentions to submit them in a timely manner. (**0008-55** [Acevedo, NK])

Comment: Today is February 5. Our contentions have to be submitted in 20 days. I would like to officially ask when will the DCD be available. The licensing procedure should be halted immediately until that is available. (**0008-56** [Hadden, Karen])

Response: *These comments express opposition to the limited availability of the Design Criteria Document during the period for filing intervention petitions. These comments provide no specific information to the NRC's environmental review of the STP Units 3 and 4 COL application, therefore, these comments will not be considered further in regards to the NRC EIS for the STP Units 3 and 4 COL.*

Comment: In section 5.4.1 of the environmental report there is a section of radiological impact and exposure pathways. Here is says -- and I will quote -- Radioactive liquids and gasses would be discharged to the environment during normal operation of STP 3 and 4. The released quantities have been estimated in Tables 12.2-20 for the gasses and Table 12.2-22 for liquids of the ABWR DCD. So the documents containing the quantities of radioactive material that would be released during normal operations are not yet available to the public. (**0008-57** [Hadden, Karen])

Response: *This comment expresses opposition to the limited availability during the scoping period of documents containing the quantities of radioactive material that would be released during normal operations. This comment provides no specific information relevant to the environmental review of the STP Units 3 and 4 COL application and therefore will not be considered further in the EIS.*

Comment: In the old days we used to have a PSAR, a preliminary safety analysis report. Now we don't have that. Now we have an FSAR. How on earth can anybody call that thing final. It's totally incomplete at this time. We don't have to fib to each other. It's not done. It's not even close. Okay. We need to extend the comment period because the information is not there. (**0008-81** [Wagner, William])

Comment: The other part of this that's a real hard spot with me because I am an old reactor operator is it is totally inappropriate to license operation on a woefully incomplete safety analysis report. I don't know how the devil you guys ever came to that conclusion, but that needs to be looked at seriously. (**0008-82** [Wagner, William])

Response: *This comment expresses opposition to the length of the NRC's scoping comment period due to a perceived lack of safety information. The safety review is outside the scope of the environmental review process and therefore this comment will not be considered further in the EIS for STP Units 3 and 4.*

D.2.2 Process - NEPA

Comment: justifies moving forward - NEPA requirements [The commenter was questioning if there should have been a NEPA review prior to accepting the application to justify moving forward with the process.] (**0020-1** [Hadden, Karen])

Response: *A NEPA environmental review could not have been conducted prior to accepting the application because the NRC would have had no project-specific information on which to base its review. Docketing an application for review is not a major federal action and therefore does not require a NEPA review. The comment provides no new information relevant to the environmental review process and will not be evaluated further.*

Comment: I'd also like to request additional scoping meetings regarding the environmental report. There are many people I know of in Austin who could not make this trip who would like to comment in person. There are people in San Antonio and Houston as well. I would urge you to set up scoping meetings in those communities for this environmental report. (**0008-52** [Hadden, Karen])

Comment: We also deserve and request that the NRC conduct public hearings in San Antonio on those [energy] alternatives and the environmental impacts of STP 3 & 4 as part of the scoping process. (**0018-2** [Cushing, Lara])

Response: *Although NEPA does require Federal agencies to initiate a scoping process, the decision of how to implement scoping is left to the agencies' discretion. It is the policy of the NRC to involve the public in the Commission's decision-making process and therefore it elects to conduct open public scoping meetings in association with their environmental review process. Meetings are generally held in a location to reach the highest population that will experience the most direct environmental impact as a result of the proposed action. In the case of STP Units 3 and 4, this population is located in the area of Bay City, Texas. The NRC will hold additional public meetings after the DEIS is published. Separate meetings will be held by the NRC in association with the safety review process. Members of the public who are unable to attend the public meetings in person may submit written comments during the open comment periods.*

D.2.3 Site Layout and Design

Comment: So how come we learned today that the design of record is by Toshiba? I think there's a big mess going on here that we don't know about. (**0007-113** [Payne, Cameron])

Response: *The applicant experienced unresolvable issues with the vendor originally identified in the application. The type and design of the reactor did not change as a result of the change in vendors, therefore, the reactor-specific information provided in the application is still valid for the analysis.*

Comment: The advance boiling water reactor in Japan, there's four of them in operation in Japan, was developed as a joint venture between General Electric, Hitachi and Toshiba. They all jointly own that design in Japan. GE took that design and got it certified in the United States. Where did that design come from, you asked about the safety, what is this, what is the safety record. We've been operating boiling water reactors in the United States since 1960. The boil water reactors, through each generation, have evolved into -- further and further involved into a more advanced design. When GE and Hitachi and Toshiba went to develop the advanced boiling water reactors, they started with the BWR-6, the latest design that's currently in operation in the United States. They took that design and they looked at the rules under Part 52, what they needed to address, and they looked at the things that were bothering them about the BWR-6 that didn't work as well as they wanted it to, things they could make it safer, things that make it more reliable, they addressed those issues and developed the advanced boiling water reactor. It's very similar in operation and design to the BWR-6. We have many, many, many years of experience operating those plants. (**0007-136** [McBurnett, Mark])

Comment: [The ABWR's] lineage is over 60 years of operation in the United States and around the world. And the plans that we're looking at are an evolutionary design that's based upon the best that was in the United States. The design's certified by the NRC, and meets all U.S. standards. (**0007-146** [Shepherd, Joe])

Comment: Besides the good operating record that we saw with the advanced boiling water reactors in Japan, we choose them also because of their record associated with on-time construction, on-budget cost, and on schedule. And that performance, we believe we can replicate in the United States. (**0007-147** [Shepherd, Joe])

Comment: This technology [ABWR] has a long lineage in the United States. The design that has been built in Japan was predicated by 60 years of operations of boiling water reactors in the United States as a evolutionary design from our very best in the United States, the BWR6. And it's better. It's a G.E. design. It's been certified by the Nuclear Regulatory Commission. And it meets all U.S. standards. We [STP] chose the ABWR because of the operating record that it has, but we also chose it because of the record that it has for being constructed on time and on budget. (**0008-128** [Shepherd, Joe])

Response: *These comments are general in nature regarding the advanced boiling water reactor (ABWR) design chosen for Units 3 and 4. No new information relevant to the environmental analysis was provided and therefore the comments will not be evaluated further.*

D.2.4 Land Use - Transmission Lines

Comment: Actually South Texas has three different power line corridors leaving the site. The advanced boiling water reactors will also have cross-ties into the Unit 1 and 2 switch yard. (**0008-121** [McBurnett, Mark])

Response: *The power transmission system will be described in Chapter 3 of the DEIS. The applicant proposes to upgrade two of the six existing transmission lines and does not intend to construct any new transmission lines or corridors. Environmental impacts associated with the planned upgrades to the existing transmission lines will be addressed under construction impacts in Chapter 4 of the DEIS.*

D.2.5 Meteorology and Air Quality

Comment: One of the new issues affecting decisions on nuclear power is the global concern over Human activity creating global climate change with unpredictable and potentially devastating results. While the nuclear industry successfully used this concern to drive their lobbying effort for a new generation of nuclear power plants, the premise that nuclear power is a positive response to global climate change concerns may not withstand objective examination. The EIS should include such an objective examination. (**0002-3** [Sinkin, Lanny])

Comment: The context for evaluating emissions of gasses attributable to a nuclear power plant should include those gasses emitted during the following: Site preparation The extraction of materials to build the plant The transportation of the materials to the plant site The construction process The extraction of materials to produce the equipment to be installed The transportation of that equipment to the site The installation of that equipment The extraction of uranium The milling and enriching of uranium The transportation of enriched uranium to the site The operation of the plant, including the emission of heat and evaporated water. (Water vapor is a powerful green house gas. The EIS should provide a conversion of the amount of water vapor created by the nuclear plant operating process to the equivalent carbon dioxide emissions.) The decommissioning of the plant. The transportation of radioactive waste, including high level, low level, and decommissioning waste to final storage. The preparation and operation of sites where the radioactive waste is to be stored. (**0002-4** [Sinkin, Lanny])

Comment: Water vapor is a powerful green house gas. The EIS should provide a conversion of the amount of water vapor created by the nuclear plant operating process to the equivalent carbon dioxide emissions. (**0002-5** [Sinkin, Lanny])

Comment: Climate change can also be associated with increased air and water temperature which could impact the ability of the cooling system and intake to operate sufficiently. Thus, temperature change must be assessed more accurately. (**0003-32** [Reed, Cyrus])

Comment: While the ER takes credit for the emissions reduction that would be made by investing in a nuclear plant as opposed to a coal or natural gas plant (see discussion above), it does not discuss the global warming emissions resulting from the mining, processing, enrichment and fuel fabrication of uranium needed for the plant. (**0003-41** [Reed, Cyrus])

Comment: We feel there are cleaner, safer and quicker ways of achieving global warming goals. For example, nuclear power plants take a long time to build, and they're not going to really do anything in terms of the carbon footprint. (**0007-105** [Singleton, Robert])

Comment: When you look at the carbon footprint for a nuclear power plant, you also have to consider the fact that mining and manufacturing -- mining of uranium and enrichment of uranium add carbon to the air, and the lower grade that uranium is, the harder it is to mine, the further you have to go to get it, all of those things add to the footprint. Also, transportation and storing of nuclear waste have to be added to that. This is not a zero carbon footprint industry. It's only a zero carbon footprint industry is you look just at plant operation. And I'm not even sure that's true. But if you look beyond plant operation to how they get the uranium, and what they do with the waste, it's to a zero carbon footprint industry. (**0007-119** [Singleton, Robert])

Comment: We are not against renewables, solar, wind, conservation, efficiency. We teach our people to look carefully at decisions, ... I think that the studies that you look at on global warming, on greenhouse gases all tell you that you need all of that, including nuclear power, to be able to make any kind impact on reducing the emission of greenhouse gases and reversing the trends that we see in our global climate. (**0007-145** [Shepherd, Joe])

Comment: Also -- it is also a myth that nuclear energy will save us from global warming. We hear that a lot and it is not. It is not the truth, it is a myth. A nuclear power plant also creates global warming. (**0007-81** [Lopez, Diana])

Comment: So you have uranium in South Texas, so you need to get it enriched, and there are only two coal power plants that do that, and they're not in Texas. So you have to transport the uranium to these coal power plants and you have to enrich it, and it causes -- it's one of the primary sources of a potent greenhouse gas that causes global warming. So -- and then you have to transport it back to the nuclear reactor, so that causes CO2 emissions, so you have all these accumulating effects just for that source of energy. (**0007-82** [Lopez, Diana])

Comment: The enrichment takes place at coal-fired facilities that pollute the air and contribute to global warming. This is an environmental impact of the South Texas Project. (**0007-93** [Cushing, Lara])

Comment: We seem to be given what we at the plant call a sucker's choice. Either you have renewables and efficiency or you have nuclear power. The studies that I have read that are done by eminent researchers say that in order to make any kind of significant contribution to the reduction of greenhouse gasses being released into the environment, you need it all. You need efficiency; you need renewables; and you need nuclear power if you want to make any kind of a significant contribution to reducing greenhouse gasses being released into the environment. (**0008-126** [Shepherd, Joe])

Comment: The two nuclear plants that are being proposed here would offset 15.8 million tons of carbon dioxide, 38.8 thousand tons of sulfur dioxide, and 10.7 thousand tons of nitrogen oxide. (**0008-6** [O'Day, Mike])

Response: *<The review team characterized the affected environment and the potential greenhouse gas impacts of the proposed actions and alternatives in this EIS. The impacts of fuel cycle, transportation, and decommissioning on climate change and global warming are addressed in Chapter 6. Appendix I provides details of the carbon dioxide footprint estimate for a 1000 MW(e) light water reactor. In addition, where it was important to do so, the review team considered the potential effects of global climate change during the period of the proposed action on other resource assessments.>*

D.2.6 Geology

Comment: We may have a problem with soil subsidence. Not too far away from the existing site, on the other side of Highway 60, there is an old Texas Gulf sulphur site at Gulf. Sulphur was mined out of there for many, many years. The site was finally abandoned. The company moved north out of the county in the area between Highway 60 and Bowling. About five years after I moved down here in 1983, that highway fell down into the ground -- a sinkhole. That was caused by that sulphur mining that was going on at a place called Newgulf. Is this a possibility for the old Gulf site? Would this offer some compromise to the ultimate heat sink or cooling pond? (**0008-69** [Wagner, William])

Response: *Geologic impacts on the proposed facility from off-site actions are in scope of the safety analysis and will be addressed in the FSAR issued and maintained by the applicant and SER issued by the NRC. The topic of subsidence and sink holes and their potential impact on* *the proposed facility will be addressed in Section 2.5 of the FSAR. This comment is out of scope with regard to the EIS.*

D.2.7 Hydrology - Surface Water

Comment: Exelon Nuclear decided to move its proposed nuclear plant from Matagorda County to Victoria County based on concerns about the costs of preparing for a 20 to 30 foot storm surge. How would those same concerns apply to the STNP Units 3 and 4? (**0002-11** [Sinkin, Lanny])

Comment: If global warming increases sea level rise by 7 meters - will STNP be within the storm surge zone? (**0010-11** [Public Citizen, Texas Office] [Smith, Tom])

Response: *As part of the NRC's site safety review, the staff will consider whether the site is suitable based on storm surge issues. The results of this review will be found in the site Safety Evaluation Report. This issue is not within the scope of the environmental review.*

Comment: There are also numerous studies underway regarding the needs of the bays and estuaries near STNP. Review of those studies regarding potential fresh water needs of the environment and potential effects on the availability of water to STNP should also be part of the EIS process. (**0002-16** [Sinkin, Lanny])

Comment: [T]he LCRA [Lower Colorado River Authority] still has an ongoing assessment of the flow needs of Matagorda Bay. The Inflow Needs Study has yet to be finalized and integrated into any management decisions of the LCRA and has yet to be incorporated into any water rights requirements. An EIS must assess the inflow needs of the Matagorda Bay and its potential impact on the South Texas Project. We would specifically suggest that an EIS examine the comments submitted by TPWD on the Matagorda Bay Inflow Criteria Report on January 22nd, 2008. (**0003-26** [Reed, Cyrus])

Comment: [A]ny EIS must address the proposed water rights permit being sought by LCRA for the so-called "excess" flows. This proposed water right is presently being contested by the Sierra Club in part because of our concern that existing and proposed water use - such as the South Texas Project - as well as the proposed permit would impact the flows into Matagorda Bay. The permit being sought by LCRA is intimately connected to the so-called LCRA -SAWS water project to provide the City of San Antonio with surface water through construction of an off-river reservoir not far from the proposed South Texas project. How construction of such a reservoir might impact water quality, water availability, water temperature and other parameters that could impact the South Texas plant must be considered. (**0003-27** [Reed, Cyrus])

Comment: [M]y wife has a place in Egypt, Texas, and that's probably why I'm here today. She couldn't come today. I'll talk a little bit on her behalf. She's a direct competitor for the water that's already allocated to the makeup water I guess for that cooling lake. And so she's concerned on a -- just a on a practical matter. She's a rice farmer, cattle rancher and a low crop farmer in Egypt, Texas. (**0007-126** [Conrad, A.C.])

Comment: My issue here today is water. If we're going to be taking water from the Colorado River, and giving 3,935 gallons per minute to cool a new nuclear reactor, we're also going to be compromising our need for water to San Antonio where humans need water to drink, because San Antonio, with the SAWS project, which is San Antonio Water System, the LCRA is going to be draining water off the Colorado River to provide for San Antonio. (**0007-133** [Schwank, Eleanor])

Comment: We have our rice farmers who absolutely need our water. We have out cattlemen who absolutely need our water. And let's not forget our aquaculture, or bays and our estuaries. Everybody's coming to Matagorda because they all love our fishing, but we're not going to have fish, we're not going to have oysters, we're not going to have shrimp, we're not going to have anything if we're not protecting our water. (**0007-134** [Schwank, Eleanor])

Comment: There are a number of river studies going on right now, not the least of which by the Lower Colorado River Authority, who is in charge of this particular chunk of water. (**0008-79** [Wagner, William])

Comment: This new plant will use 4,000 gallons of water per minute. The plant is also authorized to use both river and groundwater water. The plant is authorized to use up to 102 acre feet of river water per year, and use about half of that annually for STNP 1 & 2. If the plant uses its full allotment (of water), will there be adequate water for the new reservoir? (**0010-4** [Public Citizen, Texas Office] [Smith, Tom])

Comment: The LCRA-SAWS Water Project (LSWP) is based on a Definitive Agreement between SAWS and LCRA, signed in 2002, for the purchase of up to 150,000 acre ft/yr of surface water from the Lower Colorado River Basin at Bay City. If the plant takes its full 102 acre feet, will there be enough water for San Antonio to meet its water needs? (**0010-5** [Public Citizen, Texas Office] [Smith, Tom])

Comment: If it [the new plant] takes its full allotment of 3,935 gallons per minute will there be adequate water for rice farmers and others? (**0010-6** [Public Citizen, Texas Office] [Smith, Tom])

Response: *The impact on current and future water use in the vicinity of the site from the additional water withdrawals from the Colorado River needed to operate STP Units 3 and 4 will be evaluated and presented in Chapter 5 of the EIS.*

Comment: A similar situation would be the temperature of that water. We've had issues -- and I say we -- I mean the United States has had issues recently on nuclear plant where because the temperatures have gone up, the water temperature has gone up, which has made it difficult for those operators to be able to use the water and then discharge the water back in the rivers. And I'm speaking about some -- a nuclear plant in Tennessee. And some of the nuclear plants in Europe had a similar situation last summer. (**0007-48** [Reed, Cyrus])

Response: *The comment refers to rising temperatures in the Main Cooling Reservoir and how this condition may relate to continued operation of the STP units and to blowdown from the reservoir to the Colorado River. The NRC staff's evaluation of the thermal properties of the* *blowdown discharge from the reservoir to the Colorado River when all four units are in operation will be presented in Chapter 5 of the EIS.*

Comment: My understanding was when you reach certain amounts of -- when the water quality is of a certain type, in other words, if there's a lot of sediment in the water, you do have to discharge some back into the river. (**0007-49** [Reed, Cyrus])

Response: *The comment refers to the blowdown from the Main Cooling Reservoir to the Colorado River at the STP site. The NRC staff's evaluation of the frequency of blowdown and its impact on the Colorado River when all four STP units are in operation will be presented in Chapter 5 of the EIS.*

Comment: Our cooling reservoir's a closed cycle system. We do take make-up water out of the river to keep that reservoir filled. We take make-up water out of the river most of the times during high-flow conditions when it's, you know, a lot of water flowing through it, to keep it filled. The water actually cools in the reservoir, it goes around its little loop and cools to the air, it doesn't -- the hot water does not go back to the river. So it's closed cycle. We use it for make-up, and just to clarify the operating points, because I think that was confused earlier. (**0007-141** [McBurnett, Mark])

Response: *This comment provides some information regarding the closed-loop cooling system in use for STP Units 1 and 2. No response is needed.*

Comment: Nuclear Power Plants use vast amounts of water. The Union of Concerned Scientists, in a document entitled "Got Water? Nuclear power plant cooling water needs," details in a 14-page illustrated summary problems power plants have when the "insatiable cooling water needs were not met." The threat of drought is real in Texas, as is the potential shortage of water. (**0015-6** [Williams, Mina])

Response: *The NRC staff's assessment of water use requirements for the operation of STP Units 3 and 4 including those during drought conditions will be presented in Chapter 5 of the EIS.*

Comment: ...of the 12,200 acres containing the current South Texas Nuclear Project, 7,000 of these acres (over 57%) comprise the reservoir needed for the cooling water. ... how much of this water is lost to evaporation and how much more water might need to be diverted into the reservoir if STP expansion is approved. (**0017-1** [Scheurich, Venice])

Response: *The water withdrawal and consumptive use requirements for the operation of STP Units 3 and 4 will be provided in* <Chapter 2> *of the EIS.*

Comment: As sea levels rise, groundwater can be affected, both in terms of expansion into the surrounding soils and in water quality, e.g. salt water intrusion. The effects of such changes should be included in the EIS. (**0002-12** [Sinkin, Lanny])

Comment: The combination of reduced precipitation, higher rates of evaporation and evapotransporation, and increased number of droughts suggest that relying on the worst historical drought may not be a conservative approach. (**0002-13** [Sinkin, Lanny])

Comment: A conservative approach to evaluating the adequacy of the water supply available to STNP would incorporate the possibility that global warming would produce a drought worse than the worst historical drought at a time when available water is already reduced by reduced precipitation and increased evaporation and evaportransporation. That evaluation would consider: -- the time frame within which the global warming impacts would be expected and the projected operating life of the reactors, including renewal of licensing and -- the likelihood of a drought worse than the worst historical drought and the potential impact of such a drought on the operations of the reactors. (**0002-14** [Sinkin, Lanny])

Comment: At the same time, there are credible studies that posit greenhouse warming as a precursor to rapid cooling. Schwartz and Randall, An Abrupt Climate Change Scenario and Its Implications for United States National Security, October 2003. Any evaluation of potential global warming impacts should examine the potential impacts of this alternative scenario for climate change, including the impacts on available water. (**0002-15** [Sinkin, Lanny])

Comment: A true EIS must examine the relationship between the water needs of the proposed plants, its water use, water availability as well as how climate might impact those uses. (**0003-25** [Reed, Cyrus])

Comment: The impacts of global warming on the proposed plant must be assessed. Thus, when the first STP site was assessed, normal historic drought and water availability were a concern, and today, the flow of the Colorado upstream of STP is a real concern during summer months, when flows are often lower and evaporation is higher. Nonetheless, the recent IPCC Assessments on the impacts of global warming, as well as independent assessments in Texas - such as the 1995 Gerald North study - suggest that global warming is likely to affect climate and water availability, including in Central Texas. (**0003-28** [Reed, Cyrus])

Comment: It would seem any EIS must assess the impacts of global warming and the likelihood that droughts in coming decades could be more severe than droughts in the 1940 and 1950s which are traditionally used as the "drought of record" to determine likely flows. Contingencies must be added for flows that are 20 percent or more less than historic drought levels. The EIS should rely in part on studies being conducted by the LCRA on the issue of the impact of climate change on flows as part of the assessment. (**0003-29** [Reed, Cyrus])

Comment: What about water use? With the droughts we've been having and with the increasing belief that global warming is a significant issue in this part of the country, will there be significant decreases in the amount of available water, and what will that mean to the operations of this plant? (**0007-18** [Smith, Tom])

Comment: One of the issues that's come up in terms of what scientists are telling us is that climate is changing. Yes, it always has changed, but it's changing more rapidly than in the past.

And so, again, I would urge you, in the environmental analysis to look at how climate change might impact river flow, because I know that STP has an existing water right, and it appears on paper that you've got the water to operate your -- you know, the present plants and the plants in the future. (**0007-45** [Reed, Cyrus])

Comment: Is it really a good investment if in 30 years our flows are going to be that much less, will the water really be available and be there? Because if the plant is built and then doesn't operate, it doesn't make economic sense for anybody. (**0007-47** [Reed, Cyrus])

Comment: So I'm here to tell about global warming and how it affects it. With the growth of global warming you have to include how will this contribute the nuclear power plants, and how it will affect them. So the plant requires water to cool it down, and it requires cold water. So with global warming, there's going to be less water and it's going to be warmer, so you have to consider what the nuclear reactors will be in situations like that. (**0007-68** [Lopez, Diana])

Comment: Are there going to be temperature limits? We're living in a world where climatological change is causing warming -- global warming. We know the sea level is rising. It's already bothering the Chinese. It's not bothering us yet, but it will. Now, what's causing it isn't a concern here. The mere fact that it's happening -- and it needs to be analyzed. We're talking about a grand total of about 60 years. We need to look at that. (**0008-77** [Wagner, William])

Comment: If global warming is occurring and as severe as we anticipate: If the plant adds approximately 14.3°F to the water temperature, and the current intake temperature has been as high as 95.6°F, can the plant operate safely with a predicted 3-10°temperature increase due to global warming by 2100? (**0010-10** [Public Citizen, Texas Office] [Smith, Tom])

Comment: If global warming is occurring and as severe as we anticipate: Will there be enough water for cooling decline if a 25% decrease in river flows occurs? (**0010-7** [Public Citizen, Texas Office] [Smith, Tom])

Comment: If global warming is occurring and as severe as we anticipate: Will the cooling water be cool enough to allow the plant to operate? (**0010-9** [Public Citizen, Texas Office] [Smith, Tom])

Response: *The construction and operation of a nuclear plant involves the consumption of water. The staff will independently assess the impact of these consumptive water losses on the sustainability of both the local and regional water resources. This assessment will consider both current and future conditions, including changes in water demands to serve the needs of the future population and changes in water supply resulting from climate variability and climate change. While NRC does not regulate or manage water resources, it does have the responsibility under NEPA to assess and disclose the impacts of the proposed action on water resources. The staff's assessment of the impacts on the sustainability of water resources will be presented in Chapters 4 and 5 of the EIS for construction and operation, respectively.*

Comment: There is substantial evidence to support the prediction that melting the South Antactic ice cap and the Greenland glacier will cause a rise in sea level ranging from 6 to 12 feet (This scenario is presented as a reasonable probability, not a worst case. The sea level rise would probably take place over an extended period of time and probably within the operating life of the proposed nuclear power plants). Assuming that sea level were to rise to that extent, what would be the impact on: (1) the operations of the plant (2) the access to the plant from off-site, particularly by emergency response personnel and equipment (3) the ability to evacuate the plant in case of emergency (4) the ability to evacuate surrounding communities in case of emergency (**0002-6** [Sinkin, Lanny])

Response: *Parts (2)-(4) of this comment relate to emergency planning and response and are not within the scope of NRC staff's environmental review. Part (1) of the comment can be interpreted to have both a safety and an environmental aspect. As part of the NRC's site safety review, the staff will consider whether the site is suitable based on characteristics of the site including long-term variability in flooding levels. The results of this review will be found in the site Safety Evaluation Report. This issue is not within the scope of the environmental review and will not be discussed in the EIS. As part of the NRC's environmental review, the staff will independently assess the impact of consumptive water losses during operation of the plant on the sustainability of water resources including consideration of current and future conditions resulting from climate variability and climate change. The staff's assessment of the operation impacts will be presented in Chapter 5 of the EIS.*

D.2.8 Hydrology - Groundwater

Comment: Subsidence, no. What happens if we over-use the ground water in this community, and will there be a decrease in the level of the plant? (**0007-23** [Smith, Tom])

Response: *The NRC is also concerned about subsidence and will be evaluating the potential for subsidence at the station. Information on the NRC evaluation of subsidence will appear in Chapter 4 on water-use impacts during construction and in Chapter 5 on water-use impacts during station operation. The topic of subsidence and sink holes and their potential impact on the facility will also be addressed in Section 2.5 of the applicant's FSAR.*

Comment: If global warming is occurring and as severe as we anticipate: Will groundwater decline? (**0010-8** [Public Citizen, Texas Office] [Smith, Tom])

Comment: ...in researching in-situ uranium mining, we have discovered that that activity also requires enormous amounts of groundwater during the mining process and that there is a high likelihood that the mining will contaminate portions of the Gulf Coast Aquifer. For example, the company which has applied for a permit to mine in Goliad County, about 100 miles west of here, will need 72,000 gallons of water a day during mining and additional vast amounts when restoration (which probably won't be possible) is attempted. (**0017-2** [Scheurich, Venice])

Response: *Changes in the availability of the water resource by competing demands and long-term variability will be addressed in the cumulative impacts <Section 7.2> on water use and quality.*

D.2.9 Ecology - Terrestrial

Comment: What about endangered species? There are kemp ridley turtles, whooping cranes, and others that are on the threatened and endangered species list in this community. Many of them we are beginning to understand how significant they are since they last time this plant was permitted in this community. (**0007-21** [Smith, Tom])

Comment: There are Kemp Ridley sea turtles and whooping cranes in the vicinity. How will construction and operation of the new reactors affect their habitats? What other species will be affected? (**0010-17** [Public Citizen, Texas Office] [Smith, Tom])

Response: *The comments relate to aquatic and terrestrial ecology issues and will be considered in the preparation of the DEIS. NRC's consultations with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service regarding threatened and endangered species will be discussed in Chapter 4 of the DEIS.*

Comment: [T]he lake that [STP has] -- the 7,000 acre -- also creates some of the best bird habitats in the state of Texas. (**0008-2** [O'Day, Mike])

Comment: [R]ecently I had the opportunity to go and sit on a pier and watch my brother fish and a friend of his. ... So we sat for a time. And as we did, as the conversation waned, I heard something. And the longer you listened, the louder it got. And that that I was hearing were frogs: frogs that were speaking loudly. And if you know anything about frogs, they're the most -- or one of the most sensitive animals in our environment. And they were not only loud, but they were interactive. And I came to understand that as sensitive an issue as this is the creatures of the world tell us a lot. And for them to be out in such a large and strong body to be heard at night, and them being such a sensitive creature that they through their skins osmose anything the environment deals to them, their presence made me understand that we have a very environmentally safe -- not just our nuclear facility, but numerous facilities that operate along our river -- something I'm very proud of in our county -- something they should be proud of, and I think everyone should be well aware of. (**0008-23** [Marceaux, Brent])

Comment: Also the alligators -- the nuclear power plant is -- the whole grounds -- in a protected wildlife zone. They've not only done that, they've gone in and put in a -- what's called a wetlands -- their own private wetlands so, you know, to help that. (**0008-33** [Head, Bobby])

Comment: In the last 20 years that the nuclear power plant has been here the National Audubon Society, year in and year out -- I don't know if you all know this but Matagorda County is the number one birding center in the nation -- more birds -- more species of birds every year. They just did the Christmas bird count -- number one in the nation again this year -- more species of birds in Matagorda County. (**0008-34** [Head, Bobby])

Response: *The comments are noted. Terrestrial resources, including all the aforementioned species, will be discussed in Chapter 2 of the DEIS.*

D.2.10 Ecology - Aquatic

Comment: I had an opportunity one night working nights to go out and work where the pumps are out on the reservoir. And I walked out and I looked down and I said, Geez, as a fisherman here are these huge catfish and these huge red fish swimming together down there. Now, at -- the environment -- if they're doing something about the environment they're making the fish grow big. I can tell you that. (**0008-32** [Head, Bobby])

Response: *The DEIS will discuss the aquatic resources at STP in Chapter 2 and will consider potential impacts from construction and operation of the two new units in Chapters 4 and 5, respectively.*

Comment: As evidenced in the Environmental Report itself, low-flow conditions move the line of salinity upstream from Matagorda Bay, leading to more entrainment and entrapments of estuarine species, as well as the likely movements of bird species such as pelicans which feed on such aquatic species. Thus, the relationship between the salinity line, aquatic species and climate must be examined. (**0003-30** [Reed, Cyrus])

Response: *The DEIS will consider the aquatic biota in the Colorado River, including species that move up the river from Matagorda Bay. Recent data collected in the lower Colorado River will be used to characterize the aquatic biota, as well as, various water quality indicators (including salinity) that will be used to describe the aquatic environment and analyze potential impacts from the project. Entrainment, entrapment and impingement of the aquatic biota in the river at the vicinity of the plant's intake structure will be evaluated in Chapter 5 of the DEIS. Potential behavioral changes in other non-aquatic species, such as pelicans, resulting from the proposed construction and operation of the additional units will also be analyzed.*

Comment: It should be noted that the ER relies heavily on monitoring data of aquatic species and water levels from the initial application of 1973 which must be updated to reflect a much more saline, lower flow regime which typifies the region today. (**0003-31** [Reed, Cyrus])

Comment: In terms of the assessment of water contained in the ER, there are multiple sections which continue to rely on dated aquatic monitoring of the Colorado River which must be updated and specified as part of an EIS. Thus, as an example, relying on histograms of sediment levels in the Colorado River from 1957 to 1973, as is done in Section 2.3.1.1.5 is clearly incomplete. (**0003-34** [Reed, Cyrus])

Response: *The DEIS will include the results of a 12-month monitoring program conducted in 2007 and 2008 to assess aquatic species and conditions of the lower Colorado River.*

Comment: I know that more than half (by weight) of the biomass in the earth is in the form of microorganisms which live under the surface of the earth and bodies of water. The earth is teaming with life to depths below 10,000 feet, especially in coastal plains such as found around STP. Some of these organisms have beneficial effects on the biosphere, e.g., producing oxygen and absorbing carbon. I am concerned about the effect on these organisms which would result from a massive radioactive effluent leak into the ground, or cooling pond, or the Colorado River. An EIS should consider this important effect. (**0005-6** [Payne, Cameron])

Response: *NRC regulations require strict monitoring of radioactive effluent releases. In addition, new plants are commonly required by other State or Federal agencies to perform special monitoring of aquatic and terrestrial species for some period of time after a new plant commences operation. Ecological impacts related to radioactive effluent releases from the proposed facility will be evaluated in the DEIS.*

Comment: We need to figure out whether we're going to preserve that estuary or whether we're going to let it go to hell. Right now I understand that at the intake for the cooling [pond] we're getting brackish water. The original design was that they were not to remove enough water such that there was back-flow to cause saltwater in at the inlet station. It appears it's happening regardless of whether they pump or don't pump. This says there's been a change in the basic environmental impact statement. That needs to be analyzed for. (**0008-78** [Acevedo, NK])

Response: *The DEIS will describe the function of the intake structure on the Colorado River and will discuss the potential impacts to aquatic resources from the operation of that structure. The DEIS will also describe changes, unrelated to operation of STP Units 1 and 2, that have occurred in the lower Colorado River since publication of NRC's final environmental statement for the two existing units.*

D.2.11 Socioeconomics

Comment: Units 1 and 2 provide safe, reliable power to millions of Texans. As Mark said, that drives that economy of Texas. And it brings millions of dollars of benefits to Matagorda County and the surrounding area. (**0007-144** [Shepherd, Joe])

Comment: We believe that the benefits to Matagorda County will be significant, not only just the jobs that will be created, we've talked about the 800 permanent jobs, the 4,000 construction jobs, but we believe it'll have a significant positive affect on the quality of life in Matagorda County. (**0007-148** [Shepherd, Joe])

Comment: The STP 3 and 4 expansion, as has been mentioned earlier, would bring about 800 new jobs to the county. It's been stated that we need jobs, and we do because our high school students need opportunities that are not here now, our college-age students are going away from the county after they graduate because there's nothing here to bring them back, what limited job we have. Also, we have a number of under-skilled, or under-employed people here who are looking for new opportunities to increase the career potential that they have, and that they could stay in the county as well. (**0007-71** [Bludau, Owen])

Comment: The percentage of new employees living here is important to us. Right now we have about 60 percent of the 1200 employees that STP has living in the county, and we would like to have an equal percentage or higher of the new hires coming with 3 and 4 that would be here. They would be able to purchase homes and cars here, groceries, retail activities, they would use the services of our banks, our medical facilities, insurance, utility service providers. And if we could get 600 of those 800 living here, that would generate another 1,000 secondary support jobs. Those new employees' salaries will circulate in the community and that will expand it economically. (**0007-72** [Bludau, Owen])

Comment: [W]e're beginning to see the impacts already of the anticipation of Units 3 and 4. We saw new retailers open up in Bay City in 2007. We had new retailers who have purchased properties in Palacios and in Bay City, and there's new construction in Palacios and Bay City in anticipation of this larger customer base that is going to be here. So these businesses are coming, and they're expanding our tax base and our employee base. (**0007-74** [Bludau, Owen])

Comment: STP is looking at about 5,000 construction -- temporary construction workers here over a six year period. ... At maximum construction period they're looking at about 4,000 workers for two years, but then they would ramp down. ... [T]hose living here are going to spend most of their money here. Those commuting in are going to spend some of their money here buying gas and refreshments as they go in and out of the county. That's going to create a strong financial benefit to our local businesses and attract some new businesses. (**0007-84** [Bludau, Owen])

Comment: We are strong supporters of STP. What community would not welcome a $6.4 billion investment in their community? I mean, this is great. We're talking about 8,000 construction jobs during peak, 800 -- I mean 4,000 jobs, 800 permanent jobs. (**0007-9** [Knapik, Richard])

Comment: I'm indeed pleased to be here tonight and have a chance to talk about bringing new reactors to the South Texas Project site and increasing the capacity of the South Texas Project. It's clearly a strong boost for Matagorda County. It's important for Texans and Texas, for energy independence, and having adequate supplies of electricity, which drives our overall economic engine that keeps our society going. (**0008-113** [McBurnett, Mark])

Comment: Units 1 and 2 provide clean, reliable power to millions of Texans. ... We also provide millions of dollars of benefits to Matagorda County. (**0008-125** [Shepherd, Joe])

Comment: We think that the benefits associated with Units 3 and 4 will be significant for Matagorda County and the surrounding communities. It's not only the jobs -- the 800 permanent jobs and 4,000 construction jobs -- bit the quality of life that we believe the economic impact of Units 3 and 4 will bring to this area. (**0008-129** [Shepherd, Joe])

Comment: Palacios is going through an economic change. The shrimping industry is on the way down and it will never return. The Harris and Galveston County Council of Governments, which is 13 counties, including Matagorda County, recently started last year making plans for an additional 2.5 million people coming to our area by year 2015. (**0008-18** [Morton, Joe])

Comment: As far as the economic impact to Matagorda County ... we've got businesses here that have ... been here since the early 1900's. ... Yes, we have new industry coming in. ...But we have these old businesses too. ...down in Palacios ...Blessing and Matagorda and Clemville and Bowling ...all these communities around close that are going to have impact by Units 3 and 4. Also, it's going to secure future for our children and our children's children. (**0008-38** [Head, Bobby])

Comment: The economic impact on the state of Texas will create -- or one nuclear plant would create $9.2 billion statewide from one reactor and 5,564 jobs. (**0008-4** [O'Day, Mike])

Comment: The focus of the Matagorda County EDC and my job is to bring new economic development to Matagorda County. And this ... is a chance of a lifetime that most economic developers would dream of. The value of that STP is talking about investing equals the combined -- it exceeds the combined value of the eight largest industrial projects in Texas in the last four years. It exceeds those. So that is big. That is economic development right big. (**0008-92** [Bludau, Owen])

Comment: We're after STP 3 and 4 for a number of reasons ... We want to attract their employees to live here. If you can get 3 and 4 -- a major percentage of the employees of 3 and 4 to live here they're going to buy homes and cars. They're going to buy their groceries, their retail products. They're going to use the services of our banks, our medical facilities, their insurers, utility companies, and our various service providers. That's going to help all the existing businesses in the community. It's going to attract more businesses to the community. If we could get 600 of 800 to live here that would generate an additional 1,000 service sector jobs. And that is good economic development. (**0008-96** [Bludau, Owen])

Comment: The temporary construction workers that are going to be here will be over a six-year period. ... And while they're living here they're going to be spending their money here. While they are commuting in and out they're going to be buying gasoline and refreshments and spending some of their money here. So that's going to create additional strong business for our local employers, our local businesses, and it's going to add and attract other businesses. (**0008-97** [Bludau, Owen])

Comment: We saw some of this retail happening already, as was mentioned earlier. We had new retailers coming in in 2007. We had more of them buy -- more retailers buy property in Palacios and Bay City for new facilities. There are new retail facilities under construction because they are anticipating an increased customer base. So this is adding to our employment opportunities and it's adding to the existing tax base, which we all need. (**0008-98** [Bludau, Owen])

Comment: The plant location provides jobs on a regional basis without causing development problems, such as increased traffic, whlch would occur in a densely industrialized area. (**0013-2** [Hearn, Polly])

Response: *These comments cite some of the projected favorable socioeconomic impacts on the community of plant construction and operation. These comments are covered within the existing scope of the DEIS and will be discussed in sections < 4.4 and 5.4 of the EIS.>*

Comment: I think the first question that you all, in this community, may want to ask is, is this going to be a benefit to you, or will your taxes have to go up to pay for the infrastructure to support the growth of the plant, the additional hospitals and security systems, roads, schools and other issues. (**0007-16** [Smith, Tom])

Comment: Tax abatements for NRG will mean the community will bear costs in higher taxes. The community will have to come up with funds to build more public infrastructure. The new plant will require:1. New roads, new schools, a new hospital, and a paid fire department.2. How high will local cities have to raise taxes in order to build this infrastructure? (**0010-1** [Public Citizen, Texas Office] [Smith, Tom])

Response: *These comments briefly identify potential adverse socioeconomic impacts on the community of plant construction and operation, including required investments in community infrastructure. These topics will be discussed in Chapters 4 and 5 of the DEIS.*

Comment: I think that Matagorda County and Bay City are so much better prepared for two more units than we were for the first two units. I happen to have been on the city council at that time, and let me tell you, I believe at that time there were 13,000-plus construction workers here, which at that time it was the largest construction project in the United States at that time, or up to that time, or going on then. (**0007-129** [Rice Herreth, Georgia])

Comment: Already ... advanced education has come to the city due to our partnership with the local community colleges and with Texas A&M. There's now a satellite campus at Wharton Junior College in Bay City, we're teaching courses and there are students there today, and that did not exist a year ago. And that's all because of Units 3 and 4. (**0007-149** [Shepherd, Joe])

Comment: Ms. Dancer talked about the security of the workforce. I'm sorry if, as we went through our deliberations on how we should best manager our costs, that that caused anxiety within any of employees. But the truth is, we outsourced not one job. Not one. And we have changed our outlook. We've gone from an outlook of constriction to one of expansion, and that's the bright future for STP Nuclear Operating Company, and that's the bright future for Matagorda County. We prefer local talent, and the onsite campus in Bay City is part of our commitment to try and attract and retain that local talent. And we have many other activities that'll go forth in the future to bring that workforce to Matagorda County. (**0007-150** [Acevedo, NK])

Comment: With the announcement of expansion to Units 3 and 4, we have the opportunity to bring industry, education, and government together to solve a huge problem, but it was a good problem. ... In just a matter of months we came up with a degree program, associate degree program called Power Technology, which we have students enrolled in already today, and the Mid-Coast Education and Industry Alliance still meets quarterly. We are continuing to address the issues to see how we can improve our education systems and make this a great place to raise our young adults and have our young adults come back and raise their families for many, many years to come, creating another huge strength for our community. (**0007-79** [Dunham, D.C.])

Comment: The city of Bay City is ready to meet the challenges of the growth and expansion of Units 3 and 4. The city three years ago passed a $6 million bond issue to repave all the streets in the city of Bay City. We're also actively engaged right now in creating a diversion road around our community to help alleviate traffic that we anticipate coming. (**0008-14** [Knapik, Richard])

Comment: With this announcement we had the opportunity to bring together industry and educators and solve a really huge problem. But it was a good problem, especially for this community that has had traditionally double-digit unemployment. Our problem was how are we going to meet the demands of our local industries' needs for all of the jobs that are going to be created. ...Within just a matter of months we developed the idea of coming up with power technology, which is an associate degree program that's being taught to our students today. (**0008-47** [Dunham, D.C.])

Comment: STP has made Matagorda County a much strong economic entity by its presence. It is our largest private sector employer. Units 3 and 4 would add another 800 jobs. And those jobs, as has been mentioned before, are going to be opportunities for our high school graduates, our graduates at colleges to come back to school -- come back from school and work here and for people who are underemployed to improve their education and have better career opportunities. (**0008-94** [Bludau, Owen])

Response: *These comments discuss community responses designed to take advantage of expanding economic opportunities expected as a result of plant construction and operation. Such activities are part of the context for economic impact analysis and will be discussed in the DEIS.*

Comment: So where initially you had a workforce that by default had to be based in the local economy, that paradigm has changed. So as the economy became more global, in part due to advances in the internet and electronics communication age, STP began to court workforces elsewhere, workforces without roots in Matagorda County. And suddenly, all of those jobs, all of those careers that we had been promised, and that had largely come to fruition, suddenly lost their stability. (**0007-102** [Dancer, Susan])

Comment: If there is any doubt that STP's ownership didn't have loyalty to their workforce, or their location, pre-announcements of Units 3 and 4, Frank Mallen ended that with a comment spoken to a group -- a senior manager, with a comment spoken to a group of recently outsourced employees when he said, It's all about the money. That's the most poignant and honest thing that STP management has presented to this community so far. (**0007-103** [Dancer, Susan])

Comment: Fortunately for us, we have hindsight and we can see what building two new nuclear reactors could bring us. We can see now because we're 30 years later from the same thing happening before. Our unemployment rate is still well above the state average, our school districts are still extremely poor, and the owners and operators of the plants still don't live here or show loyalty to our community. (**0007-106** [Dancer, Susan])

Comment: When they started bringing executives in to prepare for 3 and 4, guess where they relocated those executives to? Lake Jackson. All the -- and these are the same people who tell you they have great love and loyalty for Matagorda County and that we have the infrastructure to support the plant growth and to support all the new employees here. (**0007-120** [Dancer, Susan])

Comment: As far as the concerns I have is the number of STP employees who choose to live outside of Matagorda County. I understand. They've got beautiful country clubs and stuff like that every place else. But I would like to work with both STP, our local officials, and Matagorda County to make Matagorda County the preferred residence of not only the construction families it will bring, but also the management and employees of STP. (**0008-39** [Head, Bobby])

Comment: While the company postulates that it will need between 5000-6000 construction workers, how many of them can be found locally or in the region with other major power plants being proposed or under construction? There hasn't been a new reactor ordered in the US for decades. The knowledge and skill to build the reactor design is in Japan. 1. Who will NRG hire to build and operate the new plant? 2. Will they have to rely on international labor? (**0010-2** [Public Citizen, Texas Office] [Smith, Tom])

Response: *These comments involve choices by the applicant and their contractors on where the construction and operating workforces will come from, and choices by the workforce concerning where they will live while working at the proposed plant. These factors affect the size of the local resident workforce and the potential socioeconomic impacts and will be discussed in the DEIS.*

Comment: [E]mergency planning ... has an aspect to economic development that often is not perceived. A lot of the business that I'm talking to -- the industries -- have a concern about the Texan fire services -- emergency services. And when we mention the types of planning that are undertaken in Matagorda County because of the presence of STP that gives them a good comfort level that their needs will be met also and they can participate as a member in this emergency planning and response within the county. (**0008-100** [Bludau, Owen])

Comment: STP is a major financial supporter to a lot of the activities in the community as has been mentioned -- the community events, the organization of the civic activities. Many of these events, activities, and so forth could not exist without the financial support of STP. (**0008-99** [Bludau, Owen])

Response: *These comments discuss past actions of the existing plant management and employees for activities that support the community. They provide some context for expectations regarding future behavior. Although this type of response is not an inevitable socioeconomic consequence of construction and operation, past performance will be used as part of the context in the DEIS discussion.*

Comment: If we can do energy efficiency less expensively than building this plant, and put Texans to work as opposed to people in Japan or in Russia or in Africa that will be mining this uranium. Wouldn't it be better to have the jobs and money stay here in the United States? (**0007-29** [Smith, Tom])

Response: *This comment expresses the belief that investments in energy efficiency would be less expensive and would provide more domestic jobs than an investment in nuclear power. It does not ask for an analysis within the EIS of the job and cost consequences of the nuclear fuel cycle compared with energy efficiency. Job and cost impacts will be identified and quantified to the extent possible in the EIS.*

Comment: I do think that Bay City is being presented with a false choice, either two new nuclear reactors, or you're not going to have any jobs, when, in fact, there are alternatives to that, to those two options. (**0007-96** [Cushing, Lara])

Response: *This comment states that there are alternatives to constructing and operating the proposed plant. Chapter 9 of the EIS will discuss the socioeconomic impacts of alternative technologies and sites.*

D.2.12 Environmental Justice

Comment: Environmental justice, what will the net impact be on your taxes and the community, the low-income communities of color? (**0007-25** [Smith, Tom])

Response: *This comment asks what the impact on local taxes and on communities of color will be from constructing and operating the proposed plant. Both types of impacts will be considered and discussed as part of the socioeconomic and environmental justice impacts, respectively.*

D.2.13 Health - Radiological

Comment: There is a need for measurements on the amount of radioactivity in the water currently flowing from the plant into Matagorda Bay to determine whether there is any leakage or release of any kind. If there is documentation of such leakage, that potential from two additional reactors should also be evaluated. (**0002-18** [Sinkin, Lanny])

Response: *STP has an ongoing Environmental Monitoring Program which does monitor for radionuclides in surface water, groundwater and drinking water on an annual basis. Tritium is the only anthropogenic radionuclide that has been measured in onsite water samples for the past several years. No radionuclides have been detected in offsite water samples. During 2006 there were two occurrences of the Total Dissolved Solids discharge line leaking some liquid. The water from the leaks was recovered. No radioactive material was released from the site. However, the potential for releases will be discussed in EIS Chapter 5.*

Comment: Prior to STNP Units 1 and 2 going into operation, the public health data for the three counties closest to the site showed a cancer death rate 4.5% lower than the statewide rate. In the 16 years since the nuclear plants began operating, the cancer death rate in the three counties rose to more than 7% higher than the statewide rate. The statewide rate both went up, with the three county rate rising four times faster. There is no obvious reason, other than the presence of operating nuclear power plants, explaining the data from the three counties. Based on this data, an increased cancer death rate would be expected to result from the addition of two more operational reactors at the same site. The cumulative impacts analysis for the STNP II reactors should address this question. Source: Joseph J. Mangano, MPH, MBA Radiation and Public Health Project, January 24, 2008. There is also a recent study indicating that operating nuclear power plants adversely affect infant mortality (**0002-20** [Sinkin, Lanny])

Comment: There have been numerous cancer studies and infant mortality studies involving nuclear plants that should be examined as part of the EIS. While some of these studies have been contradictory, a true ER and EIS process must assess the latest studies to estimate the actual damages in cancer incidence and death due to the opening of more nuclear power plants. (**0003-46** [Reed, Cyrus])

Comment: What will the impact of cancer be on this community? And if you look at data you see that the cancer rates have gone from below average to above average since this plant's been in operation. (**0007-17** [Smith, Tom])

Comment: I do want to go on record and say that I am concerned about increased cancer rates (**0007-99** [Dancer, Susan])

Comment: ... a large-scale, carefully conducted study concluded: "Our study confirmed that in Germany a connection has been observed between the distance of a domicile to the nearest nuclear power plant... and the risk of developing cancer, such as leukemia, before the fifth birthday." The study was conducted by the German Register of Child Cancer, an office which is funded by the 16 German states and the Federal Health Ministry. Among several alarming and unexplained findings was that 37 children living within 3 miles of nuclear power plants had come down with leukemia between 1980 and 2003, whereas the statistical average for Germany would have predicted just 17 cases In that group. Of course, additional research, which takes time, must be done to determine whether proximity to nuclear plants was a factor in causing the high number of cases. At this time, scientists can only conclude that this is just "another piece in a growing puzzle'" of childhood leukemia's association with nuclear installations and they emphasize the need to keep investigating. We all know that there are risks to almost everything we do in life and that there is no escaping some hazards. However, in the case of granting nuclear power plant expansion, the risk is too high. (**0017-4** [Scheurich, Venice])

Response: *As will be discussed in the EIS, the staff accepts the linear, no-threshold dose-response model. In a recent report entitled "Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII - Phase 2 (National Research Council 2006), the BEIR VII Committee concluded that the current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose-response relationship between exposure to ionizing* *radiation and the development of cancer in humans. Having accepted this model, the staff does think that this model is conservative when applied to workers and members of the public who are exposed to radiation from nuclear power plants. This is based on the fact that numerous epidemiological studies have not shown conclusive evidence of increased incidences of cancer at the low dose rates typical of nuclear power plant operations. Further, routine releases from operating nuclear power plants are far below the level at which regional excess cancer incidences would be expected. These studies include: (1) the National Cancer Institute study (1990) of cancer mortality rates around nuclear facilities, including 52 nuclear power plants, (2) the University of Pittsburgh study (Talbott et al. 2003) that found no link between radiation released during the 1979 accident at the Three-Mile Island nuclear power station and cancer deaths among residents, and (3) the Connecticut Academy of Sciences and Engineering study (2001) that found no meaningful associations from exposures to radionuclides around the Connecticut Yankee nuclear power plant that ceased electricity production in 1996 to the cancers studied. Radiological Health Impacts to the public will be addressed in Chapter 5 of the EIS.*

Comment: I read a story on the front page of the New York Times two days ago, and ...he discovered that his drinking water was contaminated with radioactive tritium. That's ionizing radiation, not the kind of radiation you get from the sun. And he was naturally upset about that, and went to Exelon, the largest nuclear reactor manufacturer in the country, and he asked them about it, and to make a long story short, they confessed that they knew about this. Exelon believed that the tritium found in the drinking water well near the plant in Braidwood, Illinois came from millions of gallons of water that had leaked from the plant years earlier, but went unreported at the time. That could be happening right here. That concerns me. That bothers me. (**0007-97** [Payne, Cameron])

Response: *STP has an ongoing Environmental Monitoring Program which does monitor for radionuclides in surface water, ground water and drinking water on an annual basis. Tritium is the only anthropogenic radionuclide that has been measured in onsite water sample for the past several years. No radionuclides have been detected in offsite water samples. Drinking water in the area is obtained from deep aquifer wells, which is also monitored quarterly and no tritium has been detected in this water.*

Comment: There was a comment earlier regarding cancer and radiation in the populations living near nuclear facilities. It's interesting because that question's been around a long time. In the 16 years I've been [the site doctor] at STP, the evolution of the answer has been ongoing. And I think it's time, finally, to put that question to bed, because it's been studied massively, and internationally. National Academy of Sciences, National Cancer Institute, long-term big-time studies, quality research that have concluded, unequivocally, that living in the shadow of a nuclear plant will not give you cancer. So we need to put this to bed. These are American studies, British studies, Canadian studies, and, again, it's good reading. So take it home. There's some real issues to deal with here. This is a non-issue. (**0007-115** [Hefner, James])

Comment: As far as locally, less than a year ago, right here in Matagorda County, two Rice [University] professors wanted to address his particular question, germane specifically to the county. Can the folks here in Matagorda County -- is there more cancer death rate right here than other counties in Texas? The answer is no. Two Rice professors, eminently qualified, studied this question and concluded that out of 230 counties studied, Matagorda County ranked 108 out of 230 counties as far as cancer death rates. And for sure 206 of those counties don't have a nuclear facility. (**0007-116** [Hefner, James])

Comment: [W]e're upstream of the water -- of your water, and we're downwind of any kind of problems. And Wharton County does have a lot of cancer. Now is it because of you all? Probably not. But it has a lot of cancer. (**0007-127** [Conrad, A.C.])

Comment: Advanced boiling water reactors in Japan have an impressive record on low radiation worker exposures. It's lower than what we typically see in this country in any of our plants. They have an impressive record, and we look forward to being able to do this. There's design features in those plants that enable that to happen. (**0008-117** [McBurnett, Mark])

Comment: Later there is a comment that 1.9 fatal cancers would occur from the annual fuel cycle. Please add information about the day-to-day operations as well. (**0008-65** [Hadden, Karen])

Comment: Also going on is what's known as LCRA-SAWS, or the San Antonio Water System. Now, that's not close. It's up near Interstate -- or U.S. Highway 59 between Wharton and El Campo. But they're going to build a large reservoir that's going to feed the city of San Antonio from the Colorado River. This is a large open body of potable water that is in a possible patch for any radioactive release from the site. It needs to be analyzed as part of the environmental report. (**0008-80** [Wagner, William])

Comment: The National Academy of Sciences, National Cancer Institute put together multiple studies. The NEI has put this fact sheet together ... A whole bunch of long-term studies that have concluded unequivocally now that living near a nuclear facility will not increase your incidence for cancer. It just won't happen. (**0008-90** [Hefner, James])

Comment: Two Rice [University] professors were asked to analyze the cancer death rate in Matagorda County. Statisticians, Ph.D., full professors -- one of them an adjunct professor at M.D. Anderson Hospital -- these folks know numbers, they know cancer -- one a Ph.D. environmental engineer. They concluded the same as the national and international studies. Living in the shadow of a nuclear facility will not increase the cancer death rate. (**0008-91** [Hefner, James])

Response: *Health impacts associated with plant operation will be discussed in Chapter 5 of the EIS.*

Comment: [The Environmental Report] discussed the maximally exposed individual. Please, if you would, expand this section to include impact on all age groups. It should be women and children, young children, pregnant women, not just adult males. In some sections there was analysis of children, and that's good. But the impact should be done for all categories for all types of impacts. (**0008-58** [Hadden, Karen])

Response: *The software packages that the NRC authorizes for use in calculating the maximally exposed individual (MEI) do calculate doses to various age groups, including teenagers and children. The concept of the maximally exposed individual is set to maximize the dose consequences from all pathways and all age groups.*

Comment: There was data that said water downstream is not used for drinking water or irrigation. Please analyze the impacts, however, because there is wildlife in the area and breeding grounds in the wetlands. We need to have added explanations of what the data means. There is some data provided in here, but no context given to what it means. (**0008-59** [Hadden, Karen])

Response: *In addition to STP's ongoing environmental monitoring program that monitors for radionuclides in surface water, groundwater, and drinking water, the DEIS will examine downstream water uses and impacts from construction and operation of the proposed plant.*

Comment: Gaseous pathways are analyzed in terms of 50 miles, in terms of exposure to ground and air, and inhalation. Then there's a reference to radiation shielding, but no explanation. I would like the document to include exactly what is meant by radiation shielding -- how does it work, why does it work, what does it mean. (**0008-60** [Hadden, Karen])

Response: *Shielding is any material or obstruction that absorbs radiation and is designed to protect personnel or materials from the effects of ionizing radiation.*

Comment: There's a conservation estimate of 2.5 milli[rems] per year at the site boundary. They come up with a total body exposure to the maximally exposed individual per year of .35 milli[rems] per unit. So if you double that you're talking about .70 milli[rems] per year. But we need to bear in mind this would now be four units and cumulative impacts need to be addressed throughout. (**0008-61** [Hadden, Karen])

Response: *Cumulative impacts will be discussed in Chapter 7 of the EIS. The National Council for Radiation Protection Report 93 (NCRP 1987) estimates that the average American citizen receives a natural background, (i.e., terrestrial and cosmic radiation in origin) radiological dose of 280 millirem per year, so 0.7 millirem is about 0.25 percent of that background dose rate.*

Comment: Several times the study just simply concludes that these exposure limits would be small -- in capital letters small. Please give us some context. What is the criteria for small? What do you mean? And why are they small? (**0008-62** [Hadden, Karen])

Response: *The National Council for Radiation Protection in its 1987 Report number 93 estimated that the average American citizen receives a natural background, (i.e., terrestrial and cosmic radiation in origin) radiological dose rate of 280 millirem per year. The radiological doses reported in the Environmental Report are considerably less than natural background for the average American citizen and are therefore considered 'small' as defined in 10 CFR Part 51, Appendix B. According to the noted regulation, radiological impacts are considered small if they "do not exceed permissible levels in the Commission's regulations."*

Comment: The occupational radiation doses are listed as 197.8 person-rem for the two units per year. This is over 200 times, by my calculations, of what the average exposure would be. And if you double that, workers at the plant may be getting very high levels of radiation. Cumulative impacts must be analyzed. (**0008-64** [Hadden, Karen])

Response: *The occupational population doses noted in the comment refer to the large work force (~5950 workers) that will be building the two new reactors. The average dose rate to that work force is about 33 mrem per person. Cumulative impacts will be addressed in Chapter 7 of the EIS.*

Comment: More radiation means bigger risk of cancer. The EIS should include an analysis of the impact on humans and other living systems of an increase in radiation levels as a result of 4 operating reactors at STP. ... Will the two new reactors increase the amount of low-level radiation exposure to surrounding populations? (**0010-3** [Public Citizen, Texas Office] [Smith, Tom])

Response: *Radiological impacts from the normal operation of the two new reactors will be discussed in Chapter 5 and cumulative impacts will be discussed in Chapter 7 of the EIS.*

Comment: There is a need for a baseline of current animal, bird, fish, reptile, and other non-Human creature level of radioactive uptake, so that a later comparison can determine health effects of reactor operation. (**0002-21** [Sinkin, Lanny])

Comment: [The Environmental Report] refers to the fact that gamma and beta emitters are typically part of the normally released radionucleids of power plants. Again, the impacts to biota are considered small. Please explain. (**0008-63** [Hadden, Karen])

Comment: What is the effect of low-level radiation over prolonged periods on wildlife in the area? (**0010-18** [Public Citizen, Texas Office] [Smith, Tom])

Response: *The affected radiological environment will be addressed in Chapter 2 of the DEIS. Radiological impacts to biota from operation of the reactors will be discussed in Chapter 5.*

D.2.14 Accidents - Design Basis

Comment: The last analysis of a credible accident was the CRAC II study done while STNP was still under construction. The STNP estimates were: 1. 15,200 early deaths (25 mile radius around plant) 2. 8,770 early injuries (35 mile radius) 3. $112 billion (1980 dollars) With nearly 25 years of sustained population growth in the region, it is certain that these impacts need to be updated. The review in the application is inadequate to inform citizens of the threat. (**0010-16** [Public Citizen, Texas Office] [Smith, Tom])

Response: *The environmental review of the STPNOC application will include analyses of both design-basis and severe accidents. The results of these analyses will be included in DEIS Chapter 5 that discusses the environmental impacts of reactor operation.*

D.2.15 Accidents - Severe

Comment: LCRA is involved in negotiations with San Antonio to establish long term contracts for interbasin transfers of water. The storage of that water will be in a large open reservoir. The EIS should examine the potential impact on the proposed reservoir of an accident at STNP. (**0002-17** [Sinkin, Lanny])

Comment: The ER analyzes likely dosages to the population and resulting from moderate or severe accidents. It predictable finds that all resulting dosages meet NRC requirements and guidelines. What is lacking, however, is any analysis of the potential health effect impacts of STP 3 and 4 in combination with STP 1 and 2. (**0003-45** [Reed, Cyrus])

Comment: While I understand that the proposed ABWR is safer than the Chernobyl reactor, it is possible that there could be a meltdown at STP leading to a massive explosion causing a similar nuclear catastrophe. I would like the EIS to show what would happen to the people living in Houston, as well as those who live even closer. How many would die of severe radiation poisoning? A million? How many thousands of square miles of agricultural land would have to be abandoned for years to come? Also what about those living in San Antonio, the tenth largest city in the U.S. What about Austin,TX? As a U.S. citizen, I think an EIS should make these calculations and let the public know. (**0005-4** [Payne, Cameron])

Comment: The things I want to see more concern with in the environmental review, in the -- and since this is a scoping hearing, let me say this, you have to consider the worst case scenario. What if something like Three Mile Island happens? What will the effects on this area of Texas be? And that's not even the worst accident that's been known to happen. What if something like Chernobyl happens? I want to see the environmental review include the worst case scenario, the absolute worst that could happen. You'll not find one word about that in the current environmental report. (**0007-121** [Singleton, Robert])

Response: *The DEIS for the proposed new reactors will include an evaluation of the risks associated with potential severe accidents including accidents that involve reactor core melts. The evaluation will include estimates of health and economic risks to a distance of 50 mi from exposure to the plume and from exposure to contaminated land and water. These risks will be compared with risks associated with the existing plants. This evaluation will be in the DEIS <Chapter 5> on operational impacts. In addition, the evaluation will include an estimate of the cumulative risk of severe accidents for all units at the STP site. <This evaluation will be in Chapter 7 of the DEIS.> Consistent with the general NEPA philosophy that environmental review under NEPA contain realistic estimates of impacts, the Commission in its Safety Goals policy statement (51 FR 30028, 1986) has adopted the use of mean estimates rather than worst case estimates of accident risks.*

Comment: I would point out in a boiling water -- a boiling water reactor is a very robust design. Loss of that piece of equipment [the cooling tower] does not result in a catastrophic event for a boiling water reactor. (**0008-123** [McBurnett, Mark])

Comment: Nuclear power plants are not safe. Regardless of the safety efforts and record of specific nuclear powers plants, the fact remains that there need be only one accident to have a catastrophic result. Nuclear waste poses a real threat since it is generated throughout all parts of the fuel cycle in these power plants. (**0015-7** [Williams, Mina])

Response: *These comments do not provide new information related to the environmental review. They will not be addressed in the environmental impact statement.*

Comment: LCRA is involved in negotiations with San Antonio to establish long term contracts for interbasin transfers of water. The storage of that water will be in a large open reservoir. The EIS should examine the potential impact on the proposed reservoir of an accident at STNP. (**0002-17** [Sinkin, Lanny])

Response: *The environmental impact statement for the proposed new reactors will include an evaluation of the risks associated with potential severe accidents including accidents that involve reactor core melts. The evaluation will include estimates of health and economic risks to a distance of 50 mi from exposure to the plume and from exposure to contaminated land and water. These risks will be compared with risks associated with the existing units. This evaluation will be in the DEIS <Chapter 5> on operational impacts. In addition, the evaluation will include an estimate of the cumulative risk of severe accidents for all units at the STP site. <This evaluation will be in Chapter 7 of the DEIS.> Consistent with the general NEPA philosophy that environmental review under NEPA contain realistic estimates of impacts, the Commission in its Safety Goals policy statement (51 FR 30028, 1986) has adopted the use of mean estimates rather than worst case estimates of accident risks.*

Comment: The National Environmental Policy Act (NEPA) require that plausible statements as to the prospective environmental impacts be disclosed in advance. Any Environmental Impact Statement that did not raise the twin specters of nuclear core meltdown and a meltdown in a spent nuclear fuel pool is inadequate, and should be challenged in court. (**0005-3** [Payne, Cameron])

Comment: Possibly even worse than a reactor core meltdown would be a meltdown in one of the spent nuclear fuel pools. Please give us the effects of that. (**0005-5** [Payne, Cameron])

Response: *The environmental impact statement for the proposed new reactors will include an evaluation of the risks associated with potential severe accidents including accidents that involve reactor core melts. The probability of simultaneous reactor accident involving a core melt and a spent fuel pool accident involving a fire is too low to be plausible. Therefore, the environmental impact statement will not address the consequences of simultaneous severe reactor accidents and fuel fires in the spent fuel pool.*

D.2.16 Uranium Fuel Cycle

Comment: The EIS should examine the likelihood that a solution to the high level waste disposal issue will be forthcoming any time in the near future and the consequences for STNP, such as indefinite on-site storage, if such a solution is not forthcoming. (**0002-22** [Sinkin, Lanny])

Comment: The ER is short on details on how the proposed plant will deal with thousands of curies and tons of low-level and high-level waste to be generated by the plant. Radioactive waste management in the U.S. has been and continues to be nightmarish and difficult. (**0003-35** [Reed, Cyrus])

Comment: There are now only three facilities which are taking low-level waste from nuclear plants in the States of South Carolina, Utah and Washington. However, none of the three will currently take all types of low-level radioactive waste from Texas power plants. Thus, the [EIS] must address how much of which kinds of low-level radioactive waste will go to which facilities must be addressed. In addition, because there is the real possibility that no facility will be found in the short-term for the most radioactive of low-level rad waste, an EIS must address the possibility and impacts of permanent disposal of low-level rad waste on-site. (**0003-36** [Reed, Cyrus])

Comment: If the ER fails to adequately assess the generation, storage and disposal of low-level waste, the oversights in terms of high level radioactive waste are much greater. First of all, the ER assesses the transport of spent fuel (high level waste) to a depository, using Yucca Mountain as an example. Yet both the NRC and NRG know that even if Yucca Mountain were to open sometime in the first years of operation of STP No. 3 and 4, storage of spent fuel would be taken up by existing nuclear plants. There has yet to be, and does not appear to be any resolution of the question of how to dispose of high level radioactive waste. (**0003-37** [Reed, Cyrus])

Comment: I think it's irresponsible to be considering permitting new reactors when we have yet to permit or identify a viable site to dispose of the waste. (**0007-109** [Cushing, Lara])

Comment: Even assuming that that worst case doesn't happen, you still have one non -- one problem that there is no good solution for. And that is what you're going to do with nuclear waste. I don't believe the time frame. I think it should be longer. But the federal government says we're going to have to store high-level waste for 10,000 years, that we're going to have to protect for 10,000 years. (**0007-124** [Singleton, Robert])

Comment: I assure you we have the capability at South Texas to store nuclear waste. We have the capability to store all the waste, the high-level waste out of Units 1 and 2 through 2028. We have the capability for 10 years of storage in the new advanced boiling water reactor design, and there are technologies to allow us to develop storage that goes much beyond that, and basically we can store it as long as we need to, until the federal government fulfills their contact and takes possession of that spent fuel and ultimately disposes of it. Ten thousand years? Not 10,000 years. That fuel becomes less radioactive than what we dug out of the ground originally in a few hundred years. But, yes. (**0007-140** [McBurnett, Mark])

Comment: What about wastes? The whole community of -- the whole question about the plant being permitted is dependant upon your ability to dispose of wastes. ... And we do not yet have a licensed and operating low-level radioactive waste disposal site, which means that the disposal, up until we get those things permitted, if we ever do, is here in this community. (**0007-22** [Smith, Tom])

Comment: With a nuclear power plant, the waste issue has not been solved. Yucca Mountain has been cutting back the workers to 15 now. And to bring more of this into the community is putting the community at risk. (**0007-31** [Hadden, Karen])

Comment: A third issue is radioactive waste. It's the big bugaboo in the room, nobody likes to talk about it. But the fact is, you know, for 50 years we've been talking about how we're going to deal with radioactive waste. We still haven't dealt with it. We still don't have a final repository for radioactive waste. (**0007-51** [Reed, Cyrus])

Comment: I saw some discussion about, you know, the transportation of the spent fuel rods to a final repository, and about the amount of space you would have at STP 3 and 4 to have these spent fuel rods. But I didn't see the contingency. What happens if we never -- you know, what happens if we are never able to locate a place to put all this waste? Does it just sit there forever? Do you have the capacity? (**0007-52** [Reed, Cyrus])

Comment: Similarly with low-level rad waste, you know, there are currently only three sites that are taking it, one of the which, Barnwell, has now said they're not going to take it. We haven't yet had the Andrews County site open up. Where is the contingency in here for what to do with that waste? (**0007-54** [Reed, Cyrus])

Comment: [I]n the 50 years of the nuclear industry we have yet to identify a safe way to dispose of the waste. And that is an environmental impact of the South Texas Project. High-level radioactive waste stays deadly for tens of thousands of years. And it's a real engineering challenge to think of how to contain such a thing on such a geological time scale. So I think that the NRC needs to consider all of those impacts in the environmental scope of their review. And it's a real engineering challenge to think of how to contain such a thing on such a geological time scale. So I think that the NRC needs to consider all of those impacts in the environmental scope of their review. (**0007-95** [Acevedo, NK])

Comment: Yes, we [STP] generate high level nuclear waste. We know how to store it. We store it safely. We have the capability to store it safely for as long as we need to store it. Ultimately the federal -- we have a contract with the federal government to take possession of that material and dispose of it. Until they do so, we'll store it and continue to do so in a safe manner. I want point out our waste is not in a tin building; it is a concrete building. (**0008-114** [McBurnett, Mark])

Comment: And right now we've got a crisis because the scientific process that we're looking to manage the nuclear waste South Texas 1 and 2, 3 and 4, the 104 operating reactors around the country -- right now there's only one site that's being looked at. And that's in Yucca Mountain, Nevada. And the issue is is that if this were a scientific process you would be looking at least three sites. And you would be looking -- likely you would be looking at Deaf Smith County, Texas, as one of those other sites. And it wasn't until 1987 that Deaf Smith County, Texas, was taken off of the list and Yucca Mountain, Nevada, was the only one that was left. (**0008-43** [Gunter, Paul])

Comment: Now, the issue is is that we believe and -- that you should be able to raise this issue of nuclear waste within the context of building more reactors. But currently -- the current NRC process says that we are not allowed to raise that because of what they call the nuclear waste confidence decision. And that decision was made by rule-making with the U.S. Nuclear Regulatory Commission that said someday somewhere somebody somehow is going to figure out what to do with, you know, right now 55,000 metric tons. You add more reactors -- it's going to be up to 100,000 metric tons, 120,000 metric tons. And right now the only place we're looking at is to send it off to a seismologically and volcanically active area. And it's not for sure that it's going to happen. Right now the Yucca Mountain process is alling apart. And, in fact, there is no confidence. (**0008-44** [Acevedo, NK])

Comment: How can the generation of waste which we still do not know how to safely store be justified? (**0009-4** [Lindsey, Joy])

Comment: No high or low level site has yet been permitted Recognizing that generating nuclear energy produces tons of high and low-level radioactive waste that remains dangerous to living systems for tens of thousands of years, and radioactive and toxic waste is produced at every stage of the fuel cycle, including plant operations, the EIS should address waste issues thoroughly. (**0010-19** [Public Citizen, Texas Office] [Smith, Tom])

Comment: There is still no ways to safely store nuclear waste for the millions of years during which it will remain radioactive. (**0012-5** [Edwards, Nancy])

Comment: Nuclear power plants are not a clean energy source and they are not long-lived. Radioactive waste remains dangerous to human health for thousands of years, and no country in the world has found a solution for disposing of it. (Public Citizen April 2006). These plants have a life span of only 30-40 years, after which they must be upgraded at huge costs or decommissioned, leaving the site contaminated for thousands ofyears. (Southwest Workers' Union October 25, 2007). (**0015-2** [Williams, Mina])

Comment: It has also long been common knowledge that there are health and safety concerns associated with the production of nuclear power. We all know there are huge quantities of nuclear waste produced for which there is no satisfactory storage solution, and there are documented accidents resulting in contamination due to leakages. (**0017-3** [Scheurich, Venice])

Response: *Onsite storage and offsite disposal of spent nuclear fuel are Category 1 issues. The safety and environmental effects of long-term storage of spent fuel on site has been evaluated by the NRC and, as set forth in the Waste Confidence Rule at 10 CFR 51.23, the NRC generically determined that "if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the* *licensed life for operation . . . of that reactor at its spent fuel storage basin or at either onsite of offsite independent spent fuel installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in any such reactor and generated up to that time." The comment provides no new significant information, and, therefore, will not be evaluated further.*

Comment: The low level waste analysis should examine the likelihood of off-site storage being available for such waste. (**0002-24** [Sinkin, Lanny])

Response: *Radiological wastes will be addressed in Chapter 6 of the EIS.*

Comment: Waste produced from uranium mining, including tailings, is another waste which should be included in the analysis. (**0002-27** [Sinkin, Lanny])

Comment: Chapter 10 of the Environmental Report does not discuss the land that will likely be used to mine, process, enrich and fabricate uranium fuels, and the waste and air emissions that are generated in that process, nor does it discuss the long-term implications of the low-level and high-level waste generated by the operations of the plants, including their potential impact on water resources and human health. (**0003-23** [Reed, Cyrus])

Comment: [T]here is no discussion of where uranium is likely to be mined as a result of the potential additional nuclear plants. Thus, while the ER suggests that uranium is a resource that is mainly imported and that the uranium mining industry in the U.S. has been depressed in recent years, the Sierra Club notes in Texas, there are currently 19 exploratory permits for uranium mining that have been granted or are being processed by the Railroad Commission of Texas since mid-2006, that four uranium mines are currently operating in Kleberg and Duval Counties, and that two new applications are being processed by the Texas Commission on Environmental Quality for mines in Duval and Goliad Counties. The EIS should assess different scenarios and the likely impacts, including in South Texas on water resources and health impacts. (**0003-42** [Reed, Cyrus])

Comment: If NRC is to license a new nuclear plant, it must be based on the impacts from the whole uranium cycle that will result. For 50 years, nuclear power has been presented as a clean energy source, even as communities at Three Mile Island, Pennsylvania in West Valley, New York, in Sheffield, Illinois, Hanford, Washington, Barnwell and a myriad of other locations were impacted from the generation and waste disposal, in some cases leading to deaths. Any EIS must address the full impacts so more communities do not suffer. (**0003-43** [Reed, Cyrus])

Comment: And then the source of uranium. We all think that the uranium will probably come from someplace else, and most of it will, but here in Texas we have a number of communities, particularly those around Karnes City and Kingsville where we have significant impact already to ground water as a result of uranium mining. We're about ready to get into another round of uranium mining in Goliad and Duval Counties. And the impact of the uranium extraction on those communities typically means that ground water is no longer safe. (**0007-26** [Smith, Tom])

Comment: And then also you have ... high-grade and low-grade uranium, so once you finish with the high-grade, when you enrich it you have to use energy to do that. So when you use low ...the low-level one, you have to use more energy just to get it so it could be used at the nuclear reactor plants. (**0007-83** [Lopez, Diana])

Comment: While it's true that nuclear power plants don't emit carbon dioxide, one of the principle ingredients fueling global warming, the mining of uranium to fuel these plants is anything but clean. I'd ask all of you to consider the indirect costs associated with uranium mining. It's a nasty business that can pollute aquifers, and taint drinking water and irrigation for nearby residents. (**0007-86** [Castro, Geoffrey])

Comment: Mining and enriching uranium results in radioactive contamination of the environment and risks to public health. Exposure to radon has been shown to cause kidney failure, chronic lung disease, and tumors for the brain, bone, lung, and nasal passage. The EIS needs to assess the impact of uranium mining in the regions from where STP 3 and 4 will derive its fuel. (**0010-23** [Public Citizen, Texas Office] [Smith, Tom])

Response: *Impacts from the uranium fuel cycle have been tabulated in 10 CFR 51.51 Table S-3, which is used as the basis for evaluating the contribution of the environmental effects of uranium mining and milling to the environmental costs of licensing the nuclear power reactor. Associated effects also discussed in the noted CFR include the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials and management of low-level wastes and high-level wastes related to uranium fuel-cycle activities. Health effects from normal plant operation will be addressed in Chapter 5.*

Comment: An EIS must assess the much more likely scenario that radioactive waste will be stored on-site well.... Forever. That assessment must include an assessment of any potential leaks, accidents or gases escaping from the containment zone. (**0003-38** [Reed, Cyrus])

Response: *Radiological waste will be discussed in Chapter 6 and accidents will be discussed in Chapter 7 of the EIS.*

Comment: In the economics analysis, the EIS should consider the burden on the public treasury potentially created by Units 3 and 4. For example, the Federal Government is already ten years behind in its promise to establish a long term repository for high level nuclear waste and remove such wastes from existing nuclear power sites. Based on that failure to perform, the Federal Government is having to pay for on site storage, amounting to billions of dollars. This expense is discussed in "As Nuclear Waste Languishes, Expense to U.S. Rises," New York Times, February 17, 2008. (**0004-2** [Sinkin, Lanny])

Response: *NRC regulation (10 CFR 50.75) requires the establishment of a decommissioning trust fund. Sufficient funds are required to be collected and placed in a secure trust that would assure decommissioning, including the disposal of low-level waste. Funds are also collected from licensees annually to defray costs associated with the ultimate disposal of high-level waste.*

Comment: It's mentioned in the application that you currently send it (low-level waste) to several locations. It seems like more detail would be needed so that we, the public, can be sure that this rad waste, both low-level and high waste, is taken care of. (**0007-55** [Reed, Cyrus])

Comment: I am concerned about the waste issues, and I am concerned about Matagorda County being essentially set up as a permanent radioactive waste site because there doesn't seem to be a solution for that one. (**0007-91** [Dancer, Susan])

Response: *Radiological wastes will be addressed in Chapter 6 of the EIS.*

Comment: [W]here is that uranium going to come from? We have at the Railroad Commission now 19 new exploratory permits for a uranium mine. To make the nuclear power plant you need uranium, uranium mining can have some environmental impacts here in Texas. So how are we going to make that if -- where that uranium's coming from, and what the total fuel cycle impacts are going to be. (**0007-57** [Reed, Cyrus])

Response: *The NRC staff evaluated the environmental impacts of the uranium fuel cycle including the impacts of fuel manufacturing, transportation, and the onsite storage and eventual disposal of spent fuel. The staff's evaluation accounts for the Commission's "Waste Confidence" decision embodied in 10 CFR 51.23 to the extent that decision applies to such impacts. The comment does not provide new information and will not be evaluated further.*

Comment: If you're looking at the enriching of uranium, you have to do -- and you have to do that at coal burning power plants as well. You know, so, one, maybe when it gets to the nuclear reactor here the pollution is not being produced, but every step of that process there's pollution that's impacting people, and once it arrives here at the South Texas Nuclear Project, then there's a huge question of radioactive waste which we have nowhere to put. (**0007-67** [Rendon, Genaro])

Response: *Impacts from the uranium fuel cycle have been tabulated in 10 CFR 51.51 Table S-3, which is used as the basis for evaluating the contribution of the environmental effects of uranium mining and milling to the environmental costs of licensing the nuclear power reactor. Associated effects also discussed in the noted CFR include the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials and management of low-level wastes and high-level wastes related to uranium fuel cycle activities. Radiological wastes will be addressed in Chapter 6 of the EIS.*

Comment: I'm not going to presume to tell you what's best for your community, I am going to talk in solidarity with the communities that are facing the impacts of uranium mining. Eighty percent comes from overseas. Most of those places don't even have environmental or worker protections. (**0007-107** [Cushing, Lara])

Comment: The most radical nuclear people will admit that something is going to come along that's going to be cleaner and safer and better, and that eventually -- well, we're still going to be storing the waste from this 50 years or 100 years of nuclear power and have to safeguard it. What language are we going to put on the warnings to people from the nuclear waste and have any guarantee that it's going to be spoken 10,000 years from now? (**0007-125** [Singleton, Robert])

Comment: Interestingly enough, nuclear reactors remove radiation from the environment. This is probably going to come as a startling little fact for you, but think about this. The isotopes that you put in the reactor are long-lived isotopes -- radioactive isotopes. Reactors convert them to short-lived radioactive isotopes that die off much more quickly. When you're through at the end of the day, there is a lower radiation load on the environment because of the presence of nuclear reactors. (**0008-103** [Dykes, Ed])

Comment: In terms of going forward in the years to come, obviously we have much to do in the area of disposing of the high level nuclear waste. ... but it's not something we should delay going forward with new construction and wait 20 or 25 years till the technology is developed. We should do it in parallel. (**0008-111** [McCormick, Mr.])

Response: *These comments do not provide new information relevant to the environmental impact analysis and therefore will not be evaluated further.*

D.2.17 Transportation

Comment: Transportation, how will the materials and the waste come in and out of this community? (**0007-24** [Smith, Tom])

Comment: [F]or us in San Antonio, this also raises other dangers. In 2004 we had 21 derailments in our city, 21 derailments that killed five people; one of them spilling chlorine gas in the community killing four people instantly. So how is this [uranium] being transported? Is it going to be coming through our backyards, of which -- you know, we want to make a clear statement that we would not, and do not, want this type of deadly waste passing through people's backyards. And it's literally passing through people's backyards when you look at the train system in the City of San Antonio. (**0007-65** [Rendon, Genaro])

Comment: [H]ow is the fuel going to be transported into this community? How is waste -- if they ever find a place to put the waste, how is going to be transported out of this community? What we found out in San Antonio after 21 derailments, major derailments, occurred in 2004 is that you can't get any of that information. You can't find out the routes that they're taking. They won't tell you what's on those trains, and there's no way to know that. So how can we possibly evaluation the risk to our communities when we don't even know where this stuff is going to be transported through, and how to protect it? (**0007-94** [Cushing, Lara])

Response: *The environmental impacts of transporting fuel and waste to and from the STP site will be evaluated, and the results of the analysis will be presented in Chapter 6 of the EIS. The transportation of radioactive material to and from the STP site, including unirradiated fuel, spent fuel, and radioactive waste, will be conducted in accordance with Federal regulations. The U.S. Nuclear Regulatory Commission (NRC) and Department of Transportation (DOT) are the lead Federal agencies in charge regulating the safety of shipments of radioactive materials. The NRC establishes requirements for the design and manufacture of packages for radioactive materials (10 CFR 71, Packaging and Transportation of Radioactive Materials). The Department of Transportation regulates the shipments while they are in transit, and sets standards for labeling and smaller quantity packages (Title 49, Transportation, U.S. Code of Federal Regulations).*

D.2.18 Decommissioning

Comment: Additional radioactive waste is produced in terms of the irradiated structures and equipment in the nuclear plant. A comprehensive examination of the likely method of decommissioning should also be part of the EIS. (**0002-26** [Sinkin, Lanny])

Response: *Decommissioning will be discussed in Chapter 5. The environmental impact from decommissioning a permanently shutdown commercial nuclear power reactor is discussed in Supplement 1 to NUREG-0586, Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, which was published in 2002. For most environmental issues, the impact from decommissioning activities is considered small.*

D.2.19 Cumulative Impacts

Comment: And very important when we're looking and talking about the environmental impact statement, is that we also take into effect, into consideration, the cumulative impacts that folks have to deal with when we talk about pollution, when we talk about environmental contamination. ...And if you look at the Gulf Coast of Texas, it's littered with chemical plants, it's littered as well with refineries and ports, and huge inland ports as well that are situated for ships to be able to come in. So if we're looking at ourselves here and in San Antonio, what is the whole of the impact that we've being exposed to? (**0007-62** [Rendon, Genaro])

Comment: [I]f we look at the State of Texas, we rank number seven amongst countries in pollution. As one state, we're surpassing what countries are producing in pollution. So we have to be looking at reducing that amount of pollution here within the State of Texas, reducing the impacts that communities are feeling by living around these polluting industries. (**0007-63** [Rendon, Genaro])

Response: *NEPA requires the analysis of cumulative impacts in an environmental impact statement. The cumulative impacts associated with the construction and operation of the proposed Units 3 and 4 will be evaluated and the results of this analysis will be presented in Chapter 7 of the EIS.*

Comment: [T]he analysis of the Matagorda [STP] site never acknowledges or assesses the degree to which siting a new nuclear plant next to an existing plant might present potential problems. Thus, what might the impact of a leak or problem at the existing STP No. 1 and 2 present during the construction or operation of No. [3] and 4? Could a problem at the new plant lead to a shut down or problem with the existing plants? (**0003-21** [Reed, Cyrus])

Comment: Is there an environmental impact by placing so much power, and so much waste in the same physical location, subject to an increased likelihood that a natural, operational or terrorist attack could have an even larger impact than if a nuclear plant were to be located, for example, at the site in Limestone County? Is it safer, in other words, to separate an aging and new plant? (**0003-22** [Reed, Cyrus])

Comment: When you consider that this plant would be -- if it goes through -- having construction right next door to an operating nuclear plant, you're introducing circumstances that haven't been seen before. (**0007-32** [Hadden, Karen])

Comment: I think that FEMA should be present for a safety hearing and the Department of Homeland Security. And I would like to hear how all of those agencies are, in fact, working together to assure safety. This is no small thing to have a construction site next to an operating nuclear plant. It deserves close scrutiny. (**0008-54** [Hadden, Karen])

Comment: We did not see anything that had to do with coincidental unit problems. If we have a problem on Unit 1 and 2 during construction on 3 and 4 what's going to happen about that? If we have a problem on 3 and 4 during the operation of Unit 1 and 2 and it affects Unit 1 and 2, what will happen with that? This works very strongly in things like low-pressure turbines coming apart. They just rebuilt the low-pressure turbines. Why? They obviously weren't really happy with its performance at that point, and that was done as a preventive measure. (**0008-67** [Wagner, William])

Response: *These comments address issues related to co-location of two or more nuclear power plants. Several aspects of these issues will be addressed in the DEIS. The DEIS will address the doses to construction workers from the existing units, and from Unit 3 after it starts operation. The DEIS will also address cumulative radiological impacts of normal operation and cumulative risks of severe accidents. Other aspects of these issues, which are addressed in the emergency plan that has been submitted as part of the application, are out of the scope of the environmental review and will not be addressed in the DEIS.*

D.2.20 Need for Power

Comment: Chapter 8 - the need for power - analyzes Texas-based information about the need for additional power in ERCOT, which covers the majority of Texas. While Sierra Club does not object to the use of ERCOT reports cited on 8.4-6 or 8.4-7, we would note the list is incomplete because it does not list reports which discuss other scenarios for the growth in overall and peak summer demand. Because we believe that ERCOT's evaluation of power needs in Texas in itself is incomplete, we would suggest that the EIS conduct a much more balanced full-scale independent analysis. Specifically, the ERCOT evaluations cited by the applicant do not take into account significant regulatory and statutory changes which will increase the use of load demand management and energy efficiency as a result of legislative action taken in 2007 [i.e. HB3693]. [I]t is quite likely that the future of peak and load demand will look quite differently then that presented by the applicant. (**0003-9** [Reed, Cyrus])

Response: *The determination for the need for power within a given area is not under the NRC's regulatory purview. When another agency has the regulatory authority over an issue, NRC defers to that agency's decision. The NRC staff reviews the need for power analysis to determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found to be acceptable, no additional independent review by the NRC is needed.*

Comment: In addition to these legislative and regulatory changes that will affect the need for power, several studies have come out over the last 18 months which should be assessed, as they present alternative demand scenarios based on the use of increased renewable energy, increased efficiency and increased demand response programs. (**0003-10** [Reed, Cyrus])

Comment: NRG and CPS base their need for the plant on forecasts from ERCOT that may overstate the need for power, and therefore the need for STP 3 and 4. Indeed, it should be remembered at the end of 2006, ERCOT was stating that generation capacity would fall below the required reserve capacity of 12.5 percent potentially by 2008, only to later reassess this projection based on a smaller demand as well as the opening of several gas plants. The ER states that by 2016 ERCOT projects there will be a need for between 20,000 and 50,000 MWe, and that the capacity of STP 3 and 4 - as well as many other generation sources - are therefore needed. (**0003-13** [Reed, Cyrus])

Comment: ER Chapter 9 states "NRG anticipates it would not be able to provide competitively priced power if it had to retain an extensive conservation and load modification incentive program" and further implies that demand management is not a form of baseload power. Nevertheless, this two paragraph analysis is not a true analysis of the potential for baseload demand management to provide power or make up for the need for additional power. The analysis of the ability of peak demand plants to replace baseload plants is superficial and does not incorporate the ability of different plants to be used in combination to provide power, such as the conjunctive use of solar, wind and natural gas as a way to provide power through peaking plants operating at different times of the day. (**0003-17** [Reed, Cyrus])

Comment: NRG has to prove there is a need for new energy. Their assessment of need is based on ERCOT projections of future energy demand in Texas. But, 1. The application ignores the effect energy efficiency and renewable energy will have in the future on demand. 2. Recent studies have shown that we could meet between 75-100% of Texas's growth in demand using efficiency and renewable energy ("Role of Energy Efficiency and Onsite Renewables in Meeting Energy and Environmental Needs in the Dallas/Fort Worth and Houston/Galveston Metro Areas". R. Neal Elliott and Maggie Eldridge. American Council for an Energy-Efficient Economy, September 2007 Report Number E078; (**0010-20** [Public Citizen, Texas Office] [Smith, Tom])

Comment: Federal and state-mandated energy efficiency and renewable energy goals do not appear to be factored into the energy needs assessment. The EPACT of 2007 mandated a ban on incandescent bulbs, increased air conditioning efficiency standards and standards of other appliances, and other efficiency reductions that are not counted in NRG's analysis of need. Nor are the provisions of HB 3693, passed by the Texas Legislature in 2007, factored into the energy needs assessment. The bill doubled the goal of the state of reducing by 10% per year the growth in demand for electricity to a minimum of 20%. A study completed during licensing period showed efficiency may result in as much as 50% of the growth in demand. (**0010-21** [Public Citizen, Texas Office] [Smith, Tom])

Comment: As to CPS's need for power the analysis contains an interesting logical flaw. It claims that an analysis of need is required for traditional utilities, such as CPS, but not for merchant companies such as NRG. It then further claims that since CPS has sold power at wholesale, and will continue to do so in the future, it does not have to do a needs analysis. This logic is imperfect. CPS is a municipal utility, and has not opted into competition, and is limited to incidental sales to customers beyond its traditional service area, so it should have completed a need for power analysis. CPS ignores the study done by KEMA in 2004 for CPS San Antonio that shows that over 1220 MW of baseload savings could be obtained at costs less than 2 cents per kilowatt hour (pg 3.1) or far less than the 6.5 cents per kilowatt than the cost of building and operating the plant. (**0010-22** [Public Citizen, Texas Office] [Smith, Tom])

Response: *Affected states or regions may prepare a need for power evaluation and assessment of the regional power system for planning or regulatory purposes. A need for power analysis may also be prepared by a regulated utility and submitted to a regulatory authority, such as a state public utility commission. However, the data may be supplemented by information from other sources. The determination for the need for power is not under NRC's regulatory purview. When another agency has the regulatory authority over an issue, NRC defers to that agency's decision. The NRC staff will review the need for power and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found to be acceptable, no additional independent review by the NRC is needed. The information provided in this comment will be considered to determine whether it significantly affects the forecast on which the applicant relied for its need for power analysis.*

Comment: Sierra Club believes that an EIS must more independently assess these claims [need for power], and also assess other projects currently being planned in Texas, including new wind generation, plans for solar plants, energy efficiency and demand response program, coal plants and new natural gas plants. (**0003-14** [Reed, Cyrus])

Comment: Our assessment, and along with the Energy Reliability Council of Texas basically says we need power, we need generation, we need new generation on line and we need to retire old units that are in operation, we need new power generation in Texas, we need new base load generation in Texas. (**0007-138** [McBurnett, Mark])

Comment: But the fundamental question is, do we need this plant, and will it be completed on time? And this history of this has not been clear. The last time we tried to build a plant in this community, it took eight years longer than necessary. And what we're seeing here in this particular analysis that has been presented to you all, is that the applicant says we need the plant for baseload. And it's impossible to really utilize other resources like energy efficiency and renewable energy as base load. (**0007-27** [Smith, Tom])

Comment: I wanted to make sure that the NRC is aware that legislation was passed last legislative session... that expands the amount of energy that investor-owned utilities, like NRG, are required to get from energy efficiency programs that all of us, frankly, pay for. And so I wanted to make sure that when you do the analysis of whether this power is needed, that we look at those new requirements on energy efficiency, because I think everyone agrees we can save money for our consumers, and generate more power simply by saving energy. (**0007-43** [Reed, Cyrus])

Comment: The Harris and Galveston County Council of Governments, which is 13 counties, including Matagorda County, recently started last year making plans for an additional 2.5 million people coming to our area by year 2015. That's a footprint of Los Angeles, California, coming on a 13-county area. Matagorda County is going to get its share of those people. We're having to plan for it now. But the main thing is the power that's needed for our state in this area is something we've got to work on. (**0008-19** [Morton, Joe])

Comment: I want to congratulate CPS Energy for their forward-looking windtricity and conservation programs. We've heard this afternoon people talk that we need a mix of conservation, energy saving, renewal resources, and CPS Energy is providing that to us in the San Antonio area. ...But even with this, even with the rest of the citizens doing this in San Antonio, I don't think this is surely enough to meet the future needs of electricity in San Antonio and south Texas. (**0008-25** [Kale, Stephen])

Comment: Secondly, the governments of San Antonio and Bexar County are on record that they desire -- strongly desire continued economic growth in the city -- in Bexar County and in the city. CPS Energy has determined that timely additional electrical generation capacity is required for this growth in south Texas. So I submit that the proposed action and alternatives must be able to meet these requirements. (**0008-27** [Kale, Stephen])

Comment: It has not been shown that there is a need for this expansion. (**0009-3** [Lindsey, Joy])

Comment: The governments of San Antonio and Bexar County are on record that they desire continued economic growth for the City and the County. CPS Energy has determined that timely additional electricity generation capacity Is required for economic growth in South Texas. The proposed action and alternatives must be able to meet these requirements. (**0014-2** [Kale, Stephen])

Response: *Affected states or regions may prepare a Need for Power evaluation and assessment of the regional power system for planning or regulatory purposes. A Need for Power analysis may also be prepared by a regulated utility and submitted to a regulatory authority, such as a State Public Utility Commission. However, the data may be supplemented by information from other sources. The determination for the need for power is not under NRC's regulatory purview. When another agency has the regulatory authority over an issue, NRC defers to that agency's decision. The NRC staff will review the Need for Power and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the Need for Power evaluation is found to be acceptable, no additional independent review by the NRC is needed.*

D.2.21 Alternatives - Energy

Comment: The global climate change question discussed above obviously calls into question using any fossil fuel central generators as an alternative. There are numerous other alternatives, however, that are safe and far more benign environmentally. (**0002-29** [Sinkin, Lanny])

Response: *The EIS will be prepared in accordance with 10 CFR 51.75(c). Alternative energy sources will be considered in the EIS and the potential global climate change impacts of fossil fuel generation stations will also be addressed.*

Comment: One of the applicants, CPSEnergy, has reclassified energy conservation as power generation. This essentially treats energy conservation approaches the same as baseload. (**0002-30** [Sinkin, Lanny])

Comment: The alternatives analysis should examine at least the following: 1. Energy efficiency and conservation, such as a. changing building codes that are leading to more energy efficient buildings, b. retrofitting of existing buildings that is lowering their energy consumption c. the redesign of appliances that is leading to replacing older units with more energy efficient units d. the "small is beautiful" alternatives, such as solar powered attic fans e. existing studies by utilities in the service area regarding possible reduction of energy demand through conservation and efficiency. (**0002-33** [Sinkin, Lanny])

Comment: [B]ecause CPS is an applicant, their own study, which shows the potential to economically obtain 1,220 MW of Demand Savings and Technically 1,935 MWs by 2014 alone through a suite of energy efficiency measures - approximately the energy output of one of the units and approximately 40 % of the total capacity of both plants - this ability to obtain the power they say they need through a cheaper and more alternative must be assessed as part of the EIS. (**0003-11** [Reed, Cyrus])

Comment: A CPS commissioned study, this was mentioned before, the CIMA report, concluded that 1200 megawatts of energy could be saved through stronger building codes and retrofitting programs. That's 80 percent of the half of STP reactors 3 and 4 energy that we are going to be supposedly getting. And that report is nowhere mentioned in this environmental report. So this STP application needs to include a real analysis of alternatives, and all the alternatives for meeting San Antonio's energy needs. (**0007-100** [Cushing, Lara])

Comment: In trying to look through the thousands of pages of this permit application, I realize that the entire scope of the environmental review was based on, and this is a quote, "that the purpose of the project is to sell base-load power on the wholesale market." And the only alternatives to this project that were looked at were alternatives for meeting that mission. But the fact is that that is not CPS Energy's mission. CPS Energy's mission, as a public utility, is to provide for the energy needs of San Antonio, and the other small areas that it covers and serves. (**0007-89** [Acevedo, NK])

Comment: CPS has classified efficiency and conservation measures as a source of generating power. And since it's done that, those need to be given over best analysis in the environmental report. (**0007-90** [Cushing, Lara])

Comment: I believe CPS should be smarter than nuclear power plants, and they believe that we should be the green generation that think about the future and our health, but also the future generations to come. That is why CPS should invest in solar and wind energy. (**0007-98** [Garcia, Sandra])

Comment: CPS's mandate is to serve the energy needs of the greater San Antonio area, and its Strategic Energy Plan identifies energy efficiency as one of its four main tenets. According to its publications, CPS Energy is "so committed to this goal that energy efficiency is treated as a new resource for electrical generation." As such, energy efficiency programs are a directly comparable alternative to the electricity that will be generated from STP 3 & 4 and need to be given full consideration in the EIS. (**0018-3** [Cushing, Lara])

Comment: A 2004 CPS-commissioned study by KEMA Inc. concluded that it was cost effective for CPS to save 1,200 mW through stronger building codes and retrofitting programs, nearly as much as CPS's 1,350 mW share of STP 3 &4's generating capacity, on a comparable if not shorter time scale. Neither this report nor a more recent analysis of efficiency is presented in the permit application. With houses that waste more energy than any other large city in Texas, San Antonio has a huge potential for energy savings from weatherization programs that would contribute to the local economy by lowering family's energy bills and creating "green collar" jobs in San Antonio. (**0018-4** [Cushing, Lara])

Response: *The DEIS will be prepared in accordance with 10 CFR 51.75(c) and will include a discussion of energy alternatives. Energy conservation and efficiency will be discussed as an energy alternative not requiring new generating capacity. Existing conservation programs will also be considered as part of the need for power analysis in Chapter 8 of the DEIS.*

Comment: The alternatives analysis should look at the rate at which alternatives are coming into use and project both what is likely and what is possible. A secondary question to be anwered is: Taking the same funds as will likely be spent on the nuclear plant and investing those funds in direct or subsidized implementation of alternative strategies, could the same amount of energy be saved and/or generated with far less environmental impact? A related question is: Would investment in the alternative technologies buy additional time before new generating capacity would be needed, allowing for still further innovative alternatives and improvements in existing alternatives? (**0002-31** [Sinkin, Lanny])

Comment: Alternative energy, such as a. major breakthroughs in solar energy that are lowering the per watt cost to a level competitive with other sources b. new developments in storage which would permit solar and wind energy to be included as base load plants c. scenarios in which solar, wind, biomass and other sources provide most of the baseload with the available natural gas plants filling in as needed. d. wind energy potential, acknowledging that some environmental impacts, such as the impact on birds, must be addressed e. wave energy f. temperature differential energy extraction (ocean) g. biomass as baseload h. previously suppressed technology, such as Tesla coils This list is far from comprehensive. (**0002-34** [Sinkin, Lanny])

Comment: The most obvious irreversible and irretrievable commitment of resources is the money that will be spent on building the nuclear plants that will not be available for implementation of alternative energy strategies. Once begun, nuclear power plants will demand continuing investment and can be expected to absorb a far higher level than presented when the project is being sold to the utility and public. The analysis of this irreversible and irretrievable commitment of financial resources should evaluate the impact of that commitment on the ability to pursue implementation of alternative energy strategies, such as conservation, efficiency, solar, wind, and biomass. (**0002-36** [Sinkin, Lanny])

Comment: [A]n EIS should not only assess the “no action”, “building nuclear plant at Bay City” or “building it somewhere else,” but assess other projects that NRG and CPS could be pursuing to meet their need to sell wholesale power in the first case, and meet the energy demands of its residents in the second. [T]he 2004 KEMA study commissioned by CPS sets out an alternative path for meeting the 40 percent of the plant that CPS has announced they are seeking a COL for. This should be assessed as part of an EIS. (**0003-15** [Reed, Cyrus])

Comment: If CPS Energy could achieve a better, more cost-effective and environmentally-more-friendly alternative to the proposed nuclear plant, then the EIS should examine that possibility. (**0003-5** [Reed, Cyrus])

Comment: A coal fire power plant spits out more than four times as much radiation as the average nuclear plant does because of contaminants in the coal. In fact, you could generate more power from coal by removing uranium from it and thorium and burning it in nuclear power plants. There's less environmental damage. The EPA estimates that 30,000 Americans die prematurely every year from the effluent from coal-fired power plants. (**0008-104** [Dykes, Ed])

Response: *The no-action alternative, as well as, alternative energy sources will be considered in the EIS. The analysis of alternatives in the EIS will be conducted in accordance with Section 102 of the National Environmental Policy Act and 10 CFR 51.75(c).*

Comment: [E]ach application must be carefully reviewed, and all alternatives to the siting of the plants and indeed to nuclear power itself must be considered as part of the EIS process. (**0003-2** [Reed, Cyrus])

Response: *NRC staff carefully reviews each application it receives by utilizing an acceptance review process to ensure all required components are provided by the applicant. Each application then receives additional scrutiny during the safety and environmental review processes. Examining alternative energy sources and alternative sites is a function of the environmental review process and these topics will be discussed in the EIS.*

Comment: In the case of NRG, nuclear power is not the only option it has as an energy provider. They could - and are - pursuing development of coal plants, but could also be examining demand response and energy efficiency - which because of incentives can earn a provider a profit, on-site and off-site solar, wind, geothermal, biomass and other ways to generate a similar amount of power. (**0003-16** [Reed, Cyrus])

Comment: There is no analysis of energy efficiency programs, and the solar analysis is based upon 2003 estimates of a cost of 0.108 and 0.187 per kilowatt hour, which are well above recently developed solar projects in California and Nevada. Indeed, the City of Austin has been receiving bids for proposed solar off-site plants that are on the low-end of this range, and recent technological improvements forecast lower solar energy costs over the next five years. An EIS must provide a much more extensive analysis of these alternatives than that provided in the ER. (**0003-18** [Reed, Cyrus])

Comment: While Chapter Nine does provide some analysis of coal-fired and natural gas plants, and concludes that they are not preferable to nuclear power because largely of the air quality impacts, such a conclusion does not take into account how that compares with the long-term impacts of uranium mining and radioactive waste. Indeed, there is no real comparison between the three choices other than the conclusion that air quality impacts mean nuclear power is preferable. For example, coal, gas - and the alternatives that are never really considered such as energy efficiency, biomass, solar and wind - or some combination of all - are never assessed for the fact that they do not produce radioactive waste in large quantities. (**0003-19** [Reed, Cyrus])

Comment: In the areas of alternative energy, the EIS should also consider major commitments being made to accelerate the development of alternative, renewable energy. For example, the commitment of Silicon Valley to solar cells is discussed in “Silicon Valley Turns its Face to the Sun” in the New York Times on February 17, 2008. Google intends to spend hundreds of millions of dollars to hire engineers and other experts to develop solar, wind, geothermal, and other renewable resources. Austin Chronicle, February 8, 2008 at 31. (**0004-1** [Sinkin, Lanny])

Comment: Well, let me just say it once again, so it’s absolutely clear what we’re in favor of. Conservation, renewables and energy efficiency. (**0007-118** [Singleton, Robert])

Comment: I moved to Matagorda County in 1997 and I have lived very peacefully with STP down the road, and I have felt very safe. But my problem is, is that I do have a concern about building more nuclear power plants, as opposed to looking for alternative choices, other green choices. Of course, we have this huge yellow ball in the sky that burns us to death every summer, actually from March until like November, which is an endless source of power. (**0007-132** [Schwank, Eleanor])

Comment: As a matter of fact, yes, we need solar, we need wind, we need conservation, we need nuclear, and we need clean coal. We need all of those to meet our energy demands. Energy is what drives the economy of Texas, it’s what drives the economy of the world. It’s important, we need to plan for that energy. If we don’t, we’ll go, as an economy, down the hill. (**0007-139** [McBurnett, Mark])

Comment: Yet there are three studies not referenced in this most recent submission by NRG to you all that have been done in the last several years. One on San Antonio in particular that said we could save more than 1200 megawatts, far more than CPS’s share of this plant, if we did energy efficiency at costs less than building this plant. Another by Optimal Energy that said that the state could save 80 percent of the energy -- the growth in demand for energy that this plant is designed to meet. And yet another most recently by AC Triple E indicating that we could save between 75 percent of the growth in demand for energy, and 101 percent of the growth in demand for energy in either the Houston or Dallas areas respectively, by using energy efficiency as our first resource, along with other resources like combined heating and power, and renewable energies. (**0007-28** [Smith, Tom])

Comment: And I also think that if we’re going to really analyze the power demands of -- that may be needed by these new plants, we’ve also got to look at the cities like San Antonio, like Austin, that may be investing in the plant and see -- look at how they meet their energy demands and whether they could be getting their energy in a cheaper, cleaner and faster manner. (**0007-44** [Reed, Cyrus])

Comment: -- let’s make sure we look at all the choices. If the choice is this new nuclear plant, or concentrated solar power and efficiency, which really makes the most sense. And I hope, frankly, that NRG and the other investors are looking at all the options that are out there on the table, some of which I think could be used in Matagorda County. (**0007-58** [Reed, Cyrus])

Comment: Now I understand that our energy needs here in Texas are growing. However, there are alternatives to nuclear power here in Texas, which are cleaner, more affordable, and more sustainable ways of powering our needs for the future. Alternatives include energy efficiency, solar power, wind, combined heat and power, and more. In addition, just not too long ago Optimal Energy discovered that 80 percent of our energy needs could be met by these technologies. (**0007-87** [Castro, Geoffrey])

Comment: We can also talk about alternative power and how there's no disposal plant for solar collectors. It might surprise a lot of you to understand that the incredible chemical mix that's in solar panels, including arsenic. The burden on the environment with arsenic, which, by the way, has an infinite half-time -- not a 100,000 years, but infinite. (**0008-105** [Dykes, Ed])

Comment: If you look at the carbon footprint of the life cycle of the nuclear power's life cycle from the mining of the uranium all the way through the disposal of the waste that carbon footprint is the equivalent and the same footprint for solar and for wind and for hydro. (**0008-127** [Shepherd, Joe])

Comment: [T]he land for these reactors [units 3 and 4] exists. Installation of the equivalent capacity [of solar and/or wind alternatives] -- and, again, I think when these alternatives and proposed actions are evaluated they've got to be done on an equivalent basis. So I think that installation of alternatives has got to be the equivocal capacity to what the proposed action for the nuclear plants will be. (**0008-29** [Kale, Stephen])

Comment: I'm thinking primarily of wind and solar [energy alternatives], which would I think require large areas of land -- primarily the agrarian areas -- out in west Texas. I think the EIS needs to determine whether installation of these alternatives -- and I'm thinking about Fort Stockton -- the wind farms out there -- of Big Spring just off of I-20, and if you go up to Sweetwater and over across I-20 to Spider there are hundreds of windmills up there. So the EIS I think needs to evaluate installation of either wind, solar, whatever, and determine if there are any impacts -- primarily impacts on land usage, ecology, wildlife, other natural resources. (**0008-30** [Kale, Stephen])

Comment: And as a third generation Matagorda County resident I understand the concerns and -- that we have about nuclear power. But I also understand the huge drawbacks that we're having today with our continued overuse of fossil energy. We as a county, of course, a state and nation need to look at solar, wind, bio, and, of course, nuclear energy for our future. (**0008-31** [Head, Bobby])

Comment: This area has offshore wind, and there is a small town mayor in west Texas named Sherry Phillips. I heard her say the same things -- that when wind energy came to their community for the first time their kids could come home. They could live and work in the community. They could run cattle underneath the wind turbines. That's a possibility for this community as well. And I urge NRG to seriously consider that path. (**0008-50**)

Comment: Why do we consider such a costly, potentially destructive, and unnecessary project instead of employing more benign solutions such as conservation, wind, and solar? (**0009-7** [Lindsey, Joy])

Comment: I am writing to express my concern about the proposed expansion of the South Texas Nuclear Power plant (Federal Register Vol.72, No. 245/ Friday, December 21, 2007/Notices Page 72775). As a resident of Houston, just to the north of this plant, I would like to know why this expansion has been proposed rather than expansion of our state's enormous potential for wind energy. (**0011-1** [Russell, Nancy])

Comment: Texas needs more non-polluting sources of electricity such as wind and solar. Utilities also should promote energy conservation as a way to avoid new construction of power plants. (**0012-6** [Edwards, Nancy])

Comment: The land for the proposed reactors exists. Installation of the equivalent capacity of solar and/or wind alternatives will require immense areas of agrarian lands in West Texas. The EIS should evaluate whether installation of equivalent capacity of these alternatives would negatively impact land use, ecology. wild life, or other natural resources. (**0014-4** [Kale, Stephen])

Comment: The clear alternative to coal and nuclear power plants is renewables: wind, sun, water, and geothermal. These technologies are on the horizon. Venture capitalists are presently investing in the development of the necessary technology to make these renewable sources of energy practical on a nationwide basis. According to a recent analysis by The National Renewable Energy Laboratory (NREL) - the country's primary research and development facility for renewable technology - "the entire U.S. electricity demand could technically be met by renewable energy resources by 2020. In the longer term, the potential of domestic renewable resources is more than 85 times current U.S. energy use." (**0015-8** [Williams, Mina])

Comment: [A]ccording to the November 5, 2007, U.S. News and World Report cover story, "Power Revolution," one of the most promising renewable energy sources is geothermal, which taps into Earth's steady, reliable warmth. According to this article, recent studies show that techniques developed in the oil industry can be used to release geothermal energy three or more miles underground. (**0015-9** [Williams, Mina])

Comment: We are concerned by the inadequate inclusion of the public in the decision by our public utility CPS Energy to construct two new nuclear reactors at the South Texas project (STP) and the total lack of an assessment of alternative ways to meet San Antonio's energy needs in the Environmental Impact Statement (EIS) as required under the National Environmental Policy Act. As the ratepayers that will finance this project, we have a right to a full and transparent assessment of alternatives. (**0018-1** [Cushing, Lara])

Comment: The EIS needs to include a thorough analysis of alternatives specific to meeting San Antonio's energy needs that includes proactive weatherization and retrofitting programs, stronger building codes, combined heat and power or cogeneration strategies, renewable energy production, and combinations thereof. This analysis needs to receive as much consideration in terms of technical expertise, time and financial investment as the proposed new nuclear reactors have received. (**0018-5** [Cushing, Lara])

Comment: STP 3 & 4 would be a huge financial investment for San Antonio ratepayers and will with all likelihood greatly overrun initial cost and time projections, preventing CPS from making large scale investments in efficiency and a renewable energy future. We deserve a full analysis of those different futures, free of radioactive waste, the pollution associated with uranium mining and enrichment, weapons proliferation, and the danger to public health and the environment from leaks and accidents at STP, before this project progresses any further. (**0018-6** [Cushing, Lara])

Response: *The EIS will be prepared in accordance with 10 CFR 51.75(c). Alternative energy sources, including energy conservation and renewable energy sources, will be considered in <Chapter 9 of> the EIS.*

D.2.22 Alternatives - System Design

Comment: [T]he large cooling pond you see at South Texas, that 7,000-acre reservoir, is used for cooling the main turbine. It's the main heat sink for the plant as the plant is in operation. Provided in Unit 1 and 2 is a pond for providing for emergency cooling should that be required. Unit 3 and 4 will actually have a cooling tower for emergency cooling for what we call the ultimate heat sink. ... it's not one of these monster hyperbolic towers like you see in all the pictures that one associates with a nuclear plant. These are small towers, more akin to what you see out behind a large commercial building that provided for air conditioning. (**0008-122** [McBurnett, Mark])

Response: *This comment provides some information regarding the cooling system in use for STP Units 1 and 2 and the Ultimate Heat Sink cooling towers proposed for STP Units 3 and 4. No response is needed.*

Comment: They have a giant cooling pond out there. Depending on which part of that COLA you read, they're either going to use cooling towers -- four-strap cooling towers on Units 3 and 4 or they're going to use the cooling pond itself. I'm not sure which one it is. (**0008-73** [Wagner, William])

Comment: Speaking about the cooling link, what part of makeup requirements are going to be for both instances or decide which one you're going to use and tell us that one. (**0008-76** [Wagner, William])

Response: *The Main Cooling Reservoir serves as the heat sink during normal operation of STP Units 1 and 2 and would operate similarly for STP Units 3 and 4. The make-up water for the reservoir is obtained from the Colorado River. The cooling towers for STP Units 3 and 4 would be part of the Ultimate Heat Sink that would provide cooling for safety-related systems and components during normal and accidental conditions. The cooling water required for the Ultimate Heat Sink cooling towers would be stored in basins beneath the towers and make-up water to these basins would be provided by on-site water storage basins that contain 30-day* *supply of make-up water. Make-up water to the on-site water storage basins would be provided by groundwater. A detailed description of the cooling system for STP Units 3 and 4 will be presented in Chapter 3 of the DEIS.*

D.2.23 Alternatives - Sites

Comment: The analysis of choosing an alternative site - such as NRG's land owned in Limestone County - concludes that the existing Matagorda County [STP] site is preferable but is based largely on the possibility that additional transmission lines would be needed at the Limestone County site. The analysis seems too simplistic. (**0003-20** [Reed, Cyrus])

Response: *The DEIS <Chapter 9> will include a more detailed analysis of siting the proposed nuclear generating units at alternative sites located within the applicant's region of interest.*

D.2.24 Benefit-Cost Balance

Comment: [B]ecause the City of Austin hired a consultant to study the NRG and CPS proposal and found that the risk of investing in the application process outweighed the benefit because of the potential for the cost of the construction and licensing to exceed the estimates provided by the applicant by $1 billion, this analysis must be included as part of the discussion of alternatives. (**0003-12** [Reed, Cyrus])

Comment: Failure to provide financial information needed for true alternative analysis: the applicant has asked for and the NRC has granted an exemption to disclosing basic financial information about the proposal. Thus, in Chapter 1 of the COL application, tables [1.3-1 through 1.3-9] have been declared proprietary and thus unavailable for public review. The reason that project cost, construction funds, O & M costs and plant performance are an environmental issue is because NEPA requires an analysis of alternatives to the proposed action, and without cost figures and analysis of the construction and O & M costs, it is impossible to know if the energy demand needed could be more cost-effectively be achieved through other means, or with construction of a nuclear plant at another site. (**0003-4** [Reed, Cyrus])

Comment: It is also difficult to assess whether the plant would generate the monies needed for ongoing repairs, the ability to respond to emergency situations, and the ability to provide decommissioning costs without a financial analysis. Even assuming that EPA and NRC have the needed financial information provided by the applicants to assess these issues, it will be difficult as a member of the public to add to the discussion through the draft EIS process without making at least basic financial information disclosed. (**0003-6** [Reed, Cyrus])

Comment: The lack of financial information - at least publicly available - also makes it difficult to assess Chapters 8, 9 and 10 of the applicants Environmental Report. (**0003-8** [Reed, Cyrus])

Comment: [The EIS] also needs to incorporate the true costs of nuclear power. And if it did, there's no way that nuclear power would come out on top. There's reasons why no nuclear reactors -- the construction of nuclear reactors has not been permitted in 29 years, despite that fact that it's the most government subsidized energy source of all. And one of the reasons why the true costs of nuclear are never evaluated is because NRC only looks at a small price. The fact is that the construction of new generators is -- and the speculation about the construction of new generators, is already driving up the price of uranium, which means communities are fighting tooth and nail right now to prevent new uranium mining permits from being issued in South Texas. That is an environmental impact of the South Texas Project. (**0007-92** [Cushing, Lara])

Comment: We get no cost figures out of that COLA -- none. Everything is proprietary. That's nonsense. I can get cost figures on ones that they haven't even put applications in on. And in some cases they've already decided it costs too much. The one thing that would kill this -- and it won't be guys like me -- is money. And if we don't know what's going on we'll never know, will we? (**0008-86** [Wagner, William])

Comment: Nuclear power is not competitive with other forms of power generation and requires taxpayer dollars to subsidize. (**0009-2** [Lindsey, Joy])

Comment: Nuclear power still requires Federal subsidies to make it competitive with other forms of power generation. (**0012-3** [Edwards, Nancy])

Comment: As one leading advocate for green technology puts it: "Any state that allows the construction of new nuclear power plants in the face of today's global industrial competition and financial turmoil will be committing economic suicide.- (Harvey Wasserman, Testimony to the Public Utilities Commission of the Ohio House, January 30, 2008). (**0015-11** [Williams, Mina])

Comment: Nuclear power plants are not cost effective. Nuclear power plants have required exorbitant cost overruns, are dependent on massive federal subsidies, and need continual expensive maintenance. Cost to taxpayers is extreme. (Southwest Workers' Union April 25, 2007). (**0015-4** [Williams, Mina])

Response: *The applicant is authorized by 10 CFR 2.390 that trade secrets and commercial and financial information be held by NRC as privileged or confidential, subject to certain procedural controls allowing access to the information. The Commission also determines whether the right of the public to be fully apprised as to whether the bases for and effects of the proposed action outweighs the demonstrated concern for protection of a competitive position, and whether the information should be withheld from public disclosure. The NRC has determined that the requested financial information shall be held as confidential. The comparison of alternatives in the DEIS is an environmental comparison, not a financial one.*

Comment: The intergenerational aspect of producing high level waste for every generation coming after us so that we can have supposedly cheaper electricity should be a part of the analysis of unavoidable impacts of pursuing the project. (**0002-25** [Sinkin, Lanny])

Comment: You know, as a young person I wonder why we are putting so many money and energy into this when in the last 50 years the nuclear problems have not even been solved. (**0007-73** [Lopez, Diana])

Response: *The DEIS will discuss the provisions for the long-term storage of spent fuel. The NRC's Waste Confidence Rule, found in 10 CFR 51.23, states: The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. The rule covers new reactors and applies to the staff's review of an early site permit or a combined license application. The Atomic Safety and Licensing Board presiding over the proceeding on the Grand Gulf early site permit application affirmed that the Waste Confidence Rule and its subsequent amendments clearly include waste produced by a new generation of reactors.*

Comment: Given that the applicant in the application makes it clear they will rely on the federal Department of Energy guarantees to peak interest in capital investment markets, the financing of the project would seem a reasonable area to be investigated as part of the EIS. If the financing for the project does not work, there is the potential to have the project stalled, which could have environmental impacts. (**0003-7** [Reed, Cyrus])

Response: *The benefit-cost balance for the project will rely on the best available estimate of project timing and duration and will note any uncertainties in the analysis.*

Comment: CPS provides my residential electricity at a cost much lower than the national average. My suspicion is that that's due in a large part to the operation of the nuclear plants. My own residence bill is about $35 a month lower than this national average. 35 bucks a month doesn't sound like much, but over the course of a year I think that's a pretty good piece of change. So I think that the proposed action and the alternatives need to consider this and be able to meet this type of a requirement. If they can't then the EIS should go into the impacts -- the negative impacts – socio-economic impacts on the residents and the businesses in San Antonio. (**0008-28** [Kale, Stephen])

Comment: CPS Energy provides residential electricity at a cost much lower than the national average. My own residence bill is about $35 a month less than the national average. The EIS should evaluate whether the proposed action and alternatives will improve or retain this low cost, and if not evaluate negative socioeconomic impacts. (**0014-3** [Kale, Stephen])

Response: *The purpose of the environmental impact statement is to disclose potential environmental impacts of building and operating of the proposed nuclear power plant. The determination for the impact of building and operating a nuclear power plant on retail power rates is not under NRC's regulatory authority.*

Appendix E

Draft Environmental Impact Statement Comments and Responses

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This appendix is intentionally left blank. In the final Environmental Impact Statement (EIS), this appendix will include comments and responses received on the draft EIS.

Appendix F

Key Consultation Correspondence

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Correspondence received during the evaluation process for the combined license application for the siting of two new nuclear units, Units 3 and 4, at the South Texas Project Electric Generating Station (STP) site in Matagorda County, Texas, is identified in Table F-1. In addition, full copies of the Biological Assessment and Essential Fish Habitat documents are included in this appendix.

Table F-1. Key Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (William Burton)	National Marine Fisheries Service (Mr. David Bernhart)	January 25, 2008 ML080020174
U.S. Nuclear Regulatory Commission (William Burton)	Alabama-Coushatta Tribe, Historical Preservation Department	January 25, 2008 ML080090115
U.S. Nuclear Regulatory Commission (William Burton)	Kiowa Tribe of Oklahoma (Mr. Billy Evans Horse)	January 25, 2008 ML073620378
U.S. Nuclear Regulatory Commission (William Burton)	Comanche Nation NAGPRA and Historic Preservation Program (Ms. Ruth Toahty)	January 25, 2008 ML0703620358
U.S. Nuclear Regulatory Commission (William Burton)	Tonkawa Tribe of Oklahoma (Mr. Anthony E. Street)	January 25, 2008 ML080090198
U.S. Nuclear Regulatory Commission (William Burton)	Advisory Council on Historic Preservation (Mr. Don Klima)	January 25, 2008 ML080100669
U.S. Nuclear Regulatory Commission (William Burton)	Texas State Historic Preservation Officer (Mr. Lawerence Oaks)	January 25, 2008 ML080110216
U.S. Nuclear Regulatory Commission (William Burton)	Fish and Wildlife Service (Ms. Moni Belton)	January 25, 2008 ML080090170
U.S. Nuclear Regulatory Commission (William Burton)	Texas Parks and Wildlife Department (Ms. Kathy Boydston)	April 4, 2008 ML080730469
STP Nuclear Operating Company (Mr. Gregory Gibson)	Texas General Land Office (Mr. Benjamin Rhame)	April 22, 2008 ML091760272
Texas Parks and Wildlife (Mr. Carter Smith)	U.S. Nuclear Regulatory Commission (William Burton)	May 19, 2008 ML090330752

Table F-1. (contd)

Source	Recipient	Date of Letter
Texas General Land Office (Mrs. Tammy Brooks)	STP Nuclear Operating Company (Mr. Gregory Gibson)	June 09, 2008 ML091590374
U.S. Army Corps of Engineers (Mr. Fred Anthamatten)	U.S. Nuclear Regulatory Commission (Mr. Scott Flanders)	July 7, 2008 ML082140640
U.S. Nuclear Regulatory Commission (Mr. Scott Flanders)	U.S. Army Corps of Engineers (Mr. Fred Anthamatten)	August 29, 2008 ML082310619
STP Nuclear Operating Company (Mr. Scott Head)	Texas Commission on Environmental Quality (Mr. Mark Fisher)	February 03, 2009 ML090360530
U.S. Army Corps of Engineers (Mr. Kenny Jaynes)	STP Nuclear Operating Company (Mr. Russell Kiesling)	April 07, 2009 ML091050501
U.S. Army Corps of Engineers (Mr. Kenny Jaynes)	STP Nuclear Operating Company (Mr. Russell Kiesling)	May 14, 2009 letter ML091350101 Memo ML091390111
STP Nuclear Operating Company (Mr. Scott Head)	U.S. Army Corps of Engineers (Mr. Jayson Hudson)	June 04, 2009 ML092030309
U.S. Army Corps of Engineers (Mr. Casey Cutler)	STP Nuclear Operating Company (Mr. Scott Head)	July 08, 2009 ML092030304
U.S. Army Corps of Engineers (Mr. Jayson Hudson)	U.S. Nuclear Regulatory Commission (Ms Jessie Muir)	August 10, 2009 ML092460137
U.S. Nuclear Regulatory Commission (Ms Jessie Muir)	Fish and Wildlife Service (Ms. Moni Belton)	October 15, 2009 ML092580516
U.S. Nuclear Regulatory Commission (Ms Jessie Muir)	Texas Parks and Wildlife Department (Mr. Carter Smith)	October 15, 2009 ML092580421
STP Nuclear Operating Company (Mr. Scott Head)	U.S. Army Corps of Engineers (Mr. Jayson Hudson)	October 29, 2009 ML093210232
U.S. Army Corps of Engineers (Mr. Jayson Hudson)	STP Nuclear Operating Company (Mr. Scott Head)	November 10, 2009 ML093210227
Texas Parks and Wildlife (Mr. Ross Melinchuk)	U.S. Nuclear Regulatory Commission (Mr. Ryan Whited)	November 13, 2009 ML093210221
U.S. Nuclear Regulatory Commission (Ms. Jessie Muir)	Texas Parks and Wildlife (Ms. Amy Hanna)	January 20, 2010 ML093450914

Table F-1. (contd)

Source	Recipient	Date of Letter
Texas Commission on Environmental Quality (Mr. Charles Maguire)	U.S. Nuclear Regulatory Commission (Mr. Ryan Whited)	February 2, 2010 ML100500926
U.S. Army Corps of Engineers (Mr. Casey Cutler)	U.S. Nuclear Regulatory Commission (Mr. Ryan Whited)	February 19, 2010 ML100660017

Biological Assessment

National Marine Fisheries Service

South Texas Project Electric Generating Station Units 3 and 4

U.S. Nuclear Regulatory Commission Combined License Application

Docket Nos. 52-012 and 52-013

U.S. Army Corps of Engineers Permit Application

Matagorda County, Texas

March 2010

U.S. Nuclear Regulatory Commission
Rockville, Maryland

U.S. Army Corps of Engineers
Galveston District

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application from STP Nuclear Operating Company (STPNOC) for two combined construction permit and operating licenses (combined licenses or COLs) for two new reactors at the South Texas Project Electric Generating Station (STP) site in Matagorda County, approximately 12 mi south-southwest of Bay City, Texas (Figure 1). STPNOC submitted the COL application to the NRC on September 20, 2007. The STP site and existing facilities are owned by NRG South Texas LP (NRG), City Public Service Board of San Antonio, Texas (CPS Energy), and the City of Austin, Texas. It is planned that proposed Unit 3 would be owned by Nuclear Innovation North America (NINA) South Texas 3 LLC and CPS Energy, and proposed Unit 4 would be owned by NINA South Texas 4 LLC and CPS Energy (STPNOC 2009a). Concurrent with the NRC's review, the U.S. Army Corps of Engineers (Corps) is reviewing STPNOC's application for a Department of the Army (DA) Permit to build the proposed reactors on the STP site. The NRC and the Corps are cooperating agencies with the NRC serving as the lead agency. This biological assessment (BA) supports a joint consultation with the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) pursuant to Section 7(c) of the Endangered Species Act of 1973, as amended (ESA).

The NRC and the Corps are preparing an environmental impact statement (EIS) as part of the agencies' review of the COL and DA permit applications pursuant to the National Environmental Policy Act (NEPA). As required by Title 10 of the Code of Federal Regulations (CFR) Part 51.26, the NRC has published a Notice of Intent (72 FR 72774) in the *Federal Register* to prepare an EIS, conduct scoping, and publish a draft EIS for public comment. The final EIS would be issued after considering public comments on the draft. The impact analysis in the EIS includes an assessment of the potential environmental impacts of the construction and operation of two new nuclear power units at the STP site and along the associated transmission line corridors, including potential impacts to threatened and endangered species. If approved, the COLs and DA permit would authorize STPNOC to construct and operate the new units.

This BA examines the potential impacts on threatened or endangered species due to construction of the proposed Units 3 and 4 at the STP site. As discussed in the STP EIS, operation of the proposed two new nuclear power units at the STP site would not affect critical habitat or Federally listed species within the jurisdiction of NMFS. Therefore, this BA focuses on the species that may be affected by construction activities, specifically barging of heavy equipment and materials to the site. These species include loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), and Kemp's ridley sea turtle (*Lepidochelys kempii*) (Table 1).

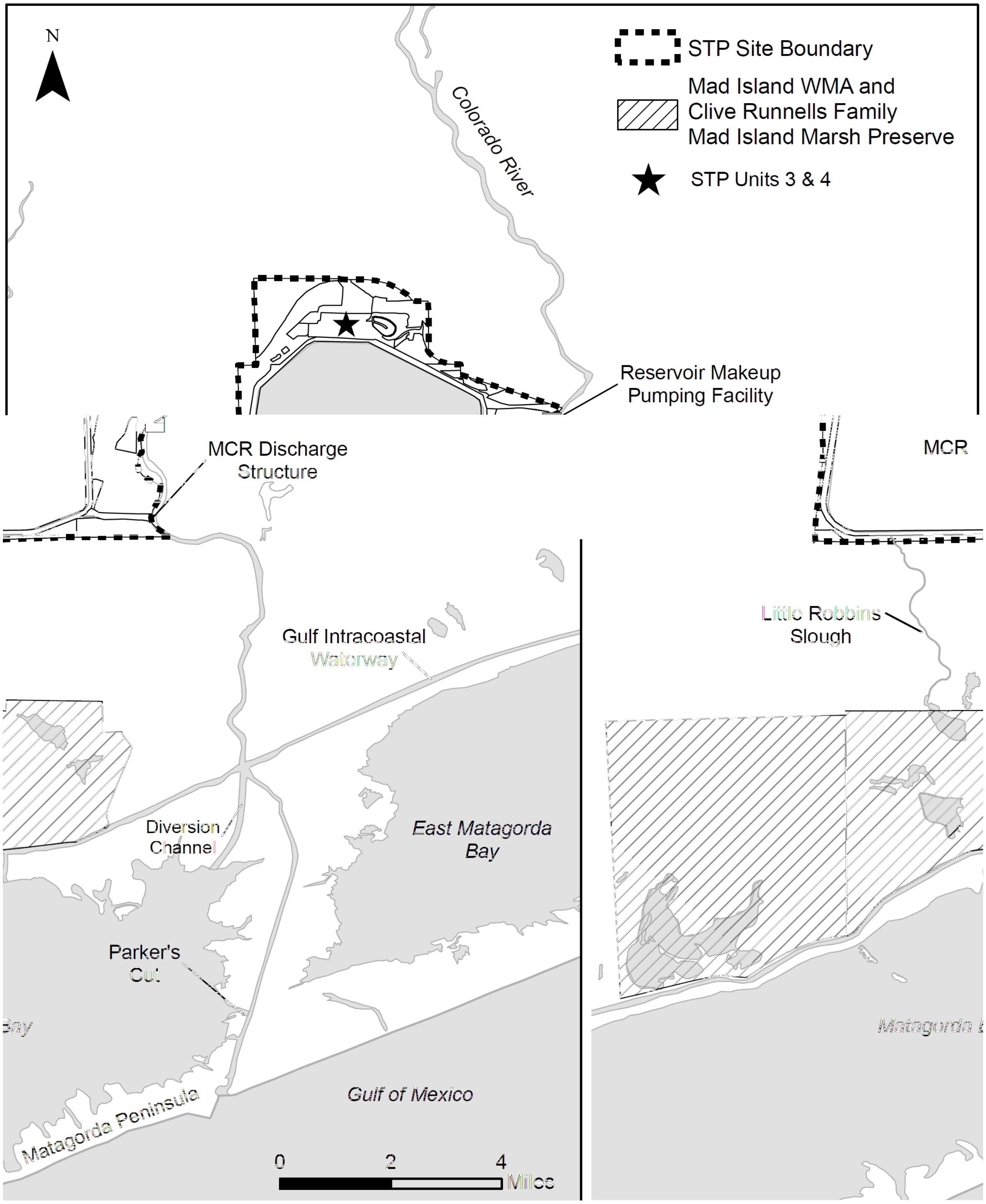


Figure 1. Location of the STP Site and Major Important Aquatic Resources

Table 1. Federally Listed Marine Species Occurring in the Vicinity of Transportation Routes to the STP Site (NMFS 2009a)

Scientific Name	Common Name	Federal Status
Caretta caretta	loggerhead sea turtle	Threatened
Chelonia mydas	green sea turtle	Threatened
Dermochelys coriacea	leatherback sea turtle	Endangered
Eretmochelys imbricata	hawksbill sea turtle	Endangered
Lepidochelys kempii	Kemp's ridley sea turtle	Endangered

2.0 South Texas Project Site Description

The STP site is located in a rural area of Matagorda County, Texas. STPNOC currently operates two nuclear generating units (existing STP Units 1 and 2) on the site. The site is located approximately 10 mi north of Matagorda Bay, 70 mi south-southwest of Houston, and 12 mi south-southwest of Bay City, Texas. The site is along the west bank of the Colorado River, approximately 6 navigable miles from the confluence with the Gulf Intracoastal Waterway (GIWW). This section provides a description of the existing and proposed facilities and the ecological resources found at the site of the proposed project and in the vicinity.

2.1 Existing and Proposed Facilities on the STP Site

The 12,220-ac STP site currently contains two pressurized water reactors and their associated facilities, which occupy approximately 300 ac. The main condenser heat sink for the existing two units is a 7000-ac reservoir called the Main Cooling Reservoir (MCR). The 7000-ac MCR is a constructed impoundment enclosed by an engineered embankment with a maximum normal operating pool of 49 ft mean sea level. The existing units also have a much smaller 46-ac Essential Cooling Pond (ECP) for their Ultimate Heat Sink (UHS). Makeup water for the MCR is withdrawn from the Colorado River at the Reservoir Makeup Pumping Facility (RMPF) to maintain the reservoir volume and control the concentration of total dissolved solids in its waters. The RMPF is located on the west bank of the river, approximately 8 navigable miles upstream of the confluence of the Colorado River and the GIWW. Near the southeast corner of the MCR is a spillway and blowdown discharge pipeline, which releases water to the Colorado River downstream from the RMPF. The spillway allows release of excess water from the MCR to the Colorado River during heavy precipitation events. The blowdown discharge pipeline allows for controlled releases of water from the MCR into the Colorado River through seven valve boxes along the river shoreline. Next to and downstream of the RMPF is a barge slip that was used for delivery of major equipment during the construction of Units 1 and 2. STPNOC's proposed location for proposed Units 3 and 4 is wholly within the STP site, approximately 1500

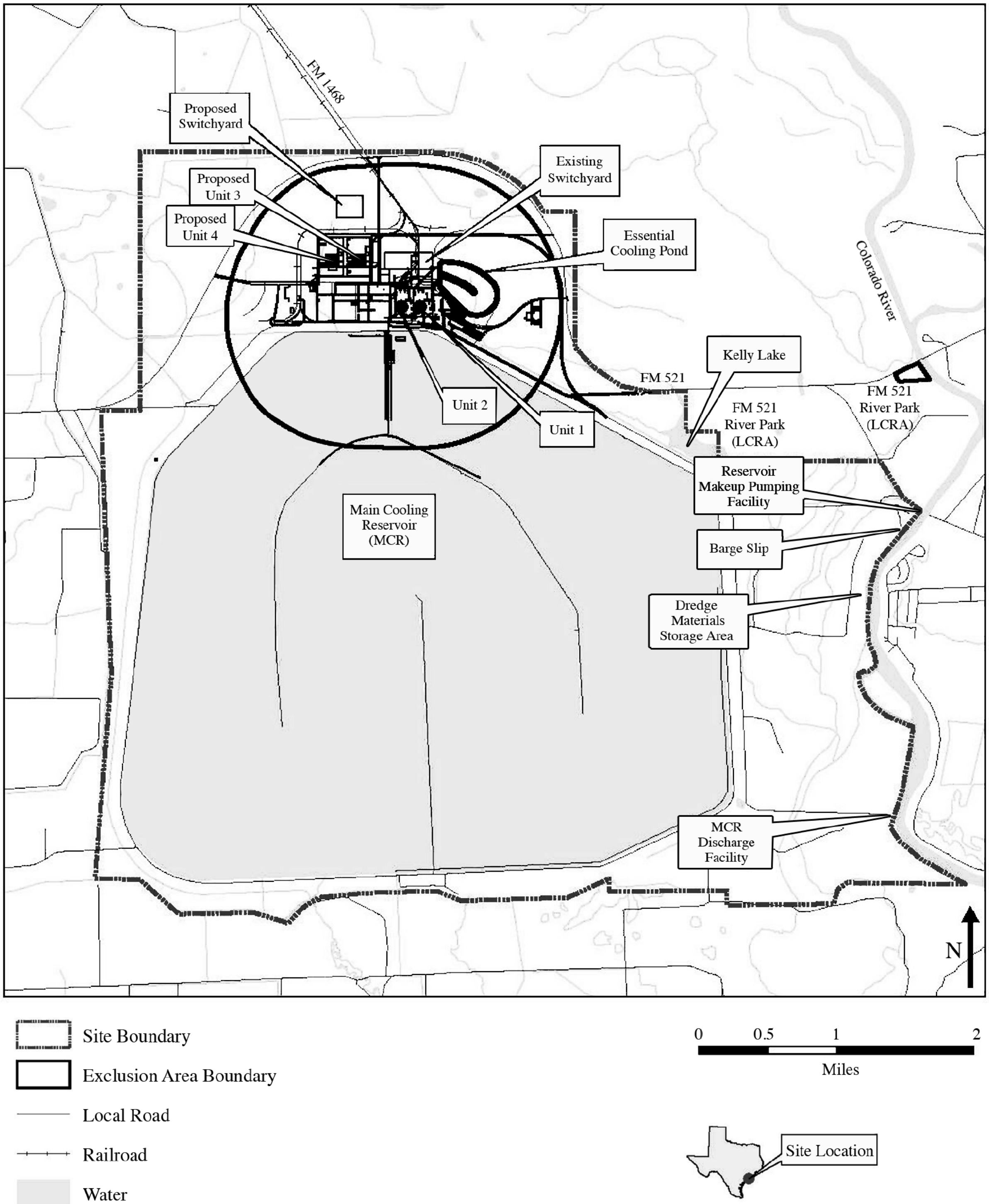


Figure 2. STP Site and Proposed Plant Footprint (STPNOC 2009a)

Many of the existing facilities already were designed to support four nuclear reactor units, and the proposed Units 3 and 4 would rely on these facilities. The main condenser heat sink for the proposed units would be the MCR. The proposed new units would not rely on the ECP as an UHS in the event of an emergency, but rather would rely on two 119-ft-tall mechanical draft cooling towers that would be located north of the MCR (STPNOC 2009a). Modifications to the RMPF associated with the two new units would be limited and include refurbishing or replacing intake screens for currently unused bays and the addition of two new pumps. Maintenance dredging in front of the intake screens and the RMPF's forebay would continue during construction and operation of the new units. No changes or upgrades are planned for the spillway and blowdown discharge pipeline from the MCR to the Colorado River to support the new units. The barge slip would be refurbished to allow delivery of material for constructing Units 3 and 4. In the event of an emergency, the proposed Units 3 and 4 would not rely on the ECP as a UHS. Instead, they will rely on two mechanical draft cooling towers as mentioned above (STPNOC 2009a). In addition, the Corps would periodically dredge the Colorado River to maintain the navigation channel from the GIWW to a point upstream of the STP site.

2.2 Aquatic Ecological Resources

The aquatic resources associated with the STP site include onsite water resources (sloughs, drainage areas, wetlands, Kelly Lake, and the MCR) and offsite water resources, particularly the Colorado River. The species of concern for this BA are associated with the offsite water resources. This section will discuss the offsite water resources likely to be affected by the barging activities for the construction and operation of the proposed STP Units 3 and 4.

The Colorado River is one of the largest river systems within the State of Texas. The river is approximately 862 mi, extending from the high plains to the coastal marshes in Matagorda County. The section of the river near the STP site, between Bay City and the GIWW, is a diverse, fluvial system that meanders through the coastal plain providing freshwater, sediments, and nutrients to Matagorda Bay (ENSR 2008a). The lower Colorado River has been studied on a limited basis with specific studies conducted in 1974, 1976, 1983, and 1984 associated with the licensing of existing STP Units 1 and 2 (NRC 1975, 1986) and in 2007-2008 associated with the licensing of the proposed STP Units 3 and 4 (ENSR 2008a).

Changes in the aquatic community in the Colorado River over time were evaluated using the results of the 1974, 1983, 1984, and 2007-2008 studies. These studies span the time of construction and operation of the existing STP Units 1 and 2, as well as the Corps' Mouth of Colorado River project that completed the diversion of the Colorado River into Matagorda Bay in July 1992. The sampling locations and gear types varied with each study, making some comparisons more difficult. Trawl samples collected from the GIWW to the STP site in 1974 showed a moderately diverse species community for the lower river based on measures for species richness, diversity, and evenness. All three measures were slightly lower than those in similar segments of the river compared to the 2007-2008 study, suggesting that the diversity of aquatic species is greater now than in the past. Data collected during 1974 examining specific segments also indicated a diverse species community for all three segments. The 1983-1984 trawl and seine data indicated overall lower species richness, diversity, and evenness relative to the present data (ENSR 2008a). Rerouting of the lower Colorado River has likely contributed to these changes in diversity of aquatic species.

The number and assortment of organisms collected during this study indicate that this portion of the lower Colorado River supports a diverse assemblage of fauna. The regular occurrence of both freshwater and saltwater species, the range of macroinvertebrate and finfish fauna, and the sheer number of species captured among various sampling gears and river reaches provide evidence of a dynamic ecosystem. There was a low to moderate level of similarity between the current 2007-2008 faunal communities and the historic communities (1974 and 1983-84) (ENSR 2008a).

Matagorda Bay is 300 mi^2 formed by a 45-mi-long barrier island parallel to the coast and is located to the southeast of STP. The Bay is connected naturally to the waters on the site through the discharges of Little Robbins Slough into the marshes next to the GIWW, which then flow into Matagorda Bay. As mentioned, the Colorado River flows past STP, across the GIWW, and into a diversion channel, which flows into the Bay. The Bay is described as the Matagorda Bay system, and it is the third largest estuary on the Texas coast. The Bay system includes Lavaca, East Matagorda, Keller, Carancahua, and Tres Palacios Bays (Corps 2007).

The aquatic community of the Matagorda Bay system includes organisms in open water areas, as well as organisms over hard substrates (including oyster reefs and offshore sands). In the open water areas of the Bay, phytoplankton (e.g., algae) are the major primary producers providing the main food source for zooplankton (e.g., small crustaceans), fish, and benthic organisms (e.g., mollusks). A study of Lavaca Bay found that phytoplankton species composition changes based on the season, with maximum abundance occurring in the winter and minimum in the summer, and the most dominant organisms were diatoms (Corps 2007). Zooplankton composition also changed seasonally, with the greatest abundance during the spring and minimum in the fall. The same composition of phytoplankton and zooplankton are thought to be found throughout the Matagorda Bay estuary (Corps 2007).

The Matagorda Bay system supports a diverse population of aquatic organisms that are found in the open water column (nekton), including fish, shrimp, and crabs. The nekton assemblages consist mainly of secondary consumers feeding on zooplankton or juvenile and smaller organisms in the water column. Some of these species are resident species, spending their entire life in the Bay, whereas other species may spend only a portion of their life cycle in the Bay. According to a summary of studies on the nekton species in the Matagorda Bay estuary, the dominant nekton species include the bay anchovy (*Anchoa mitchilli*), Atlantic croaker (*Micropogonias undulatus*), white shrimp (*Litopenaeus setiferus*), brown shrimp

(*Farfantepenaeus aztecus*), hardhead catfish (*Ariopsis felis*), sand seatrout (*Cynoscion arenarius*), blue crab (*Callinectes sapidus*), and Gulf menhaden (*Brevoortia patronus*). All of these species are ubiquitous along the Texas coast, and they are unaffected by seasonal or other short-term changes (e.g., salinity). The abundance of these species changes with the season, with biomass and number usually being the smallest in the fall after Gulfward migrations. In the winter and early spring, newly spawned fish and shellfish begin migrating into the Bay, with the maximum biomass observed during the summer months (Corps 2007). Many of these species have been collected in the Colorado River and some in the MCR at the STP site (NRC 1975, 1986; ENSR 2008a, 2008b; STPNOC 2009a).

Areas of the Matagorda Bay estuary that are not considered open water include oyster reefs (Eastern oyster, *Crassostrea virginica*) and offshore sands. The oyster reefs of Matagorda Bay are formed in areas where the substrate is hard and the current is strong enough to provide phytoplankton and nutrients to the oysters and carry sediment away from the organisms. The reefs are subtidal or intertidal and found near passes, cuts, and along the edges of marshes. The oyster reefs provide an ecologically important function to the Bay system by supplying habitat to other benthic organisms and influencing water clarity and quality (oysters can filter water 1500 times the volume of their body per hour). While oysters can survive in salinities ranging from 5 to more than 40 ppt, they thrive within a range of 10 to 25 ppt. The current distributions of oyster reefs in Matagorda Bay are not mapped, but the prominent locations (including commercial harvests) are in the vicinity of Lavaca Bay (Corps 2007). Primary goals of the diversion of the Colorado River into the Bay are to increase mixture of freshwater in the estuary and to enhance locations of the Bay for further reef development (Wilbur and Bass 1998; Corps 2005).

The offshore sands of the Matagorda Bay system include areas of open sandy substrate, as well as regions where seagrass or attached algae grow. Much of the faunal diversity in these areas is buried in the sand, and the organisms rely on the phytoplankton for food. Sand dollars (*Mellita quinquiesperforata*) and several species of brittle stars (*Hemipholis elongata*, *Ophiolepis elegans*, and *Ophiothrix angulata*) are some of the most common species found in the shallow offshore sands. The bivalves in offshore sands include the blood ark (*Anadara ovalis*), incongruous ark (*Anadara brasiliana*), southern quahog (*Mercenaria campechiensis*), giant cockle (*Dinocardium robustum*), disk dosinia (*Dosinia discus*), pen shells (*Atrina serrata*), common egg cockle (*Laevicardium laevigatum*), crossbarred venus (*Chione cancellata*), tellins (*Tellina* spp.), and the tusk shell (*Dentalium texasianum*). The most common gastropods are moon snail (*Polinices duplicatus*), ear snail (*Sinum perspectivum*), Texas olive (*Oliva sayana*), Atlantic auger (*Terebra dislocata*), Sallé's auger (*Terebra salleana*), Scotch bonnet (*Phalium granulatum*), distorted triton (*Distorsio clathrata*), wentletraps (*Epitonium* spp.), and whelks (*Busycon* spp.). Crustaceans also inhabit the open sand areas, including white and brown shrimp, rock shrimp (*Sicyonia brevirostris*), blue crabs, mole crabs (*Albunea* spp.), speckled crab (*Arenaeus cribrarius*), box crab (*Calappa sulcata*), calico crab (*Hepatus epheliticus*), and pea crab (*Pinnotheres maculatus*). With respect to the number of individuals found in the open sands, the most abundant infaunal organisms are the polychaetes (Capitellidae, Orbiniidae, Magelonidae, and Paraonidae) (Corps 2007).

Aquatic resources of the GIWW in the vicinity of Matagorda Bay up to Port Freeport are not well described. The aquatic ecology is thought to be similar to that found in Matagorda Bay. GIWW is used extensively for commercial traffic and recreational use. The locks in the GIWW at the confluence of the Colorado River probably disrupt some aquatic organisms from moving through the area. Maintenance dredging of the GIWW occurs at such a frequency that the typical benthic community found in Matagorda Bay does not fully recover (Corps 2007).

3.0 Proposed Federal Actions

This section provides information on the potential aquatic impacts of construction activities related to the proposed Units 3 and 4 at the STP site. The proposed Federal actions are NRC's issuance of two COLs for construction and operation of two new nuclear reactors at the STP site pursuant to 10 CFR Part 52 and the Corps' issuance of a DA permit pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Appropriation Act of 1899.

The NRC, in a final rule dated October 9, 2007 (72 FR 57416), limited the definition of "construction" to activities that fall within its regulatory authority in 10 CFR 51.4. Many of the activities required to build a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term "preconstruction." Preconstruction activities include clearing and grading, excavating, erection of support buildings and transmission lines, and other associated activities. These preconstruction activities may take place before the application for a COL is submitted, during the staff's review of a COL application, or after a COL is granted. Although preconstruction activities are outside the NRC's regulatory authority, many of them are within the regulatory authority of local, State, or other Federal agencies. The distinction between construction and preconstruction is not carried forward in this BA, and they are being discussed together as construction activities for this Section 7 consultation.

This BA addresses the potential impacts posed by the construction activities that have the potential to interact with aquatic threatened and endangered species under the jurisdiction of NMFS. Primarily, these activities are associated with transport of materials and equipment using barges, which is not part of the NRC action. Operations of Units 3 and 4 would not interact with Federally listed aquatic threatened and endangered species or critical habitat.

Delivery of major equipment for proposed Units 3 and 4 would be by barging the material to the site. The cargo that would be barged to the site includes heavy equipment (prefabricated modules and large components fabricated overseas) and bulk commodities (e.g., aggregate or structural fill materials). STPNOC has stated that no firm shipping contracts have been developed for transportation of the materials to the STP site. However, STPNOC has indicated the current plans call for the heavy equipment to be shipped to the Port of Freeport (or points north) where they would be transferred from ocean-going ships to inland barges. The inland barges would then enter the GIWW, move south to the confluence of the Colorado River, and proceed upstream to the site. Currently, the ports in Matagorda Bay to the south of the site do not have adequate facilities for the transfer of heavy cargo from ocean-going vessels to inland barges. Therefore, transport of these materials would not involve the Matagorda Shipping Channel or the diversion canal in Matagorda Bay (STPNOC 2009b).

STPNOC plans to ship bulk commodities (e.g., aggregate or structural fill materials) via inland barges. Access to the Colorado River by the barges would depend on the source of the materials and could be transported either from the north or south along the GIWW. However, no bulk commodity traffic is expected to traverse the diversion canal in Matagorda Bay or the Matagorda Shipping Channel (STPNOC 2009b).

4.0 Protected Estuarine and Marine Species Descriptions

NMFS lists 11 threatened and endangered species in Texas (Table 2). Of these species, only the sea turtles are expected to be associated with the construction of proposed STP Units 3 and 4. The other species listed by NMFS for Texas are either too far away from the site (e.g., whales) or have not been found in the vicinity of the Colorado River or Matagorda Bay for numerous years (e.g., smalltooth sawfish [*Pristis pectinata*] [TPWD 2009a]). This section describes the life history and habitat use for the Federally listed sea turtles along the routes for ocean-going ships and inland barges that would transport materials to the STP site.

There are two families and six genera of living sea turtles containing eight species (Pritchard 1996). All but one of the species are in the family Cheloniidae. The leatherback sea turtle is the only living member of the family Dermochelyidae. Five of the eight living species of sea turtles occur in the Gulf of Mexico. These species are the loggerhead sea turtle, the green sea turtle, the leatherback sea turtle, the hawksbill sea turtle, and the Kemp's ridley sea turtle. Although each of these species have nested along the Texas coast, no critical habitat has been designated in the State for any of these sea turtle species (Pritchard 1996; NMFS 2009a; NPS 2009).

Table 2. Federally Listed Estuarine and Marine Species Occurring in Texas (NMFS 2009a)

Listed Species	Scientific Name	Status	Date Listed
Fish			
smalltooth sawfish	*Pristis pectinata*	Endangered	04/01/2003
Marine Mammals			
sei whale	*Balaenoptera borealis*	Endangered	12/02/1970
blue whale	*Balaenoptera musculus*	Endangered	12/02/1970
fin whale	*Balaenoptera physalus*	Endangered	12/02/1970
humpback whale	*Megaptera novaeangliae*	Endangered	12/02/1970
sperm whale	*Physeter macrocephalus*	Endangered	12/02/1970
Turtles			
loggerhead turtle	*Caretta caretta*	Threatened	07/28/1978
green sea turtle	*Chelonia mydas*	Threatened	07/28/1978
leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/1970
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	06/02/1970
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/1970

4.1 Loggerhead Turtle (*Caretta caretta*)

The loggerhead turtle was named for its relatively large head and has powerful jaws used to feed on hard-shelled prey, such as whelks and conchs. Its carapace is slightly heart-shaped and reddish-brown, while the plastron is generally a pale yellowish color. Adult turtles weigh 170 to 400 lb and have a carapace up to 41 in. long. Females nest on beaches in subtropical and temperate areas and may nest several times during a breeding season (April to September), laying as many as 110 eggs per clutch. The hatchings vary in color from light to dark brown to dark gray, and they lack the reddish-brown coloration of the adults and juveniles. When loggerheads hatch, they are about 1.7 in. long and weigh approximately 0.04 lb (Prichard and Mortimer 1999; NMFS 2009b; TPWD 2009b).

4.1.1 Reasons for Status

The loggerhead turtle was listed as a threatened species throughout its range on July 28, 1978 (43 FR 32808). Until the 1970s, these turtles were commonly harvested commercially for their meat, eggs, leather, and fat. While the loggerhead is the most common and abundant turtle on the inshore coastal waters of the Gulf of Mexico, its population has been declining as a result of overexploitation by man, fishing and trawling activities inadvertently killing individuals, and natural predation. The most significant threats to the loggerhead are development, commercial fisheries, and pollution (NMFS 2009b; Corps 2007; TPWD 2009b).

4.1.2 Habitat and Life History

Loggerhead turtles are mainly found over the continental shelf and in bays, estuaries, lagoons, creeks, and mouths of rivers, but they can also occur in the open seas as far as 500 mi from shore. Loggerheads prefer warm temperate and subtropical regions not far from shorelines. Adult loggerheads occupy various habitats, from turbid bays to clear waters of reefs, while subadults occur mainly in nearshore and estuarine waters. Hatchlings move directly from their nest into the sea, and then often float in masses of sargassum (*Sargassum* sp.). Juvenile loggerheads may remain associated with sargassum for perhaps three to five years (NMFS and FWS 2008; Corps 2007).

Loggerheads consume a wide variety of both benthic and pelagic food items. Their prey has been found to include conches, shellfish, horseshoe crabs, prawns, other crustacea, squid, sponges, jellyfish, basket starts, fish (carrion or slow-moving species), and even hatchling loggerhead turtles (Corps 2007). Adults forage primarily on the bottom but will also take jellyfish from the surface. The young feed primarily on the surface, grazing on gastropods and fragments of crustaceans as well as sargassum.

Nesting usually occurs on open sandy beaches above the high-tide mark and seaward of well-developed dunes. Loggerheads prefer steeply sloped beaches with gradually sloped offshore approaches on high-energy beaches on barrier islands adjacent to continental land masses (Corps 2007).

4.1.3 Range

The loggerhead is widely distributed in tropical and subtropical seas, being found in the Atlantic Ocean from Nova Scotia to Argentina; the Gulf, Indian, and Pacific Oceans (although it is rare in the eastern and central Pacific); and the Mediterranean Sea. In the continental U.S., loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey and sporadically along the Gulf Coast. In recent years, a few have nested on barrier islands along the Texas coast (Corps 2007). The loggerhead is the most abundant sea turtle species in U.S. coastal waters (NMFS and FWS 2007a).

4.1.4 Distribution in Texas and Presence in the Study Area

The most abundant sea turtle in the Texas coastal region is the loggerhead. The species prefers the shallow inner continental shelf waters and only infrequently does it move into the bays. The turtles are often found near offshore oil rig platforms, reefs, and jetties. They are likely present off the coast year-round. However, they are most often observed in the spring when their favorite food, the Portuguese man-of-war (*Physalia physalis*), is abundant. The loggerhead turtles are the most common species of sea turtles found washed ashore, either dead or moribund (stranded), on the Texas coast each year (Sea Turtle Stranding and Salvage Network [STSSN] 2009). The greatest proportion of these deaths appears to be the result of accidental capture by shrimp trawlers, when caught turtles drown. There was no positive documentation of loggerheads nesting along the Texas shoreline before 1977 (Hildebrand 1982). Nesting sites in Texas have been confirmed since 1999 when two loggerhead nests were verified and again in 2000 when five loggerhead nests were confirmed. Between 2001 and 2005, up to five loggerhead nests per year have been recorded on the Texas coast (Corps 2007). In 2006, one nest each was observed on Padre Island National Seashore and on South Padre Island (NPS 2009). Loggerhead populations have declined in Texas as they have worldwide. In the early 1900s, the species was taken in Texas for local consumption, and a few were marketed (Hildebrand 1982; Corps 2007).

The loggerhead turtle has been found in the vicinity of Matagorda Bay. Within the study area, a loggerhead was killed in 1996 during dredging operations in the entrance channel of the Matagorda Shipping Channel. In 2006, two loggerheads were taken at the entrance channel of the shipping channel during dredging operations (Corps 2007).

4.2 Green Turtle (*Chelonia mydas*)

The green turtle has a smooth shell and is the largest of the hard-shelled sea turtles. Adult turtles can grow to be more than 3 ft long and can weigh 300 to 350 lb. They have a smooth carapace that can be shades of black, gray, green, and brown in starburst or irregular patterns. The adults are unique in that they are herbivorous, feeding on primarily seagrasses and algae. The nesting season for green turtles varies based on location, but, typically, nesting occurs from June through September. The females choose a variety of locations for nesting, from large open beaches to small cove beaches, and can lay from 110 to 130 eggs per clutch (NMFS and FWS 1991; Prichard and Mortimer 1999; Corps 2007; NMFS 2009c; TPWD 2009b).

4.2.1 Reasons for Status

On July 28, 1978, the green turtle was listed throughout its range as a threatened species except for Florida and the Pacific Coast of Mexico where it was listed as endangered (43 FR 32808). Green turtles have declined primarily due to their commercial harvest, where the eggs and adults are used for food and other body parts for leather and jewelry. The recovery of the species has been hindered by mortality of juveniles and adults caught incidentally by commercial shrimp trawling. Various other fishing operations have also affected recovery of the species (NMFS 2009c). Another threat to the survival of the species is epidemic outbreaks of fibropapillomatosis, or “tumor” infections, in green turtle populations, especially in Hawaii and Florida. The cause of these outbreaks is largely unknown, but the disease is thought to be caused by a viral infection (Barrett 1996; Corps 2007).

4.2.2 Habitat and Life History

Adult green turtles are found primarily in shallow habitats such as lagoons, bays, inlets, shoals, estuaries, and other areas where they can find an abundance of marine algae and seagrasses. They often use coral reefs and rocky outcrops near where they feed as resting areas. Individual adults passing through open ocean are thought to be migrating to feeding grounds or nesting beaches (Meylan 1982). Hatchlings often can be found floating in rafts of sargassum (sea plants) in convergence zones. The adults are primarily herbivorous, while the juveniles consume more invertebrates. Green turtles consume primarily seagrasses, macroalgae, and other marine plants. Juveniles, and sometimes adults, also feed on mollusks, sponges, crustaceans, and jellyfish (Mortimer 1982; Corps 2007).

Green turtles typically come to shore only for nesting activities. However, they sometimes can be seen basking on beaches in areas such as Hawaii and the Galápagos Islands. They prefer to enter high-energy beaches with an open offshore approach and deep sand, which may be coarse to fine with little organic content. Generally, green turtles nest at the same beach each year, which is apparently their natal beach (Balazs 1980; Prichard and Mortimer 1999; Corps 2007; NMFS and FWS 2007b).

4.2.3 Range

The green turtle is a circumglobal species in tropical and subtropical waters. They are found in U.S. Atlantic waters around the U.S. Virgin Islands and Puerto Rico and the continental U.S. from Massachusetts to Texas. Major nesting activity occurs on Ascension Island, Aves Island (Venezuela), Costa Rica, and in Surinam. Relatively small numbers nest in Florida, with even smaller numbers in Georgia, North Carolina, and Texas (NMFS and FWS 1991; Hirth 1997; Corps 2007).

4.2.4 Distribution in Texas and Presence in the Study Area

The green turtle in Texas generally inhabit shallow bays and estuaries around seagrass beds. Small juvenile turtles have been observed in bays that are devoid of seagrasses and are thought to be feeding on benthic invertebrates and jellyfish. The worldwide decline in green turtles has also been seen in the population off of the Texas coast. During the mid- to late-19th century, there was a green turtle fishery in Matagorda Bay, Aransas Bay, and the lower Laguna Madre, although a few also came from Galveston Bay. By 1900, however, the fishery had collapsed. Still, some turtles continued to be collected commercially until 1935 (Hildebrand 1982; Corps 2007).

Green turtle nests are rare in Texas. Padre Island National Seashore has recorded from one to five nests per year since 1987, except in 1999 when no nests were found (NPS 2009). Florida and Mexico are more common areas for green turtle nests. Adult green turtles found in Texas waters are thought to be in transit to distant feeding grounds or nesting beaches. Juvenile turtles found in Texas bays are thought to be using those waters as they move to other feeding grounds (Corps 2007).

A study by Williams and Renaud (1998) in 1996-1997 found that four of the green turtles fitted with radio transmitters spent time in Lavaca Bay, western Matagorda Bay, and Powderhorn Bayou. A green turtle was recorded swimming in the Matagorda Ship Channel, and one was taken during dredging operations at the same location in 2004 (Corps 2007). In 2006, two green turtles were killed during maintenance dredging of the entrance and jetty channels of the Freeport Harbor Project. No green turtle nests have been recorded in the vicinity of the STP site (Corps 2007, 2008; NPS 2009).

4.3 Leatherback Turtle (*Dermochelys coriacea*)

Leatherback turtles are the largest and most distinctive of the living sea turtles. They reach a length of 78 in. and weigh more than 2000 lbs. Large, outstretched front flippers of the adult turtles may span 106 in. Lacking a keratinized shell, they are covered instead with a tough hide. Because they have physiological adaptations for heat conservation, leatherback turtles are more widely distributed as adults than other sea turtles in temperate and boreal waters throughout the world. However, all leatherbacks return to subtropical and tropical shores to nest (NMFS 2009d).

4.3.1 Reasons for Status

On June 2, 1970, the leatherback sea turtle was listed as endangered throughout its range (35 FR 8495). Critical habitat was designated for leatherbacks in the U.S. Virgin Islands (43 FR 43688 and 44 FR 17710). Estimating the world population of leatherbacks is based on nesting populations. Spotila et al. (1996) estimated the 1995 worldwide population of nesting female leatherbacks at 26,000 to 42,000. The decline of leatherbacks is attributable to overexploitation of the turtles for various uses, as well as incidental mortality from commercial shrimping and fishing activities. Leatherbacks have been known to be killed from complications after consuming litter, particularly plastics that are thought to be mistaken for jellyfish by the turtles. Other reasons for the decline of the turtles include collection of eggs for food and destruction or degradation of nesting habitat. Leatherbacks are probably more susceptible than other turtles to drowning in shrimp trawlers equipped with turtle excluder devices (TEDs) because the adults are too large to pass through the TED exit opening. To address this, NMFS established a leatherback conservation zone extending from Cape Canaveral to the Virginia-North Carolina border, and commercial shrimping activities can be closed when there is an abundance of leatherbacks in those vicinities (NMFS and FWS 1992a; Corps 2007).

4.3.2 Habitat and Life History

The leatherback sea turtle is mainly pelagic, found in the open ocean, and seldom approaches land except for nesting. Leatherbacks are most often found in coastal waters only when nesting or when following populations of jellyfish. The turtles dive almost continuously, often to great depths. Their diet consists largely of jellyfish and sea squirts, but they are also known to consume sea urchins, squid, crustaceans, fish, blue-green algae, and floating seaweed (FWS 1980). Leatherback turtles typically nest on wide, long beaches with steep slope, deep, rock-free sand and an unobstructed deep water or mud-bottom approach (Prichard and Mortimer 1999; Corps 2007; TPWD 2009b).

4.3.3 Range

Leatherback turtles probably have the greatest range of all the sea turtle species. They are found in the Atlantic, Pacific and Indian Oceans; as far north as British Columbia, Newfoundland, Great Britain, and Norway; as far south as Australia, the Cape of Good Hope, and Argentina; and in other water bodies such as the Mediterranean Sea. Leatherbacks are known to migrate further and venture into colder water than any other marine reptile. Adult turtles appear to engage in routine migrations between boreal, temperate, and tropical waters, presumably to optimize both foraging and nesting opportunities. During the summer, leatherbacks tend to occur off the coast of the Atlantic states, from the Gulf of Maine south to the middle of Florida (Corps 2007; NMFS and FWS 2007c).

Nesting areas are primarily in the tropical regions, including Malaysia, Mexico, French Guiana, Surinam, Costa Rica, and Trinidad. The turtles nest infrequently on the Atlantic and Gulf of Mexico coasts. The largest nesting assemblages occur in the U.S. Virgin Islands, Puerto Rico, and Florida (Corps 2007; NMFS and FWS 2007c).

4.3.4 Distribution in Texas and Presence in the Study Area

There have been no recorded leatherback nests in Texas since the 1930s when one was found on Padre Island. There have been occasional reports of leatherbacks feeding on jellyfish off Port Aransas and in the Brownsville area. No leatherback turtles have been taken by dredging activities in Texas. One leatherback was caught in 2003 by a relocation trawler in a shipping channel approximately 1.5 mi north of Aransas Pass (NMFS and FWS 1992a, 2007c; TPWD 2007; Corps 2007, 2008). This species is unlikely to occur in the vicinity of the STP site.

4.4 Hawksbill Turtle (*Eretmochelys imbricata*)

The hawksbill turtle is a medium-sized tropical and subtropical species that inhabits the warm waters of the Atlantic, Pacific, and Indian Oceans (NMFS and FWS 1993). It is the most tropical of the sea turtles and is restricted primarily to warmer waters more than the other four sea turtles found in the Gulf of Mexico. In U.S. territorial waters, hawksbills occur along the U.S. coast of south Texas and along the Gulf and Atlantic coasts of Florida. Adult nesting females have a carapace length of about 34 in. and weigh about 176 lbs. The largest hawksbill on record weighed 276 lbs. Hatchlings are about 1.7 in. long and weigh 0.5 to 0.7 oz (NMFS and FWS 1993). In the U.S. Caribbean and Florida Keys, overexploitation severely depleted hawksbills during the 20th century. Since banning sales of turtle shell products, hawksbills may no longer be in decline at present. However, data are not available to indicate that numbers are increasing (NMFS and FWS 1993, 2007d; NMFS 2009e).

4.4.1 Reasons for Status

On June 2, 1970, the hawksbill turtle was Federally listed as endangered throughout its range (35 FR 8495). Critical habitat for the species was designated in Puerto Rico (43 FR 22224 and 63 FR 46693). The greatest threat to this species is commercial harvest of the turtle for its highly valued shell and as stuffed turtle curios. The hawksbill is also used in the manufacture of leather, oil, perfume, and cosmetics. Other threats to hawksbill turtles include destruction of breeding locations by beach development, incidental take in lobster and Caribbean reef fish fisheries, pollution by petroleum products (especially oil tanker discharges), entanglement in persistent marine debris, and predation on eggs and hatchlings (Corps 2007; NMFS 2009e).

4.4.2 Habitat and Life History

Hawksbills generally are found in coastal waters less than 70 ft deep, including coastal reefs, bays, rocky areas, passes, estuaries, and lagoons. Like loggerhead and green turtles, hatchlings are often found around sargassum rafts in the open ocean. Hawksbills reenter coastal waters as juveniles. Coral reefs are widely used for foraging on sponges by juveniles, subadults, and adults. In Texas, juvenile hawksbills are associated with stone jetties (FWS 1980; Corps 2007; NMFS 2009e).

Hawksbills are considered omnivorous, but they prefer invertebrates, especially encrusting organisms such as sponges, tunicates, bryozoans, mollusks, corals, barnacles, and sea urchins. Along the coast, they also consume algae, sea grasses, and mangroves. In open waters, the turtles consume jellyfish and fish. The young turtles appear to be more herbivorous than adults (Corps 2007; NMFS 2009e).

Nesting typically is the only time hawksbills are found on shore. Hawksbills almost exclusively nest in the tropics on islands or the mainland. They are typically solitary nesters and prefer nesting on narrow beaches with reefs obstructing offshore approach (Prichard and Mortimer 1999; Corps 2007).

4.4.3 Range

Although it does occur in many temperate regions, the hawksbill turtle is probably the most tropical of all the marine turtles. Its range is circumtropical, occurring in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The hawksbill turtle is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf (especially Texas) and south to Brazil. In the continental U.S., the hawksbill sporadically nests in Florida. However, a major nesting beach exists on Mona Island, Puerto Rico. Small numbers of nests have been observed elsewhere in the western Atlantic, along the Gulf Coast of Mexico, the West Indies, and along the Caribbean coasts of Central and South America (NFMS and FWS 1993; Corps 2007).

4.4.4 Distribution in Texas and Presence in the Study Area

Outside of Florida, Texas is the only state where hawksbills are encountered with any regularity. Most of these sightings are of post-hatchling and juvenile turtles around stone jetties. These small turtles probably traveled north from nesting beaches in Mexico. The first and only hawksbill nest recorded in Texas was in 1998 at Padre Island National Seashore (NMFS and FWS 1993, 2007d; Corps 2007, 2008; TPWD 2009b). This species may potentially occur in the vicinity of the STP site.

4.5 Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley turtle is one of the smallest living sea turtles. Adult females have shell lengths of 24 to 28 in., and they weigh 77 to 99 lb (NMFS and FWS 1992b). Pelagic-phase juvenile Kemp's ridleys range in size from 2 to 8 in. in carapace length. Subadults are 8 to 24 in. long, and mature adults generally are longer than 24 in. in carapace length (Marquez 1994). Kemp's ridley turtles are distributed throughout the Gulf of Mexico and into the Atlantic Ocean. The center of their distribution is in the Gulf of Mexico. The Kemp's ridley turtle is the most endangered sea turtle in the world (NMFS and FWS 1992b) and is listed as endangered throughout its range. From 1947 to 1985, the number of females nesting at the only significant Kemp's ridley nesting beach dropped from more than 40,000 to as low as 702 (NMFS and FWS 2007e). This is the most severe population decline documented for any species of sea turtles. Since the mid 1980s, there has been a noticeable increase in the number of nests. In 2003, an estimated 3,600 turtles produced over 8,000 nests (NMFS 2009f). While this trend is positive, the criteria for downlisting the status for Kemp's ridley sea turtles under the ESA put forth in the recovery plan have not yet been met (NMFS and FWS 2007e).

4.5.1 Reasons for Status

On December 2, 1970, the Kemp's ridley turtle was listed as endangered throughout its range (35 FR 18320). Primarily, the decline of this species has been the result of human activities, including collection of eggs, fishing for juveniles and adults, killing adults for meat and other products, and direct take for indigenous use. Another major factor in the loss of the species is the high level of incidental takes by shrimp trawlers (NMFS and FWS 1992b; NMFS 2009f; Corps 2007).

Campbell (1995) documented the loss of Kemp's ridley turtles due to the consumption of debris on the Texas coast. Postmortem examinations of Kemp's ridleys found stranded from 1986 through 1988 revealed 54 percent (60 of the 111 turtles examined) had eaten some type of marine debris. The most commonly ingested debris included pieces of plastic bags, Styrofoam, plastic pellets, balloons, rope, and fishing line. Other debris was also found, such as glass, tar, and aluminum foil. Campbell speculated that the source of the debris was from offshore oil rigs, cargo ships, commercial and recreational fishing boats, research vessels, naval ships, and other vessels operating in the Gulf.

Further threats to this species include collisions with boats, explosives used to remove oil rigs, and entrapment in coastal power plant intake pipes (Campbell 1995). Incidental takes of Kemp's ridley turtles have happened in association with dredging operations, particularly with hopper dredges. Placement of dredged materials, degraded water quality/clarity, and altered current flow associated with dredging activities can also affect turtles through channelization of the inshore and nearshore areas degrading foraging and migratory zones (NMFS and FWS 1992b).

4.5.2 Habitat and Life History

Kemp's ridleys inhabit shallow coastal and estuarine waters, usually over sand or mud bottoms. Adult turtles are primarily shallow-water benthic feeders, where they forage on crabs, while juveniles feed on sargassum and other organisms found in the mass of plants (NMFS and FWS 1992b). In some regions, juvenile and adult Kemp's ridleys almost exclusively eat blue crabs. Other food items in the Kemp's ridleys diet include shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and occasional marine plants (Campbell 1995; Corps 2007).

Nesting occurs in a highly synchronized manner with large numbers of females (called an "arribada") coming ashore within a period of a few hours during daylight (Marquez 1994). Hatchlings migrate rapidly down the beach and out to sea, where they spend a period of perhaps two years in the pelagic zone. They are about 8 in. long at the end of the pelagic period. Little is known about the feeding behavior and food preferences of hatchling Kemp's ridley turtles during their pelagic stage. During this period, they presumably feed on zooplankton and floating matter, including sargassum weed and the associated biotic community. Following a pelagic feeding stage shortly after hatching and lasting for several months, the juvenile Kemp's ridleys move into shallow coastal waters to feed and grow. The young subadults often forage in water less than 3 ft deep, but they tend to move into deeper water as they grow. Because of their preference for crabs and other primarily shallow-water demersal prey, juvenile and adult Kemp's ridley turtles concentrate in coastal waters less than 30 ft deep throughout their range. They make long dives to the bottom and may feed on the bottom for an hour or more at a time (Turtle Expert Working Group 1998).

4.5.3 Range

Nearly all reproduction of Kemp's ridleys takes place along a single 9.3-mi stretch of beach near Rancho Nuevo, Tamaulipas, Mexico, about 200 mi south of Brownsville, Texas (Marquez 1994). A small number of nests have been found in Texas and along the Mexican coast of the Gulf of Mexico between Playa Lauro Villar, Tamaulipas, Mexico and Isla Aguada, Campeche, Mexico, but nothing that reaches the level of nests at Rancho Nuevo.

4.5.4 Distribution in Texas and Presence in the Study Area

Kemp's ridley turtles occur in Texas in small numbers and, when observed, are probably in transit between crustacean-rich feeding areas in the northern Gulf and breeding grounds in Mexico. As mentioned earlier, the number of nesting Kemp's ridley turtles has been increasing, which may be a sign of the earliest stages of recovery for the species. The species has nested sporadically in Texas in the last 50 years with reports increasing over the last 12 years from four nests in 1995 to 102 nests in 2006 (a majority of the nests are located at Padre Island National Seashore). There was one nest recorded on Matagorda Peninsula in 2002 and four on Matagorda Island in 2004. The increase in nests is related to the success of breeding programs in Texas. A study by Williams and Renaud (1998) in 1996 found that seven of the Kemp's ridley turtles fitted with radio transmitters spent most of their time within 4 mi of the western shoreline of Matagorda Bay, but they also swam to Lavaca Bay, Carancahua Bay, Tres Palacios Bay, and Powderhorn Bayou. Two Kemp's ridleys were taken at the entrance of the Matagorda Ship Channel in 2006 during dredging operations (NMFS and FWS 1992b, 2007e; Corps 2007, 2008; TPWD 2009b). Of all the turtles, Kemp's ridleys are likely to be the most common in the vicinity of the STP site.

5.0 Potential Environmental Effects of the Proposed Actions

This section describes potential impacts from construction of the proposed Units 3 and 4 at the STP site to the sea turtle species found in the Gulf of Mexico and on the coast of Texas. As stated above, impacts from operation of the proposed new units are highly unlikely to affect sea turtles as they do not swim upstream in the Colorado River to STP site.

The potential impacts to Federally threatened and endangered sea turtle species resulting from the barging of heavy equipment and bulk commodities to the STP site are associated with collisions between the vessels and the turtles, capture in the turbine washes of the vessels, and potential disorientation from lights on the vessels. Sea turtles may be present at certain times of the year when barging traffic is moving through the Port of Freeport, Matagorda Ship Channel, and the GIWW. The five species of sea turtles discussed above would all be exposed to these potential impacts to degrees relative to their occurrence in Texas waters. There are no areas designated as critical habitat near the STP site (Corps 2007, 2008; NMFS and FWS 2007a, b, c, d, e; NMFS 2009a).

Loggerhead, green and Kemp's ridley turtles have all been recorded in the area where barging traffic for STP equipment and material would be expected to travel. Kemp's ridley turtles have nested in the vicinity, and all the other sea turtle species are known to have nested to the south of the study area. An estimate of the species of sea turtles in the study area can be obtained from the STSSN, which tracks, collects, and documents standing of marine turtles in the Gulf of Mexico. STSSN divides the Gulf into zones, and the study area is included in zone 19, which extends from Freeport to Port Aransas, Texas. From 1986 through 2007, STSSN reported a total of 1051 strandings in zone 19: 523 loggerhead, 285 Kemp's ridley, 105 green, 29 leatherback, 15 hawksbill, and 94 unknown species (STSSN 2009).

Increased vessel activity could affect sea turtles in the area. The most common effect from vessel activity on sea turtles is from propeller and boat strikes on the turtles. Direct strikes on the turtles can kill or maim the animals. The wash from the propellers of the barges is also known to entrain turtles and either temporarily disorient the organisms or potentially drown them. Lights from the vessels are thought to disorient turtles, particularly hatchlings. However, barging traffic to STP is not likely to happen in the dark (Corps 2007, 2008; STPNOC 2009b). The wash from moving barges could create flows that would disrupt food sources for the sea turtles. Organisms in the open water would be disrupted as the barge moved through the area, but the effects would be temporary. Increased vessel movements in narrow channels could erode shorelines and increase turbidity that could settle on benthic organisms, which could result in diminished food supply for the turtles. Barge traffic would be restricted to channels where traffic is common, and these areas are limited in comparison to the overall area of the bays and waterways where turtles can forage. While turtles can forage elsewhere, sea turtles that are swimming in vessel channels would be adversely affected if they interact with barges transporting materials and equipment to the STP site.

6.0 Cumulative Impacts to Federally Protected Species

Barging of heavy equipment and bulk commodities would add to the vessel traffic through the Port of Freeport, Matagorda Ship Channel, and the GIWW in the study area. STPNOC has not finalized the plans for shipping equipment and material to the STP site. While traffic in these navigation areas would increase during the building of proposed Units 3 and 4, the number of trips for the barges carrying both heavy equipment and construction materials would not add significantly to the existing traffic in the area (STPNOC 2009b).

Barging traffic may add cumulatively to the impacts on sea turtles from other activities within the study area. Sea turtles are affected by numerous activities that are common in the study area, including dredging, commercial fishing, vessel traffic, development along nesting beaches, pollution, and poaching. The Corps is responsible for maintaining over 12,000 mi of waterways throughout the United States for commercial and recreational vessel traffic, water supply, regional development, and national security. The three primary types of dredges used for maintaining navigational waters are cutterhead pipeline, mechanical, and hopper dredges. Sea turtles are most likely to be harmed or killed by hopper dredges. Based on the Corps' Sea Turtle Data Warehouse, there have been 85 incidental takes of sea turtles since 1995 within the Galveston District from dredging activities, primarily loggerhead, green and Kemp's ridley sea turtles. The Corps and the dredging industry continue to work on protocols, operational methods, and modifying dredging equipment to reduce impacts to sea turtles (Corps 2010). Some of these improvements include a plow-like deflector designed to move the turtles away from the suction of the draghead (NMFS and FWS 2007e).

Along the proposed barging routes for transporting heavy equipment and bulk commodities for the construction of proposed Units 3 and 4, there are plans for dredging and changing the shipping channels at the Port of Freeport and Matagorda Bay. The Corps has prepared BAs for both of these activities and evaluated the effects on sea turtles from the use of pipeline and hopper dredges, sedimentation, loss of benthic habitat, and disorientation from lights on vessels. The Corps concluded these activities may affect the species, and hopper dredging would adversely affect the sea turtles. The Corps and NMFS have identified "reasonable and prudent measures" to reduce the potential for affecting sea turtles from the proposed activities at the Port of Freeport (Corps 2008) and will likely agree to similar measures for the Matagorda Ship Channel (Corps 2007). These measures include the implementation of a sea turtle avoidance plan. For more than a decade, these measures have been incorporated in the Corps' regulatory and civil works projects throughout the Gulf of Mexico. Barging traffic to STP during the dredging activities planned by the Corps may create more distractions for the sea turtles in the area.

Commercial fishermen in the bay systems of Texas must use approved TEDs to minimize collection of turtles in their trawl equipment (TPWD 2009c). Kemp's ridley sea turtles are particularly susceptible to being caught in trawl nets because they inhabit shallow waters. In the past, shrimp trawls were known to kill thousands of Kemp's ridley sea turtles each year before the implementation of TEDs, which occurred in 1990 for the Texas commercial fishing industry (TPWD 2009d). In addition, in 2000 Texas Parks and Wildlife Commission established seasonal closure for shrimping from the beach out to five nautical mi from December 1 through July 15, which is the season when adult Kemp ridleys use those waters for mating, nesting, foraging and migrating (NMFS and FWS 2007e). Other sea turtle species also benefit from the implementation of TEDs and seasonal closure of the fishing industry when they are prevalent.

Vessel traffic in the area includes commercial and recreational vessels. NMFS has identified that these activities have an adverse impact on sea turtles from propeller and boat strike damage (Singel et al. 2003; NMFS and FWS 2007e). However, the magnitude of these events in the study area is not known (Corps 2008).

Development in the study area can lead to loss of nesting habitat, increased pollution, increased recreational activities, etc. As mentioned above, there have been few sea turtles nesting in the Matagorda Bay area. Increased development of Matagorda Peninsula could remove appropriate habitat for future nesting activity. Lighting of homes and on roadways can disorient adult females as well as hatchlings and diminish the success of future nesting opportunities. Turtles can be harmed through ingestion and entanglement with debris washed into waters from developed areas or dropped overboard. Coastal runoff can contribute to poor water quality that affects the food for turtles as well as potentially harming them. Organochlorine compounds, heavy metals, and petroleum products are all known to be detrimental to turtles either directly or indirectly through bioaccumulation of the toxins in the food web (NMFS and FWS 2007e).

Power plants and other large industrial systems in coastal waters also have the potential to affect sea turtles. The intake systems for cooling water at power plants have attracted and impinged turtles. Most of these power plants are located along the coastal area where turtles are foraging and nesting. It is unlikely that the operation of the nuclear units at the STP site would harm sea turtles because the intake system is located upstream in the Colorado River and turtles have not been reported in that area. Other industrial ports can attract turtles and they can be harmed by vessels approaching the port.

7.0 Conclusions

The potential impacts of barging heavy equipment and material for proposed Units 3 and 4 to the STP site on Federally protected sea turtle species in the vicinity of the site have been evaluated. The known distributions and records of those species and the potential ecological impacts of barging to the species, their habitats, and their prey have been considered in this BA.

Based on this review, the NRC and the Corps conclude that the overall effects of barging heavy equipment and material to the STP site for construction of the proposed Units 3 and 4, may affect but would not be likely to adversely affect or jeopardize the continued existence of the loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, and Kemp's ridley sea turtle in the Gulf of Mexico and on the coast of Texas.

8.0 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy,* Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

35 FR 8495. "Endangered Species Conservation Act of 1969." *Federal Register*. U.S. Department of the Interior.

35 FR 18320. December 2, 1970. "Endangered Species Conservation Act of 1969." *Federal Register*. U.S. Department of the Interior.

43 FR 22224. May 24, 1978. "Proposed Determination of Critical Habitat for the Hawksbill Sea Turtle." *Federal Register*. U.S. Department of the Interior.

43 FR 32808. July 28, 1978. "Listing and Protecting Loggerhead Sea Turtles as 'Threatened Species' and Populations of Green and Olive Ridley Sea Turtles as 'Threatened Species or Endangered Species'." *Federal Register*. U.S. Department of the Interior.

43 FR 43688. September 26, 1978. "Determination of Critical Habitat for the Leatherback Sea Turtle." *Federal Register*. U.S. Department of the Interior.

44 FR 17710. March 23, 1979. "Determination of Critical Habitat for the Leatherback Sea Turtle." *Federal Register.* U.S. Department of the Interior.

63 FR 46693. September 2, 1998. "Designated Critical Habitat; Green and Hawksbill Sea Turtles." *Federal Register*. U.S. Department of the Interior.

72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants." *Federal Register*. U.S. Nuclear Regulatory Commission.

72 FR 72774. December 21, 2007. "South Texas Project Nuclear Operating Company South Texas Project Site, Units 3 & 4; Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*. U.S. Nuclear Regulatory Agency.

Balazs, G. 1980. *Synopsis of biological data on the green turtle in the Hawaiian Islands*. NOAA Technical Memorandum. NMFS-SWFC-7, U.S. Department of Commerce, Miami, Florida.

Barrett, S. 1996. Disease threatens green sea turtles. *Endangered Species Bulletin* 21(2):8–9.

Campbell, L. 1995. *Endangered and threatened animals of Texas, their life history and management*. Texas Parks and Wildlife Department, Resource Protection Division, Endangered Resources Branch, Austin, Texas.

Clean Water Act. 33 USC 1251, et seq.

Endangered Species Act of 1973, as amended (ESA). 16 USC 1531, et seq.

ENSR Corporation (ENSR). 2008a. *Aquatic Ecology – Colorado River Monitoring Report, Unit 3 and 4 Licensing Project*. Houston, Texas.

ENSR Corporation (ENSR). 2008b. *Aquatic Ecology – Main Cooling Reservoir and Circulating Water Intake Structure Study, Unit 3 and 4 Licensing Project*. Houston, Texas.

Hildebrand, H. 1982. "A historical review of the status of sea turtle populations in the western Gulf of Mexico." In: K. Bjorndal, ed., *Biology and conservation of sea turtles*. Smithsonian Institution Press, Washington, D.C.

Hirth, H.F. 1997. "Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758)." Biological Report 97 (1). U.S. Fish and Wildlife Service, Washington, D.C.

Marquez, M.R. 1994. "Synopsis of Biological Data on the Kemp's Ridley Turtle, *Lepidochelys kempi* (Garman, 1880)." NOAA Technical Memorandum NMFS-SEFSC-343, U.S. Department of Commerce, Miami, Florida.

Meylan, A. 1982. "Sea turtle migration – evidence from tag returns." In: K. Bjorndal, ed., *Biology and Conservation of Sea Turtles*. Smithsonian Institution Press, Washington, D.C.

Mortimer, J.A. 1982. "Feeding ecology of sea turtles." In: K. Bjorndal, ed., *Biology and conservation of sea turtles*. Smithsonian Institution Press, Washington, D.C.

National Marine Fisheries Service (NMFS). 2009a. "Endangered and Threatened Species and Critical Habitats under the Jurisdiction of the NOAA Fisheries Service: Texas." NOAA Fisheries Service, Southeast Regional Office, Saint Petersburg, Florida. Accessed March 13, 2009 at http://sero.nmfs.noaa.gov/pr/esa/specieslst.htm.

National Marine Fisheries Service (NMFS). 2009b. "Loggerhead Turtle (*Caretta caretta*)." Accessed November 2, 2009 at http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm. Accession No. ML100650007.

National Marine Fisheries Service (NMFS). 2009c. "Green Turtle (*Chelonia mydas*)." Accessed November 2, 2009 at http://www.nmfs.noaa.gov/pr/species/turtles/green.htm. Accession No. ML100650007.

National Marine Fisheries Service (NMFS). 2009d. "Leatherback Turtle (*Dermochelys coriacea*)." Accessed November 2, 2009 at http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm. Accession No. ML100650007.

National Marine Fisheries Service (NMFS). 2009e. "Hawksbill Turtle (*Eretmochelys imbricata*)." Accessed November 2, 2009 at http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm. Accession No. ML100650007.

National Marine Fisheries Service (NMFS). 2009f. "Kemp's Ridley Turtle (*Lepidochelys kempii*)." Accessed November 2, 2009 at http://www.nmfs.noaa.gov/pr/species/turtles/kempsridley.htm. Accession No. ML100650007.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 1991. "Recovery Plan for U.S. Population of Atlantic Green Turtle." National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 1992a. "Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico." National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 1992b. "Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)." National Marine Fisheries Service, St. Petersburg, Florida.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 1993. "Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico." National Marine Fisheries Service, St. Petersburg, Florida.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 2007a. *Loggerhead Sea Turtle (*Caretta caretta*), 5-Year Review: Summary and Evaluation*. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Jacksonville, Florida.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 2007b. *Green Sea Turtle (*Chelonia mydas*) 5-Year Review: Summary and Evaluation*. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Jacksonville, Florida.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 2007c. *Leatherback Sea Turtle (*Dermochelys coriacea*) 5-Year Review: Summary and Evaluation*. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Jacksonville, Florida.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 2007d. *Hawksbill Sea Turtle (*Eretmochelys imbricata*) 5-Year Review: Summary and Evaluation*. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 2007e. *Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation*. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 2008. "Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (Caretta caretta)." Second Revision. National Marine Fisheries Service, Silver Spring, Maryland.

Pritchard, P.C.H. 1996. "Evolution, phylogeny and current status." In: Lutz, P.L., Musick, J.A. (Eds.), *The Biology of Sea Turtles*. CRC Press, Florida.

Pritchard, P.C.H., and J.A. Mortimer. 1999. Taxonomy, External Morphology, and Species Identification. In: Eckert, K.L., K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (Editors), *Research and Management Techniques for the Conservation of Sea Turtles*. IUCN/SSC Marine Turtle Specialist Group Publication No. 4. Consolidated Graphic Communications, Blanchard, Pennsylvania.

Rivers and Harbors Appropriation Act of 1899, as amended. 33 USC 403, et seq.

Sea Turtle Stranding and Salvage Network (STSSN). 2009. "Monthly turtle stranding by year, species, and state." Accessed January 28, 2010 at http://www.sefsc.noaa.gov/seaturtleSTSSN.jsp. Accession No. ML100650007.

Singel, K., T. Redlow, and A. Foley. 2003. "Twenty-two years of data on sea turtle mortality in Florida: Trends and factors." In: J.A. Seminoff, compiler, *Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-503, U.S. Department of Commerce, Miami, Florida.

South Texas Project Nuclear Operating Company (STPNOC). 2009a. South Texas Project Units 3 and 4 Combined License Application, Part 3, Environmental Report. Revision 3, Bay City, Texas. Accession No. ML092931600.

South Texas Project Nuclear Operating Company (STPNOC). 2009b. Letter from Scott Head (STPNOC, Manager, Regulatory Affairs, South Texas Project, Units 3 and 4) to U.S. Nuclear Regulatory Commission dated September 14, 2009 in response to NRC letter dated August 14, 2009, "South Texas Project Units 3 and 4, Docket Nos. 52-012 and 52-013, Response to Requests for Additional Information." Accession No. ML092580491.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: Are leatherback turtles going extinct? *Chelonian Conservation and Biology* 2(2):209–222.

Texas Parks and Wildlife Department (TPWD). 2007. "Leatherback Sea Turtle (*Dermochelys coriacea*)." Texas Parks and Wildlife Department, Austin, Texas. Accessed November 8, 2009 at http://www.tpwd.state.tx.us/huntwild/wild/species/endang/animals/reptiles_amphibians/lethback.phtml. Accession No. ML100650007.

Texas Parks and Wildlife Department (TPWD). 2009a. Telephone call to Tonya Wiley (Texas Parks and Wildlife Department, Fisheries Outreach Specialist, Coastal Fisheries Division) from Christa Woodley (Pacific Northwest National Laboratory, Research Scientist), "Smalltooth sawfish in southern Texas", March 18, 2009.

Texas Parks and Wildlife Department (TPWD). 2009b. "Wildlife Fact Sheets." Texas Parks and Wildlife Department, Austin, Texas. Accessed January 22, 2010 at http://www.tpwd.state.tx.us/huntwild/wild/species. Accession No. ML100650007.

Texas Parks and Wildlife Department (TPWD). 2009c. "2009-2010 Texas Commercial Fishing Guide." Texas Parks and Wildlife Department, Austin, Texas.

Texas Parks and Wildlife Department (TPWD). 2009d. "Kemp's Ridley Sea Turtle." Texas Parks and Wildlife Department, Austin, Texas. Accessed December 1, 2009 at http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_0013_kemps_ridley_sea_turtle.pdf. Accession No. ML100650007.

Turtle Expert Working Group. 1998. "An Assessment of the Kemp's Ridley (*Lepidochelys kempii*) and Loggerhead (*Caretta caretta*) Sea Turtle Populations in the Western North Atlantic." NOAA Technical Memorandum NMFS-SEFSC-406, U.S. Department of Commerce, Miami, Florida.

U.S. Army Corps of Engineers (Corps). 2005. *Galveston District Projects: Mouth of the Colorado River*. U.S. Army Corps of Engineers, Galveston District, Galveston, Texas. Accessed December 16, 2009 at http://www.swg.usace.army.mil/items/coloradoriver/default.asp. Accession No. ML100650007.

U.S. Army Corps of Engineers (Corps). 2007. *Draft Environmental Impact Statement for Calhoun County Navigation District's Proposed Matagorda Ship Channel Improvement Project Calhoun and Matagorda Counties, Texas*. Document No. 060146, U.S. Army Corps of Engineers, Galveston District, Galveston, Texas.

U.S. Army Corps of Engineers (Corps). 2008. *Final Environmental Impact Statement for the Proposed Port Freeport Channel Widening, Brazoria County, Texas*. U.S. Army Corps of Engineers, Galveston District, Galveston, Texas.

U.S. Army Corps of Engineers (Corps). 2010. "USACE Sea Turtle Data Warehouse." U.S. Army Corps of Engineers, Galveston District, Galveston, Texas. Accessed January 29, 2010 at http://el.erdc.usace.army.mil/seaturtles. Accession No. ML100650007.

U.S. Fish and Wildlife Service (FWS). 1980. "Selected vertebrate endangered species of the seacoast of the United States." FWS/OBS-80/01. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C.

U.S. National Park Service (NPS). 2009. "Padre Island National Seashore: Current Sea Turtle Nesting Season." National Park Service, U.S. Department of Interior. Accessed November 8, 2009 at http://www.nps.gov/pais/naturescience/current-season.htm. Accession No. ML100650007.

U.S. Nuclear Regulatory Commission (NRC). 1975. *Final Environmental Statement Related to the Proposed South Texas Project Units 1 & 2*. NUREG-75/019, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1986. *Final Environmental Statement Related to the Operation of South Texas Project, Units 1 and 2*. NUREG-1171, Washington, D.C.

Wilber, D.H. and R. Bass. 1998. "Effect of the Colorado River Diversion on Matagorda Bay Epifauna." *Coastal and Shelf Science* 47:309-318.

Williams, J.A., and M.L. Renaud. 1998. "Tracking of Kemp's ridley (*Lepidochelys kempii*) and green (*Chelonia mydas*) sea turtles in the Matagorda Bay System, Texas." In: S. Epperly and J. Braun (compilers), *Proceedings of the 17th Annual Sea Turtle Symposium*. NOAA Technical Memorandum NMFS SEFSC-415, U.S. Department of Commerce, Miami, Florida.

Essential Fish Habitat Assessment

National Marine Fisheries Service

South Texas Project Electric Generating Station Units 3 and 4

U.S. Nuclear Regulatory Commission Combined License Application
Docket Nos. 52-012 and 52-013

U.S. Army Corps of Engineers Permit Application

Matagorda County, Texas

March 2010

U.S. Nuclear Regulatory Commission
Rockville, Maryland

U.S. Army Corps of Engineers
Galveston District

1.0 Introduction

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801 et seq.) and amendments by the Sustainable Fisheries Act of 1996 (Public Law 104-297) recognized that habitat is important for the protection of healthy fisheries and established procedures to identify, conserve, and enhance essential fish habitat (EFH) for Federally managed fish and shellfish species (GMFMC 2004). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1801 et seq.; NMFS 2004). Federal agencies must consult with the Secretary of Commerce on all actions or proposed actions that are authorized, funded, or undertaken by the agency that may adversely affect EFH (NMFS 2004). Identifying EFH is an essential component in the development of fishery management plans (FMPs) to evaluate the effects of habitat loss or degradation on fishery stocks and to take actions to mitigate such damage. This responsibility was expanded by the National Marine Fisheries Service (NMFS) to ensure additional habitat protection (NMFS 1999). The consultation requirements of Section 305(b) of the MSA provide that Federal agencies consult with the Secretary of Commerce on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH.

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application from STP Nuclear Operating Company (STPNOC) for two combined construction permits and operating licenses (combined licenses or COLs) to construct and operate two new nuclear reactors at the South Texas Project Electric Generating Station (STP) site in Matagorda County, Texas, approximately 12 mi south-southwest of Bay City, Texas (Figure 1). The STP site is located adjacent to the Colorado River, upstream of its confluence with the Gulf Intracoastal Waterway (GIWW). STPNOC submitted the COL application to the NRC on September 20, 2007. The STP site and existing facilities (Units 1 and 2) are owned by NRG South Texas LP (NRG), City Public Service Board of San Antonio, Texas (CPS Energy), and the City of Austin, Texas. STPNOC plans for the proposed STP Unit 3 to be owned by Nuclear Innovation North America (NINA) South Texas 3 LLC and CPS Energy, and the proposed STP Unit 4 to be owned by NINA South Texas 4 LLC and CPS Energy (STPNOC 2009a). Concurrent with the NRC's review, the U.S. Army Corps of Engineers (Corps) is reviewing STPNOC's application for a Department of the Army (DA) Permit pursuant to Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC Sec. 403) and Section 404 of the Clean Water Act (CWA) (33 USC 1344) to perform site preparation activities and construct supporting facilities for two proposed new nuclear reactors at the STP site (Units 3 and 4). The Corps is a cooperating agency with the NRC to ensure that the information presented in the environmental impact statement (EIS) is adequate to fulfill the requirements of Corps regulations; the CWA Section 404(b)(1) Guidelines, which contain the substantive environmental criteria used by the Corps in evaluating discharges of dredged or fill material into waters of the United States; and the Corps public interest review process. The NRC and the Corps have formed a combined review team

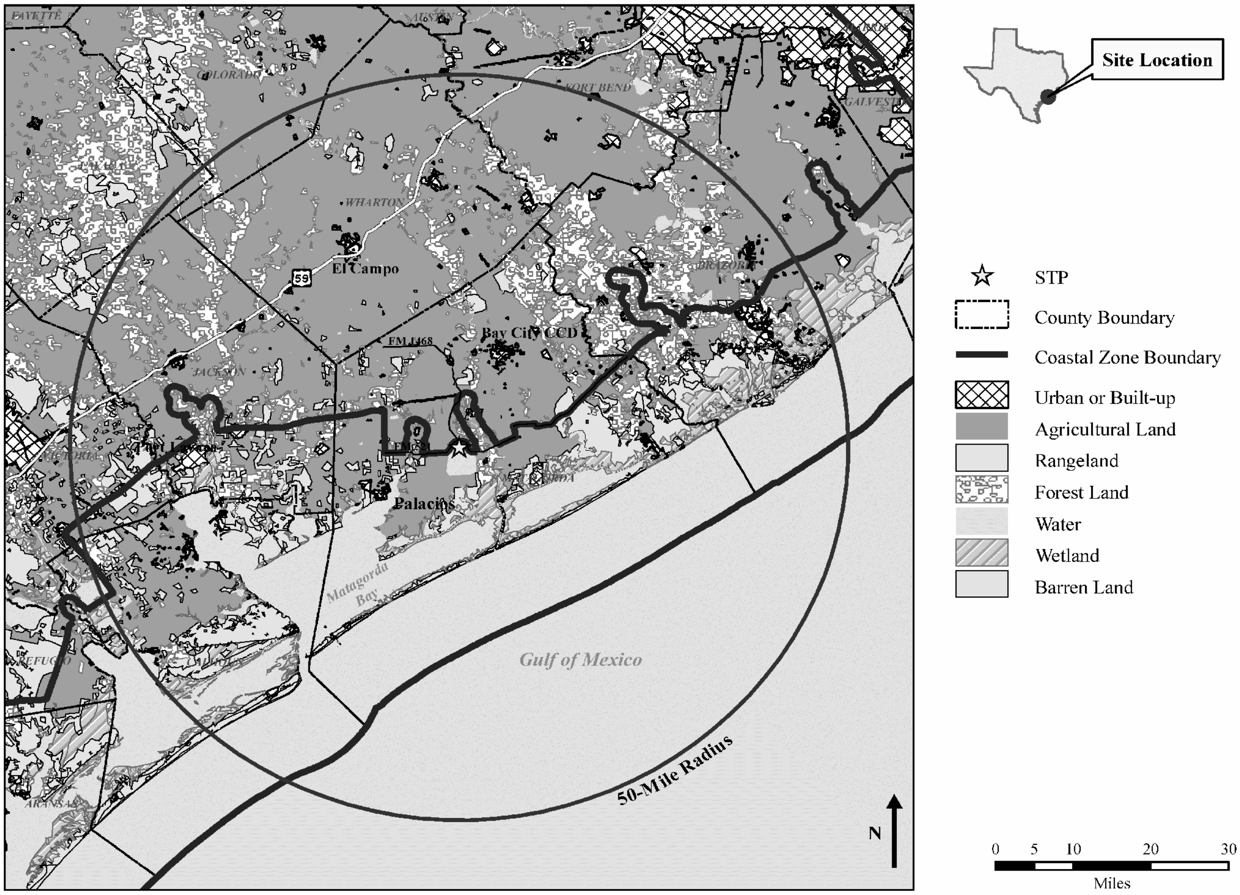


Figure 1. Location of the STP Site and General Land Use Classification for the Region

and prepared this EFH assessment to support their joint consultation with the NMFS in accordance with the MSA. The Corps permit decision will be made following issuance of the final EIS for building the two new reactors at the STP site.

The proposed project has the potential to cause temporary and permanent adverse impacts to spawning, nursery, forage, and shelter activities and habitats. The review team has evaluated potential impacts on the designated EFH and Federally-managed fish and shellfish species in the vicinity of STP based on information from communications with the NMFS (Southeast Regional Office, Habitat Conservation Division, Gulf Branch) and review of information on the Gulf of Mexico Fishery Management Council's final EIS on the generic EFH amendments (GMFMC 2004). In addition, the EFH mapper tool was used to visualize the extent of potential designated EFH in the vicinity of the STP site, with an understanding that the area may be within known areas of spatial data quality issues (NMFS 2009). Matagorda Bay, the GIWW, and the Colorado River extending up to the bridge at FM 521 (at approximately navigable mile marker [NMM] 10, upstream of the confluence of the Colorado River and the GIWW) are within Ecoregion 5 of the designated EFH by the Gulf of Mexico Fishery Management Council's FMP (GMFMC 2004; NMFS 2009). Ecoregion 5 extends from Freeport, Texas to the Mexico border. FMPs for coastal migratory pelagics, reef fish, red drum, shrimp, and stone crab fisheries include the Colorado River, the GIWW and Matagorda Bay within the vicinity of STP include coastal migratory pelagic, reef fish, red drum, shrimp, and stone crab (GMFMC 2004). This EFH assessment examines the potential impacts of the proposed actions on eight species: king mackerel (*Scomberomorus cavalla*), Spanish mackerel *(S. maculates*), gray snapper (*Lutjanus griseus*), red drum (*Sciaenops ocellatus*), brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*F. duorarum*), white shrimp (*Litopenaeus setiferus*), and Gulf stone crab (*Menippe adina*). These species are described in Section 4.0, and the impacts to them and their EFH, including their prey, are discussed in Section 5.0.

2.0 STP Site Description

The 12,220-ac STP site currently contains two pressurized water reactors (Units 1 and 2) and their associated facilities, which occupy approximately 300 ac (Figure 2). Existing Units 1 and 2 share a 7000-ac Main Cooling Reservoir (MCR). Approximately 58 percent of the 12,220-ac STP site is covered in water (STPNOC 2009a). The MCR is an engineered cooling reservoir originally sized for four nuclear units and currently dissipates heat as part of a closed-cycled cooling system for the existing Units 1 and 2. Water loss from the MCR through evaporation, seepage, and discharge is made up from the Colorado River. Colorado River water is pumped from the Reservoir Makeup Pumping Facility (RMPF) into the MCR. Operation of the RMPF requires periodic maintenance dredging of the river in the immediate vicinity. When the total dissolved solids concentration in the MCR exceeds operating criteria, water is released through a discharge structure on the Colorado River downstream from the RMPF. However, STPNOC has only discharged water from the MCR into the Colorado River once during operation of Units 1 and 2 (STPNOC 2009a). There is a barge slip near the downstream shoreline of the RMPF that was used for the construction of Units 1 and 2 and could be required in the future for continued operation of Units 1 and 2. Both existing units would continue to operate during the site preparation activities, construction, and operation of the proposed Units 3 and 4, and the proposed two new units would share many of the same systems for cooling, including the use of the existing RMPF, MCR, and discharge structure, and transmission of power.

A diverse aquatic community has developed over time since the construction of the MCR. The organisms are likely survivors of entrainment at the RMPF from the Colorado River, but it is unclear if these organisms are reproducing in the MCR. The organisms are not available for harvest as there is no public access to the MCR and STPNOC has only evaluated the aquatic community in the MCR twice (during an employee fishing tournament in 1994 and during an aquatic community survey during 2007-2008) (ENSR 2008a; STPNOC 2009a). For the purpose of this assessment and consultation, the entrained aquatic community will be considered lost to the environment and, therefore not evaluated further. Within the vicinity of the STP site, the major aquatic communities occur in the Colorado River, Matagorda Bay and the associated GIWW (Figure 3). The segment of the Colorado River adjacent to the STP site is used for recreational boating and fishing, as well as shipping to upstream ports. Matagorda Bay is used for commercial fishing and shipping as well as for recreational activities. The GIWW is used for shipping as well as for some recreational activities. Designated EFH occurs in the lower Colorado River, Matagorda Bay, and the GIWW, but there are no habitat areas of particular concern in any of those water bodies (GMFMC 2004).

2.1 Colorado River

The Colorado River is one of the largest river systems in Texas. The river is approximately 862 mi long, extending from the high plains to the coastal marshes in Matagorda County. The segment of the river near the STP site, between Bay City and the GIWW, is a diverse, tidal, fluvial system that meanders through the coastal plain providing freshwater, sediments, and nutrients to Matagorda Bay (ENSR 2008a). The substrate and bathymetry of the Colorado River from the RMPF to the confluence with the GIWW is not well characterized. The Corps' Galveston District reported in December 2009 that the Colorado River Channel from navigable mile 0 (GIWW) to the turning Basin near Bay City had a minimum width of 100 ft, minimum depth of 9 ft. In the vicinity of the STP site, the left quarter, middle half and right quarter channel had average depths of 2.1 ft, 3.8 ft, and 4.5 ft, respectively (all measurements were provided at the mean low tide datum) (Corps 2009a). The width of the river near the RMPF is approximately 900 ft. The west bank of the river channel drops off quickly to a shelf that extends approximately 400 ft, then drops again to the thalweg (lowest point in the river channel) approximately 600 ft from the west bank. The east bank of the river channel drops to the thalweg within 300 ft from the east bank. The bathymetry of the river at the discharge structure is not known, but the width is approximately 300 ft (STPNOC 2009a). The river's bottom habitat in the vicinity of the STP site is described as un-vegetated, estuarine benthic habitats with mud and sand substrate (STPNOC 2009a).

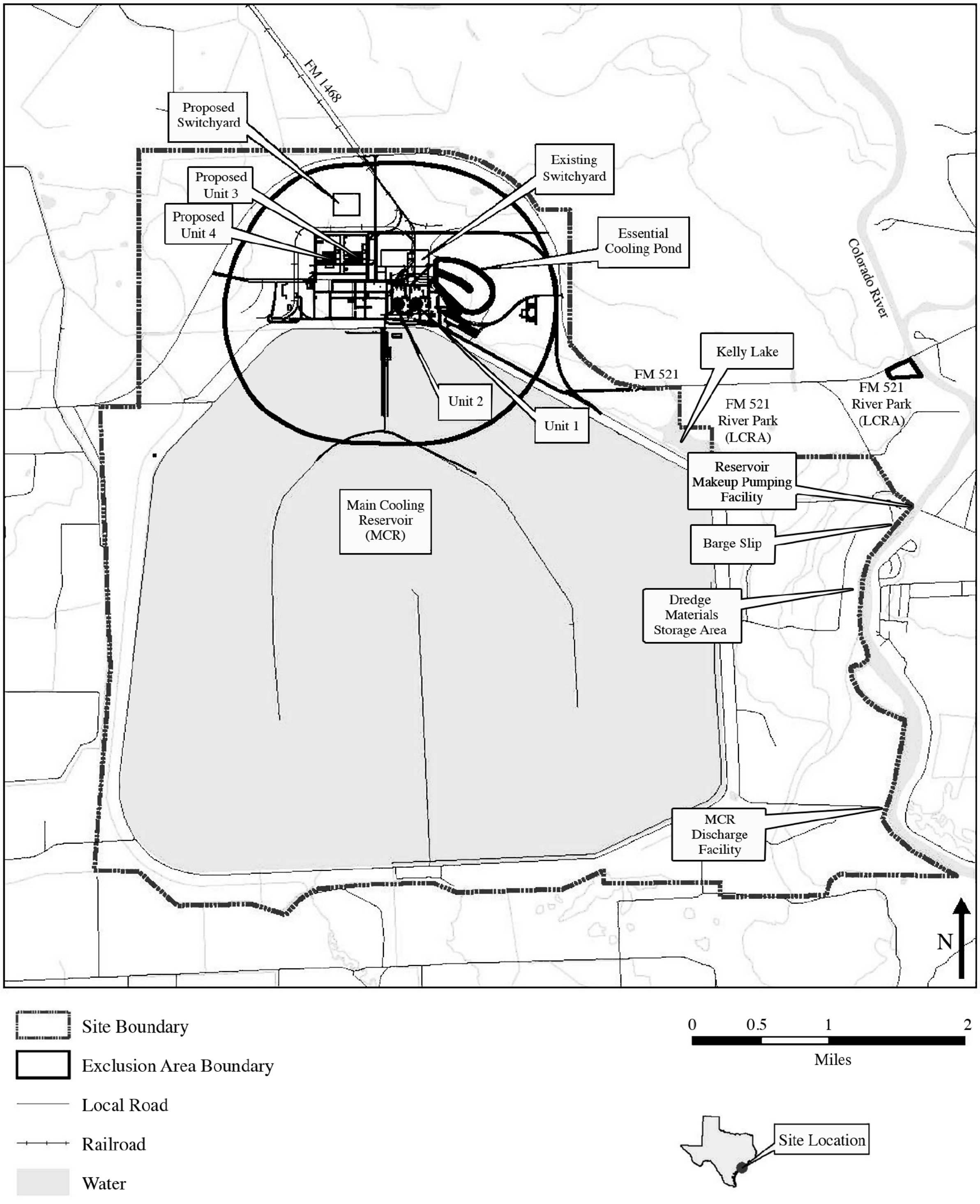


Figure 2. STP Site and Proposed Plant Footprint (STPNOC 2009a)

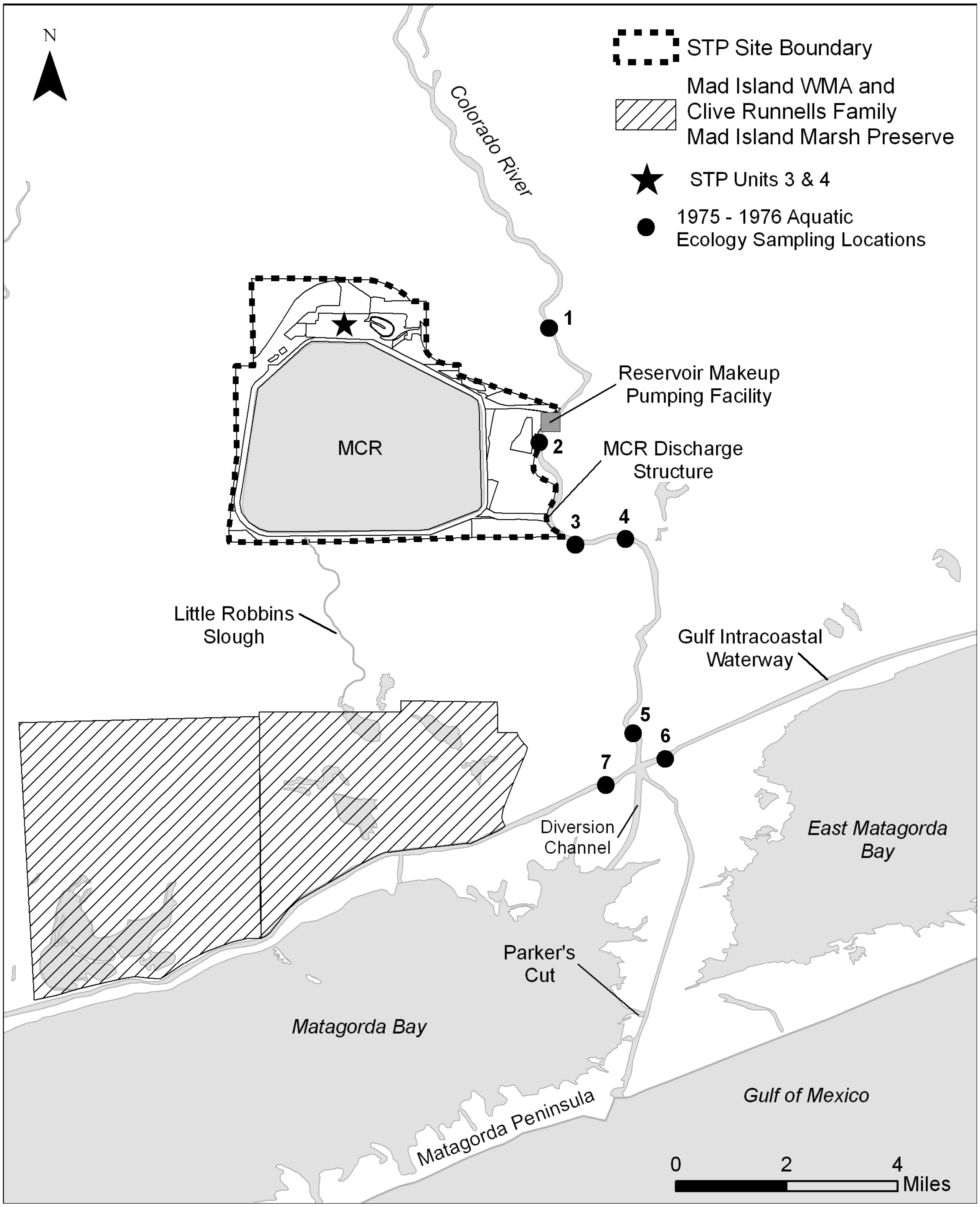


Figure 3. Location of the STP Site and Major Important Aquatic Resources

Today, there is no natural direct connection between the Gulf of Mexico and the Colorado River. Aquatic resources associated with the Gulf of Mexico can move into and out of the Colorado River through the navigation channel (that connects the Gulf to the GIWW), and through the GIWW or a diversion channel into Matagorda Bay. The major shipping channels connect to the GIWW in the northeast through the Freeport Harbor Channel (Corps 2008) and in the southwest through the Matagorda Ship Channel (Corps 2007).

The lower Colorado River has been studied on a very limited basis with specific studies conducted in 1974, 1976, 1983, and 1984 associated with the licensing of existing STP Units 1 and 2 (NRC 1975, 1986) and in 2007-2008 associated with the licensing of the proposed Units 3 and 4 (ENSR 2008a). The flow of the Colorado River and the Gulf of Mexico has changed with development of the area since the 1920s. The course of the river prior to the 1920s flowed directly into Matagorda Bay. In the 1930s, a delta began to form in the mouth of the river, and a channel was constructed through the Matagorda Peninsula, shunting the river flows away from the bay directly into the Gulf of Mexico. Then, in the 1950s, the Tiger Island Channel was constructed through the west side of the delta, re-establishing flow between the river and the bay. The Corps constructed a deeper river diversion channel northwest of the Tiger Island Channel in 1990. In 1991, two dams were constructed to divert the river flow, including one across the Tiger Island Channel (called the Tiger Island Cut dam) and a diversion dam across the river channel on Matagorda Peninsula. By July 1992, all of the Colorado River flow was diverted into Matagorda Bay through the GIWW and the newly constructed diversion channel. The changes in freshwater inflow to Matagorda Bay over time, and the changes to flow from the Gulf of Mexico into the Colorado River have likely influenced the aquatic communities historically in the river and bay (Wilber and Bass 1998).

Changes in the aquatic community over time in the Colorado River were evaluated using the results of the 1974, 1983, 1984, and 2007-2008 studies (NRC 1975, 1986; ENSR 2008a). The sampling locations and gear types varied with each study, making some comparisons more difficult. Trawl samples collected from the GIWW to the STP site in 1974 showed a moderately diverse species community for the lower river based on measures for species richness, diversity, and evenness. All three measures were slightly lower than those in similar segments of the river compared to the 2007-2008 study, suggesting that the diversity of aquatic species is greater now than in the past. Data collected during 1974 examining specific segments also indicated a diverse species community for all three segments. The 1983-1984 trawl and seine data indicated overall lower species richness, diversity, and evenness relative to the present data (ENSR 2008a). Rerouting of the lower Colorado River has likely contributed to these changes in diversity of aquatic species.

The number and assortment of organisms collected during the 2007-2008 study indicate that this portion of the lower Colorado River supports a diverse assemblage of fauna, many of which would be prey for species with designated EFH in the area (Table 1 on the following page). The regular occurrence of both freshwater and saltwater species, the range of macroinvertebrate and finfish fauna, and the sheer number of species captured among various sampling gears and river reaches provide evidence of a dynamic ecosystem. There was a low to moderate level of similarity between the current 2007-2008 faunal communities and the historic communities (1974 and 1983-1984) (ENSR 2008a).

The 2007-2008 survey of the Colorado River did not include sampling for younger life stages (e.g., ichthyoplankton). In addition, there were no reports during the 1974, 1983, 1984, and 2007-2008 studies of any submerged aquatic vegetation (SAV) in the Colorado River from the GIWW to the bridge with FM 521 (NRC 1975, 1986; ENSR 2008a).

Table 1. Fish and Shellfish Collected in the Colorado River by Gear Type, 2007-2008 (ENSR 2008b)

Common Name	Scientific Name	Bag Seine	Gill Net	Hoop Net	Trawl	Total
alligator gar	*Atractosteus spatula*	2	2	13		17
Atlantic brief squid	*Lolliguncula brevis*	1			30	31
Atlantic croaker	*Micropogonias undulatus*	562	1		482	1045
Atlantic cutlassfish	*Trichiurus lepturus*				6	6
Atlantic seabob	*Xiphopenaeus kroyeri*				127	127
Atlantic spadefish	*Chaetodipterus faber*			3		3
Atlantic threadfin	*Polydactylus octonemus*				6	6
bay anchovy	*Anchoa mitchilli*	24			264	288
bay whiff	*Citharichthys spilopterus*	15			2	17
bayou killifish	*Fundulus pulvereus*	3				3
black drum	*Pogonias cromis*	1	1	1	1360	1363
blackcheek tonguefish	*Symphurus plagiusa*				3	3
blue catfish	*Ictalurus furcatus*	51	22	3	677	753
blue crab	*Callinectes sapidus*	190	2	3	77	272
bluegill	*Lepomis macrochirus*	3				3
brown shrimp	*Farfantepenaeus aztecus*	264			192	456
bull shark	*Carcharhinus leucas*		6			6
channel catfish	*Ictalurus punctatus*	22		2	6	30
cichlid	*Cichlasoma* spp.				16	16
crayfish	*Procambarus* sp.				1	1
crevalle jack	*Caranx hippos*	2				2
cyprinid sp.	Cyprinidae	1				1

Table 1. (contd)

Common Name	Scientific Name	Bag Seine	Gill Net	Hoop Net	Trawl	Total
diamond killifish	*Adinia xenica*	11				11
flathead catfish	*Pylodictis olivaris*			2		2
freshwater goby	*Ctenogobius shufeldti*	9				9
gafftopsail catfish	*Bagre marinus*		9		183	192
gizzard shad	*Dorosoma cepedianum*	8		2	52	62
grass carp	*Ctenopharyngodon idella*		2	1		3
grass shrimp	*Palaemonetes pugio*	1762				1762
gray (mangrove) snapper	*Lutjanus griseus*				1	1
Gulf killifish	*Fundulus grandis*	15				15
Gulf menhaden	*Brevoortia patronus*	2960	5	2	1076	4043
hardhead catfish	*Ariopsis felis*		1	1	252	254
Harris mud crab	*Rhithropanopeus harrisii*				1	1
inland silverside	*Menidia beryllina*	6				6
killifish sp.	*Fundulus* sp.	5				5
ladyfish	*Elops saurus*		2		1	3
lesser blue crab	*Callinectes similis*	1			5	6
lined sole	*Achirus lineatus*				3	3
longnose gar	*Lepisosteus osseus*			1		1
mosquitofish	*Gambusia affinis*	1				1
naked goby	*Gobiosoma bosc*	3				3
pigfish	*Orthopristis chrysoptera*				1	1
pinfish	*Lagodon rhomboides*				11	11
rainwater killifish	*Lucania parva*	2				2
red drum	*Sciaenops ocellatus*	8	8	38	25	79
red eared slider	*Trachemys scripta elegans*			1		1
river shrimp	*Macrobrachium ohione*	10			5	15
rough silverside	*Membras martinica*	17				17
sailfin molly	*Poecilia latipinna*	150				150
sand seatrout	*Cynoscion arenarius*	22	5		294	321
sharptail goby	*Oligolepis acutipennis*	39				39
sheepshead	*Archosargus probatocephalus*	14	1	6	48	69
sheepshead minnow	*Cyprinodon variegatus*	79			7	86
shiner	*Notropsis* spp.	2				2

Table 1. (contd)

Common Name	Scientific Name	Bag Seine	Gill Net	Hoop Net	Trawl	Total
silver jenny	*Eucinostomus gula*				2	2
silver perch	*Bairdiella chrysoura*				350	350
smallmouth buffalo	*Ictiobus bubalus*		32	5		37
Southern flounder	*Paralichthys lethostigma*	2	2	3	12	19
southern stingray	*Dasyatis americana*				1	1
spot croaker	*Leiostomus xanthurus*	88		1	156	245
spotfin mojarra	*Eucinostomus argenteus*	3			5	8
spotted gar	*Lepisosteus oculatus*	1	1	10	1	13
spotted seatrout	*Cynoscion nebulosus*		4		53	57
star drum	*Stellifer lanceolatus*				86	86
striped mullet	*Mugil cephalus*	1676		1	1	1678
threadfin shad	*Dorosoma petenense*	4			7	11
violet goby	*Gobioides broussonnetii*	2				2
white mullet	*Mugil curema*	181			2	183
white shrimp	*Litopenaeus setiferus*	584			2870	3454
	Total	**8806**	**106**	**99**	**8760**	**17771**

2.2 Matagorda Bay

Matagorda Bay is 300 mi^2 formed by a 45-mi-long barrier island-peninsula complex that is parallel to the Gulf of Mexico and is located to the southeast of the STP site (STPNOC 2009a). The Matagorda Bay system is considered the second largest of the seven major bay systems in Texas (LCRA 2006). The bay is connected to the waters on the site as it receives water discharged from the site through drainage ditches and channels into Little Robbins Slough and downstream marshes and also through the discharge facility into the Colorado River; water in the slough, marshes, and river flows into the bay. As mentioned above, the Colorado River flows by STP then across the GIWW into a diversion channel into the bay. The bay is described as the Matagorda Bay system, and it is the third largest estuary on the Texas coast. The bay system includes Lavaca, East Matagorda, Keller, Carancahua, and Tres Palacios bays (Corps 2007).

The Colorado River and associated discharge basin is a major contributor of freshwater to Matagorda Bay (LCRA 2006). Salinity in the bay system depends on the tidal exchange and freshwater inflow. There is little vertical stratification since the bay is relatively shallow and mixing occurs from consistent winds (LCRA 2006). Salinity at the Matagorda Ship Channel is higher than in the northeastern end of the bay, closest to the diversion channel with the Colorado River, decreasing from 27 to 18 parts per trillion (ppt) (Kim and Montagna 2009).

The aquatic community of Matagorda Bay system includes organisms in the open water areas as well as organisms over hard substrates (including oyster reefs and offshore sands). In the open water areas of the bay, phytoplankton (e.g., algae) are the major primary producers that are the main food source for zooplankton (e.g., small crustaceans), fish and benthic organisms (e.g., mollusks).

3.0 Proposed Federal Actions

The proposed Federal actions are (1) NRC's issuance of two COLs for the construction and operation of two new nuclear reactors at the proposed STP site pursuant to Title 10 of the Code of Federal Regulations (CFR) 52.97, and (2) the Corps' issuance of a DA permit pursuant to Section 404 of the CWA and Section 10 of the Rivers and Harbors Act of 1899.

The NRC, in a final rule dated October 9, 2007 (72 FR 57416), limited the definition of "construction" in 10 CFR 50.10 and 51.4 to activities that fall within its regulatory authority. Many of the activities required to build a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term "preconstruction." Preconstruction activities include clearing and grading, excavating, erecting of support buildings and transmission lines, and other associated activities. These preconstruction activities may take place before the application for a COL is submitted, during the staff's review of a COL application, or after a COL is granted. Although preconstruction activities are outside the NRC's regulatory authority, many of them are within the regulatory authority of local, State, or other Federal agencies. The distinction between construction and preconstruction is not carried forward in this EFH assessment, and both are being discussed together as construction for the purposes of the NRC/Corps joint EFH consultation.

The Corps action is the decision whether to issue a permit pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Appropriation Act of 1899 for proposed structures in and under navigable waters and the discharge of dredged, excavated, and/or fill material into waters of the United States, including jurisdictional wetlands.

Prerequisites to certain construction activities include, but are not limited to, documentation of existing site conditions within the STP site and acquisition of the necessary permits (e.g., COLs, local building permits, CWA Section 402(p) Texas Pollutant Discharge Elimination System (TPDES) permit, Construction and Industrial Stormwater Permits, a DA permit, Coastal Consistency Determination per the Coastal Zone Management Act [16 USC 1451, *et seq*.], and a CWA Section 401 Certification). After these prerequisites are completed, planned construction activities could proceed and would include all or some or all the activities pursuant to 10 CFR 50.10(e)(1). Following construction, planned operation of the new reactors would be authorized if the Commission finds, under 10 CFR 52.103(g), that all acceptance criteria in the COLS are met.

Briefly, the construction and operation activities that could affect Federally-managed fish and shellfish species based on habitat affinities, life-history characteristics, and the nature and spatial and temporal considerations of the proposed actions are as follows:

Construction

- Refurbishment of the existing RMPF at the Colorado River
- Expansion of the barge slip on the Colorado River
- Barging heavy equipment and materials to STP site

Operation

- Operation of RMPF on Colorado River
- Operation of discharge structure on Colorado River
- Maintenance dredging of RMPF and barge slip

The footprint for proposed Units 3 and 4 would be approximately 2000 ft northwest of existing Units 1 and 2 (STPNOC 2009a). The cooling system would be the largest interface from the plant to the environment. The proposed new units cooling system would include the same systems currently in use for Units 1 and 2: RMFP, MCR, and discharge structure on the Colorado River. With the addition of the two proposed new units, additional makeup water would be provided to the MCR through refurbished intakes from the Colorado River at the RMPF. A portion of this makeup water would be returned to the environment via the discharge structure. The remaining portion of the water would be available for release into the atmosphere via evaporative cooling of the MCR. Groundwater is planned as the source for makeup water for the proposed Units 3 and 4 ultimate heat sink (UHS), service water for the power plants, and water for sanitary and potable water systems. The power transmission system for proposed Units 3 and 4 would not require new transmission lines or corridors, but it would use five of the nine 345-kV transmission lines that currently connect to existing STP Units 1 and 2, and involve upgrading a 20-mi section of the existing 345-kV Hillje transmission line (STPNOC 2009a). Below is further description of the major features of the proposed site.

3.1 Circulating Water Intake System

The circulating water intake system for the proposed new units consists of two parts. The RMPF pumps water from the Colorado River into the MCR. A new circulating water intake system (CWIS) would be constructed within the MCR for use by the proposed new units for cooling purposes.

Reservoir Makeup Pumping Facility. The RMPF is located along the west bank of the Colorado River and is an existing facility that would be modified solely within its existing footprint to supply makeup water to the MCR for operating all four nuclear units. The facility is located near NMM 8 on the Colorado River upstream from the confluence with the GIWW, and the structure is "flush" to the river bank with no projecting structures into the river. The RMPF withdraws water through a 406-ft-long intake along the shoreline. Water from the river flows through trash racks (with 4-in. spacing between the bars), then through traveling screens, and then over a weir into an embayment before entering the pumps into a pipeline delivering water to the MCR. There are 18 travelling screens, each of 13.5 ft width, with the bottom of the screens situated at 10 ft below mean sea level (MSL) in the Colorado River (water surface elevation in the Colorado River at 0 ft MSL). The area of the 18 screens would be 2430 ft^2. The existing traveling screens have a 3/8-in. mesh, and operate intermittently to coincide with the intermittent withdrawal of river water. For the purposes of this assessment, the review team is assuming that modifications to the RMPF would result in trash bars and travelling screens with identical characteristics to those that exist currently at the RMPF.

Fish collected on the traveling screens can be returned to the river via the existing sluice and fish bypass pipe. The fish return outfall is at the downstream end of the intake structure, approximately 2 ft below normal water elevation (STPNOC 2009a). During high-flow conditions, the accumulation of debris on the traveling screens is too high to open the fish bypass system, and screenwash discharge is directed to the sluice trench catch baskets rather than back to the river. Generally, the fish bypass system is closed when river flows are greater than 4000 cubic feet per second (cfs), and the system is occasionally closed when flows are greater than 2000 cfs (which has occurred from 2001-2006 only 7 percent of the time) (STPNOC 2009a, 2008b). Impingement mortality can be reduced based on the procedures for operating the RMPF. Operators at the RMPF are required to monitor for increased impingement rates on the traveling screens, and factors like river flow, salinity, and observations of impingement are used to determine if pumping should continue (STPNOC 2009a, 2008a, 2008b).

STPNOC has stated that periodic dredging in the future would be conducted in front of the RMPF (STPNOC 2009a). These activities are currently covered by existing permits with the Corps for the operation of Units 1 and 2. In addition, the Corps would be conducting maintenance dredging of the navigation channel in the river in the vicinity of the discharge structure and RMPF (Corps 2009a). Based on past dredging events, the substrate that would be dredged is predominantly silty-clay soils with approximately 6 in. of “detritus and silt soils” on the surface. Dredged material would be placed in the designated onsite location that is currently used for storage of material removed during maintenance activities with the RMPF (STPNOC 2009b). The area to be dredged would be approximately one ac.

Main Cooling Reservoir. The MCR is a 7000-ac engineered impoundment enclosed by an engineered embankment. STPNOC has indicated that, at the maximum normal operating pool of 49 ft MSL, the reservoir contains approximately 202,700 ac-ft of water. The CWIS for Units 3 and 4 would be located within the MCR. This CWIS would be a 131-ft by 392-ft concrete structure and would house eight pumps for the two proposed units. The structure would include trash racks and traveling screens (again, the review team assumes characteristics would be identical to those described above for RMPF trash racks and screens). Pipes carrying water from the plant would run to the turbine building. As for existing Units 1 and 2, the circulating water discharge structure for Units 3 and 4 would also be located within the MCR. The water return from Units 3 and 4 turbine buildings would enter the MCR through a new discharge structure within the MCR. The simple discharge structure would include a weir and a stilling basin to dissipate the velocity of the returning water before it enters the MCR. Dikes within the MCR increase the travel time that cooling water from the circulating water system would experience. The reject heat from the existing and proposed units would enter the MCR in the form of sensible heat in circulating water in the MCR. As the heated water circulates in the MCR, the heat is gradually dissipated to the environment through evaporation, conduction, and long-wave radiative cooling.

A diverse aquatic community exists in the MCR, but the organisms are not available for harvest. No public access or use of the MCR exists. In addition, the Corps has determined that the MCR is not considered waters of the United States (Corps 2009b), and the Texas Commission on Environmental Quality (TCEQ) has stated that the MCR is not considered waters of the State (TCEQ 2007; STPNOC 2008a).

The aquatic community in the MCR was evaluated in 2007-2008 (ENSR 2008b). A total of 11,605 finfish and invertebrates were collected over the duration of the sampling program for the MCR. The most common fish species collected were with seines, and included threadfin shad (*Dorosoma petenense*, 62 percent), inland silverside (*Menidia beryllina*, 18 percent), rough silverside (*Membras martinica*, 12 percent), and blue catfish (*Ictalurus furcatus*, three percent). The macroinvertebrates were characterized using plankton tows, and a total of 5362 organisms were collected in the MCR. The most common species (84 percent of all samples) collected were Harris mud crab larvae (*Rhithropanopeus harrisii*), and more than 99 percent of all sampled organisms were crustaceans (ENSR 2008b).

The same study also evaluated the impinged and entrained aquatic resources by the CWIS in the MCR for Units 1 and 2 (ENSR 2008b). Overall, very few fish species were impinged (less than 50 percent) or entrained (less than one percent). A total of 3982 organisms representing

25 fish species, seven invertebrate species, and one reptile species were collected during impingement sampling. Impingement rates were highest during the winter and early spring months. The dominant species collected in the impingement samples were threadfin shad (42 percent), Harris mud crab (24 percent), blue crab (*Callinectes sapidus*, 24 percent), Atlantic croaker (*Micropogonias undulates*, 5 percent), and white shrimp (*Litopenaeus setiferus*, 3 percent). A total of 207,696 organisms representing nine different fish families and 12 different invertebrate classes were collected during entrainment sampling. Entrainment rates were highest during the spring months. The dominant species collected in the entrainment samples were Harris mud crab (68 percent), unidentified decapods (15 percent), and harpacticoid copepods (6 percent). Less than one percent of the total composition of entrained organisms was fish eggs (ichthyoplankton) (ENSR 2008a).

Water quality sampling in the MCR showed that there were seasonal and spatial changes within the reservoir. Water temperature was the highest at the cooling water discharge area and gradually decreased by approximately 10°F as the water traveled through the internal levee system to the CWIS. The temperature through the water column did not vary much: 65.3°F to 96.1°F for surface measurements, and 65.1°F to 95°F for bottom measurements. Through the year, the temperature did vary. Temperature data from trawl samples increased from an average 86.4°F in May to 93.4°F in August and then decreased in October to 76.8°F and then to 70.5°F in February. Salinity remained constant throughout the reservoir and the water column at approximately 1.6 ppt.

3.2 Cooling Water Discharge System

Discharge from the MCR enters the Colorado River through a series of seven 36-in.-diameter pipes directed 45 degrees from the downstream western shore. The discharge structure is located about 2 mi downstream of the RMPF, located at NMM 6 on the Colorado River upstream from the confluence with the GIWW. The pipes entering the river are spaced 250 ft apart. Discharge that is released from the MCR approaches the diffusers through a 78-in.-diameter pipeline. As mentioned above, STPNOC has only released water through the discharge system once during the operation of Units 1 and 2. No change to the existing discharge structure is proposed for the new nuclear units (STPNOC 2009a).

3.3 Barging

The existing barge slip that was built for Units 1 and 2 would be re-excavated and expanded for use with the proposed Units 3 and 4 (STPNOC 2009c). Delivery of major equipment for Units 3 and 4 would be accomplished by barging the material to the site and would include heavy equipment (prefabricated modules, large components fabricated overseas) and bulk commodities (e.g., aggregate or structural fill materials). STPNOC has stated that no firm shipping contracts have been developed for transportation of the materials to the STP site. However, STPNOC has indicated that the current plans call for prefabricated modules and components fabricated overseas to be shipped to the Port of Freeport (or points north) where they would be transferred from ocean-going ships to inland barges. The inland barges would then enter the GIWW and move south to the confluence of the Colorado River and proceed upstream to the site. The ports in Matagorda Bay to the south of the site currently do not have adequate facilities for the transfer of heavy cargo from ocean-going vessels to inland barges. Therefore, transport of these materials would not involve the Matagorda Ship Channel or the diversion canal in Matagorda Bay (STPNOC 2009b).

STPNOC plans to ship bulk commodities via inland barge. Access to the Colorado River by the barges would depend on the source of the materials, and could be transported either from the north or south along the GIWW. However, no bulk commodity traffic is expected to traverse the diversion canal in Matagorda Bay or the Matagorda Ship Channel (STPNOC 2009b).

4.0 Essential Fish Habitat Species Descriptions

The proposed Units 3 and 4 at the STP site are located in an area that is designated as EFH in Ecoregion 5 by the Gulf of Mexico Fishery Management Council (GMFMC 2004). The NRC and the Corps conducted an evaluation by identifying and considering all designated EFH that occurs near the STP site (GMFMC 2004; NMFS 2009). Table 2 lists the species with designated EFH in Matagorda Bay, GIWW, and the Colorado River extending up to the bridge at FM 521 (located at NMM 10 on the Colorado River upstream from the confluence with the GIWW). With the exception of a few species that do not occur in the region of interest, or occupy EFH that would not be affected by the proposed actions, these species and their life stages that rely on habitats essential for species propagation are detailed below with regard to the impact of the proposed Federal actions on EFH.

During the initial review of life history and EFH requirements, some life stages were eliminated from further consideration based on depth requirements, or life history information that suggested specific life stages are unlikely in the Colorado River extending up to the bridge at FM 521, GIWW, and Matagorda Bay (Table 3). Table lists the species and life stages evaluated in this EFH assessment.

1 **Table 2.** Designated Essential Fish Habitat with Ecoregion 5

Fishery Management Plan	*Species*	Common Name	Life Stage
Coastal Migratory Pelagic	*Scomberomorus cavalla*	king mackerel	eggs, larvae, juveniles, adults
Coastal Migratory Pelagic	*Scomberomorus maculatus*	Spanish mackerel	eggs, larvae, juveniles, adults
Reef Fish	*Lutjanus griseus*	gray (mangrove) snapper	eggs, larvae, juveniles, adults
Red Drum	*Sciaenops ocellatus*	red drum	eggs, larvae, juveniles, adults
Shrimp	*Farfantepenaeus aztecus*[a]	brown shrimp	eggs, larvae, juveniles, adults
Shrimp	*Farfantepenaeus duorarum*[b]	pink shrimp	eggs, larvae, juveniles, adults
Shrimp	*Litopenaeus setiferus*[c]	white shrimp	eggs, larvae, juveniles, adults
Stone Crab	*Menippe adina*[d]	Gulf stone crab	eggs, larvae, juveniles, adults

Sources: Guillory et al. 1995; GSMFC 1995; Cascorbi 2004; NMFS 2009.
(a) This species was formerly known as *Penaeus aztecus*.
(b) This species was formerly known as *Penaeus duorarum*.
(c) This species was formerly known as *Penaeus setiferus*.
(d) *Menippe adina* has been recognized as a new species, distinct from *M. mercenaria*, and is the species most common in the Gulf along the Texas coastline.

2 **Table 3**. Species and Life Stages Excluded from Essential Fish Habitat Assessment

Common Name	Life Stages Excluded	Rationale for Exclusion
King mackerel	eggs, larvae, adults (juveniles retained)	depth requirements not present in Colorado River, GIWW, or Matagorda Bay[a]
Brown shrimp	eggs, adults (larvae, juveniles retained)	depth requirements not present in Colorado River, GIWW, or Matagorda Bay[a]
Pink shrimp	eggs, adults (larvae, juveniles retained)	depth requirements not present in Colorado River, GIWW, or Matagorda Bay[a]
White shrimp	eggs, adults (larvae, juveniles retained)	depth requirements not present in Colorado River, GIWW, or Matagorda Bay[a]

(a) GMFMC 2004

Table 4. Essential Fish Habitat Included in Evaluation

Fishery Management Plan	***Species***	Common Name	Life Stage
Coastal Migratory Pelagic	*Scomberomorus cavalla*	king mackerel	juveniles
Coastal Migratory Pelagic	*Scomberomorus maculatus*	Spanish mackerel	eggs, larvae, juveniles, adults
Reef Fish	*Lutjanus griseus*	gray (mangrove) snapper	eggs, larvae, juveniles, adults
Red Drum	*Sciaenops ocellatus*	red drum	eggs, larvae, juveniles, adults
Shrimp	*Farfantepenaeus aztecus*	brown shrimp	larvae, juveniles
Shrimp	*Farfantepenaeus duorarum*	pink shrimp	larvae, juveniles
Shrimp	*Litopenaeus setiferus*	white shrimp	larvae, juveniles
Stone Crab	*Menippe adina*	Gulf stone crab	eggs, larvae, juveniles, adults

4.1 King Mackerel

King mackerel (*Scomberomorus cavalla*) are highly migratory and are aggressive predators that prefer feeding on schooling fish. Occasionally they eat penaeid shrimp and squid. Adult king mackerels consume mainly fish around 4 to 6 in. Juveniles eat smaller fish and invertebrates, particularly bay anchovy (*Anchoa mitchilli*). King mackerel can live to at least 14 years, although most die earlier. Females grow larger than males and spawn in their third or fourth year of life, with spawning occurring in the summer months (TSFGW 2005; FMNH 2009; TPWD 2009). Adults are primarily found offshore, but juveniles occasionally frequent estuarine waters for foraging (GMFMC 2004). Although no king mackerel have been observed during sampling studies, juvenile king mackerel are likely to occur in Matagorda Bay, GIWW, and the Colorado River.

4.2 Spanish Mackerel

Adult Spanish mackerel *(Scomberomorus maculates)* forage in estuarine and marine nearshore pelagic waters, and eggs and juveniles also occur nearshore marine surface (eggs) and pelagic (juveniles) waters (GMFMC 2004). The species is often found in large schools near the water surface. Juvenile and adult Spanish mackerel are fast-moving, voracious predators that feed on other smaller schooling fish. Spawning takes place from late spring to late summer at depths of less than 50 m along the Texas inner continental shelf (DeVries et al. 1990; Patillo et al. 1997). According to an EFH assessment in Matagorda Bay by the Corps (2007), adult and juvenile Spanish mackerel are found in the Gulf and Matagorda Bay throughout the year. The surveys of the Colorado River did not report any Spanish mackerel (NRC 1986; ENSR 2008a; STPNOC 2009a).

4.3 Gray Snapper

Larval, juvenile, and adult life stages of gray snapper (*Lutjanus griseus*) are considered because these life stages primarily occupy inshore habitats, such as those in the Colorado River, GIWW, and Matagorda Bay (GMFMC 2004). Eggs are neritic and demersal, and are found primarily in marine waters. Larvae are marine, neritic, and planktonic, and are known to be in the Gulf from April through November. As they mature, gray snapper move into estuarine habitats and occupy inshore grassy areas. Juveniles and adults are found in inshore marine and estuarine habitats with SAV or near mangroves, where they forage on small fish and crustaceans (Croker 1962; Patillo et al. 1997). The Corps (2007) reported that gray snapper are found in Matagorda Bay. Patillo et al. (1997) indicated that gray snapper are rare as adults and juveniles, but other life stages were not present in Matagorda Bay. Gray snapper were collected within the first 3 mi of the Colorado River from the confluence with the GIWW during the 2007-2008 sampling events (ENSR 2008a).

4.4 Red Drum

Red drum (*Sciaenops ocellatus*) larvae and juveniles spend most of their time in estuarine soft bottom, sand/shell, and SAV habitats actively feeding on copepods, mysid shrimp (*Mysidopsis bahia*), amphipods, decapods, and small fish. All free swimming life stages of the red drum are carnivorous. Adults spend some time near inshore SAV, sandy or hard-bottom foraging habitats but are predominantly found offshore where spawning activities occur (Patillo et al. 1997; GMFMC 2004). Red drum move to deep offshore waters to spawn in the fall and then return to nearshore coastal and estuarine habitats where they spend most of their life cycle (FFWCC 2007). Tidal currents move larvae to nearshore habitats, where they grow rapidly as juveniles during the first two years, and associate with seagrass habitats, with little wave action (Buckley 1984). The Corps (2007) reported that juvenile red drum are present in Matagorda Bay throughout the year. Patillo et al. (1997) indicated that all life stages of red drum were common in Matagorda Bay. Red drum were collected in along the Colorado River in 2007-2008 with all types of sampling gear, indicating that the species was well distributed in the river (ENSR 2008a).

4.5 Shrimp

Adult brown shrimp migrate (*Farfantepenaeus aztecus*) from offshore pelagic environment as larvae to inhabit grassy, estuarine habitats as juveniles (GMFMC 2004). They spawn in offshore waters between spring and early summer. The eggs are demersal and deposited offshore. Larvae migrate into estuarine waters through passes during flood tides. Juveniles inhabit a variety of areas where they can burrow in shallow estuarine waters, ranging from areas with vegetative cover to open silty sand, nonvegetated mud substrate. Postlarvae and juveniles can tolerate a range of salinities, from 0 to 70 ppt. Juveniles and subadults prefer soft, muddy areas. Subadult brown shrimp migrate from estuaries into the Gulf (Patillo et al. 1997; GMFMC 2004; Corps 2007). Juvenile and adult shrimp are omnivorous with diets that vary between available food sources within the occupied habitat, which is preferably soft bottom, shallow estuarine areas (FWS 1983). According to an EFH assessment in Matagorda Bay by the Corps (2007), juvenile brown shrimp are common to highly abundant in Matagorda Bay year-round, while adults are common to highly abundant from April to July and are rare from August through March. Brown shrimp were collected in sampling studies all along the Colorado River in 1983-1984 and 2007-2008 (NRC 1986; ENSR 2008a; STPNOC 2009a).

Pink shrimp (*Litopenaeus duorarum*) in the Texas coastal waters are often difficult to distinguish from brown shrimp, and pink and brown shrimp are usually reported together in information about the shrimping fishery in Texas coastal waters (Patillo et al. 1997). Adults occur offshore and migrate into estuaries in the spring and fall. Postlarvae and juvenile pink shrimp select habitats with seagrass and shoalgrass, where they burrow by day and emerge and are active at night (Patillo et al. 1997; Corps 2007). Like brown shrimp, juvenile and adult shrimp are omnivorous (Patillo et al. 1997). According to an EFH assessment in Matagorda Bay by the Corps (2007), juvenile pink shrimp are common in Matagorda Bay year-round, while adults are common from November through June. Pink shrimp were not reported in surveys of the Colorado River in 2007-2008 (ENSR 2008a).

Adult white shrimp (*Litopenaeus setiferus*) also migrate from offshore pelagic environment as larvae to inhabit grassy, estuarine habitats as juveniles (GMFMC 2004). They spawn in offshore waters from spring to fall (FWS 1983). The eggs are demersal and deposited offshore (Patillo et al. 1997). White shrimp larvae may be found in the nearshore marine water column, but they prefer estuarine habitats and migrate further upstream in estuarine waters than brown shrimp (GMFMC 2004). Juvenile and adult shrimp are omnivorous with diets that vary between available food sources within the occupied habitat, which is preferably soft-bottom, shallow estuarine areas (FWS 1983). According to an EFH assessment in Matagorda Bay by the Corps (2007), adult and juvenile white shrimp are common to abundant in Matagorda Bay throughout the year, except in July when adult white shrimp are absent. White shrimp were collected in sampling studies all along the Colorado River in 1983-1984 and 2007-2008 (NRC 1986; ENSR 2008a; STPNOC 2009a).

4.6 Gulf Stone Crab

The Gulf stone crab (*Menippe adina*) occupies estuarine and marine SAV, sand/shell, and hard-bottom habitats as eggs, larvae, and juveniles (GMFMC 2004). Adults are both intertidal and subtidal and are typically found near oyster reefs or other hard-bottom substrate, and prefer a diet of oysters (Wilber 1989). Juveniles feed on small mollusks, worms, and crustaceans. Females maintain eggs on their abdomen until they hatch and become planktonic. As they metamorphose to larvae, they become epibenthic, settling to areas providing cover (e.g., rubble and seagrass beds). The stone crab FMP allows harvest only of individuals with claws greater than 2.75 in. long. Florida stone crabs (*M. mercenaria*) require high salinities for juvenile growth, but the Gulf stone crab tolerates estuarine waters (GMFMC 2004). All life stages of Gulf stone crab are considered common throughout the year in Matagorda Bay (Patillo et al. 1997; Corps 2007). Gulf stone crabs were not reported in surveys of the Colorado River in 1983-1984 and 2007-2008 (NRC 1986; ENSR 2008a; STPNOC 2009a).

5.0 Potential Environmental Effects of the Proposed Federal Actions

This section describes the potential impacts from the construction and operation of proposed Units 3 and 4 at the STP site to Federally-managed estuarine and marine fish and shellfish and their habitats. Most of the construction and operation impacts to EFH would be limited to the Colorado River. Barging traffic during construction of Units 3 and 4 would be associated with Matagorda Bay, GIWW and the Colorado River.

5.1 General Construction Impacts

Construction activities in the Colorado River for the proposed Units 3 and 4 are limited to the RMPF, the barge slip and barging traffic to the STP site. Activities within the MCR are not part of this assessment because the aquatic organisms in the MCR are considered removed from the ecological system of the Colorado River, and the MCR is not included as designated EFH.

Half of the intake screens on the RMPF have not been used during the operation of STP Units 1 and 2, and they would be removed from the water and either refurbished or replaced. New pumps for proposed Units 3 and 4 would be installed behind the embayment located behind the traveling screens. These activities would involve little underwater disturbance, which would be limited to the front of the intake structure. EFH in the Colorado River would likely not be adversely affected during construction because of the minimal activity in the river that would be required by the refurbishment of the RMPF.

When the barge slip for existing STP Units 1 and 2 was built, a sheet pile wall was installed in the river to control sedimentation and limit downstream increases in turbidity and siltation. At that time, an estimated area of less than one ac of benthic habitat was destroyed during the building of the barge slip (STPNOC 2009a). The areal extent and types of disturbances to the shoreline and in the river for the re-excavation and expansion of the slip for transporting the barged materials for proposed Units 3 and 4 is anticipated to be similar to or less than the disturbances during the building of Units 1 and 2 (STPNOC 2009c). The loss of soft-bottom habitat would likely reduce the potential forage area for the penaeid shrimp and some benthic-feeding EFH fish species. However, the area is not one of high benthic productivity, and the area that would be lost is relatively small.

STPNOC has indicated the current plans call for heavy equipment (prefabricated modules and components fabricated overseas) to be shipped to the Port of Freeport (or points north) where they would be transferred from ocean-going ships to inland barges. The inland barges would enter the GIWW, move south to the confluence of the Colorado River, and proceed upstream to the site. Bulk commodities (e.g., aggregate or structural fill material) could be barged to the STP site from ports to the north or south along the GIWW. There is no estimate for the number of barges that would deliver to the STP site (STPNOC 2009b). Based on the minimum depths and narrow channels that the barges would have to travel in the Colorado River, the barges are likely to be slow moving, and would have minimal wave disturbances along shoreline habitat. Habitat for aquatic organisms in the vicinity of the barge slip would be disturbed while barges continue to use the area. While there would be an increase in turbidity and silt in the water column associated with docking and the potential for discharge of small amounts of gas, oil, and grease from motors, the overall impact would be short in duration (STPNOC 2009b).

Erosion and sedimentation controls, are expected to minimize quantities of sediment or silt. Increase in turbidity would increase suspended sediments in the water column, but it is not likely that such sediments would be transported far down the river. Dredging would remove habitat (probably less than three ac) for organisms in the area of the barge slip, and could take individuals that cannot avoid the area. Based on the short duration and limited area of the river that would be affected, the impacts from construction activities for proposed Units 3 and 4 at STP are likely to be minor for aquatic resources in the Colorado River, the GIWW and Matagorda Bay.

5.2 General Operational Impacts

Operational activities in the Colorado River are limited to pumping water at the RMPF, discharge of the MCR water into the river, and maintenance dredging of the RMPF. Removal of water from the Colorado River at the RMPF affects aquatic organisms by impingement on screens, entrainment into the cooling system, and entrapment in the MCR. Discharging from the MCR into the Colorado River has the potential to affect the aquatic organisms because of the thermal, chemical, and physical characteristics of the discharge plume. Maintenance dredging around the RMPF and barge slip has the potential to remove habitat.

Impingement, Entrainment, and Entrapment. The RMPF has a number of design elements that are expected to minimize impingement, entrainment and entrapment of aquatic organisms during operation of all the STP units. For aquatic resources, the primary concerns related to water intake and consumption are the impacts related to the relative amount of water drawn from the cooling water source (Colorado River and MCR) and the potential for organisms to be impinged on the intake screens entrained into the cooling water system, or entrapped in the MCR. Impingement occurs when organisms are trapped against the intake screens by the force of the water passing through the screens at the RMPF on the Colorado River and the CWIS on the MCR. Impingement can result in starvation and exhaustion, asphyxiation (water velocity forces may prevent proper gill movement or organisms may be removed from the water for prolonged periods of time), and descaling. Entrainment occurs when organisms are drawn through the RMPF from the Colorado River into the MCR, or through the CWIS from the MCR into the proposed Units 3 and 4 cooling system. Organisms that become entrained are normally relatively small benthic, planktonic, and nektonic (organisms in the water column) forms, including early life stages of fish and shellfish, which often serve as prey for larger organisms (69 FR 41576). Entrained organisms from the Colorado River have survived the stresses of the intake system and colonized the MCR, creating a rather diverse aquatic community that is removed from the rest of the ecosystem in the region. The survey of the MCR in 2007 and 2008 indicates that many individuals of numerous species have survived entrainment at the RMPF and are living in the MCR. While these entrapped organisms have survived entrainment of the pumps at the RMPF, overall the entrainment and entrapment have led to a loss of the organisms in the Colorado River, and these organisms no longer contribute to the richness of the river community as they are effectively isolated. Organisms in the MCR that pass through the CWIS into the plant’s cooling system are subject to mechanical, thermal, and toxic stresses, and survival of CWIS entrainment is unlikely and assumed to be zero for the purposes of this assessment.

A number of factors, such as the type of cooling system, the design and location of the intake structure, and the amount of water withdrawn from the source water body greatly influences the degree to which impingement and entrainment affect the aquatic biota. The 7000-ac MCR is considered a closed-cycle cooling system since the water in the reservoir continues to circulate from the MCR, into the plant, and back again. Water loss from the MCR through evaporation, seepage, and discharge is made up from the Colorado River.

The RMPF is located on the Colorado River, which is designated as a tidal stream (TCEQ 2008) and includes EFH for Federally managed fish and shellfish species (GMFMC 2004). Locating intake systems in such areas with sensitive biological communities is generally considered a negative factor in protection of aquatic life (69 FR 41576). However, the segment of the river where the RMPF is situated (Segment C) has fewer organisms and less species richness than the downstream segment of the river, closer to the GIWW (Segment A)(ENSR 2008b). During 2007-2008, 18 percent of the total number of individuals collected were from Segment C as compared to 44 percent from Segment A; and 42 species were collected from Segment C as compared to 62 species from Segment A (Figures 4 and 5).

Operation of the RMPF is based on the need for makeup water in the MCR, and Section 5.2.2.1 of the EIS discusses the conditions when STPNOC would pump water from the Colorado River into the MCR. One of these conditions is pumping makeup water during periods of high flows in the Colorado River. Pumping at high-flow conditions minimizes impacts to aquatic organisms in the water column because the organisms are likely to remain in the river flow and not likely to be caught in the influence of the water being pumped into the RMPF located on the shoreline (STPNOC 2008b, 2008c, 2009a). During the 2007-2008 aquatic ecology studies in the Colorado River, there was an inverse relationship between high-flow conditions and low densities of fish (as expressed in the catch per unit effort) (ENSR 2008a; STPNOC 2008b, 2008c). Salinity can be an indicator of an influx of estuarine species moving up the river from the GIWW. STPNOC has stated that the salinity of the water being pumped would be monitored, and when the pumped water exceeds 3 ppt, the traveling screens would be monitored for increased impingement. The operation of the fish-return system at the RMPF is a function of river flow and the amount of debris and organisms removed in the screen wash discharge (STPNOC 2008a).

Location of the RMPF and the intake screens on the shoreline of the Colorado River can minimize entrainment and entrapment (as a function of minimized entrainment). The RMPF was designed to maintain the traveling intake screens on the facility parallel with the flow in the river (69 FR 41576), or "flush" to the river bank with no projecting structures that create eddies and countercurrents that would cause entrapment (NRC 1986; STPNOC 2009a). Most organisms likely to be entrained or entrapped would be present in higher densities in the main river channel and less likely to be removed from the river by an intake facility sited on the shoreline. Entrapment of aquatic organisms in a restricted area (e.g., in the sedimentation basin between the RMPF intake screens and the pumps and in the MCR) can lead to congregation of the organisms, and if environmental conditions change, the organisms may be harmed. Under such conditions, entrapment can increase impingement of aquatic organisms.

Another important factor that influences the rate of impingement, entrainment, and entrapment of organisms at a facility is the intake design through-screen velocity. The higher the through-screen velocity, the greater the number of fish impinged, entrained, and entrapped. The Environmental Protection Agency defines the through-screen velocity as the water velocity immediately in front of the screen, and the maximum design, through-screen velocity is no more than 0.5 feet per second (fps) (69 FR 41576). STPNOC has determined that the RMPF has a maximum design approach velocity at the traveling screens of 0.5 fps based on a maximum pumping rate of approximately 538,000 gpm (STPNOC 2008b, 2009a). The review team independently calculated that the velocity directly in front of the screens was dependent on the withdrawal rate of the RMPF: for withdrawals of 60 and 1200 cfs, the average velocity in front of the screen would be 0.025 and 0.49 fps. The resulting low through-screen velocity reduces the probability of impingement because most fish can swim against such low flows to avoid or swim off of intake streams.

Other design features at the RMPF would also help to reduce impingement mortality (69 FR 41576). In front of the traveling water screens are coarse trash racks and stop-log guides that allow fish that approach the RMPF to have free passage, reducing entrapment and impingement. The traveling screens have a 3/8-in. mesh, and operate intermittently to coincide with the intermittent withdrawal of river water. Fish collected on the traveling screens can be returned to the river via the sluice and a fish bypass pipe. The discharge point of the fish bypass system is at the downstream end of the intake structure, approximately two ft below normal water elevation (STPNOC 2009a). During high-flow conditions, the accumulation of debris on the traveling screens is too high to open the fish bypass system, and screenwash discharge is directed to the sluice trench catch baskets rather than back to the river. Generally, the fish bypass system is closed when river flows are greater than 4000 cfs, and the system is occasionally closed when flows are greater than 2000 cfs (which has occurred from 2001-2006 seven percent of the time) (STPNOC 2008b, 2009a). Impingement mortality can be reduced based on the procedures for operating the RMPF. Operators at the RMPF are required to monitor for increased impingement rates on the traveling screens, and factors like river flow, salinity, and observations of impingement are used to determine whether pumping should continue (STPNOC 2008b, c, 2009a).

Entrainment and impingement studies were conducted as part of the licensing process for STP Units 1 and 2, and were discussed in the Final Environmental Statement (FES) for operation (NRC 1986). Studies conducted in 1975-1976, prior to construction of the RMPF, estimated entrainment of the larvae of the most common fish and crustacean species during an 8-month period at Station 2 on the Colorado River (Figure 3): 3.37×10^6 Atlantic croaker, 1.35×10^6 Gulf menhaden (*Brevoortia patronus*), 1.32×10^6 blue crab, 5.44×10^5 bay anchovy and 1.1×10^4 shrimp (undetermined species) larvae. There was a seasonal fluctuation of the species collected monthly during the study. Atlantic croaker larvae were entrained mainly from November through January. From January through April 1976, Gulf menhaden larvae were the predominant species. Anchovy eggs and larvae occurred sporadically throughout the sampling year. Highest numbers of juvenile and megalops of blue crab were collected in October, but there were increased numbers taken in September and April (NRC 1986).

The entrainment studies in 1983-1984 were conducted during the filling of the MCR (NRC 1986). Different species of fish and crustaceans were collected compared to the studies in 1975-1976. The primary fish species collected in the vicinity of the plant intake were bay anchovies, followed by darter goby (*Ctenogobius boleosoma*) and naked goby (*Gobiosoma bosc*). The most common crustacean collected were the zoea larval stage of the Harris mud crab, followed by the zoea and postlarval stages of the ghost shrimp (*Callianassa* spp.). Postlarval stages of the brown shrimp and white shrimp and the juvenile stages of the blue crab were collected only sporadically in river samples. The variety of species collected illustrates that the lower Colorado River is used as a nursery area by estuarine-marine organisms (NRC 1986). The seasonal variations in species and numbers of individuals found in these studies

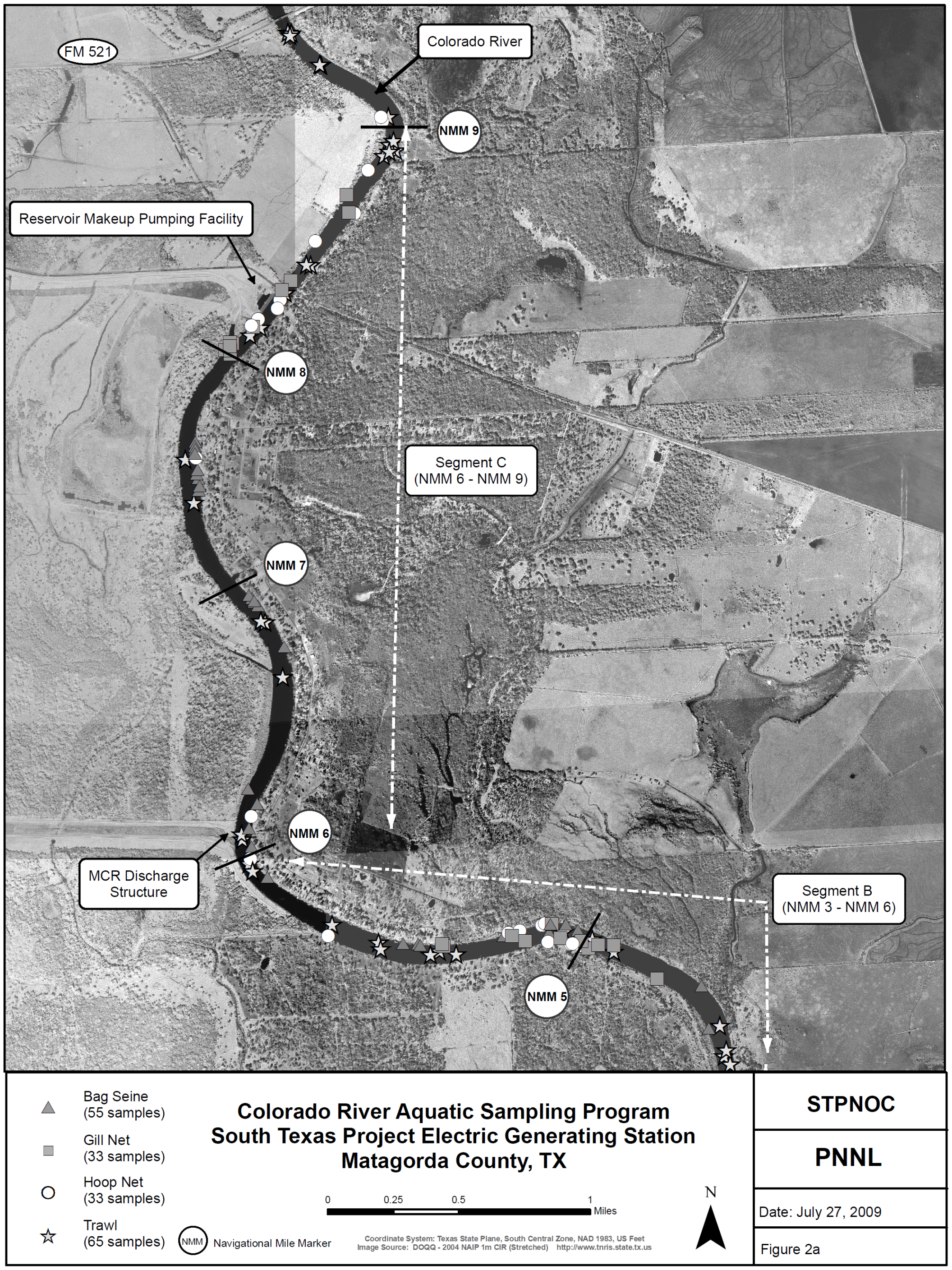


Figure 4. Aquatic Ecology Sampling Locations for 2007-2008 on the Colorado River from Navigation Mile Marker 5 to 9

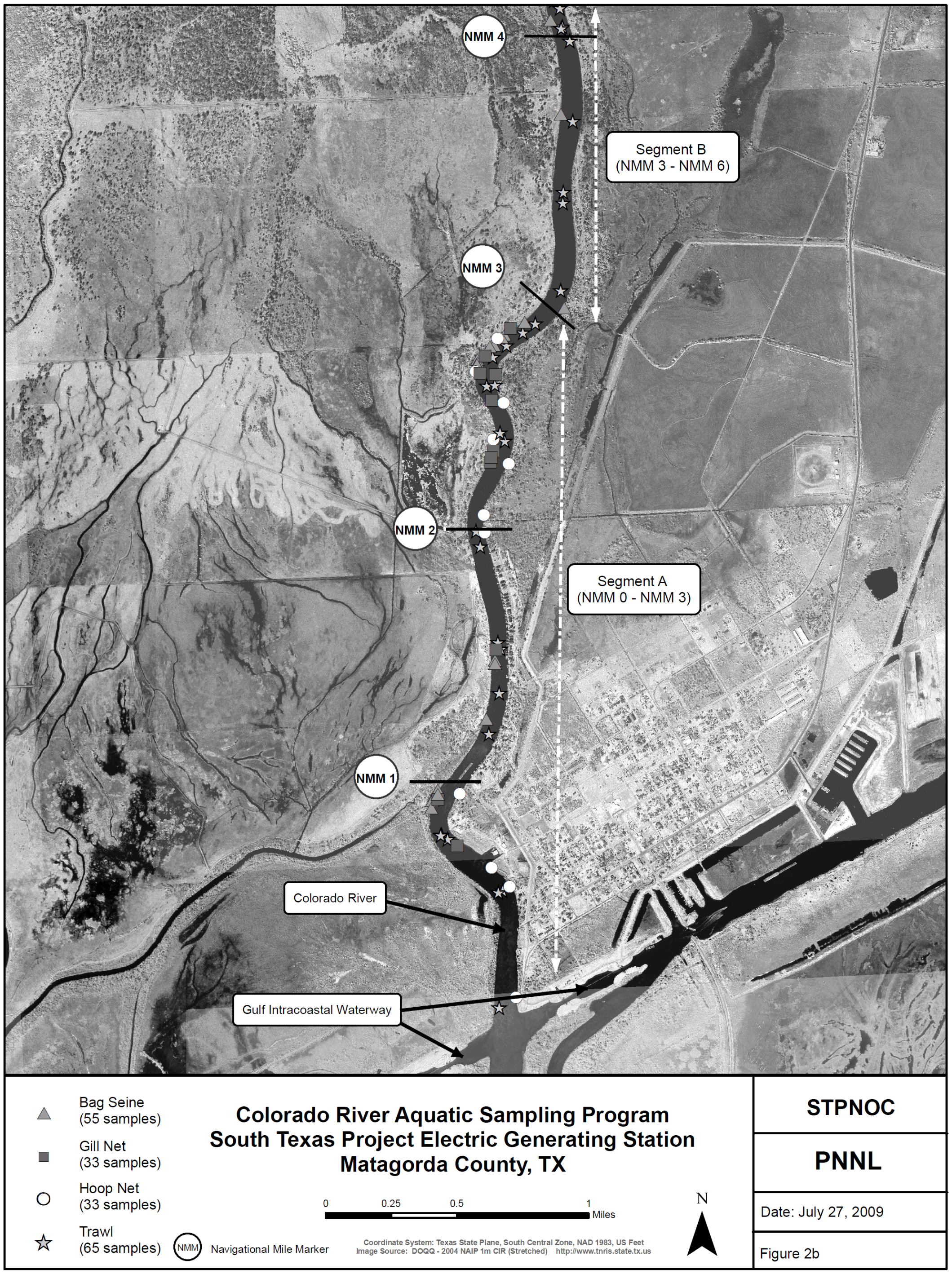


Figure 5. Aquatic Ecology Sampling Locations for 2007-2008 on the Colorado River from Gulf Intracoastal Waterway to Navigation Mile Marker 4

emphasize the complexity of the aquatic environment in the Colorado River and in the vicinity of the RMPF. These variations are a function of the species' reproductive periods, changes in the flow of the river, the mixture of freshwater coming down the river, and tidal influence of the Gulf.

The FES for operation (NRC 1986) concluded that entrainment losses for the species that were collected during the two studies would not constitute a significant impact to their respective populations for several reasons. They estimated that the actual entrainment losses would probably be near a median value of about 10 percent of the organisms passing the RMPF. This value represents the loss of organisms in the influence of the tidal flow in the river and does not represent the entire populations of those species in the Colorado River. The organisms that use the lower Colorado River as a nursery also use many other tidal river systems along the Texas and Gulf coast, and the area influenced by the RMPF is not unique. The most common species collected in the entrainment studies were bay anchovy, Gulf menhaden, Atlantic croaker and blue crab; the species are ubiquitous and abundant along the Texas and Gulf coast. The reproductive potential (fecundity) for the species collected during the entrainment studies is high (e.g., one female blue crab can produce over her lifetime at least as many larvae as were projected to be entrained by the studies). And finally, the most makeup water withdrawal would occur during high river flow conditions when tidal flows are low at the RMPF, which is when the concentrations of estuarine and marine organisms would be lowest (NRC 1986).

Impingement studies were conducted during 1983-1984, while river water was being pumped into the MCR. The study reported that the highest numbers of organisms impinged over a 30-minute collection period for two intake screens at the RMPF were 64 organisms in July and 13 organisms in September. The number of organisms that could be impinged for all 24 screens at the RMPF and for two pumping velocities (85 cfs and 260 cfs) was extrapolated to be from 156 to 768 individuals over a 30-minute period. Gulf menhaden was the most common species impinged, which relates to their small size (and thus, relatively low swim speed), dense schooling nature and high relative abundance at the site. The report estimated that Gulf menhaden could constitute about 65 percent of the total number of all individuals impinged at the RMPF. The other major species that could be impinged include: Atlantic croaker (16 percent), bay anchovy (10 percent) and mullet (eight percent, undetermined species). The remaining species that were collected during the impingement study were expected to make up less than one percent of all the individuals impinged.

The FES for operation concluded that impingement losses would have only a minor effect on the biota of the Colorado River. The reasons cited for the minor impacts due to impingement included those mentioned above for perspective on entrainment losses (e.g., the species are ubiquitous and the number of similar habitat areas along the Texas Gulf coast). Additional reasons cited included design elements of the RMPF that should reduce impingement losses. For example, the mounting of the intake screens on the RMPF flush with the shoreline and without protruding sidewalls into the flow of the river would reduce entrapment and concentration of organisms ahead of the screens. Also, the location of the screens would decrease eddy currents downstream and allow free passage of the organisms into the main channel. Trash racks and the fish handling and bypass system were other features cited that would reduce impingement losses. Finally, the location of the intake structure was designed to use the upper stratum of the river water that is primarily freshwater flowing downstream in the river and not the lower portion of the river in the salt wedge where the estuarine organisms are most common (NRC 1986).

Since the impingement and entrainment studies for the RMPF were conducted, the Corps completed the Mouth of the Colorado River Project, diverting the Colorado River flow from the Gulf into Matagorda Bay (Wilbur and Bass 1998; Corps 2005). The diversity of aquatic species has increased since the diversion of the river. Of the most common species impinged during the 1983-1984 studies (NRC 1986), Gulf menhaden, striped mullet (*Mugil cephalus*) and Atlantic croaker continue to be the most common species of fish collected around the RMPF, and probably are the most common species impinged today for the same reasons speculated above. The lack of studies over time in the lower Colorado River makes it difficult to conclude if the aquatic communities are stable based on the changes in the river system and the relationship of the species distributed in the region to the flow of freshwater and tidal changes. However, the results and conclusions of the earlier impingement and entrainment studies mentioned above are still applicable because the design features of the RMPF that would minimize losses of organisms would not change with the addition of proposed Units 3 and 4 at the STP site.

The survey of fish and shellfish in the Colorado River in 2007-2008 indicates that the river has a large population of fresh- and saltwater species, with high species richness and a strong dynamic ecosystem. Impingement, entrainment, and entrapment from current operations of the RMPF have removed individuals from the river environment. A survey of only one year provides limited information about the robustness of the populations of aquatic organisms in the river. However, based on the limited information from the latest survey and what is known about the design of the RMPF, the operation of the RMPF does not appear to have changed the populations of the species currently found in the river.

Entrapment and entrainment of the smaller organisms and early life stages would be removed from the Colorado River ecosystem. Some of these organisms may survive and thrive in the MCR. There would be indirect effects for those EFH species that forage on the organisms that are lost through entrapment and entrainment. Impingement is likely to affect the EFH species that have life stages that could not swim away from the intake screens.

Thermal, Chemical, and Physical Impacts. The operation of the discharge system into the Colorado River would likely have impacts on the aquatic resources from heated effluents, chemical impacts, and physical impacts. There is a current TPDES permit for the discharge of the MCR water into the Colorado River that would be applicable for the proposed new units as well as the existing units (TCEQ 2005). During the operation of the existing units, no discharge from the MCR to the Colorado River has been needed to maintain the dilute solutes present in MCR water quality at acceptable levels for the circulating water systems. The current TPDES permit allows an average daily MCR discharge of 144 million gallons per day (MGD) with a daily maximum of 200 MGD. The average daily MCR discharge temperature is limited to 95°F with a daily maximum of 97°F. Total residual chlorine in the MCR discharge is limited to a daily maximum of 0.05 mg/L. The pH of the MCR discharge is limited to between 6.0 and 9.0 standard units. The TPDES permit specifies that MCR discharge must not exceed 12.5 percent of the flow of the Colorado River at the discharge point. The permit also restricts the MCR discharges to periods when the flow of the Colorado River adjacent to the site is 800 cfs or greater. Whole effluent toxicity testing (i.e., biomonitoring) of the MCR water is also required prior to discharging water into the river (TCEQ 2005). The MCR discharge facility consists of seven submerged ports located on the west bank of the Colorado River approximately 2 mi downstream of the RMPF. Each port can discharge at a maximum rate of 44 cfs, for a total maximum MCR discharge of 308 cfs (STPNOC 2009a).

STPNOC stated that, as part of their operating policy, they would discharge water from the MCR into the Colorado River when they are concurrently pumping water at the RMPF (STPNOC 2009d). STPNOC would discharge water from the MCR when the specific conductivity of the water in the MCR exceeds 3000 microsiemens per centimeter (μS/cm). STPNOC would pump makeup water from the Colorado River under conditions specified by the Lower Colorado River Authority (LCRA) contract. The conditions that STPNOC would consider when planning to discharge from the MCR include: when the MCR water level is between 40 and 49 ft MSL; when the river water conductivity is less than 2100 μS/cm; and when the river flow at the discharge facility is greater than or equal to 2500 cfs. STPNOC revised these conditions and indicated that they might discharge MCR water when the river flow is as low as 800 cfs, as permitted by their TPDES permit (TCEQ 2005; STPNOC 2009e). If all these conditions are met, STPNOC would then only discharge when the MCR water had a conductivity greater than or equal to 3000 μS/cm. STPNOC would cease discharging when any of those conditions changed or when the MCR water had a conductivity less than or equal to 2100 μS/cm (STPNOC 2009d). STPNOC estimated that the need for discharging would likely be as frequent as once every 11 days and could be continuous for as nearly much as 75 days. No information was provided on the most likely time of year for discharging water (STPNOC 2009d).

STPNOC (STPNOC 2009a) as well as the NRC and Corps review team evaluated the maximum thermal plume from the discharge of the MCR water into the Colorado River using the Cornell Mixing Zone Expert System (CORMIX). The maximum thermal plume dimensions would occur when there was the greatest difference in temperatures between the MCR water and the water in the river (20.4°F) and a discharge rate from the MCR was the greatest (308 cfs). Under these discharge conditions, the minimum streamflow of the Colorado River would be 2464 cfs based on the specifications of the TPDES permit where the discharge volume cannot be less than 12.5 percent of the streamflow in the Colorado River.

Based on the results of the CORMIX modeling of the maximum expected thermal plume dimensions, the thermal plume that is 5°F above ambient conditions would be attached to the bottom of the river from the discharge pipe to 120 ft downstream, and the plume would extend approximately 25 percent across the width of the river. Approximately 100 ft downstream of the last discharge port, the plume becomes buoyant rises to the surface of the river. The surface of the river is predicted to have an elevated temperature from approximately 1060 ft downstream of the last discharge port to about 4400 ft downstream from the discharge ports. Under these conditions, there would be a portion of the water column that would remain at ambient river temperatures as the plume rises to the surface and extends from bank to bank that would allow foraging fish (e.g., Gulf menhaden, black drum [*Pogonias cromis*], striped mullet) to move up and downstream. Also, the invertebrate species (e.g., grass [*Palaemonetes pugio*], white and brown shrimp) and other bottom dwellers would be able to pass along the bottom of the river on the far side of the discharge structure without passing through the elevated temperature plume.

The review team evaluated the possibility that the thermal plume generated by discharging the MCR water into the Colorado River could coincide with poor water quality for aquatic organisms in the river at the discharge structure. ENSR (2008a) measured water quality, e.g., salinity and dissolved oxygen, at various levels in the water column while collecting fish and shellfish. There are times of the year that ENSR reported the water at the bottom of the river was anoxic or low in dissolved oxygen (hypoxic, or with dissolved oxygen less than 2 mg/L) when the salinity was high. The conditions were most often observed at or below the mid point of the water column. The combination of the maximal thermal plume and poor river water conditions (e.g., high salinity and low dissolved oxygen) would force aquatic species to avoid the area completely. STPNOC compared the results reported by ENSR (2008a) and the flow in the river at the nearest gaging station at the time of the water sampling, and determined that the salinity at the bottom of the river during flows greater than 800 cfs had salinities ranging from 0 to 18.7 ppt (STPNOC 2008a). The review team further evaluated the river flows greater than 800 cfs and dissolved oxygen at the bottom of the river and found that there was only one occurrence during 2007-2008 when the flow was greater than 800 cfs and the dissolved oxygen was less than or equal to 2 mg/L. In addition, the salinity at this sampling time was 17.5 ppt (ENSR 2008b). Although there is limited information available on river flow and water quality, the operating policy that STPNOC has established for discharging MCR water into the river in compliance with requirements in their TPDES permit would likely result in infrequent opportunities for discharging when the combined effect of the thermal plume with river conditions would cause harm to the aquatic community. The adult and juvenile life stages of the EFH species would likely avoid the thermal plume, but there could be some impacts to the earlier life stages that would not be able to avoid the plume. Depending on the frequency and duration of the discharge, the early life stages could be lost from the effects of the thermal plume.

Chemical effects on the aquatic community from future discharges from the MCR into the Colorado River can be evaluated in terms of compliance with the STPNOC's TPDES permit. Inputs to the MCR include makeup water from the river, precipitation, dissolved solids from the operation of the condensers and UHSs for all units, and permitted chemical discharges from other operations (e.g., treated sanitary sewage, biocides, algaecides, corrosion inhibitors, pH buffering, scale inhibitors, and dispersants). The most significant chemical changes in the MCR would be the concentration of total dissolved solids from the operation of the condensers and UHSs. STPNOC does not currently evaluate the water quality of the MCR in relation to the TPDES permit conditions for chemical standards for the protection of aquatic life because it is not currently discharging to the Colorado River. The permit conditions also require evaluating acute and chronic effects on aquatic organisms from the MCR discharge prior to commencing discharge into the river.

Physical effects from the operation of the discharge system in the Colorado River could affect aquatic resources, particularly through scouring of aquatic habitat. The NRC evaluated discharge-induced scouring of the seven-port diffuser and concluded that scouring would be limited to a few feet downstream of each port and would have "no adverse impacts" on the aquatic biota in the vicinity (NRC 1975). Since the discharge pipes have not been operated except for a test in 1997 (STPNOC 2009a) and the Colorado River in the vicinity of the pipes has not been dredged recently, the initial discharge of water would disturb the sediments in the area. Because the small predicted size of the potential scour area and relative impoverishment of the benthic community that would be replaced with time, the physical effects from the operation of the would have a minor effect on the regional benthic populations or their predators.

Maintenance Dredging. STPNOC has stated that periodic dredging in the future would be conducted in front of the RMPF and barge slip. These activities are currently covered by existing permits with the Corps for the operation of existing Units 1 and 2. Dredging would remove benthic habitat and the organisms that are not highly mobile (e.g., mollusks). The area to be dredged in front of the RMPF and at the barge slip would likely be no more than 3 ac total, and would not cover the entire width of the river channel. Highly mobile organisms would likely avoid the area during dredging activities. After dredging activities, these areas would be recolonized by the aquatic community. Impacts from dredging on aquatic organisms would be minor.

5.3 Potential Effects of the Proposed Federal Actions on EFH Species

The species and life stages by the Gulf of Mexico Fishery Management Council for Ecoregion 5 rely on habitats essential for species propagation. Below, each species is discussed with regard to the impact of the proposed Federal action on EFHs. The potential impacts of the construction and operation of the proposed STP Units 3 and 4 on Federally managed fish and shellfish species and their designated EFH, including their prey, near the site have been evaluated. Six categories of impacts related to STP construction and operation that could influence EFH are (1) siltation or turbidity during construction; (2) barge traffic creating turbidity or sedimentation; (3) impingement of juveniles or adults; (4) entrainment and entrapment of eggs, larvae, and zooplankton in the water column; (5) release of heated cooling water containing biocides or other chemicals; and (6) maintenance dredging at the RMPF and at the barge slip.

5.3.1 King Mackerel

Disruption of habitat for foraging in the Colorado River is expected to be minor, temporary, and largely mitigable. Construction activities around the RMPF and barge slip would involve a minimal area where juvenile king mackerel might be foraging. Barges moving heavy equipment and bulk commodities are likely to be moving slowly and prop wash and wave action from the vessel's movement would not affect juvenile mackerel in the vicinity. Therefore, construction would likely have a minimal adverse effect on juvenile king mackerel EFH. Operation of the RMPF is not expected to have an impact on the juveniles directly or indirectly since they and their prey should be able to swim away from the low approach velocities at the RMPF intake screens. Juvenile king mackerel and their pray are expected to avoid areas affected by thermal, chemical and physical changes in the Colorado River from the discharge of the MCR water and maintenance dredging at the RMPF. Their prey should be able to avoid the adverse effects from the discharge system as well. Operations of the RMPF and discharge system are not continuous, and their adverse effects would be relatively short in duration. Therefore, the construction and operation of the proposed Units 3 and 4 at the STP site are likely to have a minimal adverse effect on EFH for the king mackerel juveniles.

5.3.2 Spanish Mackerel

Construction activities would occur in a small proportion of available Spanish mackerel foraging habitat within the Colorado River at the site of intake and barge slip modifications. Barges moving heavy equipment and bulk commodities are likely to be moving slowly and prop wash and wave action from the vessel's movement would not affect any of the life stages of Spanish mackerel in the vicinity. Disruption of habitat for foraging in these areas of the Colorado River from construction and operation are expected to be minor and temporary. Juvenile and adult Spanish mackerel and their pray are expected to avoid areas affected by thermal, chemical and physical changes in the Colorado River from the discharge of the MCR water. Spanish mackerel eggs and larvae could be affected by the thermal or chemical characteristics of the discharge plume depending on the river conditions, frequency, and duration of the discharge. Eggs and larvae passing through the intake screens at RMPF would be lost. However, operations of the RMPF and discharge system are not continuous, and their effects would be relatively short in duration. Maintenance dredging at the RMPF could be easily avoided by juvenile and adult Spanish mackerel, but some eggs and larvae would be lost. Because no Spanish mackerel were collected in recent surveys near the STP site, it is unlikely that the small loss (from operation of the RMPF, discharge structure, and dredges) of eggs and larvae would be detectable. Therefore, the construction and operation of the proposed Units 3 and 4 at the STP site are likely to have a minimal adverse effect on EFH for Spanish mackerel eggs, larvae, juveniles, and adults.

5.3.3 Gray Snapper

Disruption of gray snapper foraging habitat in the Colorado River is expected to be minor, temporary, and largely mitigable from construction activities. Juvenile and adult gray snapper may move into estuarine habitats, like the downstream portion of the Colorado River. Eggs and larvae are unlikely to be in the areas of the discharge structure, barge slip and RMPF. Construction activities at the barge slip and RMPF would occur in a small proportion of available potential foraging habitat within the Colorado River. Barges moving heavy equipment and bulk commodities are likely to be moving slowly and prop wash and wave action from the vessel's movement would not affect any of the life stages of gray snapper in the vicinity. Any larvae that move up the Colorado River may become entrained in the cooling water intake system; however, juveniles and adults would likely swim away from the low approach velocity at the intake screens. Juvenile and adult gray snapper and their prey are expected to avoid areas affected by thermal, chemical and physical changes in the Colorado River from the discharge of the MCR water. Eggs and larvae passing through the intake screens at RMPF would be lost. However, operations of the RMPF and discharge system are not continuous, and their effects would be relatively short in duration. Maintenance dredging at the RMPF could be easily avoided by the juvenile and adult gray snapper. Therefore, the construction and operation of the proposed Units 3 and 4 at the STP site are likely to have a minimal adverse effect on EFH for eggs, larvae, juvenile and adult life stages of the gray snapper.

5.3.4 Red Drum

Construction activities would occur in a small proportion of available potential foraging habitat within the Colorado River at the site of RMPF and barge slip modifications. There is no SAV in the Colorado River in the vicinity of the barge slip and RMPF for the younger life stages of red drum. Disruption of habitat for foraging in these areas of the Colorado River is expected to be minor and temporary. Therefore, construction activities upstream in the Colorado River are likely to have a minimal adverse effect on the red drum. Barges moving heavy equipment and bulk commodities are likely to be moving slow and prop wash and wave action from the vessel's movement would not affect any of the life stages of red drum in the vicinity. Operation of the RMPF and discharge structure are not likely to affect the juvenile and adult red drum because they are capable of swimming out of the current created by the RMPF and can avoid the thermal, chemical and physical changes of the river water from the discharge of the MCR. However, eggs and larvae could become entrained at the RMPF and could be affected by the thermal, chemical and physical characteristics of the discharge plume, if they are transported up the Colorado River to the vicinity of the STP site. Maintenance dredging at the RMPF could be easily avoided by the juvenile and adult red drum, but some eggs and larvae would be lost. It is unlikely that the small loss (from operation of the RMPF, discharge structure, and dredges) of eggs and larvae would be detectable given the high fecundity of the red drum. Therefore, construction and operation of proposed STP Units 3 and 4 would likely have minimal adverse impact on red drum juvenile and adult EFH. STP operations would likely have a minimal adverse effect on EFH for red drum eggs, larvae, juveniles, and adults.

5.3.5 Shrimp

Juvenile and adult brown, pink, and white shrimp may forage within the Colorado River at or near the RMPF and barge slip. Disruption of habitat for foraging in these areas of the Colorado River is expected to be minor, temporary, and largely mitigable. Brown, pink, and white shrimp have been collected in the MCR and all along the Colorado River during the 1983-1984 and 2007-2008 sampling studies (ENSR 2008a, b). Construction activities at the RMPF and barge slip could remove habitat through turbidity and sedimentation resulting in siltation on the river bottom. The sheet pile wall that could be erected during barge slip modification would temporarily remove habitat for the shrimp. Barges moving heavy equipment and bulk commodities are likely to be moving slow and prop wash and wave action from the vessel's movement would not affect any of the life stages of shrimp as they are benthic. Larvae and juvenile brown, pink, and white shrimp would be lost if entrained at the RMPF. Operation of the RMPF is not likely to entrain appreciable numbers of shrimp larvae, as brown and white shrimp were more abundant at the confluence of the river and the GIWW than further up the river (ENSR 2008a), and only four pink shrimp were reported in impingement studies (NRC 1986). Maintenance dredging would remove habitat at the point where substrate is dredged and could also temporarily remove habitat from turbidity and sedimentation. Therefore, construction and operation of the proposed Units 3 and 4 at the STP site are likely to have a greater than minimal, but less than substantial, adverse effect on EFH for the brown, pink, and white shrimp larvae and juveniles EFH.

5.3.6 Gulf Stone Crab

It is possible that construction activities in the Colorado River associated with intake structure placement and barge slip modifications may disrupt foraging in these areas of the Colorado River, but the disruption is expected to be minor, temporary, and largely mitigable. Gulf stone crab eggs and larvae may drift into the upper portion of the Colorado River, and become entrained in the cooling water intake system at the RMPF. However, it is unlikely that appreciable numbers of eggs or larvae would be entrained as no Gulf stone crabs were collected in the Colorado River during the 1983-1984 or 2007-2008 studies (NRC 1986; ENSR 2008a, b). Operation of the discharge structure would likely have minimal effect on the mobile adult and juvenile life stages. While eggs and larvae could be harmed by the thermal and chemical plume, it is unlikely that these life stages are present in the vicinity of the discharge structure. Therefore, construction and operation of the proposed STP Units 3 and 4 would likely have a minimal adverse effect on stone crab EFH for eggs, larvae, juveniles, and adults.

6.0 Mitigation Measures

Potential mitigation measures regarding water withdrawal at the RMPF, chemical and thermal reductions within the discharge to the Colorado River, frequency and conditions of discharge, and dredging techniques could reduce adverse effects on EFH and Federally-managed fish and shellfish species. Because the proposed cooling system would be closed-cycle and use the best technology available, the review team could not identify any potential mitigation measures to further reduce entrainment and entrapment. However, a potential mitigation measure that might increase impingement survival would be to alter the fish-return operational procedure such that the fish return always functions when the RMPF is withdrawing water. The review team also identified that the discharge operational procedure could be modified to reduce potential impacts on aquatic biota; such modifications could include mixing ambient river water with the discharge water before discharging it to the river to reduce the discharge temperature. Although the NRC lacks the statutory authority to require any of the above potential mitigation measures, the staff recognizes that such potential mitigation could further reduce adverse impacts on designated EFH and on Federally-managed fish and shellfish species in the Colorado River, the GIWW, and Matagorda Bay.

The Corps permit, if issued, could include special conditions such as time-of-year restrictions or specific methods of work to ameliorate potential impacts to EFH for the authorized construction and maintenance dredging activities. EFH Conservation Recommendations necessary to protect EFH may also be included as conditions in the Corps permit, if issued. Mitigation may only be employed after all appropriate and practical steps to avoid and minimize adverse impacts to aquatic resources have been taken. All remaining unavoidable impacts must be compensated to the extent appropriate and practicable.

7.0 Conclusions

The potential impacts of the construction and operation of the proposed Units 3 and 4 at the STP site on Federally-managed fish and shellfish species and their EFH near the site have been evaluated. Based on the project design, the minimal short-term impacts associated with the construction activities, barging, operation of the RMPF and discharge structure, and maintenance dredging at the RMPF, and the mitigation measures planned for proposed Units 3 and 4, the review team concludes that construction and operation of STP would likely have more than minimal, but less than substantial, adverse effects on EFH within the Colorado River by loss of forage and/or shelter habitat for three of the eight species considered, brown, pink, and white shrimp, specifically larvae and juveniles (Table 5). Construction and operation activities would likely have minimal adverse effect on the remaining species considered. The NRC lacks the statutory authority to require any mitigation measures that would minimize adverse effects on EFH. The Corps does not recommend any mitigative measures to minimize adverse effects on EFH at this time. This determination may be modified if additional information indicates otherwise and would change the preliminary determination.

Table 1. Effects on EFH from Proposed Actions

Common Name	Life Stage	Expected Impact
king mackerel	juveniles	Minimal Adverse Effect
Spanish mackerel	eggs	Minimal Adverse Effect Release of MCR water could temporarily change water column and have short-term effects. Entrained eggs would be removed, and therefore lost, from the river.
	larvae	Minimal Adverse Effect Release of MCR water could temporarily change water column and have short-term effects. Entrained larvae would be removed, and therefore lost, from the river.
	juveniles	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily.
	adults	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily.
gray (mangrove) snapper	eggs	Minimal Adverse Effect Entrained eggs would be removed, and therefore lost, from the river.
	larvae	Minimal Adverse Effect Release of MCR water could temporarily change water column and have short-term effects. Entrained larvae would be removed, and therefore lost, from the river.
	juveniles	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily.
	adults	Minimal Adverse Effect Construction activities in Colorado River could disrupt

Table 1. Effects on EFH from Proposed Actions

Common Name	Life Stage	Expected Impact
		foraging habitat temporarily.
red drum	eggs	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily. Release of MCR water could temporarily change water column and have short-term affects. Entrained eggs would be removed, and therefore lost, from the river.
	larvae	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily. Release of MCR water could temporarily change water column and have short-term affects. Entrained eggs would be removed, and therefore lost, from the river.
	juveniles	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily.
	adults	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily.
brown shrimp	larvae	Greater than Minimal but Less than Substantial, Adverse Effect Construction activities in Colorado River could remove habitat over the short-term. Maintenance dredging would remove habitat and could temporarily remove habitat due to turbidity and sedimentation.
	juveniles	Greater than Minimal but Less than Substantial, Adverse Effect Construction activities in Colorado River could remove habitat over the short-term. Maintenance dredging would remove habitat and could temporarily remove habitat due to turbidity and sedimentation.
pink shrimp	larvae	Greater Than Minimal but Less Than Substantial, Adverse Effect Construction activities in Colorado River could remove habitat over the short-term. Maintenance dredging would remove habitat and could temporarily remove habitat due to turbidity and sedimentation.
	juveniles	Greater than Minimal but Less than Substantial, Adverse Effect Construction activities in Colorado River could remove habitat over the short-term. Maintenance dredging

Table 1. Effects on EFH from Proposed Actions

Common Name	Life Stage	Expected Impact
		would remove habitat and could temporarily remove habitat due to turbidity and sedimentation.
white shrimp	larvae	Greater Than Minimal but Less Than Substantial, Adverse Effect Construction activities in Colorado River could remove habitat over the short-term. Maintenance dredging would remove habitat and could temporarily remove habitat due to turbidity and sedimentation.
	juveniles	Greater Than Minimal but Less Than Substantial,, Adverse Effect Construction activities in Colorado River could remove habitat over the short-term. Maintenance dredging would remove habitat and could temporarily remove habitat due to turbidity and sedimentation.
Gulf stone crab	eggs	Minimal Adverse Effect Release of MCR water could temporarily change water column and have short-term affectseffects. Entrained eggs would be removed, and therefore lost, from the river.
	larvae	Minimal Adverse Effect Release of MCR water could temporarily change water column and have short-term affectseffects. Entrained larvae would be removed, and therefore lost, from the river.
	juveniles	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily.
	adults	Minimal Adverse Effect Construction activities in Colorado River could disrupt foraging habitat temporarily.

8.0 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52. "Licenses, Certifications, and Approvals for Nuclear Power Plants."

69 FR 41576. July 9, 2004. "National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities." Federal Register. U.S. Environmental Protection Agency, Washington, D.C.

72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants." *Federal Register*. U.S. Nuclear Regulatory Commission, Washington, D.C.

Buckley, J. 1984. *Habitat Suitability Index Models: Larval and Juvenile Red Drum*. FWS/OBS-82-10.74, U.S. Fish and Wildlife Service, Washington, D.C.

Cascorbi, A. 2004. "Wild-Caught Warmwater Shrimp (Infraorder *Penaeus* – the Penaid Shrimps)." Seafood Watch, Seafood Report. Monterey Bay Aquarium, Monterey, California.

Coastal Zone Management Act of 1972, as amended. 16 USC 1451, et seq.

Croker, R. 1962. "Growth and Food of the Gray Snapper, *Lutjanus Griseus*, in the Everglades National Park." *Transactions of the American Fisheries Society* 91(4):379-383.

DeVries, D., CB Grimes, KL Lang, and DB White. 1990. "Age and Growth of King and Spanish Mackerel Larvae and Juveniles from the Gulf of Mexico and U.S. South Atlantic Bight." *Environmental Biology of Fishes* 29(1990):135-143.

ENSR Corporation (ENSR). 2008a. *Aquatic Ecology – Main Cooling Reservoir and Circulating Water Intake Structure Study, Unit 3 and 4 Licensing Project*. Houston, Texas.

ENSR Corporation (ENSR). 2008b. *Aquatic Ecology – Colorado River Monitoring Report, Unit 3 and 4 Licensing Project*. Houston, Texas.

Federal Water Pollution Control Act (Clean Water Act). 33 USC 1251, et seq.

Florida Fish and Wildlife Conservation Commission (FFWCC). 2007. "Red Drum, *Sciaenops Ocellatus*." Florida Fish and Wildlife Conservation Commission.

Florida Museum of Natural History (FMNH). 2009. "Ichthyology at the Florida Museum of Natural History, Education, Biological Profiles: King Mackerel." Accessed January 29, 2010 at http://www.flmnh.ufl.edu/fish/gallery/descript/kingmackerel/kingmackerel.html. Accession No. ML100600370.

Guillory, V., H.M. Perry, and R.L. Leard. 1995. "A Profile of the Western Gulf Stone Crab, *Menippe adina*." Number 31, Gulf States Marine Fisheries Commission, Ocean Springs, Mississippi.

Gulf of Mexico Fishery Management Council (GMFMC). 2004. *Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment to the Following Fishery Management Plans of the Gulf of Mexico (GOM): Shrimp Fishery of the Gulf of Mexico, Red Drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico, Stone Crab Fishery of the Gulf of Mexico, Coral and Coral Reef Fishery of the Gulf of Mexico, Spiny Lobster Fishery of the Gulf of Mexico and South Atlantic Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic*. National Oceanic and Atmospheric Administration, Tampa, Florida.

Gulf States Marine Fisheries Commission (GSMFC). 1995. *A Profile of the Western Gulf Stone Crab, Menippe Adina*. Number 31, National Oceanic and Atmospheric Administration, Ocean Springs, Mississippi.

Kim, H.C., and P.A. Montagna. 2009. "Implications of Colorado River (Texas, USA) Freshwater Inflow to Benthic Ecosystem Dynamics: A Modeling Study." *Estuarine, Coastal and Shelf Science* 83:491–504.

Lower Colorado River Authority (LCRA). 2006. *Matagorda Bay Freshwater Inflow Needs Study*. Lower Colorado River Authority, Texas Commission on Environmental Quality, Texas Parks and Wildlife, and Texas Water Development Board, Austin, Texas. Available at http://www.lcra.org/library/media/public/docs/fins_2006.pdf. Accession No. ML100600370.

Magnuson-Stevens Fishery Conservation and Management Act, as amended. 16 USC 1801 *et seq.*

National Marine Fisheries Service (NMFS). 1999. *Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies*. National Marine Fisheries Service, Habitat Conservation Division, Southeast Regional Office, St. Petersburg, Florida.

National Marine Fisheries Service (NMFS). 2004. *Essential Fish Habitat Consultation Guidance Version 1.1*. National Marine Fisheries Service, Office of Habitat Conservation, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS). 2009. "Essential Fish Habitat EFH Mapper." NOAA Fisheries Services, Office of Habitat Conservation, Habitat Protection Division. Accessed May 20, 2009 at http://sharpfin.nmfs.noaa.gov/website/EFH_Mapper/map.aspx. Accession No. ML100600370.

Patillo, M.E., T.E. Czapla, D.M. Nelson, and M.E. Monaco. 1997. *Distribution and Abundance of Fishes and Invertebrates in Gulf of Mexico Estuaries, Volume II: Species Life History Summaries*. ELMR Rep. No. 11. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, Maryland.

Permits for Dredged or Fill Material. 33 USC 1344.

Rivers and Harbors Appropriation Act of 1899, as amended. 33 USC 403, et seq.

South Texas Project Nuclear Operating Company (STPNOC). 2008a. Letter from Greg Gibson, STPNOC, to NRC, dated July 2, 2008 in response to NRC letter dated May 19, 2008, "South Texas Project Units 3 and 4, Docket Nos. 52-012 and 52-013, Response to Requests for Additional Information." Accession No. ML081970465.

South Texas Project Nuclear Operating Company (STPNOC). 2008b. Letter from Greg Gibson, STPNOC, to NRC, dated July 15, 2008, Response to Requests for Additional Information." Accession No. ML082040684.

South Texas Project Nuclear Operating Company (STPNOC). 2008c. Letter from Scott Head STPNOC, to NRC, dated December 18, 2008, Responses to Requests for Additional Information." Accession No. ML090860873.

South Texas Project Nuclear Operating Company (STPNOC). 2009a. *South Texas Project Units 3 and 4 Combined License Application, Part 3, Environmental Report*. Revision 3, Bay City, Texas. Accession No. ML092931600.

South Texas Project Nuclear Operating Company (STPNOC). 2009b. Letter from Scott Head, STPNOC, to NRC, dated September 14, 2009, "Responses to Request for Additional Information." Accession No. ML092580491.

South Texas Project Nuclear Operating Company (STPNOC). 2009c. Letter from Scott Head, STPNOC, to US Army Corps, dated October 28, 2009, "Subject: South Texas Project, Permit

Determination Request, Construction Activities in Association with STP Units 3 & 4." Accession No. ML093210232.

South Texas Project Nuclear Operating Company (STPNOC). 2009d. Letter from Scott Head, STPNOC, to NRC, dated July 30, 2009, "Subject: South Texas Project, NRC Docket No. 52-012 and 52-013, Submittal of Requests for Additional Information (RAI), Pertaining COLA Part 3 Environmental Report." Accession No. ML092150963.

Texas Commission on Environmental Quality (TCEQ). 2005. *TPDES Permit No. WQ0001908000*. TCEQ, Austin, Texas.

Texas Commission on Environmental Quality (TCEQ). 2007. *Cooling Water Intake Structures Phase II Rules; South Texas Project Electric Generating Station; TPDES Permit No. WQOOO 1908000*. Letter from Mr. Kelly Holligan, TCEQ to Mr. R. A. Gangluff, STPNOC. June 27.

Texas Commission on Environmental Quality (TCEQ). 2008. *General Permit to Discharge Wastes under provisions of Section 402 of the Clean Water Act and Chapter 26 of the Texas Water Code*. TCEQ Docket No. 2007-1588-WQ, TPDES General Permit No. TXR150000, Issues February 15, 2008. Austin, Texas.

Texas Parks and Wildlife Department (TPWD). 2009. "Saltwater Fishing." Texas Parks and Wildlife Department, Austin, Texas. Accessed January 27, 2010 at http://www.tpwd.state.tx.us/publications/annual/fish/limits_saltwater/index.phtml#limits. Accession No. ML100600370.

Texas Saltwater and Fishing Guides Web (TSFGW). 2005. "King Mackerel (Kingfish)." Accessed November 24, 2009 at http://www.txsaltwaterfishingguides.com/FishFacts/kingfish.htm. Accession No. ML100600370.

U.S. Army Corps of Engineers (Corps). 2005. "Galveston District Projects, Mouth of the Colorado River." U.S. Army Corps of Engineers, Galveston District, Galveston, Texas. Accessed December 16, 2009 at http://www.swg.usace.army.mil/items/coloradoriver/MOC.asp. Accession No. ML100600370.

U.S. Army Corps of Engineers (Corps). 2007. *Draft Environmental Impact Statement for Calhoun County Navigation District's Proposed Matagorda Ship Channel Improvement Project Calhoun and Matagorda Counties, Texas*. Document No. 060146, U.S. Army Corps of Engineers, Galveston District, Galveston, Texas.

U.S. Army Corps of Engineers (Corps). 2008. *Final Environmental Impact Statement for the Proposed Port Freeport Channel Widening, Brazoria County, Texas*. U.S. Army Corps of Engineers, Galveston District, Galveston, Texas.

U.S. Army Corps of Engineers (Corps). 2009a. "December 2009 Hydrographic Bulletin: Channels with Project Depths Under 25 Feet." U.S. Army Corps of Engineers, Galveston District, Galveston, Texas.

U.S. Army Corps of Engineers (Corps). 2009b. Letter from K. Jaynes, Chief, Compliance Section, U.S. Army Corps of Engineers Galveston District to G. Gibson, South Texas Project Operating Company dated April 7, 2009, "Subject: SWG-2008-1351, South Texas Project Operating Company, Jurisdictional Determination, 7,000-Acre Mass Cooling Reservoir (MCR), Wadsworth, Matagorda County, Texas." Accession No. ML091050501.

U.S. Fish and Wildlife Service (FWS). 1983. *Habitat Suitability Index Models: Northern Gulf of Mexico Brown Shrimp and White Shrimp*. FWS/OBS-82/10.54, Slidell, Louisiana.

U.S. Nuclear Regulatory Commission (NRC). 1975. *South Texas Project, Units 1 and 2: Final Environmental Statement*. NUREG-75/019, Houston Lighting & Power Company, City Public Service Board of San Antonio, Central Power and Light Company, City of Austin.

U.S. Nuclear Regulatory Commission (NRC). 1986. *Final Environmental Statement Related to the Operation of South Texas Project, Units 1 and 2*. NUREG-1171, Washington, D.C.

Wilber, D. 1989. "Reproductive Biology and Distribution of Stone Crabs (Xanthidae, *Menippe*) in the Hybrid Zone on the Northeastern Gulf of Mexico." *Marine Ecology Progress Series* 52(1989):235-244.

Wilber, D.H. and R. Bass. 1998. "Effect of the Colorado River Diversion on Matagorda Bay Epifauna." *Coastal and Shelf Science* 47:309-318.

Appendix G

Supporting Documentation for Socioeconomic and Radiological Dose Assessment

Appendix G

Supporting Documentation for Socioeconomics and Radiological Dose Assessment

This appendix contains supporting documentation for review team determinations described in this environmental impact statement (EIS) for the socioeconomic and radiological dose assessments.

G.1 Socioeconomic Data Tables

This section contains two data tables (Table G-1 and Table G-2) related to socioeconomics as discussed in Section 2.5.

Table G-1. Current Populations by Distance and Direction and Projections to 2080 (STPNOC 2009a)

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10	10-20	20-30	30-40	40-50	0-50
N	2000	0	0	15	0	0	32	47	1237	536	14097	5445	21362
	2010	0	0	16	0	0	34	50	1311	563	14899	6121	22944
	2020	0	0	17	0	0	36	53	1397	596	15866	6946	24858
	2030	0	0	18	0	0	38	56	1484	629	16867	7914	26950
	2040	0	0	19	0	0	41	60	1583	667	18048	9103	29461
	2050	0	0	20	0	0	44	64	1681	706	19276	10482	32209
	2060	0	0	22	0	0	46	68	1792	744	20573	12145	35322
	2070	0	0	23	0	0	49	72	1903	783	21939	14094	38791
	2080	0	0	25	0	0	52	77	2026	828	23543	16500	42974
NNE	2000	0	0	0	0	205	542	747	21441	1120	2540	10968	36816
	2010	0	0	0	0	217	575	792	22727	1207	2917	13351	40994
	2020	0	0	0	0	232	613	845	24228	1310	3374	16273	46030
	2030	0	0	0	0	246	650	896	25729	1420	3912	19841	51798
	2040	0	0	0	0	262	694	956	27444	1545	4548	24265	58758
	2050	0	0	0	0	279	737	1016	29160	1677	5277	29545	66675
	2060	0	0	0	0	297	786	1083	31089	1829	6155	36110	76266
	2070	0	0	0	0	316	835	1151	33019	1993	7181	43962	87306
	2080	0	0	0	0	336	889	1225	35163	2177	8397	53732	100694
NE	2000	0	0	0	0	31	99	130	931	6687	11447	24758	43953
	2010	0	0	0	0	33	105	138	987	7527	13164	28556	50372
	2020	0	0	0	0	35	112	147	1052	8531	15225	33122	58077
	2030	0	0	0	0	37	119	156	1117	9682	17628	38466	67049
	2040	0	0	0	0	40	127	167	1192	10997	20376	44614	77346
	2050	0	0	0	0	42	135	177	1266	12458	23466	51565	88932

Table G-1. (contd)

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10	10-20	20-30	30-40	40-50	0-50
	2060	0	0	0	0	45	144	189	1350	14181	27129	59839	102688
	2070	0	0	0	0	48	152	200	1434	16148	31365	69435	118582
	2080	0	0	0	0	51	162	213	1527	18377	36173	80426	136716
ENE	2000	0	0	0	0	0	472	472	271	2480	16635	62994	82852
	2010	0	0	0	0	0	500	500	287	2732	19130	72443	95092
	2020	0	0	0	0	0	533	533	306	3032	22125	83782	109778
	2030	0	0	0	0	0	566	566	325	3366	25618	97011	126886
	2040	0	0	0	0	0	604	604	347	3748	29610	112129	146438
	2050	0	0	0	0	0	642	642	369	4164	34102	129138	168415
	2060	0	0	0	0	0	684	684	393	4651	39425	149296	194449
	2070	0	0	0	0	0	727	727	417	5195	45580	172604	224523
	2080	0	0	0	0	0	774	774	444	5810	52567	199061	258656
E	2000	0	0	0	15	3	245	263	83	1243	87	46	1722
	2010	0	0	0	16	3	260	279	88	1322	99	53	1841
	2020	0	0	0	17	3	277	297	94	1415	114	61	1981
	2030	0	0	0	18	4	294	316	100	1510	132	71	2129
	2040	0	0	0	19	4	314	337	106	1618	151	82	2294
	2050	0	0	0	20	4	333	357	113	1728	174	94	2466
	2060	0	0	0	22	4	355	381	120	1852	200	109	2662
	2070	0	0	0	23	5	377	405	128	1979	230	126	2868
	2080	0	0	0	25	5	402	432	136	2120	264	145	3097
ESE	2000	0	0	0	99	164	146	409	2	0	0	0	411
	2010	0	0	0	105	174	155	434	2	0	0	0	436
	2020	0	0	0	112	185	165	462	2	0	0	0	464

Table G-1. (contd)

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10	10-20	20-30	30-40	40-50	0-50
	2030	0	0	0	119	197	175	491	2	0	0	0	493
	2040	0	0	0	127	210	187	524	3	0	0	0	527
	2050	0	0	0	135	223	199	557	3	0	0	0	560
	2060	0	0	0	144	238	212	594	3	0	0	0	597
	2070	0	0	0	153	253	225	631	3	0	0	0	634
	2080	0	0	0	162	269	239	670	3	0	0	0	673
SE	2000	0	0	0	3	248	2055	2306	13	0	0	0	2319
	2010	0	0	0	3	263	2178	2444	14	0	0	0	2458
	2020	0	0	0	3	280	2322	2605	15	0	0	0	2620
	2030	0	0	0	4	298	2466	2768	16	0	0	0	2784
	2040	0	0	0	4	317	2630	2951	17	0	0	0	2968
	2050	0	0	0	4	338	2795	3137	18	0	0	0	3155
	2060	0	0	0	4	360	2680	3044	19	0	0	0	3063
	2070	0	0	0	5	382	3165	3552	20	0	0	0	3572
	2080	0	0	0	5	407	3370	3782	21	0	0	0	3803
SSE	2000	0	0	0	0	0	204	204	117	0	0	0	321
	2010	0	0	0	0	0	216	216	124	0	0	0	340
	2020	0	0	0	0	0	231	231	132	0	0	0	363
	2030	0	0	0	0	0	245	245	140	0	0	0	385
	2040	0	0	0	0	0	261	261	150	0	0	0	411
	2050	0	0	0	0	0	277	277	159	0	0	0	436
	2060	0	0	0	0	0	296	296	170	0	0	0	466
	2070	0	0	0	0	0	314	314	180	0	0	0	494
	2080	0	0	0	0	0	335	335	192	0	0	0	527

Table G-1. (contd)

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10	10-20	20-30	30-40	40-50	0-50
S	2000	0	0	0	0	0	40	40	0	0	0	0	40
	2010	0	0	0	0	0	42	42	0	0	0	0	42
	2020	0	0	0	0	0	45	45	0	0	0	0	45
	2030	0	0	0	0	0	48	48	0	0	0	0	48
	2040	0	0	0	0	0	51	51	0	0	0	0	51
	2050	0	0	0	0	0	54	54	0	0	0	0	54
	2060	0	0	0	0	0	58	58	0	0	0	0	58
	2070	0	0	0	0	0	62	62	0	0	0	0	62
	2080	0	0	0	0	0	66	66	0	0	0	0	66
SSW SW	2000	0	0	0	0	0	0	0	1	0	0	0	1
	2010	0	0	0	0	0	0	0	1	0	0	0	1
	2020	0	0	0	0	0	0	0	1	0	0	0	1
	2030	0	0	0	0	0	0	0	1	0	0	0	1
	2040	0	0	0	0	0	0	0	1	0	0	0	1
	2050	0	0	0	0	0	0	0	1	0	0	0	1
	2060	0	0	0	0	0	0	0	1	0	0	0	1
	2070	0	0	0	0	0	0	0	2	0	0	0	2
	2080	0	0	0	0	0	0	0	2	0	0	0	2
SW	2000	0	0	1	0	0	118	119	345	0	1111	628	2203
	2010	0	0	1	0	0	125	126	366	0	1189	672	2353
	2020	0	0	1	0	0	133	134	390	0	1255	710	2489
	2030	0	0	1	0	0	142	143	414	0	1344	760	2661
	2040	0	0	1	0	0	151	152	442	0	1433	810	2837
	2050	0	0	1	0	0	161	162	469	0	1522	860	3013

Table G-1. (contd)

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10	10-20	20-30	30-40	40-50	0-50
	2060	0	0	1	0	0	171	172	500	0	1622	917	3211
	2070	0	0	2	0	0	182	184	531	0	1722	973	3410
	2080	0	0	2	0	0	194	196	566	0	1844	1042	3648
WSW	2000	0	0	0	4	6	240	250	5671	1074	14758	3240	24993
	2010	0	0	0	4	6	254	264	5999	1142	15784	3474	26663
	2020	0	0	0	5	7	271	283	6378	1206	16676	3683	28226
	2030	0	0	0	5	7	288	300	6762	1285	17852	3953	30152
	2040	0	0	0	5	8	307	320	7186	1364	19029	4226	32125
	2050	0	0	0	5	8	326	339	7624	1446	20212	4503	34124
	2060	0	0	0	6	9	348	363	8105	1535	21538	4813	36354
	2070	0	0	0	6	9	370	385	8585	1624	22866	5126	38586
	2080	0	0	0	7	10	394	411	9124	1732	24484	5504	41255
W	2000	0	0	0	5	0	130	135	261	829	1302	3614	6141
	2010	0	0	0	5	0	138	143	275	870	1373	3925	6586
	2020	0	0	0	6	0	147	153	292	920	1457	4272	7094
	2030	0	0	0	6	0	156	162	310	970	1542	4652	7636
	2040	0	0	0	6	0	166	172	328	1020	1629	5064	8213
	2050	0	0	0	7	0	177	184	348	1078	1729	5512	8851
	2060	0	0	0	7	0	189	196	369	1136	1830	5993	9524
	2070	0	0	0	8	0	200	208	390	1194	1933	6507	10232
	2080	0	0	0	8	0	213	221	413	1260	2051	7089	11034
WNW	2000	0	0	0	0	4	878	882	1181	492	9669	1259	13483
	2010	0	0	0	0	4	931	935	1248	517	10152	1325	14177
	2020	0	0	0	0	5	992	997	1327	546	10733	1403	15006

Table G-1. (contd)

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10	10-20	20-30	30-40	40-50	0-50
	2030	0	0	0	0	5	1054	1059	1406	576	11313	1482	15836
	2040	0	0	0	0	5	1124	1129	1492	605	11893	1562	16681
	2050	0	0	0	0	5	1194	1199	1583	640	12570	1654	17646
	2060	0	0	0	0	6	1273	1279	1681	674	13247	1747	18628
	2070	0	0	0	0	6	1352	1358	1780	708	13923	1841	19610
	2080	0	0	0	0	7	1440	1447	1890	748	14697	1948	20730
NNW	2000	0	0	0	19	30	227	276	477	787	1455	222	3217
	2010	0	0	0	20	32	241	293	505	826	1528	230	3382
	2020	0	0	0	21	34	257	312	537	874	1615	240	3578
	2030	0	0	0	23	36	272	331	569	921	1702	250	3773
	2040	0	0	0	24	38	291	353	606	975	1801	261	3996
	2050	0	0	0	26	41	309	376	644	1030	1903	272	4225
	2060	0	0	0	28	44	329	401	685	1085	2005	283	4459
	2070	0	0	0	29	46	350	425	725	1140	2107	295	4692
	2080	0	0	0	31	49	372	452	771	1203	2223	308	4957
NNW	2000	0	0	0	0	0	34	34	484	4469	11928	2211	19126
	2010	0	0	0	0	0	36	36	512	4692	12524	2305	20069
	2020	0	0	0	0	0	38	38	545	4961	13240	2415	21199
	2030	0	0	0	0	0	41	41	577	5229	13956	2526	22329
	2040	0	0	0	0	0	44	44	615	5542	14791	2653	23645
	2050	0	0	0	0	0	46	46	653	5854	15626	2780	24959
	2060	0	0	0	0	0	49	49	694	6167	16461	2907	26278
	2070	0	0	0	0	0	52	52	735	6480	17296	3040	27603
	2080	0	0	0	0	0	56	56	781	6838	18250	3183	29108

Table G-1. (contd)

Sectors		Radii/Distances (miles)											
		0-1	1-2	2-3	3-4	4-5	5-10	0-10	10-20	20-30	30-40	40-50	0-50
TOTAL	2000	0	0	16	145	691	5462	6314	32515	19717	85029	115385	258960
	2010	0	0	17	153	732	5790	6692	34446	21398	92759	132455	287750
	2020	0	0	18	164	781	6172	7135	36696	23391	101680	152907	321809
	2030	0	0	19	175	830	6554	7578	38952	25588	111866	176926	360910
	2040	0	0	20	185	884	6992	8081	41512	28081	123309	204769	405752
	2050	0	0	21	197	940	7429	8587	44091	30781	135857	236405	455721
	2060	0	0	23	211	1003	7620	8857	46971	33854	150185	274159	514026
	2070	0	0	25	224	1065	8412	9726	49852	37244	166142	318003	580967
	2080	0	0	27	238	1134	8958	10357	53059	41093	184493	368938	657940

Source: STPNOC (2009a)

Table G-2. Total STP Workforce During Construction Period for Proposed Units 3 and 4, and 18 Months Beyond

Event[(a)]	Month	Unit 1 and 2 Staffing[(b)]	Unit 3 and 4 Staffing[(c)]	Construction Workforce[(d)]	Outage Workforce[(e)]	Total Workforce
Site Preparation Starts	-24	1350	99	100		1549
	-23	1353	107	200		1660
	-22	1356	116	300		1772
	-21	1359	124	400		1883
	-20	1362	133	500	45	2040
	-19	1364	142	600	310	2416
	-18	1367	150	700	1080	3297
1RE15	-17	1367	159	800	1350	3676
	-16	1368	167	900	60	2495
	-15	1368	176	1000		2544
	-14	1368	184	1100	45	2698
	-13	1369	193	1200	310	3072
	-12	1369	202	1300	1080	3951
2RE14	-11	1369	212	1400	1350	4331
	-10	1370	221	1500	60	3151
	-9	1370	230	1600		3200
[2]	-8	1370	240	1700		3310
	-7	1371	249	1800		3420
	-6	1371	258	1900		3529
	-5	1368	268	2000		3636
	-4	1365	277	2100		3742
	-3	1362	286	2200		3848
	-2	1358	296	2300	35	3989
	-1	1355	305	2400	170	4230
COL Issued/ Start Constr	1	1352	314	2500	850	5016
1RE16	2	1349	322	2650	1100	5421
	3	1346	331	2800	60	4536
	4	1343	339	2950		4632
	5	1339	348	3100	35	4822
	6	1336	356	3250	170	5112
	7	1333	365	3400	850	5948

Table G-2. (contd)

Event[a]	Month	Unit 1 and 2 Staffing[b]	Unit 3 and 4 Staffing[c]	Construction Workforce[d]	Outage Workforce[e]	Total Workforce
2RE15	8	1328	373	3550	1100	6351
	9	1324	382	3700	60	5465
	10	1319	390	3830		5539
	11	1315	399	3960		5673
	12	1310	407	4090		5807
	13	1306	431	4220		5957
	14	1301	455	4350		6106
	15	1296	479	4480		6256
	16	1292	503	4610		6405
	17	1287	527	4740	35	6590
	18	1283	552	4870	170	6874
	19	1278	576	5000	850	7704
1RE17	20	1272	600	5130	1100	8102
	21	1267	624	5260	60	7210
	22	1261	648	5390		7299
	23	1255	672	5520	35	7482
	24	1250	696	5650	170	7766
	25	1244	715	5800	850	8609
2RE16	26	1238	733	5950	1100	9021
	27	1233	752	5950	60	7994
	28	1227	770	5950		7947
	29	1221	789	5950		7960
	30	1216	807	5950		7973
	31	1210	826	5950		7986
	32	1204	844	5950		7998
	33	1199	863	5950		8011
	34	1193	881	5950		8024
	35	1187	900	5950	35	8072
	36	1181	918	5850	170	8119
	37	1176	921	5750	850	8697
1RE18	38	1170	925	5650	1100	8845
	39	1164	928	5450	60	7602
	40	1158	932	5250		7340
	41	1153	935	5050	35	7173
	42	1147	939	4850	170	7105
	43	1141	942	4650	850	7583

Table G-2. (contd)

Event[(a)]	Month	Unit 1 and 2 Staffing[(b)]	Unit 3 and 4 Staffing[(c)]	Construction Workforce[(d)]	Outage Workforce[(e)]	Total Workforce
2RE17	44	1135	945	4450	1100	7630
U3 Fuel Load	45	1128	949	4250	60	6387
	46	1122	952	4050		6124
	47	1115	956	3900		5971
	48	1109	959	3800		5868
	49	1102	959	3700		5761
	50	1096	959	3600		5655
	51	1089	959	3500		5548
	52	1083	959	3400		5442
	53	1076	959	3300	35	5370
CO U3	54	1070	959	3200	170	5399
	55	1063	959	3000	850	5872
1RE19	56	1063	959	2800	1100	5922
	57	1063	959	2600	60	4682
U4 Fuel Load	58	1063	959	2400		4422
	59	1063	959	2200	35	4257
	60	1063	959	2000	170	4192
	61	1062	959	1800	850	4671
2RE18	62	1062	959	1600	1100	4721
	63	1062	959	1400	60	3481
	64	1062	959	1200		3221
	65	1062	959	1100		3121
U4 CO	66	1062	959	525		2546
	67	1062	959	0		2021
	68	1062	959	0		2021
	69	1062	959	0	35	2056
	70	1062	959	0	170	2191
	71	1062	959	0	885	2906
3REO1	72	1062	959	0	1270	3291
	73	1062	959	0	910	2931
1RE20	74	1062	959	0	1100	3121
	75	1062	959	0	60	2081
	76	1062	959	0		2021
	77	1062	959	0	35	2056
	78	1062	959	0	170	2191
	79	1062	959	0	850	2871

Table G-2. (contd)

Event[(a)]	Month	Unit 1 and 2 Staffing[(b)]	Unit 3 and 4 Staffing[(c)]	Construction Workforce[(d)]	Outage Workforce[(e)]	Total Workforce
2RE19	80	1062	959	0	1135	3156
	81	1062	959	0	230	2251
	82	1062	959	0	850	2871
4REO1	83	1062	959	0	1100	3121
	84	1062	959	0	60	2081
	85	1062	959	0		2021

Source: STPNOC (2009a).
(a) Events at indicated months are from Table 3.10S-2, Environmental Report Rev 3, and South Texas Project Long Range Outage Plan, Rev 4b, 10/15/07. Outages numbering convention: for example, for 1RE15, 1 = Unit 1 (or 2, 3 or 4); RE = refueling; 15 = this is the 15th refueling for Unit 1.
(b) Units 1/2 estimates are from STP Staffing Plan, June 2007
(c) Units 3/4 estimates are from Owner's Estimate, 10/25/07
(d) Construction Workforce estimates are from Table 3.10S-2, ER, Rev 3
(e) Outage Supplemental Workforce estimates are based on South Texas Project 1RE14 Outage Report, 2008

G.2 Supporting Documentation on Radiological Dose Assessment

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed and performed an independent dose assessment of the radiological impacts from normal operations of the new and existing nuclear units at and near the South Texas Project Electric Generating Station (STP). The results of the assessment are presented in this appendix and are compared to the results from STP Nuclear Operating Company (STPNOC) found in the Environmental Report (ER) (STPNOC 2009a), Sections 4.5, Radiation Exposure to Construction Workers, and 5.4, Radiological Impacts of Normal Operation. This appendix is divided into five sections: (1) dose estimates to the public from liquid effluents; (2) dose estimates to the public from gaseous effluents; (3) cumulative dose estimates; (4) dose estimates to biota from gaseous and liquid effluents, and (5) dose to construction workers.

G.2.1 Dose Estimate from Liquid Effluents

The NRC staff used the dose assessment approach specified in Regulatory Guide 1.109 (NRC 1977) and the LADTAP II computer code (Strenge et al. 1986) to estimate doses to the maximally exposed individual (MEI) and the population from the liquid effluent pathway of proposed Units 3 and 4. The NRC staff used the projected radioactive effluents release values from the Final Safety Analysis Report.

G.2.1.1 Scope

Doses from each new unit to the MEI were calculated and compared to the regulatory criteria for the following:

Total Body – Dose was the total for the ingestion of aquatic organisms as food and cow meat and external exposure to contaminated sediments deposited along the shoreline (shoreline exposure). Water downstream from the STP site is used for neither drinking water nor irrigation.

Organ – Dose was the total for each organ for ingestion of aquatic food and cow meat and shoreline exposure with the highest value for adult, teen, child, or infant.

The NRC staff reviewed the assumed exposure pathways and input parameters and values used by STP for appropriateness. Default values from Regulatory Guide 1.109 (NRC 1977) were used when site-specific input parameters were not available. The NRC staff concluded that the assumed exposure pathways were appropriate – ingestion of aquatic organisms and shoreline exposure only – because water downstream of the site is not used for drinking or irrigation. In addition, the input parameters and values used by STPNOC were appropriate.

G.2.1.2 Resources Used

To calculate doses to the public from liquid effluents the NRC staff used a personal computer version of the LADTAP II code entitled NRCDOSE, version 2.3.10 (Chesapeake Nuclear Services, Inc. 2006) obtained through the Oak Ridge Radiation Safety Information Computational Center (RSICC).

G.2.1.3 Input Parameters

Table G-3 lists the major parameters used in calculating dose to the public from liquid effluent releases during normal operation. It should be noted that the 50-mi population was assumed to be for the year 2060, which is an overestimate of the population and is considered to be conservative. Section 5.4.1 of the Environmental Standard Review Plan (ESRP) (NRC 2000) guidance suggests that populations be projected only five years out from the date of the licensing action under consideration.

G.2.1.4 Comparison of Results

NRC staff's dose calculations confirmed the doses estimated by STPNOC.

Table G-3. Single Unit Source Term for Liquid Effluent Pathways

Parameter	Staff Value					Comments
Single new unit liquid effluent source term (Ci/yr)			**Fraction Reaching Colorado River**	**Fraction Reaching Matagorda Bay**	**Fraction Reaching Little Robbins Slough**	(STPNOC 2009b)
	I-131	9.05×10^{-3}	1.40×10^{-5}	2.31×10^{-5}	8.56×10^{-6}	
	I-132	1.93×10^{-3}	0.00	0.00	0.00	
	I-133	3.73×10^{-2}	6.99×10^{-11}	1.15×10^{-10}	4.27×10^{-11}	
	I-134	1.14×10^{-4}	0.00	0.00	0.00	
	I-135	1.09×10^{-2}	7.64×10^{-22}	1.26×10^{-21}	4.67×10^{-22}	
	H-3	8.00	7.87×10^{-2}	1.30×10^{-1}	4.81×10^{-2}	
	Na-24	5.05×10^{-3}	6.61×10^{-13}	1.09×10^{-12}	4.04×10^{-13}	
	P-32	5.68×10^{-4}	4.22×10^{-5}	6.96×10^{-5}	2.57×10^{-5}	
	Cr-51	1.70×10^{-2}	1.13×10^{-4}	1.87×10^{-4}	6.93×10^{-5}	
	Mn-54	3.97×10^{-3}	1.64×10^{-3}	2.71×10^{-3}	1.00×10^{-3}	
	Mn-56	2.04×10^{-3}	0.00	0.00	0.00	
	Co-58	8.38×10^{-3}	3.54×10^{-4}	5.84×10^{-4}	2.16×10^{-4}	
	Co-60	1.54×10^{-2}	7.64×10^{-3}	1.26×10^{-2}	4.67×10^{-3}	
	Fe-55	9.46×10^{-3}	4.60×10^{-3}	7.60×10^{-3}	2.81×10^{-3}	
	Fe-59	2.23×10^{-3}	2.07×10^{-4}	3.42×10^{-4}	1.27×10^{-4}	
	Ni-63	1.70×10^{-3}	2.17×10^{-2}	3.59×10^{-2}	1.33×10^{-2}	
	Cu-64	1.26×10^{-2}	3.33×10^{-14}	5.49×10^{-14}	2.03×10^{-14}	
	Zn-65	4.41×10^{-4}	1.30×10^{-3}	2.14×10^{-3}	7.92×10^{-4}	
	Sr-89	3.14×10^{-4}	2.41×10^{-4}	3.97×10^{-4}	1.47×10^{-4}	
	Sr-90	2.68×10^{-5}	1.74×10^{-2}	2.86×10^{-2}	1.06×10^{-2}	
	Y-90	0.00	4.14×10^{-7}	6.83×10^{-7}	2.53×10^{-7}	
	Sr-91	1.25×10^{-3}	5.14×10^{-17}	8.48×10^{-17}	3.14×10^{-17}	
	Y-91	2.35×10^{-4}	2.85×10^{-4}	4.70×10^{-4}	1.74×10^{-4}	
	Sr-92	4.43×10^{-4}	0.00	0.00	0.00	
	Y-92	1.69×10^{-3}	0.00	0.00	0.00	
	Y-93	1.36×10^{-3}	2.40×10^{-16}	3.96×10^{-16}	1.46×10^{-16}	
	Zr-95	1.11×10^{-3}	3.16×10^{-4}	5.22×10^{-4}	1.93×10^{-4}	
	Nb-95	3.14×10^{-4}	1.54×10^{-4}	2.54×10^{-4}	9.42×10^{-5}	
	Mo-99	2.61×10^{-3}	4.71×10^{-7}	7.77×10^{-7}	2.88×10^{-7}	
	Tc-99M	5.68×10^{-3}	2.42×10^{-23}	4.00×10^{-23}	1.48×10^{-23}	
	Ru-103	3.27×10^{-4}	1.78×10^{-4}	2.93×10^{-4}	1.09×10^{-4}	
	Ru-106	8.89×10^{-3}	1.92×10^{-3}	3.17×10^{-3}	1.17×10^{-3}	
	Ag-110M	1.20×10^{-3}	1.33×10^{-3}	2.19×10^{-3}	8.12×10^{-4}	
	Sb-124	0.00	2.95×10^{-4}	4.86×10^{-4}	1.80×10^{-4}	
	Te-129M	8.43×10^{-5}	1.46×10^{-4}	2.40×10^{-4}	8.89×10^{-5}	
	Te-131M	8.38×10^{-5}	3.10×10^{-9}	5.12×10^{-9}	1.90×10^{-9}	
	Te-132	1.35×10^{-5}	9.68×10^{-7}	1.60×10^{-6}	5.91×10^{-7}	
	Cs-134	1.13×10^{-2}	3.67×10^{-3}	3.67×10^{-3}	0.00	
	Cs-136	7.51×10^{-4}	3.64×10^{-5}	3.64×10^{-5}	0.00	
	Cs-137	1.78×10^{-2}	1.76×10^{-2}	1.76×10^{-2}	0.00	
	Cs-138	8.00×10^{-7}	0.00	0.00	0.00	
	Ba-140	1.68×10^{-3}	3.48×10^{-5}	5.74×10^{-5}	2.12×10^{-5}	
	Ce-141	2.97×10^{-4}	1.39×10^{-4}	2.30×10^{-4}	8.52×10^{-5}	
	Ce-144	3.89×10^{-3}	1.49×10^{-3}	2.47×10^{-3}	9.13×10^{-4}	
	Pr-143	8.11×10^{-5}	3.85×10^{-5}	6.36×10^{-5}	2.35×10^{-5}	
	Nd-147	2.00×10^{-6}	3.41×10^{-10}	5.62×10^{-10}	2.08×10^{-10}	
	W-187	2.23×10^{-4}	2.20×10^{-7}	3.62×10^{-7}	1.34×10^{-7}	
	Np-239	9.49×10^{-3}	2.56×10^{-4}	4.23×10^{-4}	1.57×10^{-4}	

Table G-3. (contd)

Parameter	Staff Value	Comments
Discharge Flow Rate	18.3 cfs 16.5 cfs 10700 cfs	From MCR to Little Robbins Slough Blowdown Four Unit discharge flow into MCR
Evaporation Rate	146.35 cfs	MCR evaporation rate – used for tritium calculations only
Source Term multiplier	$2 \times 2.7027 \times 10^{-5} = 5.41 \times 10^{-5}$	Converts from MBq/yr to Ci/yr and adjusts for two ABWR units.
Site Type	Fresh water	MCR to Little Robbins Slough
Reconcentration Model	None	Site-specific from Table 5.4-1 of ER (STPNOC 2009a)
Impoundment Volume	0; 7.35×10^{9} ft^{3}	Set to "0" for no impoundment at Little Robbins slough, Second value is MCR volume.
Shore width factor	0.2 and 0.3	Little Robbins slough and MCR, respectively.
Dilution factors for aquatic food and boating, shoreline and swimming	1	Liquid discharge assumed fully mixed with annual average dilution flows at Little Robbins slough. For MCR calculations Partially Mixed
Transit time to nearest drinking water	Not considered for Little Robbins slough calculations 0.1 h for MCR calculations	No drinking water downstream from STP 0.1 h to simulate doses to biota exposed to MCR concentrations.
Consumption and usage factors for adults, teens, child, and infant	Shoreline usage (hr/yr) 12 Adult 67 Teen 14 Child 0 Infant Fish Consumption (kg/yr) 21 Adult 16 Teen 6.9 Child 0 Infant	
50-mi population[(a)]	5.14×10^{5} Fractions: Adult 0.71, Teen 0.11, Child 0.18	Assumes 2060 population
50-mi sport fishing	4.5×10^{4} kg/yr	Site Specific from Table 5.4-1 of ER (STPNOC 2009a)
50-mi invertebrate catch	1.8×10^{6} kg/yr	Site Specific from Table 5.4-1 of ER (STPNOC 2009a)
50-mi shoreline usage	7.84×10^{6} person-hr/yr	Site Specific from Table 5.4-1 of ER (STPNOC 2009a)
50-mi swimming, boating usage	3.92×10^{6} person-hr/yr	Site Specific from Table 5.4-1 of ER (STPNOC 2009a)

G.2.2 Dose Estimates to the Public from Gaseous Effluents

The NRC staff used the dose assessment approach specified in Regulatory Guide 1.109 (NRC 1977) and the GASPAR II computer code (Strenge et al. 1987) to estimate doses to the MEI and to the public within 50 mi of the STP site from the gaseous effluent pathway for the proposed units. The NRC staff used the projected radioactive gaseous effluents release values from the Final Safety Analysis Report (STPNOC 2009b).

G.2.2.1 Scope

The NRC staff and STPNOC calculated the MEI dose at 2.19 mi west-southwest of the new units. Pathways included were plume, ground, inhalation, and ingestion of locally grown meat and vegetables. Milk consumption was not considered because there are no milk animals within 5 mi of the plant.

The NRC staff reviewed the parameters and values used by STPNOC (2009a), for appropriateness. Default values from Regulatory Guide 1.109 were used when site or design specific input parameters were not available. The NRC staff concluded that the assumed exposure pathways and input parameters were appropriate. These pathways and parameters were used by the NRC staff in its independent calculations using GASPAR II.

Joint frequency distribution data of wind speed and wind direction by atmospheric stability class for the STP site provided in ER Table 2.7-10 (STPNOC 2009a) were used as input to the XOQDOQ code (Sagendorf et al. 1982) to calculate the average X/Q and D/Q values for routine releases. XOQDOQ output from the applicant were examined and determined to be appropriate.

Population doses were calculated for all types of releases (i.e., noble gases, particulates, iodines H-3 and C-14) using the GASPAR II code for the following: plume immersion, direct radiation from radionuclides deposited on the ground, inhalation, ingestion of vegetables, milk, and meat.

G.2.2.2 Resources Used

To calculate doses to the public from gaseous effluents, the NRC staff used a personal computer version of the XOQDOQ and GASPAR II computer codes entitled NRCDOSE version 2.3.10 (Chesapeake Nuclear Services, Inc. 2006) obtained through the Oak Ridge RSICC.

G.2.2.3 Input parameters

Table G-4 lists the major parameters used in calculating doses to the public from gaseous effluents during normal operation. It should be noted that the 50-mi population was assumed to be for the year 2060, which is an overestimate of the population and is considered to be conservative. ESRP guidance suggests that populations be projected only five years out from the date of the licensing action under consideration.

Table G-4. Parameters Used in Calculating Dose to Public from Gaseous Effluent Releases

Parameter	Staff Value		Comments
Single new unit gaseous effluent source term (Ci/yr)	Kr-83m	8.37×10^{-4}	STPNOC (2009a) references these values in Table 3.5-2 of the ER for single new unit. These values are converted from the original SI units in MBq/yr to Ci/yr
	Kr-85m	2.11×10^{1}	
	Kr-85	5.67×10^{2}	
	Kr-87	2.51×10^{1}	
	Kr-88	3.78×10^{1}	
	Kr-89	2.40×10^{2}	
	Kr-90	3.24×10^{-4}	
	Xe-131m	5.13×10^{1}	
	Xe-133m	8.64×10^{-2}	
	Xe-133	2.40×10^{3}	
	Xe-135m	4.05×10^{2}	
	Xe-135	4.59×10^{2}	
	Xe-137	5.13×10^{2}	
	Xe-138	4.32×10^{2}	
	Xe-139	4.05×10^{-4}	
	I-131	2.59×10^{-1}	
	I-132	2.19	
	I-133	1.70	
	I-134	3.78	
	I-135	2.40	
	H-3	7.29×10^{1}	
	C-14	9.18	
	Na-24	4.05×10^{-3}	
	P-32	9.18×10^{-4}	
	Ar-41	6.75	
	Cr-51	3.51×10^{-2}	
	Mn-54	5.40×10^{-3}	
	Mn-56	3.51×10^{-3}	
	Fe-55	6.48×10^{-3}	
	Fe-59	8.10×10^{-4}	
	Co-58	2.40×10^{-3}	
	Co-60	1.30×10^{-2}	
	Ni-63	6.48×10^{-6}	
	Cu-64	9.99×10^{-3}	
	Zn-65	1.11×10^{-2}	
	Rb-89	4.32×10^{-5}	
	Sr-89	5.67×10^{-3}	
	Sr-90	7.02×10^{-5}	
	Y-90	4.59×10^{-5}	
	Sr-91	9.99×10^{-4}	
	Sr-92	7.83×10^{-4}	
	Y-91	2.40×10^{-4}	

Table G-4. (contd)

Parameter	Staff Value		Comments
	Y-92	6.21×10^{-4}	
	Y-93	1.11×10^{-3}	
	Zr-95	1.59×10^{-3}	
	Nb-95	8.37×10^{-3}	
	Mo-99	5.94×10^{-2}	
	Tc-99m	2.97×10^{-4}	
	Ru-103	3.51×10^{-3}	
	Rh-103m	1.11×10^{-4}	
	Ru-106	1.89×10^{-5}	
	Rh-106	1.89×10^{-5}	
	Ag-110m	2.00×10^{-6}	
	Sb-124	1.81×10^{-4}	
	Te-129m	2.19×10^{-4}	
	Te-131m	7.56×10^{-5}	
	Te-132	1.89×10^{-5}	
	Cs-134	6.21×10^{-3}	
	Cs-136	5.94×10^{-4}	
	Cs-137	9.45×10^{-3}	
	Cs-138	1.70×10^{-4}	
	Ba-140	2.70×10^{-2}	
	La-140	1.81×10^{-3}	
	Ce-141	9.18×10^{-3}	
	Ce-144	1.89×10^{-5}	
	Pr-144	1.89×10^{-5}	
	W-187	1.89×10^{-4}	
	Np-239	1.19×10^{-2}	
Population distribution	Table 2.5-2 of the ER (STPNOC 2009a)		Population distribution used by STP and the staff was for year 2060.
Wind Speed and Direction	Table 2.7-7 of the ER (STPNOC 2009a)		Site-specific data for 1997, 1999, and 2000.
Joint Frequency distribution of wind speed and direction by stability class	Table 2.7-10 of the ER (STPNOC 2009a)		Site specific data for 1997, 1999, and 2000.
Atmospheric Dispersion factors (sec/m^3)	Tables 2.7-15 and 2.7-16 of the ER (STPNOC 2009a)		
Ground Deposition factors	Table 2.7-15 of the ER (STPNOC 2009a)		Table to be updated with July 20, 2009 response to RAI 5.4.2 (U7-C-STP-NRC-090075)
Vegetable Production rate within 50 mi of STP site	9,640,000 kg/yr		Site-specific data provided by STPNOC in Table 5.4-2 of the ER (STPNOC 2009a)
Meat Production Rate within 50 mi of STP site	40,500,000 kg/yr		Site-specific data provided by STPNOC in Table 5.4-2 of the ER (STPNOC 2009a)
Milk Production rate within 50 mi of STP site	2,130,000 L/yr		Site-specific data provided by STPNOC in Table 5.4-2 of the ER (STPNOC 2009a)
Pathway receptor locations	Table 5.4-4 of the ER		

Table G-4. (contd)

Parameter	Staff Value	Comments
(direction, and distance,) – nearest site boundary, MEI location	(STPNOC 2009a)	
Consumption factors for milk, meat, leafy vegetables, and vegetables	Milk (L/yr) 310 Adult 400 Teen 330 Child 330 Infant Meat (kg/yr) 110 Adult 65 Teen 41 Child 0 Infant Leafy Vegetable (kg/yr) 64 Adult 42 Teen 26 Child 0 Infant Vegetable (kg/yr) 520 Adult 630 Teen 520 Child 0 Infant	Table 5.4-3 of the ER (STPNOC 2009a) Section 5.9.2 of the EIS states that there are no milk cows within 5 mi of the STP site.
Fraction of leafy vegetables grown	0.917	Table 5.4-3 of the ER (STPNOC 2009a)
Fraction of year that milk cows are on pasture	0.917	Table 5.4-3 of the ER (STPNOC 2009a)
Fraction of MEI vegetable intake from own garden	0.76	Table 5.4-3 of the ER (STPNOC 2009a)
Fraction of year beef cattle are on pasture	0.917	Table 5.4-3 of the ER (STPNOC 2009a)
Fraction of year beef cattle intake is from pasture while on pasture	1	Default value of GASPAR II code (Strenge et al. 1987).

RAI = Request for Additional Information

G.2.2.4 Comparison of Doses to the MEI from Gaseous Effluents

NRC staff's dose calculations confirmed the doses estimated by STPNOC.

Table G-5. Comparison of Cumulative Doses to the MEI with 40 CFR Part 190 Criteria (mrem per year)

DOSE	STP Units 1 and 2[(a)]			STP Units 3 and 4				Site Total	40 CFR Part 190 Criteria
	Liquid	Gaseous	Total	Direct[(b)] Radiation	Liquid[(c)]	Gaseous	Total		
Total Body	0.0042	0.0072	0.011	5	0.000525	0.70[(d)]	5.7	5.71	25
Thyroid	0.0041	0.0099	0.14	NA	0.000406	4.54[(e)]	4.54	4.55	75
Bone	0.00077	0.00079	0.0016	NA	0.00230	1.94[(d)]	1.94	1.94	25

(a) Doses from liquid and gaseous effluent releases for two existing units are taken from ER Table 5.4-8 (STPNOC 2009a).
(b) Doses from direct radiation are based on plant shielding design acceptance criteria for the ABWR that specify a maximum dose rate from direct and scattered radiation of 2.5 mrem/y at the Exclusion Area Boundary (STPNOC 2009a).
(c) Liquid pathway MEI is a combination of teen (total body and thyroid) and child (bone)
(d) Gaseous pathway MEI dose for bone and total body is a child located at 2.18 mi WSW of new units with meat animal and vegetable garden.
(e) Gaseous pathway MEI dose for thyroid is a child located 3.03 mi NNW of new units with meat animal and vegetable garden.

G.2.3 Cumulative and Population Dose Estimates

Based on parameters shown for the liquid pathway and the gaseous pathway, Table G-3 and Table G-4, respectively, doses from the two proposed units were calculated using LADTAP and GASPAR to the MEI. Doses from the existing units are taken from ER Table 5.4-8 (for the MEI) and Table 5.4-9 (for the population) (STPNOC 2009a). Table G-5 is the same table as ER Table 5-12 and compares cumulative dose estimates to the MEI with EPA's dose criteria in 40 CFR Part 190. Table G-5 includes doses from all pathways (i.e., external, liquid effluent and gaseous effluent) summed for existing Units 1 and 2 and proposed Units 3 and 4.

Based on parameters shown for the liquid pathway and gaseous pathway (Table G-3 and Table G-4, respectively), doses were calculated using LADTAP and GASPAR to the population within 50 mi of the STP site (as discussed in Section G.2.1.3 and G.2.2.3). Doses from the milk pathway were not calculated because there are no dairies within 50 mi of the STP site. Table G-6 shows dose estimates to the population within 50-mi of the STP site from operation of proposed Units 3 and 4. It should be noted that the 50-mi population was assumed to be for the year 2060, which is an overestimate of the population and is considered to be conservative. ESRP guidance suggests that populations be projected only five years out from the date of the licensing action under consideration. For comparison, the collective background dose to the regional population is estimated to be approximately 159,000 person-rem. This estimate is the product of the annual average dose rate to individuals from natural sources of 311 mrem/yr, as stated in NCRP Report 160 (NCRP 2009), and the estimated 2060 population of 5.14×10^5.

Table G-6. Doses to Population Within 50-mi Radius of the STP Site (Person-Rem)

	STP Units 3 and 4		Total
	Liquid	Gaseous	
Noble gases	0	0.11	0.11
Iodines and particulates	0.0030	0.14	0.14
Tritium and C-14	0.0000056	0.32	0.32
Total[(a)]	0.0030	0.58	0.58

(a) Differences between sum of components and totals are due to rounding.

G.2.4 Dose Estimates to the Biota from Liquid and Gaseous Effluents

To estimate doses to the biota from the liquid and gaseous effluent pathways, the STPNOC staff used the LADTAP II computer code (Strenge et al. 1986), the GASPAR II computer code (Strenge et al. 1987), and input parameters supplied by STPNOC in response to RAIs (STPNOC 2008).

G.2.4.1 Scope

It is acceptable to NRC staff to estimate radiation doses to representative biota species. Fish, invertebrates, and algae are used as reference aquatic biota species. Muskrats, raccoons, herons, and ducks are used as reference terrestrial biota species. The NRC staff recognizes the LADTAP II computer program as an appropriate method for calculating dose to the aquatic biota and for calculating the liquid-pathway contribution to terrestrial biota. The LADTAP II code calculates an internal dose component and an external dose component and sums them for a total body dose. Default values from Regulatory Guide 1.109 (NRC 1977) are used when site-specific input parameters are not available. The NRC staff concluded that all of the input parameters used by STPNOC were appropriate.

G.2.4.2 Resources Used

To calculate doses to the biota from liquid effluents, the NRC staff used a personal computer version of the LADTAP II entitled NRCDOSE Version 2.3.10 (Chesapeake Nuclear Services, Inc. 2006). NRCDOSE was obtained through the Oak Ridge RSICC.

Most of the LADTAP II input parameters are specified in Section G.2.1.3 to include the source term, the discharge flow rate to the receiving freshwater system, the shore-width factor, and fractions of radionuclides in the Main Cooling Reservoir (MCR) reaching offsite bodies of water. These parameter values are appropriate to use in calculating biota dose in the MCR. The NRC staff's dose analysis confirmed the liquid pathway doses to biota shown in Table 5-13 and Table G-7.

Table G-7. Dose Estimates to Biota from Liquid and Gaseous Effluents

	Liquid (mrad/yr)	Gaseous (mrad/yr)	Combined (mrad/yr)
Fish	2.50	0.00	2.50
Invertebrate	5.30	0.00	5.30
Algae	0.54	0.00	0.54
Muskrat	2.4	14	16
Raccoon	1.3	17	18
Heron	2.4	14	16
Duck	3.2	17	20

NRC staff assessed dose to terrestrial biota from the gaseous effluent pathway using GASPAR by assuming doses for raccoons and ducks were equivalent to adult human doses for inhalation, vegetation ingestion, plume and twice the ground pathways at the exclusion area boundary (EAB) at 0.52 mi northwest. STPNOC estimated the gaseous pathway doses to biota at the site boundary in the direction that resulted in the largest doses (maximum site boundary). The NRC staff concluded that terrestrial biota could live on the STP site and receive higher doses from the gaseous effluents. Therefore, the NRC staff estimated the doses at the exclusion area boundary (0.5 mi NW) to achieve a more reasonable estimate of doses to terrestrial biota that might live on the STP site (Table G-7). The doubling of doses from ground deposition reflects the closer proximity of these organisms to the ground. Muskrats and herons do not consume terrestrial vegetation, so that pathway was not included for those organisms.

G.2.5 Dose to Construction Workers

STPNOC used fenceline thermoluminescent dosimeters (TLDs) and environmental TLDs to measure direct radiation levels at locations in and around the STP protected area (STPNOC 2009a). Sixteen TLDs are located along the protected area fence around existing Units 1 and 2 (Figure G-1). All TLDs are read quarterly and measure the contribution to dose from any source, either natural or anthropogenic, including the current reactor buildings and Onsite Staging Facility (OSF) (Figure G-2). Data from 2002 through 2006 are provided in Table G-8 through Table G-12. Data from this five-year period provide information indicative of plant conditions. Table G-12 also contains data collected from around the Old Steam Generator Storage Facility (OSGSF) see Figure G-2. These tables show the maximum measured dose rate at monitoring stations 9 to 16 over the five years was 18.9 mR/quarter.

The difference between the maximum protected area fence reading (18.9 mR/quarter) and the average background reading yields a net maximum dose rate of 6.4 mR/quarter, as shown in Table G-13.

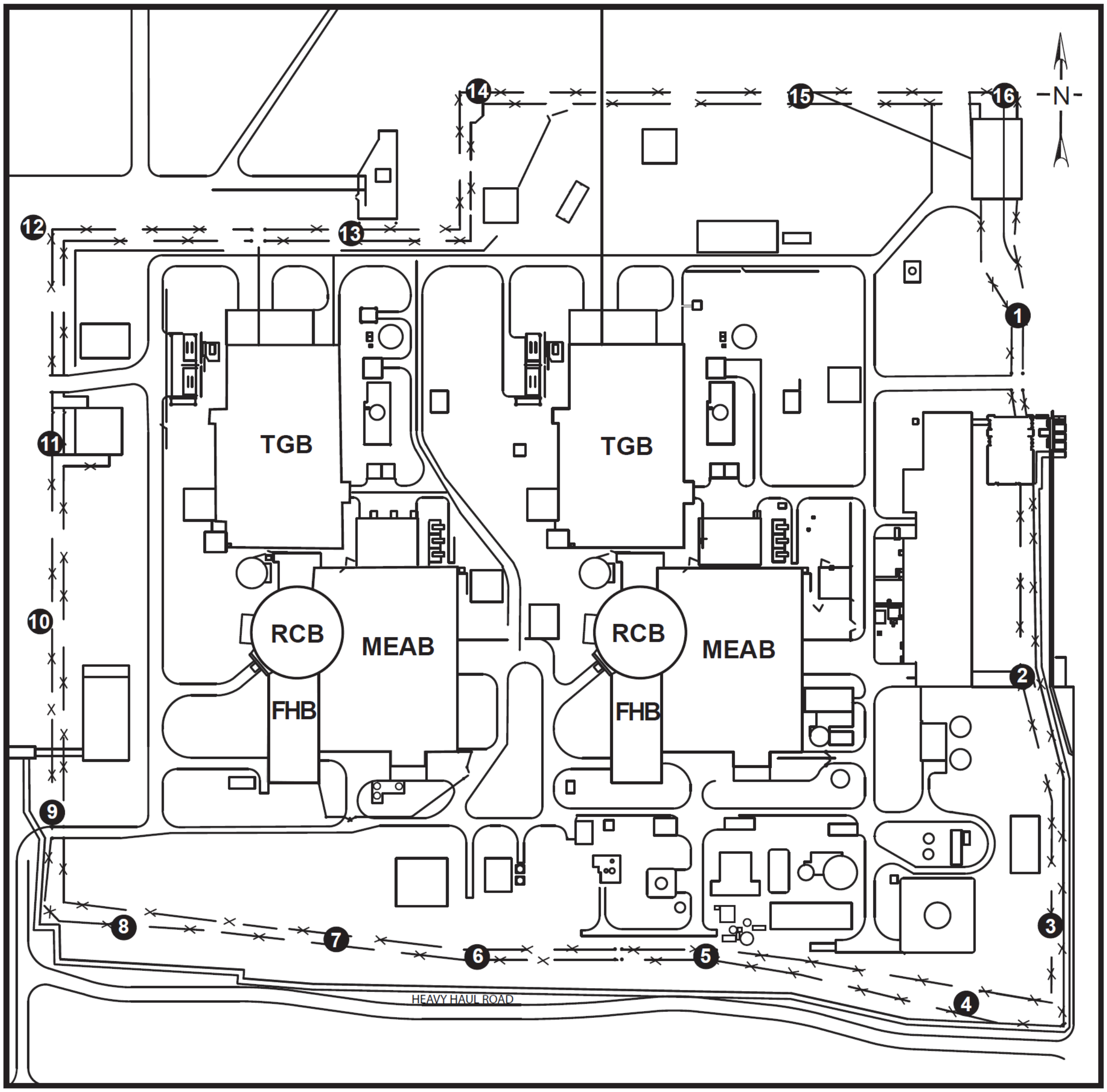
A primary source of direct radiation exposure to the workers on STP Unit 4 will be the gamma radiation from nitrogen-16 in the STP Unit 3 steam lines and steam-bearing components such as turbines, moisture separators, and re-heaters (STPNOC 2009a). The plant shielding design acceptance criteria for the ABWR specify a maximum dose rate due to direct and scattered radiation of 2.5 mrem/yr at the EAB. The distances from STP Unit 3 to the EAB and to the STP Unit 4 reactor are 0.52 and 0.17 mi, respectively. The ABWR DCD does not describe the outside condensate storage tank that STPNOC proposes (STPNOC 2009c). The dose rate from this tank was evaluated by NRC staff using the Microshield computer code and was encompassed by the 2.5 mrem/yr acceptance criteria.

In 1986, prior to operation of STP Units 1 and 2, the background exposure rate was measured at the site boundary was 15.4 mR/quarter. However, some of the current protected area fence line direct radiation measurements are lower than the 1986 site boundary measurements because the protected area was excavated and backfilled with sand and gravel that contained less naturally occurring radioactive material than exists in the native clay found near the site boundary. Between 2002 and 2006, the exposure rate along the protected area fence averaged 12.5 mR/quarter and will be used as the reference background exposure rate, see Table G-14.

Data presented in Table G-14 were determined as follows:

- STP Units 1 and 2 – The dose rate from the waste monitor tanks at the construction area was calculated in the ER by multiplying the net quarterly dose rate by a factor of four, to convert to an annual dose rate then, it was doubled for conservatism, yielding 51.2 mrem/yr at the TLD on the protected area fence. Figures 4.5-1 and 4.5-2 in the ER show the distance from Unit 2 waste monitor tanks to the protected area fence to be about 600 ft and the distance to the center of STP Unit 3 construction area is about 2300 ft. Setting D_{TLD} = 51.2 mrem/yr, R_{TLD} = 600 ft, and R_{loc} = 2300 ft, gives a dose rate of 13.4 mrem/yr at the center of the construction area of Unit 3, for 100 percent occupancy. This can be reduced by the ratio of 2080 hr (worked)/8766 hr (per yr), yielding 3.2 mrem/yr to a worker (Table G-14).

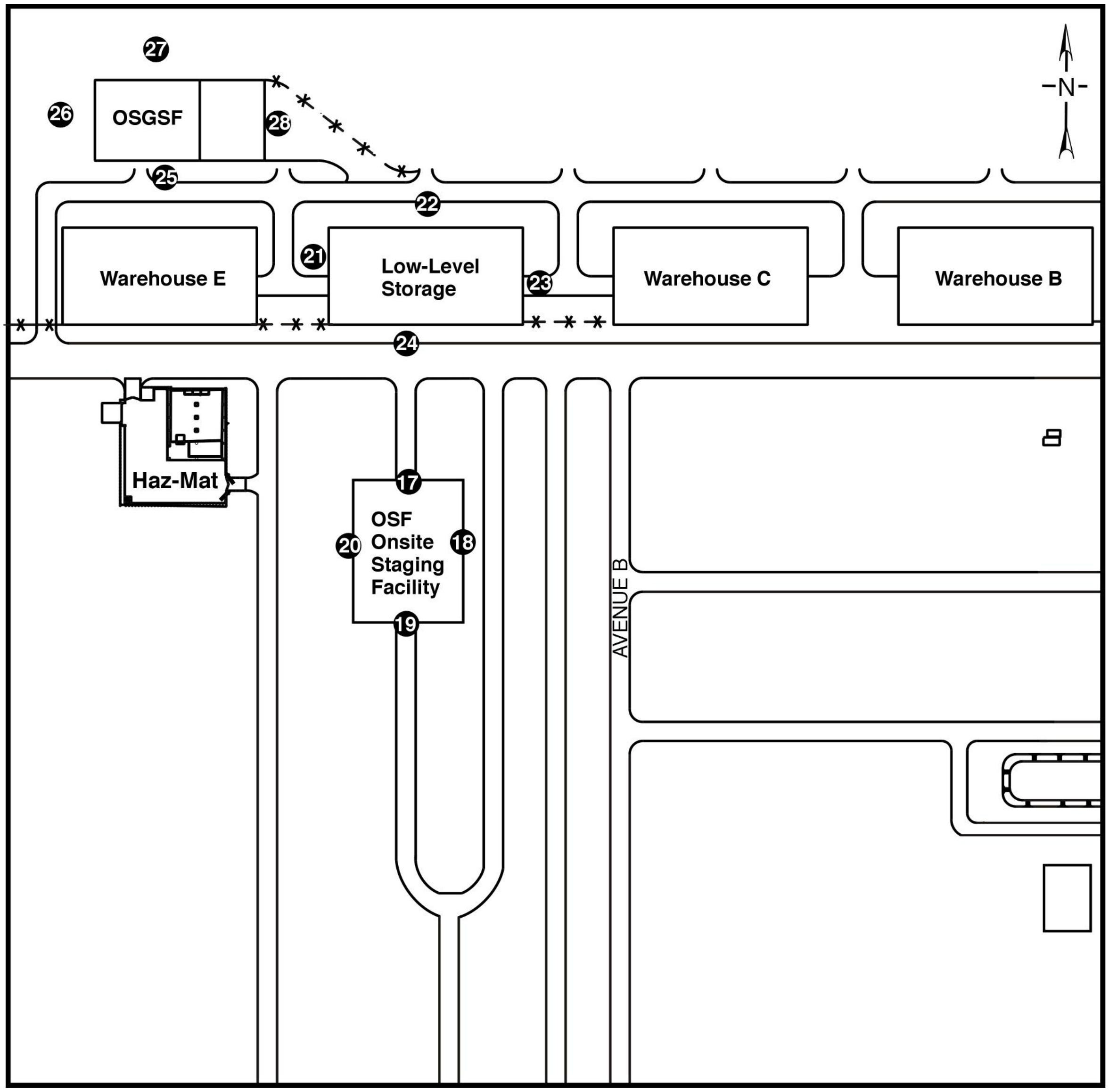
- OSGSF – The dose rate from the OSGSF was calculated by multiplying the net quarterly dose by four to get an annual dose rate, then it is doubled for conservatism, yielding 33.6 mrem/yr at the TLD. The distance from the exterior wall of the OSGSF is about 93 ft and the distance from the OSGSF to the center of STP Unit 4 construction area is about 700 ft. Setting D_{TLD} = 33.6 mrem/yr, R_{TLD} = 93 ft, and R_{loc} = 700 ft gives a dose rate of 4.5 mrem/yr at the center of the construction area of Unit 4, for 100 percent occupancy. This can be reduced by the ratio of 2080 h (worked) / 8766 h (per yr), yielding 1.07 mrem/yr to a worker (Table G-14).



Not to scale

FHB = Fuel Handling Building
MEAB = Mechanical Equipment Auxillary Building
RCB = Reactor Containment Building
TGB = Turbine Generator Building
# = Approximate Thermoluminescent Dosimeter Monitoring Location
—×—×— = Fence

Figure G-1. Protected Area Monitoring Stations (STPNOC 2009a)



Not to scale

Haz-Mat	=	Hazardous Material
OSF	=	Onsite Staging Facility
OSGSF	=	Old Steam Generator Storage Facility
#	=	Approximate Thermoluminescent Dosimeter Monitoring Location
-x -x-	=	Fence

Figure G-2. Locations of TLD Monitoring Stations at OSGSF (STPNOC 2009a)

1 **Table G-8**. TLD Measurements at STP Units 1 and 2 Monitoring Stations in 2002

Station Number	Average Dose by Quarter (mR)			
	1	2	3	4
9	12.9	11.8	18.9	12.2
10	12.4	11.1	14.1	13.2
11	11.5	11	12	11.4
12	12.5	11.3	13.3	11.9
13	12.3	11.1	13.1	11.7
14	12.2	11.4	13.3	11.3
15	13	12.1	13.9	11.9
16	12.7	11.1	13	12.1

Source: STPNOC 2009a

2 **Table G-9**. TLD Measurements at STP Units 1 and 2 Monitoring Stations in 2003

Station Number	Average Dose by Quarter (mR)			
	1	2	3	4
9	12.9	13.1	12.7	13
10	12.5	13	12.5	12.6
11	11.7	11.4	12	11.8
12	12.7	12.5	12.6	11.8
13	12.6	12.5	12.1	12.2
14	12.6	12.6	12.4	12.3
15	13.2	12.8	13.2	12.9
16	12.5	12.5	13	12.7

Source: STPNOC 2009a

3 **Table G-10**. TLD Measurements at STP Units 1 and 2 Monitoring Stations in 2004

Station Number	Average Dose by Quarter (mR)			
	1	2	3	4
9	13.1	13.1	13.4	12.9
10	12.5	12.6	13.5	12.1
11	11.5	11.5	12.3	11.2
12	12.1	12.3	12.9	12.5
13	12	12.3	13.1	12.8
14	12.3	12.1	13.2	12.3
15	13.5	12.9	13.5	13.3
16	13.2	12.4	13.4	12.8

Source: STPNOC 2009a

Table G-11. TLD Measurements at STP Units 1 and 2 Monitoring Stations in 2005

Station Number	Average Dose by Quarter (mR)			
	1	2	3	4
9	14.7	13.7	11.5	11.6
10	14.6	12.9	11.2	11.4
11	13.8	12.6	10.5	10.7
12	13.9	13.7	11.2	11.3
13	14.5	13.6	11.8	12.1
14	14.2	13.6	11.1	11.6
15	15	14.6	11.7	12.3
16	14.7	13.1	10.9	12.1

Source: STPNOC 2009a

Table G-12. TLD Measurements at STP Units 1 and 2 and Old Steam Generator Storage Facility Monitoring Stations in 2006

Station Number	Average Dose by Quarter (mR)			
	1	2	3	4
9	12.8	12.2	12.4	13.4
10	11.9	11.5	12.1	12.2
11	11.4	11.5	11.7	13.3
12	12.3	13.1	12.2	13
13	12.9	12.7	12.3	13.1
14	12.3	11.6	12.1	12.4
15	12.8	12.5	13.6	14
16	12	12.1	12.7	13
OSGSF 25	13.8	12.6	12.5	12.6
OSGSF 26	16.7	15.1	15.9	15.3
OSGSF 27	15.6	13.6	14.1	14.7
OSGSF 28	14.1	12.1	12.1	13.8

Source: STPNOC 2009a

Table G-13. Maximum Quarterly Measured Dose Rates at STP Units 1 and 2 and OSGSF

Location	Dose Rate (mrem/quarter)		
	Maximum Measured	Background	Net
STP Units 1 and 2 Protected Area Fence	18.9	12.5	6.4
OSGSF	16.7	12.5	4.2

Note: The maximum measured dose rates are from Tables 4.5-3 to 4.5-7 in the ER (STPNOC 2009a). The net dose rate is calculated by subtracting the background dose rate from the maximum dose rate.

Table G-14. Direct Radiation Doses to Unit 4 Construction Workers

Source	Distance from Source (ft) To TLD Location	Distance from Source (ft) To Construction Location	Dose Rate (mrem/yr) TLD Location	Dose Rate (mrem/yr) Construction Location	Annual Dose to Worker (mrem)
STP Units 1 and 2	600	2300	51.2	13.4	3.18
OSGSF	92.6	700	33.6	4.5	1.07
LTSF	-	700		1	0.24
OSF	-	-*		1	0.24
STP Unit 3	-	900		23	5.5
Total for STP Units 1 and 2	-	-		19.9	4.72
Total for STP Units1, 2, and 3	-	-		42.9	10.2

Location of the Onsite Storage Facility has not been specified; therefore, dose rate to construction workers is only an estimate.

- LTSF – The Long Term Storage Facility is not yet built yet but plans are to build it adjacent to the OSGSF. It is therefore assumed that the distance from the LTSF to the center of the construction area of STP Unit 4 is also 700 ft. Contamination smears and exposure measurements taken from the reactor vessel heads that will be stored in the LTSF and using MicroShield and MicroShine software yielded an exposure rate of 8×10^{-6} mR/hr at 700 ft away. With fulltime occupancy, this results in a dose rate of 0.07 mrem/yr. This is conservatively rounded up to 1 mrem/yr for the construction location, and the annual dose to the construction worker of 0.24 mrem was obtained by multiplying by the ratio of 2080 hours worked/ 8766 hours per year (Table G-14).

- OSF – As indicated above, the OSF will be relocated and have additional shielding provided such that the dose rate from this source will be negligible at the STP Units 3 and 4 construction location. However, the dose rate from the OSF is conservatively assumed to be 1 mrem/yr at the construction location, and the annual dose to the construction worker of 0.24 mrem was obtained by multiplying by the ratio of 2080 hours worked/ 8766 hours per year (Table G-14).

- STP Unit 3 – STP Unit 3, including the CST, must be considered as a source of direct radiation to construction workers at STP Unit 4 during the timeframe between STP Unit 3 becoming operational and STP Unit 4 becoming operational. The plant shielding design acceptance criteria for the ABWR specify a maximum dose rate due to direct and scattered radiation of 2.5 mrem/yr at the EAB. Distances from STP Unit 3 to the EAB and to the STP Unit 4 reactor are 0.52 and 0.17 mi, respectively. Assuming the distances were great enough to consider the source a point source, the dose rate at the construction site was estimated at 23 mrem/yr. Adjusting the calculated dose rate at STP Unit 4 from operations of STP Unit 3 for worker occupancy (2080 hours worked/8766 hours per year) yields a worker dose rate of 5.5 mrem/yr. Adding the total direct radiation dose rate from STP Units 1 and 2 (4.72 mrem/yr) to the Unit 3 direct radiation dose yields a total of 10.2 mrem/yr for the Unit 4 construction worker (Table G-14).

G.3 References

40 CFR 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

Chesapeake Nuclear Services, Inc. 2006. *NRCDOSE for Windows*. Radiation Safety Information Computational Center, Oak Ridge, Tennessee.

National Council on Radiation Protection and Measurements (NCRP). 2009. *Ionizing Radiation Exposure of the Population of the United States*. NCRP Report No. 160, Bethesda, Maryland.

Sagendorf, J.F., J.T. Goll, and W.F. Sandusky. 1982. *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*. NUREG/CR-2919, Pacific Northwest National Laboratory, Richland, Washington.

South Texas Project Nuclear Operating Company (STPNOC). 2008. Letter from Greg Gibson, STPNOC, to NRC dated July 30, 2008,, "Response to Requests for Additional Information." Accession No. ML082140629.

South Texas Project Nuclear Operating Company (STPNOC). 2009a. *South Texas Project Units 3 and 4 Combined License Application, Part 3, Environmental Report*. Revision 3, Bay City, Texas. Accession No. ML092931600.

South Texas Project Nuclear Operating Company (STPNOC). 2009b. *South Texas Project Units 3 and 4 Combined License Application, Part 2, Final Safety Analysis Report*. Revision 3, Bay City, Texas. Accession No. ML092931524.

South Texas Project Nuclear Operating Company (STPNOC). 2009c. Letter from Scott Head, STPNOC, to NRC, dated September 14, 2009 "Response to Request for Additional Information." Accession No. ML092580491.

Strenge, D.L., R.A. Peloquin, and G. Whelan. 1986. *LADTAP II – Technical Reference and User Guide*. NUREG/CR-4013, Pacific Northwest Laboratory, Richland, Washington.

Strenge, D.L., T.J. Bander, and J.K. Soldat. 1987. *GASPAR II – Technical Reference and User Guide*. NUREG/CR-4653, Pacific Northwest Laboratory, Richland, Washington.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*. Regulatory Guide 1.109, Washington, D.C. Accession No ML003740384.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Environmental Standard Review Plan — Standard Review Plans for Environmental Reviews for Nuclear Power Plants*. NUREG-1555, Vol. 1, Washington, D.C. Includes 2007 updates.

Appendix H

Authorizations, Permits, and Certifications

Appendix H

Authorizations, Permits, and Certifications

This appendix contains a list of the environmental-related authorizations, permits, and certifications potentially required by STP Nuclear Operating Company (STPNOC) from Federal, State, regional, and local agencies related to the combined licenses for the two proposed new nuclear units, Units 3 and 4, at South Texas Project (STP) site. The table is reproduced from Tables 1.2-1 through 1.2-4 of the Environmental Report submitted to the U.S. Nuclear Regulatory Commission (NRC).

Table H-1. Other Authorizations, Permits, and Certifications Potentially Required by STPNOC

Agency	Authority	Requirement	Activity Covered	Status
NRC	10 Code of Federal Register (CFR) 30	Byproduct license	Approval to possess special nuclear material (SNM).	01/2012
NRC	10 CFR Part 52, Subpart C	Combined Licenses	Construction and operation of two new nuclear units.	Application submitted 09/20/07
NRC	10 CFR 70	Special Nuclear Materials License	Approval to possess fuel.	01/2012
NRC	10 CFR 61	Licensing Requirements for Land Disposal of Radioactive Wastes	Procedures, criteria, and terms and conditions for the licensing of land disposal facilities intended to contain byproduct source, and SNM.	If required
NRC	10 CFR 71	Packaging and Transportation of Radioactive Material	The regulations in this part provide requirements, procedures, and standards for packaging, preparation for shipment, and transportation of licensed material.	If required
NRC	10 CFR 72	Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste	The issuance of licenses to receive, transfer, and possess power reactor spent fuel and other associated radioactive materials in an independent spent fuel storage installation and the terms under which the Commission will issue such a license.	If required

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
NOAA Fisheries	Endangered Species Act of 1973	Consultation regarding potential to adversely impact protected marine species	Concurrence with no adverse impact or consultation on appropriate mitigation measures.	Complete
US Fish and Wildlife Service (FWS)	Endangered Species Act of 1973	Consultation regarding potential to adversely impact protected species (non-marine species)	Concurrence with no adverse impact or consultation on appropriate mitigation measures. Triggering Activity: Cannot modify habitat of endangered or threatened species without authorization from FWS, including clearing of vegetation or earth-moving activities.	Complete
FWS	Migratory Bird Treaty Act, 50 CFR 21	Compliance with requirements of Act	Adverse impacts on protected species and/or their nests.	Complete
Department of Energy (DOE)	Nuclear Waste Policy Act (42 United States Code (U.S.C) 10101 et seq.) and 10 CFR Part 961	Spent Fuel Contract	The DOE Standard Contract for disposal of spent nuclear fuel contained in 10 CFR Part 961 is being modified by the DOE.	2008 DE-CR01-09RW09007 (Unit 3) DE-CR01-09RW09008 (Unit 4)

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
US Army Corps of Engineers (Corps)	Federal Clean Water Act (FCWA), Section 404, 33 CFR 323	Section 404 Permit	Disturbance or crossing wetland areas or navigable waters.	Permit Determination Request submitted 06/04/2009 Second Permit Determination Request submitted 10/28/2009
Corps	FCWA, Section 404, 33 CFR 323	Dredge and Fill Discharge Permit	Maintenance dredging of intake structure on Colorado River.	Covered under Permit No. SWG-1992-02707 Exp. Date: 12/31/2019
Corps	Rivers and Harbors Act	Section 10 Permit	Maintenance dredging of barge slip.	Covered under Permit No. 10570 Exp. Date: 12/31/2014
United States Department of Transportation	49 CFR 107, Subpart G Registration for Hazardous Materials Transportation	Certificate of Registration	Renew existing two-year registration for transportation of hazardous materials.	Covered under Permit No. 061506 551 0960P
Federal Aviation Administration	14 CFR 77	Construction Notice	Notice of erection of structures (>200 feet high) potentially impacting air navigation.	12/2011

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
Texas Commission on Environmental Quality (TCEQ)	Federal Clean Air Act (FCAA), General Air Quality Rules (Texas Administrative Code (T.A.C.) Title 30, Part 1, Chapter 101, 111, 116)	Air Quality Construction Permit	Construction of air emission sources – diesel combustion generator, diesel generators, vents and other air sources regulated by TCEQ. Triggering Activity: Permit must be obtained before excavation for or construction of foundation or footings supporting air emitting facilities.	Complete
TCEQ	FCAA, General Air Quality Rules (T.A.C. Title 30, Part 1, Chapter 101, 111, 116)	Air Quality Construction Permit	Construction air emission sources: Concrete batch plant (CBP) Sand blast facility and surfacing coating facility. Triggering Activity: Authorization must be obtained before excavation for or construction of foundation or footings supporting air emitting facilities.	12/2010 (Obtained by Constructor)
TCEQ	Federal Clean Water Act (FCWA) (33 U.S.C. 1251 et seq.); T.A.C. Title 30, Part 1, Chapter 307, 308	Section 401 Certification	Certify that issuance of the COL will not result in a violation of state water quality standards.	Waiver received on Feb 2, 2010.

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
TCEQ	FCWA, Texas Water Code (TWC) Chapter 26; T.A.C. Title 30, Part 1, Chapter 205, 279, 307, 308	Renewal of or amendment to existing Texas Pollutant Discharge Elimination System (TPDES) Permit	Regulates discharge of pollutants to surface water. Triggering Activity: Amended TPDES permit must be issued prior to excavation for or construction of foundation or footings to support wastewater treatment plant components for expanded capacity.	12/2009
TCEQ	FCWA, TWC Chapter 26	General Permit for Stormwater Discharges Associated With Construction Activity	Discharge stormwater from site during construction. Triggering Activity: Authorization must be obtained prior to exposure of soils from activities such as clearing, grading and excavating.	10/2009 (Obtained by Constructor)
TCEQ	T.A.C. Title 30, Part 1, Chapter 290	TCEQ approval of modification of public water system	Modify treatment, storage, distribution of potable water system as needed for expansion Approval of plans and specifications or TCEQ determination that approval is not required must occur before construction commences on any new or expanded component of water system, including water well, storage, treatment or distribution lines.	As required

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
TCEQ	FCWA, TWC, Ch. 26	TPDES General Permit	Discharge of uncontaminated groundwater encountered during construction will be included in TPDES General Permit for construction activities.	12/2009 (Obtained by Constructor)
TCEQ	T.A.C. Title 30, Part 1, Chapter 334	Certificate of Annual Tank Registration	All underground storage tanks that are in use or capable of being used for petroleum products and certain chemicals.	As required
TCEQ	T.A.C. Title 30, Part 1, Chapter 335	Notice of Registration	Onsite disposal of Class III industrial solid waste consisting of earth and earth-like products, concrete, rock, bricks, and land clearing debris.	Registration No. 30651
TCEQ	T.A.C. Title 30, Part 1, Chapter 335	Notice of Registration	Offsite disposal of industrial solid wastes.	Registration No. 30651
TCEQ	T.A.C. Title 30, Part 1, Chapter 295, 297	Water Rights	Use of additional makeup water from Colorado River.	Covered under existing water rights.Registration No. 14-5437
TCEQ	T.A.C. Title 30, Part 1, Chapter 321; FCWA; TWC, Chapter 26	Notice of Registration	Relocation of existing pond related to car wash and vehicle washdown.	12/2010
TCEQ	T.A.C. Title 30, Part 1, Chapter 290	Revision or new permit to operate a public water system - Notice of Termination	Operate a public noncommunity water system.	As required

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
TCEQ	RCRA, T.A.C. Title 30, Part 1, Chapter 334	Certificate of Annual Tank Registration - Notice of Termination	All underground storage and aboveground storage tanks that are in use or capable of being used for petroleum products and certain chemicals. Tank removal/abandonment	As required
TCEQ	FCWA, T.A.C. Title 30, Part 1, Chapter 307, 308, 309, and 317	Amendment to existing TPDES Permit	Regulates limits of pollutants in liquid discharge to surface water TPDES Permit No. 01908. Expiration date: 12/1/09.	Renewal review in process by TCEQ
TCEQ	Revision of existing Title V Operating Permit	Operation of air emission sources	Update existing permit as necessary.	Permit No. 0801 Expiration Date: 1/25/2011
TCEQ	T.A.C. Title 30, Part 1, Chapter 335	Revision/new permit for Industrial/ Hazardous Waste	Industrial/Hazardous waste generation, storage, and disposal activities.	As required
TCEQ	T.A.C. Title 30, Part 1, Chapter 327	Spill Prevention and Control	Procedures for reporting spills of hazardous materials onsite (Covered in the STPEGS Integrated Spill Contingency Plan)	As required
TCEQ	T.A.C. Title 30, Part 1, Chapter 328	Waste Minimization and Recycling	Program for waste reduction (Covered in the STPEGS Source Reduction and Waste minimization Program)	As required

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
TCEQ	Multi-sector stormwater Permit	Revision of Stormwater Pollution Prevention Plan	Areas meeting the definition of industrial activity to be added to current program.	As required
Texas Historical Commission (THC)	National Historic Preservation Act, (36 Code of Federal Regulations (CFR) 800), Texas Historical Commission T.A.C. Title 13, Part 2	Consultation regarding potential to adversely affect historic resources	Confirm site construction or operation would not affect protected historic resources. Triggering Activity: Authorization must be obtained before excavation or soil disturbance in area where historic resources are located.	Complete
NOAA, Texas Coastal Coordination Council (CCC)	Coastal Zone Management Act, Texas Coastal Management Plan implemented through CCC	Consistency review	NRC license, any individual Section 404 permit.	Complete Consistency Determination received 06/09/08
Texas Parks and Wildlife Division	Resource Protection (T.A.C. Title 31, Part 2, Chapter 69) Wildlife (T.A.C. Title 31, Part 2, Chapter 65)	Consultation regarding potential to adversely impact State-listed protected species	Adverse impacts on state-listed protected species and/or their habitat.	Complete

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
Texas Department of State Health Services	FCAA, 40 CFR Part 61, Subpart M, Texas Asbestos Health Protection (T.A.C. Title 25, Part 1, Chapter 295, Subchapter C)	Notice of intent for asbestos renovation, encapsulation, or demolition	Building demolition or renovation activities and asbestos abatement projects.	As required
State of Tennessee Department of Environment and Conservation Division of Radiological Health	Tennessee Department of Environment and Conservation Rule 1200-2-10.32	Revision of existing Tennessee Radioactive Waste License-for-Delivery	Transportation of radioactive waste into the State of Tennessee.	If required
State of Utah Department of Environmental Quality Division of Radiation Control	R313-26 of the Utah Radiation Control Rules	Revision of existing General Site Access Permit	Transportation of radioactive materials into the State of Utah.	If required
Coastal Plains Groundwater Conservation District (CPGCD)	Rules of the CPGCD, Chapter 3, Subchapter A	Groundwater Well Permit	New groundwater well installation and operation.	Issued 02/07/2008 Expires 02/28/2011

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status
CPGCD	Rules of the CPGCD, Chapter 8	Capping and plugging of groundwater wells	Capping and plugging of monitoring wells at completion of subsurface investigation.	As required
Matagorda County	Flood Plain Management Plan C Zone Requirements	Land Disturbing Activity and Construction Permit	Land disturbing activities within the boundaries of Matagorda County including new construction and renovation of buildings.	As required

Appendix I

Carbon Dioxide Footprint Estimates for a 1000 MW(e) Light Water Reactor (LWR)

Appendix I

Carbon Dioxide Footprint Estimates for a 1000 MW(e) Light Water Reactor (LWR)

The review team has estimated the carbon dioxide (CO_2) footprint of various activities associated with nuclear power plants. These activities include building, operating, and decommissioning the plant. The estimates include direct emissions from the nuclear facility and indirect emissions from workforce transportation and the uranium fuel cycle.

Construction equipment estimates listed in Table I-1 are based on hours of equipment use estimated for a single nuclear power plant at a site requiring a moderate amount of terrain modification. Equipment usage for a multiple unit facility would be larger, but it is likely that it would not be a factor of 2 larger. A reasonable set of emissions factors used to convert the hours of equipment use to CO_2 emissions are based on carbon monoxide emissions (UniStar 2007) scaled to CO_2 using a scaling factor of 165 tons of CO_2 per ton of CO. This scaling factor is based on emissions factors in Table 3.3-1 of AP-42 (EPA 1995). Equipment emissions estimated for decommissioning are one half of those for construction.

Table I-1. Construction Equipment CO_2 Emissions (metric tons equivalent)

Equipment	Construction Total[(a)]	Decommissioning Total[(b)]
Earthwork and Dewatering	1.1×10^4	5.4×10^3
Batch Plant Operations	3.3×10^3	1.6×10^3
Concrete	4.0×10^3	2.0×10^3
Lifting and Rigging	5.4×10^3	2.7×10^3
Shop Fabrication	9.2×10^2	4.6×10^2
Warehouse Operations	1.4×10^3	6.8×10^2
Equipment Maintenance	9.6×10^3	4.8×10^3
TOTAL[(c)]	3.5×10^4	1.8×10^4

(a) Based on hours of equipment usage over 7-yr period.
(b) Based on equipment usage over 10-yr period.
(c) Total not equal to the sum due to rounding.

Workforce estimates are typical workforce numbers for new plant construction and operation based on estimates in various COL applications, and decommissioning workforce emissions estimates are based on decommissioning workforce estimates in NUREG-0586 S1, *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1*

Regarding the Decommissioning of Nuclear Power Reactors (NRC 2002). A typical construction workforce averages about 2500 for a 7-year period with a peak work force of about 4000. A typical operations workforce for the 40-year life of the plant is assumed to be about 400, and the decommissioning workforce during a decontamination and dismantling period of 10 years is assumed to be 200 to 400. In all cases, the daily commute is assumed to involve a 100-mi roundtrip with 2 individuals per vehicle. Considering shifts, holidays, and vacations,1250 roundtrips per day are assumed each day of the year during construction; 200 roundtrips per day are assumed each day during operations; and 150 roundtrips per day are assumed 250 days per year for the decontamination and dismantling portion of decommissioning. If the SAFSTOR decommissioning option is included in decommissioning, 20 roundtrips each day of the year are assumed for the caretaker workforce.

Table I-2 lists the review team's estimates of the carbon dioxide equivalent emissions associated with workforce transport. The table lists the assumptions used to estimate total miles traveled by each workforce and the factors used to convert total miles to metric tons CO_2 equivalent. CO_2 equivalent accounts for other greenhouse gases, such as methane and nitrous oxide, that are emitted by internal combustion engines. The workers are assumed to travel in gasoline powered passenger vehicles (cars, trucks, vans, and SUVs) that get an average of 19.7 mi per gallon of gas (FHWA 2006). Conversion from gallons of gasoline burned to CO_2 equivalent is based on Environmental Protection Agency emissions factors (EPA 2007a; 2007b).

Table I-2. Workforce CO_2 Footprint Estimates

	Construction Workforce	**Operational Workforce**	**Decommissioning Workforce**	**SAFSTOR Workforce**
Roundtrips per day	1250	200	150	20
Miles per roundtrip	100	100	100	100
Days per year	365	365	250	365
Years	7	40	10	40
Miles traveled	3.2×10^8	2.9×10^8	3.8×10^7	2.92×10^7
Miles per gallon(a)	19.7	19.7	19.7	19.7
Gallons fuel burned	1.6×10^7	1.5×10^7	1.9×10^6	1.58×10^6
Metric tons CO_2 per gallon(b)	8.81×10^{-3}	8.81×10^{-3}	8.81×10^{-3}	8.81×10^{-3}
Metric tons CO_2	1.4×10^5	1.3×10^5	1.7×10^4	1.3×10^4
CO_2 equivalent factor(c)	0.971	0.971	0.971	0.971
Metric tons CO_2 equivalent	1.5×10^5	1.3×10^5	1.7×10^4	1.3×10^4

(a) FHWA 2006
(b) EPA 2007b
(c) EPA 2007a

Published estimates of uranium fuel cycle CO_2 emissions required to support a nuclear power plant range from about 1 percent to about 5 percent of the CO_2 emissions from a comparably sized coal-fired plant (Sovacool 2008). A coal-fired power plant emits about 1 metric ton of CO_2 for each megawatt hour generated (Miller and Van Atten 2004). Therefore, for consistency with Table S-3 of 10 CFR 51.51, the NRC staff estimated the uranium fuel cycle CO_2 emissions as 0.05 metric tons of CO_2 per MWh generated and assumed an 80 percent capacity factor. Finally, the review team estimated the CO_2 emissions directly related to plant operations from the typical usage of various diesel generators onsite using EPA emissions factors (EPA 1995). The review team assumed an average of 600 hrs of emergency diesel generator operation per year (total for 4 generators) and 200 hrs of station blackout diesel generator operation per year (total for 2 generators).

Given the various sources of CO_2 emissions discussed above, the review team estimates the total life CO_2 footprint for a reference 1000 MW(e) nuclear power plant to be about 18 million metric tons. The components of the footprint are summarized in Table I-3. The uranium fuel cycle component of the footprint dominates all other components. It is directly related to power generated. As a result, it is reasonable to use reactor power to scale the footprint to larger reactors.

Table I-3. 1000 MW(e) LWR Lifetime Carbon Dioxide Footprint

Source	Activity Duration (yr)	Total Emissions (metric tons)
Construction Equipment	7	3.5×10^4
Construction Workforce	7	1.5×10^5
Plant Operations	40	1.9×10^5
Operations Workforce	40	1.3×10^5
Uranium Fuel Cycle	40	1.4×10^7
Decommissioning Equipment	10	1.8×10^4
Decommissioning Workforce	10	1.7×10^4
SAFSTOR Workforce	40	1.3×10^4
TOTAL		1.5×10^7

In closing, the review team considers the footprint estimated in Table I-3 to be appropriately conservative. The CO_2 emissions estimates for the dominant component (uranium fuel cycle) are based on 30 year old enrichment technology assuming that the energy required for enrichment is provided by coal-fired generation. Different assumptions related to the source of energy used for enrichment or the enrichment technology that would be just as reasonable could lead to a significantly reduced footprint.

Emissions estimates presented in the body of this EIS have been scaled to values that are appropriate for the proposed project. The uranium fuel cycle emissions have been scaled by reactor power using the scaling factor determined in Chapter 6 and by the number of reactors to be built. Plant operations emissions have been adjusted to represent the number of large CO_2 emissions sources (diesel generators, boilers, etc.) associated with the project. The workforce emissions estimates have been scaled to account for differences in workforce numbers and commuting distance. Finally, equipment emissions estimates have been scaled by estimated equipment usage. As can be seen in Table I-3, only the scaling of the uranium fuel cycle emissions estimates makes a significant difference in the total carbon footprint of the project.

I.1 References

Federal Highway Administration (FHWA). 2006. *Highway Statistics 2005* (Table VM-1). Office of Highway Policy Information. Washington, D.C.

Miller, P. J., and C. Van Atten. 2004. *North American Power Plant Air Emissions*. Commission for Environmental Cooperation of North America, Montreal.

Sovacool, B. K. 2008. "Valuing the greenhouse gas emissions from nuclear power: A critical survey. Energy Policy 36:2940-2953. Elsevier Ltd.

UniStar Nuclear Energy, LLC (UniStar). 2007. *Technical Report in Support of Application of UniStar Nuclear Operating Services, LLC for Certificate of Public Convenience and Necessity Before the Maryland Public Service Commission for Authorization to Construct Unit 3 at Calvert Cliffs Nuclear Power Plant and Associated Transmission Lines*. Prepared for the Public Service Commission of Maryland, dated 6 November 2007. Accession No. ML090680065.

U.S. Environmental Protection Agency. 1995. *Compilation of Air Pollutant Emission Factors Volume 1: Stationary and Point and Area Sources*. AP-42, 5th Edition. Office of Air and Radiation, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

U.S. Environmental Protection Agency. 2007a. *Inventory of U. S. Greenhouse Gas Emissions and Sinks: 1990-2005* (Table 3-7). U.S. Environmental Protection Agency. Washington, D.C.

U.S. Environmental Protection Agency. 2007b. "Conversion Factors to Energy Units (Heat Equivalents) Heat Contents and Carbon Content Coefficients of Various Fuel Types." *Inventory of U. S. Greenhouse Gas Emissions and Sinks: Fast Facts 1990-2005*. EPA-430-R-07-002. U.S. Environmental Protection Agency. Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1 Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586 S1, Vol. 1, Washington, D.C.

Appendix J

U.S. Army Corps of Engineers Cumulative Effect Resource Analysis Table

Table J-1. U.S. Army Corps of Engineers (Corps) Cumulative Effect Resource Analysis Table

Corps Resource/Issue	Summary of Direct Impacts of the Proposed Action	Included in Analysis	Explanation of Impact	Considered in South Texas Project (STP) DEIS
Land Use Resources				
Local Land Plans and Policies	Compatible with all local Land Use plans and policies.	No	Documentation, not a resource	NA
Local and Regional Area Land Use	About 540 acres within the existing STP site would be cleared and excavated.	Yes	Area was previously disturbed by construction on Units 1 and 2. No new transmission lines are planned.	Section 7.1
Social and Economic Resources				
Environmental Justice	Disproportionate adverse effects to health or welfare of minority or low income groups	Yes	No disproportionate adverse effects of the proposed project.	Section 7.4.2
Community Cohesion	The proposed location is entirely within the existing STP site.	No	Not a pertinent resource	NA
ROW Requirements, Relocations, Displacements	A new heavy haul road would be installed for access to the barge slip. However, the activity is all onsite and there are no new ROW associated with the haul road.	No	All impacts from heavy haul road would be entirely within the existing STP site	NA
Public Facilities and Services	Hard and soft infrastructure	Yes	Moderate adverse impact to Matagorda Co in housing, schools and possibly emergency services.	Section 7.4.1

Table J-1. (contd)

Corps Resource/Issue	Summary of Direct Impacts of the Proposed Action	Included in Analysis	Explanation of Impact	Considered in South Texas Project (STP) DEIS
Visual Resources	Addition of structures and cooling towers.	Yes	Minimal impact due to proximity to existing facility.	Section 7.4.1
Existing Circulation Patterns	All current circulation patterns would remain after construction	No	Not a pertinent resource	
Traffic	Will generate additional traffic on roadways.	Yes	Peak traffic would result in congestion.	Section 7.4.1
Noise	Project will result in noise that could impact sensitive receptors	Yes	Workers, residents and recreational uses would not experience elevated noise levels.	Section 7.4.1
Recreational Boating	Project will include delivery of large components by barge	Yes	Construction and maintenance-dredging related impact.	Section 7.4.1
Marine Navigation	Project will include delivery of large components by barge	Yes	Construction and maintenance-dredging related impact.	Section 7.4.1
Natural Resources				
Prairie Uplands	No Direct Impacts	No	Not a pertinent resource, no coastal prairie as defined by USFWS identified within the project area	NA
Riparian Habitat	No Direct Impacts	No	Not a pertinent resource	NA
Wildlife Habitat	Areas that may have formerly been used for habitat would be permanently or temporarily	Yes	Incremental contribution of impacts to terrestrial resources from building and operating proposed Units 3 and 4 would	Section 7.3.1

Table J-1. (contd)

Corps Resource/Issue	Summary of Direct Impacts of the Proposed Action	Included in Analysis	Explanation of Impact	Considered in South Texas Project (STP) DEIS
	displaced, and migration routes may be temporarily or permanently blocked by construction and/or construction practices.		be SMALL.	
Threatened and Endangered Species	Construction disturbs existing habitats.	Yes	Impacts on terrestrial State and Federally listed threatened and endangered species from building activities on the STP site would be negligible.	Section 7.3.1
Migratory and Resident Birds	New structures create collision hazards.	Yes	Largest structure (cooling tower) is similar in height to other existing structures.	Section 7.3.1
Farmland	No Direct Impacts	No	Not a pertinent resource	NA
Water Quality	Water discharges to the Colorado River, minor stormwater runoff.	Yes	Construction and operations impacts would be SMALL	Section 7.2.2
Hazardous Materials	Radioactive and nonradioactive materials.	Yes	Radiological and nonradiological health impacts would be SMALL	Sections 7.7 and 7.8
Air Quality	Matagorda County is in attainment of all criteria pollutants.	Yes	Construction and operations impacts would be SMALL	Section 7.6
Wetlands: Estuarine	No Direct Impacts	No	Not a pertinent resource	NA
Wetlands: Dune Swale	No Direct Impacts	No	Not a pertinent resource	NA
Wetlands: Sand Flat	No Direct Impacts	No	Not a pertinent resource	NA
Floodplains	No Direct Impacts	No	Not a pertinent resource	NA

Table J-1. (contd)

Corps Resource/Issue	Summary of Direct Impacts of the Proposed Action	Included in Analysis	Explanation of Impact	Considered in South Texas Project (STP) DEIS
Bay Bottom	No Direct Impacts	No	Discharge to Colorado River. Not a pertinent resource	NA
Coastal Hazards	No Direct Impacts	No	Discharge in to Colorado River. Not a pertinent resource	NA
Cultural Resources				
Archeology	No known resources anticipated to be impacted.	Yes	STPNOC has agreed to follow procedures to be taken if cultural or historic resources are discovered during ground-disturbing activities associated with building Units 3 and 4. These procedures are detailed in STPNOC's Addendum #5 to procedure No. OPGP03-ZO-0025 Rev. 12 (Unanticipated Discovery of Cultural Resources) (STPNOC 2008g); the procedure includes notification of Texas Historic Commission	Section 7.5
Historical Resources	No known resources anticipated to be impacted.	Yes		Section 7.5

NRC FORM 335 U.S. NUCLEAR REGULATORY COMMISSION
(9-2004)
NRCMD 3.7

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

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Draft Report for Comment

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See Appendix A

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10. SUPPLEMENTARY NOTES

Docket Nos. 52-012, 52-013

11. ABSTRACT *(200 words or less)*

This environmental impact statement (EIS) has been prepared in response to an application submitted by STP Nuclear Operating Company (STPNOC) to the U.S. Nuclear Regulatory Commission (NRC) for combined licenses (COLs) for Units 3 and 4 at the South Texas Project Electric Generating Station (STP) site in Matagorda County, Texas. This EIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action and mitigation measures for reducing and avoiding adverse impacts.

The NRC staff's preliminary recommendation to the Commission, considering the environmental aspects of the proposed action, is that the COLs be issued. This recommendation is based on (1) the COL application, including the Environmental Report submitted by STPNOC; (2) consultation with Federal, State, Tribal, and local agencies; (3) the review team's independent review; (4) the consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitgation measures identified in the ER and this EIS.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

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Draft Environmental Impact Statement, DEIS, EIS,
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