FINAL
ENVIRONMENTAL IMPACT STATEMENT

Lead Agency: U.S. Army Corps of Engineers, Tulsa District

Title: Final Environmental Impact Statement (EIS), City of Denison Land Conveyance, Lake Texoma, Oklahoma and Texas

Designation: Final EIS

Proposed Action: Convey approximately 635 acres of Federal land at Lake Texoma to the City of Denison, Texas in accordance with Sections 3182(j) and (k) of the Water Resources Development Act of 2007 (WRDA 2007); modify the Lake Texoma Shoreline Management Plan (SMP) zoning in the area of conveyance; and evaluate future permit applications under Section 404 of the Clean Water Act of 1972 and/or Section 10 of the Rivers and Harbors Act of 1899 in accordance with all conditions and regulations relevant at the time of application submission. This is Alternative 4 in the EIS.

Affected Jurisdiction: Federal lands proposed for conveyance are located solely within Grayson County, Texas. Lake Texoma occupies portions of Bryan, Marshall, Johnston, and Love Counties, Oklahoma and Grayson and Cooke Counties, Texas.

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Abstract: The purpose of this EIS is to address alternatives and environmental impacts associated with the conveyance of approximately 635 acres of Federal land at Lake Texoma, Oklahoma and Texas, to the City of Denison, Texas. Section 3182 of the Water Resources Development Act of 2007 (Public Law 110-114) directed the Secretary of the Army to convey these lands at fair market value to the City of Denison, Texas (City). Upon receipt of title to these lands, the City intends to retain portions for development of public facilities and to transfer remaining portions to a private developer for development, along with adjacent private property, of housing and various recreational facilities. Federal actions include the conveyance of land, matters pertaining to the Lake Texoma Shoreline Management Plan (SMP), and considerations regarding Section 404 and Section 10 permits. Variations of the Federal actions are considered and four alternatives selected for further detailed evaluation. In addition to a no action alternative, three action alternatives involving land conveyance and varying degrees of shoreline development are assessed. Assessment topics include, but are not be limited to, the following: (1) concerns regarding the loss of public lands; (2) impacts to fish and wildlife and related habitat; (3) issues related to mitigation; (4) loss of public hunting lands; (5) impacts to recreational use of shoreline in the conveyance area; (6) lake recreation and boating; (7) visual and scenic effects resulting from development; (8) impacts related to private boat docks and shoreline management; and (9) lake-wide and cumulative effects.

Review Comments Deadline: Comments must be received by August 28, 2012.

FINAL

ENVIRONMENTAL IMPACT STATEMENT (EIS)
CITY OF DENISON LAND CONVEYANCE
LAKE TEXOMA
OKLAHOMA AND TEXAS

Prepared for

U.S. ARMY CORPS OF ENGINEERS
USACE, Tulsa District
1645 S 101 E Ave
Tulsa, OK 74128-4609

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°F	degrees Fahrenheit
2, 4-D	2, 4-dichlorophenoxyacetic acid
2, 4, 5-T	2, 4, 5-trichlorophenoxyacetic acid
A&G	agriculture and grazing
AADT	Annual Average Daily Traffic
ABB	American burying beetle
ACHP	Advisory Council on Historic Preservation
AR	Arkansas
Atmos	Atmos Energy
ATV	all-terrain vehicle
BAOT	boats at one time
bgs	below ground surface
BLH	bottomland hardwood
BMP	best management practice
BOD	biological oxygen demand
BUMP	Beneficial Use Monitoring Program
C&D	construction and demolition
CAA	Federal Clean Air Act
CAFO	concentrated animal feeding operation
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic-ft-per-second
CLO	Commissioners of the Land Office
cms	cubic-meters-per-second
CN	Curve Number
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2eq}	carbon dioxide equivalents
COC	contaminant of concern
CSA	combined statistical area
cy	cubic yard
CWA	Clean Water Act
DACOC	Denison Area Chamber of Commerce
dB	decibel
dBA	A-weighted decibel
DDA	Denison Development Alliance
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDR	Design Documentation Report

DDT	dichlorodiphenyltrichloroethane
DFD	Denison Fire Department
DFW	Dallas-Fort Worth
DLA	Designated Lake Area
DNL	Day-night Sound Level
DNR	Department of Natural Resources
DO	dissolved oxygen
DPD	Denison Police Department
DSFES	Draft Supplemental Final Environmental Statement
ECOMM	Ecological Communication Corporations
EDD	Economic Development District
EIS	Environmental Impact Statement
EM	Engineer Manual
EMT	Emergency Medical Technician
EO	Executive Order
EPA	Environmental Protection Agency
ER	Engineering Regulation
ERCOT	Electric Reliability Council of Texas
ESA	Endangered Species Act
FES	Final Environmental Statement
F.M.	Farm to Market
FSA	Farm Service Agency
FSFES	Final Supplemental Final Environmental Statement
ft	feet
ft^2	square feet
FY	Fiscal Year
GCHD	Grayson County Health District
GCSAA	Golf Course Superintendent Association of America
GHG	greenhouse gas
GIS	Geographic Information System
gpcd	gallons per capita per day
GSA	General Services Administration
GTUA	Greater Texas Utility Authority
GYI	North Texas Regional Airport
HAB	Harmful Algal Bloom
HCPC	Historic Climax Plant Community
HD	hydrologic dam
HUC	hydrologic unit code
I	Interstate
IPM	integrated pest management
ISD	Independent School District

JD	Jurisdiction Determination
L_{eq}	Equivalent Sound Level
LAUS	Local Area Unemployment Statistics
lb/ft^2	pound/square feet
lb/yr	pound/year
LID	low impact development
LLC	Limited Liability Company
LMCI	Labor Market and Career Information
LOS	Level of Service
LPG	liquid petroleum gas
MCF	one thousand cubic feet
MGD	million gallons per day
MHI	median household income
MLRA	Major Land Resource Area
MP	Master Plan
MPH	miles per hour
MSA	metropolitan statistical area
MSW	municipal solid waste
MSL	mean sea level
N	nitrogen
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NAIP	National Aerial Inventory Program
NDZ	No Discharge Zone
NEI	National Emission Inventory
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NO_x	nitrous oxides
NOI	Notice of Intent
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NTMWD	North Texas Municipal Water District
NWI	National Wetlands Inventory
NWP	nationwide permit
NWR	National Wildlife Refuge
O_2	Oxygen
OCC	Oklahoma Corporation Commission

ODWC	Oklahoma Department of Wildlife Conservation
OHV	off-highway vehicle
OK	Oklahoma
OMP	Operational Management Plan
ONHI	Oklahoma Natural Heritage Inventory
OPDES	Oklahoma Pollution Discharge Elimination System
OSHA	Occupational Safety and Health Administration
OSSF	on-site sewage facility
OTRD	Oklahoma Tourism and Recreation Department
OWRB	Oklahoma Water Resources Board
PCB	polychlorinated biphenyl
PCE	perchloroethylene
PCI	per capita income
PCPI	per capita personal income
PGP	Pesticide General Permit
PHD	Preston Harbor Development
PIF	Partners in Flight
PL	Public Law
P.M.	post morning
PM_{10}	particulate matter, 10 microns
$PM_{2.5}$	particulate matter, 2.5 microns
PPP	Pollution Prevention Plan
PVES	Preston Volunteer Emergency Services, Inc.
PWC	personal watercraft
RHA	Rivers and Harbors Act
RMW	regulated medical waste
ROI	region of influence
RRAT	Red River Authority
RRCCP	Red River Chloride Control Project
RV	recreational vehicle
SCS	Soil Conservation Service
SDMPO	Sherman Denison Metropolitan Planning Organization
SEE	Stell Environmental Enterprises Inc.
SFES	Supplemental Final Environmental Statement
SIP	State Implementation Plan
SMP	Shoreline Management Plan
SMS	Scenery Management System
SO_2	sulfur dioxide
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SWD	Southwestern Division
TAC	Texas Administration Code
TAPS	Texoma Area Paratransit System

TASWA	Texas Area Solid Waste Authority
TCEQ	Texas Commission on Environmental Quality
TCOG	Texoma Council of Governments
TDS	Total Dissolved Solids
TDSHS	Texas Department of State Health Services
TEC	Texas Education Code
THC	Texas Historical Commission
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TP&L	Texas Power and Light
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TRC	Texoma Regional Consortium
TRI	Toxics Release Inventory
TRRC Viewer	TRCC interactive GIS map viewer
TRRC	Texas Railroad Commission
TSCA	Toxic Substances Control Act
TSI	trophic state index
TWC	Texas Workforce Commission
TWDB	Texas Water Development Board
TX	Texas
U.S.	United States
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USLE	Universal Soil Loss Equation
UST	underground storage tank
VOC	volatile organic compound
WBID	water body identification
WESTON	Weston Solutions, Inc.
WMA	Wildlife Management Area
WMU	Wildlife Management Unit
WRDA	Water Resources Development Act
WST	Workforce Solutions Texoma
WTP	willingness to pay
WWTP	wastewater treatment plant
YMCA	Young Men’s Club of America

YWCA	Young Women's Club of America

EXECUTIVE SUMMARY

1 INTRODUCTION AND PURPOSE

This Environmental Impact Statement (EIS) was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) to assess potential impacts associated with Federal actions mandated by Sections 3182(j) and (k) of the Water Resources Development Act (WRDA) of 2007. This legislation directs the Secretary of the Army (Secretary) to convey at fair market value to the City of Denison (City) all right, title, and interest of the United States in and to approximately 900 acres of land located in Grayson County, Texas, identified in an application for lease submitted to the U.S. Army Corps of Engineers (USACE) by the City and dated 17 August 2005. The property is currently held in fee by the U.S. Government and managed by the Tulsa District USACE as part of Lake Texoma, a multipurpose reservoir located along the Red River in Oklahoma and Texas. The lead agency for this action is the USACE, Tulsa District.

Section 3182(k) of WRDA 2007 states that the mandated conveyance of land to the City is subject to any additional terms and conditions that the Secretary deems appropriate and necessary to protect the interests of the United States. Upon receipt of title to the property, the City intends to retain portions of the property for establishment of public facilities while transferring the remainder to a private developer for construction of residential housing and commercial facilities with varied recreational facilities and amenities to facilitate economic development in the City and region. In compliance with WRDA 2007, the USACE proposes to convey approximately 635 acres to the City along the eastern shore of the Little Mineral Arm of Lake Texoma, Texas. The exact acreage and property description would be determined by a survey satisfactory to the Secretary.

NEPA requires Federal agencies to assess the environmental impacts of any major Federal action on the natural and human environment and incorporate environmental considerations in their planning and decision-making through a systematic, interdisciplinary approach. All Federal agencies are required to prepare detailed statements on actions significantly affecting the human environment. Implementing regulations for NEPA are contained in Title 40 of the Code of

Federal Regulations (CFR), Parts 1500 through 1508; the USACE 33 CFR, Part 230; and in Engineering Regulation (ER) 200-2-2, Procedures for Implementing NEPA (March 4, 1988). Therefore, the purpose of this action is for the USACE to meet the requirements of WRDA 2007 and to address the Federal actions associated with the City of Denison's intended plans to develop this land for recreational and economic benefits. A Notice of Intent (NOI) was published in the Federal Register on 6 August 2008, and a public information scoping open house was conducted in Denison, Texas on 11 September 2008. Along with statutory and regulatory requirements under NEPA, the Clean Water Act of 1972, and other Federal environmental laws, comments received as part of the public scoping process are the basis for issues addressed in this EIS.

2 LOCATION

Lake Texoma is located on the Red River between Texas and Oklahoma, and lies within four Oklahoma counties (Bryan, Love, Marshall, and Johnston) and two Texas counties (Grayson and Cooke). The proposed conveyance land is located entirely within Grayson County, Texas, along the eastern shore of the Little Mineral Arm of Lake Texoma. Immediately adjacent to the proposed conveyance land is approximately 2,500 acres of private land owned by Schuler Development, a real estate development company that plans to enter into a public-private partnership with the City of Denison to develop both a portion of the proposed conveyance land and the adjacent private property.

3 ALTERNATIVES

A broad range of initial alternatives was developed and evaluated according to screening criteria to determine viable alternatives to carry forward for detailed impacts analysis in this EIS. While the central focus of legislative direction under WRDA 2007 is the conveyance of Federal property, this conveyance, along with ultimate disposition and intended future development of conveyed land, resulted in three Federal actions to be analyzed under NEPA: (1) the mandated conveyance of Federal lands to the City of Denison; (2) future actions regarding the Lake Texoma Shoreline Management Plan (SMP) in the area of conveyance; and (3) decisions regarding issuance of Federal permits under Section 404 of the Clean Water Act of 1972 (404 permits) and Section 10 of the Rivers and Harbors Act of 1899 (Section 10 permits). The Lake

Texoma SMP is a document used to allocate and manage the shoreline for specific purposes (e.g., private boat docks, public boat ramps) consistent with zoning established in the SMP.

A wide range of preliminary alternatives were developed under each of the three Federal actions and screened based on requirements of Federal legislation outlined in WRDA 2007 and associated implementation guidance issued by USACE Headquarters dated 29 September 2008. Screening criteria also included consideration of other laws, regulations, and Army policies. Upon screening of preliminary alternatives for these Federal actions, resulting preliminary alternatives were combined and once again screened using criteria described above. This resulted in selection of four (4) final alternatives analyzed in this EIS. The following paragraphs summarize alternatives evaluated in this EIS.

3.1 Alternative 1 - No Action

Evaluation of a "No Action" alternative is required under NEPA. Under this alternative, the proposed conveyance would not occur and the associated land would remain under Federal ownership. Further, no changes to the SMP would be made and no section 404 or section 10 permits would be issued for proposed development features on the proposed conveyance land requiring such a permit. Accordingly, current shoreline use designations and nature of shoreline development (none) would continue as they do at present.

While not a part of the Federal action, even without the conveyance, Schuler Development would develop its adjacent private land. The development would occur over a 20-25 year period beginning at the southern end, proceeding northward. It is expected that within the first 5-10 years the development in the southern part of the private property would include a golf course and associated clubhouse, community center, residential development, commercial and medical services, and a proposed lake. During the next 10-15 years, additional residential development and commercial services would be completed. Boat ramps and other lake access amenities would not be included. As required under NEPA, this no action scenario (which assumes development of the adjacent private land) serves as the baseline when assessing the potential impacts of the other alternatives.

3.2 Alternative 2 – Land Conveyance without Shoreline Development

This alternative would include the proposed conveyance of approximately 635 acres of Federal land as described in the City's lease application and in accordance with the WRDA 2007 mandate. No changes to the SMP or deviations from the existing USACE 2005 moratorium on private boat docks (as further explained in this EIS) would occur. Under this alternative, a condition of the conveyance would include an associated flowage easement deed restriction on conveyed land located between elevations 619 ft and 645 ft National Geodetic Vertical Datum (NGVD) to allow USACE to continue efficient operation of Lake Texoma for authorized flood control purposes. No other deed restrictions would accompany the conveyance.

Under this alternative, no boat ramps or docks would be constructed along the shoreline in the conveyance area, and pocket beaches along the proposed conveyance land shoreline would remain available for public use up to elevation 619 ft NGVD.

The conveyance land and the adjacent private land would be annexed to the City of Denison and development would be governed by City regulations. The proposed conveyance land would be expected to be developed and include single-family homes, townhomes, hotels and conference centers, medical offices, golf courses, hike and bike trails, open space, inland lakes, and a wastewater pump station.

The development would be expected to occur over a 20-25 year period beginning at the southern end, proceeding northward. It is expected that within the first 5-10 years, development in the southern part of the property would include a golf course and associated clubhouse, community center, residential development, commercial and medical services, and inland lakes. During the next 10-15 years, development would include a northern golf course and associated clubhouse, residential development, commercial services, hotels and a conference center, a wastewater pump station, and an inland lake. Finally, it is anticipated that a new wastewater treatment plant would be constructed by the City to serve the development, with the opportunity for hook-up by existing residences in the area.

3.3 Alternative 3 – Land Conveyance with Limited Shoreline Development

This alternative would include the proposed conveyance and associated flowage easement, as described for Alternative 2. No other deed restrictions would accompany the conveyance. No changes would occur to the SMP; however, under Alternative 3, the 2005 moratorium would be lifted along the conveyance shoreline (only) to allow for the issuance of SMP permits for and installation of private docks in two areas appropriately zoned for such under the current (1996) Lake Texoma SMP.

Following conveyance, it is anticipated that development on the proposed conveyance and adjacent private lands would include residential development, hotels and a conference center, medical offices, golf courses and associated clubhouses, hiking and biking trails, open space, inland lakes, a boat club, boat docks and slips, and a wastewater pump station.

The development would be expected to occur over a 20-25 year period beginning at the southern end, proceeding northward, as described under Alternative 2.

3.4 Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

This alternative would include the proposed conveyance and the associated flowage easement, as described for Alternatives 2 and 3 and in accordance with the WRDA 2007 mandate. No additional deed restrictions would accompany conveyance of Federal lands. In addition to the land conveyance, under Alternative 4, the 2005 moratorium would be lifted for the proposed conveyance land shoreline only and the SMP would be modified, as appropriate, for proposed shoreline development in the area of conveyance. No other changes to the existing (1996) Lake Texoma SMP would occur. Alternative 4 is depicted in Figure ES.1.

Following the proposed conveyance, the City has indicated that it intends to facilitate economic development through residential, commercial and recreational development of this land by further conveying portions to the developer, while retaining certain parcels (up to a total of 100 acres) for development of recreational facilities such as a public park with a boat ramp and related facilities. This alternative would include modifying and updating the SMP to allow for construction of such facilities. This alternative would likewise involve shoreline rezoning under the SMP to permit future installation of private docks, a public boat club, a commercial dry stack boat storage facility, day-use slips, and other features as detailed in this EIS. In areas proposed to be rezoned for private docks, the size, arrangement, and number of such docks would be limited by zoning lengths and SMP-dictated density and spacing requirements. This EIS both identifies a likely maximum number of docks and analyzes impacts accordingly. Modifications to the SMP would be applicable to the shoreline in the conveyance only and no other changes to the Lake Texoma SMP would occur.

Development on the proposed conveyance land and adjacent private land would be expected to include approximately 1,319 acres of residential development, hotels and a conference center, medical offices, golf courses and associated clubhouses, hike and bike trails, open space, inland lakes, a public boat club, dry stack boat storage, private boat docks, boat slips, a wastewater pump station, and a public park with a boat ramp. This alternative would require dredging in the perimeter of the public park (for the boat ramp) and in the public boat club cove (for the boat ramps and boat slips). It is anticipated that a new wastewater treatment facility would be constructed by the City to serve the development.

The development would be expected to occur over a 20-25 year period beginning at the southern end, proceeding northward. It is expected that within the first 5 years, development would include a wastewater pump station, dredging activities, a boat ramp and boat club, boat slips, boat docks, boat storage, and shoreline protection needed to protect boat club and the housing development. Further development would include the southern golf course and associated clubhouse, community center, residential development, commercial and medical services, and an inland lake.

During the next 10-15 years, development would be anticipated to include a northern golf course and associated clubhouse, residential development, commercial offices, boat slips and boat docks, and an inland lake. During the last 5 years of development, the hotels and a conference center would be anticipated to be completed, including the proposed boat slips and recreational beaches.

4 SECTION 404/10 PERMIT CONSIDERATIONS

The activities requiring coverage under a permit issued under Section 404 and/or Section 10 will occur throughout the development of Preston Harbor. The EIS identifies anticipated activities that will require Section 404 or Section 10 permits on both private and proposed conveyance properties, and provides a more detailed discussion and analysis of those activities that are anticipated to occur during the first five years of development. The proposed development is currently not at a level of planning to allow submission of specific permit applications, and therefore, as development progresses, applications would be submitted to and evaluated by the Regulatory Office of the Tulsa District USACE. The USACE, Tulsa District's review of future applications would reflect regulatory requirements and specific environmental information current at the time of submission, and to the extent that additional NEPA analysis is required for future permit applications, the USACE would conduct such NEPA review at that time.

5 POTENTIAL AREAS OF CONTROVERSY

Potential areas of controversy related to this action were identified from comments received by agencies, associations, individuals, and other stakeholders through the scoping process and coordination efforts conducted for this EIS. A complete scoping report including all comments is contained in Appendix B. Identified areas include, but may not be limited to, the following: (1) concerns regarding the loss and fragmentation of public lands; (2) impacts to fish and wildlife and related habitat; (3) issues related to mitigation for loss of public lands and fish and wildlife habitat; (4) loss of public hunting lands; (5) impacts to recreational use of shoreline in the conveyance area (particularly impacts to use of "pocket beaches"); (6) lake overcrowding by boats; (7) visual and scenic effects resulting from development; (8) impacts related to private boat docks; and (9) lake-wide and cumulative effects. All issues described above are addressed in this EIS.

6 ISSUES TO BE RESOLVED

Issues to be resolved through the NEPA process for this action include: (1) those identified through public review and comment on this draft EIS; (2) final selection of an alternative to be implemented; and (3) future considerations regarding Section 404/Section 10 permit applications. The latter will be evaluated in a future, phased approach and commensurate with environmental conditions and regulatory requirements relevant at the time of permit application.

7 PROPOSED ACTION

Alternative 4 as briefly described above, depicted in Figure ES.1, and further detailed in this EIS, is the agency's preferred alternative and proposed action.

8 SUMMARY OF IMPACTS

In accordance with NEPA requirements, this EIS evaluates direct, indirect, and cumulative effects related to alternatives. Direct effects are those caused by the USACE's actions and occur at the same time and place. Indirect effects are those caused by the USACE's actions, and occur later in time or farther in distance, but are still reasonably foreseeable. For the actions analyzed in this EIS, indirect impacts are those associated with the development that would occur on the conveyance property and any development located on the adjacent private land that would not occur or would be developed differently if the USACE did not convey the land; this development tends to be located on and along the shared boundary of the conveyance property and the adjacent private property. A significant portion of the development on the adjacent private land would be developed in the same manner notwithstanding whether the USACE takes any actions, and thus this development is neither a direct effect nor an indirect effect of the USACE actions.

A brief summary of this analysis is included below in Table ES.1.1.1 for direct and indirect impacts and Table ES-1.1.2 for cumulative impacts. In this EIS Alternative 1 (the No Action Alternative, which assumes development of the adjacent private land), serves as the baseline for comparison to the action alternatives, Alternative 2, 3 and 4. For each resource, direct and indirect impacts are discussed in greater detail in Section 4.0, while cumulative effects are discussed in Section 5.0 of this EIS. As impacts in each section are organized by resource category, additional details regarding any category can be obtained by referencing relevant sections.

Table ES.1.1.1

Summary of Human and Natural Resource Impacts

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Activities under each Alternative	No Conveyance; Development on Adjacent Private Property	Convey with deed restrictions; No changes to SMP; No Moratorium Deviation; Development on Conveyance property and Adjacent Private Property	Convey with deed restrictions; No changes to SMP; Lift Moratorium; Development on Conveyance property and Adjacent Private Property	Convey with deed restrictions; Modify the SMP; Lift Moratorium; Development on Conveyance property and Adjacent Private Property
Land Ownership and Management				
Land Ownership and Management	No effect.	635 acres removed from Federal ownership and management. Minor decrease (-0.6%) of federal land ownership lake-wide.		
Land Use and Land Use Controls				
Lake Texoma Shoreline Management Plan	No effect.			Changes in zoning along conveyance area shoreline. Minor lake-wide increases in limited development (+3.3%) and public recreation zoning (+1.5%) and minor lake-wide decrease in protected shoreline allocation (-0.9%).
Lake Texoma Master Plan	No effect.	635 acres removed from Master Plan management. Minor decrease (-1.6%) in recreation (low density use) allocated lands lake-wide.		
Geology and Soils				
Geology	No appreciable effect			
Soils	Minor ground disturbance and increased potential of sedimentation during construction on adjacent private property.	Minor ground disturbance and increased potential of sedimentation during construction on the proposed conveyance land and adjacent private property; however, installation of shoreline protection reduces long-term shoreline erosion.		
Water Storage Capacity				
Water Storage Capacity	No effect.	No appreciable effect. Any proposed changes would be subject to USACE review and approval.		
Water Resources and Water Quality				
Chloride Control	No effect.			

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Erosion, Turbidity, and Sedimentation	Minor increased potential of sedimentation, erosion and turbidity during construction; and minor additional erosion could occur due to decreased vegetative cover and increased development on the adjacent private property.	Minor increased potential of sedimentation, erosion and turbidity during construction; and minor additional erosion could occur due to decreased vegetative cover and increased development; however, installation of shoreline protection reduces long-term shoreline erosion in Little Mineral Arm.	Moderate increased potential of sedimentation, erosion and turbidity during construction and dredging; and minor additional erosion could occur due to increased development and boating activity and decreased vegetative cover; however, installation of shoreline protection reduces long-term shoreline erosion in Little Mineral Arm.	Moderate increased potential of sedimentation, erosion and turbidity during construction and dredging; and moderate additional erosion could occur due to increased development and boating activity and decreased vegetative cover; however, installation of shoreline protection reduces long-term shoreline erosion in Little Mineral Arm.
Nutrients and Biological Oxygen Demand	Locally significant increased levels as the adjacent private development would rely on septic systems.	Minor decrease from no action levels, as the development would utilize a new waste water treatment plant.	Minor decrease from no action levels, as the development would utilize the waste water treatment plant; however, also a minor but temporary increase in levels during dredging. No appreciable effect lake-wide.	
Pesticides	No appreciable effect.	Minor, but not quantifiable, long-term increases from shoreline golf courses and residences.		
Other Water Quality Pollutants	Minor increases due to commercial and industrial development.		Moderate increases from commercial and industrial development, and additional boating on the lake.	
Biological Resources				
Vegetation	No appreciable effect to conveyance land vegetation.	Moderate to significant loss of forest and grassland plants on proposed conveyance land resulting from development.		
Wildlife	Minor disruption and displacement during development of adjacent private property.	Moderate to significant disruption and displacement on conveyance land and potential for loss of wildlife during construction activities; and moderate loss of habitat. Shift to species tolerant of human disturbance.		
Waters of the United States and Regulatory Permitting	Impacts expected to be present, but are unquantifiable due to the lack of detailed development plans, and avoidance-and-minimization plans; Impacts would be assessed during permit review and necessary permits would be obtained from the USACE prior to any construction or development. Permit applications would be phased as development proceeds.			
Fisheries and Aquatic Resources	No appreciable effect.	Minor disruption and displacement during construction; however, moderate increase in suitable habitat from the installation of shoreline protection.	Significant localized disruption and displacement during dredging and construction; however, moderate local increase in suitable habitat from the installation of shoreline protection.	
Threatened & Endangered Species	No effects.			

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Wildlife Refuges and Wildlife Management Areas	No effect.			
Migratory Birds	Minor local loss of terrestrial habitat and moderate loss of aquatic habitat due to development.			
Wildlife Corridors	No appreciable effect.	Minor local loss of habitat and increased fragmentation of habitat.		
Invasive Species	Minor increased introduction of invasive species due to removal of native species.	Moderate potential for the increased introduction and spread of invasive species due to development, landscaping, and increased boating (specifically the zebra mussel).		
Socioeconomics				
Population	Approximately 17,000 new residents with anticipated growth of 3.8% per year. New residents anticipated to be older, predominantly white and contribute to urban/suburban growth.	Approximately 1,875 additional residents (19,000 total), with an increase in growth rate of only 0.4% per year. New residents anticipated to be older, predominantly white and contribute to urban/suburban growth.		
Housing	Significantly increase housing stock, median housing value and property tax revenue for the County. Many homes would be second or seasonal residences and could be vacant for portions of the year.	Significantly increase City of Denison housing stock, median housing value and property tax revenue for the County, the City, Denison Independent School District, and community colleges. Many homes would be second or seasonal residences and could be vacant for portions of the year.		
Employment	Moderate increase in temporary opportunities during construction and moderate permanent new opportunities during operation of development.	Significant increase in temporary opportunities during construction and moderate permanent new opportunities during operation of development.		
Income	Significant increase in income and median household income due to the new residents; New residents may indirectly result in income growth due to demand for specialized trade and service workers. Significant economic benefit with increased sales and service taxes for the county.	Significant increase in income and median household income due to the new residents; New residents may indirectly result in income growth due to demand for specialized trade and service workers. Significant economic benefit with increased sales and service taxes for the City, County, and schools.		

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Travel, Recreation and Tourism	Negligible economic increase to the area tourism industry from the adjacent private property development.	Significant economic increase to the area tourism industry, from the conference center, the hotel and increased recreational activities on and around the lake.		
Environmental Justice	No effect.			
Quality of Life	Increased demand for public services, public safety, medical services and education would be met by the County through property, sales, and service taxes and fees from the development.	Increased demand for public services, public safety, medical services and education would be met by the City and Denison Independent School District with revenue generated through property, sales, and service taxes and fees from the development.		
Infrastructure and Utilities				
Traffic and Transportation	Moderate increase in construction traffic; and significant increase in residential and commercial traffic.	Moderate increase in construction, residential and commercial traffic.		
Water Treatment and Distribution	Significant increase in demand on the City of Denison water treatment system.	Minor increase in demand on the City of Denison water treatment system.		
Wastewater Collection and Treatment	Development would use new septic systems.	Development would use proposed new waste water treatment plant.		
Natural Gas	Significant increase in natural gas demand.	Minor increase in natural gas demand.		
Electricity	Significant increase in electricity demand.	Minor increase in electricity demand.		
Solid Waste	Moderate increase in domestic waste and increased demand on the Texoma Area Solid Waste Landfill during construction and life of the development.	Minor increase in domestic waste and increased demand on the Texoma Area Solid Waste Landfill during construction and life of the development.		
Ground and Traffic Safety	Minor increase in need for ground and traffic safety.			
Construction Safety	Minor increase in potential of safety incidents during construction.			
Public Lands				
Public Lands	No direct impacts to public lands; however, minor increase in potential public use.	Loss of 635 acres of publically-available Federal land, up to 100 acres of which would become public under city of Denison control. Minor decrease of publically-available land lake-wide.		

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Recreation				
Recreation Visitation	Minor increase of available recreation opportunities on adjacent private property and increased access to public land.	More diverse and changed recreation opportunities relative to present (e.g., golf/hike/bike vs. hunting). Significant change in available recreation opportunities.		
Land-based Recreation	Minor disturbances during construction and significant increase due to the adjacent private development.	Changed recreation opportunities on conveyance land. Moderate increase from additional recreation opportunities.		Changes in opportunities relative to present. Moderate increase from additional recreation opportunities and public park.
Land-Water Interface-based Recreation	No appreciable effect.	Moderate decrease in accessibility to land-water interface areas for recreation in the area of the conveyance.	Moderate decreased accessibility to land-water interface areas for recreation in the area of the conveyance, especially during peak holiday use.	Moderate decreased accessibility to land-water interface areas and pocket beaches for recreation in the area of the conveyance, especially during peak holiday use.
Water-based Recreation	No appreciable effect.		Increase in water-based recreation due to additional boat slips.	Increase in water-based recreation due to additional boat slips, ramps, and storage, especially during peak holiday use.
Lake Carrying Capacity	No appreciable effect.		Localized increased boat usage with moderate relative decreases in capacity in the area of the conveyance during peak holiday use. Already crowded boating conditions are expected to worsen.	Localized increased boat usage with significant relative decreases in capacity in the area of the conveyance during peak use periods. Already crowded boating conditions are expected to worsen.
Pocket Beaches	No effect.	Impacts dependent upon lake level. Access restrictions due to the shoreline protection and private land ownership.	Impacts dependent upon lake level. Access restrictions or loss due to the shoreline protection, shoreline construction, and private ownership. Likely shift to use of other pocket beaches lake-wide.	
Public Beaches	No effect.			Negligible increase due to access on hotel beach below 619 NGVD.
Fishing	No effect.	Significant localized reduction due to the loss of shoreline access for fishing.		Change in fishing access with a significant localized reduction of shoreline access; but a moderate increase from public boat ramp and park.
Hunting	Minor decrease in hunting quality due to adjacent development.	Local loss of 635 acres for hunting. Minor reduction of lake-wide public hunting land.		

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Privately Operated Recreation Areas	Minor potential increase in usage due to population increase.	Minor increase of privately operated recreation areas; and potential increase in use of existing private marinas due to population increase.		
Private Boat Docks	No effect.		Moderate increase of new private docks and slips lake-wide. Significant number of new private docks along conveyance area shoreline where none currently exist.	
Cultural Resources				
Cultural Resources	No effect.			
Visual Resources				
Visual Resources	No appreciable effect to views of the lake or of the conveyance property; however, adjacent private property would change from undeveloped to developed.	Significant changes from undeveloped scenery to developed land from the lake.	Significant changes from undeveloped scenery to developed land and shoreline from both the lake and the conveyance land.	
Hazardous, Toxic, and Radioactive Waste				
Oil and Gas	No effect.			
Commercial Waste	Minor increase in commercial waste from development.	No appreciable effect.		
Industrial Waste	No appreciable effect.			
Medical Waste	Minor increase in generated medical waste from development.	No appreciable effect.		
Boat Waste	No effect.		Minor potential for increased boat waste.	
Air Quality				
Air Quality	No appreciable effect			
Noise				
Noise	Minor increase in background noise during construction; and moderate increase in background due to development.	Minor increase in background noise during construction and due to development.	Minor increase in background noise during construction; and moderate increase in background noise due to development and boating.	

Table ES.1.1.2

Summary of Cumulative Impacts for all Alternatives

<table>
<tr><th colspan="2">Resource</th><th>Alternative 1:
No Action</th><th>Alternative 2:
Land Conveyance without Shoreline Development</th><th>Alternative 3:
Land Conveyance with Limited Shoreline Development</th><th>Alternative 4:
Land Conveyance with Modified Shoreline Development (Proposed Action)</th></tr>
<tr><td colspan="2">Land Ownership and Management</td><td colspan="4">Minor decrease of federal land ownership and management lake-wide.</td></tr>
<tr><td rowspan="2">Land Use and Land Use Controls</td><td>Lake Texoma Shoreline Management Plan</td><td colspan="3">No known effect.</td><td>Minor lake-wide effect. Minor increase in limited development and public recreation and minor decrease in protected shoreline zoning.</td></tr>
<tr><td>Lake Texoma Master Plan</td><td>No known effect.</td><td colspan="3">Minor decrease in recreation (low density use) and recreation (high density use) allocated lands lake-wide.</td></tr>
<tr><td colspan="2">Geology and Soils</td><td>No appreciable lake-wide effect to geology and minor adverse impacts to soils.</td><td colspan="3">No appreciable lake-wide effect to geology and no net appreciable lake-wide effect to soils/erosion due to shoreline protection.</td></tr>
<tr><td colspan="2">Water and Flood Storage Capacity</td><td colspan="4">No effect. Proposals potentially affecting flood storage subject to USACE review and approval.</td></tr>
<tr><td colspan="2">Water Quality</td><td colspan="4">No appreciable effect lake-wide.</td></tr>
<tr><td rowspan="3">Biological Resources</td><td>Vegetation</td><td colspan="4">Minor decrease in regional vegetation resources.</td></tr>
<tr><td>Wildlife</td><td colspan="4">Minor decrease in regionally available habitat for terrestrial wildlife.</td></tr>
<tr><td>Fisheries and Aquatic Resources</td><td colspan="4">No appreciable lake-wide effect on fisheries or aquatic resources.</td></tr>
<tr><td colspan="2">Socioeconomics</td><td colspan="4">Moderate population increase and continued suburban/urban growth leading to an overall increase in regional economic activity.</td></tr>
<tr><td colspan="2">Infrastructure and Utilities</td><td>No known effect to regional utilities and significant adverse impact to regional traffic.</td><td colspan="3">No appreciable regional effect.</td></tr>
<tr><td colspan="2">Public Lands</td><td colspan="4">Minor decrease of publically-available land lake-wide.</td></tr>
<tr><td rowspan="2">Recreation</td><td>Land-based Recreation</td><td colspan="4">Minor increase of land-based recreation opportunities lake-wide.</td></tr>
<tr><td>Land-Water Interface-based Recreation</td><td colspan="4">No appreciable effect to fishing and minor increase in land-water interface based recreation opportunities lake-wide.</td></tr>
</table>

Resource		Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
	Water-based Recreation	No appreciable effect to boat density lake-wide.			
	Lake Carrying Capacity	No appreciable effect to spatial, facility, and social capacity lake-wide.			
	Pocket Beaches	Minor decrease in available pocket beaches lake-wide.			
Cultural Resources		No effect lake-wide.			
Visual Resources		Moderate lake-wide decrease in undeveloped scenery and increase in views of developed land.			
Hazardous, Toxic, and Radioactive Waste		Minor increase in regional medical and commercial wastes.	No appreciable increase in regional medical and commercial waste.		
Air Quality		No appreciable effect lake-wide.			
Noise		No appreciable effect lake-wide.			

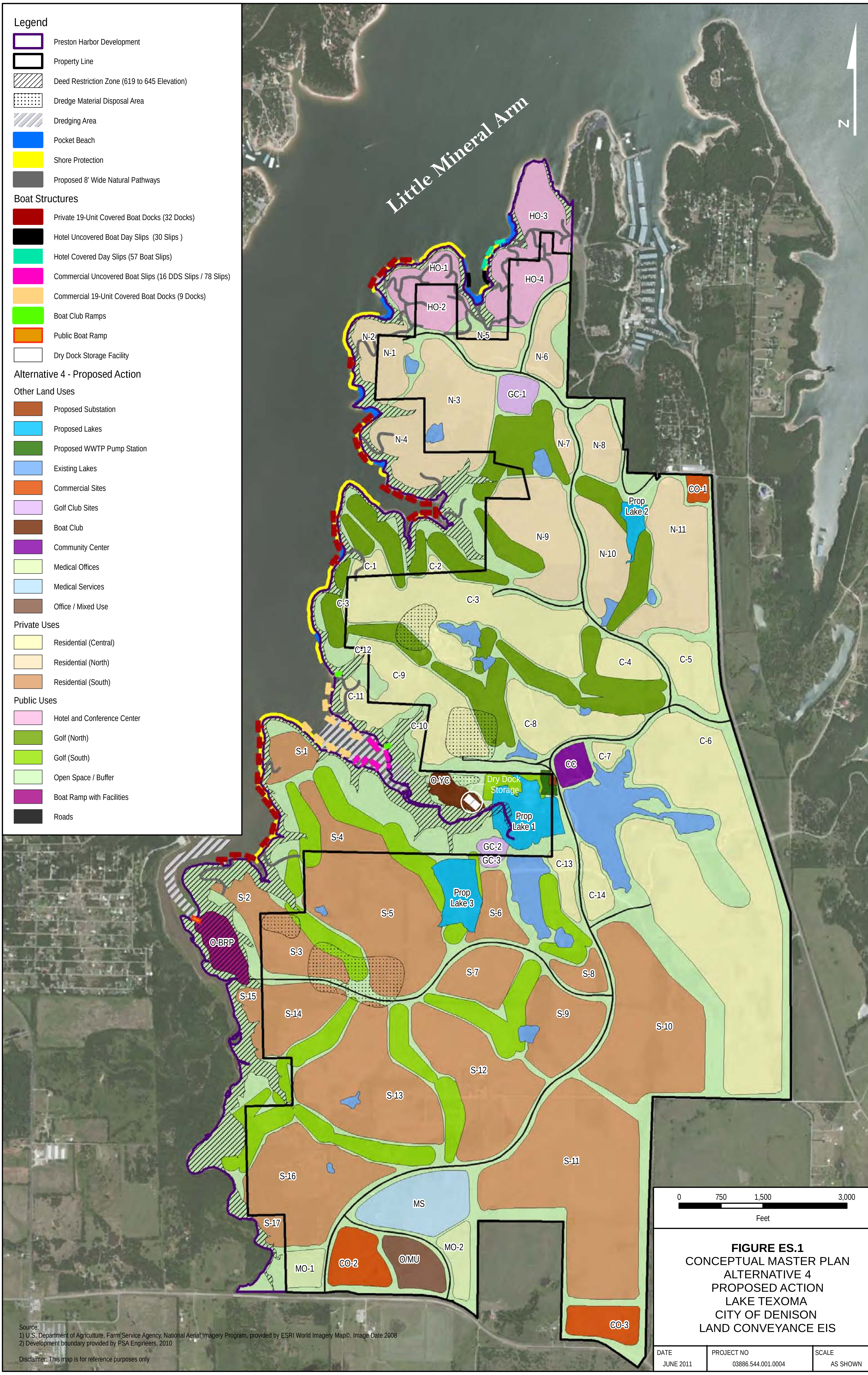

FIGURE ES.1
CONCEPTUAL MASTER PLAN
ALTERNATIVE 4
PROPOSED ACTION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

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1. PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

This Environmental Impact Statement (EIS) was prepared in compliance with the National Environmental Policy Act (NEPA) to assess potential impacts associated with Federal actions mandated by Section 3182(j) of the Water Resources Development Act (WRDA) of 2007 (see Appendix A, Sections 3182 (j) and (k)), in which Congress directed the Secretary of the Army to convey a parcel of Federally-owned land at Lake Texoma, Oklahoma and Texas, to the City of Denison, Texas (City). Land subject to this action is currently managed by the Tulsa District, U.S. Army Corps of Engineers (USACE) as part of Lake Texoma, a multipurpose reservoir located along the Red River in Oklahoma and Texas.

1.2 NEPA AND THE WATER RESOURCES DEVELOPMENT ACT OF 2007

The National Environmental Policy Act of 1969 (Public Law 91-190) requires all Federal agencies to assess the environmental impacts of any major Federal action on the natural and human environment. Specifically, NEPA Section 102 requires Federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. All Federal agencies are required to prepare detailed statements on actions significantly affecting the environment. Implementing regulations for complying with NEPA are contained in Title 40 of the Code of Federal Regulations (CFR), Parts 1500 through 1508; the USACE 33 CFR Part 230; and in Engineering Regulation (ER) 200-2-2, *Procedures for Implementing NEPA (March 4, 1988).*

Section 3182(j) of the WRDA 2007 requires the Secretary of the Army to convey at fair market value to the City all right, title, and interest of the United States up to approximately 900 acres of land that was the subject of an application for lease submitted to USACE by the City and dated 17 August 2005 (see Appendix A, Sections 3182 (j) and (k)). Congress mandated the conveyance in order to allow for development that could address the economic development needs of the City of Denison and the region. To meet these economic needs and to accommodate associated development plans anticipated to be implemented by the City and its private development partner, Schuler Development, following the proposed land conveyance, Federal actions under the Clean Water Act of 1972 and/or Rivers and Harbors Act of 1899 and revisions to the Lake Texoma Shoreline Management Plan (SMP) in the vicinity of proposed conveyance land would be required. This EIS addresses impacts associated with these actions as well.

Section 3182(k) of the WRDA 2007 states that the mandated conveyance of land to the City is subject to any additional terms and conditions that the Secretary of the Army deems appropriate and necessary to protect the interests of the United States. Accordingly, the USACE proposes to take necessary measures and actions to assure that USACE can continue to efficiently operate and manage Lake Texoma in accordance with all authorized purposes for which the reservoir was constructed. These purposes include flood control, water supply, hydroelectric power generation, regulation of Red River flows, improvement of navigation, fish and wildlife, and recreation.

1.3 LAKE TEXOMA OVERVIEW

Lake Texoma was initially authorized by the Flood Control Act approved on 28 June 1938, Project Document HD 541, the 75th U.S. Congress, 3rd Session, for flood control and power production. Later, the Rivers and Harbors Act of 1940, Public Law 868, the 76th U.S. Congress, 3rd Session, approved on 17 October 1940, expanded project authorization to include navigation, regulation of flow of the Red River, flood control, and other beneficial uses. The WRDA of 1986, Public Law 662, the 99th U.S. Congress, 2nd Session, approved on 17 November 1986, added recreation as a project purpose and authorized reallocation of additional storage for water supply.

The Lake Texoma dam site (Denison Dam) is located on the Red River at river mile 725.9. The dam is approximately 5 miles northwest of the City of Denison in Grayson County, Texas. The surface area of the lake is 74,686 acres at the top of the power pool, or at the maximum elevation (617 feet [ft] National Geodetic Vertical Datum [NGVD]) that the lake is allowed to rise for hydropower operation (USACE, 2004). A map showing the geographical location of the lake is shown in Figure 1.1.

The location of the proposed conveyance, as mandated by WRDA 2007, is along the eastern shore of the Little Mineral Arm of Lake Texoma. While WRDA 2007 language references conveyance of up to 900 acres in this area, the lands to be conveyed are defined by the 17 August 2005 lease application (approximately 635 acres). These lands are the subject of the proposed conveyance. The Little Mineral Creek originates in the uplands of Grayson County and is a northward flowing tributary. It enters Lake Texoma just east of the town of Pottsboro, Texas to form the Little Mineral Arm of the lake, as shown in Figure 1.2. At elevation 617 NGVD, the surface area of the Little Mineral Arm is approximately 1,871 acres. All of the land and water areas associated with the Little Mineral Arm are located on the Texas side of the lake.

Immediately adjacent to Federally owned land proposed for conveyance are approximately 2,500 acres of private land owned by Schuler Development (Figure 1.3), a Texas real estate development company. Schuler Development plans to enter into a public-private partnership with the City to develop a master-planned community known as the Preston Harbor Development. As part of this partnership the City proposes to transfer portions of the proposed conveyance land to Schuler Development for the construction of the Preston Harbor Development.

1.4 NEEDS AT LAKE TEXOMA

Lake Texoma is located within two counties in Texas and four counties in Oklahoma. Given the relatively close proximity of the lake to several metropolitan areas in north Texas, including the cities of Denison, Sherman, Plano, Denton, and the metropolitan statistical area (MSA) of Dallas-Ft. Worth, Lake Texoma is an important recreation location. The many types of recreational activities at the lake benefit the local and regional economies in both Texas and Oklahoma. Congress recognized the importance of recreation at Lake Texoma with passage of the WRDA of 1986 by adding recreation as an authorized project purpose.

Shoreline and direct water access are considered to be vital features for future development to occur around the lake. Without direct access to or across USACE lands, development of adjacent private land is limited or slow to occur and economic development opportunities are limited. Conveyance of approximately 635 acres of USACE lands to the City for development purposes would facilitate development on several thousand acres of adjacent private land. The adjacent private land is located near Denison, Texas (TX) and is bounded on the south by Farm to Market (F.M.) 406, on the east by F.M. 84 and Kelsoe Road, and on the north and west by the USACE lands (Figure 1.3). Access to the lake from the adjacent private land would enhance recreational and economic development opportunities at and around the lake. Opportunities for development and enhanced recreation would need to be balanced with environmental protection, sustainability, and protection of lake authorizations and purposes for the benefit of all users. The development of the proposed conveyance land and adjacent private land, with implementation of appropriate safeguards for continued operation of Lake Texoma for its authorized purposes, would help meet the expanding recreational demands on the lake. Likewise, environmentally sustainable development would also promote economic development within the City, surrounding counties, and the north Texas region.

The need for the conveyance action and resulting development has been noted by the Denison Development Authority, the Denison Chamber of Commerce, the City, and Congressman Ralph Hall. Letters from these entities are included as Appendix A and emphasize the importance of generating economic development and meeting recreational needs of the City and the surrounding region through the conveyance of USACE lands. Correspondence from Congressman Hall, the member of Congress responsible for the WRDA request, demonstrates that Congress intended that the conveyance facilitate economic development in the City and region. Consideration of economic and recreational needs of the region was central to the WRDA 2007 conveyance mandate.

The report demonstrates that the Preston Harbor Development (PHD) would bring short- and long-term economic benefits to the City (Impact DataSource, 2008). These benefits could include capital and labor investments made during the construction phase, and employment opportunities, increased living standards, and improved infrastructure when the development is operational. Additionally, the development could work as an overall economic accelerator, with spill-over affecting many areas of the City's economy (Kaai, 2010). Economic impacts are discussed in greater detail in Section 4.8.

In addition to recreational and economic development needs for Lake Texoma and the surrounding region, a need exists for environmental safeguards and sustainability to ensure the lake authorizations and purposes (see Section 1.3) are realized for lake users long into the future. Lake Texoma currently faces a number of environmental challenges ranging from invasive species, loss of lake volume owing to sedimentation, water quality degradation, and other issues identified in this EIS. Balancing recreational and economic development needs with environmental protection and sustainability represents a major challenge, and a critical objective, in the management of Lake Texoma for all users.

1.5 STATEMENT OF PURPOSE AND NEED

The purpose of this action is for USACE to meet the requirements of and intent behind conveyance of Federally owned land as directed by WRDA 2007. Section 3182(j) of WRDA 2007 requires the Secretary of the Army to offer to convey a parcel of land at Lake Texoma to the City of Denison, Texas. Congress mandated the conveyance in order to address economic development needs of the City of Denison and the region. In addition to the land conveyance itself, it is also necessary for USACE to address other Federal actions associated with the City of Denison's intended plans to develop this land for recreational and economic benefits. These actions include the potential granting of permits under the Clean Water Act of 1972 and/or Rivers and Harbors Act of 1899 as well as potential modification of the Lake Texoma SMP in the vicinity of the proposed conveyance land.

Section 3182(j) of WRDA 2007 likewise states that the conveyance of land to the City of Denison is to be subject to additional terms and conditions that the Secretary of the Army deems appropriate and necessary to protect the interests of the United States. USACE would meet this need by taking necessary actions to assure that it can continue to effectively operate and manage the project in accordance with all authorized project purposes including flood control, water supply, hydroelectric power generation, regulation of Red River flows, improvement of navigation, fish and wildlife, and recreation.

1.6 SCOPE

This EIS has been prepared pursuant to the Council on Environmental Quality implementing regulations contained in Title 40 of the CFR, Parts 1500 through 1508; the USACE implementing regulations published at 33 CFR, Part 230; and in ER 200-2-2 *Procedures for Implementing NEPA.* The EIS identifies, evaluates, and documents the potential environmental and socioeconomic effects of the Proposed Action at Lake Texoma. The EIS examines three alternatives and a "No Action" alternative. These alternatives are fully described in Section 2.

An interdisciplinary team was formed to identify and analyze the potential effects of appropriate alternatives. A list of all personnel who contributed to preparing this EIS is shown in Section 7. Effects are measured against the 2009 and 2010 Lake Texoma environment baselines which are described further in Section 3. Direct and indirect effects of the alternatives have been analyzed and are described in Section 4. Discussion of connected, similar and cumulative effects is analyzed in Section 5. Methodologies employed to assess potential environmental and socio-economic impacts on the human and natural environment from implementing the Proposed Action and alternatives include review of previous environmental studies and documentation for the lake, visual reconnaissance, modeling (water quality), mapping and Geographic Information System (GIS) assessment, and conducting a boat density carrying capacity analysis. A detailed discussion of these methodologies is provided under the respective resource in Section 4. The consequences of implementing the Proposed Action are discussed in Section 4. Mitigation measures are identified for each alternative analyzed and are summarized in the respective resource area sections.

1.7 PUBLIC PARTICIPATION

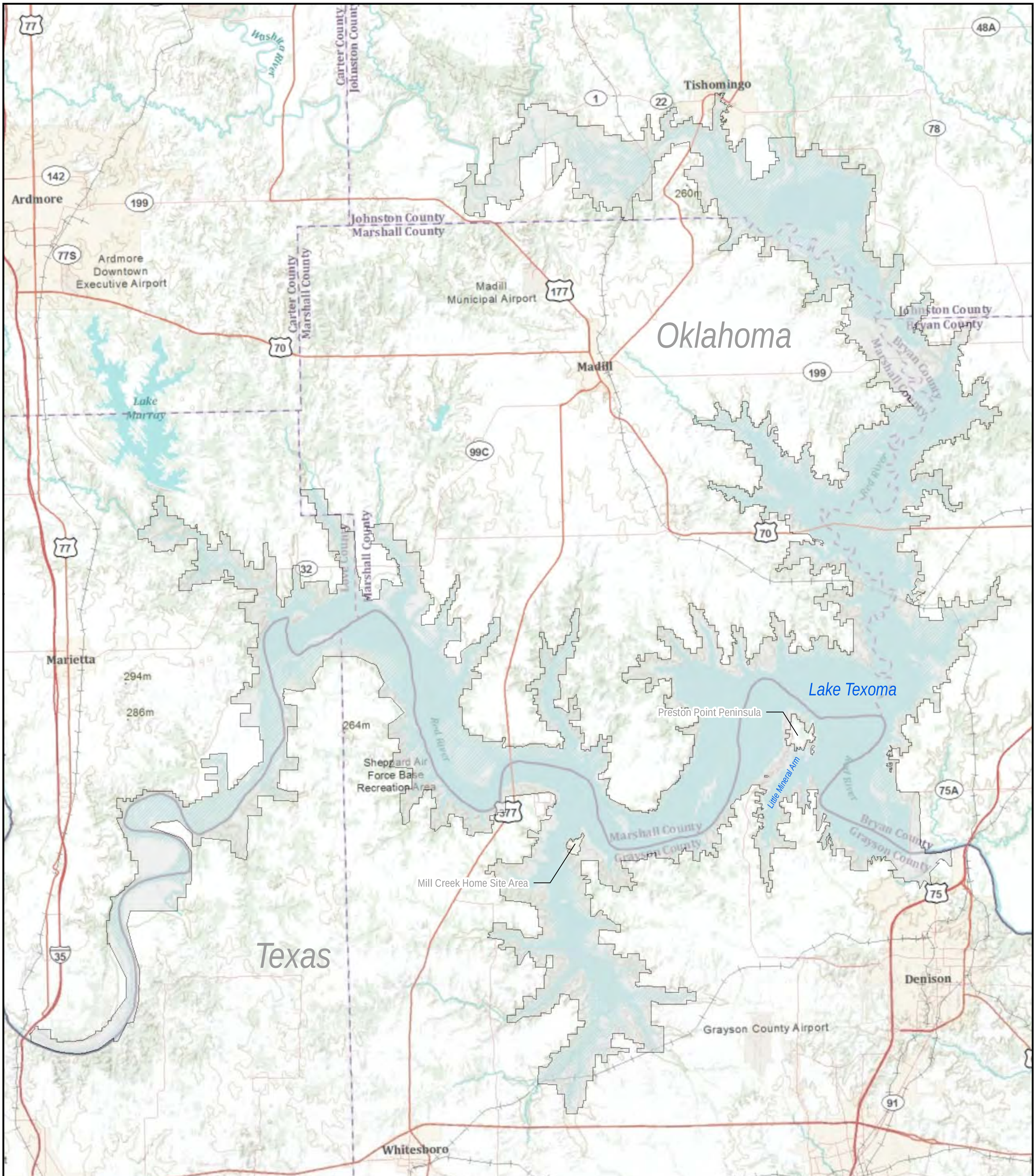
NEPA requires public participation during the environmental review process in order to facilitate open communication between USACE, other resource agencies, and the public, as well as promote better decision-making. Through the EIS process, all persons who have a potential interest in the Proposed Action or alternatives, including minority, low-income, disadvantaged, and American Indian groups, have been urged and will have the opportunity to participate in the environmental review process. The Council of Environmental Quality (CEQ) NEPA regulations and USACE guidelines (ER 200-2-2) provide for five major aspects of public participation in conjunction with preparation of an EIS: issuing a notice of intent; scoping; establishing a public review and comment period for the Draft EIS; convening a public meeting on the Draft EIS; and releasing the Final EIS to the public, accompanied by a 30-day public review period. Each occasion represents opportunities for the Tulsa District USACE to share information with the public. Similarly, the scoping and draft EIS comment period provide opportunities for the public to offer comments concerning the Proposed Action.

The need for public involvement is an important part of the NEPA process and is detailed in 40 CFR, Part 1501.7. It generally involves providing the public an opportunity to provide input on environmental issues and to comment on the agency's NEPA document. In accordance with the referenced guidance, a Notice of Intent (NOI) for this action was published in the Federal Register on 6 August 2008. A copy of the NOI is included in Appendix B. In accordance with 40 CFR 1501.6, the Tulsa District, USACE sent coordination letters and cooperating agency letters to the appropriate agencies. The copies of these letters are included in the Scoping Summary Report located in Appendix B. On 11 September 2008, the Tulsa District, USACE hosted a public information/scoping open house in Denison, Texas. Paid advertisements were placed in the *Durant Daily Democrat* and the *Denison Herald Democrat* announcing the open house and the beginning of the NEPA scoping process. Comments received from the scoping meeting were incorporated into a Scoping Report included in Appendix B.

The draft EIS (DEIS) for this action was filed with the USEPA and a Notice of Availability (NOA) published in the Federal Register on 4 November 2011. This initiated the 45-day public review period as specified under NEPA. Prior to issuance of the NOA, the Tulsa District USACE mailed copies of the DEIS on compact disc to appropriate agencies and other stakeholders identified during the scoping process. Hardcopies of the DEIS were made available for public review at the Denison, Texas and Madill, Oklahoma public libraries. On 15 November 2011, the Tulsa District hosted a public review/comment open house workshop for the DEIS at the Denison Senior Citizens Center, Denison, Texas. Paid advertisements were placed in the *Denison Herald Democrat* announcing the open house and 45-day comment period for the DEIS. Copies of informational materials on display and the attendees list from the public meeting are included in Appendix P. All comments received during the 45-day public review period, along with associated responses to these comments by the Tulsa District, USACE, are included in Appendix Q.

1.8 LEAD AGENCY, COOPERATING AGENCIES, AND STAKEHOLDERS

The Lead Agency is the Tulsa District, USACE. Other identified stakeholders directly involved in implementation of the Proposed Action include the City of Denison, Texas and Schuler Development. Federal, state, and local agencies, as well as tribes with an interest in this action, include a wide range of entities that were identified and coordinated with during the NEPA process. Cooperating agency request letters are included in the Scoping Summary Report (Appendix B). Only one agency, the Texas Historical Commission, requested to be included as a cooperating agency. Stakeholders in this matter include a wide range of agencies, tribes, municipalities, associations, and private citizens that have a stake in the management and enjoyment of the water resources of Lake Texoma. A complete list of stakeholders and agencies coordinated with during the NEPA process are included in Section 9.



Legend

USACE Property Boundary

SOURCE: UNITED STATES TOPOGRAPHIC MAP PROVIDED BY ESRI ARCGIS TOPOGRAPHIC MAP ONLINE© – 2008

DISCLAIMER: THIS FIGURE IS PREPARED FOR REFERENCE ONLY AND SHOULD NOT BE USED AND IS NOT INTENDED FOR SURVEY OR ENGINEERING PURPOSES

0 2.5 5
Miles

FIGURE 1.1
LAKE TEXOMA LOCATION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
April 2011	03886.544.001.0004	AS SHOWN

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0 0.75 1.5
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FIGURE 1.2
LITTLE MINERAL ARM
LOCATION MAP
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
April 2011	03886.544.001.0004	AS SHOWN

SOURCE: U S GEOLOGICAL SURVEY 7 5 MIN TOPOGRAPHIC QUADRANGLE POTTSBORO AND DENISON DAM TEXAS AND KINGSTON SOUTH AND PLATTER OKLAHOMA 1984 PROVIDED BY ESRI ARCGIS TOPOGRAPHIC MAP ONLINE©

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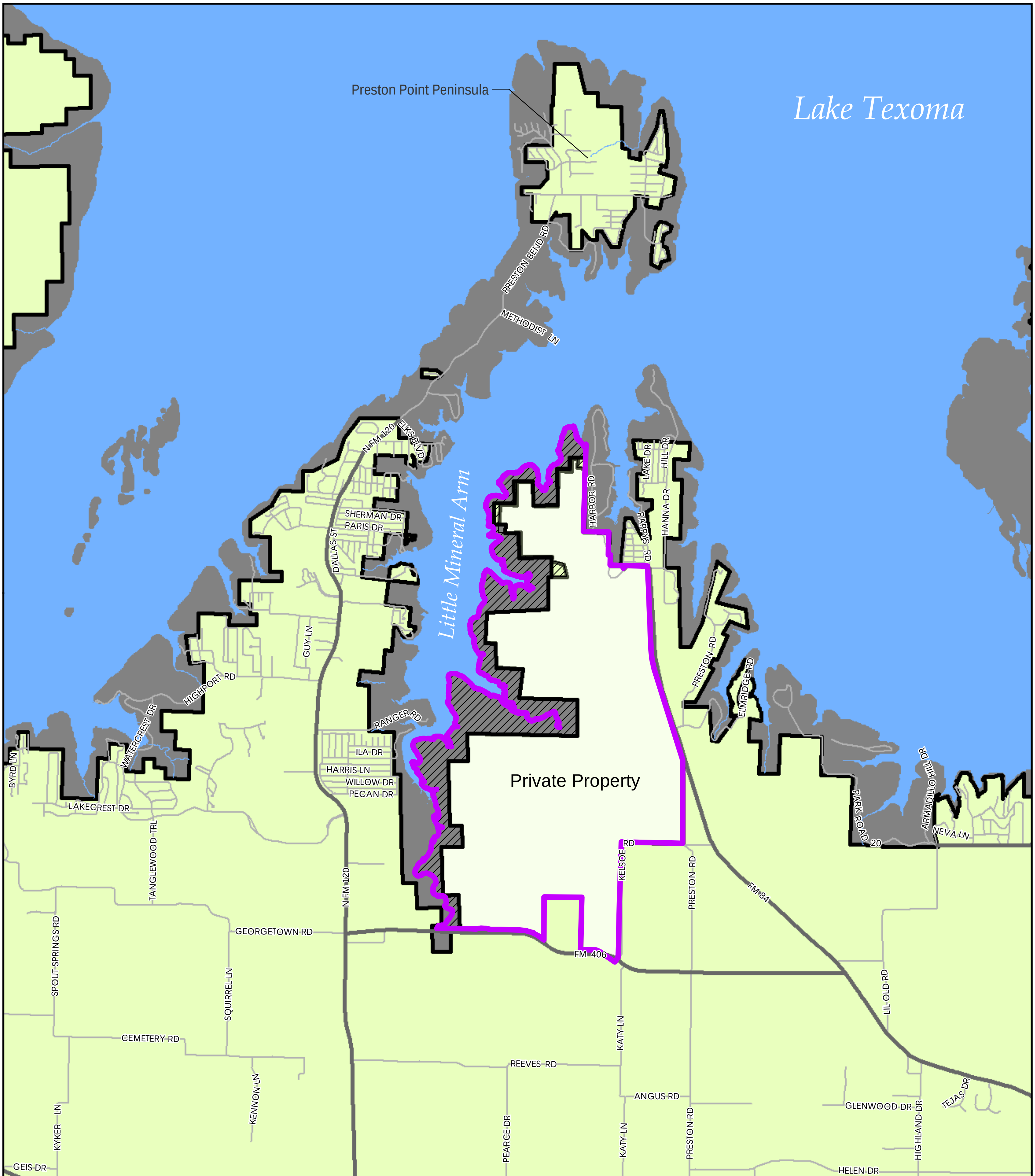

LEGEND

Proposed Preston Harbor Development

Private Property

Conveyance Land

USACE Property Boundary

SOURCE: U S GEOLOGICAL SURVEY 7 5 MIN TOPOGRAPH C QUADRANGLE POTTSBORO AND DENISON DAM TEXAS AND KINGSTON SOUTH AND PLATTER OKLAHOMA 1984 PROVIDED BY ESRI ARCGIS TOPOGRAPHIC MAP ONLINE©

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0 0.5 1

Miles

FIGURE 1.3
PROPOSED PRESTON HARBOR DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
April 2011	03886.544.001.0004	AS SHOWN

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2. ALTERNATIVES AND PROPOSED ACTIONS

NEPA requires Federal agencies to rigorously explore and objectively evaluate all reasonable alternatives, including a No Action Alternative; discuss alternatives eliminated from detailed study; and analyze the environmental impacts of alternatives carried forward so that reviewers may evaluate the environmental consequences of each alternative (40 CFR 1502.14). This section describes the range of alternatives that were developed for all Federal actions associated with both the conveyance and future development of Federal lands described in Section 3182(j) of WRDA 2007. Alternative scenarios were evaluated according to screening criteria in order to determine reasonable alternatives to be carried forward for detailed analysis.

2.1 FEDERAL ACTIONS TO BE ANALYZED UNDER NEPA

While the central focus of legislative direction under WRDA 2007 was the conveyance of Federal property, this conveyance, along with ultimate disposition and intended future development of conveyed land, result in three Federal actions to be analyzed under NEPA: (1) the mandated conveyance of Federal lands to the City; (2) amendment to the Lake Texoma SMP in the vicinity of the conveyance lands; and (3) issuance of Federal permits under Section 404 of the Clean Water Act of 1972 (404 permits) and Section 10 of the Rivers and Harbors Act of 1899 (Section 10 permits). In addition to these major Federal actions, elements of varying forms of mitigation are associated with each and are described in further detail in this section. Section 2.2 describes the screening criteria used to evaluate preliminary alternatives. Sections 2.3 - 2.5 discuss preliminary alternative and screening results associated with each of the three Federal actions described above.

2.2 PRELIMINARY ALTERNATIVES SCREENING CRITERIA

A wide range of preliminary alternatives were developed and screened based on requirements of Federal legislation outlined in WRDA 2007, and associated implementation guidance issued by USACE Headquarters dated 29 September 2008, which synthesized requirements of the USACE flood control mission at Lake Texoma (USACE, 2008a). Screening criteria also included consideration of other laws, regulations, and Army policies. The paragraphs below describe all alternatives considered and identify those that were carried forward for detailed analysis and those eliminated from consideration based on screening criteria.

The WRDA 2007 requirements and USACE guidance include the following constraints which framed alternatives development:

- Lands will be sold (not leased) to the City of Denison at fair market value;
- Consistent with the WRDA 2007-referenced City lease application, subject lands would be conveyed from the line of government-private ownership down in elevation to the top of the Lake Texoma seasonal conservation pool level, which is located at elevation 619 ft; and
- The USACE must retain the ability to operate Lake Texoma for its authorized purposes including flood control. The flood control function is legislatively authorized in the original authorization for the reservoir and is a central mission at Lake Texoma. This requires that USACE retain the ability to increase the elevation of the pool up to the authorized top of flood surcharge pool, which is elevation 645 ft. This requirement influenced the range of options that may be implemented by the City in the proposed development of conveyed lands. For example, USACE would require a flowage easement with deed restrictions indicating that no habitable structures be constructed between elevations 619 and 645 ft.

Each preliminary alternative was screened against the above criteria which eliminated some from further consideration. Remaining alternatives were carried forward for detailed analysis as project alternatives and assessed in Section 4.0 of this EIS. The three major Federal actions associated with this action, preliminary alternatives, screening results, and alternatives carried forward, are described below.

2.3 ALTERNATIVES FOR CONVEYANCE OF FEDERAL LANDS

Land conveyance is the central Federal action triggering analysis under NEPA and the primary component of Section 3182(j) of WRDA 2007. Specifically, the legislation calls for conveyance of up to 900 acres of the lands included in the 17 August 2005 lease application (Appendix A). The lease application designated a sub-lessee, Schuler Development, and if executed, the lease would have permitted pedestrian access to the shoreline and installation of boat ramps, slips, and other recreational amenities along the shoreline. Lake access for these activities would require a lease to elevation 619 ft NGVD, the current elevation of the top of the Lake Texoma seasonal pool. Elevation of the top of the flood control pool of the lake is 640 ft NGVD with a 5-ft flood surcharge pool elevation to 645 ft NGVD. The approximate acreage of proposed conveyance lands from elevation 619 ft NGVD that is consistent with the 17 August 2005 lease application is approximately 635 acres, which is less than the 900 acres referenced in WRDA 2007 language. In accordance with Section 3182(k) of WRDA 2007, the exact acreage and legal description of real property to be conveyed shall be determined by a survey that is satisfactory to the Secretary of the Army. In order to facilitate continued attainment of authorized project purposes of Lake Texoma (flood control, water supply, hydroelectric power, regulation of Red River flows, improvement of navigation, and recreation), deed restrictions will be required to create a flowage easement between the top of the seasonal pool (619 ft) and the flood control surcharge pool (645 ft). In accordance with Section 3182 (k)(3) of WRDA 2007, these conditions would be necessary to protect interests of the United States.

The No Action Alternative with respect to land conveyance is evaluated in this EIS. Without conveyance, the Federally owned lands would not be developed. Schuler Development currently owns a large unbroken tract of land immediately adjacent to the Federally owned land, and intends to develop that private property in some manner, regardless of the outcome of this land conveyance action. Therefore, the No Action Alternative includes the contemplated development of the private land immediately adjacent to the Government-owned land.

For ease of identification, alternatives related to the conveyance component of this action were assigned with a “C” (conveyance) designation. Preliminary alternatives and screening results were as follows:

2.3.1 Alternative C-1

This preliminary alternative would include no conveyance or lease of Federal lands to the City. Proposed conveyance land would continue under Federal ownership, and the undeveloped nature that has characterized the land since lake construction would be maintained. This alternative represents the No Action Alternative relative to land conveyance.

As will be discussed in further detail in this section and in Section 4, the No Action Alternative for land conveyance would include development on adjacent private land owned by Schuler

Development. However, without land conveyance, the nature of this development would differ in certain respects from the development that would occur with conveyance of Federal lands. Based on information provided by Schuler Development, under the No Action Alternative for land conveyance, Schuler Development would develop approximately 2,489 acres of private land. The development may include mixed residential, light commercial, recreational opportunities, and roadways. The development of the adjacent private property would be expected to take place in phases over a 20-year period. It is anticipated that development would begin at the southern most end of the private property and develop northward in 5-year increments. Thus, the No Action alternative, which serves as a baseline for assessing environmental impacts, assumes development of approximately 2,489 acres of Schuler Development's private land.

The No Action Alternative must be carried forward as required by NEPA.

2.3.2 Alternative C-2

Under this preliminary alternative, USACE would lease, rather than sell, the property to the City of Denison. Development as generally described in the City's 17 August 2005 revised lease application (Appendix A) would likely occur under a lease scenario. This development might include such recreational development as golf courses, light retail, and access to the lake through pedestrian trails, boat ramps, and a boat club.

This preliminary alternative was eliminated from further consideration because it is not in compliance with WRDA 2007 legislation mandating that Federal lands be conveyed to the City.

2.3.3 Alternative C-3

This preliminary alternative would involve conveyance of Federal lands down to elevation 645 ft, the top of the flood control surcharge pool for Lake Texoma. Land below elevation 645 ft NGVD would remain Federally-owned and undeveloped. This would facilitate operation of the lake to protect the authorized project purpose of flood control as discussed earlier in this section.

This preliminary alternative was eliminated from further consideration because it does not meet the requirements of WRDA 2007 legislation, which mandates conveyance of the lands subject to the City lease application. The City lease application included lands down to elevation 619 ft NGVD.

2.3.4 Alternative C-4

This preliminary alternative would involve proposed conveyance of Federal lands to the City and resulting development above elevation 645 ft NGVD combined with a lease of lands to the City between elevations 645 ft and 619 ft NGVD.

This preliminary alternative was eliminated from further consideration because it is not in compliance with WRDA 2007 legislation, which mandates conveyance of the lands subject to the City lease application referenced in WRDA 2007. The City lease application included lands down to elevation 619 ft NGVD.

2.3.5 Alternative C-5

This preliminary alternative would involve conveyance of Federal lands down to elevation 619 ft NGVD (top of seasonal pool) to the City, with no associated deed restrictions for measures to protect authorized project purposes such as flood control. Under this alternative, no controls would be in place to prevent development of habitable structures or meet other requirements necessary to protect the flood control purpose of Lake Texoma as specified in flowage easement restrictions (defined under Alternative C-7 below).

This preliminary alternative was eliminated from further consideration, as it does not allow and would thus be in conflict with the proper operation of the project for the authorized project purpose of flood control. This alternative would not protect the interests of the United States.

2.3.6 Alternative C-6

This preliminary alternative would involve conveyance of Federal lands down to elevation 645 ft NGVD (top of the flood control surcharge pool) and include necessary deed restrictions. Land below elevation 645 ft NGVD would remain Federally-owned, allowing operation of the lake to protect authorized project purposes, as discussed earlier in this section.

This preliminary alternative was eliminated from further consideration, as it does not meet the requirements of WRDA 2007 legislation for conveyance of Federal lands subject to the City lease application referenced in WRDA 2007, which is down to elevation 619 ft.

2.3.7 Alternative C-7

This preliminary alternative would involve the sale of Federal lands down to elevation 619 ft, as described in the City's lease application. A condition of the conveyance under this alternative would be an associated flowage easement deed restriction on lands located between elevations 619 ft and 645 ft NGVD to allow USACE to continue effective operation of Lake Texoma for authorized flood control. Estimated acreage of flowage easement that would be within the conveyed property is 158 acres. A flowage easement deed restriction would include the following:

- Right to regularly overflow, flood, and submerge all or part of lands subject to flowage easement. Grantee would agree to save and hold harmless the Government from any and all claims arising from or incident to flooding of lands subject to flowage easement.
- No structures for human habitation could be constructed or maintained on lands subject to flowage easement. No other types of structures could be constructed or maintained without prior written permission and consent to easement from the USACE.
- No excavation or fill could occur in the lands subject to the flowage easement without prior written approval from the USACE. Should this occur without such permission, the Government can remove or correct at expense of Grantee.
- Right of Government access on, over, and through lands subject to easement. Except in case of emergency, the Government would provide reasonable notice prior to access.

Following conveyance of Federal lands under this alternative, the City has indicated that it intends to facilitate development on the conveyed lands by further conveying portions to Schuler Development, while retaining certain parcels for development of recreational facilities, such as a public boat ramp, related facilities, and a park. Accordingly, this alternative acknowledges the future anticipated development of conveyed lands in accordance with development plans provided by the City/Schuler Development.

The development of the Federally conveyed lands and adjacent private lands would be known as Preston Harbor Development. This development would include residential development, a hotel complex, two golf courses, recreational lakes, hike and bike trails, boat docks, a boat club, a public boat ramp, and picnic area.

As shown in Table 2.3.1, this preliminary alternative was carried forward for analysis, as it meets all requirements of the WRDA 2007 legislation while protecting the authorized project purpose of flood control at Lake Texoma. This alternative is the Proposed Action and USACE's preferred alternative relative to the land conveyance action.

Table 2.3.1

Summary of Alternatives Related to Conveyance of Federal Lands

Alternative #	Alt. Description	Eliminated Based on Screening Criteria	Carried Forward
C1 (No Action)	No conveyance/ no lease		X
C2	No conveyance of lands, but lease of the property to the City.	X	
C3	Conveyance only to top of flood surcharge pool (elevation 645 ft).	X	
C4	Conveyance of lands to elevation 645 ft NGVD (top of flood control surcharge pool) and lease land to the City between elevation 645 and 619 ft NGVD.	X	
C5	Conveyance of lands subject to lease request with no deed restrictions.	X	
C6	Conveyance of lands from elevation 645 ft NGVD and above with necessary deed restrictions.	X	
C7 (Proposed Action)	Conveyance of all lands subject to City lease application with deed restrictions necessary to protect interests of the United States.		X

2.4 ALTERNATIVES FOR ACTIONS RELATED TO THE LAKE TEXOMA SHORELINE MANAGEMENT PLAN

Private and exclusive uses of the shoreline of USACE lakes where recreation and operation activities are allowed are governed by permits issued under a lake-specific SMP. A SMP for a lake is prepared as part of the overall Operational Management Plan (OMP) for that lake. In general, permits are issued for such activities as installation of private floating facilities (private boat docks), minor vegetation modification, and related activities on lands owned by the USACE. The issuance of a private shoreline use permit does not convey any real estate or personal property rights or exclusive use rights to the permit holder, and the public's right of access and use of the permit area is maintained and preserved. While owners of permitted facilities may take necessary precautions to protect their property, they may in no way preclude the public right of pedestrian or vessel access to the water surface or public land adjacent to the facility. Regulations and policy guidance for shoreline management at USACE civil works projects (lakes) are contained in ER 1130-2-406 (USACE, 1999).

While complete details of SMP regulations and guidance can be found in ER 1130-2-406 (USACE, 1999), a SMP can generally be viewed as a "zoning" document for shoreline use at a lake. The entire shoreline is designated with use classifications that govern the issuance (or denial) of shoreline use permits. Use classifications are as follows:

- <u>Limited Development Areas</u> – those areas in which private facilities (such as private boat docks) and/or activities (such as vegetation modification) may be allowed;
- <u>Public Recreation Areas</u> – those areas designated for commercial concessionaire facilities, Federal facilities, or similar public use;
- <u>Protected Shoreline Areas</u> – areas designated to maintain or restore aesthetics, fish and wildlife, cultural, or other environmental values. No shoreline use permits are issued in protected areas; and
- <u>Prohibited Access Areas</u> – areas where public access is not allowed or is restricted for health, safety, or security reasons.

Development and periodic modification (i.e., updates) of a SMP is a public process, where consultation is conducted with natural and cultural resource agencies and input and comments are actively sought from the public. The history and current status of the SMP for Lake Texoma is illustrative of both public interest and varying viewpoints related to shoreline management.

The last update to the Lake Texoma SMP was completed in 1996, and shoreline uses are currently managed according to this plan. Specific details regarding the current and complete Lake Texoma SMP are provided in Section 3.3.1 of this EIS. With respect to the proposed conveyance land, Lake Texoma SMP includes designations for limited development in two small coves, public recreation at a portion near the northern end, and protected designation for the majority of the shoreline. Such designations according to the current (1996) SMP for Lake Texoma for the proposed conveyance land are shown in Figure 3.3.2 in Section 3.

Shoreline Management Plans are to be reviewed periodically, but no less often than every 5 years (USACE, 1999). During this review, consideration is given to the need for updating a SMP for a given lake. Cumulative environmental impacts of permit actions and the possibility of preparing or revising project NEPA documentation are considered.

Recent reviews and attempts by the Tulsa District, USACE to update the 1996 Lake Texoma SMP have been characterized by a high level of agency and public interest, divergent viewpoints regarding the appropriate level of shoreline development, and considerable controversy. Numerous comments received by the Tulsa District during these reviews focused on changed environmental conditions at Lake Texoma, the need to provide updated NEPA documentation, and considerations regarding cumulative effects. In response, the Tulsa District Commander issued a moratorium in 2004 on further SMP permits at Lake Texoma until a time as such issues could be addressed through completion of an EIS addressing an overall SMP update for the lake. To date, there is not sufficient funding to allow for such a comprehensive EIS covering a lake-wide SMP review. In 2005, the moratorium was partially lifted, allowing changes to existing permits and new boat dock permits only in coves where existing private docks are already in place. In accordance with this moratorium, no new private docks are permitted in areas where none currently exist, even in areas designated as Limited Development Areas under the current (1996) Lake Texoma SMP. As noted above, two such coves exist along the east side of the Little Mineral Arm in the area of the proposed WRDA 2007 land conveyance, and no new SMP permits have been issued for these areas. To date, both the 1996 Lake Texoma SMP and 2005 moratorium are in place and govern shoreline use permits on the lake.

The development proposed by the City/Schuler Development following potential land conveyance along the shoreline would require certain SMP modifications. For instance, the two largest coves on the east side are currently identified in the SMP as “limited development.” If development plans include a boat club with private, individually-owned boat slips that would be constructed solely within the area identified as “limited development,” no modification to the SMP would be required. However, considerations regarding the current moratorium would need to be addressed. In this case, the 2005 moratorium on shoreline development might be lifted within the project area if deemed appropriate. On the other hand, if portions of the boat club – or other associated features such as individual boat docks – are planned for areas outside that currently zoned as “limited development” (i.e., in areas currently identified as “protected”), then a modification to the SMP would be required to accommodate such features. Alternatives relating proposed development features and SMP-related requirements are therefore the focus of this section.

For ease of identification, alternatives related to SMP-related issues for this action were assigned with an “S” (shoreline) designation. Preliminary alternatives and screening results were as follows:

2.4.1 Alternative S-1

This preliminary alternative involves no change to the existing 1996 Lake Texoma SMP or lifting of the SMP moratorium in place since 2005. Under this alternative, no SMP permits would be issued for proposed development features in the proposed conveyance land requiring such a permit. Accordingly, current shoreline use designations and nature of shoreline development (none) would continue as they do at present. This is therefore the No Action Alternative with respect to SMP-related matters.

This preliminary alternative was carried forward as part of a No Action scenario as required by NEPA.

2.4.2 Alternative S-2

This preliminary alternative would not involve changes to the current Lake Texoma SMP. This alternative would, however, lift the existing moratorium, allowing boat docks and other developments in the Little Mineral Arm consistent with the current SMP. Accordingly, uses of the shoreline would be limited to those designated in the current version of the Lake Texoma SMP. This would essentially limit permitting of private docks and other features requiring SMP permits to the two coves currently zoned for "Limited Development" on the eastern shore of the Little Mineral Arm of Lake Texoma (Figure 3.3.2, Section 3).

This preliminary alternative was carried forward for further analysis.

2.4.3 Alternative S-3

This preliminary alternative would include reviewing, and modifying (if appropriate) the SMP for the entirety of the Lake Texoma shoreline. Under this alternative, a public participation process as described in ER 1130-2-406 (USACE, 1999) would be implemented to garner updated proposals and viewpoints related to shoreline management issues. In addition to lake-wide updates, matters pertaining to proposed development features along the shoreline for proposed conveyance land could be considered as part of the overall update. As the result of this process, a new and updated SMP for the lake would be developed; this alternative could also include elimination of the moratorium established in 2005. Shoreline Management Plan permit requests would then be evaluated in accordance with the revised plan.

It has been the Tulsa District's desire to update the Lake Texoma SMP for a number of years, however, funding for this effort, including a required NEPA study, is not available. This limitation was recognized in Headquarters USACE-issued implementation guidance for Section 3182(j) of WRDA 2007 (USACE, 2008a), which states that the NEPA analysis and review for land conveyance will be done in advance of the update of the lake-wide SMP. Until such a time as adequate funds are available, this overall update will not occur.

This alternative was therefore eliminated from further consideration.

2.4.4 Alternative S-4

This preliminary alternative would include modifying and updating the SMP for only the portion of shoreline adjacent to the WRDA 2007 conveyance lands. The proposed SMP zoning is depicted in Figure 2.1. This alternative would consider rezoning portions of the shoreline on the proposed conveyance land and permitting of shoreline features in appropriately zoned areas. In addition, this alternative would lift the existing moratorium for the proposed conveyance land only, to facilitate SMP permitting under the revised SMP.

In accordance with Section 3182(k)(4) of WRDA 2007, all costs associated with conveyance of lands, including environmental documentation costs, are to be paid by the City. Therefore, while funding is not available for a lake-wide update of the Lake Texoma SMP, funding is available for impact assessment of SMP-related matters specifically concerning the proposed conveyance land, which is why a limited SMP modification could go forward at this time but a lake-wide assessment could not.

Accordingly, as depicted in Table 2.4.1, this alternative was carried forward for further analysis and is the Proposed Action and USACE's preferred alternative for SMP-related issues.

Table 2.4.1

Summary of Alternatives Related to Lake Texoma SMP

Alternative #	Alt. Description	Eliminated Based on Screening Criteria	Carried Forward
S-1 (No Action)	No changes to existing Lake Texoma SMP, and no deviation from existing 2005 moratorium		X
S-2	No changes to the existing Lake Texoma SMP, but allowed deviation from 2005 moratorium for Proposed Action area only.		X
S-3	Modify (update) SMP for entire reservoir.	X	

Alternative #	Alt. Description	Eliminated Based on Screening Criteria	Carried Forward
S-4 (Proposed Action)	Modify existing Lake Texoma SMP and lift existing 2005 moratorium on the proposed conveyance land only to contemplate proposed development features.		X

2.5 ALTERNATIVES RELATED TO REQUIRED PERMITS UNDER SECTION 404 OF THE CLEAN WATER ACT OF 1972 AND/OR SECTION 10 OF THE RIVERS AND HARBORS ACT OF 1899

Permits required by Section 404 of the Clean Water Act of 1972 and/or Section 10 of the Rivers and Harbors Act of 1899 will be required for some elements of the proposed development on both private and Federally-conveyed lands. Actions potentially requiring permits range from construction activities associated with the development in the uplands portion of the project area to construction activities planned at or below the conservation pool level of the reservoir. Section 404 of the Clean Water Act regulates fill material placed in waters of the United States, including wetlands, while Section 10 regulates fill material placed below the ordinary high water mark of navigable waters of the United States.

Section 404 and Section 10 permits required for the Preston Harbor Development are issued by the Regulatory Office, USACE, Tulsa District. Permits must be obtained for applicable activities, regardless of whether the activities are Federal or private in nature. Projects conducted entirely on private land and without Federal funds may still be subject to the permitting requirements of Section 404 and Section 10. An example of a project that might require a Section 404 permit would be filling a stream and constructing an alternate channel in order to construct a housing addition. Similarly, an example of a project that might require a Section 10 and 404 permit would be bank stabilization of an eroding cutbank along the lakeshore.

In order to comply with Section 404 and Section 10 requirements, an applicant would typically submit documentation to the USACE. In the case of Section 404, the USACE must evaluate the project to determine whether the waterbody or waterway is a "water of the U.S.," or an associated wetland. Typically, this judgment applies to streams and associated wetlands with flows over a certain threshold. Similarly, in the case of Section 10, the USACE will determine if the project area is located within a navigable water of the United States. The current presence of a dam is excluded from this consideration, meaning that impounded reservoir waters are considered navigable by definition, like the Red River upstream of Denison Dam. The USACE is responsible for addressing permit application and issuing permits where appropriate

The USACE prepared a Section 404 jurisdictional determination of the proposed conveyance lands and the private land. This jurisdictional determination is provided in Appendix C. The discharge of dredge or fill material within the areas identified as jurisdictional would require regulatory review by the USACE and potentially require Section 404 permits. Because Lake Texoma is considered a water of the U.S., the discharge of dredge or fill material below elevation 617 ft NGVD (normal Lake Texoma conservation pool which is used for regulatory purposes) will require a permit.

The development of the proposed Preston Harbor project will occur over an approximately 25 year horizon in a phased manner. The activities requiring coverage under a Section 404 or Section 10 permit will occur throughout the project's development, and thus while some jurisdictional activities will occur in the initial phases, others will occur far later in time (i.e., up to 25 years from now). While the EIS will seek to identify anticipated activities that will require a Section 404 or Section 10 permit, only those activities that are anticipated to occur within 5 years of conveyance and which require a permit will be assessed in detail in this EIS. This is because information used in permit-related decisions must reflect both current regulatory requirements and environmental information. In addition, permits have a finite period (usually up to a maximum of 5 years) during which they remain valid if the permitted action is not taken. Accordingly, complete evaluation and impact assessment for required Section 404 and Section 10 permits for activities that are anticipated to occur beyond 5 years would not be appropriate or feasible at this time. Moreover, given the early stages of the Project's planning and design for future phases, it would be impossible to identify with the level of accuracy needed for a permit application and accompanying NEPA study, the locations and potential acreage of future dredge and fill activities. Thus, to the extent that additional NEPA analysis is required for future permit applications, the USACE would conduct that NEPA review at the time such future permits are sought.

Based on information provided by Schuler Development, it is anticipated that construction would begin on the southern end of the property and would be phased geographically. All phases would likely include the construction of boat docks, ramps and shoreline protection along with residential and commercial development, which could occur in and around jurisdictional wetlands and waters of the U.S. Therefore, Section 404, 401 and 10 permit applications, as detailed in Table 2.5.1, would be required for all phases of development for Waters of the U.S. that would be affected. Detailed analysis of alternatives and impacts are provided in Section 4.7.3 of this EIS. Applications for remaining permits, as necessary, are expected to be submitted as development progresses over the 25 year planning horizon.

Table 2.5.1

Permit Requirements for the Proposed Development

Action	Permit
Installing shoreline protection	Section 10/404/401
Dredging lake sediment	Section 10
Construction of upland contained dredge disposal site	Section 404/401
Filling wetlands/waters of US - roads, culverts and bridge footings - paths to boat docks - anchorage footings for boat storage facilities - ground leveling - creating lakes/ponds	Section 404
Boat Ramp Installation	Section 10/404/401

Section 10 Rivers and Harbors Act
Section 404 Clean Water Act
Section 401 Clean Water Act

2.6 MITIGATION CONSIDERATIONS

Mitigation, as defined by NEPA, refers to a sequence of steps involving avoidance, minimization, rectification, reduction, and compensation for impacts associated with some action. In the context of compensation, mitigation often refers to offsetting the loss or adverse effects of an action on certain resources.

Mitigation requirements are most often determined through consultation between the agency responsible for the Federal action and resource agencies at Federal and state levels. Mitigation considerations are often determined through consultation conducted between the USACE and several agencies, including the U.S. Fish and Wildlife Service (USFWS), the Texas Parks and Wildlife Department (TPWD), Texas Historical Commission (THC), and others as appropriate. Specific laws under which mitigation consultation could be conducted include, but are not limited to, the Fish and Wildlife Coordination Act and Section 106 of the National Historic

Preservation Act (NHPA) of 1966. Mitigation considerations may also be dictated by specific legislation authorizing or mandating a Federal action. Mitigation considerations are described in the impacts analysis of project alternatives and detailed to the furthest extent possible in Section 4 of this EIS.

2.7 SYNTHESIS OF THE THREE FEDERAL ACTIONS WITHIN THE EIS

The three Federal actions described are the Federal actions that require analysis under NEPA. While the three actions are somewhat independent, they are also related and dependent on each other to varying degrees. For instance, while the conveyance of Federal land would seem to be the primary driving Federal action, an equally important component in satisfying the purpose and need would involve modification of the Lake Texoma SMP as appropriate. Finally, the remaining Federal component, Section 404 and/or Section 10 permits, will be needed for future development contemplated in association with land conveyance.

Finally, natural and cultural resources mitigation, to the extent necessary and appropriate, would be developed as a part of impacts analysis for the project alternatives and integrated accordingly.

2.8 SUMMARY OF ALTERNATIVES CARRIED FORWARD FOR FURTHER SCREENING

The process of alternatives development and subsequent screening of alternatives as described in this section resulted in a preliminary list of alternatives, organized by Federal action, to be carried forward. These alternatives are combined into overall final alternatives to be analyzed in detail in Section 4 of this EIS. These final alternatives are identified in Table 2.8.1. Mitigation components for each alternative are also discussed under appropriate resources in Section 4 of this EIS.

Table 2.8.1

Preliminary Alternatives Carried Forward for Further Screening

Component Action	Number	Alternative
Land Conveyance	C1	No Conveyance/No Lease (No Action)
	C7*	Convey to 619 ft NGVD elevation with deed restrictions
Lake Texoma Shoreline Management Plan	S1	No changes to SMP and no lifting of existing moratorium (No Action)
	S2	No changes to the SMP, but allowed lifting of moratorium for proposed conveyance land only
	S4*	Modify SMP as necessary to contemplate proposed development and lift moratorium – proposed conveyance land only (Proposed Action)
Section 404/10 Permits	As identified in EIS Section 4*	

*Proposed Action/Agency Preferred Alternatives.

2.9 COMBINED ALTERNATIVES CARRIED FORWARD

Below are the six combined alternatives that were carried forward for further screening. Each of the alternatives would include the future issuance of one or more permits under Section 404/Section 10, to the extent such Section 404/Section 10 permits would be required by the contemplated development activities. As discussed above, this EIS will only focus on those Section 404/Section 10 permits that may be required within the first five years of development.

2.9.1 Alternative 1

This alternative combines preliminary Alternatives C1 and S1. Overall, this represents the No Action Alternative required to be carried forward under NEPA. As discussed previously in this document, this alternative would include the proposed conveyance land remaining under Federal ownership. No SMP permits would be issued for proposed development features on the proposed conveyance land requiring such a permit. Accordingly, current shoreline use designations and nature of shoreline development (none) would continue as they do at present.

While not a part of this alternative, analysis of impacts of this alternative would include and consider development on approximately 2,489 acres of the adjacent private lands, as the owner of that property has indicated that development would occur if the USACE does not convey its land. This development would include hotels, one golf course, various residential type development (approximately 7,035 units), and limited commercial/ retail development. Boat ramps and other water related access entities would not be included. The adjacent land would also remain outside the jurisdiction of the City of Denison, and thus would not be subject to City land use controls or other regulations. Moreover, no wastewater treatment plant would be constructed to accommodate development or address leaking septic systems around the lake. Finally, without a conveyance, any Section 404 permits would be limited to dredge and fill activities, if any, on the private land. Figure 2.2 represents what such development may look like on private lands adjacent to the conveyance area under this scenario.

2.9.2 Alternative 2

This alternative combines preliminary Alternatives C7 and S1 and would convey approximately 635 acres of Federal lands to 619 ft NGVD with specific deed restrictions, no changes to SMP, and no deviation from existing moratorium. This alternative would involve proposed conveyance of Federal lands down to elevation 619 ft NGVD as described in the City’s lease application and in accordance with the WRDA 2007 mandate. A condition of the conveyance under this alternative would be an associated flowage easement deed restriction on lands located between elevations 619 and 645 ft NGVD to allow USACE to continue to efficiently operate Lake Texoma for the authorized flood control purpose. No other deed restrictions would be included.

Following conveyance of Federal lands under this alternative, the City has indicated that it intends to facilitate development of these lands for economic development and recreation purposes by further conveying portions to Schuler Development while retaining certain parcels for development of recreational facilities. However, under this alternative, no SMP permits would be issued for proposed development features on the proposed conveyance land requiring such a permit. Accordingly, current shoreline use designations and nature of shoreline development (none) would continue as they do at present. Development on the conveyance property and adjacent private land associated with this alternative would include a mix of residential units, a hotel and conference center, and various recreation opportunities including two 18-hole golf courses, inland lakes, and hiking and biking trails. Although no boat docks or ramps are associated with this alternative, 14,473 ft of shore protection would be installed along the shoreline for erosion protection. A new regional wastewater treatment plant (WWTP) is planned in conjunction with the private development to treat wastewater from the new residences and facilities. The WWTP would be constructed east of the development, along Lake Randell. The WWTP is further discussed in Sections 4.5 to 4.8. The location of the planned WWTP is shown in Figure 3.7.3 in Section 3.7. In addition, a wastewater treatment pump station and substation would be constructed on the private lands adjacent to the conveyance property. Figure 2.3, which is based upon information provided by Schuler Development, presents the proposed development under this scenario.

2.9.3 Alternative 3

This alternative combines preliminary Alternative C7 with S2 and would involve conveyance of Federal lands down to elevation 619 ft, as described in the City's lease application. A condition of the conveyance under this alternative would be an associated flowage easement deed restriction on lands located between elevations 619 and 645 ft NGVD to allow the USACE to continue to efficiently operate Lake Texoma for authorized flood control purpose. No other deed restrictions would be included. Following conveyance of Federal lands under this alternative, the City has indicated that it intends to facilitate development of these lands for economic development and recreational purposes by further conveying portions to Schuler Development while retaining certain parcels for development of recreational facilities. This alternative would not involve changes to the current Lake Texoma SMP. Uses (development) of the shoreline would be limited to those designated in the current version (1996) of the Lake Texoma SMP. In addition to those activities in Alternative 2, this alternative would lift the existing SMP moratorium, allowing new boat docks and other developments in the Little Mineral Arm consistent with the current SMP. However, the current SMP limits development of boat docks and facilities to only the two areas previously designated as limited development, as shown in Figure 2.4.

Development on the conveyance property and adjacent private land associated with this alternative would include a mix of residential units, a hotel and conference center, and various recreation opportunities including two 18-hole golf courses, inland lakes, and hiking and biking trails.

Like Alternative 2, a new regional WWTP is planned in conjunction with the private development to ensure that there is adequate capacity to treat wastewater generated by the new residences and retail/commercial development. The WWTP would be sized to also serve existing residences and facilities on the lake that are currently utilizing septic systems. The location of the planned WWTP is shown in Figure 3.7.3 in Section 3.7. In addition, Figure 2.4, which is based upon information provided by Schuler Development, presents the proposed development under this scenario.

2.9.4 Alternative 4

This alternative combines preliminary Alternatives C7 and S4 and would involve proposed conveyance of Federal lands down to elevation 619 ft, as described in the City's lease application and an associated flowage easement deed restriction on lands located between elevations 619 ft and 645 ft NGVD to allow USACE to continue to efficiently operate Lake Texoma for the authorized flood control purpose. No other deed restrictions would be included. Following conveyance of Federal lands under this alternative, the City has indicated that it intends to facilitate development of these lands for economic development and recreational purposes by further conveying portions to Schuler Development while retaining certain parcels for development of recreational facilities such as a public boat ramp and related facilities.

This alternative would also include modifying and updating the SMP for only the portion of shoreline adjacent to the Federal lands proposed for conveyance under WRDA 2007 (i.e., eastern shore of Little Mineral Arm of Lake Texoma). This alternative would include rezoning a percentage of the shoreline on the proposed conveyance land and permitting of shoreline features in appropriately zoned areas. In addition, this alternative would lift the existing moratorium (in existence since 2004) on the proposed conveyance land only to facilitate SMP permitting under the revised plan.

A WWTP is planned for development in conjunction with the private development to ensure that there is adequate capacity to treat wastewater generated by the new residences and retail/commercial development. The WWTP would be sized to also serve existing residences and facilities on the lake that are currently utilizing septic systems. The WWTP would be constructed east of the development, along Lake Randell, which is located several miles from the Preston Harbor Development. The WWTP is further discussed in Sections 4.5 to 4.8. The location of the planned WWTP is shown in Figure 3.7.3 in Section 3.7. In addition, a wastewater treatment pump station and substation would be constructed on the private lands adjacent to the conveyance property.

This alternative is the Proposed Action. Figure 2.5, which is based upon information provided by Schuler Development, presents the proposed development under this scenario, and displays the proposed development located on the conveyance land and associated development located on the adjacent private land. All development proposed to occur on conveyance lands from elevation 645 NGVD down to elevation 619 NGVD would be subject to a flowage easement deed restriction that protects the operation and management of the project for its authorized project purposes. A description of the types of development proposed on the conveyance land includes the following:

- 2 hotel complexes
- A shoreline docking facility to accommodate hotel visitors
- A system of pedestrian paths leading from the hotel to the shoreline
- 2 golf courses
- Residential development
- Boat club
- Boat ramp
- Dry dock facility storage

- Public picnic facilities
- Hike and bike trails winding throughout portions of the development and along the shoreline
- Parks/Open Space
- Roadways

2.9.5 Alternative 5

This alternative combines preliminary Alternative C1 and S2. As discussed previously in this document, this alternative would ensure the proposed conveyance land would continue under Federal ownership and would maintain the undeveloped nature that has characterized them since lake construction. This alternative would lift the existing moratorium, allowing new boat docks and other developments in the Little Mineral Arm consistent with the current SMP. However, since land would not be conveyed under this alternative, the alternative is not in compliance with WRDA 2007 legislation mandating the Federal lands be conveyed to the City. Additionally, this combined alternative involves actions regarding the Lake Texoma SMP and therefore does not represent a no action alternative. Accordingly, this combined alternative was eliminated from further analysis.

2.9.6 Alternative 6

This alternative combines preliminary Alternatives C1 and S4. As discussed previously in this document, this alternative would ensure the proposed conveyance land would continue under Federal ownership and would maintain the undeveloped nature that has characterized them since lake construction. This alternative would also essentially consider, if appropriate, rezoning of some percentage (or all) of the shoreline on the proposed conveyance land and permitting of shoreline features in appropriately zoned areas. However, since land would not be conveyed under this alternative, the alternative is not in compliance with WRDA 2007 legislation mandating the Federal lands be conveyed to the City. Additionally, this combined alternative involves changes to the Lake Texoma SMP and therefore does not represent a no action alternative. Accordingly, this combined alternative was eliminated from further analysis.

A summary of the screening results for the combined alternatives is included below in Table 2.9.1.

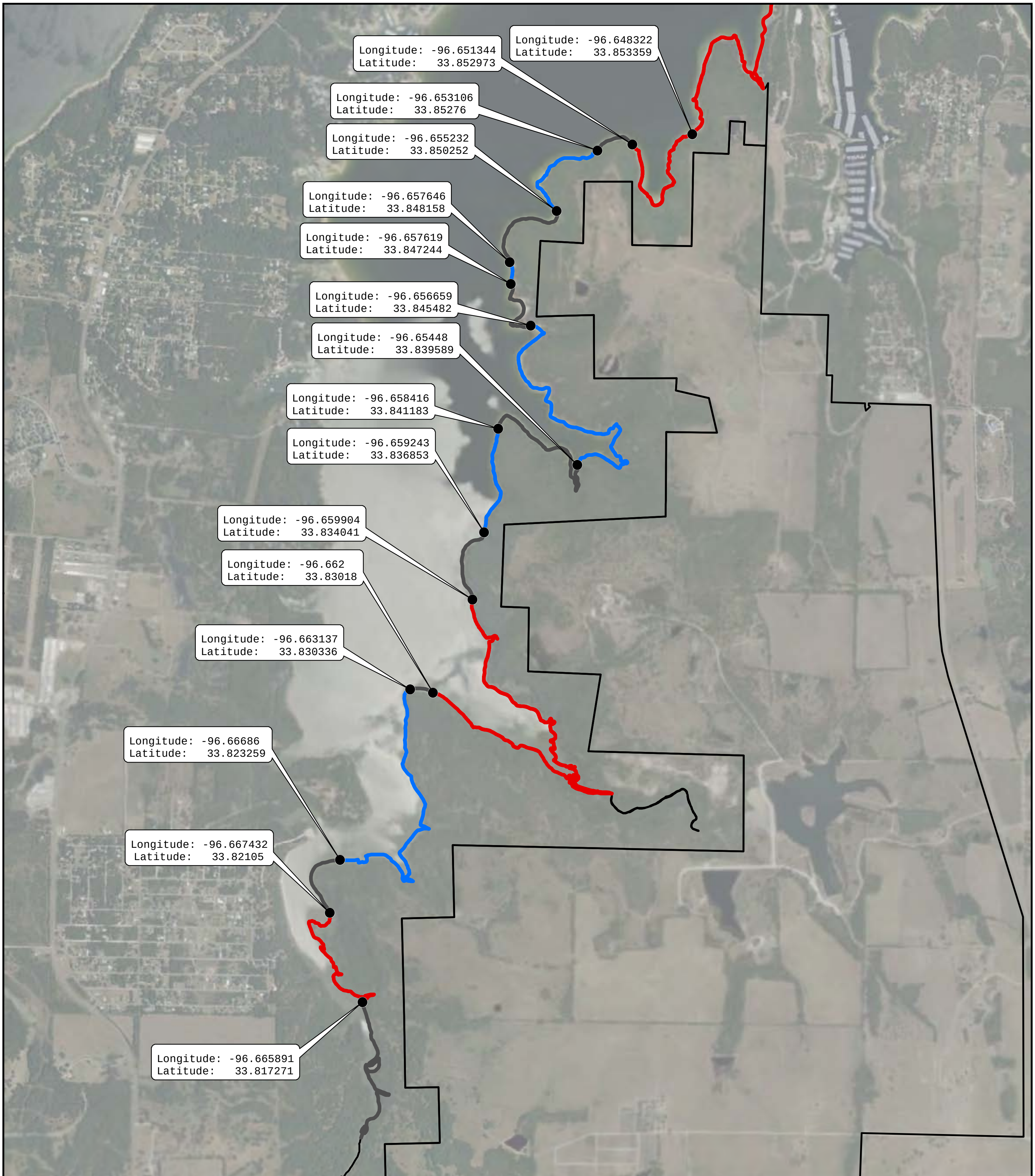
Table 2.9.1

Screening Results for Combined Alternatives

Alternative #	Alt. Description	Eliminated Based on Screening Criteria	Carried Forward
1 (No Action)	Combined C1 and S1. No conveyance/no lease, no changes to SMP, and no deviation from existing moratorium.		X
2	Combined C7 and S1. Convey land to 619 ft elevation, with deed restrictions, with no changes to the SMP and no deviation from the existing moratorium.		X
3	Combined C7 and S2. Convey to 619 ft elevation with deed restrictions and no changes to the SMP, but allow deviation from the existing moratorium.		X
4 (Proposed Action)	Combined C7 and S4. Convey to 619 ft elevation with deed restrictions and modify the SMP as necessary to contemplate proposed development and lift moratorium.		X
5	Combined C1 and S2. No conveyance/no lease with no changes to the SMP, but allow deviation from existing moratorium.	X	
6	Combined C1 and S4. No conveyance/no lease and modify SMP and lift existing moratorium.	X	

2.9.7 Proposed Action

The Proposed Action is identified as Alternative 4, and is comprised of a combination of the preferred alternative for each Federal component action. Accordingly, the overall Proposed Action includes Alternative C7, Alternative S3, and Section 404/Section 10 permits as required. Future required Section 404/Section 10 permits would be applied for and evaluated according to regulatory requirements relevant at the time of application. Alternative 4 is briefly described in this section, with specific details and features associated with this alternative provided in Section 4 of this EIS.



Legend

- Proposed SMP Zoning Demarcation Point
- Property Line

Proposed SMP Zoning

- Limited Development Area (13,900 lf)
- Protected Shoreline Area (8,663 lf)
- Public Recreation Area (14,376 lf)

D SCLAIMER: TH S FIGURE S PREPARED FOR REFERENCE ONLY AND SHOULD NOT BE USED AND S NOT INTENDED FOR SURVEY OR ENGINEERING PURPOSES

0 1,000 2,000
Feet

FIGURE 2.1
EAST LITTLE MINERAL ARM
PROPOSED SMP ZONING
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JUNE 2011	03886.544.001.0004	AS SHOWN

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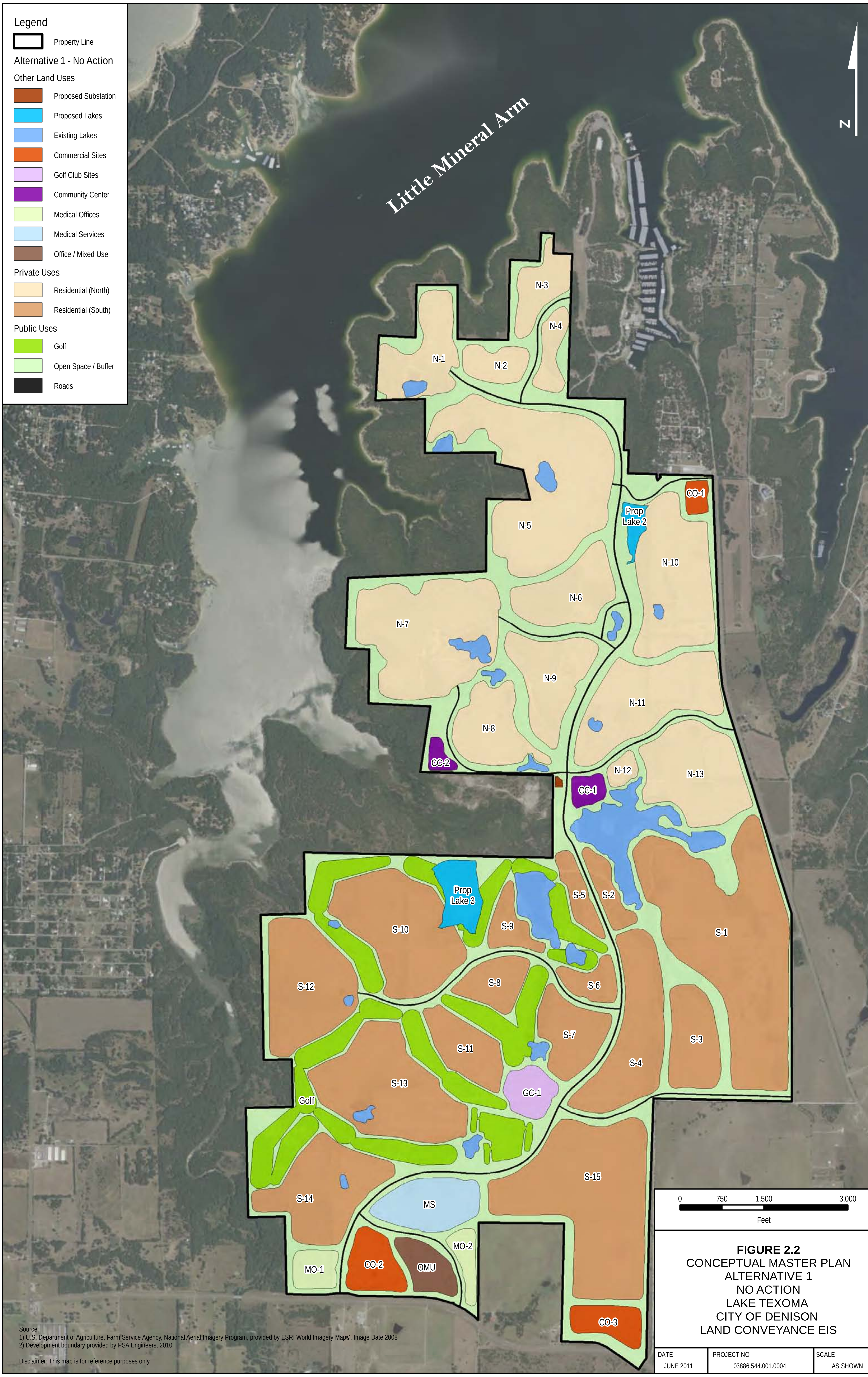

FIGURE 2.2
CONCEPTUAL MASTER PLAN
ALTERNATIVE 1
NO ACTION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

Source:
1) U.S. Department of Agriculture, Farm Service Agency, National Aerial Imagery Program, provided by ESRI World Imagery Map©, Image Date 2008
2) Development boundary provided by PSA Engineers, 2010

Disclaimer: This map is for reference purposes only

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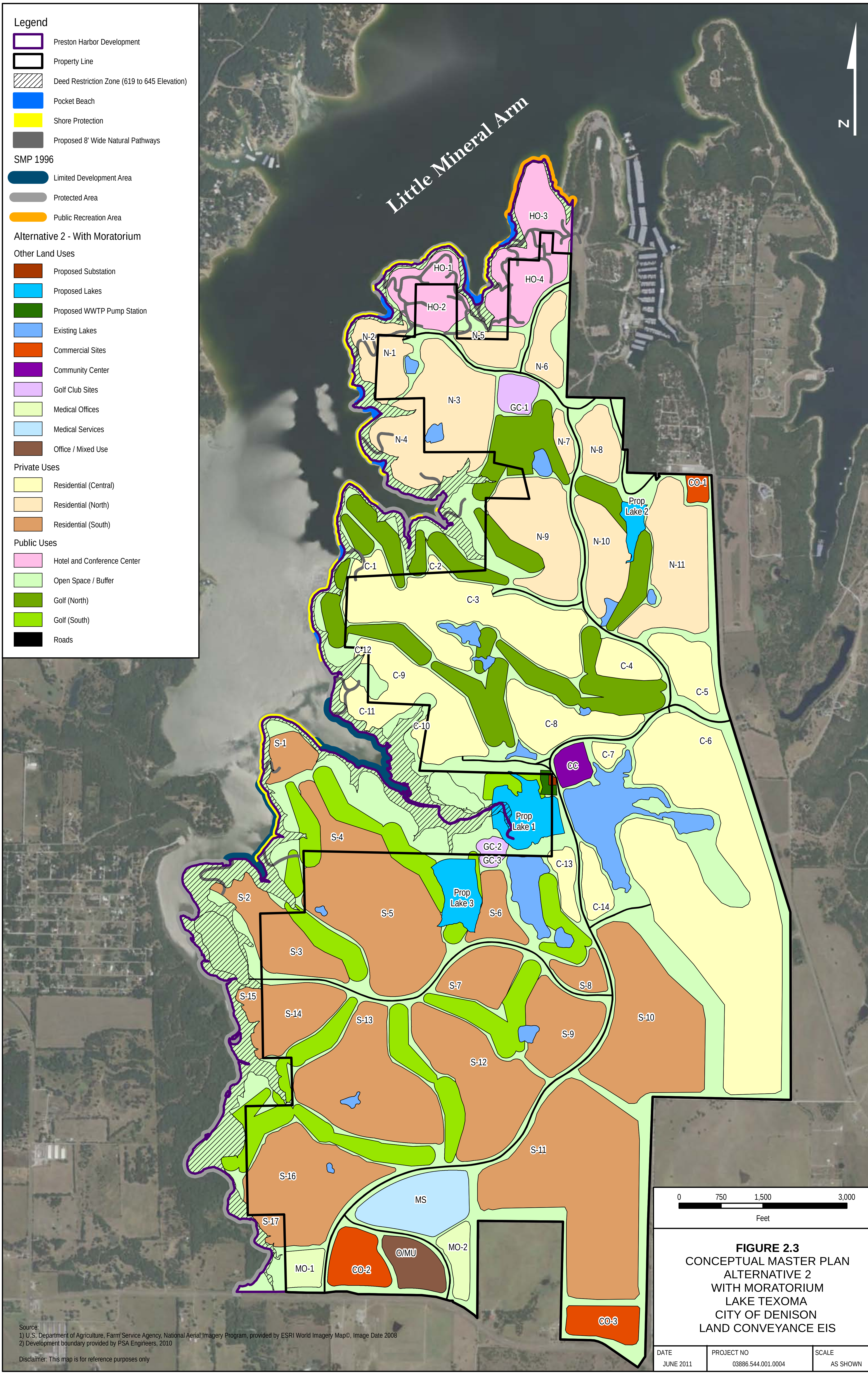

FIGURE 2.3
CONCEPTUAL MASTER PLAN
ALTERNATIVE 2
WITH MORATORIUM
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

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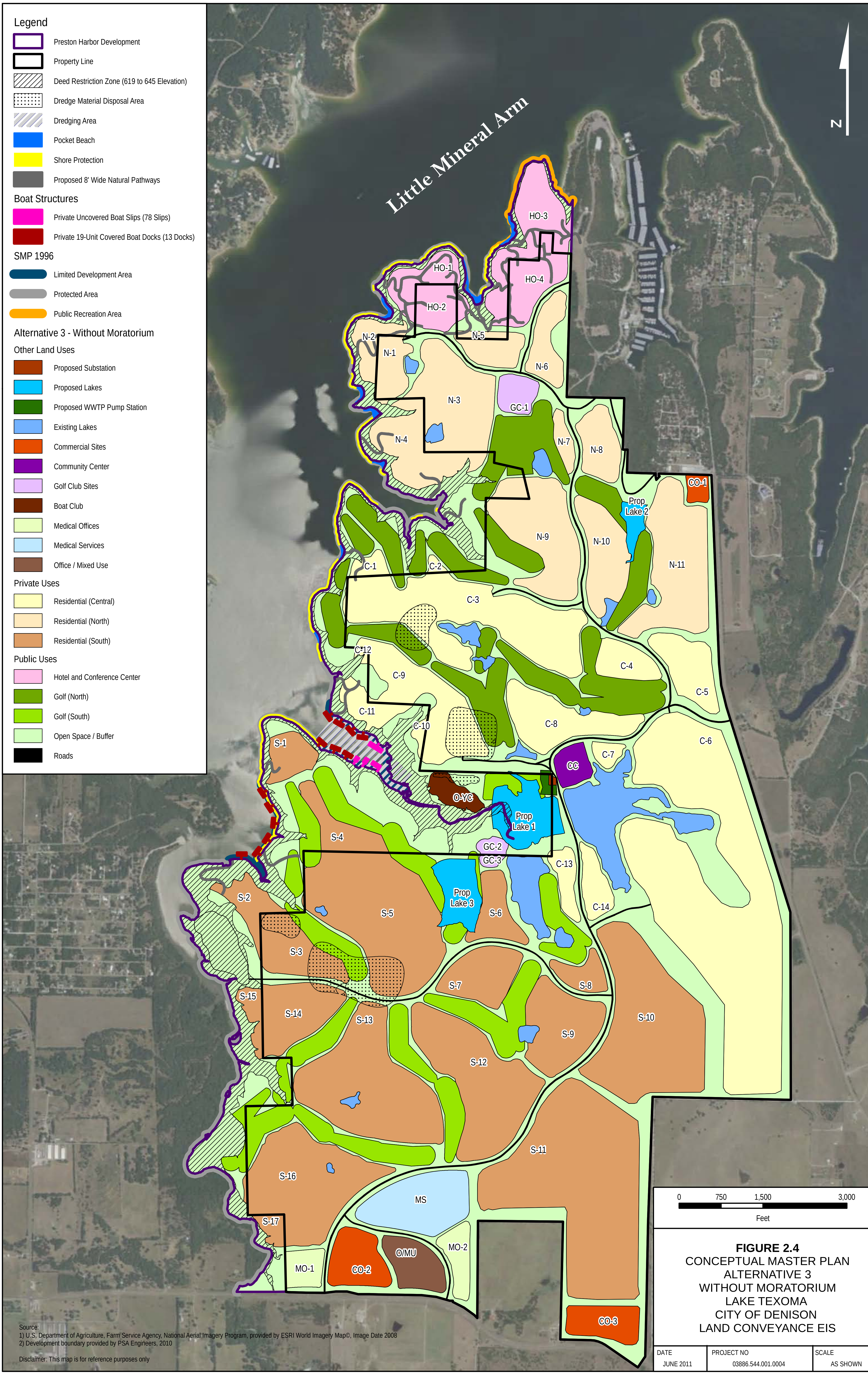

FIGURE 2.4
CONCEPTUAL MASTER PLAN
ALTERNATIVE 3
WITHOUT MORATORIUM
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

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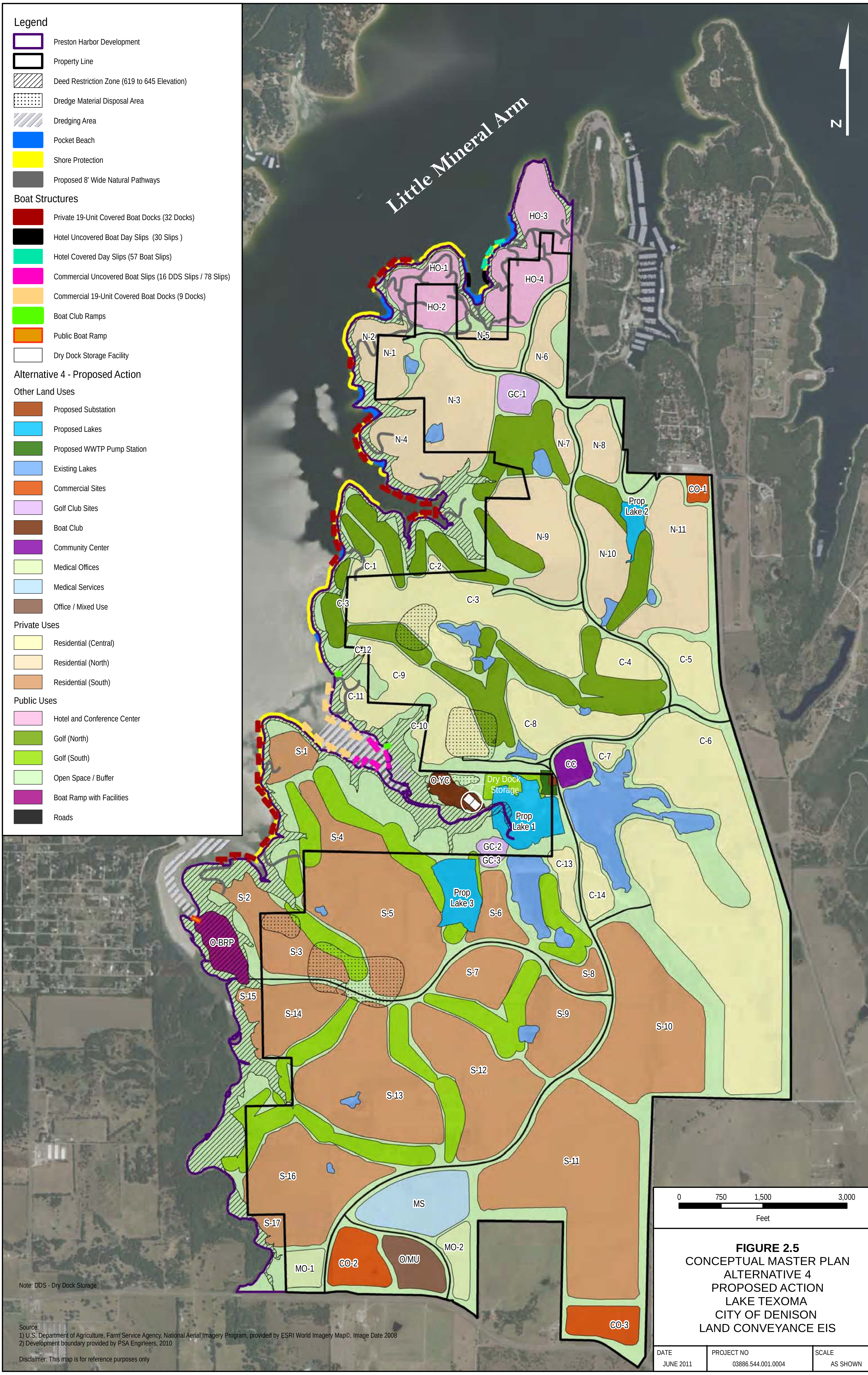

FIGURE 2.5
CONCEPTUAL MASTER PLAN
ALTERNATIVE 4
PROPOSED ACTION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

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3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This section 1) describes current environmental and socioeconomic conditions at Lake Texoma and surrounding areas, 2) identifies resources or topical areas potentially affected by the Proposed Action and alternatives, and 3) provides the baseline information used in Section 4 to identify and evaluate potential impacts resulting from the Proposed Action and alternatives. This information is being provided as a baseline for the analysis of effects of the Proposed Action and alternatives on the environment and is intended to reduce, but not eliminate, uncertainty regarding these conditions in connection with the property. Conditions are depicted as they currently exist and in accordance with the most recent data available.

3.2 ENVIRONMENTAL SETTING

3.2.1 Regional Geographic Setting and Location and Climate

Lake Texoma is located on the Red River between Texas and Oklahoma (Figure 3.2.1). The lake spans a total of six counties in both states, including Bryan, Marshall, Johnston, and Love counties, Oklahoma and Grayson and Cooke counties, Texas. Lake Texoma receives water from the drainage area of the Washita and Red Rivers (approximately 39,719 square miles) (USACE, 2003a).

The Lake Texoma area has long, hot summers and relatively short, mild winters. The average summer temperature is 80 °Fahrenheit (°F), and the average winter temperature is 46.6 °F. Average annual precipitation in the region is 35.2 inches, with an average of 23 inches falling April through October (NCDC, 2002). Annual average snowfall is 3 to 4 inches. The prevailing winds in the vicinity of Lake Texoma (as recorded in Sherman, Texas, approximately 15 miles south of Denison Dam) are from the south-southeast (NOAA, 1998).

3.2.2 Lake History and operations

Denison Dam and Lake Texoma were authorized by the Flood Control Act of 1938 (Public Law [PL] No. 761, 75th Congress, 3rd Session). Construction of the dam and spillway began in

August 1939 (USACE, 2008b). Although original project authorizations solely included flood control and generation of hydroelectric power, Congress later added navigation and municipal and industrial water supply to project authorizations. PL 868, adopted 17 October 1940, added navigation and Red River flow regulation to project authorizations. PLs 273 and 622, adopted in 1953 and 1986, added water supply storage and recreation. Impoundment of the lake began on 6 January 1944, and by 15 March 1945 the normal pool elevation of 617.0 ft NGVD was reached. On 13 September 1944, the reservoir impounded by the Denison Dam was officially named "Lake Texoma" by the Senate (USACE, 2008b). The total surface area of the lake at the top of the normal pool elevation (617 ft NGVD) was 74,686 acres (USACE, 2004). The normal pool elevation and lake surface area has not changed since the initial impoundment.

Denison Dam

Denison Dam is located at river mile 725.9 of the Red River, approximately 5 miles northwest of Denison, Texas and 15 miles southwest of Durant, Oklahoma (USACE, 1976). The dam is located at the narrowest part of the Red River valley, downstream of the Washita River. The dam is 17,200 ft in length and has a maximum height above the streambed of 165 ft (USACE, 1976). The dam spillway is a 700-ft, uncontrolled, gravity, chute-type structure with 2,400 ft radius weir at the upper end of the spillway that decreases to a 2,000 ft radius at the lower end of the spillway (USACE, 1976).

Of seven possible locations, the present site of Denison Dam was chosen for the general location, because it afforded the most economical site measured by the volume of embankment, the best available foundation for the outlet works, and topography (which permitted the spillway to be constructed independent of the main dam).

The construction of Lake Texoma required modification of nearby natural and man-made environments. Some existing railroads, highways, and utilities were relocated/removed to accommodate the project. Aylesworth and Woodville communities in Oklahoma and the Hagerman community in Texas were also relocated (USACE, 2008b).

Flood Control and Reservoir Regulation

Denison Dam provides flood protection downstream on the Red River in addition to contributing to flood control on the Mississippi River. Spillway capacity at maximum pool (elevation 666.4 ft) is 1,000,000 cubic-ft-per-second (cfs). Capacity of the outlet works is 67,500 cfs at the top of the flood control pool and 60,120 cfs at the top of the power pool. Limiting channel capacity downstream of the dam is 45,000 cfs (USACE, 2004). Exceedence of that capacity may result in flooding of lands, downstream of the dam. Elevations of significance with relation to flood control on Lake Texoma are as follows:

- Surcharge Pool: 640 to 645 ft above NGVD, represents the temporary flood control level during extreme storm events (USACE, 1993)
- Denison Dam Spillway: 640 ft above NGVD
- Flood Control Pool: 617 to 640 ft above NGVD, represents the flood control level during major flooding events
- Conservation Pool: 590 to 617 ft above NGVD, represents the lake level range maintained by USACE for conservation purposes (also referred to as "Power Pool")
- Seasonal Conservation Pool: 590 to 619 ft above NGVD, represents the lake level range maintained by USACE for conservation purposes during peak season (summer) months to satisfy recreational interests (USACE, 2010c)

In FY 2009, $33,069,000 in flood damages was prevented by flood control operations provided by Denison Dam. According to USACE estimates, cumulative flood damages prevented from dam creation up to 2009 are valued at $939,299,000 in 2009 dollars (USACE, 2010h).

Hydroelectric Power Generation

The first hydroelectric turbine was installed in March 1945 and the second in September 1949 (USACE, 1976). The total power output of the Texoma plant is marketed by the Southwestern Power Administration (USACE, 2006). The powerhouse contains two 35,000-kW generators, with provisions for three additional 43,000-kW units. One 20-ft diameter, steel-lined conduit provides water for each power unit. Each of the power conduits is equipped with two 9-by-19 ft vertical life gates located in the intake structure. The powerhouse and power conduits are located adjacent to the outlet works near the right abutment of Denison Dam. When conservation pool is full, Lake Texoma has approximately 103.2 ft of water depth available for power production (USACE, 2004).

Section 838 of the Water Resources Development Act of 1986 (PL 99-662) authorized the Secretary of the Army to reallocate 300,000 acre-ft of hydropower storage to water supply storage. According to the letter dated 16 February 2010, the Secretary of the Army reallocated an additional 300,000 acre-ft of hydropower storage to water supply storage. In addition, the Secretary of the Army provided credits equal to the replacement cost of any lost hydropower due to the implementation of any water supply contracts pursuant to this storage authorization. These credits would extend for as long as the water storage reallocated under the authority of Section 838 is used for municipal and industrial purposes (USACE, 2006).

Regulation of Red River Flows

The regulation of Red River flows is tied to flood control operation of the reservoir. Flood releases are made in accordance with operation of the entire Red River system to alleviate downstream flooding on the Red River. Bank caving and sedimentation are problems that have occurred along the Red River for many years due to the characteristics of the river. Flood releases are managed to minimize bank caving along the Red River. During basin-wide events, flood releases from all Red River Basin projects are coordinated to maintain longer periods of scouring flows to minimize sedimentation impacts on navigation.

Since completion, the lake has experienced several large flood events. The estimated peak discharge for the May through June 1908 flood was 470,000 cfs. The volume was 8,517,000 acre-ft (4.73 inches runoff). Peak inflow for the May 1990 flood was 300,000 cfs, with a volume of 5,087,000 acre-ft. Peak inflow for the May through June 1987 flood was 315,000 cfs, with a volume of 2,879,000 acre-ft. The total volume for the 1957 flood was 8,864,000 acre-ft (USACE, 2004).

Water Supply

According to the OMP for Fiscal Year (FY) 2009-2013, the flood control storage at Lake Texoma is at an elevation of 617-640 ft NGVD and contains a volume of 2,660,000 acre-ft. Table 3.2.1 shows the water storage of the lake.

Table 3.2.1

Water Storage Lake Texoma

Feature	Elevations (NGVD [ft])	Reservoir Area (Acres)	Reservoir Capacity (Acre-ft)
Top of Surcharge Pool	645	-	-
Top of Dam	670	-	-
Top of Flood Control Pool	640	141,418	5,061,062[1]
Top of Power Pool	617	74,686	2,516,232[2]
Top of Inactive Pool	590	40,434	1,048,949[2]
Flood Control Storage	617 – 640	-	2,544,830[1]
Power Storage	590 – 617	-	1,467,283[2]

Source: USACE, 2010c
[1]Includes storage in Cumberland Pool.
[2]Excludes storage in Cumberland Pool, which is not accessible for conservation storage purposes

Lake Texoma serves north Texas and south-central Oklahoma water supply needs. As discussed previously under Hydroelectric Power Generation in this Section 3.2.2, immediate water supply needs resulted in the reallocation of an additional 300,000 acre-ft of water storage on 16 Feb 2010. This additional water storage was to be split evenly between Texas and Oklahoma. The North Texas Municipal Water District (NTMWD) and Greater Texas Utility Authority (GTUA) have already petitioned for the 150,000 acre-ft of reallocated storage volume to be authorized for the Texas side. Water supply storage in Lake Texoma is under contract to specified users as shown in Table 3.2.2.

Table 3.2.2

Useable Water Supply Storage Lake Texoma (Forecasted to 2044)

Water Supply Storage	Useable Storage (acre-ft) [1]	Useable Storage (%)
Former Hydropower Water Storage[2]	300,000	8.348
City of Denison	21,300	0.59
Texas Power and Light (TP&L)	16,400	0.46
Red River Authority (RRAT)	450	0.013
RRAT	2,054	0.057
North Texas Municipal Water District (NMTWD)	85,406	2.37
GTUA	5,500	0.15
Buncombe Creek View	0.3	0.000008
GTUA	11,600	0.32
Oklahoma Tourism and Recreation Department (OTRD)	275	0.008
GTUA	1,514.7	0.042
NTMWD	100,000	2.78
GTUA	50,000	1.39

Source: USACE, 2010a, USACE, 2010b, USACE 2010c.
[1] Storage remaining after 100 years sedimentation from the date the project became operational based on the 2002 sediment survey.
[2] Section 838 of Public Law 99-662 authorizes the Secretary of the Army to reallocate up to 300,000 acre-feet (150,000 acre-feet to Texas and 150,000 acre-ft to Oklahoma) of storage for water supply from hydropower in 1999.

Improvements of Flows for Navigation

Although improvement of navigation is one of the designated project purposes of Lake Texoma and Denison Dam, there is no storage provided nor is there currently any significant commercial navigation along the Red River upstream of Fulton, Arkansas (AR). Consequently, there are no regulating procedures for Lake Texoma that are solely for the purpose of navigation (USACE, 2010a).

Flood releases are managed in all Red River Basin projects to improve flows for navigation. Bank caving and sedimentation are problems that have occurred along the Red River for many years due to the characteristics of the river. Bank caving not only impacts land adjacent to the river but also ultimately impacts downstream commercial navigation. Flood releases are managed to minimize bank caving along the Red River. During basin-wide flood events, sedimentation in reaches of the Red River can result in increased dredging costs.

Recreation

The close proximity of Lake Texoma to the Dallas-Fort Worth metroplex (about 1 hr drive south of the lake) and other towns and cities in close proximity, makes the lake a popular recreation location. Approximately 5.6 million people visit Lake Texoma annually (USACE, 2009b). Towns and cities surrounding the lake in Texas include Denison, Sherman, Denton, and Gainesville, and in Oklahoma include Durant and Ardmore.

The lake is a popular fishing location for striped bass; white bass; blue, channel, and flathead catfish; crappie; and largemouth, spotted, and smallmouth bass. Other water-based recreation activities include boating, waterskiing, jet skiing, and swimming. Lake Texoma facilities and surrounding lands are used for camping, golfing, hiking, horseback riding, nature watching, photography, four-wheeling, hunting, and picnicking. The existing environment for recreation is further discussed in Section 3.11.

Operational Management Plan

The FY 2009 – 2013 OMP for Denison Dam and Lake Texoma contains operational goals, objectives, and implementation plans for the lake. This Plan updates and replaces the earlier appendices to the 1986 Master Plan. The OMP was authorized by ER 1130-2-400, dated 1 June 1986, and includes three main plans: the Natural Resources Management Plan, Park Management Plan, and Implementation Plan.

The Natural Resources Management Plan includes long-term management objectives for the entire lake. Natural resource components include topography; aquatic resources; vegetation; fish and wildlife; special considerations such as archaeological sites, endangered species, and fragile wildlife habitats; encroachments; shoreline erosion; hazardous materials and oil spills; fire suppression; pesticides; animal control; and aquatic plant control. Long-term objectives for eight different Fish and Wildlife Management "compartments" are described in the OMP. A summary of the compartments is shown in Table 3.2.3.

Table 3.2.3

Fish and Wildlife Management Compartments - Operational and Management Plan Lake Texoma

Compartment Number	Long-term Objectives	Description	Area (acres)
1	Improve, protect, enhance, and create habitat to support a wide variety of different fish and wildlife species.	All USACE managed land and water from the north end of Denison Dam to the south side of highway 70.	4,443
2		All USACE managed land and water from the north side of highway 70 to the southeast lease boundary of Tishomingo National Wildlife Refuge (NWR).	20,434
3		All USACE managed land and water from the southwest lease boundary of Tishomingo NWR to the north lease boundary of Texoma State Park.	7,610
4		All USACE managed land and water from the south lease boundary of Texoma State Park to the east lease boundary of Fobb Bottom Game Management Area.	5,786
5		All USACE managed land and water from the north lease boundary of Fobb Bottom Game Management Area to the east lease boundary of Hickory Creek Game Management Area.	7,807
6		All USACE managed land and water from the east side of interstate highway 35 to the west side of highway 377.	10,290
7		All USACE managed land/water from the east side of highway 377 to the northwest lease boundary of Hagerman NWR and from the northeast lease boundary of Hagerman NWR to the south lease boundary of Highport Resort.	20,025
8		All USACE managed land and water from the south lease boundary of Highport Resort to the north end of Denison Dam.	5,860

Source: USACE, 2008c.

The Park Management Plan includes several provisions and instructions for implementation including the following: safety in USACE parks; assistance to visitors; a SMP; education for private property owners of the lake; inspections of outgrants; rehabilitation and maintenance of USACE parks; goals and methods of fee collection for recreation use fees; public safety and information outreach; inventory and management of cultural resources; as well as support and maintenance of volunteer and public outreach programs.

The Implementation Plan identifies the budgetary needs to complete both the natural resources management and park management for the period FY2009 – 2010. The total USACE estimated budgetary needs were $48,674,826.62 in FY2009 dollars without inflation ($48,248,362.62 for park management and $426,464.00 for natural resources management).

Land Ownership and Land Management

As discussed in Section 3.3, land-use refers to human use of land for economic production (residential, commercial, industrial, and recreational) and for natural resource protection. Land-use categories can change over time, and property that has been changed from a former condition can be restored to its former state. Land-use describes what is practiced, permitted, or planned.

Lake Texoma shoreline federal fee land was purchased by the Federal government for the public good and authorized project purposes in the 1940s. USACE land-use zonings were established to maintain a balance between lakeside development and the environment. The USACE lands at Lake Texoma are dedicated or zoned for parks, recreation areas, and wildlife habitats as well as critical shoreline buffers for onshore developments. Development on shoreline and public lands has been limited in accordance with the zoning established by the SMP.

Land around the lake (108,753 acres) is owned by the USACE. These lands are managed by several state and Federal agencies, including the USACE, the USFWS, the State of Oklahoma, and the State of Texas.

Two types of Federally managed lands are present: USACE lands (managed by the USACE) and wildlife refuges (managed by USFWS). The USFWS manages two wildlife refuges located on USACE lands at Lake Texoma (total of 24,950 acres), which include the Tishomingo National Wildlife Refuge (Oklahoma) and Hagerman National Wildlife Refuge (Texas). Detailed discussion about the refuges is provided in Section 3.7.9.

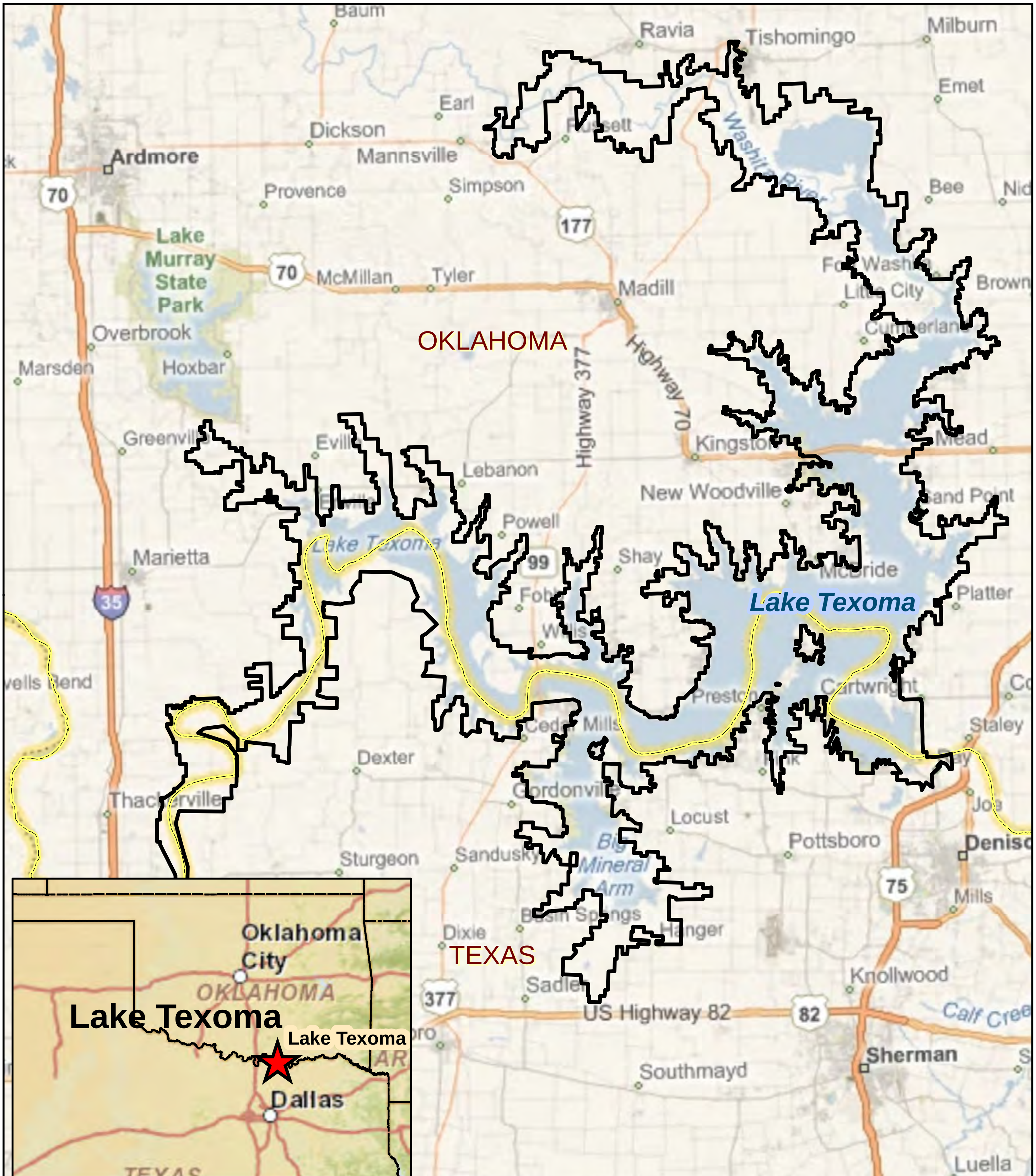
USACE manages 1,170 acres for project operations and 11,770 acres for recreation-intensive use. Approximately 39,092 acres of USACE lands are designated as recreation-low density use.

Figure 3.2.2 shows the USACE public access to the lake and includes recreation-intensive use and recreation-low density areas, Wildlife Management Areas (WMAs), and NWRs. The USACE manages 11 parks, 57 miles of equestrian/hiking trails, and 10 primitive campgrounds. The existing USACE-managed recreational areas consist of approximately 700 campsites with electric and individual hookups at most sites (USACE, 2008c).

Presently, the OTRD and TPWD manage 2,473 acres for public parks, including the Catfish Bay Marina and the Eisenhower State Park. The Oklahoma Department of Wildlife Conservation (ODWC) manages 29,112 acres for wildlife management purposes which includes the Fobb Bottom WMA, the Love Valley WMA, the Hickory Creek WMA, the Tishomingo NWR-WMU, and the Texoma/Washita Arm Unit. The TPWD also manages 36 acres for a fisheries lab on the Little Mineral Arm of the lake.

From 1972 through 1995, the General Services Administration (GSA) disposed of 83 parcels of Federally owned USACE land on Lake Texoma totaling approximately 2,750 acres (900 acres in Texas and 1,850 acres in Oklahoma) (GSA, 2011). These parcels were each purchased primarily by private individuals and public entities including the State of Oklahoma and the Colbert Public School District. Additionally, the WRDA of 1999 (PL 106-53 113 Stat. 359) authorized USACE to sell approximately 1,580 acres of Federally owned land to the state of Oklahoma. The land, on the north shore of Lake Texoma in Marshall County, Oklahoma, was under lease at that time to the OTRD. It was also part of the Lake Texoma State Park, a combination of state-owned lands and Federally owned lands leased to the state, totaling approximately 1,882 acres.

In 2006, the State of Oklahoma Commissioners of the Land Office purchased 558 acres from USACE. The State reached an agreement with the Pointe Vista Development, Limited Liability Company (LLC) (private development group) for the sale of approximately 750 acres, which included the land to be purchased from USACE and lands already owned by the State. This area is slated for the development of home sites and an upscale resort. In 2007, the Governor of Oklahoma indicated that the State would likely purchase all or most of the remaining land at Texoma State Park under lease from USACE to transfer to Pointe Vista for further development. The new development is proposed to include facilities such as an 18- to 36-hole championship golf course, a hotel, a club house and practice facility, a marina, an aquatic center, an outdoor recreation center, nature parks, campgrounds, retail shops, and an amphitheater. This Federal action requires an EIS in compliance with NEPA, and the USACE Tulsa District is in the process of preparing this document. The conveyance action to the State of Oklahoma under provisions of WRDA 1999 is a separate action and is not connected to the Denison conveyance under WRDA 2007.



LEGEND

- U.S. Highway
- River
- State Boundary
- USACE Property Boundary

0 1.5 3 6

Miles

SOURCE ® WORLD STREET MAP ESRI AND ®MICROSOFT CORPORATION 2010

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT INTENDED FOR SURVEY OR ENGINEERING PURPOSES.

FIGURE 3.2.1
VICINITY MAP
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

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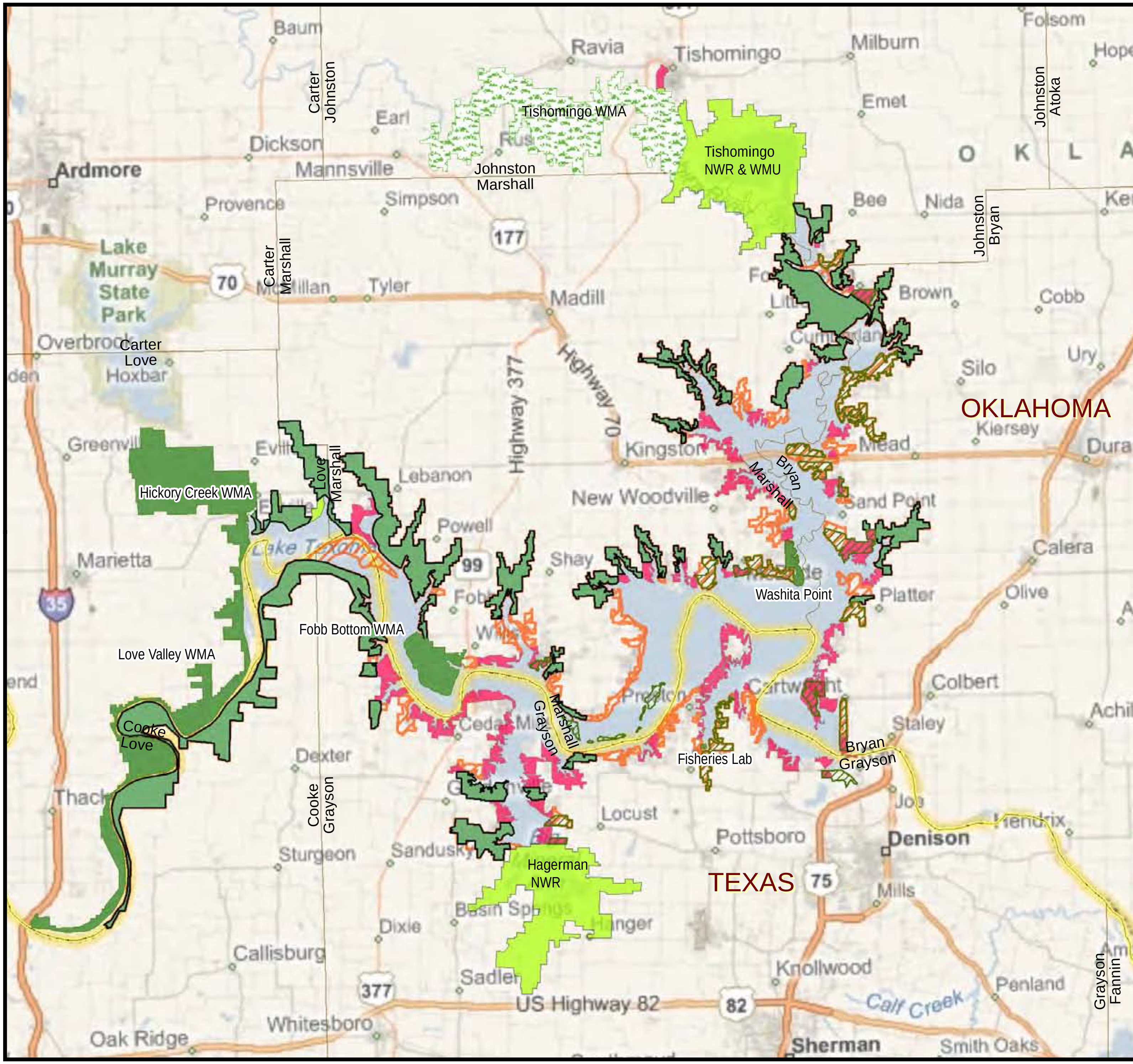

LEGEND

State Boundary

Recreation - Low Density Use

- State Areas Open for Hunting
- USACE Areas Open For Hunting
- See USACE Restrictions for Specified Use
- Recreation - Low Density

Recreation - Intensive Use

- USACE Open Public Recreation Areas
- Fish and Wildlife Management

N

0 3 6

Miles

SOURCE: (c)2009 Microsoft Corporation, Bing Streets

This figure is prepared for reference purposes only and should not be used, and is not intended for, survey or engineering purposes.

FIGURE 3.2.2

USACE PUBLIC ACCESS LANDS
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

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3.3 LAND-USE AND LAND-USE CONTROLS

The study area for land-use baseline data collection includes Lake Texoma and all associated Federally owned lands. Baseline land-use for the entire lake is as described in the 1996 SMP. The proposed conveyance land shoreline allocations were determined by digitizing 1996 SMP maps in Portable Data File (PDF) format into image files and geo-referencing with ArcView GIS software. The proposed conveyance shoreline allocations were digitized from the PDF files and then used to calculate lengths and areas of the SMP allocated shoreline. In the summer of 2009, the USACE, Lake Texoma Project Office was in the process of updating the SMP shoreline use allocation data and the lake facilities information to create a current, complete GIS-based data set. This information was not official at the time of writing this report, and hence was considered estimated data, and was used to develop lake-wide maps depicting the current shoreline allocation (See Figure 3.3.1).

The Lake Texoma Master Plan was prepared to meet the current and projected recreational needs of the lake; to accommodate the increased number of visitors; to evaluate preferred activities; to understand degree of overuse, resources degradation, existing and needed facilities, access routes, changes in land-use, operational deficiencies, and acquisition needs; as well as to provide a program for future development and management of the lake to the year 2020. Further discussion of the Master Plan is provided in Section 3.3.2.

3.3.1 Lake Texoma Shoreline Management Plan

USACE regulations regarding shoreline management are contained in ER 1130-2-406 (USACE, 1999). With regard to shoreline management, these regulations state: “The objectives of all management actions will be to achieve a balance between permitted private uses and resource protection for general public use.” They also state: “Shoreline uses that do not interfere with authorized project purposes, public safety concerns, violate local norms, or result in significant environmental effects should be allowed unless the public participation process identifies problems in these areas” (USACE, 1999).

According to the 1996 SMP, the Lake Texoma Lakeshore Management Regulation was published in the Federal Register in 1974. These regulations were developed considering input from a public review process, including comments from public, state, and Federal agencies; the Lake Texoma Association; and other interested parties. It was approved by the Southwestern Division (SWD) of the USACE in 1976. The regulations were reviewed and opened for comment in 1981 and 1986, in accordance with SWD guidance to review these plans every 5 years (USACE, 1996).

The purpose of the SMP for Lake Texoma is to make the shoreline available to the general public for unrestricted use and to manage and protect the shoreline while honoring past written commitments and promoting the safety and health of all users (USACE, 1996). The SMP establishes policy and guidance for the protection of environmental characteristics of the lake and restoration of the shoreline. The 1976 SMP divides the Lake Texoma shoreline into four categories of use: limited development areas, public recreation areas, protected shoreline areas, and prohibited access areas. These areas are discussed in greater detail below.

In 1991 and 1996, the SMP was again reviewed, and changes were made to reflect the trends in use of the lake which are compatible with then-present policy. In 2004, a moratorium was placed on all Shoreline Management Permits at Lake Texoma to address concerns associated with the level of shoreline development (see Section 2.4). In 2005, the moratorium was partially lifted, allowing changes to existing permits and new boat dock permits, only in coves where existing private docks are in place.

The Lake Texoma shoreline length at the top of the power pool is 585 miles. Appendix D includes the Lake Texoma Shoreline Management Plan. Maps 1 to 8 in Appendix D depict shoreline allocations for Lake Texoma. Table 3.3.1 summarizes existing shoreline zoning for Lake Texoma in accordance with the 1996 SMP. Figure 3.3.1 shows the current lake SMP shoreline allocation according to data collected from the USACE Lake Texoma Project Office.

Table 3.3.1

Shoreline Allocation Lake Texoma

Allocation	Miles	Percentage of Total Shoreline
Limited Development	21.0	3.6
Public Recreation	174.5	329.8
Protected Shoreline[1]	382.0	65.3
Prohibited Access	7.5	1.3
Total	**585.0**	**100.0**

Source: USACE, 1996
[1]Includes aesthetic areas.

The total shoreline within the proposed conveyance land of Lake Texoma has a length of 9.4 miles. Most of this shoreline (81%) is allocated as "protected shoreline areas" (USACE, 1996). Table 3.3.2 summarizes the existing zoning for the shoreline within the proposed conveyance land in accordance with the 1996 SMP. Figure 3.3.2 shows the shoreline allocation for the proposed conveyance land.

Table 3.3.2

Shoreline Allocation within Proposed Conveyance Land

Allocation	Miles	Percentage	Acres	Percentage
Limited Development	1.90	20.1	89.7	13.9
Public Recreation	0.57	6.1	32.0	5.0
Protected Shoreline[1]	6.97	73.8	521.6	81.1
Total	**9.44**	**100.0**	**643.0**	**100.0**

Source: USACE, 1996
[1]Includes aesthetic areas.

Limited Development Areas

This zoning designation consists of areas where private activities are permitted, such as construction and operation of private docks or floating facilities. The modification of existing vegetation may be permitted with appropriate authorization and permits.

Private floating facilities must be authorized and comply with the current regulations. The density of development in these areas cannot exceed 50% of the allocated shoreline. Within Lake Texoma, there are 120 shoreline areas allocated to Limited Development with an overall length of 21 miles (3.6 %) (USACE, 1996). These areas are allocated for private activities, such as mooring of privately owned floating facilities. Currently, approximately 75% of the lake wide land allocated to Limited Development is developed. Private land with lakefront ownership accounts for 654 private floating facilities and 1,230 slips/mooring spaces (USACE, 2009a).

Within the proposed conveyance land, two shoreline areas are zoned as Limited Development. These areas are designated as Little Mineral East and Little Mineral South; the total feet of zoned shoreline are shown in Table 3.3.3 and in Figure 3.3.2. These areas are currently undeveloped.

Table 3.3.3

Limited Development Proposed Conveyance Land

Limited Development Area	Zoned Shoreline (feet)	Acreage
Little Mineral East	6,362	37.8
Little Mineral South	3,525	51.9
Total	**9,887**	**89.7**

Source: Weston Solutions, Inc. (WESTON), 2010 based on USACE, 1996

Public Recreation Areas

This zoning designation includes public recreational sites developed by Federal or State agencies and commercial concessions. Privately owned floating facilities are not permitted in these areas. Concession marinas include areas leased to private entities for construction and operation of marinas that provide goods and services to the public. Land uses within the Public Recreation

Areas may include marinas, public parks, public campgrounds and picnic areas, public boat launching ramps, restrooms, parking spaces, and swimming areas.

The lake has approximately 5,860 slips/mooring spaces and 620 dry dock spaces. Approximately 70 public boat ramps/launch facilities and 70 parking areas with approximately 2,100 parking spaces are associated with the boat ramps/launch facilities. There are four designated public swimming beaches on Lake Texoma: West Burns Run, East Burns Run, Eisenhower State Park, and Texoma State Park (Catfish Bay Marina). There are approximately 50 parking spaces at each beach for a total of 200 parking spaces (USACE, 2009a).

Modification of land form or vegetation by private individuals or groups is not permitted. At Lake Texoma, approximately 174.5 miles of shoreline (30%) are allocated for public recreation.

Public organization recreation areas are also zoned under this allocation. These areas, also known as quasi-public lease properties, include Federal lands that are leased to special interest groups, such as the Boy and Girl Scouts, Young Men's Club of America (YMCA), Young Women's Club of America (YWCA), and church groups. Boat docks in quasi-public lease areas are managed under the terms of the real estate agreement for the individual site. Public organization recreation areas are also present (quasi-public leases) in addition to agriculture and grazing leases (A&G leases). Figure 3.3.3.1 depicts areas open to the public and Figure 3.3.3.2 depicts limited access areas. Figure 3.3.1 depicts shorelines allocations as detailed in the 1996 SMP.

According to 2009 USACE data, the total acreages allocated for concessions marinas was estimated at 3,368 acres (24 areas), state parks at 2,305 acres (2 areas), quasi-public leases at 3,362 acres (34 areas), USACE-operated public recreation areas at 11,770 acres (59 areas), and A&G leases at 15,531.4 acres (47 areas). Within the area proposed for conveyance, there are no Public Recreation Areas according to the 1996 SMP.

Protected Shoreline Areas

This zoning designation includes areas that protect or restore aesthetic resources, fish and wildlife habitat, cultural resources, or other environmental resources. Protected shoreline areas may also be designated for physical protection from heavy siltation, rapid dewatering, erosion, or exposure to high wind or wave action. Land access and boating are permitted along these shorelines as long as aesthetic, environmental, and natural resources are not damaged or destroyed. Mooring of private floating recreation facilities is restricted in these areas.

Protected Shoreline Areas are suitable for uses such as nature hiking, fishing, bird-watching, etc. Modification of land form or vegetation by private individuals is permitted only after consideration of the effects of such action on the environmental and physical characteristics of the area. At Lake Texoma, approximately 382 miles (65.3%) of shoreline are classified as protected shoreline (USACE, 1996).

Within the protected shoreline of Lake Texoma, two wildlife refuges and WMAs are present. According to USACE 2009 data, the total acreages allocated for NWRs and WMAs was estimated at 24,950 acres (2 areas) and 29,148 acres (5 areas), respectively. This is a total of 54,098 acres.

Within the area proposed for conveyance, almost 7 miles of shoreline are protected (73.8%). This includes 36,802 ft and 521.6 acres of protected shoreline.

Prohibited Access Areas

This zoning designation limits public access to selected areas due to security, the protection of ecosystems, and the physical safety of visitors. Examples include unique fish spawning beds, certain hazardous locations, and areas located near dams or spillways. Mooring of private floating facilities and/or the modification of land form and vegetation are restricted within Prohibited Access Areas. At Lake Texoma, 7.5 miles (1.5%) are designated as Prohibited Access Areas. Prohibited Access Areas include Denison Dam, its control, and overflow areas, as well as the Cumberland Levee system in Bryan County, Oklahoma.

According to 2009 data collection by the USACE, Lake Texoma Project Office to update the 1996 SMP, the total acreages allocated for Prohibited Access Areas include 1,132.21 acres.

Within the area proposed for conveyance, no Prohibited Access Areas are present.

3.3.2 Lake Texoma Master Plan

The first document that addressed recreational uses at Lake Texoma was published in 1945 (Recreational Resources of the Denison Dam & Reservoir Project). The Lake Texoma Master Plan (MP) was written in 1952. Originally, the MP was a program for development and management of the lake. It provided an assessment of existing development in order to meet the recreational needs of the lake. In 1960, the MP was complemented with "Design Memorandum 3C, Master Plan for Lake Texoma." The 1960 MP was again updated in June 1978 (USACE, 1978). The purpose of the Updated Master Plan was to meet the current and projected recreational needs of the lake; accommodate the increased number of visitors; evaluate preferred activities; understand degree of overuse, resources degradation, existing and needed facilities, access routes, changes in land-use, operational deficiencies, and acquisition needs; as well as provide a program for future development and management of the lake to the year 2020. The 1978 MP was reviewed and supplemented in 1996. According to the 1978 Lake Texoma MP and its updates, all land is allocated to provide sound development and resource management practices. Agricultural use of land is not an authorized purpose, but an interim or collateral use to maximize land productivity and/or to maintain open park-like areas consistent with the authorized purposes is permitted. Table 3.3.4 provides a summary of land-use allocations according to the FY 2009 – 2013 OMP for the entire lake. Figure 3.3.4 shows land-use designations for the proposed conveyance land according to the FY 2009 – 2013 Operational Management Plan.

Table 3.3.4

Present Land Use Designations Lake Texoma

Land Use Designations	Acres*
Project Operations	1,170
Recreation – Intensive Use	14,393
Recreation – Low Density Use	39,092
Wildlife Management	54,098
Total	**108,753**

Source: USACE, 2008c
Note: *At pool elevation 617.0 ft above NGVD

Project Operations

Project Operations are lands acquired and allocated to provide safe, efficient operation of the lake and other authorized project purposes. Typically this land includes, but is not restricted to, the land on which project operational structures are located (dams, powerhouses, etc.). Agricultural use of this land is permitted on an interim basis when such use does not interfere with operational, recreational, or wildlife protection uses.

Recreation – Intensive Use

Recreation – Intensive Use lands are areas allocated for public use areas for intensive recreational activities by the visiting public (e.g., public camp grounds), including areas for concession (e.g., commercial marina) and quasi-public development. No agricultural uses are permitted on these lands except on an interim basis. This category includes 47 designated USACE public-use areas and commercial concessions, public recreation areas (state and city parks), quasi-public sites, and private recreation (club) sites.

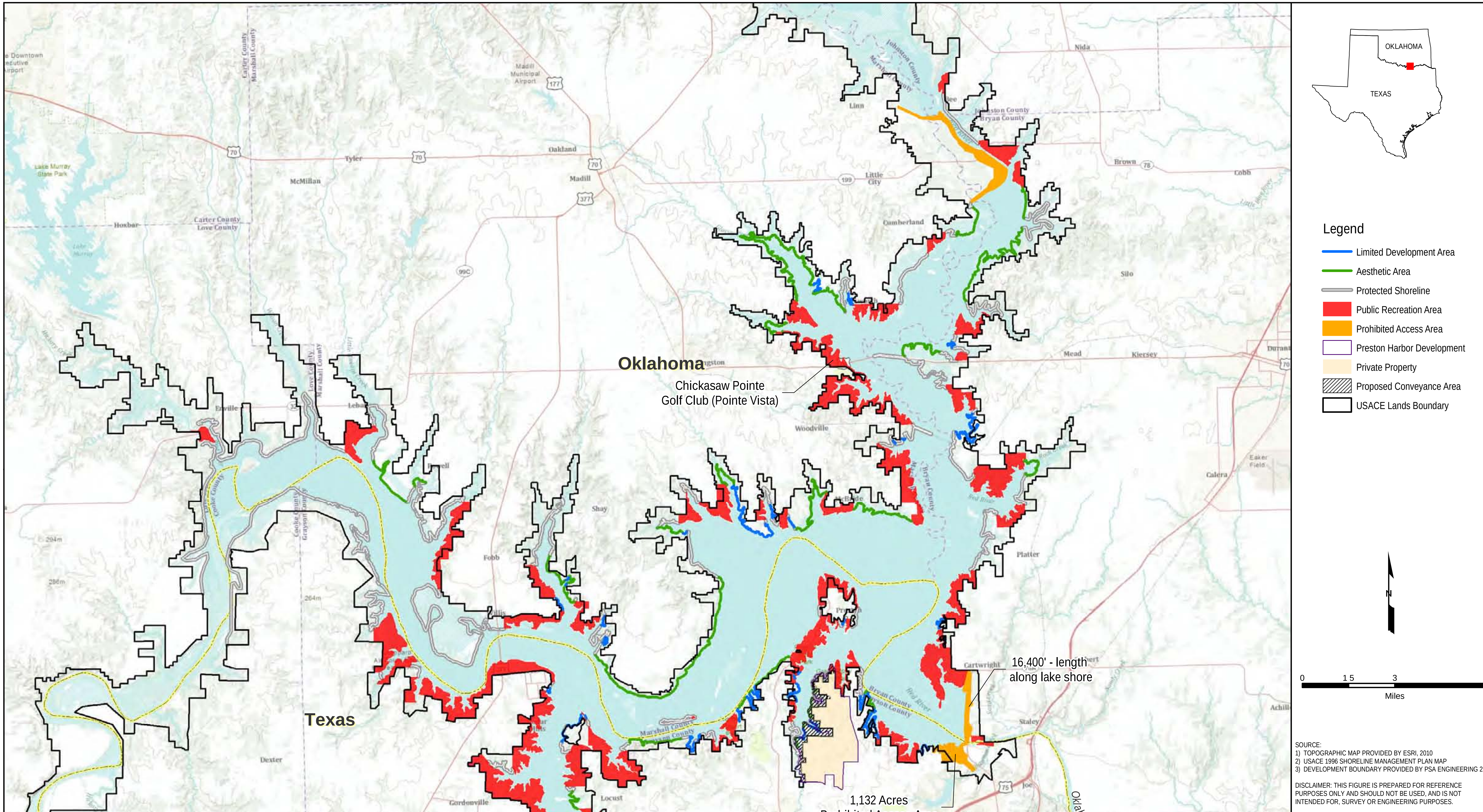
Recreation – Low Density Use

Recreation – Low Density Use lands are areas allocated for low density recreation activities by the visiting public. They usually are open space between intensive recreational developments or between these and land that is incompatible with intensive recreational use. Under this allocation are lands used for ecological workshops and forums, hiking trails, primitive camping, fishing, hunting, bird watching, or similar low density recreational use. No agricultural uses are permitted on these lands except on an interim basis for terrain adaptable for maintenance of open space and/or scenic values.

The present land-use designation of the proposed conveyance land is Recreation – Low Density Use (Figure 3.3.4).

Wildlife Management

Wildlife Management lands are areas allocated as habitat for fish and wildlife or for propagation of such species. Wildlife Management lands include lands licensed to the USFWS for two national wildlife refuges, lands licensed to the ODWC for wildlife management purposes, and lands licensed to the TPWD for a fisheries lab.



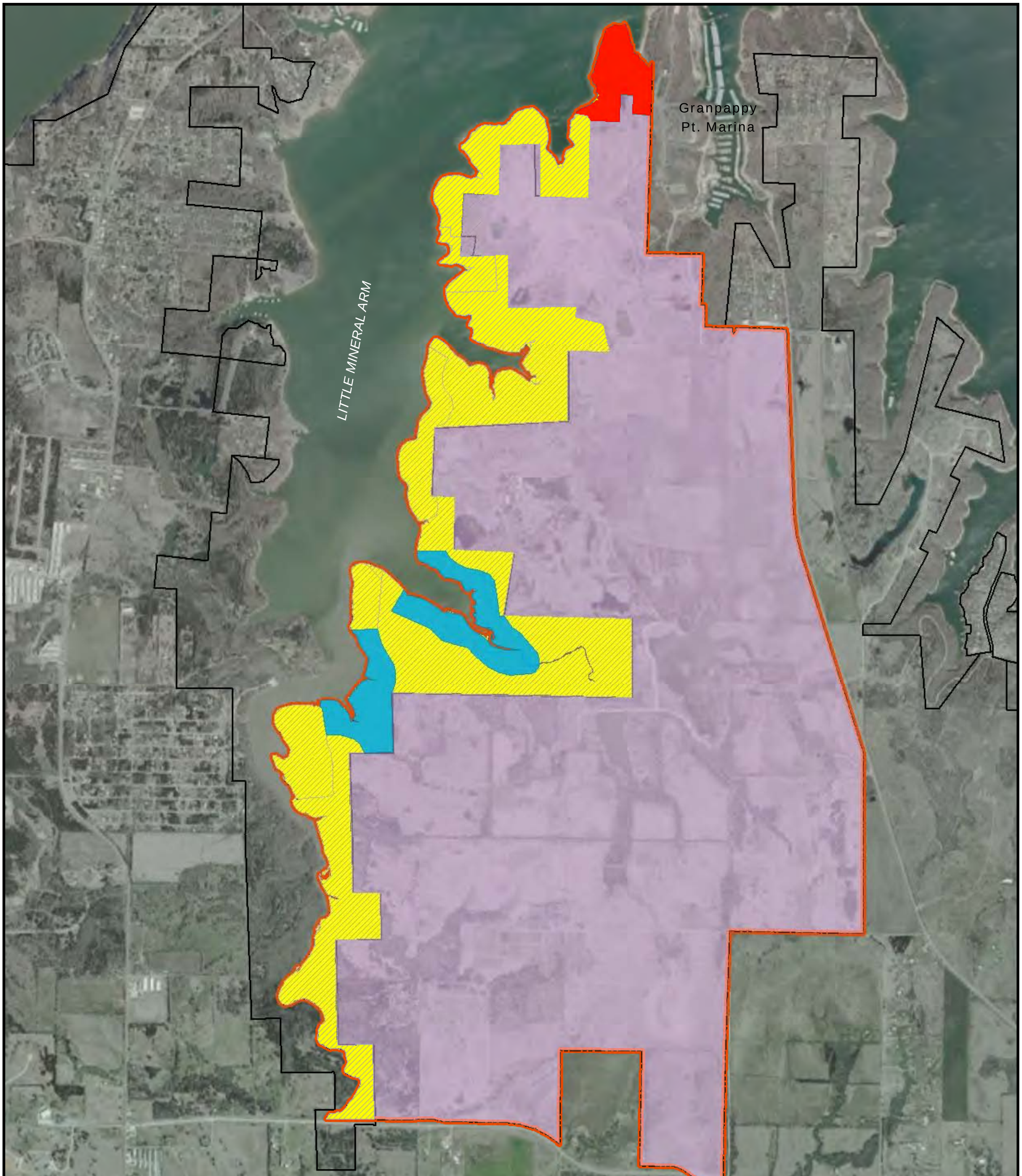
SOURCE:
1) TOPOGRAPHIC MAP PROVIDED BY ESRI, 2010
2) USACE 1996 SHORELINE MANAGEMENT PLAN MAP
3) DEVELOPMENT BOUNDARY PROVIDED BY PSA ENGINEERING 2009

DISCLAIMER: THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED, AND IS NOT INTENDED FOR, SURVEY OR ENGINEERING PURPOSES.

FIGURE 3.3.1
LAKE TEXOMA SMP
SHORELINE ALLOCATION
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

Path: I:\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Chapter_3\Fig3-3-1 Lake Texoma SMP 1996.mxd, Date: 5/27/2011 10:51,User: WILDERJ



LEGEND

- Limited Development Area
- Public Recreation Area
- Protected Area
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development
- USACE Lands Boundary

SOURCE
1) U.S. DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM
FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
2) USACE LAKE TEXOMA PROJECT OFFICE SHORELINE MANAGEMENT PLAN 1996
3) BOUNDARY PROVIDED BY PSA ENGINEERING 2009
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0 1,250 2,500
Feet

FIGURE 3.3.2

LAKE TEXOMA SMP
CURRENT SHORELINE ALLOCATION
PROPOSED CONVEYANCE AREA
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

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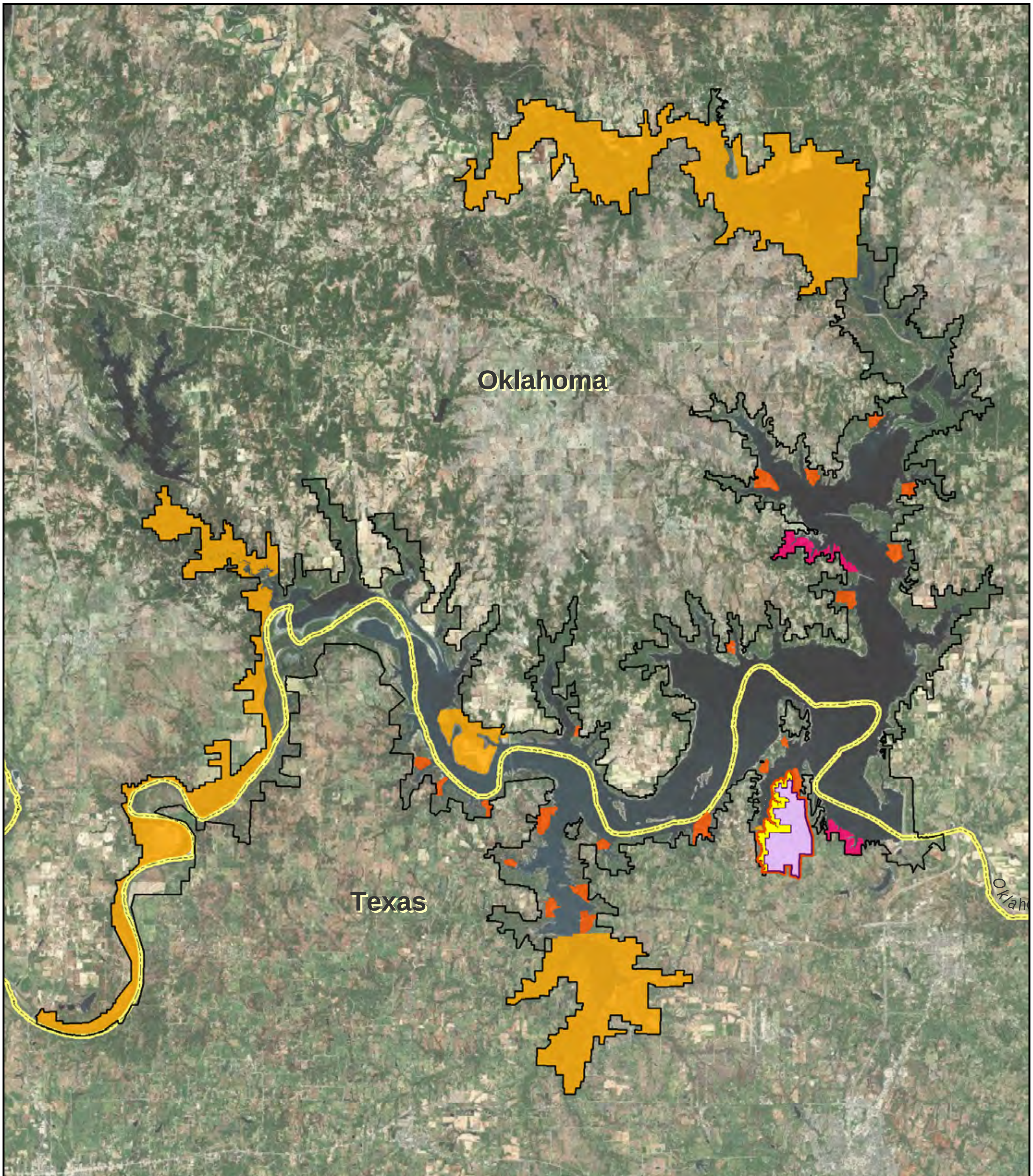

LEGEND

- Concession Marinas
- Fish & Wildlife
- State Parks
- State Line
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development
- USACE Lands Boundary

SOURCE
1) U.S. DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
2) USACE LAKE TEXOMA PROJECT OFFICE DATA COLLECTION 2009
3) BOUNDARY PROV DED BY PSA ENGINEERING 2009

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0 2.5 5
Miles

FIGURE 3.3.3.1
LAKE TEXOMA SMP
AREAS OPEN TO THE PUBLIC
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

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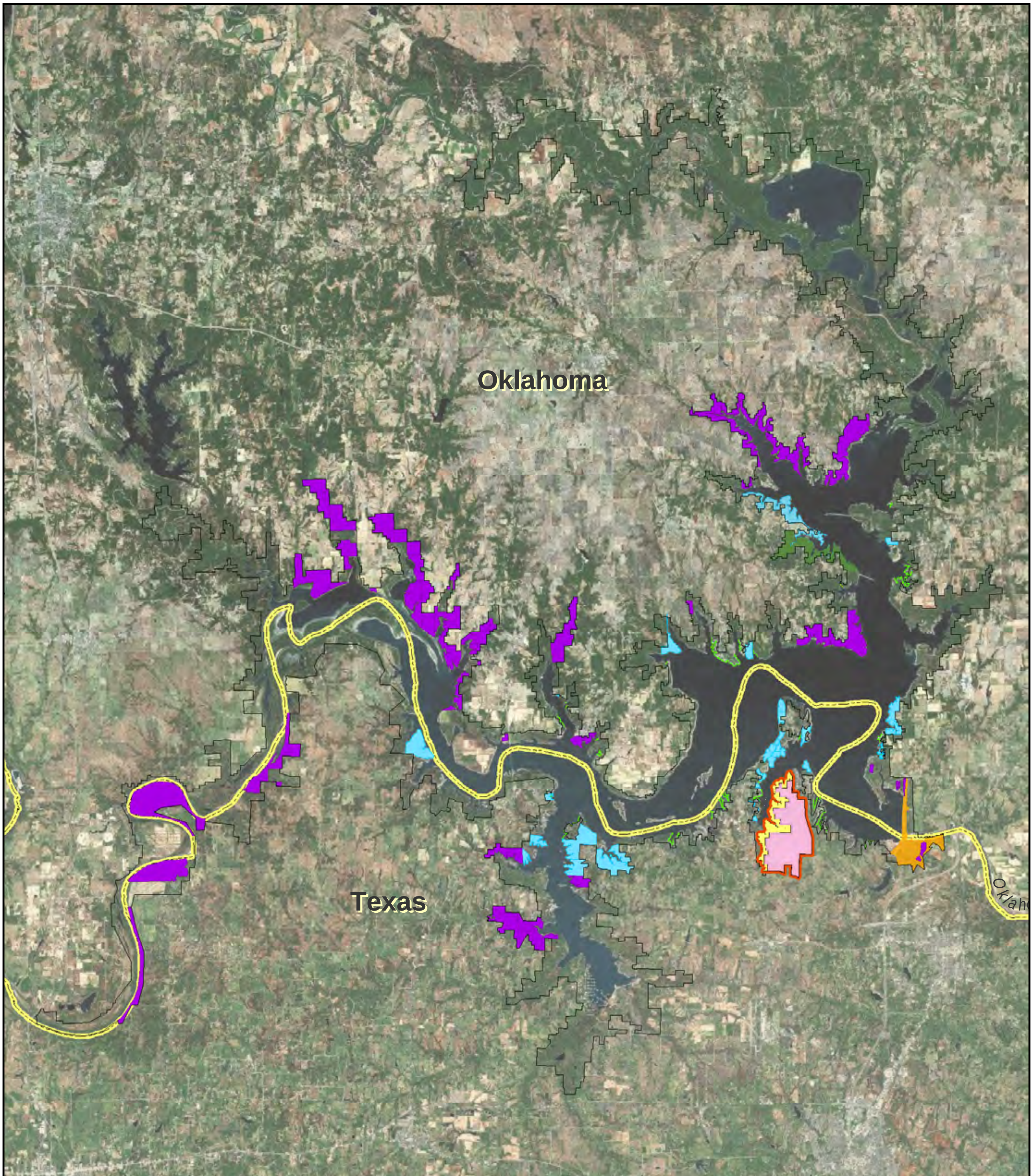

LEGEND

- A and G Leases
- Clubsite Quasi Leases
- Zoned Boat Dock Development
- Prohibited Access Areas
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development
- USACE Lands Boundary
- State Line

SOURCE
1) U.S. DEPARTMENT OF AGRICULTURE NATIONAL
AERIAL IMAGERY PROGRAM FARM SERVICE AGENCY
GRAYSON COUNTY TEXAS 2008-09-09
2) USACE LAKE TEXOMA PROJECT OFFICE DATA COLLECTION 2009
3) BOUNDARY PROV DED BY PSA ENGINEERING 2009

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0 2.5 5
Miles

FIGURE 3.3.3.2
LAKE TEXOMA SMP
LIMITED ACCESS
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

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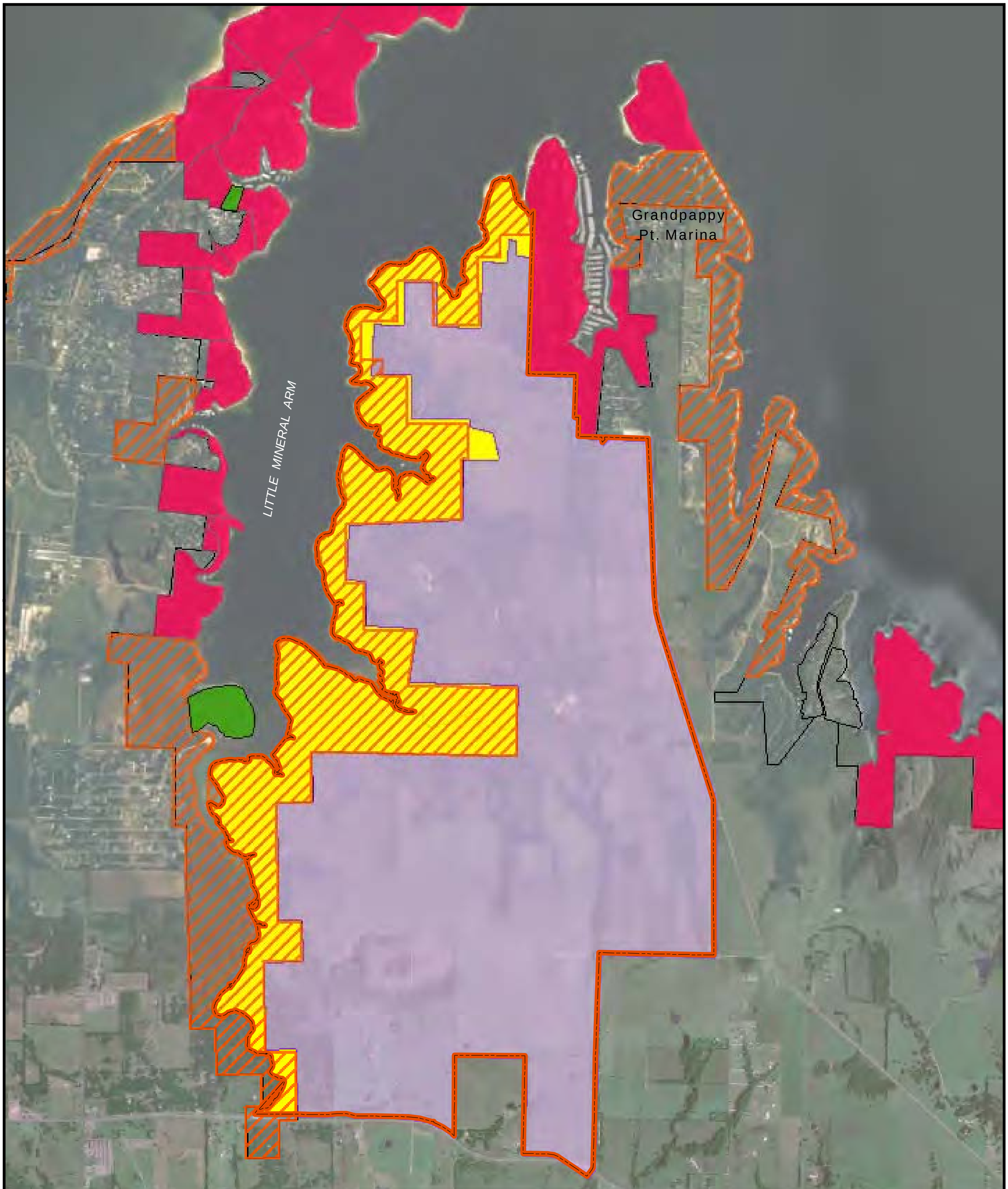

LEGEND

- Recreation - Intensive Use
- Recreation - Low Density
- Fish and Wildlife Management
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development
- USACE Lands Boundary

0 1,500 3,000
Feet

FIGURE 3.3.4
EXIST NG LAND USE ALLOCATION
FOR PROPOSED CONVEYANCE AREA
OMP LAND-USE DESIGNATIONS
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

SOURCE 1) U.S. DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM
FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
2) USACE LAKE TEXOMA PROJECT OFFICE DATA COLLECTION 2009
3) BOUNDARY PROVIDED BY PSA ENGINEERING 2009
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3.4 GEOLOGY AND SOILS

3.4.1 Topography and Physiography

The topography of the Lake Texoma shoreline varies from gently sloping flats to rocky and precipitous cliffs and steep wooded hillsides. Of the 585 miles of shoreline, there are approximately 9 miles of rip-rap (shoreline protected against erosion by special structures or rocks), 50 miles of standing timber, and 50 miles of submersed vegetation. The remainder is cut banks, sandy beaches, rocky shoreline, and bluffs. The lake has a shoreline development ratio of 13.88, which is an indication of an irregular and branched shoreline (USACE, 2003a). The terrain varies with an elevation of approximately 580 ft NGVD in Marshall County, Oklahoma, and is approximately 500 ft NGVD at the base of Denison Dam. The general topography of the area is rolling to hilly, with occasional escarpments and benches. In many places, the valley slopes are steep, resulting in rugged cliffs, hills, and promontories along the shoreline.

The study area ranges from 750 ft NGVD to 619 ft NGVD. The steepest portion is within the proposed conveyance land where the elevation ranges from 710 ft NGVD to 619 ft NGVD along the shore of Lake Texoma (Figure 3.4.1).

3.4.2 Structure and Stratigraphy

Lake Texoma lies within the dissected coastal plain (Gulf Coast Plain). The Gulf Coast Plain is comprised of both Upper and Lower Cretaceous units including the Antlers Sandstone, the Fredericksburg Group, and the Washita Group. The specific units found in the proposed development area (in order from the north end of the property to the south) are Antlers Sands, Goodland Limestone and Walnut Clay, Kiamichi Formation, Duck Creek Formation, and Fort Worth Limestone. The geology within the proposed development area is shown on Figure 3.4.2. The characteristics of each unit are described below.

Antlers Sands – also known as “Trinity Sands” – are composed of sand, clay, and conglomerate. The lower and upper parts are mainly sand. The middle is mostly clay and tends to grade northward to interbedded sand and clay. The sands tend to be fine- to coarse-grained, conglomeratic in the lower portions, and argillaceous in the upper. The clays are interbedded with fined-grained sand. The conglomerates are granule- to pebble-sized clasts of chert, quartz, and quartzite. The formation tends to have a thickness of 500 to 650 ft.

Goodland Limestone and Walnut Clay (undivided) – Goodland Limestone is fine-grained, well-indurated, massive, nodular toward the base, grades downward to the Walnut Clay, and is interbedded coquinite and dark-gray, marly shale. The thickness of this unit ranges from 13 to 20 ft in Texas.

Kiamichi Formation – is marl (fine-grained, consisting of clay minerals, calcite or aragonite, and silt) and limestone. The marl is shaly, in part sandy, and carbonaceous. The limestone is sandy, platy, full of fossils, and sometimes contains thin beds of fissile sands. The unit thickness is approximately 20 to 50 ft.

Duck Creek Formation – The upper part is mostly marl interbedded with thin beds of marly limestone. The lower part is composed of 6- to 12-inch-thick limestone beds intercalated with marly clay. The average formation thickness is approximately 100 ft.

Forth Worth Limestone – is gray, aphanitic (mineral grains too small to distinguish without visual aid), contains 6- to 12-inch thick beds, and is interbedded with gray marl 2-ft-thick or less. The upper 8 to 10 ft is mostly limestone. Thickness of the unit averages approximately 35 ft.

The geology of Lake Texoma region is shown on Figure 3.4.2 and described on Table 3.4.1.

Table 3.4.1

Geologic Formations Lake Texoma Region

Geologic Formation	Lithology of Formation	Formation Thickness (ft)
Pleistocene Deposits	Sand, silt, clay, and gravel	As much as 100
Upper Cretaceous	Woodbine Sand and Eagle Ford Shale	300 to 400
Washita Group	Tan to gray shales and limestones	425
Fredericksburg Group	Goodland Limestone is fine-grained, well- indurated, massive, nodular toward the base, and grades downward to the Walnut Clay	2 to 4
	Walnut Clay, interbedded coquinite and dark-gray, marly shale.	25

Geologic Formation	Lithology of Formation	Formation Thickness (ft)
Fredericksburg Group	Kiamichi Formation is marl (a fine-grained, consisting of clay minerals, calcite or aragonite, and silt) and limestone. The marl is shaly, in part sandy, and carbonaceous. The limestone is sandy, platy, full of fossils, and sometimes contains thins beds of fissile sands.	20 to 50
Basal Lower Cretaceous Antlers Sandstone (Trinity Sands)	Fine-grained, massive and cross-bedded white to orange sandstone with a conglomeratic sandstone containing pebbles of black chert, jasper, and quartz. It may include red-brown shale in the Baum area.	50 to 600

Source: USDA, 1980a, 1980b, 1979, 1978and 1977.

3.4.3 Mineral Resources

Mineral resources associated with Lake Texoma include limestone, oil and gas, bituminous coal, sand, and gravel (TSHA, 2010). During acquisition of lands for the project, many of the mineral rights were not subordinated and remain in private ownership. Consequently, production of oil and gas is very prominent in and around Lake Texoma. A list of oil and gas well locations is included in Table 3.14.1 in Section 3.14.

Several active oil well sites are located within the conservation pool of Lake Texoma in the Cumberland oil field upstream of Highway 70 on the Washita Arm of the lake. A similar condition is prevalent within the Hagerman National Wildlife Refuge on the Red River Arm of the lake, where numerous active well locations have been elevated to avoid flood waters. Numerous oil and gas wells are also located on lands above the top of power pool around the lake. Many oil transmission lines carrying crude oil cross government property (USACE, 2006).

In 1930, the first oil field opened in Grayson County, Texas and produced 120 million of barrels of oil. In 2000, more than 1,546,800 barrels of oil were produced (TSHA, 2010). Oil and gas development is present near the Proposed Action area, but there are no visible signs of any active production on the proposed conveyance lands.

Stone is listed as one of the natural resources in Grayson County (TSHA, 2010). There are several old limestone gravel quarries within the proposed development area. None of these are active, and most have filled with water. Most of these are located on the central and northern portions of the adjacent private land proposed for the Preston Harbor Development, but one appears to be partially located on the proposed conveyance lands. Since they have filled with water, most of these are shown on the National Wetlands Inventory map.

There is no evidence of any mining for bituminous coal within the proposed development area.

3.4.4 Seismicity

Texas has no active or dormant volcanoes and few earthquakes, being situated far from an active plate tectonic boundary. Seismic activity in Texas mainly affects West Texas and the Texas Panhandle. The largest earthquake in Texas occurred on 16 August 1931. With a magnitude of 6.4, the earthquake heavily damaged many buildings in Valentine, Texas, which is approximately 600 miles from the proposed conveyance land.

An analysis of Oklahoma earthquake data indicates at least four principal seismic areas, based upon a consistent pattern of recurrence. These areas include eastern McClain and Garvin counties and southeastern Grady County; Canadian County; south-central Oklahoma, including Love, Carter, and Jefferson counties; and the Arkoma Basin in southeastern Oklahoma. Love county is located near the northwest corner of Lake Texoma. The remaining areas with seismic activity are located in central and northern Oklahoma. Based on the seismic activity in the Texas and Oklahoma region, the proposed conveyance land and the Lake Texoma Region are not expected to be affected by seismic activity.

3.4.5 Soils

The soils surrounding Lake Texoma are generally nearly level to sloping, loamy and clayey soils. Approximately 25 soil associations have been identified in counties around Lake Texoma (Table 3.4.2). Table 3.4.3, on the following pages, shows the soil association acreages surrounding Lake Texoma broken down by state.

Table 3.4.2

Soil Associations in Counties Around Lake Texoma

State	County	Soil Type	Soil Association Description
Oklahoma	Bryan	Muskogee-Boxville	Deep, nearly level to sloping, moderately well-drained or well-drained, loamy soils that have a loamy or clayey subsoil. Found on uplands. Makes up about 16 % of soils in Bryan County.
		Bernow-Romia	Deep, strongly sloping to moderately steep, well-drained, sandy or loamy soils that have a loamy subsoil. Found on uplands. Makes up about 11 % of soils in Bryan County
	Johnston	Verdigris-Gracemont-Oklared	Deep, nearly level or very gently sloping, well-drained to somewhat poorly drained, loamy or sandy soils that have a loamy subsoil. Found on floodplains. Makes up about 8 % of soils in Johnston County
		Konawa-Dougherty	Deep, nearly level or very gently sloping, well-drained, loamy or sandy soils that have a loamy subsoil. Found on uplands. Makes up about 4 % of soils in Johnston County.
		Gasil-Stephenville	Deep or moderately deep, very gently sloping to strongly sloping, well-drained loam soils that have a loamy subsoil. Found on uplands. Makes up about 21 % of soils in Johnston County.
		Burleson-Durant-Ferris	Deep, nearly level to strongly sloping, moderately well-drained or well-drained, clayey or loamy soils that have a clayey subsoil. Found on uplands. Makes up about 18 % of the soils in Johnston County.
	Love	Dougherty-Eufaula	Deep, nearly level to gently rolling, well-drained, sandy soils that have a loamy subsoil. Found on uplands. Makes up about 23 % of soils in Love County.
		Teller-Minco	Deep, nearly level to moderately sloping, well-drained, loamy soils that have a loamy subsoil. Found on uplands. Makes up approximately 9 % of the soils in Love County.
		Windthorst-Stephenville	Deep, nearly level and gently rolling, well-drained loamy soils that have clayey or loamy subsoils. Found on uplands. Makes up approximately 34 % of soils in Love County.
		Miller-Yahola	Deep, nearly level, moderately well-drained to well-drained, clayey and loamy soils that have clayey and loamy subsoils. Found on bottomlands along the Red River. Makes up about 3 % of soils in Love County
		San Saba-Durant	Deep, gently sloping to rolling, moderately well-drained, clayey soils that have clayey subsoils. Found on uplands. Makes up about 18 % of soils in Love County

State	County	Soil Type	Soil Association Description
Oklahoma	Marshall	Bastrop-Konawa	Deep, nearly level to sloping, well-drained soils with a loamy surface layer and loamy subsoil. Found on terraces along the Red River, Washita River, and some major streams. Makes up about 10 % of the soils in Marshall County.
		Dougherty-Konawa	Deep, nearly level to sloping, well-drained soils with a sandy and loamy surface layer and loamy subsoils. Found on terraces along the Red River and some major streams. Makes up about 8 % of soils in Marshall County.
		Ferris-Tarrant-Heiden	Deep and shallow, very gently sloping to moderately steep, well-drained soils that are clayey or and clayey throughout. Found on uplands. Makes up about 42 % of soils in Marshall County.
		Durant-Collinsville	Deep and shallow, very gently sloping to strongly sloping, moderately well-drained and somewhat excessively drained soils with a loamy surface layer and loamy and clayey subsoils. Found on uplands. Makes up about 17 % of soils in Marshall County.
		Frioton-Gracemont	Deep, nearly level, well-drained and somewhat poorly drained soils with a loamy surface layer over loamy sediments. Found on floodplains. Makes up about 3 % of soils in Marshall County.
		Konsil-Madill	Deep, nearly level to moderately steep, well-drained soils with a loamy surface layer and a loamy subsoil (on uplands), and a loamy surface layer over loamy sediments (on floodplains). Found on uplands and floodplains. Makes up about 18 % of soils in Marshall County.
Texas	Cooke	Sanger-Slidell-San Saba	Deep and moderately deep, nearly level to sloping, well-drained, clayey soils that have clayey subsoils. Found on uplands. Makes up about 20 % of soils in Cooke County.
		Gaddy-Teller-Miller	Deep, nearly level, well-drained to somewhat excessively drained, loamy sands, and clayey soils that have sandy loam and clayey subsoils. Found on bottomlands and terraces. Makes up about 4 % of soils in Cooke County.
		Sanger-Maloterre-Venus	Deep and very shallow, gently undulating to hilly, well-drained to somewhat excessively drained, clayey and loamy soils that have loamy and clayey subsoils. Found on uplands and terraces. Makes up about 14 % of soils in Cooke County.
	Grayson	Normangee-Crockett-Wilson	Deep, nearly level to sloping, very slowly permeable loamy soils with clayey subsoils. Found on ridges and side slopes of uplands. Makes up about 27 % of soils in Grayson County.

State	County	Soil Type	Soil Association Description
Texas	Grayson	Sanger-Bolar	Deep and moderately deep, gently to strongly sloping, very slowly permeable to moderately permeable, clayey and loamy soils with clayey subsoils. Found on ridges and side slopes of uplands. Makes up about 2 % of soils in Grayson County.
		Callisburg-Crosstell-Gasil	Deep, gently sloping to sloping, moderately permeable to very slowly permeable, loamy and sandy soils that have clayey subsoils. Found on uplands. Makes up about 16 % of soils in Grayson County.
		Aubrey	Moderately deep, gently to strongly sloping, slowly permeable, loamy soils with sandy, loamy, and clayey subsoils. Found on ridgetops and on convex, strongly sloping, upper side slopes of ridges. Makes up about 2 % of soils in Grayson County.
		Bastrop-Okay-Oklared	Deep, nearly level to gently sloping, moderately permeable and moderately rapidly permeable, loamy soils with sandy, loamy, and clayey subsoils. Found on terraces. Makes up about 2 % of soils in Grayson County.

Source: USDA, 1980b, 1980a, 1979, 1978, 1977

Table 3.4.3

Soil Associations and Acreages Surrounding Lake Texoma

Soil Unit	Acres	State
Bosville-Bernow (s6339)	2,041	OK
Durant-Clarita-Chigley (s6310)	4,623	OK
Heiden-Ferris (s7369)	12,205	OK
Heiden-Ferris-Burleson (s6307)	1,794	OK
Konsil (s6304)	24,239	OK
Konsil-Gasil-Birome-Aubrey (s7182)	3,276	OK
Minco-Bastrop (s6255)	5,844	OK
Muskogee-Durant-Boxville (s6345)	8,343	OK
Normangee-Heiden-Durant (s6314)	9	OK
Purves-Maloterre-Dugout-Brackett (s7575)	2,416	OK
Rock outcrop-Chigley-Agan (s6308)	405	OK
Rock outcrop-Kiti (s6315)	7	OK
Stidham-Konawa-Galey (s6303)	5,381	OK
Tarrant-Heiden-Ferris-Burleson (s6312)	8,352	OK
Wilson-Crockett (s7752)	2,508	OK
Windthorst-Weatherford (s6306)	2	OK
Yahola-Gaddy (s6284)	227	OK
Yahola-Reinach-McLain-Dale (s6279)	10,110	OK
Yomont-Yahola-Mangum-Clairemont (s7248)	152	OK
Water (s8369)	58,694	OK
Eufaula-Dougherty (s6293)	3,462	TX
Gasil-Callisburg-Birome-Aubrey (s7233)	10,300	TX
Konsil-Gasil-Birome-Aubrey (s7182)	6	TX
Normangee-Heiden-Durant (s6314)	566	TX
Purves-Maloterre-Dugout-Brackett (s7575)	5	TX
Water (s8369)	23,879	TX
Whakana-Vesey-Ruston (s7722)	464	TX
Windthorst-Weatherford (s6306)	6,462	TX
Yahola-Gaddy (s6284)	3,927	TX
Yomont-Yahola-Mangum-Clairemont (s7248)	5,905	TX

Source: USDA, 2010a.
OK – Oklahoma; TX - Texas

Within the study area, soils are generally nearly level to sloping, clayey and loamy, and on uplands (Figure 3.4.3). Table 3.4.4 lists soil association acreages within the Preston Harbor Development. Table 3.4.5, on the following page, lists the total acreages of soil association in the proposed conveyance lands. The Preliminary Geotechnical Exploration and Soil Analysis Report for the Preston Harbor Development is included in Appendix K.

Table 3.4.4

Soil Associations and Acreages Within the Preston Harbor Development Area

Private Property		
Soil Unit Name	**Number of Units**	**Total Acres**
Aledo gravelly clay loam, 3 to 8 % slopes	6	40
Aledo soils, hilly	1	1
Bolar clay loam, 1 to 5 % slopes	11	151
Bolar clay loam, 5 to 8 % slopes	1	30
Bolar-Aledo complex, 3 to 12 % slopes	5	48
Bunyan and Whitesboro soils, frequently flooded	2	12
Crockett loam, 1 to 3 % slopes	1	3
Crockett loam, 2 to 5 % slopes, eroded	2	57
Gasil loamy fine sand, 1 to 5 % slopes	1	5
Lewisville silty clay, 3 to 5 % slopes	1	55
Lindy loam, 1 to 3 % slopes	2	6
Normangee clay loam, 1 to 4 % slopes	7	194
Pits	4	381
Purves clay loam, 1 to 5 % slopes	19	352
Sanger clay, 1 to 3 % slopes	9	226
Sanger clay, 3 to 5 % slopes	14	383
Sanger stony clay, 3 to 8 % slopes	2	391
Whitesboro loam, occasionally flooded	2	1
Wilson silty clay loam, 1 to 3 % slopes	2	87

Source: WESTON, 2010

Table 3.4.5

Soil Associations and Acreages within Proposed Conveyance Lands

Proposed Conveyance Lands		
Soil Unit Name	**Count of Units**	**Total Acres**
Aledo soils, hilly	4	206
Bolar clay loam, 1 to 5 % slopes	1	7
Bunyan and Whitesboro soils, frequently flooded	7	5
Konsil fine sandy loam, 2 to 5 % slopes	1	23
Konsil fine sandy loam, 5 to 8 % slopes	2	40
Lewisville silty clay, 3 to 5 % slopes	1	38
Purves clay loam, 1 to 5 % slopes	1	2
Sanger clay, 1 to 3 % slopes	4	28
Sanger stony clay, 3 to 8 % slopes	5	74
Wilson silty clay loam, 1 to 3 % slopes	1	3

Source: WESTON, 2010

There are approximately 1,050 acres of Sanger-Bolar soils in the Preston Harbor Development and proposed conveyance lands. These are deep to moderately deep, very slowly permeable and moderately permeable, clayey and loamy soils. The southern and southwestern portions (approximately 300 acres) are made up of Normangee-Crockett-Wilson soils. They are deep, very slowly permeable, and loamy soils.

The Sanger-Bolar soils tend to have an erosion rating of 0.32 on a scale of 0.05 to 0.69 (the higher the value, the higher the erosion rate). Based on these ratings, the soils are a moderate to highly erodable. The Normangee-Crockett-Wilson soils have an erosion rating of 0.37 to 0.43.

The primary soils underlying the 635 acres of USACE proposed conveyance property are composed predominantly of the Purves, Sanger, and Konsil series. The Purves series consists of shallow, loamy soils on uplands and were formed in material weathered from interbedded hard limestone and calcareous marl (USDA, 1980b). The Sanger series consists of deep, clayey soils on uplands, which were formed in alkaline marine sediment (USDA, 1980b). This soil type is suited for various uses including cultivation of crops and wildlife habitat suitability. The Konsil series consists of deep, loamy, and sandy material on uplands, which were formed in loamy material and interbedded sandstone.

The primary soils within Preston Harbor Development include the Purves Sanger and Konsil series as well as soils from the Aldeo, Bolar, Bolar-Aldeo, Crockett, Normangee clay loam, and Pits series. The Aldeo soils are rated poor for production of grain and seed crops, grasses, legumes, and wild herbaceous plants; fair for production of shrubs; very poor for open land wildlife; and poor for rangeland wildlife.

The Sanger, Normangee, Crockett, and Wilson soils are "very limited" in terms of building site development (the soil has one or more features that are unfavorable for this use) (USDA, 2009). Bolar is rated as "somewhat limited" (moderately favorable). The primary limiting factors in the building site development ratings were shrink-swell and depth to bedrock (too shallow).

3.4.6 Prime and Unique Farmlands

Soil that is prime or unique farmland is defined in the Farmland Protection Policy Act (7 United States Code [U.S.C.] 4201–4209). Prime farmland is defined as follows:

> "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Further, it could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas."

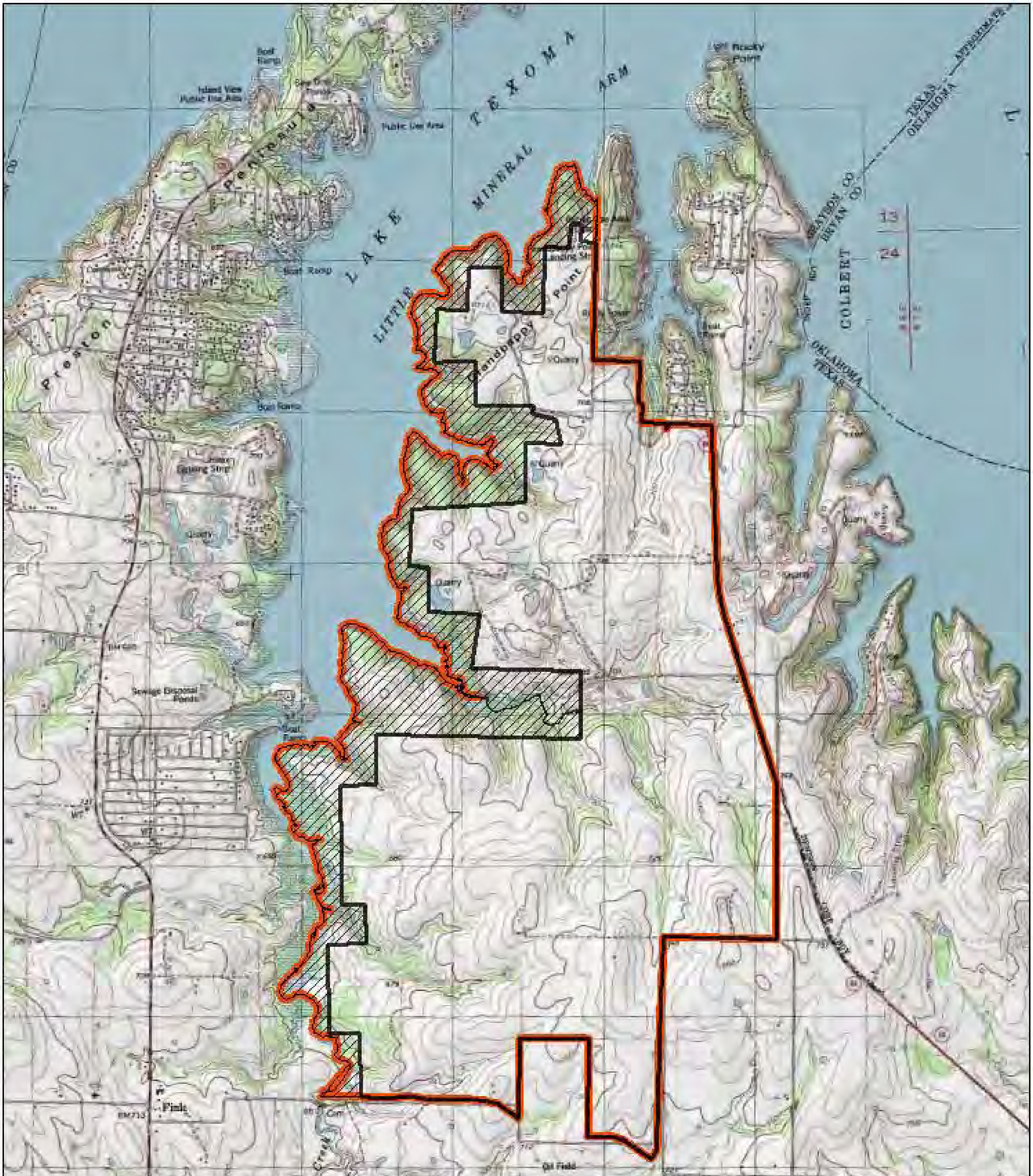
The proposed conveyance land is located in Grayson County, Texas. According to the U.S. Census Bureau, Grayson County has a total area of 979 square miles (95% land and 5% water). Approximately 31.34% of the soils in Grayson County meet the requirements for prime farmland (USDA, 1980b). Those soil associations that have a potential for prime farm lands are shown in Table 3.4.6. Within the proposed conveyance and the Preston Harbor Development areas there are no soils classified as Prime or Unique Farmland.

Table 3.4.6

Prime Farmland in the Vicinity of Lake Texoma County, State Soil Series

County, State	Soil Series
Bryan County, OK	Bernow, Boxville, Dennis, Durant, Freestone, Karma, Madill, Muskogee, Okay
Johnston County, OK	Burleson, Dale, Dela, Dennis, Durant, Frioton, Gasil, Gowton, Heiden, Kaufman, Konawa, Lula, Oklared, Ravia, Steedman, Stephenville, Verdigris
Love County, OK	Brewer-Vanoss Complex, Durant, Minco, Pulaski, Teller, Vanoss, Windthorst, Yahola
Marshall County, OK	Bastrop, Burleson, Counts, Durant, Frioton, Heiden, Konawa, Konsil, Madill, Teller
Cooke County, TX	Bolar, Miller, Minco, San Saba-Slidell Complex, Slidell, Slidell-San Saba Complex, Teller, Venus, Yahola
Grayson County, TX	Bastrop, Bolar, Callisburg, Gasil, Okay, Oklared, Sanger

Source: USDA 2000a, 2000b, 2000c, 2002, and 2004



LEGEND

Private Property

Proposed Conveyance Land

Preston Harbor Development

SOURCE
1) USGS 7.5 MIN TOPOGRAPHIC QUADRANGLE POTTSBORO TEXAS - 1982
2) BOUNDARY PROVIDED BY PSA ENG NEERING 2009

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N

0 1,500 3,000
Feet

FIGURE 3.4.1
TOPOGRAPHY MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

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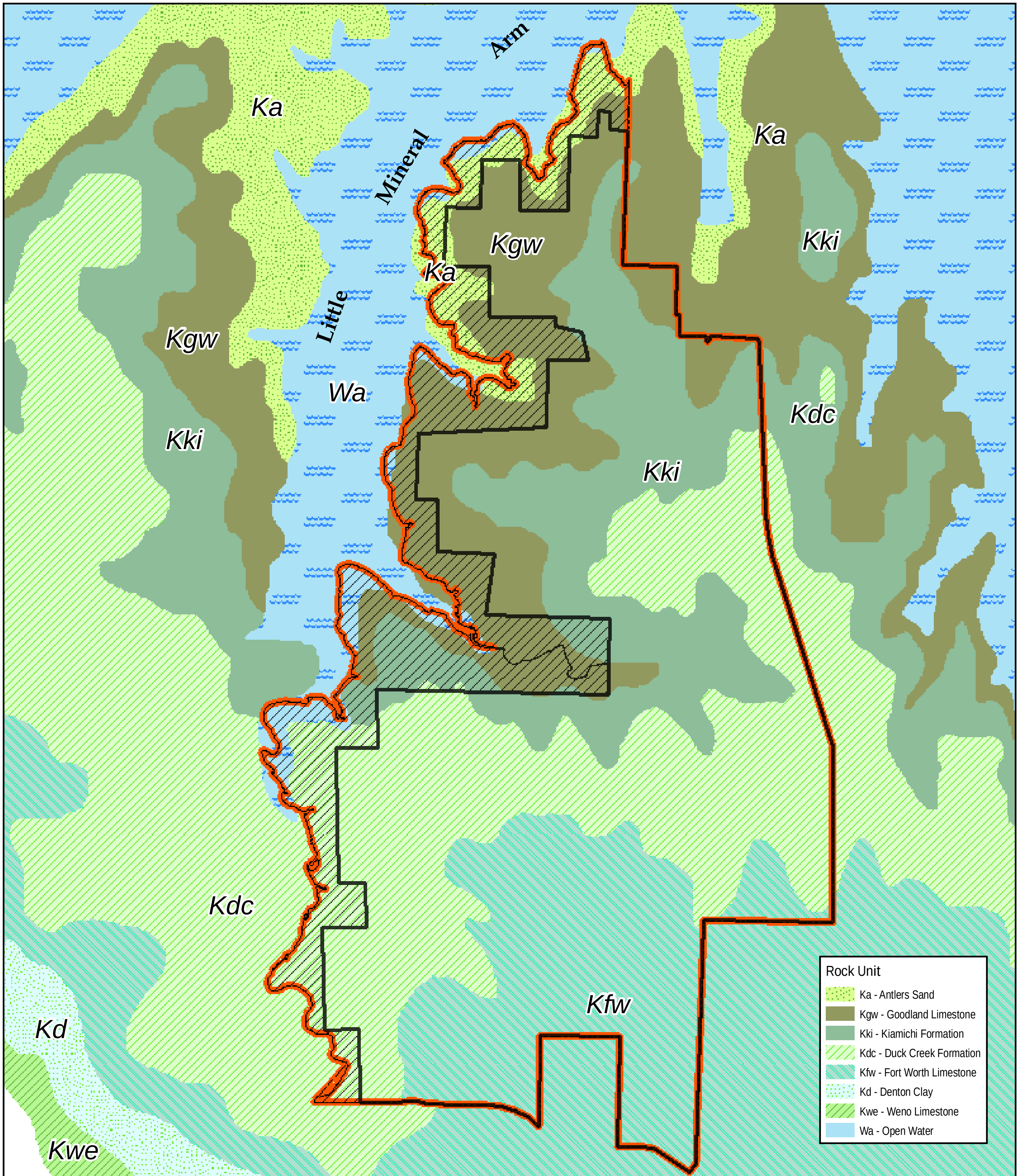

LEGEND

Proposed Conveyance Land

Private Property

Preston Harbor Development

SOURCE
1) BUREAU OF ECONOMIC GEOLOGY 1967 SHERMAN SHEET GEOLOGIC ATLAS OF TEXAS
BUREAU OF ECONOMIC GEOLOGY UNIVERSITY OF TEXAS AT AUSTIN SCALE 1 250 000. REVISED 1991.
2) BOUNDARY PROVIDED BY PSA ENG NEERING 2009

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N

0 1,600 3,200
Feet

FIGURE 3.4.2
GEOLOGY MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

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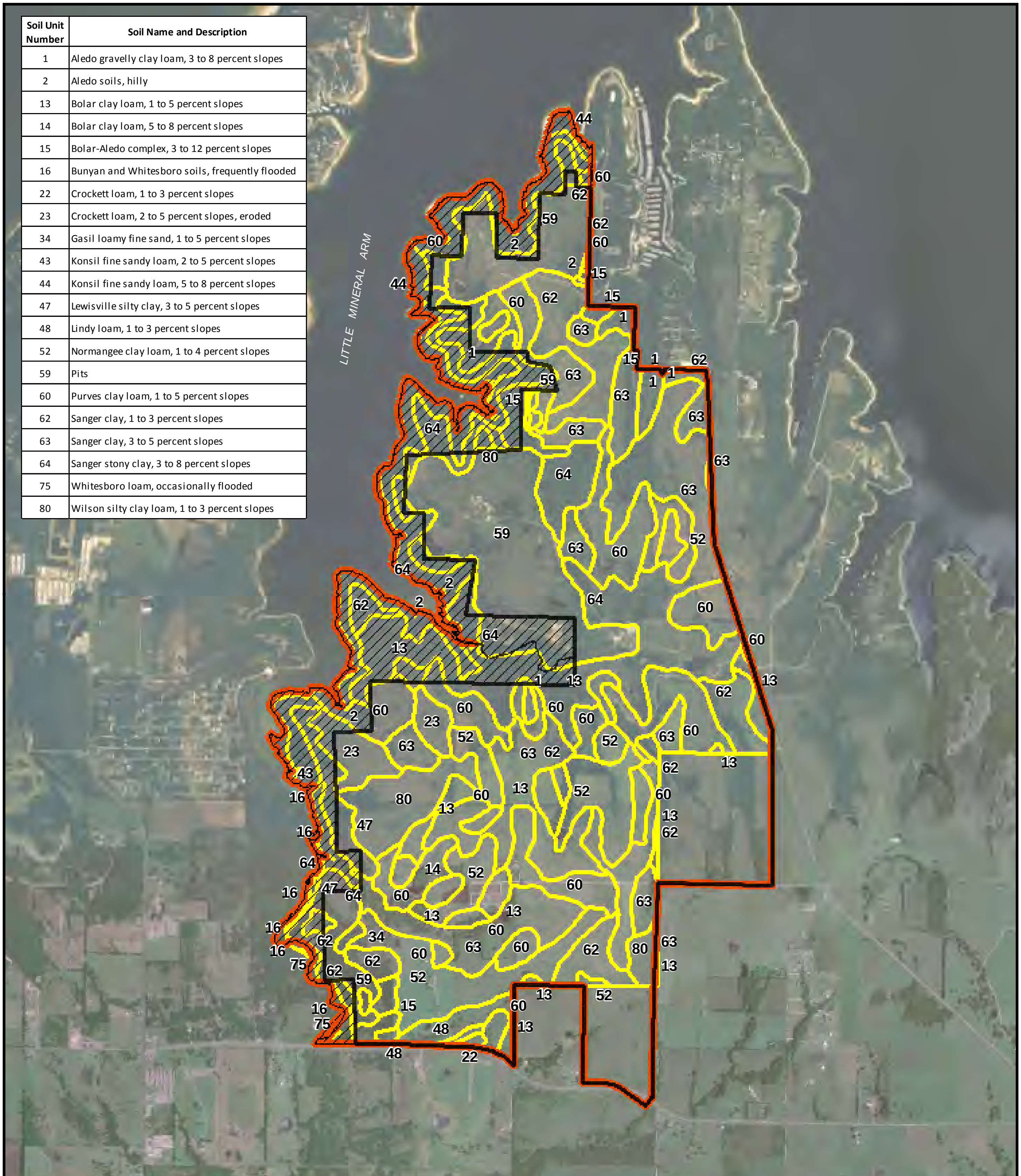
Soil Unit Number	Soil Name and Description
1	Aledo gravelly clay loam, 3 to 8 percent slopes
2	Aledo soils, hilly
13	Bolar clay loam, 1 to 5 percent slopes
14	Bolar clay loam, 5 to 8 percent slopes
15	Bolar-Aledo complex, 3 to 12 percent slopes
16	Bunyan and Whitesboro soils, frequently flooded
22	Crockett loam, 1 to 3 percent slopes
23	Crockett loam, 2 to 5 percent slopes, eroded
34	Gasil loamy fine sand, 1 to 5 percent slopes
43	Konsil fine sandy loam, 2 to 5 percent slopes
44	Konsil fine sandy loam, 5 to 8 percent slopes
47	Lewisville silty clay, 3 to 5 percent slopes
48	Lindy loam, 1 to 3 percent slopes
52	Normangee clay loam, 1 to 4 percent slopes
59	Pits
60	Purves clay loam, 1 to 5 percent slopes
62	Sanger clay, 1 to 3 percent slopes
63	Sanger clay, 3 to 5 percent slopes
64	Sanger stony clay, 3 to 8 percent slopes
75	Whitesboro loam, occasionally flooded
80	Wilson silty clay loam, 1 to 3 percent slopes



LEGEND

- Soil Unit Boundary
- Proposed Conveyance Land
- Private Property
- Preston Harbor Development

0 1,600 3,200
Feet

FIGURE 3.4.3
SOILS MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

SOURCE
1) U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE FOR GRAYSON COUNTY TEXAS 2007
2) BOUNDARY PROVIDED BY PSA ENGINEERING 2009
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3.5 WATER RESOURCES

3.5.1 Watershed Characterization

Lake Texoma's two main water sources are the Red River (west) and Washita River (north), with the Red River contributing the predominant flow during most of the year. Figure 3.5.1 shows the Red River Basin and Lake Texoma. The Red River receives surface water from a watershed that encompasses parts of the states of Texas, Oklahoma, Arkansas, New Mexico and Louisiana with geology containing significant naturally occurring salt deposits. High concentrations of these salts are dissolved and conveyed downstream. "The Washita's river bed is made up of unstable mud and sand. The banks of the Washita are steep and subject to erosion, making it one of the most silt-laden streams in North America" (Benke and Cushing, 2005).

"The primary land-use within the drainage basin consists of 37.7% undeveloped upland grasses and forbs and 36.2% cultivated agriculture" (Gonsoulin et al., 2003). "The notable human impacts in the headwaters of Lake Texoma include the influence of agriculture (wheat, cattle) and oil production" (Benke and Cushing, 2005).

Table 3.5.1 lists major tributaries found within the Red River and Washita watersheds and Lake Texoma.

Table 3.5.1

Major Watershed Tributaries, Lake Texoma

River	Major Tributaries	State	System	Location with regard to Lake Texoma
Washita	Rock Creek	OK	Washita[1]	Above
	Wildhorse Creek			
	Little Washita River			
	Pond Creek			
	South Fork	TX	Red River[1]	Above
	Middle Fork			
	North Fork			
North Fork	Otter Creek	OK	Red River[1]	Above
	Elm Fork			
	Sweetwater Creek	TX		
	McClean Creek			
	Elm Fork			
Red River	Salt Fork	OK	Red River[1,2]	

River	Major Tributaries	State	System	Location with regard to Lake Texoma
	Cow Creek			Above
	Beaver Creek			
	Cache Creek			
	Deep Creek			
	Mud Creek			
	Oscar Creek			
	Pease River	TX	Red River[1,2]	Above
	Salt Fork			
	Prairie Dog Town Fork			
	Little Wichita River			
	Farmers Creek			
Red River / Washita	Rock Creek	OK	Lake Texoma[3]	Within
	Buncombe Creek			
	Briar Creek			
	Huani Creek			
	Wilson Creek			
	Hickory Creek			
	Sandy Creek			
	Glasses Creek			
	Little Glasses Creek			
	Soldier Creek			
	Alberta Creek			
	Newberry Creek			
	Butcher Pen Creek			
	Kansas Creek			
	McLaughlin Creek			
	Caney Creek			
	Boggy Creek			
	Cochran Creek			
	Corcoran Creek			
	Little Mineral Creek	TX	Lake Texoma[3]	Within
	Big Mineral Creek			
	Brushy Creek			
	Sandy Creek			
	Walnut Creek			
	Mill Creek			
	Paw Paw Creek			
	Rock Creek			
	Briar Creek			
	Hickory Creek			
	Jenny Creek			
	Sycamore Creek			

Source: [1]USACE, 2010d; [2]DeLorme, 1998; and [3]USACE, 1992

Red River

"The Red River, which forms the main arm of Lake Texoma, rises near the eastern boundary of New Mexico and flows in a generally eastward direction for a distance of approximately 1,360 miles to join the Mississippi River. It has one of the largest watersheds of any river in the United States, covering an area of 91,430 square miles" (USACE, 2008b). The mean annual precipitation is 82 cm or about 32 inches (Benke and Cushing, 2005).

The river is the southernmost major tributary of the Mississippi, and the southernmost major river system in the Great Plains. Its drainage basin is mostly in the states of Texas and Oklahoma, but also covers parts of New Mexico, Arkansas, and Louisiana. The river basin is characterized by flat, fertile agricultural land, and there are only a few major cities. "The headwater region of the Red River lies in a semi-arid plains area. The river drainage of this region gradually develops from stream courses that ordinarily carry water only intermittently due to the sparse rainfall, the porosity of the soils, the steep stream slopes, and evaporation. In general, the stream banks are low, poorly defined, unstable, and widely spaced with large, flat sand deposits between" (USACE, 2008b). The flow is dramatically moderated in the lower course of the river as it flows through a series of marshes and swamps.

Washita River

"The Washita River is the largest low-gradient, western tributary of the Red River that flows into Lake Texoma" (Benke and Cushing, 2005). The mean annual precipitation is 76 cm or about 30 inches (Benke and Cushing, 2005). "The Washita River Basin is long and narrow. The river flows generally from northwest to southeast, perpendicular to the axis of major frontal storms. This basin shape and orientation results in the generation of damaging flood flows. It is not unusual for several consecutive flood crests to follow within comparatively short periods" (Bureau of Reclamation, 2011).

"The Washita River rises in southeastern Roberts County, Texas and flows east for 35 miles, crossing southern Hemphill County, Texas to enter Roger Mills County, Oklahoma. The stream flows from the state line southeast for 260 miles to its junction with the Red River in Johnston County, Oklahoma. On its course through Texas, the river flows through flat to rolling country where clay and sandy loams support brush and grasses" (TSHA, 2011).

The Washita's river bed is made up of unstable mud and sand. The land-use along the river includes primarily range-land or pasture and some crops (Benke and Cushing, 2005). No major cities exist along the river. "The Washita River basin is heavily affected by agriculture, with cattle, farming and row crops dominating the landscape, along with oil and gas operations" (Benke and Cushing, 2005).

3.5.2 Lake Texoma

"Lake Texoma receives water from the drainage area (approximately 39,719 square miles) of the Red River and the Washita River, its main tributary upstream of the dam. The Red River Arm of the lake is about 60 miles long, and the Washita River Arm is about 45 miles long. The gradient of the Red River is approximately 1.6 feet per mile for the entire length of Lake Texoma, while the channel capacity is approximately 45,000 cfs downstream of Denison Dam. From Denison Dam to Fulton, Arkansas, the river flows between high banks about 1,000 feet apart" (USACE, 2005).

"At normal pool, the lake encompasses more than 74,686 surface acres, which can increase to 143,000 acres at the top of the flood control pool; and has more than 580 miles of shoreline (USACE, 2004). Water storage (for hydropower, water supply, and flood control purposes) occurs between 590 and 640 feet above mean sea level (MSL)" (USACE, 2005). Elevation 640 to 645 ft above MSL is the surcharge pool, which acts as temporary flood control during extreme storm events (USACE, 1993). A seasonal pool plan was implemented at Lake Texoma in 1992 at the request of the Lake Texoma Advisory Board. The seasonal pool plan provided benefits for recreation, downstream flood control, hydropower, and fish and wildlife (USACE, 2005). "The plan includes the following:

- Drawdown of lake levels to 615 feet above MSL in the late winter and early spring
- Rise to 619 feet above MSL during May and through the summer
- Drawdown to 616.5 feet above MSL in the late summer and early fall
- Rise to 618.5 feet above MSL in late fall and early winter" (USACE, 2005)

A detailed discussion of the lake operations, maintenance, and management is included in Section 3.2.2. Lake Texoma is part of the U.S. Geological Survey (USGS) hydrologic unit code (HUC) 11130210, as shown in Figure 3.5.2, a watershed which consists of 982 square miles.

Lake Texoma currently has 1,467,000 acre-feet of conservation storage. The reservoir is projected to have only 986,730 acre-feet of conservation storage by year 2044 due to sedimentation (USACE, 2010f). The lake is the third surface water source utilized by the NTMWD. Water storage allocations for Lake Texoma are included in Table 3.2.1 and Table 3.2.2 of this EIS in Section 3.2.

The 2003 water rights to the lake for the State of Texas are included in Table 3.5.2.

Table 3.5.2

Lake Texoma Water Rights (Texas)

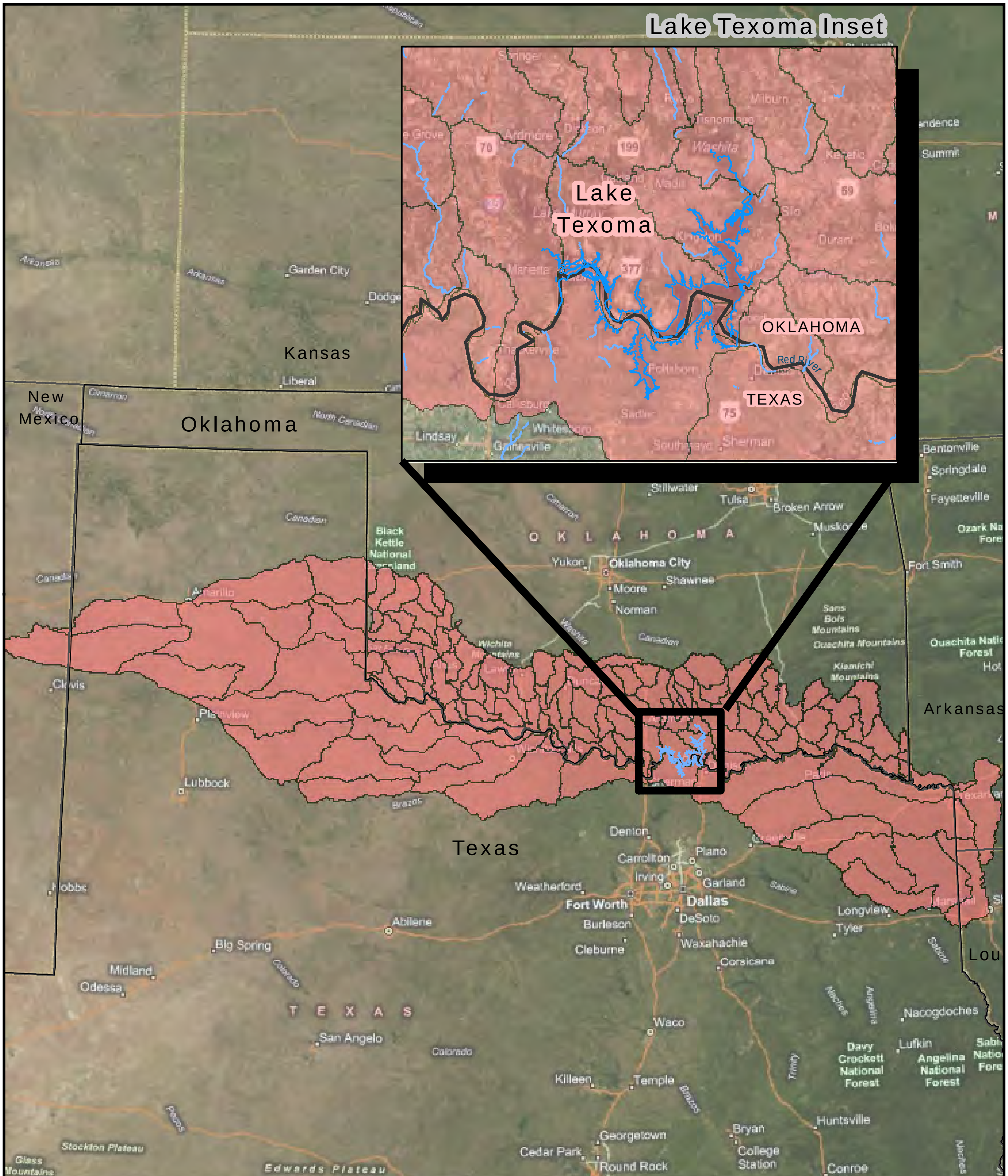
Entity	Allocation (acre-ft/year)	Use Type
RRAT	250	irrigation
	1,650	municipal
	100	mining
	250	municipal
City of Denison	24,400	municipal
GTUA	15,000	municipal
	10,000	industrial
NTMWD	77,300	municipal
Texas Utilities	10,000	industrial cooling

Source: TWDB, 2003.

3.5.3 Groundwater

The Trinity Aquifer, also known as the Antlers Aquifer in Oklahoma, is found in the counties surrounding Lake Texoma. From southwest Arkansas to southeastern Oklahoma, the aquifer spans central Texas to the eastern edge of Bandera and Medina counties. The Trinity Aquifer has a relatively low recharge rate, with only 4-5% of rainfall entering the aquifer (Eckhardt, 2010). In addition to this major aquifer, three minor groundwater aquifers are located around Lake Texoma: the Marietta basin is to the west, the Texoma basin is to the north, and the Woodbine basin is to the north, east, and south of the lake. Figure 3.5.3 presents these aquifers in relation to Lake Texoma and the proposed Preston Harbor Development area (TWDB, 2003). In addition, Appendix E includes a map that presents locations of spring-fed lakes on the adjacent private land, indicating potential surface water to groundwater connections and transfer pathways. The geologic formations that comprise the aquifers around Lake Texoma are defined in Section 3.4.2.

Water supply from the Trinity Aquifer is minimal due to the availability of surface water. The majority of residents within the City of Denison utilize surface water; however, residents in the area of the North Texas Regional Airport are served by a combination of surface water and groundwater (City of Denison, 2010a and 2003). The Town of Pottsboro in Grayson County has two water wells in the Trinity Aquifer permitted for municipal water supply. The Preston Shores Water Treatment Plant in Grayson County uses groundwater and surface water provided by the RRAT. The groundwater source is supplemented by surface water (Southwest Water Company, 2010a). Currently, there are no groundwater wells on the USACE conveyance land and only about 20 wells are present on the adjacent private land supplying water to residences and businesses (TCEQ, 2010a). Groundwater wells used for drinking water sources in this area are completed to a depth greater than 100 ft below ground surface (bgs) (TCEQ, 2010a).



LEGEND

State Boundary

Red River Basin

Rivers

SOURCE: 1) U.S. DEPARTMENT OF AGRICULTURE, NATIONAL AERIAL IMAGERY PROGRAM, FARM SERVICE AGENCY, GRAYSON COUNTY, TEXAS 2008-09-09
2) WATERSHED PROVIDED BY USACE TULSA CORP

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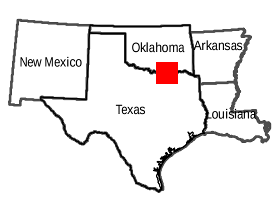


N

0 40 80

Miles

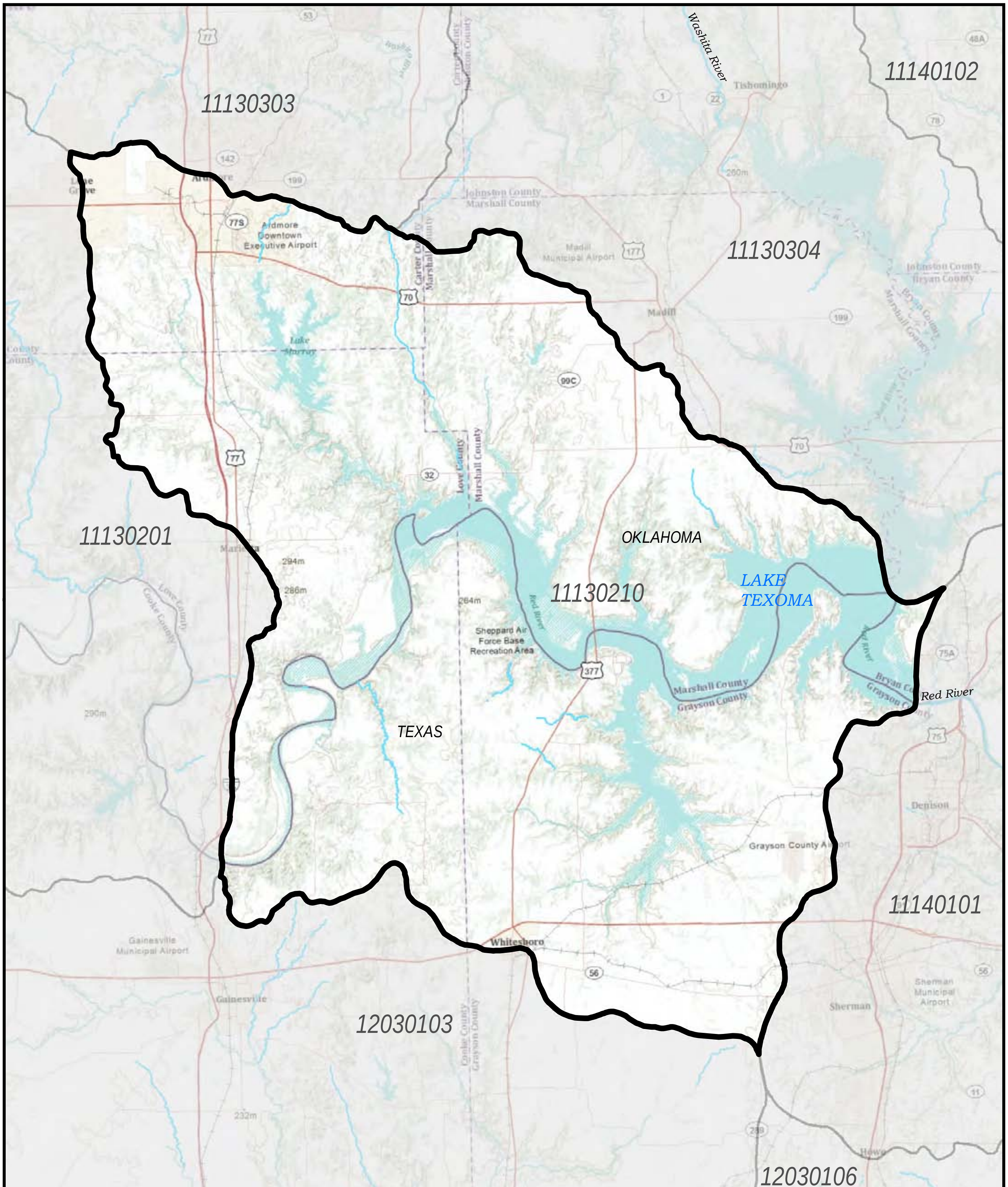
FIGURE 3.5.1

RED RIVER WATERSHED BASIN
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\FIG3-5-1_STATEWIDE_WATERSHEDS.mxd, 30-Sep-10 11:06, perrint

NOTE



LEGEND

Hydrologic Unit Code (HUC) 11130210 Boundary

Surrounding HUC Boundaries

Rivers

SOURCE
1) USGS 7.5 MIN TOPOGRAPHIC QUADRANGLE GRAYSON COUNTY TEXAS 2008-09-09
3) HUC BOUNDARY PROVIDED BY TEXAS WATER DEVELOPMENT BOARD 2009

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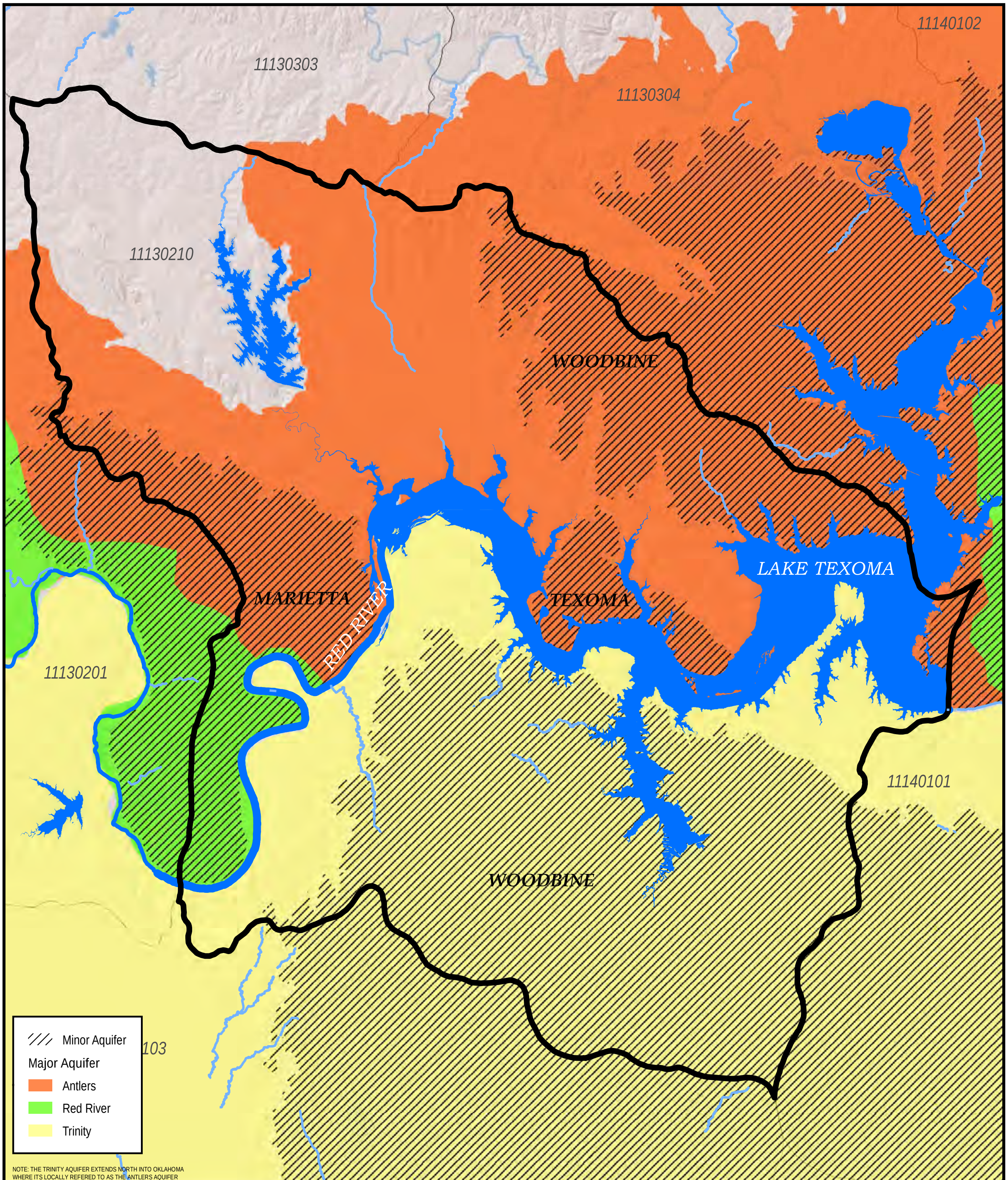
0 3 6
Miles

FIGURE 3.5.2
HYDROLOGIC UNIT CODE
11130210 BOUNDARY
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-5-2_WatershedMap.mxd, 08-Feb-11 11:15, perrint



LEGEND

11130210 Hydrologic Unit Code (HUC) 11130210 Boundary

Surrounding HUC Boundaries

Rivers

SOURCE
1) USGS 7 5 MIN TOPOGRAPHIC QUADRANGLE GRAYSON COUNTY TEXAS 2008-09-09
2) HUC AND AQUIFER BOUNDARY PROVIDED BY THE TEXAS WATER DEVELOPMENT BOARD 2009 AND OKLAHOMA WATER RESOURCES BOARD 2004

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT INTENDED FOR SURVEY OR ENGINEERING PURPOSES.

N

0 3 6
Miles

FIGURE 3.5.3
AQUIFERS
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

Path: I:\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-5-3_AquiferMap.mxd, 09-Feb-11 11:24, perrint

3.6 WATER QUALITY

3.6.1 Major Tributaries of Lake Texoma – Red and Washita Rivers

Marine evaporate salt (sodium chloride) deposits in the Red River Basin strongly influence the ionic composition of Lake Texoma and make chloride the predominate anion (Atkinson et al., 1999). Additionally, the river tends to carry a high suspended-solids loading, and the total dissolved solids (TDS) content is in the range of 800-1,200 mg/L (Freese and Nichols, Inc. et al., 2006). This is above the EPA's TDS secondary water quality standard of 500 mg/L (EPA, 2010b).

Differences between sections of Lake Texoma influenced by the Red River and those influenced by the Washita River are clearly evident based on the correlation between specific conductivity and turbidity. At the base flow level, the Red River area of the lake has both higher dissolved solids concentrations and higher specific conductivity than the Washita River area of the lake. Dilution decreases specific conductivity as water moves down lake from the Red River area of the lake to the Main Lake waters. In the Washita River Arm, specific conductivity actually increases as the dilute water of the Washita River Zone moves down the lake and mixes with water influenced by the Red River (Mabe, 2002).

3.6.2 Lake Texoma

"River discharges (or flow) into Lake Texoma have been measured in some locations for at least 70 years. Discharges are variable in both the Red and Washita Rivers, ranging from nearly zero cubic-feet-per-second (cfs) to nearly a quarter million cfs during some flood events" (Atkinson et al., 1999). The USGS gauging stations "Red River near Gainesville, Texas" and "Washita River near Dickson, Oklahoma" reported annual mean stream flows of 94 cubic-meters-per-second (cms) (3,319.6 cfs) and 54 cms (1,907.0 cfs), respectively (Gonsoulin et al., 2003). According to the USACE 1999 water quality study, for the 35-year period from 1962 to 1997 the annual average discharge of the Red River was 44% greater than the Washita River (Atkinson et al., 1999).

"The ionic composition of Lake Texoma is a direct result of soils and surface geology of its watershed, which is rich in calcium carbonate, calcium sulfate, and marine evaporite salt (sodium chloride) deposits formed by the subsidence of inland Permian seas" (Atkinson et al., 1999). "General water quality is characterized by moderate to high levels of mineralization with a predominance of sodium and calcium salts of chloride and sulfate" (Leifeste et al., 1971).

The lake is naturally high in salinity and TDS due to salt deposits from the evaporation of an inland sea 25 million years ago in the Red River Basin in northwestern Texas and western Oklahoma. According to the USACE 1999 Study of Lake Texoma, Lake Texoma can be divided into various salinity gradients. The highest chloride concentrations occur in the Red River Arm and the lowest chloride concentrations occur in the Washita River Arm (Atkinson et al., 1999).

According to a source in the Operations Division of the USACE, Tulsa District, routine monitoring for fecal coliform occurred at Lake Texoma beaches from 1978 to about 2010 to assure they were safe for recreational use. Since then, the sampling protocol has changed to routinely monitor for E. coli based on current EPA guidance. If the sample analysis results fail to meet EPA criteria, the beach is resampled, then closed upon confirmation of impaired water quality conditions. No beaches at Lake Texoma have been closed within the past year (USACE, 2011a).

"The Oklahoma Water Resources Board (OWRB) routinely collects samples for analysis of water properties, nutrients, and chlorophyll information as part of the Beneficial Use Monitoring Program (BUMP)" (Gonsoulin et al., 2003). A water quality study on five Lake Texoma beach sites indicated that "water quality at each of the five beach sites was considered to be good for recreational purposes" (Gonsoulin et al., 2003). The five sampling sites were at Island View, Burns Run East, Burns Run West, Lake Texoma Lodge 1, and Lake Texoma Lodge 2 (Gonsoulin et al., 2003).

Little Mineral Arm

The Water Quality Data, Analysis Methodology, and Results report included in Appendix F discusses water quality monitoring within Little Mineral Arm. One Texas Commission on Environmental Quality (TCEQ) monitoring station is located in the approximate center of Little Mineral Arm. The historical water quality data collected from this station is included in Appendix F.

The waters adjacent to the proposed conveyance land shoreline vary from deep, open waters within the northern part of the Little Mineral Arm to relatively shallow (less than 20-ft deep) in the southern portion of the arm.

"Pollution from recreational vessels emanates from a variety of sources, and includes the following: gray water, bilge water, black water (sewage), anti-fouling paints (and their leachate), hazardous materials, and municipal and commercial garbage and other wastes" (EPA, 2011c). "Vessel sewage discharge is regulated under Section 312 of the Clean Water Act (CWA)" (EPA, 2011e). A state can have all or portions of their waters designated as a no-discharge zone for vessel sewage to achieve any of the following three objectives: 1) protect aquatic habitats where pumpout facilities are available; 2) protect special aquatic habitats or species; and 3) safeguard human health by protecting drinking water intake zones (EPA, 2011d).

The potential localized and periodic water pollution sources within the Little Mineral Arm include gasoline refueling from a fueling station (Grandpappy Point Marina) and accidental oil and gasoline leaks from boats in boathouses, moored watercrafts, as well as during boat launching and boat maintenance. Solid waste in the water may include garbage disposed from boats and other shoreline uses. Lake Texoma, including the Little Mineral Arm, is designated as a no-discharge zone (EPA, 2010c).

The western shoreline of the Little Mineral Arm includes structures that are used for recreational activities (quasi-public recreational areas), high-intensity public recreation activities, and low-density residential purposes. The western shore of the Little Mineral Arm also includes a private airfield. The entire western peninsula of the Little Mineral Arm uses septic tanks for wastewater disposal. Also, the residential area in the southern end of the Little Mineral Arm (Simmons Shores subdivision) has septic tanks for wastewater disposal (Southwest Water Company, 2010b). In 2001, a Regional Sewer System Study was conducted around Lake Texoma to assess the existing conditions, project future needs, and analyze institutional options that could possibly improve conditions and satisfy demands. This study found that aging septic systems accompanied by poor soils and lack of wastewater disposal alternatives are contributing factors to water quality degradation in the Little Mineral Arm watershed (USACE, 2001). Section 3.9.4 of this report further explains the institutional options that were evaluated in the Regional Sewer System Study to resolve this problem.

The Grayson County Health Department (GCHD) is the local septic system permitting authority around Little Mineral Arm. A notice was posted by GCHD in early 2011 stating that all homeowners with septic systems must submit a signed maintenance contract or certificate of self-maintenance training completion within 120 days to comply with TCEQ regulations. This is a sign that GCHD is taking action in attempt to improve the septic system status within their jurisdiction, but without plans for enforcement the results are difficult to project.

The proposed conveyance land is undeveloped. The northern tip of the Little Mineral Arm includes a commercial private marina (Grandpappy Point Marina) with concessions, boat houses, and boat docks. The marina is active and licensed under Texas Pollutant Discharge Elimination System (TPDES) permit no. TX0127396. The marina operates under the license name of Commodore Marine, Limited (EPA, 2010c). According to the TCEQ, the Grandpappy Point Marina has an active wastewater permit (WQ0014584001), a stormwater water permit (TXR05V542), and a petroleum storage tank registration for three tanks (no. 9724). The tanks are for petroleum and diesel, for a total of 16,198 gallons. Presently, there are no major violations under the permitted operations (TCEQ, 2010b). The Pottsboro WWTP is located on County Line Road at Little Mineral Creek, approximately 1.6 miles north of the intersection of F.M. Road 120 and F.M. Road 996, and approximately 0.5 mile east of F.M. Road 120 in Grayson County, Texas. The Pottsboro WWTP plant operates under the TPDES permit no. WQ0010591001. The Pottsboro WWTP is currently permitted for a maximum of 350,000 gallons per day (Town of Pottsboro, 2010; Vaden, 2011). The effluent is discharged into Little Mineral Creek that drains into Lake Texoma. The WWTP accepts residential wastewater from surrounding residential subdivisions that are not on septic systems. From January 2008 to December 2010, the Pottsboro WWTP has had five noncompliance quarters for the treated discharge. The largest noncompliance took place February 2010 for total ammonia nitrogen, in which a release of 6,655 lbs per day exceeded the 0.5255 lbs per day limit (EPA, 2010c).

3.6.3 Chloride Control

Dissolved Solids

"Dissolved solids or salts are impurities that occur in all natural waters because of weathering of rocks and soils. TDS or salinity increases as waters move over land surface and through soils and underground" (Wurbs, 1997). The EPA's secondary drinking water standard recommends limits for TDS, chloride, and sulfate concentrations of 500 mg/l, 250 mg/l, and 250 mg/l, respectively (EPA, 2010b). These are recommendations based on health effects and taste preferences. Conventional water treatment does not remove salinity. In irrigation water, "acceptable salt concentrations vary greatly depending on the type of crop, soil conditions, climate, and the relative amounts and timing of precipitation versus supplemental rainfall" (Wurbs, 1997). "Control measures are concentrated around sources of salt contamination in the Red River Basin and include a variety of mechanisms including ring dikes, low-flow collection dams, deep-well injection, and pipeline transfer to man-made brine lakes. Projected results include reducing concentrations of chloride and sodium" (Mabe, 2002).

"Some concerns have been voiced about possible effects of the chloride control project on the quality of Lake Texoma's waters and the economically important striped bass fishery it supports. Laboratory and field evidence suggests that salinity levels can affect the settling rates of suspended clay particles" (Mabe, 2002). The relationship between TDS and turbidity in Lake Texoma reveals that a reduction in TDS would contribute to a decrease in the lake's sedimentation rate and, in turn, a decrease in the percentage of non-algal turbidity removed (Schroeder and Toro, 1996). A reduction in the dissolved chloride concentration of Lake Texoma could contribute to a decrease in the sedimentation rates of suspended clays and an increase in turbidity. Higher turbidity could, in turn, have a negative effect on the productivity, recreational value, and environmental quality of the lake (Wurbs, 1997; Mabe, 2002). "The project proponents emphasize the benefits of the proposed salt control projects to municipal and agricultural water supply" (Wurbs, 1997).

History and Authorization of the Chloride Control Projects

"The U.S. Public Health Service initiated a study in 1957 to locate natural brine source areas and determine the contribution of brine sources to the Wichita River and Red River. The USACE entered the study in 1959 and recommended measures to control the natural chloride sources" (USACE, 2003a). A timeline for the project can be constructed as follows.

1957: U.S. Public Health Service is directed to locate major sources of natural chloride discharges.

1959: Congress directs the USACE to determine if chloride sources can be controlled and, if so, to determine the costs and benefits of alternative control plans.

1962: Experimental work at Estelline Springs (Area V in the upper Red River Basin) authorized.

1964: An effective control plan at Area V is implemented. Area V is used as an indicator of the potential for chloride control in remaining portions of the basin.

1966: The USACE reported on chloride control plans for chloride sources in the Wichita River (Areas VII, VIII, and X). These plans were known as Part I and were authorized by Congress the same year.

1968: Pre-construction planning is started for Phase I.

1970: Construction at other areas in the Red River Basin (Part II) are authorized, though, to date, construction on these areas has not been initiated.

1972: Detailed studies for Phase I completed.

1974: Funds allotted by the Water Resources Development Act (Public Law 93-251) for construction at Area VIII and Truscott Brine Disposal Reservoir. (Truscott Brine Disposal Reservoir is a storage reservoir for collected brine.)

1976: In accordance with NEPA, a Final Environmental Statement (FES) for the overall Red River Chloride Control Project (RRCCP) is completed.

1977: FES for Phase I is filed with the EPA in May 1977. Construction on Area VIII begins.

1978: The USACE requests an economic re-analysis of the entire RRCCP.

1986: Congress authorizes further construction on the Red River.

1987: Area VIII becomes operational. (Area VIII is currently seen as an indicator of the effectiveness that can be realized with inflatable dam retention and pump-out collection techniques.)

1991: A second economic reanalysis is requested by the Office of the Assistant Secretary of the Army prior to construction of any other areas outside Area X.

1993: Economic reevaluation completed in June confirming economic benefits.

1994: A Supplemental Final Environmental Statement (SFES) is required to comply with the intent of NEPA due to changes in the proposed project.

1995: A Draft Supplemental Final Environmental Statement (DSFES) was prepared and released to the public, but due to continuing changes in the proposed project no Final Supplemental Final Environmental Statement (FSFES) was coordinated or filed with the EPA.

1997: Delay ordered in construction of chloride control project for economic reevaluation of Wichita River Basin. This informal economic re-evaluation was completed in October 1997 and indicated that a thorough reevaluation of the Wichita River Basin features was warranted based upon the project's economic effectiveness.

2003: FSFES for the Wichita River portion of the RRCCP was prepared and filed with the EPA.

2003: A reevaluation of the Wichita River portion of the RRCCP was prepared and released for the Wichita River Basin.

2004: A reevaluation of the Elm Fork, Area VI portion of the RRCCP is requested by the Oklahoma Governor.

2005: The Design Documentation Report (DDR) for the Wichita River portion of the RRCP is completed.

2006: Reevaluation of the Elm Fork, Area VI portion of the RRCCP began. (USACE, 2003a, 2003b, 2010e)

2010-2011: Area VI studies are in progress, and an EIS is being prepared.

According to the USACE Tulsa District, "the recommended plan for the Wichita River chloride control consists of the continued operation of existing chloride control facilities, completion of other facilities under construction, and resumption of construction of additional authorized facilities with modifications" (USACE, 2010f).

"Facilities where operation would continue consist of the following:

- The existing ring dike at Area V - Estelline Springs.
- The exiting brine collection area, Area VIII, and its pipeline to Truscott.
- The Truscott Brine Dam and Area VIII pipeline outfall evaporation field.

Facilities where construction would be completed consist of the following:

- Brine collection area, Area X (Installation of pumps).

Authorized facilities where construction should be resumed, contingent upon required funding, consist of the following:

- The Area X pipeline to Truscott.
- Brine collection area, Area VII, and its pipeline to Truscott.
- The addition of evaporation fields at pipeline intakes and outfalls at Area VII and Area X, and the intake at Area VIII" (USACE, 2010f).

Chloride Amounts

"About 3,540 tons of chlorides entered the Red River per day before the Red River Chloride Control Project was started. The annual Red River chloride load is greater than the amount of salt consumed by humans and animals in the United States annually. Operation of Area V, Estelline Springs, has stopped about 240 tons per day from entering the Red River since January 1964. Operation of Area VIII has stopped about 165 tons per day from entering the Wichita River and the Red River downstream since May 1987. The authorized but unconstructed features of the Red River Chloride Control Project located in the Wichita River Basin are designed to remove an additional 244 tons per day from the Wichita and Red Rivers. The Wichita River Basin chloride control features would remove approximately 409 of 491 tons per day for control efficiency of 83%" (USACE, 2010f).

3.6.4 Shoreline Erosion and Sedimentation Rate

Bank caving and sedimentation are natural problems that have occurred along the Red River for many years. In an effort to minimize these problems, when the Lake Texoma pool is below an elevation of 640 ft NGVD, flood releases are gradually increased to the needed level at a rate of no more than 7,500 cfs at one time and no more than 22,500 cfs in one day when possible (USACE, 2010a). During shutdown of flood control operations of the lake, releases are regulated to minimize stream bank caving. Bank erosion on the Red River also causes large amounts of sediment to be deposited in the river channel during a flood recession (USACE, 2010a).

Flowing water typically has a higher sediment load, greater turbidity, and increased nutrients which favors higher plankton species richness. The 1996 - 1997 USACE Lake Texoma Water Quality Survey, found the Red River and Washita River arms had greater species richness than the main lake body (Atkinson et al., 1999).

The storage capacity of Lake Texoma has been reduced by sedimentation. “A sediment study was completed by the Texas Water Development Board (TWDB), which compared the total volume of water storage available in Lake Texoma from the original design in 1942, with the results of studies conducted in 1969, 1985, and 2002” (TWDB, 2003). Table 3.6.1 displays the rate of storage loss at the top of the power pool (617 ft NGVD) since 1942.

Table 3.6.1

Volume of Lake Texoma

Year	1942[2]	1969[3]	1985[3]	1992[3]	2002[4]
Volume (acre-ft)[1]	3,132,293	2,688,411	2,580,389	2,534,958	2,516,232
Percentage of storage lost (compared to original design)	--	14.2	17.6	19.1	19.7

Source: TWDB, 2003
Notes:
[1] All results for total storage at conservation pool elevation 617.0 ft
[2] Original Design
[3] USACE survey
[4] TWDB survey

While there are some methodological differences between the USACE and the TWDB sedimentation survey methods, it appears that the storage capacity of Lake Texoma seems to be generally decreasing and may have been reduced by approximately 20%.

3.6.5 Cultural Eutrophication

As nutrients build up in a body of water, a natural process known as eutrophication can take place which stimulates growth of plant life and algal blooms. When a waterbody is receiving elevated levels of nutrients specifically from human activities, resulting in excessive growth of plant life and algal blooms, it is called cultural eutrophication. Eutrophication is not necessarily adverse, however, when the process is artificially initiated, lake inhabitants can suffer. As plant life and algal blooms increase in a waterbody, dissolved oxygen (DO) is consumed at a higher rate or biological oxygen demand (BOD). As levels of DO in a body of water are depleted, plants and animal species such as fish and mollusks can suffocate. Eventually, as these organisms die, the remaining organic matter falls to the bottom of the waterbody and sediment starts to accumulate. Eutrophication can also affect aesthetic qualities of drinking water (odor, taste, and color).

Land upstream of Lake Texoma is used mainly for agricultural purposes including crop and livestock farming. These land-uses tend to deliver elevated levels of nutrients such as nitrates and phosphates to waterbodies. The National Eutrophication Survey conducted by EPA in 1977 identified Lake Texoma as eutrophic, i.e., well supplied with nutrients and quite productive. According to the 2008-2009 Oklahoma Lakes Report developed by OWRB through BUMP, the trophic state index (TSI) in Lake Texoma, derived using Carlson's Chlorophyll-*a* TSI, was 56, which classifies it as eutrophic, indicative of high levels of nutrients and productivity. This is similar to the TSI from previous years indicating no significant increase or decrease in productivity has occurred since previous evaluations. In addition, the DO measured in Lake Texoma was considered insufficient for support of fish and wildlife propagation (OWRB, 2009). Appendix F includes all data from the 2008-2009 Oklahoma Lakes Report.

3.6.6 Pesticides

"The term "pesticide" is a composite term that includes all chemicals that are used to kill or control pests. In agriculture, this includes herbicides (weeds), insecticides (insects), fungicides (fungi), nematocides (nematodes), and rodenticides (vertebrate poisons)" (NRMED, 1996).

About 70-80% of pesticides used today are used for agriculture (USGS, 1999). Agriculture has been identified as the leading source of national water quality degradation in rivers, streams, and lakes (USDA, 2003). However, the extent and magnitude of water quality impairment caused by agriculture is difficult to assess because of its nonpoint source nature.

Point source discharges are controlled through the National Pollutant Discharge Elimination System (NPDES) implemented through Texas and Oklahoma as the TPDES and the Oklahoma Pollution Discharge Elimination System (OPDES). The U.S. EPA developed a Pesticide General Permit (PGP) that requires a NPDES permit for the application of pesticides to, over, or near waters of the United States by 9 April 2011 (EPA, 2010a).

The TCEQ has also begun to regulate concentrated animal feeding operations (CAFO) through a general water quality permitting program. Each permitted CAFO is required to develop and maintain a Pollution Prevention Plan (PPP) by the TCEQ CAFO Regulations. Other significant users of pesticides are home owners and golf courses. Golf courses typically develop an integrated pest management (IPM) plan to develop the most efficient strategies to handle pesticide and herbicide use, but there are no regulations that specifically require an IPM plan. All the major sources of pesticides occur from nonpoint sources, which are difficult to quantify and control.

Lake Texoma, Red River, and the Washita River are currently not listed as being affected by pesticides that limit the consumption of fish according to the current advisories posted by the Texas Department of State Health Services (TDSHS).

Historical studies have been completed in Lake Texoma and have found concentrations of pesticides in fish tissue and sediments. One such study conducted in 1979 found that 71% of the sampled fish had detectable levels of 2,4-dichlorophenoxyacetic acid (2,4-D), with the largest amount being 1,888 μg/kg, and 85% of the fish contained detectable concentrations of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), with a maximum of 11,063 μg/kg. The mean content of 2,4-D in the sediment samples was 284 μg/kg, and the maximum was 844 μg/kg. 2,4,5-T averaged 861 μg/kg and was as high as 2,197 μg/kg. These chlorophenols are now banned from use (Hunter and Carroll, 1982).

In 1990, Lake Texoma was sampled for pesticides in water near U.S. 377 at Station 10131. All sampling results were marked with a less than sign indicating the values were less than the identified value. The highest reported value in water was less than 0.315 μg/L for malathion. All other values for other pesticides were reported at less than 0.05 μg/L.

In a consequent sampling in 1993 at Station 10131, pesticides were sampled in sediments near U.S. 377 in Lake Texoma. All sampling results were marked with a less than sign indicating the values are less than the identified value. The highest reported sediment values were less than 4,473 μg/kg for toxaphene, less than 2,546 μg/kg for malathion, less than 2,511 μg/kg for chlordane, less than 1,166 μg/kg for diazinon, less than 320 μg/kg for pentachlorophenol, less than 164 μg/kg for methoxychlor, and less than 62.6 μg/kg for aldrin. All other pesticides sampled in sediments were reported below 50 μg/kg.

A special study was completed by the TPWD in 2004 at Lake Texoma near the dam at Station 10128 that indicated all fish samples were less than the reporting limit of 0.005 mg/kg for aldrin, chlordane(s), dieldrin, endosulfan sulfate, edrin, Gamma BHC, heptchlor(s), hexachlorobenzene, methoxychlor, toxaphene, dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyltrichloroethane (DDT). All sample data from 1990, 1993, and 2004 summarized above were downloaded from the TCEQ Surface Water Quality Information System and is included in Appendix F as data files.

Historical sampling results presented from research and sampling data indicate pesticides may have historically affected Lake Texoma, but no current evidence has been identified that suggest the lake has been affected by more recent events with pesticides since more strict regulations have been enacted that ban and restrict the use of pesticides. The 2004 sampling of fish tissue indicated that the fish sampled were not affected with concentrations of pesticides elevated above the reporting limit.

3.6.7 Fertilizer and Nutrients

Fertilizers are nitrogen- and phosphorus- rich compounds used to enhance plant growth. When nutrients enter the aquatic ecosystems, they cause over-enrichment with phosphorus and nitrogen which can cause a wide range of problems, including toxic algal blooms, increased growth of aquatic weeds (invasive vegetation such as hydrilla), loss of dissolved oxygen, fish kills (from toxicity of algae and low dissolved oxygen), loss of essential aquatic vegetation (typically crowded out by invasive vegetation), and loss of biodiversity. Eutrophication caused by over-enrichment with phosphorus and nitrogen is a widespread problem across the country in rivers, lakes, estuaries, and coastal oceans.

Phosphorus is generally the limiting nutrient in fresh water systems as approximately 99% of the phosphorus in soils is unavailable for plant consumption and does not contribute to eutrophication. By design, the phosphorus compounds in fertilizers are highly soluble and contribute directly to plant growth, so these sources of phosphorus can contribute significantly to eutrophication (Bell and Koh, 2011). If the fertilizers are applied just before irrigation or prior to large rainfall events, typically within 5 days, they have a high chance of being dissolved in runoff and washed into streams and lakes.

Sources of nutrients in Lake Texoma are primarily attributed to agricultural practices, but leaking septic systems also contribute.

> *Currently, the State of Texas has no numerical criteria for nutrients in the Texas Surface Water Quality Standards. Nutrient controls do exist in the form of narrative criteria, watershed rules, and antidegradation considerations. The TCEQ screens phosphorus, nitrate nitrogen, and chlorophyll monitoring data as a preliminary indication of areas of possible concern for the 303(d) listings of impaired waterbodies* (TCEQ, 2010c).

Fertilizers and nutrients as point-sources are primarily regulated through point source programs such as the NPDES, TPDES (Texas), and the OPDES (Oklahoma). WWTPs are required to sample wastewater prior to discharging to surface water according to TPDES permit regulations and these discharges are directly regulated by the TCEQ. Nonpoint sources such as leaking sewer lines, septic tanks, golf courses, and agricultural discharges are not easily quantified. Nonpoint sources from agriculture operations remain the primary source of both phosphorus and nitrogen. As mentioned in Section 3.6.6, the TCEQ has begun to regulate CAFOs through general water quality permitting program. Each permitted CAFO is required to develop and maintain a PPP by the TCEQ.

The water quality sample results presented in the 2008-2009 Oklahoma Lakes Report, developed by OWRB through BUMP, were collected throughout Lake Texoma and at the point of discharge into the lake from the Red River and the Washita River. They report a range of total nitrogen (TN) from 0.24 mg/L to 1.41 mg/L with the highest value being reported at the Upper Red River Arm of Lake Texoma. The maximum reported TN exceeded the EPA reference criteria for lakes and reservoirs of 0.492 mg/L and for streams of 0.507 mg/L by two-fold. Water sampling results also indicate that total phosphorus (TP) ranges from 0.012 mg/L to 0.153 mg/L with the highest value being reported at the lower Red River Arm of Lake Texoma. The reported TP did not exceed the TCEQ screening levels for lakes and reservoirs of 0.18 mg/L and for streams of 0.80 mg/L, but did exceed the EPA reference criteria for lakes and reservoirs of 0.0325 mg/L and for streams of 0.05 mg/L.

3.6.8 Cyanobacteria and Cyanotoxins

"Blue-green algae are also called cyanobacteria because they are biologically similar to bacteria in many ways. One characteristic of these cyanobacteria is their ability to form blooms so thick it appears that blue-green paint covers the surface of the water" (TPWD, 2011a). Blue-green algae can produce Harmful Algal Blooms (HAB), which can prove harmful through reductions in DO and toxin release.

Approximately 20 freshwater genera of blue-green algae are known to release a variety of harmful toxins. Blue-green algae releases primarily Microcystin, which produces hepatotoxin. Ingestion of hepatoxin can cause liver damage or failure. "In some cases, blue-green algae, particularly *Anabaena* and *Microcystis*, can produce toxins that are poisonous to fish and wildlife" (TPWD, 2011a). "Four major chemical factors that influence HAB development are pH, nutrients (nitrogen and phosphorous), salinity, and trace metal inputs. For the majority of freshwater blooms, the effect of pH, salinity, and trace metal changes on growth are minimal. Nitrogen and phosphorous loading dominate chemical algal growth" (Linkov et al., 2009).

According to Clyde (2004), the algal assemblage present in Lake Texoma is dominated by blue-green algae (Cyanophyta), which comprised 82.1% of the assemblage total standing crop, with one species, *Microcystis incerta*, comprising 57.0% of the assemblage (Clyde, 2004). This situation is typical of a temperate eutrophic lake.

The State of Oklahoma through its Water Watch HAB Project has implemented a program to coordinate data collection regarding HAB, establish a widespread HAB monitoring program, and provide outreach and education on cultural eutrophication and reduce its impacts.

3.6.9 Golden Algae

Freshwater HABs can be also be caused by golden algae. Golden alga (*Prymnesium parvum)* is a naturally occurring microscopic flagellated alga that typically occurs in saline (salty) waters. It has invaded Texas waters since the mid-1980s. In the 1990s it moved northward into the Red River Basin and Canadian River basin. In 2004, golden algae caused fish kills in Lake Texoma (ODWC, 2010a). According to the TPWD, "in winter and spring 2004, over 1.5 million fish were killed in Lake Texoma in the Red River Basin. In each of these fish kills, most of the fish killed were threadfin and gizzard shad, although other types of fish were killed, including gar, carp, buffalo, catfish, largemouth bass, white bass, striped bass, warmouth, bluegill, crappie, drum, and sunfishes" (TPWD, 2010a). According to the 2002 TCEQ Water Quality Inventory, 200 fish kills were reported in 1997 in the east side of F.M.-120 off the little Mineral Arm. The cause was listed as a "disease" (TCEQ, 2010d). According to the TPWD algae status reports, no fish kills due to golden alga have occurred between 2008 and 2010 at Lake Texoma (TPWD, 2010b). "Golden algal blooms typically occur in winter months, often leaving a golden yellow ring around the lake shoreline" (ODWC, 2010a). Golden alga is native to estuarine habitats around the world. Under certain environmental stresses, this alga can produce toxins which can cause massive fish and bivalve (i.e., clams and mussels) kills. "The alga kills fish by releasing toxins into the water that cause fish gills to bleed internally. There is no evidence to suggest the toxins are a threat to human health" (ODWC, 2010a).

3.6.10 Total Maximum Daily Loads

According to the EPA Total Maximum Daily Loads (TMDL) (303d) website (EPA, 2011a), the CWA has two types of methods for protecting the nations' water bodies/receiving waters. One approach uses best available technology and is implemented through permitting systems such as Texas's TPDES permit system. This method relies on best available treatment technologies and is implemented as end-of-pipe limits in the TPDES permit system. The other method is water quality based to preserve the desired use of the receiving water body. The 303(d) program is a core integral in the water quality based method. Water quality standards define goals by designating uses (e.g. recreation, water supply, aquatic life, agriculture) for the water body and then by setting water quality criteria (e.g. pollutant loading limits) to protect the designated uses (EPA, 2011a). The CWA requires each state, authorized tribe, and territory to develop a 303(d) list every two years for water bodies that are impaired or that are in threat of becoming impaired. The water bodies listed on the 303(d) list are in need of a TMDL. The TMDL calculates the maximum pollutant load the water body can receive and still maintain water quality standards for its designated use and the TMDL allocates the pollutant load to sources (EPA, 2011a). Sometimes conditions improve after 303(d) listing prior to TMDL development or increased monitoring after listing indicates water bodies are not yet threatened (EPA, 2011a).

The 2008 and 2010 Oklahoma Integrated Reports under the guidance of the EPA and CWA provides the year 2010 303(d) list of impaired waterbodies (Category 5) (ODEQ, 2008a and 2010b). This Integrated Report provides an effective tool for maintaining high quality waters and improving the quality of waters of impaired or threatened water bodies. The Integrated Report also provides water resources managers and citizens with detailed information about the waterbodies. The 2008 303(d) list is considered Oklahoma's official list of impaired waters until the 2010 303(d) list is approved by EPA Region 6.

The Oklahoma 2008 303(d) list has five water body identification (WBID) numbers for Lake Texoma (ODEQ, 2008a). According to the 2008 report, the overall status of Lake Texoma is Category 5 for all five WBID numbers: The water quality standard is not attained for the designated use. Lake Texoma's designated use of Fish and Wildlife Propagation-Warm Water Aquatic Community Subcategory was impaired according to the 2008 report. The cause of impairment is Organic Enrichment and/or Oxygen Depletion. According to the 303(d) standard, TMDLs are required. The TMDLs are underway for the Upper and Lower segments of the Red River Arm of Lake Texoma and Lake Texoma waterbodies and would be scheduled for the Upper and Lower segments of the Washita Arm of Lake Texoma. Table 3.6.2 and Table 3.6.3 summarize Lake Texoma water quality assessment results for 2008.

Table 3.6.2

Water Quality Assessment Status Lake Texoma 303(d) Standard

Designated Use	Designated Use	Status
Aesthetic	Aesthetic Value	Good
Agriculture	Agricultural	Good
Fish and Wildlife Propagation-Warm Water Aquatic Community Subcategory	Aquatic Life Harvesting	Impaired
Fish Consumption	Aquatic Life Harvesting	Not Assessed
Primary Body Contact Recreation	Recreation	Not Assessed
Public and Private Water Supply	Public Water Supply	Not Assessed

Source: ODEQ, 2008b.

Table 3.6.3

Causes of Impairment 303(d) Standard Lake Texoma

Cause of Impairment	Cause of Impairment Group	Designated Use(s)	State TMDL Development Status
Dissolved Oxygen	Organic Enrichment/ Oxygen Depletion	Fish and Wildlife Propagation – Warm Water Aquatic Community	TMDL needed

Source: EPA, 2011b.

3.6.11 Mercury Content of Fish

"Mercury is released into the atmosphere through man-made (mining, manufacturing processes, coal-fired utilities or industries) or natural processes (volcanoes or weathering of rocks)" (ODEQ, 2010a). Although initially considered as air pollution, mercury ends up in waterbodies due to rainfall and/or snow. "In river and lake sediments, mercury can be converted to methyl mercury, which enters the food chain and accumulates most readily in predator species of fish. It can then be passed to people who eat these fish" (ODEQ, 2010a).

According to a report released 2010 by the Oklahoma Department of Environmental Quality (ODEQ), Lake Texoma was classified within the lakes with low mercury levels in fish (ODEQ, 2010a). Fish from these lakes can be eaten often without excessive exposure to mercury.

3.6.12 Groundwater

Groundwater in the Lake Texoma region is not a primary source of drinking water due to availability of surface water. Water quality in the Antlers formation of the Trinity Aquifer is generally good, with dissolved solids between 200 and 1,000 milligrams per liter. Though the groundwater is high in TDS, it is considered an acceptable source of water for some due to lack of alternative sources.

Shallow groundwater is located closer to the surface and is directly impacted by septic tanks and surface water recharge. The current quality of shallow groundwater is affected by nutrient loads from septic systems. A 2-year study conducted from 1999 to 2001 indicates that the sources of nutrients to groundwater are higher in residential areas than in agricultural areas (An et al., 2005).

3.7 BIOLOGICAL RESOURCES

3.7.1 Land Cover

Land cover refers to the physical material at the surface of the earth and includes all the elements that cover the earth such as grass, asphalt, trees, bare ground, and water (Comber et al., 2005). Land cover was determined for Lake Texoma by field investigations and remotely sensed imagery. The 2001 U.S. Geological Survey (USGS) National Land Cover Database (NLCD) for mapping zone 32, which is specific to Texas, Oklahoma, and Kansas, was used as a basis for creating a Lake Texoma specific land cover classification scheme. The proposed imagery used in land cover classification was 2008 U.S. Department of Agriculture (USDA) National Aerial Inventory Program (NAIP), Farm Service Agency (FSA) 1-meter, color-infrared aerial photography.

A customized land cover analysis was performed for two different property parcels along the eastern shore of the Little Mineral Arm of Lake Texoma based on the current ownership of the properties. Land cover types, associated acreages, and land cover percentages for the proposed conveyance land are shown in Table 3.7.1. Similar information for the Preston Harbor Development Property is shown in Table 3.7.2. Figures 3.7.1.1 through 3.7.1.5 depict the land cover types presently occurring around Lake Texoma. Figure 3.7.2 depicts the land cover types within the PHD.

Existing land cover at Lake Texoma is composed of eight different cover types as defined in the following land cover descriptions:

Open Water – All areas of open water, generally with less than 25% cover, vegetation, or soil. This class is limited to Lake Texoma and its tributaries and excludes upland water bodies such as ponds or upland aquatic areas.

Aquatic Inland – All areas, natural or manmade, consisting of non-tidal standing water surrounded by herbaceous vegetation. This class is limited to upland aquatic features such as ponds.

Grasslands/Herbaceous – Areas dominated by grasses or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing. This includes both native blackland prairie grasslands and non-native grassland species (Native grasslands are depicted in Figure 3.7.2 for the conveyance land only based on field surveys. Owing to the techniques used, native grassland acreages were not distinguished as part of the lake-wide assessment).

Mixed Upland Forest – Areas dominated by trees, generally with 60 to 100% total vegetation cover. Within these areas, trees greater than 5 meters tall are greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 % of total tree cover.

Bottomland Hardwoods –These areas consist of frequently flooded, deciduous forest within the Bunyan and Whitesboro soil type.

Developed (Impervious Cover) – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 100% of the total cover. These areas most commonly range from single-family housing units to apartment complexes, row houses, commercial/industrial facilities, gravel and asphalt roads, and parking lots.

Unconsolidated Shore – Unconsolidated material such as silt, sand, or gravel that is subject to inundation and redistribution due to the action of water. Characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms representing this class.

Barren/Disturbed Land – Barren areas (Rock/Sand/Clay) of bedrock, strip mines, gravel pits, and other accumulations of earthen material. Generally, vegetation accounts for less that 15% of total cover.

Most of the land (84 %) within the proposed USACE conveyance property is covered by a mixed upland forest community. Within the Preston Harbor Development Property, the predominant land cover type is a grassland/herbaceous community (67%).

Table 3.7.1

Land Cover Proposed USACE Conveyance Lands (Approx. 635 acres)

USACE Property		
Land Cover Class	**Land Cover (acre)**	**Land Cover (%)**
Mixed Upland Forest (Deciduous/Evergreen)	531	84
Grassland/Herbaceous[1]	67	10
Unconsolidated Shore	8	2
Aquatic inland	0.22	0.3
Bottomland hardwoods	20	3
Barren/Disturbed Area	5	0.85
Open Water	4	0.7
TOTAL	**635**	**100**

Source: WESTON, 2010

1. Of the grassland/herbaceous landcover, approximately 50 acres were native grasslands.

Table 3.7.2

Land Cover Preston Harbor Development Property (Approx. 2,508 acres)

Adjacent Private Land		
Land Cover Class	**Land Cover (acre)**	**Land Cover (%)**
Mixed Upland Forest (Deciduous/Evergreen)	638	25
Grassland/Herbaceous[1]	1,686	67
Aquatic inland	83	3
Developed (Impervious cover)	44	2
Barren/Disturbed Area	58	3
TOTAL	**2,508**	**100**

Source: WESTON, 2010

1. Of the grassland/herbaceous landcover, approximately 170 acres were native grasslands.

3.7.2 Ecological Description

Lake Texoma lies within the West Gulf Coastal Plain of North America which includes western Louisiana, eastern Texas, southeastern Oklahoma, and southern Arkansas (BRIT, 2009). The vegetation of the West Gulf Coastal Plain is divided into four regions including Oak-Pine-Hickory Forest, Longleaf Pine Forest, Post Oak Savanna, and Prairie. Lake Texoma is located within the Prairie region that extends from Texas to Canada and covers most of central North America, forming the western boundary of the West Gulf Coastal Plain (BRIT, 2009). The U.S. Department of Agriculture, Forest Service classifies the area as being within the Prairie Parkland Province of the Prairie Division (Bailey, 1995). This province is characterized as a region of gently rolling to flat plains ranging from sea level to 1,300 ft and consists of prairies and savannas (Bailey, 1995). The area is dominated by various short and medium to tall grasses, along with some hardy tree species adapted to fire and grazing.

The Natural Resource Conservation Service (NRCS) classifies the study area as an Eroded Blackland ecological site located within the 28-40" PZ of Major Land Resource Area (MLRA) 086A, also referred to as the Northern Blackland Prairie MLRA (NRCS, 2009). The Historic Climax Plant Community (HCPC) of Eroded Blackland is tall grass and mid-grass plant communities with a high diversity of forbs and occasional woody shrubs and trees. The area is within "*a fire-influenced mosaic of tallgrass and midgrass plant communities, interspersed with a high diversity of perennial forbs and occasional woody shrubs and trees,*" (NRCS, 2009). The NRCS notes that, without fire, the tall grass species will decline and there will be an increase in composition of mid-grasses, unpalatable forbs, and woody species. This appears to project the existing conditions for the majority of the study area.

3.7.3 Vegetation Resources

The vegetation resources of the proposed USACE conveyance property, the private land adjacent to the USACE property, and the area for the proposed wastewater treatment plant and collection line were mapped and assessed in detail. A description of the proposed wastewater treatment plant is provided in Section 4. Information on regional vegetation was gathered from available literature, on-line databases, and Federal and State websites in Texas and Oklahoma for the Lake Texoma area. The properties and respective vegetation types are described below and shown in

Figures 3.7.1 and 3.7.2. Detailed descriptions of the different habitat types are presented in Appendix G and summarized in the following sections. Approximately 760 species of plants have been recorded for the Lake Texoma area, and are listed in the Botanical Inventory of Lake Texoma provided in Appendix G.

Vegetation Communities on Proposed Conveyance Lands

The proposed USACE conveyance property is dominated by upland forest. Most of the area from elevation 619 ft (NGVD) to the top of the flood control pool (elevation 640 ft NGVD) contains sparse vegetation due to operation of the flood control pool of the lake. From the top of the flood control pool to the current boundary of the USACE property, there are four vegetative communities that include a small remnant of bottomland hardwoods (BLH), two very narrow riparian zones, an upland forest complex interspersed with small native grass savannas, and grassland communities. The upland forest complex comprises most of the area on the USACE property, as shown in Table 3.7.1 and delineated in Figure 3.7.2. The small remnant of BLH is located just downstream of the Texas F.M. Road 408 bridge and is dominated by species such as sycamore (*Platanus occidentalis*), bur oak (*Quercus macrocarpa*), green ash (*Fraxinus pennsylvanica*), box elder (*Acer negundo*), and broad leaved uniola (*Chasmanthium latifolium*). This site appears to have been disturbed by bridge and/or road construction activities in the past.

Two small riparian zones varying in width from 1 to 3 meters exist along the upper reaches of Little Mineral Creek and at least one tributary. Some of the more common species in this zone include lead plant (*Amporpha fruiticosa*), sedges sp., horsetail (*Equisetum sp.*), cardinal flower (*Lobelia cardinalis*), water willow (*Justicia americana*), and black willow (*Salix nigra*). This vegetative community is very small in width and appears to be heavily influenced by operation of the project for flood control. As shown in Table 3.7.1 and Figure 3.7.2, a few small native grassland savannahs (approximately 50 acres) are interspersed throughout the upland forests.

The proposed conveyance lands generally consist of somewhat level areas near the Government fence line, with steeper slopes toward the lake. The areas of more level terrain are composed of upland forests interspersed with native grass savannahs, while the steeper slopes are more mesic and dominated by an upland forest classified as a cedar elm-oak forest (University of Tulsa, 1971). The areas of more level terrain are composed of tree species such as cedar elm (*Ulmus* *crassifolia*), post oak (*Quercus stellata*), black oak (*Quercus velutina*), Osage orange (*Maclura pomifera*), upland ash (Fraxinus sp.), eastern red cedar (*Juniperus virginiana*), hackberry (*Celtis occidentalis*), and Mexican plum (*Prunus mexicana*). The steeper sloped areas are more mesic and are dominated by species such as Northern red oak (*Quercus rubra*), chinkapin oak (Quercus *muehlenbergii*), and Texas oak (*Quercus shumardii microcarpa*). The understory is composed of species such as coral berry (*Symphoricarpos orbiculatus*), red bud (*Cercis candensis*), rough leaved dogwood (*Cornus drummondii*), poison ivy (*Rhus radicans*), green briar (*Smilax glauca*), prickly ash (*Zanthoxylum americanum*), and American beautyberry (*Callicarpa americana*).

The native grass community is small and is becoming dominated by woody species. It is composed of species such as switch grass (*Panicum virgatum*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), silver bluestem (*Bothriochloa laguroides*), Johnson grass (*Sorghum halepense*), annual ragweed (*Ambrosia artemisifolia*), dotted gayfeather (*Liatris punctata*), black Sampson (*Echinacea angustifolia*), serecia lespedeza (*Lespedeza cuneata*), Maximillian sunflower (*Helianthus maximiliana*), annual brome (Bromus japonicus), common broomweed (Gutierrezia dracunculoides), butterfly milkweed, and Illinois bundleflower *(Desmanthus illinoensis*). A detailed listing species for the Proposed Action area and Lake Texoma is shown in the Botanical Inventory of Lake Texoma provided in Appendix G.

Vegetation Communities on Private Property

The private property tract adjacent to the proposed conveyance property, as shown in Table 3.7.2, is covered by a mixture of grassland/herbaceous vegetation (67%). Much of the southern end of the property shows evidence of having been farmed in the recent past and can presently be characterized as a mid to short grass community rapidly being converted into a shrubland.

The central and northern portions of the private property show evidence of having been heavily disturbed. In the past, these areas were commercially mined for gravel and several ponds exist that were created by mining activities. A large portion of the commercially mined area was reclaimed and planted to various species of grasses. The vegetation within the reclaimed area is composed of species such as bermuda grass *(Cynondon dactylon*), old world bluestem (*Bothriochloa ischaemum*), cocklebur (*Xanthium strumarium*), annual ragweed (*Ambrosia artemisifolia*), crabgrass (*Digitaria sanguinalis*), honey locust (*Gleditsia triacanthos*), common broomweed (*Gutierrezia dracunculoides*), cottonwood (*Populus deltoides*), black willow (*Salix nigra*), snow-on-the-mountain (*Euphorbia marginata*), eastern red cedar *(Juniperus virginiana*), silver bluestem (*Bothriochloa laguroides)*, giant ragweed (*Ambrosia trifida*), and persimmon (*Diospyros virginiana*).

More recently, much of the central area has been cleared and developed with roads and several large ponds or lakes, as shown in Figure 3.7.2. The disturbed area contains most of the species found within the previously mined area as well as species such as chickasaw plum (*Prunus angustifolia*), smooth sumac (*Rhus glabra*), winged elm, Virginia creeper (*Parthenocissus quinquefolia*), buffalo bur (*Solanum rostratum*), American pokeweed (*Phytolacca americana*), blue wild indigo (*Baptisia australis*), and buttonbush (*Cephalanthus occidentalis*).

Vegetation Communities Associated with Proposed Wastewater Treatment Plant and Pipeline Route

The locations of the proposed wastewater treatment plant and collection line are shown in Figure 3.7.3. The proposed collection line begins near the middle of the private property and extends southward near Kelso Road where it turns east and intersects Texoma Road (F.M. 84). The collection line then proceeds southeast along F.M. Road 84 for several miles, and turns eastward to the proposed wastewater treatment plant located near the upper end of Lake Randell. Lake Randell is located on Shawnee Creek and is owned by the City of Denison. The lake is used as a source of water supply for the City of Denison and receives pumped raw water from Lake Texoma.

Approximately 90% of the collection line that would be located on the private property is within the Mixed Upland Forest (Deciduous/Evergreen) and Grassland/Herbaceous cover types (Figure 3.7.3). The line would cross some native prairie along Kelso Road. The portion of the line running from F.M. Road 84 to the upper limits of the City of Denison's property around Lake Randell follows existing road right-of-ways; uses vary from agriculture fields to grasslands, to mowed yards. The right-of-way for the pipeline to the proposed wastewater treatment plant on the Lake Randell property would run for over a mile through a mature upland forest composed of species similar to those located on the USACE property at Lake Texoma. The vegetation communities associated with the wastewater treatment plant and collection line with a 200 foot right-of-way are delineated in Table 3.7.3, Vegetation Communities of the Proposed Wastewater Treatment Plant and Collection Line with a 200-foot Buffer.

Table 3.7.3

Vegetation Communities of the Proposed Wastewater Treatment Plant and Collection Line with a 200-foot Buffer

Classification Type	Acres	Land Cover %
Mixed Upland Forest (Deciduous/Evergreen)	32	24
Grassland/Herbaceous	83	62
Aquatic Inland	8	6
Developed(Impervious Cover)	3	2
Barren/Disturbed Area	7	6
Total	**133**	**100**

Source: WESTON, 2010

Lake- Wide Vegetation Communities

The vegetation resources of the USACE lands surrounding all of Lake Texoma were mapped in the same manner as the vegetation around the Little Mineral Arm of the lake. The vegetative communities were derived from U.S. Department of Agriculture, Farm Service Agency, NAIP 2008 digital aerial imagery using image processing and unsupervised classification techniques. The results of the vegetative mapping lake-wide are shown in Figures 3.7.1.1 through 3.7.1.5 and Table 3.7.4.

Table 3.7.4

Vegetation Communities of Lake Texoma on USACE Lands

Classification Type	Acres
Mixed Upland Forest (Deciduous/Evergreen)	65,118
Grassland/Herbaceous	16,193
Unconsolidated Shore	3,077
Aquatic Inland	993
Developed (Impervious Cover)	2,235
Open Water	87,342
Bottomland Hardwoods	19,446
Barren/Disturbed Area	5,710
Active Agricultural Land	5,456
Total	**205,570**

Source: WESTON, 2010

The mixed upland forest biome is composed of approximately 65,118 acres and is the largest vegetation component on USACE lands. While all the designated upland forest is similar, some variation in species composition occurs due to variations in soil types, slope, and moisture availability. They have been characterized as uplands occurring on sandy soil, sandy ravines, uplands on silty and/or clay soils, and ravines on limestone or clay formations (University of Tulsa, 1971). The University of Tulsa resource listed 164 total species associated with upland habitats. A complete list of vegetative species known or expected to occur in the upland forest habitats at Lake Texoma is presented in the Botanical Inventory for Lake Texoma, provided in Appendix G.

Bottomland hardwoods comprise approximately 19,446 acres of USACE lands at the lake, and are the second largest vegetative component on USACE lands. They are also one of the most valuable habitats around the lake for wildlife species. They are located primarily on USACE lands in the upper reaches of the Red and Washita Rivers and upper reaches of major tributaries (Figures 3.7.1.1 – 3.7.1.5). A total of 220 plant species have been reported to occur in this biome at Lake Texoma (University of Tulsa, 1971). A complete list of vegetative species known or expected to occur in the lake area is provided in the Botanical Inventory for Lake Texoma (Appendix G).

Approximately 16,193 acres were classified as a grassland/herbaceous vegetative community. This biome is the third largest vegetative component of USACE lands. It is composed primarily of native prairies and areas of old field succession, and were probably more prevalent at the time of impoundment than at present. Much of what appears to be old grasslands or old agricultural fields are being rapidly invaded with tree species such as eastern red cedar, persimmon (*Diospyros virginiana*), cedar elm, slippery elm (*Ulmus crassifolia*), and Osage orange. This transition is noticeable within the study area and lake-wide, and is probably due to suppression of fire and lack of periodic burning. This biome is quite diverse and has the largest total number of species of the three major vegetative communities. A total of 347 different vegetative species have been recorded as occurring in this biome (University of Tulsa, 1971).

Approximately 3,077 acres of unconsolidated shoreline exist around the lake. It consists primarily of sand, silt, and rock. In shallow protected areas, species such as black willow, sand bar willow, buttonbush, and salt cedar have become sporadically established, but their viability appears to be dependent upon operation of the lake and stability of water levels. They are most prevalent in the upper reaches of the lake and the delta regions of the Red and Washita rivers.

The remainder of USACE property is composed of approximately 2,235 acres classified as developed/impervious cover, 5,700 acres classified as barren/disturbed, and 5,456 acres classified as active agriculture. The developed/impervious areas consist largely of features such as roads, buildings, and parking lots. The barren/disturbed areas contain little vegetation and may consist of rock outcrops, sandy areas, or construction scars. The 5,456 acres of agriculture lands consist of areas farmed for wildlife or USACE agriculture and grazing leases that are planted to crops such as winter wheat, milo, corn, or hay grazer. They may also contain areas that are mowed and bailed for hay.

At the time of construction and impoundment of the lake, most of the private lands around the lake's perimeter did not contain the native vegetation and habitats historically present in the area. The majority of the land had been converted to farm and ranch lands. As Lake Texoma has become more popular for water oriented recreation, the use of perimeter lands around the lake has changed. To support the approximately 6 million annual visitors and accommodate year-round residents, homes, cottages, hotels, and camping areas were constructed. Some of these are located in designated commercial concession areas, but most are located on lands that were once rural and were subsequently subdivided into smaller tracts for housing development. Many tracts are located immediately adjacent to USACE property, while others have been developed up to a mile or further from the lake. As shown in Table 3.7.5, approximately 20,000 acres of land within a mile of the USACE property surrounding Lake Texoma is currently developed land.

Approximately 30,000 acres within a mile of the USACE land are agricultural lands. Approximately 88,000 acres within a mile of the USACE land are upland forest.

Table 3.7.5

Land Cover Class Within 1-Mile Radius of Lake Texoma USACE Property

One Mile Radius Land Cover Acreage	
Land Cover Class	**Acres**
Open Water	2,615
Developed, Open Space	14,039
Developed, Low Intensity	2,323
Developed, Medium Intensity	484
Developed, High Intensity	105
Barren Land	473
Deciduous Forest	82,894
Evergreen Forest	6,731
Mixed Forest	34
Herbaceous	95,903
Hay/Pasture	29,437
Cultivated Crops	11,067
Woody Wetlands	48
Emergent Herbaceous Wetlands	56
Total	**246,209**

Source: WESTON, 2011

The fragmentation and conversion of rural lands surrounding Lake Texoma and throughout Texas is prevalent. According to the U.S. Department of Agriculture, the conversion of rural land to urban uses in Texas from 1982 to 1997 exceeded 2.6 million acres, and the annual rate of conversion from 1992 to 1997 nearly doubled from the previous 10 years (WESTON, 2010). For the state of Oklahoma, the conversion of rural land was not as significant as Texas (13,400 acres for the period 1982-1997), with a percentage increase of 20.9 for the same time period (WESTON, 2010).

3.7.4 Wildlife Resources at Lake Texoma

Wildlife present within the Proposed Action area and on USACE project lands surrounding Lake Texoma is dependent upon the quantity, quality, and types of existing habitat(s). The following sections describe the wildlife species associated with the various identified habitat types.

Mammals

Lake Texoma has a diverse population of mammals. Over 57 species of mammals have been documented as occurring in the Lake Texoma area (University of Tulsa, 1971). A complete list of mammalian species documented or expected to occur in the area is shown in the Animal Species Inventory of Lake Texoma, provided in Appendix G. Some of the more common species expected to occur in the upland forest areas include the eastern cottontail (*Sylvilagus floridanus*), opossum, (*Didelphis marsupialis*), armadillo (*Dasypus novemcinctus*), deer mouse (*Peromyscus maniculatus*), brush mouse (*Peromyscus boylei*), and cotton rat (*Sigmodon hispidus*). Some of the species commonly associated with both upland forest and bottomland hardwood habitats include the gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), raccoon (*Proycon lotor*), striped skunk (*Mephitis mephitis*), and bobcat (*Lynx rufus*). Examples of species more restricted to the bottomland hardwood habitats include the beaver *(Castor canadensis)*, muskrat (Ondatra *zibethicus*), and swamp rabbit (*Sylvilagus aquaticus*). Some of the more common species associated with grassland habitats include the thirteen lined ground squirrel (*Citellus tridecemlineatus*), prairie pocket gopher (*Geomys bursarius)*, badger (*Taxidea taxus)*, and the coyote (*Canis latrans*). The white-tailed deer (*Odocoileus virginiana*) and feral wild hogs (*Sus scrofa*) are probably the largest mammals occurring in the area. Since they are highly mobile, they can utilize all the different habitat types.

Mammalian species that have historically occurred in the past, but which are probably no longer present or extremely rare include the red wolf (*Canis niger*), gray wolf (*Canis lupus*), black-footed ferret (*Mustela nigripes*), and the mountain lion (*Felis concolor*).

Amphibians and Reptiles

Lake Texoma has a diverse population of amphibians and reptiles due in part to its geographical location and diversity of habitat types. A total of 57 species of reptiles and 22 species of amphibians have been recorded for the area (University of Tulsa, 1971). A complete list of these species occurring in the study area is shown in the Animal Species Inventory of Lake Texoma provided in Appendix G. Many of the reptile and amphibian species are dependent upon water. Examples of reptile species common to the lake, bottomland hardwoods, and wetland type of habitats include most of the turtle species such as the cooter (*Pseudemys floridana*), common snapping turtle (*Chelydra serpentine*), spiny softshell (T*rionyx spiniferus*), and smooth softshell turtle (*Trionyx muticus*).

Some of the more common species of water snakes include the cottonmouth (*Agkistrodon piscivorus*), blotched watersnake (*Natrix erythrogaster*), diamondback watersnake (*Natrix rhombifera*), and the midland watersnake (*Natrix sipedon*).

Amphibian species associated with the lake, wetlands, and bottomland hardwood habitats include the small-mouth salamander (*Ambystoma texanum*), tiger salamander (*Ambystoma tigrinum*), dwarf siren (*Siren intermedia*), leopard frog (*Rana pipiens*), bullfrog (*Rana catesbeiana*), and crawfish frog (*Rana areolata*).

Examples of reptiles commonly associated with upland habitats include the Western box turtle (*Terrapene ornate*), box turtle (*Terrapene carolina*), garter snake (*Thamnophis sirtalis*), ribbon snake (*thamnophis proximus*), rough green snake (*Opheodrys aestivus*), and the copperhead (*Agkistrodon contortrix*). Examples of amphibian species associated with the upland habitats include the American toad (*Bufo americanus*), Great Plains toad (*Bufo cognatus*), Gray tree frog (*Hyla vesicolor)*, and the chorus frog (*Pseudacris triseriata*).

Examples of lizard and snake species commonly associated with grassland habitats include the collard lizard (*Crotaphytus collaris*), Texas horned lizard (*Phrynosoma cornutum*), six-lined racerunner (*Cnemidophorus sexlineatus)*, little brown skink (*Lygosoma laterale*), Great Plains rat snake (*Elaphe guttata*), Prairie kingsnake (*Lampropeltis calligaster*), speckled kingsnake (*Lampropeltis getulus*), and the timber rattlesnake (*Crotalus horridus*).

Birds

Lake Texoma has a large number of resident and migratory bird species using the various habitats around the lake. Since many of the migratory species are associated with the two

National Wildlife Refuges located on USACE lands at Lake Texoma they are discussed in detail in Section 3.7.9. A total of 338 species of birds have been recorded to occur at Hagerman National Wildlife Refuge (USFWS, 2010a). Over 300 species of birds were recorded for the Lake Texoma area (University of Tulsa, 1971, USFWS, 2010a). A compilation of all avian species recorded for the area is shown in the Animal Species Inventory of Lake Texoma provided in Appendix G. Birds are highly mobile and may travel great distances in relatively short amounts of time. Their mobility also enables them to transcend habitat boundaries easily or use multiple habitats. Consequently, they may be reported from several types of habitats or locations.

Numerous species of waterfowl, shore birds, and wading birds have been reported to use Lake Texoma and its associated wetlands. Some of the more common species using these habitat types include the common loon (*Gavia immer*), Pied-billed grebe (*Podilymbus podiceps*), great blue heron (*Ardea Herodias*), little blue heron (*Florida caerulea*), common egret (*Casmerodius albus*), killdeer (*Charadrius vociferous*), spotted sandpiper (*Actitis macularia*), greater yellowlegs (*Totanus melanoleucus*), lesser yellowlegs (*Totanus flavipes*), short-billed dowitcher (*Limnodromus griseus*), sanderling (*Crocethia alba*), herring gull (*Larus argentatus*), white pelican (*Pelecanus erythrorhynchos*), double crested cormorant (*Phalacrocorax aurit*us), Canada goose (*Branta canadensis*), snow goose (*Chen hyperborean*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), green-winged teal (*Anas carolinensis*), blue-winged teal (*Anas discors*), wood duck (*Aix sponsa*), common coot (*Fulica americana*), northern harrier (*Circus hudsonius*), belted kingfisher (*Megaceryle alcyon*), fish crow (*Corvus ossifragus*), ring billed gull (*Larus delawarensis*), Franklin's gull (*Larus pipixcan*), common tern (*Sterna hirundo*), least tern (*Sterna albifrons*), sharp-tailed sparrow (*Ammodramus bairdi*), and red wing blackbird (*Agelaius phoeniceus*). Both the bald eagle (Haliaeetus *leucocephalus*) and Osprey (*Pandion haliaetus*) occur around the lake and utilize the lake for fishing and trees adjacent to the shoreline for perching and roosting.

Examples of bird species that utilize both upland and bottomland habitats include the barn owl (Tyto alba), barred owl (Strix varia), great horned owl (Bubo virginianus), Mississippi kite (*Ictinia mississippiensis*), red-shouldered hawk (*Buteo lineatus*), red-shafted flicker (Colaptes cafer), pileated woodpecker (*Dryocopus pileatus*), red-headed woodpecker *(Melanerpes erythrocephalus)*, blue jay *(*Cyanocitta cristata), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*), mockingbird (*Mimus* polyglottos), wood thrush (Hylocichla mustelina), cardinal (Pyrrhuloxia cardinalis), painted bunting (*Passerina ciris*), and tree sparrow (*Spizella arborea*). Some of the species utilizing both the upland and grassland habitats include the bobwhite (*Colinus virginianus*), wild turkey (*Meleagris gallopavo*), red-tailed hawk (*Buteo jamaicensis*), and common crow (Corvus cryptoleucus).

Species known to utilize the grassland habitats include the rough-legged hawk *(Buteo lagopus*), Ferruginous hawk (*Bueto regalis*), Swainson's hawk (*Buteo swainsoni*), field sparrow (*Spizella pusilla*), Savannah sparrow (*Passerculus sandwichensis*), Eastern blue bird (*Sialia sialia*), Eastern meadowlark (*Sturnella magna*), Western meadowlark (*Sturnella neglecta*), brown headed cowbird (*Molothrus ater*), Scissor-tailed flycatcher (*Muscivora forficta*), Western kingbird (*Tyrannus verticalis*), Eastern kingbird (*Tyrannus tyrannus*), and mourning dove (*Zenaidura macroura*).

Game Animals

The fish and wildlife resources of the states of Oklahoma and Texas are primarily managed by the ODWC, TPWD, USFWS, and USACE. Numerous species of game animals occur around Lake Texoma and the proposed conveyance land. The two state resource agencies, USFWS, and the USACE permit hunting on designated USACE lands in accordance with applicable state and Federal rules and regulations, and established seasons and bag limits.

Big game animals occurring in the area include white-tailed deer and wild turkey. Feral hogs are present and can also be hunted, but they are considered pests, and are not regulated for the most part. Small game species prevalent in the area include fox squirrel, gray squirrel, cottontail, swamp rabbit, and black-tailed jackrabbit.

Upland game bird species include bobwhite quail, and mourning dove. Waterfowl species are numerous during migration periods especially around the two NWRs. During established seasons, waterfowl hunting for the various species of migrating and overwintering geese and ducks is very popular. Some of the more common species of waterfowl selected for hunting include the Canada goose, white-front goose, snow goose, Ross's goose, gadwall, American widgeon, wood duck, blue-winged teal, green-winged teal, greater and lesser scaup, shoveler, pintail, canvasback, and redhead.

Permitted hunting is also available for species such as the gray and red fox, coyote, and bobcat. Additionally, regional species including raccoon, badger, beaver, striped skunk, mink, muskrat, and opossum may be hunted in accordance with appropriate state and Federal regulations.

3.7.5 Wetlands

According to the USFWS National Wetlands Inventory (NWI) the wetland classification code for Lake Texoma is (L1UB1Hh), which places it in the lacustrine system of wetlands (USFWS, 2010b). Lacustrine systems possess the following characteristics: (1) they are situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30% areal coverage; and 3) total area exceeds 8 hectares (20 acres). The Subsystem is Limnetic and Class is unconsolidated bottom with a special modifier (h) that stands for Diked/Impounded. All of Lake Texoma would be included in this classification. Other wetlands may occur on lands around the lake and may consist of other lacustrine wetlands, or Palustrine wetlands. Any Riverine wetlands would be associated with the Red or Washita Rivers upstream of their confluence with the lake.

Inland aquatic and semi-aquatic habitats within the proposed development area include ponds, bottomland hardwoods, and riparian communities. A small remnant of BLH is located just downstream of the Texas F.M. Road 408 bridge and is dominated by species such as sycamore (*Platanus occidentalis*), bur oak (*Quercus macrocarpa*), green ash (*Fraxinus pennsylvanica*), box elder (*Acer negundo*), and broad leaf uniola (*Chasmanthium latifolium*). This site appears to have been disturbed by bridge and/or road construction activities in the past.

Approximately 20.37 acres of BLH vegetation is present within the proposed USACE conveyance lands, and extends along Little Mineral Creek. The habitat is divided by areas of upland forest. Two small riparian zones varying in width from 1 to 3 meters exist along the upper reaches of the Little Mineral Creek and at least one of its tributaries. These riparian zones are present from the top of flood pool to the upper limits of USACE property and are not noted in Figure 3.7.2 due to their small size. Some of the more common species in this zone include lead plant (*Amorpha canescens*), sedges (*Carex sp.*), horsetail (*Equisetum sp.*), cardinal flower (*Lobelia cardinalis*), water willow (*Justicia americana*), and black willow (*Salix nigra*). This vegetative community is very small in width and appears to be heavily influenced by operation of Lake Texoma for flood control. A list of vegetation observed in the bottomland hardwoods and riparian communities are presented in the Botanical Inventory of Lake Texoma provided in Appendix G. Lists of wildlife species known, or expected, to inhabit the bottomland hardwoods and the riparian habitat within the proposed development is provided in the Animal Inventory for Lake Texoma, in Appendix G. The numbers of wildlife species currently inhabiting the area are expected to be limited by the small size of both the bottomland hardwoods and riparian habitat available.

Approximately 20 ponds totaling approximately 83 acres are present within the adjacent private property boundaries. All of the ponds are classified by the National Wetlands Inventory (NWI) as Lacustrine and are either diked/impounded or excavated as a result of human activity. The ponds range from temporarily and seasonally flooded, to permanently or semi-permanently flooded. An NWI map including the proposed USACE Conveyance Lands and adjacent private property is provided in Figure 3.7.4. The ponds within the PHD are primarily a result of historical commercial mining activities. Currently, three of the main ponds that are maintained for private recreational purposes have been stocked with several species of fish (Schuler Development, 2009). Fish species expected to be present within the ponds as a result of stocking and migration are provided in the Animal Species Inventory of Lake Texoma presented in Appendix G. The species listed are those commonly associated with these types of water features in the geographic area; however, additional species could be present.

A wetlands delineation was performed by USACE to determine if wetlands or other waters on the proposed conveyance property and the adjacent private property are under the jurisdiction of USACE under Section 404 the CWA. The results of the survey are included in Appendix C. The final Jurisdiction Determination (JD) based on the delineation concludes that 30,460 linear ft of streams, and 5 acres of wetlands and water bodies, within the proposed conveyance land are jurisdictional waters. In addition, adjacent private property has 45,668 linear ft of streams and 28 acres of wetlands and water bodies that are under the jurisdiction of USACE. The wetlands and waters are subject to jurisdiction based on the unnamed tributaries that are connected to both wetlands and other waters that flow directly into Lake Texoma, which is a navigable waterway.

The placement of dredge or fill material in jurisdictional water of the United States will require prior authorization from USACE pursuant to Section 404 of the CWA. A copy of the final JD, along with associated maps and GIS data is provided in Appendix C.

3.7.6 Lake Texoma Fisheries and Aquatic Resources

With a surface area of nearly 74,686 acres, Lake Texoma is one of the largest manmade reservoirs in the Southern Great Plains. It contains a variety of aquatic habitats that support a rich and diverse fishery within the region. It provides habitat for numerous native fish species and several introduced species. Over 70 species of fish have been reported to occur within the lake (University of Tulsa, 1971). Several other species were noted as occurring in Lake Texoma or vicinity by USACE, 1976; USFWS, 2006; and TPWD, 2011b. A comprehensive compilation of the fishery and aquatic resources of Lake Texoma are shown in the Animal Species Inventory of Lake Texoma, provided in Appendix G.

Striped bass spawning has been documented by the ODWC in both the Red and Washita Rivers above Lake Texoma (USACE, 2003a). Successful spawning is dependent upon the presence and timing of suitable inflows from these tributaries. Striped bass may spawn as far as 80 miles upstream of the lake and after spawning the eggs are held in suspension until they hatch. The larval fish make their way downstream with the current into the upper reaches of the reservoir where they mature. As they mature the small striped bass disperse throughout the reservoir feeding upon large schools of shad, and often reach sizes of 12 to 20 pounds (5 to 9 kg), with a lake record of 35.12 pounds (15.93 kg) caught 25 April 1984. Information on recreational fishing is presented in Section 3.11.

Fish Spawning Habitat

Several species of sport and forage fishes are likely to spawn within the Little Mineral Arm of Lake Texoma. These include the centrarchids or sunfishes composed of species such as the longear sunfish (*Lepomis megalotis*,) redear sunfish (*Lepomis microlophus*), bluegill sunfish (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus)*, largemouth bass, spotted bass, smallmouth bass, black crappie, and white crappie.

White bass and striped bass utilize areas within the Little Mineral Arm of the lake, but generally make spawning runs into the larger tributaries or rivers and probably do not spawn within the Little Mineral Arm. However, white bass have been known to spawn within reservoirs.

Suitable spawning habitat is present for catfishes including channel catfish, blue catfish, and flathead catfish. Suitable spawning habitat also exists for forage fish species including the gizzard shad, threadfin shad, and the Inland silversides. No attempt was made to organize or categorize spawning requirements of rough fish species, or those species that are generally undesirable and are not considered to have an economic or recreational significance.

A literature search was conducted to determine the generalized spawning requirements for the noted species with respect to depth and habitat, and the findings are characterized as follows:

Centrarchid Species

Green Sunfish

This species is a colonial nester. Nests are usually located in sheltered areas in association with rocks, logs, or clumps of vegetation. Nests are shallow and located in water that may range from 1.5 to 13.7 inches deep (Scott and Crossman, 1973).

Bluegill Sunfish

The bluegill is also a colonial nester, and nests over a substrate consisting of a firm bottom composed of gravel, sand, or mud. It spawns at a depth of approximately 2.5 ft (Scott and Crossman, 1973).

Longear Sunfish

Longear sunfish are also a colonial nest builders and shallow spawners, which nest over a substrate consisting of gravel, sand, or hard mud. They spawn at a depth of approximately 12 inches (Scott and Crossman, 1973).

Redear Sunfish

The species is a colonial nester and prefers a firm substrate composed of gravel, sand, or mud. It nests in about 2.5 ft of water (Pflieger, 1975).

Largemouth Bass

The largemouth bass is the largest member of the centrarchid family and is a territorial nester. It prefers a substrate associated with roots of emergent vegetation and spawns at depths ranging from 1 to 4 ft (Scott and Crossman, 1973).

Smallmouth Bass

The smallmouth bass is an introduced species in Lake Texoma. It is a territorial nester utilizing a single nest usually guarded by the male. It may nest over substrate composed of compacted sand, gravel, or rocky bottoms, usually near rocks, logs, or dense vegetation. Smallmouth bass spawn on rocky lake shoals, river shallows, or backwaters, but may also move into creeks or tributaries to spawn. Nests are usually located in water less than 1 meter deep, but may spawn in water as deep as 7 meters (Scott and Crossman, 1973).

Spotted Bass

The spotted bass is also a territorial nester utilizing a single nest. In reservoirs it usually spawns in coves and along steep shorelines. They show a strong preference for nesting on rocky or other firm substrate near cover of logs, brush, or clumps of submerged vegetation. The mean depths of nests are reported as 2.3 to 3.7 meters (Scott and Crossman, 1973).

White Crappie

White crappies are colonial nesters and nest over a variety of substrates, but usually near rooted plants or vegetation. They nest fairly shallow in depths ranging from 8 to 38 inches (Scott and Crossman, 1973).

Black Crappie

The spawning requirements for this species are similar to white crappie. They nest over a variety of substrates including sand, gravel, and mud, but usually associated with some type of vegetation. They spawn at depths ranging from 10 to 24 inches (Scott and Crossman, 1973).

Sea Bass Species

White Bass

The white bass generally make spawning runs up larger tributaries or rivers. They usually spawn in flowing freshwater over shoals or riffles. However, they may also spawn at mid-water depths or near the surface (Scott and Crossman, 1973).

Striped Bass

The striped bass is an introduced species at Lake Texoma, but is known to spawn in both the Red and Washita Rivers. It descends these rivers in the spring and spawns at considerable distances upstream of the lake. Its eggs are sessil and must remain in suspension until they hatch (Scott and Crossman, 1973).

Catfishes

Channel Catfish

Depending upon availability of habitat, this species may or may not migrate up rivers and tributaries to spawn. They are cavity spawners and prefer dark or semi-dark areas such as holes in banks, undercut banks, log jams, rocks, and barrels. They will spawn in water less than 5 meters deep (Scott and Crossman, 1973).

Blue Catfish

Spawning requirements for this species are similar to channel catfish requirements (Pflieger, 1975).

Flathead Catfish

Spawning requirements are similar to channel catfish requirements, noted to spawn in water from 2 to 5 meters in depth (USFWS, 1987).

Forage Fish Species

Gizzard Shad

Gizzard shad are known to spawn in protected bays and inlets. They are broadcast spawners and spawn at all depths (Scott and Crossman, 1973).

Threadfin Shad

Threadfin shad are prolific spawners and spawn along shorelines, often jumping onto the land. They are broadcast spawners and spawn along shorelines at depths less than 12 inches in depth (Pflieger, 1975).

Inland Silversides

Inland silversides are shallow spawners and spawn on algal mats, dead leaves, and/or stems of emergent vegetation. They usually spawn in shallow water (USFWS, 1986).

Fish spawning and nursery habitat exists within most of the Little Mineral Arm of the lake for all the centrarchid species. Most of the centrarchid species spawn in water depths of less than 10 ft, but the smallmouth and spotted bass may spawn in water depths up to 20 ft. Spawning requirements also dictate that nests be somewhat protected from wind and wave action and located near some type of cover. Consequently, not all areas are suitable for spawning, even though they are within the appropriate ranges for depth.

It is doubtful that either the white bass or striped bass spawn in the Little Mineral Arm of Lake Texoma due to the lack of spawning habitat. However, the large delta areas formed in the upper reaches of the Red and Washita Rivers are important nursery areas for these species. The more protected upper reaches of the Little Mineral Arm of the lake may likely provide nursery areas for young of these species, as well.

Suitable spawning habitat exists within the Little Mineral Arm of Lake Texoma for all the catfish species. They will generally spawn in water less than 5 meters in depth, but spawning must be associated with features such as holes in banks, undercut banks, rocks, logs, or artificial spawning vessels such as barrels. One of the most important attributes catfish spawning habitat must possess is darkness or semi-darkness. Numerous habitats such as clay banks with holes, rocks, and logs provide these features for this species within the Little Mineral Arm.

Suitable spawning habitat exists within the Little Mineral Arm for all the noted forage fish species. Gizzard shad are the most ubiquitous in their spawning requirements and probably spawn within the entire Little Mineral Arm. The threadfin shad and Inland silversides would be most likely to spawn in the protected shallow areas along the shoreline, especially if emergent vegetation, logs, or detritus are present.

Within Little Mineral Arm, potential nest sites for fish are common. A reported high abundance of larval communities and juveniles of centrarchids species of littoral fish are found in well protected, low-exposure sites in marinas and off-lake coves. These species are nest-builders and require relatively stable, structurally complex habitats that are common in protected or less-exposed areas (Etnier & Starnes, 1993, as cited in Eggleton et al., 2005).

An analysis of near-shore habitats (Figure 3.7.5) was developed for shoreline areas adjacent to the proposed conveyance lands and within the Little Mineral Arm of the lake. The near shore habitats adjacent to the proposed conveyance land are listed in Table 3.7.6. The near shore habitat was considered to extend into the water and be indicative of underwater habitat immediately adjacent to the shoreline.

Table 3.7.6

Near Shore Habitats and Quantities

Habitat Characterization	Quantity (Linear Feet)
Clay Bank/Rock	17,183
Clay Bank/Rock/Dead Trees	7,025
Clay Bank/Rock/Scattered Live Vegetation	761
Sand/Cobble/Scattered Live Vegetation	2,826
Sand/Gravel/Scattered Live Vegetation	1,025
Sand Silt	9,959
Stream Habitat	8,199

Source: WESTON, 2010

An example of near-shore habitat termed "Sand Silt" is shown in Photograph 1, provided in Appendix H. An example of near-shore habitat termed "Clay Bank/ Rock/Dead Trees" is shown in Photograph 2, Appendix H.

As shown in Table 3.7.6, the bulk of the shoreline adjacent to the proposed conveyance land is characterized as clay bank with rock or clay bank with rock and dead trees. These areas provide a substantial amount of the more desirable spawning habitat when it is associated with suitable water depth and protection from the wind. Areas characterized as sand/silt also comprise a substantial portion of the area and are usually associated with the upper ends of coves or along eroded shorelines or pocket beaches. Approximately 8,299 linear feet of stream habitat exists within the study area, and is located in the uppermost reaches of Little Mineral Creek and an unnamed tributary, as shown in Figure 3.7.5.

A bathymetric map was developed for the study area depicting potential suitable spawning depths from elevation 617-607 ft NGVD (10' range) and 607-597 ft NGVD (20' range) and is included as Figure 3.7.6. In addition to water depth, other important spawning requirements include suitable cover and protection from heavy winds and wave action. The prevailing winds in the study area during the spawning season are from the south-southwest. A map showing suitable protected spawning areas along the shoreline adjacent to the proposed conveyance land within the Little Mineral Arm of the lake was developed using the 10 and 20-foot depth ranges and consideration for the prevailing wind during the spawning season (Figure 3.7.7). Based upon spawning criteria for water depth and protection from wave action, it was estimated that a total of approximately 145 acres of potential spawning habitat exists adjacent to the proposed conveyance lands within the Little Mineral Arm of the lake.

Approximately 111 acres is located between elevations 607 – 617 ft NGVD and 34 acres between elevations 597 - 607 ft NGVD. Using the same criteria, an estimate was made of available spawning habitat lake-wide. As shown in Figure 3.7.8, there are an estimated 15,712 acres of potential fish spawning habitat in Lake Texoma. Approximately 4,668 acres of potential spawning habitat is located in Oklahoma, and 11,044 acres of potential spawning habitat is located in Texas. The delta areas of the Red River and Washita River (including the Cumberland Pool area) were not factored into this analysis due to the extremely shallow water depths, heavy accumulations of sediment, and high turbidity levels normally associated with periods of heavy inflows during the spawning season.

The best spawning habitats include those areas with water depths ranging from 10 to 20 ft, areas afforded protection from the prevailing winds and wave action, and areas containing some type of spawning cover such as rocks, trees, logs, or vegetation. An example of a protected spawning area within the Little Mineral Arm is shown in Photograph No. 3, Clay, Rock, Bank with Dead Trees provided in Appendix H.

3.7.7 Threatened and Endangered Species

Lake Texoma is surrounded by Cooke and Grayson counties in Texas, and by Bryan, Johnson, Love, and Marshall counties in Oklahoma. Records of occurrences for listed threatened and endangered species, sensitive species, and species of concern for Lake Texoma were developed from the following sources and data bases: Texas Parks and Wildlife list of species for Grayson and Cooke Counties, Texas (TPWD, 2009); the USFWS; the Oklahoma Natural Heritage Inventory (ONHI); and the ODWC (ODWC, 2010c). Eleven threatened and five endangered species were on the Grayson County list; eight threatened and five endangered species were on the Cooke County list; four endangered and two threatened species were on the USFWS list; two threatened and four endangered species were on the ONHI list; one threatened and one endangered species were on the ODWC list; and 33 species of special concern were on the ONHI and/or ODWC list. A complete list of the Texas and Oklahoma State-listed regional rare, threatened, and endangered species, sensitive species, and species of concern is presented in List of Threatened and Endangered Species, Sensitive Species, and Species of Concern provided in Appendix G.

Federally listed species potentially occurring at Lake Texoma are shown in Table 3.7.7 and include the whooping crane (*Grus americana*), piping plover (*Charadrius melodius*), interior least tern (*Sterna antillarium*), American alligator (*Alligator mississippiensis*), scaleshale mussel (*Leptodea leptodon*), and American burying beetle *(Nicrophorus americanus*).

Table 3.7.7

Federally Listed Threatened and Endangered Species with the Potential to Occur at Lake Texoma

Common Name	Scientific Name	Status: (T) Threatened, (E) Endangered
Interior least tern	*Sterna antillarum*	(E)
Whooping crane	*Grus americana*	(E)
Piping plover	*Charadrius melodius*	(T)
American alligator	*Alligator mississippiensis*	(T)
Scaleshale mussel	*Leptodea leptodon*	(E)
American burying beetle	*Nicrophorus americanus*	(E)

Source: USACE, 2005 and modified by WESTON, 2011

The whooping crane is a very rare migrant to the Lake Texoma area, but has been documented at the Hagerman NWR. Whooping cranes generally use shallow water habitats and islands along the Red River in Jackson and Tillman counties to the west of Lake Texoma during migration periods.

The piping plover is also considered a migrant to this area, and might only be present during spring and fall migration periods.

The American alligator is present in the lower Red River Basin, but its occurrence in the lake is unlikely.

The interior least tern nests along the Red River, both upstream and downstream of the lake, and on the Hagerman NWR.

The scaleshale mussel has been recorded from several counties in eastern Oklahoma, and is a resident of larger creeks and small to medium size rivers having good water quality. It has been recorded from Choctaw County just to the east of Lake Texoma. While habitat for this species is present in the region, it is doubtful this species occurs in association with the lake.

The American burying beetle (ABB) is found in several counties along the Red River near Lake Texoma,though it is not listed by the USFWS as occurring in Grayson County, Texas where the proposed conveyance area is located. The ABB was Federally listed in 1989 as an endangered species primarily because habitat fragmentation has reduced the availability of prey species, increases in competing scavengers, and isolation of breeding populations causing a decrease in gene flow.

By letter dated 2 December 2008 (Appendix B), the USFWS informed USACE that the ABB was likely the only Federally listed species of concern potentially present on the proposed conveyance area. Since the ABB was identified as a species potentially occurring, a presence-absence survey for the beetle was conducted in September 2009 on the proposed development property. Appropriate habitat was identified within the Proposed Action area for the American burying beetle. The survey was conducted following the methods described in the USFWS *American Burying Beetle Survey Guidance for Oklahoma (May 2009).* No ABBs were captured during this survey effort. Based upon the results of the recent survey and lack of reports of the ABB at other locations in Grayson County, Texas, the American burying beetle is not believed to be currently present within the boundaries of the Proposed Action area. The survey results are furnished in the American Burying Beetle Survey Report provided in Appendix G.

The Texas Wildlife Diversity Database was reviewed for reported occurrences of rare species on or near the proposed development. A review of this database found no threatened or endangered species had been reported within the study area. Based on a review of the available habitats within the study area, and the habitat requirements for the listed species, it is doubtful that any of the Federally listed threatened or endangered species would occur within the study area.

The available habitat in and surrounding the proposed project area was reviewed for appropriate features preferred by each regional threatened or endangered species. Based on the available habitat, no other threatened or endangered species are expected to be present in or near the project area. The results of the evaluation were presented in a letter to the USFWS on 5 April 2011. The USFWS provided concurrence in an email dated 5 April 2011. The letter and concurrence is provided in Appendix G.

3.7.8 Unique Resources

The study area contains several habitat types including native grasslands, bottomland, hardwoods and potential fish spawning areas. Nationwide, these habitat types have been declining over the past several decades. Approximately 20 acres of bottomland hardwoods and an approximate combined 50 acres of relatively undisturbed, but fragemented, native grasslands are present within the proposed USACE conveyance lands. Additionally, approximately 170 acres of native grasslands are present on the PHD property. While these resources provide valuable and uncommon habitats in the study area, they are not considered unique because they are not specifically capable of supporting types of wildlife with highly specialized habitat requirements. No parts of the study area have been identified as providing specialized wildlife habitat, habitat preferential to protected species, or significant spawing or wildlife nesting areas. Regionally, the two USFWS National Wildlife Refuges provide large managed wetlands and bottomland hardwood areas in addition to native grasslands. While they provide valuable habitats for both migratory and resident fish and wildlife species, and are important components of the National Refuge System, they are not unique habitats. To date no unique resources have been identified as occurring within the proposed USACE conveyance properties or adjacent private property.

3.7.9 Wildlife Refuges and Wildlife Management Areas

Two national wildlife refuges operated by the USFWS are present on USACE lands at Lake Texoma, and are shown on Figure 3.2.2. They include the Tishomingo NWR located on the Washita Arm of Lake Texoma in Oklahoma, and the Hagerman NWR located on the Big Mineral Arm of the lake in Texas. Both refuges are managed on an ecosystem approach for the benefit of resident and migratory fish and wildlife species. The ecosystem management approach is based on protecting or restoring the natural function, structure, and species composition of an ecosystem while recognizing that all components are interrelated. The two wildlife refuges are part of the Arkansas/Red River Ecosystem as defined by the USFWS. This ecosystem is approximately 245,000 square miles extending from the eastern Rocky Mountains to the northern bayous of Louisiana, and contains all of Oklahoma. The Arkansas/Red River Ecosystem has a total of 16 wildlife refuges. The overall objectives of wildlife refuges in the Arkansas/Red river ecosystem are:

- Water quality and quantity maintenance and improvement

- Focus species conservation and restoration
- Conserve and restore focus habitats
- Increase public outreach efforts relative to Service Programs
- Improve outdoor recreational opportunities

Tishomingo National Wildlife Refuge

The Tishomingo NWR contains approximately 16,464 acres and is located along the upper Washita Arm of Lake Texoma, near the town of Tishomingo, Oklahoma. Most of the refuge, including the 4,500-acre Cumberland Pool, were acquired in 1946 as part of the Lake Texoma project and are USACE lands licensed to the USFWS. The refuge was established to benefit migratory waterfowl in the Central Flyway. A total of 284 bird species have been recorded at the refuge. The refuge encompasses a variety of habitats including murky waters of the Cumberland Pool with a high nutrient load, seasonally flooded willow flats and elm woodlands. Approximately 900 acres of croplands are planted to winter wheat, milo, or corn and provide forage and grain for migrating waterfowl and resident wildlife.

Up to 100,000 ducks and 45,000 geese feed and roost at the refuge in fall and winter. Geese are primarily snows, but also include white-fronts and Canada geese. Mallards, pintails, and other dabblers are the most common ducks. Waterfowl numbers generally peak between mid-December and late January. Bald Eagles are typically present from November to March (USFWS, 2011).

During fall and spring migration periods, species such as white pelicans, grebes, ducks, herons, sandpipers, gulls, and numerous upland birds can be found at the refuge. Summer bird residents may include egrets, herons, and woodland birds. In addition to birds, white-tailed deer, cottontail, and fox squirrel are plentiful, with raccoon and beaver abundant near sources of water. Skunk, opossum, and armadillo are other common mammals.

The Cumberland Pool is normally cut off from Lake Texoma, but can support a large fish population, including rough fish species such as carp, buffalo, and gars as well as popular sport fish species such as black and white crappie, white bass, and channel, flathead, and blue catfish.

Hagerman National Wildlife Refuge

The Hagerman NWR was also established in 1946 as part of the Lake Texoma project and contains approximately 11,320 acres of USACE lands licensed to the USFWS. It is located in Grayson County, Texas, within the Big Mineral Arm of Lake Texoma, and is approximately 13 miles southwest of the project area. Physiographically, the refuge is located within the Blackland Prairie Province of north Texas, and provides sanctuary and breeding ground habitat for migratory birds and other wildlife species in addition to wildlife-oriented recreation for the public. The refuge has high biologic value as evidenced by the diversity of fish and wildlife species utilizing the refuge, and is an important migratory route for waterfowl along the Central Flyway.

A total of 338 species of birds have been documented to occur at the refuge. Of these, 292 are considered to be abundant or rare in occurrence and are listed seasonally. Another 46 species have only been seen once or twice and are deemed “accidentally” (USFWS, 2010a).

The refuge is composed of approximately 3,000 acres of marsh and lake and 8,000 acres of uplands and farmlands. The refuge farming program provides grain and forage for migratory waterfowl and resident wildlife species. The refuge is located within the Partners in Flight (PIF) Oaks and Prairies Physiographic Area, which extends from the Red River of Oklahoma south to San Antonio, Texas, east to the sandy soils of the East Texas Pineywoods and west to the Eastern Cross Timbers. Within this area, the Texas Blackland Prairie represents the southernmost extension of the North America tallgrass prairie. The refuge is an important habitat for the priority migratory birds listed below. All but the greater prairie chicken occur on the refuge. Over 99% of Blackland Prairie within the Oaks and Prairies Physiographic Area has been converted to agricultural uses. Therefore, large “islands” of native habitats such as those found on the refuge play a critical role in sustaining these bird populations.

Priority bird populations and habitats within this Physiographic Area include: Grassland and Scrub habitats specifically for the greater prairie chicken (*Tympanuchus cupido*), Bewick’s wren (*Thryomanes bewickii*), scissor-tailed flycatcher (*Tyrannus forficatus*), Bell’s vireo (*Vireo bellii*), painted bunting (*Passerina ciris*), and bobwhite (*Colinus virginianus*). These species are indicators of the condition of the grasslands, bottomland hardwood forests, and scrub habitats within the Lake Texoma area. Their populations have been emphasized as a priority for monitoring. The painted bunting is uncommon, but has been recorded at the Hagerman NWR. Historically, the greater prairie chicken has been identified at the Hagerman NWR, but it probably no longer exists in the area. The Bewick's wren, Bell's vireo, and scissor-tailed flycatcher are common winter migrants in the region and have been recorded at Tishomingo and Hagerman NWR. The grassland/scrub habitat is available on the project area, but only a small amount is undisturbed native habitat preferred by the above bird species. Regionally, native prairie and bottomland hardwood forests are limited with the best undisturbed habitats being present on the national wildlife refuges.

Wildlife Management Areas

There are five wildlife management areas on USACE lands at Lake Texoma. They are all located in Oklahoma and are operated by, or in cooperation with, the wildlife department (ODWC, 2011a). They include: Fobb Bottom WMA, Love Valley WMA, Hickory Creek WMA, Texoma -Washita Arm WMA, and the Tishomingo NWR/WMU. The locations of these WMAs are shown in Figure 3.2.2. Additional details regarding these areas are provided in Section 3.10 in this EIS. The TPWD operates a fishery laboratory on approximately 36 acres of USACE lands located near the southern end of the Little Mineral Arm of Lake Texoma.

3.7.10 Migratory Birds

Lake Texoma is located within the Central Flyway, which is a major duck and goose migration corridor. Lake Texoma is also within the routes of many neo-tropical migrant bird species migrating from Canada to Central America and Mexico. The Central Flyway extends from central Canada to the region surrounding the Gulf of Mexico. The flyway is favored because of the lack of large mountains in the region and typically good sources of food and cover are available. The avian fauna of Lake Texoma is quite diverse. The University of Tulsa in 1971 reported a total of 300 species occurring in the area, and the USFWS lists a total of 338 species as having been documented to occur on Hagerman NWR (USFWS, 2010a). A list of the migratory species that winter in the region of Lake Texoma is shown in the Animal Species Inventory of Lake Texoma provided in Appendix G.

A total of 83 species are considered migratory, and can be found in the Lake Texoma area during spring and fall migration periods. Some of the more notable migratory species include the once threatened bald eagle and Federally listed endangered Interior least tern and threatened piping plover. The Federally listed endangered whooping crane has been recorded for the area, but is considered to an accidental occurrence and not a regular migrant.

3.7.11 Wildlife Corridors

Wildlife corridors are valuable in order to link similar habitat patches into a landscape that facilitates the movement of species among fragmented habitats. These corridors can include a strip of forest or meadow, or structures that allow animals to cross roadways. Corridors are physical connections between disconnected fragments of wildlife habitat.

Wildlife corridors can reduce the negative effects of habitat fragmentation by facilitating the movement of wildlife species through habitat patches, helping key carnivore species establish their own home ranges. The most valuable corridors are frequently along water bodies such as riparian systems. When animal populations are unable to travel through a highly fragmented landscape to find mates, they may become locally rare or extinct.

Impoundment of the Red River to form Lake Texoma created a major barrier to the movement of animal species up and down the Red and Washita Rivers and may have altered the north to south movement of many animal species back and forth across the Red River for the entire length of Lake Texoma. However, travel corridors consisting of native habitats existed on both sides of the lake, and while animal movements were more restrictive, they could still migrate around this obstacle. Over time, these travel corridors have been impacted by development associated with the lake and are becoming more fragmented because of development of recreation areas, lake cabins, urban sprawl, golf courses, housing developments, roads, fence lines, and agriculture. The wildlife habitats and land cover around Lake Texoma were mapped and are shown in Figures 3.7.1.1 – 3.7.1.5. As can be seen in these figures, wildlife travel corridors for species moving up and down the Red and Washita Rivers still exist around both sides of Lake Texoma, but are becoming increasing smaller and fragmented due to the aforementioned causes. Other than the designated Central Flyway for migratory waterfowl, there are no designated major wildlife corridors that include the Lake Texoma region.

Wildlife corridors are typically designed to provide a connection in highly fragmented habitat for key large species. In some parts of the U.S., these species may include bears, mountain lions, wolves, fox, bobcat, coyote, deer, moose, badger, and often their prey. Currently, the states of Oklahoma and Kansas are identifying crucial habitat for the Lesser Prairie Chicken. The plan will include identifying habitats in the five state region including Texas. The plan will not only include identifying habitat, but also connecting corridors between the habitats (Western Governors Association, 2010).

Because water and cover are frequent requirements of wildlife corridors, any large areas of undeveloped land surrounding Lake Texoma is a valuable wildlife corridor for smaller mammals, birds, and reptiles. The continuous habitat allows for movement of populations, and prevention of local extinction. The woodlands present on the USACE land are not connected to regional woodlands. The areas surrounding the proposed development and lake-wide USACE land are not connected to other woodland habitat in the region. The native grasslands present in the region are highly fragmented with no organized wildlife corridor between the stands.

A major threat to the upland forest is fragmentation from other regional upland forest stands. Some animal species are expected not to require large swaths of contiguous habitat and are adapted to human disturbances, while others must have these requirements. Although upland forest is generally present surrounding the entire lake, it is separated to the inland from other upland forest in the region by grasslands, current and former agricultural lands, development, and roads. The upland forest along areas adjacent to the proposed study are also fragmented from each other by developed recreational areas such as camp grounds, developed leased properties, and maintained grasslands. This fragmentation limits the species currently present to those that require small areas for suitable habitat, those that easily transition between habitat types, and those that are adapted to development and human disturbance. This is why species such as the Greater Prairie Chicken, badger, red wolf, black-footed ferret, and mountain lion that are intolerant of these conditions have become increasingly rare or extinct within the study area and region. As development continues to occur, fragmentation would probably accelerate, and the number of species considered to be rare or extinct would increase.

3.7.12 Invasive Species

Invasive species are defined as introduced species that can thrive in areas beyond their natural range of dispersal (USDA, 2010b). Executive Order 13112 defines invasive species as, "an alien species whose introduction does or is likely to cause economic or environmental harm to human health." Invasive species are highly adaptable and oftentimes displace native species. The characteristics that enable them to do so include high reproduction rates, resistance to disturbances, lack of natural predators, efficient dispersal mechanisms, and the ability to out-compete native species (OSU, 2010). A total of 28 invasive species occur within the region. Of these, 21 species were determined to already occur or have the potential to occur in the Proposed Action area and/or on USACE lands at Lake Texoma (OSU, 2010). A list of these species is shown in Table 3.7.8. It is composed of thirteen species of plants, and six species of animals.

Table 3.7.8

Invasive Species Known to Occur or Likely to Occur at Lake Texoma

Species	Scientific Name	Known/Probable Occurrence	Potential to Occur
Russian Olive	*Elaeagnus augustifolia*	X	
Hydrilla	*Hydrilla verticillata*		X
Purple loosestrife	*Lythrum salicaria*		X
Mesquite	*Prosopis glandulosa*	X	
Johnson grass	*Sorghum halepense*	X	
Salt cedar	*Tamarix spp.*	X	
Field bindweed	*Convolvulus arvensis*	X	
Giant Reed	*Arundo donax L.*	X	
Eastern Red cedar	*Juniperus virginiana*	X	
Tall Fescue	*Festuca arundinacea*	X	
Ashe Juniper	*Juniperus ashei*		X
Sericea lespedeza	*Lespedeza cuneata*	X	
Multiflora rose	*Rosa multiflora*	X	
Grass carp	*Ctenopharyngodon idella*	X	
Daphnia or waterflea	*Daphnia lumholtzi*	X	
Zebra Mussel	*Driessenia polymorpha*	X	
Red Imported Fire Ant	*Solenopsis invicta*	X	
Feral Hogs	*Sus scrofa*	X	

Species	Scientific Name	Known/Probable Occurrence	Potential to Occur
Africanized honeybee	*Apis mellifera scutellata*		X

Source: WESTON, 2010

Russian olive was introduced in the late 1800s as an ornamental plant, but was later planted throughout the United States for soil moisture conservation and wildlife habitat. It produces some food for wildlife, but may out-compete other native plants (OSU, 2010).

Hydrilla is an aquatic plant species that was introduced into the United States in the 1950s via the aquarium trade. It is a very rapid growth species and forms dense mats near the surface of the water. It out competes native vegetation, acts as a breeding ground for mosquitoes, and destroys fish and wildlife habitat. It can also cause flooding by clogging rivers and canals, and clog water supply intakes. It is considered one of the most troublesome aquatic plants in the United States (OSU, 2010).

Purple loosestrife was introduced into the United States in the 1800s as an ornamental plant, but it has spread throughout the United States rapidly. It adapts easily to wetland environments. It forms dense homogenous stands that restrict other native wetland plant species (OSU, 2010).

Mesquite is an invader from Mexico. It was brought to New Mexico and Texas during the late 1800s as part of the cattle drives from Mexico. Mesquite is not very palatable and is not browsed by a large number of species. At high densities mesquite suppresses native grasses and reduces species diversity. However, mesquite is a legume and adds nitrogen to the soil, and provides fuel, and timber (OSU, 2010).

Johnson grass is an invasive species that was introduced in the early 1800s for cattle forage. It provides forage for livestock, but can produce cyanide toxins, if improperly harvested. It provides some cover for wildlife, but has several negative impacts on other types of crops (OSU, 2010).

Salt cedar was introduced in the United States in the 1830s and was widely used in windbreaks and for stream bank erosion control. It is designated as one of the 10 worst noxious weeds in the United States. It displaces native species, exhibits very high water uptake, and can increase flooding potential. It can decrease water velocity in streams causing increased siltation. It provides little value to wildlife as a food source, and displaces many native species, resulting in declines in many animal species (OSU, 2010).

Field bindweed is believed to have been brought to the United States in the mid 1700s. It is found mostly in highly disturbed agricultural areas. It directly competes with other native species, and has a large economic impact on farming (OSU, 2010).

Giant reed was introduced into the United States for erosion control, and as an ornamental. It is a very hardy plant and can rapidly invade stream banks and roadside habitats. It out competes many native species and forms large homogenous stands that can reduce the water-carrying capacity of the area (OSU, 2010).

Eastern red cedar is a native species of the eastern United States. It has become a problem in the mid-west because of the suppression of fire, which historically kept it from spreading. It has been used in windbreaks, and wildlife habitat plantings, and is spread by birds that eat the seeds. It can out-compete other native plant species that usually results in the loss of native prairie and native prairie bird species. It creates dense thickets that can also reduce forage for cattle and create problems in handling livestock (OSU, 2010).

Tall fescue was introduced into the United States in the late 1800s, for improving pastures, and erosion control. It invades most native habitats and has a competitive edge over native species that results in communities dominated by tall fescue. Many ground nesting birds are adversely impacted by this plant and unable to use it for food or nesting cover. It produces alkaloids, which can be toxic to ungulates including cattle, deer, and elk. Livestock will graze young plants (OSU, 2010).

Ashe juniper is a dioecious tree that can reach 15m in height. The trees are native to the Edwards Plateau in Texas and provide valuable habitat for native and endangered species in the region. The Ashe juniper colonizes easily when natural fires are suppressed and in areas where heavy livestock grazing has occurred. As a result, the trees have spread north through Texas and southern Oklahoma, creating dense stands, shading out native species and consuming large amounts of groundwater.

Sericea lespedeza was first used in the United States in the late 1800s, and has been widely used for erosion control. It is very drought tolerant and produces allelopathic chemicals that harm the germination and growth of native plants. These attributes help this species outcompete native species, which results in losses of wildlife species (OSU, 2010).

Multiflora rose was first introduced as an ornamental, but escaped into the wild. It has been used for erosion control, roadside barriers, and horticulture. It spreads rapidly and forms an impenetrable barrier to both wildlife and cattle. It lowers the quality of forage for cattle and reduces wildlife habitat (OSU, 2010).

The grass carp or white amur was first released in Arkansas Lakes in the 1960s as a control measure for aquatic plant infestations. It was believed they were vegetarian, but studies show they feed on many different food items including aquatic plants, algae, invertebrates, and vertebrates. Consequently, they have the potential to adversely impact native fish and aquatic plant communities (OSU, 2010).

The Zebra mussel is a highly invasive aquatic species of specific concern in Lake Texoma as well as most of the river systems in the eastern and central U.S. The zebra mussel was first discovered in the Great Lakes in 1988. Since then, it has rapidly spread throughout the Mississippi River system. Zebra mussels are filter feeders and adversely impact native aquatic species through overcrowding and by altering the food chain and water chemistry. Because one adult zebra mussel can filter up to one liter of water per day, their feeding activity reduces the abundance of plankton, the microscopic organisms that form the bottom of the aquatic food chain, thereby reducing the populations of other plankton eating organisms. In April 2009, a landowner reported the first living zebra mussels in Lake Texoma (TPWD, 2009). Zebra mussels were monitored at six locations in Lake Texoma from January to September 2010 (Boeckman and Bidwell, 2010). The largest populations of both larval (140/L) and adult mussels (18,000/m^2) were observed at Highpoint Marinas and Eisenhower Yacht club.

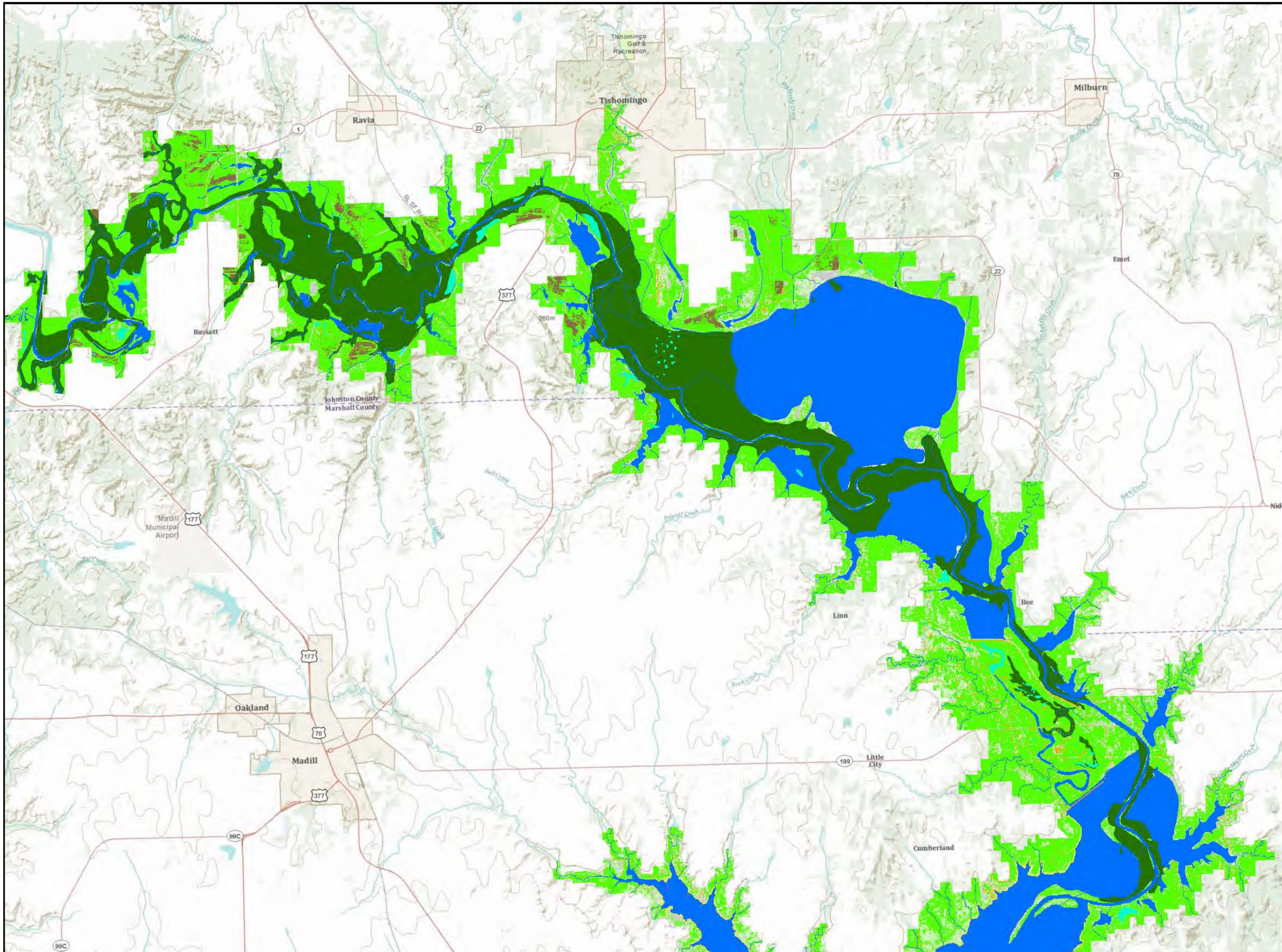
Zebra mussels create a particular nuisance to municipalities, industries, power plants, and irrigation systems, by clogging water pipes and intake. Additionally, they can reach population densities as great as hundreds of thousands per square meter. The NTMWD initiated Stage 1 of its Water Conservation and Drought Contingency and Water Emergency Response Plan in response to zebra mussels effective April 2010. The NTMWD is working with state and Federal agencies to minimize zebra mussels from being transferred from Lake Texoma into the Trinity River basin (Markovic, 2011). The TPWD, the ODWC, and the USACE Tulsa District all have outreach and education programs to reduce zebra mussels invading Lake Texoma.

Daphnia or “water flea” was probably introduced into the United States in Texas and has rapidly spread throughout much of the country. The impact of this introduction is not fully known presently, but it is speculated that it may negatively impact native Daphnia populations and organisms that feed on Daphnia. Some scientists believe this species is more resistant to predation than other native species of Daphnia, which would allow it to out-compete native Daphnia species and cause them to decline. The loss of native Daphnia species could impact the entire aquatic ecosystem and fish community (OSU, 2010).

The imported red fire ant was unintentionally brought to the United States from South America in the 1930s. Fire ants reduce and destroy habitat for other insect and animal species, and are thought to reduce ground nesting populations of rodents and birds. They oftentimes invade crops and negatively impact crop yields. They have been known to cause damages to a number of crops including soybeans, citrus, corn, okra, bean, cabbage, cucumber, eggplant, potato, sweet potato, peanut, sorghum, and sunflower (OSU, 2010).

Hogs were introduced into the United States in the 1500s. They were intended to be domesticated and used as a food source, but have been released and escaped from captivity. Feral hogs directly compete with most wildlife species. They disrupt the soil when they “root for food,” which can change soil properties, and alter plant communities. Negative effects associated with feral hogs include soil erosion, consumption of native seed crops, consumption of threatened and endangered species, altered plant succession, and a reduction in overall species diversity (OSU, 2010).

Africanized honeybees or “killer bees” were first discovered in Texas in 1990. Since that time they have spread northward and into Arizona. They have been found in several counties along the Red River. The bees were imported and bred with European honey bees to increase honey production. They are more aggressive than European bees when defending their hive and have reportedly attacked people, stinging individuals hundreds of times, which in some cases resulted in death (OSU, 2010).



LEGEND

Landcover Vegetation Class

- Mixed Upland Forest
- Grassland/Herbaceous
- Unconsolidated Shore
- Aquatic Inland
- Developed (Impervious Cover)
- Open Water
- Bottomland Hardwood
- Barren/Distrubed Area
- Active Agricultural Land

SOURCE:
1) U.S. DEPARTMENT OF AGRICULTURE, NATIONAL AERIAL IMAGERY PROGRAM, FARM SERVICE AGENCY, GRAYSON COUNTY, TEXAS 2008-09-09
2) Background world topographic map service ESRI.
3) Boundary provided by PSA Engineering 2009

This figure is prepared for reference purposes only and should not be used, and is not intended for, survey or engineering purposes.

N

0 1.5 3
Miles

FIGURE 3.7.1.1
LAND COVER MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	12632.000.000	AS SHOWN

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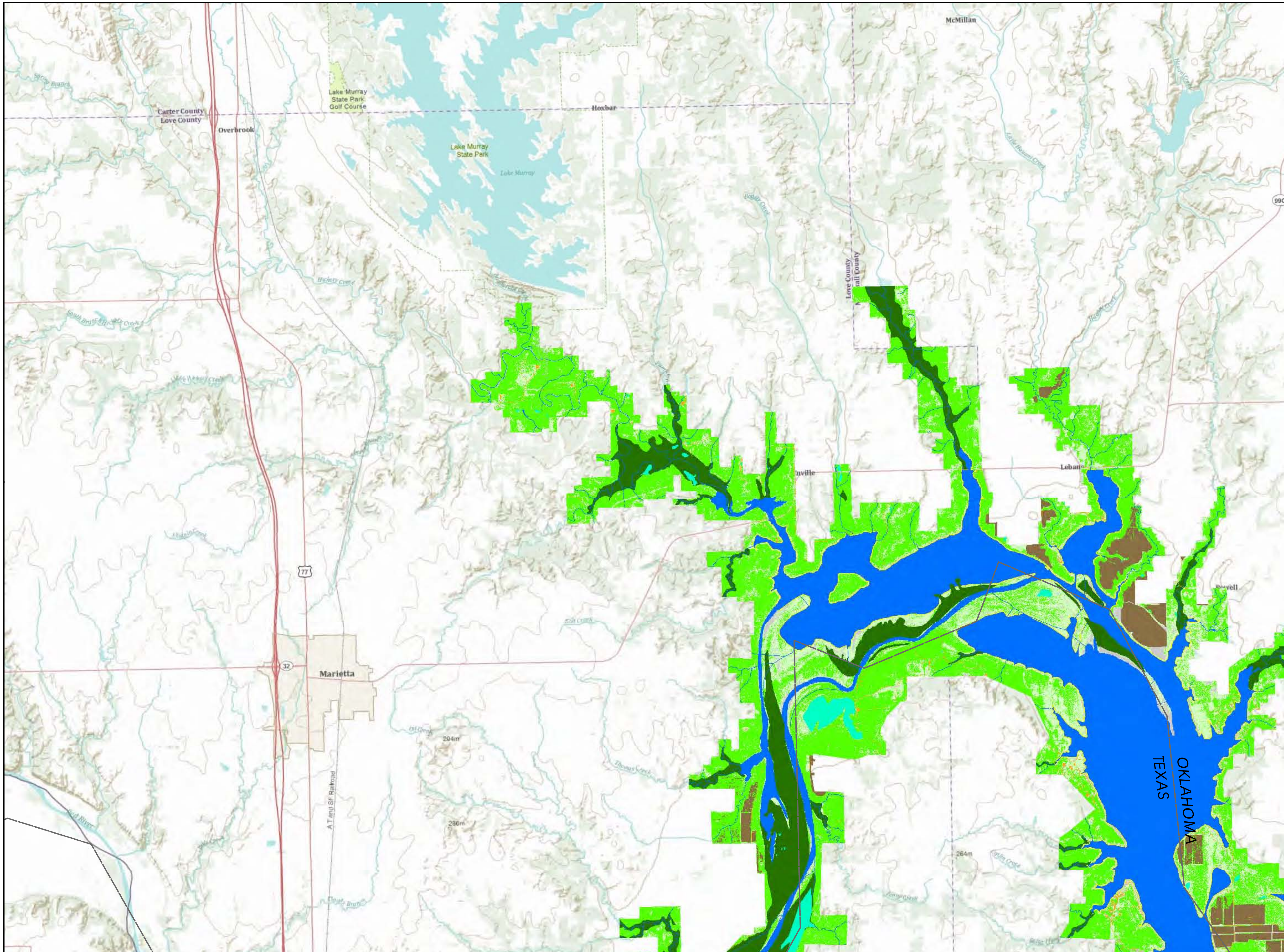

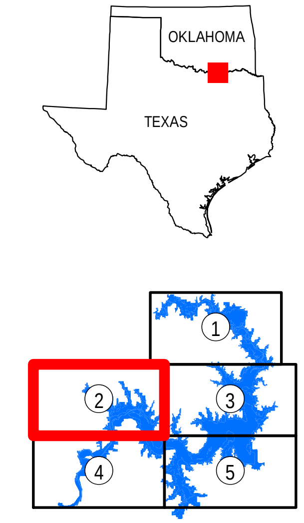

LEGEND

Landcover Vegetation Class

- Mixed Upland Forest
- Grassland/Herbaceous
- Unconsolidated Shore
- Aquatic Inland
- Developed (Impervious Cover)
- Open Water
- Bottomland Hardwood
- Barren/Distrubed Area
- Active Agricultural Land
- State Boundary

SOURCE:
1) U.S. DEPARTMENT OF AGRICULTURE, NATIONAL AERIAL IMAGERY PROGRAM, FARM SERVICE AGENCY, GRAYSON COUNTY, TEXAS 2008-09-09
2) Background world topographic map service ESRI.
3) Boundary provided by PSA Engineering 2009

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0 1.5 3
Miles

FIGURE 3.7.1.2
LAND COVER MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	12632.000.000	AS SHOWN

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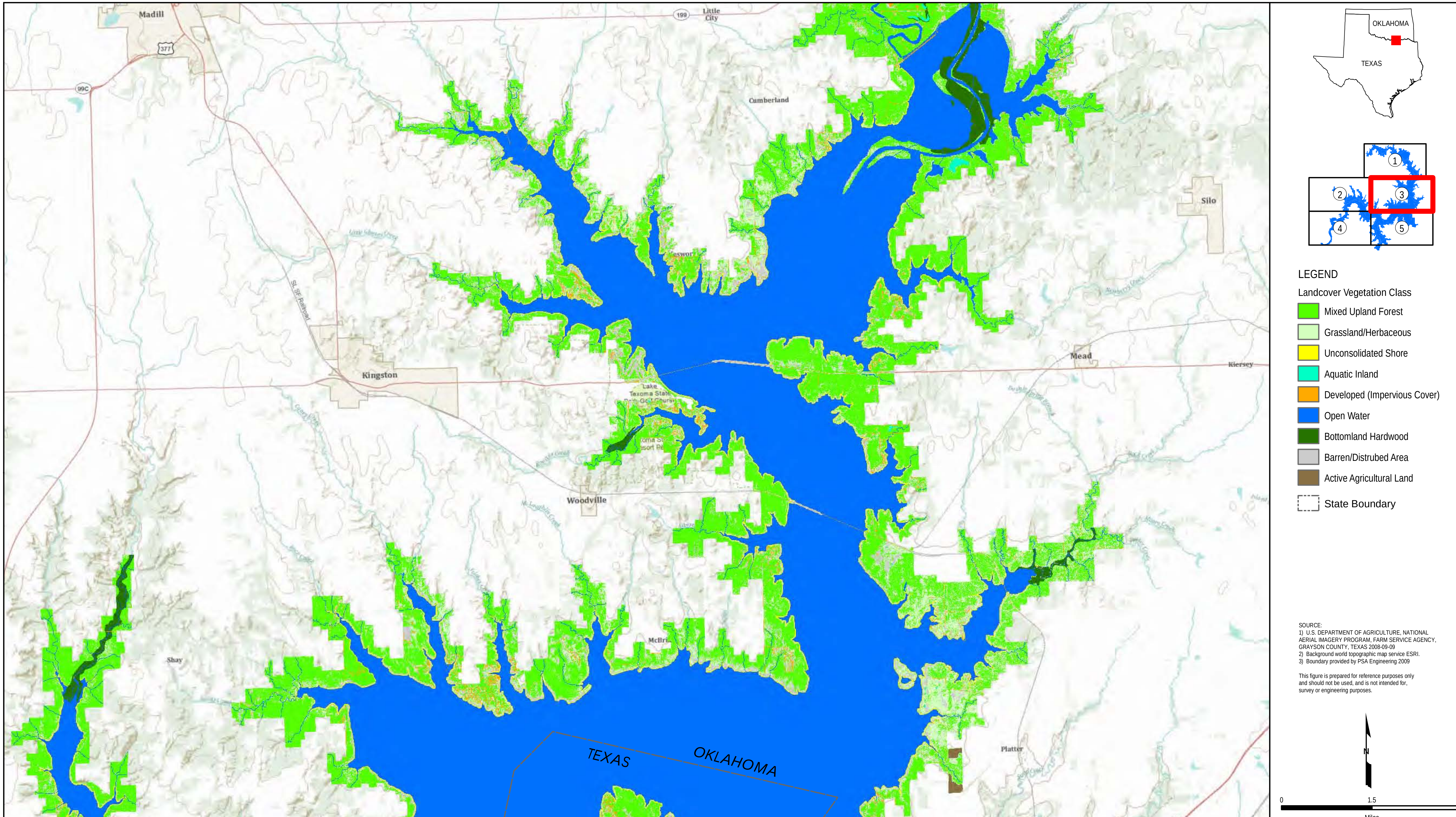

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2) Background world topographic map service ESRI.
3) Boundary provided by PSA Engineering 2009

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FIGURE 3.7.1.3
LAND COVER MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	12632.000.000	AS SHOWN

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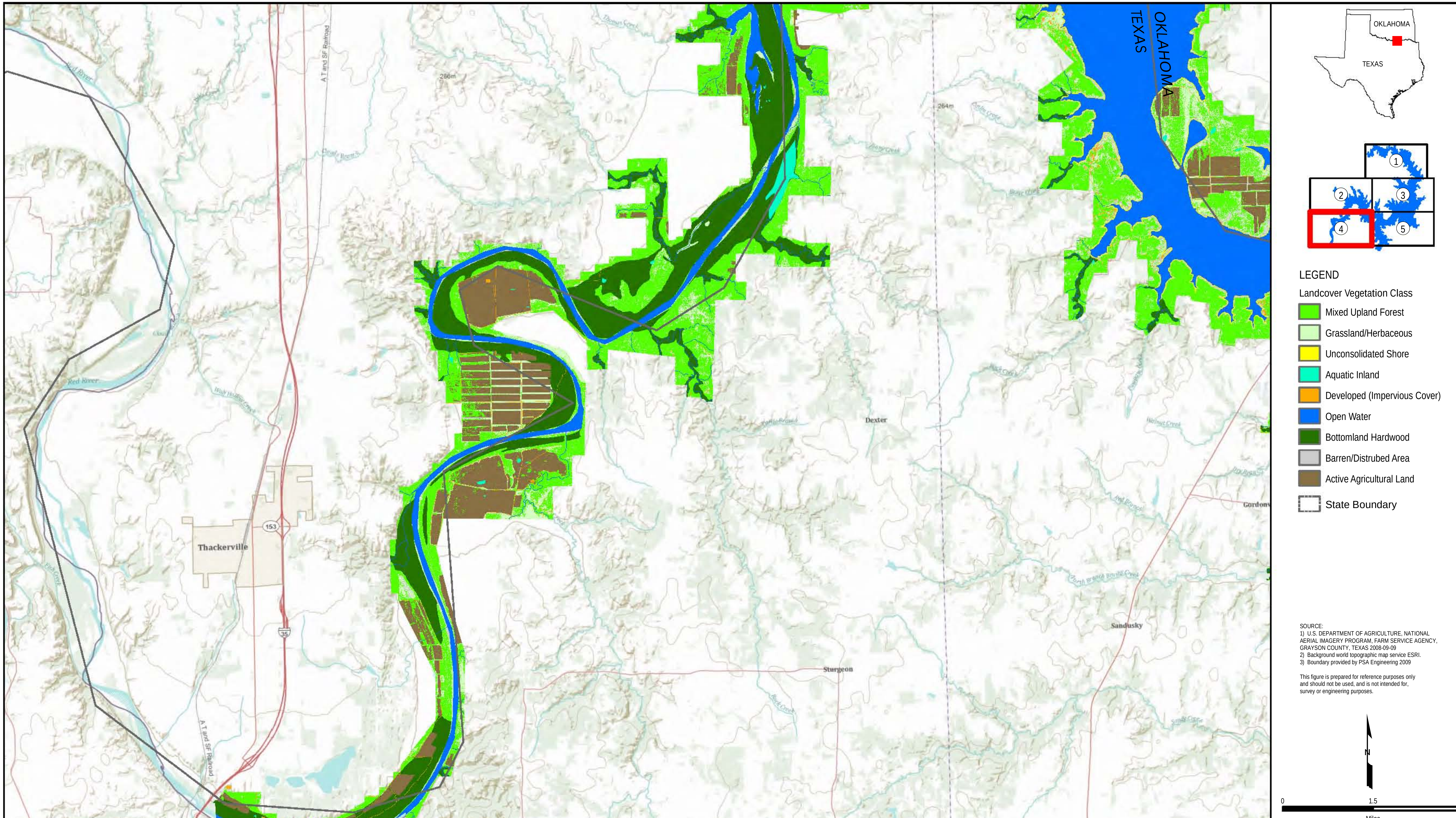

SOURCE:
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2) Background world topographic map service ESRI.
3) Boundary provided by PSA Engineering 2009

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FIGURE 3.7.1.4
LAND COVER MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	12632.000.000	AS SHOWN

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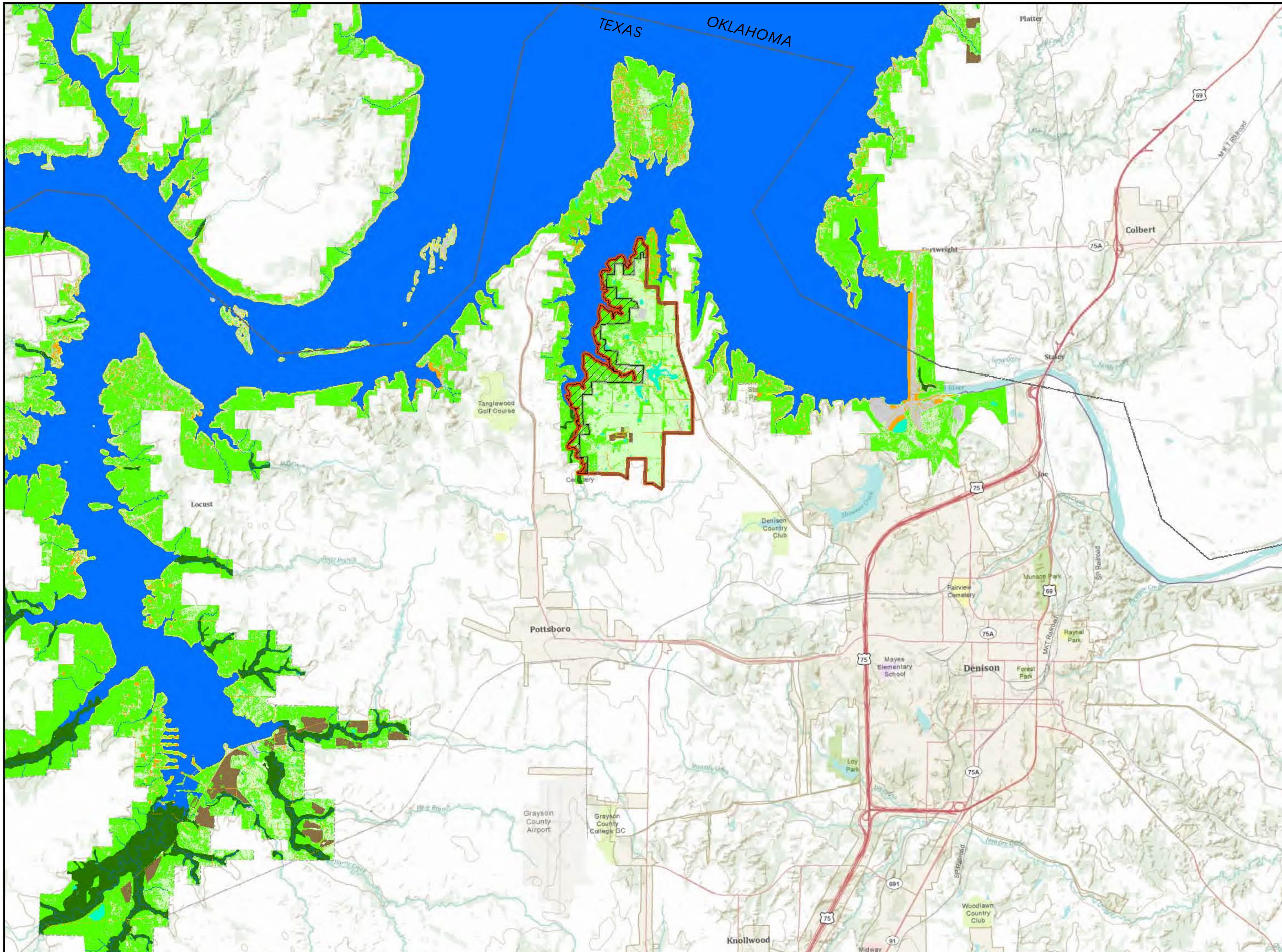

LEGEND

Landcover Vegetation Class

- Mixed Upland Forest
- Grassland/Herbaceous
- Unconsolidated Shore
- Aquatic Inland
- Developed (Impervious Cover)
- Open Water
- Bottomland Hardwood
- Barren/Distrubed Area
- Active Agricultural Land
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development
- State Boundary

SOURCE:
1) U.S. DEPARTMENT OF AGRICULTURE, NATIONAL AERIAL IMAGERY PROGRAM, FARM SERVICE AGENCY, GRAYSON COUNTY, TEXAS 2008-09-09
2) Background world topographic map service ESRI.
3) Boundary provided by PSA Engineering 2009

This figure is prepared for reference purposes only and should not be used, and is not intended for, survey or engineering purposes.

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Miles

FIGURE 3.7.1.5
LAND COVER MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	12632.000.000	AS SHOWN

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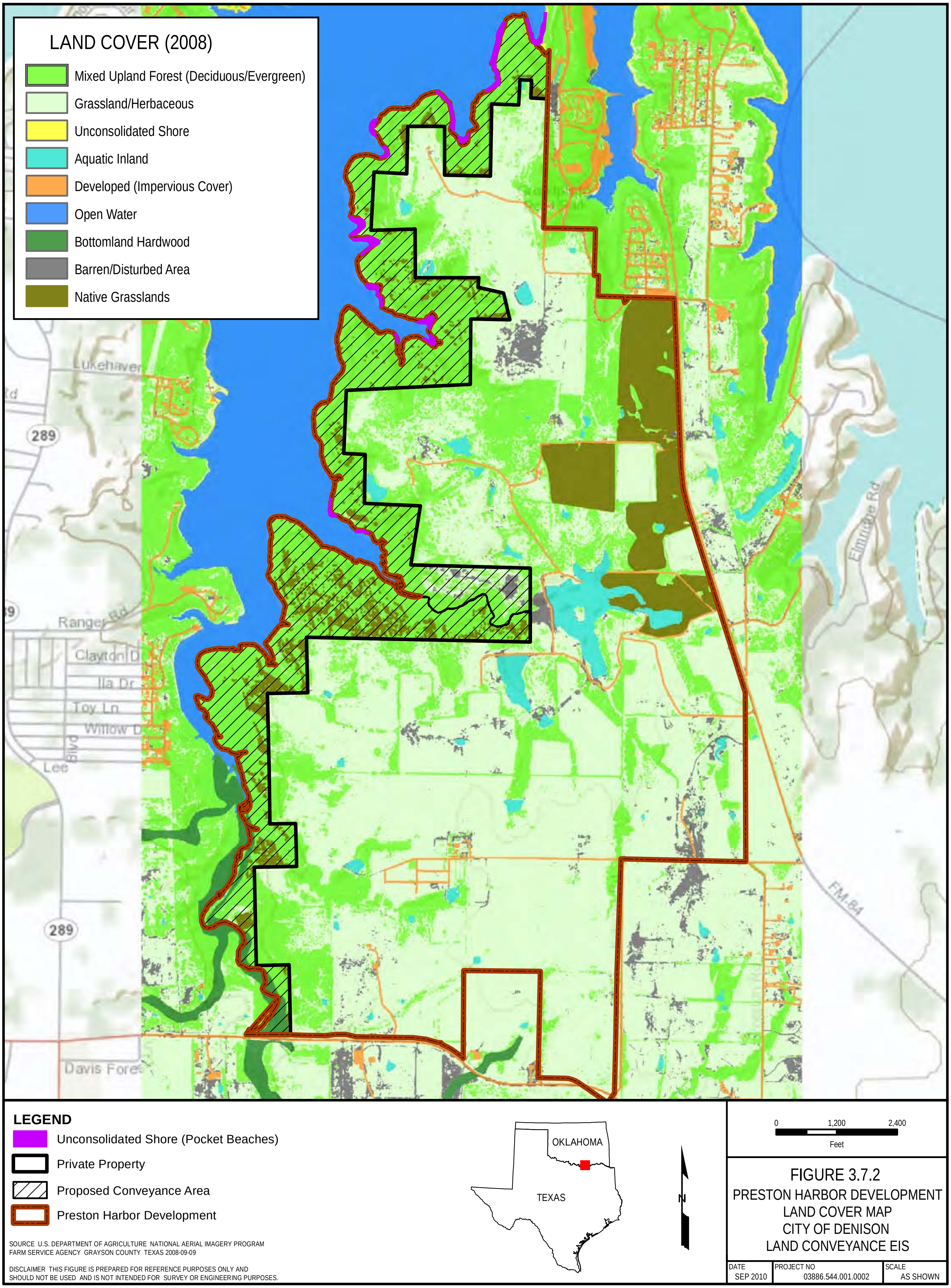

FIGURE 3.7.2
PRESTON HARBOR DEVELOPMENT
LAND COVER MAP
CITY OF DENISON
LAND CONVEYANCE EIS

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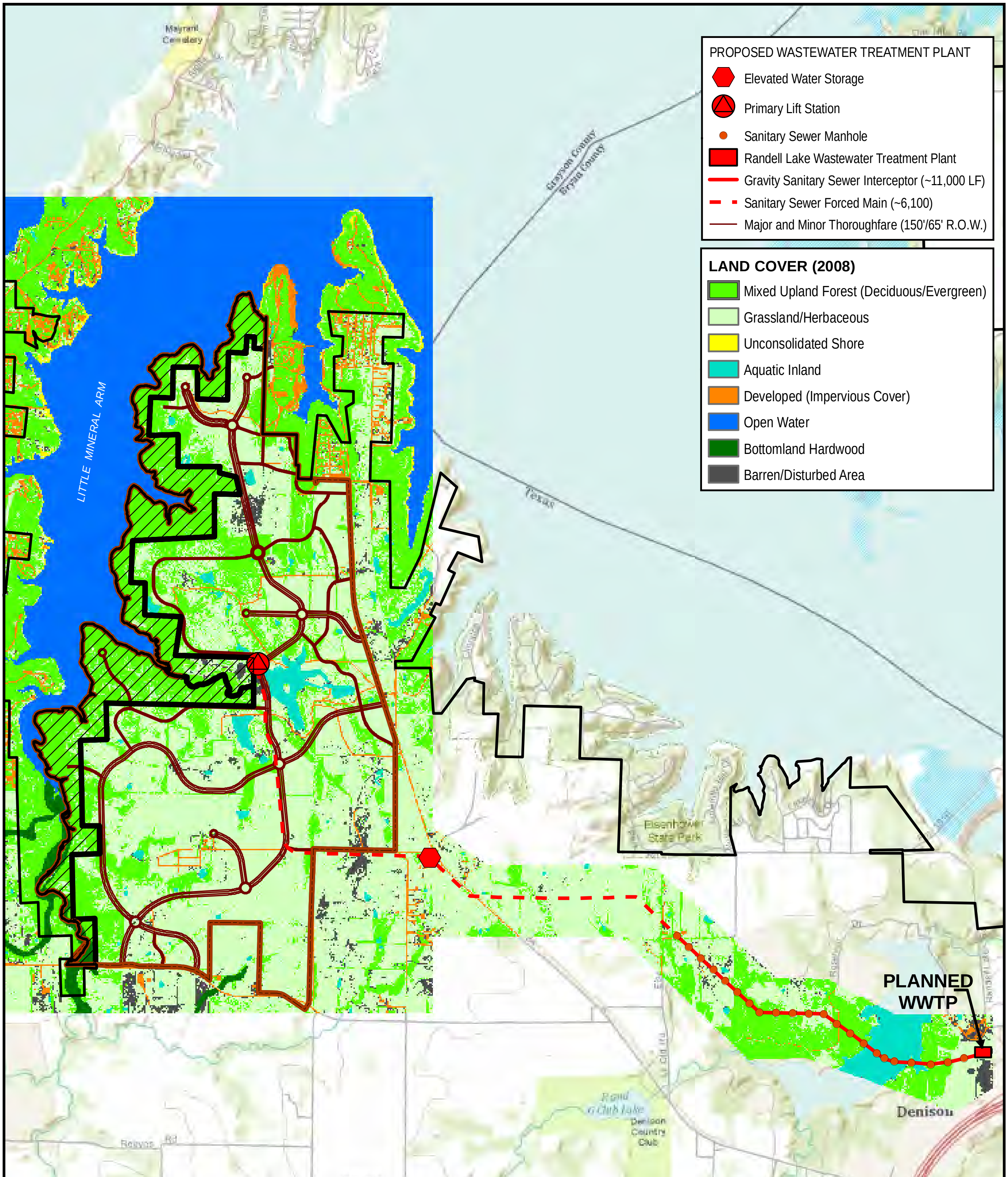

LEGEND

- Private Property
- Proposed Conveyance Area
- Preston Harbor Development

OKLAHOMA
TEXAS

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Miles

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FIGURE 3.7.3
WASTEWATER TREATMENT PLANT AND COLLECTION L NE LAND COVER MAP
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	14531.001.001	AS SHOWN

SOURCE
1) U.S. GEOLOGICAL SURVEY 7.5 MIN TOPOGRAPHIC QUADRANGLE POTTSBORO AND DENISON DAM TEXAS 2000
2) BOUNDARY AND PROPOSED WWTP PROVIDED BY PSA ENGINEERING 2009

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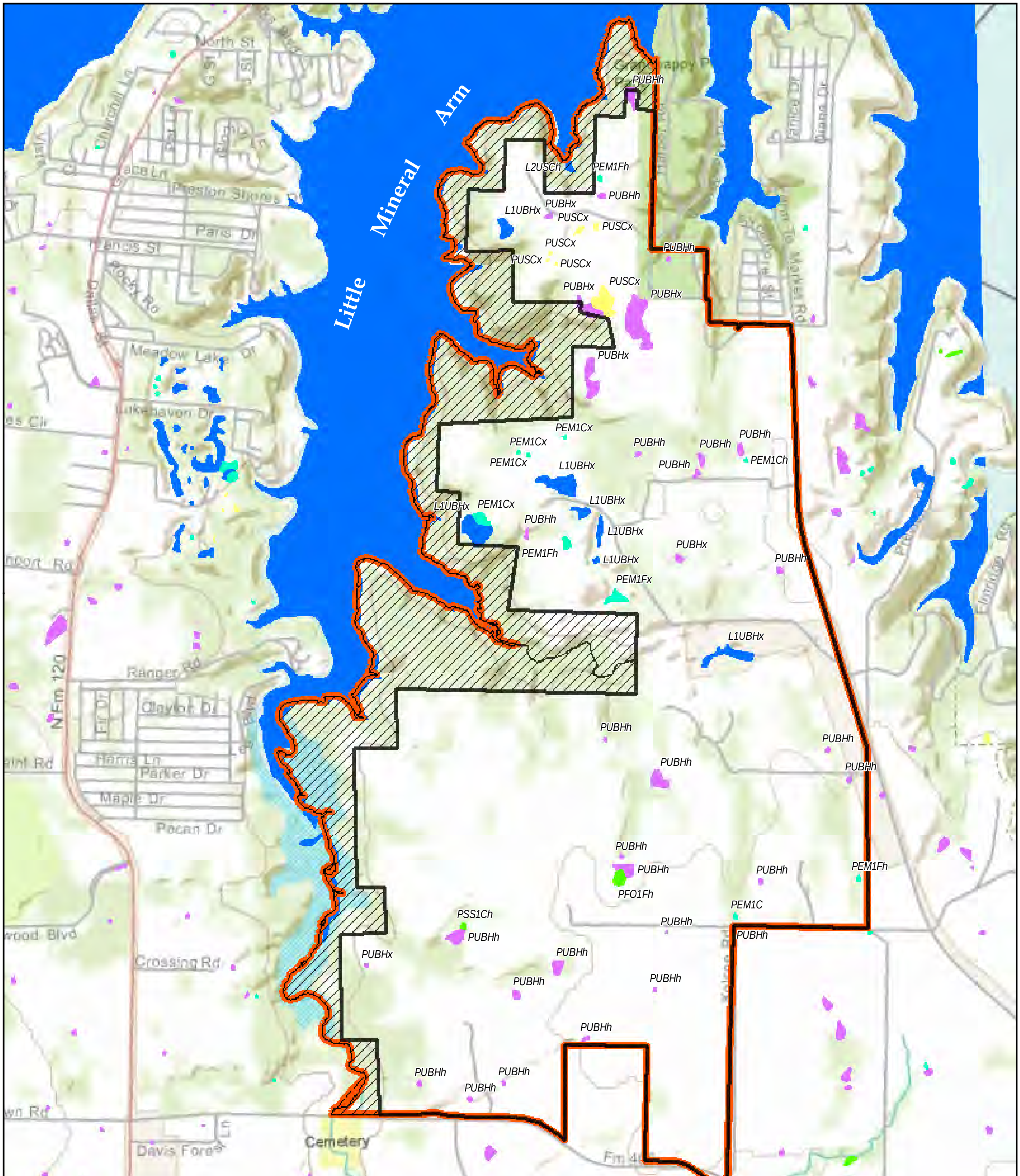

LEGEND

- Proposed Conveyance Land
- Private Property
- Preston Harbor Development

WETLAND TYPE

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other

SOURCE
1) U.S. FISH AND WILDLIFE SERVICE WETLANDS AND DEEPWATER HABITATS OF THE CONTERMINOUS UNITED STATES POTTSBORO TEXAS 1982
2) BOUNDARY PROVIDED BY PSA ENGINEERING 2009

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N

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Feet

FIGURE 3.7.4
NATIONAL WELANDS INVENTORY MAP
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

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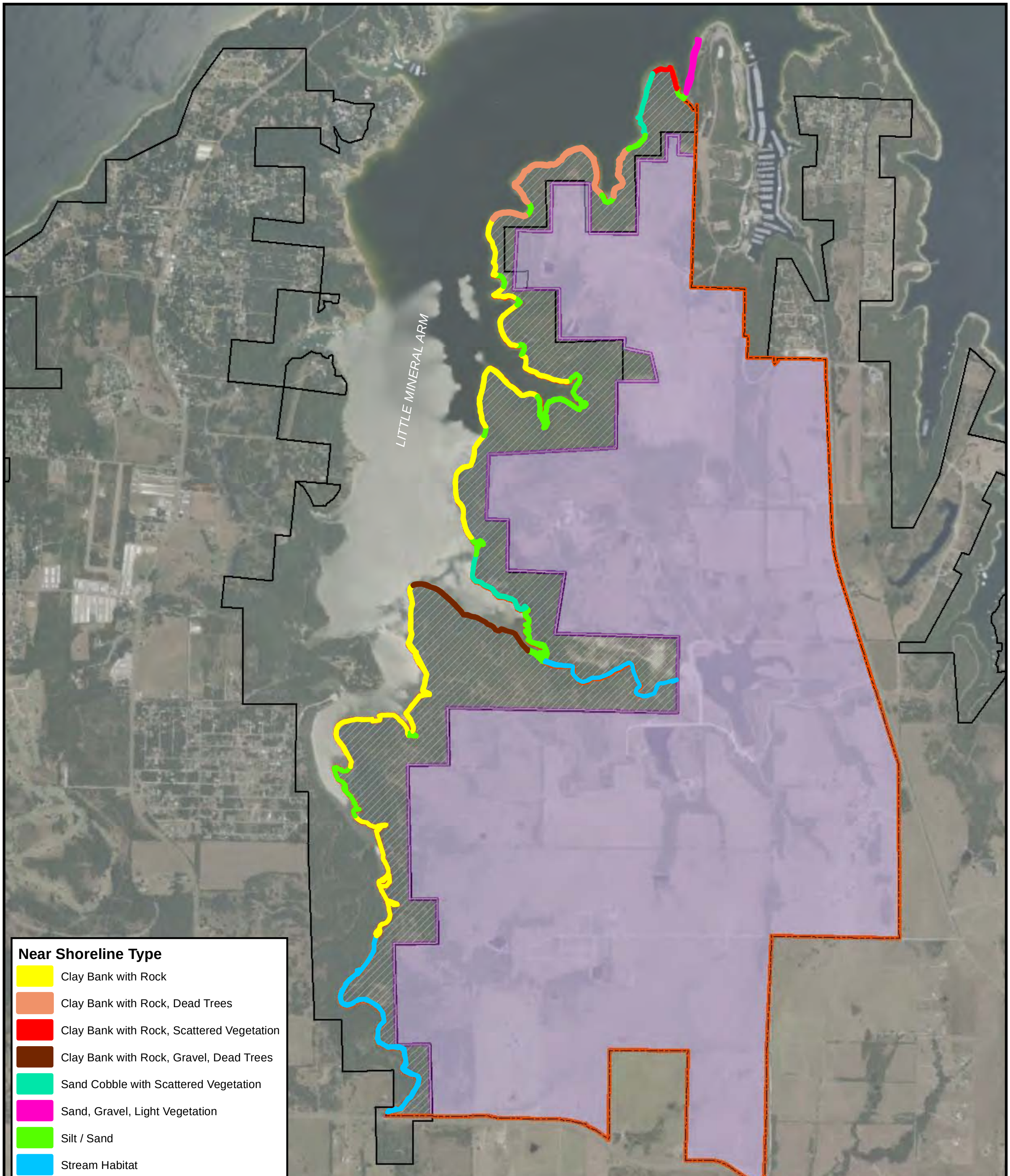

LEGEND

- Proposed Conveyance Area
- Private Property
- Preston Harbor Development
- USACE Public Access Lands

SOURCE 1) U.S. DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM
FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
2) BOUNDARY PROVIDED BY PSA ENGINEERING 2009
3) BATHYMETRY PROVIDED BY USACE TULSA CORP
DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY
AND SHOULD NOT BE USED AND IS NOT INTENDED FOR SURVEY OR ENGINEERING PURPOSES.

0 1,300 2,600
Feet

FIGURE 3.7.5
NEAR SHORE FISH HABITATS
ADJACENT TO PROPOSED
CONVEYANCE LANDS
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

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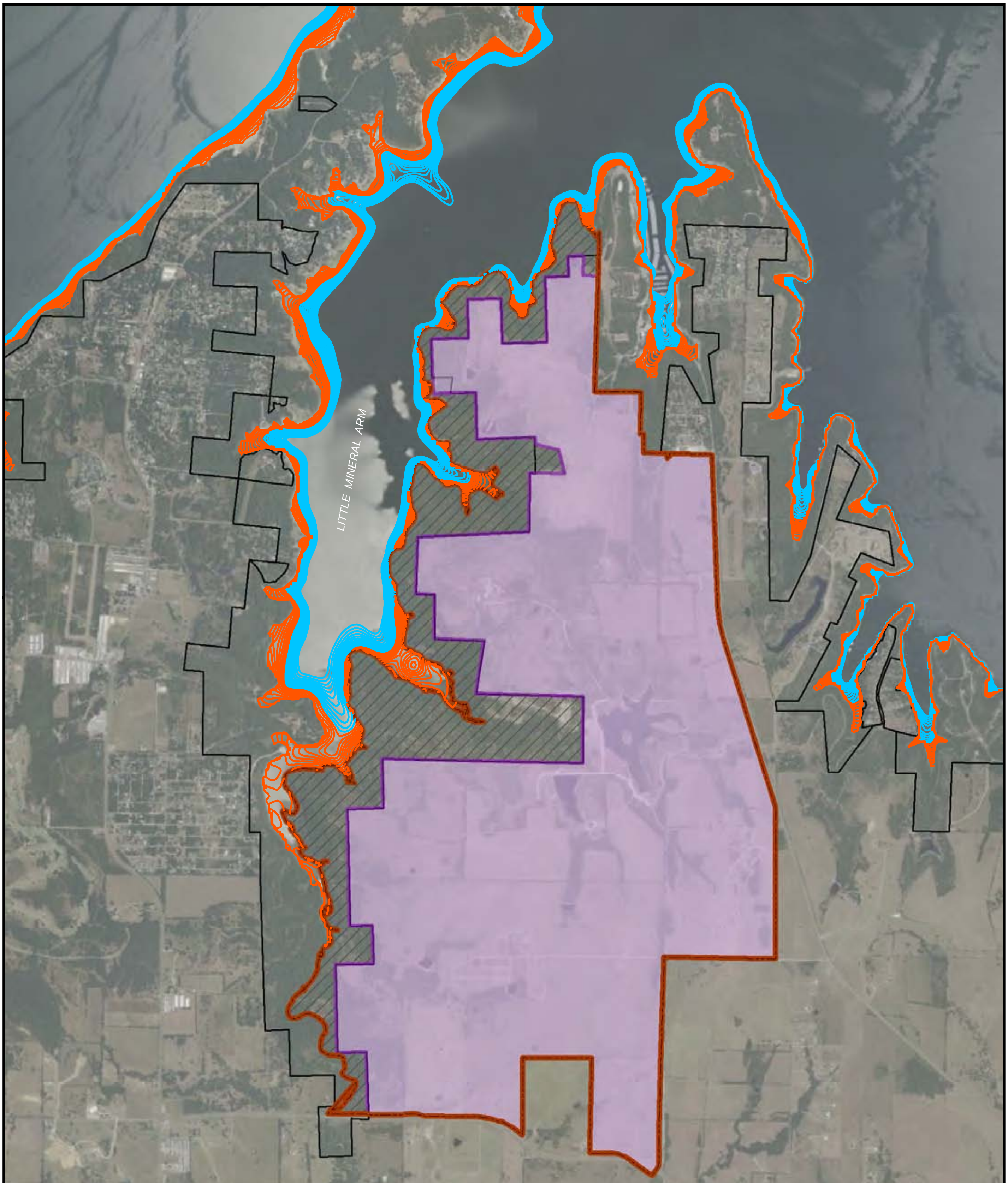

LEGEND

- 597 - 607 NGVD 20' RANGE
- 607 - 617' NGVD 10' RANGE
- USACE Public Access Lands
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development

SOURCE 1) U.S. DEPARTMENT OF AGRICULTURE NATIONAL AERIAL MAGERY PROGRAM
FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
2) BOUNDARY PROVIDED BY PSA ENGINEERING 2009
3) BATHYMETRY PROVIDED BY USACE TULSA CORP
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AND SHOULD NOT BE USED AND IS NOT INTENDED FOR SURVEY OR ENGINEERING PURPOSES.

N

0 1,500 3,000
Feet

FIGURE 3.7.6
POTENTIAL FISH SPAWNING AREAS
BY DEPTH ADJACENT TO
PROPOSED CONVEYANCE LANDS
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

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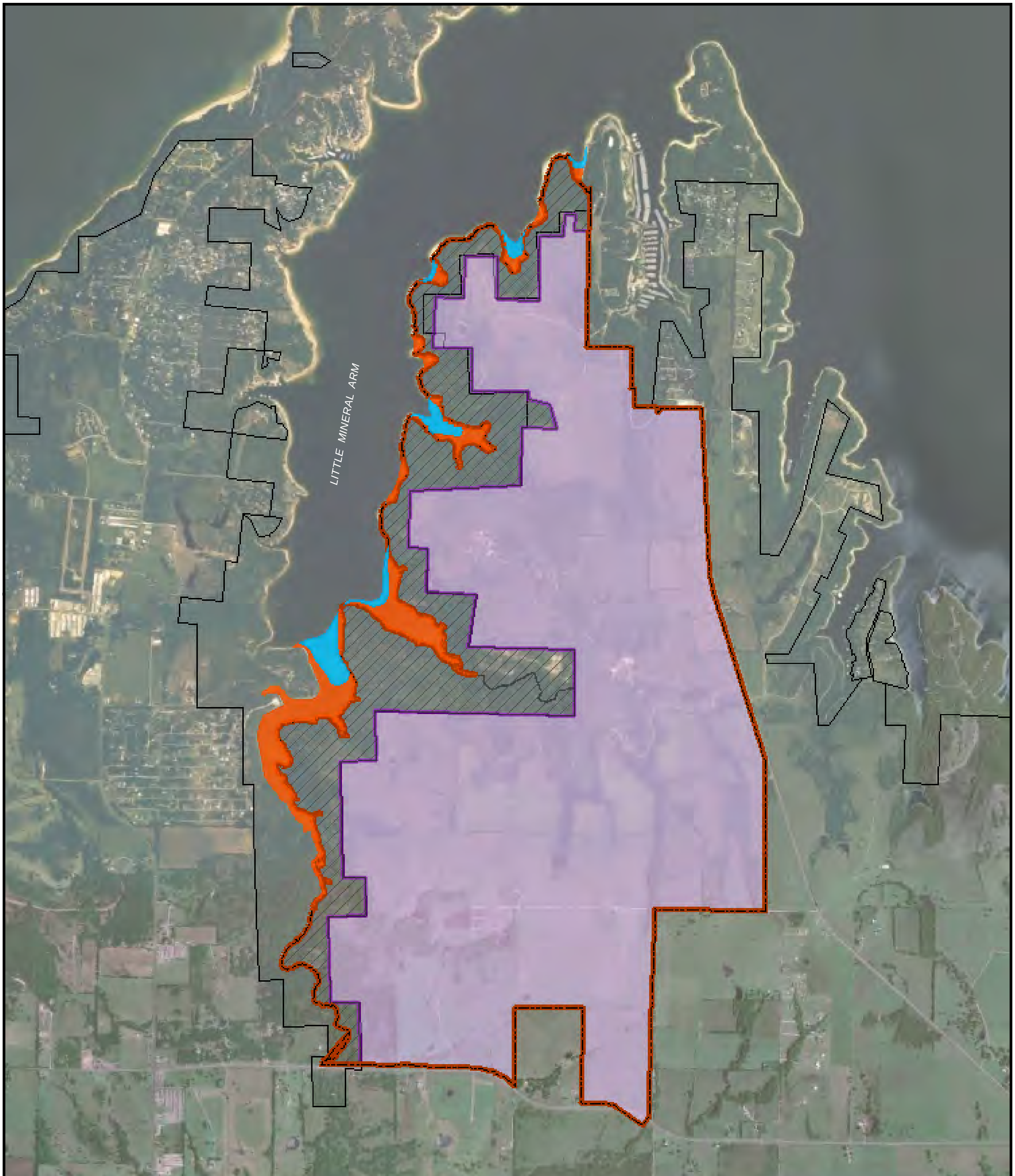
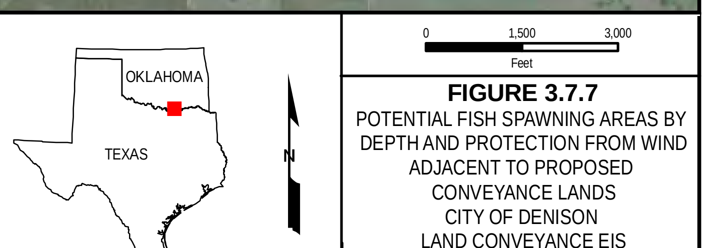


LEGEND

- Potential Fish Spawning NGVD 10 Feet
- Potential Fish Spawning NGVD 20 Feet
- USACE Public Access Lands
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development



SOURCE 1) U.S. DEPARTMENT OF AGRICULTURE
NATIONAL AERIAL IMAGERY PROGRAM FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
2) BOUNDARY PROVIDED BY PSA ENGINEER NG 2009

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY
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FIGURE 3.7.7

POTENTIAL FISH SPAWNING AREAS BY DEPTH AND PROTECTION FROM WIND ADJACENT TO PROPOSED CONVEYANCE LANDS
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544 001.0002	AS SHOWN

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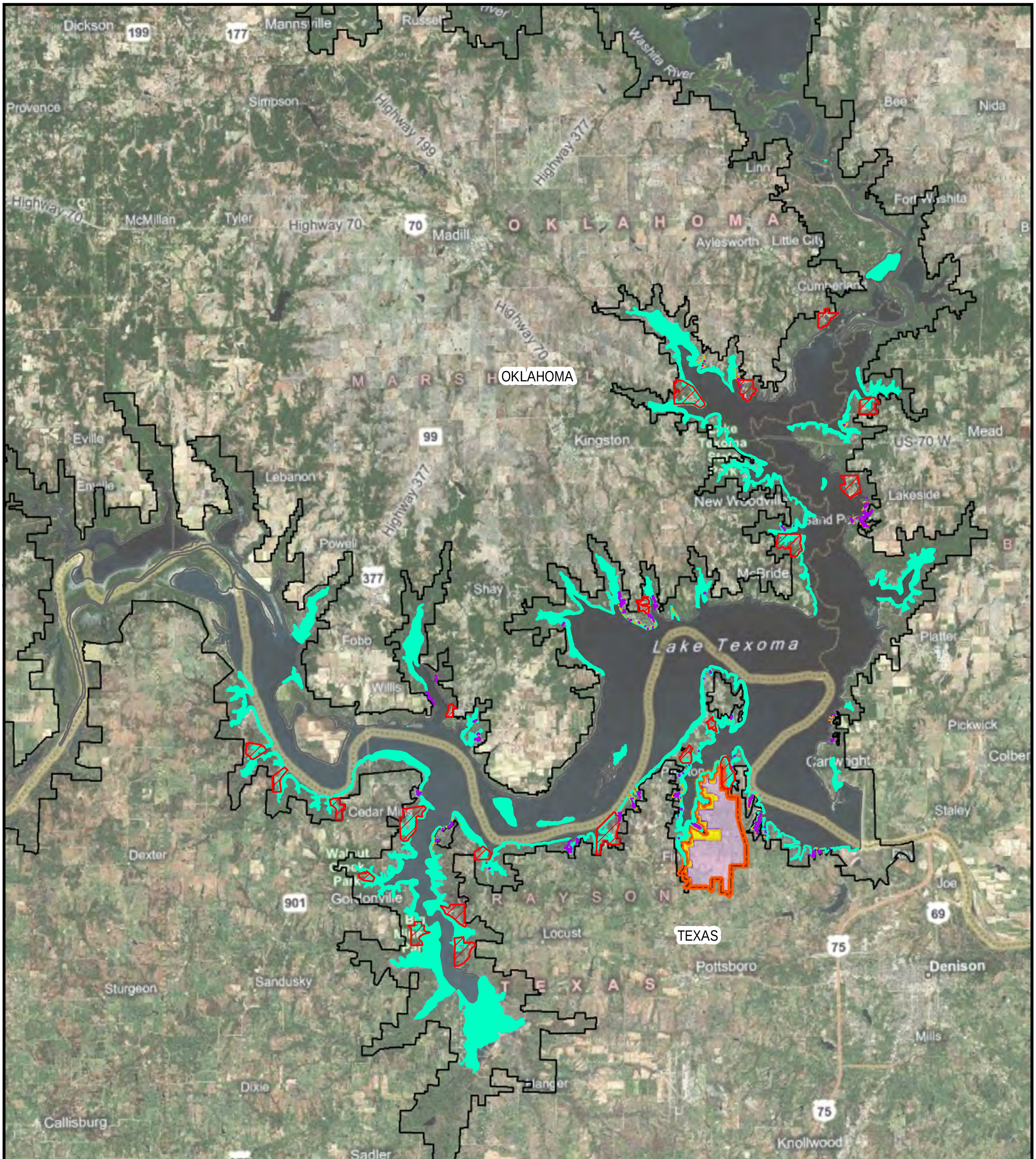

LEGEND

- Potential Fish Spawning Areas
- BoatDocks
- Zoned Boat Dock Development
- Concession Marinas
- Conveyance Area
- Private Property
- Preston Harbor Development
- USACE Public Access Lands

SOURCE 1) U.S. DEPARTMENT OF AGRICULTURE
NATIONAL AERIAL MAGERY PROGRAM FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
2) BOUNDARY PROVIDED BY PSA ENGINEERING 2009
3) BATHYMETRY PROVIDED BY USACE TULSA CORP
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0 3 6
Miles

FIGURE 3.7.8
POTENTIAL FISH SPAWNING AREAS
BY DEPTH AND BY PROTECTION
FROM WIND ON LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

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3.8 SOCIOECONOMICS

This section describes the socioeconomic characteristics of the study area. Socioeconomic characteristics include population, employment, income, housing, education, and appropriate quality of life factors, all of which determine the demographic nature of an area or region. Data sources consulted include Federal agencies, particularly decennial US Census 2000 and 2010 data, other governmental sources such as the Texas Workforce Commission, and private enterprises typically specializing in one or more facets of the demographic spectrum (e.g., housing).

From a socioeconomic perspective, the study area consists primarily of Cooke and Grayson counties in Texas. Both counties border Lake Texoma, with the proposed conveyance land located entirely within Grayson County. Several counties in Oklahoma also border Lake Texoma, the closest to the proposed conveyance land being Bryan and Marshall Counties. Figure 3.8.1 shows the counties and cities/towns in the general region.

Cooke, Grayson and the bordering Fannin County are part of the Texoma Regional Consortium (TRC), an informal economic development network consisting of 10 counties in Oklahoma and 3 in Texas. Although Lake Texoma lies at the heart of the region, most economic activity is focused on linear development along 1) the I-35 corridor, linking Gainesville and Cooke County north to Ardmore, Oklahoma, and 2) US 75 connecting Sherman and Denison in Grayson County with Durant in Oklahoma (TRC, 2010).

Historically, the 13-county region has been predominantly composed of low cost-of-living rural areas with small towns that relied on oil and gas extraction, ranching, and low-wage manufacturing for jobs and income (TRC, 2007). These characteristics have resulted in a typical regional demographic profile that includes slow population growth, an older age structure, lagging educational attainment, and lower average earnings and per capita income than state and national averages (TRC, 2007).

Cooke, Grayson, and Fannin counties also comprise the Texoma Council of Governments (TCOG) Texoma Region, which is a US Economic Development Administration (EDA)-designated Economic Development District (EDD). This Texoma Region is also recognized by the Texas Workforce Commission (TWC) workforce investment board, specifically, the Workforce Solutions Texoma (WST) board (TCOG, 2010). The TWC further segregates the region into a two-county area, specifically Cooke and Grayson, for county-based statistical data that are used in County Narrative Profiles by the TWC's Labor Market and Career Information (LMCI) department.

While regional interstate economic development collaboration continues, particularly with respect to development around Lake Texoma, the Cooke and Grayson counties are becoming more influenced by and integrated with the Dallas-Fort Worth metroplex as it continues to experience rapid growth (TRC, 2010).

As depicted in Figure 3.8.1, Bryan and Marshall counties in Oklahoma are located across Lake Texoma from the proposed conveyance land. Although these two counties, in addition to Cooke and Grayson counties, benefit from Lake Texoma, they are not integrated in any significant socioeconomic manner for the Proposed Action.

Grayson County includes the Sherman-Denison Metropolitan Statistical Area (MSA), while Cooke County includes the Gainesville Micropolitan Statistical Area. Both counties are part of the 19-county Dallas-Fort Worth Combined Statistical Area (CSA), reflecting the high degree of economic and social interaction among the CSA counties. Given this officially recognized integration of Cooke and Grayson counties, they are the only two counties considered further as the study area for socioeconomic analyses.

3.8.1 Population

The 2000 US Census reports the population of Cooke and Grayson counties as 36,363 and 110,595, respectively (USCB, 2000). By 2010, the population of Cooke County had increased to 38,437, representing a 5.7% increase, while that of Grayson County had increased to 120,877, a 9.3% increase (USCB, 2010). This rate of growth is in contrast with the 20.6% growth experienced in the general Texas population from 2000 to 2010, and the respective 9.7% growth in the US population. Table 3.8.1 shows the population per county.

Table 3.8.1

Total Population by County

	Texas	
	Cooke County	**Grayson County**
2000 Population	36,363	110,595
2010 Population	38,437	120,877
Percent Change (%)	+ 5.7	+ 9.3

Source: USCB, 2000 and USCB, 2010

Prior to lake development, most counties surrounding the lake suffered population losses (USACE, 1976). Population growth in the study area has lagged for a number of reasons, including its decidedly older age structure, the national recession beginning in 2007, and population migration dynamics. While Grayson County experienced a net migration inflow from 2007 through 2008, Cooke County experienced an appreciable migration outflow with most of the migration either to or from the Dallas-Fort Worth MSA (TRC, 2010).

The Dallas-Fort Worth MSA continues its surging growth (29.4% from 1990-2000), and its CSA is now the seventh largest in the nation, with over 6,700,000 inhabitants in 2010 (USCB, 2010). Growth in the northern counties of the CSA has been explosive, with four of the region's counties now among the states' most populous. According to the Texas State Data Center, this growth is expected to continue to 2040 (Dallas News, 2011). The northward sprawl of the Dallas-Fort Worth metroplex can be expected to contribute to significant future growth in the study area.

The Sherman-Denison MSA grew rapidly from 1990 to 2000 (16.4%) (USCB, 2000 and USCB, 1990); however, growth slowed from 2000 to 2010, as discussed above. The MSA contains several towns and cities including Denison, Sherman, and Pottsboro, while the Gainesville Micropolitan Statistical Area is dominated by the city of Gainesville. The population of Denison declined from 1970 to 1990, grew from 1990 to 2000 (5.9%), and has declined slightly since (USCB, 2010; USCB, 2000; USCB, 1990; and USCB, 1970). Suburban areas of Denison grew substantially since 1970, with the greatest growth between 1990 and 2000 at 16% (USCB, 2000;

USCB, 1990; and USCB, 1970). The City of Sherman and the Town of Pottsboro have had similar growth patterns, but have not experienced population decline like Denison. Table 3.8.2 details the population changes in the principal municipalities of the study area Table 3.8.2.

Table 3.8.2

Total Population by Principal Cities and Towns

	Texas			
	Cooke County	Grayson County		
City/Town	**Gainesville**	**Sherman**	**Denison**	**Pottsboro**
2000	15,538	35,082	22,773	1,579
2010	16,200	38,521	22,682	2,160
Percent Change (%)	+ 4.3	+ 9.8	- 0.4	+ 36.8

Source: USCB, 2000 and USCB, 2010

Age

The residential year-round age structure for counties and cities in the Lake Texoma area has traditionally included older persons (USACE, 1976). Peak-season recreational use of the lake has attracted younger persons to the area (USACE, 1976). However, 70% of the visitors to Lake Texoma are considered “senior citizens” (USACE, 2007).

As stated above, the age structure of the Texoma region is decidedly older than national or state averages (TRC, 2010). This is typical for a largely rural, agricultural area, such as the region has been historically. As of 2009, according to American Community Survey estimates, the population under 18 in Cooke and Grayson counties was 25.7% and 24.5%, respectively, versus 27.8% in Texas and 24.3% nationally. The population age 65 and over in Cooke and Grayson counties was 14.9% and 15.5%, respectively, versus 10.2% in Texas and 12.9% nationally (USCB, 2010). These age statistics were little changed from 2000 Census numbers.

Although the 2009 age structure of Sherman was similar to Grayson County averages, the 65 and older population in Denison was 17.4%, appreciably higher. The median age in Denison was 38 versus 33.6 overall in Texas (USCB, 2010), while Texas had one of the lowest median ages in the nation in 2010.

Urban-Rural

The area surrounding Lake Texoma has traditionally been considered rural because of the characteristics of its economic base as well as its population density. Urban and rural population percentages for Cooke and Grayson counties are shown in Table 3.8.3.

Table 3.8.3

Urban and Rural Population by Study Area Counties

	Texas	
	Cooke County	**Grayson County**
Urban	43%	54%
Rural	57%	46%

Source: USCB, 2000

Most population growth since 2000 has been in Grayson County, particularly in the southern areas adjacent to the booming outer suburban counties of the Dallas-Fort Worth metroplex. The county is becoming more urban and is most likely more urban today than in 2000.

Ethnicity

According to the 2010 Census, the majority of the population in Cooke County was white (85.7%), with Hispanic or Latino peoples comprising 15.6%, Black or African American peoples accounting for 2.7%, and American Indian peoples comprising 1%. In Grayson County, the ethnic composition was similar, with 83.9% being white; 11.3% Hispanic or Latino, 5.9% Black or African American, and 1.5 % American Indian. These percentages were little changed from the 2000 Census, for the exception of Hispanic or Latino composition. The region's population is becoming more ethnically diverse, particularly with respect to the Hispanic population which has been growing significantly (TRC, 2010). As the largest minority group in the region, the Hispanic population has grown from approximately 11,350 in 2000 to over 20,000 in 2010, with over 13,000 living in Grayson County.

3.8.2 Housing

Housing characteristics for the study area include data on housing units, occupancy, household size, and value. Housing units are part of the area tax base. The 2005–2009 average home ownership rate for Grayson and Cooke counties was 70.3% and 72%, respectively. The comparable Texas state-wide ownership rate was 63.7% (USCB, 2010).

The 2000 Census housing unit counts for the City of Gainesville, City of Denison, the Town of Pottsboro, and the City of Sherman are listed in Table 3.8.4. However, data presented by the Denison Development Alliance (DDA) indicated that only 45.3% of households in Denison and 47.1% in Grayson County were owner-occupied as of 25 August 2010 (DDA, 2011).

Occupancy varies between homeowner and rental vacancy as well as by location. The homeowner vacancy rate in Texas was 2.2% in 2010 and 10.6% for rental units (USCB, 2010). As shown in Table 3.8.4, vacancy rates vary from about 6% in Pottsboro to 11% in Denison.

The national housing foreclosure crises associated with the recent recession has affected Texas and the study area as well. As of August 2011, one in every 958 Texas housing units was a foreclosed property for sale (RealtyTrac Inc., 2011). This average ratio was lower in the study area at 1:1,250 in Grayson County; 1:1,336 in Cooke County; and 1:1,792 in Denison.

According to American Community Survey data, the US average household size in 2010 was 2.63 persons, and the average family size was 3.23 (USCB, 2010). The average household size in Texas was 2.75, and the average family size was 3.41 (USCB, 2010). Average household size from 2005-2009 in Grayson and Cooke counties was 2.55 and 2.68, respectively. In general, average household size is, and has been, between 2.5 and 2.8 persons and average family size is, and has been, about 3.2 persons across the study area.

Table 3.8.4

Housing Unit by Study Area Counties

	Texas			
	Cooke County	Grayson County		
City/Town	**Gainesville**	**Denison**	**Pottsboro**	**Sherman**
Total	6,423	10,309	620	14,926
Occupied	5,969	9,185	586	13,739
Vacant	454	1,124	34	1,187

Source: USCB, 2000

All of the Lake Texoma shoreline is zoned, and land-use is allocated according to the Texoma SMP (USACE, 1996). The areas around Lake Texoma contain a mix of residential areas; areas for production of agriculture and livestock; and retail, commercial, and concession operations. The development of the western shoreline of the Little Mineral Arm includes both year-round residential and seasonal housing. Based on review of current aerial imagery, the housing density appears to be low in this area (USDA, 2008). The western shoreline across the proposed land conveyance is zoned for recreational use, with some limited development areas (USACE, 1996). The residential sub-divisions along the western shoreline were developed before the SMP was implemented. The Lake Texoma shoreline allocations are discussed in detail in Section 3.3.

The 2000 and 2010 median housing values for the study area are included in Table 3.8.5. There are no updated Census estimates for the median housing values in cities/towns. The 2000 median housing values for the study area cities and towns are included in Table 3.8.6. The median value of homes in the study area remains well below the national and state median home values.

Table 3.8.5

Median Housing Values
Study Area Counties, State and Nation

Median Housing Value ($)	Texas			US
	Cooke	Grayson	State-wide	
2000	73,200	67,800	82,500	119,600
2010	95,300	106,100	118,900	185,400

Source: USCB, 2000 and USCB, 2010

Table 3.8.6

Median Housing Values, 2000 Census,
Study Area Cities and Towns

	Texas			
	Cooke County	Grayson County		
Cities/Towns	Gainesville	Denison	Pottsboro	Sherman
Median Housing Value ($)	54,500	52,100	84,800	67,500

Source: USCB, 2000

3.8.3 Employment

Regional median household income has historically been generated from employment related to agriculture and the oil and gas industry. The non-agricultural and non-oil/gas industry portion of the economic base of the area presently consists of health care, manufacturing, and retail sales. The communities of Sherman and Denison serve as centers for retail and service businesses, while Lake Texoma is a major recreation destination, especially for the residents of north Texas and southern Oklahoma. Recreation opportunities at Lake Texoma are described in detail in Section 3.11.

According to the USCB 2008 County Census Business Patterns per North American Industry Classification System (NAICS), the top four employment sectors in the study area are listed in Table 3.8.7.

Table 3.8.7

Employment per Employment Sector

	Texas	
	Cooke	**Grayson**
Employment Sector	Manufacturing (31%)	Health care and social assistance (23%)
	Retail trade (10%)	Manufacturing (22%)
	Health care and social assistance (8%)	Retail trade (12%)
	Wholesale trade (5.3%)	Construction (8.5%)

Source: USCB, 2008

According to the Bureau of Labor Statistics LAUS July 2010 data (not seasonally adjusted), the unemployment rate was 8.5% for Grayson County and 6.7% for Cooke County (USBLS, 2010). Similarly, the TWC reported that unemployment in the study area in August 2011 was 8.4%, representing an increase from 8.2% in 2010 (TWC, 2011). Although unemployment has risen dramatically in the area over the last few years, it remains lower than state and national averages (TRC, 2010).

Current employment in the immediate area of the proposed conveyance land is primarily seasonal to support Lake Texoma recreational activities during the summer season. Both the private and USACE-operated recreational areas and facilities are manned seasonally. The USACE-operated recreational facilities employ contractors to provide park and facilities maintenance services and staff to the park entrance booths (USACE, 2007).

According to the TWC's 2010 Employer Database, there were 1,264 establishments with 10 or more employees in Cooke and Grayson counties (the Multi-County region). Of these establishments, only 0.5% had 1,000 or more employees, 0.1% had 500-999 employees, and 6.5% had 100 to 499 employees. Most establishments were relatively small, with 49% having between only 10-19 employees (TWC, 2011).

Although manufacturing remains one of the highest targeted industries for economic development in the region (TCOG, 2010), a number of the current top 10 manufacturing establishments in the study area are declining, and some have suffered recent employment losses (TWC, 2011). Other industries targeted for economic development in the study area include construction, extraction/drilling, food manufacturing, retail, transportation and warehousing, and healthcare (TCOG, 2010).

Substantial economic development funds accrue to the local Texas municipalities from sales taxes. In 2008, Cooke and Grayson county totals for economic development were $7,973,950 and $23,197,471, respectively (TCOG, 2010).

3.8.4 Income

Table 3.8.8 lists the median household income (MHI) according to the 2000 Census for the study area counties. Table 3.8.9 lists 2000 median household income for cities and towns in the study area. County, state and national MHI updates from the 2010 Census are also included.

Table.3.8.8

Median Household Income

Median Household Income ($)	Texas			US
	Cooke	Grayson	State-Wide	
2000	37,649	37,178	39,927	41,994
2010	49,790	43,229	48,286	50,221

Source: USCB, 2000 and USCB, 2010

Table 3.8.9

Median Household Income, 2000 Census by Cities and Towns

	Texas			
	Cooke County	Grayson County		
Cities/Towns	Gainesville	Denison	Pottsboro	Sherman
Median Housing Income ($)	30,571	31,474	43,977	34,211

Source: USCB, 2000

According to the DDA, as of 25 August 2010, the MHI in Denison was $41,112; $47,191 in Grayson County; and $52,111 in Texas. The per capita incomes (PCI) for Denison, Grayson County, and the State of Texas were $20,060; $20,693; and $23,487, respectively (DDA, 2011). The 2010 Census American Community Survey lists Texas MHI in 2000 inflation adjusted dollars as $48,615.

Wages and income in the study area remain below state and national averages, but these are positively offset by a lower cost of living. Since 2000, regional PCI has declined slightly in comparison to national wage trends (TCOG, 2010).

According to the 2010 Census, the percentage of persons in the study area below the poverty level in 2009 was about the same as the national average, but below the Texas state average. The poverty levels in Cooke and Grayson counties were 14.8% and 14.1%, respectively, about the same as the national average of 14.3%. The Texas state average was 17.1%, which rose to 17.9% in 2010 (USCB, 2010).

3.8.5 Travel, Recreation, and Tourism

Travel, recreation, and tourism have not been singled out by regional planning/development agencies as a separate employment category or development industry. However, travel, recreation, and tourism activities contribute to a number of economic sectors, particularly retail services.

The total Grayson County, including the Sherman-Denison metro area, tax revenue collected by counties and municipalities, as levied on applicable travel-related businesses (includes local sales taxes) in 2009 was $2,115,200, which has declined from 2008. In Cooke County, the tax revenue in 2009 was $858,300, which has declined from 2008. The county-level travel-related tax revenues derive from recreation-related services to lake users (e.g., marinas, gas stations, lodging, restaurants, boat rentals, and camping/picnic areas). The tax revenue from travel-related businesses in 2009 in the City of Sherman was $1,067,900. (Dean Runyan Associates Inc., 2011)

Lake Texoma was the 48th top attraction for Texas visitors in 2008 (Texas Economic Development and Tourism, 2010). Lake Texoma offers a variety of outdoor recreation opportunities including camping, hiking, boating, swimming, hunting, and fishing. Two National Wildlife Refuges (Hagerman and Tishomingo) managed by the USFWS provide additional recreational opportunities to the area. A detailed discussion of these refuges is provided in Section 3.10.1 of this EIS. There are also five wildlife management areas operated by the State of Oklahoma located on USACE-owned lands and twelve USACE-operated parks located around Lake Texoma. USACE collects approximately $700,000 annually in user fees at these Lake Texoma recreation areas (USACE, 2007). The revenue is primarily collected from individual camp-site use fees at USACE campgrounds and day-use boat ramps.

Lake Texoma Fishing and Hunting

Fishing is popular and a major industry at Lake Texoma. Management of the fishery resources at Lake Texoma is the responsibility of the ODWC and the TPWD. Lake Texoma supports a diversity of sport fish species, making it additionally attractive to anglers. Sport fish species commonly caught include striped, white, largemouth, spotted, and smallmouth bass; channel, blue, and flathead catfish; and black and white crappie. The Lake Texoma Fishing License (specific to the lake) costs $12 and is valid for the entire lake (above Denison Dam only). The anglers can also purchase the Oklahoma or/and Texas fishing licenses that are valid throughout the state as well as at Lake Texoma (Lake Texoma Designs, 2011).

An economic impact study in 1990 estimated the regional economic impact of the Lake Texoma sport fishery. It was estimated that anglers contributed $25,640,000 in direct fishing expenditures to the regional economy in 1990 (Schorr et. al., 1995). The expenditures were calculated from a seven county area around Lake Texoma. The estimated indirect expenditures amounted to $57,390,000 in total business sales.

A detailed discussion on the fishery of Lake Texoma is located in Section 3.11 of this EIS. Public hunting is discussed in detail in Section 3.11.2 of this EIS. Each hunter must have the following appropriate permits: state permits (Texas and Oklahoma) and special permits for wildlife refuges and wildlife management areas. Hunting is strictly recreational and not intended for wildlife population control within Lake Texoma public hunting lands.

Striped Bass Fishery

Striped bass fishing is one of the most popular recreation activities at Lake Texoma. The striped bass is a saltwater species that has been successfully introduced into many lakes throughout the United States to provide additional angling opportunities. Striped bass were introduced into Lake Texoma in 1965 by the ODWC and have become well established. This fishery is considered to be one of the most successful inland striped bass fisheries in the nation (USACE, 2006).

The direct economic activities generated by the striped bass fishery include recreational fishing, guided fishing tours, and employment for fishing guides. There are between 450 and 700 service guides at the lake according to a USACE 2007 study (USACE, 2007).

3.8.6 Environmental Justice

The Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, requires that, “each Federal Agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” In an accompanying Presidential memorandum, the President specified that Federal agencies shall analyze the environmental effect of their Proposed Actions on minority and low-income communities, including human health, economic, and social effects when such analysis is required by NEPA.

Disadvantaged groups within the affected area, including minority and low-income communities, are specifically considered in order to assess the potential for disproportionate occurrence of impacts.

Minority Population

The term "minority" typically refers to racial or ethnic groups that are not a majority ethnicity or race in a specific community. For the 2000 Census, race and Hispanic origin (ethnicity) were considered two separate concepts and were recorded separately. For the purposes of this EIS, both the minority race population and minority ethnicity (Hispanic origin) recorded in the 2010 Census were considered when analyzing environmental justice.

As previously discussed in this Section (3.8.1), the counties within the study area are comprised of a large majority white population. The total non-white population is comprised of one, or a combination of more than one race (white included). These non-white races include Black or African American; American Indian or Alaska Native; Asian; and Native Hawaiian or other Pacific Islander.

As discussed in Section 3.8.1, although the white population in the study area is about 85% of the total, the Hispanic population has been growing rapidly and now represents over 15% of the Cooke County population and 11% of the Grayson County population (USCB, 2010). According to the Sherman Denison Metropolitan Planning Organization (SDMPO) long range (2035) plan there is a minority community/population located approximately 0.5 mile south of the intersection of F.M. 84 (a "minor arterial" roadway also named Texoma Drive, leading to the east property line of the conveyance from Denison) and US 75 (adjacent to east side of highway)(SDMPO, 2010).

Low-Income Population

Economic minorities include low-income persons living below the poverty level. Based on the 2000 Census data, poverty levels (individuals with incomes below the poverty level) for the counties surrounding Lake Texoma were as follows: Grayson County 11.3%, Cooke County 14% (USCB, 2000). The 2000 Census study area city/town poverty levels were as follows: City of Denison 15%; Town of Pottsboro 8%; and City of Sherman 18%. As discussed in Section 3.8.4, these levels increased somewhat by 2010.

The SDMPO long range (2035) transportation plan identifies two low-income block groups located adjacent or near the south sides of F.M. 84, east of Highland Drive and along either side of US 75 in Denison (SDMPO, 2010).

3.8.7 Quality of Life

Public Safety

The proposed USACE conveyance land is located within Grayson County. The nearest major city to the proposed conveyance land is the City of Denison. Law Enforcement services are provided in the City of Denison by the Denison Police Department (DPD). The DPD consists of 45 officers and 12 support staff (City of Denison, 2010b). Police service in Grayson County is provided by the Grayson County Sheriff's Office. The sheriff's office is staffed with 142 direct employees and approximately 25 contract employees (Grayson County, 2010). According to the Grayson County website, the sheriff's office serves approximately one-third of the Grayson County population. The remaining portion of the county is served by the local city or town police department.

Fire protection services are provided to the City of Denison by the Denison Fire Department (DFD). According to the Denison Area Chamber of Commerce (DACOC), 53 firefighters are employed by DFD (DACOC, 2010). In addition to fire protection services, responders are trained Emergency Medical Technicians (EMTs). According to the City webpage, DFD responded to over 6,000 requests for service in 2010 (DFD, 2010). Preston Volunteer Emergency Services, Inc (PVES) provides emergency services including fire fighting and emergency transport for the Preston Peninsula located west of the proposed land conveyance land near Pottsboro, Texas (PVES, 2010).

Medical Services

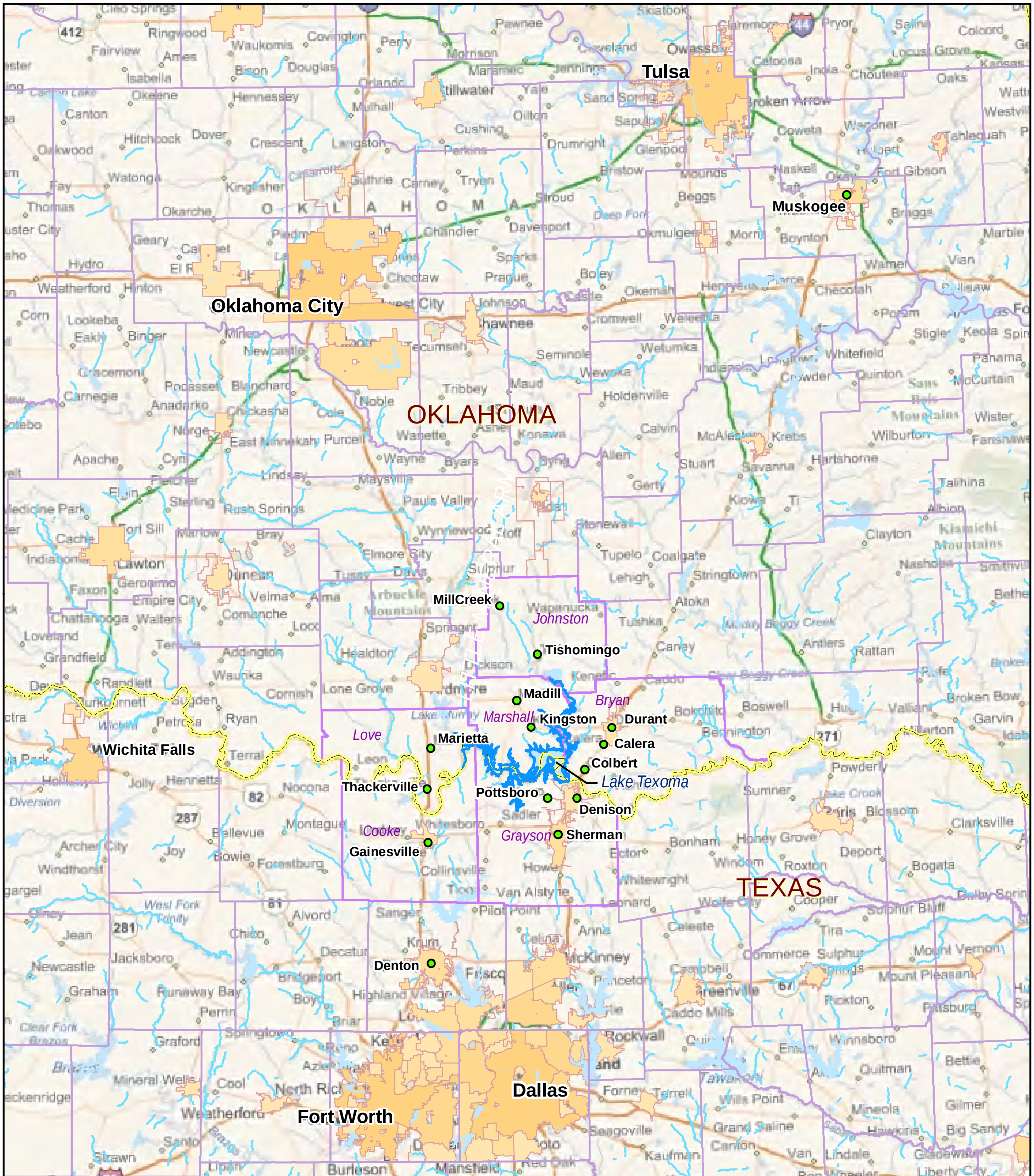
Medical services are provided by a variety of medical professionals with a wide range of specialty fields. The Texoma Medical Center is a major health care facility with four branches located in the surrounding areas of Lake Texoma. The main campus of the center is located in the City of Denison, Texas.

Education

The Denison Independent School District (ISD) is the closest school district to the proposed land conveyance. Denison ISD includes Denison High School, Pathways High School, B. McDaniel Middle School, and seven elementary schools (Golden Rule, Houston, Hyde Park, Lamar, Layne, Mayes, and Terrell). Additional school districts in Grayson County include Bells, Collinsville, Gunter, Howe, Pottsboro, S&S, Sherman, Tioga, Tom Bean, Van Alstyne, and Whitesboro. Grayson Community College is also located in the area.

According to the 2000 Census, the number of students over the age of 3 years that were enrolled in school in Grayson County was 27,885, estimated at 28,986 for 2006-2008. Student enrollment in the City of Denison was 5,302 in 2000 and was estimated at 5,965 for 2006-2008.

The study area region's overall educational attainment lags behind national averages. This puts the region at a disadvantage in the competition for high tech development and in meeting the demands of many jobs of the current and future employers (TRC, 2010). Though higher than the state average, nearly 1 in 5 of the population 25 years in age and older are without a high school diploma. The percentage of the Cooke and Grayson populations holding bachelor or higher degrees is 18.9% and 19.0 % respectively, versus 28.1% in the US (USCB, 2010).



LEGEND

- City / Town
- U.S. Highway
- State Boundary
- County Boundary
- Rivers

SOURCE WORLD STREET MAP ESRI

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT INTENDED FOR SURVEY OR ENGINEERING PURPOSES.

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Miles

FIGURE 3.8.1
TOWNS AND CITIES WITHIN LAKE TEXOMA REGION
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
AUG 2010	03886.544.001.0002	AS SHOWN

File: \\Asa x01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-8-1_Towns-Eco Map.mxd, 30-Sep-10 12:28, perrint

3.9 INFRASTRUCTURE AND UTILITIES

This section summarizes existing conditions of infrastructure within the proposed land conveyance land and the private adjacent land, including shoreline structures, traffic and transportation, water supply and distribution, wastewater treatment, septic tanks, natural gas, electricity, and safety. The descriptions and condition summaries of the utility systems are based upon the most recently available published documents.

3.9.1 Shoreline Structures

No structures are located along the Lake Texoma shoreline within the boundaries of this study.

3.9.2 Traffic and Transportation

This section provides a description of the existing transportation resources near the proposed land conveyance site, including an overview of the regional and local traffic, airports, public transit, boating, and rail resources. Transportation resources are well developed in the region and surrounding areas. The area can be accessed via many transportation modes, and Lake Texoma can be easily accessed from all sides.

Regional and Local Traffic

Transportation in and around the proposed conveyance land is achieved mainly via road and street networks. Due to its rural location, pedestrian and public transit access is limited. There is no cohesive network supporting non-motorized transportation. Sidewalks are not readily available for foot traffic throughout the area. The transportation system serves local and regional traffic consisting of everyday work, living, and recreation trips. Lake Texoma and its surrounding transportation area are known as the Paris District. Nine Counties are sectioned into seven regions within the Paris District; Grayson County is in Region 1 (TXDOT, 2010). The proposed land conveyance site is located along F.M. 84 (Texoma Drive) and F.M. 406 (Georgetown Road) between Denison and Lake Texoma (Figure 3.9.1).

The closest cities to the proposed development are Pottsboro, approximately 3 miles to the south, and Denison, approximately 7 miles to the southeast. Interstate (I)-35, west of Lake Texoma, travels north to south between Dallas-Fort Worth and Oklahoma City. State Highway 75 travels north to south from Plano to Denison and is the main connector to F.M. 84, F.M. 406, and the proposed development. At the Red River, Texas State Highway 75 combines with Oklahoma State Highway 69 and links Lake Texoma to Dallas, Denison, Durant and all of eastern Oklahoma. U.S. Highway 82 travels east to west from I-35 to State Highway 75 providing access to F.M. 120, F.M. 84, and the Little Mineral Arm.

Table 3.9.1 outlines the Annual Average Daily Traffic (AADT) on nearby roadways. The two roadways most likely to be affected are F.M. 84 and F.M. 406, which are adjacent to the proposed development. Traffic on roadways surrounding the proposed development is free flowing during both the A.M. and P.M. peak periods.

Table 3.9.1

Annual Average Daily Traffic and Driving Distance to the Proposed Development

Roadway at Intersection	City	Approximate Drive Time to Proposed Development (minutes)	Annual Average Daily Traffic (vehicles per day)
F.M. 84 Adjacent to the Development	Denison	<1	900
F.M. 84 at State Highway 75	Denison	5	5,500
F.M. 406 at F.M. 120	Fink	2	4,000
F.M. 406 at F.M. 84	Denison	3	3,900
State Highway 75 at U.S. Highway 82	Denison	15	56,000

Source: TXDOT, 2010

Air Transit

The North Texas Regional Airport (GYI) is approximately 8 miles from the proposed development. North Texas Regional Airport was founded in 1941 as a training site for World War II pilots and part of the Perrin Air Force Base. Grayson County currently owns and operates GYI, which averages 146 flights per day including single- and multi- engine prop planes, small jets, helicopters, and ultra lights (AirNav, 2010). The Dallas-Fort Worth (DFW) International Airport is approximately 60 miles from Lake Texoma and provides passenger, commercial, and cargo services. DFW International Airport, ranked 3rd in the world for operations, opened in

1974 and serves approximately 155,900 passengers daily (DFW, 2011). In addition to GYI and DFW International Airport, there are five private airfields within 4 miles of Little Mineral Arm.

Public Transit

Public transit is limited in the area of the proposed development. Texoma Area Paratransit System (TAPS) is a local not-for-profit agency that provides public transportation on two fixed routes (TAPS, 2010). These routes have stops near local businesses in Denison and are designed for residents who choose public transportation on a regular basis. Neither of the routes provides direct access to the proposed development.

Rail

There are many active rail spurs throughout the area. The closest active rail spur runs east to west 2 miles south of the proposed development. Union Pacific and Texas Northeastern Division Railroad are the primary rail carriers in Grayson County. Amtrak does not provide direct service to Denison, and the closest passenger station is approximately 40 miles from the proposed development in Gainesville, TX.

Boating

Lake Texoma has 18 marinas along its shores (Lake Texoma Online, 2011). These marinas provide a variety of services and amenities for tourists and residents. Some provide camping and lodging facilities, recreational vehicle (RV) hookups, restaurants, and luxury gated communities; but boating and recreational water activities are the focus of the marinas along Lake Texoma. All forms of watercraft are available for sale or rent at most major locations around the lake. The Grandpappy Point Resort and Marina is at the edge of Grandpappy Point Park and approximately 900 ft from the proposed development. Grandpappy Point Resort and Marina has more than 800 slips, restaurants, banquet facilities, lodgings, and dock-o-minimums (ownership of a boat slip and a portion of all common areas) sales (Grandpappy Point Resort & Marina, 2010). A boating survey was conducted for this EIS during the summer of 2009, and results of this survey are included in Appendix I and discussed in Section 4 of this EIS.

3.9.3 Water Treatment and Distribution

The proposed USACE conveyance land is undeveloped, and there are no water distribution systems or water wells present in the area. Within the private adjacent land and nearby area, there are approximately 20 private water wells that supply water to residences and businesses. These wells are approximately 6.5-12 inches in diameter and range in depth from 106-386 ft (TCEQ, 2010a).

The Preston Shores Water Treatment Plant, which is supplied with groundwater and surface water provided by the RRAT, distributes drinking water to recreation areas and approximately 450 residential connections in the subdivisions of Tanglewood, Ridgecrest, and Sherwood Shores north and west of the Little Mineral Arm (Southwest Water Company, 2010a).

The City of Denison is supplied with surface water from City-owned Lake Randell, which is also supplemented by surface water from Lake Texoma and groundwater (City of Denison, 2003). The rated nominal capacity for the City's water treatment is 13 million gallons per day (MGD). The average daily demand for the City is 4.5 MGD. The peak demand is 9 MGD (Howerton, 2010). Presently the City has excess capacity for water treatment. According to Mr. David Howerton, Director of Public Works, City of Denison, the existing water treatment infrastructure could support a community four times the current size of the City of Denison. Additionally, Mr. Howerton stated that the City of Denison has an unlimited expansion capacity for water treatment (Howerton, 2010). In 2008, the City of Denison drinking water met or exceeded all EPA drinking water requirements (City of Denison, 2003).

3.9.4 Wastewater Collection and Treatment

Wastewater is any water that has been adversely affected in quality by anthropogenic (human) influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture. In the most common usage, it refers to the municipal wastewater.

Wastewater Treatment Plant

There are currently no buildings located on the proposed conveyance land, and no sewer lines are present on the area within the boundaries of the proposed conveyance lands. Additionally, all structures located within the private adjacent land utilize septic systems to manage wastewater. No wastewater is pumped to an off-site WWTP. Currently, the closest WWTP to the Preston Harbor Development is the Pottsboro WWTP. The Pottsboro wastewater treatment plant is on County Line Road at Little Mineral Creek, approximately 1.6 miles north of the intersection of F.M. Road 120 and F.M. Road 996 and approximately 0.5 mile east of F.M. Road 120 in Grayson County, Texas. The Tanglewood residential subdivision in the southern end by the Big Mineral Arm and the Town of Pottsboro use the Pottsboro WWTP for wastewater disposal (Town of Pottsboro, 2010; Vaden, 2011).

Septic Tanks

There are currently no buildings located on the proposed conveyance land; and no septic tanks are known to be there. The Grayson County Planning Department identified two septic tanks on the private adjacent land (Burnett, 2010). The condition and age of these septic tanks are unknown.

Across from the proposed conveyance lands is the western peninsula of the Little Mineral Arm. All residential subdivisions and public recreation areas in this peninsula use septic tanks for wastewater disposal. The Simmons Shores residential subdivision in the southern end of the Little Mineral Arm also uses septic tanks for wastewater disposal (Southwest Water Company, 2010b).

According to the 2001 Lake Texoma Regional Sewer System Study, septic systems and poor soils in the Lake Texoma area may contribute to water quality impacts at Lake Texoma. This report examined several study areas, including Region TX1 (which contains the proposed conveyance lands, as well as the private adjacent land), and Region TX2 (which contains the western peninsula of Little Mineral Arm, the Simmons Shores subdivision, and the town of Pottsboro). Within Regions TX1 and TX2, 622 and 2,201 housing units utilized a septic system, respectively. The study states that soils in Region TX1 are unsuitable, and soils in Region TX2 are generally unsuitable for septic system operation due to slow percolation and insufficient depth to rock for each soil type. Some soils in Region TX2 are considered suitable for septic system operation (USACE, 2001).

The 2001 Lake Texoma Regional Sewer System Study identified seven institutional options for wastewater treatment for the area surrounding Lake Texoma. Each option was evaluated against six criteria and ranked based on the likelihood that those specific criteria would be met. Creation of a new regional sewer system was ranked as the option that would most likely achieve the goals of providing wastewater service to the population and preserving the water quality of the Lake Texoma watershed. The study stated that separate treatment systems would have to be developed for each state and that new users would be automatically added to the system, while septic users would be offered the opportunity to participate (USACE, 2001). Aside from the Preston Harbor Development, no regional sewer system is or has been planned for this area.

The TCEQ requires owners of private aerobic septic systems to obtain a maintenance contract for their septic system for a period of 2 years, beginning the date that the system is first used. At the end of the initial 2-year service policy, the owner of a septic system for a single family residence may either maintain the system personally or obtain a new maintenance contract (TCEQ, 2010e; THSC, 2005).

Conventional systems do not require any type of maintenance contract, but it is recommended that these systems be pumped every 3 to 5 years to prevent short circuiting of the treatment process (TCEQ, 2010e). For aerobic treatment systems, the recommended frequency of pumping depends on the size of the tank, the depth of sludge, household size, and manufacturer's recommendations (TCEQ, 2010f).

3.9.5 Utilities

Natural Gas

There is currently no natural gas infrastructure on the USACE conveyance land. Within the City of Denison, residences and businesses utilize natural gas provided by Atmos Energy (Atmos). According to the 2010 Natural Gas Annual Statistics Reports provided by the Texas Railroad Commission (TRRC), Atmos energy provided 332,636 one thousand cubic feet (MCF) to domestic facilities, and 150,889 MCF to commercial and industrial facilities in the city of Denison in 2009. Atmos energy provided 21,936 MCF to domestic facilities and 7,619 MCF to commercial and industrial facilities in the city of Pottsboro in 2009 (TRRC, 2010). According to the TRRC interactive GIS map viewer (TRRC Viewer) liquid petroleum gas (LPG) is supplied to developments on the western shoreline of Little Mineral Arm. Grandpappy Point is also supplied with LPG. An LPG supply is not indicated on the conveyance land or on the private adjacent land by the TRRC Viewer.

Electricity

There is currently no electricity infrastructure on the USACE conveyance land. With deregulation of electricity in Texas, residents of Denison can choose their electricity service from a variety of retail electric providers; however, the electricity infrastructure for the area is provided by Oncor Electric. The total electricity consumption for the City was unavailable at the time of preparation of this EIS due to the fact that multiple companies provide electrical service to the City of Denison.

3.9.6 Solid Waste

Currently, there are no construction activities occurring on the USACE conveyance land or the adjacent private land; therefore, no construction and demolition (C&D) waste is being generated. Residences and businesses within the private adjacent land generate municipal solid waste (MSW). Using an estimated daily rate of 4.5 pounds of MSW per person (EPA, 1998), and a 2000 population estimate of 22,773 it is estimated that approximately 18,702 tons of municipal solid waste is generated annually within the City of Denison.

Municipal solid waste collected from the City of Denison is disposed at the Texoma Area Solid Waste Authority (TASWA) landfill. This landfill was permitted in 2003 and opened in 2005. The TASWA landfill accepts approximately 120,000 tons of waste per year, including C&D waste. Based upon the estimated annual municipal solid waste disposal rate for the City of Denison of 18,702 tons, the City currently contributes approximately 15.5% of the waste disposed annually at the TASWA landfill. The cities of Gainesville and Sherman also utilize the TASWA landfill for disposal of municipal solid waste. The landfill is in operation 5.5 days per week (closed on Christmas day) and currently operates on 231 acres, with the possibility of expanding to a total of 921 acres of previously purchased land. Based upon current disposal rates and projected growth rates of contributing cities, the landfill has a life expectancy of 50-70 years. Additionally, the life expectancy of the landfill could be doubled if a permit were acquired which allowed TASWA to double the height of the landfill. The current cost per ton of waste disposed is $33 (Sissney, 2010; TASWA, 2010).

The TASWA landfill does not operate a residential recycling program; however, they do accept materials including tires, computers (no monitors or televisions), oil (maximum of 3 gallons), oil filters, appliances with Freon, and sludge. No aluminum, cardboard, or plastics are accepted for recycling (Sissney, 2010; TASWA, 2010).

3.9.7 Safety

A safe environment is one in which there is no, or an optimally reduced, potential for death, serious bodily injury or illness, or property damage. The elements of an accident-prone environment include the presence of a hazard and an exposed population at risk of encountering the hazard. Numerous approaches are available to manage the operational environment to improve safety, including reducing the magnitude of a hazard or reducing the probability of encountering the hazard. The primary safety categories discussed in this analysis include Ground and Traffic Safety and Construction Safety.

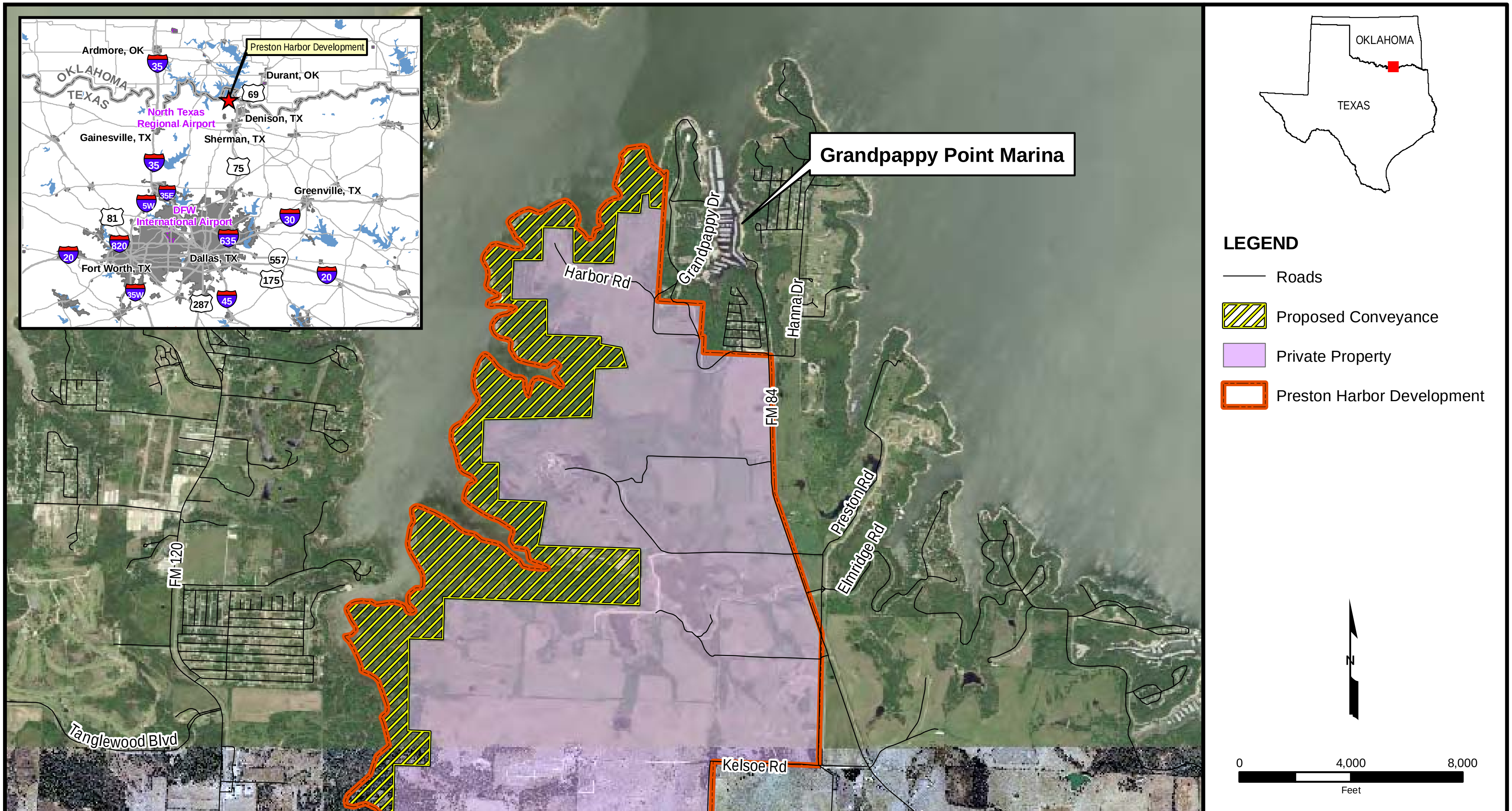
Ground and Traffic Safety

Within the proposed conveyance land there are no roads; therefore, there is no authorized vehicular traffic. Natural hazards may be present in the proposed conveyance land due to the heavily wooded nature of the area. Naturally occurring potential health and safety hazards include insects, snakes, climactic conditions, and floods. Due to the lack of development and traffic within the proposed conveyance land, there are no man-made health and safety hazards located on the property.

At the time of this study, no records were available to detail the number or type of accidents that have occurred on this property.

Construction Safety

Construction site safety is largely a matter of adherence to regulatory requirements imposed for the benefit of employees, and implementation of operational practices that reduce risk of illness, injury, death, and property damage. The health and safety construction workers are safeguarded by Occupational Safety and Health Administration (OSHA) standards. These standards specify the amount and type of training required for industrial workers, the use of protective equipment and clothing, engineering controls, and maximum exposure limits for workplace stressors. Since there has been no development within the proposed conveyance land, there are no known historical construction accidents associated with this property.



SOURCE:
1) STEL Figure; USGS, ESRI, National Atlas of United States Tele Atlas, US Census
2) Boundary provided by PSA Engineering 2009

This figure is prepared by Stel, for reference purposes only and should not be used, and is not intended for, survey or engineering purposes.

FIGURE 3.9.1
TRANSPORTATION NETWORK
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886 544.001.0002	AS SHOWN

File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\FIG3-9-1_Transportation Network 8.5x11.mxd, 30-Sep-10 12:32, perrint

3.10 PUBLIC LANDS

Public access lands are areas where people can visit at their leisure and where permits such as special memberships are not required in order to enjoy outdoor pursuits. Most state and Federally managed public lands are open for public recreational use at Lake Texoma. The shoreline around Lake Texoma (108,753 acres) is owned by the USACE (USACE, 2008c). These lands are managed by several state and Federal agencies including the USACE, USFWS, State of Oklahoma, and State of Texas. The 1996 SMP for Lake Texoma is discussed in Section 3.3 of this EIS. Figure 3.3.2 details the location of SMP shoreline allocations within the proposed conveyance land.

Table 3.10.1 summarizes USACE land-use designations within Lake Texoma according to the OMP FY 2009-2013. The OMP FY2009 – FY2013 is discussed in Section 3.2 of this EIS.

Table 3.10.1

Land-Use Designations

Land-Use Designation	Operation	Area (Acres)
Recreation - Intensive Use	USACE	11,770
	State Agencies	2,473
	Other	150
Recreation - Low Density Use	USACE	39,092
Wildlife Management	USFWS	24,950
	ODWC	29,112
	TPWD	36
Total Acres		**108,753**

Source: USACE, 2008c
ODWC - Oklahoma Department of Wildlife Commission

3.10.1 Wildlife Management

Federal Lands - Wildlife Refuges

The National Wildlife Refuge System, managed by the USFWS, is a system of public lands and waters set aside for the benefit and propagation of fish and wildlife and their respective habitats. As described in Section 3.7.9, two national wildlife refuges exist on the USACE lands within

Lake Texoma and include the Tishomingo National Wildlife Refuge located on the Washita Arm of the lake near the town of Tishomingo, Oklahoma, and the Hagerman National Wildlife Refuge located on the Red River Arm of the lake near Pottsboro, Texas. A breakdown of acreages for the two refuges is shown in Table 3.10.2.

Table 3.10.2

Wildlife Refuges, Lake Texoma

Wildlife Refuge	Acreage	Location
Tishomingo National Wildlife Refuge	13,314[1]	Oklahoma
Hagerman National Wildlife Refuge	11,320	Texas
Total	**24,634**	

Source: USACE, 2008c and USFWS, 2010c

[1]Total acreage for the Tishomingo NWR/WMU is 16,464 acres. 3,150 acres are managed as Tishomingo WMU.

These two wildlife refuges encompass approximately 25,000 acres. A detailed discussion of the refuges is provided in Section 3.7 and recreation opportunities are discussed in Section 3.11 of this EIS.

State Lands - Wildlife Management Areas

The ODWC manages four WMAs on the USACE lands at Lake Texoma and cooperates with the USFWS to manage and conduct controlled hunts on the Tishomingo NWR/Wildlife Management Unit (WMU). The State of Texas manages an aquatic biology and fishery laboratory near the southern end of the Little Mineral Arm of the lake. The WMAs provide public access for hunting and low density types of recreational uses. Table 3.10.3 identifies these areas, and provides a breakdown of acreages for each WMA. The WMA locations on Lake Texoma are depicted in Figure 3.2.2.

Table 3.10.3

State Wildlife Management Areas, Lake Texoma

Wildlife Management Area	Acreage	State
Hickory Creek	7,363	OK
Love Valley	7,746	OK
Fobb Bottom	2,205	OK
Texoma/Washita Arm Unit/Tishomingo WMU	13,286[1]	OK
Aquatic Biology Lab	36	TX
OU Biological Station	338	OK
Southeastern Oklahoma Biological Sciences Station	377	OK

Source: ODWC, 2011b and USACE, 2008c

[1]Land acreage represents the total for Texoma/Washita Arm Unit and Tishomingo WMU.

The WMAs are located on USACE lands in the upper reaches of the reservoir. These areas provide large contiguous tracts of lands, and contain much of the remaining bottomland hardwood habitats around the lake. Game species of interest on most of the WMAs include quail, white-tailed deer, Rio-Grande turkeys, cottontail and swamp rabbits, mourning dove, squirrel, waterfowl, and furbearers such as bobcats, coyote, and raccoon. Primitive camp areas are provided at some of the WMAs. Some of the non-game species of interest include the Bald Eagle and Interior Least Tern (ODWC, 2011b). A description of each of the WMAs follows:

Wildlife Management Areas in Oklahoma (ODWC)

The following information regarding Lake Texoma Wildlife Management Areas in Oklahoma was provided by ODWC.

Hickory Creek—"Hickory Creek WMA covers 7,363 acres of eastern Love County and is located east of Highway 377, approximately 5 miles northeast of Marietta, Oklahoma. Post oak-blackjack timber dominates the uplands with bottomland hardwoods occurring in the low-lying areas. Native grasslands comprised of little bluestem and Indian grass dominate the upland openings" (ODWC, 2011b).

Love Valley—"Love Valley WMA covers 7,746 acres of south central and eastern Love County, located just east of Interstate Highway 35. Post oak-blackjack timber dominates the uplands with bottom land hardwoods occurring next to the Red River. Native grasslands comprised of little bluestem and Indian grass dominate the upland openings" (ODWC, 2011b).

Fobb Bottom—"Fobb Bottom WMA is located in southern Marshall County. The nearest town is Willis, Oklahoma. The area is 2,205 acres in size and consists of mainly flood plain, river bottom, and cropland" (ODWC, 2011b).

Texoma/Washita Arm Unit/Tishomingo NWR/WMU—"Texoma/Washita Arm/ Tishomingo WMA covers 13,286 acres in southern Johnston County. The area is located southwest of Tishomingo. The area consists of mainly flood plain and river bottom habitats" (ODWC, 2011b).

Wildlife Management Areas in Texas (TPWD)

There are no WMAs managed by the State of Texas on Federally owned lands at Lake Texoma. The TPWD has a license for approximately 36 acres near the southern end of the Little Mineral Arm of the lake, which they operate as an aquatic biology and fisheries laboratory.

3.10.2 Lands for Recreation

Lake Texoma lands and shoreline are used for various types of recreation activities. The 1996 SMP governs all the lake shoreline uses. The USACE lands at Lake Texoma are zoned to maintain a balance between lakeside development and the environment. According to the 1996 SMP, Lake Texoma shoreline and land can be accessed and used for recreation by the public where the shoreline is allocated as Public Recreation Areas (Public Use Areas) or Protected Shoreline Areas. Privately owned floating facilities are not permitted in these areas.

Approximately 30% of the lands around Lake Texoma are zoned for public use areas and are accessible to the public for various types of outdoor recreational pursuits. Approximately 65% of the lake shoreline is allocated for Protected Shoreline Areas. The recreational activities in these shoreline areas include both high intensity and low density uses.

The Public Recreation and Protected Shoreline Areas zoning according to the 1996 SMP permit different types of recreation activities. The sites and the activities are managed by state and Federal agencies or commercial concessions. All sites are intended for public use. The Public

Recreation zoning includes recreation intensive use. The Protected Shoreline Areas include recreation low density use.

There are two types of public recreation area designations at Lake Texoma. These areas include Recreation - Intensive Use and Recreation - Low Density Use (USACE, 2008c).

Recreation - Intensive Use

Recreation - Intensive Use includes USACE lands for public recreation intended for high intensity recreational opportunities in the public use areas. These include commercial marinas, public parks, public campgrounds and picnic areas, public boat launching ramps, restrooms, parking spaces, and swimming beaches. The areas can be accessed by water or land. Intensive use includes all 1996 SMP Public Recreation Areas. The 2009 - 2013 OMP for Lake Texoma lists a total of 14,393 acres of Recreation - High Density lands at Lake Texoma.

Recreation - Low Density Use

Recreation - Low Density Use includes USACE lands for public recreation intended for low impact recreational activities such as hunting, hiking, and fishing. These lands are open to the public and do not have structures or facilities for camping, boating, or picnicking. The 2009 - 2013 OMP for Lake Texoma lists a total of 39,092 acres of Recreation-Low Density lands at Lake Texoma. Public recreation low density use includes hunting at USACE managed hunting areas and can include wildlife and nature watching and photography.

State Parks

Two State Parks are presently located at Lake Texoma: Lake Texoma State Park (Oklahoma) and Eisenhower State park (Texas). Both state parks are considered as Recreation-Intensive use. Lake Texoma State Park is located in Marshall County, east of the town of Kingston. The park offers fishing, swimming, camping, hiking and picnic areas. The park was originally operated by the State of Oklahoma, but is presently in a transitional state and is being privatized. WRDA 1999 authorized the disposal and sale of approximately 1,580 acres of Federally owned land at Lake Texoma, which was leased to the OTRD for the park. In accordance with the NEPA, USACE, Tulsa District, prepared an Environmental Assessment dated June 2005 addressing the environmental and social impacts of selling approximately 564 acres of land to the State of Oklahoma. These lands were subsequently sold, and the Texoma State Lodge and many of the structures associated with it were demolished and removed. The OTRD presently operates some recreational features and campgrounds at site, but continued future operations have not been determined.

The State of Oklahoma has requested conveyance of additional lands up to the balance (approximately 1,022 acres) of that authorized by WRDA 1999. Presently, USACE, Tulsa District, is preparing NEPA documentation addressing the environmental and social impacts associated with remainder of the land conveyance authorized by WRDA 1999.

Unlike past Federal land conveyance in accordance with provision of the 1999 WRDA discussed above, the land conveyance for the Denison conveyance is a result of separate legislation contained in WRDA 2007. This legislation requires that the Secretary of the Army convey to the city of Denison up to 900 acres of lands at Lake Texoma which were included in a 2005 lease application. The conveyance is to be at fair market value and is subject to completion of NEPA documentation and other real estate requirements such as a survey and appraisal. All costs are to be funded by the city. Accordingly, land conveyance actions mandated by the two distinct WRDA bills are not connected or related to one another.

Eisenhower State Park (Texas) encompasses 423.1 acres and is located in Grayson County, northwest of the City of Denison. The park has facilities for picnicking, hiking, biking, nature study, fishing, boating and boat rentals, water skiing, swimming, wildlife observation, all-terrain vehicle (ATV) and mini-bike use, and a variety of camping grounds.

USACE-Operated Lands

According to the USACE Tulsa District OMP FY2009 - 2013 for Lake Texoma, the existing USACE-managed recreational development consists of ten class A parks and over 700 campsites with electric and individual water hookups at most sites (USACE, 2008c). Each park contains a variety of facilities.

Approximately 57 miles of equestrian trails and a 14-mile scenic Cross Timbers hiking trail are also available. The trails meander through Juniper Point, Cedar Bayou, Paw Paw Creek, and

Rock Creek Parks. A list of USACE-managed recreation areas at Lake Texoma according to the FY2009 - 2013 OMP is shown in Table 3.10.4.

Table 3.10.4

USACE-Managed Recreation Areas, Lake Texoma

Park Name	Area in Park (acres)
Buncombe Creek	280
Caney Creek	390
Dam site (Oklahoma)	260
Dam site (Texas)	
East Burns Run	200
Johnson Creek	75
Juniper Point	390
Lakeside	430
Old Ranger Station	180
Platter Flats	185
Preston Bend Recreation Area	71
West Burns Run	355
Total	**2,816**

Source: USACE, 2008c

Note: USACE also manages Island View Park, which is currently closed.

Quasi-Public Areas

According to the 1996 SMP, a total of 3,362 acres of Quasi-Public Lease areas are used at Lake Texoma (USACE, 1996). These areas include public use areas of Federal lands that are leased to special interest groups such as the Boys Scouts and Girls Scouts, YMCA, YWCA, and religious groups. Access to Quasi-Public Lease areas is restricted to special interest, non-commercial groups. Boat docks in quasi-public lease areas are managed under the terms of the real estate agreement for the individual site. Table 3.10.5 lists the major Quasi-Public Areas within Lake Texoma as depicted in Figure 3.10.1.

Table 3.10.5

Major Quasi-Public Areas, Lake Texoma

Lessee	Conditions of Use	Acres
All Saints Camp and Conference Center, Inc.	Use restricted to Special Interest, Non-Commercial Group.	600.0
Archdiocese of Oklahoma City	Use restricted to Special Interest, Non-Commercial Group.	95.0
Austin College	Use restricted to Special Interest, Non-Commercial Group.	28.7
Boy Scouts of America-Circle Ten Council	Use restricted to Special Interest, Non-Commercial Group.	477.0
Cross Timbers Girl Scout	Use restricted to Special Interest, Non-Commercial Group.	150.0
Future Farmers	Use restricted to Special Interest, Non-Commercial Group.	127.0
Grayson Baptist	Use restricted to Special Interest, Non-Commercial Group.	22.9
Lake Texoma Baptist Resort Ministry, Inc.	Use restricted to Special Interest, Non-Commercial Group.	50.0
Lake Texoma Baptist Resort Ministry, Inc, Bryan Baptist Assoc	Use restricted to Special Interest, Non-Commercial Group.	155
Lake Texoma Youth Conf. Grounds Of The Disc. of Christ, Inc.	Use restricted to Special Interest, Non-Commercial Group.	2.5
Methodist Camp	Use restricted to Special Interest, Non-Commercial Group.	177.14
Presbyterian Camp on Lake Texoma, Inc.	Use restricted to Special Interest, Non-Commercial Group.	38.0
Straight Arrow Clubs & Camps, Inc	Use restricted to Special Interest, Non-Commercial Group.	54.5
Sundance Camp, Inc.	Use restricted to Special Interest, Non-Commercial Group.	80.0
Tejas Girl Scout Council	Use restricted to Special Interest, Non-Commercial Group.	59.8
Texas Baptist Bible Fellowship	Use restricted to Special Interest, Non-Commercial Group.	60
Texoma Council of Camp Fire Inc.	Use restricted to Special Interest, Non-Commercial Group.	75.0
Texoma Youth Camp, Inc	Use restricted to Special Interest, Non-Commercial Group.	53.4
United Methodist Church, North Texas Conference	Use restricted to Special Interest, Non-Commercial Group.	65.0
Victory Life Camp, Inc.	Use restricted to Special Interest, Non-Commercial Group.	185.0

Source: USACE, 2010g; USACE, 2011b.

The major Quasi-Public Leases are located on the western shore of the Little Mineral Arm across the water from the proposed USACE conveyance area and include Texoma Youth Camp, Straight Arrow Clubs, Texas Baptist Bible Fellowship, Grayson Baptist, and Austin College.

Public Boat Ramps

Other high intensity public recreation areas include boat ramps/public boat launch facilities and public parking areas at Lake Texoma. Approximately 70 public boat launching ramps with access roads are located at Lake Texoma and are open to the general public (USACE, 2008c). At the time of this report, data collection efforts regarding public boat ramps were being performed by USACE, and detailed information of types of the ramps was not readily available (USACE, 2011a). No public boat ramps exist within the proposed conveyance land. There is one public boat ramp in the northern tip of the eastern shore of the Little Mineral Arm close to Grandpappy Point. The public boat ramp located near Grandpappy Point is the closest boat ramp to the proposed conveyance property.

Public Beaches

Two USACE-managed public swimming beaches are present at Lake Texoma. The public beaches are located at West Burns Run and East Burns Run. The two designated swimming beach day-use areas provide additional group shelters and picnic sites to the public. Each beach has approximately 50 parking spaces (USACE, 2008c). There are no public beaches within the proposed conveyance land.

Pocket Beaches

Approximately 195 secluded “pocket beaches” are identifiable from aerial imagery along the shoreline of Lake Texoma, totaling 108,702 linear feet. Pocket beaches are unmanaged beach areas located in relatively undeveloped areas and are typically only accessible for recreational use by the public from the water. Of the 195 pocket beaches, 15 exist along the east and west shorelines of Little Mineral Arm totaling 9,953 linear feet. The pocket beaches are used for swimming, fishing, boat mooring, shelter from wind, and wildlife observation. Pocket beaches outside the Little Mineral Arm were identified using aerial imagery only, whereas the pocket beaches along the shoreline of Little Mineral Arm were documented using aerial imagery as well as field verification during the recreational helicopter field survey. Little Mineral Arm was specifically studied to find out the use of the pocket beaches along its shoreline in order to determine impacts from the proposed USACE land conveyance. Additional information regarding use of pocket beaches is provided in Section 3.11.6.

Pocket beaches exist on both the west and east sides of the Little Mineral Arm. The majority of these beaches is situated along the eastern shore of the Little Mineral Arm, adjacent to the proposed USACE land conveyance, and is located within the Protected Shoreline Areas according to the 1996 SMP. One pocket beach area is located along the western shore, adjacent to the Hiland Shores development.

There are approximately 8,153 linear feet of pocket beaches along the eastern shore and 1,800 linear feet of pocket beaches along the western shore of Little Mineral Arm. The pocket beaches are accessible when the lake is at normal and seasonal conservation pool elevation. Pocket beaches within the Little Mineral Arm are shown in Figure 3.11.1. Pocket beaches along the entire shoreline of Lake Texoma are shown in Figures 3.10.2.1 to 3.10.2.3.

Hunting

USACE lands within Lake Texoma permit public hunting in designated areas. The public hunting areas are shown in Figure 3.2.2.

The proposed conveyance land is presently open to limited hunting with restrictions in accordance with applicable state and Federal regulations and established seasons. The shoreline adjacent to the proposed USACE conveyance lands is zoned as Protected Shoreline Areas according to the 1996 SMP.

Privately Operated Recreation Areas

The intensive land-use designation for USACE lands at Lake Texoma include all the privately operated recreation areas and include concessions, marinas, resorts, camp grounds, picnic facilities, shelters, and swimming beaches. The privately operated recreation is zoned as Public Recreation Areas according to the 1996 SMP. Table 3.10.6 lists the privately operated recreation areas at Lake Texoma. Figure 3.10.3 depicts the locations of these areas.

Table 3.10.6

Privately Operated Recreation Areas, Lake Texoma

Recreation Areas	Facility Type	Conditions of Use
Alberta Creek Marina	Concession Marina	Open to General Public - By Fee
Arrowhead Point Marina	Concession Marina	Open to General Public - By Fee
Big Mineral Camp	Concession Marina	Open to General Public - By Fee
Bridgeview Camp Marina	Concession Marina	Open to General Public - By Fee
Cedar Bayou	Concession Marina	Open to General Public - Hiking is free for walk-ins, all other services are fee-based
Cedar Mills Marina	Concession Marina	Open to General Public - By Fee
City of Tishomingo	Public Park	Open to General Public - Hiking on trails is free
Cumberland Cove Marina	Concession Marina	Open to General Public - Free to walk around marina but fee for accessing water
Eisenhower State Park and Yacht Club	Public Park and Marina	Open to General Public - By Fee
Flowing Wells Marina	Concession Marina	Open to General Public - By Fee
Grandpappy Point Marina	Concession Marina	Open to General Public - Using launch ramp is free
Highport Marina	Concession Marina	Open to General Public - Can fish off the banks for free
Lebanon Resort	Public Park	Open to General Public - By Fee
Little Glasses Marina	Concession Marina	Open to General Public - By Fee
Mill Creek Resort	Concession Marina	Open to General Public - Can fish off the banks for free
Newberry Creek Marina	Concession Marina	Open to General Public - Residents who live up the street can fish and swim along banks for free (otherwise parking fee)
Paradise Cove Resort	Concession Marina	Open to General Public - By Fee
Paw Paw Point	Concession Marina	Open to General Public - By Fee
Pennington Creek (Part of City of Tishomingo)	Public Park	Open to General Public - By Fee
Preston Bend Resort – Little Mineral	Concession Marina	Open to General Public - Can fish off the bank for free
Preston Fishing Camp Lighthouse Marina	Concession Marina	Open to General Public - By Fee
Rock Creek Camp	Concession Marina	Open to General Public - By Fee

Recreation Areas	Facility Type	Conditions of Use
Soldier Creek Marina	Concession Marina	Open to General Public - Can fish off the bank for free
Texoma State Park and Catfish Bay Marina	Public Park and Marina	Open to General Public – By Fee
Walnut Creek Marina	Concession Marina	Open to General Public - Can swim off the bank for free
Willow Springs Marina	Concession Marina	Open to General Public - By Fee

Source: USACE, 2010g; USACE, 2011b

The closest privately operated recreation area within vicinity of the proposed conveyance land is the Grandpappy Point Resort & Marina. This is located at the northern tip of the eastern shore of the Little Mineral Arm.

Marinas and Associated Access Areas

A total of 23 marinas are present throughout the shoreline of Lake Texoma. Marinas have a total of 5,860 slips/mooring spaces and approximately 620 dry dock spaces (USACE, 2008c). At present, no new spaces have been approved for expansion of commercial and private marinas.

Private Leases

When USACE issues "private" leases that means these leases are issued for private recreational uses for club sites, boat clubs, cottages sites, and non-profit organizations operating as "private clubs" that are not generally open to the public (USACE, 2010g). Ten recreational private leases are present at Lake Texoma. Most of these private leases belong to clubs as shown in Table 3.10.7 and Figure 3.10.4.

Table 3.10.7

Private Leases, Lake Texoma

Private Lease	Type	Conditions of Use	Acreage
Bryant Boat Club, Inc	Recreation – private (club)	Not Open to the General Public – Membership Required	7.00
American Legion Post 231	Recreation – private (club)	Not Open to the General Public – Membership Required	17.00
Camp Sandy Point, Inc.	Recreation – private (club)	Not Open to the General Public – Membership Required	3.90
Cedar Point Club, Inc.	Recreation – private (club)	Not Open to the General Public – Membership Required	25.00

Private Lease	Type	Conditions of Use	Acreage
Dallas Texins Association	Recreation – private (club)	Not open to the general public - Membership required (accessible only by Texas Instrument employees and relatives)	51.00
Lakeview Lodge, Inc.	Recreation – private (club)	Not Open to the General Public – Membership Required	3.38
Lukehaven Rec Club	Recreation – private (club)	Not Open to the General Public – Membership Required	3.40
Mineral Bay Private Club, LLC	Recreation – private (club)	Not Open to the General Public – Membership Required	15.00
Taylor, Ronald	Recreation – private (cottage)	Not Open to the General Public	1.20
Veterans of Foreign Wars	Recreation – private (club)	Not Open to the General Public – Membership Required	49.00
Total			**175.88**

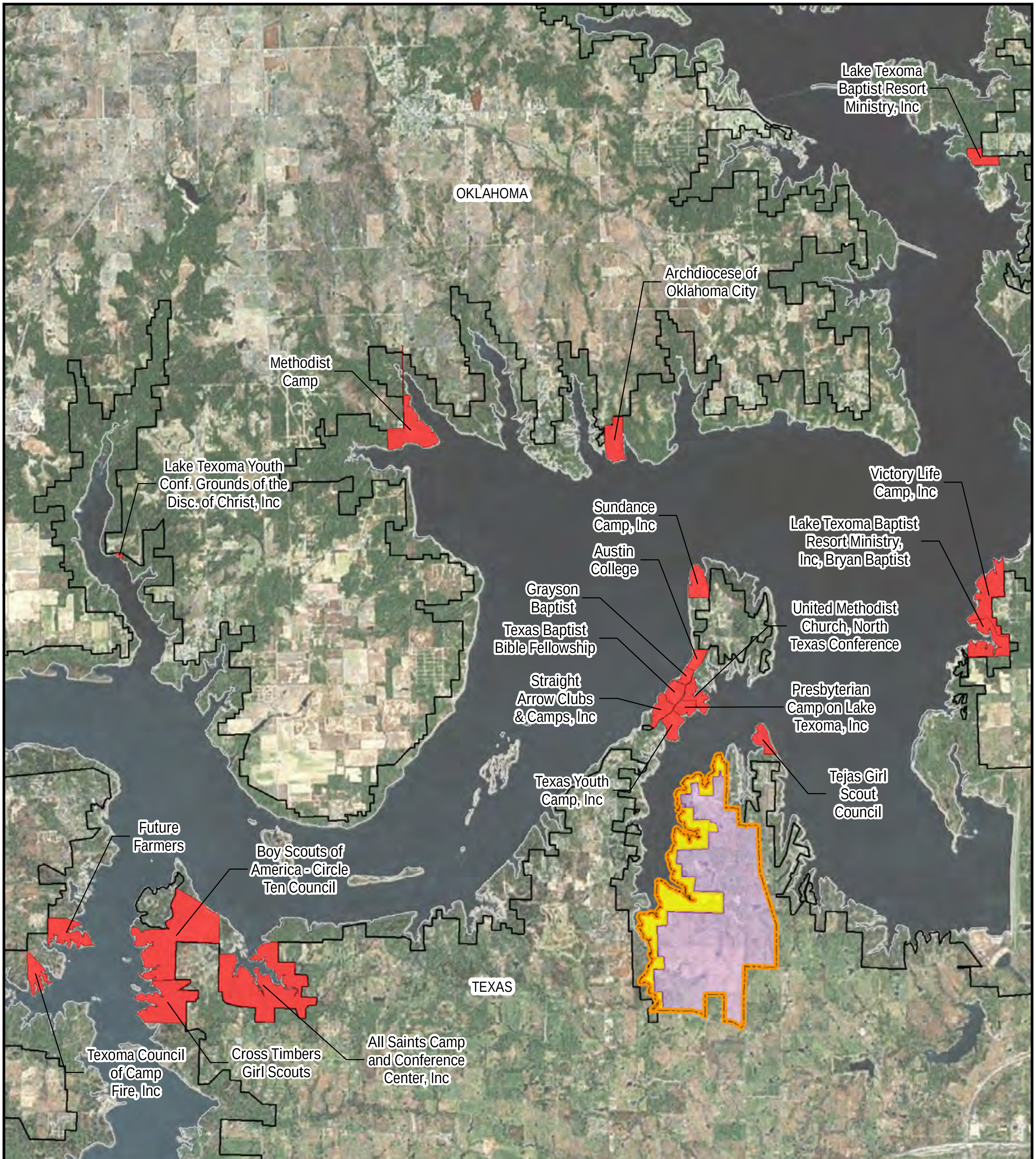
Source: USACE, 2010g

Lukehaven Recreation Club, Dallas Texins Association, Texas Instruments Club Sites 4, Veterans of Foreign Wars Club Sites 2 and 3, American Legion Post 231 Club Site 9, Mineral Bay Private Club, and Bryant Boat Club are located within the vicinity of the proposed USACE land conveyance.

Private Boat Docks

At the present time there are 111 real estate subdivisions adjacent to public lands. Most subdivisions have a boat dock and a boat ramp. As of 2009, a total of 688 private boat docks had been permitted within the entire Lake Texoma area (USACE, 2008c).

In accordance with the provisions of 36 CFR 327.19 (see Appendix J), private shoreline uses may be authorized in designated areas consistent with approved use allocations specified in the SMP. One of the approved uses in accordance with USACE regulations permits moorage facilities when they will not create a safety hazard and inhibit public use or enjoyment of project waters or shoreline. A portion of the shoreline adjacent to the proposed conveyance property is zoned Limited Development as shown in the 1996 SMP (Figure 3.3.2), and some shoreline activities are permitted. Presently, 14 Shoreline Use Permits for private moorage facilities have been issued for the cove where the boat club is being proposed (Figure 2.5). These consist of appropriately marked buoys where boats can be moored for private use.



LEGEND

- Major Quasi-Public Areas
- USACE Public Access Lands
- Conveyance Area
- Private Property
- Preston Harbor Development

SOURCE 1) U.S. DEPARTMENT OF AGRICULTURE
NATIONAL AERIAL IMAGERY PROGRAM FARM SERVICE AGENCY GRAYSON COUNTY TEXAS 2008-09-09
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FIGURE 3.10.1

MAJOR QUASI-PUBLIC AREAS
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JUL 2011	03886.544.001.0002	AS SHOWN

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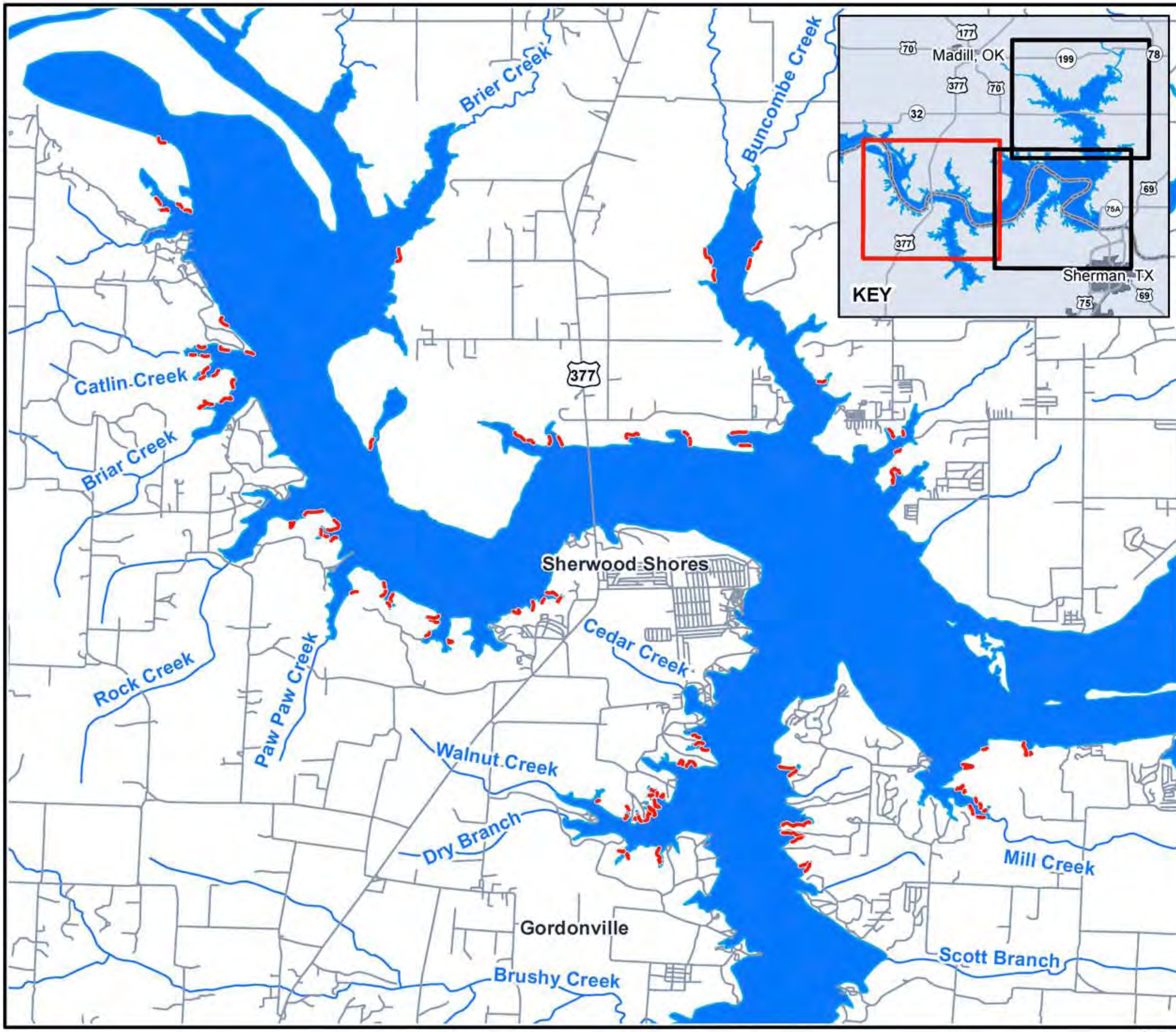

Figure 3.10.2.1
Lake Texoma Pocket Beaches

Lake Texoma
City of Denison
Land Conveyance EIS

Legend

Pocket Beach Area

*Pocket Beach Locations outside of the Little Mineral Arm are based on Aerial Imagery and are not field verified.

Source: USGS, ESRI, National Atlas of the United States, Tele Atlas, US Census, Texas General Land Office, University of Oklahoma Data Services (High Activity Areas): 2009 Google Earth 5.1.3533.1731, 2009 Microsoft Bing Maps, USACE 2008 Oklahoma aerials hosted by maps.scigis.com

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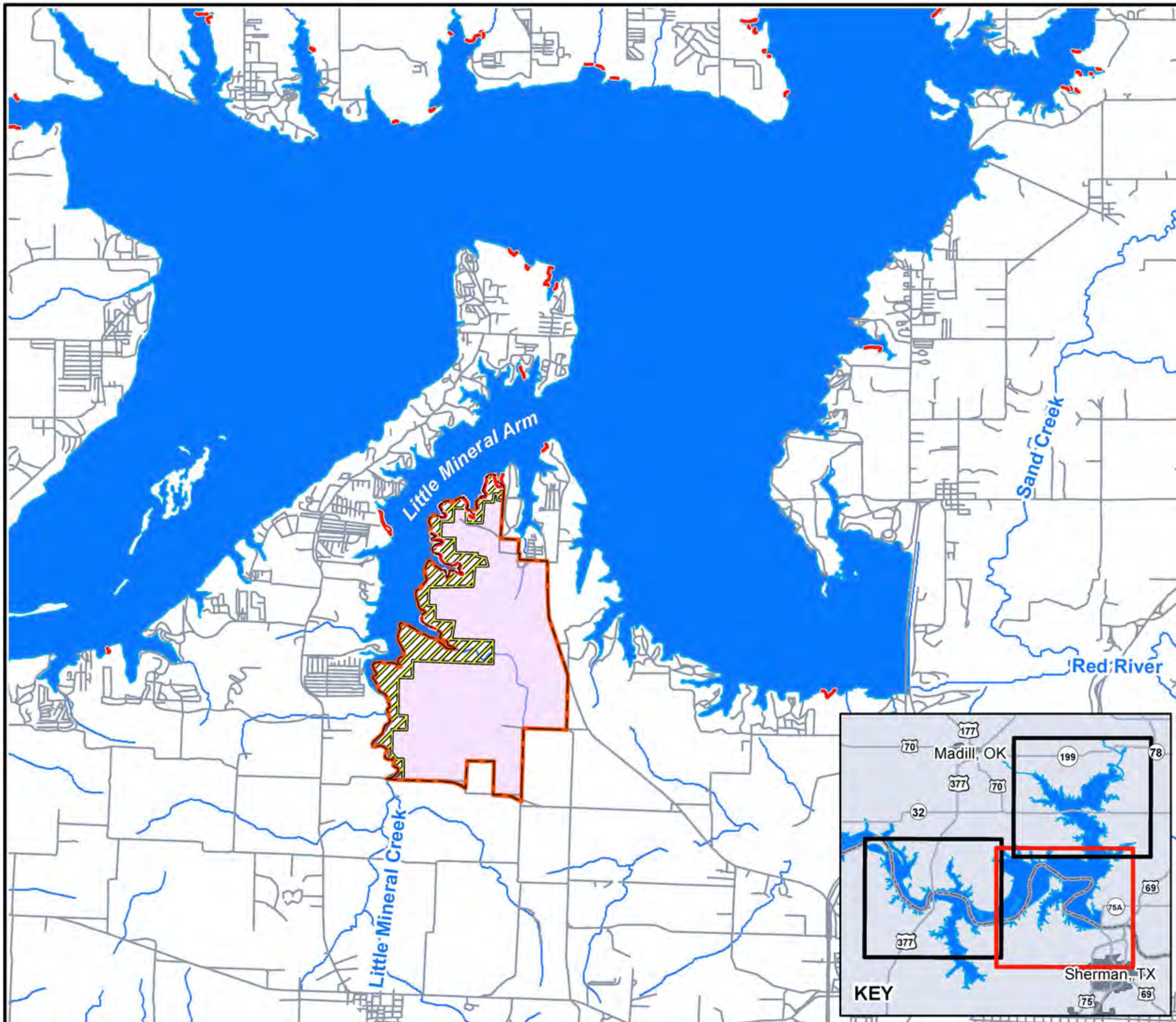
Figure 3.10.2.2
Lake Texoma Pocket Beaches

Lake Texoma
City of Denison
Land Conveyance EIS



Legend

Pocket Beach Area

Proposed Land Conveyance

Private Property

Preston Harbor Development

*Pocket Beach Locations outside of the Little Mineral Arm are based on Aerial Imagery and are not field verified.

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Source: USGS, ESRI, National Atlas of the United States, TeleAtlas, US Census, Texas General Land Office, University of Oklahoma Data Services (High Activity Areas): 2009 Google Earth 5.1.3533.1731, 2009 Microsoft Bing Maps, USACE 2008 Oklahoma aerials hosted by maps.scigis.com

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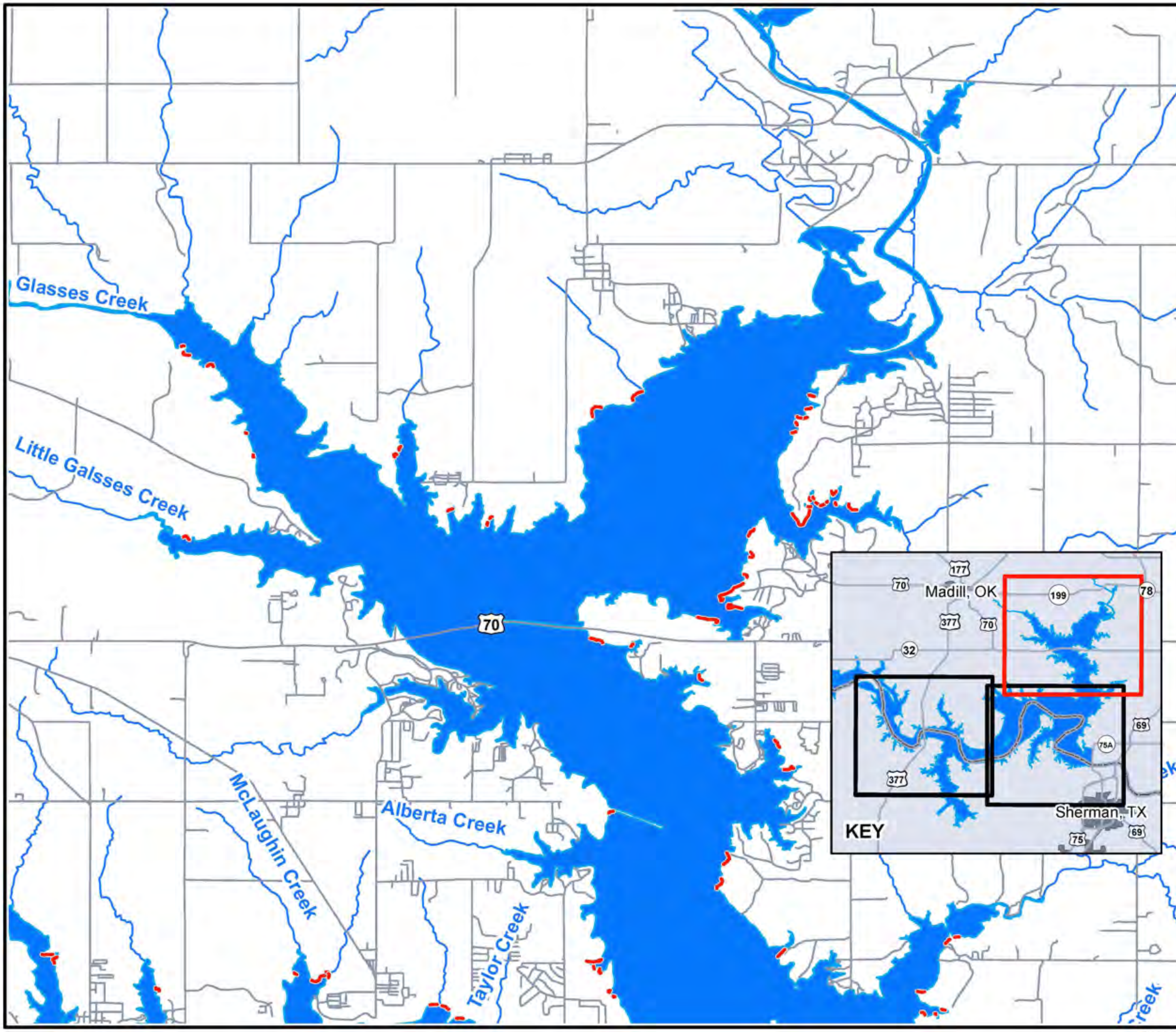
Figure 3.10.2.3
Lake Texoma Pocket Beaches

Lake Texoma
City of Denison
Land Conveyance EIS



Legend

Pocket Beach Area

*Pocket Beach Locations outside of the Little Mineral Arm are based on Aerial Imagery and are not field verified.

N

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Miles

Source: USGS, ESRI, National Atlas of the United States, TeleAtlas, US Census, Texas General Land Office, University of Oklahoma Data Services (High Activity Areas): 2009 Google Earth 5.1.3533.1731, 2009 Microsoft Bing Maps, USACE 2008 Oklahoma aerials hosted by maps.scigis.com

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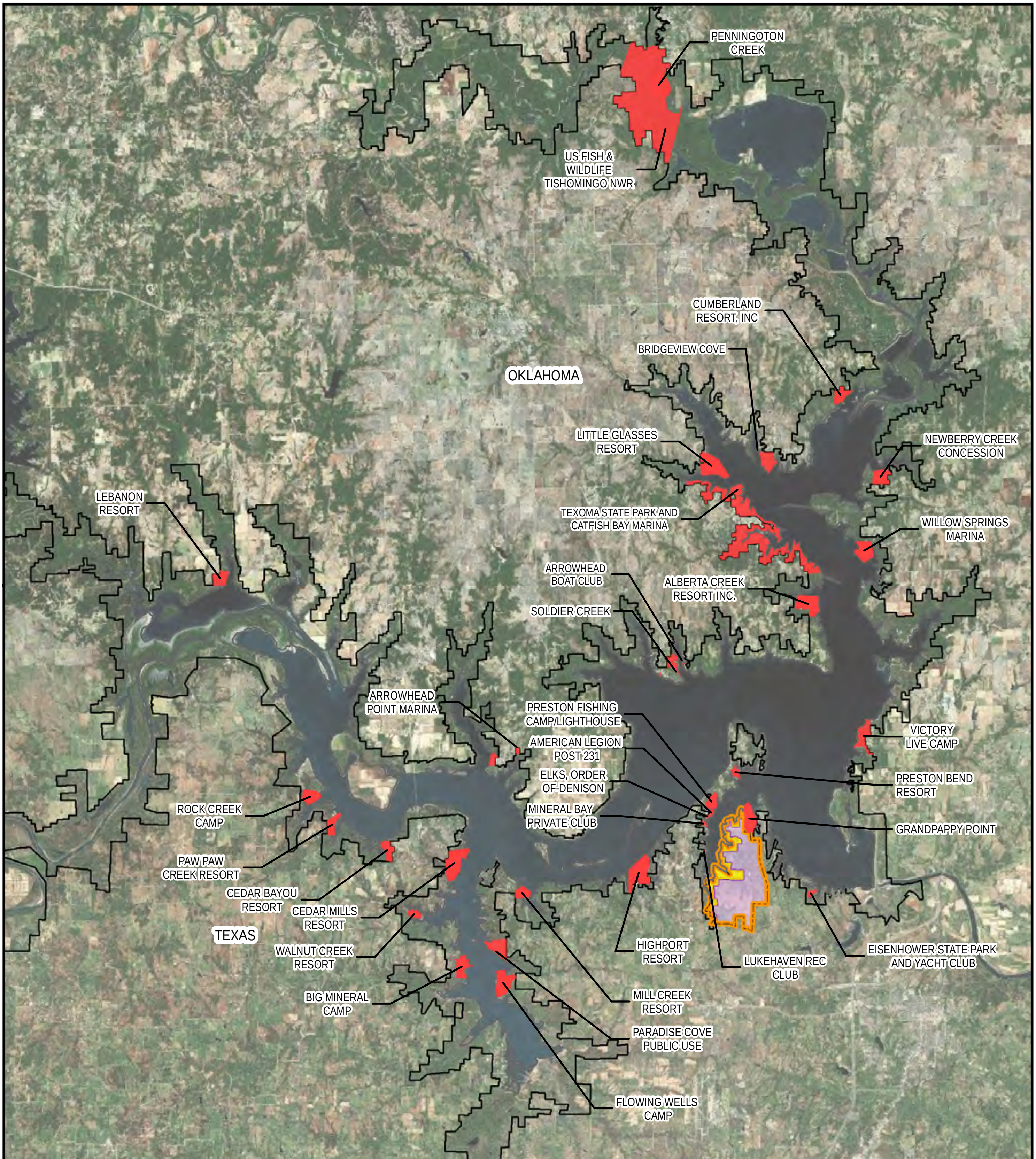

LEGEND

- Privately Operated Recreation Areas
- USACE Public Access Lands
- Conveyance Area
- Private Property
- Preston Harbor Development

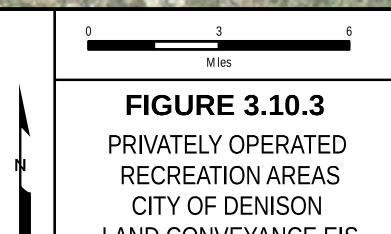

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FIGURE 3.10.3

PRIVATELY OPERATED
RECREATION AREAS
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

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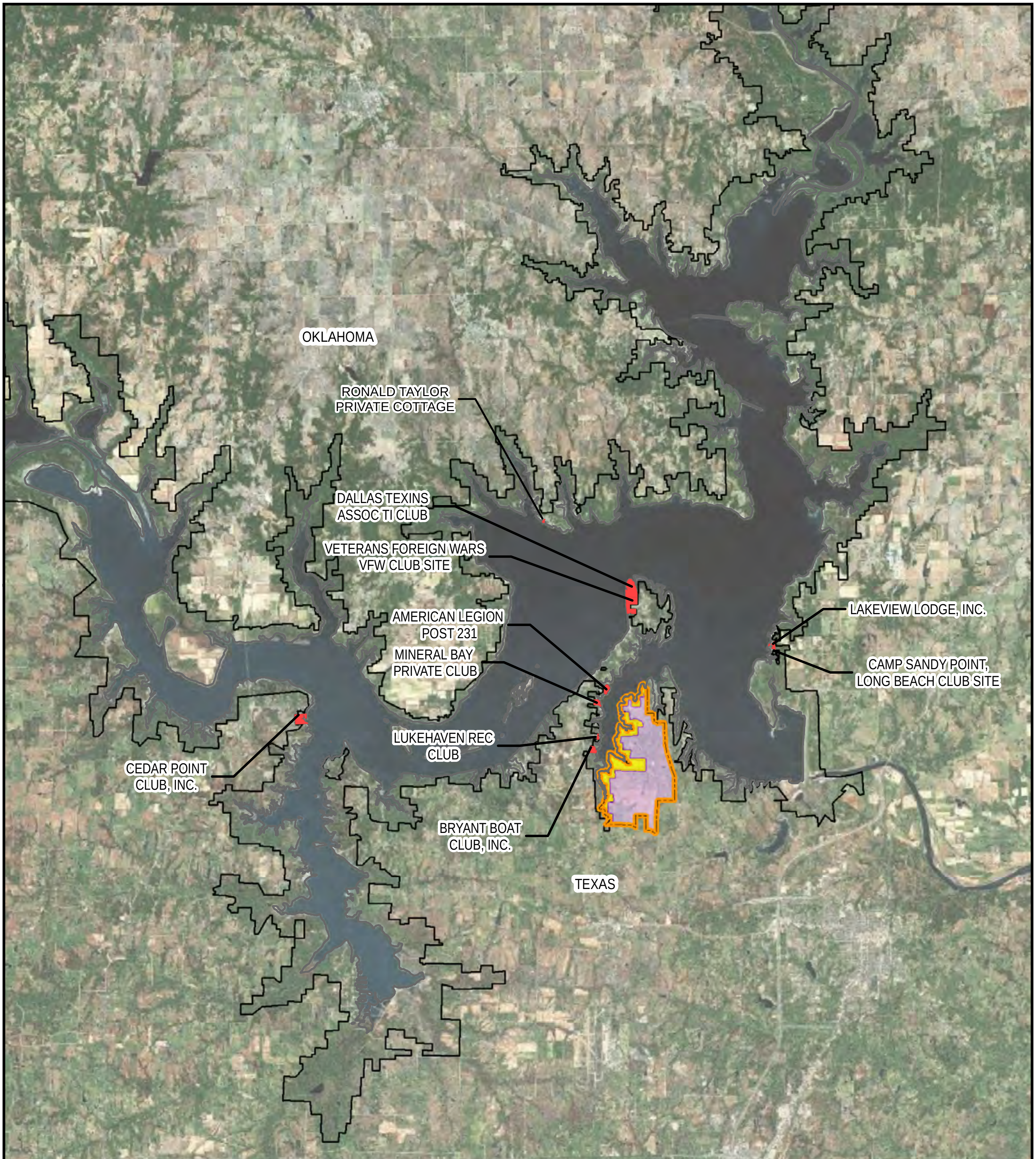

LEGEND

- Privately Operated Private Club Sites
- USACE Public Access Lands
- Conveyance Area
- Private Property
- Preston Harbor Development

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FIGURE 3.10.4

PRIVATELY OPERATED
PRIVATE CLUB SITES
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JAN 2011	03886.544.001.0002	AS SHOWN

Path: I:\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Chapter_3\Fig3-10-4_Private Clubs.mxd, Date: 7/22/2011 14:24,User: WILDERJ

3.11 RECREATION

Recreation was added as one of the six authorized project purposes at Lake Texoma in 1986 (Public Law 622, 99th Congress, 2nd Session). Lake Texoma supports a variety of recreational activities including boating, fishing, horseback riding, all terrain vehicle use, hunting, golf, wildlife observation, photography, hiking, camping, and picnicking. The public beaches and sandy pocket beaches throughout the lake are used for swimming and shoreline fishing.

The broad category of "recreation activities" at the lake can occur either on water or in a variety of land-use and shoreline designations. The water-based recreation at Lake Texoma and land-based and land-water interfaced-based recreation are addressed separately in this EIS. The land-based recreation includes all recreation on land where as land-water interface-based recreation includes all recreation that occurs on the shorelines and the immediate waters of the lake. The water-based recreation includes all recreation occurring in the water.

The land-based recreation inventory is based on desktop surveys of the lake and other relevant published reports, including the Land Recreation Data Collection Summary Report in Appendix O. The information on the land-water interface-based and water-based recreation were obtained during 2009 field observations by Stell Environmental Enterprises Inc. (SEE). The detailed methodologies, the standards used, and the results are included in the Water-Based Recreation Inventory and Assessment Report (Appendix I). Based on the field observations of the water-based recreational facilities and uses, the carrying capacities of the lake and its facilities were assessed. This included data collection and analysis to characterize and quantify the existing level of water-based recreational activity on Lake Texoma and comparison of this data to the carrying capacities of the lake and its facilities.

3.11.1 Recreation Visitation

When the Lake Texoma MP was developed in 1978 , the visitation zone of influence for Lake Texoma was defined as areas within 75 miles from the lake (USACE, 1978). While recent park visitation data does not specifically track the origination of visitors; anecdotal data from the USACE indicates that the current zone of influence is larger than the 75 miles defined in 1978 (USACE, 2011c). The counties within this zone include Collin, Cooke, Dallas, Delta, Denton, Fannin, Grayson, Hopkins, Hunt, Lamar, Montague, Rockwall, Tarrant, and Wise counties in Texas. In Oklahoma, the counties include Atoka, Bryan, Carter, Coal, Garvin, Johnston, Love, Marshall, Murray, Oklahoma, and Pontotoc counties. Due to easy highway and interstate access to the lake, it is frequently visited from the Dallas/Fort Worth Metroplex area (Interstate 35 and Highway 75).

Traditionally, the highest visitation months at the lake include the summer months of June, July and August. According to this visitation data, July is generally the busiest month of the year, experiencing the highest number of visits, visitor hours, and visitor days for 6 of the 9 years (2000, 2003 to 2006, and 2008). An average of 5.8 million people used Lake Texoma for recreational purposes in 2006 (USACE, 2009b). This number reflects all recreational visitations. According to the 1978 MP, it was estimated that 48% of the total visitation was at the USACE managed areas (USACE, 1978).

The total number of annual visits in 2008 was the highest recorded during the 9-year timeframe evaluated. The number of visits to Lake Texoma by recreational activity and the relative percentage for each activity for the years 2006 through 2008 is included in Table 3.11.1, on the following page.

In 2006, the visitation to Lake Texoma ranked first among the USACE lake projects nationwide, with visitors spending over 90 million hours at the lake. Since then, visitor hours spent at the lake have not declined considerably below 90 million. Fishing, sightseeing, and boating activities are popular activities at the lake. It is important to note that fishing and boating may occur together, which may influence the relative order of these activities, possibly making boating the top recreational pursuit.

Table 3.11.1

Visitation per Recreation Activity, Lake Texoma, 2006-2008

Year	Visits	Type of Recreation Activity									
		Boating	**Camping**	**Fishing**	**Hunting**	**Picnicking**	**Sightseeing**	**Swimming**	**Waterskiing**	**Other**	**Total**
2006	Visits	1,326,349	829,839	2,825,144	104,768	732,495	1,996,341	1,038,553	370,151	742,098	9,965,738
	%	13.3%	8.3%	28.3%	1.1%	7.4%	20.0%	10.4%	3.7%	7.4%	100.0%
2007	Visits	1,251,316	747,922	2,769,622	105,632	677,533	2,182,556	944,714	320,105	633,797	9,633,197
	%	13.0%	7.8%	28.8%	1.1%	7.0%	22.7%	9.8%	3.3%	6.6%	100.0%
2008	Visits	1,426,810	775,213	2,862,018	84,654	719,855	2,126,964	1,036,991	356,365	730,083	10,118,953
	%	14.1%	7.7%	28.3%	0.8%	7.1%	21.0%	10.2%	3.5%	7.2%	100.0%

Source: USACE, 2009b

3.11.2 Land-Based Recreation

Land-based recreation includes activities such as hunting, golfing, horseback riding, four-wheeling, wildlife watching and photography, hiking, camping, and picnicking. The majority of land-based recreation areas at Lake Texoma offer both land-based recreation opportunities as well as land-water interface-based recreation opportunities.

The Lake Texoma shoreline is governed by the 1996 Lake Texoma SMP (USACE, 1996). The 1996 SMP allocates the lake shoreline into four categories based on the intended use, management, and access. As discussed previously, these four categories include Limited Development Areas, Public Recreation Areas, Protected Shoreline Areas, and Prohibited Access Areas. The different land-based and land-water interface-based recreation opportunities are permissible in the Public Recreation Areas as well as in the Protected Shoreline Areas according to the 1996 SMP. The lands allocated as Public Recreation Areas in the 1996 SMP include recreation opportunities operated by the states of Texas and Oklahoma (state parks and wildlife management), USFWS (wildlife refuges), and the USACE-Tulsa District. All the Protected Shoreline Areas are managed by the USACE. The 1996 SMP land-use allocations are discussed in Sections 3.3.1 of this EIS.

The present USACE land-use designations for the different types of recreation activities managed and/or operated by different entities include recreation – intensive use and recreation – low density use. The recreation - intensive land-use designation includes USACE managed and operated parks and leases for civic organization (quasi-public recreation), privately operated concessions, parks, resorts, and marinas, and state-operated parks. The recreation - low density land-use designation includes USACE managed wildlife management areas that are operated by other Federal agencies (wildlife refuges by USFWS) and wildlife management areas and units (WMAs and WMUs operated by the states of Oklahoma and Texas).

The FY2009 - 2013 OMP guides the management of the USACE parks and natural resources within Lake Texoma (USACE, 2008c). The OMP provides operational goals, objectives, and implementation that guide the USACE parks management and natural resources. The FY2009 - 2013 OMP is discussed in Sections 3.2 and 3.3 of this EIS.

USACE Parks

Presently USACE manages and operates 12 parks at Lake Texoma (total of 2,816 acres) (USACE, 2008c). Ten of these parks are considered Class A parks. The USACE parks include 700 campsites with electric and individual water hookups at most sites. USACE collects fees for use of the parks and the associated facilities. Approximately $700,000 in user fees are collected annually at USACE-operated facilities (USACE, 2009b). In addition to the USACE-managed parks, USACE permits quasi-public use areas and club sites to offer recreational opportunities for civic organizations (different clubs, churches, scouting activities). These are called quasi-public recreation areas. The recreational opportunities on these sites include swimming, camping, picnicking, boating, fishing, hiking, and wildlife watching. Additional public recreation opportunities are offered in 23 concessions on Texoma. These are privately-managed and operated concessions that provide camping and recreational facilities for the visiting public (USACE, 2008c).

State Parks

As discussed in Section 3.7.9, two state-operated parks in the study area are the Eisenhower State Park (Texas) and Lake Texoma State Park (Oklahoma). These are state-operated public access areas and offer a variety of outdoor recreation activities and facilities.

Lake Texoma State Park is a large water-based resort of intensive and broad-spectrum recreational development (USACE, 1978). Lake Texoma State Park, located on the north shore of Lake Texoma, is one of many public use areas at Lake Texoma. It is comprised of a conglomerate of state-owned lands, as well as Federally owned lands that are leased to the state, originally totaling approximately 1,882 acres (USACE, 2005). Besides fishing, the park offers swimming, camping, picnic areas, horseback riding, trail rides, tennis, hiking, nature programs, golfing, and recreation programs. Other facilities include RV and tent sites, boat ramps, playgrounds, tennis courts, hiking trails, riding stables, full service marina, and striper guide fishing services.

Of the original 1,882 acres, 564 acres of the Lake Texoma State Park were transferred for use as private development under a congressionally mandated action and carried out in accordance with the provision of the Water Resource Development Act of 1999 (Public Law 106-53, 113 Stat. 359). The action included the area known as Lake Texoma State Park north of U.S. Highway 70, including the Chickasaw Pointe golf course, along with portions of the state park south of U.S. Highway 70, and USACE-lands located along the south shore of Rooster Creek.

Eisenhower State Park is located on the south shore of the lake. The park consists of 423 acres of land that is used for camping, hiking, and other outdoor recreation activities. Some of the activities include picnicking, hiking, biking, nature study, fishing, boating and boat rentals, water skiing, swimming, wildlife observation, ATV and mini bike use (off-highway vehicle [OHV] permit required), and a variety of camping. The shorelines are accessible for swimming and fishing. The boating is arranged through a private marina at Eisenhower Yacht Club. According to the park staff, the highest daily park visitation in 2009 was Memorial Day weekend with 1,929 visitors. The 2008 highest visitation was 2,864 over the 4th of July weekend. According to the park staff, approximately half of the visitors are day users and the other half stay overnight.

Wildlife Management

A detailed discussion of WMAs is included in Section 3.10.2 of this EIS. The state-operated wildlife management areas offer similar recreation opportunities to the NWRs. In addition to wildlife-related activities, the WMAs offer camping sites and related facilities. The Texoma Washita Arm WMA offers two primitive camping areas and a 100-yard shooting range (ODWC, 2011b). Several undesignated primitive camping areas are available on the Hickory Creek WMA and Love Valley WMA, and a shooting range is located on the north side of the Hickory Creek WMA (ODWC, 2011b). Fobb Bottom WMA does not have campgrounds.

Privately Operated Areas

Twenty-three commercial enterprises operated by concessionaries on USACE lands include marinas, campgrounds, and resorts. The discussion on privately operated areas at Lake Texoma is included in Section 3.10 of this EIS.

Hunting

The USACE allows public hunting in designated tracks of land at Lake Texoma. The USACE public hunting lands at Lake Texoma are shown in Figure 3.2.2 of this EIS. The WMAs and NWRs provide hunting opportunities in restricted areas. All state and Federal hunting regulations apply to hunting activities in all USACE managed lands. The state hunting regulations for Grayson County include deer hunting by archery only; including the conveyance lands. In addition to the general state and Federal regulations, USACE and wildlife management areas implement area-specific hunting restrictions.

3.11.3 Land-Water Interface-Based Recreation

According to the 1978 MP, beaches and designated swimming areas are sized based upon Engineer Manual (EM) 1110-2-400, which assumes that 55% of the public-use area visitors would use these facilities. The beach (sand and turf) area is sized assuming that 60% of the facility users are sunbathing while 30% of the facility users are in the water. The remaining 10% are elsewhere. According to the 1978 MP, swimming accounted for 35% of all visitation to the public use areas of the lake (USACE, 1978).

USACE manages two public beach areas located at West Burns Run and East Burns Run. Eisenhower State Park and Lake Texoma State Park also have public swimming beaches. According to data collected by SEE in 2009, recreational use of the managed beaches is reported to be highest during the July 4th weekend, and the most used beach was West Burns Run. USACE-managed public beaches are considered to have low-density use. Sixteen pocket beaches along the Little Mineral Arm of Lake Texoma are also utilized for recreational use. Many of these are located within the proposed land conveyance. The pocket beaches are shown in Figure 3.11.1.

Currently, 69 public boat ramps are available for use at Lake Texoma. Twenty-four concession marinas are in the vicinity with a total of 5,860 slips/mooring spaces and approximately 620 dry dock spaces. Private lands along Lake Texoma shoreline include 654 private floating facilities with 1,230 slips/mooring spaces (USACE, 2009a). Seventy boat launching ramps provide access to the lake, 15 of which are operated by the USACE. Six additional boat launching sites are available.

Land/Water Interface-Based Recreation Facilities and Visitation

Data supplied by USACE for the types and numbers of facilities with access to Lake Texoma are included in Table 3.11.2.

Table 3.11.2

Summary of Land/Water Interface-Based Recreational Facilities

Facility Type	Number
Commercial and Private Marinas	24
Number of Slips/Mooring Spaces	Approx. 5,860
Number of Dry Dock Spaces	approx. 620
Number of Spaces Approved for Lease Expansion[1]	none
Private Land Areas with Lakefront Ownership	
Number of Private Floating Facilities	654
Number of Slips/Mooring Spaces	1,230
Public Boat Launches and Ramps	
Number of Paved Parking Spaces and Overflow Parking Spaces	approx. 2,100
Number of Boat Ramps	approx. 70
Public Beaches	
Size	not available
Number of Parking Spaces[2]	approx. 200 (approx. 50 per beach)
Fishing Areas	
Number of Fishing Piers and Jetties	estimate 50

[1] The lake is under a moratorium restricting any lease expansions. However, additional boat slips may be approved in existing lease areas.
[2] Only 4 designated public swimming beaches exist on Lake Texoma - East Burns Run, Eisenhower State Park, Texoma State Park (Catfish Bay Marina), and West Burns Run.
Source: USACE, 2009a

Field observations of the visitation levels were collected by SEE at nine selected recreational land-water interface-based facilities over three weekends during the summer of 2009 near the proposed USACE land conveyance location. Different types of recreation activities were calculated in these areas and facilities to obtain visitor carrying capacities. The different capacity standards per different recreation activity measure the available space per person (linear square feet or square feet).

Intermittent spot counts were conducted at the facilities between 8 a.m. and 11 a.m. and between 2 p.m. and 5 p.m. on one non-holiday weekend and two holiday weekends during the summer of 2009. Field observations were conducted on the following dates:

- Non-holiday weekend: Saturday, 27 June and Sunday, 28 June 2009
- July 4th holiday weekend (Independence Day weekend): Friday (3 July), and Saturday (4 July) 2009
- Labor Day holiday weekend: Sunday (6 September) and Monday (7 September) 2009

Table 3.11.3 lists the recreational areas and facilities surveyed. These facilities are also shown in Figure 3.11.2.

Table 3.11.3

Field Observation: Land/Water Interface-Based Recreational Facilities

Facility Name	Features Surveyed
Dam Site Recreation Area	Boat ramp
East Burns Run Recreation Area	Boat ramps, courtesy dock, and swimming beach
Eisenhower State Park and Eisenhower Yacht Club	Fishing piers and swimming beach
Eisenhower Yacht Club (within Eisenhower State Park)	Boat ramp and courtesy dock
Grandpappy Point Marina	Boat ramp
Lighthouse Resort Marina	Boat ramp
Little Mineral Marina	Boat ramp
Preston Bend Recreation Area	Boat ramp and courtesy dock
West Burns Run Recreation Area	Boat ramp and swimming beach

Source: SEE, 2011

Fishing

According to the 1978 MP, fishing is reported as the most frequent recreation activity at Lake Texoma, accounting for 45% of all visits in the USACE public use areas (USACE, 1978). The Texas user population is approximately 39,000 anglers, and the Oklahoma user population is an estimated 62,000 anglers per year (USACE, 2008c). An estimated 50 piers and jetties exist in the lake, with nine courtesy boat/fishing docks located within their parks, and an additional five jetties near the outlet structure downstream of the dam (USACE, 2008c).

Management of the fishery resources at Lake Texoma is primarily the responsibility of the ODWC and the TPWD. Any fishery resources present on lands licensed to the two National Wildlife Refuges is the responsibility of the USFWS. These agencies maintain a supplemental stocking program to improve the fishery resources of the lake and sport fish harvest. Several non-native species were introduced into the lake by the two state resource agencies to benefit anglers and include the walleye (*Stizostedion vitreum*), striped bass (*Morone saxatalis)*, and smallmouth bass *(Micropterus dolomieui*). Species popular with anglers include the largemouth bass (*Micropterus salmoides*); spotted bass (*Micropterus punctulatus*); and smallmouth bass; (*Micropterus dolomieui*); white bass (*Morone chrysops);* striped bass (*Morone saxatalis*); white and black crappie (*Pomoxis annularis* and *Pomoxis nigromaculatus*); and channel, blue, and flathead catfish (*Ictalarus punctatus*, *Ictalarus furcatus*, and *Pylodictis olivaris*). The Red River downstream of Denison Dam provides a tail water fishery that supports striped bass, as well as other native species such as white bass, channel, blue, and flathead catfish.

In addition to numerous sunfish species, Gizzard shad (*Dorosoma cepedianum*), threadfin shad (*D. petenense*), and Inland silversides (*Menidia berryllina*) are considered the important forage species in the lake. Freshwater drum (*Aplodinotus grunniens*), carp (*Cyprinus carpio*), longnose gar (*Lepisosteus osseus*), shortnose gar (*Lepisosteus platostomus*), spotted gar (*Lepisosteus oculatus*), Alligator gar (*Lepisosteus spatula)*, largemouth buffalo (*Ictiobus cyprinellus*.), smallmouth buffalo (*Ictiobus bubalus*), black buffalo (*Ictiobus niger*), and river carpsucker (*Carpiodes carpio*) make up the bulk of rough fishes in the lake (USACE, 1989).

The striped bass fishery at Lake Texoma is extremely popular and is considered one of the most successful inland striped fisheries in the nation (USACE, 2003a). The lake was stocked with striped bass in the late 1960s, and these stockings were quite successful. Estimates of the annual striped bass harvest in Lake Texoma from 1987 through 1990 range from 630,000 to 930,000 (USACE, 2003a). Lake Texoma is one of only seven U.S. inland lakes where the striped bass reproduce naturally. The town of Kingston, Oklahoma, celebrates the importance of striper fishing to the local area with the annual Kingston Striper Festival each September.

Smallmouth bass were first introduced into Lake Texoma in 1981 and natural reproduction documented in 1985 (USACE, 2003a). Since then, the smallmouth bass fishery has developed quite well and is very popular with anglers. Several Oklahoma state record fish have been caught from the lake in recent years. Smallmouth bass are usually associated with the less turbid regions of the lake and rocky shoreline habitats.

In a recent survey focusing on the recreational fishery at Lake Texoma, 34% of the respondents ranked the quality of fishing very high, number 5 on a scale of 1 to 5, and 41% ranked it as a number 4 on a scale of 1 to 5 (USACE, 2009b). The same survey found the top three fish species targeted by anglers at the lake to be striped bass, catfish (blue or channel), and largemouth bass. Results from 2009 gillnetting fish surveys conducted on Lake Texoma rate white bass populations as excellent, blue catfish as above average, channel catfish as average, and white crappie as above average (ODWC, 2010b).

Most of the fish species found within Lake Texoma would also be expected to occur within the Little Mineral Arm of the lake provided suitable habitat exists for the particular species. Angling for sport fish species such as largemouth, smallmouth, and spotted bass, black and white crappie, walleye, white and striped bass, and blue, channel, and flathead catfish occur within the Little Mineral Arm of the lake.

Four fishing areas are located near the proposed conveyance land and their facilities accommodate bank fishing. These include East Burns Run Boat Ramp No. 1 Courtesy Dock, Eisenhower State Park Fishing Pier No. 1, Eisenhower State Park Fishing Pier No. 4, and Preston Bend Boat Ramp Courtesy Dock. Table 3.11.4 lists the SEE visitation spot counts during the summer of 2009. Based on the observations, the highest number of persons observed fishing from piers/docks and fishing from the shoreline area occurred over the 2009 Labor Day weekend.

Table 3.11.4

Summary of Fishing Pier/Courtesy Dock Capacity Levels

Site/Weekend	Number of Persons on Pier	Perimeter of Fishing Pier (feet)	Linear Feet per Fisherman	Carrying Capacity Level[a] Based on Low Standard	Carrying Capacity Level[b] Based on High Standard
East Burns Run Boat Ramp No. 1 Courtesy Dock					
Non-Holiday Weekend Average	0.7	180	257	Below Capacity	Below Capacity
July 4th Weekend Average	1.2	180	150	Below Capacity	Below Capacity
Labor Day Weekend Average	0.8	180	213	Below Capacity	Below Capacity
Eisenhower State Park Fishing Pier No. 1					
Non-Holiday Weekend Average	1.6	225	141	Below Capacity	Below Capacity
July 4th Weekend Average	0.7	225	321	Below Capacity	Below Capacity
Labor Day Weekend Average	1.8	225	129	Below Capacity	Below Capacity
Eisenhower State Park Fishing Pier No. 4					
Non-Holiday Weekend Average	2.2	143	65	Below Capacity	Below Capacity
July 4th Weekend Average	2.1	143	68	Below Capacity	Below Capacity
Labor Day Weekend Average	6.3	143	23	Below Capacity	Exceeding Capacity
Preston Bend Boat Ramp Courtesy Dock					
Non-Holiday Weekend Average	0.2	204	1326	Below Capacity	Below Capacity
July 4th Weekend Average	0.0	204	n.a.	Below Capacity	Below Capacity
Labor Day Weekend Average	0.3	204	680	Below Capacity	Below Capacity

Source: SEE, 2011

[a] Low carrying capacity standard = 10 linear feet per fisherman, [b] high carrying capacity standard = 40 linear feet per fisherman. Standards are based on the Visitor Carrying Capacity Guidelines by Florida Department of Environmental Protection, Division of Recreation and Parks.

Eisenhower State Park Fishing Pier No. 4 recorded the highest number of observed anglers during the afternoon of 7 September. Based on the Florida Department of Environmental Protection, Division of Recreation and Parks visitor carrying capacity standards, Eisenhower State Park Fishing Pier No. 4 was the only one that exceeded capacity on a regular basis of the four fishing piers observed.

Swimming

Three public swimming beaches are located in close proximity to the proposed conveyance land. These include East Burns Run Swim Beach, West Burns Run Swim Beach, and Eisenhower State Park Swim Beach. According to the 2009 summer field observations at Lake Texoma, July 4th weekend (Independence Day weekend) had the highest occupancy rates for the parking lots servicing these public beaches and the highest number of persons observed swimming in the water or located nearby on the observed beaches. The West Burns Run Beach contained the maximum number of bathers and the uppermost bather densities over the July 4th weekend, while East Burns Run Beach averaged the second highest. Table 3.11.5 lists the total number of persons observed on the beach during the field observation, the area of the beach, and the carrying capacities.

According to the carrying capacity standards used in USACE Walla Walla District Report, all three swimming beach areas are categorized as having low densities (function below capacity) during all observation periods.

Table 3.11.5

Public Swimming Beach Occupancy Levels

Beach Area	Total Number of Persons on Beach and in Water	Size of Beach Area (ft^2)	Maximum Beach Density (ft^2/ person)	Density Level[a]
East Burns Run Swim Beach				
Non-Holiday Weekend Average	103.3	36,327	351.7	Low
July 4th Weekend Average	156.6	36,327	231.9	Low
Labor Day Weekend Average	69.1	36,327	525.7	Low

Beach Area	Total Number of Persons on Beach and in Water	Size of Beach Area (ft^2)	Maximum Beach Density (ft^2/ person)	Density Level[a]
West Burns Run Swim Beach				
Non-Holiday Weekend Average	93.5	31,630	338.3	Low
July 4th Weekend Average	264.3	31,630	119.7	Low
Labor Day Weekend Average	73.9	31,630	428.0	Low
Eisenhower State Park Swim Beach				
Non-Holiday Weekend Average	25.2	18,824	747.0	Low
July 4th Weekend Average	73.4	18,824	256.5	Low
Labor Day Weekend Average	62.7	18,824	300.4	Low

Source: SEE, 2011
[a] USACE Walla Walla District *Lucky Peak Master Plan Technical Report - Volume 2 Supporting Data - Item 11 Carrying Capacity*. High = 5 to 16 ft^2, Medium = 17 to 25 ft^2, Low = over 25 ft^2

Boat Ramp Parking Facilities

Parking facilities available to the public vary in size and condition throughout the nine facilities observed. The parking lots and spaces observed are irregular in condition, ranging from paved spaces striped for regular-sized vehicles and vehicles with boat trailers to paved areas un-striped but with spaces defined by other method (i.e., wheel stops). In some cases, parking spaces are gravel and/or mowed grass areas serving as the main parking area or available for overflow parking. Other spaces included undefined gravel and/or mowed grass areas, such as road shoulders, lawn areas, and other unofficial areas used for overflow parking.

Parking facilities at the Dam Site-Spillway boat ramp, East Burns Run boat ramps No.1 and No. 2, and Preston Bend boat ramp did not exceed capacity during any time over the three weekends. Occurrences of boat ramp parking approaching or exceeding capacity are shown in Table 3.11.6.

Table 3.11.6

Occurrences of Boat Ramp Parking Approaching, At, or Exceeding Capacity

Location	Weekend	Number of Observations	Number of Occurrences	
			Parking Lot Approaching Capacity	Parking Lot at or Exceeding Capacity
Dam Site-Spillway Boat Ramp Parking Lot	All	33	0	0
East Burns Run Boat Ramp No. 1 Parking Lot	Non-Holiday	10	0	0
	July 4th	10	2	0
	Labor Day	13	0	0
East Burns Run Boat Ramp No. 2 Parking Lot	All	33	0	0
Eisenhower State Park Boat Ramp Parking Lot	Non-Holiday	10	0	0
	July 4th	10	0	0
	Labor Day	12	2	1
Grandpappy Point Boat Ramp Parking Area	Non-Holiday	10	*	*
	July 4th	12	*	*
	Labor Day	12	*	*
Lighthouse Resort Boat Ramp Parking Lot	Non-Holiday	13	0	0
	July 4th	15	0	0
	Labor Day	20	7	3
Little Mineral Marina Boat Ramp Parking Lot	Non-Holiday	13	2	0
	July 4th	15	0	3
	Labor Day	20	1	4
Preston Bend Boat Ramp Parking Lot	All	48	0	0
West Burns Run Boat Ramp Parking Lot	Non-Holiday	10	0	0
	July 4th	10	1	2
	Labor Day	13	2	0
Totals	**Non-Holiday**	**99**	**2**	**0**
	July 4th	**107**	**3**	**5**
	Labor Day	**136**	**12**	**8**

Source: SEE, 2011
* - no specific designated parking spaces

The closest that any of the three boat ramp parking facilities were to approaching capacity was the afternoon of 6 September 2009. No boat ramp parking facilities exceeded capacity levels at any time during the non-holiday weekend in June 2009.

The July 4th weekend (Independence Day weekend) exceeded capacity at West Burns Run, one each in the afternoons of 3 and 4 July 2009. Grandpappy Point boat ramp parking lot did not have delineated parking spaces. Vehicles were observed parked in numerous alternate locations which exceeded capacity for approximately the entire afternoon of 4 July. Little Mineral Marina boat ramp parking was also observed to be over capacity on 4 July.

Labor Day weekend, specifically the afternoon of 6 September 2009, saw the most consistent over capacity conditions at any time period. Lighthouse Resort, Little Mineral Marina, Grandpappy Point, and Eisenhower State Park facilities were all approaching or at full capacity for the entire weekend.

3.11.4 Water Based Recreation

Water-based recreation in this EIS includes different types of boating activities at Lake Texoma. The baseline water-based recreation was accomplished by boat counts, boat densities, and boating activities.

Boat Counts, Boating Densities and Boating Activities

Boat counts on Lake Texoma were collected by SEE using an aerial count (helicopter) during the same weekends in June, July, and September as the ground observations for land-water interface-based visitation counts. Boat counts were taken at the same weekends during the summer 2009 as the ground-level observations (see Table 3.11.7 below).

The boat counts consisted of two data sweeps or "runs": morning and afternoon. The morning run had two observation periods: Run 1 - early morning and Run 2 - late morning. The afternoon run also had two observation periods: Run 3 - early afternoon and Run 4 - late afternoon. Therefore, the data for each day consists of four collections of data based on the field observations.

Boat counts were used to calculate boat densities for both the entire lake and designated lake areas (DLAs) to identify high activity areas. The DLAs are shown in Figure 3.11.3. The Lake was divided into 12 DLAs based on physical features, historical usage, and activity to provide a manageable scale and level of detail for data collection.

Observed boats were categorized based on their type of activity as a way to quantify and characterize the boating uses occurring on the lake. The Water-Based Recreation Inventory and Assessment Report (Appendix I) provides data on the boating use of Lake Texoma collected over three observation weekends. Boating activities observed included the following:

- Pleasure/power boating
- Sail boating
- Waterskiing/tubing
- Fishing
- Jet ski/personal watercraft (PWC)
- Canoe/Kayak

Boat Counts

Total number of boats observed by SEE on the selected weekends is provided in Table 3.11.7.

Table 3.11.7

Total Number of Boats Observed on Select Weekends

Time Period	Boats Observed - Total
Non-Holiday Weekend	4,798
July 4^{th} Weekend	9,111
Labor Day Weekend	9,234

Source: SEE, 2011

Boat Counts by Weekend and Day

Table 3.11.8 shows the total number of boats observed during the three observation weekends in the summer of 2009. Each weekend was observed for four runs.

Table 3.11.8

Boat Counts for Entire Lake

	Non-Holiday Weekend			July 4th Weekend			Labor Day Weekend		
Run	# of Boats 6/27	# of Boats 6/28	Weekend Total	# of Boats 7/3	# of Boats 7/4	Weekend Total	# of Boats 9/6	# of Boats 9/7	Weekend Total
1	453	410	863	489	475	964	544	461	1,005
2	475	391	866	518	571	1,089	681	524	1,205
3	800	704	1,504	1,365	1,963	3,328	2,520	1,091	3,611
4	911	654	1,565	1,546	2,184	3,730	2,430	983	3,413
Totals	2,639	2,159	4,798	3,918	5,193	9,111	6,175	3,059	9,234

Source: SEE, 2011
Note: Run 1 occurred during early morning, Run 2 occurred during late morning, Run 3 occurred during early afternoon, and Run 4 occurred during late afternoon.

Based on results of the helicopter survey, it was determined that Labor Day weekend experienced the heaviest lake-wide boating use for any of the weekends. A total of 9,234 boats were counted during 6 and 7 September 2009 (Labor Day weekend). The single busiest day on the lake was 6 September, with 6,175 boats on the lake throughout that day. Over the July 4th weekend, 9,111 boats were observed. The non-holiday weekend in June had the lowest boat numbers in 2009, when a total of 4,798 boats were observed. The highest boat counts were consistently observed during the afternoons on all days (Runs 3 and 4). The fewest numbers of boats were consistently recorded during the early morning (Run 1) on all days except one.

It is important to note that these totals (i.e., the reported number of boats) do not reflect the number individual and distinct boats on the lake during the day, because it is very possible that an individual boat was counted more than once in the same day (i.e., same boats observed during multiple runs).

Boat Counts by DLAs

Table 3.11.9, on the following page, shows the boat counts for 12 DLAs, the observation period, and the respective runs per observation period at Lake Texoma. The highlighted cells on the table show the busiest runs per day per DLA.

Table 3.11.9

Boats by Designated Lake Areas and Time of Day

Day	Run	Designated Lake Areas												Totals
		1	2	3	4	5	6	7	8	9	10	11	12	
27 June	1	5	35	44	16	32	57	13	72	95	15	61	8	453
	2	6	22	45	33	48	53	21	53	120	10	45	19	475
	3	6	52	36	77	91	102	58	99	116	26	102	35	800
	4	0	54	110	62	102	81	45	110	158	19	122	48	911
28 June	1	5	16	59	45	26	31	28	55	60	5	52	28	410
	2	3	18	69	45	16	38	25	23	61	9	62	22	391
	3	8	48	118	55	73	62	39	66	84	22	100	29	704
	4	3	34	78	61	55	48	54	69	106	15	104	27	654
3 July	1	11	24	48	32	28	51	19	108	90	15	48	15	489
	2	16	29	62	51	58	68	52	40	68	10	42	22	518
	3	6	70	175	117	146	164	81	124	191	53	165	73	1,365
	4	8	69	271	130	186	124	87	114	197	45	214	101	1,546
4 July	1	6	22	57	57	42	51	19	52	81	15	55	18	475
	2	10	24	95	80	62	59	41	56	61	18	45	20	571
	3	11	113	287	123	313	205	100	171	253	56	234	97	1,963
	4	13	143	334	166	425	199	118	194	188	56	215	133	2,184
6 September	1	2	27	84	49	85	82	10	40	81	5	58	21	544
	2	9	50	76	55	118	90	47	75	69	10	64	18	681
	3	14	274	496	154	668	338	30	226	108	31	138	43	2,520
	4	18	148	440	157	667	340	45	187	153	32	177	66	2,430
7 September	1	5	32	91	54	54	52	17	29	62	9	37	19	461
	2	8	29	77	46	71	69	20	52	64	16	57	15	524
	3	10	82	206	79	181	133	41	105	86	21	112	35	1,091
	4	10	58	149	71	213	116	24	82	79	18	121	42	983

Source: SEE, 2011

Note: Run 1 occurred during early morning, Run 2 occurred during late morning, Run 3 occurred during early afternoon, and Run 4 occurred during late afternoon.

Based on field observations, the non-holiday weekend in June, DLA 9 (Preston Point to Alberta Creek) was the busiest part of the lake. DLA 9 was the busiest part of the lake during six runs (total eight runs in 2 days). The most boats at one time (BAOT) in DLA 9 or any other DLA during this weekend was 158. On 28 June 2009, DLA 3 (Big Mineral Arm/Buncombe Creek to Treasure Island) was the busiest part of the lake for the remaining two time periods.

The two holiday weekends (July 4th weekend and Labor Day weekend) saw the heaviest usage in DLA 5 (Treasure Island to North Island) for 7 of 16 observation periods. The peak BAOT in DLA 5 during these two weekends was 668, which occurred in the afternoon of 6 September 2009. Similar to the non-holiday weekend, DLA 3 was again one of the busiest parts of the lake for 5 of the 16 time periods over the same two holiday weekends.

As Table 3.11.9 shows, the boat counts were generally lower during the morning runs than during the afternoon runs in all DLAs. DLA 1 is the only area of the lake that ever had higher numbers of boats in the morning than in the afternoon. When the early morning boat counts were greater than the late morning boat counts, most this was caused by fishing activities on the DLAs. The peak boat count on the entire lake during any morning was 681 and occurred on 6 September 2009.

The observed boat counts peaked during the afternoon runs during the major holiday weekends. The highest peak was the Labor Day weekend. The peak observed number of boats during any holiday weekend afternoon was 2,520. The non-holiday weekend afternoon peak was 911.

Density Analysis

Boat density is expressed as acres per boat. Fewer acres per boat equate to a higher density of boats in a given area. Table 3.11.10, on the following page, includes a summary of the average boat densities for Lake Texoma by weekend, day, and time period.

The single highest average lake-wide density observed, 27 acres per boat, was recorded during the afternoon of 6 September (Labor Day weekend). The lowest average lake-wide density occurred the morning of Sunday, 28 June (non-holiday weekend), with an average of 172 acres per boat.

Table 3.11.10

Average Boat Densities Lake-Wide

Run	DENSITY (Acres per Boat)					
	Non-Holiday Weekend		July 4th Weekend		Labor Day Weekend	
	27 June	28 June	3 July	4 July	6 September	7 September
1	156	172	144	148	123	146
2	148	180	136	124	99	128
3	88	100	52	36	27	62
4	77	108	46	32	28	68

Source: SEE, 2011
Note: Run 1 occurred during early morning, Run 2 occurred during late morning, Run 3 occurred during early afternoon, and Run 4 occurred during late afternoon.

Table 3.11.11, on the following page, shows the results of boat density calculations per DLA per time period per run. The calculation of boat densities by DLA indicates specific areas of the lake that are busiest for each observed time period. DLA 5 (Treasure Island to North Island) experienced the highest boat density during any observation period (7 acres per boat) during the afternoon of 6 September 2009. The lowest boat density observed in any DLA at any time (2,450 acres per boat) occurred in DLA 1 (Hauani Creek to Briar/Brier Creeks). DLA 7 (Little Mineral Arm) experienced the highest boat density of any DLA most consistently over the non-holiday weekend. On five occasions, this area recorded the highest densities of all the DLAs during the weekend in June. DLA 5 was observed with the highest density more times than any other area of the lake during the holiday weekends in July and September. It is important to note that while boat densities are presented as averages for each DLA, the averages do not reveal the possible variation (low and high counts) in boat densities in each DLA. During the field observations, the boaters were seen to cluster together, usually along a desirable feature such as a beach or island.

Boating Activities

Boating use was compiled and assessed to characterize boating activity on the lake. Boating use was characterized by weekend, day, and time of day for the entire lake and each DLA.

Table 3.11.11

Boat Densities (acres/boat)

Day	Run	Designated Lake Areas												Entire Lake
		1	2	3	4	5	6	7	8	9	10	11	12	
27 June	1	1,248	141	125	204	154	191	152	95	128	70	118	697	156
	2	1,040	224	122	99	102	206	94	129	101	105	160	294	148
	3	1,040	95	153	42	54	107	34	69	105	40	71	159	88
	4	n.d.	91	50	53	48	135	44	62	77	55	59	116	77
28 June	1	1,248	308	93	72	189	352	71	124	203	210	139	199	172
	2	2,079	274	80	72	307	287	79	296	199	116	116	254	180
	3	780	103	47	59	67	176	51	103	145	48	72	192	100
	4	2,079	145	70	53	89	227	37	99	115	70	69	207	108
3 July	1	567	205	115	102	176	214	104	63	135	70	150	372	144
	2	390	170	89	64	85	160	38	170	179	105	172	254	136
	3	1,040	70	31	28	34	67	24	55	64	20	44	76	52
	4	780	71	20	25	26	88	23	60	62	23	34	55	46
4 July	1	1,040	224	96	57	117	214	104	131	150	70	131	310	148
	2	624	205	58	41	79	185	48	122	199	58	160	279	124
	3	567	44	19	26	16	53	20	40	48	19	31	58	36
	4	480	34	16	20	12	55	17	35	65	19	34	42	32
6 September	1	2,450	172	63	64	57	131	188	168	148	192	120	244	123
	2	544	93	70	57	41	120	40	90	173	96	109	284	99
	3	350	17	11	20	7	32	63	30	111	31	50	119	27
	4	272	31	12	20	7	32	42	36	78	30	39	78	28
7 September	1	980	145	58	58	90	207	110	232	193	107	188	269	146
	2	612	160	69	68	68	156	94	130	187	60	122	341	128
	3	490	57	26	40	27	81	46	64	139	46	62	146	62
	4	490	80	36	44	23	93	78	82	151	53	57	122	68

Source: SEE, 2011
Note: Run 1 occurred during early morning, Run 2 occurred during late morning, Run 3 occurred during early afternoon, and Run 4 occurred during late afternoon.
n.d. - No data available due to counter error.

Boating Activity by Weekend

On the following page, Table 3.11.12 lists different types of boating activities at Lake Texoma during the observation weekends**.**

Pleasure/power boating was the most frequent activity observed on the lake every weekend, including all six days of observations. Labor Day weekend recorded the highest pleasure/power boating activity, with a combined total of 5,713 boats observed. Fishing was the second most frequent boating activity for non-holiday weekends. Jet skiing was a more popular activity than fishing on the holiday weekends. All other assessed boating activities were significantly lower than pleasure boating, fishing, or jet skiing.

Table 3.11.12

Boating Activity by Weekend

Boat Activity Type	Non-Holiday Weekend			July 4th Weekend			Labor Day Weekend		
	Saturday 27 June	Sunday 28 June	Weekend Totals	Friday 3 July	Saturday 4 July	Weekend Totals	Sunday 6 Sep	Monday 7 Sep	Weekend Totals
Pleasure/Power	1,224	1,074	2,298	2,229	3,072	5,301	3,977	1,736	5,713
Sail	63	77	140	126	225	351	202	106	308
Waterskiing/Tubing	238	165	403	387	505	892	383	241	624
Fishing	720	585	1,305	520	457	977	770	548	1,318
Jet Ski/ PWC	383	251	634	640	913	1,553	815	407	1,222
Canoe/ Kayak	11	7	18	16	21	37	28	21	49
Totals	2,639	2,159	4,798	3,918	5,193	9,111	6,175	3,059	9,234

Source: SEE, 2011

Boat Activity by Time of Day

Table 3.11.13 displays boating activity by time of day.

Table 3.11.13

Boating Activity Summary by Time of Day

Boat Activity Type	Run 1 Early Morning	Run 2 Late Morning	Run 3 Early Afternoon	Run 4 Late Afternoon	Totals
Pleasure/Power	668	1,285	5,537	5,822	13,312
Sail	87	135	290	287	799
Waterskiing/Tubing	44	167	836	872	1,919
Fishing	1,918	1,229	277	176	3,600
Jet Ski/PWC	96	312	1,484	1,517	3,409
Canoe/Kayak	19	32	19	34	104
Totals	2,832	3,160	8,443	8,708	23,143

Source: SEE, 2011

The type of boating activity varied as the time of day progressed. Table 3.11.14 displays individual boating activity as a percentage of the total boat activity observed.

Fishing was the most dominant activity during the early morning, with a total of 1,918 boats fishing, accounting for 62.5% to 71.7% of the total boating activity on the lake over the three weekends observed. Fishing and pleasure/power boating activities were almost equal during the late morning, with 1,229 and 1,285 boats recorded, respectively, accounting for 45.7% to 58.6% and 39.9% to 42.2%, respectively. Pleasure/power boating was the dominant use observed during all afternoon times accounting for 53.6% to 72.7% of the boating activity. Jet skis/PWC was the second most common activity during the afternoon times accounting for 14.3% to 20.8% of the boating activity.

Table 3.11.14

Boating Activity Levels

Run	Boat Type[a]	Non-Holiday Weekend		July 4th Weekend		Labor Day Weekend	
		Saturday 27 June	Sunday 28 June	Friday 3 July	Saturday 4 July	Sunday 6 Sep	Monday 7 Sep
1	Pleasure/Power	25.6%	22.0%	21.7%	23.8%	23.0%	25.6%
	Fishing	69.3%	71.7%	71.4%	63.6%	68.2%	62.5%
	Jet Ski/PWC	2.4%	3.4%	2.2%	5.3%	2.0%	5.2%
	Other	2.6%	2.9%	4.7%	7.4%	6.8%	6.7%
	Totals Run 1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2	Pleasure/Power	31.4%	39.4%	47.3%	49.2%	36.3%	39.9%
	Fishing	56.8%	46.8%	29.5%	20.1%	45.7%	37.6%
	Jet Ski/PWC	6.5%	6.9%	10.2%	15.6%	8.7%	10.1%
	Other	5.3%	6.9%	12.9%	15.1%	9.4%	12.4%
	Totals Run 2	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
3	Pleasure/Power	53.6%	62.1%	65.2%	62.5%	72.7%	66.1%
	Fishing	10.6%	9.7%	0.8%	1.2%	2.1%	3.2%
	Jet Ski/PWC	20.8%	14.3%	19.1%	20.0%	14.9%	17.2%
	Other	15.0%	13.9%	14.9%	16.3%	10.2%	13.5%
	Totals Run 3	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
4	Pleasure/Power	58.2%	60.1%	63.9%	66.4%	72.9%	70.0%
	Fishing	5.6%	6.1%	0.5%	0.7%	1.4%	2.8%
	Jet Ski/PWC	19.2%	16.7%	20.4%	18.6%	15.2%	14.4%
	Other	17.0%	17.1%	15.3%	14.2%	10.4%	12.7%
	Totals Run 4	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: SEE, 2011
[a] "Other" category includes sailing, waterskiing/tubing, and canoes/kayaks.

Boating Activity by DLAs

Table 3.11.15 summarizes boating activity by DLA by combining all runs for all 6 days of observations.

Table 3.11.15

Boating Activity by Designated Lake Areas

Boat Activity Type	Designated Lake Areas												Totals
	1	2	3	4	5	6	7	8	9	10	11	12	
Pleasure/Power	91	915	2,346	942	2,564	1,389	514	1,238	1,358	217	1,199	539	13,312
Sail	2	8	155	151	118	113	47	106	86	8	5	0	799
Waterskiing/Tubing	18	152	222	181	150	193	143	186	197	97	280	100	1,919
Fishing	66	206	276	213	384	498	128	407	671	82	464	205	3,600
Jet Ski/ PWC	11	185	493	310	541	414	193	255	310	119	475	103	3,409
Canoe/ Kayak	5	7	15	18	3	6	9	10	9	8	7	7	104
Totals	193	1,473	3,507	1,815	3,760	2,613	1,034	2,202	2,631	531	2,430	954	23,143

Source: SEE, 2011
Note: DLA 5 (Treasure Island to North Island) had the highest number in pleasure/power boating (2,564) and jet skiing (541). DLA 9 (Preston Point to Alberta Creek) had the highest number in boats participating in fishing (671). The highest number waterskiing/tubing (280) was recorded in DLA 11 (Alberta Creek to Glasses Creek Arm). DLA 3 (Big Mineral Arm/Buncombe Creek to Treasure Island) had the highest number of sailboats (155). DLA 4 (Big Mineral Arm) experienced the highest number of canoes/kayaks (18).

3.11.5 Lake Carrying Capacity

The capacity of a body of water to accommodate boating activities can be defined and measured in a number of ways. Lake Texoma boat carrying capacity was evaluated in the following three ways:

- Spatial capacity – Concerned with the minimum space requirements for various activities such as the area required for waterskiing.
- Facility capacity – Concerned with facility handling thresholds such as the number boat slips or moorings, or the number of boat ramp parking spaces.
- Social capacity – Concerned with social conditions such as user conflicts, visitor perceptions versus expectations, or facility management goals.

The methodologies used and standards applied for determining carrying capacity are identified in Appendix I.

Spatial Capacity

The Lake Texoma carrying capacities per DLA per observation time periods are shown in the summary Table 3.11.16. Table 3.11.16 lists the results of boating densities at Lake Texoma using two boating density standards: low and high. The data report in Appendix I, Water-Based Recreation Inventory and Assessment Report, includes tables and figures of the results for five different boating density standards used to evaluate the boating densities at different DLAs at the lake. The "low standard" is the smallest area required per boat. The "high standard" is the largest area required per boat.

The lake-wide boating levels during any observation time period were not exceeded using any of the carrying capacity standards. The highest percentage of lake-wide carrying capacity utilization occurred on 6 September, when approximately 88% of total available capacity was in use. The carrying capacity standards were not exceeded in any DLA during the non-holiday weekend of 27 and 28 June 2009. The carrying capacity standards were not exceeded during any morning time of the holiday weekends in July and September.

Six DLAs (2, 3, 4, 5, 7, and 10) exceeded one or more carrying capacity standards at some time during the field observation period. These DLAs encompass the areas of Briar/Brier Creek to Big Mineral/Buncombe Creek (DLA 2), Big Mineral Arm/Buncombe Creek to North Island (DLA 3), Big Mineral Arm (DLA 4), Treasure Island to North Island (DLA 5), Little Mineral Arm (DLA 7), and Rock Creek Arm (DLA 10). The afternoon time periods of 3 and 4 July (Independence Day weekend), and all time periods of 6 and 7 September (Labor Day weekend) recorded at least one DLA approaching or exceeding at least one of the five carrying capacity area requirement standards. The afternoon of 4 July had the most occurrences of DLAs exceeding capacity (DLAs 3, 4, 5, 7, and 10). Of all lake areas observed, DLA 3 and DLA 5 exceeded a spatial carrying capacity standard most frequently. DLA 7 (Little Mineral Arm) and DLA 10 (Rock Creek Arm) were observed exceeding carrying capacity on more than one occasion. The single highest incident of overcapacity conditions occurred the afternoon of 6 September (Labor Day weekend) in DLA 5 (Treasure Island to North Island), which was 332.1% of available capacity.

Table 3.11.16

Observed Carrying Capacity Levels

DLA	Location	Low Standard						High Standard					
		June 27	June 28	July 3	July 4	Sept 6	Sept 7	June 27	June 28	July 3	July 4	Sept 6	Sept 7
1	Hauani Creek to Briar/Brier Creeks												
2	Briar/Brier Creeks to Big Mineral Arm/Buncombe Creek												
3	Big Mineral Arm/Buncombe Creek to Treasure Island												
4	Big Mineral Arm												
5	Treasure Island to North Island												
6	North Island to Preston Point												
7	Little Mineral Arm												
8	Preston Point to Denison Dam												
9	Preston Point to Alberta Creek												
10	Rock Creek Arm												
11	Alberta Creek to Glasses Creek Arm												
12	Washita River Arm												
Entire Lake													

below capacity for all standards

approaching capacity on one or more standards

at or exceeding capacity on one or more standards

Source: SEE, 2011

Facility Capacity

The theoretical maximum carrying capacity of the entire lake, based on 100% usage and efficiency of all available facilities, was calculated to be approximately 7.5 acres per boat. It is, however, very unlikely that all facilities would operate at 100% efficiency, and so the theoretical capacity can be modified following the selected methodologies, outlined in, Appendix I (Water-

Based Recreation Inventory and Assessment Report) to provide reasonable facility carrying capacities.

Application of two methods and formulas selected to estimate the potential peak usage on the lake result in an expected BAOT to be between 2,207 and 2,453. The methodologies used are contained in Appendix I. As shown earlier in Table 3.11.9, the actual peak BAOT observed on Lake Texoma during this study was 2,520, during the early afternoon of 6 September (Labor Day weekend). The similarity of the BAOT numbers created using the spatial method and the two facility methods seem to indicate that the facilities are generally operating at expected usage levels.

Social Capacity

Social carrying capacity analysis can be used to evaluate stakeholder perceptions of lake carrying capacity conditions. A review of the 48 scoping comments identified four comments related to overcrowding and boating activity levels such as traffic loading, boating safety, and Little Mineral Arm carrying capacity. These comments reflect perceptions of lake carrying capacity being strained at the current level of use. One comment indicated, however, that existing facilities were underutilized. Data collected during the 2009 field observations indicates that all boat use can and does occur within recommended standards for area required for those boating activities. See Appendix I, Water-Based Recreation Inventory and Assessment Report for discussion of the recommended standards.

Accident data for the Oklahoma and Texas portions of the lake for years 2000 through 2008 were reviewed. The highest number of accidents and the highest accident rates occurred in 2002. Most boating accidents for which location information was available occurred near North Island in DLA 5. Factors contributing to accidents include excessive speed, operator inattention, careless/reckless operation, rules of the road, faulty equipment, hazardous waters, and weather conditions. Other notable areas where clusters of accidents historically occurred include DLAs 3 (Big Mineral Arm/Buncombe Creek to Treasure Island), 9 (Preston Point to Alberta Creek), and 11 (Alberta Creek to Glasses Creek Arm). These historical accident areas appear to be similar in location to the high activity areas reported by USACE and the carrying capacity exceedances.

The coincidence of high accident numbers occurring in these DLAs suggests that social carrying capacity may also be strained during high use time periods.

Due to the lack of agreement of the areas identified between user perceptions and historical accident data numbers, the accident data is not a good indicator of social carrying capacity.

3.11.6 Pocket Beaches

Sixteen secluded "pocket beaches" are situated along the west and east sides of the Little Mineral Arm cove (Figure 3.11.1). These pocket beaches are located in relatively undeveloped areas with no formal recreation access to the lake making them popular destination points for boaters.

A total of 16 pocket beaches are located on the shoreline of the Little Mineral Arm, with most located on the eastern shore of the Little Mineral Arm. During field observations, different activities were observed on the eastern shore and the western shore of the Little Mineral Arm. Primary activities observed during the field survey included swimming, sunbathing, beach walking, and other athletic activities (e.g., volleyball, frisbee throwing). Table 3.11.17 lists the number of people and boats observed in the Little Mineral Arm pocket beaches during the different observation times and dates.

Table 3.11.17

Little Mineral Arm Pocket Beach Activity Levels

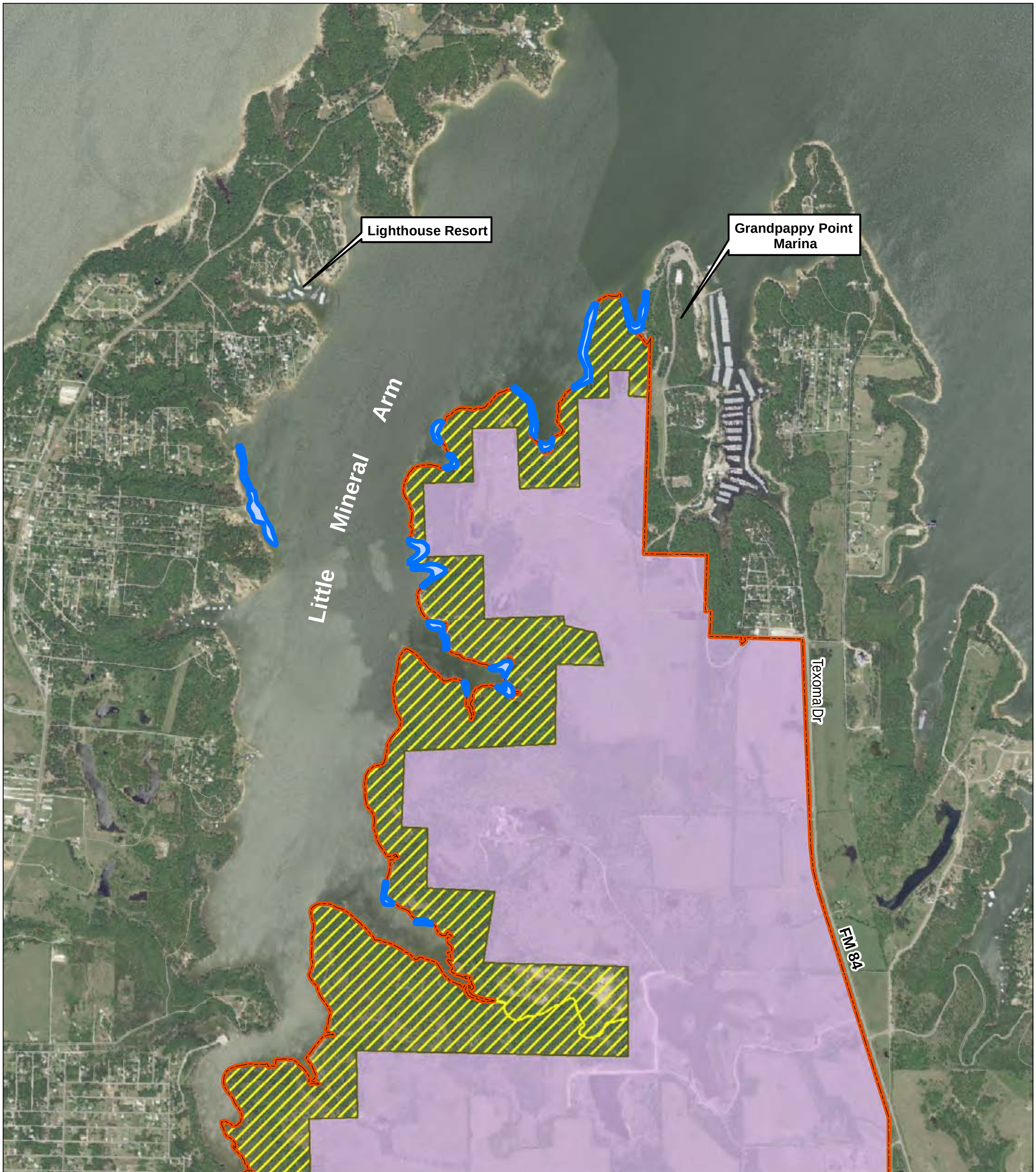
	Date	Run	East Shore		West Shore	
			People	Boats	People	Boats
Non-Holiday Weekend	27 June	1	0	0	1	0
	27 June	2	9	6	13	1
	27 June	3	185	32	50	15
	27 June	4	100	36	93	17
	27 June	Totals	294	74	157	33
	28 June	1	3	2	0	2
	28 June	2	7	1	6	2
	28 June	3	91	33	45	10
	28 June	4	65	19	53	13

	Date	Run	East Shore		West Shore	
			People	**Boats**	**People**	**Boats**
	28 June	Totals	166	55	104	27
July 4th Weekend	3 July	1	4	1	0	0
July 4th Weekend	3 July	2	43	10	18	5
July 4th Weekend	3 July	3	112	35	72	14
July 4th Weekend	3 July	4	161	42	79	21
July 4th Weekend	3 July	Totals	320	88	169	40
July 4th Weekend	4 July	1	5	1	6	2
July 4th Weekend	4 July	2	14	4	28	8
July 4th Weekend	4 July	3	235	54	151	41
July 4th Weekend	4 July	4	203	58	171	42
July 4th Weekend	4 July	Totals	457	117	356	93
Labor Day Weekend	6 Sep	1	6	10	13	31
Labor Day Weekend	6 Sep	2	6	9	49	33
Labor Day Weekend	6 Sep	3	228	103	73	27
Labor Day Weekend	6 Sep	4	138	86	137	50
Labor Day Weekend	6 Sep	Totals	378	208	272	141
Labor Day Weekend	7 Sep	1	3	6	4	28
Labor Day Weekend	7 Sep	2	4	1	20	25
Labor Day Weekend	7 Sep	3	110	60	75	33
Labor Day Weekend	7 Sep	4	109	46	53	25
Labor Day Weekend	7 Sep	Totals	226	113	152	111

Source: SEE, 2011
Note: Run 1 occurred during early morning, Run 2 occurred during late morning, Run 3 occurred during early afternoon, and Run 4 occurred during late afternoon.

110 Shaded areas indicate the largest number of boats and people observed each day

The pocket beaches experienced relatively elevated use on both holiday weekends compared to the non-holiday weekend in June as shown in Table 3.11.17. The peak activity time period for all surveyed pocket beaches occurred during the afternoon period. The peak use of the east shore pocket beaches on the Little Mineral Arm occurred on 4 July with approximately 457 people and 117 boats using the pocket beaches. Although the majority of the pocket beaches are situated along the eastern shore of Little Mineral Arm, it is important to note that the pocket beaches located along the western shore of the Little Mineral Arm also generate substantial activity. Based on the field observations, the peak use for the western shore pocket beaches for the same day was 356 people and 93 boats.



LEGEND

- Pocket Beach Area
- Proposed Conveyance Area
- Private Property
- Preston Harbor Development

SOURCE 1) (C)2009 MICROSOFT CORPORATION BING AERIAL
2) BOUNDARY PROVIDED BY PSA ENGINEERING 2009

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT NTENDED FOR SURVEY OR ENGINEERING PURPOSES.

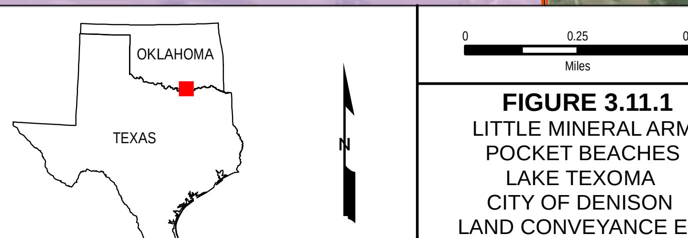


FIGURE 3.11.1
LITTLE MINERAL ARM
POCKET BEACHES
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

File: \\ASATX01\gis_cad\GIS Project F les\SchulerDevelopment_14531\Corp_03886\Fig3-11-1_Pocket_Beaches_LilMinArm.mxd, 22-Sep-10 12:20, perrint

NOTE

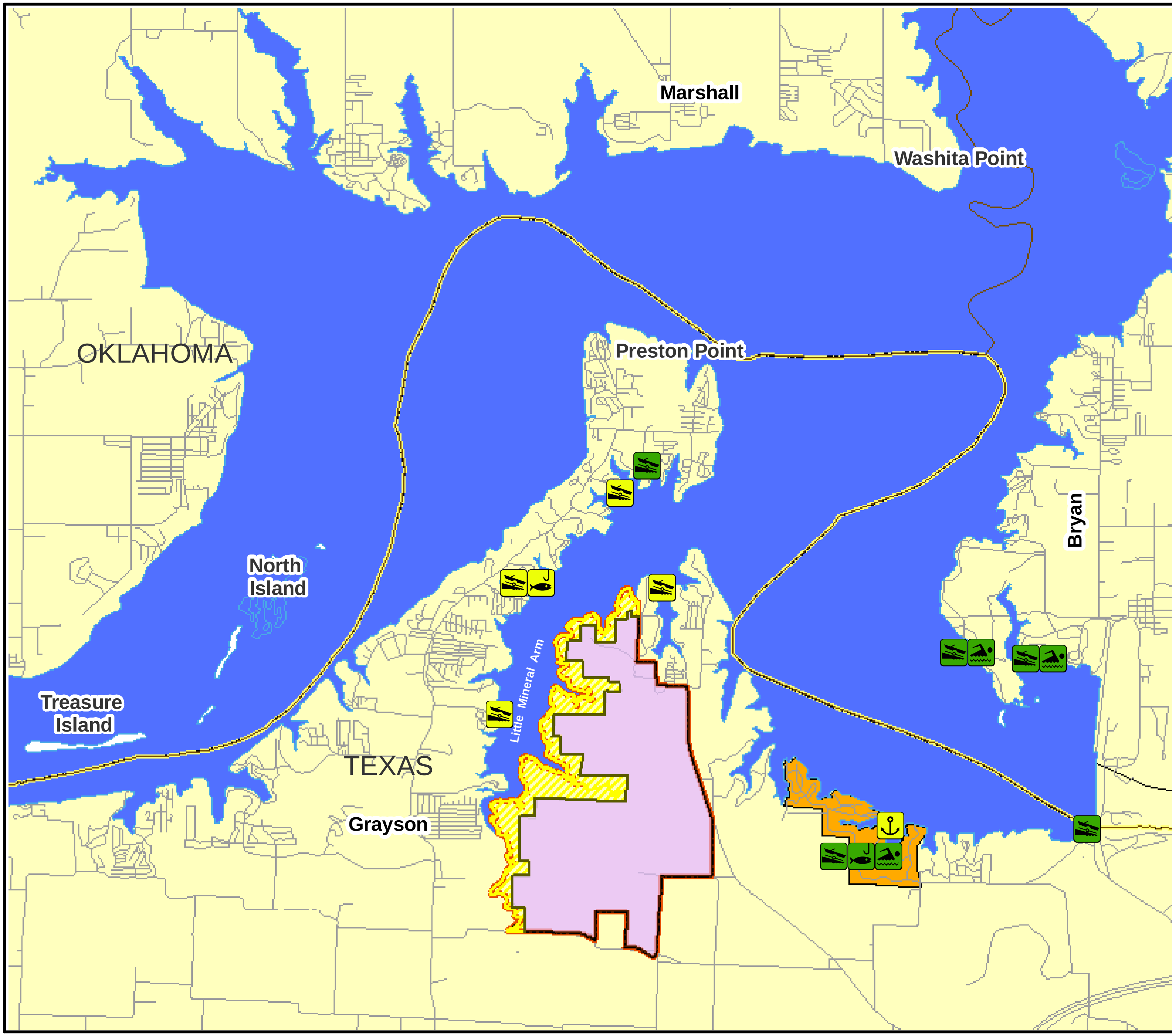


FIGURE 3.11.2
OBSERVED LAND-BASED RECREATION AREAS
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

Orginal Completed by: STEL, JDD 8/25/2010 N:\Projects\05002 Weston Texoma EIS\Mapping File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-11-2_Land Based Fac.mxd, 30-Sep-10 13:20, perrint

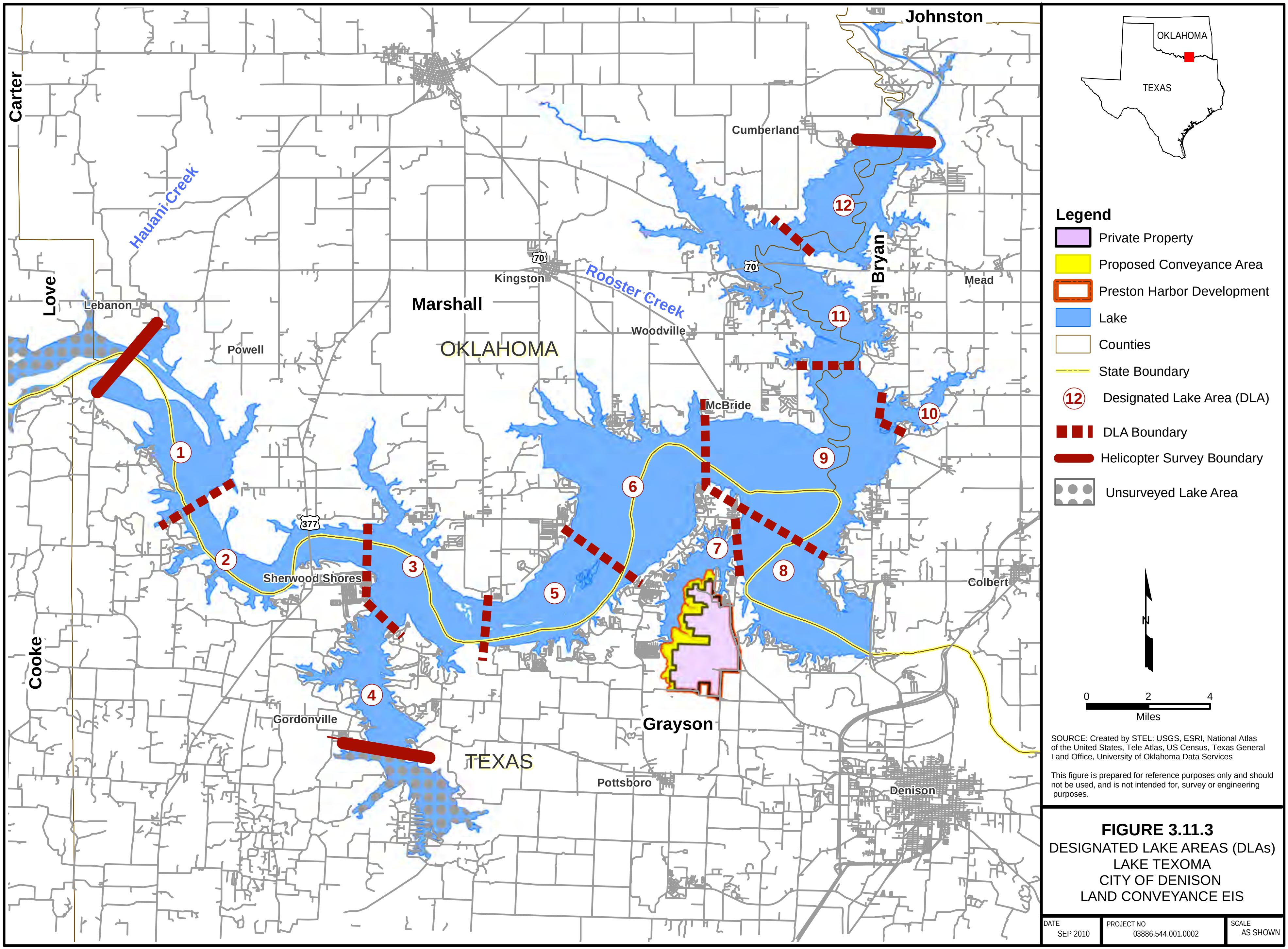
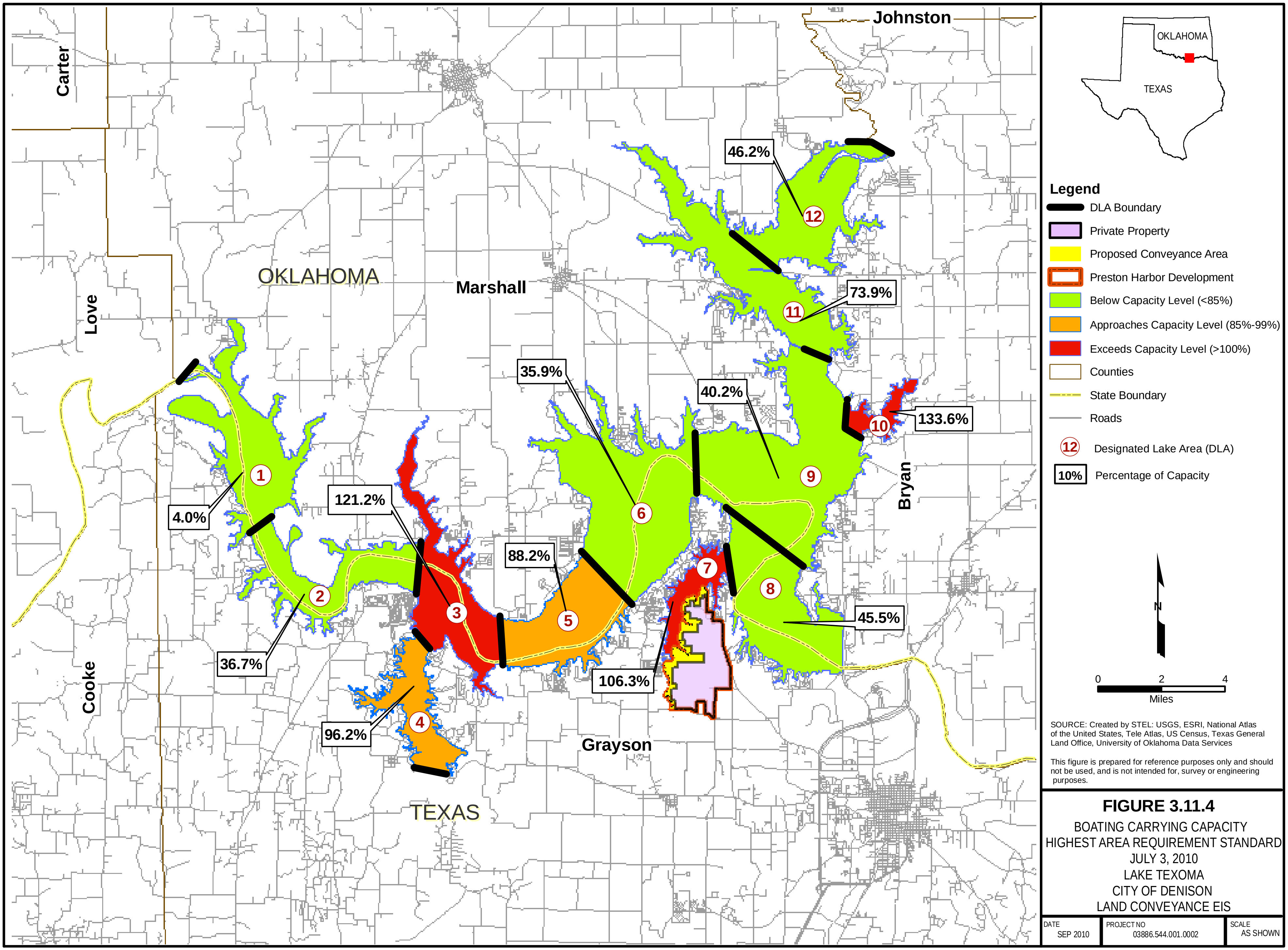


FIGURE 3.11.3
DESIGNATED LAKE AREAS (DLAs)
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

Completed by: Stel; JDD 8/25/2010 N:\Projects\05002 Weston Texoma EIS\Mapping File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-11-3-Designated Lake Areas Stel.mxd, 30-Sep-10 13:04, perrint



SOURCE: Created by STEL: USGS, ESRI, National Atlas of the United States, Tele Atlas, US Census, Texas General Land Office, University of Oklahoma Data Services

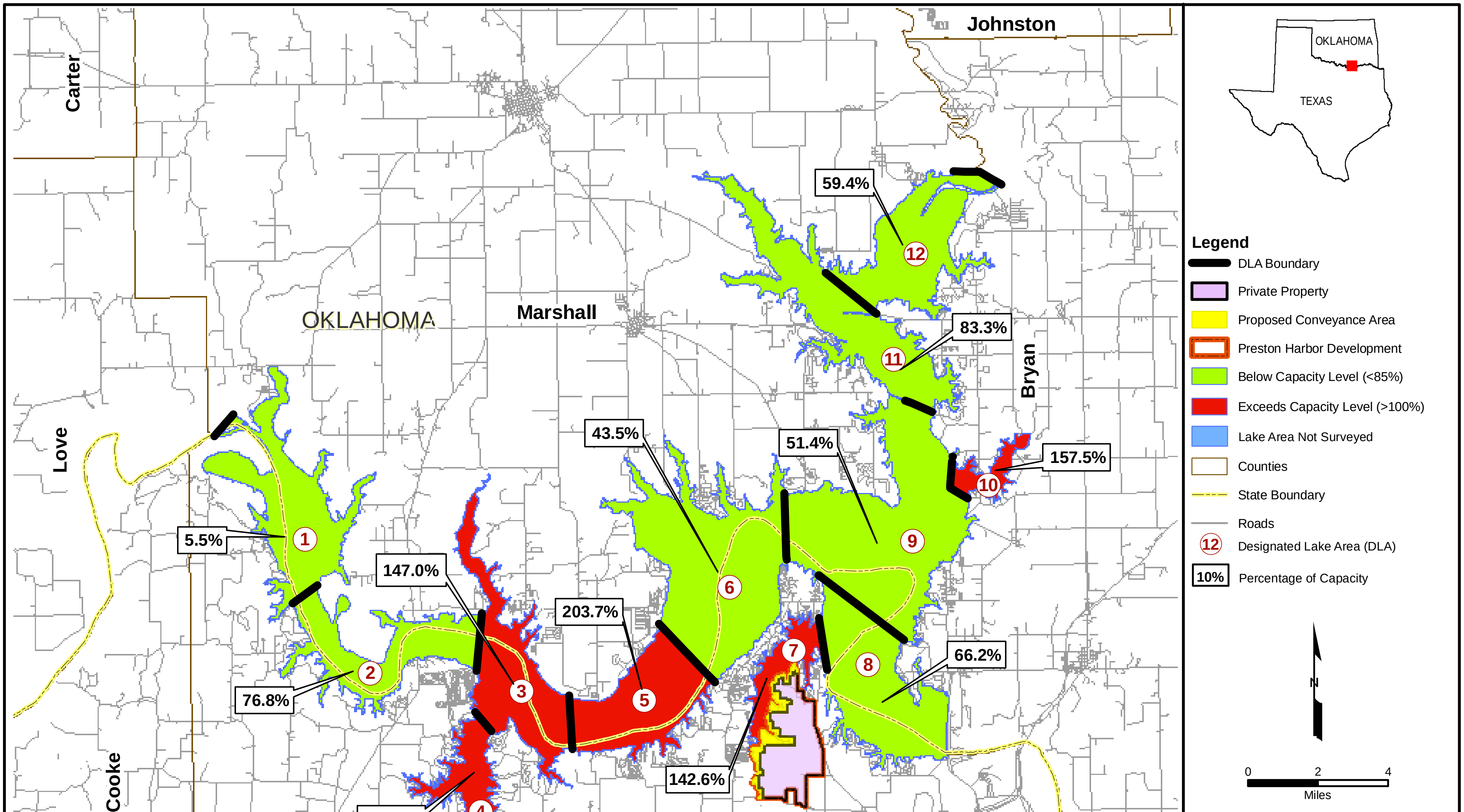
This figure is prepared for reference purposes only and should not be used, and is not intended for, survey or engineering purposes.

FIGURE 3.11.4

BOATING CARRYING CAPACITY
HIGHEST AREA REQUIREMENT STANDARD
JULY 3, 2010
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

Completed by: STEL -JDD 8/25/2010 N:\Projects\05002 Weston Texoma EIS\Mapping File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-11-4-July_3 Capacity Stel.mxd, 30-Sep-10 12:53, perrint



SOURCE: Created by STEL: USGS, ESRI, National Atlas of the United States, Tele Atlas, US Census, Texas General Land Office, University of Oklahoma Data Services

This figure is prepared for reference purposes only and should not be used, and is not intended for, survey or engineering purposes.

FIGURE 3.11.5

BOATING CARRYING CAPACITY
HIGHEST AREA REQUIREMENT STANDARD
JULY 4, 2010
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

Completed by STEL -JDD 8/25/2010 N \Projects\05002 Weston Texoma EIS\Mapping File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-11-5-July_4 Capacity Stel.mxd, 30-Sep-10 12:52, perrint

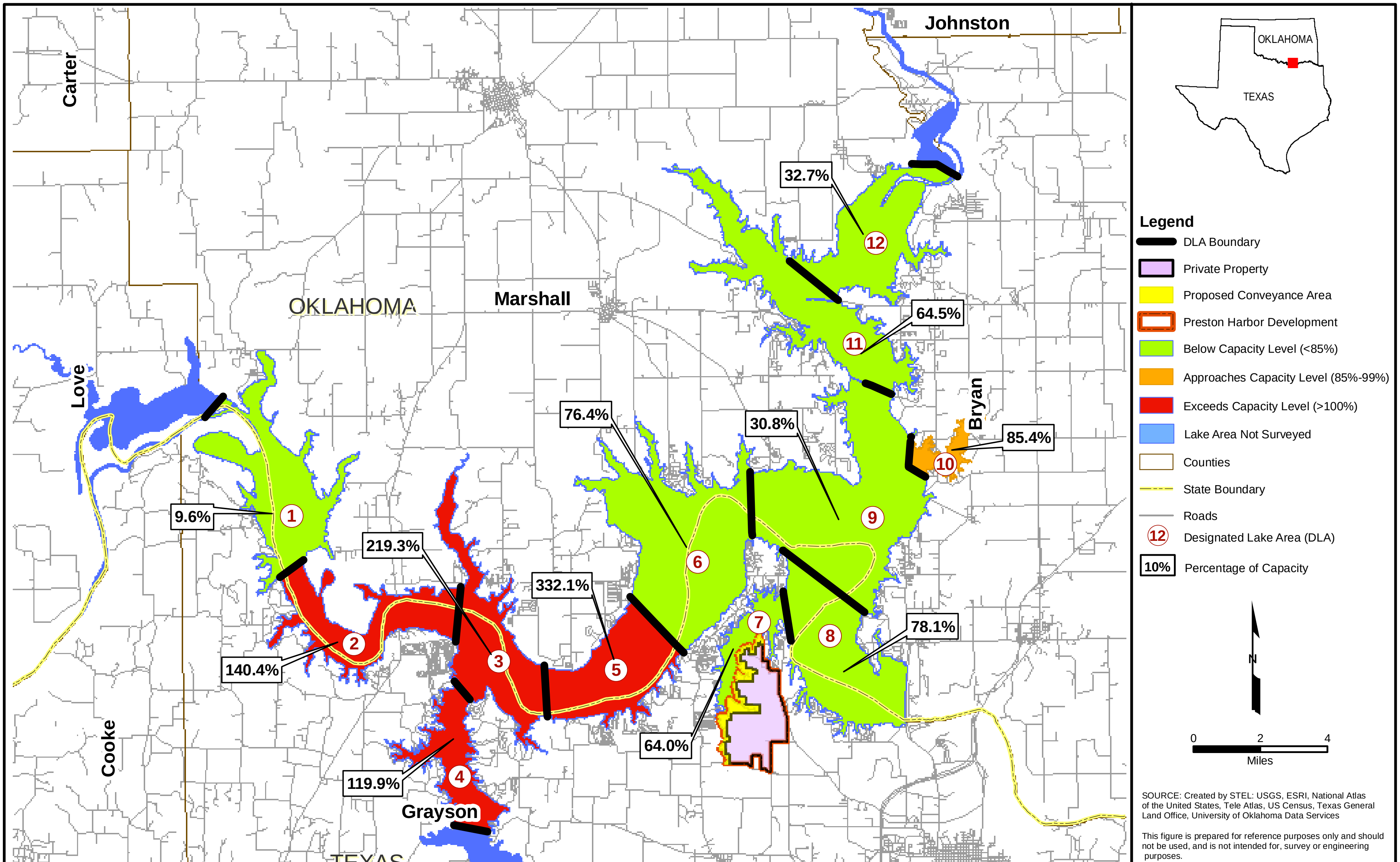


FIGURE 3.11.6
BOATING CARRYING CAPACITY
HIGHEST AREA REQUIREMENT STANDARD
SEPTEMBER 6, 2010
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

Completed by STEL -JDD 8/25/2010 N \Projects\05002 Weston Texoma EIS\MappingFile: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-11-6_Sept-6-Capacity Stel.mxd, 30-Sep-10 12:49, perrint

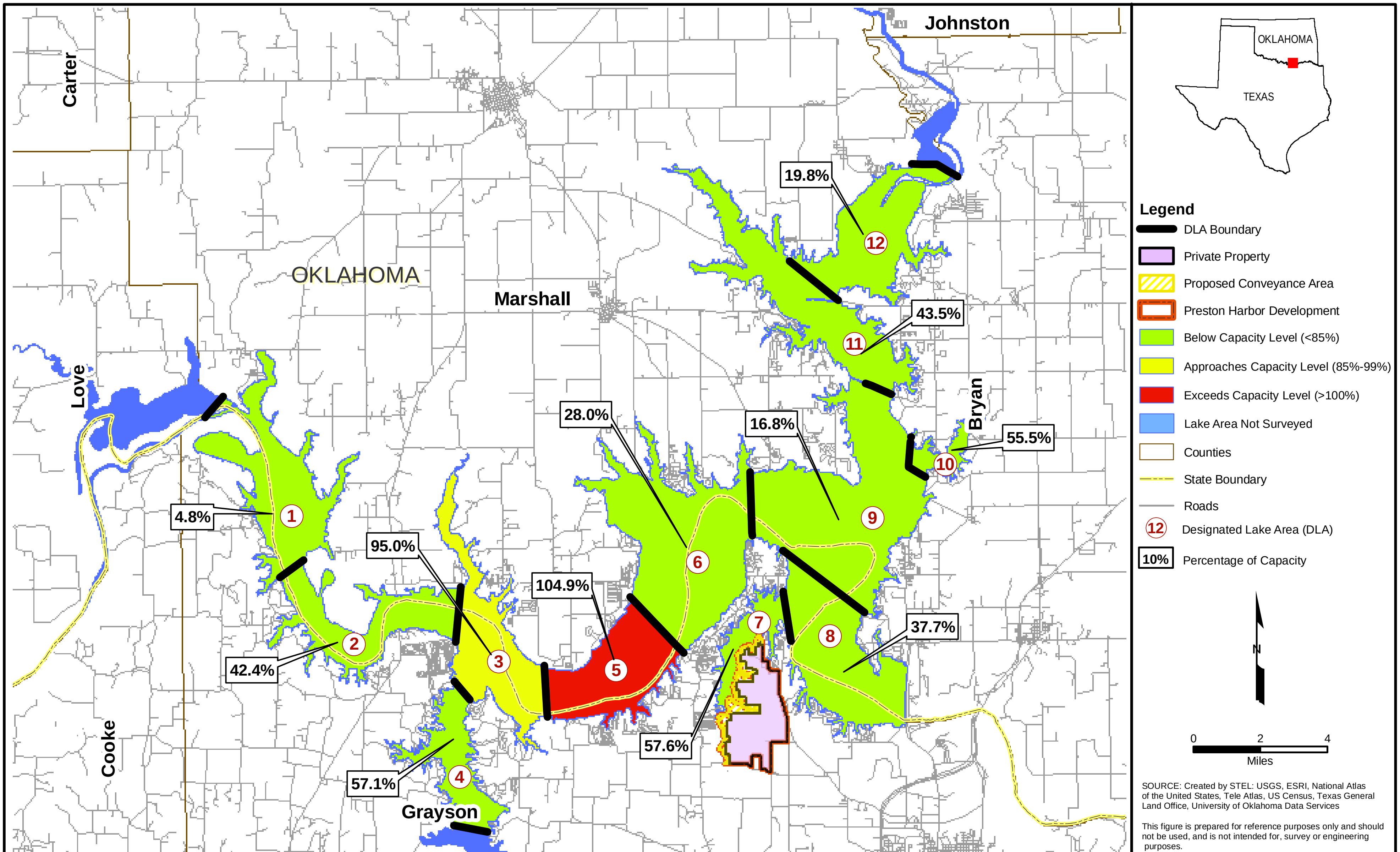


FIGURE 3.11.7

BOATING CARRYING CAPACITY
HIGHEST AREA REQUIREMENT STANDARD
SEPTEMBER 7, 2010
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

Completed by STEL -JDD 8/25/2010 N \Projects\05002 Weston Texoma EIS\MappingFile: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-11-7_Sept-7-Capacity Stel.mxd, 30-Sep-10 13:00, perrint

3.12 CULTURAL RESOURCES

Archaeological sites representative of the Early Archaic Period through the Middle and Late Archaic, Woodland, Caddoan, and Historic Periods are known in the larger vicinity of Lake Texoma in northern Texas. This culture-historical sequence falls generally within the overall sequence that has been established for northern Texas and southern Oklahoma. Many archaeological sites in this area have undisturbed, deeply-buried deposits; and many are comprised of multi-component prehistoric and/or historic occupations. A number of cultural resources investigations, including archaeological survey and excavation, were conducted incidental to the construction of Lake Texoma (USACE, 1976). At Lake Texoma and in the larger regional area there are hundreds of archaeological sites and historic standing structures on record with the Texas Historical Commission (THC). Specific historical context for the project area is included in the *Cultural Resource Survey of the Proposed Denison Land Conveyance* conducted by Rose and Darnell and included in Appendix R.

While archaeological reconnaissance efforts undertaken in the area by the USACE have resulted in the identification of hundreds of archaeological sites, none of these investigations have occurred within the proposed conveyance property. A literature review conducted at the Texas Historical Commission (THC) of archaeological sites in the immediate area revealed that nine sites are recorded within one mile of the conveyance property (Rose and Darnell, 2011). These include three prehistoric archaeological sites, four historic archaeological sites, and two archaeological sites that have both prehistoric and historic components (Rose and Darnell, 2011). While these archaeological sites represent the current base of recorded properties in the immediate vicinity of the project area, it is important to note that other archaeological sites may be present but as yet unrecorded.

3.13 VISUAL AND AESTHETIC RESOURCES

Visual and aesthetic resources are those natural resources, landforms, vegetation, and manmade structures in the environment that generate one or more sensory reactions and evaluations by the observer, particularly with respect to pleasurable responses. These sensory responses are traditionally classified as visual, auditory, and olfactory (sight, sound, and smell) responses. The landscape ecology establishes the environmental context for aesthetics and scenery. An ecosystem is a place where life and environment interact. Ecosystem includes the interaction between environments: physical and biological, as well as social dimensions.

The following discussion includes the existing landscape and ecosystem inventories applicable to the assessment of visual and scenic resources associated with the Proposed Actions. Landscape and ecosystem inventories are descriptions of observed landscape. They are not assessments. The inventory identifies typical landforms, vegetation, water, and land-use elements that are present within a study area (Litton, 1979).

The landscape evaluations are based on professional evaluation of the observed landscape. Since no single nationally recognized visual and aesthetic analysis system exists, the commonly used U.S. Forest Service (USFS) general structure of the Scenery Management System (SMS) has been adapted for this evaluation (USFS, 1995 and USFS, 2003). The Scenery Management System (USFS, 1995 and USFS, 2003), details criteria to be used in evaluating visual and scenic resources. The SMS is a guideline intended to assist decision-makers and the public in understanding the scenic resource management framework for making project level decisions as well as larger area analyses.

3.13.1 Landscape Inventory

Existing Land-Use Patterns and Themes

The 1996 SMP delineates the Lake Texoma shoreline into four categories of use that include limited development areas, public recreation areas, protected shoreline areas, and prohibited access areas as discussed in detail in Section 3.3.1 of this EIS. There are approximately 9.4 miles of lake shoreline adjacent to the proposed conveyance land. According to the 1996 SMP, most of this shoreline is zoned as “aesthetic and protected areas” (approximately 74%). Two small sections of the shoreline are zoned “limited development area,” where private recreational development is permitted. The zoning designation for protected shoreline areas includes areas that protect or restore aesthetic resources such as fish and wildlife, cultural resources, or other environmental resources. Limited development areas are areas where private activities are permitted such as construction and operation of private docks or floating facilities.

Ecological Unit Description

Lake Texoma lies within the West Gulf Coastal Plain of North America that includes western Louisiana, eastern Texas, southeastern Oklahoma and southern Arkansas (BRIT, 2009). The vegetation of the West Gulf Coastal Plain is divided into four regions that include Oak-Pine-Hickory Forest, Longleaf Pine Forest, Post Oak Savanna, and Prairie. The proposed conveyance land is located within the Prairie region that extends from Texas to Canada, covers most of central North America, and forms the western boundary of the West Gulf Coastal Plain (BRIT, 2009). The USDA USFS classifies the area as being within the Prairie Parkland Province of the Prairie Division (Bailey, 1995). This province is characterized as a region of gently rolling to flat plains ranging from sea level to 1,300 ft and consisting of prairies and savannas (Bailey, 1995). Due to rainfall and land-use activities such as fire and grazing, the area is dominated by various short and medium to tall grasses, along with some hardy tree species.

Within the proposed conveyance land of 635 acres of USACE land, the areas of more level terrain are composed of tree species such as cedar elm post oak, black oak Osage orange, upland ash, eastern red cedar, hackberry, and Mexican plum. The steeper sloped areas are more mesic and are dominated by species such as Northern red oak, chinkapin oak, and Texas oak. The understory is composed of species such as coral berry, red bud, rough leaved dogwood poison ivy, green briar, prickly ash, and American beautyberry. The native grass community is small and is becoming dominated by woody species. It is composed of species such as switch grass, big bluestem, little bluestem, silver bluestem, Johnson grass, annual ragweed, dotted gayfeather, black Sampson, serecia lespedeza, Maximillian sunflower, annual brome, common broomweed, butterfly milkweed, and Illinois bundleflower. A detailed listing of species found during the botanical inventory is provided in Appendix G of this EIS. A tabular listing of the plant species and specified areas in which they occur or likely to occur are shown in Appendix G of the EIS. A small remnant of BLH is located just downstream of the Texas F.M. Road 408 bridge and is dominated by species such as sycamore, bur oak, green ash, box elder, and broad leaved uniola. This site appears to have been disturbed by bridge and/or road construction activities in the past.

Two small riparian zones varying in width from 1 to 3 meters exist along the upper reaches of Little Mineral Creek and at least one tributary. These riparian zones are present from the top of flood pool to the upper limits of the USACE property. Some of the more common species in this zone include lead plant, sedges sp., horsetail, cardinal flower, water willow, and black willow. This vegetative community is very small in width and appears to be heavily influenced by operation of the project for flood control. No threatened or endangered vegetative species or unique habitats are present on the proposed conveyance lands.

The topography of the proposed conveyance lands generally consists of somewhat level areas near the USACE boundary fence line, and then rapidly descends into steeper slopes toward the lake. The areas of more level terrain are composed of upland forests interspersed with small native grass savannahs, while the steeper slopes are more mesic and dominated by an upland forest classified as a cedar elm-oak forest (University of Tulsa, 1971).

Visual Unit and Visibility Sectors

The aim of visual resources analysis is to ensure recognition and consideration of the visual qualities of the landscape. In order to inventory and evaluate the landscape in a meaningful manner, the landscape needs to be delineated into visual units (also called visual corridors or character types). A visual unit is defined as "a portion of the landscape enclosed and limited topography, bounding an observer's field of view" (Tetlow and Sheppard, 1979). The dominant criteria for delineating the visual unit boundaries are determined by topography and the ability to observe the landscape. Furthermore, a visual unit is an area of land that has common distinguishing visual characteristics of landform, rock formations, water forms, and vegetative patterns. The visual and scenic inventory can be divided into two classes: aerial and routed. The routed inventory uses a road, trail, or a stream as the location of traveling observer, limiting attention to the landscape within the visual corridor.

Specific views and visibility can be altered by a change of observer positioning within the unit boundary. The proposed conveyance shoreline area and its vicinity within the eastern shoreline of Little Mineral Arm were delineated into a visual unit that was further subdivided into visibility sectors (character subtypes). Figure 3.13.1 depicts the delineated four visibility sectors within the visibility unit of the eastern shoreline of Little Mineral Arm. The total length of the shoreline included for the visual unit is greater than the total length of shoreline associated with the proposed USACE land conveyance because visual units and visibility sectors are not bounded by property boundaries, but what is deemed visible to an observer from a determined observation point. The extended length of the visual unit allows a more meaningful inventory of the representative landscape and ecological unit. This in turn allows a more meaningful assessment of the visual unit.

The visibility sectors along the eastern shore of Little Mineral Arm were inventoried from the water at three observation points, and thus are classified as “routed inventories.” Extensive color photographs of the visibility sectors were taken from water on two separate field investigations to represent two distinct seasons: summer and winter (August 2009 and February 2010). The proposed conveyance land is bounded on the east by private property; therefore, a scenic assessment was not performed from land. No aerial inventories were performed.

Visual Unit Inventory

When observing the Little Mineral Arm from the water, the proposed conveyance land and its vicinity represent a portion of a landscape in the area that can be considered as one visual unit based on the spatial characteristics of the land forms in the study area and the vegetation that are relatively homogenous and uniform. The visual unit consists of over 10 miles of shoreline adjacent to the 635 acres of proposed conveyance lands. The visual unit is bounded on the north by the Grandpappy Point Marina and the confluence of Little Mineral Creek with Lake Texoma on the south (Figure 3.13.1).

A breakdown of the total types of land cover and acreages on the USACE property are as follows: upland forest complex (531 acres), native grassland (approximately 50 acres), and shoreline (8 acres), bottomland hardwood (20 acres), barren disturbed areas (5 acres), and open water (4 acres). Natural disturbances (including fires, storms, insects, and diseases) and recovery processes have the greatest influence on vegetation patterns.

Visibility Sector Inventory

The eastern shoreline of the Little Mineral Arm adjacent to the proposed conveyance land (“visibility unit”) was delineated into four visibility sectors for detailed landscape inventory. The visibility sectors were delineated to provide more specific information about views and visibility of the eastern shoreline of the Little Mineral Arm. The four visibility sectors were chosen based on field observations when traveling by water looking toward the visual unit. Three observation points from the water were used facing the shoreline adjacent to the proposed USACE conveyance lands. From the three observation points, four distinct visibility sectors were determined.

Figure 3.13.1 shows all four visibility sectors and the respective observation points. Table 3.13.3 includes pertinent data about the visibility sectors including water, land, minimum and maximum elevations of the area, and percent of lands that are forested.

The ecological characteristics and existing land-uses were assessed for each visibility sector from the visibility points and are described below. All visibility sectors as described below are primarily allocated as protected shoreline according to the SMP of 1996 (74%). This zoning designation protects the natural resources, but permits limited public use and recreation.

Visibility Sector 1

Sector 1 is located at the northern most point of the eastern shore of the Little Mineral Arm of Lake Texoma and contains approximately 13,090 ft of the shoreline (Figure 3.13.1). The view of this sector is primarily from the north looking to the south and southwest into the mouth of Little Mineral Creek. Much of the topography is steep ranging from an elevation of 700 to 715 ft NGVD, and the shoreline within this visual sector is diverse.

The 1996 SMP zoning for the northern point of Visibility Sector 1 is public recreation. The area consists of one boat ramp adjacent to Grandpappy Point Marina. Much of the view-shed near the tip of the point consists of disturbed areas containing a public boat ramp, a café, and Grandpappy Point Marina with marina, mooring facilities, and breakwater made of floating car tires. The other manmade structures visible from the water include a narrow, looping paved access road, a parking lot for more than 20 cars, a fueling station for boats, an outdoor chapel, and manmade signage. No power lines are visible. A tall communication tower is visible above the tree line. Toward the northern point of the Little Mineral Arm, visitors frequently encounter other people due to operation and maintenance of the marina and boat launching ramp.

The remainder of the shoreline within the Visibility Sector 1 is zoned as protected shoreline. The area is composed of rip rap near the boat ramp, some sand and gravel banks with sparse

Table 3.13.1

Pertinent Data Information Visual Sectors Little Mineral Arm Lake Texoma

Visibility Sector	Distance from Visibility Point to Shoreline (feet)	Visual Sector Total Area (acres)	Visual Sector On-Land Area (acres)	Mixed Forest (acres)	On-Land Mixed Forest (%)	Max Elevation (feet)	Min Elevation (feet)	Distance of Visible Shoreline (feet)
1	2,870	353	122	72	59%	715	620	13,090
2	2,100	386	172	128	74%	715	620	12,265
3A	1,260	193	132	108	82%	695	620	16,966
3B	340	116	72	61	85%	699	620	5,513

Source: WESTON, 2010

vegetation, and sand/silt areas within the backs of coves. The majority of the shoreline in this sector is composed of eroded clay banks with rocks, clay banks with rock, and dead trees. The ecological community view is toward a fairly steep shoreline containing a mesic upland forest.

The predominant vegetation includes trees common to the upland forest such as the eastern red cedar that can grow to heights of 40 to 50 ft and with a trunk diameter of 1 to 2 ft on older specimens, cedar elm that can grow to a height of 80 ft and up to 3 ft in diameter, northern red oak that can grow to heights of 60 to 80 ft and 3 or more ft in diameter, blackjack oak that can grow to a height of 20 to 30 ft, post oak that can attain heights of 100 ft and be 2 to 3 ft in diameter, and chinkapin oak that can grow to a height of 60 to 80 ft with a diameter of 2 to 3 ft. Trees common to the wetter areas and bottomlands include the American sycamore that reaches heights of 100 ft or more, the burr oak that grows to a height of 100 ft and 3 to 4 ft in diameter, green ash that can grow from 50 to 60 ft in height, and box elder that can grow from 50 to 70 ft having a diameter of 1 to 2 ft.

Visibility Sector 2

This sector is located within the middle section of the eastern shore of the Little Mineral Arm and contains approximately 12,265 ft of the shoreline (Figure 3.13.1). The view of this sector from the water is looking east and southeast. The banks are steep ranging in elevation from 700 to 720 ft NGVD near the southward boundary of Sector 1, but become somewhat less steep as the sector progresses to the south and range in elevation from 650 to 680 ft NGVD. The majority of the shoreline is composed of areas containing clay banks with rocks, clay banks with rocks and dead trees, or silt/sand areas in the backs of coves. The ecological community view is toward the mesic upland forest, but with some small interspersed native grassland beginning to appear. Several sandy pocket beaches exist within this sector. During the recreation off-season, a visitor often experiences isolation from the sights and sounds of other people while walking the beach areas. During peak recreation season, the same beaches are popular for recreational activities such as boating and swimming. A large communications tower is visible on the eastern horizon. There are no other manmade structures visible such as roads, power lines, trails, or housing.

The entire visibility sector is designated as a protected shoreline either due to aesthetic reasons or physical protection reasons such as erosion control according to the 1996 SMP.

Visibility Sector 3 A

The sector is located near the upper end of the eastern shoreline of the Little Mineral Arm and contains approximately 16,966 ft of shoreline (Figure 3.13.1). The view-shed from the water is looking east and southeast. The topography is somewhat steep with a maximum elevation of 715 ft NGVD along a major tributary, but otherwise of fairly gentle slope. The shoreline is fairly diverse and composed of clay banks with rock, of clay banks with rock and trees, and of silt/sand. The ecological community is diverse and contains a mixed upland forest, a remnant of bottomland hardwoods, native grassland, and a small segment of a riparian/stream community. Private buoys can be seen in the cove of this sector. This sector does not contain other manmade structures such as visible roads, power lines, trails, or housing. The main designation according to the 1996 SMP of this sector is limited development with a small area of protected shoreline.

Visibility Sector 3 B

The sector is located at the southern end and uppermost portion of the Little Mineral Arm and contains approximately 5,513 ft of the shoreline (Figure 3.13.1). The view-shed from the water is looking south or southeast. Much of the view-shed ranges from an elevation of 640 to 660 ft NGVD with a small portion rising up to an elevation of 700 ft NGVD. The shoreline is somewhat less diverse and is composed primarily of clay banks and rocks, and sand/silt, but it does encompass some of the Little Mineral Creek and riparian habitat. The ecological community is composed primarily of the mixed upland forest interspersed with small irregular native grasslands (see height and diameter tree descriptions of upland forest in Visibility Sector 3A). This sector contains a public boat ramp, a courtesy dock, an access road, a parking lot and manmade signage for navigational aid that are visible from water. No other structures such as roads, power lines, trails, or housing are visible. Half of the area in this sector is designated according to the 1996 SMP as limited development, and the other half is protected for aesthetic reasons.

3.13.2 Landscape Evaluation

Scenic Attractiveness

Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape and of the positive responses it evokes in people. It helps determine landscapes that are important for scenic beauty based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, land-use patterns, and cultural features (USDA, 1995).

Photographs in Appendix H provide examples of the different scenic attractiveness classes at the eastern shoreline of Little Mineral Arm from water (summer 2009 and winter 2010).

Table 3.13.2 provides definitions of the three scenic attractiveness classifications developed by the U.S. Forest Service (USFS, 1995).

Table 3.13.2

Scenic Attractiveness Classification

Class A	Class B	Class C
Distinctive	**Typical**	**Indistinctive**
Areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide unusual, unique, or outstanding scenic quality. These landscapes have strong positive attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.	Areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide ordinary or common scenic quality. These landscapes have generally positive, yet common, attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance. Normally they would form the basic matrix within the ecological unit.	Areas where landform, vegetation patterns, water characteristics, and cultural land-use have low scenic quality. Often water and rock form of any consequence are missing in class C landscapes. These landscapes have weak or missing attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, and balance.

Source: USDA, 1995

Table 3.13.3 provides a breakdown of scenic attractiveness classifications for the four water-based visibility sectors within the eastern shoreline of the Little Mineral Arm. The following scenic attractiveness ratings were determined for each visibility sector in accordance with the denoted classifications and photography.

Table 3.13.3

Scenic Attractiveness Classifications Little Mineral Arm Lake Texoma

Classification Type	Classification Percent per Sector			
	Visibility Sector 1	Visibility Sector 2	Visibility Sector 3A	Visibility Sector 3B
A	60	80	70	70
B	30	15	20	20
C	10	5	10	10

Source: WESTON, 2010

The assessment is based on the photographs included in the Appendix H. Based on these photographs (summer and winter) and descriptions in Table 3.13.4, all four visibility sectors are mainly "Class A – Distinctive" according to the scenic attractiveness rating.

Scenic Integrity

Scenic integrity indicates the degree of intactness and wholeness of the landscape character. Human alterations can sometimes raise or maintain integrity. Scenic integrity is a measure of the degree to which landscape is visually perceived to be "complete" (USDA, 1995). The scenic integrity assessment was performed for the four visibility sectors using the USDA Forest Service SMS (1995) framework and criteria in conjunction with adjustments for local factors. The scenic integrity levels are shown and described in Table 3.13.4.

Table 3.13.4

Scenic Integrity Definitions

Integrity Classification	Definition
VERY HIGH (Unaltered)	Scenic integrity refers to landscapes where the valued landscape character "is" intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.
HIGH (Appears Unaltered)	Scenic integrity refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
MODERATE (Slightly Altered)	Scenic integrity refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed.

Integrity Classification	Definition
LOW (Moderately Altered)	Scenic integrity refers to landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character being viewed, but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.
VERY LOW (Heavily Altered)	Scenic integrity refers to landscapes where the valued landscape character "appears heavily altered." Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.
UNACCEPTABLY LOW	Scenic integrity refers to landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern, or scale from the landscape character. Landscapes at this level of integrity need rehabilitation.

Source: USDA, 1995

Table 3.13.5 is a matrix that provides a quick summary of the integrity level descriptions according to the USFS. The first line, labeled “Dominance”, indicates which element has the strongest visual weight (or stands out visually over the other): the landscape character or the deviation from it. The second line describes the *degree of deviation* from the landscape character in terms of dominance. The third line describes the degree of intactness of the landscape character. Reading down each column gives a summary word picture of each level of integrity. Using the scenic integrity criteria and definitions, each visibility sector was classified for scenic integrity. The representative photographs are included in the Appendix H.

Table 3.13.5

Scenic Integrity Summary

Criteria for Scenic Integrity	Very High	High	Moderate	Low	Very Low	Unacceptably Low
Dominance Landscape Characteristics vs. Deviation	Landscape Character	Landscape Character	Landscape Character	Deviation	Deviation	Deviation
Degree of Deviation From the Landscape Charterer	None	Not Evident	Evident but not Dominant	Dominant	Very Dominant	Extremely Dominant

Criteria for Scenic Integrity	Very High	High	Moderate	Low	Very Low	Unacceptably Low
Intactness of Landscape Character	Landscape Character Fully Expressed	Landscape Character Fully Expressed	Slightly Altered and Character Expression Moderate	Altered and Low Expression of Character	Heavily Altered and Very Low Expression of Character	Extremely Altered

Source: USDA, 1995

Visibility Sector 1

Moderate Scenic Integrity

This sector is dominated by development, but the southern and southwestern portions of the area possess some natural appearing views. This visibility sector includes areas of developed recreation facilities, concentrated use areas, and undeveloped recreation impact with the foreground of the view-shed (0.5 mile). In this area, the roadway, recreation amenities, and development are part of the valued natural appearing landscape. Users of these amenities are part of the valued natural appearing landscape. Users of these amenities are attracted to the natural appearing landscape, but desire a moderate, easy interaction with the landscape through the use of these amenities. Parking lots and low-impact recreational facilities are present but appear part of the natural appearing landscape by elimination of the geometry of the built feature upon the landscape. Road cuts do not slice through the landscape, but are shaped contoured and constructed so that the landscape is only interrupted by the track of road.

Visibility Sector 2

High Scenic Integrity

This sector is dominated with natural appearing views. The existing landscape character has been influenced by both direct and indirect human activities, but appears natural to the majority of viewers. Landscape appears unaltered and "intact." Deviations repeat the form, line, color, texture, and pattern common to the surrounding landscape character. While there is evidence of human influence from different types of low-impact activities, it is part of the valued built environment in the landscape to the majority of the viewers. Natural elements such as native trees, shrubs, grasses, forbs, and erodable shoreline dominate the view.

Visibility Sector 3A

High Scenic Integrity

This visibility sector is dominated by natural appearing views. The existing landscape character has been influenced by both direct and indirect human activities, but appears natural to the majority of viewers. The landscape appears unaltered and "intact." Deviations repeat the form, line, color, texture, and pattern common to the surrounding landscape character. While there is evidence of human influence from different types of low-impact activities, it is part of the valued built environment in the landscape to the majority of the viewers. Natural elements such as native trees, shrubs, grasses, forbs, and erodable shoreline dominate the views.

Visibility Sector 3B

Moderate Scenic Integrity

This visibility sector's landscape is slightly altered and contains vegetated faces with cuts and fills that are not evident. Vegetation is natural appearing openings, lines, edges, and forms found in the existing landscape. A parking lot and public boat ramp are present but appear part of the natural appearing landscape by elimination of the geometry of the built feature upon the landscape. The access road does not slice through the landscape, but is shaped, contoured, and constructed so that the landscape is only interrupted by the track of road.

3.13.3 Landscape Visibility

Landscape visibility is a function of many interconnected considerations, including the following: (1) context of viewers, (2) duration of view, (3) degree of discernible detail, (4) seasonal variations, and (5) number of viewers (USDA, 1995). Viewers of the eastern shoreline of the Little Mineral Arm include active and passive recreational lake users such as boaters, water-skiers, fishermen, wildlife watchers, swimmers, and visitors to the shoreline. Other viewers of the eastern shoreline include recreational and residential users of the western shoreline of the Little Mineral Arm.

For the purpose of this EIS, the eastern shoreline of the Little Mineral Arm adjacent to the proposed USACE conveyance lands was zoned into four distinct zones per landscape visibility from water observance: the immediate foreground, the foreground, the middle ground, and the background. The ecological characteristics and existing land-uses were assessed for each zone within the visual unit and are defined and characterized as follows:

The immediate foreground (0 to 300 ft from the viewer) of the eastern shoreline of Little Mineral Arm adjacent to the proposed conveyance land includes lands from the shoreline of the lake from the top of power pool (elevation 617 ft NGVD) to top of flood control pool (elevation 640 ft NGVD). This area contains sparse vegetation due to operation of the flood control pool of the lake. The viewer perceives a predominantly natural landscape but sees some evidence of human disturbance. These perturbations include natural debris such as tree limbs, logs, and manmade items such as styrofoam blocks from boat houses and large automobile and heavy equipment tires awash on the shore. Operation of the project for flood control purposes and wind and wave action have created bank erosion and are evidenced by numerous uprooted trees along the shoreline and sloughing banks.

The foreground (up to ½ mile from the viewer) of the Little Mineral Arm adjacent to the proposed conveyance land appears to have a conspicuous surface pattern due to strong erosion features. This creates an irregular pattern of scattered erosional slopes. A small community of native grasses consisting of species such as little bluestem, switchgrass, and Indian grass can be identified above the top of the eroded areas. One boat ramp on the eastern shoreline can be noticed by an observer as openings in the tree line where the vegetation has been modified to enable boating pursuits. Also, one parking lot is visible in the foreground.

The middle ground (½ mile up to 4 miles from the viewer) of the Little Mineral Arm adjacent to the proposed conveyance land consists of an area from the top of the flood pool to the current boundary of the USACE property. Color and texture are broken by forest canopy with some openings and meadows. This area includes primarily three vegetative communities consisting of a small remnant of BLHs, two very narrow riparian zones, and an upland forest complex interspersed with small native grass savannas. The upland forest complex is the dominant land cover type in this visual unit. One communications tower is visible.

The background (4 miles from the viewer) of the Little Mineral Arm adjacent to the proposed conveyance land appears to be closed and is dominated by a uniform tree line. The general vegetative pattern in the visual unit is dominated by a uniform and definitive pattern of upland forest canopy consisting of cedar elm, various oaks, and eastern red cedar.

3.13.4 Visual Resource Concerns

The issues identified as important included the natural beauty, views of the wilderness and wildlife, and the picturesque landscape of the eastern shoreline of the Little Mineral Arm.

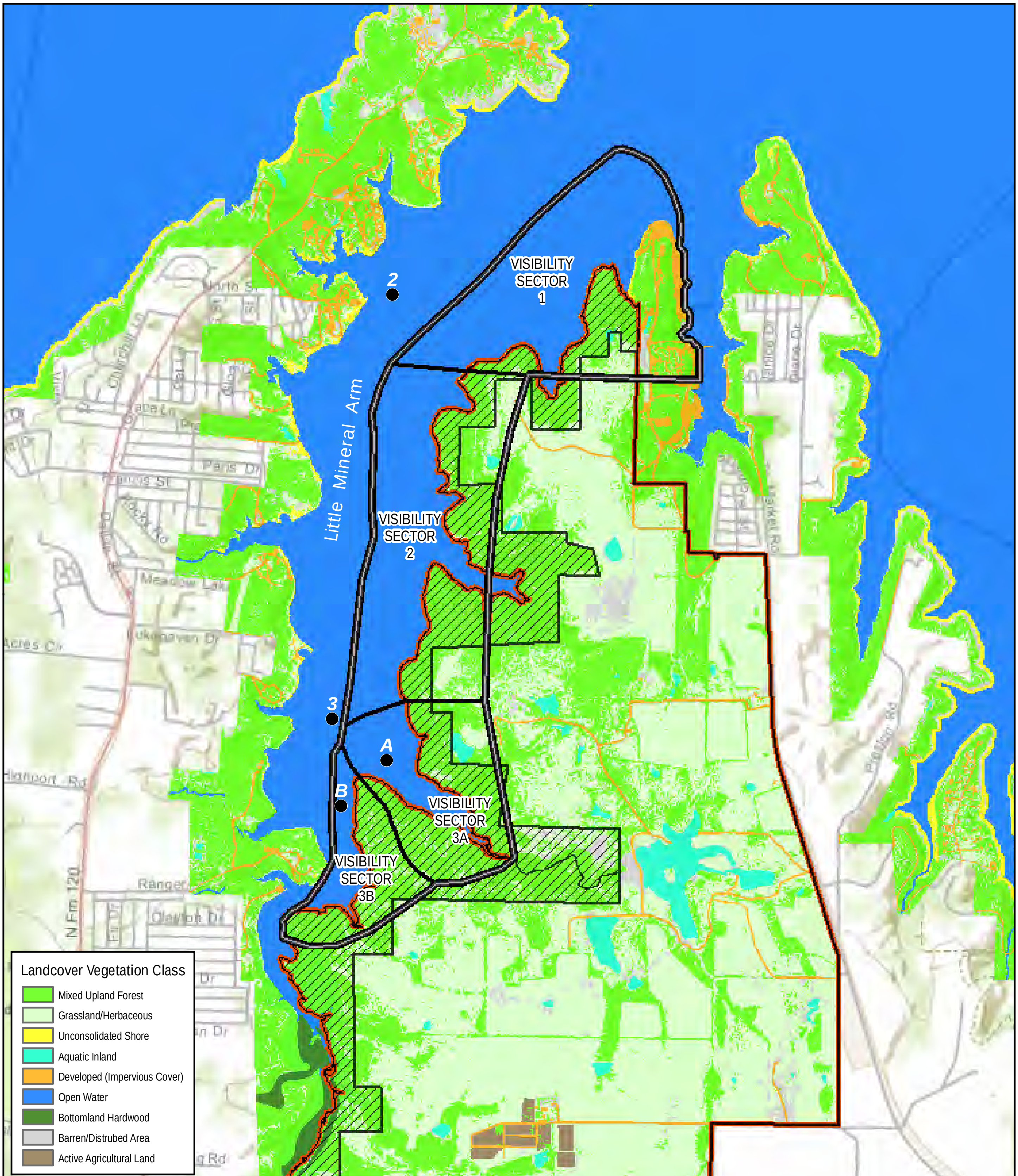
Table 3.13.6 summarizes the landscape evaluation of the visibility sectors within the eastern shoreline of the little Mineral Arm of Lake Texoma based on the baseline inventory of the landscape character attributes and the ecological unit resources of the area.

Table 3.13.6

Visual Resources Eastern Shoreline Little Mineral Arm Lake Texoma

Visibility Sector	Scenic Attractiveness Rating - Primary Class	Scenic Integrity
1	A – Distinctive	Moderate
2	A – Distinctive	High
3A	A – Distinctive	High
3B	A – Distinctive	Moderate

Source: WESTON, 2010 and based on USDA, 1995



LEGEND

Proposed Conveyance Land
Private Property
Preston Harbor Development
Visual Unit
Assessment Point

0 0.25 0.5
Miles

SOURCE
1) U.S. FISH AND W LDLIFE SERVICE WETLANDS AND DEEPWATER HABITATS OF THE CONTERMINOUS UNITED STATES POTTSBORO TEXAS 1982
2) BOUNDARY PROV DED BY PSA ENGINEERING 2009

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT NTENDED FOR SURVEY OR ENG NEERING PURPOSES.

FIGURE 3.13.1
VISUAL UNIT AND VISIBILITY SECTORS
PROPOSED DEVELOPMENT
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
SEP 2010	03886.544.001.0002	AS SHOWN

File: \\Asatx01\GIS_CAD\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Fig3-13-1_VisualScenic.mxd, 30-Sep-10 13:36, perrint

3.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

This section summarizes existing facilities and operations that may generate regulated hazardous, toxic, and radioactive waste within the proposed conveyance land, the private adjacent land, and surrounding areas.

3.14.1 Oil and Gas

Oil and gas production and transportation pose the greatest threat regarding hazardous materials in and around Lake Texoma. As shown in Table 3.14.1, approximately 5,088 different types of wells are located within the Lake Texoma watershed (HUC 11130210) as derived from data provided by the TRRC and the Oklahoma Corporation Commission (OCC).

Table 3.14.1

Oil and Gas Wells within the Lake Texoma Watershed (HUC 11130210)

Wells				
Type	**Texas**	**Oklahoma**	**Proposed USACE Conveyance Land**	**Adjacent Private Property**
Permitted Location	157	43	--	--
Dry Hole	916[1]	364	1	7
Oil	977	210	--	--
Gas	18	71	--	--
Oil/Gas	43	--	--	--
Plugged Oil	651	261	--	--
Plugged Gas	12	17	--	--
Canceled/Abandoned	59	8	--	--
Plugged Oil/Gas	11	166	--	--
Injection/Disposal	22	38	--	--
Shut-In Well (Oil)	8	--	--	--
Injection/Disposal from Oil	138	--	--	--
Injection/Disposal from Oil/Gas	1	--	--	--
Water Supply	2	2	--	--
Water Supply from Oil	3	--	--	--

Wells				
Type	**Texas**	**Oklahoma**	**Proposed USACE Conveyance Land**	**Adjacent Private Property**
Horizontal Drainhole	3	--	--	--
Sidetrack Well Surface Location	212	--	--	--
Unknown	--	675	--	--
Total	**3,233**	**1,855**	--	--

Source: TRRC, 2011 and OCC, 2011

[1]Count includes wells on the USACE proposed conveyance land and the adjacent private property.

According to the 1978 Lake Texoma Master Plan, numerous oil and gas wells were located within the total drainage area of the lake. In addition, the 1978 MP reports that approximately 710 wells were located in the oil and gas fields surrounding the lake. Approximately 530 of these were on the Texas side of the project in three well fields: Walnut, Handy, and Big Mineral fields. The remaining 180 wells were on the Oklahoma side of the project in three production areas: the Aylesworth, Isom Springs, and Endville areas (USACE, 1978). The Cumberland oilfield in Oklahoma extends about 4 miles along the Washita River, approximately 30 miles upstream from its confluence with the Red River. The 1978 MP states that the pre-project exploration of mineral resources had no adverse effect to the public (USACE, 1978).

In addition to many oil and gas production fields, it has been reported that hundreds of transport pipelines cross land and waterways that supply Lake Texoma (USACE, 2008d). TRRC and OCC are primarily responsible for the enforcement of environmental compliance of oil and gas facilities in the Lake Texoma area.

3.14.2 Other Potential Pollutant Sources

The properties adjacent to the proposed USACE conveyance lands currently contain some potential sources of pollution such as septic tanks and marinas. Discussion of septic tanks and wastewater treatment and discharge near the proposed USACE land conveyance is included in Sections 3.6 and 3.9 of this EIS. No septic tanks or WWTPs are located on the conveyance land. Septic tanks are the primary source of existing impacts to shallow groundwater in existing residential areas as discussed in Section 3.6.2. WWTPs require a TCEQ wastewater permit for wastewater treatment and discharge. Individual wastewater permits through the TCEQ require monitoring of discharge and compliance to a degree that would protect the receiving water body; in this case, Little Mineral Arm.

Outside the proposed conveyance land, no manufacturing and industrial facilities are located in the immediate shoreline of Lake Texoma. Most industrial and manufacturing facilities reporting to the Toxics Release Inventory (TRI) are located in the surrounding towns and cities according to the EPA EnviroMapper. According to the EnviroMapper, less than 20 large quantity generators and hazardous waste generators, transporters, treaters, storers, and disposers of hazardous waste are located within the HUC 11130210 watershed. No radiological waste sources are reported (EPA, 2010d).

As discussed in Section 3.6.2, potential localized and periodic water pollution sources within the Little Mineral Arm include gasoline refueling from a fueling station (Grandpappy Point Marina) and accidental oil and gasoline leaks from boats in boathouses, moored watercrafts, as well as during boat launching and boat maintenance. Other sources of pollutants from recreational vessels include the following: gray water, bilge water, black water (sewage), anti-fouling paints (and their leachate), hazardous materials, municipal and commercial garbage, and other wastes. The entire Little Mineral Arm is designated as a no discharge zone (NDZ). Vessel sewage discharge is prohibited in Lake Texoma as well (EPA, 2010d).

According to the SMP, the potential pollution sources have had no significant adverse effect on the Lake Texoma area (USACE, 1996). Since the proposed conveyance property has been under government control, no development has been initiated, and no site information indicating past or present storage or disposal of hazardous materials or toxic waste has been recorded.

3.15 AIR QUALITY

Air emission sources include mobile sources, industrial processes, and electric power generation. The Federal Clean Air Act of 1970 (CAA) (43 U.S.C. 7401 et seq., as amended in 1977 and 1990) provides the principle framework for national and state agencies to protect air quality and requires the adoption of National Ambient Air Quality Standards (NAAQS) to protect the public health, safety, and welfare from known or anticipated effects of air pollution. Amendments to the CAA require the U.S. Environmental Protection Agency (EPA) to promulgate rules to ensure that Federal actions conform to the appropriate state implementation plan. These requirements are known as the General Conformity Rule (40 C.F.R. 51.100 et. seq. and 93.100 et. seq.).

EPA has established NAAQS for six air pollutants (criteria pollutants): ozone, lead, carbon monoxide, sulfur dioxide, nitrogen dioxide, and particulate matter. Ozone, as regulated by EPA, is not emitted directly into the air, but is formed when sunlight reacts with emissions of nitrogen oxides and volatile organic compounds. Ozone also occurs naturally in the stratosphere approximately 10 to 30 miles above the earth's surface and forms a layer that protects life on earth from the sun's harmful rays.

The NAAQS were established to protect the public from exposure to harmful amounts of pollutants. When the pollutant levels in an area have caused a violation of a particular standard, the area is classified as "nonattainment" for that pollutant. EPA then imposes Federal regulations on that pollutant’s emissions and designates a time period in which the area must again attain the standard.

The primary and secondary NAAQS concentrations are presented in Table 3.15.1. Primary standards are also known as health effects standards, which are set at levels to protect the most susceptible individuals in the human population (very young, very old, and those with respiratory problems such as asthma) (EPA, 2010e). Secondary standards, also known as quality of life standards, set limits to protect public welfare including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. Since both short- and long-term exposures are addressed, a single pollutant may have more than one primary standard.

Table 3.15.1

Primary and Secondary NAAQS Six Criteria Pollutants

Pollutant	Averaging Time	Primary NAAQS	Secondary NAAQS
Ozone[1]	8 hr	0.075 ppm	0.075 ppm
Carbon Monoxide	1 hr	35 ppm	35 ppm
	8 hr	9 ppm	9 ppm

Pollutant		Averaging Time	Primary NAAQS	Secondary NAAQS
Sulfur Dioxide		1 hr	75 ppb	none
		24 hr	0.14 ppm	0.5 ppm 3 hr
		Annual	0.03 ppm	
Nitrogen Dioxide		Annual	53 ppb	53 ppb
Particulate Matter	PM10	24 hr	150 µg/m^3	150 µg/m^3
		Annual	51 µg/m^3	51 µg/m^3
	PM2.5	24 hr	35 µg/m^3	35 µg/m^3
		Annual	15 µg/m^3	15 µg/m^3
Lead		Quarterly	1.55 µg/m^3	1.55 µg/m^3

Source: EPA, 2010e
[1]EPA is proposing to set the "primary" standard at a level between 0.060 and 0.070 ppm measured over 8 hours.
PM10 – particulate matter, 10 microns; PM2.5 – particulate matter, 2.5 microns

State air quality standards in Texas and Oklahoma are based on Federal Standard, though other states have set theirs to be more stringent than the Federal standards, are . The criteria pollutants are the only air pollutants for which standards have been established. The EPA assigns designations based on an area meeting or attaining these standards. At this time, the Conformity Rule only applies to Federal actions in nonattainment areas. A nonattainment area is an area that does not meet one or more of the NAAQS for the criteria pollutants designated in the CAA. A near attainment area currently meets Federal standards, but is at risk of violating standards.

Lake Texoma is located in the Oklahoma counties of Love, Bryan, Marshall, and Johnson and in the Texas counties of Grayson and Cooke. According to maps in the EPA "Green Book" (for criteria pollutant nonattainment areas), all counties within Oklahoma have been designated as attainment areas for criteria pollutants and air toxins, including the 8-hour ozone standard (EPA 2004). According to the "Green Book" within the State of Texas, three counties are considered nonattainment for 8-hour ozone, and one county is considered nonattainment for both carbon monoxide and PM 10. All the Texas counties in the Lake Texoma area are in attainment for criteria air pollutants.

A State Implementation Plan (SIP) is an enforceable plan developed at the state level that explains how the state will comply with air quality standards according to the CAA. The closest

SIP area to the proposed USACE conveyance lands is located in the DFW area (TCEQ, 2010g). The area includes Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties. There are no SIPs for the Oklahoma counties surrounding the lake.

Air pollutants come from a variety of natural and manmade sources. Natural sources can include windblown dust and soot from wildfires. Manmade sources can include motor vehicles, electric utility and industrial fuel burning, and manufacturing operations. Particulate matter pollution is the major cause of reduced visibility (haze). The CAA requires the EPA to adopt regulations to reduce visibility impairment resulting “from manmade air pollution” in 156 Class I Federal areas. The regulations require each state SIP to include control measures to make reasonable progress toward the national goal of natural visibility conditions in all Class I areas.

The closest Class I area in Oklahoma is the Wichita Mountains Wilderness Area. The two Class I areas in Texas are Big Bend and Guadalupe Mountains National Parks; neither is in close proximity to Lake Texoma (EPA, 2010f). There are no Class I areas within the Lake Texoma area.

3.16 NOISE

Sound is a physical phenomenon consisting of vibrations that travel through a medium such as air and are sensed by the human ear. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities essential to a community’s *quality of life* such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz (Hz) are used to quantify sound frequency. The human ear responds differently to different frequencies. A-weighing, measured in A-weighted decibels (dBA), approximates a frequency response expressing the perception of sound by humans. Sounds encountered in daily life and their dBA levels are provided in Table

3.16.1. The dBA noise metric describes steady noise levels; although, very few noises are, in fact, constant. Therefore, Day-night Sound Level (DNL) has been developed. DNL is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10 p.m. to 7 a.m.). It is a useful descriptor for noise because (1) it averages ongoing yet intermittent noise, and (2) it measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in dB.

Table 3.16.1

Common Sounds and Their Levels

Outdoor	Sound Level (dBA)	Indoor
Motorcycle	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	Television audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: Harris, 1998

3.16.1 Regulatory Requirements

The Noise Control Act of 1972 (PL 92-574) directs Federal agencies to comply with applicable Federal, state, interstate, and local noise control regulations. In 1974, EPA provided information suggesting continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land-uses such as residences, schools, churches, and hospitals. Texas has no statewide noise regulation, and Grayson County in Texas has no countywide noise regulation.

3.16.2 Existing Conditions

Different types of land-uses and the human activities associated with them have different sensitivities to changes in ambient noise levels. In order to characterize these parameters, aerial maps were reviewed and a visual survey of the study area was performed. In general, the area is rural and the properties within the area are typically low density residential. The majority of the study area is in undeveloped and rural residential portions of Grayson County.

Existing sources of noise near the proposed sites include roadway traffic, high altitude aircraft over flights, boating activities, and natural noises such as the rustling of leaves and bird vocalizations. In general, noise levels would be comparable to a rural setting, and existing noise is predominantly due to primary and secondary roadways. Existing noise levels (L_{eq} and DNL) were estimated for the surrounding area using the techniques specified in the American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-term measurements with an observer present (Table 3.16.2) (ANSI, 2003).

Table 3.16.2

Estimated Existing Noise Levels at Nearby Noise Sensitive Receptors

Nearby Noise Sensitive Receptors			Land Use Category	Estimated Existing Sound Levels (dBA)[1]		
Distance to Proposed Development Boundary	**Direction**	L_{eq} **(Daytime)**		**DNL**	L_{eq} **(Daytime)**	L_{eq} **(Nighttime)**
1,000 ft (300 m)	West	Residential on Ranger Road	Rural Agricultural Undeveloped	45	43	37
100 ft (30 m)	North	Residential on Harbor Drive				
100 ft (30 m)	East	Residential on F.M. 84				
100 ft (30 m)	South	Residential on F.M. 406				
500 ft (150 m)	Southwest	Church				

[1] Source: ANSI, 2003

4. ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This section presents the detailed analysis of environmental impacts associated with the alternatives, any adverse environmental effects from implementing an alternative, the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources if an alternative is implemented. Direct and indirect effects and their significance, cumulative effects, and means to mitigate adverse environmental impacts are also discussed for each resource.

4.1.1 Definition of Terms

The terms “impact” and “effect” are used synonymously in this section and throughout this EIS. An *impact,* or effect, is defined as a modification to the environment as it presently exists that is brought about by an outside action. Impacts can vary in severity from no change to significant change. Definition of these levels varies by resource section and thus is introduced in the following sections as applicable. *Direct effects* are caused by an action and occur at the same time and place. *Indirect effects* are caused by an action and occur later in time or farther in distance, but are still reasonably foreseeable. In addition, effects may be *short-term* (temporary) or *long-term* (permanent and long-lasting). Specifically, this EIS assesses the direct and indirect impacts of the three proposed Federal actions: 1) conveyance of Federal land, 2) proposed changes to the shoreline management plan (SMP), and 3) decisions regarding issuance of Federal permits. Indirect impacts are those associated with the development that would occur on the conveyance property and any development located on the adjacent private land that would not occur or would be developed differently if the USACE did not convey the land; this development tends to be located on and along the shared boundary of the conveyance property and the adjacent private property (i.e., golf course, hotel complex, open space and some residential area). A significant portion of the development on the adjacent private land would be developed in the same manner notwithstanding whether the USACE takes any actions, and thus this development is neither a direct effect nor an indirect effect of the USACE actions. Indirect impact assessment also includes development associated with proposed changes to the SMP.

Implementing Guidelines for NEPA contained in (40 CFR 1502.14(f)) require the inclusion of a discussion of appropriate mitigation measures for all reasonable alternatives including the Proposed Action. A framework for implementing mitigation is provided in 40 CFR 1508.20. The steps to mitigating for impacts include the following: (a) Avoiding the impact altogether by not taking a certain action or parts of an action; (b) Minimizing impacts by limiting the degree or magnitude of the action and its magnitude; (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) Compensating for the impact by replacing or providing substitute resources or environments. Mitigation features or measures are presented as applicable for each resource element in the impacts analysis in this section.

4.1.2 Summary of Alternatives

As discussed in Section 2, a range of alternatives were developed and evaluated according to screening criteria to determine alternatives to carry forward for impacts analysis. The alternatives that have been carried forward following screening are summarized below.

Alternative 1 – No Action

Under this alternative, the proposed conveyance land would remain under Federal ownership. No SMP permits would be issued for proposed development features on the conveyance land. Similarly, no Section 404/Section 10 permits would be issued for activities on the conveyance lands or on the lake. Accordingly, current shoreline use designations and nature of shoreline development would continue as they do at present.

No direct impacts are associated with this alternative, as there would be no conveyance, no associated permits in the reasonably foreseeable future, and no proposed changes to the SMP.

Baseline conditions related to Alternative 1 include development that would occur on the adjacent private property, which would be different from development that would occur under Alternatives 2, 3, and 4. As shown in Figure 2.2, development would remain as mixed use, but the development under Alternative 1 would include 1,348 acres of various residential developments (approximately 7,035 units), limited commercial/ retail development, and one golf course. Boat ramps, boat docks and other water related access entities, as described in

Alternatives 3 and 4 would not be included. The hotel complex and additional golf course described in Alternatives 2, 3, and 4 would also not be included.

Alternative 2 – Land Conveyance without Shoreline Development

This alternative would convey approximately 635 acres of Federal lands down to elevation 619 ft NGVD with deed restrictions, with no changes to the SMP and no deviation from the existing moratorium. Section 404 permits under this alternative would be limited to activities occurring on the conveyance land that do not require changes to the SMP or that otherwise are located in the lake (e.g., shoreline protection features).

Following conveyance of Federal lands under this alternative, the City intends to facilitate development of these lands by conveying portions to Schuler Development (Preston Harbor Development). The development would be primarily land-based, with limited access for shoreline recreation. Although anticipated development under both Alternatives 1 and 2 is land-based, the Alternative 2 anticipated development would differ from that for Alternative 1. Additional development features anticipated under this alternative that are not contemplated under Alternative 1 include a hotel complex, an additional golf course and associated club house, expanded residential development, an inland lake, medical office space and shoreline protection. The addition of approximately 635 acres of conveyance property changes the configuration of the likely development in this alternative (Figure 2.3) from that displayed in Alternative 1 (Figure 2.2).

Direct impacts under this alternative include only those impacts associated with the conveyance of approximately 635 acres and potentially future issuance of upland Section 404 permits. No changes are proposed to the SMP and no associated permit applications are included with this alternative.

Indirect impacts associated with this alternative would include impacts resulting from development that would occur on the conveyance property and any development located on the adjacent private land that would not occur if the USACE did not convey the land, which tend to be located on and along the shared boundary of the conveyance property and the private property (i.e., golf course, hotel complex, open space and residential area).

Alternative 3 – Land Conveyance with Limited Shoreline Development

Similar to Alternative 2, this alternative would convey Federal lands down to elevation 619 ft NGVD with deed restrictions with no changes made to the SMP. However under Alternative 3, the 2005 moratorium would be lifted to allow for the development of a boat club, boat docks, and slips. The boat club, docks and slips would be privately owned and would be located in two areas zoned as limited development under the existing SMP (Figure 2.4).

Direct impacts would include impacts immediately resulting from the conveyance of approximately 635 acres of Federal land, the lifting of the 2005 moratorium, and future issuance of Section 404 permits.

Indirect impacts would include impacts resulting from the development listed under Alternative 2 above, including residential development, a hotel and conference center, golf course and associated club house, open space, inland lakes, shoreline protection, and medical offices. Additionally, indirect impacts would result from shoreline development features to include a limited number of privately-owned docks, slips, and a private boat club along the shoreline of the conveyance area (in accordance with the 1996 SMP limited development zoning designations). As shown in Figure 2.4, privately owned boat docks would be allowed in two areas along the eastern shore of Little Mineral Arm. The maximum number of docks and anticipated configuration are shown in Figure 2.4. Each of the slips in a boat dock would be owned by a different private entity. For a description of the various boat mooring structures, please refer to the glossary.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Like Alternatives 2 and 3, this alternative would convey Federal lands to elevation 619 ft NGVD with deed restrictions. Also, the 2005 moratorium would be lifted and modifications to the SMP would occur along the shoreline adjacent to the proposed conveyance land only (i.e., eastern shore of Little Mineral Arm of Lake Texoma). Under this alternative, a portion of the shoreline adjacent to the proposed conveyance lands would be rezoned as shown in Figure 2.1 to permit construction of private boat docks, boat day slips, a public boat club, and a swimming beach in appropriately zoned areas (Figure 2.5). Under this alternative, the City would retain certain parcels for development of recreational facilities such as a public park with a boat ramp and related facilities. Finally under this alternative, the USACE would issue Section 404 and Section 10 permits, where appropriate, to facilitate the proposed development.

Direct impacts assessed under this alternative include impacts immediately resulting from the Federal land conveyance, proposed changes to the SMP (as depicted in Figure 2.1), lifting of the 2005 moratorium for the conveyance area only, and permit issuance. Under this alternative, several miles of protected shoreline would be rezoned to allow for additional limited development and public recreation zoning as summarized in Table 4.1.1.

Table 4.1.1

Comparison of Existing to Proposed SMP Zoning For Proposed Conveyance Area

Allocation	Existing Zoning Miles	Proposed Miles
Limited Development	1.9	2.60
Public Recreation	0.57	3.24
Protected Shoreline	6.97	3.60
Total	**9.44**	**9.44**

Source: WESTON, 2011

Indirect impacts under this alternative would include impacts resulting from development on land as described in Alternatives 2 and 3 above, as well as development that would result from proposed changes to the SMP and activities authorized by Section 404 and Section 10 permits. Some development features anticipated on the proposed conveyance land would be identical to those described in Alternatives 2 and 3, including residential development, a hotel and conference center, golf course and associated club house, open space, a boat club (though open to the public under this alternative), and inland lakes. Additional development proposed with Alternative 4 includes up to a 100-acre city-owned public park with a boat ramp, public use day slips in the cove adjacent to the hotel complex, privately owned slips along the eastern shore of Little Mineral Arm, 2 public boat ramps, public boat slips, and dry stack boat storage in the cove where the boat club would be located (Figure 2.5). The boat club and dry stack storage facility under this alternative would be operated as a commercial lease to the City of Denison (or its designee) and available for public rental of slips. Dry stack storage would be a large storage facility, where the general public could house their boats for a fee. Lessees would access their boats by calling ahead to the commercial establishment and having their boat pulled from storage and placed in the water in one of the day use slips. This alternative would also require dredging in the perimeter of the public park (for the boat ramp), in the boat club cove (for the boat ramps and boat slips), and along a channel in the boat club cove.

Facilities that are anticipated for development if the SMP is revised as proposed are shown in Table 4.1.2.

Table 4.1.2

Shoreline Development Associated with Proposed SMP Zoning Changes

Area of Shoreline	Zoning Designation	Shoreline Development
North — Hotel cove	Public Recreation	▪ 30 uncovered boat day slips ▪ 57 covered boat day slips ▪ Private swimming beach (above 619 ft)
Portions of shoreline between hotel cove and south to the boat club cove.	Limited Development	32 Private covered boat docks (each dock containing 19 slips)
Boat club cove	Public Recreation	▪ 9 Commercial covered boat docks (containing 19 slips each) ▪ 78 Commercial uncovered boat slips ▪ 16 day slips for use by the dry dock storage facility and ▪ 2 public boat ramps
City park	Public Recreation	1 public boat ramp and recreational facilities

4.1.3 Assumptions

Given the size (number of acres), long term development horizon, and other variables associated with the Preston Harbor Development, it is not possible to say with certainty or specificity exactly what will be developed as part of the Preston Harbor Development. To obtain the information necessary to conduct this EIS study, the USACE coordinated very closely with the City of Denison and Schuler Development to determine the type of development proposed and to identify reasonable assumptions associated with the proposed development. These areas are identified below.

As stated, assumptions have been formed through collaboration of all parties associated with this EIS, including USACE, the City of Denison, and Schuler Development (Preston Harbor Development). They are based on information known at present and information projected into the future based on market research and the development scenarios presented by the City of Denison and Schuler Development. While market conditions in the future may change some configuration or development features, the assumptions are based on a conservative estimate of conditions that will be reasonable expected to exist in the future. Assumptions for impacts analyses include the following:

- The City of Denison estimates that the City would retain up to approximately 100-acres of the proposed conveyance land for a public park. Approximately 30 acres could be for active park uses, including a boat ramp. The remaining 70 acres would be undeveloped for passive park uses, such as unimproved walking trails or beach uses. The City Council will make the final determinations on the size and use of the park.

- Public access to property associated with private residences would not be allowed, except to the extent that hike-and-bike trails cross properties (which is proposed in certain areas). The private property boundary would be at elevation 619 ft NGVD; land exposed below elevation 619 ft NGVD would remain within the public domain.

- Non-residential shoreline use would include a hotel and conference center (and related amenities), golf courses, a boat club, the City park, and hike-and-bike trails. Public use of these areas would be permitted as follows:

    - Hotel and Conference Center (and related amenities): Hotels would include indoor and outdoor restaurants, bars/lounges, and shopping that would be open to the public. Boaters wishing to utilize the restaurants/bars/lounges/shopping would be authorized to use hotel day slips. Use of the hotel beach on private property (i.e., above elevation 619 ft NGVD) would be limited to hotel guests.

  - Golf Courses: Golf courses would be open to the public for a daily fee.

  - Boat Club: The boat club would include a boat ramp, boat slips, and dry dock storage. Use of the boat club would be open to the general public for a fee. The boat club would not include fuel sales or pump-out station services for boat waste.

  - City Park: The City park, including its boat ramp and park amenities, would be available for public use.

  - Hike-and-Bike Trails: Hike-and-bike trails would be threaded throughout the development, both on the conveyance lands and adjacent private lands. Portions of the hike-and-bike trails would be located on the shoreline, including on rights-of-way located on private property. The hike-and-bike trails would be open for public use.

  - Conveyed land may be developed with permanent habitable structures above the elevation of 645 ft NGVD. Below the elevation of 645 ft NGVD, no habitable structures would be developed, although non-habitable structures that are authorized by City of Denison zoning, pre-approved by USACE, and consistent with the flowage easement may be developed (for example, a deck/patio associated with the hotel or dry docking facilities).

- Shoreline would retain at least 50% (net) of the current tree population. Mowing would occur on these lots.

- Golf courses would be irrigated with water from in-land lakes on the development, the WWTP, and reclaimed water (grey water) from the City of Denison.

- Recreational use of inland lakes would be limited to use by residents or users associated with Preston Harbor Development.

- Access to the boat docks would be by "golf cart" via paths that would not be used by vehicles (cars or trucks).

- Roadways that would be constructed on the private property, but would connect to the conveyance land, will be assessed as contiguous development under indirect impacts.

- Dredging will occur in limited areas of the Little Mineral Arm to provide adequate depths for launching, mooring, and maneuvering recreational boats. Areas anticipated for dredging would include the boat club cove and public boat ramp/park area.

- Dredged material will be hydraulically placed into temporary dewatering cells constructed on-site. Exhibit F in Appendix E, Preston Harbor Development Maps, depicts the proposed temporary cells. Dredged material, once sufficiently dried, would be removed from the cell and mixed with fine wood chips, clean soil, and organic compost for spreading on the fairway areas of the proposed golf courses. This soil mixture would either be stockpiled or taken directly to the golf course. After the removal of dried dredged material is complete, the areas of temporary cells would be re-graded.

4.2 LAND OWNERSHIP AND LAND MANAGEMENT

Existing land ownership and land management in the proposed conveyance area are described in Section 3.2. As discussed in Section 3.2.2, USACE-owned land along Lake Texoma consists of approximately 108,753 acres and includes lands managed by USACE, USFWS, the State of Oklahoma, and the State of Texas. Approximately 52,032 acres of USACE-owned lands are managed by USACE.

Whether impacts are considered beneficial or adverse is subjective; therefore, impacts to land ownership and management are not described in these terms. Expected impacts to land ownership and management under each alternative are presented below.

Alternative 1 – No Action

Alternative 1 would have no effect on land ownership or land management of USACE land. Under Alternative 1, conveyance would not occur, and the approximately 635 acres of USACE land would remain Federally owned and managed as recreation-low density land. Under Alternative 1, the adjacent land owned by Schuler Development would remain outside of the jurisdiction of the City of Denison.

Alternatives 2 through 4 – Conveyance Land with Varying Shoreline Development

Under these alternatives, approximately 635 acres of USACE land would be conveyed to the City of Denison, with the majority of the land then being transferred to Schuler Development, resulting in a minor lake-wide decrease of USACE-owned land by approximately 0.6% and a lake wide decrease of USACE-managed lands by approximately 1.2%. In addition to the conveyed land being annexed into the City of Denison, the adjacent private land owned by Schuler Development would also be brought within the City's jurisdiction.

4.3 LAND USE AND LAND USE CONTROLS

As discussed in Section 3.3, use of Federally-owned land is in accordance with zoning as designated in the Lake Texoma Master Plan, and shoreline use is in accordance with zoning specified in the 1996 SMP. Because the Master Plan and SMP are each individually subject to change based on the alternatives considered, this subsection is divided to address impacts associated with the Master Plan separately from those associated with the SMP.

During the public scoping meeting, comments and concerns received regarding Land Use and Land Use Controls included the following:

- Loss of land available for public use, including the loss of shoreline available for public use below flood pool identified as easements or beaches (e.g., "Pocket Beaches"); and
- Existing uses of Federally owned lands (e.g., quasi-public leases of Federal land).

Impacts to land-use and land-use controls expected under each alternative were evaluated to address NEPA requirements, with a focus on public scoping meeting concerns.

Whether impacts are considered beneficial or adverse is subjective to parties making use of land; therefore, impacts to land-use and land-use controls are not described in these terms.

4.3.1 Lake Texoma Shoreline Management Plan

Existing zoning for the shoreline within the proposed conveyance land is summarized in Table 3.3.2 and shown on Figure 3.3.2. Impacts to shoreline use as related to SMP zones along the conveyance area are provided below.

Alternative 1 – No Action

No impacts to the SMP shoreline use allocation adjacent to the conveyance land or lake-wide are expected under Alternative 1. The shoreline along the proposed conveyance property would remain as outlined in the 1996 SMP (see Figure 3.3.2): 81.08% protected shoreline, 13.94% limited development, and 4.98% public recreation. No development would occur along the shoreline, and no boat docks would be constructed, due to the 2005 moratorium in place on Lake Texoma.

Alternative 2 – Land Conveyance without Shoreline Development

No impacts to SMP shoreline use allocation are expected under this alternative. Under this alternative, the allocation along the immediate shoreline would continue to be governed by the

1996 SMP, as in Alternative 1, and construction of new boat docks, or slips would be restricted under the 2005 moratorium for Lake Texoma.

Alternative 3 – Land Conveyance with Limited Shoreline Development

No impacts to SMP shoreline use allocation adjacent to the conveyance land are expected under this alternative. Under this alternative, conveyance of approximately 635 acres of USACE land would occur, and shoreline development restrictions associated with the 2005 moratorium would be lifted, to allow the private floating facilities (i.e., boat slips and docks) to be constructed along the shoreline currently allocated for limited development. The locations of the proposed boat slips and docks that would be authorized under this alternative are shown on Figure 2.4. No additional changes to the shoreline would occur within the remaining areas of the conveyance property zoned as protected shoreline or public recreation.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

SMP zoning for the shoreline adjacent to the conveyance land would increase limited development areas from 1.90 miles to 2.60 miles. Changes in the SMP and lifting the 2005 moratorium would allow development of private boat docks within lands designated as limited development. Additionally, areas zoned as public recreation would substantially increase from 0.57 miles to 3.24 miles along the conveyance property. These areas would be located in the hotel cove, the boat dock cove, and in the area of the public park with a public boat ramp. Changes in the above zoning would decrease the amount of protected shoreline by approximately 48% (from 6.97 miles to 3.6 miles) Proposed shoreline use allocation changes along the proposed conveyance land under Alternative 4 are presented in Table 4.3.1. Locations of the proposed shoreline allocations are shown in Figure 2.1.

From a lake-wide perspective, proposed zoning changes under Alternative 4 would result in an increase of limited development zoning from 21.0 to 21.7 miles (+3.3%), an increase of public recreation zoning from 174.5 to 177.2 miles (+1.5%), and a decrease of protected shoreline allocation from 382.0 to 378.6 miles (-0.9%). Prohibited area zoning would remain unchanged at 7.5 miles. Accordingly, while proposed allocations along the conveyance area shoreline would undergo substantial local changes, lake-wide percentage zoning changes would be relatively minor, slightly above 3% or less for all allocation categories.

Table 4.3.1

Proposed Changes to the Conveyance Area Shoreline Allocations, Alternative 4

SMP Allocation	Proposed Miles within Conveyance Property	Proposed Percentage of Conveyance Property (%)	Change from 1996 SMP (miles)	Change from 1996 SMP (%)
Limited Development	2.60	28	+ 0.70	+ 36.8
Public Recreation	3.24	34	+ 2.67	+ 468.4
Protected Shoreline	3.60	38	- 3.37	- 48.4
Total	**9.44**	**100**	--	--

Source: WESTON, 2011

4.3.2 Lake Texoma Master Plan

As discussed in Section 3.3.2, the updated Master Plan allocates USACE lands surrounding Lake Texoma for one of four purposes: project operations, recreation - intensive use, recreation - low density use, or wildlife management. Impacts to land-use allocations designated by the Lake Texoma Master Plan are described below.

Alternative 1 – No Action

Alternative 1 would have no impact to areas allocated by the Master Plan as recreation - low density use. Under this alternative, the conveyance would not occur, and the approximate 635 acres of USACE land would remain designated as recreation - low density use land under the Lake Texoma Master Plan.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Alternatives 2, 3, and 4 would have a long-term, direct impact on the land-use above elevation 619 ft NGVD. Under these alternatives, the conveyance would occur, resulting in a loss of 635 acres of recreation — low density land, as described in and managed under the along Lake

Texoma Master Plan. This equates to a 1.6% lake-wide decrease in areas allocated as recreation — low density use by the Master Plan. Under these alternatives, the conveyance land would no longer be classified or managed in the Texoma Master Plan. The extent of continued Federal management would be limited to a flowage easement.

4.4 GEOLOGY AND SOILS

Sedimentation and bank caving along the Lake Texoma shoreline have historically posed concerns for lake managers as well as the public. As described in Section 3.4 of this EIS, much of the regional soil, including that on the proposed conveyance land, is moderately to highly erodible. Therefore, it is expected that any action that causes additional soil disturbance would increase erosion rates and associated sedimentation in Lake Texoma. The following sections describe the expected impacts associated with the geologic and soil resources of the proposed conveyance land under each alternative.

4.4.1 Geology

Under all four alternatives, appreciable or minor impacts regarding the overall topography and physiography of the proposed conveyance land are expected. There would be no appreciable topographic changes, with the exception of localized minor impacts due to leveling and grading of areas for development of roads, structures, or recreation areas. Minor, long-term topographic impacts would also occur during the excavation of retention ponds. The minor topographic impacts would be consistent between Alternatives 2, 3, and 4 (Figures 2.3, 2.4, and 2.5 respectively). Under Alternative 1, there would be no appreciable impacts to the topography of the proposed conveyance land.

Under all four alternatives, no appreciable impacts to geologic structure and stratigraphy, mineral resources, or seismicity are expected.

4.4.2 Soils – Compaction and Erosion

Soil compaction would increase with the use of heavy equipment during land clearing and development, through the placement of impervious cover, and through increased use of land area by both foot and vehicle traffic.

Soil erosion would also increase as a result of land clearing and construction during development. Erosion would increase through the use of heavy machinery during land clearing and construction on moderately to highly erodible soils and through the removal of vegetation for development.

Approximately 30 acres of the proposed conveyance land contain highly erodible soil. Highly erodible soil has a maximum potential for erosion that equals or exceeds eight times the tolerable erosion rate (defined by the USDA as the maximum annual soil loss that can occur on a particular soil while sustaining long-term agricultural productivity and replacement of soil through organic matter). The highly erodible soil within the proposed conveyance area is often correlated with steeply sloped areas. The slopes within the proposed conveyance land range from 1% to 100%, with the average slope of 13%. The steepest slopes (greater than 43%) are primarily located directly adjacent to the lake shoreline, or along stream banks. Under Alternatives 2, 3, and 4, most of the highly erodible soil is in areas proposed to be undeveloped open areas, thus reducing the likelihood of erosion of these highly-erodible soils.

Removing vegetation increases soil erosion. The root systems of the vegetation prevent the erosion of soil. By removing vegetation, the soil in sloped areas, areas exposed to wind, and areas with the potential for surface water runoff would erode without the implementation of proper best management practices (BMPs) during and after site construction. The degree in which soil is eroded depends on the slope of the area, the erosivity rating of the soil, and the protection of the soil from wind and rain. Vegetation thinning is expected to take place in approximately 50% of open areas. The removal of trees would expose a cleared area of soil to erosion and sedimentation. Erosion would be greater in areas of steep slopes, along drainages, and in areas of highly erodible soil. Biological impacts associated with vegetation thinning are discussed in Section 4.7.

A shoreline protection system is proposed as part of the Preston Harbor Development to protect the soil along the shoreline from wave action resulting from wind and boats. Soil erosion therefore would decrease along the shoreline under Alternatives 2, 3 and 4. Details regarding the shoreline protection system are provided in Section 2.

The impacts to soil resulting from proposed development with each alternative are presented in the following sections.

Alternative 1 – No Action

No impacts to soils would occur under Alternative 1 because conveyance or development would occur on the proposed conveyance property.

While not a part of the federal actions studied in this EIS, construction activities on the adjacent property have the potential to result in increased sedimentation of streams and drainages on the USACE property and Lake Texoma, and soil deposits along the USACE/private property boundary.

Alternative 2 – Land Conveyance without Shoreline Development

Under Alternative 2, approximately 50% of the 635 acres of land proposed for conveyance would be cleared of vegetation and developed. Approximately 200 acres of moderately erodible soil would be converted to impervious cover, and 100 acres would be converted to maintained landscapes. The remaining approximately 300 acres would be designated as open area. Approximately 30 acres within the proposed open area are designated as highly erodible soil. It is estimated that at least 50% of the proposed open area would be cleared of trees and understory vegetation for the development of access paths and roads to create views and for private landscaping interests.

Short-term effects would result from construction activities, use of heavy machinery, and temporary clearing of vegetation. Due to the use of appropriate BMPs effects are expected to be moderate in areas of steep slopes, along drainages, and in areas of highly erodable soil. Without implementation of proper BMPs to prevent erosion in the highly erodable soils, effects would be significant. Long-term adverse effects to soils are attributed primarily to vegetation clearing and the development of impervious cover. Grass and other related ground cover are anticipated to be planted throughout the development; therefore long-term adverse effects would be minor from the lack of vegetative cover, sustained clearing in steeper sloped areas, and foot and vehicle traffic in designated open spaces. Long-term impacts due to partial vegetative clearing in the proposed open areas would create minor to moderate adverse effects to soil.

Approximately 14,473 linear feet of shoreline protection would be constructed under Alternative 2. The creation of shoreline erosion control structures would provide a long term benefit to soils and Lake Texoma due to the reduction in shoreline erosion. When assessing the impacts to geology and soils as a whole, the long-term beneficial impacts of the shoreline protection outweighs the temporary adverse impacts of disturbance activities.

Alternative 3 – Land Conveyance with Limited Shoreline Development

The impacts to soils under Alternative 3 (Figure 2.4) would be similar to those under Alternative 2. In addition to the development described under Alternative 2, nine acres of forested area on highly erodable soil would be developed for a boat club. Impacts in the short-term are expected to be moderate due to construction activities. Long-term beneficial impacts on soils would be expected from the installation of the shoreline protection system. Users of the boat club and associated boat docks would cause increased soil erosion and compaction when accessing boat docks. However, as under Alternative 2, the long-term beneficial impacts of the shoreline protection outweigh the temporary adverse impacts of disturbance activities.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

All development is expected to remain the same as under Alternative 3, but an additional 16 acres of shoreline would be developed for the construction of boat docks. Short-term impacts are expected due to construction activities from the installation of the boat docks. The boat docks would be accessed through moderately and highly erodible soils using approximately 8-foot wide pervious paths intended for foot and golf cart traffic. The potential for increased boating activity to increase wave action and contribute to increased shoreline erosion is addressed by the proposed shoreline protection in areas where such protection is proposed. Unprotected areas, however, could experience increased erosion owing to boat wakes. As under Alternative 3, the long-term beneficial impacts of the shoreline protection outweigh the temporary adverse impacts of disturbance activities.

Mitigation

All construction activities would follow the regional guidelines for erosion control and include development of a site-specific Storm Water Pollution Prevention Plan. Mitigation measures would include, but not be limited to, minimizing erosion during construction through the use of silt fencing, erosion blankets, and the immediate planting of a temporary cover crop. The shoreline protection will mitigate against erosion caused by wave and wind activity in areas where such protection is installed.

4.5 LAKE TEXOMA WATER AND FLOOD STORAGE CAPACITY

Lake Texoma water storage for purposes including hydropower, water supply, and flood control operation exists between elevations 590 ft and 640 ft NGVD, as discussed in Section 3.2.2. From elevation 617 ft to 640 ft NGVD is the flood control pool and from elevation 640 ft to 645 ft NGVD is the surcharge pool, which acts as temporary flood storage during extreme storm events (USACE, 1993). Any proposed excavation and/or fill up to 645 ft NGVD must be reviewed and approved by USACE. Depending on the alternative, proposed lakes, shoreline protection, and dredging associated with the Preston Harbor Development could affect water storage capacity in Lake Texoma and would need to be approved by USACE prior to construction. It is likely that the USACE would require measures (e.g. excavation elsewhere) to ensure that no net change in flood storage occurs with any proposed development feature.

Alternative 1 – No Action

Without the conveyance of land, development below 645 ft NGVD, or proposed shoreline protection or dredging (as would be the case with Alternative 1), there would be no impacts to water storage capacity. While not a part of the federal actions, as shown on Figure 2.2, Lakes 2 and 3, proposed in the Preston Harbor Development, also would not reside at or below 645 ft NGVD.

Alternative 2 – Land Conveyance without Shoreline Development

As seen on Figure 2.3, Lake 1, in addition to Lakes 2 and 3, and shoreline protection are proposed in the Preston Harbor Development in Alternative 2.

Lake 1 and the associated dam structure consist of approximately 403,000 cubic ft or over 9 acre-feet within the flood control and surcharge pools as shown on Figure 4.5.1. Lake Texoma has crested the Denison Dam spillway three times: once in 1957, again in 1990, and most recently in 2007. The highest recorded crest occurred in 1990 at an elevation of 645.75 ft NGVD, with an estimated flood control storage capacity of 5,087,000 acre-ft. The loss of approximately 9 acre-feet in flood control storage capacity with the installation of proposed Lake 1 would equate to less than 0.0002% of the flood control storage capacity of the 1990 flood event. Regardless, construction of this feature would require pre-approval and Section 404 permitting under the CWA by the USACE and, if approved, would likely require additional measures ensuring that no net loss of flood storage capacity occurs.

Predicted impacts on loss of water storage capacity, as a result of the proposed shoreline protection, are dependent on the materials and associated construction methods chosen. Upon full build out, the shoreline protection associated with the Preston Harbor Development would span about 15,000 ft, with an estimated vertical reach of 20 ft ranging from 615 to 635 ft NGVD, an assumed thickness of 1 ft, and a total volume of approximately 300,000 cubic ft, or almost 6.9 acre-feet. Based on the these assumptions, the addition of the proposed shoreline protection would result in a loss in seasonal conservation pool storage capacity of approximately 60,000 cubic feet, or almost 1.4 acre-feet, and a loss in flood control storage capacity of approximately 240,000 cubic feet, or over 5.5 acre-feet. Pre-approval and Section 404 permitting under the CWA by the USACE would be necessary and would likely involve measures ensuring no net loss of storage.

The purpose of the shoreline protection is to minimize erosion and soil sloughing into the lake, resulting in a benefit to the lake. Potential loss in water storage capacity as a result of the addition of shoreline protection would be outweighed by the long-term benefit of reduced shoreline erosion and sedimentation. Section 4.6.2 includes further discussion of erosion, sedimentation, and associated impacts.

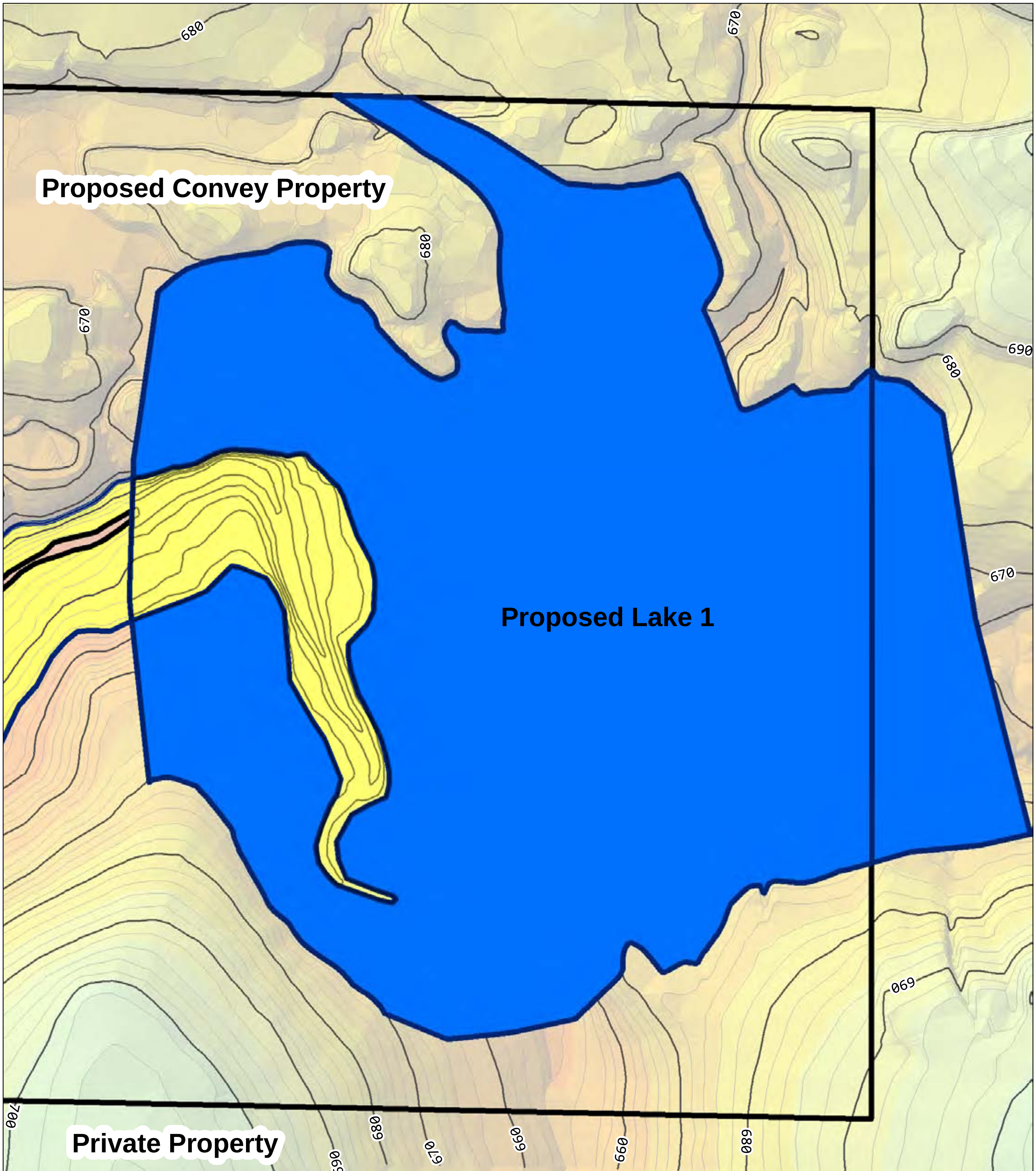
Alternative 3 – Land Conveyance with Limited Shoreline Development

In addition to the proposed lakes and shoreline protection presented in Alternative 2, the Preston Harbor Development would include dredging in Alternative 3. Dredging is expected to remove approximately 130,000 cubic yards (cy), or about 81 acre-feet, of material increasing the storage capacity of the conservation pool in the dredging area identified on Figure 2.4. A small increase in cross sectional area, relative to the cross section of the entire Little Mineral Arm, would also result from dredging. These changes are not anticipated to have an effect on hydraulic conditions in Lake Texoma or sediment transport patterns.

Though Alternative 3 would result in a net gain of approximately 115,000 cy, or about 71 acre-feet, in water storage capacity, the added capacity resulting from dredging would occur in the conservation pool whereas the losses due to the addition of lakes and shoreline protection would occur in the flood control and surcharge pools. The conservation and surcharge pools are previously defined in Section 3.2.1.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

In addition to the proposed lakes, shoreline protection, and dredging presented in Alternative 3, the Preston Harbor Development would include more dredging in Alternative 4. Dredging anticipated under this alternative is expected to remove a total of approximately 420,000 cy, or about 260 acre-feet, of material increasing the capacity of the conservation pool in the dredging areas identified on Figure 2.5. Alternative 4 would result in a net gain of approximately 405,000 cy, or about 251 acre-feet, in water storage capacity, but as discussed in Alternative 3, the gains and losses in capacity would occur in different pools (the conservation and surcharge pools, as defined in Section 3.2.1).

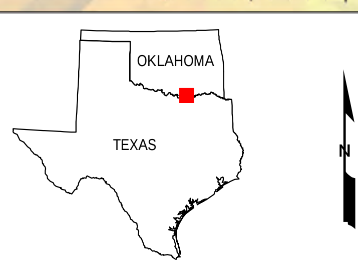


LEGEND

- Property Line
- Deed Restriction Zone (619 to 645 Elevation)
- Proposed Lake 1

SOURCE 1) BOUNDARY ELEVATION CONTOURS AND PROPOSED LAKE 1 BOUDNARY PROVIDED BY PSA ENGINEERING 2009

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT NTENDED FOR SURVEY OR ENGINEERING PURPOSES.



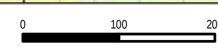


FIGURE 4.5.1
PROPOSED LAKE 1
BATHYMETRY
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
MAR 2011	03886.544.001.0004	AS SHOWN

Path: I:\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Chapter_4\Figure 4.5.1 Proposed Lake 1 Bathymetry.mxd, Date: 5/24/2011 10:52, WILDERJ

4.6 WATER QUALITY

The addition of Preston Harbor Development on the proposed conveyance land and the adjacent private land would have indirect impacts to water quality in Little Mineral Arm. The Preston Harbor Development (including proposed conveyance land and the adjacent private land) makes up approximately 19% of the Little Mineral Arm watershed, and 0.5% of the Lake Texoma Watershed. The impacts to Little Mineral Arm as result of the varying alternatives were evaluated in this section because Little Mineral Arm is the portion of the waterbody that could have the most immediate and noticeable impacts relative to the entirety of Lake Texoma.

Land disturbance activities including, but not limited to, land clearing and dredging could contribute increased sediment loads and cause temporarily increased turbidity in Little Mineral Arm during the construction activities. The development of the land also results in increased impervious cover, which increases the quantity and decreases the overall quality of stormwater runoff.

Once the project is complete, activities on the land will generate pollutant loads that could continue to contribute to Little Mineral Arm as long as the development persists. Development at Preston Harbor that could impact water quality includes residential developments, golf courses, roads, parking lots, boat club, and various other commercial and private developments. Residential development impacts could include septic systems, which historically have been shown to contribute to water degradation in Little Mineral Arm (refer to Section 3.6.2 for more information on historical septic tank issues). Other impacts associated with residential development include improper application of fertilizers and pesticides to lawns and general runoff issues associated with pet waste and improper use/disposal of hazardous household chemicals. Golf courses, as further discussed in Section 4.6.3, require frequent fertilization weekly to monthly depending on the turfs development stage in addition to frequent pesticide application to maintain healthy, disease-free, and pest-free turf suitable for golfing. Other impacts to pollutant loading that are not quantifiable are releases that occur as a result of commercial operations.

This section evaluates the impacts related to the Preston Harbor Development on the following water quality parameters: sediment (from erosive soils and stirring up in-lake sediment), nutrients, dissolved oxygen in the form of biological oxygen demand (BOD), and pesticides. This section also includes a general category for other pollutants that result from unquantifiable sources of potential hazardous materials. Because of the lake's 303(d) listing for organic enrichment and/or oxygen depletion as further discussed in Section 3.6.10, specific focus was placed on evaluating contributing factors to the 303(d) listing such as nutrient loadings and BOD. As discussed in Section 3.6.7, excess nutrients from sources such as fertilizers, and human and animal wastewater provide nitrogen and phosphorus needed for plant growth, which leads to excessive plant and microorganism (including algae) growth that then increases the demand for dissolved oxygen, and can also result in harmful algal blooms. The increased dissolved oxygen demand is measured as BOD. High BOD correlates to lower dissolved oxygen because the dissolved oxygen is being quickly utilized by the organic materials (e.g. plants and microorganisms).

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL), developed by Tetra Tech Inc for the EPA, was used to analyze the Little Mineral Arm watershed to understand existing conditions and analyze impacts under each alternative. STEPL uses the USDA NRCS (previously known as the Soil Conservation Service [SCS]), Curve Number (CN) Method as well as the Universal Soil Loss Equation (USLE) to calculate nitrogen, phosphorous, BOD, and sediment loads. Conservative assumptions were used in the STEPL analysis based on conceptual development plans discussed and shown in Section 2. The Water Quality Data, Analysis Methodology, and Analysis Results report included in Appendix F further discusses the methods, assumptions, and results associated with the STEPL analysis. The STEPL analysis incorporates locally available inputs for soil type/properties, rainfall intensity/duration, land use, and septic tank failures to estimate nutrient and BOD based on the specified land-uses.

4.6.1 Chloride Control

An analysis of impacts to chloride control was considered not applicable because sources contributing to high chloride amounts throughout the Red River Basin and associated control projects will be unaffected by the Federal actions assessed in this EIS.

4.6.2 Erosion, Turbidity, and Sedimentation

As discussed in Sections 3.4.5 and 3.6.4, soils around Little Mineral Arm are present that are highly erodible. When erosion occurs, sediment is transported downstream, increasing turbidity in the receiving water, and eventually reducing the depth of the waterbody as sedimentation occurs. Activities and modifications on proposed conveyance and adjacent private lands associated with the Preston Harbor Development such as construction, decreased vegetative cover, increased impervious cover, shoreline recreational activities, and boating contribute to erosion, which in turn increases turbidity and sedimentation. Additionally, dredging activities temporarily increase turbidity in the waterbody in which they occur.

In the short-term, construction activities that tend to disturb vegetative cover and soils would make it easier for runoff to carry sediment downstream. In the long-term, the addition of impervious cover (e.g., paved roads and concrete sidewalks) would allow runoff to flow at a higher velocity and further erode soil surfaces when contact is made if adequate controls are not provided. Recreational activities on the shoreline such as picnicking, swimming, hiking, and fishing, could create additional pedestrian traffic that would contribute to long-term shoreline erosion. Boat wakes create waves that erode the shoreline upon impact, and boating activities stir up sediment which temporarily increases turbidity. During dredging, sediments become temporarily suspended in the water at and around the dredging site causing a short-term increase in turbidity.

Wetlands act as a natural filter for sediment, reducing loads delivered to the receiving water body. No assumptions regarding the amount of wetlands that may be impacted, if any, can be made until future permit applications are received and evaluated. See Section 3.7.5 for further wetlands discussion.

Although the Preston Harbor Development would replace some existing vegetative cover with impervious cover, proposed land-uses would also consist of maintained lawns which would minimize soil loss. In addition, proposed shoreline protection would prevent shoreline erosion on the east side of Little Mineral Arm, and proposed inland lakes serve to trap sediments in runoff prior to them entering Little Mineral Arm. Both of these features would ultimately reduce turbidity and sedimentation in Little Mineral Arm. The inland lakes are designed to maximize the capture of run off for this purpose and to provide a partial source of irrigation water for the golf courses.

Erosion, turbidity, and sedimentation impacts applicable to each alternative are discussed in the designated sections to follow. The STEPL spreadsheet was used to roughly estimate soil loss. It should be noted that STEPL does not consider erosion or soil losses as a result of stream bank erosion or losses during construction and land clearing activities. It projects long-term soil losses as a result of land-use, soil type, and precipitation. In all four alternatives, STEPL results show minor sediment load increases (3% to 6%) in the Little Mineral Arm watershed when compared to existing conditions as summarized in Table 4.6.1. When Alternatives 2, 3, and 4 are compared to Alternative 1, the increases in sediment load are even smaller (2% to 3%). Increases observed are solely a result of the Preston Harbor Development as other land within the Little Mineral Arm watershed remained constant throughout all analysis scenarios.

Table 4.6.1

Little Mineral Arm Sediment Load Summary

Model Scenario	Sediment Load (lb/yr)	Percent Change from Existing Conditions	Percent Change from Alternative 1
Existing Conditions	4,325,085.8	N/A	N/A
Alternative 1	4,468,920.6	+ 3.33%	N/A
Alternative 2	4,561,309.6	+ 5.46%	+ 2.3%
Alternative 3	4,563,139.2	+ 5.50%	+ 2.4%
Alternative 4	4,576,303.2	+ 5.81%	+ 2.7%

Source: EPA, 2011g
lb/yr = pounds per year

Alternative 1 – No Action

Impacts associated with the development of the adjacent private lands are not associated with the Federal action. The conditions are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3 and 4). Under Alternative 1, short-term minor shoreline erosion, turbidity, and sedimentation in Little Mineral Arm would result from construction, while long-term, minor erosion could occur due to decreased vegetative cover and increased impervious cover associated with the Preston Harbor Development on the adjacent private property. With no conveyance of land, a vegetative buffer would exist between Preston Harbor Development and Little Mineral Arm, minimizing impacts to erosion. Additionally, the two lakes proposed within Preston Harbor Development in Alternative 1 would provide a minor, beneficial impact to sediment transport in the Little Mineral Arm.

Alternative 2 – Land Conveyance without Shoreline Development

In Alternative 2, short-term minor increases in shoreline erosion, turbidity, and sedimentation in Little Mineral Arm would result from construction. There would also be long-term minor increases in shoreline erosion, turbidity, and sedimentation in the Little Mineral Arm from decreased vegetative cover, and increased impervious cover associated with the Preston Harbor Development on the proposed conveyance land and the adjacent private property. In addition, because natural pathways from the adjacent private land through the proposed conveyance land will provide improved shoreline access, a minimal increase in recreational activity on the shoreline could result in minor sedimentation increases as well.

Shoreline protection proposed with the Preston Harbor Development in Alternative 2 would reduce shoreline erosion, turbidity, and sedimentation in Little Mineral Arm. In addition to the two inland lakes proposed in Alternative 1, a third lake is proposed. Altogether these proposed inland lakes would provide a minor reduction of turbidity in the Little Mineral Arm.

Alternative 3 – Land Conveyance with Limited Shoreline Development

In Alternative 3, impacts to shoreline erosion, turbidity, and sedimentation in Little Mineral Arm resulting from construction, decreased vegetative cover, and increased impervious cover would be very similar to those discussed in Alternative 2. In addition to the proposed natural pathways discussed in Alternative 2, increased boating resulting from the addition of boat slips and the boat club would further increase recreational activity on the shoreline and create increased wave activity in Little Mineral Arm. Dredging near the boat club would result in a moderate, short-term adverse impact to turbidity, and the activities associated with dredged material placement would result in similar impacts to those of construction activities. Alternative 3 will have the same beneficial impact resulting from the proposed shoreline protection and proposed inland lakes as discussed in Alternative 2.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

In Alternative 4, impacts to shoreline erosion, turbidity, and sedimentation in Little Mineral Arm resulting from construction, decreased vegetative cover, and increased impervious cover would be very similar to those discussed in Alternative 2. Additional increased boating as result of the development of the boat ramps, and boat docks in addition to the proposed boating facilities proposed in Alternative 3 would further increase recreational activity on the shoreline and create more waves in Little Mineral Arm. More dredging, in addition to that discussed in Alternative 3, would result in moderate temporarily increased turbidity, and the activities associated with dredged material placement would result in similar impacts to those of construction activities. Alternative 4 will provide the same benefits from the proposed shoreline protection and proposed inland lakes as discussed in Alternative 2.

Mitigation

The use of erosion and sedimentation control BMPs would be required to comply with TPDES General Permit TXR150000 for construction and dredging activities, and would include techniques such as silt fence, hay bales, rock berms, erosion control blankets, stabilized construction entrances and vehicle paths, minimized vegetation disturbance/staging of vegetation disturbances, immediate revegetation/stabilization of disturbed areas, and tree protection. Future USACE permitting for dredging activities would also require BMPs to minimize turbidity and erosion.

Alternatives 2, 3, and 4 include construction of shoreline protection on the east side of the Little Mineral Arm, which would prevent erosion. If deemed necessary, no-wake zones could be posted and enforced in the Little Mineral Arm to minimize impacts to the shoreline from boat wakes. The decision to utilize pervious, non-erodable shoreline access via pathways designed for foot traffic and small motorized vehicles such as golf carts, rather than paved roadways for cars and trucks with parking along the shore, would also minimize erosion.

The disturbance of root zones that stabilize soil within the deed restricted areas and/or are within 50 ft of the shoreline would be minimized as much as possible by deed restrictions on tree clearing. Shoreline lots with lake access would be deed restricted, as mandated by the developer to maintain at least 50% of the current number of trees. It is anticipated that this would be managed by a homeowners association, or similar entity, as well as regulated by the City. The deed restriction would allow for tree replacement to count toward the 50% tree retainage.

4.6.3 Nutrients and Biological Oxygen Demand (BOD)

As discussed in Sections 3.6.5 and 3.6.7, Lake Texoma currently suffers from high nutrient loads as a result of agricultural practices and leaking septic systems in the watershed, and high BOD, both of which ultimately contribute to the eutrophic state of the lake (USACE, 2001). Anticipated sources of elevated nutrient loads and BOD in the analyzed alternatives are fertilizers from golf courses and commercial and residential developments, and wastewater from existing leaking septic systems. The Little Mineral Arm of Lake Texoma is particularly well-known for nutrient loading from leaking septic systems.

Golf courses are fertilized frequently to maintain turf on fairways and greens, with weekly application when establishing grass and monthly applications at all other times (Duble, 2011). Commercial and residential developments use fertilizers to maintain landscaping and lawns. Residential developments use a lower frequency of fertilization than golf courses, where homeowners typically apply fertilizer 1-2 times per year (Duble, 2011). On average, less than half of homeowners choose to fertilize their lawns (BBNEP, 2011).

Nutrient transport in surface runoff is affected by rainfall or irrigation amount, intensity, and duration of rainfall or irrigation, vegetative cover, soil moisture, soil texture, slope, fertilizer application rate, and fertilizer formulation (Bell and Koh, 2011). The natural soils in Preston Harbor Development have low infiltration rates for irrigation and stormwater runoff. Golf courses typically engineer the greens for irrigation by bringing in sandy soils and, in some cases, install infiltration systems to maintain the greens. The exact design of the golf courses was not available during this analysis, so general assumptions relating to similar golf courses were used. The frequency of irrigation is dependent on water use rate and soil type. Clay soils, for example, hold more water than sandy soils and consequently require less frequent irrigation. The depth of the root zone also influences the frequency of irrigations.

During a vegetation inventory on the proposed conveyance and adjacent private lands conducted by WESTON personnel in July 2009, it was noted that although climate conditions had been dry for an extended period of time, tributaries connecting inland lakes on the adjacent private land to Lake Texoma contained flow, which suggests that the inland lakes are spring fed (Randolph, 2011). Therefore, it is assumed in the following analysis that the proposed lakes would also have interaction with groundwater.

Wetlands act as a natural filter for nutrients, reducing loads delivered to the receiving water body. No assumptions regarding wetlands can be made until future permit applications are evaluated. See Section 3.7.5 for further wetlands discussion.

The STEPL spreadsheet was also used to estimate nutrient and BOD loads. The projected loads as a result of land-use, septic systems, and precipitation are discussed in the following sections. Table 4.6.2 summarizes the nutrient and BOD loads for existing conditions and all four alternatives. Each alternative was compared to existing conditions and Alternatives 2, 3, and 4 were compared to Alternative 1.

Table 4.6.2

Nutrient and BOD Load Summary

Scenario	Nutrient/ Sediment	Total Load (lb/yr)	Total Δ from Existing Conditions	Total Δ from Alternative 1
Existing Conditions	N	113,844.0	N/A	N/A
	P	19,107.8	N/A	N/A
	BOD	314,173.0	N/A	N/A
	Sediment	4,325,085.8	N/A	N/A
Alternative 1	N	133,200.8	+ 17.00%	N/A
	P	25,150.5	+ 31.62%	N/A
	BOD	406,348.2	+ 29.34%	N/A
	Sediment	4,468,920.6	+ 3.33%	N/A
Alternative 2	N	127,661.4	+ 12.14%	- 4.2%
	P	21,233.4	+ 11.12%	- 15.6%
	BOD	375,648.8	+ 19.57%	- 7.6%
	Sediment	4,561,309.6	+ 5.46%	+ 2.1%
Alternative 3	N	127,719.4	+ 12.19%	- 4.1%
	P	21,239.2	+ 11.15%	- 15.6%
	BOD	375,993.2	+ 19.68%	- 7.5%
	Sediment	4,563,139.2	+ 5.50%	+ 2.1%
Alternative 4	N	127,978.1	+ 12.42%	- 3.9%
	P	21,286.9	+ 11.40%	- 15.4%
	BOD	376,824.6	+ 19.94%	- 7.3%
	Sediment	4,576,303.2	+ 5.81%	+ 2.4%

Source: EPA, 2011g
Note: N = Nitrogen, P = Phosphorus, and BOD = Biological Oxygen Demand

Alternative 1 – No Action

No changes to the land-use distribution of the proposed conveyance land would occur in Alternative 1. While not a part of the Federal action, the private adjacent land would include the Preston Harbor Development as shown on Figure 2.2. In addition to the change in land-use distribution, no WWTP would be built and there would also be an extreme increase in the number of septic systems contributing to nutrient and BOD loads on the private adjacent land, in the event of septic system leaks. Two proposed inland lakes would act as reservoirs containing golf course runoff. Golf course runoff would contain irrigation water, which would be sourced from grey water provided by the City of Denison. Due to continuous nutrient loads from the golf course, the lakes would become eutrophic unless maintained appropriately. The proposed inland lakes would not be lined, increasing the potential for them to leach to shallow groundwater which discharges to Lake Texoma.

Table 4.6.2 summarizes changes to nutrient and BOD loads in the Little Mineral Arm watershed under Alternative 1. Approximately 9.2% and 3.5% of the total nitrogen load, 19.0% and 2.8% of the total phosphorous load, and 12.3% and 2.4% of the total BOD load can be attributed to the proposed septic systems and golf course in the Preston Harbor Development, respectively. With these items considered, Alternative 1 would have a significant, long-term, adverse impact on nutrients and BOD in the Little Mineral Arm watershed and receiving waters due to sources associated with the Preston Harbor Development.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Both the proposed conveyance land and the private adjacent land would include the Preston Harbor Development in Alternatives 2, 3, and 4 as shown on Figures 2.3, 2.4, and 2.5, respectively. Alternatively, there would be no increase in the number of septic systems in Alternatives 2, 3, and 4, as the proposed WWTP would provide service to the development. The WWTP plant would be permitted by the TCEQ. The TCEQ will set regulatory requirements, including discharge limits to protect receiving streams and require monitoring of treated effluent. The WWTP will not discharge into Little Mineral Arm or Lake Texoma (APAI, 2007). In addition to the two inland lakes proposed in Alternative 1, a third inland lake is proposed in Alternatives 2, 3, and 4. Altogether these proposed inland lakes would result in impacts similar to those previously identified in Alternative 1.

Table 4.6.2 summarizes changes to nutrient and BOD loads in the Little Mineral Arm watershed as a result of Alternatives 2, 3, and 4. The changes to nutrient and BOD loads are similar for Alternatives 2, 3, and 4. The overall increase is approximately 12% in total nitrogen load, 11% in total phosphorous load, and 20% in total BOD load from existing conditions. However, when compared to Alternative 1, decreases of approximately 4% in total nitrogen load, 15.5% in total phosphorous load, and 7.5% in total BOD load occur with Alternatives 2, 3, and 4. This is primarily a result of the wastewater service provided by the proposed treatment plant and the absence of septic systems that would otherwise be in place. With these items considered, the

STEPL analysis results indicate that Alternatives 2, 3, and 4 would have a minor long-term benefit on the Little Mineral Arm watershed due to the proposed wastewater treatment plant associated with the Preston Harbor Development.

Under Alternatives 3 and 4, dredging operations would result in release of nutrients from the sediments into the water at and around the dredging site. However, any increase of ambient nutrient levels would be temporary and quickly subside. The nutrients remaining in the dredged material in the temporary dewatering cells would be contained, tested, and the water treated, if necessary, before returning to the lake or nearby streams. Details of these actions would be addressed in permitting actions necessary for this activity. Dredging activities would result in minor, short-term increases in nutrients and BOD in Little Mineral Arm.

Mitigation

The Preston Harbor Development would implement a golf course management plan to incorporate fertilization practices that lead to minimization of nutrient loads from golf courses following BMPS developed by the Golf Course Superintendant Association of America (GCSAA) and Environmental Institute for Golf.

4.6.4 Pesticides

As discussed in Section 3.6.6, Pesticide and Herbicide Runoff, the term pesticide includes herbicides, insecticides, and fungicides. All proposed alternatives include golf course development within Preston Harbor Development.

Alternative 1 – No Action

While not a part of the federal action, development of a 177-acre golf course on the southern portion of the Preston Harbor Development on the adjacent private land, without infringement onto the shoreline, would be constructed in the No Action Alternative. Development of the golf course on the private land would have no appreciable effect to water quality resulting from pesticides in runoff (from both stormwater and irrigation water) since the golf course does not directly border Lake Texoma. Runoff from the golf course will either be directed to the proposed inland lakes or will be filtered through existing shoreline buffer lands provided by the adjacent private property. The proposed septic systems which increased nutrient loadings and BOD (as discussed in previous sections) are expected to have no impact on pesticide loading.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Alternatives 2, 3, and 4 include two golf courses totaling 363 acres distributed across the proposed conveyance and adjacent private lands. Approximately 93 acres of golf course are on the conveyance land. Pesticides (including insecticides, herbicides, and fungicides) are applied to golf courses at higher concentrations per acre than most other types of land, including farmland. Pesticide risks from golf course management are similar to those described in Section 4.5.3. Proper application of pesticides and proper pesticide choice can reduce the risk to the environment. Though impacts are not quantifiable owing to uncertainties regarding specific pesticides, application rates, and other factors, Alternatives 2, 3, and 4 are assumed to have a minor, adverse impact to water quality resulting from pesticides in runoff (from both stormwater and irrigation water), since there are two golf courses and portions of the golf courses directly bordering Lake Texoma.

Mitigation

Schuler Development has indicated that the golf course will utilize an Integrated Pest Management (IPM) Plan to develop the most efficient strategies to handle pesticide and herbicide use, but there are no regulations that specifically require an IPM Plan. The GCSAA has funded the Environmental Institute for Golf to develop guidance documents for golf course superintendents to use to develop an IPM Plan that fits the needs of their golf course. The Preston Harbor Development would implement a golf course management plan that would include an IPM Plan.

4.6.5 Other Water Quality Pollutants

As discussed in Section 4.13, Alternatives 1, 2, 3, and 4 could contain facilities such as gas station/convenience stores, restaurants, grocery stores, fast food shops, home improvement stores, sports shops, dry cleaners, and various medical facilities including emergency care, dentist offices, imaging centers including X-rays, etc with the potential to generate contaminants of concern (COCs). The increased development also results in considerable increases in traffic both on land and in lake traffic that result in the need for fueling and maintenance of vehicles. Gas stations, repair shops, and dry cleaners historically pose the largest risk to the environment, including surface water and groundwater, but fast food, restaurants, and medical facilities can generate COCs in wastewater that typically affect the receiving WWTP. In Alternative 1, a centralized WWTP is not utilized, so facilities would need to treat their own wastewater and obtain a TCEQ permit as necessary.

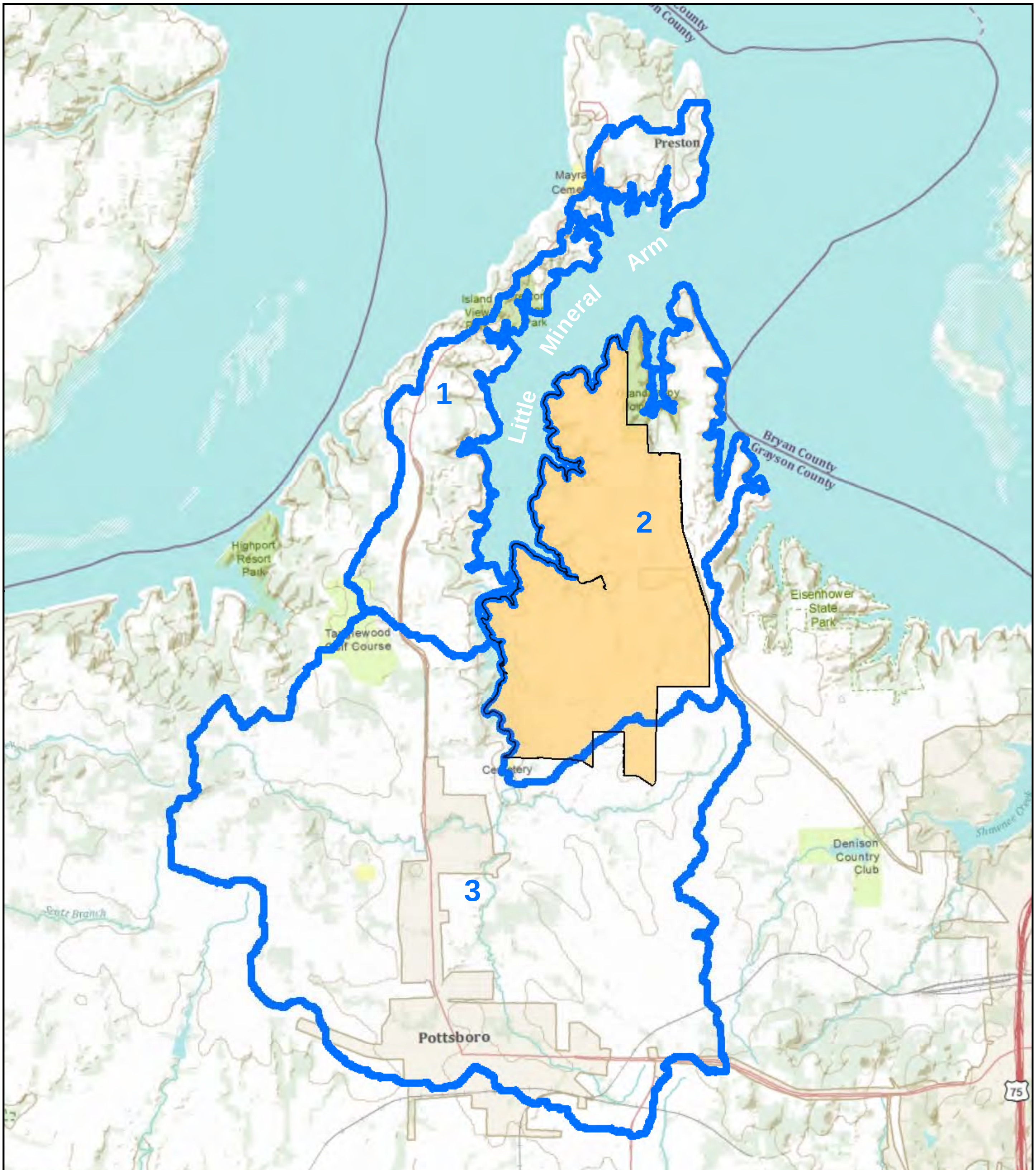
Alternatives 3 and 4, as further discussed in Section 4.11.4, would cause an increase in the number of boats on the lake. As a result, boat maintenance and fueling activities would increase within the Little Mineral Arm watershed. There would be no fueling facilities associated with development of the boat club, so refueling would mostly occur at one of the existing marinas with fueling capabilities. However, it is likely that boat operators would transport cans of fuel on land to their boat resulting in the potential for accidental fuel spills, which would not be expected to occur with any regularity. Any watercraft accidents that cause fuel or oil leaks would directly impact the lake water.

Additionally, the boat club and individual boat users may use herbicides, solvents, antifouling coatings, or other hazardous substances that could be occasionally released into Little Mineral Arm. Furthermore, sewage wastes from boats, even though rules prohibit direct discharge of sewage waste into the lake and authorized surface storage tanks are provided, could accidentally be spilled into the lake during transfer.

Pollutant loads from developed areas such as parking lots and roofs containing harmful COCs such as oils, metals, and nutrients could discharge into Little Mineral Arm. It is commonly known that water quality degradation is a direct relation to land development, which has led to the implementation of BMPs such as water quality ponds in some areas to comply with local and federal regulations to capture and treat runoff by filtration, plant uptake or infiltration. Since water quality ponds are not required in this area at this time, it is assumed that the runoff will not be filtered or treated to remove harmful pollutants. It is also assumed that the removal of lake buffer land (non-developed shoreline), which can provide a natural filtering for stormwater runoff, increases the overall probability that generated pollutants from parking lots and development activities will directly runoff into Little Mineral Arm. As shown by the STEPL analysis, the nutrient loadings increased substantially from existing conditions as a result of increased development. This trend is expected to be similar for other pollutants as well. In this case, there is no benefit received from including the WWTP instead of septic systems on water quality (Section 4.9.3 discusses impacts resulting from wastewater collection and treatment in more detail). Alternatives 1 and 2 are considered to have minor, long-term, adverse impacts on water quality as a result of increased commercial and industrial development in the Little Mineral Arm watershed. When compared to Alternatives 1 and 2, Alternatives 3 and 4 are considered to have moderate, long-term, adverse impacts on water quality as a result of increased commercial and industrial development in the Little Mineral Arm watershed and increased boating activities as a result of the proposed development.

Mitigation

State regulations are enforced for many of the pollutants discussed in this section to prevent releases to the environment. For instance, petroleum storage tanks and associated piping and fuel dispensers must be registered through the TCEQ and must meet spill prevention and detection requirements set forth in 30 Texas Administration Code (TAC) 334.45 and 334.46. A grease trap is required for sources of grease such as restaurants and fast food and is regulated by the Texas State Department of Health Services. Dry cleaners must comply with release prevention requirements in 30 TAC 337.20 and air regulations such as 30 TAC 106.411. The operator of the boat club would actively enforce the no fuel rule to prevent fuel spills and maintain a spill kit that includes an oil absorbing boom.



LEGEND

Preston Harbor Development

1 Watershed Boundary and Identification Number

SOURCE 1) UNITED STATES GEOLOG CAL SURVEY TOPOGRAPHIC MAP OF THE CONTINENTAL U.S. PROVIDED BY ESRI ONLINE WORLD TOPOGRAPHIC MAP SERVICE
2) UNITED STATES GEOLOG CAL SURVEY NATIONAL HYDROGRAPHY DATASET CATCHMENT BOUNDARY 2011
3) BOUNDARY PROVIDED BY PSA ENGINEERING 2009

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT NTENDED FOR SURVEY OR ENGINEERING PURPOSES.

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FIGURE 4.6.1
LITTLE MINERAL ARM
WATERSHED
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JUNE 2011	03886.544.001.0004	AS SHOWN

Path: I:\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Chapter_4\Figure 4.6.1 Little Mineral Arm Watershed.mxd, Date: 6/27/2011 10:52, WILDERJ

4.7 BIOLOGICAL RESOURCES

Short- and long-term effects on vegetative communities, wildlife, and sensitive species would be expected under all alternatives as a result of potential new residential and commercial development, including development along the shoreline.

4.7.1 Vegetation

Existing vegetation in the area of the proposed Preston Harbor Development is described in detail in Section 3.7 of this EIS. Because USACE land surrounding Lake Texoma is largely forested, the impact of development occurring adjacent to the lake is of concern to natural resource agencies and some members of the public. Impacts to vegetation are expected as a result of clearing land for residential and commercial development. While limited areas of the proposed Preston Harbor Development would remain undeveloped, it is expected that an increase in human traffic in the area and the lake shoreline, along with the transfer of land to individual private property owners, would still impact most areas planned as open space through extensive vegetation thinning; though approximately 70 acres associated with the City park would remain undisturbed. Available vegetative resources within the proposed Preston Harbor Development are not unique and do not provide specific habitat for rare, threatened, or endangered species. The loss of additional native habitat would, however, contribute to the rate of overall habitat loss regionally. Additionally, habitat available on the proposed development property, specifically the proposed conveyance property, is part of a largely contiguous band of habitat surrounding Lake Texoma, and removal or alteration of the vegetation will result in habitat fragmentation. Specific impacts expected under the varying alternatives are presented in the following sections.

Alternative 1 – No Action

Under Alternative 1, conveyance would not occur, and no subsequent development would take place on the proposed conveyance property. As a result, conditions described for Alternative 1 are not associated with Federal action, but are presented here to provide a baseline for comparison to action (Alternatives 2, 3, and 4). The indirect effects on vegetation on the conveyance land resulting from the development of the adjacent private land are expected to be not appreciable and short-term.

Approximately 1,600 acres of adjacent private property would be developed with impervious cover; the remaining 800 acres would remain pervious, but be altered either through vegetation clearing for the creation of a golf course, park areas, lakes, and/or private yards. Development of the adjacent private land would result in a loss of approximately 430 acres of upland forest; 1,300 acres of native and non-native grasslands; and 12 acres of aquatic inland habitat on the private property. The remaining approximately 190 acres of forest and 340 acres of grasslands within the development are proposed as open areas. Although these areas are not expected to be developed, it is expected that 50% of the vegetation, or tall trees, would be thinned to create views, access trails and paths, and account for individual landscaping preferences. At most, less than appreciable impacts to vegetation on the proposed conveyance property could occur during construction due to sedimentation from adjacent property development or unintentional impacts from heavy machinery in the short-term. Long-term minor impacts may occur on USACE land due to potential invasive or non-native species spreading and propagating and/or residual pesticide and fertilizer runoff associated with the adjacent private property.

Alternative 2 – Land Conveyance without Shoreline Development

Under Alternative 2, approximately 635 acres of USACE land would be conveyed and developed as shown on Figure 2.3. Vegetation within the proposed development would be directly altered or thinned to develop private residences, commercial developments, roads, golf courses, inland lakes, hike and bike trails, and maintained open areas. Adverse effects on vegetation are expected to be moderate to significant as shown in Table 4.7.1 on the following page.

Table 4.7.1

Projected Loss to Vegetation Communities with Proposed Development (Alternative 2)

Proposed Development on Conveyed Land	Land Cover Classification (2008) in Acres					
	Mixed Upland Forest (Deciduous / Evergreen)	Grassland / Herbaceous	Unconsolidated Shore	Open Water	Bottomland Hardwoods	Barren / Disturbed Area
Hotel and Conference Center	50	5	0	0	0	0
Only Residential	121	15	0	0	0	0
Golf Course and Club	83	13	0	0	0	0
Proposed Lake	16	5	0	0	0	3
Utilities	1	0	0	0	0	0
Total Loss (% loss)	**271 (51%)**	**38 (57%)**	**< 1 (3%)**	**0 (0%)**	**< 1 (2%)**	**3 (76%)**
Open Space / Buffer	260	29	8	4	19	1

Source: WESTON, 2011
Note: Table shows proposed conveyance lands only.

Development of the conveyed land would include a loss of 271 acres of upland forest, 38 acres of primarily native grasslands, and less than an acre of bottomland hardwoods (described in Section 3). Because the loss of vegetative habitat under Alternative 2 includes more than 50% of the available habitat in the proposed conveyed area (Table 4.7.1), the effects of the loss of upland forest, native grasslands, would be adverse and significant on conveyed land. Development plans under this alternative include approximately 300 acres of open space, of which 260 acres are upland forest, 19 acres are bottomland hardwoods, and 29 acres are grasslands. Open space includes areas of the proposed development where buildings, roads, golf courses, and other maintained areas are not planned. Although the area is designated as open space, it can be expected that the clearing of vegetation would account for an approximately 50% loss of open space vegetation due to increased use, individual landscape preferences, and the creation of lake views. Clearings expected in open space account for an additional loss of approximately 150 acres of mature habitat. This additional loss is not accounted for in Table 4.7.1. While the overall impact on vegetation is expected to be adverse, the inclusion of open space is itself beneficial and would preserve much of the open space along the shoreline and steeply sloped areas of the proposed conveyance property. This open space would be contiguous and connect to undeveloped areas of adjacent USACE lands on both the north and south sides of the proposed development area, allowing for continuous communities of vegetation.

Under this alternative, approximately 2.7 miles of the lake shoreline from elevation 619 ft NGVD to 635 ft NGVD, encompassing approximately 19 acres, would be protected from bank caving and erosion with riprap stone protection. The construction of this protection would result in the loss of existing terrestrial and aquatic habitats due to the shore protection footprint, but is considered minimal. Most of this area is characterized as unconsolidated shoreline and is relatively void of vegetation due to operation of the lake for flood control and hydropower. Terrestrial habitat is limited to a few hardy species such as button bush, black willow, and Bermuda grass, which can withstand extreme environmental conditions. Details on how the shoreline protection system would impact aquatic communities are provided in Section 4.7.9.

Alternative 3 – Land Conveyance with Limited Shoreline Development

The impacts on vegetation expected under Alternative 3 are similar to those under Alternative 2, except that 4 additional acres of forest and 4 additional acres of grasslands would be lost due to the construction of the boat club along the shoreline. Expected vegetative acreages lost under Alternative 3 are shown on Table 4.7.2 on the following page.

Table 4.7.2

Projected Loss to Vegetation Communities with Proposed Development (Alternative 3)

Proposed Development on Conveyed Land	Land Cover Classification (2008) in Acres					
	Mixed Upland Forest (Deciduous/ Evergreen)	Grassland/ Herbaceous	Unconsolidated Shore	Open Water	Bottomland Hardwoods	Barren/ Disturbed Area
Hotel and Conference Center	50	5	0	0	0	0
Residential	121	15	0	0	0	0
Golf Course and Club	83	13	0	0	0	0
Boat Club	4	4	0	0	0	1
Proposed Lake	16	5	0	0	0	3
Utilities	1	0	0	0	0	0
Total Loss (% Loss)	**275 (52%)**	**42 (62%)**	**< 1 (3%)**	**0 (0%)**	**< 1 (2%)**	**3 (76%)**
Open Space/ Buffer	256	25	8	4	19	1

Source: WESTON, 2011
Note: Table shows proposed conveyance lands only.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

The impacts on vegetation expected under Alternative 4 are similar to those for Alternative 2, except that an additional 4 acres of forest and 4 acres of grasslands would be lost due to the construction of the boat club, and an additional 16 acres of forest would be lost in the development of the public boat ramp, associated parking area, and public park space. In addition, under Alternative 4, 41 boat houses would be constructed along the lake shoreline. The length of the pathways necessary to access these private docks is site-specific depending upon the slope of the shoreline and adjacent water depth. Design criteria for the private docks require a minimum 50 ft of pathway from shoreline to dock for boat access between the shoreward side of the facility and the shoreline. The impacts to vegetation include the development of approximately forty 8 ft-wide pathways within the open space to access the docks. The roads would be constructed with paver stones or similar and native soil, creating a pervious surface. The roads would be used for pedestrian or golf cart access. Expected losses to the vegetative communities under Alternative 4 are shown in Table 4.7.3 below.

Table 4.7.3

Projected Losses to Vegetation Communities with Proposed Development (Alternative 4)

Proposed Development on Conveyed Land	Land Cover Classification (2008) in Acres					
	Mixed Upland Forest (Deciduous / Evergreen)	**Grassland / Herbaceous**	**Unconsolidated Shore**	**Open Water**	**Bottomland Hardwoods**	**Barren / Disturbed Area**
Hotel and Conference Center	50	5	0.2	0	0	0
Residential	121	15	0	0	0	0
Golf Course and Club	83	13	0	0	0	0
Boat Club	4	4	0	0	0	1
Boat Ramp Access and Parking	21	0	0	0	0	0
Proposed Lake	16	5	0	0	0	3
Utilities	1	0	0	0	0	0
Total Loss (% Loss)	**296 (56%)**	**38 (60%)**	**< 1 (3%)**	**0 (0%)**	**< 1 (2%)**	**3 (76%)**
Open Space / Buffer	235	25	8	4	19	1

Source: WESTON, 2011
Note: Table shows proposed conveyance lands only.

Mitigation

As shown in the preceding tables, significant long-term losses of vegetative communities are associated with Alternatives 2-4. Mitigation measures may include BMPs for vegetation loss such as selective clearing in areas of development to allow for the retention of mature native tree species. Implementation of deed restrictions, home owner association, or City of Denison regulations that restrict the amount of vegetation cleared on and near private properties would contribute to a decrease in the severity of the impacts to vegetation. Re-vegetation of areas within the development, where possible, could also be implemented. Areas proposed for re-vegetation include the golf course (between tees), in medians of roadways and surrounding parking lots, in small parks throughout the development, and within the area surrounding the hotel/resort area. This re-vegetation would account for small amounts of isolated, immature, vegetative communities and may include high percentages of aesthetically desirable, but non-native species. The severity of impacts associated with vegetation clearing would be lessened by assuring that undeveloped areas are clustered together to form corridors of contiguous habitat. In addition, providing a connection between undeveloped areas within the proposed development and undeveloped areas adjacent to the proposed development would decrease the impact of the overall loss of vegetation in the proposed development area on conveyed lands. However, it is quite certain that implementation of these BMPs and avoidance measures would not fully mitigate the identified losses to vegetation and associated wildlife habitat.

Mitigation, as defined in 40 CFR 1508.20, includes many considerations other than compensating for impacts by replacing or providing substitute resources or environments. Therefore, while other forms of mitigating actions defined in section 1508.20 are discussed throughout this EIS, there is no specific duty to mitigate under NEPA; therefore, there is no requirement in this instance for purchase of additional lands to replace those conveyed. Recent guidance published by the Council on Environmental Quality (CEQ) (Memorandum for Heads of Federal Departments and Agencies, Subject: Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact, date January 14, 2011) acknowledges that NEPA itself “does not create a substantive duty on Federal agencies to mitigate adverse environmental effects.” The land conveyance is a Congressionally-mandated action without specific language or direction regarding required replacement of lost habitat or resources. Accordingly, while some avoidance and minimization measures are possible, a requirement for mitigation in the form of replacement of lost land resources and habitat is not included as part of the proposed plan.

4.7.2 Wildlife

The vegetative communities surrounding Lake Texoma provide habitat for terrestrial resident and migratory species. Under existing conditions, vegetation along the shoreline is largely undisturbed, although fragmentation exists in areas where parks and private leases extend to the lake shoreline. As described in Section 3.7 of this EIS, a wide variety of species are expected to use the proposed conveyance property for foraging or nesting throughout the year. The development of approximately 635 acres of previously undisturbed forest and grasslands would be anticipated to impact wildlife in the region. Impacts on wildlife for all four alternatives are directly related to the habitat loss described in the preceding sections.

Alternative 1 – No Action

Impacts associated with the development of the adjacent private lands are not associated with the Federal action. The conditions are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3, and 4).

Proposed developments of adjacent private lands would result in the net loss of 430 acres of upland forest habitat. This habitat currently supports a range of species, both as year-round and seasonal residents. Land-dwelling mammals are restricted to those with limited ranges due to the fragmented nature of the habitats in the region. Due to the size of the forest habitat that would be lost, and because it a relatively small part of a larger upland forest habitat that is present throughout the USACE property surrounding the lake, the adverse impact from this long-term loss of forest habitat is expected to be minor. Under this alternative, approximately 1,300 acres of grasslands would also be lost. The grassland present on the private property includes small remnants of native grassland (1,655 acres), but it is primarily previous agricultural land and current rangeland. The grasslands are not currently actively managed, and therefore provide continuous habitat for a variety of wildlife species (presented in detail in Section 3). The long-term adverse impacts of the loss of grasslands habitat based on its size, fragmentation, and available habitat within the region, is expected to be minor.

Alternative 2 – Land Conveyance Land without Shoreline Development

Direct adverse impacts to wildlife under Alternative 2 are anticipated to be significant due to the conversion of 271 acres of upland forest habitat, less than 1 acre of bottomland forest habitat, and 38 acres of grasslands habitat to residential and commercial development (Table 4.7.1). Residential and commercial land use would be expected to eliminate vegetation and wildlife from formerly forested or grassland habitat. Only species tolerant of human disturbance (e.g., deer, squirrel) would be expected to remain common in disturbed areas. Additionally, short-term significant impacts on wildlife are expected to occur during land clearing. Birds, amphibians, reptiles, invertebrates, and small mammals inhabiting the proposed development area would suffer sudden and immediate elimination of habitat. Many of these species are not equipped to move quickly to available habitat and would lose burrows and nesting sites during clearing activities. Additional potential impacts could occur as a direct result of the use of heavy machinery striking slow moving wildlife. Only wildlife species tolerant of human disturbance would be expected to remain in the limited vegetated areas of the development.

Although areas of the development are proposed as open areas, it is expected that limited clearing or thinning (approximately 50%) would occur to facilitate views, provide hiking trails and lake access, and account for individual landscape interests. Therefore, it is expected that most habitat would be altered in some way under this alternative. It is beneficial to the preservation of the aquatic/upland interface that the areas designated as open areas are adjacent to the lake. Forested areas near the shoreline would aid in preventing sediment/soil erosion, in addition to preventing pesticides, nutrient, and other materials from entering the surface water through runoff. In addition, trees and shrubs along the shoreline provide food and shelter for wildlife species in the upland/aquatic habitat interface. Trees and shrubs along the shoreline also act as corridors for wildlife that use these features to traverse from habitat in the undeveloped land to habitat in the adjacent undeveloped land on USACE property.

Clearing of vegetation in the open areas is expected to be focused on shrubs, vines, and small trees, leaving the overstory canopy of larger trees in place. This understory would likely continue to be cleared over time. As a result, the dominant plant species in the understory would shift from small trees, vines, and tall shrubs to herbaceous plants, grasses, and short shrubs. Without young trees to replace older trees as they die, it is expected that forested areas would develop into lawns in the long-term. This type of selected clearing in the open spaces would result in a long-term moderate adverse effect on wildlife species.

In the developed areas and the open spaces, species tolerant of human disturbance (such as white-tailed deer) that prefer forest edge habitats would be expected to remain in the area, while some songbirds that require forest interior habitats for successful nesting would be expected not to be present. Minor adverse impacts on other wildlife and some sensitive species would be expected.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Impacts under Alternative 3 are expected to be consistent with those under Alternative 2, except that an additional 4 acres of forest habitat and 4 acres of grasslands habitat would be lost due to the construction of the boat club along the shoreline. In addition, thirteen 19-unit covered boat docks and 78 private boat slips would be constructed. The length of the pathways necessary to access the private docks is site-specific, depending upon the slope of the shoreline and adjacent water depth. The pathways would be constructed with pavers spaced with soil and vegetation. The pathways are planned to accommodate foot traffic and golf carts and would be 8 ft wide. Design criteria for the private docks require a minimum 50 ft of pathway from shoreline to dock for boat access between the shoreward side of the facility and the shoreline. The impacts to wildlife habitat include the development of approximately nineteen 8-ft-wide pathways within the open space to access the docks. The creation of these paths would further fragment the available wildlife habitat as an addition to those impacts already discussed under Alternative 2. Additionally, the creation of the paths and boat docks would result in the clearing of additional vegetation on and near the shoreline, therefore decreasing the amount of habitat in the important upland/aquatic interface and resulting in moderate and adverse impacts to wildlife.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

The impacts on wildlife expected under Alternative 4 are similar to those for Alternative 2, except for an additional 4 acres of forest and 4 acres of grasslands lost due to the construction of the boat club, and an additional 16 acres of forest along the shoreline would be lost in the development of the public boat ramp and associated parking area and public park space. In addition, under Alternative 4, 32 private boat docks and 9 commercial boat docks would be constructed along the lake shoreline. Impacts to wildlife habitat include the development of approximately thirty-two 8-ft-wide pathways within the open space to access docks. The creation of pathways would fragment the available wildlife habitat further than those impacts presented under Alternative 2. Additionally, the creation of the paths and boat docks would result in the clearing of additional vegetation on and near the shoreline, therefore decreasing the amount of habitat in the important upland/aquatic interface. Impacts on wildlife due to the construction of private boat docks are expected to be adverse and moderate. The proposed density of the docks along the shoreline would eliminate shoreline habitat for species sensitive to human presence. In addition, the creation of the shoreline protection would alter available habitat for terrestrial wildlife. The effects of the shoreline protection system are discussed in more detail in the following sections.

Mitigation

Impacts on wildlife are a result of impacts to wildlife habitats. As shown in Tables 4.7.1-4.7.3, there are significant long-term losses to the vegetative communities or wildlife habitats associated with the alternatives involving the proposed land conveyance. Measures to reduce identified impacts on vegetative resources are discussed in Section 4.6.2 and likewise affect wildlife. However, implementation of BMPs and avoidance measures will not fully mitigate losses to vegetation and wildlife habitat. For reasons provided in Section 4.7.1, mitigation in the form of replacement of lands and associated habitat is not proposed in association with this action.

4.7.3 Waters of the United States and Regulatory Permitting

USACE regulates waters of the United States, including wetlands, under Section 404 of the CWA of 1972 and Section 10 of the Rivers and Harbors Act (RHA) of 1899. On 29 September 2010, the USACE, Tulsa District issued a JD for the proposed development area, including the proposed conveyance and the adjacent private land. Approximately 28 acres and 45,668 linear feet of jurisdictional waters of the United States were identified within the entire proposed development area. Specific findings regarding these jurisdictional features are discussed in Section 3.7.5 and in the attached report located in Appendix C.

Activities associated with the proposed development would likely require permitting under Section 404 of the CWA or Section 10 of the RHA. Specifically, placement of dredged or fill material in jurisdictional waters of the United States would require prior authorization from USACE pursuant to Section 404 of CWA, and all activities occurring within navigable waterways would require prior authorization pursuant to Section 10 of the RHA. Proposed development activities that could require permitting include, but are not limited to the following:

- Dredging within Lake Texoma in the manner proposed by the developer;
- Fill associated with the installation of shoreline protection along the banks of Lake Texoma;
- Fill associated with construction and anchorage of boat storage facilities within Lake Texoma;
- Fill associated with the construction of roads, culverts, or bridges across jurisdictional streams and water bodies located in the proposed development area; and
- Fill associated with the construction of residential and any other structures within waters of the United States.

Alternative 1 – No Action

Dredge and fill activities on the adjacent private land could require USACE authorization under Section 404. These conditions are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3, and 4).

Under this alternative, there would be no development on USACE property or lake shoreline, and no installation of shoreline protection, boat ramps, boat storage facilities, or dredging within Little Mineral Arm of Lake Texoma. Therefore, a Section 10 permit from USACE would not be required. Development of privately owned lands, shown in Figure 4.7.1, that would impact jurisdictional waters of the United States will be subject to Section 404 permitting requirements. It is anticipated that these activities could include the construction of culverts and/or bridges at roadway crossings and potential development within jurisdictional wetlands. However, due to the current planning stage, adequate detail is not yet available to identify and assess specific impacts to jurisdictional waters of the United States from the construction of roads and residential and commercial structures.

During the continued refinement of development plans, impacts to waters of the United States would be avoided to the greatest extent possible. Those impacts that cannot be avoided would be minimized during engineering and construction design. All unavoidable impacts would require USACE authorization under Section 404 prior to construction. As the specific impacts to waters of the United States are not yet determined, the final permitting strategy cannot yet be defined. Appropriate permits that may be obtained from USACE under Section 404 for anticipated impacts could include coverage under the following:

- Nationwide permits (NWPs) that regulate activities having minimal impacts. An activity is authorized under a NWP only if that activity and the permittee satisfy all NWP terms and conditions. To be in compliance, the permittee must (1) meet NWP requirements, (2) meet the USACE general and regional conditions, and (3) maintain water quality. Depending on the final development plan and activity, notification of the USACE Tulsa District may be required by the permittee. NWPs authorize a range of activities, including roadway crossings and the installation of culverts and/or bridges.

- A general permit (OK00G30015) issued by the USACE, Tulsa District for developments utilizing Low Impact Development (LID) strategies. Depending on the final development and stormwater plan, activities impacting jurisdictional waters of the United States may qualify for this general permit. To be in compliance, the permittee must (1) meet the general permit requirements, (2) meet the USACE general and regional conditions, and (3) maintain water quality. The general permitting process includes a more detailed project review and an agency public comment period.

- An individual permit could also be required for development activities. The individual permit process is typically for more complex projects and those activities with more than minimal impacts to waters of the United States. The individual permitting process involves a more robust review of proposed activities and includes a public comment period for the permit.

Impacts to waters of the United States would be mitigated through appropriate compensatory action, to be determined during the Section 404 permitting process with the USACE.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under Alternatives 2, 3, and 4, development would occur on adjacent private land and the proposed conveyance property, which includes the shoreline of Lake Texoma. All three of these alternatives would require compliance with Section 10 and Section 404 permitting with a variation of the amount of each permitted activity. For all three alternatives, approximately 2.7 miles of shoreline protection would be installed in Lake Texoma. This would constitute the placement of fill materials within a navigable waterway and require Section 10 RHA compliance under Alternatives 2, 3, and 4. In addition to the shoreline protection installed in Alternative 2, Alternative 3 would include the removal of approximately 290,000 cy of dredged material from Lake Texoma for construction of boat docks and fill associated with the anchoring of boat dock facilities. Alternative 4 includes the additional dredging of approximately 130,000 cy of material and installation of additional boat facilities. These activities would also require compliance with Section 10 RHA and Section 404 CWA permitting from USACE.

The potential impacts to waters of the U.S. for all proposed activities under Alternatives 2 and 3 are the same as those under Alternative 4, which is shown in Figure 4.7.2.

Development of the uplands area, shown in Figure 4.7.2 could also impact jurisdictional waters of the United States. Under Alternatives 2-4, appropriate permits that may be obtained from USACE under Section 404 and Section 10 for anticipated impacts would include NWPs, a general permit, or an individual permit as discussed for Alternative 1. For Alternative 2, obtaining an individual permit for fill associated with shoreline protection would also be required. Under Alternatives 3 and 4, obtaining individual permits for dredging activities, boat dock facilities and construction of the proposed lakes would also be required in addition to those already noted.

As discussed in Section 2, construction is anticipated to occur over approximately 20 years. It is expected that that as construction progresses, various Section 404 permitting will be required. Once the design is advanced for the work that will take place in the first five years of the Preston Harbor Development, the identification of specific dredge or fill activities in jurisdictional waters will be identified. At that time, Schuler Development will submit a permit application to the USACE and the USACE may supplement this EIS to the extent necessary by law and determine whether to issue, and the conditions associated with, a Section 404 or Section 10 permit, which will evaluate alternatives, impacts and mitigation for the permitted activities. All permits would be obtained prior to beginning construction activities.

4.7.4 Lake Texoma Fisheries and Aquatic Resources

A detailed discussion regarding the fishery and aquatic resources of Lake Texoma is located in Sections 3.7 and 3.11 of this EIS. Several concerns were raised during the public scoping process with respect to the potential impacts of the conveyance action and proposed development on the fishery and aquatic resources of Lake Texoma. Issues to be addressed in this section include 1) potential impacts associated with changes in aquatic habitats and fish spawning habitat with the proposed conveyance; 2) potential ecological impacts due to permitting and construction of private docks; 3) potential impacts associated with changes in fishing access and fishing opportunity due to construction of private boat docks; and 4) potential impacts on the fishery and fish spawning habitat associated with the construction of shoreline protection measures. The potential impacts associated with the change in public fishing access and opportunities due to the proposed conveyance of USACE lands are discussed under recreation in Section 4.11.8. A general discussion of these issues follows:

Potential Impacts Associated With Changes in Aquatic Habitats and Fish Spawning Habitat

The shoreline associated with the proposed conveyance land is composed of approximately 9.4 miles, or 49,843 linear ft, of undisturbed shoreline. As shown in Figure 3.7.5, much of this area contains suitable fish spawning habitat based upon water depth and protection from the wind. Dredging in these areas would result in a direct physical loss of aquatic habitats and fish spawning habitats, in addition to the potential for increased turbidity levels in the Little Mineral Arm and portions of the main body of the lake. Consequently, alternatives containing dredging would have the potential to impact the aquatic ecosystems of Lake Texoma. Potential impacts associated with lake dredging could include loss of physical habitat such as rocks, trees, and stumps, increased turbidity, decreases in primary productivity, low dissolved oxygen levels, reduced fish standing crops, and a decrease in angler harvest of sport fish species.

Impacts to aquatic resources from the construction of boat ramps and bulkheads (Alternatives 3 and 4) would occur as a result of dredging, dredged material placement and through boat traffic when the facilities are operational. Dredging and construction under Alternative 3 would impact approximately 22 acres of shallow and deep water habitat. Dredging under Alternative 4 would impact approximately 30 acres of shallow and deep water habitat.

Mechanical and hydraulic dredging has the potential to be disruptive to both the benthic environment and the water column. Benthic invertebrates, or other bottom-dwellers, may be temporarily lost as a result of dredging, but the area would most likely be re-colonized once dredging is complete. Hydraulic dredging, dredged material placement, and the in-water/near shore construction activities could also temporarily increase the level of turbidity and suspended solids, which could impact the aquatic ecosystem for a limited period. With development, existing benthic invertebrates and existing benthic communities within the proposed dredging footprints would be temporarily lost. To the extent that suitable substrate is available within the dredging footprint, re-colonization would be expected to occur relatively soon after completion of dredging activities. Any existing benthic communities within the area to be filled to elevations above the average high water line during shoreline protection construction would be permanently lost. It is anticipated that dredging for Alternative 3 would result in the temporary loss of up to 22 acres of benthic habitat and 30 acres under Alternative 4. All dredging activities would cause the destruction of non-motile benthos.

Because freshwater fish are highly mobile, they are expected to vacate the area during dredging and return following its completion. Despite their mobility, the potential exists for some freshwater fish to be suctioned into a hydraulic dredge. Pelagic fish, which live and swim in the water column, are less likely to be entrained. Dredging, dredged material placement, and in-water construction activities would increase turbidity temporarily in the dredging footprint and immediate surrounding area; however, as noted above, freshwater fish are expected to vacate the area during construction, and dredging would only be conducted during allowable windows to prevent impacts during spawning periods.

Under both Alternatives 3 and 4 that require dredging, excavation of bottom sediments would result in areas of permanent and temporary loss of habitat currently utilized as probable spawning and foraging areas. After dredging, some of the resulting substrate may provide areas for continued spawning, provided suitable structure remains. Re-colonization should also occur, and these areas would eventually return to a productive foraging area for a number of freshwater fish species. In addition, the resulting deeper, open-water areas under boat docks might provide habitat diversity and a protected habitat for prey species.

The loss of aquatic habitat due to removal of structure such as rocks, woody debris, or other materials used as habitat by aquatic organisms) would be a permanent long-term impact, while potential increases in turbidity would be considered short-term. Woody structure is critical to the ecosystem and provides structure that is used as habitat (Christensen et al., 1996). Existing structure along the 9.4 miles of shoreline, Little Mineral Creek, or in coves adjacent to the proposed land conveyance provides important fish habitat, fish spawning habitat, and nursery areas within the lake. Any removal or alteration of this habitat due to proposed development activities could impact recruitment of fishes (Christensen et al., 1996).

Expected increase in boat traffic after facilities are operational should not affect freshwater fish in the vicinity of either the boat storage and dock area or the public boat ramp due to their mobility. However, increased boat traffic and prop wash from boats could negatively impact species such as largemouth, spotted, and smallmouth bass, which spawn in shallow water around cover.

There are approximately 49,843 linear ft of undeveloped shoreline along the eastern shore of Little Mineral Arm. Under Alternatives 2, 3 and 4 (Figures 2.3, 2.4, and 2.5), approximately 2.7 miles of bank protection is proposed along the eastern shore of the lake to prevent bank caving and shoreline erosion. Rock or riprap shore protection would provide approximately 2.7 miles of aquatic habitat in the Little Mineral Arm of the lake, and would provide a long-term moderate benefit to the lake aquatic community after construction. Construction of the riprap bank protection could also improve fishing success along the eastern shoreline of Little Mineral Arm, particularly if it is placed in silted muddy areas lacking existing fish habitat. If some other form of shoreline protection is chosen for construction, the described benefits or impacts may change.

Potential Ecological Impacts Due to Permitting and Construction of Private Boat Docks

According to the 1996 SMP, and as shown in Table 3.3.2, the existing shoreline within the proposed conveyance land is zoned for limited development (1.90 miles), public recreation (0.57 miles), and protected shoreline (6.97 miles). While boat docks are normally permitted in areas zoned as limited development, no private boat docks exist along the proposed conveyance land zoned as limited development. USACE implemented a 2005 moratorium on issuance of additional dock permits in areas currently devoid of docks until the lake-wide EIS could be supplemented and address impacts associated with updating the SMP.

Lifting of the 2005 moratorium and modification of the SMP to allow private boat docks is proposed under some of the alternatives and would provide varying numbers of day slips, covered slips, and private boat docks. A breakdown of the proposed numbers and locations of boat docks for each alternative is shown in Table 4.7.4.

Table 4.7.4

Proposed Numbers and Types of Boat Docks for Each Alternative

Alternative 1 (Figure 2.2)
No additional boat docks
Alternative 2 (Figure 2.3)
No additional boat docks
Alternative 3 (Figure 2.4)
78 Private boat slips in boat club cove
13 Private boat docks (each containing 19 slips)
Alternative 4 (Figure 2.5)
32 Private 19-unit covered boat docks
78 Commercial uncovered boat slips in boat club cove
16 Slips for boats in dry dock storage
9 Commercial covered boat docks (each containing 19 slips)
57 Hotel covered boat day slips
30 Hotel uncovered boat day slips

Source: WESTON, 2011

Presently, there are 688 private boat docks, piers, and platform-type docks on Lake Texoma (USACE, 2009a). Lifting the 2005 moratorium on private boat docks and modification of the SMP to permit the number of additional boat docks could have long-term localized impacts on public access to the waters of the lake for recreational activities and fishing access.

Under existing SMP criteria, private boat docks can be constructed on 50% of the shoreline length zoned for limited development. The numbers and approximate locations of the proposed private boat docks are shown in Figures 2.4 and 2.5. To reduce user conflicts and to maintain the integrity of the natural shoreline and fisherman access to the shoreline, the proposed boat docks were spaced at intervals rather than placed in a solid continuous line.

The boat docks would be private, and access to the boat docks and walkways would be restricted. However, the public would still be able to fish around the boat docks. Since the boat docks are constructed off-shore to obtain suitable water depths and allow boat dock access to slips on the shoreward side of the dock, fishermen would still have access to the lake areas around the perimeter of the boat docks, walkways, and shoreline areas behind the boat docks. The only areas of the shoreline which would be off limits to the public would be the point of attachment of the walkway to the shore. The walkway from the point of attachment on the shore to the boat dock would present an inconvenience to fishermen in boats moving parallel to the shore, but there would be a minimal loss of boating access. Bank fishermen could still access the shoreline when the lake is below elevation 619 ft NGVD, provided they do so by boat or utilize either of the two access points at each end of the property. When the lake is above elevation 619 ft NGVD, bank fisherman would not be able to access the shoreline. Any fishing access would be restricted to boating fisherman only.

In general, numerous impacts have been attributed to boat docks in water bodies. USACE (2002) reported that floating docks blocked sunlight to the lake water column, which could limit production of phytoplankton and aquatic plants. Other noted potential impacts include spillage of boat oil and gas, littering, and debris buildup underneath docks (USACE, 2001). Garrison et. al., (2005) evaluated the effects of sunlight availability on macrophytes, macroinvertebrates, and juvenile and small non-game fishes under piers in small lakes in Wisconsin. These findings report a significant reduction in aquatic plant abundance, a shift in community composition, and a reduction in the macroinvertebrate numbers around piers. The study reported catch rates of juvenile centrarchids found around piers to be statistically lower than catch rates for control areas. The authors suggest that placement of piers and other near-shore structures may have contributed to the degradation of shallow water habitats and biological diversity.

The Minnesota Department of Natural Resources (MDNR) (2008) reported that increased lakeshore development negatively impacted water quality by increasing nutrient levels and shoreline erosion, which can contribute to increased algal blooms, aquatic plant growth, and suspended sediments (MDNR, 2008).

Lakeshore development has also been found to negatively affect the nesting success of largemouth bass. Since largemouth bass typically spawn in shallow areas along shorelines, the removal of woody structure can negatively affect nesting success two ways. Removal of woody structure increases the risk of predation and/or siltation, and secondly the high visibility of black bass nests increases their vulnerability to angling (Christensen et. al., 1996; Radomski and Goeman, 2001; Wagner et. al., 2006).

Other indirect long-term impacts attributable to boat docks include increased erosion of lands adjacent to the boat docks, and siltation in the lake resulting from increased vehicular and foot traffic and dock access roads. Construction of bulkheads associated with docking facilities or shore facilities can create loss of aquatic habitat and impact water flow patterns in coves, creating low dissolved oxygen levels and potential fish kills. The increase in boating activities associated with boat docks could result in indirect effects, including discharges of pollutants in addition to physical disruption of wetlands, benthic communities, and ecosystems due to actions associated with boat hulls, propellers, anchors, or wakes (EPA, 2001).

Positive impacts associated with boat docks include reduction of shoreline erosion as a result of attenuation of wave action and energy disruption on adjacent shorelines. Boat docks can also act as fish attractors and provide places of attachment and/or habitat for aquatic organisms (EPA, 2001). In many Oklahoma lakes, private dock owners suspend trees or artificial habitat from the boat docks and walkways to attract and hold fish. There is also numerous commercial fishing docks located on USACE lakes in conjunction with marinas operated for the sole purpose of fishing.

Boat docks also have the potential to create additional fishing opportunities and facilitate angler harvests over that which is present in Little Mineral Arm. Private boat dock owners would control the uses and activities associated with these boat docks. Consequently, boat dock owners would ultimately control the placement of any fish attracting structure(s) around individual boat docks and slips, and determine the amount and quality of additional fish habitat and success of fishing that would occur on or around boat docks.

Boat docks also provide excellent habitat for both smallmouth and largemouth bass. Carrasquero (2001) reported that both smallmouth and largemouth bass have a strong attraction to structures such as boat docks. Boat docks provide shade and cooler water temperatures during the hot summer months as well as ambush sites for predator fish such as the black bass and crappie. Howick and O’Brien (1983) found that prey species such as bluegill could locate largemouth bass in high light intensities before they could be seen by the predator. However, in low light conditions, the bass could locate the prey species before being seen. This is consistent with one of the most common methods of catching black bass, which is a pattern of fishing around boat docks. Numerous professional bass tournaments have been won using this pattern of fishing around boat docks. On Lake Fork in East Texas, areas containing boat docks were reported to provide fishing opportunities for largemouth bass.

Potential Impacts Due to Construction of Shoreline Protection Measures

Bank caving and shoreline erosion from wave action and operation of Lake Texoma flood control are occurring sporadically around the shoreline adjacent to the proposed conveyance property. Areas identified as needing shore protection measures are shown in Figures 2.3, 2.4, and 2.5. An additional component proposed for several of the alternatives includes the construction of shoreline protection features to prevent bank caving and erosion as well as reduce sedimentation in the lake. Similar features have been constructed on other USACE lakes in the Tulsa District with similar shoreline erosion problems.

There are approximately 49,843 linear ft of undeveloped shoreline along the eastern shore of Little Mineral Arm. Under Alternatives 2, 3 and 4 (Figures 2.3, 2.4, and 2.5), approximately 2.7 miles of bank protection is proposed along the eastern shore of the lake to prevent bank caving and shoreline erosion. Construction of bank protection from elevation 615 ft NGVD to 636 ft NGVD is proposed, which would encompass approximately 19 acres of shoreline. Several methods are currently approved by the USACE for shoreline bank protection, but the use of riprap is the one most commonly used in other Tulsa District USACE lakes and is likely the most cost-effective and efficient method of shoreline erosion control.

Much of the shoreline in the areas proposed for bank protection are in high energy areas and experiencing major bank caving due to wave action and operation of the lake for flood control and hydropower; additionally, most shoreline is classified as unconsolidated shoreline. Very little aquatic or terrestrial vegetation is present within these areas due to the major growing conditions associated with long periods of inundation from flooding, and desiccation during periods of drought and/or reservoir drawdowns due to hydropower operations. Consequently, much of these areas offer little in the way of habitat for aquatic or terrestrial organisms and species. With construction of the bank protection, approximately 19 acres of unconsolidated shoreline composed primarily of rock, clay, and sparse vegetation would be replaced with rock. Potential impacts resulting from the construction of the bank protection would be the physical loss of existing terrestrial and aquatic habitats due to the footprint of the shore protection, increased turbidity levels during the construction period, temporary construction impacts such as increased noise levels, and fugitive dust. Rock for the riprap would not be from the site, but would come from an established commercial quarry located away from the proposed conveyance property.

Rock substrate is a key feature for fish and other aquatic organisms. Submerged rock provides a place of attachment for periphyton and aquatic invertebrates which are an essential part of the aquatic food chain. It also provides cover and habitat for forage species such as crayfish and minnows. It acts as spawning substrate for many different fish species and as habitat for some as well. Catfish species are cavity nesters and require holes in banks or rocks to spawn successfully. Properly constructed riprap embankments are a recognized approach to shoreline stabilization in Canada and were found to greatly increase slope stability and provide additional habitat, food, and cover for a variety of fish species (Fisheries and Oceans Canada, 2010). A combination of riprap along with the planting of vegetation above or behind the riprap can provide additional habitat and benefits to the fishery.

The use of riprap is proposed for the required bank protection with the toe of the riprap to be placed down to elevation 615 ft NGVD, which is 2 ft below the top of power pool. The riprap would extend up the bank to elevation 636 ft NGVD. This rock would provide approximately 2.7 miles of aquatic habitat in the Little Mineral Arm of the lake, and would provide a long-term positive benefit to the lake aquatic community after construction. Construction of the riprap bank protection could also improve fishing success along the eastern shoreline of Little Mineral Arm, particularly if it is placed in silted muddy areas lacking existing fish habitat. If some other form of shoreline protection is chosen for construction, the described benefits or impacts may change.

The following paragraphs provide specific discussion concerning environmental consequences for each alternative with respect to the above noted issues:

Alternative 1 – No Action

Under this Alternative, there would be no change in access to the proposed conveyance lands or adjacent shoreline for fishing or other ongoing recreational pursuits. As a result, there would be no long- or short-term direct impacts on the lake fishery, fish habitat, fish spawning habitat, or public fishing opportunities under this alternative. Development would occur only on privately owned lands, and there would be no additional development on USACE property or lake shoreline. Development of the area shown in Figure 2.2 could produce short-term, indirect impacts from siltation runoff from construction sites. A detailed discussion of these impacts is provided in Section 4.6.

Alternative 2 – Land Conveyance without Shoreline Development

Some development, as shown in Figure 2.3, would occur on approximately 635 acres of proposed conveyance lands under Alternative 2. The proposed development directly impacting the lake shoreline would be the construction of shoreline bank protection. Approximately 2.7 miles of the lake shoreline from elevation 619 ft NGVD to 636 ft NGVD encompassing approximately 19 acres would be protected from bank caving and erosion with riprap stone protection. This rock would provide approximately 2.7 miles of aquatic habitat within Little Mineral Arm and should provide a long-term positive benefit to the fishery and aquatic community after construction. Construction of the riprap bank protection could improve fishing success along the shoreline, especially if it is placed in silted muddy areas lacking suitable fish habitat.

Potential impacts resulting from the construction of the bank protection would be the physical loss of existing terrestrial and aquatic habitats due to the footprint of the shore protection on 19 acres of unconsolidated shoreline, increased turbidity levels during the construction period, and short-term temporary construction impacts such as increased noise levels and fugitive dust. Implementation of the shoreline protection measures will require compliance with Section 10 of the RHA and Section 404 of the CWA, which would be obtained prior to initiation of construction. Any mitigation required for construction of these features would be determined during the USACE permitting process and implemented accordingly.

Under Alternative 2, the 2005 moratorium on boat docks would remain in place, and no new private boat docks would be permitted.

Alternative 3 – Land Conveyance with Limited Shoreline Development

With Alternative 3, development would be similar to that proposed in Alternative 2, except that the 2005 moratorium on private boat docks would be lifted to permit construction and operation of a boat club in one of the coves and in an area south of this location as shown in Figure 2.4.

The same amount (2.7 miles) of shoreline protection proposed and discussed in Alternative 2 is proposed for Alternative 3. Potential impacts resulting from the construction of the bank protection would be the physical loss of existing terrestrial and aquatic habitats due to the footprint of the shore protection. However, existing aquatic habitat would be replaced by newly-created alternate habitat provided by shoreline protection materials. Other impacts could include increased turbidity levels during the construction period, and temporary construction impacts such as increased noise levels and fugitive dust. Rock or riprap shore protection would provide approximately 2.7 miles of aquatic habitat in the Little Mineral Arm of the lake, and would provide a long-term positive benefit to the lake aquatic community after construction. Construction of the riprap bank protection could also improve fishing success along the eastern shoreline of Little Mineral Arm, particularly if it is placed in silted muddy areas lacking existing fish habitat.

Development of the boat club under this alternative would not require modification to the 1996 SMP or change the present zoning from limited development to public recreation. As shown in Table 4.7.4, boat docks to be constructed under Alternative 3 include 13 private boat docks (containing 19 slips each) and 78 private boat slips. The 7 boat docks associated with the boat club cove would cover approximately 2.0 surface acres of the cove and represent approximately 9% of the cove surface area, while all 13 boat docks would represent 0.45% of the Little Mineral Arm surface area.

A breakdown of the total lake surface area covered by boat docks under Alternative 3 is shown in Table 4.7.5. All existing boat docks, including private marinas and concessions, cover approximately 78.1 surface acres of the lake (Figure 4.7.3). With implementation of Alternative 3, an additional 4.0 acres of boat docks would be added for a total of 82.1 acres which is approximately 0.11% of the surface area of the entire lake. Based on such a small percentage, impacts of boat docks on the amount of surface area available to the public would be minimal. Alternative 3 would impact approximately 22 acres of shallow and deep water habitat.

Table 4.7.5

Total Lake Surface Area Covered by Boat Docks at Lake Texoma (Alternative 3)

Boat docks	Area (acres)
13 Private boat docks (each containing 19 slips)	3.0
78 Private slips	1.0
Subtotal	4.0
Existing marinas & concessions	53.0
Existing boat docks (688)	25.1
Total	**82.1**

Source: WESTON, 2011

The Little Mineral Arm contains approximately 881 surface acres of water and the cove containing the proposed boat club contains approximately 22 surface acres. Implementation of Alternative 3 would result in impacts to aquatic resources from the construction of the boat docks, bulkheads and associated dredging, dredged material placement, and through increased boat traffic when facilities are operational. The proposed dredging for the implementation of Alternative 3 would impact approximately 22 acres of shallow and deep water habitat. Dredging of the 22-acre cove would be required for construction, operation, and maintenance of the boat club, which would result in the temporary loss of approximately 22.0 acres of aquatic and fish spawning habitat in the cove, and the additional direct long-term loss of 6,400 linear feet of fish spawning habitat and public fishing access due to construction of bulkheads and other shoreline development features associated with operation of the boat club.

Alternative 4 – Land Conveyance with Modified Shoreline Development

Alternative 4 (Figure 2.5) is the Proposed Action and represents the projected 20-year full development scenario. Development features for Alternative 4 associated with the shoreline and lake that might impact the fishery include 1) installation of shoreline erosion features protection; 2) dredging two areas associated with the boat club cove and boat ramp; 3) lifting the 2005 moratorium and modification of the SMP to permit the following (see Table 4.7.4):

- 32 Private covered boat docks (each containing 19 slips)
- 30 Hotel uncovered boat day slips
- 57 Hotel covered boat day slips

- 9 Commercial covered boat docks (each containing 19 slips)
- 78 Commercial uncovered boat slips
- 16 Commercial boat slips for boats in dry dock storage
- 2 boat ramps in boat club cove
- Development of a public park and boat ramp
- Swimming beach at hotel conference center cove

The public park and boat ramp on the southern end of the property and two ramps in the boat club cove would be open to the general public. The facilities proposed for development at the proposed hotel/conference center cove would be open to those using the hotel facilities, including boaters that are using the hotel restaurants/bars or shopping facilities.

Impacts associated with the proposed shoreline protection would be the same as those discussed for Alternatives 2 and 3. Presently, there are 688 private boat docks, piers, and platform type docks on Lake Texoma (USACE, 2008c). Lifting the 2005 moratorium on private boat docks and modification of the SMP to permit additional boat docks would have both direct and indirect long-term impacts on public fishing access.

With Alternative 4, several new private boat docks and slips are proposed to support various development features. Under existing SMP criteria, private boat docks can be constructed on 50% of the shoreline length zoned for limited development. The maximum numbers and types of floating facilities proposed for permitting and construction under Alternative 4 are shown in Figure 4.7.3. Under existing USACE rules and criteria, the proposed floating facilities shown in Figure 4.7.3 would be the maximum allowed in this area. Lifting the 2005 moratorium on private boat docks and modification of the SMP to permit additional boat docks would both impact public fishing access. As shown in Table 4.7.6, an additional 10.8 acres of the lake surface would be covered with construction of boat docks under Alternative 4. Approximately 9.6 surface acres would be covered with new private boat docks, 0.7 acres occupied by boat docks associated with the boat club cove, and 0.5 acres covered by boat docks associated with the hotel cove. The Little Mineral Arm area occupies approximately 881 surface acres. Construction of all proposed boat docks (Table 4.7.6) under this alternative would reduce the amount of water surface area in Little Mineral Arm available for use by the general public by approximately 10.8 acres, or 1.22%. This would equate to an estimated reduction in available surface area for all of Lake Texoma of about 0.01%.

The length of the walkways necessary to access the private boat docks is site-specific, depending upon the slope of the shoreline and adjacent water depth. Design criteria for the private boat docks require a minimum 50 ft of walkway from shoreline to dock for boat access between the shoreward side of the facility and the shoreline. Since most of the private boat docks are moored some distance away from the shoreline and spaced at intervals along the shoreline, they should have minimal impacts on fishing access to the shoreline and shoreline habitat. While they would occupy space on the surface of public waters, they would not be available for access by the general public. Boating fishermen would have access to fish in the water surrounding private boat docks and walkways, but not to the boat docks or walkways themselves. Additionally, boat docks may also provide a benefit to the shoreline by reducing wave action and bank caving.

The hotel cove is approximately 11 surface acres and would be developed with a swimming beach, 57 covered boat day slips, and 30 uncovered boat day slips, occupying approximately 0.5 surface acres (Table 4.7.6). The facilities proposed for development in the 11 acre cove at the proposed hotel/conference center cove would be open to those using the hotel facilities, including boaters that are using the hotel restaurants/bars or shopping facilities. This would result in reduced access of approximately 1.2 % of the available surface area of Little Mineral Arm currently available for use by the general public. This would equate to an estimated reduced access of available surface area of approximately 0.015% for all of Lake Texoma.

Construction of the boat club would require dredging of a major cove and result in the physical loss of approximately 22 acres of aquatic habitat and limitations to 22 surface acres of public fishing access. An additional 6,412 linear feet of shoreline fish spawning habitat and fishing access would be impacted due to construction of bulkheads, day slips, boat ramp, and other shoreline development features associated with operation of the boat club.

As previously discussed, the potential impacts from dredging include loss of physical habitat such as rocks, trees, and stumps, increased turbidity, decreases in primary productivity, low dissolved oxygen levels, reduced fish standing crops, and a decrease in angler harvest of sport fish species.

Implementation of Alternative 4 would result in impacts to aquatic resources from the construction of the boat slips, boat ramps, bulkheads and associated dredging, dredged material placement, and through increased boat traffic when the facilities are operational. The proposed dredging for the implementation of Alternative 4 would impact approximately 32 acres of shallow and deep water habitat. The expected impacts from dredging are more fully discussed in Section 4.5.

A breakdown of the amount of lake surface area covered by boat docks at Lake Texoma with Alternative 4 is shown in Table 4.7.6. All existing boat docks, including private marinas and concessions, cover approximately 78.1 surface acres of the lake. With implementation of Alternative 4, an additional 10.8 acres of boat docks would be added for a total of 88.9 surface acres occupied by boat docks, or approximately 0.12% of the Lake Texoma surface area. Based on the relatively small percentage, impacts of boat docks on lake surface area available to the public would be considered minimal.

Shading of the water column has been found to impact the aquatic community. As noted in Table 4.7.6, the existing 688 private boat docks at the lake cover approximately 25.1 lake surface acres, and existing marina and concession boat docks cover an estimated 53 lake surface acres. Under Alternative 4, lake surface area covered with boat docks would increase by 11 acres. The total amount of lake surface with associated shading is estimated to be 88.9 acres, or only 0.12% of the total lake surface area. As discussed in Alternative 3, shading of the water column from boat docks has been noted to impact aquatic ecosystems in some lakes. A review of existing scientific literature found no evidence of adverse ecosystem impacts attributable to shading of the water column in Lake Texoma. Shading in some lakes has been linked to a reduction in aquatic macrophytes and population shifts in benthic macroinvertebrates. However, within the

Little Mineral Arm area, aquatic plants are scarce due to the extreme environmental conditions they must withstand as a result of major wave action and operation of the project for hydropower and flood control. Consequently, only negligible impacts would be expected to aquatic plant communities or benthic macroinvertebrates associated with aquatic vegetation as a result of any shading.

The total area of water column shading attributable to boat docks is negligible (88.9 acres) when compared to the amount of unshaded surface area of the lake (74,686 acres). Also, shading is likely to be noncontiguous, and would change in relation to daily movement of the sun. Consequently, it is unlikely that such limited shading would impact primary productivity, aquatic plant growth, or the fishery of the lake.

Table 4.7.6

Total Lake Surface Area Covered by Boat Docks at Lake Texoma (Alternative 4)

Boat Docks	Area (acres)
32 Private covered boat docks (each containing 19 slips)	9.6
78 Commercial boat club cove uncovered boat slips 16 commercial uncovered dry dock storage slips 9 Commercial covered boat docks (each containing 19 slips)	0.7
57 Hotel covered boat day slips 30 Hotel uncovered boat day slips	0.5
Subtotal	10.8
Existing Marinas & Concession boat docks	53.0
688 Existing private boat docks	25.1
Total	**88.9**

Source: WESTON, 2011

Potential positive impacts of boat docks on aquatic resources include additional areas of attachment for periphyton and aquatic organisms; these would enter into the food chain and increase primary productivity. Boat docks may also act as buffers from wind and wave action and provide additional protection to shoreline habitats.

Recently invasive zebra mussels have been discovered in Lake Texoma and the boat docks and boats stored within the boat docks could provide additional habitat (substrate for attachment) for them as well, which would be a negative for the aquatic ecosystem. However, construction and operation of the dry stacked boat storage facility would be a positive impact to the aquatic ecosystem by reducing potential places of attachment for zebra mussels relative to floating structures required to house an equivalent number of boats.

Alternative 4 also includes the construction and operation of a public boat ramp, parking area, and park, to be located at the extreme southern end of the property (Figure 2.5). Access to this area would be open to the general public and provide an additional boating and bank access point to Little Mineral Arm. Construction of this area would require dredging of sediments on approximately 10 surface acres of the lake to permit boat access to the main lake body. This would result in the physical loss of 10 acres of aquatic habitat. It is also likely that future maintenance dredging would be required to keep the ramp at an operable depth for boats. This facility would be operated by the City and provide needed public access to this portion of the lake. Bank fishermen would have access to the lake shoreline at the park most of the time. Only when the lake level elevation exceeds 619 ft NGVD would bank fisherman have no shoreline access outside the park boundary.

Mitigation

Identified impacts on fisheries and associated resources are presented below and followed by potential mitigation measures.

1. Physical loss of fish habitat could occur due to dredging and shoreline development in Alternatives 3 and 4 as defined above. Potential mitigation includes the following:
   - Implement BMPs for reducing turbidity levels from dredging for the boat ramp and boat club cove.
   - Mitigate for loss of physical aquatic and spawning habitat at the boat dock cove (22 acres) and spawning shoreline habitat, public boat ramp (10 acres) and private boat docks (11 acres) by constructing and maintaining spawning habitat in other sections of Little Mineral Arm or the adjacent cove. Habitat associated with shoreline protection features would provide some level of habitat offset for these impacts.
2. Ecological impacts on the aquatic resources of Lake Texoma due to construction of boat docks associated with Alternatives 3 and 4. Construction of private boat docks and the boat club would result in minimal ecological impacts. Mitigation measures for construction of the boat docks could include the following:
   - Implement BMPs to reduce shoreline erosion during construction of the boat docks.
   - Potentially utilize pencil anchors for all boat docks to avoid cables or stiff arms that restrict use of the areas between the shoreline and the dock.
   - Make use of multiple-slip docks to minimize dock footprint on the shoreline (as proposed).
3. Loss of fishing access and fishing opportunities due to the lifting of the 2005 USACE moratorium of boat docks and modification of the 1996 SMP to permit construction of new private boat docks and shoreline development. Mitigation measures could include the following:

- The loss of public access is difficult to avoid, but might be minimized with construction, operation, and maintenance of additional fish attracting features such as piers, jetties, or fishing boat docks.
- Mitigate the loss of shoreline access to fishermen by providing some controlled access into the conveyance area.
- Construction, operation, and maintenance of the public park, parking lot, and boat ramp would mitigate some of the lost public access for the project.
- Increases in turbidity that might occur during construction of the bank protection could be minimized by constructing during dry periods and implementing best management practices.

4. Long-term ecological impacts on lake aquatic resources resulting from construction of 2.7 miles of shoreline protection proposed with Alternatives 2, 3, and 4 would be beneficial. Any adverse ecological impacts associated with construction of the shoreline protection would be minimal and short-term. Mitigation measures for proposed dredging activities are discussed in Section 4.5.

4.7.5 Threatened and Endangered Species

Under the Endangered Species Act (ESA) of 1973 (Public Law 93-205, 87 Statute 884, 16 U.S.C.), it is unlawful for a person to take a listed animal without a permit. “Take” is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.” ESA defines “harm” as “an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.” Section 7 of the ESA requires Federal agencies to use their legal authorities to promote the conservation purposes of the ESA and to consult with the USFWS and the National Marine Fisheries Service (NMFS), as appropriate, to ensure that effects of actions they authorize, fund, or carry out would not jeopardize the continued existence of listed species.

As detailed in Section 3.7.7, six threatened and endangered species listed by the USFWS have the potential to occur at Lake Texoma. However, suitable habitat for these species is not present within the proposed conveyance land. Additionally, no endangered species are known to be present within the proposed conveyance land. Therefore, all four alternatives will have no effect on Federally listed threatened and endangered species listed for Grayson County. Though not included on the Grayson County List of threatened and endangered species, the invertebrate American burying beetle is of regional concern. Based on the American burying beetle survey (Section 3.7 and Appendix G) the Proposed Action is "not likely to adversely affect" the American burying beetle.

The USFWS reviewed threatened and endangered species determinations provided by the USACE and has provided concurrence regarding listed species and the Proposed Action: the "USFWS concurs with the USACE determination (interior least tern, piping plover, whooping crane and American burying beetle) in the 5 April 2011, Section 7 letter […] provided for the Denison land transfer." This letter provides concurrence that threatened and endangered species listed for Grayson County are not expected to be present within the proposed conveyance land and therefore no effects on threatened and endangered species are expected due to the Proposed Action Alternative. Concurrence that the proposed action is "not likely to adversely affect" the ABB was also provided by the USFWS (Appendix G).

A list of State listed threatened and endangered species for Grayson and Cooke County Texas is presented in Appendix G, along with a review of available habitat and the potential for occurrence for each State listed species. While this information is provided in this EIS, federal agency requirements for threatened and endangered species compliance is found in Section 7 of the Endangered Species Act for federally-listed species only. Similar requirements for State-listed species do not apply to federal actions.

4.7.6 Wildlife Refuges and Wildlife Management Areas

Regionally, there are two wildlife refuges along the shore of Lake Texoma. They are described in further detail in Section 3.7.9 of this EIS. These refuges are run as part of the NWR System managed by the USFWS and are part of a system of public lands and waters set aside to conserve America's fish, wildlife, and plants. Direct and indirect impacts to wildlife refuges and wildlife management areas under all four alternatives are negligible. There are no refuges or management areas on/or adjacent to the proposed conveyance land. The nearest management area is approximately 13 miles west of Little Mineral Arm. Impacts due to the proposed alternative are not expected to affect habitat, migratory behavior, and species present within the regional wildlife refuges and wildlife management areas.

4.7.7 Migratory Birds

Under the Migratory Bird Treaty Act, there is a Federal prohibition to

> *pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention […] for the protection of migratory birds […] or any part, nest, or egg of any such bird* (16 U.S.C. 703).

Because Lake Texoma is within the central flyway for migratory avian species, impacts to these species are expected due to the alternation of the habitat within the proposed conveyance land.

Direct and indirect impacts to migratory birds under the No Action Alternative, as a result of the development on the adjacent private property are expected to be adverse and minor. When compared to the No Action Alternative, the three action alternatives are also expected have minor impacts to migratory birds. No specific unique habitat for migratory birds is present within the proposed conveyance land or adjacent private property. The general loss of habitat due to the conversion of grasslands and forests to developed areas decreases available habitat for nesting and foraging for all species, including migratory species. Because Lake Texoma is located within the central flyway, the lake provides valuable habitat for waterfowl, including ducks, water birds, and geese. Development along the shoreline under Alternatives 2 through 4 would have moderate long-term adverse effects on migratory water birds. The development of shoreline protection and docks along the shore would adversely impact the habitat in the upland/ aquatic interface. In addition, increased human activities along the shoreline would prevent sensitive species from using the area for foraging or nesting.

4.7.8 Wildlife Corridors

Wildlife corridors are important for allowing species to access habitat pockets throughout their ranges. Although several large wildlife corridors within the U.S. are recognized and protected through state agreements, no corridors are present in the region of Lake Texoma. Local wildlife corridors, such as the upland forest surrounding Lake Texoma provide species with large areas to forage. When corridors such as this are fragmented by clearing of vegetation, installation of fences, and the addition of utility right-of-ways, important cover area for species is removed and the ability to roam freely between areas of the habitat is eliminated. Impacts associated with wildlife corridors are expected to be minor under all four alternatives. Regionally, there are no significant wildlife corridors that have not been fragmented throughout years of agricultural and residential development. Therefore, the wildlife corridors that would be impacted under all four alternatives are small corridors connecting fragments of habitat around the lake.

Alternative 1 – No Action

Direct and indirect impacts to wildlife corridors under Alternative 1 are negligible. While not a part of this action, the clearing of vegetation for the proposed development primarily consists of previously disturbed and fragmented habitats. Approximately 120 acres of upland forest that is connected to the large broad band of forest that surrounds much of Lake Texoma would be cleared. Because the forest within the proposed conveyance land would remain as open space, the clearing would not result in complete fragmentation of the habitat.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under Alternatives 2, 3, and 4, adverse effects on wildlife corridors are expected to be minor. The clearing that would occur for development under these alternatives would include 270 acres of upland forest that is currently connected to large broad band of forest surrounding much of Lake Texoma, effectively forming a corridor for wildlife around the lake. Although the proposed development includes open space along much of the shoreline, open space remaining farther inland would be fragmented by access roads to boat ramps, private and public docking facilities, and a boat club. Additionally, it is expected that much of the understory within the open space would be cleared. The loss of the understory fragments the wildlife corridor by eliminating cover which provides protection from predators for small species that use and travel along the wildlife corridor. Because the 300 acres of forest proposed for clearing under this alternative constitutes only a small percentage (0.3%) of the overall corridor, and because some limited vegetation would remain in place within the corridor on the proposed conveyance land, the overall effect on the wildlife corridor is expected to be minor.

4.7.9 Invasive Species

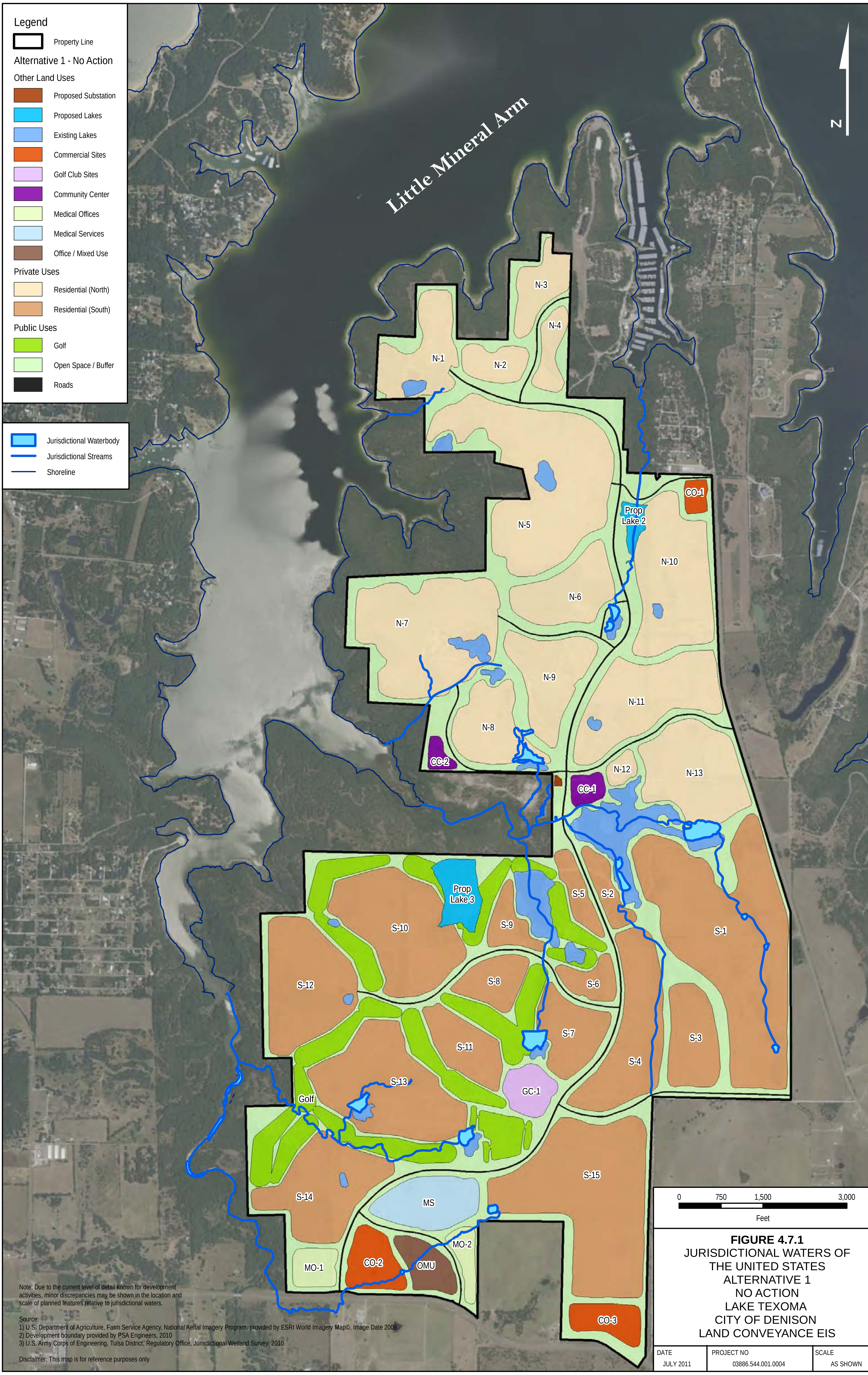
Alternative 1

While not a part of this action, the development of the adjacent private property would require clearing of vegetation that may include the removal of invasive species. Initially, this beneficial removal would reduce the rate of initial species colonization onto the proposed conveyance land (not developed under this alternative). However, long-term adverse effects could result from the intentional planting of non-native species on the adjacent property, which may colonize nearby proposed conveyance land. Additionally, many wildlife species that have adapted to developed areas are non-native, invasive, or considered nuisance species. In general, an increase in non-native and invasive wildlife species is expected with the decrease of undisturbed habitat. Impacts on aquatic invasive species would be negligible under Alternative 1.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under Alternatives 2, 3, and 4, increased development and disturbed vegetation would result in a moderate increase of non-native and invasive terrestrial plant species. The removal and/or replacement of these native species with non-natives would result in decreased pollination and/or seed stock for vegetative species, and a decrease in suitable mates and/or nesting or burrowing sites for wildlife species in the proposed conveyance land. Clearing of vegetative understory in the proposed buffer/open area would remove young native trees and over time change the make-up of the forest area from predominantly slow-growing native tree species (as mature trees die) to fast-growing tree and shrub species inclusive of non-native and invasive species. As the vegetative habitat changes, the wildlife species would change to those species adapted to the new vegetative community.

Under Alternatives 2, 3, and 4 a riprap shoreline protection system would be installed along 2.7 miles of the shoreline. As needed to install the riprap shoreline protection system, areas of the shoreline and lake bottom would be dredged. The resulting shoreline protection system would result in a change in the slope of the lake bottom near the shore. This, along with the installation of boat docks on the shoreline under Alternatives 3 and 4, would increase available habitat for some invasive aquatic species, specifically the zebra mussel. Zebra mussels attach to any flat surface and frequently colonize the submerged portions of boat docks. Educational warning signs regarding the zebra mussel are posted at access points throughout Lake Texoma. These signs provide the public with an awareness of the dangers of spread of invasive mussels and measures to help control this problem. Under Alternative 4 specifically, the impact on aquatic invasive species would be moderate and potentially contribute to an increase in zebra mussels in Lake Texoma; this has the potential to result in a significant future impact to the lake (see Section 5, Cumulative Impacts). However it should be noted that the implementation of dry stack boat storage, instead of additional boat docks, minimizes the overall introduction of suitable habitat for the zebra mussel.



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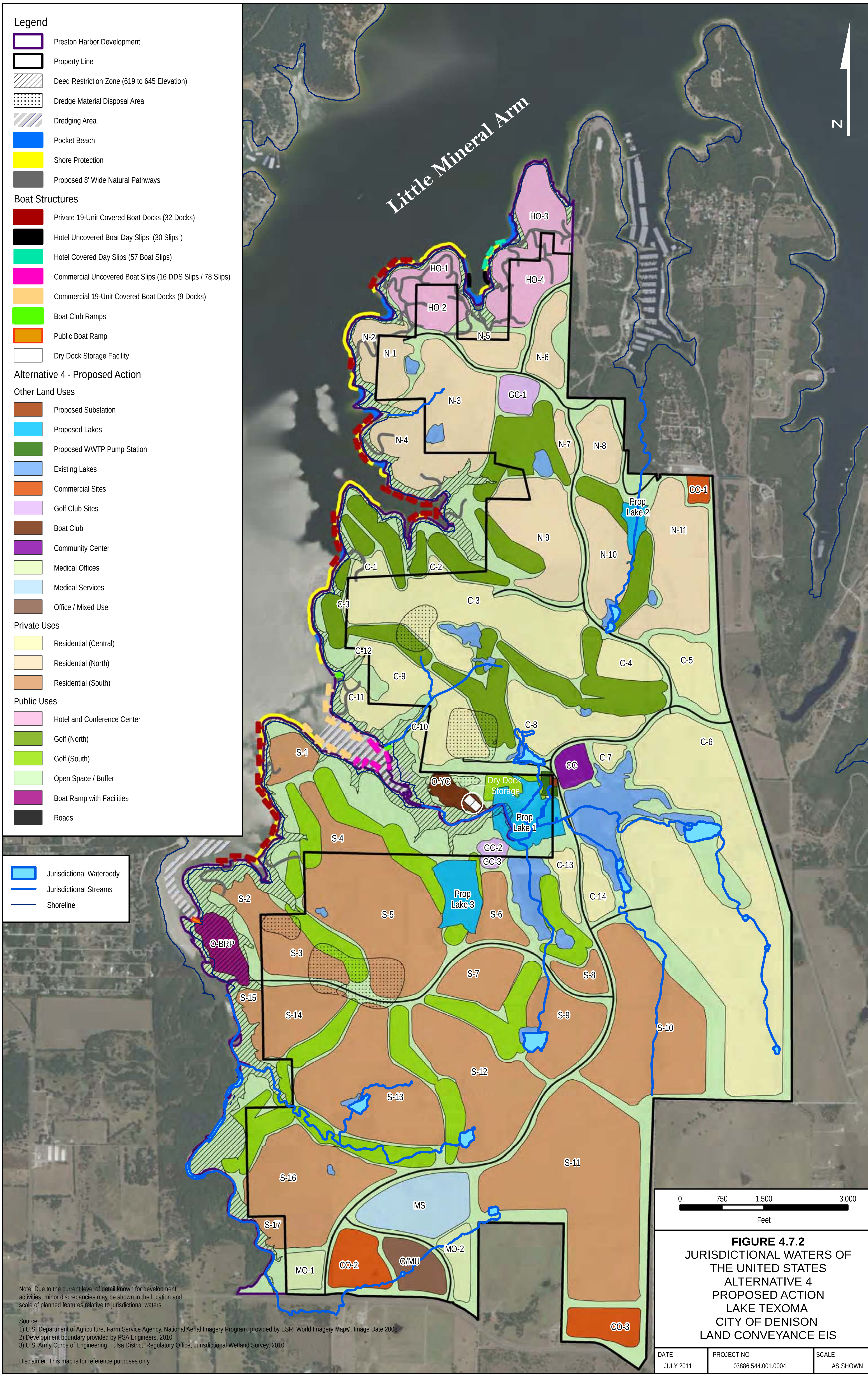

FIGURE 4.7.2
JURISDICTIONAL WATERS OF THE UNITED STATES
ALTERNATIVE 4
PROPOSED ACTION
LAKE TEXOMA
CITY OF DENISON
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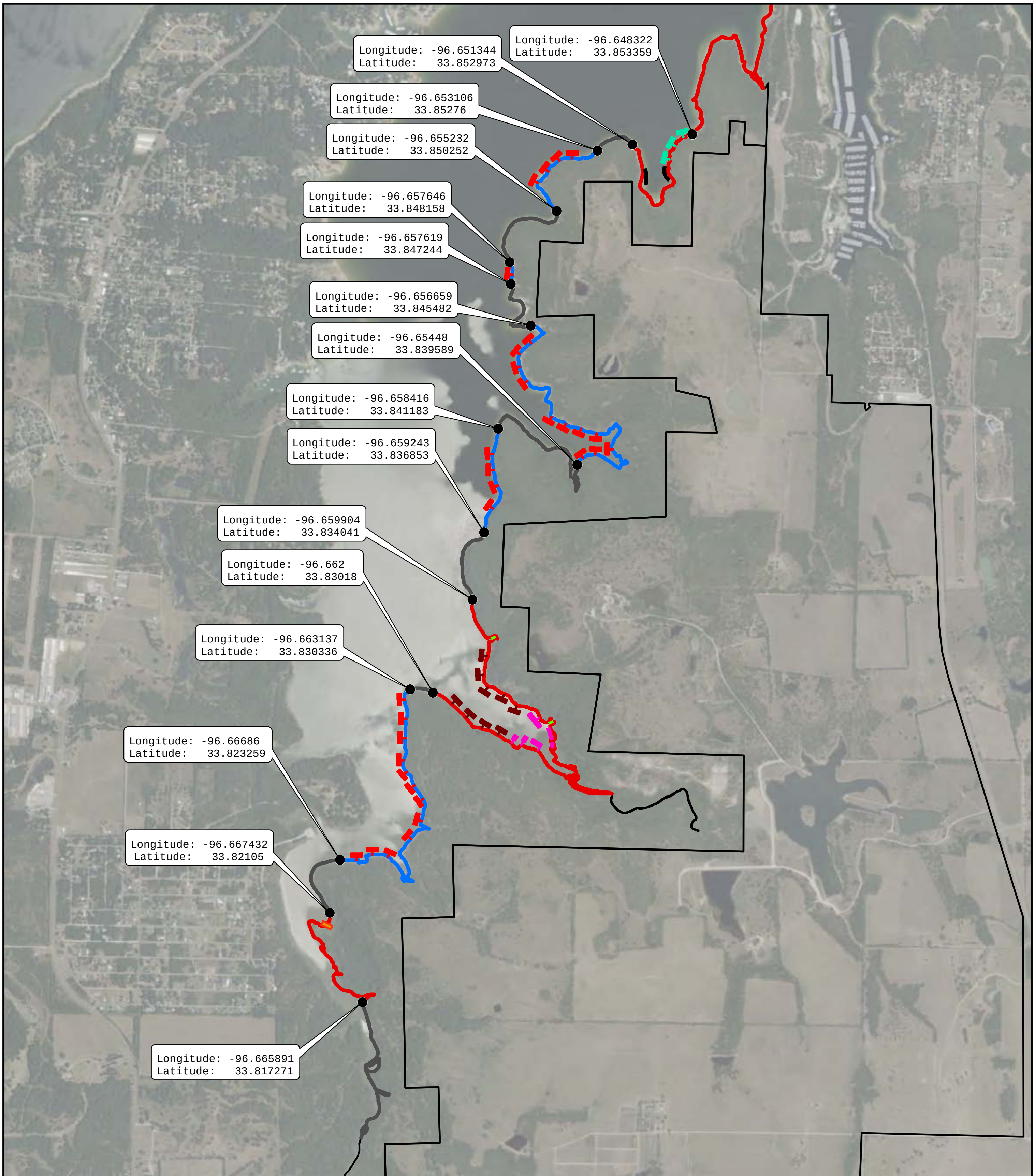

Legend

- Proposed SMP Zoning Demarcation Point
- Property Line

Proposed SMP Zoning

- Limited Development Area (13,900 lf)
- Protected Shoreline Area (8,663 lf)
- Public Recreation Area (14,376 lf)

Proposed Boat Structures

- Private 19-Unit Covered Boat Docks (32 Docks)
- Hotel Uncovered Boat Day Slips (30 Slips)
- Hotel Covered Boat Day Slips (57 Boat Slips)
- Commercial Uncovered Boat Slips (16 Dry Dock Storage Slips / 78 Slips)
- Commercial 19-Unit Covered Boat Docks (9 Docks)
- Public Boat Ramp
- Private Boat Ramp

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FIGURE 4.7.3
EAST LITTLE MINERAL ARM
PROPOSED SMP ZON NG AND
BOAT DOCK LOCATIONS
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JUNE 2011	03886.544.001.0004	AS SHOWN

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4.8 SOCIOECONOMICS

Socioeconomic analysis includes a description of a region's social and economic fiscal characteristics including demographics, employment, income, housing, education, and quality of life aspects associated with public services. As described in Section 3.8, the study area consists of two Texas counties, Cooke and Grayson. The proposed conveyance land is located entirely within Grayson County. A description of the current socioeconomic characteristics of the study area is provided in Section 3.8.

Socioeconomic impacts from the proposed alternatives were analyzed under the following assumptions:

- The majority of new housing residents would generally migrate from beyond the City of Denison and Grayson County.
- A 2000 Census figure of 2.43 people per household was used to estimate new residential population as a conservative benchmark. This 2000 Census figure for local average is below the state and national averages. The approximate average household size for Grayson County, according to 2010 Census data, is 2.55. With new residential units targeted to senior living and second homes, the actual future average household size would likely be lower.
- The southern residential development would be comprised of mostly retirement age residents (over 55). Residents of the northern and central portions of the development would likely be older than the Grayson County average, but not necessarily of retirement age. The northern, central, and southern residential development locations under each alternative are shown on Figures 2.2 through 2.5.
- Residents of the development would typically have a higher average income (possibly greater than $100,000) than the average income for Grayson County and the City of Denison. This amount is approximately two and one-half to three times the local average.
- The ethnic composition of new residents in the development is expected to be predominantly white, expanding the current white county population. Hispanic or Latino, Black or African American, and Native American ethnicities would still represent the minority population.
- The proposed development would be annexed by the City of Denison, except under Alternative 1.
- The estimated time of completion for the development is 20 years; residential construction would be completed gradually over this time.

The assumptions used in impacts analysis are considered to represent a conservative assessment based on maximum construction of the proposed development to be implemented in phases over the next 20 years. Development is proposed to begin on the south end of the property and progress to the north, dependent on the economic climate.

From a socioeconomic perspective, all four alternatives have a very similar impact scenario. The development schemes are mostly residential with varying mixes of commercial, medical, and recreational developments over the bulk of the property. Alternatives 2 and 3 are nearly identical except for some recreational boating options. The Proposed Action includes the same residential and related development mix as Alternatives 2 and 3, but with more recreational development including boating facilities, golf courses, and hotels. It also includes additional recreational opportunities through public boat ramp facilities.

Under any of the alternatives, and especially under the Proposed Action, the study area would be expected to benefit from a significant economic boost. This would result from short-term construction-related impacts as well as long-term direct and indirect economic impact resulting from increased population, employment, income, and tax revenues.

A detailed economic impact study of the proposed development, issued in 2008, concluded that the project would result in hundreds of construction and long-term jobs, billions of dollars in construction revenues, hundreds of millions of dollars in tax receipts, and possibly over $4 billion in total direct and indirect gross area product (all related economic activity) over the life of the project (Impact DataSource, 2008). This study utilized numerous economic variables such as wage, inflation rates, material and housing costs and included various assumptions such as future tax and occupancy rates in order to determine specific project-related costs and benefits over the 20 – 25 year life of the project. As stated above, the study projected significant, net positive, economic benefits over the life of the project. Any commonly used economic forecasting methods would result in similar conclusions. Consequently, from a socioeconomic impact perspective, the proposed development would result in net short-term and long-term positive benefits.

The economic variables and some of the assumptions utilized in the 2008 study are subject to change (e.g. inflation and tax rates). Some of the 2008 or earlier data have changed, particularly since the national housing "bust" and economic recession that have occurred since 2007 (NBER, 2008). Utilizing more current data for the forecasts made in the 2008 study would produce different results, but the relationships of the variables, their trends, and the conclusions of net positive economic outcomes evaluating the public costs of the project versus the anticipated public benefits would still be valid.

In spite of the net beneficial, long-term economic impact to the study area, minor, short-term negative impacts associated with growth effects on infrastructure and/or quality of life issues such as public services are possible.

4.8.1 Population

Alternative 1 – No Action

Although no development and no change in housing or population would occur on the proposed conveyance land under Alternative 1, an increase in local population would be expected from development on the adjacent private land, and therefore represent baseline conditions for evaluation of all alternatives. Approximately 7,206 dwelling units could be constructed on private lands adjacent to the proposed conveyance land. The dwelling units may include a mix of condominiums, attached townhomes or apartments, and detached single-family units. A breakdown of residential structures proposed for development on private lands is shown in Table 4.8.1. The approximate location of residential areas is shown on Figure 2.2.

As discussed in Section 3.1, population growth in the study area slowed from 2000 to 2010, with the City of Denison actually decreasing in population size. The anticipated population growth would result in the study area growing approximately 3.8% per year; however, City of Denison population is expected to remain constant, as development under Alternative 1 would not be annexed by the City.

Additionally, under Alternative 1, the WWTP would not be constructed and the development would be dependent on septic systems, as discussed in Section 4.9.3. A dependence on septic systems could decrease the proposed unit density and types.

Table 4.8.1

Residential Structures Proposed for Development on Private Lands (Alternative 1)

Residential Type	Residential Acres within Adjacent Private Property	Dwelling Units per Acre	Dwelling Units Adjacent Private Property	Approximate Number of Residents[1]
Attached Townhomes	157	9	1413	3435
Attached Townhomes/ Apartments	76	12	912	2216
Condominium	60	18	1080	2624
Single Family	1167	15	3630	8821
Total	**1460**	**NA**	**7,035**	**17,096**

[1] Based on 2.43 persons per household, as stated in the Section 3.8 assumptions

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Increases to the study area population are expected under Alternatives 2 through 4. Approximately 770 units on 136 acres would be constructed on the proposed conveyance land, potentially resulting in an increase of an additional 1,875 residents (approximation); this would bring the total direct project population increase of the total development to approximately 19,000 over 20 years. The residential structures and number of units proposed for development within the proposed conveyance land are shown in Table 4.8.2.

The anticipated population growth would result in only a 0.4% rate of increase per year for the study area when compared to the baseline. However, with annexation, Denison population growth would be approximately 4.2% per year, representing a substantial growth over the 10- to 20- year project life, and essentially doubling the population of the city. Cumulative effects of population growth are discussed in Section 5.8.

Additionally, local and study area population growth would be expected from the indirect job and economic effects associated with the project.

Table 4.8.2

Residential Structures Proposed for Development within the Proposed Conveyance Land (Alternatives 2 through 4)

Residential Type	Residential Acres within Proposed Conveyance Land	Dwelling Units per Acre	Dwelling Units within Proposed Conveyance Land	Approximate Number of Residents
Attached Townhomes	30	9	270	656
Attached Townhomes/ Apartments	3	12	36	87
Single Family	103	14	466	1132
Total	**136**	**NA**	**772**	**1876**

4.8.1.1 Age

As previously discussed in the assumptions for socioeconomic impact analysis, portions of the proposed development are expected to target retirement-aged individuals, as much as 60%-70% in the southern parcels (Schuler Development, 2011). This age composition of the anticipated development population would further contribute to the already decidedly older population of the area and Denison in particular (see Section 3.8.1). While this population typically possesses more wealth than younger ones (especially given the assumptions regarding income), they also tend to present a set of requirements or demands associated with health care/emergency response, transportation, and amenities ranging from education and leisure activities to specialized retail and other commercial services. At the same time, however, demand in such areas as school is decreased.

Many of these new residents will initially be second homeowners, and therefore, be somewhat similar to tourists in economic behavior. Over time, however, many of these seniors are likely to retire to their second homes (Schuler Development, 2011).

The further aging of the Denison/Grayson County population will do little to improve the workforce structure, as discussed in Section 3.8. However, the wealth and spending of this group has the potential to generate career and job opportunities that will help retain younger workers in the area.

4.8.1.2 Urban-Rural

Local and regional population growth would occur under each of the alternatives. All new population associated with the project site would be urban/suburban. Specifically, the Sherman-Denison MSA would experience growth, contributing further to the urbanization of the study area. Indirect population growth would most likely occur in existing urban areas, but may also occur in rural areas.

Additional growth resulting from expansion of the Dallas-Fort Worth metroplex would most likely occur and contribute to further urbanization of the area.

4.8.1.3 Ethnicity

Based on assumptions discussed previously in this Section, none of the proposed development alternatives are expected to significantly alter the ethnic composition of the study area or Grayson County. Although the residents of the proposed development are anticipated to be predominantly white at percentages similar to or greater than the current study area average, the Hispanic population is expected to continue to grow, as discussed in Section 3.8.1 (TRC, 2010) and thereby preserve or even increase minority diversity in the study area.

4.8.2 Housing

All of the proposed development alternatives would increase the housing stock of the study area and Grayson County. Alternatives 2–4 would significantly increase the housing stock of the City of Denison. Alternatives 2-4, given the specifics of the proposed development, would likely increase the median housing value for the city and county and provide or increase the housing style options in the study area, especially in Denison. These would include senior living communities and leisure/golf/recreation oriented developments (Schuler Development, 2011).

Additionally, the new housing would provide additional property tax revenues to the City of Denison under Alternatives 2-4 (Impact DataSource, 2008). The upper scale housing proposed for the development would result in proportionally greater property tax revenues for the City, Grayson County, Grayson Community College, and the Denison Independent School District. This would result in a beneficial economic impact for the specific entities.

Owner occupancy within the proposed development, however, would range (depending on development section) from a low of 15% to a high of 30% (Impact DataSource, 2008). This is substantially below the 2010 Denison and Grayson County estimates of 45% and 47%, respectively, as discussed in Section 3.8.2. A lower owner-occupancy rate is typical, however, of resort/recreational developments and, therefore, not considered as a negative consequence.

4.8.3 Employment

All of the proposed development alternatives would provide new, short-term employment opportunities associated with construction activities. These opportunities would be significantly greater under Alternatives 2-4, with the Proposed Action providing (direct effect) the greatest number of opportunities. These would result from the additional construction of hotels, recreational, commercial, and public works facilities. Estimates of construction related jobs range from about 300 direct under Alternative 1 to over 1,500 under Alternatives 2-4 (Impact DataSource, 2008) at various periods during the 20-year development life cycle. Estimated jobs associated indirectly with the development range from approximately 350 to over 1,600. These indirect jobs would stem from construction activity and worker spending.

Increases in permanent employment opportunities are also expected under all alternatives and would result from the proposed development's retail, recreational, and other related functions. The number of permanent jobs has been estimated at 565, with an additional 208 indirect, spin-off jobs. Indirect jobs in the retail and recreation sectors may be more seasonal. Most direct employment would occur with hotel operations, and most of the jobs would be created in years 6-10 of the project development (Impact DataSource, 2008).

Significant shares of the proposed development's residents are anticipated to be senior citizens or retired and to be high income households (Schuler Development, 2011). Few local jobs would be available for those still in their prime working years (typically 55-65), given the low-wage nature of local employment. Conversely, the new residents with primarily non-wage, disposable income may initiate new businesses, particularly if there is a demand for new services that are absent in the local area (e.g. specialty restaurant). At a minimum, their spending patterns would further support creation of new indirect retail and service jobs, possibly including new or expanded high-end retail and service businesses and occupations (e.g., luxury services, financial planning, fine restaurants, etc.).

4.8.4 Income

Based on the previously stated assumption that new residents would have an average income possibly greater than $100,000, increases in average income would be anticipated under all of the proposed development alternatives, especially for Alternatives 2-4. The direct increases to median household income and per capita income would stem from the anticipated higher incomes of the new residents, which would be substantially greater than current local averages. While an increase in these averages would tend to make the area more attractive from a civic marketing perspective versus its current below average wage and income levels, it could also result in wage and price inflation that would increase the local cost of living.

Additional income growth would be expected from the wages and expenditures associated with relatively short-term new construction and indirect spin-off jobs, in addition to long-term permanent direct and indirect jobs resulting from the development. Although there would be income growth, the proposed development is not likely to result in any significant direct increase in wage or salary levels, as most of the jobs could be filled by the local/regional relatively low-wage labor force. Service demands and spending by the new high income residents, however, could result in income growth for specialized trade, service, retail, or medical workers.

Finally, all of the alternatives would result in additional tax revenues to appropriate taxing districts. The City of Denison would especially benefit from tax revenues under Alternatives 2-4, where the development is annexed into the city. The revenues would derive from building and permit fees, property taxes, sales taxes, and hotel occupancy taxes.

According to the Impact DataSource economic study (2008), over a 25-year development and operation time frame for the study area, the development could generate over $25 million in sales taxes, over $916 million in property taxes, and $65 million in hotel occupancy taxes. The City of Denison could receive over $11 million in sales taxes and nearly $3 million in building and permit fees over this period that would derive from the development.

The beneficiaries of these tax revenues consist of the City of Denison (Alternatives 2-4), the Denison Independent School District, Grayson County, and Grayson Community College. According to the 2008 study, the net positive revenue from the proposed development to the various entities after allocating new and additional public service costs would amount to over $500 million over 25 years (Impact DataSource, 2008). Most of this would occur beyond year 5, suggesting that some "up front" local costs may be necessary. In the long-term, however, the additional tax revenues indicate that the proposed development would represent a good investment and a significant economic benefit.

4.8.5 Travel, Recreation, and Tourism

The proposed development, although a major tourism attraction in Denison and Little Mineral Arm, would represent a relatively minor component of the overall Lake Texoma tourism industry. As detailed in Section 4.11, Alternative 1 would not include the extensive shoreline and related recreational developments, or the hotel complexes. Alternatives 2-4 would result in direct development of more locally based recreation facilities and activity, and would serve as a draw for more seasonal and weekend tourist visitation, spending, and economic activity for such activities as boating, golfing, and hiking/biking.

The second home aspects of Alternatives 2-4 (Schuler Development, 2011), would result in more tourist-oriented recreational activities, particularly boating related with longer visitor stays throughout the year. The development, specifically the resort-type hotels with larger conference facilities described in Section 2.9, would contribute significantly to additional tourist visitations and expenditures. Conferences with recreational opportunities would potentially result in additional business dollars spent locally.

In total, Alternatives 2-4, and especially Alternative 4 which includes more public facilities, would result in a significant, beneficial economic boost to the study area tourism industry. They would also tend to reduce the seasonality of tourism activity by providing additional stay options and/or opportunities that could occur as needed throughout the year.

Some indirect impacts associated with tourism centered around development of the proposed conveyance may include additional public infrastructure/service demands during holiday periods such as Memorial Day, July 4th, and Labor Day (see discussion in Section 4.8.7 below).

4.8.6 Environmental justice

No environmental justice impacts are expected under any alternative. There are currently no concentrations of minority or low-income residents within or adjacent to the proposed development area. The nearest identified environmental justice population is a low-income neighborhood along FM 84 near its junction with US 75 (SDMPO, 2010). This area is within the City of Denison, about two miles southeast of the proposed development.

4.8.7 Quality of Life

4.8.7.1 Public Services

Alternative 1 – No Action

No residents currently occupy the proposed conveyance property, and none would occupy the proposed conveyance property under Alternative 1. Therefore, no impact to public services from the proposed conveyance land would occur under Alternative 1. The development on adjacent private lands would be expected, however, to increase demand for all public services, specifically those provided by Grayson County. Demands for safety services and medical services would also occur. These demands would stem largely from population growth associated with the private development.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

PHD would be responsible for constructing the streets, sidewalks, drainage, utilities, and other required infrastructure for the development, which has been estimated to cost at least $168 million (Impact DataSource, 2008). Following annexation, the City of Denison would incur operation and maintenance costs of these facilities at an estimated cost of over $17 million for the first 25 years of the development (Impact DataSource, 2008).

Alternatives 2 through 4 would result in an increase in demand for local public safety resources from the City of Denison Police Department, Fire Department, as well as local medical services. These alternatives would require City and other local services due to the anticipated significant population and tourism growth associated with the proposed development. As previously discussed, tax revenues from the proposed development would be available to meet the publically required investments and operational funding to ensure adequate capacities (Impact DataSource, 2008). There is, however, the potential for lag time between the initial needed funding, development of required capacities, and availability of anticipated tax revenues, most of which are not generated until after year 5 of the project.

4.8.7.2 Public Safety

Alternative 1 – No Action

Under Alternative 1, the area of proposed development would remain within Grayson County jurisdiction and would not be annexed to the City of Denison. Therefore, an increase in demand for public safety resources for the City of Denison would not be expected. No additional residents would occupy the proposed conveyance property; this is not expected to result in increased demand on the Grayson County Sheriff's Office.

Residential development on adjacent private lands would potentially result in over 17,000 additional residents requiring public safety service from the Grayson County Sheriff's Office staff. This would result in a ratio of sheriff staff to population (per 1,000) of approximately 1.0:1, a minor decrease from the current ratio of 1.2:1. Fire protection services under Alternative 1 would be provided by the existing Preston Volunteer Emergency Services, Inc, and would be expected to have a significant impact on the demand for fire protection services as a result of the population increase on adjacent private lands.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

In 2009, the approximate ratio of law enforcement officers to population (per 1,000) for the City of Denison was 1.9:1. The ratio of firefighters to population (per 1,000) was approximately 2.2:1. Without additional hiring/service improvements, these ratios would decrease, potentially to unsafe levels.

Denison police, fire, and ambulance services are all funded through the City's General Fund, which is determined at least biannually. For the 2010/2011 Budget, appropriations for these services decreased slightly for fire suppression, and increased (up to 8%) for fire prevention, ambulance, and police services (City of Denison, 2011a). As previously discussed, the tax revenues generated by the proposed development (Impact Data Source, 2008) would represent revenue for the General Fund and allow the City to fund the required growth. Timing between fund revenues and expenditures could present an issue as previously discussed. This potential impact, however, would likely be minor given the planned pace of the proposed development.

4.8.7.3 Medical Services

Alternative 1 – No Action

No direct impacts to medical services on the proposed conveyance land are expected under Alternative 1. While residential development on adjacent private lands would result in over 17,000 additional residents (see section 3.8.1) potentially needing medical services, an additional 22 acres of medical offices and 33 acres of medical service facilities would be included in the development on adjacent private lands. The addition of these facilities, if fully staffed and operated, would be expected to reduce the demand on existing surrounding medical facilities.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Increased demand for medical services from both additional residents and potentially non-resident visitors and tourists would be a direct effect of development under Alternatives 2-4. The anticipated older and higher income population of the proposed development would also potentially add to the demand for specialized medical services, including emergency response, home assisted living or nursing care, and possibly a different mix of medical specialties.

The prospective medical facilities associated with the proposed development would help to meet these needs as well as those of tourists and others near the site. The new Texoma Medical Center hospital is also an important service addition to meeting local/regional medical needs. The availability of adequate medical specialties and skilled medical staff may, however, present short-term local personnel and medical care problems as discussed in Section 3.

4.8.7.4 Education

Alternative 1 – No Action

No impacts to education would be expected under Alternative 1. Currently, no children reside within the proposed conveyance land, and under Alternative 1, no additional children would reside within the proposed conveyance land; therefore no additional demand on education would be created.

However, as a result of residential development on adjacent private lands, a significant impact on educational resources could occur. Assuming that approximately 25% (the approximate 2009 percentage of the local population age 18 and under) of the added population of adjacent private lands would be enrolled in school, over 4,000 additional children could be enrolled in area schools. Under Texas Education Code (TEC) 25.111, an average student/teacher ratio of not less than one teacher per 20 students must be maintained (TEC, 1995). This could result in the need for up to 200 additional teachers for area schools, assuming all 4,000 students would be enrolled in public schools. These estimates are conservative and likely overestimate the actual number of additional children that could be enrolled in area schools as a result of the proposed development (USCB, 2010). The actual number of school-aged children would likely be substantially fewer than the conservative estimate for several reasons: 1) the youngest (0-4) children would not be in public school, 2) the local population is anticipated to be older with fewer school-age children, and 3) some of the new residents would be seasonal or second home types.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

The potentially significant demand for educational resources from the City of Denison/Denison Independent School District under Alternatives 2-4 would be similar to that of Alternative 1. As described under Alternative 1, conservative assumptions would result in a significant addition of new school-aged children requiring new teachers and potentially school facilities. As described above, these estimates are considered to be conservative and likely overestimate the potential demand on area schools. This is especially true for Alternatives 2-4 due to the high percentages of planned senior living and likely weekend or second home residents. Few of these residents would be expected to contribute to the number of new children requiring public education, particularly at the elementary and middle school levels.

Additional staffing and new school facilities would be required as a result of the proposed development, but the anticipated revenues generated by the development for the Denison Independent School District would allow for adequate capacity development (Impact DataSource, 2008). Short-term impacts and disruptions could, however, occur until the needed educational resources are operational.

4.9 INFRASTRUCTURE AND UTILITIES

Under each of these alternatives, new residential and commercial facilities on the adjacent private land result in an increase in utility demands and the need for an expansion of infrastructure. Additionally, Alternatives 2, 3, and 4 include development of the proposed conveyance property, which currently contains no infrastructure or utilities. Under Alternative 1, the utility demand analysis incorporated 2030 Preston Harbor Development population estimates of about 17,100 (projected in Section 4.8.1) based upon the development of the private land. Under Alternatives 2, 3, and 4, estimates for the 2030 Preston Harbor Development population were calculated using the 2000 City of Denison average household size of 2.43 (USCB, 2000) and the total number of housing units proposed for development. Based on this calculation, the 2030 Preston Harbor Development population under Alternatives 2, 3, and 4 is estimated to be approximately 18,000. Population estimates for all alternatives, in conjunction with per capita utility rates, were used to estimate utility demand resulting from implementation of each alternative, assuming populations associated with the new development would use utilities at the same rate per capita as the current City of Denison or Grayson County. It is likely, however, that the EIS estimates are conservative, since many of the homes will only be occupied part time or seasonally, and the senior living housing would likely have only one or two individuals per household.

The construction of Preston Harbor Development under each alternative would include installation of additional utility distribution and collection mains and service lines. Short-term effects associated with construction are addressed in Section 4.6.2 and Section 4.9.6. Long-term impacts include ongoing maintenance and eventual replacement of infrastructure. According to

A Report of the Economic Impact of Schuler Development on Lake Texoma in Denison, Texas, approximately $168 million of Preston Harbor Development's cost will be used for infrastructure, streets, sidewalks, drainage, and utilities. In addition to the developers cost, it is also anticipated that the City of Denison would incur costs of approximately $17.3 million to provide public services to the Preston Harbor Development over the first 25 years (Impact DataSource, 2008). As discussed in Section 4.8.4, it is anticipated that costs incurred by the City of Denison could be offset by the city's tax revenue generated by the development.

4.9.1 Traffic and Transportation

This EIS defines the region of influence (ROI) for traffic and transportation as those areas inclusive of and directly adjacent to the proposed conveyance and development. The land conveyance would not generate traffic or changes to transportation infrastructure. Therefore, the land conveyance did not undergo detailed traffic analysis. The focus of the analysis in this EIS is the construction and long-term activities associated with the proposed development and all resulting impacts to traffic and transportation, which are indirect impacts of the actions. Specifically, this section documents effects of construction activities, and long-term changes in the traffic volume on roadways in the vicinity of the proposed development.

At the time of this EIS, the design of the proposed development is not progressive enough to allow for a detailed Level of Service (LOS) or volume to capacity analysis. The two roadways most likely to be affected are FM 84 and FM 406, each of which is 2-lane roadways adjacent to the proposed development. A more detailed list of nearby roadways is in Section 3.9. The capacity of a two-lane highway is 1,700 vehicles per hour for each direction of travel (TRB, 2000). Unstable traffic can be reached when the volume of a roadway equals 77% the capacity. For two, two-lane roadways, the critical traffic volume to cause unstable traffic flow would be approximate 2,600 vehicles per hour in either direction. For the purpose of this analysis, impacts would be considered significant if the estimated future trips under each alternative exceed this critical traffic volume in either direction. Under these conditions it is expected that existing infrastructure would not support long-term changes in traffic. The City and Schuler Development, however, have indicated that roadway capacity would be increased to accommodate traffic needs in the future as the capacity increases (Schuler Development, 2011).

Additionally, the USACE encourages the Schuler Development and the City to consult with nearby property owners when determining the development's access point.

Alternative 1 – No Action

While not part of this action, short-term moderate and long-term significant adverse effects to traffic and transportation would be expected due to the development on the adjacent private property, assuming no traffic improvements are made. As discussed in Section 2, the development would occur in phases over a 20-25 year period beginning at the southern end and proceeding northward. At initiation, a primary entrance and exit would be constructed from F.M. 406. As development phases proceed north, a secondary entrance and exit would be developed from F.M. 84.

Traffic increase from construction vehicles would result in delays near construction sites. In addition, road closures or detours to accommodate utility work would be expected, creating short-term delays. These effects would take place throughout the development and conclude upon completion of construction. Initially, local roadway infrastructure would be sufficient to support construction vehicle traffic. However, as roadways become overly congested due to occupation of proposed residential areas and active commercial use, local roadway infrastructure would no longer be sufficient to support construction vehicle traffic becoming active. Effects on vehicle traffic due to residential and commercial use are outlined below. In this context, the overall impacts from construction on traffic and transportation would be moderate.

During construction, the following vehicular BMPs would be observed. The BMPs would include:

- Equipping all construction vehicles with backing alarms, two-way radios, and "Slow Moving Vehicle" signs when appropriate;
- Routing and scheduling construction vehicles to avoid conflicts with other traffic; and
- Strategically locating staging areas to minimize traffic impacts.

Under Alternative 1, the proposed development would create approximately 7,035 additional residential units and develop an estimated 106 acres of additional commercial property. These changes in land-use and additional infrastructure would generate an additional 76,697 vehicle trips per day and 7,827 trips during the afternoon, or post morning (p.m.), peak period when compared to existing conditions. This represents an approximately 16-fold increase in daily traffic when compared to existing traffic on F.M. 84 and F.M. 406 (4,900 vehicles per day combined [TXDOT, 2010]). Therefore, additional trips from the proposed development would exceed the capacity of F.M. 84 and F.M. 406 to support stable traffic flow by approximately 170% (Table 4.9.1). A detailed breakdown of vehicle trips for each proposed land-use is included in Appendix M.

Under these conditions it is expected that existing infrastructure would not support these long-term changes in traffic. Substantial infrastructure improvements to the existing roadway network such as lane additions and intersection upgrades would likely be required under Alternative 1, which the City and Schuler Development have indicted will occur as demand requires and comply with TXDOT requirements. Periodically during the phased development, traffic studies will be conducted for the Preston Harbor Development and surrounding roadway network, following TXDOT guidance and as deemed necessary, to monitor traffic infrastructure demands as the development progresses (Schuler Development, 2011). Although this analysis is confined to the roadways adjacent to the proposed development, additional traffic may result as far away as several miles, particularly along Route 289 and approaching Highway 75.

Alternative 1 would result in a negligible incremental increase to patrons using regional airports and passenger rail services.

The project is in the preliminary design stages; however, it is anticipated that sufficient parking would be incorporated into the proposed development final design. This parking would be located near the buildings and land uses that would be developed including the residences, medical services, and hotel complex.

Table 4.9.1

Trips Generated by Alternative 1

	Weekdays					Saturday		Sunday	
	AADT	A.M. Peak Period		P.M. Peak Period		Peak Hour		Peak Hour	
		Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting
Northern Residential	28,651	523	1,680	1,882	1,048	1,474	1,256	1,269	1,280
Southern Residential	25,964	430	1,551	1,659	915	1,271	1,083	1,097	1,116
Commercial	12,535	177	104	587	587	795	795	795	795
Medical Services	8,884	539	161	318	743	-	-	-	-
Office/Mixed Use	663	84	4	4	85	-	-	-	-
Total	**76,697**	**1,753**	**3,500**	**4,450**	**3,377**	**3,540**	**3,134**	**3,161**	**3,191**
Estimated Percentage of Trips Required to Create Unstable Traffic Conditions		67%	134%	170%	129%	135%	120%	121%	122%

AADT = Average Annual Daily Traffic
Source: Trip generation factors obtained from ITE, 2003 and TRB, 2000

Alternative 2 – Land Conveyance without Shoreline Development

When compared to the No Action Alternative, Alternative 2 would have additional moderate adverse effects to traffic and transportation. As with Alternative 1, short-term effects would occur from the use of vehicles during construction, and long-term effects would occur from additional vehicle trips from residents, commercial employees, patrons, and visitors.

As with Alternative 1, and for similar reasons, the overall impacts from construction traffic would be moderate. The total amount of construction and associated traffic would be greater than that outlined under Alternative 1. As with Alternative 1, the local roadway infrastructure would not be sufficient to support construction vehicle traffic as the roadways became overly congested due to occupation of proposed residential areas and active commercial use. BMPs would be identical to those outlined under Alternative 1.

Under Alternative 2, the proposed development would create approximately 397 additional residential units and develop an estimated 77 acres of additional commercial property, in addition to those outline under Alternative 1. These changes in land-use and additional infrastructure would generate an additional 14,553 vehicles per day and 1,144 trips during the p.m. peak period in addition to those outlined under Alternative 1. This represents an approximately 16% increase in daily traffic when compared to the No Action Alternative. Additional trips from the proposed development would exceed the capacity of F.M. 84 and F.M. 406 by approximately 197% (Table 4.9.2). A detailed breakdown of vehicle trips for each proposed land-use is included in Appendix M.

As with Alternative 1, under these conditions it is expected that existing infrastructure would not support long-term changes in traffic under Alternative 2. Notably, these changes would be incremental and would occur over the long-term as development takes place. Substantial infrastructure improvements to the existing roadway network such as lane additions and intersection upgrades would likely be required. Schuler Development has indicated that such improvements will be made or designed as demand requires and comply with TXDOT requirements. Periodically during the phased development, traffic studies will be conducted for the Preston Harbor Development and surrounding roadway network, following TXDOT guidance and as deemed necessary, to monitor traffic infrastructure demands as the development progresses (Schuler Development, 2011). Although this analysis is confined to the roadways adjacent to the proposed development, additional traffic may have impacts as far away as several miles, particularly along Route 289 and approaching Highway 75.

Alternative 2 would result in a negligible incremental increase to patrons using regional airports and passenger rail services.

The project is in the preliminary design stages; however, it is anticipated that sufficient parking would be incorporated into the proposed development final design, following applicable zoning requirements. This parking would be located near the buildings and land uses that would be developed including the residences, medical services, and hotel complex.

Table 4.9.2

Trips Generated by Alternatives 2, 3, and 4

	Weekdays					Saturday		Sunday	
	AADT	A.M. Peak Period		P.M. Peak Period		Peak Hour		Peak Hour	
		Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting
Northern Residential	16,490	239	1,008	1,018	555	757	645	656	675
Central Residential	16,778	324	971	1,121	628	890	758	765	768
Southern Residential	25,971	493	1,510	1,726	965	1,364	1,162	1,173	1,179
Commercial	12,535	177	104	587	587	795	795	795	795
Hotel	10,593	642	192	379	885	-	-	-	-
Medical Services	8,884	539	161	318	743	-	-	-	-
Office/Mixed Use	663	84	4	4	85	-	-	-	-
Total	**91,250**	**2,413**	**3,946**	**5,149**	**4,361**	**3,806**	**3,360**	**3,388**	**3,417**
Difference over No Action Alternative	14,553	661	446	698	984	266	226	227	225
Difference Over No Action Alternative (%)	16%	27%	11%	14%	23%	7%	7%	7%	7%
Estimated Percentage of Trips Required to Create Unstable Traffic Conditions		92%	151%	197%	167%	145%	128%	129%	131%

AADT = Average Annual Daily Traffic

Source: Trip generation factors obtained from ITE, 2003 and TRB, 2000.

Alternative 3 – Land Conveyance with Limited Shoreline Development

When compared to Alternative 1, the No Action Alternative, Alternative 3 would have additional moderate adverse effects to traffic and transportation. As with Alternative 2, short-term effects would occur from the use of vehicles during construction, and long-term effects would occur from additional vehicle trips from residents, employees, patrons and visitors.

The overall impacts from construction traffic would be similar to those for Alternative 2 and would be moderate in intensity, extent, context, and duration. The total amount of construction and the overall level of impact would be similar to Alternative 2, and the local roadway infrastructure would not be sufficient to support construction vehicle traffic, as roadways become overly congested due to occupation of proposed residential areas and active commercial use. BMPs would be identical to those outlined under Alternatives 1 and 2.

Additional trips from the proposed development would exceed the capacity of FM 84 and FM 406 to support sable traffic conditions by approximately 197%, thereby overwhelming the existing roadway infrastructure (Table 4.9.2). Substantial infrastructure improvements to the existing roadway network such as lane additions and intersection upgrades would likely be required. Schuler Development has indicated that such improvements will be made or designed as demand requires and comply with TXDOT requirements. Periodically during the phased development, traffic studies will be conducted for the Preston Harbor Development and surrounding roadway network, following TXDOT guidance and as deemed necessary, to monitor traffic infrastructure demands as the development progresses (Schuler Development, 2011). Although this analysis is confined to the roadways adjacent to the proposed development, additional traffic may have impacts as far away as several miles, particularly along Route 289 and approaching Highway 75.

Alternative 3 would result in a negligible incremental increase to patrons using regional airports and passenger rail services.

The project is in the preliminary design stages; however, it is anticipated that sufficient parking would be incorporated into the proposed development final design following applicable City of Denison zoning requirements. This parking would be located near the buildings and land uses that would be developed including the residences, medical services, and hotel complex.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

When compared to Alternative 1, the No Action Alternative, Alternative 4 would have additional moderate adverse effects to traffic and transportation. As with Alternative 3, short-term effects would occur from the use of vehicles during construction, and long-term effects would occur from additional vehicle trips from residents as well as the staff and patrons of the proposed commercial facilities (i.e., hotel, conference center, office space, and medical offices).

As with Alternative 3, and for similar reasons, the overall impacts from construction traffic would be moderate. The total amount of construction and the overall level of impact would be similar to Alternative 3, and the local roadway infrastructure would not be sufficient to support construction vehicle traffic as the roadways became overly congested due to occupation of proposed residential areas being occupied and active commercial use. BMPs would be identical to those outlined under Alternatives 1, 2 and 3.

Under Alternative 4, additional trips from the proposed development would exceed the capacity of FM 84 and FM 406 by approximately 197%, thereby overwhelming the existing roadway infrastructure (Table 4.9.2). Traffic to and from the proposed boat club and boat ramp would be negligible compared to the overall traffic associated with the new residential units and commercial facilities. Because the volume of traffic is substantially more than the existing capacity, substantial infrastructure improvements to the existing roadway network such as lane additions and intersection upgrades would likely be required. The City of Denison and Schuler Development have indicated that such improvements will be made or designed as required in compliance with TXDOT requirements. Periodically during the phased development, traffic studies will be conducted for the Preston Harbor development and surrounding roadway network, following TXDOT guidance and as deemed necessary, to monitor traffic infrastructure demands as the development progresses (Schuler Development, 2011). Although this analysis is confined to the roadways adjacent to the proposed development, additional traffic may have impacts as far away as several miles, particularly along Route 289 and approaching Highway 75.

Alternative 4 would result in a negligible incremental increase to patrons using regional airports and passenger rail services.

The project is in the preliminary design stages; however, it is anticipated that sufficient parking would be incorporated into the proposed development final design following applicable City of Denison zoning requirements. This parking would be located near the buildings and land uses that would be developed including the residences, medical services, and hotel complex.

Because existing roadway infrastructure in the area of the proposed development would not be sufficient to support additional traffic under Alternatives 2, 3, and 4, state roadway permitting requirements and associated studies will be required for the additional roadway infrastructure for the development. It is anticipated that necessary additional roadway infrastructure will be constructed as needed.

4.9.2 Water Treatment and Distribution

Currently a City of Denison water line is located on FM 80 that could service the initial phase of construction. As the development increases, additional infrastructure, including water lines and towers, would be constructed by the City of Denison for added redundancy and reliability (City of Denison, 2011b). At this stage of analysis, the cost for providing water to the Preston Harbor Development is unknown; however, it is assumed that the infrastructure needed to supply water to residents would be paid for by the developer. For the purposes of estimating the water demand for Preston Harbor Development in this section, it is assumed that the associated population would use water at the same rate per capita as the City of Denison. This assumption, however, will provide an overly conservative assessment because many of the homes in the Preston Harbor Development will be occupied on only a part-time basis, and the senior living housing would likely have only one or two individuals per household. As discussed in Section 3.9.3, the average water demand for the 2010 City of Denison population of about 24,300, adapted from Section 3.8.1, was 4.5 MGD or 186 gallons per capita per day (gpcd), with a peak demand of 9 MGD or 372 gpcd (Howerton, 2010). Cumulative impacts to the City of Denison water treatment and distribution system that address the Preston Harbor Development (at completion) and the projected 2030 City of Denison population are further discussed in Section 5.9

Alternative 1 – No Action

While no development would occur under this alternative on the conveyance land, development would proceed on the adjacent private property, which would increase demand and expand the distribution system on the adjacent private property. These conditions are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3, and 4). Based on the 2030 Preston Harbor Development population projected in Section 4.8.1, and the City of Denison water demands per capita noted above, the estimated average and peak water demands would be approximately 3.2 MGD and 6.4 MGD, respectively, on the private property. Under Alternative 1 the adjacent private property would not be annexed to the City of Denison and the private developer would provide a potable source of water for the residents of the Preston Harbor

Development. This added demand would require an increase in the City of Denison water treatment and distribution capacity of over 70%.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under these alternatives, a water demand and distribution system would be utilized on the proposed conveyance property, private property water demand would increase significantly, and the distribution system would expand substantially. Based on the 2030 Preston Harbor Development population, and the City of Denison water demands per capita noted above, the estimated average water demand would be 3.4 MGD, and peak demand would be 6.7 MGD in the Preston Harbor Development. This added demand would require an increase in the City of Denison water treatment and distribution capacity of over 75%, based on existing circumstances, though when compared to the No Action Alternative, would only require an additional 5% increase in capacity. Since the City of Denison has excess treatment and distribution capacity which could support a community four times the size of the City of Denison, the added demand that would result from these alternatives could be supported by the existing treatment and distribution capacity.

4.9.3 Wastewater Collection and Treatment

As discussed in Section 3.9.4, there are currently no WWTPs in the region that would have the ability to serve the Preston Harbor Development. Within the Little Mineral Arm watershed, there are already a significant number of septic systems supporting the existing wastewater load. Figure 4.9.1 presents the reported septic system density within the Little Mineral Arm watershed as of the 1990 Census (USACE, 2001), and Table 4.9.3 summarizes an estimated number of septic systems currently located in the Little Mineral Arm watershed. The Little Mineral Arm watershed has been divided further into subsections in Table 4.9.3 to more closely assess potential impacts. Subsection 2, which currently consists mostly of the proposed conveyance land, the adjacent private land, and other private residential property on Grandpappy Point, contains the fewest septic systems. In each alternative, the wastewater load on the properties associated with the Preston Harbor Development would increase significantly.

Table 4.9.3

Existing Septic System Count

Septic System Density Subsections (see Figure 4.9.1)	Area (square miles)	Septic System Density (per square mile)		Septic System Count		Average Septic Count
		Low	High	Low	High	
1-A	1.96	276	469	540	917	728
1-B	1.69	123	275	208	466	337
					Subwatershed 1 Total	1066
2	6.47	11	23	71	149	110
					Subwatershed 2 Total	110
3-A	2.14	123	275	264	589	427
3-B	6.93	6	10	42	69	55
3-C	6.24	11	23	69	144	106
					Subwatershed 3 Total	588
					Total	**1,763**

Source: USACE, 2001

Alternative 1 – No Action

While no development would occur under this alternative on the conveyance land, development would proceed on the adjacent private property, which would require wastewater collection and treatment. While no federal actions would occur, these conditions are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3, and 4). Because there is no proposed WWTP under Alternative 1, on-site sewage facilities (OSSFs) would be required to support all proposed development on the private parcel that produce wastewater. Most of the planned residential properties are properly sized for septic systems, but other facilities, particularly those located on lands designated for commercial, office/mixed, and medical use, may have wastewater loads that are too large or not compatible with septic systems. In these cases, larger TCEQ-permitted OSSFs may be installed.

A total of approximately 7,035 residential dwelling units would be included in the Preston Harbor Development in addition to two community centers and a golf course. The following assumptions were made to estimate the number of septic systems that would be installed under Alternative 1:

- each single-family housing unit would require one septic system.
- each condominium complex would require an OSSF with capacity equivalent to one septic system per unit.
- each apartment and/or townhome complex would require an OSSF with capacity equivalent to one septic system per unit.
- land designated for commercial, office/mixed, or medical use would require a TCEQ-permitted OSSF due to wastewater loads that are too large or not compatible with septic systems, and therefore would not be considered in the septic count.
- each community club would require one septic system.
- the golf club would require one septic system.

Based on these assumptions, it is estimated that the Preston Harbor Development would include about 7,038 additional septic systems. This increases the total number of septic systems in the Little Mineral Arm watershed to approximately 8,800, representing a 500% increase over current conditions. Assuming an average installation price of $10,000 per septic system, this would result in an additional cost of approximately $70.4 million. Preston Harbor Development would be responsible for coordinating installation of septic systems for residents of the Preston Harbor Development. Section 4.6 further discusses the water quality impacts that may result from the additional septic systems.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

A new WWTP would be constructed by the City of Denison on the north side of Lake Randell in conjunction with the Preston Harbor Development under Alternatives 2, 3, and 4 to service new residences and facilities and provide hook-up opportunities to existing residences and businesses that are currently on septic systems. The location of the planned WWTP is shown on Figure 3.7.3 of this EIS. Wastewater loads and a collection system would be introduced to the USACE conveyance property and would increase significantly on the adjacent private land.

In the Preliminary Design Report for the proposed WWTP, it was estimated that the ultimate wastewater flow for the Preston Harbor Development would be approximately 1.75 MGD. The WWTP would be constructed in three phases, each phase increasing the capacity by about 0.475 MGD for an ultimate capacity of 1.9 MGD, sufficient to serve the Preston Harbor Development. If the service area were to expand beyond the Preston Harbor Development, the capacity of the WWTP would need to be increased accordingly. The estimated cost for the proposed WWTP is $8.6 million, which would be paid for by the City of Denison (APAI, 2007). Note that the proposed WWTP would not discharge to Lake Texoma and that all permitting and monitoring requirements associated with construction and operation of the WWTP would be in accordance with TCEQ regulations. A discussion of the water quality impacts of the proposed WWTP can be found in Section 4.5.

4.9.4 Natural Gas

Under each alternative, the implementation of Preston Harbor Development would increase natural gas demand on the associated properties. To assess these impacts, future natural gas demand was estimated for the projected population under each alternative. As discussed in Section 3.9.5, the City of Denison used a total of 483,525 MCF of natural gas in 2009 supplied by Atmos Energy (TRRC, 2010) for domestic, commercial, and industrial uses. This equates to an annual natural gas demand for the 2009 City of Denison population of 24,127 of approximately 20 MCF per capita.

Alternative 1 – No Action

Under this alternative, natural gas demand would increase significantly on the adjacent private land. While no development would occur under this alternative on the conveyance land, development would proceed on the adjacent private property, which would require wastewater collection and treatment. While no federal actions would occur, these conditions are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3, and 4). Based on the 2030 Preston Harbor Development population projected in Section 4.8.1 and the City of Denison natural gas demand per capita noted above, the estimated additional annual natural gas demand would be approximately 342,000 MCF, representing a 70% increase over existing conditions. According to a Market Development Specialist with Atmos Energy, there is sufficient natural gas supply and infrastructure at the City of Pottsboro transmission station to support this increase in population. Construction of new natural gas distribution lines would be necessary to convey the natural gas to the adjacent private land (Atmos Energy, 2011a).

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under these alternatives, natural gas demand would extend to proposed conveyance land and adjacent private land. Based on the 2030 Preston Harbor Development population of approximately 18,000 for these alternatives and the City of Denison natural gas demand per capita noted above, the estimated additional annual natural gas demand would be approximately 361,120 MCF, representing a 75% increase over existing conditions, but only a 5% increase over the No Action Alternative. According to a Market Development Specialist with Atmos Energy, there is sufficient natural gas supply and infrastructure at the City of Pottsboro transmission station to support this increase in population. Construction of new natural gas distribution lines would be necessary to convey the natural gas to the Preston Harbor Development (Atmos Energy, 2011a).

4.9.5 Electricity

Under each alternative, the implementation of Preston Harbor Development would increase the electricity demand on associated properties. To assess these impacts, future electricity demand was estimated for the projected population under each alternative. The Electric Reliability Council of Texas (ERCOT) manages the flow of electricity throughout most of the state of Texas. The electricity load for Grayson County is projected to be 903 megawatts in the 2010-2011 year (ERCOT, 2010). This equates to an annual electricity demand for the projected 2010 Grayson County population of about 120,100, adapted from Section 3.8.1, of approximately 7,519 watts per capita.

Alternative 1 – No Action

Electricity demand would increase significantly on the adjacent private land. While no development would occur under this alternative on the conveyance land, development would proceed on the adjacent private property, which would require wastewater collection and treatment. While no federal actions would occur, these conditions are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3, and 4). Based on the 2030 Preston Harbor Development population projected at 17,000 in Section 4.8.1, and the 2010 Grayson County electricity demand per capita noted above, the estimated additional annual electricity demand would be approximately 129 megawatts, representing a 14% increase over existing conditions. Since electricity service is deregulated in Denison, and residents could choose their electrical service provider from eight providers available in the area, it is reasonable to assume that these providers would be able to accommodate this increase in demand, if appropriate electrical infrastructure was in place.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under Alternatives 2-4, electricity demand would be introduced to the proposed conveyance property and the adjacent private land. Based on the 2030 Preston Harbor Development population of about 18,000 for these alternatives and the Grayson County electricity demand per capita noted above, the estimated additional annual electricity demand would be approximately 136 megawatts. While this represents a 15% increase over the estimated 2010-2011 electrical load presented above, it would only be a 1% increase from the No Action Alternative. Since electricity service is deregulated in Denison, and residents could choose their electrical service provider from eight providers available in the area it is reasonable to assume that these providers would be able to accommodate this increase in demand, assuming that appropriate electrical infrastructure was in place.

4.9.6 Solid Waste

As discussed in Section 3.9.6, the TASWA landfill currently accepts 120,000 tons of MSW per year, including construction wastes (TASWA, 2010). Under each alternative, construction and future population associated with the Preston Harbor Development would generate additional MSW.

In 2009, the average American generated about 4.34 lbs of MSW per day (EPA, 2009). When considered in conjunction with the 2010 City of Denison population of approximately 24,300, adapted from Section 3.8.1, the City of Denison produces approximately 19,260 tons of MSW annually which is subsequently discarded at the TASWA landfill.

Alternative 1 – No Action

Under this alternative, no MSW would be generated on the proposed conveyance land. Construction on the adjacent private land would include approximately 7,035 residential units ranging in size from 1,800 square feet (ft^2) to 15,000 $ft.^2$ Based on the nation-wide weighted average residential construction waste generation rate of 4.39 pounds per square feet (lb/ft^2) (EPA, 2003) and a total of 13.5 million ft^2 of residential units, approximately 52,200 tons of waste would be generated during residential construction under Alternative 1. Additional development would include the construction of a golf club, commercial and office/mixed use facilities, medical offices, and medical service facilities. The nation-wide weighted average non-residential construction waste generation rate is 4.34 lb/ft^2 (EPA, 2003). Though land-use acreage has been provided for this non-residential infrastructure, the size of associated buildings is still unknown; therefore, the total amount of construction waste that may be generated cannot be effectively estimated. Additionally, specific details regarding the 20-year construction period are not available, therefore construction intensity cannot be predicted at this time. Regardless, the assumption can be made that the amount of waste that would be generated during construction of Preston Harbor Development under Alternative 1 would be minimal in comparison to the 120,000 tons per year currently accepted by the TASWA landfill. Waste generated during construction activities will be disposed of in accordance with applicable local, State, and Federal environmental laws and regulations.

Based on the 2030 population of 17,000 projected in Section 4.8.1, and the nation-wide average waste generation rate per capita of 4.34 lb/day, development of the private property would generate approximately 74,200 lbs of MSW per day, or 13,553 tons annually under Alternative 1. This would increase the amount of waste TASWA landfill accepts by 11.3%. Based upon the current life expectancy of the landfill, this moderate increase in solid waste generation could be accommodated. Additionally, a permit could be acquired which would allow the TASWA to double the height of the landfill, thus providing extra capacity.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under Alternatives 2-4, significant construction would occur on the proposed conveyance land and the adjacent private land. As further delineated in Section 4.8.1, approximately 7,480 residential units ranging in size from 1,800 ft^2 to 15,000 ft^2 would be included in the Preston Harbor Development. Based on the nation-wide weighted average residential construction waste generation rate of 4.39 lb/ft^2 and a total of 25 million ft^2 of residential units, approximately 54,900 tons of waste would be generated during residential construction under Alternatives 2, 3, and 4 (EPA, 2003). In addition to this non-residential infrastructure, a hotel would be constructed. As in Alternative 1, information necessary to effectively estimate the total amount of construction waste that may be generated in Alternatives 2, 3, and 4 is unknown. Regardless, the assumption can be made that the amount of waste that would be generated during construction of the Preston Harbor Development under Alternatives 2, 3, and 4 would be minimal in comparison to the 120,000 tons per year currently being accepted by the TASWA landfill.

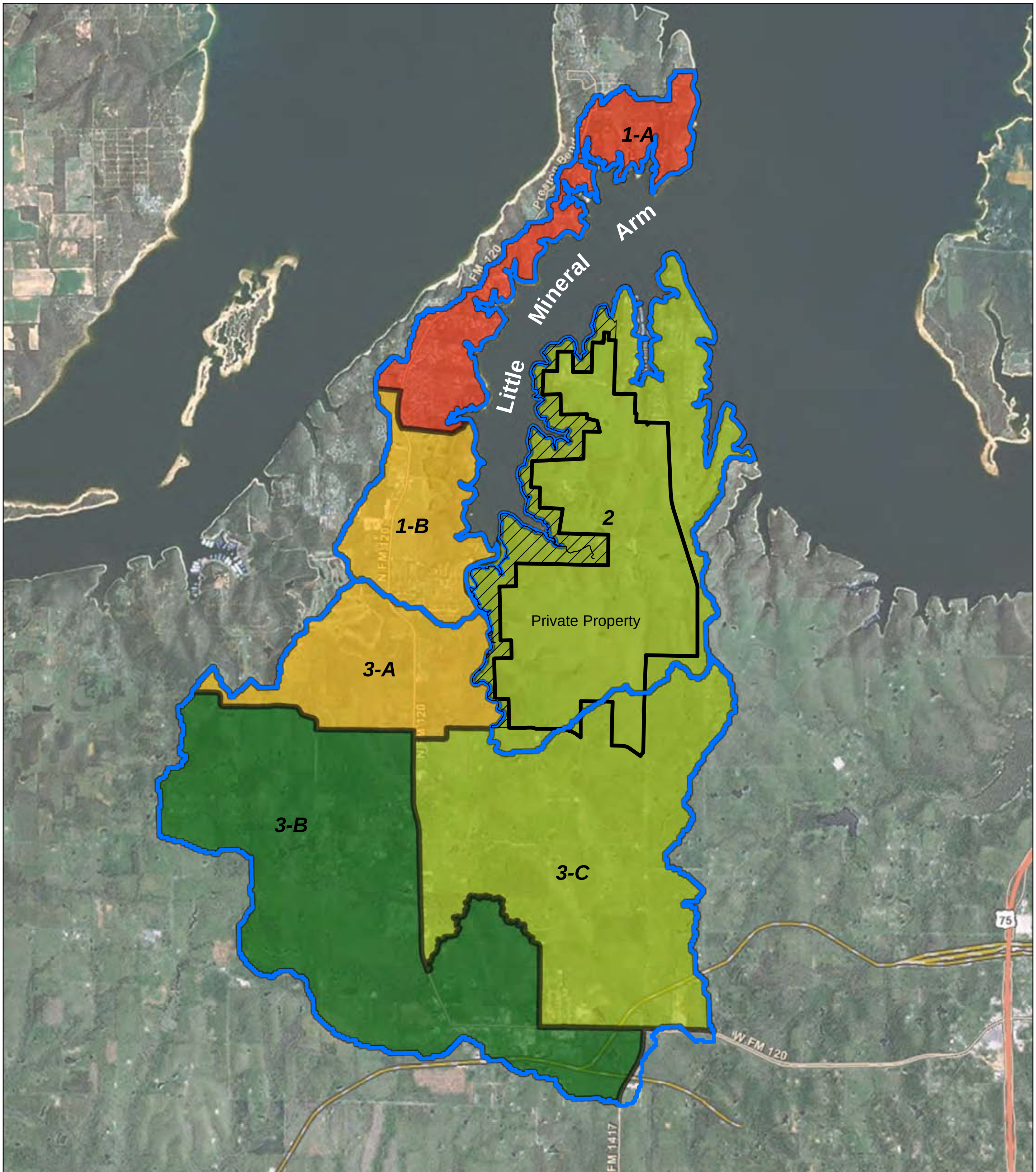
Based on the 2030 population of about 18,000 and the nation-wide average waste generation rate per capita of 4.34 lb/day, Preston Harbor Development would generate approximately 78,363 lbs of MSW per day, or 14,301 tons annually under Alternatives 2 through 4. This would increase the amount of waste accepted by TASWA by 12.0%. Based on the current life expectancy of the landfill, this increase in solid waste generation could be accommodated. Additionally, if landfill space was constrained, a permit could be acquired that would allow the TASWA to double the height of the landfill, thus providing extra capacity.

4.9.7 Ground and Traffic Safety

Under Alternative 1, the addition of the Preston Harbor Development on the adjacent private land could result in an approximate 8% increase in residents within the six counties surrounding Lake Texoma. This increase in population for the surrounding area would result in a potential increase in traffic accidents. Under Alternatives 2, 3, and 4, development on the conveyance property would result in an approximate increase of 1,875 residents in addition to the increase resulting under Alternative 1. The increase in population would result in a potential increase in traffic accidents.

4.9.8 Construction Safety

Under each alternative there would be an increase in the short-term risk associated with the construction of the Preston Harbor Development. Construction contractors would be required to establish and maintain safety programs that would provide protection to their workers and limit the exposure of their personnel to construction hazards.

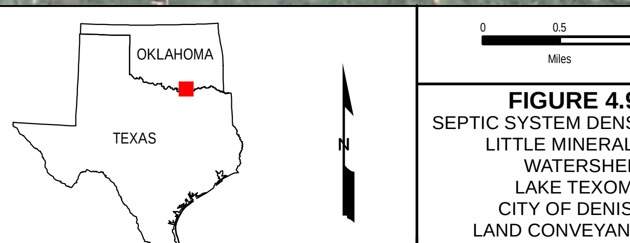


LEGEND

Private Property
Septic System Density Subsections
Watershed Boundary
Proposed Conveyance Property

Septic System Density Per SQMI

6-10
11-23
123-275
276-469



SOURCE
1) SEPTIC TANK DENSITIES FROM LAKE TEXOMA REGIONAL SEWER SYSTEM STUDY 2001
2) PRIVATE AND CONVEYED BOUNDARY PROV DED BY PSA ENGINEERING 2009
3) 2010 UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) IMAGERY PROVIDED BY ESRI

FIGURE 4.9.1
SEPTIC SYSTEM DENSITY IN THE LITTLE MINERAL ARM WATERSHED
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JUNE 2011	03886.544.001.0004	AS SHOWN

Path: I:\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Chapter_4\Figure 4.9.1 Septic Tank LMA.mxd, Date: 8/2/2011 10:52, WILDERJ

4.10 PUBLIC LANDS

As discussed in Section 3.10, public lands are areas the general public may access for outdoor activities and where permits or memberships are not required. Most State and Federally managed public lands are open for public recreational use at Lake Texoma. USACE owns 108,753 acres of land surrounding Lake Texoma that are available for public use and managed by several State and Federal agencies including the USACE, USFWS, State of Oklahoma, and the State of Texas (USACE, 2008c).

Under Alternatives 2, 3, and 4, the majority of the proposed conveyance land would be entered into a public-private partnership between the City of Denison and Schuler Development (Preston Harbor Development). Impacts to public land under each alternative were evaluated to address public scoping meeting concerns in addition to NEPA requirements. Comments and concerns received regarding public lands included the loss of land available for public use, specifically land located along accessible shoreline.

Alternative 1 – No Action

Under Alternative 1, no direct impact would occur on public lands, as USACE land would not be conveyed to the City of Denison and would remain available for public use. However, the close proximity of the private development on the adjacent land could increase the number of people on the 635 acres located along the shoreline. This is in part due to the increased accessibility to the public land, as discussed in Land Use (Section 4.3) and Recreation (Section 4.11).

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Under Alternatives 2, 3, and 4, 535 acres of public land previously available for recreational activities would be permanently converted to private land. The majority of the proposed conveyance land would become privately owned and used for a variety of residential, commercial, and recreation purposes resulting in direct and long-term decrease in public land. However, 100 acres of the conveyance land would be retained by the City of Denison as a public park and boat ramp available for public recreation as discussed in Section 4.11.

While the 100 acres of the city park would be public land, it would also no longer be federally-owned public lands. The following analyses focus on the impact of the conveyance land to federally-owned public land. Federally-owned public land surrounding Lake Texoma would decrease from 108,753 acres to 108,116 acres, resulting in a net loss of approximately 0.6%. As shown in Table 4.10.1, the proposed conveyance would reduce available Federal public land on Lake Texoma from 32,572 acres to 31,937 acres in the State of Texas, resulting in a net loss of 1.9% of Federal public lands available to Texas residents on Lake Texoma. However, when specifically addressing the area directly impacted by these alternatives, available Federal public lands of Little Mineral Arm would experience a 40.3% decrease in Federal public lands. However, 32,572 acres of Federal public lands would remain available on Lake Texoma in Texas.

Table 4.10.1

Impacts to Acreage of Federal Public Lands

Public Land	Existing Federal Public Land (acres)	Proposed Federal Public Land (acres)	Net Change to Federal Public Land
Lake Texoma (Oklahoma)	76,181	76,181	0 %
Lake Texoma (Texas)	32,572	31,937	- 1.9%
Lake Texoma (Little Mineral Arm)	1,575	950	- 40.3%
Lake Texoma (Overall)	108,753	108,118	- 0.6 %

Source: WESTON, 2011

It should be noted that some Federal public lands currently have restrictive leases that limit accessibility for the general public. Approximately 3,362 acres of Federal public lands are limited to special interest groups such as the YMCA, Boy Scouts, or other youth groups and are not accessible to the general public and approximately 175 acres of federal public land operate under private leases as a private club. Table 4.10.2 details the overall impact to accessible Federal public land acreage. Due to the quantity of accessible Federal public lands, these impacts are similar to those previously presented for all Federal public lands. However, these impacts to accessible Federal public lands become slightly more substantial when taking into consideration the localized impact on publicly accessible Federal lands. Of the 1,575 acres of

Federal public land on Little Mineral Arm, approximately 178 acres are leased by special interest groups or operate as private clubs. The conveyance of 635 acres of Federal public lands on Little Mineral Arm is moderate, with a net decrease of 45.5% of accessible Federal public land on Little Mineral Arm. However, 29,551 acres of accessible Federal public lands on Lake Texoma in Texas would still remain. It should be noted these alternatives would have no effect on assessable Federal public lands in the State of Oklahoma.

Table 4.10.2

Impacts to Acreage of Accessible Federal Public Lands[1]

Public Land	Existing Public Land (acres)	Proposed Public Land (acres)	Net Change to Public Land
Lake Texoma (Oklahoma)	75,831	75,831	0 %
Lake Texoma (Texas)	29,384	28,749	- 2.2%
Lake Texoma (Little Mineral Arm)	1,397	762	- 45.5%
Lake Texoma (Overall)	105,215	104,580	- 0.6%

Source: WESTON, 2011
[1] Quasi-public lands, or those leased to special interest groups, have been removed from the federal public lands calculation and are not considered accessible to the general public.

As described in Section 3.11, Lake Texoma supports a variety of recreational activities including use of public shorelines and beaches. Some of these beaches may only be accessible from the water and do not have formal access from inland areas. Under Alternatives 2, 3 and 4, approximately 9.4 miles of Federal public land shoreline (at elevations equal to or exceeding 619 ft NGVD) would be permanently converted to private property. Overall decrease in federal public land shorelines is similar to those for the loss of Federal public land. The net decrease of Federal public land shoreline would be 1.7% from the reported 585 miles (USACE, 1996). The proposed conveyance of 635 acres of Federal public land would reduce the available Federal public land shorelines on Lake Texoma in the State of Texas by 2.7%. Localized impacts of these alternatives on available shoreline to Federal public land off of Little Mineral Arm would be moderate with a net decrease by 44.5%. Impacts to the Lake Texoma shoreline are discussed in Section 4.3.1, while impacts to pocket beaches are discussed in Section 4.11.6. Additionally, it should be noted that portions of this property, although considered private, would remain open to the public for recreation purposes including golfing, hiking, biking, boating, and swimming. Additional information regarding recreational use of the property is provided in Section 4.11.

4.11 RECREATION

Lake Texoma supports a variety of recreational activities including boating, fishing, horseback riding, hunting, golfing, wildlife observation, photography, hiking, camping, and picnicking. Approximately 5.8 million people visit the lake annually from Texas and Oklahoma (USACE, 2007).

Lake recreation activities occur on a variety of land-use and shoreline designations. Impacts to recreation activities include water-based recreation, land-water-interface-based recreation, and land-based recreation. Land-based recreation includes all recreation on land, while land-water-interface-based recreation includes recreation on shorelines and immediate lake waters. Water-based recreation includes all recreation on water.

4.11.1 Recreation Visitation

Recreational visitors to Lake Texoma include residents from Collin, Cooke, Dallas, Delta, Denton, Fannin, Grayson, Hopkins, Hunt, Lamar, Montague, Rockwall, Tarrant, and Wise Counties in Texas. Due to readily available highway and interstate access (Interstate 35 and Highway 75), the lake frequently experiences visitors from the Dallas/Fort Worth Metroplex area. In 2006, visitors spent over 90 million hours at the lake; and total visitation hours has remained consistent since 2006 (USACE, 2009b).

Alternative 1 – No Action

Under Alternative 1, both adverse and beneficial impacts to recreation visitation would be expected. These impacts would not be appreciable and indirect. While the entire proposed conveyance land would remain available to the public for existing recreational uses, no additional recreation opportunities would be created on the proposed conveyance land.

However, additional recreation opportunities would be created on adjacent private lands with limited public access. One 18-hole golf course (approximately 177 acres), a golf club house site (approximately 16 acres), open space (approximately 579 acres), a community center (11 acres), and inland lakes (109 acres) would be available on the adjacent private property as shown in Figure 2.2. For a fee, the golf course and associated club would be available for public use; the community center, inland lakes, and open space for hiking would be available only to residents of Preston Harbor Development. The addition of these recreation opportunities on the adjacent private land would minimally increase visitation to the proposed conveyance property and the Lake Texoma area. Moreover, the addition of residents on adjacent private land may increase recreation visitation on the proposed conveyance property and the lake.

Alternative 2 – Land Conveyance without Shoreline Development

Under Alternative 2, changes in the type of visitation to the proposed conveyance land would be significant and long-term. The proposed conveyance land would no longer be available for hunting. While accessibility would be greatly reduced, hiking, biking, and bird watching would be available on the proposed hike and bike trails and from the City of Denison public park. Additionally, two 18-hole golf courses would be available on portions of the proposed conveyance land and the adjacent private property. As described under Alternative 1, recreation visitation on the proposed conveyance property and the lake may also increase due to the additional residents associated with development on adjacent private land.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Under Alternative 3, similar significant and long-term increases to recreation visitation to the proposed conveyance land would be expected as under Alternative 2. However, recreation visitation would further increase due to the addition of the boat club and associated boat docks and slips on the shoreline adjacent to the proposed conveyance land. The increase in visitation under Alternative 3 would be minor and most likely limited to Little Mineral Arm because the boat club and associated boat docks and slips would be private and restricted for general public use.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Under Alternative 4, recreation visitation to the proposed conveyance land would be expected to further significantly increase due to the addition of a public park and boat ramp operated by the City of Denison. Under this alternative, the hotels and conference center, boat docks and slips, boat ramps, boat club, and shopping opportunities would be open to the public. Although the beach area associated with the hotel cove would be available for use only to the hotel guests, an increase in the number of additional recreation users to Little Mineral Arm and Lake Texoma would be expected. Further discussion regarding use of the public boat ramp is provided in Section 4.11.4.

4.11.2 Land-Based Recreation

Land-based recreation includes activities such as hunting, golfing, horseback riding, wildlife watching, photography, hiking, camping, and picnicking. The majority of land-based recreation areas at Lake Texoma offer both land-based recreation opportunities as well as land-water-interface-based recreation opportunities. Impacts to land-based recreation for the conveyance land under each alternative are described below.

Alternative 1 – No Action

No direct impacts to recreation activities are expected on the proposed conveyance land under Alternative 1. The proposed conveyance land would remain open to the public for recreational activities including hiking, wildlife observation, photography, hunting, and picnicking. Recreational use of the proposed conveyance land may increase indirectly due to the increase in residents and visitors to recreation facilities on adjacent private lands. The increase in residential development on adjacent private lands may also result in an increase in the recreational use of the proposed conveyance land due to the ease of access to the proposed conveyance land by nearby residents and guests.

Recreational use of adjacent private lands would significantly increase under Alternative 1 as a result of the construction of an 18-hole, public golf course with club facilities, hiking trails, and open space. Increased recreation use on adjacent private lands may also result from the construction of an additional lake, including a swimming beach and community center facility. However, a fee or membership requirement may be associated with use of these amenities, or use may be restricted to residents and/or guests of the development.

Short-term indirect impacts to the recreational use of the proposed conveyance land may be expected under this alternative due to the construction activities on the adjacent private lands. Noise and air quality issues related to construction activities may create an undesirable atmosphere for leisure activities on the proposed conveyance land, including fishing along the shoreline and use of pocket beaches. Future hunting opportunities could also be restricted owing to nearby development on adjacent private lands and related safety considerations.

Alternatives 2 through 4 – Conveyance Land with Varying Shoreline Development

Under Alternatives 2 through 4, moderate benefits are expected to land-based recreation on the proposed conveyance land above elevation 645 ft NGVD. Although the proposed conveyance land would no longer be accessible to the public for hunting, the use of land-based recreation facilities constructed on the proposed conveyance land would be available for other recreational activities. Construction of the public golf courses (on proposed conveyance land and adjacent private land), the additional inland lake, and hiking trails available for use by the general public would create new recreation opportunities and result in increased recreation use.

Under Alternative 4, public park use would be expected to increase due to the installation of a public park on the proposed conveyance property maintained by the City of Denison. The park is expected to be approximately 7 acres (including 3 acres for parking) and would be open to the general public for recreational use including open space (100 acres), trails, picnic facilities, and playgrounds. The location of the park is shown on Figure 2.5. The exact acreage and design of the park would require approval by the City of Denison City Council.

4.11.3 Land-Water Interface-Based Recreation

Land-water-interfaced-based recreation (also referred to as “water’s edge recreation”) activities in and around the proposed conveyance land include fishing, swimming, and boating. Access to these activities and the lake is primarily through boat-handling facilities (ramps and docks) and associated parking lot structures.

As indicated in Section 3 of this EIS, SEE collected field observations of the visitation levels at nine selected recreational land-water-interface-based facilities near the proposed conveyance land over 3 weekends during the summer of 2009 (see Tables 3.11.5 through 3.11.14). Information derived from the 2009 observations serves as the baseline data for evaluating potential impacts to recreational uses of the proposed alternatives in this EIS.

Alternative 1 – No Action

Alternative 1 would not impact land-water-interface-based recreational activities currently provided at Lake Texoma. No land would be conveyed, and no changes to the SMP or moratorium would occur. Additionally, Alternative 1 would not add or remove any fishing areas, public swimming beaches, or boat-handling facilities and associated parking lot structures within or outside the proposed conveyance land. These facilities would remain open for public use and visitation, as they do under existing conditions.

Alternative 2 – Land Conveyance without Shoreline Development

Alternative 2 would not impact land-water-interfaced-based recreational facilities currently provided at Lake Texoma. Although land would be conveyed down to elevation 619 ft NGVD with deed restrictions between elevations 619 ft and 645 ft NGVD, no changes to the SMP, and no deviation from the existing moratorium would occur. Therefore, existing fishing, swimming, and boat-handling facilities and associated parking lot structures in the area would remain in place, and any development along the shoreline would be restricted by the existing SMP and moratorium.

Direct impacts would occur relating to the accessibility of the general public to enter and use much of the proposed conveyance land. With the exception of publicly-accessible areas described in this EIS, accessibility of the conveyance land would be restricted and limited to private landowners.

Potential indirect impacts to fishing, swimming, and boat-handling facilities and associated parking lot structures may occur as a result of the increase in residents and visitors to the proposed development. However, the additional residents and visitors are not anticipated to substantially exceed visitation rates at facilities beyond what was observed in 2009 (SEE, 2011).

Those facilities that exceeded capacity (one fishing pier and three boat ramp parking facilities over Labor day weekend, and two boat ramp parking facilities over the July 4th weekend), are expected to continue to surpass capacity during the busiest times of the year regardless of the proposed development's status, and would not be able to accommodate additional visitors. Visitors discovering that their destination facility is operating at full capacity during these times would likely seek out similar use facilities around the lake. All alternate available fishing areas, swimming beaches, and parking facilities were well below capacity during the 2009 observations; therefore, it is anticipated that although increases in use levels may occur, the increase shifted to other facilities would not likely result in overcapacity issues on those facilities.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Unlike Alternatives 1 and 2, Alternative 3 would directly impact land-water-interface-based recreational facilities currently provided at Lake Texoma. Alternative 3 would include conveyance of the USACE land to elevation 619 ft NGVD with deed restrictions between elevation 619 ft NGVD and 645 ft NGVD, no changes to the SMP, but the lifting of the 2005 moratorium for portions of the shoreline adjacent to the proposed conveyance land. Proposed development within the proposed conveyance land under Alternative 3 includes single-family homes, townhomes, hotels, golf clubs, open space, inland lakes, and a pump station.

Approximately 13 covered boat docks (19 units each) and 78 private boat slips are proposed for development within the proposed conveyance land along the shoreline. The increase in boat slips and boat docks would increase the number of boats on the lake potentially impacting lake carrying capacity. Boat carrying capacity increases are discussed in Section 4.11.5.

Fourteen pocket beaches are located along the eastern shoreline of the Little Mineral Arm, and public access could be significantly impacted by the proposed conveyance (for a discussion of pocket beach impacts, see Section 4.11.6). The increase in users derived from the new development would likely not exceed capacity of the public swimming beaches even if the new users decide to use one of the existing public swimming beaches rather than the proposed hotel/conference area beaches.

No public swimming, fishing areas, or boat ramp parking facilities would be removed as a result of Alternative 3. Impacts to fishing piers are not anticipated as a result of the actions proposed under Alternative 3. Potential indirect impacts to developed public swimming and fishing areas would be the same as those presented under Alternatives 1 and 2.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Alternative 4 would not directly impact fishing areas (piers), as fishing areas are not being removed or added as a result of the actions proposed under this alternative; however, impacts are likely to occur to public swimming beaches and boat handling facilities and associated parking lot structures. Alternative 4 includes the conveyance of land with deed restrictions, revising the existing SMP, and lifting the moratorium within the proposed conveyance land of Lake Texoma. As a result, new boat ramps, boat slips, a boat club, two golf courses, inland recreational opportunities, hike and bike trails, a hotel/conference center, single-family homes, and townhomes are proposed for development.

Alternative 4 includes development within and adjacent to most existing pocket beaches in the conveyance area (for a discussion of pocket beach impacts, see Section 4.11.6). Additionally, the existing available swimming beach area for residents and visitors would increase under this alternative. The increase in users derived from the new development would likely not exceed capacity of the public swimming beaches, even if the new users decide to use one of the existing public swimming beaches rather than the proposed hotel/conference area beaches.

Alternative 4 also includes the development of three additional boat-ramps and associated parking lot structures. This increase in boat ramps and associated parking lot structures would increase the number of available boat launching facilities within Little Mineral Arm and potentially alleviate the exceeded capacity conditions observed at existing boat ramp parking facilities over the two holiday weekends in 2009 (SEE, 2011). An increase in boat slips and boat docks would increase the number of boats expected to be on the lake at any one time, potentially impacting lake carrying capacity. Boat carrying capacity impacts are discussed in Section 4.11.5.

Potential indirect impacts to fishing areas would be the same as those presented under Alternatives 1, 2, and 3.

Mitigation

Mitigation measures for land-water-based recreation under Alternatives 3 and 4 are limited. Alternative 4 introduces the construction of three boat ramps and associated parking lot structures for public use. This would increase existing available facilities for residents and visitors and likely alleviate the burden on existing boat ramps and associated parking lot structures in the area.

4.11.4 Water-Based Recreation

For the purposes of this EIS, water-based recreation focuses on boating and includes the different types of boating activities, boat numbers, and boating densities present at Lake Texoma. Evaluated boating activities occurring on the lake include the following:

- Pleasure/power boating
- Sail boating
- Waterskiing/tubing
- Fishing
- Jet skiing/Personal Watercraft
- Canoeing/kayaking

As indicated in Section 3, estimation of baseline water-based recreation was accomplished by field observations (boat counts, boat densities, and boating activities) conducted in June, July, and September of 2009 (see Appendix I). Boat counts were used to calculate boat densities for both the entire lake and Designated Lake Areas (DLAs). This information is the baseline data to which the water-based recreational activities will be compared. As noted in Section 3, the lake was broken into 12 separate DLAs in an attempt to capture variations in boating densities across the lake typically found in boating recreation, as identified as a potential concern in the scoping report public comments. DLA 7, Little Mineral Arm, is directly adjacent to the proposed land conveyance.

It should be noted that impacts as a result of the Proposed Action cannot be evaluated with certainty for each DLA because the ultimate destination of additional boats originating from the conveyance area is unknown. Because the Proposed Action and associated development would generate additional boating facilities only within DLA 7, it can be inferred that all additional boats resulting from the Proposed Action must spend time in DLA 7 before (or if) they disperse to other areas of the lake. Therefore, the impacts discussed in this section will focus on DLA 7 during its peak use on 4 July 2009.

Section 1052.22 of NEPA allows for incomplete or unavailable information (data gaps). Therefore, pursuant to Section 1502.22, the government must make the following available within the EIS:

- *a statement that such information is incomplete or unavailable;*
- *a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;*
- *a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and*
- *the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.*

Based on these requirements, the data gaps associated with water-based recreation are the result of uncertainties and unavailable published data on which way water craft may travel and how far they may travel outside of DLA 7. Determining the percentage of boats that would travel to each DLA is not quantifiable in any reliable scientific manner. In such cases, NEPA allows for a best credible estimation in an attempt to fill such data gaps. Where possible, this EIS attempts to estimate the ultimate destination for additional boaters emanating from DLA 7; however, impacts discussed in this section are based on data from DLA 7 during its peak use on 4 July 2009.

Alternative 1 – No Action

Under Alternative 1, water-based recreational activities at and within Little Mineral Arm in Lake Texoma would not be impacted. No land would be conveyed, and no changes to the SMP or moratorium would occur. However, potential impacts to water-based recreational activities may occur as a result of the increase of residents and visitors on the adjacent private land to the proposed development. The additional residents and visitors associated with the proposed development on the adjacent private land are not anticipated to substantially exceed usage rates of the lake beyond what was observed in 2009. Additionally, Alternative 1 would not add or remove any facilities that provide boat access to the lake. As a result, those facilities that exceeded capacity (three boat ramp parking facilities over Labor day weekend, and two boat ramp parking facilities over the July 4th weekend within DLA 7), are expected to continue to surpass capacity during the busiest times of the year regardless of proposed development status and would not be able to accommodate additional visitors. However, visitors discovering destination facilities operating at full capacity would likely seek out other nearby facilities, and because all alternate facilities were well below capacity during the 2009 observations, it is anticipated the increase would not likely result in overcapacity issues on those facilities or the lake. Therefore, it is expected that water-based recreation would continue to operate at current levels of service.

Alternative 2 – Land Conveyance without Shoreline Development

Similar to Alternative 1, Alternative 2 would not directly impact water-based recreational activities at and within Little Mineral Arm. Although land would be conveyed down to elevation 619 ft NGVD with deed restrictions between elevation 619 ft NGVD and 645 ft NGVD, no changes to the SMP or deviation from the existing moratorium would occur. In addition, indirect impacts similar to Alternative 1 are expected under Alternative 2, and water-based recreation would continue to operate at current levels of service.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Alternative 3 would include conveyance of USACE land to elevation 619 ft NGVD with deed restrictions, no changes to the SMP, and lifting of the 2005 moratorium. Due to the deviation from the existing moratorium, construction of private boat docks would be allowed in areas designated as limited development. A maximum of approximately 247 private boat slips (13 covered boat docks 19 units each) and 78 uncovered private boat slips are proposed for development within the proposed conveyance land along the shoreline. This would introduce a maximum total of 325 additional boat slips within DLA 7 (Little Mineral Arm).

Boat Counts

This projection was made by applying the peak BAOT method used for comparing observed boat counts and densities to those expected (methods are described Appendix I). Accordingly, a maximum increase of 81 boats is projected as a result of the additional boat slips proposed under Alternative 3. This would bring the peak number of boats observed over the busiest holiday weekend/time (July 4th/afternoon) within DLA 7 to 199 boats. Assuming boating use patterns remain consistent with those observed in 2009, the peak non-holiday boat count within DLA 7 would be an additional 43% of boats. The peak number of boats observed over non-peak days and times within DLA 7 would be 93 boats.

Boat Counts by DLA

As previously discussed, determining the percentage of boats that would travel to each DLA is not quantifiable in a reliable manner. However, the following best credible estimation is provided for the ultimate destination for additional boaters emanating from DLA 7.

The most common method used to measure the economic value associated with water-based recreation is the travel cost model. It is based on the travel costs and travel time required to engage in a recreational activity, while accounting for the next best use of an individual’s time and the other available recreational alternatives. Since this method is survey based, it is often time and labor intensive to employ, and a commonly-utilized alternative to measuring recreation value relies on a case-specific and well-informed transfer of benefits from existing travel cost literature. Several travel cost model studies show an average boating day value range from $47-$87. For the purposes of this study, the value of $50 is used as an appropriate daily value target.

Boat fuel usage is measured in gallons of fuel burned per hour. Travel distance is variable because of many factors like wind, currents, wind waves, swells, and other unfixed constants. It is estimated that the average recreation boat operating at optimum levels uses approximately 10 gallons of fuel per hour. With an average marine gasoline cost of approximately $5/gallon, a 1 hour round trip would be valued at $50. That means that an average boater would travel up to 1/2 an hour from launch to point before turning around for its return trip. It is anticipated that an average boat speed of 10 miles per hour (MPH) is appropriate for Lake Texoma. At that rate, an average boat will travel up to 5 miles for its desired destination.

It is anticipated that the majority (75%) of boats launching from DLA 7 will stay there (due to cost), and that the number of boats emanating from DLA 7 will decrease as distance from launch point increases. Boaters leaving DLA 7 must traverse DLA 8 before entering any other DLA, such that DLA 8 would be impacted by all the new boats emanating from DLA 7 (25%). It is estimated that approximately half of those boats that entered DLA 8 from DLA 7 would continue into DLA 9 (15%) and that only a small percentage of boats launching from DLA 7 (less than 5%) would travel beyond DLA 9 based on travel cost modeling. It is anticipated that boat usage patterns would continue to peak during the afternoons of major holiday weekends, as seen with field observations in 2009.

Density Analysis

Boat density is expressed as acres per boat. Fewer acres per boat equates to a higher density of boats in a given area. The addition of 81 boats on the entire approximate 81,965-acre lake would result in a decrease of 0.17 acres per boat lake-wide; therefore, the average impact to boat density lake-wide as a result of Alternative 3 would be negligible. The projected boat density in DLA 7 will be analyzed rather than the other DLAs because each additional boat would spend some time in DLA 7 as they leave and return to the additional boating facilities.

Table 4.11.1 shows pre-development and projected post-development boating densities within DLA 7 for Alternative 3.

Table 4.11.1

Pre- and Post-Development Boating Densities within DLA 7 (Alternative 3)

Boat Densities within DLA 7			
	Peak # of Boats	DLA Surface Area (Acres)	Boat Density (Acres/ Boat)
Pre-Development	118	1,974	17
Post-Development	199	1,974	10

Source: SEE, 2011
Notes: Peak number of boats observed late afternoon on 4 July 2009.
DLA surface area based on water level during the field observations in 2009.

The increase in the number of boats within DLA 7 is projected to reduce available acres from 17 to 10 acres per boat during peak use times. This resulting boat density would have the following impacts during peak use (July 4, late afternoon):

- The acres per boat required for waterskiing within DLA 7 would fall below the minimum standard for area needed to safely water ski in 5 out of 5 high area standards and 3 out of 5 low area standards.
- The acres per boat required for pleasure/power boating within DLA 7 would fall below the minimum standard for area needed to safely power/pleasure boat in 4 out of 5 high area standards and is at the lowest end of acceptable range for 2 out of 5 low area standards.
- The acres per boat required for jet skiing/PWC within DLA 7 would fall below the minimum standard for area needed to safely jet ski/utilize PWC in 4 out of 5 high area standards and is at the lowest end of acceptable range for 2 out of 5 low area standards.
- The acres per boat required for sailing, fishing, and kayaking/canoeing within DLA 7 are each at the lowest end of acceptable ranges for each specific boating activity in 1 out of 5 high area standards, but do not fall below or approach the lowest end of acceptable ranges for any of the low area standards.

The increase in the number of boats within DLA 8 (20 boats for Alternative 3) is projected to reduce available acres from 30 to 28 acres per boat during peak use times. This resulting boat density would have the following impacts during peak use:

- The acres per boat required for waterskiing within DLA 8 would fall below the minimum standard for area needed to safely water ski in 2 out of 5 high area standards.

The increase in the number of boats within DLA 9 (10 boats for Alternative 3) is projected to reduce available acres from 48 to 46 acres per boat during peak use times. This resulting boat density would have the following impacts during peak use:

- The acres per boat required for waterskiing within DLA 9 would fall below the minimum standard for area needed to safely water ski in 1 out of 5 high area standards.

It is important to note that these impacts have potential to occur only during peak days and would be short lived and intermittent throughout those days. In response to locally crowded conditions, recreational boaters frequently seek out less congested areas on a lake for boating activities. While it is not possible to anticipate or quantify such responses, it is reasonable to assume that some boaters would respond accordingly. For an explanation of the standards required for boat type see Appendix I.

Boating Activity

Table 4.11.2 shows the number of additional boats and projected boating activities expected at peak use within DLA 7 for Alternative 3.

Based on projected peak use presented in Table 4.11.2, it can be assumed that the individual boating activity as a percentage of the total boating activity would be consistent with conditions observed in 2009. Pleasure/power boating would remain the most frequent activity on the lake totaling 56.8% of the overall boating activity.

Impacts to waterskiing, pleasure/power boating, and jet skiing/PWC are expected to occur within DLA 7 due to the reduced area per boat accessible during peak use periods. Analysis of projected boating density indicate that it is likely that waterskiing, pleasure/power boating, and jet skiing/PWC use cannot occur safely within DLA 7 during peak use as a result of Alternative 3 impacts. Sailing, fishing, and kayaking/canoeing would be impacted slightly; however, these boating activities would likely continue to occur safely within DLA 7.

Table 4.11.2

Projected Peak Boating Activity within DLA 7 (Alternative 3)

Boat Activity Type	Peak Observations in DLA 7 Based on Recreation Inventory & Assessment Report		Projected Increase in Boat Type Based on Potential Peak Usage from Alternative 3	Projected Number of Boats in DLA 7
	#	%	#	#
Pleasure/Power	67	56.8%	46	113
Sailing	8	6.8%	6	14
Waterskiing/Tubing	16	13.6%	11	27
Fishing	3	2.5%	2	5
Jet Ski/PWC	24	20.3%	16	40
Canoe/Kayak	0	0.0%	0	0
Totals	**118**	**100.0%**	**81**	**199**

Source: SEE, 2011

Impacts to boating activity projected for DLA 7 under normal weekend periods fall within acceptable low area standards for all boating activities, except for water skiing which would still exceed 2 of the 5 standards. Pleasure/power boating and jet ski activities would exceed the highest area standards, but could still be safely pursued under the lowest area requirements for 4 of the 5 standards.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Alternative 4 includes the conveyance of land with deed restrictions, revising the existing SMP, and lifting the moratorium within the proposed conveyance land. As a result, new boat ramps, boat slips, a boat club, two golf courses, inland recreational opportunities, hike and bike trails, a hotel/conference center, single-family homes, and townhomes are proposed for development.

Alternative 4 includes the development of existing shoreline by proposing the following:

- 57 covered boat slips for day use in the area of the proposed hotel/conference center;

- 46 uncovered boat day slips (30 at the proposed hotel/conference center and 16 commercial slips at the dry dock storage);
- 78 commercial uncovered boat slips and 171 commercial boat slips (comprising nine 19-unit covered boat docks) at the proposed boat club location; and
- 608 private slips (comprising thirty-two 19-unit covered boat docks).

Alternative 4 also proposes three additional boat ramps, 213 additional boat ramp parking facilities, and 56 parking spaces for trailers at proposed boat ramp facilities.

In summary, Alternative 4 proposes the addition of 960 total boat slips and 3 boat ramps within DLA 7 (Little Mineral Arm), and 269 additional parking spaces associated with water recreation on the conveyance property. For information on land-water-interface-based recreation see Section 4.11.3 of this EIS.

Boat Counts

As a result of the additional boat slips proposed for Alternative 4, the number of additional boats on the lake can be projected by applying the peak BAOT method used for comparing observed boat counts and densities to those expected (methods are described in Appendix I). An increase of 307 boats at one time is projected as a result of the additional boat slips proposed under Alternative 4. This would bring the peak number of boats observed over the busiest holiday weekend, (July 4th) and the busiest time of day on July 4th (the afternoon) within DLA 7 to 425 boats. Assuming boating use patterns remain consistent from those observed in 2009, the boat count within DLA 7 would be an additional 43% of boats on non-holiday weekends. This increase would bring the peak number of boats observed over the non-peak days and non-peak times of day within DLA 7 to 185 boats.

Boat Counts by DLA

As with Alternative 3, it is anticipated that the majority (75%) of boats launching from DLA 7 will remain in DLA 7 (due to cost), and that the number of boats emanating from DLA 7 will decrease as distance from the launch point increases. Boaters leaving DLA 7 must traverse DLA 8 before entering any other DLA, such that DLA 8 would be impacted by all the new boats emanating from DLA 7 (25%). It is estimated that approximately half of those boats that entered DL8 from DLA 7 would continue into DLA 9 (15%). Additionally, it is estimated that only a small percentage of boats launching from DLA 7 (less than 5%) would travel beyond DLA 9 based on travel cost modeling. It is anticipated that boat usage patterns would continue to peak during afternoons on major holiday weekends, as seen with the field observations in 2009.

Density Analysis

Boat density is expressed as acres per boat. Fewer acres per boat equate to a higher density of boats in a given area. The addition of 307 boats on the entire approximate 81,965-acre lake would result in a decrease of 0.62 acres per boat lake-wide; this decrease is considered negligible lake-wide.

Table 4.11.3 shows pre-development and projected post-development boating densities within DLA 7 for Alternative 4.

Table 4.11.3

Pre- and Post-Development Boating Densities within DLA 7 (Alternative 4)

Boat Densities within DLA 7			
	Peak # of Boats	DLA Surface Area (Acres)	Boat Density (Acres/ Boat)
Pre-Development	118	1,974	17
Post-Development	425	1,974	5

Source: SEE, 2011
Notes: Peak number of boats observed late afternoon on 4 July 2009.
DLA surface area based on water level during the field observations in 2009

The increase in the peak number of boats within DLA 7 is projected to reduce available acres from 17 to 5 acres per boat. This resulting boat density would have the following impacts during peak use (July 4, late afternoon):

- The acres per boat required for waterskiing within DLA 7 would fall below the minimum standard for area needed to safely water ski in 5 out of 5 high area standards and 4 out of 5 low area standards.
- The acres per boat required for pleasure/power boating within DLA 7 would fall below the minimum standard for area needed to safely pleasure/power boat in 5 out of 5 high area standards, 3 out of 5 low area standards, and is at the lowest end of acceptable range for 1 additional low area standard.

- The acres per boat required for jet skiing/PWC boating within DLA 7 would fall below the minimum standard for area needed to safely jet ski/utilize PWC in 4 out of 5 high area standards, 2 out of 5 low area standards, and is at the lowest end of acceptable range for 1 additional low area standard.
- The acres per boat required for sailing, fishing, and kayaking/canoeing within DLA 7 fall below the minimum standards for area needed to safely conduct each specific boating activity in 1 out of 5 high area standards, and are at the lowest end of acceptable range for 1 out of 5 high area standards, and 1 out of 5 low area standards.

The increase in the number of boats within DLA 8 (76 boats for Alternative 4) is projected to reduce available acres from 30 to 22 acres per boat during peak use times. This resulting boat density would have the following impacts during peak use:

- The acres per boat required for waterskiing within DLA 8 would fall below the minimum standard for area needed to safely water ski in 2 out of 5 high area standards.
- The acres per boat required for pleasure/power boating within DLA 8 would fall below the minimum standard for area needed to safely power/pleasure boat in 1 out of 5 high area standards.
- The acres per boat required for jet skiing/PWC within DLA 8 would fall below the minimum standard for area needed to safely jet ski/utilize PWC in 1 out of 5 high area standards.

The increase in the number of boats within DLA 9 (38 boats for Alternative 4) is projected to reduce available acres from 48 to 42 acres per boat during peak use times. This resulting boat density would have the following impacts during peak use:

- The acres per boat required for waterskiing within DLA 9 would fall below the minimum standard for area needed to safely water ski in 1 out of 5 high area standards.

It is important to note that these potential impacts would occur only during peak days and would be short lived and intermittent throughout those peak days. In response to locally crowded conditions, recreational boaters frequently seek out less congested areas on a lake for boating activities. While it is not possible to anticipate or quantify such responses, it is reasonable to assume that some boaters would respond accordingly. For an explanation of the standards required for boat type see Appendix I.

Boating Activity

Table 4.11.4 shows the number of additional boats and projected boating activities at peak use within DLA 7.

Based on the projected peak use presented in Table 4.11.4, it can be assumed that the individual boating activity as a percentage of the total boating activity would be consistent with conditions observed in 2009. Pleasure/power boating would remain the most frequent activity on the lake, totaling 56.8% of the overall boating activity.

Impacts to waterskiing, pleasure/power boating, and jet skiing/PWC are expected to occur within DLA 7 due to the reduced area per boat during peak holiday hours and non-holiday summer weekend peak use periods. Analysis of projected boating density indicates that waterskiing, pleasure/power boating, and jet skiing/PWC use most likely cannot occur safely within DLA 7 during peak holiday use or regular summer weekend peak use as a result of Alternative 4 impacts. Sailing, fishing, and kayaking/canoeing would be impacted slightly; however, these boating activities would likely continue to occur safely within DLA 7.

Table 4.11.4

Projected Peak Boating Activity within DLA 7 (Alternative 4)

Boat Activity Type	Peak Observations in DLA 7 Based on Recreation Inventory & Assessment Report		Projected Increase in Boat Type Based on Potential Peak Usage from Alternative 4	Projected Number of Boats in DLA 7
	#	%	#	#
Pleasure/Power	67	56.8%	174	241
Sail	8	6.8%	21	29
Waterskiing/Tubing	16	13.6%	42	58
Fishing	3	2.5%	8	11
Jet Ski/PWC	24	20.3%	62	86
Canoe/Kayak	0	0.0%	0	0
Totals	**118**	**100.0%**	**307**	**425**

Source: SEE, 2011

4.11.5 Lake Carrying Capacity

The carrying capacity of Lake Texoma to accommodate boating activities was evaluated in three ways:

- Spatial capacity – Concerned with minimum space requirements for various activities such as area required for waterskiing.
- Facility capacity – Concerned with facility handling thresholds such as the number of boat slips or moorings, or the number of boat ramp parking spaces.
- Social capacity – Concerned with social conditions such as user conflicts, visitor perceptions versus expectations, or facility management goals.

These methodologies help define and measure the capacity of a body of water to accommodate boating activities. Impacts to these capacities due to dredging activities are discussed below, while methodologies used and standards applied for determining carrying capacity at Lake Texoma are identified in Appendix I.

Alternative 1 – No Action

Under Alternative 1, no impacts or increases to the percentage of lake carrying capacity utilized (spatial capacity, facility capacity, and social capacity) are anticipated. Alternative 1 would not add any facilities that would increase the number of boats on Lake Texoma or DLA 7, or impact the carrying capacity.

Alternative 2 – Land Conveyance without Shoreline Development

Similar to Alternative 1, no impacts or increases to the percentage of lake carrying capacity utilized (spatial capacity, facility capacity, and social capacity) are anticipated as a result of Alternative 2. Alternative 2 proposes to convey land down to elevation 619 ft NGVD, but the existing SMP and moratorium would remain in place restricting any shoreline development. Therefore, Alternative 2 would not add any facilities that would increase the number of boats on Lake Texoma or DLA 7, or impact the carrying capacity.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Alternative 3 would include conveyance of the USACE land to elevation 619 ft NGVD with deed restrictions, no changes to the SMP, and the lifting of the 2005 moratorium for the proposed conveyance land shoreline. Due to lifting of the existing moratorium, construction of private boat docks would be allowed in areas designated as limited development, as described in detail in Section 4.11.4. The addition of boating facilities and boats would impact carrying capacity, most acutely in DLA 7, as boats must pass through this DLA to get on or off the lake.

Spatial Capacity

Additional boats using the lake above observed baseline levels would impact the capacity of the lake to safely accommodate existing boating activities. The low standard is the smallest area required per boat, while the high standard represents the largest area required per boat.

DLA 7 exceeded carrying capacity standards at various times during the field observations in 2009, including two high-standards on July 3 and four high-standards on July 4th. None of the low-standards were exceeded.

Projected carrying capacity standards per DLA based on the increase in the peak number of boats as a result of Alternative 3 are shown in Table 4.11.5. Note that although the table lists each DLA, only the impacts to DLA 7 and the entire lake were calculated for this EIS due to destination uncertainty. All other capacity levels presented in Table 4.11.5 remain unchanged from the results of 2009 field observations as presented in Appendix I.

Alternative 3 projections, when compared to the least stringent area standards, result in exceeded capacity on the busiest holiday weekends (Table 4.11.5), but accommodate normal summer weekend use. When compared to the most stringent area standards, Alternative 3 projections exceed capacity over both the busiest holiday weekends and average summer non-holiday weekends (Table 4.11.5).

It is important to note that impacts to carrying capacity would likely be short in duration and likely occur only during peak times of the day under both the high- and low-standards.

Facility Capacity

Under Alternative 3, facility capacity of the lake would increase, allowing additional boats to enter and exit active use on the water. An additional 325 boat facilities are planned under Alternative 3, increasing the total number of actual boat facilities on the lake from 9,810 to 10,135. While increasing the level of service to boaters entering and exiting the lake is positive from a facility capacity point of view, it applies additional pressure on the spatial carrying capacity of the lake.

Social Capacity

USACE has no pre-determined facility management goals for recreation on Lake Texoma; as such, facility management goals were not evaluated. Visitor perceptions were gleaned from the scoping report and relate to overcrowded boating conditions on the lake. Perceptions of overcrowding may result from a sense of user conflicts or boaters not being able to comfortably enjoy the boating activities they seek.

Table 4.11.5

Projected Carrying Capacity Levels as a Result of Alternative 3 (Spatial Method)

		Low Standard						High Standard					
DLA	**Location**	**June 27**	**June 28**	**July 3**	**July 4**	**Sept 6**	**Sept 7**	**June 27**	**June 28**	**July 3**	**July 4**	**Sept 6**	**Sept 7**
1	Hauani Creek to Briar/Brier Creeks												
2	Briar/Brier Creeks to Big Mineral Arm/Buncombe Creek												
3	Big Mineral Arm/Buncombe Creek to Treasure Island										4	4	
4	Big Mineral Arm										2	2	
5	Treasure Island to North Island					3					4	5	
6	North Island to Preston Point												
7	Little Mineral Arm				2			4	4	4	4	4	4
8	Preston Point to Denison Dam												
9	Preston Point to Alberta Creek												
10	Rock Creek Arm									2	3		
11	Alberta Creek to Glasses Creek Arm												
12	Washita River Arm												
Entire Lake													

below capacity for all standards
approaching capacity based on one or more standards
2 at or exceeding capacity. The digit represents the number of standards exceeded out of 5.

Source: SEE, 2011
Note: Four density standards contain a range of low and high area requirements. Catawbe-Wateree study contains only one standard, which is treated as both a low and high standard for this analysis. The density standards are explained in detail in Appendix I.

Under Alternative 3, boating activity conflicts would emerge. Increased boat density means a decrease in the amount of acres available per boat to participate in their selected activity. The standards used to calculate the lake's spatial carrying capacity are based on the area needed to safely partake in particular boating activities.

Under Alternative 3, conditions that exceed minimum boat density standards for waterskiing, pleasure/power boating, jet skiing/PWC, at even the lowest area required safety standard would exist.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Alternative 4 includes the conveyance of land with deed restrictions, revising the existing SMP, and lifting the moratorium within the proposed conveyance land. Construction of boat slips, boat ramps, and associated parking would be allowed as described in Section 4.11.4.

Spatial Capacity

Additional boats using the lake above observed baseline levels would impact the capacity of the lake to safely accommodate existing uses. The low-standard is the smallest area required per boat while the high-standard represents the largest area required per boat. DLA 7 exceeded carrying capacity standards at some time during the field observations in 2009, including two high-standards on July 3 and four high-standards on July 4. None of the low-standards were exceeded.

Projected carrying capacities per DLA based on the increase in the peak number of boats as a result of Alternative 4 are shown in Table 4.11.6. Note that although the table lists each DLA, only the impacts to DLA 7 were calculated for this EIS due to destination uncertainty. Therefore, besides the carrying capacities for DLA 7 and the entire lake, all other capacity levels presented in Table 4.11.6 remain unchanged from the results of the 2009 field observations as presented in Appendix I.

Alternative 4 projections, when compared to the least stringent standards as well as the most stringent standards result in exceeded capacity standards not only over the busiest holiday weekends of the year, as well as average summer non-holiday weekends (Table 4.11.6). It is important to note that the projected impacts to carrying capacity would likely be short in duration and only occur during the peak times of a day, under both the high and low standards.

Table 4.11.6

Projected Carrying Capacity Levels as a Result of Alternative 4 (Spatial Method)

		Low Standard						High Standard					
DLA	**Location**	**June 27**	**June 28**	**July 3**	**July 4**	**Sept 6**	**Sept 7**	**June 27**	**June 28**	**July 3**	**July 4**	**Sept 6**	**Sept 7**
1	Hauani Creek to Briar/Brier Creeks												
2	Briar/Brier Creeks to Big Mineral Arm/Buncombe Creek												
3	Big Mineral Arm/Buncombe Creek to Treasure Island										4	4	
4	Big Mineral Arm										2	2	
5	Treasure Island to North Island					3					4	5	
6	North Island to Preston Point												
7	Little Mineral Arm	3	3	3	3	3	3	5	5	5	5	5	5
8	Preston Point to Denison Dam												
9	Preston Point to Alberta Creek												
10	Rock Creek Arm									2	3		
11	Alberta Creek to Glasses Creek Arm												
12	Washita River Arm												
Entire Lake													

below capacity for all standards

approaching capacity based on one or more standards

2 at or exceeding capacity. The digit represents the number of standards exceeded out of 5.

Source: SEE, 2011

Note: Four density standards contain a range of low and high area requirements. Catawbe-Wateree study contains only one standard, which is treated as both a low and high standard for this analysis. The density standards are explained in detail in Appendix I.

Facility Capacity

Under Alternative 4, facility capacity of the lake would increase, allowing additional boats to enter and exit active use on the water. An additional 1,229 boat facilities are planned under Alternative 4, increasing the total number of boat facilities on the lake from 9,810 to 11,039. While increasing the level of service to boaters entering and exiting the lake is positive from a facility capacity point of view, it applies additional pressure on the spatial carrying capacity of the lake.

Social Capacity

USACE has no pre-determined facility management goals for recreation on Lake Texoma; as such, facility management goals were not evaluated. Visitor perceptions were gleaned from the scoping report and relate to overcrowded boating conditions on the lake. Perceptions of overcrowding may result from a sense of user conflicts or boaters not being able to comfortably enjoy the boating activities they seek.

Under Alternative 4, boating activity conflicts would emerge. Increased boat density, (created by the addition of boating facilities, and more boats) would decrease the amount of acres available per boat to participate in their selected activity. The standards used to calculate the lake's spatial carrying capacity are based on the area needed to safely partake in particular boating activities.

Under Alternative 4, conditions that exceed minimum boat density standards for waterskiing, pleasure/power boating, or jet skiing/PWC, would exist, at even the lowest area-required safety standard. It is important to note that impacts would likely be short in duration and likely occur only during peak times of the day under both the high- and low-standards.

Proposed Dredging Activities

Alternative 4 would expand upon the same activities described under Alternative 3 to include additional dredging for a public boat ramp and associated entrance channel. This boat ramp would provide additional public access to Lake Texoma, giving non-residents of Preston Harbor Development the ability to launch their boats and other recreational equipment into Little Mineral Arm. This dredging would provide a minor increase to the lake carrying capacity.

4.11.6 Pocket Beaches

Pocket beaches within Lake Texoma are located in relatively undeveloped areas and have no formal recreation access from land, making them popular destinations for boaters. There are approximately 195 secluded pocket beaches along the shoreline of Lake Texoma, totaling 108,702 linear feet (Figures 3.10.2.1 through 3.10.2.3). Of these pocket beaches, 15 exist along the shoreline of Little Mineral Arm, totaling 9,953 linear feet or 9.2% of total Lake Texoma pocket Beaches (Figure 3.11.1). Pocket beaches exist on both the west and east sides of the Little Mineral Arm. The majority of these beaches (approximately 8,153 linear feet, and 14 of the 15 pocket beaches) are situated along the eastern shore of Little Mineral Arm within the proposed conveyance area, and are also located within SMP designated protected shoreline areas.

Little Mineral Arm pocket beaches were studied in 2009 to evaluate and characterize levels and types of use. The density of boats along pocket beaches on the east shore during the 2009 field observations reached a maximum of 1 boat for every 79 linear feet of beach. One area of pocket beaches (approximately 1,800 linear feet) is located along the western shore of Little Mineral Arm, adjacent to the Hiland Shores development. The density of boats along the pocket beaches on the west shore during the field observations in 2009 were observed at a maximum of 1 boat for every 36 linear feet of beach.

Alternative 1 – No Action

Alternative 1 would not directly impact existing pocket beaches or current visitation availability of pocket beaches along the shoreline of Little Mineral Arm. No land would be conveyed, and no changes to the SMP or moratorium would occur. These beaches would remain open for public use and visitation as they do under existing conditions.

Alternative 2 – Land Conveyance without Shoreline Development

Alternative 2 would convey Federal lands down to elevation 619 ft NGVD with deed restrictions, but would not change the existing SMP and would not propose any deviation to the existing moratorium. Although the land would be conveyed under this alternative, any shoreline development would be restricted due to the current SMP and the existing moratorium.

Under Alternative 2, 5 of the 14 pocket beaches in Little Mineral Arm would be directly impacted by shoreline protection and experience diminished levels of service. Approximately 785 linear feet of pocket beaches would be lost due to shoreline protection (see Figure 4.11.6.1), and portions of these beaches would no longer be available for public beach use. In addition, impacts to all 14 of the pocket beaches along the eastern shore of Little Mineral Arm would occur. While the level of service of the remaining pocket beaches on the lake would not be affected, the proposed conveyance land would be privately owned down to elevation 619 ft NGVD, restricting public use of the shoreline above this elevation. The public would still legally be able to use pocket beaches adjacent to the conveyance property up to elevation 619 ft, the lake seasonal conservation pool elevation, when the lake water levels are lower than 619 ft. This would leave only one publicly available pocket beach (located on the western shore in Little Mineral Arm) for public use as it is under existing conditions.

The loss of public access to the 14 pocket beaches along eastern Little Mineral Arm would likely result in existing users redeploying to one of the other 181 pocket beaches along the shoreline of Lake Texoma. It is also possible that users would continue to moor their boats in the water outside the shoreline of the existing pocket beaches and utilize the shore below elevation 619 ft NGVD. If all displaced boaters were to utilize other pocket beaches within Little Mineral Arm along the proposed conveyance land, the area available for boats to moor would decline from 1 boat for every 79 linear feet of pocket beach to 1 boat for every 71 linear feet of pocket beach during peak use. This alternative accommodates the recommended mooring width, 22 linear feet per boat, for an average 30-foot-long powerboat of 15 feet (Mellor, 1992).

Alternative 3 – Land Conveyance with Limited Shoreline Development

Alternative 3 would include conveyance of USACE land to elevation 619 ft NGVD with deed restrictions, no changes to the SMP, and lifting of the 2005 moratorium. Construction of private boat docks would be allowed in areas allocated as limited development. Approximately 247 private boat slips (comprising 13, 19-unit private covered boat docks), 78 uncovered private boat slips, and shoreline protection would be constructed within the proposed conveyance. This would create a total of 325 new boat slips under Alternative 3.

Under this alternative, impacts to the 14 pocket beaches along the eastern shore of Little Mineral Arm, and the redeployment of users as a result of the impacts under Alternative 3, would be the same as those described under Alternative 2. In addition, 7 of the 14 pocket beaches would experience further diminished levels of service as approximately 785 linear feet of pocket beach would be lost due to shoreline protection, and 825 linear feet would be lost due to boat slip construction (see Figure 4.11.6.2). These combined impacts total approximately 1,610 linear feet of pocket beach impacts within the proposed conveyance land. In addition, 3,594 linear feet of existing pocket beach area is intended for beach enhancements. These beaches would no longer function as under current conditions, but the available beach area/linear footage would not be impacted. Portions of those pocket beaches intended for shoreline protection and boat slip construction would no longer be available for public beach use.

These impacts would likely result in the increased use of remaining pocket beaches within Little Mineral Arm or other pocket beaches around Lake Texoma. If displaced boaters utilize the other pocket beaches within Little Mineral Arm along the proposed conveyance land, the area available for boats to moor would decline from 1 boat for every 79 linear feet of pocket beach to 1 boat for every 63 linear feet of pocket beach during peak use. This alternative accommodates the recommended mooring width, 22 linear feet per boat, for an average 30-foot-long powerboat of 15 feet (Mellor, 1992).

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Alternative 4 includes the conveyance of land with deed restrictions, revising the existing SMP, and lifting the moratorium within the proposed conveyance land of Lake Texoma. Impacts to the 14 pocket beaches along the eastern shore of Little Mineral Arm, the redeployment of users, and diminished levels of service to 7 of the 14 pocket beaches that would be impacted by shoreline protection and/or development as described under Alternative 3. Approximately 710 linear feet would be lost due to shoreline protection, and 1,505 linear feet would be lost due to boat slip construction (see Figure 4.11.6.3). These combined impacts total approximately 2,215 linear feet within the proposed conveyance land. In addition, 3,369 linear feet of existing pocket beach area intended for enhancements would no longer function as they do under current conditions, but available beach area/linear footage would not be impacted. Portions of those pocket beaches intended for shoreline protection and boat slip construction would no longer be available for use as pocket beach.

These impacts to the pocket beaches would likely result in the increased use of the remaining pocket beaches within Little Mineral Arm or the other pocket beaches around Lake Texoma, as described in Alternatives 2 and 3. If boaters were to utilize the other pocket beaches within Little Mineral Arm along the proposed conveyance land, the available area for boats to moor would decline from 1 boat for every 79 linear feet of pocket beach to 1 boat for every 58 linear feet of pocket beach during peak use. This alternative accommodates the recommended mooring width, 22 linear feet per boat, for an average 30-foot-long powerboat of 15 feet (Mellor, 1992)

4.11.7 Public Beaches

As described in Section 3.10, two USACE-managed public swimming beaches are present at Lake Texoma, (located at West Burns Run and East Burns Run). There are no public beaches within the proposed conveyance land; therefore, no impact to existing public beaches would be expected under Alternatives 1 through 4. The recreation beaches associated with the hotels and conference center will be considered private and will be available for use by hotel guests only except for portions that may exist below elevation 619 NGVD.

4.11.8 Fishing

Scoping comments were received concerning the loss of public access to 9.4 miles of shoreline for recreation activities, specifically fishing. Additional comments included a reduction in the surface area of the lake and shoreline available for public fishing, as well as. Additional losses in fishing opportunities associated with lifting the existing 2005 moratorium on boat docks and changing the SMP to permit additional docks were also raised during scoping.

The proposed conveyance land comprises approximately 635 acres and extends from the USACE property line down to elevation 619 ft NGVD of the lake shoreline. Currently, all 635 acres of USACE property can be accessed by the public from boat or from two access points located on the north and south ends of the USACE property. Under Alternatives 2-4, the proposed conveyance land would become private property controlled by the City and/or its designee, with limited or controlled public access. Portions of the area such as golf courses, hotel and a conference center, a boat club, a City park, and hike and bike trails would be open to controlled public access, but other portions of the development would be private.

Presently, all 635 acres and the shoreline are available to the general public for various outdoor recreational activities, including fishing. Under the proposed conveyance there would be a change in public use of the property and portions of the lake shoreline. Those portions of the proposed conveyance property shoreline above elevation 619 ft NGVD would become private property with controlled access. However, portions of the lake shoreline below elevation 619 ft

NGVD would remain under USACE ownership and accessible to the public for recreational activities and fishing, provided the shoreline below elevation 619 ft NGVD is accessed from a boat or the two noted limited access points. There would be no general public access to the shoreline above elevation 619 ft NGVD. However, under Alternative 4 a public boat ramp, parking area, and park would be constructed and operated by the City at the southern end of Little Mineral Arm, as shown in Figure 2.5, which would provide public boating and fishing access to the lake.

The cove containing the proposed day slips and swimming beach associated with the proposed hotels and conference center (Figure 2.5) would be limited in land access by the general public for recreation and fishing, except to the extent that the public is utilizing hotel amenities or facilities. Use of the cove and the facilities within this cove would be primarily for guests of the hotel and conference center, as well as members of the general public that are utilizing the hotel facilities (i.e., restaurants, bars, lounges, etc.) with land access to the amenities. The cove would remain accessible and useable from the water for boating and/or fishing, as discussed in Section 4.7.4, but constructed features may impair use and could potentially create conflict among recreation users.

4.11.9 Hunting

As stated in Section 3.11.2, USACE lands within Lake Texoma permit public hunting in designated areas, as shown in Figure 3.2.2. The loss of hunting opportunity is of noted concern to both the public and natural resource agencies. The proposed conveyance land is presently open to limited hunting for deer during archery season and small game and waterfowl with restrictions in accordance with applicable State and Federal regulations and established seasons.

The two State resource agencies (TPWD and ODWC), USFWS, and USACE permit hunting on designated USACE lands in accordance with applicable State and Federal rules and regulations, established seasons, and bag limits. Big game animals occurring in the area include white-tailed deer and wild turkey. Feral hogs, also present, are considered pests and are not regulated for hunting activities. Small game species prevalent in the area include fox squirrel, gray squirrel, cottontail, swamp rabbit, and black-tailed jackrabbit.

Alternative 1 – No Action

Under Alternative 1, no direct effect on hunting would occur, as use of public lands on USACE property would not change. The proposed conveyance land would remain under Federal ownership, and hunting would continue to be allowed. However, short-term indirect impacts to hunting activities on the proposed conveyance land may be expected under this alternative due to the construction activities on the adjacent private lands. Noise and air quality issues related to construction activities may create an undesirable atmosphere for hunting activities on the proposed conveyance land. Additionally, development on the adjacent private land may reduce hunting due to safety issues and a reduced animal population due to habitat fragmentation. Impacts presented for Alternative 1 are not associated with Federal action and are provided as a baseline for comparison to the action alternatives (Alternatives 2, 3, and 4).

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Alternatives 2 through 4 would eliminate hunting on the proposed conveyance property. Because the proposed conveyance land would be privately owned, and within the city limits of Denison, where hunting is not permitted; public hunting for deer during archery season and small game would no longer be permitted. Additionally, habitat for game species would be reduced and fragmented as a result of the development.

4.11.10 Privately Operated Recreation Areas

This section addresses impacts to privately operated recreation areas, including concession marinas and associated access areas. As described in Section 3.10.2, there are currently no privately operated recreation areas within the conveyance area. The nearest marina is Grandpappy Marina, which is adjacent to the study area at the northern-most edge. Impacts to privately operated recreation areas under each alternative are described below.

Alternative 1 – No Action

No direct impacts to private recreation areas would be expected under Alternative 1. The proposed conveyance land would remain Federally owned, and 635 acres of public access land would remain along the shore of Little Mineral Arm. However, development on the adjacent private land could benefit privately operated recreation areas, especially the nearby Grandpappy Point Marina, as residences of the proposed development may utilize such privately operated recreation areas for boating and recreation needs including lake access, supplies, and boat fueling. Impacts presented under Alternative 1 are not associated with a Federal action, but are provided as a baseline for comparison to the action Alternatives (Alternatives 2, 3, and 4).

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Because the proposed conveyance land would be privately owned under this alternative, recreation areas developed on this land, such as the golf course and swimming lake, would be classified as privately operated. The increase in recreation opportunities and residents as a result of the development would provide for privately operated recreations areas that were not previously present, and this would increase use of privately operated recreation areas in the vicinity of the proposed conveyance.

There are currently no marinas within the proposed conveyance land, and none would be constructed under Alternative 2. Therefore, Alternative 2 would not affect private marinas directly. However, the development of the conveyance parcel would likely result in additional customers for private marinas along Lake Texoma.

Under Alternative 3, privately operated recreation areas would also be created from the addition of the boat club on the proposed conveyance property. However, it should be noted that while the proposed boat club would not be considered a marina with concessions, limited, privately-owned boat storage facilities could be constructed. The proposed boat club would not include boat ramps or direct lake access for additional public boats. Privately operated recreation areas and marinas along the lake would continue to experience increased use for lake access, boat fueling, and supplies.

Increased use of privately operated recreation areas under Alternative 4 would further increase the need for boat fueling and supplies from nearby marinas due to the addition of the boat ramps, boat storage, and lake access along the shoreline of the proposed conveyance property. The proposed boat club would not sell fuel or boating supplies and the demand for these at existing facilities would likely increase.

4.11.11 Private Boat Docks

As described in Section 3.10.2, a total of 688 private boat docks have been permitted on Lake Texoma (USACE, 2008c). Within the cove proposed for the boat club location, 14 private mooring buoys have been permitted and installed, but docks have not been constructed due to the 2005 moratorium. Impacts relevant to private boat docks under each alternative are described below.

Alternative 1 – No Action

Under Alternative 1, the proposed conveyance land would remain Federally-owned, no change to SMP shoreline allocations would occur, and the 2005 moratorium would not be lifted. Construction of new docks would remain prohibited along the proposed conveyance area shoreline. Existing private docks elsewhere on the lake would not be affected.

Alternative 2 – Land Conveyance without Shoreline Development

No impacts to private boat docks would occur under Alternative 2. Impacts related to private docks would be identical to those described for Alternative 1.

Alternative 3 –Land Conveyance with Limited Shoreline Development

Construction of private boat docks along the proposed conveyance property shoreline would be expected under Alternative 3. The lifting of the 2005 moratorium along the conveyance area shoreline would allow construction of a maximum of the 78 uncovered private boat slips and 13 private boat docks proposed under this alternative. Ultimately, these would require approximately 4 acres of land/water interface along conveyance shoreline. Locations of the maximum number of proposed private boat docks under this alternative are shown in Figure 2.4. It is likely that these docks would be phased in over an extended (20+ year) development period.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Relative to other alternatives, increases in the number of boat docks along the proposed conveyance property shoreline would be expected to be greatest under Alternative 4. Proposed changes to the SMP and lifting of the 2005 moratorium would allow construction of private boat docks to meet boat storage requirements for the associated development. The addition of the proposed maximum of 32 private docks containing 608 individual private boat slips would require approximately 10 acres of land/water interface along the shoreline of the proposed conveyance property. Locations of the maximum number of private docks under this alternative are shown in Figures 2.5 and 4.7.3. It is likely that these docks would be phased in over an extended (20+ year) development period.

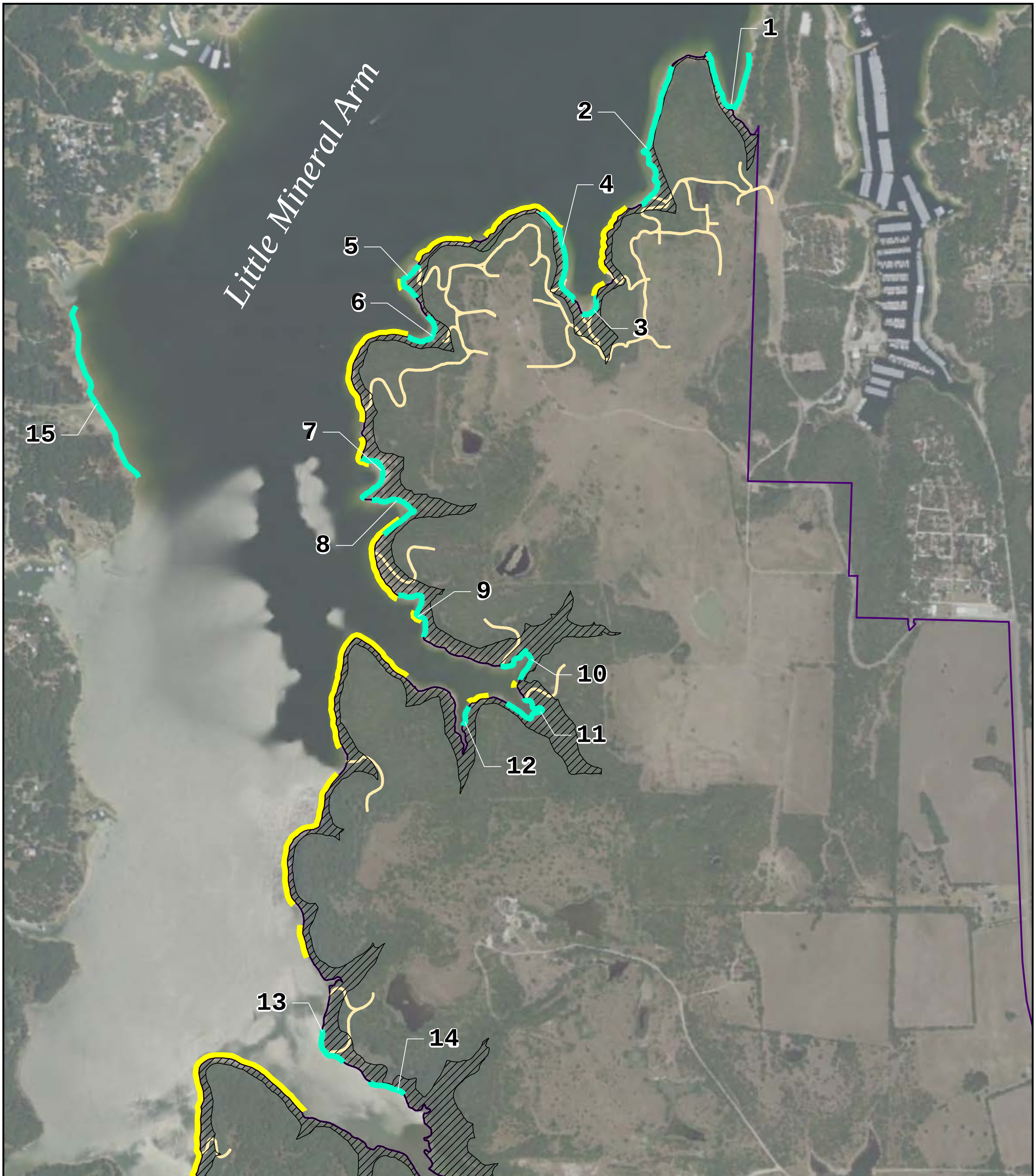
Mitigation

The City/developer would reduce impacts to the loss of current recreation and visitation on the conveyance land by developing a public park with a public boat ramp that would be designated as a public recreation area. The park would include picnic tables, restrooms, a parking lot, and public boat ramp. Additional recreation features within the development include open space, inland lakes, golf courses, hike and bike trails, golf clubs, and a boat club with boat ramps. Accordingly, while uses would change, development features would provide for additional and varied recreational opportunities not present absent the proposed development.

Proposed development of both onshore and water-based boat storage facilities is intended to meet boat storage requirements reasonable for residents of a large development area while minimizing, to the extent possible, the on-lake footprint for such facilities.

Specific impacts due to private boat docks would be minimized from the following design measures:

- Private docks would contemplate construction in “clusters” incorporating multiple slips in a dock to meet development needs, while minimizing the on-water dock footprint.
- The boat club will use dry dock storage to reduce the amount of dock structures on the shoreline.
- The boat dock facilities for the boat club would limit the length of boats stored at the facility to a maximum of 25 feet.



Legend

- Pocket Beach
- Preston Harbor Development Boundary
- Proposed 8' Wide Pervious Pathways
- Deed Restriction Zone (619 to 645 Elevation)
- Shoreline Protection

N

0 0.125 0.25
Miles

FIGURE 4.11.6.1
ALTERNATIVE 2 POTENTIAL IMPACTS
TO POCKET BEACHES
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JULY 2011	03886.544.001.0004	AS SHOWN

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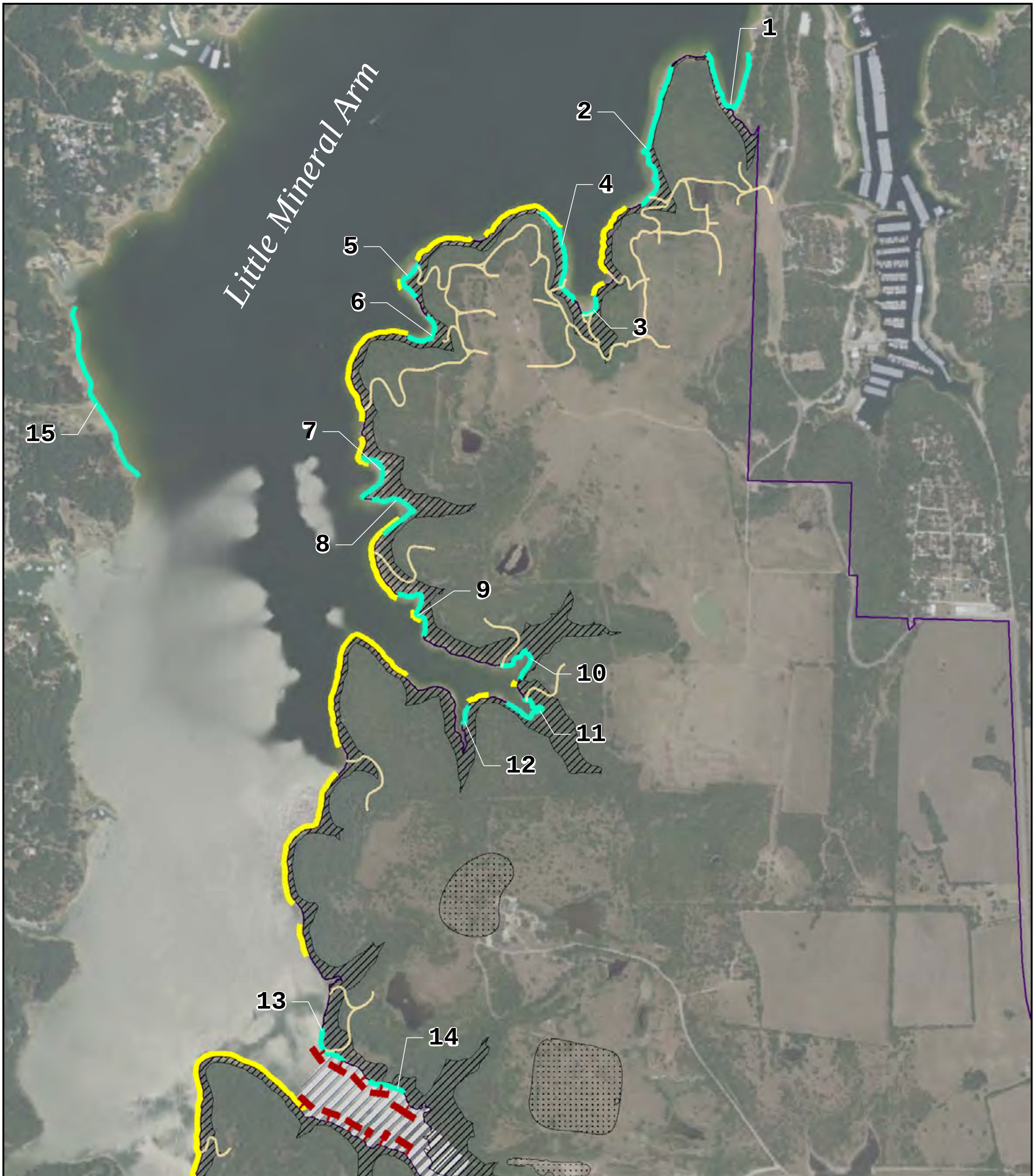

Legend

- Pocket Beach
- Preston Harbor Development Boundary
- Proposed 8' Wide Pervious Pathways
- Deed Restriction Zone (619 to 645 Elevation)
- Private Boat Structures
- Dredge Material Disposal Area
- Dredging Area
- Shoreline Protection

N

0 0.125 0.25
Miles

FIGURE 4.11.6.2
ALTERNATIVE 3 POTENTIAL IMPACTS
TO POCKET BEACHES
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JULY 2011	03886.544.001.0004	AS SHOWN

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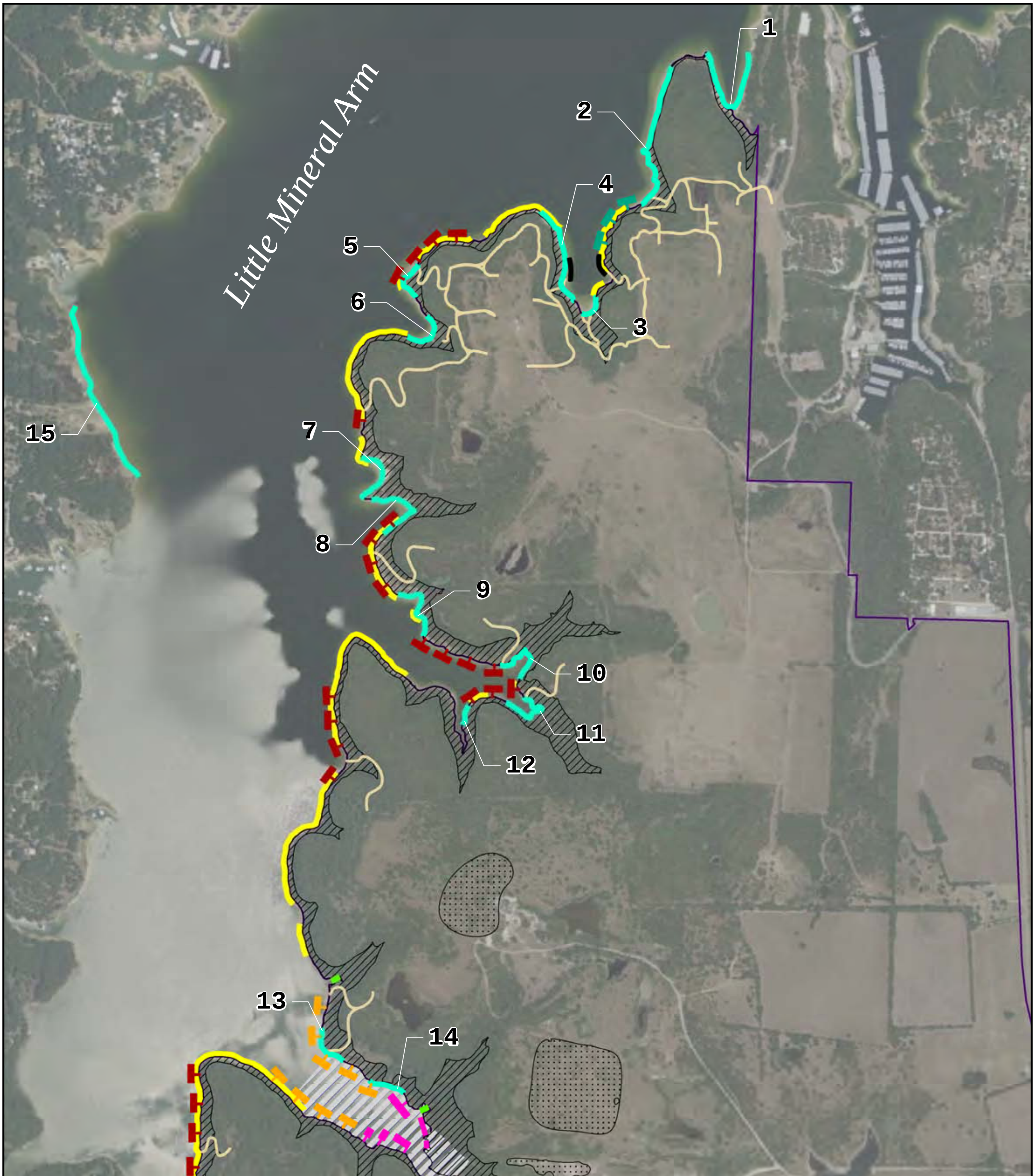

Legend

- Pocket Beach
- Preston Harbor Development Boundary
- Proposed 8' Wide Pervious Pathways
- Deed Restriction Zone (619 to 645 Elevation)
- Private 19-Unit Covered Boat Docks
- Hotel Uncovered Boat Day Slips
- Hotel Covered Boat Day Slips
- Commercial Uncovered Boat Slips
- Commercial 19-Unit Covered Boat Docks
- Private Boat Ramp
- Dredge Material Disposal Area
- Dredging Area
- Shoreline Protection

0 0.125 0.25
Miles

FIGURE 4.11.6.3
ALTERNATIVE 4 POTENTIAL IMPACTS
TO POCKET BEACHES
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JULY 2011	03886.544.001.0004	AS SHOWN

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4.12 CULTURAL RESOURCES

The proposed land conveyance has the potential to impact cultural resources. Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended) requires agencies to evaluate the impacts of federal undertakings on historic properties, which include prehistoric and historic archaeological sites, and historic standing structures. Section 106 requires the identification of all historic properties, which emphasizes an evaluation of eligibility for listing on the National Register of Historic Places (NRHP). Agencies must then determine which historic properties (those eligible for listing on the NRHP) will be adversely impacted. Section 106 requires that agencies resolve adverse effects to these properties. Plans for resolving adverse effects are determined through consultation with the Texas Historical Commission, potentially the Advisory Council on Historic Preservation (ACHP), and appropriate and interested Native American tribes and other interested parties.

Alternative 1 – No Action

The conveyance of 635 acres of federal land to the City of Denison would not occur under Alternative 1 (No Action). Without conveyance, there would be no federal undertaking as defined by Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended). Therefore, any historic properties identified within that 635 acres would remain in federal management and thus would not be affected by this action. No inventory of historic properties would therefore be required.

Adjacent private property totaling approximately 1,600 acres in area would be developed under Alternative 1, as described in Section 2.9. In consultation with the Texas Historical Commission (THC), Tulsa District determined that the 1,600 acres of private property would not be considered part of the Area of Potential Effect (APE) under Section 106 procedures associated with the conveyance of 635 acres of federal land. Therefore, the 1,600 acres of private property were not inventoried for historic properties. However, portions of the private property may require Section 404 Clean Water Act (CWA) or Section 10 of the Rivers and Harbors Act (RHA) of 1898 permits. If Section 404 or Section 10 permits are required, Tulsa District will determine an appropriate APE and will require Section 106 inventory of that APE and subsequent identification of historic properties as applicable. Requirements and triggers for Section 404 and Section 10 permits are discussed in Section 4.7.3.

Alternatives 2 through 4 – Land Conveyance with Varying Shoreline Development

Alternatives 2 through 4 would result in conveyance of 635 acres of federal land to the City of Denison, which is a federal undertaking as defined by Section 106 of the NHPA of 1966 (as amended).

In order to comply with Section 106 requirements, an archaeological survey of the proposed 635 acre conveyance area was conducted in July 2010 by Ecological Communications Corporation (ECOMM). A report of the investigations (Rose and Darnell, 2011) is included in Appendix R of this EIS. During the course of those archaeological investigations, one prehistoric archaeological site, 41GS220, was recorded in the conveyance area. Site 41GS220 was investigated thoroughly by excavating 35 shovel tests, during which nearly 60 artifacts were recovered. However, the investigation failed to produce archaeological features, diagnostic artifacts, or stratified cultural deposits that suggest a potential to yield archaeological information (Rose and Darnell, 2011). Accordingly, ECOMM recommended that 41GS220 be considered not eligible for listing on the National Register of Historic Places (NRHP). After review, Tulsa District concurred with the ECOMM recommendation and coordinated the survey results with the Texas Historical Commission (THC) and appropriate Native American Tribes. The Texas Historical Commission concurred with the Tulsa District determination that site 41GS220 is not NRHP-eligible, concluding the Section 106 process for the 635 acre conveyance area. Copies of this correspondence are included in Appendix R of this EIS.

Similar to the No Action Alternative 1, Alternatives 2 through 4 would result in development of adjacent private property totaling approximately 1,600 acres in area. Again as previously discussed, in consultation with the THC, Tulsa District determined that the 1,600 acres of private property would not be considered part of the APE under Section 106 procedures associated with the conveyance of 635 acres of federal land. Therefore, the 1,600 acres of private property were not inventoried for historic properties. However, portions of the private property may require Section 404 CWA or Section 10 of the RHA of 1898 permits. If Section 404 or Section 10 permits are required, Tulsa District will determine an appropriate APE and will require Section

106 inventory of that APE and subsequent identification of historic properties as applicable. Requirements and triggers for Section 404 and Section 10 permits are discussed in Section 4.7.3.

4.13 VISUAL RESOURCES

Assessment of visual and aesthetic impacts requires analyses of a subjective quality. Visual impacts are a function of changes to physical components of the landscapes and necessarily reflect preferences and perceptions of the observers. As defined in Section 3.13.2, scenic integrity indicates the degree of intactness and wholeness of the landscape character and is a measure of the degree to which landscape is visually perceived to be "complete" (USDA, 1995). For this section, a method of assessing impacts was developed with the assumption that change from the undeveloped to developed scenery would reduce visual scenic integrity and alter scenic characteristics. Currently, Lake Texoma shoreline is generally heavily vegetated with differences in topography, slope, aspect, vegetative type, and cover. The building of additional boat docks and shoreline protection would affect the landscape and visual character of the shoreline as viewed from the lake and from on land. Additionally, the creation of a residential and commercial development would cause a significant change in the landscape and visual character visible from both the lake and from on land. Visual impacts discussed for each alternative are evaluated by change in linear feet from undeveloped to developed areas. Thus characteristics would be altered under all four alternatives. In preparation for structures, boat docks, boat ramps, golf courses, roads, and utilities, the vegetation currently present on the shoreline and adjacent land visible from the lake and the land would be altered and/or removed, thereby changing the visual landscape even in areas where boat docks, shoreline protection, and structures are not immediately present. Comparisons of existing shoreline conditions (as of 2010) and renditions of the development will be introduced in Alternative 4.

Alternative 1 – No Action

Under Alternative 1, the nature of shoreline development is expected to continue as it currently exists (Figure 2.2). Boat docks would not be built, and shoreline protection would not be installed. As such, views from the lake and shoreline under Alternative 1 are expected to remain the same as those described in Section 3 for each visibility sector. However, in limited areas, specifically looking south and east in Visibility Sector 1 towards the shoreline, and east in parts of Visibility Sector 2, the adjacent private property would be present within 400 ft of the shoreline. Extensive thinning of trees and structures greater than 20 ft in height on the adjacent private property would be expected to be slightly visible from the lake. Views for each visibility sector would not be expected to change greater than 5% from the views described in Section 3. It is possible that implementation of Alternative 1 could lead to the expansion of existing dry land boat storage facilities in areas around the lake and/or the building of new dry land boat storage facilities in the immediate vicinity of the proposed development. Due to the increased population at the lake, and because the proposed development under Alternative 1 does not include boat access, residents would require additional on-land storage along areas of the lake where storage and lake access is currently permitted. Without knowing the specifics of the sites or locations where increase boat storage may occur, a visual resource impact assessment of the dry land storage facilities cannot be made. However, it is assumed that the need for additional dry land boat storage could, in the future, lead to some loss of the surrounding area's scenic attractiveness as natural settings are developed into boat storage buildings, though effects would likely be negligible. On land views of the proposed conveyance land would not change under Alternative 1. Views form the proposed conveyance land to the lake would not change. Views from the proposed conveyance land to the adjacent private property would change from undeveloped fields and forest, to residential and commercial property with maintained landscaping. As visual impacts described for the no action alternative would be not appreciable, the existing conditions are used in this analysis as a baseline for comparison to impacts associated with other alternatives.

Alternative 2 – Land Conveyance without Shoreline Development

Under this alternative, the land would be conveyed and developed with structures readily visible from all visibility sectors described in Section 3 (Figure 4.13.1). Additionally, the on land views both within the development area and views of the lake from on land would be altered. Although no docks or boat houses would be built under this alternative, a shoreline protection feature would be constructed along 2.7 miles of shoreline. Residential development would be present along approximately 5 miles of the shoreline, some within 50 ft of the shoreline. A hotel and associated conference area and amenities would be present along approximately 1 mile of shoreline, and golf courses would be present within 100 ft of the lake, along approximately 1 mile of shoreline. An open space buffer would be present along the entire approximate 8 miles of shoreline, primarily in the areas below 645 NGVD. The open space is currently forest, and would remain forested under this alternative, although thinning of the vegetation in the buffer would be expected. The existing vegetation (trees and shrubs) below elevation 645 ft NGVD may be cleared or thinned in some areas to accommodate for individual landscape interests and the creation of lake views from the inland structures proposed under this alternative. The existing view from both the lake and the land (Section 3.13) would be changed from undeveloped, forested shoreline, with steep, eroded slopes to a thinned forest generally less than 200 ft in width, with small to large structures readily viewable through and above the forest vegetation. Thinning of vegetation near the shoreline could increase the available views of the lake from the land. As shown in Table 4.13.1, the impacts to the visual integrity for each visibility sector (as measured by the change to the visual resources) is greater than 50% for all views from the lake. In addition, the shoreline protection system itself would reduce eroding shorelines and turbidity in the lake water which could alter the scenic characteristics of the water and portions of the shoreline. A graphic depiction of the view of the shoreline from the lake for each of the four visibility sectors under Alternative 2 is provided in Appendix H.

Table 4.13.1

Change in View for Visual Sectors, Little Mineral Arm Lake Texoma (Alternative 2)

Visibility Sector	Percent of shoreline length with visual change
1	52%
2	100%
3A	100%
3B	100%

Source: WESTON, 2010

Visibility Sector 1

Sector 1 is located at the northern-most point of the eastern shore of Little Mineral Arm and contains approximately 13,090 feet of shoreline (Figure 4.13.1). Under Alternative 2, the view shed of this sector would change from developed along the north shoreline and undeveloped along the southern shoreline to developed views throughout. These changes in the view would include the extensive thinning of trees below 645 ft NGVD and the inclusion of a multi-story hotel, conference center, and associated parking areas and roads on bluffs overlooking the shoreline. Additionally, utilities such as power lines would be included in this view. The buffer/open area that would be present in this sector would be relatively thin (less than 50 ft), as compared to areas of the remaining visibility sectors. Approximately 2,000 feet of riprap shoreline protection would also be part of this view shed. Approximately 5,320 ft of shoreline that is not part of proposed conveyance would not be expected to change.

Visibility Sector 2

This sector is located within the middle section of the eastern shore of Little Mineral Arm and contains approximately 12,265 feet of shoreline (Figure 4.13.1). The view of this sector from the water is looking east and southeast. Banks are steep, ranging in elevation from 700 ft to 720 ft NGVD near the southward boundary of Sector 1, but become less steep as the sector progresses to the south, ranging in elevation from 650 to 680 ft NGVD.

The view from this sector under Alternative 2 would change from undeveloped forested shoreline (including pocket beaches) to areas developed with a mid-size hotel, townhomes, moderate-sized houses, maintained landscapes, golf course greens and tees, and associated utilities and roadways. The northern shoreline of this sector would contain views of a hotel, forested buffer/open space from 50 ft to approximately 400 ft in depth in front of approximately 70 viewable townhome units along the northern portion of the sector, and approximately 100 single-family homes on small sized lots to the south. Some homes would be visible both above and through forest vegetation. In the open area, trees would be cleared or thinned to 50% of current density. Private lots associated with the homes and other maintained areas would extend to or near the shoreline; as a result, the buffer/open space would be expected to be altered due to individual landscape preferences. In addition to the changes in the views at or above the shoreline, approximately 4,000 ft of riprap shoreline protection would be constructed within this visibility sector.

Visibility Sector 3A

The sector is located near the upper end of the eastern shoreline of Little Mineral Arm and contains approximately 16,966 feet of shoreline (Figure 4.13.1). The viewshed from the water is looking east and southeast. The topography is somewhat steep, with a maximum elevation of 715 feet NGVD along a major tributary, but otherwise is of fairly gentle slope. The shoreline is fairly diverse and includes clay banks with rock and/or trees, and silt/sand.

Under Alternative 2, the view for this sector would change from a diverse ecological community (of mixed upland forest, a remnant of bottomland hardwoods, native grasslands, and a small segment of a riparian/stream community) to areas of residential development and two golf courses. A large area within the sector would be part of an open space/buffer and deed restricted to prohibit development of permanent structures. Throughout much of the cove viewable in this sector, the shoreline would be included in the open space/buffer. At its widest point, the open space/buffer would be approximately 1,000 ft. Although structures would not be erected in the open space, extensive tree thinning could occur. Private land owners could remove trees and other vegetation to suit their landscaping preferences, consistent with deed restrictions, municipal regulations, and any homeowner association rules. Therefore, it is assumed that the views from this visibility sector would result in an approximate 50% change in forest density along the entire 16,966 ft of shoreline. Two areas of residential development, one on the north and one on the south side of the cove, would be visible. Approximately 100 zero lot line, single-family houses would be visible or partially visible along the northern shore of the cove. Approximately 30 small lot, single-family homes would be visible on the point that extends into Lake Texoma on the southern end of Visibility Sector 3. A portion of a golf course green and associated extensive tree thinning would be visible from within this sector. Two small sections of shoreline protection would also be present in this sector, encompassing a total of approximately 1,000 ft.

Visibility Sector 3B

The sector is located at the southern end and uppermost portion of Little Mineral Arm and contains approximately 5,513 feet of the shoreline (Figure 4.13.1). The viewshed from the water is looking south or southeast. Much of the viewshed ranges from an elevation of 640 ft to 660 ft NGVD, with a small portion rising up to an elevation of 700 ft NGVD. The shoreline is somewhat less diverse and primarily includes clay banks with rocks and sand/silt; however, this sector does encompass some of the Little Mineral Creek and riparian habitat.

Under Alternative 2, the view from this sector would change from primarily mixed upland forest interspersed with small irregular native grasslands to thinned forest with views of single-family homes and a golf course greens. Approximately 3,000 ft of shoreline protection would be present along the northern portion of this sector.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Impacts under Alternative 3 would be similar to those presented under Alternative 2, with the addition of boat docks along limited areas of the shoreline in Visibility Sector 3A (Figure 4.13.2). The percent changes in view for the visual sectors under Alternative 3 would be the same as those under Alternative 2 (Table 4.13.1). The addition of boat docks, boat slips, shoreline protection, and commercial and residential development along Little Mineral Arm would alter the scenic characteristics of this portion of lake shoreline as viewed from the land and the lake. A graphic depiction of the view of the shoreline from the lake for each of the four visibility sectors under Alternative 3 is provided in Appendix H.

Visibility Sector 1

Changes in view from Visibility Sector 1 under Alternative 3 would be the same as those described under Alternative 2.

Visibility Sector 2

Changes in view from Visibility Sector 2 under Alternative 3 would be the same as those described under Alternative 2.

Visibility Sector 3A

Changes in view from Visibility Sector 3A under Alternative 3 would include those described under Alternative 2 in addition to changes on the shoreline due to the addition of boat docks and slips. Visibility Sector 3A primarily includes views of a large cove off the eastern shore of Little Mineral Arm (as described in Section 3.13). Under Alternative 3, private covered boat docks and boat slips would be constructed within the cove (Figure 4.13.2). Boat docks would be associated with homes in the area and be connected to the neighborhoods via 8-ft wide pervious pathways. Viewing the shoreline under Alternative 3, looking east and north within Visibility Sector 3A, 13 private boat docks (each including 19 units) would be present along approximately 2,500 ft of the shoreline. Deeper in the cove (viewing east), 78 uncovered private boat slips would be present. The boat slips would also be accessed by 8-ft-wide pervious pathways that would lead to the on-land boat club located to the east-northeast of the end of the cove. Under Alternative 3, boat docks, boat slips, and extensive tree thinning due to pathways would be viewable and prominent from all locations within Visibility Sector 3A.

Visibility Sector 3B

The changes in view from Visibility Sector 3B under Alternative 3 would be the same as those described under Alternative 2.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Visual impacts under Alternative 4 include all those described under Alternative 2, and impacts due to the proposed development of boat docks (both private and commercial), boat slips (both covered and uncovered), a dry dock storage facility and associated boat ramps, and access roads (Figure 4.13.3). Due to these new structures as well as the shoreline protection, commercial and residential development along Little Mineral Arm, the scenic characteristics of this portion of the lake shoreline would be altered. Percent changes in view for the visual sectors under Alternative 4 would be the same as those under Alternative 2 (Table 4.13.1). Some proposed structures were rendered and compared to the existing conditions as of 2010 (Figures 4.13.4 through 4.13.6). These renditions were created for the spring/summer seasons and would appear different during the fall/winter seasons, when trees have changed color and/or lost leaves. In addition to these variations in seasonality, there is uncertainty regarding the ultimate visual appearance of the rendered structures, so reasonable assumptions regarding appearance were used. Visual characteristics would be expected to change gradually over an extended (20+ year) development period.

Visibility Sector 1

Changes in view from Visibility Sector 1 under Alternative 4 would include all those described under Alternative 2, along with changes on shoreline due to the addition of boat docks and hotel boat day slips. Under Alternative 4, the cove located adjacent to the proposed hotel and conference area would be developed with 57 covered boat day slips along approximately 800 ft of the north eastern shoreline (Figure 4.13.3). A rendition of the proposed hotel and conference area can be seen in Figure 4.13.4. As mentioned in Section 4.13.4., the foliage and the appearance of the structures may vary from presented renditions. Thirty hotel uncovered boat day slips along approximately 200 ft of either side of the hotel/conference center would also be present under this alternative. Access pathways for the boat docks and the associated extensive tree thinning from the hotel area would also be included. Cleared access pathways would be present to connect the three pocket beaches located within the cove to the hotel area. Three private 19-unit covered boat docks along approximately 800 ft of the southern part of Visibility Sector 1 would also be added to the view shed. Under Alternative 4, boat docks, boat slips, and pathways would be viewable and prominent from all but the northern-most section of Visibility Sector 1. Although the northern section of the view shed would not include views of new docks and boat slips, the view would be severely altered by the construction of the hotel conference center on the northern point of the proposed conveyance land.

Visibility Sector 2

The changes in view from Visibility Sector 2 under Alternative 4 would include all those described under Alternative 2, along with changes on the shoreline due to the addition of boat docks and associated access pathways. Under Alternative 4, 17 private covered boat docks (each with 19 units) would be present primarily within the central portion of this unit (in and around the small cove) (Figure 4.13.3). Four of the 19 boat docks would be present along the southern portion of the sector, below golf course greens. A total of approximately 3,500 ft of shoreline within this sector would have a changed view due to boat docks and associated access pathways. These boat docks as well as the shoreline protection and residential housing described under Alternative 2 would be viewable and prominent from all of Visibility Sector 2. A rendition of the proposed residential development and golf course area can be seen in Figure 4.13.5. This rendition is representative of any proposed residential development and golf course areas along the entire shoreline, not just those present in Visibility Sector 2. As mentioned in Section 4.13.4., the foliage and the appearance of the structures may vary from presented renditions.

Visibility Sector 3A

The changes in view from Visibility Sector 3A under Alternative 4 would include all those described under Alternative 3, along with changes on the shoreline due to the addition of dry dock storage located at the end of the cove. The design plan for the dry dock storage, boat club, and surrounding area in the cove is shown on Figure 4.13.3. A rendition of the proposed boat club area can be seen in Figure 4.13.6. As mentioned in Section 4.13.4, the foliage and the appearance of the structures may vary from presented renditions. Under Alternative 4, boat docks, boat slips, dry dock storage, and extensive tree thinning (due to pathways, docks and parking lots), along with the residential development and shoreline protection described in Alternative 2, and would be viewable and prominent from all locations within Visibility Sector 3A.

Visibility Sector 3B

The changes in view from Visibility Sector 3B under Alternative 4 would include all those described under Alternative 2 along with changes on the shoreline due to the addition of more boat docks and associated access pathways. Under Alternative 4, 12 covered boat docks (each with 19 units), would be present along the entire 5,280 feet of Visibility Sector 3B (Figure 4.13.3). The boat docks would be present below the two areas of residential development and golf course greens. These boat docks and associated pathways as well as the shoreline protection and residential housing described under Alternative 2 would be viewable and prominent within all of Visibility Sector 4.

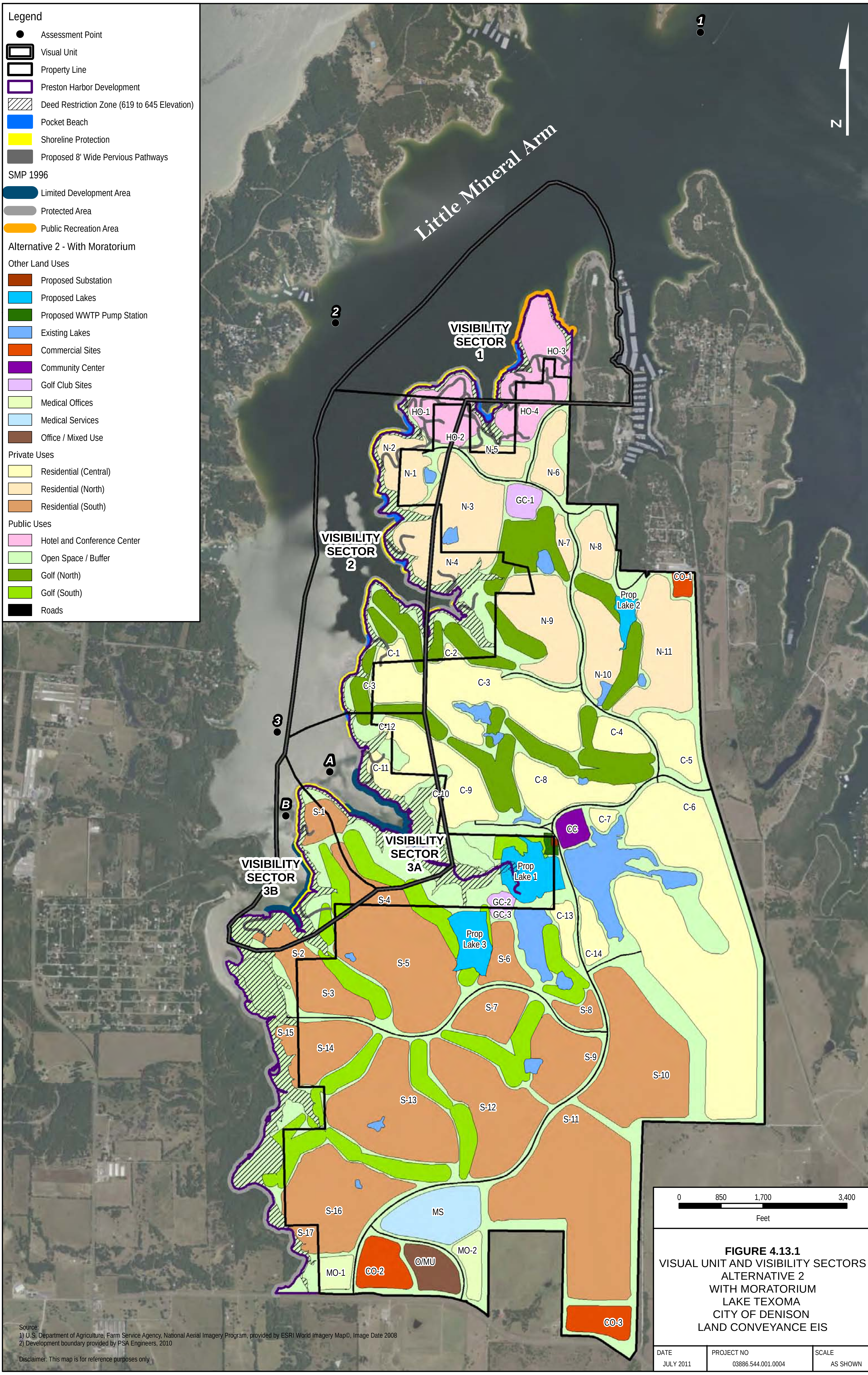

FIGURE 4.13.1
VISUAL UNIT AND VISIBILITY SECTORS
ALTERNATIVE 2
WITH MORATORIUM
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

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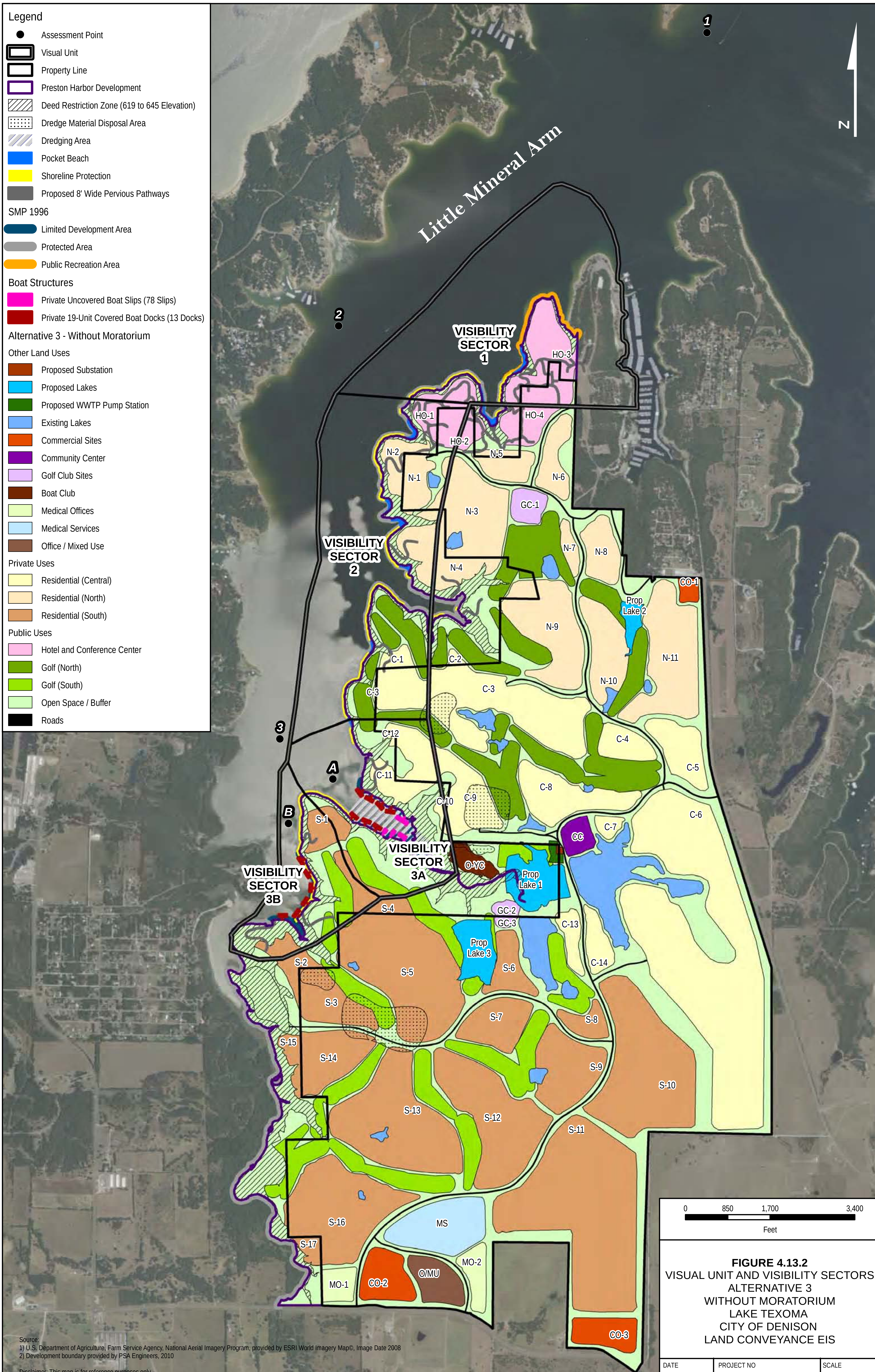

FIGURE 4.13.2
VISUAL UNIT AND VISIBILITY SECTORS
ALTERNATIVE 3
WITHOUT MORATORIUM
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

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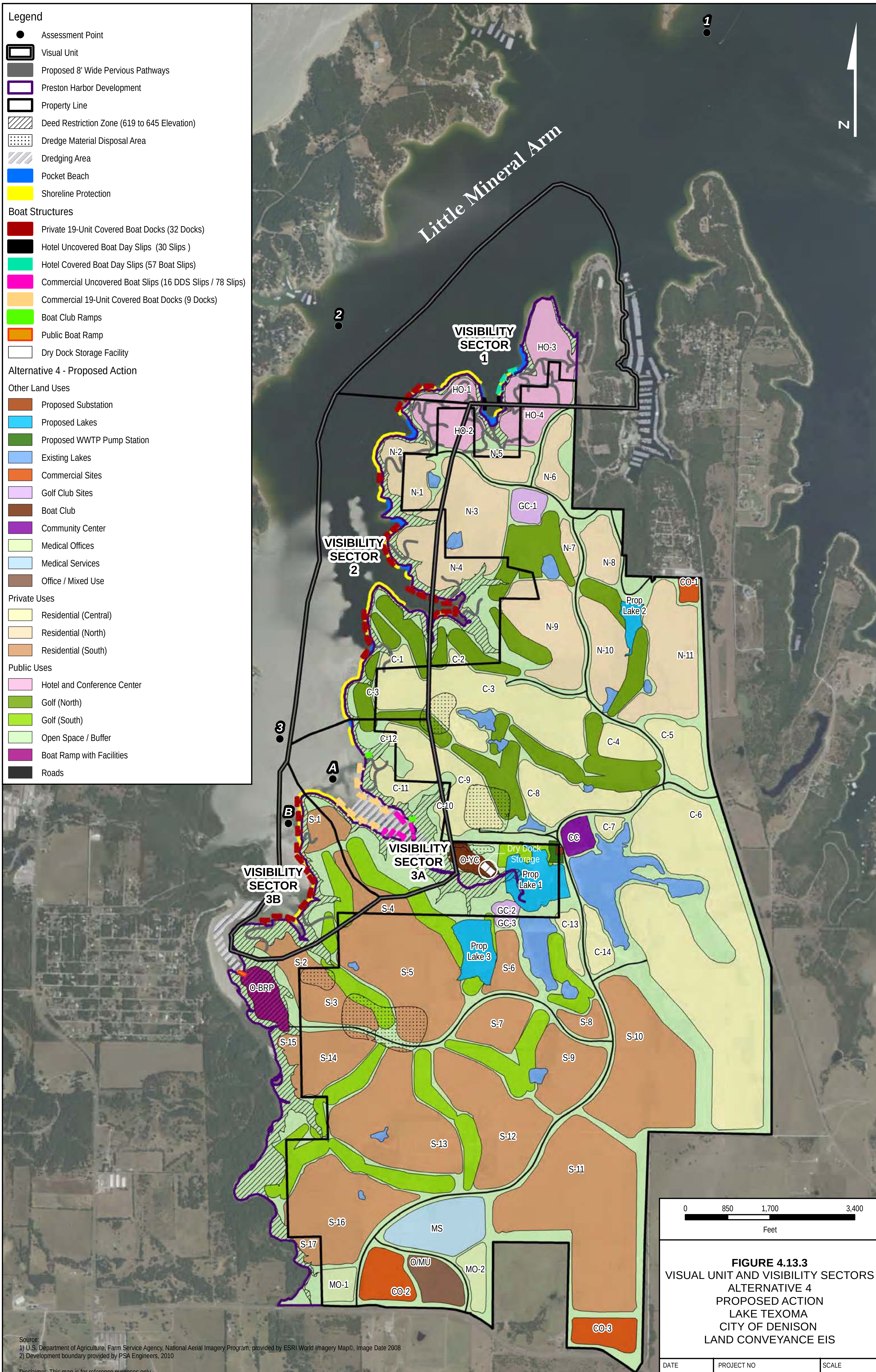

FIGURE 4.13.3
VISUAL UNIT AND VISIBILITY SECTORS
ALTERNATIVE 4
PROPOSED ACTION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

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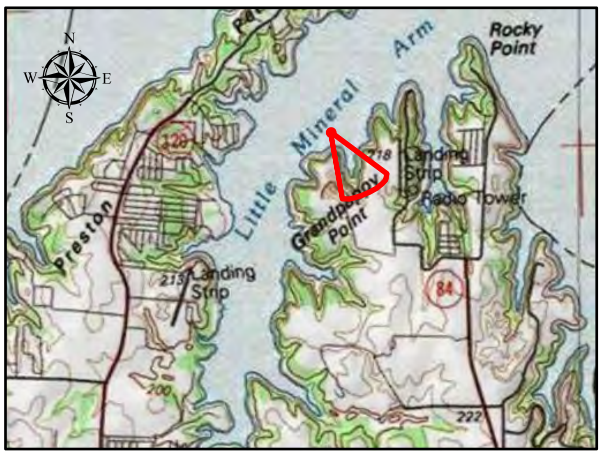
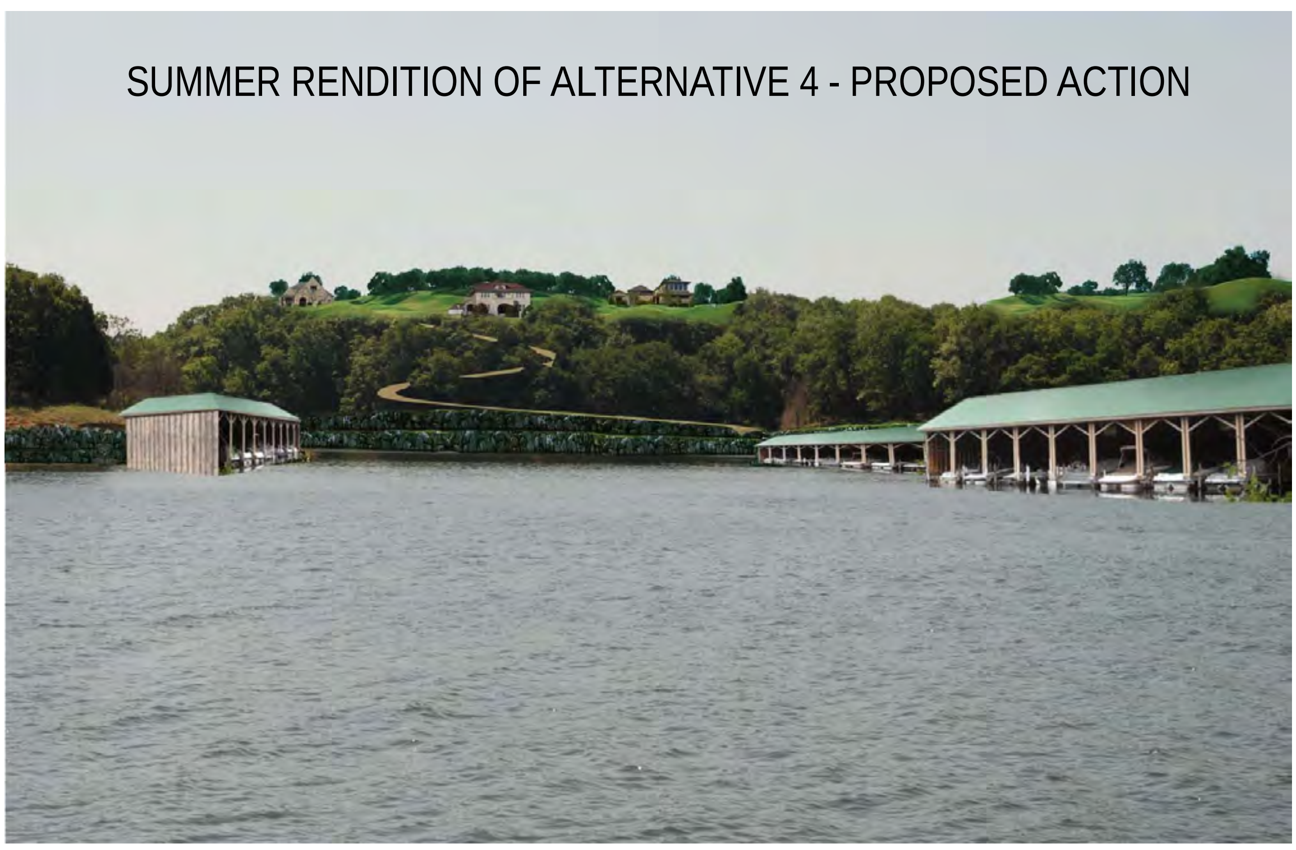


Disclaimer: The images portrayed are artistic representations of proposed aesthetic enhancements. The actual built aesthetics will vary from these images.

FIGURE 4.13.4
CONCEPTUAL REPRESENTATION OF
VISIBILITY SECTOR 1
PROPOSED HOTEL
AND CONFERENCE AREA
ALTERNATIVE 4 - PROPOSED ACTION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JULY 2011	03886.544.001.0004	NOT TO SCALE

Path: I:\GIS Project Files\SchulerDevelopment_14531\Corp_03886\Chapter_4\Figure 4.13.X Visual Representations Hotel Alt-4.mxd, Date: 9/1/2011 10:52, wilderj



Disclaimer: The images portrayed are artistic representations of proposed aesthetic enhancements. The actual built aesthetics will vary from these images.

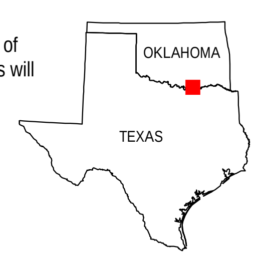


FIGURE 4.13.5
CONCEPTUAL REPRESENTATION OF VISIBILITY SECTOR 2
PROPOSED RESIDENTIAL AND GOLF COURSE AREA
ALTERNATIVE 4 - PROPOSED ACTION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JULY 2011	03886.544.001.0004	NOT TO SCALE

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Disclaimer: The images portrayed are artistic representations of proposed aesthetic enhancements. The actual built aesthetics will vary from these images.

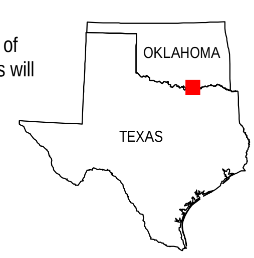

FIGURE 4.13.6
CONCEPTUAL REPRESENTATION OF
VISIBILITY SECTOR 3A
PROPOSED BOAT CLUB AREA
ALTERNATIVE 4 - PROPOSED ACTION
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JULY 2011	03886.544.001.0004	NOT TO SCALE

4.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The purpose of hazardous, toxic, and radioactive waste analysis is to assess impacts associated with each alternative, including those related to concerns previously identified in Section 3.14. Since the conveyance lands are previously undeveloped, it is not expected that any hazardous, toxic, or radioactive wastes would be encountered during construction activities. However, the addition of the Preston Harbor Development, regardless of the alternative chosen, could result in generating wastes regulated by the EPA and TCEQ.

All regulated waste generated as a result of construction or operation of facilities associated with the Preston Harbor Development would be managed and transported in accordance with 30 TAC, Chapter 335 – Industrial Solid Waste and Municipal Hazardous Waste; 40 CFR 260 – Hazardous Waste Management System; 29 CFR 1910 – Occupational Safety and Health Standards; 40 CFR Part 263 – Hazardous Waste Transportation, and 49 CFR Parts 100-185 – Hazardous Materials Regulations. Medical waste generated would be managed in accordance with 30 TAC, Section 330, Subchapter Y – Municipal Solid Waste: Medical Waste Management.

To determine the consequential effects of these increases, the study area was defined to identify proposed facilities or activities that may generate regulated waste and furthermore assess the potential for releases to the environment.

4.14.1 Oil and Gas

Under each alternative, there are no plans to develop additional oil and gas wells on the proposed conveyance land or the adjacent private land; in this regard, no associated direct or indirect adverse effects would be expected. However, as a result of the Preston Harbor Development, increased automobile and boat traffic could lead to more petroleum releases in roads, parking lots, and Lake Texoma; these concerns are further addressed in Section 4.9.1 and Section 4.14.5.

4.14.2 Commercial Waste

Commercial development is planned under each alternative, but specific businesses to be included have not been identified at this time. While each alternative indicates a variety of commercial business, none of these establishments would be located on the conveyance property.

All commercial facilities would be located on the adjacent private property as indicated in Figures 2.2 through 2.5, and would be part of the No Action Alternative baseline conditions and independent of the federal action. The following addresses the types of businesses that generate regulated waste and may exist in the areas designated for commercial use in the Preston Harbor Development.

Gas Stations

Underground storage tanks (USTs) containing petroleum are typically installed with the construction of a gas station and regulated by EPA and TCEQ, 30 TAC Part 1 Chapter 334. All USTs are required to be registered with TCEQ, and delivery certificates should be renewed annually. Depending on the level of services provided, automotive wastes could include antifreeze, chlorinated and/or non-chlorinated solvents, used oil, contaminated rags, and other hazardous substances and materials that should be disposed of at an authorized facility. Wash water could potentially contain metals, oil, grease and other contaminants, and could runoff into sumps, floor drains, or storm drains that discharge into storm sewers.

Dry Cleaners

In Texas, authorization from TCEQ is required to operate a dry-cleaning facility. Dry-cleaning facilities must comply with release prevention requirements defined in 30 TAC 337.20 and air regulations such as 30 TAC 106.411; associated machines must meet applicable performance standards, as defined in 30 TAC Section 337.20, based on the type of solvent used in the dry-cleaning process in conjunction with gross annual receipts. Secondary containment would be required around dry-cleaning units and solvent waste storage containers.

Most dry-cleaning facilities produce small amounts of hazardous waste. However, all waste generated by dry-cleaning activities is regulated under the Clean Water Act and the Texas Water Code Chapter 26 and must be characterized and disposed of at an authorized facility. Discharge from dry cleaners is subject to the pre-treatment requirement in 40 CFR Part 403 prior to disposal into an OSSF or wastewater system. Some dry-cleaning facilities use perchloroethylene (PCE) in the cleaning process, which can be a hazardous air pollutant and is regulated under Title 40 CFR Part 63, Subpart M, National Emission Standards for Hazardous Air Pollutants.

4.14.3 Industrial Waste

Under each alternative, a power substation containing mineral-oil-based or dry equipment would be constructed in the Preston Harbor Development. The power substation would be located on the adjacent private property as indicated in Figures 2.2 through 2.5, and would be part of the No Action Alternative baseline conditions and independent of the federal action. Polychlorinated biphenyls (PCBs) were historically used in electrical equipment at power substations because of their high thermal resistance, but they are now prohibited by Toxic Substances Control Act (TSCA), 40 CFR Chapter I, Part 761 and would not be present at the substation. Mineral oil is not considered toxic. Long-term adverse impacts associated with the power substation would be minor and limited to the small increase in impervious cover and resulting stormwater runoff.

4.14.4 Medical Waste

Though medical offices and services are planned for the southern portion of the Preston Harbor Development under all alternatives, the types of medical facilities and services to be included are not known at this time. These medical offices would be located on the adjacent private property as indicated in Figures 2.2 through 2.5, and would be part of the No Action Alternative baseline conditions and independent of the federal action. Common hazardous materials used in health care facilities include mercury-containing equipment and products, pharmaceuticals, radiological equipment and materials, sterilants and disinfectants, cleaning supplies, laboratory chemicals, and pesticides. Hospitals generate several types of wastes including solid waste, universal waste, hazardous waste, and medical waste. Medical wastes include non-regulated and regulated medical waste (RMW).

Solid waste comprises the majority of the waste stream for hospital facilities. Paper and cardboard represent the largest portion of the hospital solid waste stream. Organic wastes include yard and food wastes. Plastics represent the third highest percentage of hospital sold waste.

Universal waste includes batteries, pesticides, hazardous waste lamps (containing lead of mercury), and mercury-containing equipment. Common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps. Elemental mercury is contained in thermometers, manometers, barometers, relay switches, and gauges.

Hazardous waste or listed waste may include solvents, laboratory chemicals, pharmaceuticals, chemotherapy agents, antiseptics, and disinfectants. Ignitable, corrosive, reactive and toxic wastes may also be generated.

Medical waste consists of sharps in addition to pathological and microbiological wastes containing blood or other potentially infectious materials.

4.14.5 Boat Waste

Boat activities such as fueling and maintenance could result in the use or transport of potentially hazardous substances, including petroleum-related products, cleaning solvents, paint and coatings, and sewage wastes over water. Though there are laws in place protecting waters of the U.S. from boat waste, it is difficult to predict associated accidents and negligence that may result in unexpected pollution. Additionally, a quantitative projection of the increase in boat activity with the addition of the Preston Harbor Development is further discussed previously in Section 4.11.

Alternatives 1 and 2 – No Action and Land Conveyance without Shoreline Development

While no boat ramps, club, houses, or slips, would be included in the Preston Harbor Development under Alternatives 1 and 2, the additional residences at the lake would likely result in some level of increased boating activity; therefore there could be some resulting increase in boat waste.

Alternatives 3 and 4 - Land Conveyance with Varying Shoreline Development

Under both Alternatives 3 and 4, Preston Harbor Development would include additional boat docks. Additionally, under Alternative 4, boat ramps and dry dock storage would be anticipated. While the boat club would not offer fueling or maintenance facilities the added infrastructure would still increase boat activity as discussed in Section 4.11. Though the amount of boat waste discharged cannot be effectively quantified, it can be assumed that increased boat activity would result in some level of increased impacts to the surrounding environment from boat waste.

4.15 AIR QUALITY

The following factors were considered in evaluating air quality: (1) the short- and long-term air emissions generated from construction, grading, asphalt paving and dredging operations; (2) the type of emissions generated; and (3) the potential for emissions to result in ambient air concentrations that exceed one of the NAAQS or SIP requirements. The air emission calculations for the alternative actions included in the sections below are detailed in Appendix N.

Alternative 1 – No Action

Without conveyance or development of the conveyance parcel, Alternative 1 would have no impact on air quality. While not a part of the federal action, the development on the adjacent private land would result in short-term increased emissions during construction, grading, and asphalt paving. There would be negligible ambient air impacts from these localized short-term emissions that would quickly dissipate from the activity source. Additionally, construction activities may produce dust or other and particulate emissions, though these actions would pose no significant impact upon air quality standards. Dust and particulate emissions would be controlled through the use of best management practices (e.g., dust mitigation techniques). Annual long-term emissions associated with new homes, population increase, and other amenities in the proposed on private land would have negligible impacts on long-term emissions in an area that experiences approximately 5.8 million visitors a year.

The combustion of fuel by the construction equipment, grading equipment, paving equipment and transport vehicles involved in would result in emissions of carbon monoxide (CO), volatile organic compounds (VOCs), nitrous oxides (NO_x), sulfur dioxide (SO_2), and 10 microns and 2.5 microns particulate matter (PM_{10} and $PM_{2.5}$ respectively) (EPA, 2004). $PM_{2.5}$ emissions factors have not been developed for all operations; thus, it was conservatively assumed that $PM_{2.5}$ emissions are equivalent to PM_{10} emissions. Hot mix asphalt would be used, which would result in minimal fugitive VOC emissions. To conservatively account for the short-term annual emission increase, it was assumed that all development would be equally divided among the staged 5-year periods. Short-term annual emissions, shown in Table 4.15.1, is just 1 year of the 5 years assumed completion of all development.

Table 4.15.1

Expected Annual Emissions from Each Alternative

	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2
Alternative 1 (tpy): (Private Land Only)	80.3	420	1,164	134	83.3	74.4
Alternative 1: Percent of Regional Emissions	0.45	0.51	7.1	0.27	1.3	2.4
Alternative 2 (tpy): (Conveyed Land)	2.9	19.4	34.9	18.9	5.6	2.2
Alternative 2 (tpy): (Private Land)	82.5	430	1,196	136	85.2	76.4
Alternative 2: Percent of Regional Emissions	0.48	0.55	7.5	0.31	1.4	2.6
Alternative 3 (tpy): (Conveyed Land)	3.5	23.0	43.1	32.2	8.0	2.7
Alternative 3 (tpy): (Private Land)	83.5	437	1,211	161	89.9	77.3
Alternative 3: Percent of Regional Emissions	0.49	0.57	7.7	0.43	1.6	2.6
Alternative 4: Proposed Action (tpy) Conveyed Land	3.5	23.0	43.3	32.3	8.0	2.7
Alternative 4: Proposed Action (tpy) Private Land	83.5	437	1,211	161	89.9	77.3
Alternative 4: Percent of Regional Emissions	0.49	0.57	7.7	0.43	1.6	2.7
Regional Emissions (tpy)a	17,791	81,881	16,463	50,455	6,603	3,054

CO = carbon monoxide
NO_x = nitrogen oxides
$PM_{2.5}$ = particulate matter equal or less than 2.5 micrometers in diameter
PM_{10} = particulate matter equal or less than 10 micrometers in diameter
SO_x = sulfur oxides
tpy = tons per year
VOC = volatile organic compound

[a] Includes emissions from point, area, on-road, non-road mobile sources, and biogenic sources. Texas Counties: Cooke and Grayson; Oklahoma Counties: Bryan, Love, and Marshall are shown, as they are the main source of emissions in the area.

Source: EPA AIRData; Emissions come from an extract of EPA's National Emission Inventory (NEI). Data for year 2002 were extracted from the NEI final version August 2008. NEI is an emissions database developed by EPA; 2002 is the latest year of emissions available. http://www.epa.gov/air/data/geosel.html

Alternative 2 – Land Conveyance without Shoreline Development

Alternative 2 would result in short-term emissions during construction, grading, and asphalt paving on the conveyed land. There would be negligible ambient air impacts from these localized short-term emissions that would quickly dissipate from the activity source. Annual long-term emissions associated with new homes, population increase, and other amenities in the proposed conveyance land would be similar to the short-term emissions and would have negligible impacts on long-term emissions in an area that experiences approximately 5.8 million visitors a year. Due to the sheer size, attraction and tourism in this area, the future increase in development on private land in the region is anticipated to far exceed that of proposed conveyance land. The additional emissions from development on the conveyed land would negligible compared to the existing emissions.

To conservatively account for the short-term annual emission increase, it was assumed that all development would be equally divided among a 5-year period. Alternative 2 short-term annual emissions, shown in Table 4.15.1, is just 1 year of the 5 years assumed completion of all development.

Review of the short-term annual emissions from Alternative 2 in Table 4.15.1 indicates that the greatest percentage of impact to the local emissions from the construction, grading, and paving operations on conveyed and private land would be NO_x (1,231 tons per year [tpy]) at 7.5%. These emissions would be temporary and eliminated upon completion.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Alternative 3 would result in short-term emissions during construction, grading, dredging, and asphalt paving on the conveyed land. There would be negligible ambient air impacts from these localized short-term emissions that would quickly dissipate from the activity source. To conservatively account for the short-term annual emission increase, it was assumed that all development would be equally divided between the 5-year periods (except dredging). Dredging would take place during only 1 year; Alternative 3 short-term annual emissions, shown in Table 4.15.1, represent the worst case annual emissions during the year dredging would take place.

Review of short-term annual emissions from Alternative 3 in Table 4.15.1 indicates that the greatest percentage of impact to the local emissions from the construction, grading, dredging, and paving operations on the conveyed and private land would be NO_x (1,254 tpy) at 7.7%. These emissions would be temporary and eliminated upon completion.

Annual long-term emissions associated with new homes, population increase, and other amenities in the proposed conveyance land would be similar to the short-term emissions and have negligible impacts on long-term emissions in an area that experiences approximately 5.8 million visitors a year. Due to the sheer size, attraction and tourism in this area, the future increase in development on private land in the region is anticipated to far exceed that of proposed conveyance land. The additional emissions from development on the conveyed land would negligible compared to the existing emissions.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

The Proposed Action would result in short-term emissions during construction, grading, dredging, and asphalt paving on the conveyed land. There would be negligible ambient air impacts from these localized short-term emissions that would quickly dissipate from the activity source. To conservatively account for the short-term annual emission increase, it was assumed that all development would be equally divided between a 5-year period (except dredging). Dredging would take place during only 1 year; Proposed Action short-term annual emissions shown in Table 4.15.1 represent the worst case annual emissions during the year dredging would take place.

Review of short-term annual emissions from the Proposed Action in Table 4.15.1 indicates that the greatest percentage of impact to the local emissions from the construction, grading, dredging, and paving operations on the conveyed and private land would be NO_x (1,254 tpy) at 7.7%. The emissions would be temporary and would be eliminated upon completion.

Annual long-term emissions associated with new homes, population increase, and other amenities in the proposed conveyance land would be similar to the short-term emissions and have negligible impacts on long-term emissions in an area that experiences approximately 5.8 million visitors a year. Due to the sheer size, attraction and tourism in this area, the future increase in development on private land in the region is anticipated to far exceed that of proposed conveyance land. The additional emissions from development on the conveyed land would negligible compared to the existing emissions.

4.15.1 Greenhouse Gases

Vehicles and equipment used during construction, grading, dredging, and paving operations would emit carbon dioxide (CO_2). These emissions were estimated using current EPA methodologies (see Appendix N for detailed emission calculations). Under the Proposed Action, approximately 242,393 metric tons of carbon dioxide equivalents (CO_{2eq}) would be released. The amount of CO_{2eq} released under the Proposed Action represents less than 0.00005% of the 2009 U.S. anthropogenic emissions of CO_{2eq} (EPA, 2011f).

Annual long-term emissions associated with new homes, population increase, and other amenities in the proposed conveyance land would be similar to the short-term emissions and have negligible impacts on long-term emissions in an area that experiences approximately 5.8 million visitors a year. Due to the sheer size, attraction and tourism in this area, the future increase in development on private land in the region is anticipated to far exceed that of proposed conveyance land. The additional emissions from development on the conveyed land would negligible compared to the existing emissions.

These limited amount of emissions and would not contribute significantly to global warming, but any emission of greenhouse gases (GHGs) represents an incremental increase in global GHG concentrations. Activities do not fall under one of the source categories listed in 40 CFR 98, and therefore would not be subject to the requirements of the EPA National Greenhouse Gas Reporting Rule.

4.16 NOISE

This EIS evaluates potential changes to the noise environment that would result from implementation of the alternatives. For the purpose of this analysis, noise impacts would be considered significant if the long-term DNL estimated for the proposed activities exceeds 65 dBA for nearby noise sensitive areas (NSAs), or would contribute to a violation of any Federal, State, or local noise regulation. The area of interest for noise evaluation would be those areas directly adjacent to the proposed conveyance and Preston Harbor Development. This analysis focuses on construction and other long-term activities associated with each alternative.

Alternative 1 – No Action

Without conveyance or development of the conveyance parcel, no increase in noise would occur. While not a part of the federal action, development of the adjacent parcel would result in both short- and long-term moderate adverse effects to the noise environment. Short-term effects would be due to noise generated during the construction of the proposed developments on the adjacent private land. Long-term effects would be due to a general increase in human activity (i.e., traffic). These increases would not result in long-term DNL greater than 65 for nearby NSAs, nor would they contribute to violation of any Federal, State, or local noise regulations.

Construction Noise

Construction noise would result from the operation of heavy equipment. Subsequent impacts on NSAs would vary depending on the type, number, and loudness of equipment in use at any given time. Individual pieces of heavy construction equipment typically generate noise levels of 80 to 90 dBA at a distance of 50 feet. Table 4.16.1 presents typical noise levels (dBA at 50 feet) that EPA has estimated for the main phases of outdoor construction. With multiple items of equipment operating concurrently, noise levels would be greater than 62 dBA during daytime periods at locations within several hundred feet of active construction sites.

The zone of high construction noise levels typically extends to distances of 400 to 800 feet from the site of heavy equipment operations. There are several residences within 800 feet of the proposed site that would experience temporary, but appreciable, noise during the construction phase. Locations more than 800 feet from construction sites seldom experience substantial levels (greater than 62 dBA) of construction noise. For NSAs closer than 5,000 feet (1,525 meters) (approximately 1 mile) to the site, construction noise would be audible, but distant. The overall impacts from construction noise would be minor and, due to the extended period of construction, of moderate duration.

Table 4.16.1

Noise Levels Associated with Outdoor Construction

Construction Phase	L_{eq} (dBA) at 50 feet from Source
Ground Clearing	84
Excavation, Grading	89
Foundations	78
Structural	85
Finishing	89

Source: EPA, 1971

During construction, BMPs and applicable municipal regulations with respect to noise would be observed. BMPs would include the following:

- Limiting construction primarily to normal weekday daylight or business hours, specifically in areas adjacent to noise sensitive land-uses such as residential areas;
- Ensuring construction equipment mufflers are properly maintained and in good working order; and
- Coordinating with residence owners and/or tenants prior to unavoidable construction activities directly adjacent to established residential areas.

Long-term Noise

Future sources of noise would include roadway traffic and boating activities. In general, noise levels would be comparable to a typical suburban setting. Noise would predominantly be due to primary and secondary roadways and would be louder and more persistent than existing conditions. The increase in population density within the development would result in an increase in human sources of noise, and natural noises such as the rustling of leaves and bird vocalizations would not be present, or would be masked.

Future noise levels under this alternative (L_{eq} and DNL) were estimated for the surrounding area in Table 4.16.2 below (ANSI, 2003). An approximate increase in human background noise (DNL) would be expected due to the additional traffic and general human activities associated with a high-density mixed-use development. These ongoing impacts would be moderate in intensity, extent, and context. No boat slips or associated boating noise would be expected under this alternative.

Table 4.16.2

Estimated Existing Noise Levels at Nearby Noise Sensitive Receptors

<table>
<tr><th rowspan="2">Alternative</th><th rowspan="2">Population Density (Population per Square Mile)</th><th rowspan="2">Land Use Category</th><th colspan="3">Estimated Existing Sound Levels (dBA)[1]</th></tr>
<tr><th>DNL</th><th>L_{eq} (Daytime)</th><th>L_{eq} (Nighttime)</th></tr>
<tr><td>Existing Condition</td><td>-</td><td>Rural Agricultural Undeveloped</td><td>45</td><td>43</td><td>37</td></tr>
<tr><td>Alternative 1</td><td>7493</td><td rowspan="2">Noisy Suburban Residential with Commercial</td><td rowspan="2">60</td><td rowspan="2">58</td><td rowspan="2">52</td></tr>
<tr><td>Alternatives 2, 3, and 4</td><td>7195</td></tr>
</table>

Source: [1]ANSI, 2003.

Alternative 2 – Land Conveyance without Shoreline Development

Under Alternative 2, moderate increases in noise would be expected. As with Alternative 1, short-term effects would result from noise generated during construction, and long-term effects would result from a general increase in human activity such as traffic. These increases would not result in long-term DNL greater than 65 dBA for nearby NSAs, nor would they contribute to a violation of any Federal, state, or local noise regulation.

Construction Noise

As with Alternative 1, overall impacts from construction noise would be minor in intensity, extent, context, and of moderate duration. Under this alternative, the total amount of construction would be comparable to that outlined under Alternative 1; however, it would be less compact and somewhat farther away from existing NSAs to the south and east. Construction noise along the shoreline would be audible, but perceived as distant, for residences across Lake Texoma to the west. BMPs would be identical to those outlined under Alternative 1.

Long-term Noise

As with Alternative 1, there would be an approximate increase in manmade background noise when compared to existing conditions (Table 4.16.2) (ANSI, 2003). These changes would be due to the additional traffic, and general human activities associated with a high-density mixed-use development. No boat slips or associated boating noise would be expected under this alternative.

Alternative 3 – Land Conveyance with Limited Shoreline Development

Alternative 3 would result in short- and long-term moderate adverse effects to the noise environment. As with Alternative 1, short-term effects would be due to noise generated during the construction, and long-term effects would be due to a general increase in human activity such as traffic. However, unlike Alternatives 1 and 2, additional noise would result from boating activities. Increases in noise would not result in long-term DNL greater than 65dBA for nearby NSAs, nor would they contribute to a violation of any Federal, State, or local noise regulation.

Construction Noise

As with Alternative 1, and for similar reasons, the overall impacts from construction noise would be minor in intensity, extent, context, and of a moderate duration. Under this alternative, the total amount of construction would be comparable to that outlined under Alternative 1; however, it would be less compact and somewhat farther away from existing NSAs to the south and east. Construction noise along the shoreline, including the proposed boat club, would be audible, but perceived as distant, for residences across Lake Texoma to the west. BMPs would be identical to those outlined under Alternative 1.

Long-term Noise

As with Alternative 1, there would be an approximate increase in manmade background noise (Table 4.16.2) (ANSI, 2003). These changes would be due to the additional traffic and general human activities associated with a high-density mixed-use development. A maximum of 325 boat slips and associated boating noise are expected under this alternative, as discussed in detail below.

Because boating activity changes throughout the year and throughout any given day, DNL was chosen to evaluate its effects on the noise environment. Although the exact nature and locations of water-based activities has not been specifically inventoried, this analysis provides a bounded approach to determine the upper bound of effects.

Throughout the year, boats would be audible from locations along the shoreline, more so in the summer than in the winter due to recreational activities. In general, the number of boats passing a single location would not be sufficient to generate areas of incompatible land-use or significantly affect noise-sensitive areas (Table 4.16.3). For example, a common midsized watercraft would have an overall sound level of 68-71 dBA at a distance of 82 feet (25 meters) (PWIA, 2008).

Table 4.16.3

Noise Levels for Boating Activities

Individual Pass-by	Alternative 3	Alternative 4	Units
Sound Level	71.0	71.0	dBA
Distance of Measurement (m)	25.0	25.0	meters
Sound Level at 25 m	71.0	71.0	dBA
Speed	30	30	mph
Audible Distance	2	2	miles
Audible Time	4	4	minutes
Annual Activity	**Alternative 3**	**Alternative 4**	**Units**
Slips	325	960	slips
Maximum Trips Per Day	81	240	trips
Total Monthly Pass-bys	4,860	14,440	trips
Percent Time Audible (Equivalent)	1.5%	4.44%	percent
Distance to Receptor	60	60	meters
DNL from activity	47.1	51.8	dBA

Source: PWIA, 2008.

In order to develop a conservative estimate, it was assumed that all boat slips are occupied, and 25% of the boats are used an average of once per day. Under these conditions, a single NSA would have the potential to be passed 4,860 times per month in the peak of summer. Under these conditions, boats would generate DNL of 47.1 dBA. These levels would be well below the 65-dBA DNL threshold, and noise from boating would blend with the other activities throughout the proposed development such as vehicle traffic. Because of their widespread and sporadic nature, actual boating activities at any location would be much less than those described herein. Effects of noise from these activities would be minor in intensity, extent, context, and duration.

Alternative 4 – Land Conveyance with Modified Shoreline Development (Proposed Action)

Under Alternative 4, noise increases would be expected. As with Alternative 3, short-term effects would be due to noise generated during the construction, and long-term effects would be due to a general increase in human activity such as traffic and boating activities. Increases in noise would not result in long-term DNL greater than 65 for nearby NSAs, nor would they contribute to a violation of any Federal, State, or local noise regulation.

Construction Noise

As with Alternative 3, and for similar reasons, the overall impacts from construction noise would be minor in intensity, extent, context, and of a moderate duration. Under this alternative, the total amount of construction would be comparable to that outlined under Alternative 3; however, it would be less compact and somewhat farther away from existing NSAs to the south and east. Construction noise along the shoreline, including the proposed boat club and boat ramp, would be audible, but perceived as distant for residences across Lake Texoma to the west. BMPs would be identical to those outlined under Alternative 3.

Long-term Noise

As with Alternative 3, there would be an approximate increase in man-made background noise (Table 4.16.2) (ANSI, 2003). These changes would be due to the additional traffic, and general human activities associated with a high-density mixed-use development.

However, unlike Alternative 3, 960 boat slips would be expected. To develop a most conservative estimate, it was assumed that all proposed boat slips are occupied, and 25% of the boats are used an average of once per day. Under these conditions, a single NSA would have the potential to be passed 14,400 times per month, and boats would generate DNL of 51.8 dBA. These levels would be well below the 65-dBA DNL threshold and would blend with the other activities throughout the proposed development such as vehicle traffic. In general, the number of boats passing a single location would not be sufficient to generate areas of incompatible land-use or significantly affect noise-sensitive areas (Table 4.16.3). Because of their widespread and sporadic nature, actual boating activities at any location would be much less severe than those described herein. Effects of noise from these activities would be minor in intensity, extent, context, and duration. Small changes in the long-term noise environment due to heavy equipment use of the stacked storage facility would be expected. This noise would be seasonal and intermittent, and these effects would be negligible.

4.16.1 Dredging

Noise impacts to the natural and human environment are expected to be localized and short-term, occurring during dredging and placement of dredged material. Noise generated from dredging activities would be similar to that generated from typical construction activities as described above.

4.17 SUMMARY OF ALTERNATIVE IMPACTS

A summary of environmental consequences discussed in Section 4 is presented below in Table 4.17.1. In this EIS the No Action Alternative, or Alternative 1, is used as a baseline for comparison to the action alternatives, Alternative 2, 3 and 4. Cumulative impacts of these alternatives are discussed in the following Section 5.

Table 4.17.1

Summary of Human and Natural Resource Impacts

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Activities under each Alternative	No Conveyance; Development on Adjacent Private Property	Convey with deed restrictions; No changes to SMP; No Moratorium Deviation; Development on Conveyance property and Adjacent Private Property	Convey with deed restrictions; No changes to SMP; Lift Moratorium; Development on Conveyance property and Adjacent Private Property	Convey with deed restrictions; Modify the SMP; Lift Moratorium; Development on Conveyance property and Adjacent Private Property
Land Ownership and Management				
Land Ownership and Management	No effect.	635 acres removed from Federal ownership and management. Minor decrease (-0.6%) of federal land ownership lake-wide.		
Land Use and Land Use Controls				
Lake Texoma Shoreline Management Plan	No effect.			Changes in zoning along conveyance area shoreline. Minor lake-wide increases in limited development (+3.3%) and public recreation zoning (+1.5%) and minor lake-wide decrease in protected shoreline allocation (-0.9%).
Lake Texoma Master Plan	No effect.	635 acres removed from Master Plan management. Minor decrease (-1.6%) in recreation (low density use) allocated lands lake-wide.		
Geology and Soils				
Geology	No appreciable effect			
Soils	Minor ground disturbance and increased potential of sedimentation during construction on adjacent private property.	Minor ground disturbance and increased potential of sedimentation during construction on the proposed conveyance land and adjacent private property; however, installation of shoreline protection reduces long-term shoreline erosion.		
Water Storage Capacity				
Water Storage Capacity	No effect.	No appreciable effect. Any proposed changes would be subject to USACE review and approval.		
Water Resources and Water Quality				
Chloride Control	No effect.			

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Erosion, Turbidity, and Sedimentation	Minor increased potential of sedimentation, erosion and turbidity during construction; and minor additional erosion could occur due to decreased vegetative cover and increased development on the adjacent private property.	Minor increased potential of sedimentation, erosion and turbidity during construction; and minor additional erosion could occur due to decreased vegetative cover and increased development; however, installation of shoreline protection reduces long-term shoreline erosion in Little Mineral Arm.	Moderate increased potential of sedimentation, erosion and turbidity during construction and dredging; and minor additional erosion could occur due to increased development and boating activity and decreased vegetative cover; however, installation of shoreline protection reduces long-term shoreline erosion in Little Mineral Arm.	Moderate increased potential of sedimentation, erosion and turbidity during construction and dredging; and moderate additional erosion could occur due to increased development and boating activity and decreased vegetative cover; however, installation of shoreline protection reduces long-term shoreline erosion in Little Mineral Arm.
Nutrients and Biological Oxygen Demand	Locally significant increased levels as the adjacent private development would rely on septic systems.	Minor decrease from no action levels, as the development would utilize a new waste water treatment plant.	Minor decrease from no action levels, as the development would utilize the waste water treatment plant; however, also a minor but temporary increase in levels during dredging. No appreciable effect lake-wide.	
Pesticides	No appreciable effect.	Minor, but not quantifiable, long-term increases from shoreline golf courses and residences.		
Other Water Quality Pollutants	Minor increases due to commercial and industrial development.		Moderate increases from commercial and industrial development, and additional boating on the lake.	
Biological Resources				
Vegetation	No appreciable effect to conveyance land vegetation.	Moderate to significant loss of forest and grassland plants on proposed conveyance land resulting from development.		
Wildlife	Minor disruption and displacement during development of adjacent private property.	Moderate to significant disruption and displacement on conveyance land and potential for loss of wildlife during construction activities; and moderate loss of habitat. Shift to species tolerant of human disturbance.		
Waters of the United States and Regulatory Permitting	Impacts expected to be present, but are unquantifiable due to the lack of detailed development plans, and avoidance-and-minimization plans; Impacts would be assessed during permit review and necessary permits would be obtained from the USACE prior to any construction or development. Permit applications would be phased as development proceeds.			
Fisheries and Aquatic Resources	No appreciable effect.	Minor disruption and displacement during construction; however, moderate increase in suitable habitat from the installation of shoreline protection.	Significant localized disruption and displacement during dredging and construction; however, moderate local increase in suitable habitat from the installation of shoreline protection.	
Threatened & Endangered Species	No effects.			

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Wildlife Refuges and Wildlife Management Areas	No effect.			
Migratory Birds	Minor local loss of terrestrial habitat and moderate loss of aquatic habitat due to development.			
Wildlife Corridors	No appreciable effect.	Minor local loss of habitat and increased fragmentation of habitat.		
Invasive Species	Minor increased introduction of invasive species due to removal of native species.	Moderate potential for the increased introduction and spread of invasive species due to development, landscaping, and increased boating (specifically the zebra mussel).		
Socioeconomics				
Population	Approximately 17,000 new residents with anticipated growth of 3.8% per year. New residents anticipated to be older, predominantly white and contribute to urban/suburban growth.	Approximately 1,875 additional residents (19,000 total), with an increase in growth rate of only 0.4% per year. New residents anticipated to be older, predominantly white and contribute to urban/suburban growth.		
Housing	Significantly increase housing stock, median housing value and property tax revenue for the County. Many homes would be second or seasonal residences and could be vacant for portions of the year.	Significantly increase City of Denison housing stock, median housing value and property tax revenue for the County, the City, Denison Independent School District, and community colleges. Many homes would be second or seasonal residences and could be vacant for portions of the year.		
Employment	Moderate increase in temporary opportunities during construction and moderate permanent new opportunities during operation of development.	Significant increase in temporary opportunities during construction and moderate permanent new opportunities during operation of development.		
Income	Significant increase in income and median household income due to the new residents; New residents may indirectly result in income growth due to demand for specialized trade and service workers. Significant economic benefit with increased sales and service taxes for the county.	Significant increase in income and median household income due to the new residents; New residents may indirectly result in income growth due to demand for specialized trade and service workers. Significant economic benefit with increased sales and service taxes for the City, County, and schools.		

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Travel, Recreation and Tourism	Negligible economic increase to the area tourism industry from the adjacent private property development.	Significant economic increase to the area tourism industry, from the conference center, the hotel and increased recreational activities on and around the lake.		
Environmental Justice	No effect.			
Quality of Life	Increased demand for public services, public safety, medical services and education would be met by the County through property, sales, and service taxes and fees from the development.	Increased demand for public services, public safety, medical services and education would be met by the City and Denison Independent School District with revenue generated through property, sales, and service taxes and fees from the development.		
Infrastructure and Utilities				
Traffic and Transportation	Moderate increase in construction traffic; and significant increase in residential and commercial traffic.	Moderate increase in construction, residential and commercial traffic.		
Water Treatment and Distribution	Significant increase in demand on the City of Denison water treatment system.	Minor increase in demand on the City of Denison water treatment system.		
Wastewater Collection and Treatment	Development would use new septic systems.	Development would use proposed new waste water treatment plant.		
Natural Gas	Significant increase in natural gas demand.	Minor increase in natural gas demand.		
Electricity	Significant increase in electricity demand.	Minor increase in electricity demand.		
Solid Waste	Moderate increase in domestic waste and increased demand on the Texoma Area Solid Waste Landfill during construction and life of the development.	Minor increase in domestic waste and increased demand on the Texoma Area Solid Waste Landfill during construction and life of the development.		
Ground and Traffic Safety	Minor increase in need for ground and traffic safety.			
Construction Safety	Minor increase in potential of safety incidents during construction.			
Public Lands				
Public Lands	No direct impacts to public lands; however, minor increase in potential public use.	Loss of 635 acres of publically-available Federal land, up to 100 acres of which would become public under city of Denison control. Minor decrease of publically-available land lake-wide.		

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Recreation				
Recreation Visitation	Minor increase of available recreation opportunities on adjacent private property and increased access to public land.	More diverse and changed recreation opportunities relative to present (e.g., golf/hike/bike vs. hunting). Significant change in available recreation opportunities.		
Land-based Recreation	Minor disturbances during construction and significant increase due to the adjacent private development.	Changed recreation opportunities on conveyance land. Moderate increase from additional recreation opportunities.		Changes in opportunities relative to present. Moderate increase from additional recreation opportunities and public park.
Land-Water Interface-based Recreation	No appreciable effect.	Moderate decrease in accessibility to land-water interface areas for recreation in the area of the conveyance.	Moderate decreased accessibility to land-water interface areas for recreation in the area of the conveyance, especially during peak holiday use.	Moderate decreased accessibility to land-water interface areas and pocket beaches for recreation in the area of the conveyance, especially during peak holiday use.
Water-based Recreation	No appreciable effect.		Increase in water-based recreation due to additional boat slips.	Increase in water-based recreation due to additional boat slips, ramps, and storage, especially during peak holiday use.
Lake Carrying Capacity	No appreciable effect.		Localized increased boat usage with moderate relative decreases in capacity in the area of the conveyance during peak holiday use. Already crowded boating conditions are expected to worsen.	Localized increased boat usage with significant relative decreases in capacity in the area of the conveyance during peak use periods. Already crowded boating conditions are expected to worsen.
Pocket Beaches	No effect.	Impacts dependent upon lake level. Access restrictions due to the shoreline protection and private land ownership.	Impacts dependent upon lake level. Access restrictions or loss due to the shoreline protection, shoreline construction, and private ownership. Likely shift to use of other pocket beaches lake-wide.	
Public Beaches	No effect.			Negligible increase due to access on hotel beach below 619 NGVD.
Fishing	No effect.	Significant localized reduction due to the loss of shoreline access for fishing.		Change in fishing access with a significant localized reduction of shoreline access; but a moderate increase from public boat ramp and park.
Hunting	Minor decrease in hunting quality due to adjacent development.	Local loss of 635 acres for hunting. Minor reduction of lake-wide public hunting land.		

Resource	Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Privately Operated Recreation Areas	Minor potential increase in usage due to population increase.	Minor increase of privately operated recreation areas; and potential increase in use of existing private marinas due to population increase.		
Private Boat Docks	No effect.		Moderate increase of new private docks and slips lake-wide. Significant number of new private docks along conveyance area shoreline where none currently exist.	
Cultural Resources				
Cultural Resources	No effect.			
Visual Resources				
Visual Resources	No appreciable effect to views of the lake or of the conveyance property; however, adjacent private property would change from undeveloped to developed.	Significant changes from undeveloped scenery to developed land from the lake.	Significant changes from undeveloped scenery to developed land and shoreline from both the lake and the conveyance land.	
Hazardous, Toxic, and Radioactive Waste				
Oil and Gas	No effect.			
Commercial Waste	Minor increase in commercial waste from development.	No appreciable effect.		
Industrial Waste	No appreciable effect.			
Medical Waste	Minor increase in generated medical waste from development.	No appreciable effect.		
Boat Waste	No effect.		Minor potential for increased boat waste.	
Air Quality				
Air Quality	No appreciable effect			
Noise				
Noise	Minor increase in background noise during construction; and moderate increase in background due to development.	Minor increase in background noise during construction and due to development.	Minor increase in background noise during construction; and moderate increase in background noise due to development and boating.	

5. CUMULATIVE EFFECTS

5.1 INTRODUCTION

As stated in 40 CFR 1508.7, cumulative effects are defined as follows:

> *impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant, actions taking place over a period of time.*

These impacts are not directly resulting from an action associated with a particular alternative over time, but rather are from past, present, and reasonably foreseeable future actions that should be considered along with each alternative. These effects can be generated from single or multiple events and may be additive or interactive. Principles of cumulative effects analysis, as described in the CEQ guide *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ, 1997), are described as follows:

- Caused by the aggregate of past, present, and reasonably foreseeable future actions.
- Include the total effect, both direct and indirect, on a given resource, ecosystem, and human community of all actions taken, no matter who (Federal, nonfederal, or private) has taken the actions.
- Need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.
- May result from the accumulation of similar effects or the synergistic interaction of different effects.

The assessment of cumulative effects under each alternative was projected 25 years in accordance with the proposed development schedule of Preston Harbor Development. Cumulative effects were assessed regionally for each resource using reasonable assumptions of changes, growth, and development in and around Lake Texoma based on previous lake history (past), current conditions (present), and reasonably anticipated (foreseeable) future activities.

New development has diminished around the shoreline of Lake Texoma in the last 7 years due to the 2005 moratorium on private boat docks and lease expansions. In addition to the 2005 moratorium, the SMP zones regulate development on the shoreline. In addition, Federal land uses at Lake Texoma are controlled by the Texoma Master Plan. Since lake construction, the proposed conveyance area has remained undeveloped and available for use by the public for hunting, fishing, swimming, hiking, camping, wildlife observation, and other land-water recreation activities. The adjacent private land has remained mainly undeveloped and used for cattle grazing and recreation. In contrast, other areas around the lake have developed as a result of leases or other activities. Collectively, development has occurred since lake conditions were described in the original operational EIS for Lake Texoma (USACE, 1976).

To assess past and present development of the Lake Texoma region, an analysis of impervious cover was conducted for the 108,753 acres of USACE-owned property surrounding Lake Texoma using a combination of historical imagery from 1974 (NASA Landsat Program, 2011; P2 Energy Solutions, Inc., 2011) and recreational development maps from the 1978 Lake Texoma Master Plan to assess past development. The most recently available aerial imagery (2008) was used to assess present development (USDA, 2008). Development acreage was derived by interpreting geo-referenced maps and historic aerials to identify impervious cover, such as roads, buildings, parking lots, and other manmade structures. For areas where past aerial coverage was missing or of low quality, the recreational development maps from the 1978 Lake Texoma Master Plan were used to capture additional impervious cover. Based on these assessments, impervious cover has increased from 2,025 acres to 2,235 acres on the USACE land directly adjacent to Lake Texoma over the past 34 years. This additional 210 acres of impervious cover represents a 0.2% increase of development on USACE lands, for an overall development of 2.1% of USACE lands surrounding the lake. Based on review of the 1978 Lake Texoma Master Plan maps, approximately 67 miles (11.5%) of the Lake Texoma shoreline was developed. By following the development trend indicated above, the current shoreline development has increased lake-wide by 1.1% to 74 miles in total. This assessment was conducted without consideration of any individual tract status as protected or limited under USACE plans or the level of development on those tracts (no physical surveys were performed), and therefore is a conservative estimate of development trends on the lake.

Reasonably foreseeable future development is difficult to predict with certainty in the Lake Texoma region. However, given the close proximity of the lake to major population centers such as the Dallas-Fort Worth Metroplex, recreational needs are anticipated to increase and result in additional development around the lake. In addition to the Preston Harbor Development, anticipated future development (over the next 25 years) revealed two new or expanding developments in some phase of initial planning or implementation that were identified through consultation with the Lake Texoma Association, USACE Tulsa District Real Estate Division, and local county development boards (Ashby, 2011; Blevins, 2011; Bone, 2011; Brockett, 2011; Chaney, 2011; Croasdale, 2011; Franks, 2011; Hartin, 2011; Hoffman, 2011; Johnston, 2011; Kaai, 2011; Lothridge; 2011; Montgomery, 2011; Morrow, 2011; Nance, 2011; Night, 2011; Richardson, 2011; Sharp, 2011; Smith, 2011; USACE, 2011d; White, 2011; Yates, 2011; and Young, 2011). These proposed developments are shown on Figure 5.1.1 and include the Rock Creek Resort (developed by Double Diamond Companies) and the Pointe Vista Development, which includes a joint venture involving adjacent Chickasaw Nation lands. None of these developments are directly associated with the proposed action. To the extent possible, potential impacts associated with these new developments were considered in cumulative impacts analysis for this EIS. Outside of these reasonably anticipated developments, future similar development around the lake is anticipated, but currently not quantifiable.

The Preston Harbor Development is located on the northeastern side of Little Mineral Arm on the Texas side of Lake Texoma, as previously described in this EIS. The development would occur over a 20-25 year period beginning at the southern end and extending northward. It is expected that the first 5 years of development would include the construction of the wastewater pump station, boat ramp, and boat club (including associated dredging activities), boat slips, a dry dock storage facility, and shoreline protection to the extent needed to protect the boat club and the housing development. Further development would include the southern golf club, golf course, community center, single-family and townhome residential development, commercial and medical services, and an inland lake (Figure 2.5). During the following 10-20 years, development of the Preston Harbor would include a northern golf course, golf club, single-family and townhome residential development, commercial services center, boat slips and boat docks, and the possible expansion of the wastewater pump station, and another inland lake. During the last 5 years of development, the hotel and conference center would be completed, including the proposed day use boat slips and recreational beaches.

The Rock Creek Resort (by Double Diamond Companies) is in Texas on the upper end of the Red River Arm of Lake Texoma and contains approximately 1,300 acres of private lands adjacent to USACE property (Figure 5.1.1). The partially developed resort already contains an existing marina located in a 100-acre cove with approximately 1-mile of shoreline access. According to resort publications (Rock Creek Resort, 2011), the marina and yacht club are proposed to be expanded to include approximately 700 boat slips within the 100-acre cove. Based on available information, it is anticipated that Rock Creek will not include development on USACE-owned land. The proposed development would include approximately 800 acres of residential development (with approximately 6,000 residents), a yacht club and (existing) marina, a boat ramp, boat slips, a mail center, a new 18-hole golf course, a practice range, a golf club, restaurants, a swim beach, hike and bike trails, parks, lakes, tennis courts, a fitness center, a pool and pool houses, and a lighthouse. Additional details are available at the Rock Creek website (http://www.rockcreekontexoma.com).

The Pointe Vista Development (Pointe Vista Development, LLC) is located in Marshall County, Oklahoma on the Washita Arm of Lake Texoma near the Highway 70 (Roosevelt) bridge (Figure 5.1.1). The total area of proposed development is composed of approximately 1,850 acres and would be modified into a resort setting. With contiguous development areas surrounding the Pointe Vista Development, total area would include approximately 2,815 acres. Pointe Vista acquired 750 acres of land from Oklahoma Commissioners of the Land Office (CLO), which included 558 acres previously conveyed in 2005 by USACE to the CLO in accordance with WRDA 1999. Under the same provision, the development could involve future further conveyance and development of an additional 950 acres of USACE property. Approximately 1,508 total acres of the proposed 1,850 development could ultimately be conveyed USACE property. Additionally, the development could include the purchase of approximately 100 acres of land from the Oklahoma Tourism and Recreation Department (OTRD). The area presently contains the Catfish Bay Marina, which could be expanded, and a portion of the former Lake Texoma State Park. The state park is proposed to be relocated in some fashion to another location(s) at the lake. Development of the area surrounding the Catfish Bay Marina would include residential lots, marina expansion, and public boat slips. Some shoreline modification associated with expansion, such as grading and paving for public access and erosion control features, is anticipated. The Pointe Vista Development is proposed to include facilities such as a golf course, a hotel, a club house and practice facility, a marina, an aquatic center, an outdoor recreation center, nature parks, campgrounds, retail shops, and an amphitheater. Further details regarding this development are provided in Section 3.2.2 of this EIS. Additionally, portions of land held by the Chickasaw Nation may be developed in a partnership arrangement between Pointe Vista LLC and the Chickasaw Nation (Figure 5.1.1). Located immediately to the northwest of the Pointe Vista Development, proposed future development of this property may include a casino, hotel, golf course, and shoreline-related development. Conceptual development plans provided to USACE by Pointe Vista Development, LLC can be found at the Tulsa District website (http://www.swt.usace.army.mil). Additional details can likewise be found at Pointe Vista's website (http://www.pointe-vista.com). As it is a distinct and separate action from the Denison conveyance under WRDA 2007, the USACE is currently conducting NEPA documentation (EIS) for the additional transfer of lands to the State of Oklahoma under WRDA 1999.

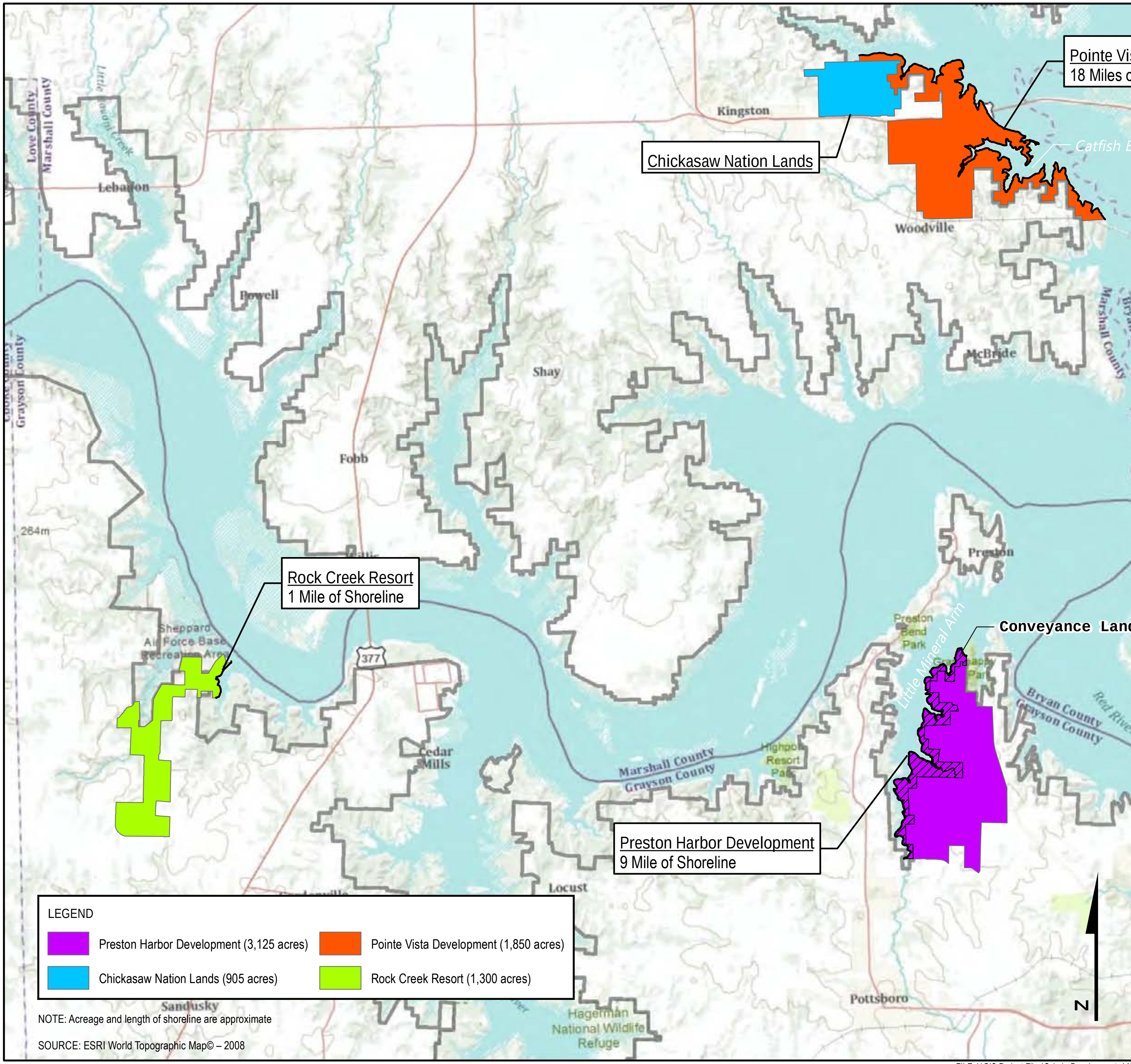

FIGURE 5.1.1
PROPOSED FUTURE DEVELOPMENTS
LAKE TEXOMA
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
OCTOBER, 2011	03886.525.001.0004	AS SHOWN

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5.2 LAND OWNERSHIP AND LAND MANAGEMENT

As previously discussed in Section 3.2, Lake Texoma Federal fee land was purchased by the Federal government for the public good and authorized project purposes in the 1940s. This section assesses past, present, and reasonably foreseeable cumulative impacts to ownership and management of Lake Texoma lands.

As discussed in Section 3.2.2, from 1972 to 1995 the GSA disposed of/transferred approximately 2,750 acres of Federally owned land at Lake Texoma from Federal ownership (GSA, 2011). The most recent conveyance of Federally owned land includes an additional 558 acres conveyed to the State of Oklahoma in 2005 in accordance with WRDA 1999. Presently, USACE owns 108,753 acres of land surrounding Lake Texoma that are managed by several State and Federal agencies including USACE, USFWS, the State of Oklahoma, and the State of Texas (USACE, 2008c).

Alternative 1 would have no effect on land ownership and land management at Lake Texoma. However, under Alternatives 2 through 4, land ownership and management would change, as approximately 635 acres of Federally owned and managed land would be sold to the City of Denison, and then a portion of the conveyance land would be sold again to a private developer (Schuler Development). As discussed in Section 4.2, the conveyance of 635 acres of Federally owned property would result in a 0.6% decrease of current Federally owned land lake-wide. Combined with past conveyances noted above, this would result in a total decrease of 3,943 acres or a cumulative lake-wide decrease of 3.5%. No impacts to the management of Federally owned lands managed by USFWS, State of Oklahoma, or the State of Texas would be expected.

It is anticipated that additional minor cumulative impacts to land ownership and land management would occur from the reasonably foreseeable potential conveyance of an additional 950 acres of Federally owned land to the State of Oklahoma in accordance with WRDA 1999 associated with the Pointe Vista Development. As a result of both the currently-proposed and future potential conveyances, a decrease of approximately 1.4% of current Federally-owned land surrounding the lake would occur. These lands would no longer be owned or managed by USACE. When combined with past conveyances noted above and currently-proposed conveyance of 635 acres, this additional potential future land transfer would result in a total decrease of 4,893 acres or a cumulative lake-wide decrease of 4.4%. Additionally, the loss of these public use areas would result in increased demand on remaining USACE-owned land available for public use on Lake Texoma as discussed in Section 5.10. Additional future conveyance of Federally owned land along Lake Texoma (beyond that identified as reasonably foreseeable here) is always possible; however, at the time of this report, there are no known plans for additional conveyance of Federally owned property.

5.3 LAND USE AND LAND-USE CONTROLS

As discussed in Sections 3 and 4, land use is a description of how people utilize the land, whereas land-use controls refers to the methods of regulating human use of land for economic production (residential, commercial, industrial, and recreational) and natural resource protection. This section describes the past, present, and reasonably foreseeable effects of the alternatives on land use and land-use controls at Lake Texoma.

Land surrounding Lake Texoma is primarily used for recreation. Past development activities within the project area have modified the type of recreation available along Lake Texoma by including the addition of concession marinas and boat ramps. Based on the assessment detailed in Section 5.1, there has been an increase of approximately 200 acres of impervious cover on USACE land adjacent to Lake Texoma over the past 34 years. This additional 210 acres represents a 0.2% increase of development on USACE lands, bringing the overall development of USACE lands to approximately 2.1%. Alternative 1 would have no effect on land use or land-use controls for the proposed conveyance. For Alternatives 2, 3, and 4, the cumulative effects on land use and land-use controls includes the addition of approximately 3,125 acres (4.9 square miles) to City of Denison jurisdiction. This would result in an approximately 20% increase of land to the City and continued development on Lake Texoma.

As discussed in Section 3.3, use of Federally owned land surrounding the lake must comply with the zoning restrictions specified in the 1978 Texoma Master Plan, and use of the lake shoreline must comply with the zoning restrictions specified in the 1996 SMP. Therefore, cumulative impacts to land use and land-use controls as related to the SMP and Texoma Master Plan are discussed separately in the subsections below.

5.3.1 Shoreline Management Plan

As discussed in Section 3.3, the SMP was created in 1974 (previously called the Lake Texoma Lakeshore Management Plan). As a result of the 1996 review of the SMP, an additional 3.4 miles of shoreline were designated as limited development (USACE, 1996). No changes have been made to the SMP since 1996. A moratorium, as described in this EIS, has been in place since 2005.

For the currently-proposed action, no impact to lake-wide SMP allocations would occur under Alternatives 1 through 3. Under Alternative 4 (the proposed action), impacts to shoreline use allocations adjacent to the proposed conveyance property would change, resulting in lake-wide changes in shoreline allocations described in Section 4.3.1. No additional changes to the SMP are anticipated to be associated with the Rock Creek Resort development. A Federal land conveyance is associated with the Pointe Vista Development. However, current plans as submitted by Pointe Vista would not appear to result in the need for additional SMP allocation changes. All proposed features appear to be consistent with current zoning. Should this change, additional NEPA documentation being developed for this action will address these effects. In summary, SMP zoning changes associated with the proposed action, as described in Section 4.3.1, appear to be the only anticipated lake-wide changes for reasonably foreseeable future actions. Accordingly, lake-wide impacts to SMP zoning would include increases in limited development (+3.3%) and public recreation (+1.5%) and decreases in protected area (-0.9%) zoning.

The USACE desires to review and potentially update the Lake Texoma SMP in the future. Any such future updates to the lake-wide SMP will be accompanied by additional impacts analysis in accordance with NEPA requirements.

5.3.2 Lake Texoma Master Plan

As described in Section 3.3.2, the Lake Texoma Master Plan was originally written in 1952 with updates completed in 1960 and 1978. The plan was supplemented in 1996. Past conveyance of Federally-owned land includes 558 acres conveyed to the State of Oklahoma in 2005. Prior to conveyance of the 558 acres, this land was designated as recreation – intensive use in the Master Plan. Such lands have been taken out of management under the Lake Texoma Master Plan.

The current land-use designations for Federally-owned land at Lake Texoma are shown in Table 3.3.4. No impact to land allocated by the Master Plan is anticipated under Alternative 1. As described in Section 4.3.2, impacts to Lake Texoma Master Plan allocations under Alternatives 2 through 4 would result in a minor long-term, impact on land use above elevation 619 ft NGVD and the loss of 635 acres (1.6%) of recreation low-density land at Lake Texoma. The conveyance land would no longer be classified or managed under the Texoma Master Plan, and the extent of Federal management would be limited to a flowage easement. No additional changes to recreation low-density lands are expected as a result of other known future developments surrounding Lake Texoma. However, approximately 950 acres of land allocated as recreation-intensive use would be removed from Master Plan management should conveyance of Federal lands associated with the Pointe Vista Development occur, as discussed in Section 5.1. Additional future changes to Lake Texoma Master Plan allocations would be assessed separately in accordance with NEPA requirements.

5.4 GEOLOGY AND SOILS

Cumulative impacts under all alternatives include increased soil erosion due to extensive vegetation thinning, site development, and increase in impervious cover. In contrast, shoreline soil protection could occur through the installation of shoreline protection systems, resulting in both beneficial and temporary adverse (during installation) minor impacts associated with alternatives involving shoreline protection.

As discussed in Section 5.3, impervious cover has increased by approximately 10% (from 2,025 acres to 2,235 acres) since 1976, resulting in a total of approximately 2.0% of the USACE land occupied by impervious cover. Development accounts for a 0.2% increase of impervious cover on the USACE land adjacent to Lake Texoma over the past 34 years. Lands surrounding the impervious cover include areas of altered, cleared, or thinned vegetation. Known potential future actions adjacent to the lake include two additional developments (Pointe Vista Development and Rock Creek Resort), that are expected to account for additional, yet unquantified increases in impervious cover and additional altered land in the region. This, combined with additional acres of impervious cover projected for Preston Harbor Development, would increase the amount of impervious cover adjacent to the lake and result in an increase in altered land. This could lead to cumulatively increased, but currently unquantifiable, levels of soil erosion in developed areas.

New shoreline development has been limited around the shoreline of Lake Texoma since 2005 due to the 2005 moratorium. Past shoreline protection was mostly limited to protection of bridges, roads, boat ramps, public use areas, and marinas. With the future proposed developments, a larger area of the shoreline may become protected.

As discussed in Section 4, impacts to soil under Alternative 1 would occur on private lands. These effects would occur regardless of Federal action. Other areas around the lake would experience similar disturbances to soils but are not quantifiable. Since development under Alternative 1 does not include steeply sloped areas and shoreline land, the contribution to an increase in the rate of soil erosion and lake sedimentation under this alternative is anticipated to be negligible. Under Alternative 1, there would be no increase in impervious cover on land adjacent to Lake Texoma attributable to the proposed Federal action. An increase in the regional population would be expected, which would result in higher use of lake recreational facilities and boating activities and may cause an increase in erosion and sedimentation due to increased wave action from boating activities.

Long-term adverse and beneficial cumulative impacts could be expected under Alternatives 2, 3, and 4. Cumulative impacts to soil would include those under Alternative 1, in addition to those arising from the shoreline protection system. Development including and beyond USACE property surrounding Lake Texoma is planned; therefore, soil disturbance and subsequent increased sediment runoff would occur during construction of new structures. Future shoreline development could occur along approximately 27.4 miles (9.4 miles of Preston Harbor Development lands plus approximately 18 miles of Pointe Vista Lands) on Lake Texoma. An increase in impervious surfaces such as rooftops and roads would increase surface runoff and, consequently, the potential for soil erosion.

Minor adverse impacts similar to those discussed in Section 4 would be expected to result from construction or expansion of foreseeable future developments (Rock Creek Resort and Pointe Vista Development). Under Alternatives 2 through 4, shoreline protection features would be constructed along 2.7 miles of shoreline for Preston Harbor Development. Although not currently projected, similar shoreline protection features could be constructed for the Pointe Vista Development. Because the presence or location of shoreline protection features are unknown, future impacts associated with shoreline erosion due to shoreline protection features are not quantifiable. Three new developments along Lake Texoma could cause an increase in boating activity due to increased population numbers; this may result in increased wake action along the shorelines. As discussed in Section 4.6.2, increased wake action can erode unprotected shorelines and increase soil loss.

Although no prime farmland is present within the Preston Harbor Development or other known future development, there is potential for increasing development to consume prime farmland soils or unique farmlands present in the region. No other actions with the potential for additive, cumulative impacts on the geology and soil resources of Lake Texoma have been identified.

In summary, cumulative impacts on soils in the Lake Texoma region may be both beneficial and adverse. Cumulative impacts under all three action alternatives are beneficial due to decrease in soil loss and erosion resulting from an increase in shoreline protection along the Preston Harbor Development and potentially along other developments. Adverse impacts may be experienced due to increased development-related erosion and impervious cover, and an increase in wave action along shorelines.

5.5 LAKE TEXOMA WATER AND FLOOD STORAGE CAPACITY

As discussed in Section 3.6.4, the storage capacity of Lake Texoma decreased approximately 20% between 1942, when the lake was constructed, and 2002. Sedimentation and loss of storage capacity is therefore a concern at Lake Texoma. The present condition of decreased storage capacity has been primarily a result of past sediment loading from the extensive watershed upstream of Lake Texoma (USACE, 2010a). Such a pattern is reasonably anticipated to continue into the future absent major management measures in the watershed. To capture its immensity, Figure 5.5.1 shows the Lake Texoma watershed relative to the Little Mineral Arm watershed, and Table 5.5.1 presents a size comparison of watersheds and developments known to be constructed around Lake Texoma within the reasonably foreseeable future, as shown on Figure 5.1.1.

Table 5.5.1

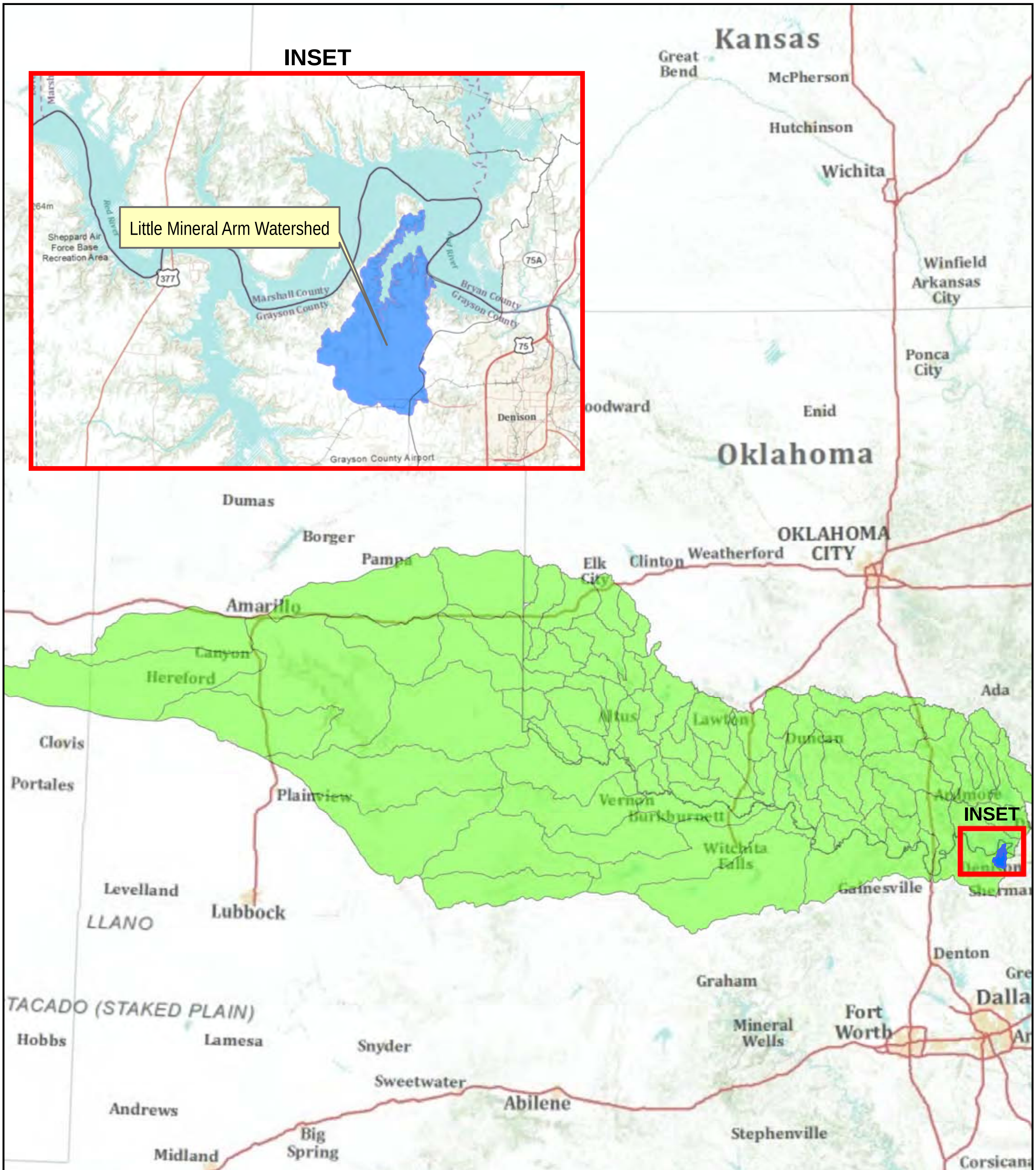
Watershed Comparison

Watershed or Property	Drainage Area (acres)	Percentage of Lake Texoma Watershed (%)
Lake Texoma Watershed[1]	25,088,000	NA
Little Mineral Arm Watershed	16,281	0.065%
Preston Harbor Development (Alternative 4)	3,125	0.012%
Pointe Vista Development[2]	1,850	0.007%
Rock Creek Resort[2]	1,300	0.005%

Source: WESTON, 2011
[1] as defined by USGS, 2011
[2] does not contribute to Little Mineral Arm

As seen in Table 5.5.1, the developments known to be constructed around Lake Texoma make up less than 0.03% of the Lake Texoma watershed. The vast majority of the sediment load currently being delivered to Lake Texoma is from sources upstream of the reservoir. Cumulative impacts to Lake Texoma storage capacity as a result of the alternatives and the known or reasonably foreseeable developments listed in Table 5.5.1 and described in Section 4.5 would not measurably worsen the current trend of decreasing storage capacity of Lake Texoma.

Flood storage capacity of the Lake Texoma flood pool would not be affected by any of the anticipated developments. Any proposed construction with the potential to affect flood storage capacity would require prior review and approval by the Tulsa District USACE. It is likely that no net loss of flood storage capacity would be required for any proposal.



LEGEND

Lake Texoma Watershed

Little Mineral Arm Watershed

SOURCE 1) UNITED STATES GEOLOG CAL SURVEY TOPOGRAPHIC MAP OF THE CONTINENTAL U.S.
PROVIDED BY ESRI ONL NE WORLD TOPOGRAPHIC MAP SERVICE
2) UNITED STATES GEOLOG CAL SURVEY NATIONAL HYDROGRAPHY DATASET CATCHMENT BOUNDARY 2011

DISCLAIMER THIS FIGURE IS PREPARED FOR REFERENCE PURPOSES ONLY AND SHOULD NOT BE USED AND IS NOT NTENDED FOR SURVEY OR ENGINEERING PURPOSES.

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FIGURE 5.5.1
LAKE TEXOMA WATERSHED
CITY OF DENISON
LAND CONVEYANCE EIS

DATE	PROJECT NO	SCALE
JUNE 2011	03886.544.001.0004	AS SHOWN

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5.6 WATER QUALITY

The water quality of a waterbody is contingent upon the characteristics of upstream watersheds. Lake Texoma is located on the Red River; therefore, the watershed of the Red River Basin, upstream of the lake, is a key driver for the water quality conditions in Lake Texoma. As discussed throughout Section 4.6, Water Quality, activities and modifications associated with developments such as those proposed around Lake Texoma typically contribute to water quality degradation. Though specific details are unknown about most of the reasonably foreseeable developments surrounding Lake Texoma, it is important to consider that they make up a relatively small portion, less than 0.03%, of the extensive Lake Texoma watershed, as presented in Table 5.5.1 and shown on Figure 5.5.1. Additionally, though the analysis in Section 4.6 revealed minor water quality impacts associated with the Preston Harbor Development in the Little Mineral Arm, they are generally localized, affecting an even smaller portion of the entire Lake Texoma watershed.

As further discussed in Section 3.6.3, USACE has been involved with the Red River Chloride Control Project (RRCCP) since 1959, reducing the amounts of chloride in the Red River Basin, including Lake Texoma, by developing and implementing controls. In addition to existing RRCCP operations, controls in Area VI, located on the Elm Fork of the North Fork of the Red River in Harmon County, Oklahoma, have been re-evaluated, are under review, and may be implemented in the reasonably foreseeable future to reduce chloride loads delivered upstream of Lake Texoma.

The turbidity of Lake Texoma would be affected in a similar manner as storage capacity, discussed in Section 5.5, as it is also primarily dependent on rates of erosion and sedimentation which have led in the past to substantial loss of reservoir capacity due to sedimentation. Only approximately 5% of the Lake Texoma shoreline would be consumed by known developments proposed within the reasonably foreseeable future, including Preston Harbor Development; therefore no appreciable impact to the turbidity of Lake Texoma is anticipated as a result of shoreline erosion and sedimentation. Any dredging activities associated with known developments proposed within the reasonably foreseeable future, including the Preston Harbor Development, would be localized and short-term, and it is assumed they would not be concurrent. For these reasons, proposed dredging would not appreciably impact the turbidity of Lake Texoma.

As discussed in Section 3.6.10, Lake Texoma is currently listed as an impaired waterbody on the Oklahoma 303(d) list and is need of a TMDL. The cause of the impairment is listed as organic enrichment and/or oxygen depletion. Anticipated sources of this impairment include agricultural practices, leaking septic systems, commercial and residential development, and fertilizers. The 2010 Oklahoma Integrated Report indicates that a TMDL is scheduled for development in 2012 for Lake Texoma and that the lake remains impaired. A TMDL implementation plan would propose corrective actions and/or BMPs to address the 303(d) list status and, once in place, would facilitate management of water quality in the watershed. Until a TMDL and implementation plan are developed, the water quality of Lake Texoma it is reasonably expected to continue to be impaired. Although a quantifiable impact was estimated as reasonably foreseeable due to the Preston Harbor Development on Little Mineral Arm, this is not an appreciable impact with regard to the continuing trend of increasing pollutant loading to Lake Texoma within this large watershed. While impacts of other foreseeable developments are not quantifiable at this time, it is reasonable to assume that impacts, if any, would be minor relative to extensive watershed loading of pollutants and not appreciably affect water quality lake-wide.

5.7 BIOLOGICAL RESOURCES

The cumulative effects to biological resources resulting from past actions on Lake Texoma, the proposed implementation of the Preston Harbor Development, and reasonably foreseeable changes to the lands surrounding Lake Texoma within the next 25 years are considered in this section. New shoreline development has diminished around the shoreline of Lake Texoma since 2005 due to the 2005 moratorium on private boat docks and lease expansions. Known potential major future development includes at least two additional or expanding new developments (Rock Creek Resort and Pointe Vista Development) around the lake that may occur within the next 25 years (Figure 5.1.1). Combined, the anticipated developments would impact approximately 27.4 additional miles of shoreline or approximately 5% of the Lake Texoma shoreline.

As discussed previously, the USACE property has experienced a 0.2% (210 acres) increase in impervious cover over the previous 34 years, bringing the overall impervious cover on USACE lands up to 2,235 acres or 2.1%.

5.7.1 Vegetation

Generalized cumulative impacts of the proposed developments on the vegetative and wildlife communities of Lake Texoma would be similar to those discussed in Section 4.7 for the proposed conveyance land. Impacts would be expected to include 1) decrease in vegetative cover, 2) decrease in vegetative diversity, and 3) increase in invasive or non-native species. All of the forecasted developments include resort-style landscape planning with golf courses, residential homes, lake access, and docks where appropriate.

The impacted vegetation communities present on the proposed conveyance land and adjacent private property are part of a larger ecological system surrounding Lake Texoma. From a regional perspective, the total potential impacts measured by the percent of acreage for a specific vegetative community within the Preston Harbor Development property compared to the total available in the Lake Texoma area were evaluated. Figures 3.7.1.1 through 3.7.1.5 show the vegetative communities surrounding Lake Texoma. The breakdown of the different vegetative communities present on the proposed Preston Harbor Development, compared with regional values (2010 USACE land, and 2008 land within 1 mile of USACE land) is shown on Table 5.7.1 below.

Cumulative impacts on the vegetative resources under all four alternatives would be similar on a regional scale. As shown in Table 5.7.1, each vegetative community potentially impacted due to the Proposed Action accounts for less than 2.7% of the acreage present for each vegetative community regionally. When compared to the vegetative communities present on only USACE land, the potential acreage impacted is between 0.4% and 11% of the acreage present for each vegetative community type. Although the local impact, as described in Section 4.7, on vegetative resources would be significant under Alternatives 2, 3, and 4, the loss of the resource on a regional scale is minor.

Table 5.7.1

Existing Land Cover/Vegetative Communities for Lake Texoma Region Compared to the Proposed Preston Harbor Development Land Cover

Land Cover/ Vegetative Community	USACE Land (acres)[1]	1 mile buffer from USACE perimeter (acres)	PHD (acres)	PHD vs. Regional Cover (%)
Developed	2,235	2,912	109	2.12%
Mixed Forest	65,118	89,659	1,156	0.75%
Herbaceous/Grasslands	16,193	95,903	1,722	1.54%
Bottomland Hardwoods	19,446	48	20	0.10%
Emergent Herbaceous Wetlands/ Aquatic	993	2,566	95	2.67%
Agricultural Land	5,456	40,504	22	0.05%
Total	**109,441**	**231,592**	**3,125**	**0.92%**

Source: WESTON, 2011

[1] Due to the scale of the land cover dataset; the above referenced acreage is slightly larger than then actual acreage.
PHD = Preston Harbor Development

Reasonably foreseeable future developments other than the Preston Harbor Development would encompass approximately 3,150 additional acres of shoreline and near shoreline land. Based on the site locations of the future developments (Figure 5.1.1) and the current vegetative cover of these areas (Figures 3.7.1.1 – 3.7.1.5), the total acres of vegetative cover potentially impacted for the Lake Texoma shoreline and surrounding areas are shown below as estimated cumulatively over the next 25 years. It should be noted that this comparison does not quantify vegetation losses associated with potential developments as those for proposals other than Preston Harbor Development are undefined. Rather, this comparison provides total vegetative communities present which could potentially be impacted to some degree.

Table 5.7.2

Existing Land Cover/Vegetative Communities for Lake Texoma Region Compared to the Current and Proposed Future Developments

Land Cover Class/Vegetation Community	USACE Land (acres)	1 mile buffer from USACE perimeter (acres)	Current and Future Development (acres)	Future Development vs. Regional Cover (%)
Developed	2,235	2,912	141	2.74%
Mixed Forest	65,118	89,659	2,989	1.93%
Herbaceous/Grasslands	16,193	95,903	2,418	2.16%
Agriculture Land	5,456	40,504	482	1.05%
Bottomland Hardwoods	19,446	48	20	0.10%
Emergent Herbaceous Wetlands/ Aquatic	993	2,566	225	6.32%
Total	**109,441**	**231,592**	**6,275**	**1.84%**

Source: WESTON, 2011and Homer et al., 2004
Note: Land cover acreages are not available for all categories

[1] Due to the scale of the land cover dataset; the above referenced acreage is slightly larger than then actual acreage.

As shown above, the total maximum potential impact of each vegetative resource due to the proposed and reasonably foreseeable developments is less than approximately 2% of the existing resources within 1 mile from the lake and the USACE property. The total coverage of vegetative resources relative to those only on the USACE land surrounding Lake Texoma is approximately 6%.

From a regional perspective, the anticipated cumulative impact of the proposed development on the vegetative resources under all four alternatives would be minor over the next 25 years assuming that the rate of development is limited to that of the known reasonably foreseeable future developments around the lake.

5.7.2 Wildlife

Cumulative impacts to wildlife would be directly correlated to vegetation community impacts for all four alternatives as vegetative communities serve as habitat for terrestrial species. Loss of habitat surrounding the lake decreases the likelihood of success for and extent of wildlife communities. Under all four alternatives, the loss of habitat in comparison to the total regional habitat available at the lake is nearly identical. The loss of shoreline and forested habitat is greater under Alternatives 2, 3, and 4, but would be expected to remain minor regionally.

Cumulative impacts under Alternatives 2, 3, and 4, include the following: 1) the decrease in wildlife corridors, 2) the reduction of available and preferential habitat for resident and migratory species, and 3) an increase in invasive species due to landscape modification, mowing, and decrease in available habitat. Under Alternatives 3 and 4, the cumulative impact of dock development on the lake would have an adverse moderate effect on the colonization of zebra mussels in the lake due to an increase of available boat docks and structures.

Preston Harbor Development and the proposed Pointe Vista Development both provide relatively undisturbed habitat along the lake shoreline that connects to similar habitat on either side of the proposed development areas. Cumulatively, these developments would result in some level of impact to approximately 27 miles of primarily forested shoreline habitat, potentially altering or eliminating 1,600 acres of forested habitat. Species expected to be impacted by the future conditions include mammals with large home ranges. Examples could include deer, skunk, fox, and coyote. Many other species including many migratory birds, shrews, mice, and snakes have smaller home ranges, but select habitat away from disturbed areas. The increase in impervious cover and associated development decreases the availability of habitat and lessens the suitability of the surrounding habitat for all wildlife species. Only species tolerant of human disturbance would be expected to be present within the proposed future developments. Short-term impacts on wildlife are expected to occur during land clearing in all reasonable foreseen future developments. Birds, amphibians, reptiles, invertebrates, and small mammals inhabiting the proposed development area would suffer sudden and immediate modification to or elimination of habitat.

Habitat adjacent to Lake Texoma has become fragmented though development; cumulative effects of the Proposed Action would result in additional habitat fragmentation. Although cumulative impacts under reasonably foreseeable future conditions adversely impact terrestrial wildlife, the extent of the impacts is minor when compared to the available wildlife habitat regionally.

5.7.3 Fisheries and Aquatic Resources

The cumulative effects to the fisheries and aquatic resources of Lake Texoma are addressed in this section and include past actions, impacts resulting from the implementation of the Preston Harbor Development, and predicted changes to Lake Texoma within the next 25 years based on anticipated future conditions. Major concerns regarding the Lake Texoma fishery and aquatic resources include the following: 1) potential cumulative impacts associated with changes in aquatic habitats and fish spawning habitat with the proposed conveyance; 2) potential cumulative impacts due to permitting and construction of private boat docks; and 3) potential impacts due to construction of shoreline protection measures. The expected impacts of each of these are discussed in Section 4.7 for each alternative.

Past actions or events which have contributed, or may contribute, to cumulative impacts on the aquatic resources of the lake include the loss of storage capacity of the lake (20%) due to sedimentation, construction of shoreline protection features, nuisance algal blooms (golden and blue-green algae), introduction of pest species such as the zebra mussel, and an increase in the numbers of private docks and marinas. The loss of storage capacity from siltation impacts the aquatic community by reducing the amount of available space for fish and other aquatic organisms. Sedimentation may also 1) reduce thermal refuge areas within the lake that are necessary for the survival of species such as striped bass during the hot summer months and 2) reduce the amount of suitable spawning habitat within the lake. Documented golden algae blooms in the lake have resulted in fish kills. Since 2009, zebra mussels have been found in Lake Texoma. The non-native mussel poses a threat to the native aquatic resources, water supply users, and recreational users of the lake. The non-native mussel also poses a threat to other recreational lakes within Texas due to the potential increase of the species within Lake Texoma and the increase in boat traffic in and out of Lake Texoma. These factors could result in the increased transportation of the non-native mussel from Lake Texoma to other lakes, consequently increasing zebra mussel populations in other water bodies. Finally, a most recent development in the summer of 2011 was extensive blooms of blue-green algae species in Lake Texoma. The likelihood of future blooms and extent of impacts of localized development on such blooms is currently unknown.

Known potential future expansion within the next 25 years on Lake Texoma includes two additional developments, Rock Creek Resort and Pointe Vista Development (Figure 5.1.1). The Rock Creek Resort is not located on USACE lands and was not considered to directly impact the lake or shoreline, except for potential marina expansion. Potential development activities associated with construction and operation of Pointe Vista Development would be similar to those proposed for the Preston Harbor Development project and would include an associated increase in boat docks, construction of additional shoreline protection measures, and the potential for limited dredging.

The shoreline of Lake Texoma is regulated by the 1996 SMP. New shoreline development has diminished around the shoreline of Lake Texoma since 2005 due to the 2005 moratorium on construction of private boat docks and lease expansion. Shoreline protection in the past has been limited and usually associated with protection of bridges, roads, boat ramps, public use areas, and marinas. A larger area of the shoreline is likely to become protected with the implementation of future proposed development. Depending upon the design of protection features (e.g., rip-rap vs. vertical concrete bulkheads), such changes could either increase or decrease habitat quality for fish and aquatic organisms.

Under Alternative 1 (No Action Alternative) there would be no potential cumulative impacts to aquatic habitats and fish spawning habitats attributable to the Preston Harbor Development project. However, there would be potential for cumulative impacts on this resource from development of the Pointe Vista Development. Expansion of the Catfish Bay Marina could have a long-term adverse impact on approximately 377 acres of fish spawning habitat. Most of the Catfish Bay area contains potential fish spawning habitat as shown in Figure 3.7.8. Construction and operation activities within the cove for the proposed marina expansion could impact approximately 202 acres of spawning habitat in Catfish Bay Cove, or a significant portion of 11 miles of shoreline habitat. While this potential exists, specific impacts would be determined during separate ongoing NEPA analysis for this action.

An additional 88 acres of spawning habitat might also be impacted if a satellite to Catfish Bay Marina on the north shoreline of the development proposed by Pointe Vista and the Chickasaw Nation lands is found to be feasible and approved by USACE. Under Alternative 2, impacts on aquatic habitats and fish spawning habitats would be similar to those discussed for Alternative 1. Under Alternatives 3 and 4, there would be additional cumulative impacts on aquatic resources and fish spawning habitats. Under Alternative 3, there would be an additional loss of approximately 22 acres of shallow water spawning habitat due to dredging a cove for a private boat club, and a loss of approximately 6,400 linear feet of spawning habitat along the shoreline due to development features. Under Alternative 4, there would be an additional 10 acres of shallow water spawning habitat impacted by dredging for access to the public boat ramp in the public park area.

There may also be potential cumulative effects associated with construction of boat docks. A detailed discussion of expected impacts of boat docks on the aquatic resources of the lake with respect to each proposed alternative are discussed in Section 4.7. The numbers and types of boat docks to be constructed within the Preston Harbor Development under various alternatives, and the surface area of the lake to be occupied by the boat docks are shown in Tables 4.7.5 and 4.7.6. The maximum total surface area of the lake impacted by existing boat docks, including described cumulative actions, is 191 surface acres. This equates to approximately 0.25% of the total surface area of the lake. Consequently, it is unlikely that such limited shading of the water column would cumulatively impact primary productivity, aquatic plant growth, or the fishery of the lake.

With the described cumulative actions there could be additional shoreline erosion control measures. Consequently, there are potential cumulative impacts due to construction of shoreline protection measures. Potential impacts resulting from the construction of the shoreline protection would be the physical loss of existing terrestrial and aquatic habitats due to the footprint of the shore protection, increased turbidity levels during the construction period, and temporary construction impacts such as increased noise levels and fugitive dust. A detailed discussion of these impacts is provided in Section 4.7 relative to each proposed alternative. It is reasonably foreseeable that additional shoreline control features constructed under future development conditions could result in additional spawning habitat for certain species, and altered aquatic habitat along portions of the shoreline.

5.8 SOCIOECONOMICS

Socioeconomic analysis includes a description of a region's social and fiscal characteristics. The Lake Texoma region, including 3 Texas counties and 10 Oklahoma counties, has typically experienced an increase in population and economic growth since the development of the lake. As discussed in Section 3.8, historically, the 13-county region has been predominantly a low cost-of-living rural area with small towns that relied on oil and gas extraction, ranching, and low-wage manufacturing for jobs and income (TRC, 2007). These characteristics have resulted in a typical regional demographic profile that includes slow population growth, an older age structure, lagging educational attainment, and lower average earnings and per capita income than state and national averages (TRC, 2007).

While regional interstate economic development collaboration continues, particularly with respect to development around Lake Texoma, Cooke and Grayson counties are becoming more influenced by and integrated with the Dallas-Fort Worth metroplex, as it continues to experience rapid growth (approximately 50% or more from 2000 to 2010) (TRC, 2010). All alternatives would contribute to cumulative effects on the population of Grayson County and the region. When completed, the development associated with the Proposed Action would result in an approximate 17% increase to the Grayson county population and essentially double the population of the City of Denison. Additionally, population growth resulting from the proposed developments by others discussed in Section 5.1 (Rock Creek Resort and Pointe Vista Development) in addition to indirect economic effects associated with the project would also contribute to long-term population growth. Some of this growth would occur as part of the ongoing urban/suburban development that has been typical in the region over the past few decades. Moreover, regional population growth is also expected from the continuing northward expansion of the Dallas-Fort Worth metroplex.

The Proposed Action would result in a long-term, beneficial increase in regional economic activity due to residential, commercial, and recreational developments. Employment opportunities created by the proposed development could reduce the current, relatively high unemployment rate and offset somewhat recent job losses from manufacturing and related activities as discussed in Section 4.8. Revenue for the taxing entities would be generated from property, hotel occupancy, and sales taxes associated with the development, as detailed in Section 4.8.4. Additionally, revenue would be generated for the Lake Texoma surrounding area from the increased recreational use associated with the Preston Harbor Development, discussed in Section 4.11, along with the other known developments along the lake. However, excessive development around a water-based tourism attraction, especially intensive shoreline development, could indirectly lead to diminished recreational opportunities, reduced tourism, and resulting negative economic consequences. No additional shoreline changes to the SMP are anticipated under the foreseeable developments (Pointe Vista Development and Rock Creek Resort). The USACE desires to review and potentially update the Lake Texoma SMP in the future. Any such future updates to the lake-wide SMP will be accompanied by additional impact analyses in accordance with NEPA requirements.

The Proposed Action would result in an increase in demand for public safety services, medical services, and educational resources as a result of the long-term population increases including those associated with the foreseeable developments on the lake (Pointe Vista Development and Rock Creek Resort). While demand for these services and the funds to pay for them would increase, taxes and revenues generated by the lakeshore developments are expected to cover the funding needs over time as discussed in Section 4.8.

In short, the Proposed Action would result in significant economic benefits for the region, and specifically in Grayson County and the Sherman-Denison Metropolitan Planning Area. When added to the prospective socioeconomic consequences of the other lakeshore developments described above, additional economic benefits would accrue to the entire Lake Texoma region, representing a cumulative economic benefit.

While the socioeconomic benefits of these lakeshore developments would be largely resource based (Lake Texoma) and recreation/tourism oriented, the other ongoing urban/suburban development projects in the region and study area would also contribute to economic development and potential socioeconomic effects.

The overall cumulative impact of the lakeshore and ongoing urban/suburban development would result in net positive, economic, and socioeconomic benefits since the Proposed Action and other foreseeable lakeshore developments would result in only minor additional shoreline and impervious urban development as discussed throughout this section. The ongoing pace of land use changes due to urban/suburban developments in the region beyond the lakeshore, as measured by population growth, has been relatively modest over the last 10 to 20 years (Section 4.8.1). The historic character of the region is a rural/small town area with Grayson County enjoying a natural environment (SDMPO, 2010). As discussed throughout Section 5, the region has the physical land base and sufficient infrastructure to sustain current and anticipated population-related growth and economic development at rates comparable to those that have occurred the last several decades. Together, the cumulative impacts of the lakeshore and urban/suburban developments are not expected to result in any significant negative environmental impact to the Lake Texoma resource base in the foreseeable future.

However explosive growth, similar to the 50% or more per year experienced by Collin and Denton counties, immediately south of the region, could potentially stress current infrastructure and public service capacities. This potential growth, related to the northward expanding Dallas-Fort Worth metroplex, could lead to numerous growth-related issues such as rapid expansion of development of the greater Sherman-Denison urban area, a decline in environmental quality and natural resources, and an increase in traffic congestion (SDMPO, 2010). Therefore, the cumulative impacts on the socioeconomics of the study area are anticipated to be beneficial based upon the proposed action, but potentially adverse based upon the actions of others outside the region.

5.9 INFRASTRUCTURE AND UTILITIES

In addition to the Preston Harbor Development, two developments (Rock Creek Resort and Pointe Vista Development) are proposed on Lake Texoma. However, Pointe Vista Development and the potentially associated Chickasaw Nation lands are located in Oklahoma and are therefore unlikely to impact utility demands, capacity, or infrastructure in Texas. Therefore, for purposes of cumulative effects analysis, only utility impacts from the Rock Creek Resort and Preston Harbor Development are considered below. It is assumed that the current growth trends for the counties surrounding the lake would continue. As a result, construction of new infrastructure and increased utility demands associated with development would have cumulative impacts on the affected environment and supporting facilities.

As discussed in Section 3.9.2, transportation resources are well developed within the proposed conveyance area, the region, and surrounding areas. The two roadways adjacent to the proposed conveyance are F.M. 84 and F.M. 406, located northwest of Denison. While improvements to these existing roadways such as lane additions and intersection upgrades could improve operating conditions such as vehicle carrying capacity, speed and safety (frequently qualitatively assessed as Level of Service [LOS]) adjacent to the development, there are no planned improvements except for seal coating a portion of FM84 in Denison in Fall 2011 Sherman Denison Metropolitan Planning Organization [SDMPO] FY 2011-2014 Transportation Improvement Plan [SDMPO, 2011], 2035 Metropolitan Transportation Plan (SDMPO, 2010). SDMPO has indicated that their transportation model is being rebuilt to assess Level of Service for the roadways within their planning area (Johnson, 2011); however, that information is not available at this time. The TXDOT Paris District office also indicated that no current LOS information was available for F.M. 84 and F.M. 406 in the area of the Preston Harbor Development (Mackey, 2011); however TXDOT is currently evaluating a request to generate that information (Norton, 2011). The Grayson County Regional Mobility Authority and TXDOT are proposing a tollway from F.M. 121 south of Gunter to US 75 in the City of Denison (identified in the SDMPO's 2035 Plan (SDMPO, 2010) as unfunded). Several alternatives considered for the proposed tollway would be routed through and around the town of Pottsboro. However, the preferred tollway alternative would be routed south of Pottsboro and intersect F.M. 84 northwest of Denison and continuing northeast beyond the city limits of Denison to intersect at US 75 (northern terminus). The preferred tollway alternative would extend the proposed tollway 33 miles and provide traffic relief to US 75. In addition, the proposed tollway would increase regional mobility and connect the Sherman-Denison metropolitan planning area with the Dallas-Fort Worth metropolitan area (DFW Metroplex) (TXDOT, 2011). It is anticipated that, should the Grayson County Tollway be developed, an increase in local and regional traffic levels would result from development related to increased commuter access to the DFW Metroplex. This possible increase in regional traffic could result in a long-term adverse impact on the LOS for both directly affected roads (e.g., F.M. 84) and indirectly affect roads (e.g., F.M. 406) should those roadways not be improved prior to or in conjunction with this reasonably foreseeable project.

Alternative 1 – No Action

The Rock Creek Resort development would result in increased short-term traffic due to construction, as well as a long-term increase in traffic associated with new residences and commercial areas. The Preston Harbor Development would result in both short- and long-term increases in traffic as well; however, these increases in traffic and congestion would be relatively localized to the project area and would not be expected to add to the traffic congestion in other development areas. Finally, it is anticipated that, should the Grayson County Tollway be developed, the LOS on FM 84 and FM 406 could be significantly reduced.

According to Michael Johnson, Double Diamond Utilities Director, the Rock Creek Resort would not utilize water from the City of Denison, but would rather utilize water supplied by individual wells drilled on the Rock Creek property (Johnson, 2011). Therefore, impacts to water demand, capacity, and infrastructure resulting from the Rock Creek Resort would not contribute to cumulative impacts from Preston Harbor Development.

Under Alternative 1, Preston Harbor Development residents would utilize septic systems to manage sanitary waste. For the Rock Creek Resort, an activated sludge plant has already been constructed to treat sewage generated from the resort. The plant is expected to be able to accommodate all of the future Rock Creek Resort residents, considering some planned future upgrades to the plant (Johnson, 2011). Therefore, no cumulative effects to water collection and treatment are anticipated for Alternative 1.

The Preston Harbor Development and the Rock Creek Resort would result in an increased demand for natural gas and electricity under Alternative 1 for the Lake Texoma area. It is unknown what provider would supply natural gas to the Rock Creek Resort; however, according to an Atmos Energy Market Development Specialist, if the Rock Creek Resort did acquire natural gas from Atmos Energy, it would be provided from a different system than that provided for Preston Harbor Development. Additionally, that source would have sufficient capacity to supply natural gas to the Rock Creek Resort residents and businesses (Atmos Energy, 2011b). Furthermore, because electricity service is deregulated in Grayson County, it is assumed that companies providing electrical service to Grayson County would be able to accommodate this increase in demand. Therefore, other than a cumulative increase in natural gas and electricity demand, there would be no cumulative impact to natural gas or electricity infrastructure or systems.

Assuming that construction and municipal solid waste generated from the Rock Creek Resort, as well as waste from the Preston Harbor Development, would be disposed at the TASWA landfill, there would be a long-term increase in the annual solid waste loading of the landfill. Since the TASWA landfill serves multiple cities and counties, and the opportunity exists to double the total capacity of the landfill with a permit, the overall increase in solid waste generation from these two projects could be supported by the existing solid waste landfill. The increase in population associated with the Preston Harbor Development under Alternative 1, along with expected growth and development of the surrounding area (including that from the Rock Creek Resort), would result in increased potential for traffic and construction accidents.

Alternatives 2 through 4 – Conveyance Land with Varying Shoreline Development

Since traffic impacts would be relatively localized to the project area, impacts under Alternative 2-4 would not be expected to add to the traffic congestion in other development areas. It is anticipated that only a slight impact to traffic would occur should the Grayson County Tollway be developed.

Under these alternatives, water, natural gas, and electricity demand, as well as solid waste generated from the Preston Harbor Development, would be slightly higher than that described for Alternative 1, and therefore would contribute only slightly more to the cumulative effects described for Alternative 1.

Alternatives 2, 3, and 4, in conjunction with the Rock Creek Resort, would result in an overall increase in the amount of wastewater generated of the Texas side of Lake Texoma. The WWTP planned by the City of Denison is only designed to support the new Preston Harbor Development, and wastewater generated from the Rock Creek Resort would be managed by the activated sludge plant constructed on the Rock Creek Resort property. Therefore, the cumulative effect under Alternatives 2, 3, and 4 would be an overall increase in wastewater. However, there would be no cumulative impact to wastewater treatment systems, as each development would treat wastewater independently.

The cumulative increase in traffic and construction accidents identified under Alternative 1 would be anticipated to be slightly higher under Alternatives 2, 3, and 4 due to the additional increase in population and construction activities.

5.10 PUBLIC LANDS

The USACE owns 108,753 acres of land surrounding Lake Texoma that are available for public use and managed by several State and Federal agencies including the USACE, USFWS, State of Oklahoma, and the State of Texas (USACE, 2008c). As discussed in Sections 3 and 4, public access lands are areas people can visit where permits, such as special memberships, are not required in order to enjoy outdoor pursuits. Of the 108,753 acres of Federally owned public land, approximately 3,537 acres are no longer accessible to the public due to quasi-public leases and private leases that limit the land use to special interest groups and private clubs, discussed in Section 3.10.

From 1972 through 1995, the General Services Administration (GSA) disposed of 83 parcels of Federally owned USACE land totaling approximately 2,750 acres (900 acres in Texas and 1,850 acres in Oklahoma) (GSA, 2011). These parcels were each purchased primarily by private individuals and a few public entities including the State of Oklahoma and the Colbert Public School District. Additionally, WRDA 1999 authorized the disposal and sale of approximately 1,580 acres of Federally owned USACE land that had been leased to the OTRD for the Lake Texoma State Park. In 2005, the USACE, Tulsa District, conveyed 558 acres of land to the State of Oklahoma. These lands were subsequently sold to Pointe Vista Development, LLC in conjunction with an additional 192 acres of State-owned property.

Unlike past Federal land conveyance in accordance with provision of the 1999 WRDA discussed above, the land conveyance for the Denison conveyance is a result of separate legislation contained in WRDA 2007. Alternatives 2, 3, and 4 would have a long-term effect on Federal public land due to the conversion of 635 acres of Federal public land to private land and municipal land. While 100 acres of the city park would be municipal public land, it would also cease to be Federally owned public land. The following analyses focus on the impact of the conveyance land on Federally owned public land. This conveyance from Federal ownership represents an overall 0.6% decrease of Federal public lands and accessible Federal public lands along the entire lake. Specific localized effects of the loss of Federal public lands are included in Section 4.10.

As discussed in Section 5.1, two potential developments have also been identified on Lake Texoma, Rock Creek Resort and Pointe Vista Development. As part of Pointe Vista Development, an additional 950 acres of USACE Federal public lands could be conveyed as originally authorized under WRDA 1999. The USACE, Tulsa District is currently performing NEPA analysis for this 950-acre potential conveyance separate from this EIS for the Preston Harbor Development. No conveyance or impact to Federal public land is associated with the Rock Creek Resort.

Therefore, with the current action and foreseeable actions 1,585 acres in total could be transferred from Federal-public ownership under the Preston Harbor Development and Pointe Vista Development conveyances, resulting in the overall future net loss of 1.4% of accessible Federal public lands on Lake Texoma. After the potential conveyances associated with Pointe Vista Development and Preston Harbor Development, approximately 19.5 miles of shoreline adjacent to former Federal public lands would be located adjacent to private land, resulting in an overall decrease of 3.3% of shoreline adjacent to the Federal public land. These public lands and public shorelines would be permanently converted to privately owned, developed property used for a variety of residential, commercial, and recreation purposes resulting in long-term, direct, and adverse impacts to public lands. The cumulative effect of conveyance on Federal public lands, including those already conveyed and sold and those that are reasonably foreseeable under WRDA 1999 and WRDA 2007, is a minor reduction of 4.4% in Federal public lands ownership at Lake Texoma.

5.11 RECREATION

The following section addresses cumulative impacts to Lake Texoma recreation and resources, specifically land-based recreation, land-water-interface-based recreation, water-based recreation, lake carrying capacity, and pocket beaches. Cumulative effects are those from past actions, the present proposed land conveyance action, the proposed Preston Harbor Development on Little Mineral Arm, and the reasonably foreseeable future actions of others on Lake Texoma as discussed in Section 5.1 (Pointe Vista Development with the associated Chickasaw Nation lands and Rock Creek Resort).

Past development along Lake Texoma, as described in Section 5.1, has increased recreation opportunities and activities along the lake. However, development has been limited since 2005 due to the moratorium on private boat docks and lease expansions. In addition to the 2005 moratorium, the SMP zones regulate development on the shoreline, and the Lake Texoma Master Plan controls Federal land use. Since lake construction, the proposed conveyance area has remained undeveloped and available for use by the public for hunting, fishing, swimming, hiking, camping, wildlife observation, and other land-water recreation activities. The adjacent private land has remained mostly undeveloped. In contrast, portions of other areas around the lake have developed as a result of leases or other activities.

The above description shows the general trend of all recreation aspects as a result of past development. The following subsections include an analysis of cumulative impacts to recreation from present and reasonably foreseeable future development along the lake for land-based recreation, land-water-interface-based recreation, water-based recreation, lake carrying capacity, and pocket beaches.

5.11.1 Land-Based Recreation

Under Alternative 1, the approximate 635 acres of proposed conveyance land would remain available to the public for hunting, fishing, and pocket beach use and the existing recreational uses. While no additional recreation opportunities would be created on the proposed conveyance land, the residential development on adjacent private lands could result in a minor increase in the lake-wide recreational use of the proposed conveyance land due to readily available access to nearby residents and guests. However, public hunting on the proposed conveyance land would be affected by habitat fragmentation and the proximity to human development.

In addition to recreation development on the adjacent private land, there could also be similar minor increases in recreation opportunities lake-wide from new developments (described in Section 5.1), including boating, fishing, parks, swimming, golf, wildlife observation, photography, hiking, camping, and picnicking. The public beaches and sandy pocket beaches throughout the lake could be used for recreation, including swimming and shoreline fishing.

Under Alternatives 2, 3, and 4, approximately 635 acres of Federal hunting and public recreation land would be lost to municipal and private ownership. In addition to the impacts discussed in Alternative 1, development on the conveyance land would include a public park with a boat ramp that may lead to increased visitors and residents, which may lead to increased lake recreation and increases of boat traffic near Preston Harbor. The increase in recreation within the vicinity may result in increased use of surrounding parks (USACE-operated and Eisenhower State Park). The use of public parks would be expected to increase due to the construction of a public park (maintained by the City of Denison) on the conveyance land. The construction of public docks and boat ramps on the conveyance land would likely increase the number of visitors using the lake and surrounding properties for recreational purposes including boating, swimming, and fishing. In addition to recreation created by the Preston Harbor Development, lake-wide developments could also increase recreation opportunities lake-wide from the new developments.

With the proposed development on Lake Texoma, additional growth would be expected in neighboring vicinities (i.e., housing developments, marinas, recreational areas, grocery stores, retail stores, commercial businesses, industrial business, medical care, daycare, senior care, and increased infrastructure).

5.11.2 Land-Water-Interface-Based Recreation

Cumulative impacts to fishing are not anticipated, as it is unlikely that fishing areas would be added or removed as a result of future actions. Cumulative impacts to public swimming and boat handling facilities including associated parking lot structures are anticipated and described in the following paragraphs.

Beach enhancements are likely proposed for the future developments. This could potentially increase the existing swimming beach area for additional residents and visitors of proposed developments. It is anticipated that the minor lake-wide increase in users derived from the new developments would not exceed capacity of the remaining public swimming beaches, even if the new users decide to use one of the existing public swimming beaches rather than potential new or enhanced beach areas.

Boat handling facilities and associated parking lot structures are also reasonably foreseeable future developments. The additional boat handling facilities and parking lot structures would likely alleviate overcapacity conditions at existing facilities. The increase in boat slips and boat docks would increase the number of boats expected on the lake at any one time and impact the boat carrying capacity of the lake. Impacts to lake carrying capacity are described in the subsection below.

5.11.3 Water-Based Recreation

As discussed in Section 3.11, water-based recreation activities were assessed in terms of designated lake areas (DLAs). While the vast majority of DLAs have no limitations for water based recreation, several DLAs associated with existing development may have greater impacts. As described above in Section 5.1, past development has resulted in increased water-based recreation on Lake Texoma. Based upon past trends, present usage, and reasonably foreseeable future development, impacts to water-based recreation are likely to be directly proportional to the number of boats utilizing the lake at any given time, specifically:

1. Based upon the BAOT analysis in Section 4.11, an additional 307 boats are expected at Lake Texoma as a result of the additional boat slips associated with the Preston Harbor Development proposed under Alternative 4.

2. The majority of the impacts to water-based recreation activities as a result of the Preston Harbor Development affect DLA 7; lake-wide impacts are expected to be negligible.

3. The Rock Creek Resort development is located within DLA 2, which was identified as a high activity area through aerial photography in the 2009 field observations. As discussed in Section 5.1, over 700 boat slips associated with the Rock Creek Resort are expected to be constructed along the shoreline. Based on the BAOT method used to determine the number of additional boats associated with the Preston Harbor Development, a minimum of 175 boats would be expected on Lake Texoma as a result of

the Rock Creek Resort development, although the exact number cannot be known until construction is complete.

4. The Pointe Vista Development is located within DLA 11, which was also identified as a high activity area through aerial photography in the 2009 field observations. Additionally, DLA 11 was identified as a USACE-reported high use area. However, the exact number of boats expected to be added to Lake Texoma as a result of the Pointe Vista Developments cannot be known until further design and development has occurred.

5. The additional number of boats would likely have a moderate impact on each associated DLA (2, 7, and 11); however, the addition of approximately 482 boats on the entire 81,965-acre lake would result in a decrease of at least 0.96 acres per boat lake-wide.

Therefore, the increase in average lake-wide boat density as a result of reasonably foreseeable future developments would be negligible. It is anticipated that boat use patterns would likely continue to peak during the afternoons on major holidays, as indicated in Section 4.11.4 of this EIS. An additional increase in lake-wide boat density may also result from the addition of boats associated with the Pointe Vista Development; however, an analysis of impacts to boat density as a result of this development is not possible at this time.

It can be assumed that the DLAs adjacent to each of the proposed land conveyances would also experience decreased level of service due to the reduction in available acres per boat in their respective DLAs. Power/pleasure boating, waterskiing, and jet skiing/PWC use would likely exceed the standard area needed to operate safely during peak use periods. Kayaking/canoeing, sailing, and fishing may experience slight increases, but they are all expected to remain viable activities within the DLAs and lake-wide.

5.11.4 Lake Carrying Capacity

As noted, uncertainty in the number of proposed boat slips, boat handling facilities, and associated parking structures for the Rock Creek or Pointe Vista developments is problematic when projecting the cumulative impacts to Lake Texoma's boat carrying capacity. However, an increase of at least 482 boats would be expected lake-wide as a result of the proposed and reasonably foreseeable future developments. Cumulative impacts to spatial capacity, facility capacity, and social capacity are provided below.

Spatial Capacity

Additional boats utilizing the lake above existing conditions would impact the carrying capacity of the lake to safely accommodate existing uses. The 2009 field observations indicated that DLA 2 exceeded capacity over the Labor Day weekend, and DLA 11 did not exceed capacity over any weekend. Based on the potential increase in the number of boats in DLAs 2 and 11, it is anticipated that carrying capacity standards would likely be exceeded on at least the busiest of holiday weekend peak use periods (September 6th), and possibly on non-holiday summer peak use periods within DLA 2. Additionally, carrying capacity standards would likely be exceeded on at least the busiest of holiday weekend peak use period (July 4th) in DLA 11. Although carrying capacity standards may be exceeded in these specific DLAs, the impact to the lake-wide carrying capacity is considered to be negligible from the addition of boats associated with the developments.

Facility Capacity

Facility capacity of the entire lake is projected to increase, allowing additional boats to enter and exit active use on the water. While increasing the level of service to boaters entering and exiting the lake is positive from a facility capacity point of view, it applies additional pressure on the spatial carrying capacity of the lake, particularly within DLAs 2, 7, and 11.

Social Capacity

Boating activity conflicts are likely to emerge as a result of the proposed conveyances and developments within Lake Texoma. Increased boat density would decrease the amount of acres available per boat to participate in their selected activity. It is anticipated that the cumulative impacts of the two major conveyances and associated developments within the shoreline of Lake Texoma would present conditions that exceed the minimum boat density standards for waterskiing, pleasure/power boating, and jet skiing/PWC use in some portions of the lake; however, lake-wide impacts to social capacity are expected to be negligible.

5.11.5 Pocket Beaches

Cumulative impacts to pocket beaches are likely to occur at Lake Texoma and are expected to be minor and adverse. There are approximately 195 pocket beaches located along the shoreline of

Lake Texoma. Based on the 2009 field observations and baseline data, 15 pocket beaches are located in DLA 7 (the proposed land conveyance and associated Preston Harbor Development). Based on aerial photograph imagery, one pocket beach is located in DLA 11 (Pointe Vista Development area), and 6 are located in DLA 2 (Rock Creek Resort). Due to the proximity of the developments to existing pocket beaches, it is possible the use of these areas may be impacted as a result of development; however, at the time of this report, changes to accessibility of the pocket beaches by the public is unknown. The potential lake-wide impacts to pocket beaches are considered to be minor since the known developments are in the vicinity of only approximately 11% of the pocket beaches located along Lake Texoma. As a result, users would redeploy to one of the remaining pocket beaches along the shoreline of Lake Texoma. This increase in users on remaining beaches would reduce the available area for boats to moor along pocket beach shorelines.

5.12 CULTURAL RESOURCES

As discussed in Sections 3 and 4, there is an established survey history for cultural resources associated with Lake Texoma. While the Texas Historical Commission and Oklahoma State Historic Preservation Office maintain records for hundreds of sites and resources on Lake Texoma, many additional cultural resources are anticipated to be unreported. The construction of Denison Dam significantly altered the historic banks of the Red River and Lake Texoma, making likely cultural resource sites inaccessible underneath the lake. However, cultural resources are routinely surveyed for any proposed action on the lake that is subject to Section 106 of the National Historic Preservation Act, such as Pointe Vista Development and other developments on the lake. As there is no loss of cultural resources associated with any of the alternatives, there are no additional cumulative impacts to cultural resources anticipated due to the Proposed Action.

5.13 VISUAL RESOURCES

The cumulative effects to visual and aesthetic resources resulting from the implementation of the Preston Harbor Development in addition to projected changes to Lake Texoma within the next 25 years are considered in this section. Table 5.13.1, Shoreline Allocation, compares the sizes of the known developments along Lake Texoma within the next 25 years and the associated amount of shoreline designated as aesthetic under the Shoreline Management Plan. As shown in Table 5.13.1, Preston Harbor Development is the largest known development (3,125 acres). Pointe Vista Development (1,850 acres) is the second largest known development. Additionally, there are several closely related developments including Rock Creek Resort (1,300 acres). Combined, the known developments make up less than 5% of the Lake Texoma shoreline.

Table 5.13.1

Shoreline Allocation Lake Texoma

	Lake Texoma		Future Developments			
			PHD[2]	Pointe Vista Development	Rock Creek Resort	Percentage of Lake Shoreline Allocation
Allocation	**Miles**	**%**	**Miles**	**Miles**	**Miles**	**%**
Limited Development	21.0	3.5	1.90	0	0	9%
Public Recreation	174.5	30.0	0.57	10	0.25	6.2%
Protected Shoreline[1]	382.0	65.0	6.97	0	0.75	2.02%
Prohibited Access	7.5	1.5	0	0	0	0%
Total	**585.0**	**100**	**9.44**	**18**	**1.00**	**4.9%**

Source: USACE, 1996
[1] Includes aesthetic area
[2] Existing zoning before proposed changes; PHD = Preston Harbor Development

The above table shows the shoreline allocation for each future development and the cumulative total of the allocated shoreline in miles for all reasonably foreseeable future shoreline development. The proposed Preston Harbor Development shoreline is primarily protected shoreline which includes designated aesthetic areas. Although the impact of the development on aesthetic/protected shoreline is significant for the Preston Harbor Development development, when compared to the total miles of aesthetic/protected shoreline available on Lake Texoma it only encompasses 2% of the aesthetic/protected shoreline. When combined with the shoreline that would be impacted under all known future development, 0.75 miles of additional protected shoreline would be impacted.

The Preston Harbor Development is located along the cove created by Little Mineral Arm along the south shore of Lake Texoma. Visually, there are four similar cove areas within Lake Texoma. One cove, located to the northwest of Little Mineral Arm on the Oklahoma side, and another, located north east of the Little Mineral Arm on the Oklahoma side, are not developed and are allocated as protected shoreline. The vegetative community and shoreline elevation in areas of these coves are similar to those of the Little Mineral Arm. The two remaining coves, Big Mineral Arm to the west of Little Mineral Arm on the Texas side of the Lake, and the cove where the proposed Pointe Vista Development is located on the north side of the lake, are allocated for public recreation areas. There is shoreline development within both of these coves, including boat docks, marinas, and shoreline structures. The areas that are not developed have similar visual characteristics as those of Little Mineral Arm. Although the loss of views due to the proposed Preston Harbor Development relative to the total miles of protected shoreline is minor, foreseeable future development would increase the loss of similar highly aesthetic views.

The proposed Preston Harbor Development is located along a protected area of the lake within a large cove. Because of the shape of the shoreline, most of the proposed development would be visually concealed from all of the lake, with the slight exception of the northern-most point of the proposed development (visibility sector 1) that would be visible just outside the cove. The views that would be available from the main body of Lake Texoma would be limited to partial views of the proposed hotel and convention center. Therefore, the visual impacts described in Section 4 are generally limited to Little Mineral Arm and are not extended into the larger portion of the lake.

Alternative 1 and 2 – No Action and Conveyance Land without Shoreline Development

Long-term cumulative adverse impacts under Alternatives 1 and 2 would be negligible. Development would not take place along the shoreline and, as described in Section 4, the impacts to the immediate viewshed would be minor. The implementation of Alternative 1 is not expected to change the overall trend of the shoreline views on Lake Texoma.

Alternatives 3 and 4 – Conveyance Land with Varying Shoreline Development

The long-term cumulative adverse impacts on aesthetic resources under these alternatives would be moderate on a lake-wide basis. Under reasonable foreseeable future conditions, three of the four similar cove areas would have increased development and significant changes in aesthetic views. Secluded, undeveloped lake areas would become rare and would require longer lake travel times for most observers.

Past development has led to approximately 2,235 acres of impervious cover on the USACE property. Vegetation clearing, thinning, maintained landscapes, boat docks, lake access, and shoreline protection features are associated with the impervious cover. Historically, approximately 67 miles of the lake shoreline is associated with development (previous to 1976). Since 1976, approximately 7 miles of additional shoreline has been developed, totaling approximately 12% of the lake's shoreline. Although all past changes on the USACE property are not visible from the lake shoreline, available views have changed due to development surrounding the lake. Implementation of Alternatives 2, 3, and 4, combined with anticipated changes in other lake areas where development is reasonably anticipated, would result in changes to views, from undeveloped to developed, along an additional 29 miles, or 5% of the shoreline, over the next 25 years. Based on the historic development of 7 miles over 34 years, the current and foreseeable change in the aesthetic resources over 25 years is estimated to occur at approximately five times the approximate rate of historical changes.

5.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

Since Preston Harbor Development lands are previously undeveloped, it is not expected that any hazardous, toxic, or radioactive wastes would be encountered during construction activities. Therefore, Preston Harbor Development construction activities are not expected to contribute to cumulative effects with regard to hazardous, toxic, and radioactive waste. This section summarizes facilities and operations that may generate regulated hazardous, toxic, and radioactive waste within the Preston Harbor Development, Rock Creek Resort, and Pointe Vista. Cumulative effects to hazardous, toxic, and radioactive waste were assessed in terms of impacts to oil and gas, commercial waste, industrial waste, medical waste, and boat waste for the Lake Texoma surrounding area.

Alternative 1 – No Action

There are currently no known plans to develop additional oil and gas wells within the Preston Harbor Development or other known developments along Lake Texoma; therefore, no cumulative impacts are expected in regard to oil and gas production. Additional automobile and boat traffic associated with the Preston Harbor Development, Pointe Vista, and Rock Creek Resort would result in potential increases in petroleum releases to roadways and surface water.

Increased development as a result of the proposed and known projects along Lake Texoma would create the need for additional gas and service stations to support the increase in traffic. The introduction of new gas and service stations would result in increased amounts of disposed chemicals including antifreeze, chlorinated and/or non-chlorinated solvents, motor and used oil, chemical-soaked rags, and other potentially hazardous waste. These wastes would require disposal at an authorized facility.

Additionally, the increase in population to the Lake Texoma surrounding area is expected to slightly increase the number of dry cleaner facilities in the vicinity of future development, thereby increasing the amount of waste generated from these facilities including solvents and waste solvents.

The known and proposed future development along Lake Texoma is not expected to significantly increase the amount of industrial waste produced in the immediate vicinity of the lake. Therefore, the proposed future or expanding developments would not contribute to cumulative impacts to industrial wastes.

An increase in population to the Lake Texoma area including the Preston Harbor Development and other proposed developments is expected to increase the demand for medical facilities within close proximity to the lake. Under Alternative 1, various medical offices/services are proposed. Although it not known if additional proposed developments along Lake Texoma would include medical facilities, the increased residential capacity associated with these developments would likely result in future development of medical facilities. The addition of medical facilities to the Lake Texoma area would increase the amount of medical waste generated in the vicinity of the lake. Types of waste expected to increase from the addition of medical facilities include non-regulated and regulated medical waste, solid waste, universal waste, and hazardous waste.

The additional population, as well as construction of boating amenities at the Preston Harbor Development, together with additional population, boating amenities, and lake access proposed for the Rock Creek Resort and Pointe Vista Development would result in an increase in the amount of boating activities, and thereby waste generated, at Lake Texoma.

Alternatives 2 through 4 – Conveyance Land with Varying Shoreline Development

The cumulative impacts to hazardous, toxic, and radioactive waste for the Lake Texoma area under Alternatives 2, 3, and 4 would be similar to those described for Alternative 1, except that the amount of waste generated would be greater under Alternatives 2, 3, and 4 due to the increased population and amount of proposed development at Preston Harbor Development. However, when compared to the No Action Alternative, this increase in waste would be negligible.

5.15 AIR QUALITY

For all four alternatives, grading, dredging, and paving operations would result in short-term emissions. The emissions would be temporary, localized, and eliminated after the activity is completed. The increase in emissions would not be significant when compared to the annual emissions in the region. The 2002 regional emissions consist of Cooke and Grayson counties in Texas, and Bryan, Love, and Marshall in Oklahoma. The increased development on the proposed conveyance land would have minimal impact on long-term emissions in an area that experiences approximately 5.8 million visitors a year. The growth planned on private land in the region is far greater than what is planned for the proposed conveyance land.

Emissions from all four alternatives result from mobile sources (equipment and vehicles) and are short-term in nature. These emissions quickly dissipate from the activity source, thereby preventing contribution to cumulative impacts of future potential projects that may be conducted in the area.

The proposed and alternative actions would not be expected to have significant cumulative impacts when compared to the criteria pollutant emissions for the region. The limited amount of GHG emissions would not contribute significantly to global climate change, but any emission of GHGs represents an incremental increase in global GHG concentrations.

5.16 NOISE

All four alternatives would contribute a moderate increase in noise to currently undeveloped areas. These effects would be due to changes in motor vehicle and boat use and concentrated human activities within the proposed developments. Vehicle noise is the primary contributor to the noise environment within and surrounding the areas. Despite these activities, the region remains relatively rural and undeveloped; therefore, the amount of noise-sensitive receptors adjacent to the proposed development is unlikely to increase within the near future. No large-scale projects or proposals, including other developments in the area (e.g., Rock Creek Resort and Pointe Vista Development), have been identified that, when combined with any of the alternatives, would create areas of incompatible land use or violate any Federal, State, or local noise ordinance resulting in a no appreciable cumulative impact.

5.17 SUMMARY OF ALTERNATIVE CUMULATIVE IMPACTS

Cumulative effects were assessed regionally for each resource using reasonable assumptions of changes, growth, and development in and around Lake Texoma based in previous lake history, current known conditions, and known (reasonably foreseeable) future development. A summary of cumulative effects discussed in Section 5 is presented below in Table 5.17.1. In this EIS the No Action Alternative, or Alternative 1, is used as a baseline for comparison to the action alternatives, Alternative 2, 3 and 4. Where reasonable, subsets have been grouped together to show the overall cumulative impact under each major resource area. While Alternatives 2 through 4 have both beneficial and adverse or unquantifiable impacts, these alternatives serve the purpose of WRDA 2007 by conveying Federally-owned land as mandated by Congress. Alternative 4 best meets the need of this Federal Action by best addressing the economic development needs of the City of Denison and the Lake Texoma region within the constraints of the USACE permitting process and under the auspices of the NEPA environmental impact assessment process.

Table 5.17.1

Summary of Cumulative Impacts for All Alternatives

Resource		Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
Land Ownership and Management		Minor decrease of federal land ownership and management lake-wide.			
Land Use and Land Use Controls	**Lake Texoma Shoreline Management Plan**	No known effect.			Minor lake-wide effect. Minor increase in limited development and public recreation and minor decrease in protected shoreline zoning.
	Lake Texoma Master Plan	No known effect.	Minor decrease in recreation (low density use) and recreation (high density use) allocated lands lake-wide.		
Geology and Soils		No appreciable lake-wide effect to geology and minor adverse impacts to soils.	No appreciable lake-wide effect to geology and no net appreciable lake-wide effect to soils/erosion due to shoreline protection.		
Water and Flood Storage Capacity		No effect. Proposals potentially affecting flood storage subject to USACE review and approval.			
Water Quality		No appreciable effect lake-wide.			
Biological Resources	**Vegetation**	Minor decrease in regional vegetation resources.			
	Wildlife	Minor decrease in regionally available habitat for terrestrial wildlife.			
	Fisheries and Aquatic Resources	No appreciable lake-wide effect on fisheries or aquatic resources.			
Socioeconomics		Moderate population increase and continued suburban/urban growth leading to an overall increase in regional economic activity.			
Infrastructure and Utilities		No known effect to regional utilities and significant adverse impact to regional traffic.	No appreciable regional effect.		
Public Lands		Minor decrease of publically-available land lake-wide.			
Recreation	**Land-based Recreation**	Minor increase of land-based recreation opportunities lake-wide.			
	Land-Water Interface-based Recreation	No appreciable effect to fishing and minor increase in land-water interface based recreation opportunities lake-wide.			

Resource		Alternative 1: No Action	Alternative 2: Land Conveyance without Shoreline Development	Alternative 3: Land Conveyance with Limited Shoreline Development	Alternative 4: Land Conveyance with Modified Shoreline Development (Proposed Action)
	Water-based Recreation	No appreciable effect to boat density lake-wide.			
	Lake Carrying Capacity	No appreciable effect to spatial, facility, and social capacity lake-wide.			
	Pocket Beaches	Minor decrease in available pocket beaches lake-wide.			
Cultural Resources		No effect lake-wide.			
Visual Resources		Moderate lake-wide decrease in undeveloped scenery and increase in views of developed land.			
Hazardous, Toxic, and Radioactive Waste		Minor increase in regional medical and commercial wastes.	No appreciable increase in regional medical and commercial waste.		
Air Quality		No appreciable effect lake-wide.			
Noise		No appreciable effect lake-wide.			

6. APPLICABLE LAWS AND REGULATIONS

Following completion of this EIS, the USACE will issue a written Record of Decision (ROD) concerning the Proposed Action. While issued pursuant to NEPA, the ROD will also address and discuss several laws, regulations, and Executive Orders (EOs). Some of these authorities pertain directly to USACE management of water resource development projects. Others establish regulatory compliance standards for environmental resources or provide guidance for planning for management of environmental resources. Reliance on these authorities results in effective project management and sound environmental stewardship. Table 6.1 below references statutory authorities that could apply to federal and other development projects and actions. As shown in Table 6.1, many of these statutory authorities do not apply to the Proposed Action or its alternatives, and therefore these inapplicable requirements were not addressed in detail or otherwise referenced in this DEIS.

Table 6.1

Environmental Protection Statutes and Other Environmental Requirements

Policies	Description	Compliance of Alternatives
Rules and Regulations Governing Public Use of Water Resource Development Projects Administered by the Chief of Engineers, 36 CFR Part 327	Requires preparation of an SMP for each USACE project where private shoreline use is allowed. This plan must honor past commitments. It must be reviewed at least once every 5 years and revised as necessary. Shoreline uses that do not interfere with authorized project purposes pose public safety concerns, violate local norms, or result in significant environmental effects should be allowed unless the public participation process identifies problems in these areas. If sufficient demand exists, consideration should be given to revising the shoreline allocations (increasing/decreasing).	All activities in full compliance
The Rivers and Harbors Act of 1894, as amended and supplemented, Title 33 of the United States Code [U.S.C.] 1	Under Section 301, provides that storage may be included for present and future municipal or industrial water supply in USACE or Bureau of Reclamation projects.	Not applicable

Policies	Description	Compliance of Alternatives
The Rivers and Harbors Act of 1899, 33 U.S.C. 403, Section 10	Prohibits construction of bridges, causeways, dams, etc. on any navigable water of the United States until the consent of Congress is obtained and approved by the Chief of Engineers and by the Secretary of the Army	All plans in full compliance for current stage of planning/development. Additional future work likely required as development proceeds.
Flood Control Act of 1936	Requires Federal government to improve or participate in improvement of navigable waters or their tributaries, including their watersheds, for flood-control purposes if the benefits to whomever they might accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected.	All activities in full compliance
Flood Control Act of 1944, as amended, 16 U.S.C. 460d	Authorizes the USACE to construct, maintain, and operate public park and recreational facilities at its water resource developments.	All activities in full compliance
Archaeological and Historic Preservation Act (AHPA), 1974, as amended, 16 U.S.C. 469, et seq	Requires Federal agencies to identify and recover data from archeological sites threatened by their actions.	All activities in full compliance
Archeological Resources Protection Act (ARPA), 16 U.S.C. 470aa-470ll	Requires permits and provides for civil and criminal penalties for persons who disturb archeological resources on Federal and tribal land without a permit.	All activities in full compliance
Clean Air Act (CAA), as amended, 42 U.S.C. 7609, et seq.	Requires agencies to comply with State air quality standards set in State Implementation Plans (SIPs).	All activities in full compliance

Policies	Description	Compliance of Alternatives
Clean Water Act, 1977, as amended (Federal Water Pollution Control Act, 33 U.S.C. 1251), et seq	Established requirements that limits be determined for point sources that are consistent with State water quality standards, procedures for State issuance of water quality standards, guidelines to identify and evaluate the extent of nonpoint source pollution be developed, water quality inventory requirements be implemented, and toxic and pretreatment effluent standards be developed. Further defined liability for discharges of oil and hazardous substances and the Federal role in cleanup operations. Section 404 of the amendments authorized USACE to issue permits for the discharge of dredged or fill material into navigable waters at specified disposal sites. Established the requirement that EPA study and monitor the water quality effects attributable to the impoundment of water by dams.	All activities in full compliance at this stage of planning and development. Permits under Section 404 for future development features are likely to be required. Permit applications will be reviewed as appropriate at the time of application.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675	Requires reporting and cleanup of releases of hazardous substances; also assigns liability for cleanup.	All activities in full compliance
Emergency Wetlands Resources Act of 1986, 16 U.S.C. 3901-3932	Promotes the conservation of wetlands to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions.	All activities in full compliance
Endangered Species Act, 1973, as amended, 16 U.S.C. 1531, et seq.	Requires consultation with the U.S. Fish and Wildlife Service to ensure that actions do not jeopardize threatened or endangered species or their critical habitat.	All activities in full compliance
Farmland Protection Policy Act, 7 U.S.C. 4201, et seq.	Establishes criteria for identifying and considering the effects of Federal actions on the conversion of farmland to nonagricultural uses.	All activities in full compliance

Policies	**Description**	**Compliance of Alternatives**
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1-12, et seq.	Requires Federal agencies to consider the potential outdoor recreational opportunities and potential fish and wildlife enhancement when planning navigation, flood control, reclamation, hydroelectric, or multipurpose water resource projects.	All activities in full compliance
Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701-1784	Provides for the management of public lands that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values that, where appropriate, will preserve and protect certain public lands in their natural condition.	All activities in full compliance
Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq.	Encourages all Federal departments and agencies to utilize their statutory and administrative authority, to the maximum extent practicable and consistent with each agency's statutory responsibilities, to conserve and promote conservation of nongame fish and wildlife and their habitats.	Not applicable to proposed action.[1] Will be applicable for future review of Section 404 of Clean Water Act permits as they are submitted.
Migratory Bird Treaty Act, 16 U.S.C. 701-719c	Decreed that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected.	All activities in full compliance
Land and Water Conservation Fund Act, 1965, as amended, 16 U.S.C. 4601, et seq.	Established a fund from which Congress can make appropriations for outdoor recreation. Entrance and user fees at reservoirs were made possible by Section 2 (a). Requires coordination with the National Park Service, if lands or associated park development purchased or developed by Land and Conservation Fund Act monies are impacted by a Proposed Action.	Not applicable.
National Historic Preservation Act, 1966, as amended, 16 U.S.C. 470a, et seq.	Requires agencies to identify historic properties subject to effect by their actions, and to consult with the State Historic Preservation Officer and others about alternatives and mitigation.	All actions in full compliance

Policies	**Description**	**Compliance of Alternatives**
National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4321, et seq.	Requires agencies to consider impacts on the human environment from Proposed Actions and document environmental impacts during project planning.	All actions in full compliance upon completion of NEPA process (pending with this document).
Noise Control Act of 1972, PL 92-574	Requires the Federal government to set and enforce uniform noise control standards for aircraft and airports, interstate motor carriers and railroads, workplace activities, medium and heavy-duty trucks, motorcycles, portable air compressors, and Federally assisted housing projects located in noise-exposed areas. The control of environmental or community noise is left to State and local agencies.	Not applicable
Resource Conservation and Recovery Act (RCRA) of 1976, 42 U.S.C. 6901-6992k	Regulates collection, storage, transport, and disposal of hazardous and solid waste and regulates underground storage tanks.	Not applicable
Water Resources Development Act of 1986 33 U.S.C. 2201-2330, November 17, 1986, as amended 1988, 1990, 1992, 1995, and 1996; PL 99-662	Provides for the conservation and development of water and related resources and the improvement and rehabilitation of the Nation's water resources infrastructure.	All actions in full compliance
Watershed Protection & Flood Prevention Act, 16 U.S.C. 1001	Provides for cooperation with State and local constituents for the purpose of preventing erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States; of furthering the conservation, development, utilization, and disposal of water, and the conservation and utilization of land; and thereby of preserving, protecting, and improving the Nation's land and water resources and the quality of the environment.	All actions in full compliance
Water Pollution Control Act Amendments of 1961, PL 87-88	Requires Federal agencies to consider, during the planning for any reservoir, storage to regulate stream flow for the purpose of water quality control.	Not applicable.

Policies	Description	Compliance of Alternatives
EO 11988: Floodplain Management (May 24, 1977)	Directs all Federal agencies to avoid, if possible, development and other activities in the 100-year base floodplain. Design and siting are to be based on scientific, engineering, and architectural studies; consideration of human life, natural processes, and cultural resources; and the planned life span of the project. Federal agencies are required to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibility.	All actions in full compliance
EO 11990: Protection of Wetlands (May 24, 1977)	Directs all Federal agencies to avoid, if possible, adverse effects on wetlands and to preserve and enhance the natural and beneficial values of wetlands. Each agency must avoid undertaking or assisting in wetland construction projects unless the head of the agency determines that there is no practicable alternative to such construction and that the Proposed Action includes measures to minimize harm.	All actions in full compliance for this stage of planning and implementation. Future actions regarding Section 404 (Clean Water Act) permitting will ensure compliance for future activities.
EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 11, 1994)	Requires each Federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.	All actions in full compliance

Policies	Description	Compliance of Alternatives
EO 13045: Protection of Children from Environmental Health Risks and Safety Risks (April 21, 1997)	Requires each Federal agency to make it a high priority to identify and assess environmental health risks and safety risks that might disproportionately affect children and ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.	All actions in full compliance
EO 13101: Greening of Government Through Waste Prevention, Recycling, and Federal Acquisition (September 14, 1998)	Directs the head of each Federal agency to incorporate waste prevention and recycling into the agency's daily operations and work to increase and expand markets for recovered materials. Under the order, each agency develops goals for improvements in areas such as recycling and solid waste diversion.	Not applicable
EO 13123: Greening the Government Through Efficient Energy Management (June 3, 1999)	Directs the Federal government, the nation's largest energy consumer, to significantly improve its energy management in order to save taxpayer dollars and reduce emissions that contribute to air pollution and global climate change. Goals of the EO include reducing greenhouse gas emissions, improving energy efficiency, expanding the use of renewable energy sources, reducing the use of petroleum products, and conserving water.	Not applicable.

Policies	Description	Compliance of Alternatives
EO 13148: Greening of Government Through Leadership in Environmental Management (April 21, 2000)	Delegates' responsibility to the head of each executive agency for ensuring that all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes. The order directs Federal agencies to incorporate pollution prevention, regulatory compliance, toxic chemical use and release reduction, and ozone-depleting substance reduction into their planning and operational processes.	All actions in full compliance
EO 13175: Consultation and Coordination with Indian Tribal Governments (November 6, 2000)	Requires agencies, in formulating or implementing policies that have tribal implications, to consult with tribal officials as to the need for Federal standards and any alternatives that would limit the scope of Federal standards or otherwise preserve the prerogatives and authority of Indian tribes.	All actions in full compliance

[1] The Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) (FWCA) requires consultation with the U.S. Fish and Wildlife Service (USFWS) and State fish and wildlife agencies "where the waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted, or otherwise controlled or modified." Given that the current action involves the conveyance of real property and does not involve the impoundment, diversion, control, or modification of a body of water, the requirements of the FWCA are not applicable to this conveyance action. Further, Section 662(g) of the FWCA states that the act is not applicable to projects for the control or use of water or units thereof authorized before the date of enactment of the FWCA if construction of the project has been substantially completed. Congress enacted the FWCA in 1958. Lake Texoma, a USACE project for the control of water, was authorized in 1938 and completed in 1944. Section 662(g) therefore exempts the current action at Lake Texoma from consultation requirements of the FWCA. For these reasons, the USACE was not required to and did not pursue coordination under the FWCA for this action.

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Years of Experience: 2

8. REFERENCES

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Mr. Matthew Looney 3930 W FM 120 Denison, TX 75020	

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10. GLOSSARY

Adjacent Private Land — Approximately 2,489 acres of land designated for the proposed Preston Harbor Development, owned by Schuler Development, and bound on the west by the proposed conveyance land.

Algal Blooms — An excessive growth of algae on or near the surface of water. May occur naturally or as a result of an excess of nutrients from organic pollution.

Aquatic Inland — All areas, natural or man-made, consisting of non-tidal standing water surrounded by herbaceous vegetation. This class will be limited to upland aquatic features such as ponds.

A-weighted Decibels — An expression of the relative loudness of sounds in air as perceived by the human ear.

Barren/Disturbed Land — Barren areas (rock/sand/clay) of bedrock, strip mines, gravel pits, and accumulations of earthen material.

Baseline Conditions — Current conditions for natural resource area within the study area.

Biological Oxygen Demand — Demonstrates how much dissolved oxygen is needed by organisms to break down the organic material in a water sample. This is dependent on temperature, time, and the composition of the water sample.

Boat Carrying Capacity — Boat densities compared to the range and average of the recommended spatial densities from the literature.

Boat Density — Observed Boat Counts ÷ Average Lake Surface Area.

Boat Dock Cluster — A single covered structure composed of a series of (19) slips. Each cluster dock would contain approximately 10,000 square feet and occupy approximately 0.2 surface acres of space.

Boat Slip — An individual opening where a single boat is moored. These slips can be either for day-use (can use the slip only during one day) or for extended-use (can use the slip for multiple days).

Bottomland Hardwoods	Areas frequently flooded, with deciduous forest within the Bunyan and Whitesboro soil type.
BUMP Program	Created in 1998, this program provides critical information that supports the state of Oklahoma's Water Quality Standards and helps the state to prioritize pollution control activities.
Conservation Pool	590 to 617 ft above NGVD represents the lake level range maintained by USACE for conservation purposes (also referred to as Power Pool).
Cumulative Effects	The Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) define cumulative effects as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or nonfederal) or person undertakes such other actions (40 CFR ~ 1508.7).
Curve Number	Method developed by the USDA that helps predict runoff from rainfall.
Day-night Sound Level	The A-weighted equivalent sound level for a 24-hour period with 10 dB added to levels between 10 p.m. and 7 a.m.
Decibel	A unit of measurement that expresses the magnitude of a physical quantity (usually intensity) relative to a specified or implied *reference level*. The decibel is useful for a wide variety of measurements in science (for this application, it is sound).
Developed (Impervious Cover)	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-100% of the total cover.
Dry Dock Storage Facility	The dry boat storage would consist of a large warehouse building for dry storage of approximately 180 boats, a boat ramp leading to the storage area, and parking lots surrounding the cove for approximately 120 vehicles.
Environmental Consequences	The direct, indirect, and cumulative environmental impacts of an action.

Equivalent Sound Level — The level of a steady-state noise without impulses or tone components, which is equivalent to the actual noise emitted over a period of time.

Eutrophication — A characteristic trait assigned to bodies of water that contain excessive nutrients. Eutrophication can either be natural or artificial.

Facility Capacity — Concerned with facility handling thresholds such as the number boat slips or moorings, or the number of boat ramp parking spaces.

Flood Control Pool — For Lake Texoma, the pool from elevation 617 to 640 ft NGVD used to temporarily store flood waters.

Grasslands/Herbaceous — Areas dominated by grasses or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing. This includes both native black land prairie grasslands and non-native grassland species.

Hertz — A unit of frequency equal to one cycle per second.

Integrated Pest Management Plan — A plan that relies on common-sense practices and knowledge of available pest control methods to determine the most effective way to treat, manage, and control pests while limiting injury to people and the surrounding environment.

Lake Texoma Shoreline Management Plan (SMP) — The approved 1996 Lake Texoma SMP.

Land Cover — What is physically on the surface of the earth.

Land Use — Refers to human use, adopted plans, and goals of the land for economic production (residential, commercial, industrial, recreational, or other purposes) and for natural resource protection.

Land-Based Recreation — Recreational activities occurring on land may include picnicking, hiking, hunting, nature observation, horseback riding, swimming on the beach, fishing off the shoreline, and camping.

Level of Service (LOS) — A qualitative measure of the operating conditions of an intersection or other transportation facility. There are six LOS (A through F) defined; LOS A

	represents the best operating conditions with no congestion, and LOS F represents the worst with heavy congestion.
Limited Development Areas	Land allocated for private activities, such as construction and operation of private docks or floating facilities.
Littoral Zone	An interface zone between the land or shore and the open water of lakes. On or near a shore.
Macro-invertebrates	A collective group of small animals that do not possess a backbone or spinal column.
Macrophytes	Plants large enough to be visible with the unaided eye, especially a water plant.
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
National Geodetic Vertical Datum	National standard reference for elevation measurements.
Natural Resources Inventory	List from the literature of natural resources within the region of influence.
No-Discharge Zone	An area of a waterbody, in which discharging of both treated and untreated sewage is prohibited.
Open Water	Areas of open water, generally with less than 25% cover or vegetation or soil. This class will be limited to Lake Texoma and its tributaries and will exclude upland water bodies, such as ponds or upland aquatic areas.
Pesticide	A composite term that includes all chemicals that are used to kill or control pests. In agriculture, this includes herbicides (weeds), insecticides (insects), fungicides (fungi), nematocides (nematodes), and rodenticides (vertebrate poisons).
Pocket Beaches	Unmanaged beach areas located in relatively undeveloped areas with no formal recreation access to the lake.

Preston Harbor Development	The master-planned community that Schuler Development plans to construct on the adjacent private land and potentially the proposed conveyance land, depending on the alternative chosen, based on this EIS.
Primary Productivity	Productivity of an ecosystem is a quality whereby living substance is manufactured through interactions of community and environment. The rate at which energy-containing material is formed by plants represents the rate of primary production.
Prohibited Access Areas	Areas with limited or restricted access due to security reasons, protection of ecosystems, and physical safety of the recreation visitors.
Project	A lake, as defined by USACE.
Proposed Conveyance	The conveyance of approximately 635 acres of Federal land located on the eastern shore of the Little Mineral Arm of Lake Texoma to the City of Denison, TX in accordance with provisions of WRDA (2007).
Protected Shoreline Areas	Areas around the lake designated primarily to protect or restore aesthetic, fish and wildlife, cultural, or other environmental values.
Public Recreation Areas	Areas that are designated as public recreational sites to be used with or without a fee for outdoor low-impact recreational activities as designated for Federal, state, or similar public use and for commercial concessions. Public organization recreation areas are also zoned under this allocation. Approved activities include picnicking, hiking, nature observation, horseback riding, swimming on the beach, and fishing off the shoreline.
Quantification of Habitat Types	Map of Terrestrial and aquatic habitats within the study area.
Recreation – Intensive Use	USACE lands for public recreation intended for high intensity recreational opportunities including commercial marinas, public parks, public campgrounds and picnic areas, public boat launching ramps, restrooms, parking spaces, and swimming beaches.

Recreation – Low Density Use	USACE lands for public recreation intended for low impact recreational activities such as hunting, hiking, and fishing.
Riprap	Loose or broken stone used along the edge of the water to stabilize caving banks.
Schuler Development	A Texas real estate development company that plans to enter into a public-private partnership with the City to develop a master-planned community known as the Preston Harbor Development.
Seasonal Conservation Pool	590 to 619 ft above NGVD represents the lake level range maintained by USACE for conservation purposes during peak season (summer) months to satisfy recreational interests.
Secchi Depth	Measure of the clarity of water, especially seawater. Secchi depth is measured using a circular plate, known as a Secchi disk, which is lowered into the water until it is no longer visible. High Secchi depths indicate clear water, whereas low Secchi depths indicate cloudy or turbid water.
Social Capacity	Concerned with social conditions such as user conflicts, visitor perceptions versus expectations, or facility management goals.
Spatial Capacity	Concerned with the minimum space requirements for various activities such as the area required for waterskiing.
STEPL	The Spreadsheet Tool for Estimating Pollutant Loads was developed by Tetra Tech, Inc. for the EPA to calculate nitrogen, phosphorus, biological oxygen demand, and sediment loads. This tool uses both the Curve Number equation and the Universal Soil Loss equation.
Surcharge Pool	640-645 ft above NGVD represents the temporary flood control level during extreme storm events.
Total Maximum Daily Load	The maximum amount of a pollutant that a waterbody can receive before it exceeds water quality standards.

Unconsolidated Shore Unconsolidated material such as silt, sand, or gravel that is subject to inundation and redistribution due to the action of water.

Universal Soil Loss Equation Based on rainfall patterns, soil type, topography, etc., this equation can be used to predict the long-term average annual rate of soil erosion.

Viewshed The shoreline and nearby areas that are visible, in this instance, from various vantage points on the lake.

Water-Based Recreation Recreational activities occurring in water including fishing, boating, swimming, wind surfing, hunting, wildlife watching, photography, and beach walking.