REGION C WATER PLANNING GROUP

Senate Bill One Fifth Round of Regional Water Planning - Texas Water Development Board

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April 16, 2020

Jeff Walker
Executive Administrator
Texas Water Development Board
1700 North Congress
Austin, Texas 78711-3231

Dear Mr. Walker:

On February 10th, 2020 the Region C Regional Water Planning Group voted to approve and adopt the 2021 Region C Initially Prepared Plan with:

- Minor formatting or editorial changes
- Addition of ongoing Socio-Economic Study on Impacts of Marvin Nichols Reservoir (Attachment to Appendix J) with the understanding that this would be completed in early April.

Attached to this correspondence is both the updated Appendix J as well as a small update to a page in the Executive Summary. The Executive Summary previously had an earlier date listed for the Public Hearing, however due to the current circumstances, was moved to May 26th, 2020. Region C respectfully submits this supplemental information for TWDB review.

If you have any questions or comments, please call me at (817) 467-4343.

Sincerely,

Kevin Ward
Region C Chairman

cc: North East Texas Region D Water Planning Group
Tony Smith, P.E., Region D Consultant

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Executive Summary

This report presents the *2021 Initially Prepared Region C Water Plan* developed in the fifth round of the Senate Bill One regional water planning process. Region C covers all or part of 16 North Central Texas counties, as shown in **Figure ES.1**. The Region C water plan was developed under the direction of the 22-member Region C Water Planning Group. This initially prepared regional water plan was adopted by the Region C Water Planning Group on February 10, 2020 and made publicly available at that time. A public hearing will be held on May 26, 2020. Public comment will be accepted through July 27, 2020 and the state agency comment period extends through August 24, 2020. A final *2021 Region C Water Plan* will be produced based on this initially prepared plan, comments, and other updates, and that final plan is due to the Texas Water Development Board by October 14, 2020.

This Executive Summary focuses on current water needs and supplies in Region C, the projected need for water, the identification and selection of recommended water management strategies, the costs and impacts of the selected strategies, and county summaries for each county in the region. Other elements of the plan are covered in the main text and the appendices.

Chapter Outline

Section ES.1 – Current Water Use and Supplies in Region C

Section ES.2 – Projected Need for Water

Section ES.3 – Identification and Selection of Water Management Strategies

Attachment 1 – Water Management Strategies DB22 Report

Related Appendices

Appendix D – DB22 Reports (Volume II)

Required Chapters for Plan:

1. Description of Region C
2. Population and Water Demand Projections
3. Water Availability and Existing Water Supplies in Region C
4. Identification of Water Needs
5. Water Management Strategies
6. Impacts of the Region C Water Plan
7. Drought Response Information, Activities, and Recommendations
8. Unique Stream Segments and Reservoir Sites, and Policy Recommendations
9. Reporting of Financing for Water Management Strategies
10. Adoption of Plan and Public Participation
11. Implementation and Comparison to the Previous Region C Water Plan

Public Comments May be Submitted to:

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Appendix J

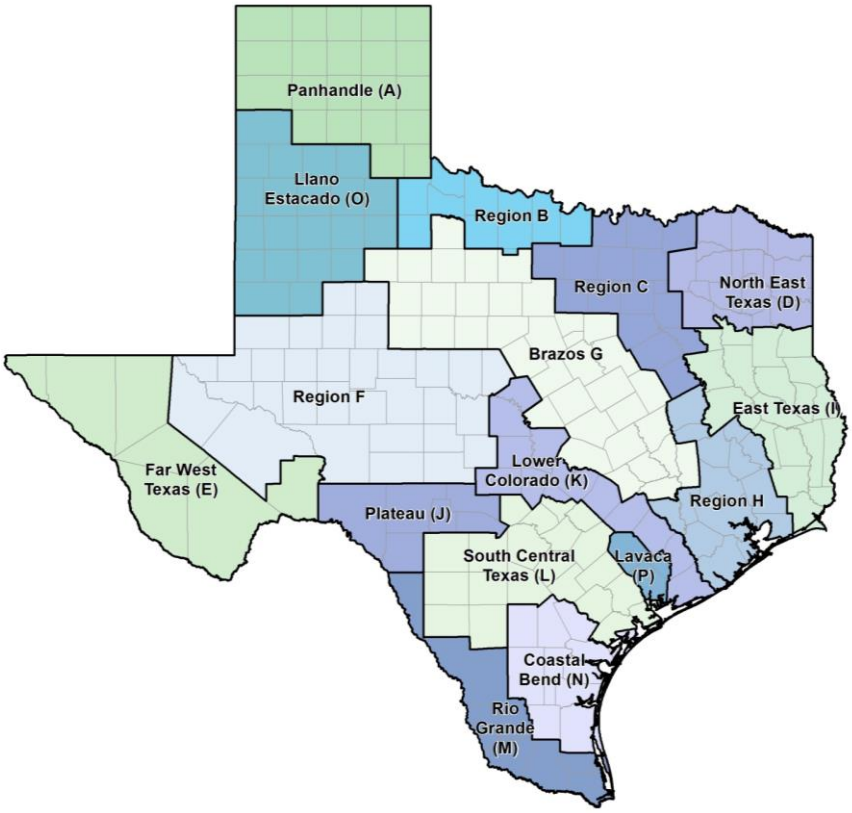
2020 Quantitative Analysis of the Impact of Marvin Nichols Reservoir

Appendix J 2020 Quantitative Analysis of the Impacts of Marvin Nichols Reservoir

Introduction

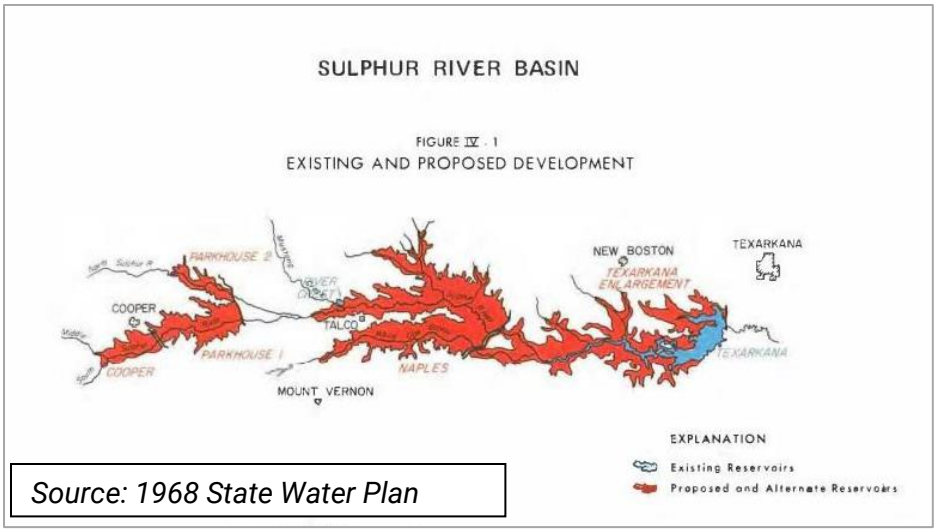
In 1997, the Texas Legislature passed Senate Bill One, which initiated a regional water planning process for Texas. The planning process was implemented by the Texas Water Development Board (TWDB), which set up rules governing planning and established 16 water planning regions across the state (See **Figure J.1**) Planning in each region is overseen by a regional water planning group, which develops a water supply plan addressing the future water needs of the region. The 16 regional plans are reviewed and approved by the Texas Water Development Board and assembled into a state water plan.

Figure J.1 Regional Water Planning Areas Established by Texas Water Development Board



The water planning process is conducted on a five-year cycle. Regional water plans were approved in 2001, 2006, 2011, and 2016, and the fifth round of planning is currently underway. State water plans based on the regional plans were developed in 2002, 2007, 2012, and 2017.

The Region C Regional Water Planning Area includes all or part of 16 counties and includes the Dallas-Fort Worth Metropolitan area. Region C has over a fourth of the state's population and is the most populous of the 16 planning regions. The population of Region C is increasing rapidly, and the *2016 Region C Water Plan* [1] included a number of water management strategies to supply additional water to meet growing needs. **Figure J.2** shows the location of Region C, the North East Texas Regional Water Planning Group (Region D), and the proposed Marvin Nichols Reservoir. One of the water management strategies included in the *2021 Region C Water Plan* is the proposed Marvin Nichols Reservoir (elevation 328 msl), which would be located in Red River, Titus, and Franklin Counties in the Sulphur River Basin. This strategy is recommended for implementation by 2050. A separate Sulphur Basin strategy includes the reallocation of flood storage at the existing Wright Patman Reservoir (raising the conservation storage to 235 msl), which would be implemented by 2070. These strategies, which are in North East Texas Regional Water Planning Area (also known as Region D), would be developed to meet needs in Region C. The total yield from both strategies is 573,700 acre-feet per year, of which 483,400 acre-feet per year would be used to meet needs in Region C and the remainder available for local use.



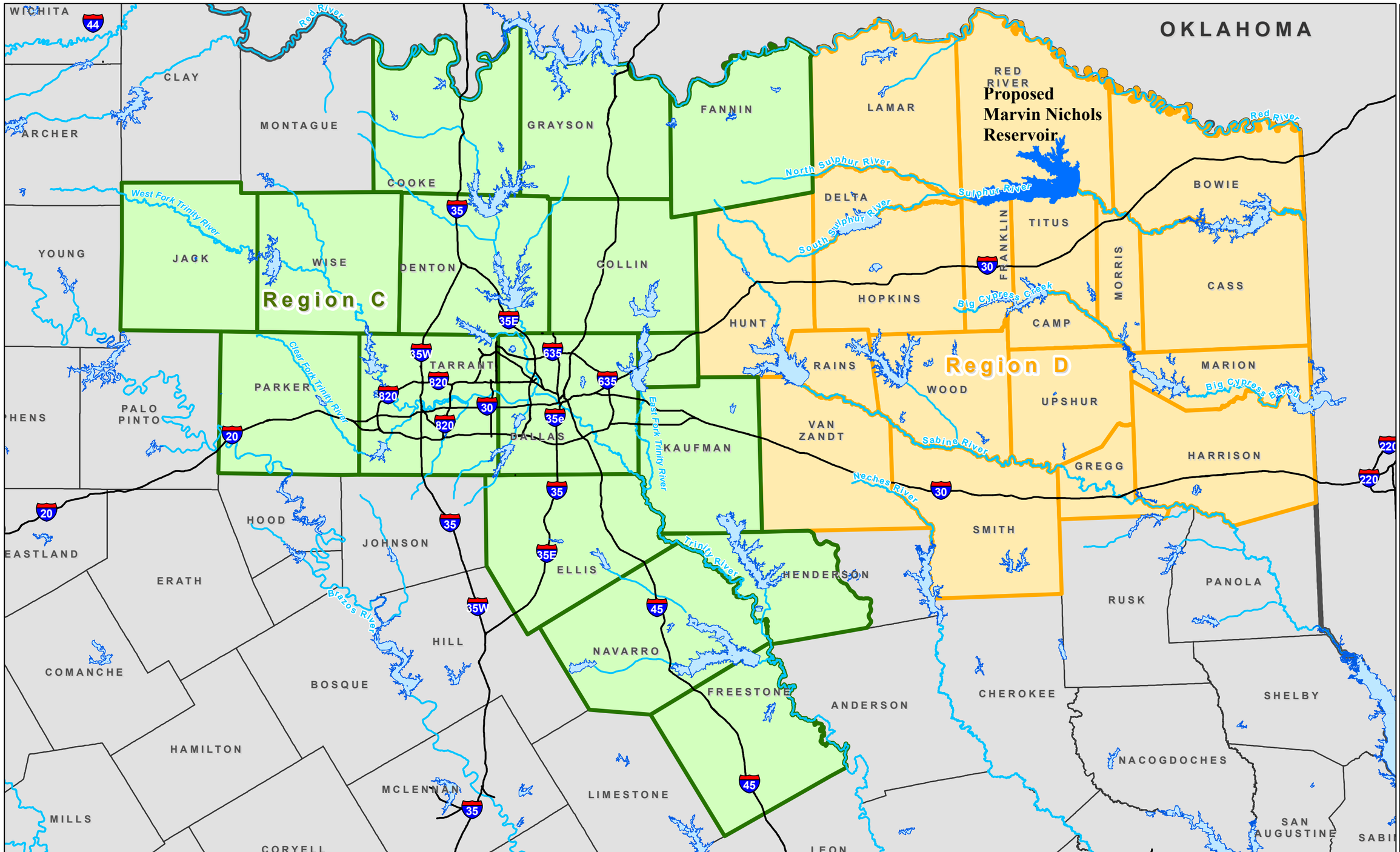
Source: 1968 State Water Plan

Technical memoranda for each of these strategies are included in **Appendix G** in the *2021 Region C Water Plan*. This supplement, included as **Appendix J** to the *2021 Region C Water Plan,* focuses on additional information on the proposed Marvin Nichols Reservoir, with emphasis on the quantification and analysis of the impact of Marvin Nichols Reservoir on agricultural and natural resources. Also included is information on the Socio-Economic Assessment of developing the Marvin Nichols Reservoir and the TWDB's socio-economic assessment of impacts to Region C if needs are not met (**Section J.5**).

In the last round of regional planning (2016 water plans), there was an interregional conflict between the Region C and Region D regional water plans regarding the inclusion of the proposed Marvin Nichols Reservoir, requiring TWDB to take action to resolve the interregional conflict.

On August 7, 2014, the TWDB Board met to consider the interregional conflict and requested additional information from Region C. The Board action is reflected in the Interim Order of August 8, 2014, which included the following language:

> "Region C is directed to conduct an analysis and quantification of the impacts of the Marvin Nichols Reservoir Water Management Strategy on the agricultural and natural resources of Region D and the State, pursuant to



Proposed Marvin Nichols Reservior

Existing Reservior

Rivers

Region C

Region D

0 12.5 25 50

Miles

N W E S

Figure 2

FN PROJECT NO. NTD11336

DATE CREATED 10/10/2014

DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas North Central

FILE NAME Figure2

PREPARED BY JLA

REGION C WATER PLANNING GROUP

MARVIN NICHOLS QUANTITATIVE ANALYSIS REPORT

LOCATION MAP FOR REGION C, REGION D, AND THE PROPOSED MARVIN NICHOLS RESERVIOR

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> Sections 16.051 and 16.053 of the Texas Water Code and Chapters 357 and 358 of Board rules. Region C should submit this analysis and quantification to the Board by November 3, 2014. Upon receipt of the analysis and quantification, the Executive Administrator and Region D will be given the opportunity to submit a written response to the submission, and the matter will be scheduled for Board consideration. If no submittal is received by the Board on or before November 3, 2014, this matter will set for a Board Meeting to direct the Regions to revise their regional water plans reflecting the removal of the Marvin Nichols Reservoir Water Management Strategy from the 2011 Region C Plan, without prejudice."

The full Interim Order of August 8, 2014 is included as **Attachment J-1** to this appendix. The original version of this report (August 2014) was submitted to TWDB and provided the information requested by the TWDB Board in the Interim Order of August 8, 2014. This January 2020 update to that report has been modified to include additional information developed since 2014 and is included in the *2021 Region C Water Plan* as **Appendix J**.

Section J.2 of this report provides the analysis and quantification of the impacts of Marvin Nichols Reservoir on natural resources. **Section J.3** provides the analysis and quantification of the impacts of the project on agricultural resources. **Section J.4** discusses potential mitigation requirements for the project and how they might affect impacts on natural and agricultural resources**. Section J.5** provides a socio-economic assessment. **Section J.6** provides additional information, and the Attachments include supporting material.

J.1 Background

The transfer of water from the Sulphur River Basin in east Texas to users in the greater Metroplex area has been included in every state plan, in some form, since the 1968 State Water Plan. The originally named Naples Reservoir was projected to meet Dallas-Fort Worth's 2020 water needs in the 1968 plan. This first mention of the now proposed Marvin Nichols Reservoir includes intention to use the reservoir to meet the water need in what is now Region C and has remained in the plan with that intent throughout the years. In the 1990 State Water Plan (when the plan was developed according to river basins) the Sulphur Basin's second largest demand was projected to be exporting water by 2040.

Throughout the continuous development of the Region C Regional Water Plan (2001-2016) the Marvin Nichols Reservoir has been extensively studied and the footprint has changed several times in an effort to reduce the environmental impacts associated with the proposed reservoir. During the first round of regional water planning, representatives of both Region C and Region D met to discuss the proposed development of water supplies in the Sulphur River Basin. It was preferred by the Region D representatives that Region C recommend one large project (Marvin Nichols Reservoir) rather than multiple smaller reservoirs. As a result, the Marvin Nichols Reservoir was included in each Region C Water Plan since the inception of regional water planning. Implementation of this project was recommended for 2030 in each regional water plan until the *2016 Region C Water Plan*. For that plan, the original implementation date of 2050 was modified to 2070 as part of the negotiated resolution of the declared conflict.

J.2 Analysis and Quantification of the Impacts on Natural Resources

J.2.1 Requirements of Texas Water Code and Texas Water Development Board Rules

The requirements for quantitative reporting on the impacts of water management strategies on natural resources are included in the Board rules in Texas Administrative Code §357. Specifically §357.34(e)(3)(B), requires that the quantitative reporting address impacts on certain specific aspects of natural resources:

- Environmental water needs
- Wildlife habitat
- Cultural resources
- Effect on bays, estuaries, and arms of the Gulf of Mexico

A quantitative reporting of impacts on each of these areas is provided below, as is additional information on impacts on threatened and endangered species.

J.2.2 Available Data for Impacts on Natural Resources

Data on impacts of the proposed Marvin Nichols Reservoir on environmental flow needs were updated during the hydrologic analyses of the reservoir conducted for this *2021 Region C Water Plan*. Data on impacts on other natural resources is taken from the *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment* [(2)]. The environmental evaluation is a report developed in 2013 for the U.S. Army Corps of Engineers as part of an on-going basin-wide assessment of the Sulphur River Basin. The report includes environmental analyses of Marvin Nichols Reservoir and other potential water supply projects in the Sulphur Basin.

J.2.3 Impacts on Environmental Water Needs

Texas Administrative Code §357.34(d)(3)(B) includes specific requirements for the evaluation of environmental water needs:

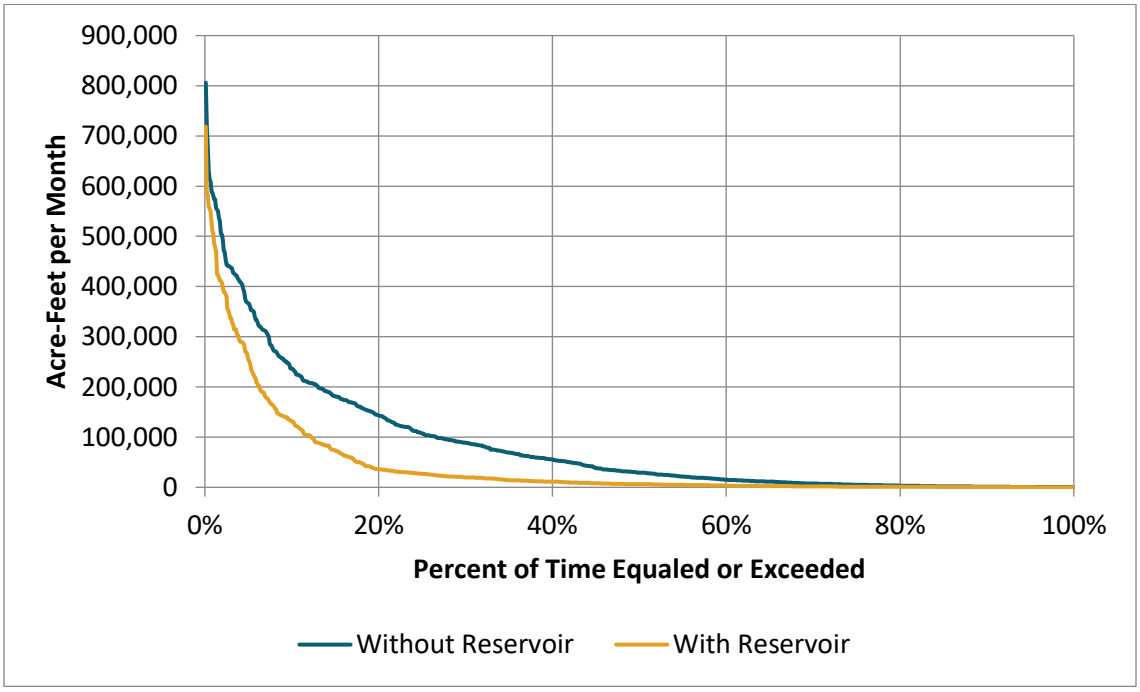
> "Evaluations of effects on environmental flows will include consideration of the Commission's adopted environmental flow standards under 30 TAC Chapter 298 (relating to Environmental Flow Standards for Surface Water). If environmental flow standards have not been established, then environmental information from existing site-specific studies, or in the absence of such information, state environmental planning criteria adopted by the Board for inclusion in the state water plan after coordinating with staff of the Commission and the Texas Parks and Wildlife Department to ensure that water management strategies are adjusted to provide for environmental water needs including instream flows and bays and estuaries inflows."

The Texas Commission on Environmental Quality (TCEQ) has not yet adopted environmental flow standards under 30 TAC Chapter 298 for the Sulphur Basin. As required by TWDB rules, the operation of the proposed reservoir was evaluated using state environmental planning criteria adopted by the Board for inclusion in the state water plan. **Table J.1**and **Figure J.3** summarize the flow-frequency relationship for the Sulphur River immediately below the proposed Marvin Nichols Reservoir with and without the reservoir. It is likely that the detailed studies required for reservoir permitting will result in different streamflow bypass requirements and different impacts on downstream flows. The results in **Table J.1** and **Figure J.3** reflect current TWDB consensus requirements.

Table J.1 Monthly Flow Frequency Relationship with and without Marvin Nichols Reservoir

% of Months Flow is Exceeded	Flow in Acre-Feet/Month	
	Without Marvin Nichols	With Marvin Nichols
5%	366,534	255,222
10%	236,232	131,508
20%	143,577	35,937
30%	88,805	19,741
40%	55,545	11,232
50%	29,145	6,141
60%	15,137	3,384
70%	7,404	1,715
80%	3,310	922
90%	1,135	431
95%	506	252

Figure J.3 Flow-Frequency Relationship of Sulphur River at Marvin Nichols Dam Site with and without the Reservoir



J.2.4 Impacts on Wildlife Habitat

The primary impact of the proposed Marvin Nichols Reservoir on wildlife habitat would be the inundation of habitat by the reservoir. This impact was evaluated as part of the *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment*,[2] prepared for the U.S. Army Corps of Engineers as part of an on-going basin-wide assessment of the Sulphur River Basin. The *Environmental Evaluation Interim Report* used the existing Texas Parks and Wildlife Ecological Systems Classification data set, which was developed by analysis of color infra-red and multi-spectral satellite imagery. The data set was considered to be the most recent, readily available data on land cover types in the Sulphur River Basin. The cover types determined from the Ecological Systems Data set were grouped into larger categories based on EPA's Level One National Land Cover Data classifications. U.S. Fish and Wildlife Service National Wetlands Inventory data were used to further refine the classifications. The approach used in the *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment* [(2)] is described in greater detail in **Attachment J-2**, which reproduces Sections 2.1 and 2.2 of that report.

Table J.2 shows the acreage of each cover type within the footprint of the proposed Marvin Nichols Reservoir. For comparison, the area of each cover type in all of Region D is also included. (Cover areas in Region D were developed for this study using the database developed in the *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment*.) **Attachment J-3** is a map of the cover types in the Marvin Nichols Reservoir site, taken from *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment*.

Table J.2 also presents the impact of the proposed Marvin Nichols Reservoir on wildlife habitat in terms of the acreage of different types of habitat inundated by the reservoir. The reservoir will affect 5.2 percent of the forested wetlands, 2.4 percent of the bottomland hardwood forests, and 0.4 percent of the upland forests in Region D. Bottomland hardwoods and forested wetlands are often lumped together as bottomland hardwoods, and they are considered to be particularly important as wildlife habitat. The total of these two types in the proposed Marvin Nichols Reservoir represents 3.8 percent of the bottomland hardwood and forested wetland areas in Region D. The 31,600 acres of bottomlands and forested wetlands that would be inundated by the proposed reservoir represents less than 1 percent of the estimated 5,973,000 acres [(3)] of bottomland hardwoods in Texas. As a part of permitting for the project, there will be more detailed assessments of the quality of the wildlife habitat that would be affected by the project, which will aid in the development of mitigation plans.

Table J.2 Quantitative Reporting on Impacts on Wildlife Habitat

Cover Type	Area (Acres)		Marvin Nichols Reservoir Area as a Percent of Region D
	Marvin Nichols Reservoir	Region D	
Barren	<1	8,437	0.0%
Bottomland Hardwood Forest	10,156	417,265	2.4%
Forested Wetland	21,444	414,573	5.2%
Grassland/Old Field	18,241	2,843,656	0.6%
Herbaceous Wetland	1,244	32,011	3.9%
Open Water	1,162	211,761	0.5%
Row Crops	706	314,184	0.2%
Shrub Wetland	1,405	16,445	8.5%
Shrubland	444	47,485	0.9%
Upland Forest	11,223	2,869,079	0.4%
Urban	78	158,878	0.0%
Total	**66,103**	**7,333,774**	**0.9%**

J.2.5 Impacts on Cultural Resources

The impacts of Marvin Nichols Reservoir on cultural resources would result from the inundation of cultural resource sites. The *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment*[2] collected the following data on potential cultural resource impacts from Marvin Nichols Reservoir site and other proposed reservoir sites in the Sulphur River Basin:

- Number of known cultural resources
- Presence of known human remains/burials
- Acres of zones of archaeological potential
- Percentage of reservoir footprint with previous cultural resource surveys
- Surveyed site density

Table J.3 is a quantitative reporting of known cultural resources in the Marvin Nichols Reservoir footprint. **Table J.4** is a quantitative reporting of other measures of potential impacts on cultural resources. The data in both tables is taken from *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment*.

Table J.3 Quantitative Reporting of Impacts on Cultural Resources – Known Cultural Resources

Likely Eligibility of Sites for the National Register of Historic Properties (NRHP)	Historic	Pre-historic	Caddo	Multi-Component	Prehistoric Multi-Component	Total*
Likely NRHP Eligible	0	20	9	2	3	34
Possibly NRHP Eligible - Fair Chance	0	4	2	0	0	6
Possibly NRHP Eligible - Poor Chance	0	4	1	0	0	5
Not Likely NRHP Eligible	0	15	1	2	0	18

**Total for "Likely NRHP Eligible" is corrected from 31 in Environmental Evaluation Interim Report - Sulphur River Basin - Comparative Assessment* [(2)].

Table J.4 Quantitative Reporting of Impacts on Cultural Resources – Other Factors

Measurement of Impact on Cultural Resources	Value for Measurement
Ratio of High Value Sites to Low Value Sites	1.7*
Number of Known Cemeteries	1 (57 graves)
Acres with High Potential for Archaeological Sites	51,654
Percentage of Project Area Previously Surveyed for Cultural Resources	13%
Number of Acres Surveyed per Site Found in Survey	90.1

*"Ratio of High Value Sites to Low Value Sites" is corrected from 1.6 in *Environmental Evaluation Interim Report - Sulphur River Basin - Comparative Assessment* [(2)].

In general, impacts on cultural resources are mitigated through coordination with the Corps of Engineers and the Texas State Historical Commission during permitting. Coordination with Indian tribes on archeological issues would also be a part of the permitting process. Mitigation is accomplished by investigating and recording archaeological sites and proper relocation of cemeteries. This process of archaeological mitigation adds to project costs, and it has been considered in costs developed for the proposed Marvin Nichols Reservoir.

J.2.6 Impacts on Bays, Estuaries and Arms of the Gulf of Mexico

The proposed Marvin Nichols Reservoir would not directly affect flows discharging to bays, estuaries and arms of the Gulf of Mexico. The Sulphur River, on which the Marvin Nichols Reservoir would be located, is a tributary of the Red River, which does not flow to any bay, estuary or arm of the Gulf of Mexico in Texas. According to the U.S. Geological Survey, the Red River discharges to the Atchafalaya River, which flows to the Gulf of Mexico in Louisiana [(4)(5)]. Natural discharges from the Atchafalaya to the Gulf of Mexico average 58,000 cubic feet per second, or 42 million acre-feet per year [(4)(5)]. In addition, human diversions of flood flows from the Mississippi River to the Atchafalaya River add about 167,000 cfs, or 121 million acre-feet per year, to the discharge of the Atchafalaya [(4)(5)], making a total discharge of 163 million acre-feet per year.

Assuming full use of Marvin Nichols Reservoir and no return flows, the project would reduce flows by about 450,500 acre-feet per year. This could reduce the discharge from the

Atchafalaya River to the Gulf of Mexico in Louisiana by less than 0.4%. It should be noted that reducing the discharge from the Atchafalaya is moving toward natural conditions, offsetting a very small part of the flows added to the Atchafalaya by human diversion from the Mississippi River. The impact of Marvin Nichols Reservoir on bays, estuaries and arms of the Gulf of Mexico would be negligible.

J.2.7 Impacts on Threatened and Endangered Species

The Texas Water Development Board rules do not require reporting on potential impacts to threatened and endangered species. However, data on potential impacts to endangered and threatened species are available in the *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment*[2] and are presented here. The U.S. Fish and Wildlife Service maintains lists of federally endangered and threatened species by county. The Texas Parks and Wildlife Department maintains a separate Texas, or State, list of endangered and threatened species by county. **Table J.5** summarizes State and Federally listed threatened and endangered species in the counties in which Marvin Nichols Reservoir would be located. The potential impact ranking was based on professional judgement, descriptions of habitat, and scarcity of the habitat in the project vicinity.

Table J.5 Quantitative Reporting of Potential Impacts on Endangered and Threatened Species

Classification of Endangered and Threatened Species	Potential for Impact Due to Marvin Nichols Reservoir	Number Present in Counties Where Marvin Nichols Reservoir Would be Located
Federal Endangered Species	No Potential to Low Potential	1
	Moderate Potential	1
	High Potential	0
Federal Threatened Species	No Potential to Low Potential	2
	Moderate Potential	0
	High Potential	0
Texas Endangered Species	No Potential to Low Potential	1
	Moderate Potential	1
	High Potential	0
Texas Threatened Species	No Potential to Low Potential	14
	Moderate Potential	4
	High Potential	0

Of the Federally listed species, there are four potential species that are listed in the counties where Marvin Nichols would be located, but none of these species are expected to be impacted by the reservoir. There is a total of 20 threatened or endangered State-listed species within these counties, but only four threatened species have moderate potential to be impacted by the reservoir, and none have high potential. Because there are four State-listed threatened species

with moderate potential to be impacted by Marvin Nichols Reservoir, additional studies may be required to assess the impact on these species, if any, as reservoir development continues. According to the *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment*, "The Texas Endangered Species Act does not protect wildlife species from indirect or incidental take (e.g., destruction of habitat, unfavorable management practices, etc.). The TPWD has a Memorandum of Understanding with every state agency to conduct a thorough environmental review of state initiated and funded projects, such as highways, reservoirs, land acquisition, and building construction, to determine their potential impact on state endangered or threatened species."

J.3 Analysis and Quantification of the Impacts on Agricultural Resources

J.3.1 Requirements of Texas Water Code and Texas Water Development Board Rules

The requirements for quantitative reporting on the impacts of water management strategies on agricultural resources are included in the Board rules in Texas Administrative Code §357. Specifically, §357.34(d)(3)(C) requires that the quantitative reporting address impacts on agricultural resources. The rules do not include any more detailed description of what quantitative reporting is required. To respond to this requirement, this report provides the following quantitative reporting on the impacts of the proposed Marvin Nichols Reservoir on agricultural resources:

- Inundation of land potentially useful as agricultural resources
- Loss of timber harvests
- Inundation of prime farmlands.

J.3.2 Available Data for Impacts on Agricultural Resources

Data on impacts to land cover types potentially useful as agricultural resources is based on a land classification developed for the *Environmental Evaluation Interim Report – Sulphur River Basin – Comparative Assessment.* The data available from that report has been adapted by a simplified re-classification that expands the geographic scope of the analysis for purposes of comparison within this study. Data on the loss of timber harvests is developed from data maintained by the Texas A&M Forestry Service. In the early 2000s, two analyses of the proposed Marvin Nichols reservoir's impacts on timber resources were performed, which reached radically different conclusions [(6)(7)]. Both reports consider the impacts of a previous concept for the proposed Marvin Nichols Reservoir that differs in both size and location from the current concept for the reservoir and which is no longer being considered. Because these studies analyze a different project, they are not considered to be relevant for the current analysis. Data on inundation of prime farmlands is developed from prime farmland data maintained by the U.S. Department of Agriculture Natural Resources Conservation Service.

J.3.3 Impacts Due to Inundation of Land Potentially Useful as Agricultural Resources

The development of land cover type information for the proposed Marvin Nichols Reservoir is discussed in **Section J.2.4** and **Appendices G and H**. Five of the land cover types present in the footprint of the reservoir are potentially useful as agricultural resources. Forested wetlands, bottomland hardwoods, and upland forests might be useful in the growth and harvesting of timber (silvicultural activities). Row crops represent current farming activities. Grassland/old field would potentially include land used for grazing of livestock, although it would also include grassland not currently used for agricultural purposes. **Table J.6** includes information on the area of these land cover types that would be inundated by the Marvin Nichols Reservoir. To allow consideration of the impacts to agricultural resources of Region D and Texas, the areas of these cover types for Region D are included in the table.

Table J.6 Quantitative Reporting on Impacts to Agricultural Resources - Land Potentially Useful for Agriculture

Cover Type		Area (Acres)		Marvin Nichols Reservoir Area as a Percent of Region D
		Marvin Nichols Reservoir	Region D	
Timberlands	Bottomland Hardwood Forest	10,156	417,265	2.4%
	Forested Wetland	21,444	414,573	5.2%
	Upland Forest	11,223	2,689,079	0.4%
Active/Potential Agricultural and Pasture Lands	Row Crops	706	314,184	0.2%
	Grassland/Old Field	18,241	2,872,649	0.6%
Non-Agricultural Lands	Other Land Cover Types	4,333	626,024	0.7%
	Total	**66,103**	**7,333,774**	0.9%

The most significant impacts to agricultural resources relative to the resources of Region D and of Texas are on resources that could potentially be useful to the silviculture industry. These impacts are discussed further (in terms of impacts on timberland and timber sales) in **Section J.3.5**.

J.3.4 Impacts Due to Inundation of Prime Farmland

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) maintains data on prime farmland, which is defined as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses [(8)]". Prime farmland is not necessarily currently in agricultural use, but it must be available for agricultural use. For example, prime farmland soils underlying an urban area would not be counted as prime farmland because they are not available for agricultural

uses. **Table J.7** shows the acreage of prime farmland that would be inundated by the proposed Marvin Nichols Reservoir compared to prime farmland area in Region D and Texas. Marvin Nichols Reservoir would inundate 0.76 percent of the prime farmland in Region D and 0.04 percent of the prime farmland in Texas.

Table J.7 Quantitative Reporting on Impacts on Agricultural Resources – Prime Farmland

Cover Type	Area (Acres)			Marvin Nichols Reservoir Area as a Percent of Area:	
	Marvin Nichols Reservoir	Region D	Texas	Region D	Texas
Prime Farmland	14,893	1,949,929	35,087,200	0.76%	0.04%

J.3.5 Impacts on Timberland and Timber Harvests

Agricultural use of the land that would be inundated by the proposed Marvin Nichols Reservoir includes the production of timber. The Texas A&M Forest Service maintains data on timberland, timber harvest, and the stumpage value of harvests by county. As part of this study, Freese and Nichols contacted the Texas A&M Forest Service to obtain information on the impact of the proposed Marvin Nichols Reservoir on timber resources. Unfortunately, the Texas A&M Forest Service database was not designed to provide information for relatively small areas like the proposed Marvin Nichols Reservoir. The Texas A&M Forest Service indicated that analysis of the data at the county level and above would be most meaningful.

The Texas A&M Forest Service produces annual reports of Harvest Trends for timber products in East Texas, which includes most of the timberland and timber production in Texas. **Figure J.4** shows the area covered by the Harvest Trends reports, as well as the location of the proposed Marvin Nichols Reservoir and the boundaries of Region D. Most of Region D (except for the western counties) is covered by the Harvest Trends Reports.

Although information on the inundation of timberland by the proposed reservoir cannot be gathered directly from data maintained by the Texas A&M Forest Service, it is possible to estimate the magnitude of impacts by looking at county data. Almost all of the footprint of the proposed Marvin Nichols Reservoir is located in Red River, Titus and Franklin Counties. (There are extremely small areas of the reservoir in Delta and Lamar Counties, but they are contained on the Sulphur River floodway channel and would not have forested land.) The total timberland in these three counties is 523,629 acres, and the total of the bottomland hardwood, forested wetland, and upland forest cover types is slightly more, at 531,200 acres. If we treat these three land cover types as a close approximation of timberland, the proposed Marvin Nichols Reservoir will inundate about 42,823 acres of timberland (**Table J.8**), or about 8.2 percent of the 523,629 acres of timberland in Red River, Titus and Franklin Counties.

Table J.8 provides data on potential timberland in Marvin Nichols Reservoir and timberland in Region D [(9)] and East Texas [(10)]. Note that the data for Region D and East Texas include only the area shown in **Figure J.4**. The data for Region D and East Texas were obtained from the Texas Forest Service data set [(9)(10)].

Figure J.4 Region D and Area Covered by Harvest Trends Report

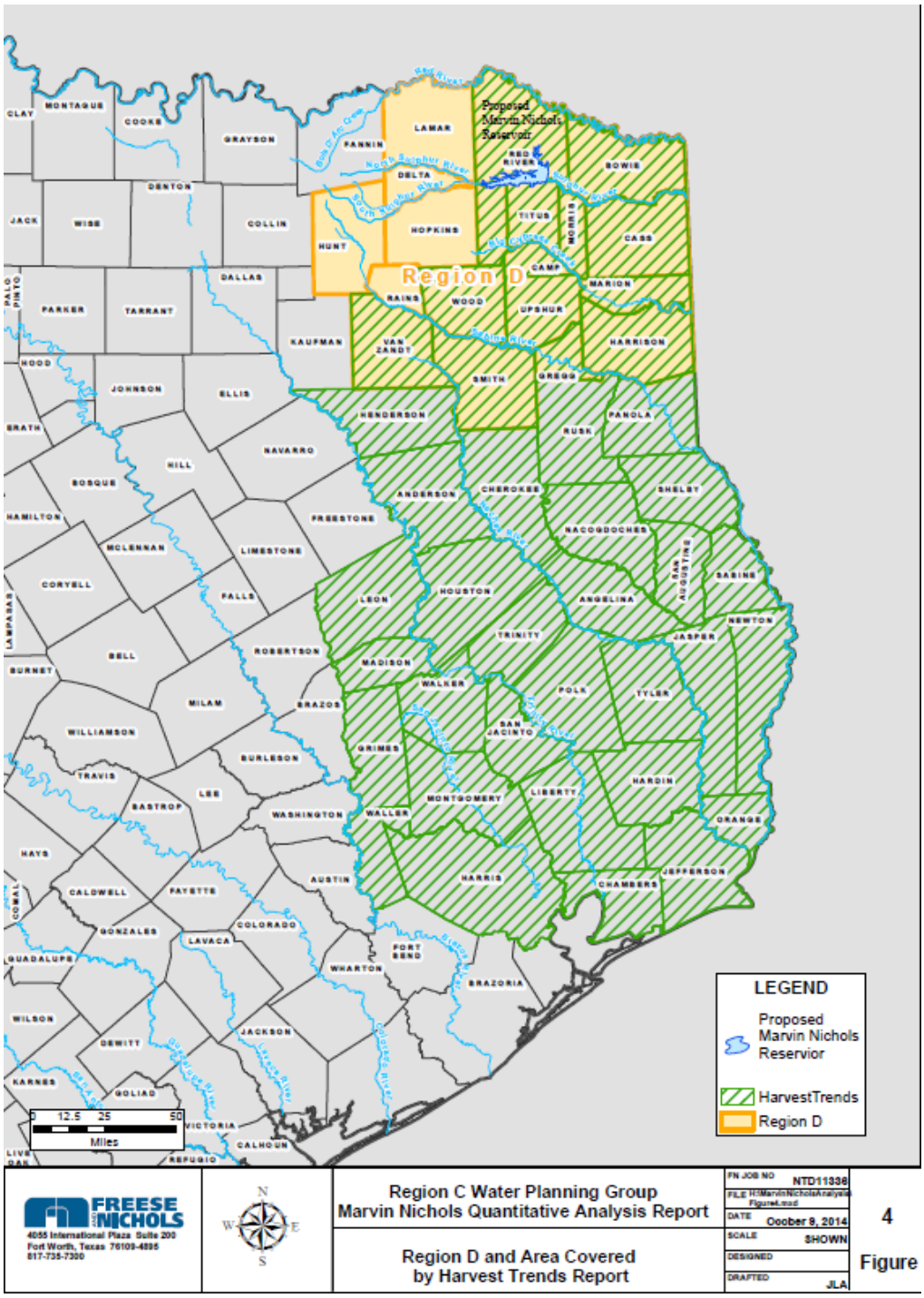


Table J.8 Potential Timberland in Marvin Nichols Reservoir

	Area (Acres)	Percent in Marvin Nichols
Potential Timberland in Marvin Nichols Reservoir		
Bottomland Hardwoods	10,156	
Forested Wetlands	21,444	
Upland Forest	11,223	
Total Potential Timberland in Marvin Nichols	**42,823**	
Total Timberland in Red River, Titus, & Franklin Counties	**523,629**	**8.2%**
Total Timberland in Region D	**3,520,917**	**1.2%**
Total Timberland in East Texas	**11,906,539**	**0.4%**

Table J.9 is a summary of data on timber sales taken from the Texas A&M Forest Service report *Harvest Trends 2017* [11]. These data are available only on a county-wide basis. Note that the potential timberland inundated by the proposed Marvin Nichols Reservoir is estimated to be 8.2 percent of the timberland in Red River, Titus and Franklin Counties. As a result, the timber harvest volume and stumpage value from the reservoir area is assumed to be about 8.2 percent of the total value for the three counties. (The stumpage value is the value of the timber harvested, not including the costs of processing and delivering the timber.) The estimated stumpage value of the timber harvests in the Marvin Nichols Reservoir pool is less than one percent of the total for Region D and less than 0.2 percent of the total for East Texas. (None of the 19 East Texas Counties with the highest stumpage timber harvest values (all over $5,000,000) would be affected by Marvin Nichols Reservoir.)

Table J.9 Estimated Impact of Marvin Nichols Reservoir on Timber Harvest Values

County	Volume Harvested (Cubic Feet)			Stumpage Value of the Harvest (thousand dollars)
	Pine	Hardwood	Total	
Franklin	17,424	47,990	65,414	$67
Red River	7,689,356	2,561,886	10,251,242	$4,188
Titus	435,802	328,019	763,821	$537
Total for Marvin Nichols Counties	8,142,582	2,937,895	11,080,477	$4,792
Estimated Stumpage Value for Marvin Nichols (8.2% of Total for Counties)				**$392**
Total for Region D (not including Hunt, Lamar, Delta, Hopkins and Rains Counties)	91,938,000	27,133,561	119,071,561	$57,800
Total for East Texas	432,274,383	66,507,907	498,782,290	$244,834

J.4 Mitigation and the Effect of Mitigation on Impacts to Natural and Agricultural Resources

Developers of a new reservoir project are often required to provide mitigation for the impacts on natural resources in the form of land set aside, protected from development, and managed to enhance ecological value. Mitigation is generally only required for specific types of resources that would be impacted such as waters of the U.S. and the state, including wetlands. The developer of a project gets mitigation credit for improving the environmental functions of the land used for mitigation. The usual approach is to purchase degraded areas with limited environmental value and improve them through restoration, enhancement and careful management to achieve desired compensatory results at minimum cost.

Table J.10 gives information on historical mitigation requirements for Texas reservoirs constructed or permitted since 1980. Significant changes have taken place to the mitigation process since the 1980s. Mitigation is no longer based strictly on acreage. It now considers the quality of the land being taken out of use as well as the improvements made to the mitigation land. It may be more beneficial to examine a more recent example of reservoir mitigation, Bois d'Arc Lake, which is now under construction. Significant land was initially acquired for mitigation (15,000 acres) for Bois d'Arc Lake, and the transaction was on a willing buyer-willing seller basis, with no condemnation of land. Approximately 2,000 additional acres are currently being purchased for mitigation with the same willing seller approach. The total mitigation for Bois d'Arc Lake is 17,000 acres, which is equivalent to a 1:1 ratio to the area impacted by construction. Another reservoir, Lake Ralph Hall, is currently in the permitting process, and mitigation requirements have not yet been finalized.

One of the key differences in recently permitted projects and those permitted decades earlier is the approach to mitigation. No longer are ratios used, but rather habitat value. Also, as previously noted, preferred lands for mitigation are lands that could be improved and developed into new ecological habitats. The potential impacts to the timber industry from mitigation would be much less than claimed by opponents because the preferred land for mitigation would be non-forested. For the Bois d'Arc Lake project, ranch lands are currently being improved, with over 5 million trees planted, to create aquatic and terrestrial habitats on lands that otherwise had limited ecological value.

Mitigation offsets the impacts of a project on natural resources by improving the ecological functions of other land. Mitigation would be expected to offset the impacts of the proposed Marvin Nichols Reservoir on natural resources. While most of the lands dedicated to mitigation may not be active agricultural lands, the potential use of these lands in the future for agricultural purposes would be limited and probably not compatible for the purpose of the mitigation.

Mitigation requirements for new reservoirs are generally determined during the permitting process, and the requirements for the proposed Marvin Nichols Reservoir are not yet known. Estimates of mitigation requirements have been developed as part of cost estimates used for the *2021 Region C Water Plan*. For this Plan, the required mitigation acreage is estimated at approximately equivalent to the total acreage of the proposed new reservoir. For the proposed Marvin Nichols Reservoir, the acreage of the reservoir is 66,103 acres, and the estimated

mitigation requirement is equal to that amount (66,103 acres). This is consistent with historical mitigation requirements for reservoirs in Texas. It should be emphasized that this is only an estimate. Actual mitigation requirements and location will be developed as permitting for the proposed reservoir proceeds. As discussed above, mitigation is intended to offset impacts on natural resources but may increase impacts to agricultural resources.

Table J.10 Mitigation Requirements for Texas Reservoirs

Reservoir	Date Impounded	Conservation Pool (Acres)	USACE Mitigation (Acres)	Ratio	Mitigation Site
Alan Henry	1993	2,884	3,000	1.04:1	Down Stream
Applewhite	Permitted in 1989	2,500	2,500	1.00:1	Accepted Down Stream
Bois d'Arc Lake	Permitted in 2018	16,641	16,800	1.01:1	Upstream and Down Stream
Cooper (including Flood Pool)	1991	19,200 (22,740)	35,500	1.85:1 (1.56:1)	Next to Reservoir and 50 miles Down Stream
Gilmer	1997	1,010	1,557	1.54:1	
Joe Pool	1986	7,470	0	0.00:1	None
Mitchell County	1993	1,463	0	0.00:1	None
O. H. Ivie	1990	19,149	5,990	0.31:1	Next to Reservoir
Palo Duro	1989	2,413	0	0.00:1	None
Ray Roberts	1986	29,350	0	0.00:1	None
Richland-Chambers	1987	44,752	13,700	0.31:1	Down Stream

J.5 Socio-Economic Assessment

In 2014, the Corps of Engineers produced the report Sulphur River Basin – Socio-Economic Assessment [12].It was estimated that the construction phase of Marvin Nichols Reservoir would produce over 12,000 direct, indirect, and induced jobs, and have an overall positive effect on the economy of $1.47 billion (in 2014 dollars).

An updated socio-economic study was conducted in April 2020 by Clower & Associates for the recommended Marvin Nichols Reservoir strategy. This strategy assumes the full-size reservoir (elevation 328 ft msl) with over 200 miles of transmission to NTMWD, TRWD, and UTRWD. All costs are in 2018 dollars, which is consistent with the 2021 regional water planning guidance.

The *Economic, Fiscal and Developmental Impacts of the Proposed Marvin Nichols Reservoir* (2020 Clower Report) is included as **Attachment 4** to this appendix. The study found that the development of the lake and transmission system would result in over 38,000 direct, indirect and induced temporary jobs during construction and 1,800 permanent jobs during operations. The total economic activity would increase by $5.5 billion during construction and $228 million during operations. Much of this increased economic activity would occur in Region D, where the reservoir is located.

Terms

***Employment*:** the number of annual average monthly jobs that would be created, and can be either full-time or part-time.

Labor income: represents all forms of employment income, including employee compensation (wages and benefits) and proprietor income.

Value added: gross output (sales or receipts and other operating income, plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported), which consists of compensation of employees, taxes on production and imports less subsidies, and gross operating surplus.

Output: the value of industry production.

***Direct* employment:** jobs associated with the project itself.

***Indirect* employment:** employment generated from spending by employees of the project.

***Induced* employment:** employment generated from spending by indirect employees.

Table J.11 provides additional detail during construction and **Table J.12** presents the economic summary during operations. It should be noted that these impacts occur over different geographic areas and at different times, pending construction schedules and project component locations. All values represent direct, indirect and induced economic impacts.

Table J.11 Socio-Economic Impact of Constructing Marvin Nichols Reservoir

	Construction			
	Dam (6 years)	Transmission (6 years)	Housing/ Commercial (20 years)	Total
Economic Activity	$1,223,035,000	$3,830,050,000	$497,573,000	$5,550,658,000
Value Added	$545,522,235	$2,355,441,235	$236,857,235	$3,137,820,705
Labor Income	$396,345,000	$1,667,439,000	$168,042,000	$2,231,826,000
Employment	8,266	25,921	4,061	38,248
Indirect State and Local Taxes	$34,018,000	$109,615,000	$15,506,000	$159,139,000

Table J.12 Socio-Economic Impact of Operating Marvin Nichols Reservoir

	Annual Operations			
	Dam	Transmission	Visitor/Resident Spending	Total
Economic Activity	$39,877,000	$81,106,000	$106,906,000	$227,889,000
Value Added	$17,945,000	$46,802,000	$56,608,000	$121,355,000
Labor Income	$12,569,000	$17,701,000	$29,957,000	$60,227,000
Employment	289	216	1,327	1,832
Indirect State and Local Taxes	$1,121,000	$5,065,000	$9,282,000	$15,468,000

The 2020 Clower Report also addressed potential socio-economic impacts to the North Texas region if this water supply project is not developed. The report notes that the North Texas region, including most of the communities served by the sponsors of the Marvin Nichols Reservoir, has witnessed an unprecedented economic boom over the past decade with record levels of population growth and job creation. Economic forecasts see this growth continuing for at least the next several decades.

Much of the driving factors for the North Texas growth is the growth of industries and migration of workers to service these industries. Water is a major factor for both residents and industry. If water supplies are limited due to the inability to secure reliable new sources of water, continued growth in North Texas will slow. Industries most likely to slow are those that are most dependent upon water, which include pharmaceutical, aerospace and semiconductor manufacturing, hospitals, and service industries such as hotels and restaurants. The impacts to projected job growth for just these six industries could be substantial with the loss of 136,000 jobs and $19 billion in annual economic activity. This assessment assumes a lack of water for growth. The TWDB looked at the effects a one-year drought would have on Region C.

As part of the 2021 Region C Water Plan, the TWDB evaluated the socio-economic impacts of not meeting water needs in Region C. This report is included in **Appendix L** of the 2021 Plan and summarized in **Chapter 6** of the plan. The TWDB analysis is based on the projected needs for the all of Region C, which reach approximately 1.3 million acre-feet per year by 2070. The analysis assumes that these needs cannot be met in a single year in the decade. Projected needs in other years in the decade are assumed to be met. This approach is predicated on the assumption that the needs are solely drought driven. In Region C, the most of the projected

water needs are growth related. This means that the impact from not meeting the water need is not limited to a single year in the decade. Previous analyses by the TWDB for Region C (2006 Region C Water Plan) indicate the socio-economic impacts associated with growth could be much higher than estimated using the standard TWDB protocol.

Even with this restricted approach to impacts, the TWDB reported job losses of up to 473,000 and $48 million in income loss by 2070. The limited analysis of not developing Marvin Nichols in the 2020 Clower Report confirms there would likely be substantial impacts to economic growth in the North Texas region. The Marvin Nichols Reservoir is expected to provide about 30 percent of the projected need for Region C providers in 2070 and much more of the need in earlier decades. Not being able to sustain the continued growth in Region C due to the lack of water would have tremendous impacts on the State's economy. In addition to the impacts to Region C, there would be expected indirect impacts to Region D. Region C is the economic engine in North Texas, which supports labor and local industries such as the timber industry in Region D.

J.6 Additional Information

Table J.13 shows the needs for additional water supplies in the Trinity and Sulphur Basins, taken from the Texas Water Development Board database for the 2021 regional water plans [13]. The Texas Water Development Board defines needs as the difference between the supply currently available and the projected demands for a water user group. **Table J.13** shows the sum of net needs by river basin and planning group. For suppliers that have a surplus, needs are set at zero. As the table shows, there is need for considerable additional water supply in the Trinity Basin, particularly in Region C.

Table J.13 Needs for Additional Water Supply in the Trinity and Sulphur Basins

Basin	Region	Sum of Supply Needs for All Suppliers (Acre-Feet)					
		2020	2030	2040	2050	2060	2070
Trinity Basin	B	545	50	51	136	226	323
	C	59,557	322,103	538,331	774,198	1,014,402	1,261,260
	D	38	74	136	234	372	582
	G	7,985	8,962	10,072	12,434	15,327	18,494
	H	12,558	13,856	14,147	14,773	15,588	16,457
	I	1,641	1,752	1,796	1,882	2,006	2,172
	Total	**82,324**	**346,797**	**564,533**	**803,657**	**1,047,921**	**1,299,288**
Sulphur Basin	C	215	229	219	299	504	650
	D	29,817	30,765	31,421	32,570	34,180	36,206
	Total	**30,032**	**30,994**	**31,640**	**32,869**	**34,684**	**36,856**

Appendix J List of References

(1) Freese and Nichols, Inc., Alan Plummer Associates, Inc., CP&Y, Inc., and Cooksey Communications, Inc. *2016 Region C Water Plan*. December 2015.

(2) Freese and Nichols, Inc. *Environmental Evaluation Interim Report - Sulphur River Basin - Comparative Assessment.* 2013.

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(5) U.S. Census Bureau: *Statistical Abstract of the United States: 2012*, Table 365, Washington, D.C.

(6) Xu, Ph.d. Weihuan, and Publication 162. *The Economic Impact of the Proposed Marvin Nichols I Reservoir to the Northeast Texas Forest Industry* (n.d.): n. pag. Texas Forest Service, Aug. 2002. Web. 15 Oct. 2014.

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(11) Texas A&M Forest Service. *Harvest Trends 2017*. Texas A&M Forest Service. January 2019. Web. November 4, 2019. [Available only on internet: https://tfsweb.tamu.edu/uploadedFiles/TFSMain/Data_and_Analysis/Forest_Economics_and_Resource_Analysis/Resource_Analysis/Resource_Analysis_publications/HarvestTrends2017.pdf]

(12) Freese and Nichols, Inc. *Sulphur River Basin: Socio-Economic Assessment*. Prepared for the Fort Worth USACE. 2014b. Print.

(13) *2021 Regional Water Planning Database (DB22)*. Texas Water Development Board. Obtained from DB22, November 21, 2019.

Attachment J-1

Interim Order of August 8, 2014

TEXAS WATER DEVELOPMENT BOARD

AN INTERIM ORDER concerning the interregional conflict between the 2011 North Central Texas Regional Planning Area Regional Water Plan and the 2011 North East Texas Regional Planning Area Regional Water Plan in accordance with Texas Water Code § 16.053.

On August 7, 2014, the Texas Water Development Board (Board) considered the interregional conflict between the 2011 North Central Texas Regional Planning Area (Region C) Regional Water Plan and the 2011 North East Texas Regional Planning Area (Region D) Regional Water Plan.

After considering the oral argument of the parties and the filings in this matter, the Board determined that there was inadequate analysis and quantification of the impact of the Marvin Nichols Reservoir Water Management Strategy on the agricultural and natural resources of Region D and the State.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS WATER DEVELOPMENT BOARD that:

1. Region C is directed to conduct an analysis and quantification of the impacts of the Marvin Nichols Reservoir Water Management Strategy on the agriculture and natural resources of Region D and the State, pursuant to Sections 16.051 and 16.053 of the Texas Water Code and Chapters 357 and 358 of Board rules. Region C should submit this analysis and quantification to the Board by November 3, 2014. Upon receipt of the analysis and quantification, the Executive Administrator and Region D will be given the opportunity to submit a written response to the submission, and the matter will be scheduled for Board consideration. If no submittal is received by the Board on or before November 3, 2014, this matter will set for a Board Meeting to direct the Regions to revise

their regional water plans reflecting the removal of the Marvin Nichols Reservoir Water Management Strategy from the 2011 Region C Plan, without prejudice.

2. The Executive Administrator is directed to undertake an examination of current rules and guidance pertaining to the development of regional water plans, and identify any opportunities for: ensuring that future regional and state water planning efforts include all statutorily-required analyses; and defining "interregional conflict" in a manner that is consistent with the ruling of the 11th Court of Appeals in *Texas Water Development Board vs. Ward Timber, Ltd.*, 411 S.W.3d 554 (Tex. App.-Eastland 2013, no pet.).

3. The Region C and Region D regional water planning groups are encouraged to continue to participate in the Sulphur River Basin Study.

Issue Date: August 8, 2014

TEXAS WATER DEVELOPMENT BOARD

Carlos Rubinstein, Chairman

Attachment J-2

Background and Methodology for Land Resource/Cover Type Assessment – Excerpt from Section 2 of the Environmental Evaluation Interim Report – Sulphur River Basin Comparative Assessmen

Land Resource / Cover Type Assessment

Background

The Texas Parks and Wildlife Department (TPWD) Ecological Systems Classification data set was utilized to develop the cover types within the footprints of the alternative reservoir sites, including Parkhouse I, Parkhouse II, Marvin Nichols 1A, Wright Patman (237.5 ft. msl and 259.5 ft. msl), Jim Chapman, and Talco. A number of key partners including the Texas Natural Resources Information System (TNRIS), Texas Forest Service, Natural Resources Conservation Service (NRCS), NatureServe, The Nature Conservancy (TNC), and the Missouri Resource Assessment Partnership (MoRAP) were involved in developing the Ecological Systems Classification project.

The creation of the Ecological Systems Classification took into consideration a wide variety of biotic and abiotic variables to establish detailed regional comparisons of vegetation and habitats. Data sources utilized in this classification system included the Farm Service Agency (FSA) National Agriculture Imagery Program (NAIP) aerial imagery, satellite imagery, 10-meter digital elevation models (DEM), U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) soil data types, TPWD vegetational areas, U.S. Geologic Survey (USGS) National Hydrography Dataset (NHD) layers, USGS Geologic Atlas of Texas, as well as field verified site data. The objective of this classification was to create a land cover type set with sufficient detail to be useful at the sub-county level, targeting the scale of 1:24,000, such as the USGS's 7.5 minute quadrangle scale.

Supervised classifications were performed on both color infra-red and multi-spectral satellite imagery to break down the images into objects that were more easily definable. Both leaf-on and leaf-off imagery conditions were used to establish a proper baseline. Detailed spatial analysis was performed at a 10-meter resolution, with the use of DEM's to identify areas of steep slopes (20% or greater), cliffs, and aspect. The "Ecological Site Type/Range Site" attributes from the NRCS soils data provided more detail to the species typically found in specific soils types, and field verification along public roads and public lands were used to sample present species. Seasonally flooded, versus temporarily flooded areas were estimated based on information from the SSUGRO soil data layer. Riparian data was determined to be either small or large stream riparian areas based on the NHD stream types.

All of the alternative reservoir sites evaluated in this report fell within the area surveyed in the Ecological Classification System project. As such, the data from the TPWD Ecological Classification System project was considered to be the most recent, readily available data collected for all alternative reservoir sites that would allow for a balanced comparison.

Methodology

The cover types used in the TPWD Ecological Systems Classification were derived from the NatureServe Ecological Classification System (Comer, 2003). This classification methodology resulted in a large number of cover types that were not readily observable or comparable at the scale spanning much of the Sulphur River Basin. To produce a cover type/vegetation classification within each alternative reservoir site that would be more readily observable and comparable, the Ecological Classification System cover types were re-assigned into broader and more general categories based on the EPA's Level I National Land Cover Data (NLCD). The definitions from the NLCD cover types were compared to the definitions contained in the Draft Descriptions of Systems, Mapping Subsystems, and Vegetation Types for Phase II (Elliott, 2009), and matched accordingly. Table 1 identifies the cover types resulting from this re-classification and the corresponding Ecological Classification System cover types that were included. Once this initial re-classification was complete, an additional re-classification was conducted utilizing the U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) data within each alternative reservoir site. A GIS analysis was then conducted and the re-classified vegetation/cover types were clipped to the NWI data layer in an effort to try and distinguish the bottomland hardwood forest cover type from the forested wetland cover type, as these cover types often overlap when based solely on remotely sensed data. Table 2 summarizes the final types and amounts (acres) of each cover type that were identified within the footprint of each alternative reservoir site. Figures 2 through 8 display the cover types identified within the footprint of each alternative reservoir site.

Table 1:Results of the Re-Classification of the Ecological Classification System Cover Types into EPA-based Level I NLCD Cover Types

EPA-Based Level I Cover Types	TPWD Ecological Systems Classification Cover Types
Barren	○ Barren
Bottomland Hardwood Forest	○ Pineywoods: Bottomland Seasonally Flooded Hardwood Forest ○ Pineywoods: Bottomland Temporarily Flooded Hardwood Forest ○ Pineywoods: Bottomland Temporarily Flooded Mixed Pine / Hardwood Forest ○ Pineywoods: Small Stream and Riparian Seasonally Flooded Hardwood Forest ○ Pineywoods: Small Stream and Riparian Temporarily Flooded Hardwood Forest
Forested Wetland	○ Pineywoods: Bottomland Baldcypress Swamp ○ Pineywoods: Small Stream and Riparian Baldcypress Swamp ○ Swamp
Grassland/Old Field	○ Blackland Prairie: Disturbance or Tame Grassland ○ Pineywoods: Bottomland Wet Prairie ○ Pineywoods: Small Stream and Riparian Wet Prairie ○ Post Oak Savanna: Savanna Grassland ○ Pineywoods: Disturbance or Tame Grassland
Herbaceous Wetland	○ Marsh ○ Pineywoods: Bottomland Herbaceous Wetland ○ Pineywoods: Herbaceous Seepage Bog ○ Pineywoods: Small Stream and Riparian Herbaceous Wetland ○ Pineywoods: Wet Hardwood Flatwoods
Open Water	○ Open Water ○ Pineywoods: Herbaceous Flatwoods Pond
Row Crops	○ Row Crops
Shrub Wetland	○ Pineywoods: Bottomland Deciduous Successional Shrubland ○ Pineywoods: Small Stream and Riparian Deciduous Successional Shrubland
Shrubland	○ Native Invasive: Deciduous Shrubland ○ Native Invasive: Juniper Shrubland ○ Native Invasive: Mesquite Shrubland ○ Pineywoods: Small Stream and Riparian Evergreen Successional Shrubland ○ Red River: Floodplain Evergreen Shrubland
Upland Forest	○ Native Invasive: Deciduous Woodland ○ Pine Plantation > 3 meters tall ○ Pine Plantation 1 to 3 meters tall ○ Pineywoods: Dry Pine / Hardwood Forest or Plantation ○ Pineywoods: Dry Pine Forest or Plantation ○ Pineywoods: Dry Upland Hardwood Forest

EPA-Based Level I Cover Types	TPWD Ecological Systems Classification Cover Types
	○ Pineywoods: Hardwood Flatwoods ○ Pineywoods: Longleaf or Loblolly Pine / Hardwood Flatwoods or Plantation ○ Pineywoods: Longleaf or Loblolly Pine Flatwoods or Plantation ○ Pineywoods: Northern Mesic Hardwood Forest ○ Pineywoods: Northern Mesic Pine / Hardwood Forest ○ Pineywoods: Pine / Hardwood Forest or Plantation ○ Pineywoods: Pine Forest or Plantation ○ Pineywoods: Sandhill Pine Woodland ○ Pineywoods: Small Stream and Riparian Temporarily Flooded Mixed Forest ○ Pineywoods: Upland Hardwood Forest ○ Post Oak Savanna: Oak / Hardwood Slope Forest ○ Post Oak Savanna: Post Oak / Redcedar Motte and Woodland ○ Post Oak Savanna: Post Oak Motte and Woodland
Urban*	○ Urban High Intensity ○ Urban Low Intensity

* According to the descriptions contained within the TPWD Ecological Systems Classification, urban areas consist of built-up areas including wide transportation corridors that are dominated by impervious cover (Elliott, 2009). By definition, this cover type could include smaller roadways, parking lots, and other areas dominated by impervious cover.

Table 2:Summary of Types and Approximate Amounts (acres) of Cover Types within the Footprint of each Alternative Reservoir Site

ALTERNATIVE RESERVOIR SITES	Wright Patman (237.5)	Wright Patman (259.5)	Marvin Nichols 1A	Talco	Parkhouse I	Parkhouse II	Jim Chapman (446.2)
COVER TYPES							
Barren	<1	<1	<1	<1	1	1	1
Bottomland Hardwood Forest	2,566	8,202	10,156	7,251	4,267	1,960	2,264
Forested Wetland	16,069	35,098	21,444	10,316	5,487	1,116	736
Grassland/Old Field	201	4,026	18,241	18,107	12,133	7,718	373
Herbaceous Wetland	438	1,151	1,244	276	432	91	94
Open Water	2,636	3,376	1,162	394	181	182	42
Row Crops	39	292	706	1,989	3,987	3,626	2
Shrub Wetland	55	204	1,405	468	278	28	109
Shrubland	34	187	444	288	65	19	241
Upland Forest	5,951	34,062	11,223	9,803	1,521	602	1,029
Urban	17	105	78	23	10	14	9
TOTAL	**28,006**	**86,703**	**66,103**	**48,915**	**28,362**	**15,357**	**4,900**

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TPWDd. http://www.tpwd.state.tx.us/huntwild/wild/species/blackbear/

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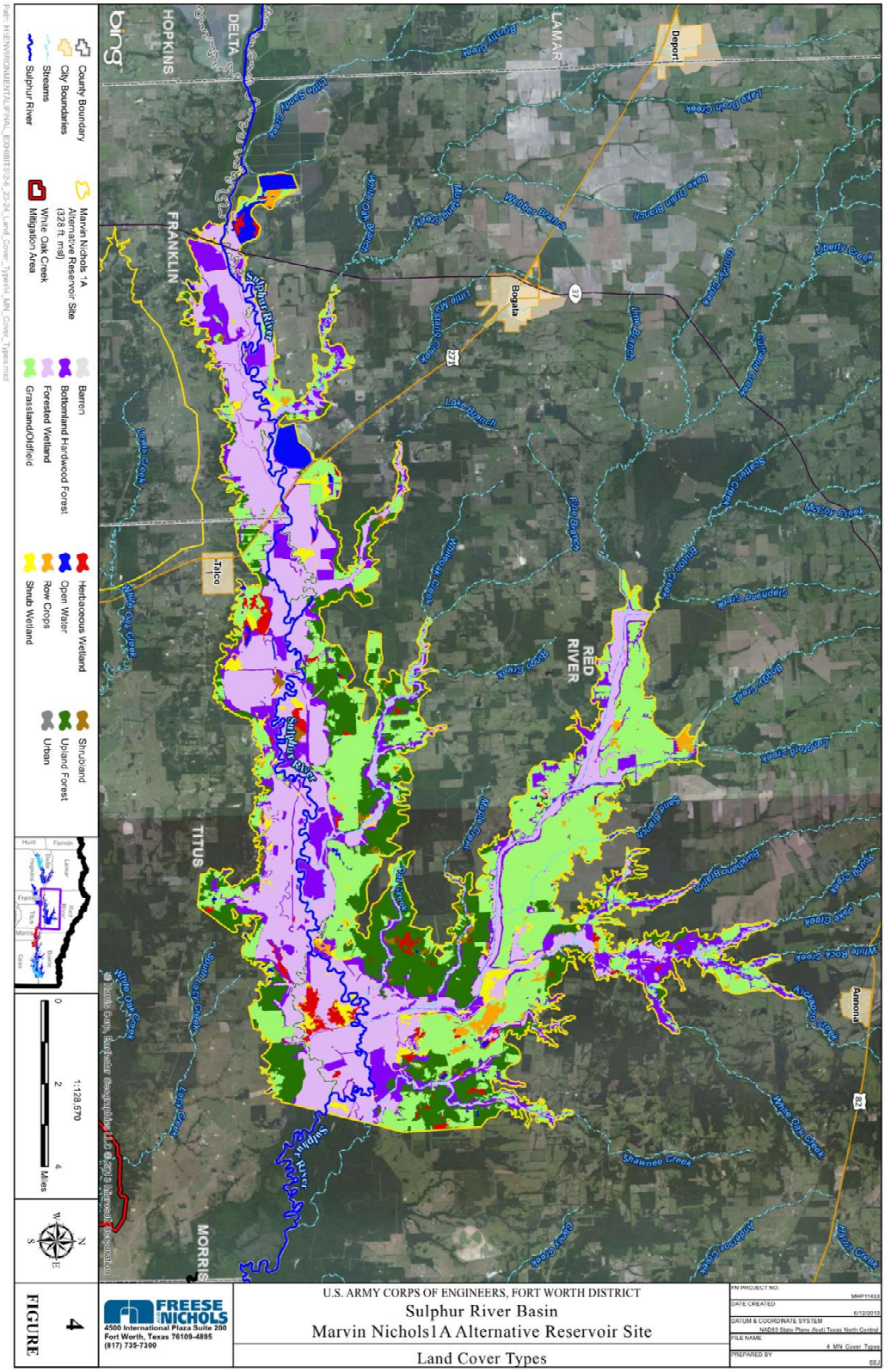
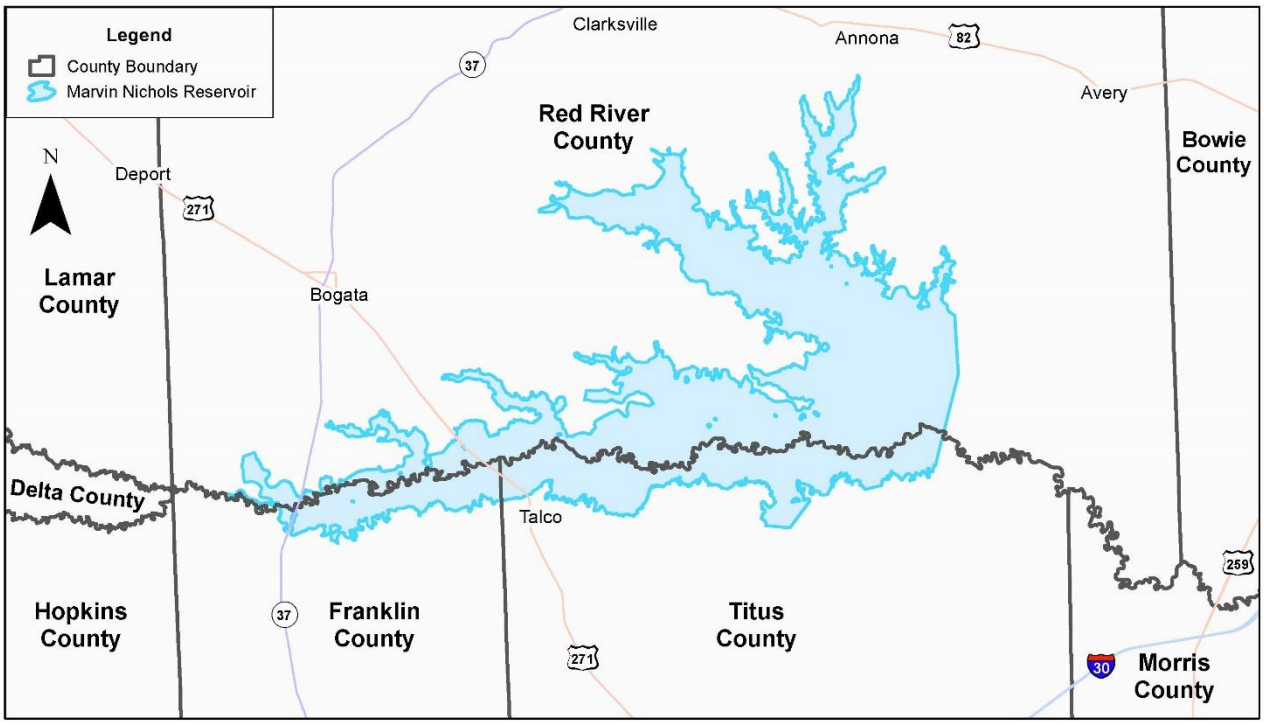
Attachment J-3

Land Cover Type Figure 4 from the Environmental Evaluation Interim Report – Sulphur River Basin Comparative Assessment


County Boundary
City Boundaries
Streams
Sulphur River
Marvin Nichols 1A Alternative Reservoir Site (328 ft. msl)
White Oak Creek Mitigation Area
Barren
Bottomland Hardwood Forest
Forested Wetland
Grassland/Oldfield
Herbaceous Wetland
Open Water
Row Crops
Shrub Wetland
Shrubland
Upland Forest
Urban
1:128,570
0
2
4
Miles
FREESE AND NICHOLS
4500 International Plaza Suite 200
Fort Worth, Texas 76109-4895
(817) 735-7300
4
FIGURE
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
Sulphur River Basin
Marvin Nichols1A Alternative Reservoir Site
Land Cover Types
FN PROJECT NO.
MHP11453
DATE CREATED
6/12/2013
DATUM & COORDINATE SYSTEM
NAD83 State Plane (feet) Texas North Central
FILE NAME
4_MN_Cover_Types
PREPARED BY
SEJ

Attachment J-4

Economic, Fiscal and Developmental Impacts of the Proposed Marvin Nichols Reservoir, April 13, 2020



Economic, Fiscal and Developmental Impacts of the Proposed Marvin Nichols Reservoir

Prepared for:

North Texas Municipal Water District

Upper Trinity Regional Water District

Tarrant Regional Water District

Dallas Water Utilities

April 13, 2020

Clower & Associates

Dallas-Fort Worth / Washington DC
(202) 769-6868

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Statement of Report Status: This is a draft report based on initial estimates of development and operating costs associated with the proposed Marvin Nichols Reservoir. Subsequent adjustments in total spending and budget allocations may influence the reported economic impacts.

Clower & Associates is a professional services firm providing economic and public policy analysis and advisory services to clients in the public, private, and non-profit sectors.

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Executive Summary

The following summarizes the findings of our analysis of the potential economic, fiscal, and developmental impacts that would attend the creation of the proposed Marvin Nichols Reservoir. This new Sulphur River basin lake will cover over 66,000 acres of surface area in Franklin, Red River, and Titus counties of northeast Texas, collectively referred to herein as the "Lake Counties."

Our analysis considers geographical differences in the effective economic study area at differing phases of development and operations of the reservoir. Therefore, the economic impacts of each development phase cannot be considered additive.

- Construction of the dam to impound the proposed Marvin Nichols Reservoir will cost in excess of $760 million, including work conducted to address required environmental mitigation strategies. The effective economic geography for this work includes the counties surrounding the proposed reservoir plus Bowie and Morris counties since it is expected that these counties will supply workers for the construction project. Construction of the dam and related infrastructure will boost local area economic activity by more than $1.2 billion during the multi-year project. This activity will increase gross regional product by over $545 million and support well over 8,200 person years of employment, boosting labor earnings by $396 million. A person-year of employment is one job lasting for one year and is the most accurate way to describe job impacts from projects that last more than one year.

- This proposed water resource development project also includes building a new raw water transmission pipeline from the reservoir to facilities in the Dallas-Fort Worth Metroplex. The related construction activities will occur in Collin, Delta, Denton, Fannin, Franklin, Hopkins, Hunt, Red River, Titus and Wise counties. Total spending for materials, services, and the purchase of right-of-way and other construction and permitting-related activities will exceed $3 billion. Building the water transmission pipeline will temporarily boost regional economic activity by $3.8 billion, increase gross regional product by about $2.4 billion, and support almost 26,000 person-years of employment paying almost $1.7 billion in salaries, wages, and benefits.

- On-going annual expenditures for operations and maintenance of the dam will boost economic activity in nearby counties. We estimate that recurring annual maintenance and operations spending to support the Marvin Nichols Reservoir will increase local economic activity by $39.9 million per year, expressed in constant 2020 dollars, and increase local labor income by $12.6 million through the creation of 289 direct, indirect, and induced jobs.

- Operations and maintenance of the transmission pipeline will spread across a wider region and will include water district employees based in Dallas and Fort Worth. The annual economic impact of maintenance and operations spending for the pipeline and related infrastructure will boost regional economic activity by $81.1 million, increase gross regional product by $46.8 million, and support 216 direct, indirect, and induced jobs paying more than $17.7 million in salaries, wages and benefits.

- Once the lake is impounded, the surrounding counties will attract new investment and spending for commercial and residential properties, as well as spending by visitors who will enjoy lake-based recreational activities. We expect the local area to see 2,000 new residential units constructed, as well as commercial facilities such as campgrounds, lodging venues, marinas, restaurants and similar businesses. Total investment in new residential and commercial properties will boost construction spending by more than $360 million over a 20-year period. This spending will increase local economic activity by more than $497 million, enhance labor income by $168 million, and support over 4,000 person-years of employment. On average that would be about 200 jobs per year, helping to create recurring economic opportunities in Franklin, Red River, and Titus counties.

- The housing that will be built near the new reservoir will include homes for full-time residents as well as vacation homes. New residents will be contributing about $30 million in annual regional spending by year 20. In addition, based on the experience of other Texas lakes, we estimate that annual visitor spending will be about $56 million per year. Combined, this new spending will increase local economic activity by almost $107 million per year, in 2020 dollars, and support more than 1,300 permanent jobs paying about $30 million in annual labor income.

- The presence of the proposed Marvin Nichols Reservoir will enhance the region's attractiveness for business location. As a recreational amenity, the lake will enhance the quality of life features of the region, which is an increasingly important factor in business site location decisions. Industries requiring reliable local water resources will also find new reasons to locate in the area.

- In addition to temporary gains in tax revenues associated with construction and project development activities, local taxing jurisdictions in the Lake Counties will enjoy new property tax revenues from adjacent residential and commercial developments, as well as recurring tax revenue associated with household and visitor spending. By year 20, we project that Lake Counties governments will share about $3.3 million in new property tax revenues and that local school district revenues will increase by over $6.6 million annually. Local jurisdictions' recurring annual revenues from new residents and visitors will be about $6 million per year, assuming visitor-focused commercial enterprises are located within a taxing jurisdiction.

- In addition to creating substantial growth and development opportunities in northeast Texas, building the Marvin Nichols Reservoir is paramount for the Dallas-Fort Worth Metroplex to sustain its competitive economic advantage over the long term. Continued population growth, and the ability to attract new and expanding businesses in key industries, is highly dependent on reliable water supplies.

Table ES1
Temporary Local Economic Impacts of Construction Activities
(2020 dollars)

Description	Impact ($2020, Direct, Indirect, Induced)
Dam Construction Impacted counties: Bowie, Franklin, Morris, Red River, Titus.	
Total Economic Activity (economic transactions)	$ 1,223,035,000
Total Value Added (gross regional product)	$ 545,522,235
Total Labor Income (salaries, wages, benefits)	$ 396,345,000
Total Employment (person-years of employment)	8,266
Indirect State Taxes	$ 18,357,000
Indirect Local Taxes	$ 15,661,000
Pipeline & Pump Station Construction Impacted counties: Collin, Delta, Denton, Fannin, Franklin, Hopkins, Hunt, Red River, Titus, Wise	
Total Economic Activity (economic transactions)	$ 3,830,050,000
Total Value Added (gross regional product)	$ 2,355,441,235
Total Labor Income (salaries, wages, benefits)	$ 1,667,439,000
Total Employment (person-years of employment)	25,921
Indirect State Taxes	$ 52,719,000
Indirect Local Taxes	$ 56,896,000
Housing and Commercial Construction Impacted counties: Franklin, Red River, Titus. Construction period: 20 years.	
Total Economic Activity (economic transactions)	$ 497,573,000
Total Value Added (gross regional product)	$ 236,857,235
Total Labor Income (salaries, wages, benefits)	$ 168,042,000
Total Employment (person-years of employment)	4,061
Indirect State Taxes	$ 7,315,000
Indirect Local Taxes	$ 8,191,000

Sources: Freese & Nichols, IMPLAN, Authors' estimates

Table ES2
Recurring Annual Local Economic Impacts
(2020 dollars)

Description	Impact ($2020, Direct, Indirect, Induced)
Dam Operations Impacted counties: Bowie, Franklin, Morris, Red River, Titus	
Total Economic Activity (economic transactions)	$ 39,877,000
Total Value Added (gross regional product)	$ 17,945,000
Total Labor Income (salaries, wages, benefits)	$ 12,569,000
Total Employment (headcount)	289
Indirect State Taxes	$ 605,000
Indirect Local Taxes	$ 516,000
Pipeline & Pump Station Operations Impacted counties: Collin, Dallas, Delta, Denton, Fannin, Franklin, Hopkins, Hunt, Red River, Tarrant, Titus, Wise.	
Total Economic Activity (economic transactions)	$ 81,106,000
Total Value Added (gross regional product)	$ 46,802,000
Total Labor Income (salaries, wages, benefits)	$ 17,701,000
Total Employment (headcount)	216
Indirect State Taxes	$ 2,477,000
Indirect Local Taxes	$ 2,588,000
Visitor and Resident Spending Impacted counties: Franklin, Red River, Titus	
Total Annual Household Income: New Permanent Residents	$ 58,300,000
Total Annual Household Income: New Weekend Residents (portion while in local area)	$ 8,162,000
Total annual spending: recreational visitors	$ 56,090,000
Total Economic Activity (economic transactions)	$ 106,906,000
Total Value Added (gross regional product)	$ 56,608,000
Total Labor Income (salaries, wages, benefits)	$ 29,957,000
Total Employment (headcount)	1,327
Indirect State Taxes	$ 4,455,000
Indirect Local Taxes	$ 4,827,000

Sources: Freese & Nichols, IMPLAN, Authors' estimates

ES3
Recurring Annual Fiscal Impacts of New Housing Developments and Resident and Recreational Out-of-Area Visitor Spending+

Description	Impact ($2020 Direct, Indirect, Induced)
Total Taxable Value of New Housing (permanent & weekend)	$ 408,000,000
Total Taxable Value of New Commercial Structures	$ 21,350,000
Total Increase in Taxable Land Values Adjacent and Near the Lake	$ 368,151,000
Net New Taxable Value (after removing lake & all mitigation land)	$ 539,794,000
Net# gain in county property tax revenues	$ 3,360,000
Net# gain in school district property tax revenues	$ 6.669.000
Other Local Government Revenue (taxes, fees, other)	$ 6,054,000

+ At buildout. # Net of losses to taxable property value of lake and environmental mitigation areas.
* Value will be impacted by land annexation and business location decisions.
Sources: Freese & Nichols, IMPLAN, Authors' estimates

Section 1: Introduction

The following updates our 2003 analysis of the economic, fiscal and developmental impacts of the proposed Marvin Nichols Reservoir. The proposed reservoir will be located in Franklin, Red River, Titus counties in the Sulphur River basin of northeast Texas about 16 miles north of the city of Mount Pleasant. The project also includes a major investment in new pipeline infrastructure that will cross several counties from Red River County to north central Texas. The creation of a new large reservoir will bring temporary and recurring economic activity to the host regions from the reservoir and related pipeline, and it will also support economic development in localities near the reservoir and for communities gaining access to a new reliable source of water.

We begin our report with an overview of the regional economy in the three counties immediately surrounding the proposed reservoir including Franklin, Red River, and Titus counties, hereinafter referred to as the "Lake Counties." Section 3 describes the methodology used in this analysis. Section 4 presents the findings of our analysis of the temporary economic impacts that will attend the construction of the dam to impound the proposed reservoir, the water transmission pipeline and associated infrastructure. In addition, these temporary impacts include an assessment of the economic benefits from construction spending on new residential and commercial properties as the lake attracts households and business investment to the region. Section 5 discusses how on-going operations of the dam, pipeline, and spending by visitors and new residents around the reservoir will impact area economic activity and revenues for local taxing jurisdictions. Section 6 considers how increasing the availability of reliable water supplies will impact development opportunities in Region C that can create positive economic spillover effects across the state. Finally, Section 7 offers our conclusions.

Section 2: Economic Overview of the Host Counties Region

As noted, the proposed reservoir will cover parts of Franklin, Red River, and Titus counties in northeast Texas. According to the most recent data from the U.S. Census Bureau (five-year estimate 2014-2018), the resident population of this region is 55,684. The population has recently been growing at about 0.3 percent per year, on average, which is less than half the national annual population growth rate of 0.7 percent. The region has slightly higher proportions of the population under the age of 18 and 65+ years of age, which is reflected in the region's labor force participation rate at 59.3 percent versus the national average of 62.3 percent. Median annual household income in the Lake Counties region also trails the U.S. at $45,646 and $60,293, respectively. Unsurprisingly, the poverty rate in the Lake Counties is 2.8 percent higher than the national average of 14.1 percent. However, housing costs are comparably affordable with a median value of owner-occupied dwellings being $97,585, less than half the U.S. median, while the local cost of living is about 13 percent below the national average. Still, total area cost of living adjusted household purchasing power in this region is almost 25 percent below the national average.

While the percentage of working age adults possessing a college degree is lower than the national average, the workforce data suggests there is a good supply of workers with at least basic skills. As of the fourth quarter of 2019, total jobs in the Lake Counties region had grown to 24,743, a 4.9 percent year-over-year increase. The area unemployment rate of 4.2 percent is higher than the

national average but has dropped by one-half percent over the past year, as of January 2020.[1] Average wages of the jobs in the Lake Counties was $37,882 in 4Q2019 with a 2.1 increase over the preceding year. Table 1 below shows the ten largest industry sectors by jobs. The regional economy, particularly Franklin and Titus counties, has historically been built around Pilgrim's Pride's poultry processing operations and related agricultural and transportation activities. The region also has a concentration in transportation equipment manufacturing (trailers). Because of a somewhat older population, social services providers and residential care facilities are also important regional employers.

Table 1: Top Ten Industries by Employment, Lake Counties Region (4Q2019)

NAICS	Industry	Jobs	Avg Annual Wages	5-Year Job Change
311	Food Manufacturing	3,860	$41,498	156
611	Educational Services	2,249	$35,193	-156
621	Ambulatory Health Care Services	1,616	$44,852	255
722	Food Services and Drinking Places	1,478	$16,850	163
336	Transportation Equipment Manufacturing	1,071	$56,739	102
112	Animal Production and Aquaculture	1,006	$26,563	50
622	Hospitals	856	$49,495	302
493	Warehousing and Storage	813	$32,382	-29
624	Social Assistance	797	$14,308	500
623	Nursing and Residential Care Facilities	739	$26,487	-133

Source: JobsEQ, Chmura Economics.

Overall, due to the on-going influence of the poultry industry, and a few other key employment sectors, the Lake Counties regional economy is doing relatively well, especially for an area outside a major metropolitan market. But with population growth slowing, the counties that will host the proposed Marvin Nichols Reservoir need to attract new residents and investment. Importantly, over the past several years it has become clear that the region needs to diversify its economic base and bring in new sources of business and household spending. The addition of a major recreational amenity can help attract commercial development and households to the Lake Counties region, bringing new spending and economic opportunity for current and new area residents. In the following sections we provide estimates of the magnitude of this new regional economic activity.

Section 3: Overview of Methodology

In assessing the economic impacts of new spending related to the proposed Marvin Nichols Reservoir, we rely on data provided by Freese and Nichols (FNI), a professional engineering and planning firm, and the IMPLAN economic input-output model.

[1] At the time this report is being written we are just beginning to see the profound, and hopefully short-term, impacts the COVID-19 pandemic is having on U.S. labor markets.

The data provided to Clower and Associates is based on planning data and costs for the recommended strategy developed in accordance with state and regional water supply planning rules administered by the Texas Water Development Board (TWDB). This strategy assumes the Marvin Nichols Reservoir would have a conservation elevation of 328 feet mean sea level, a surface area of about 66,100 acres, and require approximately an equivalent number of acres for mitigation. The sponsors of the recommended project include NTMWD, TRWD and UTRWD. This project is an alternate strategy for Dallas Water Utilities (DWU) and therefore, associated transmission and operations spending by DWU related to water from the Marvin Nichols Reservoir is not included in this study. Land costs for both the reservoir and mitigation lands were obtained from the Lake Counties' tax assessors' offices.

The IMPLAN model is a planning tool that estimates how spending in a given sector of the economy flows through regional industries and households. The IMPLAN model is widely used in academic and professional research. The model provides estimates of direct, indirect and induced impacts of new spending. Direct impacts are those made by the companies, agencies or individuals who are the subject of the study, such as a water district engaging in new resource investments for planning, designing and building the dam and related infrastructure to create a new reservoir. Indirect effects capture the economic activity associated with the supply chain of the business/agency who is doing the spending. In this case, a water district hires a construction contractor who in turn buys materials and supplies, rents equipment, and makes other purchases of goods and services. The equipment rental company purchases equipment, buys parts, and hires an accounting service to prepare their tax filings. The accountant hires bookkeepers, rents office space and pays a janitorial service to clean the office, and so on. The model adjusts the spending to account for items that are not likely to be sourced from local vendors. For example, there are no petroleum refineries in the Lake Counties region, so the money used to purchase fuel for earthmovers would largely "leave" the regional economy. Induced effects are related to employees of all these firms spending a portion of their earnings in the regional economy for goods and services. The model provides estimates of total economic activity (business transactions), value added (gross regional product), employment (headcount jobs), and labor income (salaries, wages, and benefits). IMPLAN models also offer estimates of revenue that is generated by the indirect and induced economic activity for state and local jurisdictions. These revenues include sales and use taxes, property taxes, fees and other sources.

Because the IMPLAN model adjusts for spending that stays in a particular region, it is important to appropriately define the study area. Due to the varying geographic scale of the project components in creating the Marvin Nichols Reservoir, we use multiple study geographies in this research. Table 2 summarizes the geographies used for each research component. By convention, the study region will always include the location of physical activity, such as building the dam or pipeline, but can also be expanded to account for area labor markets.

Table 2: Study Geographies for Economic Modeling

Research Component	Counties	Notes
Dam Construction and Operations	Bowie, Franklin, Morris, Red River, Titus	Because of the location of the dam, we expect that contractors will draw some workers from Morris and Bowie counties.
Pipeline Construction	Collin, Delta, Denton, Fannin, Franklin, Hopkins, Hunt, Red River, Titus, Wise	Reflects the pipeline's path.
Pipeline Operations	Collin, Dallas, Delta, Denton, Fannin, Franklin, Hopkins, Hunt, Red River, Tarrant, Titus, Wise	Pipeline and base location for water district employees.
New Commercial Operations & Households	Franklin, Red River, Titus	Core activities based at the new reservoir.

Source: FNI, Authors' estimates

In addition to geography, we also consider the nature of the spending. Construction spending is temporary by nature. The impacts may be large, but once the dam and pipeline are built, that spending and its related economic impacts cease. The temporary nature of construction spending requires one important change in the way we report job impacts. The construction of the dam and pipeline will take a few years to complete. Therefore, the job impacts from construction and related spending are expressed as person-years of employment, one job lasting for one year. If the employment impact were 500 person years of employment, and the project lasted for 5 years, that would suggest that the average annual employment impact would be 100 jobs. Since we do not know exactly how long the construction of the dam and pipeline will take, we present the jobs impacts as total person-years of employment for the entire project. Other key assumptions used in estimating the economic impacts of specific project components will be described in the relevant sections of this report.

Section 4: Economic Impacts of Construction Activities

Because the effective geography of impact is different across the reservoir development components and stages, we separate the discussion of our findings into three sub-sections: dam construction, pipeline construction, and the building of new commercial and residential properties near the new reservoir.

Dam Construction

Construction of the dam to impound the proposed Marvin Nichols Reservoir will cost in excess of $760 million, including work conducted to prepare required environmental mitigation areas. This spending includes project planning, design work, environmental studies and other outlays. However, to take a conservative approach in considering the potential regional impacts, we have adjusted some spending categories. For this project component we do not include budgeted contingency costs and interest costs during construction. Budgeted contingency costs, while in

practice are often actually spent, are not guaranteed spending so we do not include them in our economic impacts. Interest costs are the temporary borrowing costs incurred during construction. At the time of this analysis we do not know what entity or entities will be used for these financial services, so we do not know if any of those costs are relevant to the study area. In addition, we only include a portion of the costs to resolve conflicts and acquire land for the reservoir and mitigation area. Of the costs allocated for resolving conflicts, we assume that no more than 10 percent of these expected expenditures will be spent in the study area. Finally, our assessment of the economic impacts of construction spending include land acquisition costs. Based on data provided by FNI, we allocated land acquisition costs between the dam and pipeline construction projects. We assumed that no more than 50 percent of the monies paid for land acquisition would go to local landowners. We then modeled the reduced land acquisition spending as income to area households that would be spent in the regional economy. Combined, it is likely our exclusion of several categories of expenditure will result in estimates understating the total potential economic impact associated with building the proposed dam and related infrastructure.

Construction of the dam and related infrastructure will boost local area economic activity by more than $1.2 billion during this multi-year project (see Table 3). This activity will increase gross regional product by over $545 million and support well over 8,200 person years of employment, boosting labor earnings by $396 million. Area taxing jurisdictions will share more than $15.6 million in new revenues due to building the proposed dam and related economic activities.

Table 3: Temporary Local Economic Impacts of Dam Construction

Description	Impact ($2020 Direct, Indirect, Induced)
Dam Construction Impacted counties: Bowie, Franklin, Morris, Red River, Titus.	
Total Economic Activity (economic transactions)	$ 1,223,035,000
Total Value Added (gross regional product)	$ 545,522,235
Total Labor Income (salaries, wages, benefits)	$ 396,345,000
Total Employment (person-years of employment)	8,266
Indirect State Taxes	$ 18,357,000
Indirect Local Taxes	$ 15,661,000

Sources: Freese & Nichols, IMPLAN, authors' estimates.

Pipeline Construction

This proposed water resource development project also includes building a new transmission pipeline from the reservoir to facilities in the Dallas-Fort Worth region. The related construction activities will occur in Collin, Delta, Denton, Fannin, Franklin, Hopkins, Hunt, Red River, Titus and Wise counties, which serve as the economic region for this component of our analysis. Total spending for materials, services, and the purchase of right-of-way, combined with other construction and permitting-related spending, will exceed $3 billion. As noted above, we do not include more than 10 percent of projected conflict costs, any of the budgeted financing or contingency costs, and we assume that only half of land and right-of-way acquisition expenses will go to study area households.

Building the water transmission pipeline will temporarily boost regional economic activity by $3.8 billion, increase gross regional product by about $2.4 billion, and support almost 26,000 person-years of employment paying almost $1.7 billion in salaries, wages, and benefits (see Table 4). Local government entities in the study area, combined, will receive an estimated $56.9 million in new revenues from taxes, fees and other government revenue sources.

Table 4: Temporary Local Economic Impacts of Pipeline Construction

Description	Impact ($2020 Direct, Indirect, Induced)
Pipeline & Pump Station Construction Impacted counties: Collin, Delta, Denton, Fannin, Red River, Wise	
Total Economic Activity (economic transactions)	$ 3,830,050,000
Total Value Added (gross regional product)	$ 2,355,441,235
Total Labor Income (salaries, wages, benefits)	$ 1,667,439,000
Total Employment (person-years of employment)	25,921
Indirect State Taxes	$ 52,719,000
Indirect Local Taxes	$ 56,896,000

Sources: Freese & Nichols, IMPLAN, authors' estimates.

New Commercial and Residential Construction

Once the reservoir is impounded and begins to fill, we expect substantial new residential and commercial development to be attracted to the lake. In developing our estimates of total potential housing and commercial property development we referenced multiple studies examining the impacts of reservoirs on their local communities. However, we focused our attention on a recent study[2] that examined the development of properties near several lakes in the "upper highland" area of central Texas. These lakes are Colorado River fed reservoirs including Buchannan, Inks, LBJ, Marble Falls, and Travis. Recognizing there are notable socio-economic and population density variances across these reservoirs, we focused our attention of those lakes that are further away from population centers. We also noted that these reservoirs are much smaller than the proposed Marvin Nichols Reservoir, but we chose not to simply scale-up the development impacts of the Upper Highlands Lakes based on relative surface area. We did use this study to inform our estimates of the value of new commercial and residential properties that we then tailored to the MNR study area.

Importantly, we do not attempt to forecast the specific timing of new commercial and residential property development in the Lake Counties. There are many environmental, socio-economic and regulatory factors that will influence the pace of new development. These include rainfall levels after impoundment, overall economic conditions, the permitting and development of supporting infrastructure, and the strategies employed by local government to plan and manage this potential growth. For purposes of this analysis, we have assumed development will occur over a 20-year

[2] The study can be accessed at: https://www.co.llano.tx.us/upload/page/0978/docs/Economic%20Impact%20Of%20The%20Upper%20Highland%20Lakes%20Of%20The%20Colorado%20River%20-%20Fall%202012%20(2).pdf

period after reservoir impoundment. We feel we have been conservative in both this timeline and our projections of development potential. We took this conservative approach specifically to show that even with careful management that keeps the pace of development in line with local government capacity to deliver services, there is tremendous economic potential for the Lake Counties region. Moreover, our assessment does not include the value of growth that will likely happen after this initial development period.

We expect the local area will attract 2,000 new residential units as well as commercial facilities such as campgrounds, lodging venues, marinas, restaurants and similar businesses. This new development activity will likely show up as a surge of initial investment, followed by market-driven growth over a twenty-plus year time horizon. The housing units will have an average value, not including land, of about $170,000 per unit, suggesting the Lake Counties will remain relatively affordable compared to the state's major metropolitan areas. Total investment in new residential and commercial properties will boost construction spending by more than $360 million over this extended time period. This spending will increase local economic activity by more than $497 million, enhance labor income by $168 million, and support over 4,000 person-years of employment (see Table 5). On average that would be about 200 jobs per year, creating recurring economic opportunities in Fannin, Red River, and Titus counties. New revenues to local tax jurisdictions related specifically to these construction activities will be $8.1 million.

Table 5: Temporary Local Economic Impacts of New Commercial and Residential Property Construction

Description	Impact ($2020 Direct, Indirect, Induced)
Housing and Commercial Construction Impacted counties: Franklin, Red River, Titus. Construction period: 20 years.	
Total Economic Activity (economic transactions)	$ 497,573,000
Total Value Added (gross regional product)	$ 236,857,235
Total Labor Income (salaries, wages, benefits)	$ 168,042,000
Total Employment (person years of employment)	4,061
Indirect State Taxes	$ 7,315,000
Indirect Local Taxes	$ 8,191,000

Sources: Freese & Nichols, IMPLAN, authors' estimates.

Section 5: Recurring Economic Impacts of Marvin Nichols Reservoir

Recurring economic impacts of the proposed Marvin Nichols Reservoir include four separate types of spending: operations and maintenance of the dam, operations of the water transmission pipeline, household spending by new permanent and weekend residents, and visitor spending by non-residents. As noted previously, the operations of the dam, pipeline and new commercial and household spending will impact different regions.

Dam Operations

As with the construction of the dam, we expect employment and supplier opportunities for dam maintenance and operations to be concentrated in Bowie, Franklin, Morris, Red River and Titus counties. We estimate that recurring annual maintenance and operations spending to support the Marvin Nichols Reservoir will increase local economic activity by $39.9 million per year, expressed in constant 2020 dollars, and boost local labor income by $12.6 million through the creation of 289 direct, indirect, and induced jobs (see Table 6). Tax revenues for local governments will total $516,000 per year.

Table 6: Recurring Annual Local Economic Impacts

Description	Impact ($2020 Direct, Indirect, Induced)
Dam Operations Impacted counties: Bowie, Franklin, Morris, Red River, Titus	
Total Economic Activity (economic transactions)	$ 39,877,000
Total Value Added (gross regional product)	$ 17,945,000
Total Labor Income (salaries, wages, benefits)	$ 12,569,000
Total Employment (headcount) (190 direct jobs)	289
Indirect State Taxes	$ 605,000
Indirect Local Taxes	$ 516,000

Sources: Freese & Nichols, IMPLAN, authors' estimates.

Pipeline Operations

Operations and maintenance expenditures for the pipeline will spread across the counties where the infrastructure is located and will also include Dallas and Tarrant counties, since some of the operations and maintenance work will be performed by employees based at headquarters of the North Texas Municipal Water District and the Tarrant Regional Water District. The annual economic impacts of maintenance and operations spending include boosting regional economic activity by $81.1 million, increasing gross regional product by $46.8 million, and supporting 216 direct, indirect, and induced jobs that will pay more than $17.7 million in salaries, wages and benefits (see Table 7). New tax and other revenues to local jurisdictions will increase by $2.6 million per year.

Table 7: Recurring Annual Local Economic Impacts

Description	Impact ($2020 Direct, Indirect, Induced)
Pipeline & Pump Station Operations Impacted counties: Collin, Dallas, Delta, Denton, Fannin, Franklin, Hopkins, Hunt, Red River, Tarrant, Titus, Wise	
Total Economic Activity (economic transactions)	$ 81,106,000
Total Value Added (gross regional product)	$ 46,802,000
Total Labor Income (salaries, wages, benefits)	$ 17,701,000
Total Employment (headcount) (90 direct jobs)	216
Indirect State Taxes	$ 2,477,000
Indirect Local Taxes	$ 2,588,000

Sources: Freese & Nichols, IMPLAN, authors' estimates.

Household and Visitor Spending

For this component of our analysis we focus on the economic and tax revenue impacts that will occur in the Lake Counties of Franklin, Red River, and Titus. In this preliminary assessment we do not attempt to forecast specific locations for the projected commercial and residential property development, which may prove to be unrelated to the amount of lake shoreline in each county.

The economic impact of new residents is based on household spending in the Lake Counties region. Our key assumptions in this analysis address average household income, the proportion of new households that are permanent versus weekend/vacation residents, and the number of days in residence for weekender households. We have assumed the average household income for new residents will be a little over $58,000 per year, which is higher than that of current residents. Our estimate is based on the level of income needed to afford the type of housing that will likely be built around the lake, acknowledging that some new residents will be retirees who have lower incomes but higher levels of assets. Some owners of vacation properties will have higher income levels but will not have proportionately higher levels of local spending. To illustrate this last point, we would assume that weekend/vacation residents would bring in some retail items like groceries with them, suggesting their proportional local household spending will be lower than permanent residents. We assumed that half of the 2,000 new households added over a 20-year period will be weekend/vacation residents who will spend an average of 51 days per year in-residence.

We modeled the economic impacts of new household spending at the projected 20-year build-out using the household spending module of the IMPLAN model. The model adjusts household consumption for total income, recognizing the relative wealth affects in spending patterns.

Our estimates of visitor spending are further informed by the previously referenced study of the economic impacts of the Upper Highlands lakes in central Texas and data from the Texas Governor's Office of Economic Development and Tourism. Using hotel receipts data from counties with a reservoir in the Upper Highlands, and adjusting for overall development density,

we estimated that at full development spending by visitors on lodging near the Marvin Nichols Reservoir will approach $20 million per year. This includes both hotel properties and receipts from vacation homes and AirBNB-type rentals. Using overall tourism spending data, we estimated other categories of visitor outlays including food and beverages, retail purchases, and local travel expenditures, which we modeled as purchases at gas stations for automobiles and boats. Our estimates suggest that at full development, visitors will bring about $56 million in new spending to the Lake Counties region.

When combined with household spending by new permanent and weekend residents, recurring annual economic activity in the Lake Counties region will increase by almost $107 million, boosting gross regional product by $56.6 million, generating almost $30 million in new labor income, and supporting over 1,300 jobs in the local economy (see Table 8). Taxes on the indirect and induced economic activity will add $4.8 million to annual revenues for local taxing jurisdictions.

Table 8: Recurring Annual Local Economic Impacts

Description	Impact ($2020, Direct, Indirect, Induced)
Visitor and Resident Spending Impacted counties: Franklin, Red River, Titus	
Total Annual Household Income: New Permanent Residents	$ 58,300,000
Total Annual Household Income: New Weekend Residents	$ 8,162,000
Total annual spending: recreational visitors	$ 56,090,000
Total Economic Activity (economic transactions)	$ 106,906,000
Total Value Added (gross regional product)	$ 56,608,000
Total Labor Income (salaries, wages, benefits)	$ 29,957,000
Total Employment (headcount)	1,327
Indirect State Taxes	$ 4,455,000
Indirect Local Taxes	$ 4,827,000

Sources: Freese & Nichols, IMPLAN, authors' estimates.

Recurring Revenues for Local Tax Jurisdictions

The combination of new property development, resident household spending, and visitor spending will have an impact on direct tax receipts in addition to the taxes paid on economic activities described in previous sections of this report. What is more, land values, especially for those properties located adjacent to the new reservoir, should increase significantly based on the experiences of other Texas counties not located immediately adjacent to a major metropolitan area. (For example, we did not consider land values around Lake Travis to be relevant to this analysis.) We estimate that the construction of 2,000 new residential units, along with higher land values on residential-sized lots, will increase total taxable values of residential properties in the Lake Counties by $408 million by year 20. In addition, larger properties and those not immediately converted to residential lots will see a substantial increase in value when they become waterfront, water view, or near waterfront properties totaling $368 million. Our estimates include an allowance

for homestead exemptions for permanent residents. New taxable commercial property value is estimated to be $21 million.

An important consideration in assessing the increase in area property taxes is accounting for the loss of value associated with the lake's footprint and the required environmental mitigation area. Using data gathered by FNI, and assuming that all the mitigated land will be in the Lake Counties, the creation of Marvin Nichols Reservoir will remove about $257 million in property values. This assumption likely overstates the loss of property value in the Lake Counties area since the final mitigation area may be smaller and located at least partially outside the area. Still, even if we maximize the assumed mitigation related property losses and use conservative projections of development, the net gain in taxable property values at year 20 will be almost $540 million (see Table 9). In assessing the tax revenues that will be generated, we have used an average current tax rate for jurisdictions in the Lake Counties area. We again caution that, in this preliminary assessment, we do not know exactly where the new development will be located within the study area. Based on these valuation assumptions, we expect the Lake Counties to share an additional $3.4 million in annual property tax revenues by year 20. Area school districts will see about $6.7 million in new property taxes each year.

Visitor and household spending will also generate new sales tax revenues in the Lake Counties region. We assume that as commercial and residential development occurs, local jurisdictions will look to expand their effective taxing jurisdictions and/or the counties will use their existing or new authority to tax hotel revenues. Adjusting visitor spending for sales that will likely be taxable, we estimate that annual local sales and hotel occupancy taxes will increase by $1.2 million. Overall, total tax revenues associated with recurring household and visitor spending, in addition to direct property tax payments, will reach $6 million per year as lake properties develop.

Table 9: Recurring Annual Fiscal Impacts

Description	Impact ($2020 Direct, Indirect, Induced)
Total Taxable Value of New Housing (permanent & weekend)	$ 408,000,000
Total Taxable Value of New Commercial Structures	$ 21,350,000
Total Increase in Taxable Land Values Adjacent and Near the Lake	$ 368,151,000
Net New Taxable Value (after removing lake & all mitigation land)	$ 539,794,000
Net# gain in county property tax revenues	$ 3,360,000
Net# gain in school district property tax revenues	$ 6,669,000
Other Local Government Revenue (taxes, fees, other)	$ 6,054,000

+ At 20 years. # Net of lake and environmental mitigation areas. Sources: FNI, IMPLAN, Authors' estimates

Section 6: The Developmental Impacts of the Marvin Nichols Reservoir on Region C and the Consequences of a "No Build" Scenario

In this analysis we examine how increasing the effective water supply by building the Marvin Nichols Reservoir will sustain economic growth and opportunities in North Central Texas and especially in the Dallas-Fort Worth area, a major driver of overall economic growth and resiliency in Texas. In assessing these impacts, it is essential to review how the planning and investment for water resources has allowed Texas to emerge over the past 40 years as a premier state attracting new residents and business investment.

Water and regional economic development

It almost goes without saying that access to clean water is an economic driver. Conversely, scarce water, either in terms of quantity or quality, will become a key limiting factor in regional economic growth. Since North Texas does not have any natural lakes of significant size, reservoirs are constructed to control flooding and to collect and store surface water to meet regional water supply needs. Without question, the huge economic success of the North Texas region over the past 70 years would not have occurred absent access to abundant, available and affordable water supplies for residential and industrial use—accomplished by building an extensive network of reservoirs. The proposed Marvin Nichols Reservoir Project is but an extension of that function.

Gone to Texas

Texas, now America's second largest state with a population more than 29 million, has been America's economic bellwether for the past several decades. No other large state comes close in terms of population growth, job creation, and business formation. Net migration to Texas has totaled nearly 2 million over the past decade and shows no signs of abating. Moreover, for years Texas has ranked first in the nation for corporate relocations and expansions.

According to the U.S. Census Bureau, between July 2018 and July 2019, Texas had the largest numeric growth among the 50 states, adding 367,215 people. By contrast, California—with a population about one-third larger than Texas—added only 50,635. Put differently, **Texas is currently growing seven times faster than California.** Texas grew both from more births than deaths and from a large net gain in movers from within and outside the United States. In percentage terms, Texas' population grew 1.3 percent last year, nearly twice the national rate of 0.7 percent. California's growth rate has been falling for nearly a decade and just equaled the national average last year.

The Census Bureau also recently reported that of the nation's 15 fastest-growing counties in terms of numeric population change, eight are in Texas while California only recorded one. What is more, three of the **top five fastest-growing cities** in numeric terms are found in Texas—San Antonio**, Dallas and Fort Worth**. Indeed, over the past decade Dallas-Fort Worth has added 1.2 million residents, **the most of any U.S. metropolitan area.** Seven of the 15 fastest-growing cities

in percentage terms last year are here in Texas. **Last year, Frisco, Texas grew at 8.2 percent, 11 times faster than the national average.**

Unlike in many other states, net-migration into Texas has accounted for a large share of the state's population growth over the past decade. According to the U.S. Bureau of the Census, net-migration to the state has averaged about 200,000 annually over the past decade. California sends more migrants to Texas than to any other state. Of total net out-migration of 521,000 between 2012 and 2016, more than 114,000 Californians relocated to Texas. Cities that had once been popular destinations for young people—in particular, New York, Los Angeles and Chicago—are now losing residents in large numbers. Last year alone, New York City registered a loss of more than 60,000 people, the biggest population decline of any American city. Many of those "out-migrants" chose to relocate to the Dallas area.

Another indicator of Texas' magnetic pull is the inflow of U-Haul vehicles. In 2018, for the third year in a row, Texas led the nation in "net inflow" of trucks and trailers. Locations in Houston, **Dallas-Fort Worth** and Austin saw the **largest influxes of U-Haul traffic**. Illinois, California and Michigan saw the largest "net outflow" of U-Hauls. Most migrants to Texas locate in the state's large metropolitan areas. In 2017, according to an analysis of Census data by Bloomberg, **Dallas-Fort Worth led the nation in net in-migration, with 246 more people moving into the region than out every day.**

Migration to Texas is partly due to a record number of business relocations from other states. Toyota's move from Torrance, California to Plano and PGA America's relocation from Palm Beach Gardens, Florida to Frisco have garnered the most attention. But a steady stream of small and middle-sized companies to the state has also spurred the in-migration of people. According to a recent analysis by Spectrum Location Solutions, Texas is the number one destination for California companies relocating to other states. In 2016 alone, 299 of these departures landed in Texas. The Dallas Regional Chamber reports that 43 of the 123 corporate headquarters that have relocated to Dallas-Fort Worth since 2010 came from California.

Employment trends

Job gains in Texas have been nothing short of remarkable in recent years. Over the past decade, total state employment has jumped by more than two million, or 18.3 percent, compared to a 5.6 percent increase for the nation. No other large state comes close. Indeed, Pennsylvania, Illinois and Ohio actually lost jobs over the decade. Incredibly***, one of every four U.S. jobs created over the past ten years has been in Texas.***

Demographic and employment changes in North Central Texas

Within the state of Texas, Dallas-Fort Worth has been the economic superstar over the past decade. As mentioned above, the North Texas region attracts the largest numbers of immigrants and the lion's share of corporate relocations. This population growth is occurring in cities that touch all three of the region's water districts sponsoring the Marvin Nichols Reservoir Project, North Texas

Municipal Water District (NTMWD), Tarrant Regional Water District (TRWD), and the Upper Trinity Regional Water District (UTRWD) plus Dallas Water Utilities (DWU).

As indicated in Tables 10 & 11, the North Central Texas Region (as defined by the North Central Texas Council of Governments) added about 830,000 residents between 2010 and 2019 for a population gain of 14 percent, or a 1.5 percent compounded average. But many of the cities grew at a much faster pace. Frisco and McKinney were the fastest-growing large cities served by NTMWD, adding 57 percent and 44 percent to their populations over the nine-year period. Plano, the largest municipality in the service area, grew more slowly than the region—mainly because the city is already close to its build-out potential. Frisco is the fastest growing city in America among places with a population of 50,000 or more. Over the past two years, the city's population grew by more than 22,000, or 14 percent. That's a growth rate 11 times faster than the national average. Some of the smaller cities grew at astronomical rates between 2010 and 2019. Melissa and Prosper posted triple-digit percentage gains while Princeton, Forney, and Little Elm grew four to five times faster than the region.

TABLE 10: Fastest Growing North Texas Cities by Count: 2010-2019

	2010	2019	Change	% Change	CAGR*
Fort Worth	741,206	848,860	107,654	14.5%	1.5%
Dallas	1,197,816	1,301,970	104,154	8.7%	0.9%
Frisco	116,989	183,560	66,571	56.9%	5.1%
McKinney	131,117	188,500	57,383	43.8%	4.1%
Plano	259,841	284,070	24,229	9.3%	1.0%
Irving	216,290	240,420	24,130	11.2%	1.2%
Denton	113,383	134,460	21,077	18.6%	1.9%
Arlington	365,438	386,180	20,742	5.7%	0.6%
Little Elm	25,898	44,530	18,632	71.9%	6.2%
Carrollton	119,097	136,170	17,073	14.3%	1.5%
Grand Prairie	175,396	191,720	16,324	9.3%	1.0%
Prosper	9,423	25,630	16,207	172.0%	11.8%
Allen	84,246	99,020	14,774	17.5%	1.8%
Richardson	99,223	113,710	14,487	14.6%	1.5%
Midlothian	18,037	32,100	14,063	78.0%	6.6%
N. Central Texas Region	5,927,539	6,755,320	827,781	14.0%	1.5%

* Compounded Annual Growth Rate Source: North Central Texas Council of Governments

TABLE 11: Fasting Growing North Central Texas Cities by Percent Change: 2010-2019

	2010	2019	Change	% Chng	CAGR
Celina	6,028	17,680	11,652	193.3%	12.7%
Prosper	9,423	25,630	16,207	172.0%	11.8%
McLendon-Chisholm	1,373	3,470	2,097	152.7%	10.9%
Northlake	1,724	4,140	2,416	140.1%	10.2%
Fate	6,434	14,940	8,506	132.2%	9.8%
Melissa	4,695	10,820	6,125	130.5%	9.7%
Annetta	1,288	2,780	1,492	115.8%	8.9%
Josephine	812	1,550	738	90.9%	7.4%
Princeton	6,807	12,680	5,873	86.3%	7.2%
Anna	8,249	15,010	6,761	82.0%	6.9%
Midlothian	18,037	32,100	14,063	78.0%	6.6%
Aubrey	2,595	4,530	1,935	74.6%	6.4%
Lavon	2,219	3,860	1,641	74.0%	6.3%
Little Elm	25,898	44,530	18,632	71.9%	6.2%
Ponder	1,395	2,390	995	71.3%	6.2%

* Compounded Annual Growth Rate Source: North Central Texas Council of Governments

Employment and business development trends in North Central Texas

As discussed above, Texas led the nation in job growth last year, adding 284,414 positions (2.1 percent) and bringing the state's unemployment rate down to 3.5 percent. For Dallas-Fort Worth, employment jumped by 109,647 (2.9 percent) and the unemployment rate fell to 2.9 percent. Put differently, **with about 24 percent of Texas' population, 38.6 percent of all the job growth in the state occurred in North Central Texas**. Office jobs in the Dallas-Fort Worth Metroplex grew 5.7 percent in 2019, more than in the tech markets of San Francisco and Seattle, and the region is forecast by CBRE to lead again in 2020.

Job growth is being seen in core cities and suburban markets. For example, Frisco has been adding jobs at a rapid clip as many businesses and corporate headquarters have relocated to the city. According to the U.S. Bureau of Labor Statistics, just in the past eight years Frisco's employment jumped from 64,000 to almost 93,000. That's about two-thirds the number of jobs located in downtown Dallas.

The entire North Texas region is becoming one of the most dynamic data center markets in the country. For instance, Compass Datacenters LLC maintains a huge processing facility in Allen. According to Cushman & Wakefield**, Dallas-Fort Worth is now the third-largest data center market in the world** with more than 80 megawatts of capacity currently under construction in North Texas. **Importantly, the availability of reliable water supplies is a key site location consideration in the placement of data centers**.

Logistics—the movement of people and products—is one of the largest industries in the North Central Texas region. In fact, the Dallas-Fort Worth area is the largest transportation and distribution center between the two coasts and employs several hundred thousand people.

Defense-related manufacturing, food processing, and the health care/hospital industry also rank among the largest employers in the region. **Both manufacturing and food processing require huge amounts of water.**

Corporate relocations continue apace in North Texas, with Uber and Charles Schwab perhaps the most notable in recent months. Boeing, Samsung, Fannie Mae, JP Morgan and USAA have recently undertaken expansions or relocations to Plano. Last year, PGA of American and Keurig Dr Pepper announced relocations of their corporate headquarters to Frisco. Frisco is also home to The Star, the huge retail, residential, office, hotel and sports complex developed by the Dallas Cowboys organization that has become a major employment center.

Other indicators point to a robust North Texas economy. Last year, Dallas-Fort Worth was the top homebuilding market in the country with 33,000 new homes. North Texas also leads the nation in overall home sales, up 21 percent over the past year. According to RealPage, North Texas is the leading rental construction market in the country with 43,000 units permitted to date for 2020. At $22.5 billion, Dallas-Fort Worth ranked second nationwide in total construction last year after New York City while the region attracted nearly $10.5 billion in commercial investments.

What may happen to the North Texas economy if Marvin Nichols is not built?

The North Texas region, including most of the communities served by the North Texas Municipal Water District, has witnessed an unprecedented economic boom over the past decade with record levels of population growth and job creation. The Dallas-Fort Worth area also receives more migrants from other states than any other metropolitan region in the U.S. Recent forecasts from the North Central Texas Council of Governments see this growth continuing for at least the next several decades.

By 2040, the region's population is projected to grow to 10.7 million people, or 58 percent. That's an annual average growth rate of almost 3 percent. Employment, currently at 3.9 million, is expected to reach 6.7 million by 2040, a 72 percent increase from today's levels. Because economic development tends to compound where it is already occurring, a sizeable share of Dallas-Fort Worth's population and employment growth will likely occur in the NTMWD, TRWD and UTRWD service areas. However, realizing this growth potential requires new water resources to be brought on-line. Other water development projects, including the new Bois d'Arc Lake and the Integrated Pipeline will help but is clearly not enough.

Another way to consider the potential effects of *not building* the proposed Marvin Nichols Reservoir is to look at the potential contributions of industries that are particularly reliant on water availability. We previously mentioned data centers and food processing as key examples of these kind of industries. Using data available in the IMPLAN model we can identify the industries in the Dallas-Fort Worth region who are especially sensitive to water availability based on the value of their consumption of this resource. Aside from electric power generation and the rapidly growing higher education sector, examples of industries that have notable water requirements include Pharmaceutical Manufacturing, Aerospace Products and Parts Manufacturing, and Semi-

Conductor Manufacturing. In the services sector we include hotels, restaurants and hospitals. Table 12 shows current employment and projected new jobs for these industries in the Dallas-Fort Worth Metropolitan Area. These are some of the industries Texas and Dallas-Fort Worth need to support in order to remain competitive in an increasingly globalized economy. In rough terms, if a lack of available water supply were to disrupt the projected job growth in just the six industries shown in Table 12, the region would lose $19 billion in annual economic activity, expressed in 2020 dollars, and more than 136,000 total jobs.

Table 12: Selected Water Dependent Industries: Dallas-Fort Worth Metropolitan Area

Industry	4Q2019 Jobs	Projected 10-Year Growth
Pharmaceutical Manufacturing	4,580	460
Semiconductors and Related Devices Manufacturing	21,982	456
Aerospace Products & Parts Manufacturing	35,534	350
Hospitals	106,344	14,714
Restaurants	284,486	66,831
Hotels	33,747	3,565

Source: IMPLAN, JobsEQ,

Section 7: Conclusions

The construction of the proposed Marvin Nichols Reservoir is an important component of the state's overall resource management plan **to support economic development across Texas**. The spending for planning and development of the reservoir will boost economic activity in northeast Texas, along the proposed pipeline route, and in Region C creating thousands of job opportunities for local workers. Importantly, the operations of the dam and the creation of a high-quality recreational amenity will bring well over $100 million in new economic activity to the host region and support more than 1,300 direct, indirect and induced jobs. This will help diversify the economic base of the Lake Counties, thereby enhancing regional economic resiliency. Local taxing jurisdictions will receive millions in temporary and recurring revenues, especially as property development occurs around the lake over the next 20 years.

From a broader economic development perspective, bringing additional water resources online is a necessary condition for Texas, and especially North Texas, to remain competitive in the quest for jobs, new residents, and investment. Marvin Nichols, and other water projects planned for the region, must come online in order to support the rapid population and employment growth projected for the next several decades. **In a "no build" scenario for the Marvin Nichols Reservoir, economic development in the North Texas region will be constrained, especially in the fast-growing communities currently served by participating Region C water providers.**