Marvin Nichols Reservoir Project Feasibility Review

Report to the Legislative Budget Board and Governor

TEXAS WATER DEVELOPMENT BOARD

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January 5, 2025

TEXAS WATER DEVELOPMENT BOARD

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Summary of Findings

As Rider 28 to House Bill 1 in 2023, the 88th Texas Legislature directed the Texas Water Development Board (TWDB) to conduct a project feasibility review to

> *"…evaluate the feasibility of the proposed Marvin Nichols Reservoir project to be located on the Sulphur River and upstream of the confluence of the White Oak Creek in Franklin, Titus, and Red River counties. The review shall analyze the implementation timeline, associated costs, land acquisition considerations, and the economic impact of the proposed project. A report regarding the findings of the review shall be prepared and submitted by TWDB to the Legislative Budget Board and Governor no later than January 5, 2025."* (Texas, 2023)

This report describes the TWDB's feasibility review of the proposed reservoir project, as conducted by TWDB staff, and summarizes its findings to inform the governor and legislature with respect to the four factors in the legislative directive.

Information solicited by the TWDB and received from the public in fall 2023 to support this specific effort, public comments on the draft report solicited in September and October 2024, as well as previously available information and documentation associated with the regional and state water planning processes, was reviewed. The following results are based on the relevant information available to the TWDB for this feasibility review of the Marvin Nichols Reservoir:

As related to the implementation timeline, the TWDB did not identify any basis to conclude that the implementation timeline for the Marvin Nichols Reservoir to be online in 2050 would render the project infeasible.

As related to associated costs, the TWDB did not identify any basis to conclude that the estimated costs of implementing the Marvin Nichols Reservoir would render the project infeasible.

As related to land acquisition considerations, the TWDB did not identify any basis to conclude that land acquisition requirements would render the project infeasible.

As related to the economic impact, the TWDB did not identify any basis to conclude that economic impacts associated with the project would render the project infeasible.

There are uncertainties associated with any large public infrastructure project, including related project costs and permitting, that will diminish as the sponsors advance the project from the planning phase through the implementation phases.

Introduction, Background, and Purpose of Report

Feasibility Review

A fundamental principle of the regional water planning process, established by the legislature in 1997 via Senate Bill 1 (SB1), has been that planning groups are required to identify potentially feasible projects for their plans. In this bottom-up process, planning groups are required to use common metrics to evaluate these projects, most of which are heavily informed by the water plans of regional and local water providers that will be responsible for implementing the projects. During the planning process, if a project reveals itself to be infeasible during the development of the regional water plans, the project is not recommended in the regional or state water plan. All projects evaluated and recommended in final regional water plans must be considered feasible.

Beyond this underlying, general expectation of project feasibility in the planning process, *infeasibility* has been defined in the Texas Water Code to address a specific issue, primarily related to temporal feasibility. For reference, the statutory definition of *infeasible*, as included in Texas Water Code (TWC) § 16.053(h)(10), is:

> *"For purposes of this subdivision a water management strategy or project is considered infeasible if the proposed sponsor of the water management strategy or project has not taken an affirmative vote or other action to make expenditures necessary to construct or file applications for permits required in connection with the implementation of the water management strategy or project under federal or state law on a schedule that is consistent with the completion of the implementation of the water management strategy or project by the time the water management strategy or project is projected by the regional water plan or the state water plan to be needed."*

In lieu of a broader definition from the legislature regarding what would classify a recommended regional and state water plan project as feasible or infeasible, the TWDB focused on the four directives included in Rider 28, in addition to the statutory definition of infeasible provided above, for the purposes of conducting this review: 1) the implementation timeline, 2) associated costs, 3) land acquisition considerations, and 4) the economic impact of the proposed project. The directives in Rider 28 are similar to considerations used in Texas' regional and state water planning processes. Accordingly, the TWDB specifically reviewed the Marvin Nichols Reservoir to assess the feasibility of developing and supplying water in the online decade specified in the 2021 Region C Regional Water Plan and the 2022 State Water Plan.

Scope of Review

The scope and intent of this report was strictly limited to undertaking a "feasibility review" of the four project factors described in Rider 28 (timeline, costs, land acquisition considerations, and economic impact) as they apply to the recommended Marvin Nichols Reservoir project *as configured* in the 2022 State Water Plan. This feasibility review was not for the purpose of expressing support for or opposition against the project or for determining whether the reservoir should be constructed.

The narrow scope of the review under Rider 28 did not entail peripheral topics or activities, for example, discussion of condemnation authority or the consideration of potential alternatives to the reservoir project. This review is neither an engineering feasibility nor an alternatives analysis. This review did not attempt to summarize all estimates of every potential impact of the reservoir, develop new estimates of the magnitudes of potential project impacts, judge the merits or thoroughness of one report or estimate versus another, or compare relative estimates of the magnitudes of potential reservoir impacts between various reports or from different time periods.

This feasibility review also did not attempt to quantify or otherwise characterize the impact of not implementing the Marvin Nichols Reservoir project.

The scope of this review, as well as the nature of the public input sought by the TWDB to support its conduct of this feasibility review and the draft report, was focused solely on obtaining and considering relevant, available documentation regarding the reservoir project feasibility.

Major Reservoir Development

The process of planning for and implementing major reservoir projects takes decades. Proposed reservoirs generally begin to appear in long-horizon, regional and state water plans well before the implementation of these projects begins due to the significance of the water supply volumes provided and the long lead time required to bring them online. Table 1 presents the status of all the major reservoir projects that are recommended in the 2022 State Water Plan.

Existing and future major reservoir projects continue to be an important water supply strategy in Texas. Reservoirs are an efficient means of capturing and storing significant volumes of this renewable, state surface water resource for beneficial use. The water supply yield estimates from surface water reservoir models take into account inflows, evaporation, and other factors. Implementation of surface water reservoirs generally involves an extensive permitting process at the state and federal levels. The recommendation of a reservoir project in a water plan does not guarantee that the project will be permitted and implemented.

The general phases of implementing major reservoirs, some of which overlap, include planning, design, permitting, land acquisition, and construction. These are similar phases to those of other public works, such as transportation projects.

Table 1. Current status of major reservoirs in the 2022 State Water Plan (as reported to the TWDB by project sponsors as of January 1, 2023)*

		Sponsor actions		State water right permitting		Land acquisition		Federal permitting		Construction	
Reservoir name	Water plan online decade	Local action taken	Sponsor funds spent	Applied for water right	Water right granted	Begun	Complete	Applied for 404 permit	404 permit issued	Begun	Complete
Beaumont West regional lake/reservoir	2020										
Bois D'Arc Lake/Reservoir	2020										
Cedar Ridge Lake/Reservoir	2040**										
GBRA Lower Basin off-channel lake/reservoir	2020										
DOW Harris Reservoir expansion	2030										
GBRA Lower Basin new appropriationoff-channel reservoir	2030										
Columbia Lake/Reservoir	2030										
NCTMWA Lake Creek Lake/Reservoir	2040**										
Ralph Hall Lake/Reservoir	2030										
LCRA new off-channel reservoir (2030 decade - excess flows)	2030										
LCRA new off-channel reservoir (2030 decade)	2030										
New Throckmorton Lake/Reservoir	2050**										
Turkey Peak Lake/Reservoir	2030										
Allens Creek Lake/Reservoir	2040										
Baylor Creek Lake/Reservoir	2040										
Brushy Creek Lake/Reservoir	2040										
Lake 7 (Jim Bertram Lake/reservoir system)	2040										
Ringgold Lake/Reservoir	2040										
Lavaca River off-channel lake/reservoir	2040										
Tehuacana Lake/Reservoir	2040										
DWU mainstem balancing reservoir	2050										
Marvin Nichols Lake/Reservoir	2050										
Austin off-channel lake/reservoir	2070										

**Colors indicate milestones achieved. Activities are shown in a generalized order of execution but are not sequential and may occur simultaneously.*
*** Online decade since revised through amendments to the 2021 regional water plans.*

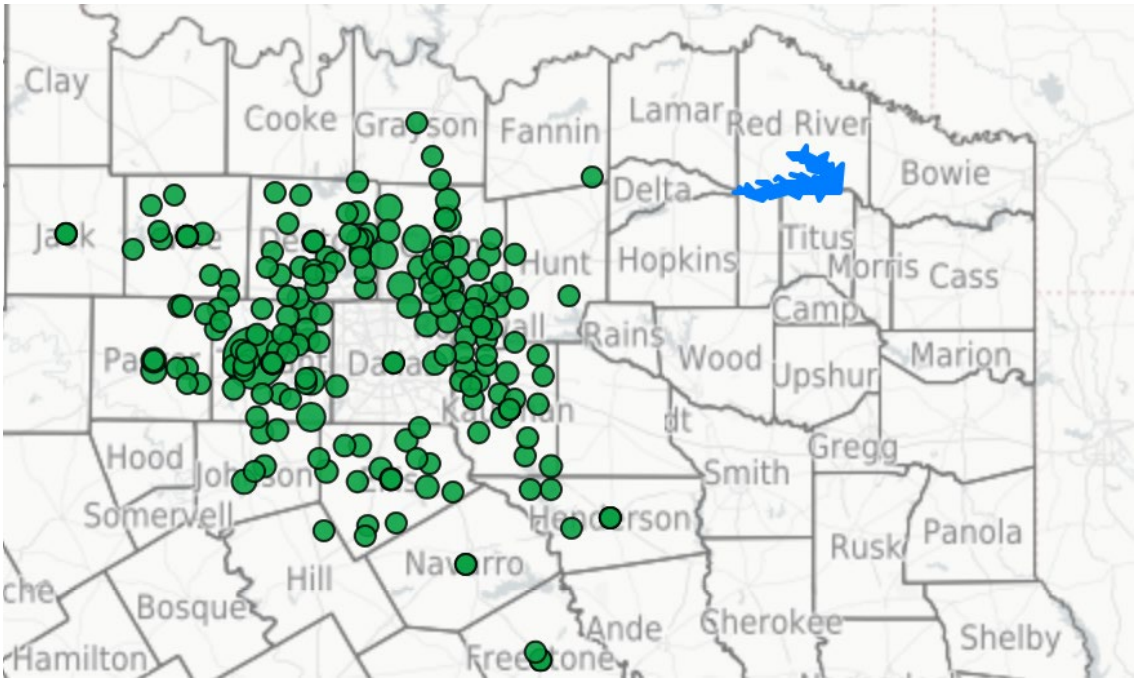
Status and Timeline Key

- Local action taken to authorize expenditures
- Sponsor funds spent. Funds expended early on may be related to reconnaisance work, technical studies, permit preparation, or land acquisition.
- Applied for state water right
- State water right granted
- Land acquisition process begun
- Complete land acquisition
- Applied for federal 404 permit
- 404 permit issued
- Begun construction
- Construction complete and operating. Recommended state water plan projects that reach this fully developed status shift to 'existing supplies' in the next state water plan.

Proposed Marvin Nichols Reservoir Background

The proposed Marvin Nichols Reservoir is a planned water supply reservoir in the Sulphur River Basin in Titus, Red River, and Franklin counties about 100 miles northeast of the Dallas-Fort Worth Metroplex (Figure 1). The Marvin Nichols reservoir site was one of the top-ranked reservoir sites for protection or acquisition in a 2008 study of approximately 150 potential reservoir sites in Texas due in part to the abundance of state surface water available in the Sulphur River basin and the relatively low estimated unit cost of water from an associated reservoir (TWDB, 2008).

Figure 1. Marvin Nichols Reservoir location (blue) and anticipated users in 2070



Green dots indicate benefitting water user groups in the 2022 State Water Plan.
Source: 2022.texasstatewaterplan.org/wms/2429

Prior to the passage of Senate Bill 1 in 1997, the Marvin Nichols Reservoir site was included as a proposed project in multiple[1] state water plans dating back to 1968. Following the passage of Senate Bill 1 in 1997, versions of the reservoir project have been included as a recommended strategy in:

- the 2001, 2006, 2011, 2016, and 2021 Region C regional water plans;
- the 2001 Region D Regional Water Plan[2]; and
- the 2002, 2007, 2012, 2017, and 2022 state water plans.

In 2007, the Texas Legislature designated the Marvin Nichols Reservoir site as a *"site of unique value for the construction of a reservoir."* As a result of actions taken by the project sponsors prior to September 1, 2015, that designation remains as codified under Texas Water Code § 16.051(g).

The Region D Regional Water Planning Group has expressed opposition to the Marvin Nichols Reservoir as a recommended water supply strategy in their regional water plans, letters, and other actions during each regional water planning cycle since 2002 due to

[1] 1968 State Water Plan as the Naples Reservoir; 1984, 1990, and 1997 state water plans as the Marvin Nichols Reservoir.
[2] In December 2002, the Region D Regional Water Plan was amended to remove the Marvin Nichols Reservoir due to the concerns regarding negative impacts. No subsequent action was taken by the TWDB since the project remained recommended by another planning group.

anticipated negative impacts to agricultural resources, timber resources, natural resources, local economies, and environmental considerations.

As of November 2024, the Marvin Nichols Reservoir is being considered by the Region C Regional Water Planning Group for inclusion as a recommended strategy in its 2026 Region C Regional Water Plan.

In its currently planned configuration in the 2022 State Water Plan and 2021 Region C Regional Water Plan, the reservoir would store up to approximately 1.5 million acre-feet of water, have an inundated footprint area of approximately 66,103 acres, and provide a firm yield of approximately 451,500 acre-feet of water per year[3] (TWDB, 2021). The firm yield was based on the most recent drought of record in the Sulphur River Basin. Of this amount, it is assumed in the Region C plan that approximately 361,200 acre-feet per year would be available to water providers in the Dallas-Fort Worth Metroplex area and the remaining 20 percent of the total firm yield would remain in the Sulphur Basin for local use. The project, if developed, would involve construction of significant infrastructure in addition to the reservoir itself, including pipelines and pump stations required to convey the water supply from the reservoir to the users.

The Marvin Nichols Reservoir is considered an important future water supply strategy for the region and, if implemented, is anticipated to provide water supply to approximately 213 water user groups (Figure 1) by 2070 representing a projected population of approximately 10.4 million (TWDB, 2022).

The population of the Region C water planning area, which includes much of the Dallas-Fort Worth Metroplex and all or part of 16 counties in North Texas, has grown from just under one million people in 1930 to approximately 7.2 million in 2016—representing approximately one-quarter of Texas' total population (TWDB, 2021). With a projected population reaching approximately 14.7 million people by 2070, comprising approximately 29 percent of the state's projected population, the region faces some of the most significant future growth in population and municipal water demand in Texas, requiring additional water supplies (TWDB, 2022).

According to the Region C plan, the Dallas-Fort Worth Metroplex is a major economic engine with a significant concentration of over 20 Fortune 500 companies and 69 companies headquartered in the area that posted revenue of $1 billion or more in 2018 (TWDB, 2021). In 2023, Dallas Fort Worth International Airport ranked as the third busiest in the world (ACI, 2024). In 2022, the Dallas-Fort Worth-Arlington Metropolitan Statistical Area's estimated gross domestic product of $688 billion comprised approximately 28 percent of Texas' total estimated gross domestic product of $2,402 billion (USBEA, 2024).

[3] A more recent (fall 2024) preliminary water supply firm yield estimate for the Marvin Nichols Reservoir that is being developed as part of the 2026 Region C plan is 400,940 acre-feet per year.

According to the Region D plan, population in the area, which encompasses more than 18 counties (Region D partially includes Smith County), has grown by approximately 54 percent from 1970 to 2000, compared to Texas' growth rate of 86 percent, and 38 percent growth in the United States. The population in Region D is projected to increase from approximately 831,000 in 2010 to over 1.3 million in 2070 (TWDB, 2021).

The northeast Texas region's primary economic base is agribusiness (grains, various food crops, cattle, poultry, and eggs), followed by timber, oil and gas, and mining. Gross domestic product in the region totaled $66.2 billion in 2022, accounting for 2.8 percent of Texas' gross domestic product (USBEA, 2024).

Roles and Responsibilities of the TWDB

The TWDB's mission is to lead the state's efforts in ensuring a secure water future for Texas. The main responsibilities of the TWDB are threefold: collecting and disseminating water-related data; assisting with regional water supply and flood planning that contributes to preparing the state water plan and state flood plan; and administering cost-effective financial assistance programs to eligible project sponsors for planning and constructing water supply, wastewater treatment, flood control, and agricultural water conservation projects.

To accomplish its water supply planning responsibilities, the TWDB administers the regional water planning program and incorporates regional water plans into a comprehensive state water plan for the orderly and responsible development, management, and conservation of the state's water resources to ensure sufficient supplies during periods of drought.

While the TWDB works in conjunction with other state agencies and political subdivisions to serve the needs of Texans (e.g., the Texas Commission on Environmental Quality, groundwater management and/or conservation districts, etc.), the TWDB is not a regulatory agency and has no permitting authority. Furthermore, the TWDB does not develop water supply project proposals or implement any of the recommended water supply projects in the state water plans. Recommended strategies and projects in the regional and state water plans are solely implemented by local and regional sponsors of those strategies and projects; regional water planning groups do not sponsor or otherwise implement projects in the regional plans.

Water Management Strategy Evaluation Criteria for Planning

Texas' water supply planning process is a bottom-up approach that assesses water availability, demands, and existing water supplies at the regional and state levels for approximately 3,000 water user groups. These assessments are used as "snapshots" for each of the five planning decades for municipal, manufacturing, irrigation, mining, livestock, and steam-electric power generation water use. Where feasible, the process recommends projects to meet the potential water shortages of those almost 3,000 water

user groups that would occur in any of the planning decades within the 50-year planning horizon if drought of record conditions were to return.

As a key part of the water supply planning process, regional water planning groups must identify and evaluate potentially feasible water management strategies and the associated water management strategy projects (projects) required to implement those strategies for each water user group and wholesale water provider where potential future water supply needs (i.e., potential shortages) are identified, as required by statute (TWC § 16.053) and administrative rules (31 TAC § 357.34 and § 357.35). A water supply need is identified when existing water supplies are less than projected water demands for that same water user group or wholesale water provider within any planning decade (e.g., 2030, 2040, 2050, 2060, 2070). Based on more than 14,000 planning snapshots considered (nearly 3,000 separate water user groups each evaluated in the five planning decades), the regional planning groups recommend solutions, where feasible.

A water management strategy is a plan to address potential water supply shortages for an entity, which can mean increasing the total water supply or maximizing an existing supply by reducing demands (i.e., through conservation and drought management measures). A water management strategy project is a capital infrastructure water project that has a non-zero capital cost and is developed to implement a strategy. When a project is implemented, it is intended to develop, deliver, and/or treat additional water supply volumes or conserve the existing water supply. A water management strategy may or may not require the development of an associated capital project for strategy implementation, and one water project may be associated with multiple strategies.

During each planning cycle, all water management strategies and projects identified for the region must be evaluated in accordance with 31 TAC § 357.34 and meet the requirements specified in the *General Guidelines for Development of Regional Water Plans*[4] contract document, updated and issued by the TWDB to regional water planning groups. Evaluations include a quantitative reporting for each water management strategy of the net quantity, reliability, cost, and impacts on environmental factors and agricultural resources. This information must be included in chapter 5 of the final adopted regional water plans.

Regional water planning groups are required to prepare a new, standalone regional water plan during each five-year cycle, which often involves updating or modifying water management strategies or project evaluations developed as part of previous regional water plans to address the following:

- Meet current rule and guidance requirements.
- Reflect changed conditions that have since occurred.

[4] Guidelines are developed and issued by the TWDB to specify the technical and regulatory requirements for regional water plans for each planning cycle. The current guidelines document is the Second Amended General Guidelines for Development of the 2026 Regional Water Plans (2023), https://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2026/documents.asp

- Consider newly identified water user groups or wholesale water providers.
- Reflect updated costs.
- Reflect updated information related to potential impacts to natural or agricultural resources.
- Any other relevant changes that require modifying, removing, and/or replacing a water management strategy (TWC § 16.053).

For a water supply project to be recommended in a final regional water plan, the regional water planning group and its technical consultants must consider it to be feasible (31 TAC § 357.34). In this context, a project must not only be considered technically feasible, which means being able to be permitted and built to provide the associated water supply during drought conditions, but it must also be considered "feasible in time." In other words, it must be possible to permit and construct the project in time for it to deliver the associated water supply volume required by the associated planning decade as reflected in the featured regional water plan.

For example, some potential water supply shortages identified in the 2021 regional plans, primarily associated with irrigated agriculture, could not be met in the regional water plans. This is because planning groups must recommend feasible projects and, in several instances, the planning groups determined there were no economically feasible alternatives capable of addressing these potential irrigation shortages under drought of record conditions.

Development of this Report

Prior Evaluations of the Marvin Nichols Reservoir

Several sources of information were reviewed in the development of this report. The most recently updated evaluations of the Marvin Nichols Reservoir impacts available to the TWDB are from the 2021 Region C and Region D Regional Water Plans and preliminary information from the Region C planning group as they continue to develop their 2026 regional water plan. Other published sources, including information on the potential impacts of the Marvin Nichols Reservoir, were also consulted. The documents reviewed for this report are identified in the reference list contained in Appendix A and, as appropriate, cited in the subsequent sections of this report.

Public Input for Report Preparation

Although not required by Rider 28, the TWDB requested public input associated with this feasibility review from October 1 to December 1, 2023. The public was asked to provide input and to submit any supporting documentation on timing, costs, land acquisition, and economic impacts that the TWDB should consider in developing the feasibility report. The notification was posted in the *Texas Register* and on the TWDB website; an email was sent to agency stakeholders; and specific notifications were made to key, interested parties including the chairs of Regions C and D.

In response to this public input period, the TWDB received 120 submissions prior to the initial December 1, 2023, deadline (Table 2). These 120 submissions included 20 from potentially impacted businesses and two elected officials: State Representative Gary VanDeaver and Cass County Judge Travis Ransom.

The TWDB was made aware of a significant number of emails that stakeholders attempted to submit to prior to the December 1, 2023, deadline, but the emails were likely filtered by Microsoft as a potential attack on the TWDB's server due to the labeling and pattern of these third-party, website-generated emails. Because Microsoft's quarantine period for the emails had passed, the TWDB subsequently reached out directly to the organization whose server was involved and obtained copies of the associated email submissions. The TWDB received and reviewed all those submissions as part of this study.

The TWDB received 241 submissions between December 2, 2023, and September 15, 2024, 240 of which were form letters.

Table 2: Summary of submissions received by the TWDB

Activity period	Dates	Count of submissions received
Initial TWDB request for public submissions of any supporting documentation for feasibility review	October 1 - December 1, 2023	120
Additional comments sent but not initially delivered to TWDB due to Microsoft server protections - but that were subseqently obtained and reviewed by TWDB	sent prior to December 1, 2023	938
Comments/input received after deadline and prior to draft report posting	December 2, 2023 - September 15, 2024	241
TWDB request for comments on draft report	September 16 - Oct 25, 2024	520
Public input/comments received after the draft report comment deadline	October 26 - November 1, 2024	59
	Total*	**1,878**

**Count may include duplicative and/or multiple submissions by a single or multiple commentors over different periods of the process. It does not represent the number of emails received, which included some blank comments, nor does it include emails received after November 1, 2024.*

Upon completion of the draft feasibility review report, the TWDB posted a copy of the report on its website on September 16, 2024, for public review and comment. Notification for this opportunity was again provided to agency stakeholders, planning group chairs, and other interested parties via email. Comments regarding the draft report were accepted through October 25, 2024.

The TWDB received more than 500 public comment submittals from September 16, 2024, through October 25, 2024. Some changes were made to the draft report, as appropriate, based upon comments received.

During the process of conducting this feasibility review, the TWDB received a total of 1,878 submissions. The vast majority expressed general opposition to the reservoir project but did not provide substantive comments or additional relevant information either to inform the report or in response to the draft document.

The TWDB appreciates all the input submitted by stakeholders prior to drafting the report and in response to the draft report.

Directive: Review of the Implementation Timeline

Implementation Timeline of the Marvin Nichols Reservoir

A key tenet of regional water supply planning in Texas is ensuring that recommended water management strategy projects can be developed to meet identified water supply needs in the event of drought or before the time water supplies are needed. Both the 2021 Region C Regional Water Plan and the 2022 State Water Plan indicate that the Marvin Nichols Reservoir project is planned to be constructed and implemented to supply water by the year 2050.

Appendix G.3.5 of the 2021 Region C Regional Water Plan states that permits (water quality and water rights) for a new lake/reservoir developed in Texas may require 15 to 20 years or more to obtain, pending public opposition. No other discussion of timing for development and construction of reservoirs is mentioned for Marvin Nichols or any other reservoir projects included in the regional water plan or state water plan. As of the publication of this report, the TWDB is not aware of any timeline for the Marvin Nichols Reservoir that differs from the information contained in the 2021 Region C Regional Water Plan.

In addition, no entity has yet submitted permit applications to either the Texas Commission on Environmental Quality (TCEQ) or United States Army Corps of Engineers (USACE) for the proposed Marvin Nichols Reservoir project.

Recent Development Timelines for Major Reservoir Projects in Texas

Although the implementation timeline of each major reservoir project will differ, we include here two relevant timelines of recently implemented major reservoir projects that were recommended in regional and state water plans. Both the Bois d'Arc Lake reservoir and Lake Ralph Hall reservoir projects have been in planning for decades, have been recommended in multiple state water plans, are major reservoirs that have successfully obtained permits similar to those required for the Marvin Nichols Reservoir and, importantly, have recently reached the construction phase. This information is not intended to imply or attempt to predict the timeline for the development of the Marvin Nichols Reservoir but is, nevertheless, generally relevant to this feasibility review since the permitting and construction of major reservoirs in the future will include similar steps and milestones.

Two key milestones required to develop surface water reservoirs in Texas regard permits: obtaining a state surface water right permit from the TCEQ and obtaining a federal Section 404 permit from the USACE[5].

All surface water reservoir projects in Texas are required to obtain a water right from the TCEQ because surface water in Texas is the property of the state:

> *"The water of the ordinary flow, underflow, and tides of every flowing river, natural stream, and lake, and of every bay or arm of the Gulf of Mexico, and the storm water, floodwater, and rainwater of every river, natural stream, canyon, ravine, depression, and watershed in the state is the property of the state. The right to the use of state water may be acquired by appropriation in the manner and for the purposes provided in this chapter. When the right to use state water is lawfully acquired, it may be taken or diverted from its natural channel." (*TWC § 11.021 and § 11.022)

Section 404 of the Clean Water Act requires permits to be obtained prior to discharging dredged or fill materials into waters of the United States. These permits are called Section 404 permits. Section 404 permits are administered through the USACE and coordinated with state agencies charged with the regulation of water quality.

Table 3 shows the dates and total estimated development times associated with the implementation of two major reservoirs that were recommended in the 2022 State Water Plan: Bois d'Arc Lake reservoir and Lake Ralph Hall reservoir. Although the TWDB acknowledges that the Marvin Nichols reservoir is larger than these two reservoir projects, their development timelines are instructive of the general reservoir permitting process.

Table 3. Timelines of development for two major reservoirs in Texas

	Bois d'Arc Lake reservoir	**Lake Ralph Hall reservoir**
Pre-permitting and design start	2005	2003
Year TCEQ permitting started	2006	2004
Year USACE permitting started	2008	2006
Construction started	May 2018	June 2021
Constructed and delivering water	2023	*(anticipated 2026)*
Approximate total implementation time	**18 years**	***(anticipated 23 years)***

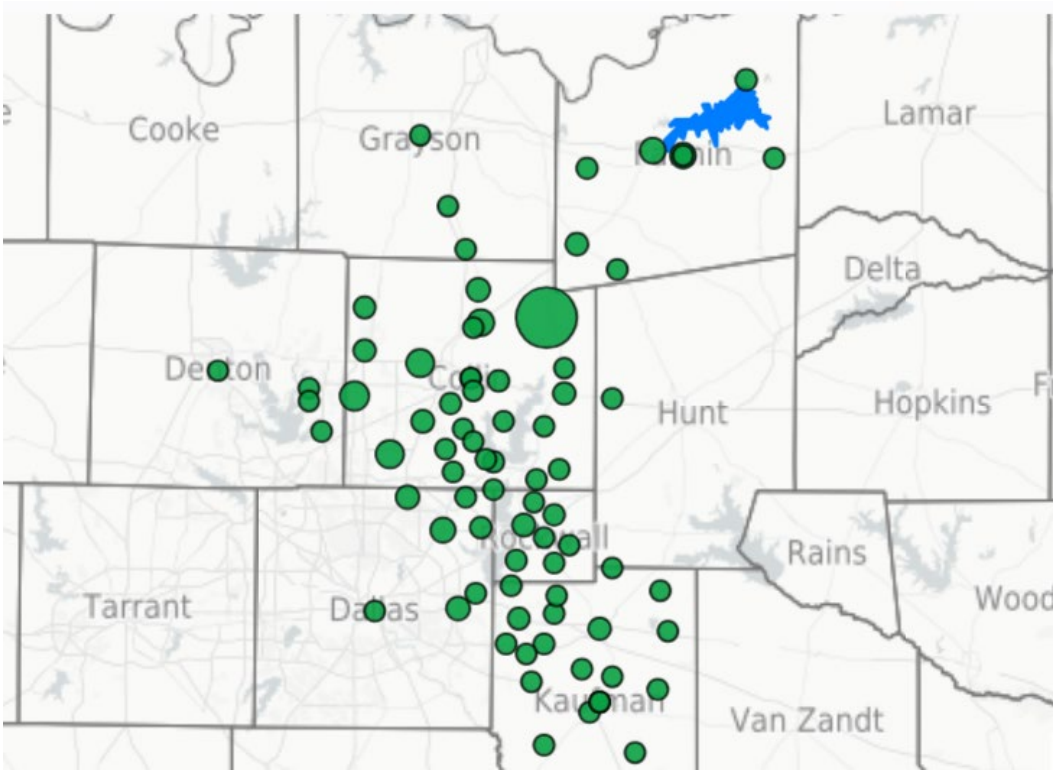
[5] USEPA (United States Environmental Protection Agency), n.d., Section 404 of the Clean Water Act Program, https://www.epa.gov/cwa-404

Sources: TWDB, 2021; TCEQ, n.d. – a; TCEQ, n.d. – b; project sponsors

Bois d'Arc Lake Reservoir

Bois d'Arc Lake reservoir is a recommended water supply project in the 2021 Region C Regional Water Plan and 2022 State Water Plan that has now been implemented (permitted and constructed) by the North Texas Municipal Water District (NTMWD) and completed in 2023 (Figure 2).

Figure 2. Bois d'Arc Lake reservoir location (blue) and anticipated users in 2070



Green dots indicate benefitting water user groups in the 2022 State Water Plan.
Source: 2022.texasstatewaterplan.org/wms/2236

The Bois d'Arc Lake reservoir is a water supply reservoir situated within the Red River Basin in Fannin County approximately 15 miles northeast of the City of Bonham. When at full storage, or its maximum anticipated conservation elevation, the reservoir is expected to inundate 16,641 acres, store 367,609 acre-feet of water, and provide 175,000 acre-feet of water supply per year.

NTMWD applied for a water rights permit from the TCEQ in December 2006, and the TCEQ issued NTMWD's water rights permit June 26, 2015.

NTMWD applied to the USACE Fort Worth District for a Section 404 water quality permit for this project on June 3, 2008, and received its permit on January 29, 2018.

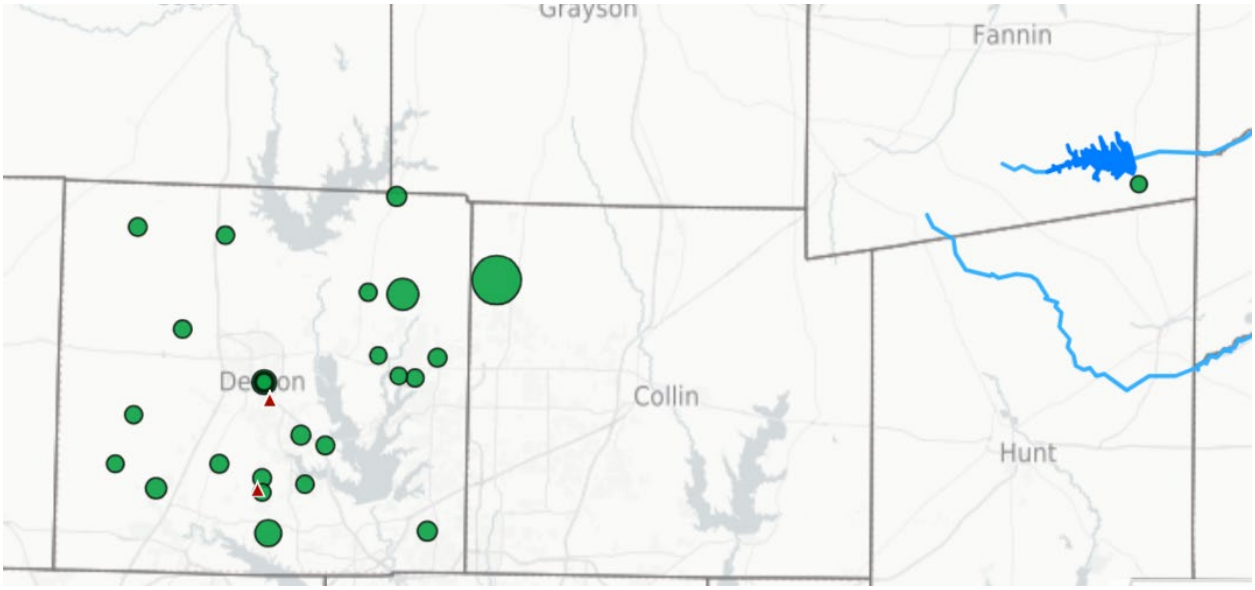
Construction on the Bois d'Arc Lake reservoir was initiated in May 2018 and was substantially completed by mid-2023 with the ability to deliver water to a NTMWD treatment plant located approximately 35 miles from the reservoir.

Lake Ralph Hall Reservoir

Lake Ralph Hall reservoir is being implemented by the Upper Trinity Regional Water District (UTRWD) and is anticipated to be completed in 2026.

The proposed Lake Ralph Hall reservoir is a water supply reservoir situated within the Sulphur River Basin in Fannin County along the North Fork of the Sulphur River near the City of Ladonia (Figure 3). At its full storage, the reservoir is expected to inundate approximately 7,600 acres, store 180,000 acre-feet of water, and provide up to 45,000 acre-feet of water supply per year.

Figure 3: Lake Ralph Hall reservoir location (blue) and anticipated users in 2070



Green dots indicate benefitting water user groups in the 2022 State Water Plan.
Source: 2022.texasstatewaterplan.org/wms/2469

UTRWD applied for a water rights permit from the TCEQ in August 2004, and the TCEQ issued UTRWD's water rights permit in December 2013.

In November 2007, UTRWD applied for a Section 404 water quality permit from the USACE Fort Worth District and received its permit in January 2020.

Construction on Lake Ralph Hall reservoir began in June 2021 and is anticipated to be completed in 2026.

Conclusion

Based on the date of this report preparation and the estimated 15- to 20-year time window in the 2021 Region C Regional Water Plan, the general knowledge of TWDB staff, and recently implemented major reservoirs in Texas, the TWDB does not consider it unreasonable to expect the Marvin Nichols Reservoir to be implemented by 2050. In the event that, for whatever reason, the development of the project either begins later or takes longer than 25 years to implement (from 2024), the associated shift in the timing would need to be reflected in a subsequent regional water plan but, more importantly, would not render the project itself infeasible as an eventual source of a significant volume of reliable water supply. If at some point in the future the project was determined to be infeasible, it would be removed from the regional and state water plans.

Directive: Review of Associated Costs Related to Project Development

Estimated Cost of the Marvin Nichols Reservoir

A detailed cost estimate for the proposed Marvin Nichols Reservoir is included in the 2021 Region C Regional Water Plan (Section 5C.1.7, Appendix G.3.5, and tables H.20 and H.21). For the proposed reservoir design covering a water surface area of 66,103 acres, the estimated total design and construction cost of this project is $4,467,478,000 in year 2018 dollars, the cost-indexed year for all projects in the 2022 State Water Plan[6].

All 16 regional water planning groups used costs based on year 2018 dollars to estimate the costs of all projects in their plans. The year 2018 was selected because the regional plan cost estimates, which relied on the TWDB costing tool and relevant cost indices, had to be developed ahead of time so they could be considered by the regional planning groups and incorporated into the draft regional water plans. A new dollar year must be selected for use during each five-year planning cycle.

By requiring all cost estimates to use year 2018 dollars, it allows comparisons of alternative projects and ensures that cost information from all 16 planning regions could be aggregated in a meaningful way for the development of the state water plan.

The cost includes debt service associated with the issuance of debt to finance the reservoir, design, feasibility studies, environmental and cultural resource studies and mitigation, land purchase/acquisition, legal fees, contingency costs, and interest during a two-year construction period. The cost also includes conveyance and delivery of the water to the users.

Based on an anticipated firm yield supply volume of 361,200 acre-feet per year available to Region C, the estimated initial annual unit cost of water from the project is approximately $931 per acre-foot. The unit cost of the supply will decrease over time as the debt associated with the project is retired.

It is important to acknowledge that, similar to all other projects in the 2022 State Water Plan that have yet to begin construction, the Marvin Nichols Reservoir will be implemented sometime after the year 2018 and, as such, will cost more in actual dollars when built than the 2018 cost estimate indicated in the plan, due partly to inflation. The cost of the project may also change, for example, because of the federal permitting process that will, among other things, determine land mitigation requirements.

[6] Note that an updated estimate for the project, in year 2023 dollars, of $7.04 billion has been developed as part of the initial drafting of the 2026 Region C Regional Water Plan. Significant increases in construction costs since development of the previous regional and state water plans will likely have substantial impacts on the costs of all capital projects in the upcoming regional and state water plans.

Costs of Recommended Projects in the 2022 State Water Plan

Cost considerations are a major factor in the selection, planning, design, construction, and operation of major public infrastructure projects, including those in the regional water planning process. Cost is one of the key considerations when regional water planning groups and project sponsors are considering and comparing options to address potential water shortages. Texas Water Code § 16.051 requires the state water plan and underlying regional water plans to ensure *"…that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare. . ."*.

During each planning cycle, the estimated costs for all projects considered by regional water planning groups, including the proposed Marvin Nichols Reservoir, must be prepared. Doing so requires updating the project costs to reflect changed project conditions and to reflect the costing guidance provided by the TWDB, including related to the specific dollar year that will be the basis for all costs in that five-year planning cycle.

Using a common dollar year for estimating costs of all water supply projects also allows for general but consistent comparisons between water supply costs for both similar and dissimilar projects. There are many ways to calculate and compare costs. In the context of water supply projects, one of the most useful comparisons is the unit cost of water, which is calculated by taking all the costs associated with a single year (including debt service) and dividing that by the volume of water supply in that year to give an estimated dollars-per-acre-foot unit value. Simply comparing the total estimated cost to build two projects, on the other hand, would not be very meaningful as it leaves out annual operation and maintenance costs and does not reflect the expected cost of the water supply actually delivered, per unit, over time.

Table 4, originally published as Table 7-5 in the 2022 State Water Plan, provides weight-averaged unit costs based on year 2018 dollars for different types of projects in each planning region and across the state. As indicated, these costs are weight-averaged based on the volume associated with each underlying project and its associated unit cost.

Table 4. Weight-averaged unit costs (dollars per acre-foot)* of strategy water supplies by region and strategy type in 2070

Water management strategy type	A	B	C	D	E	F	G	H	I
Agricultural conservation	$66	$83	$307	na	$39	$0	$1,330	$132	na
Aquifer storage & recovery	$391	na	$99	$99	$212	na	$418	$3,256	na
Conjunctive use	na	na	na	na	$251	na	$235	$1,060	na
Direct potable reuse	$1,228	na	na	na	na	$2,443	$606	na	na
Drought management**	na	na	na	na	na	na	na	na	na
Groundwater desalination	na	na	na	na	$818	$403	$1,540	$4,927	na
Groundwater wells & other	$355	$396	$408	$383	$710	$340	$407	$481	$173
Indirect reuse	na	$698	$273	$1,032	na	$269	$275	$326	$435
Industrial conservation	na	$385	$147	$0	na	$0	$0	na	na
Municipal conservation	$779	$356	$103	$679	$92	$663	$546	$584	$398
New major reservoir	na	$384	$625	$540	na	na	$659	$411	$281
Other direct reuse	na	na	$278	na	$479	$201	$384	$525	na
Other strategies	na	na	$899	na	$307	$10	na	$1,560	na
Other surface water	na	$828	$527	$199	$290	$80	$521	$273	$475
Seawater desalination	na	na	na	na	na	na	na	$1,293	na

** Unit costs include a mixture of projects, some of which will be beyond their debt service period by 2070.*

*** Unit costs for drought management strategies represent possible costs to municipal water users from foregone consumer surplus of imposed reduced water use rather than capital expended to produce water supply.*

na = not applicable or not available.

(Table 4 continued)

Water management strategy type	J	K	L	M	N	O	P	Texas
Agricultural conservation	$0	$151	na	$315	$3,597	$450	$200	$181
Aquifer storage & recovery	$148	$2,109	$221	na	$171	$824	na	$664
Conjunctive use	na	na	na	na	na	na	na	$814
Direct potable reuse	$6	$1,961	$1,980	$1,709	na	na	na	$1,505
Drought management**	$0	$66	$358	$55	$0	na	$100	$169
Groundwater desalination	$294	$2,995	$1,227	$1,085	$1,088	na	na	$1,080
Groundwater wells & other	$154	$523	$435	$85	$93	$174	na	$402
Indirect reuse	na	$214	na	na	na	na	na	$297
Industrial conservation	na	$109	na	$2,983	$0	$0	$0	$292
Municipal conservation	$408	$999	$625	$582	$502	$332	$1,990	$515
New major reservoir	na	$715	$97	na	na	$518	na	$511
Other direct reuse	$56	$1,036	$625	$354	$157	$1,407	na	$630
Other strategies	$0	$1,618	na	$10	na	na	na	$1,066
Other surface water	$244	$143	$621	$2,890	$229	$783	na	$523
Seawater desalination	na	na	na	$3,188	$1,364	na	na	$1,371

** Unit costs include a mixture of projects, some of which will be beyond their debt service period by 2070.*

*** Unit costs for drought management strategies represent possible costs to municipal water users from foregone consumer surplus of imposed reduced water use rather than capital expended to produce water supply.*

na = not applicable or not available.

As shown, the unit costs of water vary by type of water supply project and region. Regardless, projects associated with larger supply volumes dominate the calculations in Table 4. Note that because unit costs shown are weight-averaged, the underlying ranges of unit costs between individual projects recommended in the 2022 State Water Plan are greater than that shown in Table 4.

While the estimated unit cost of $931 per acre-foot per year[7] of water for the Marvin Nichols Reservoir is higher than the weight-averaged unit cost of all new major reservoirs in the 2022 State Water Plan, the unit cost of the recommended Marvin Nichols Reservoir water management strategy water supply is lower than the reported unit costs of a number of other recommended major reservoir strategies in the 2022 State Water Plan[8]. The estimated unit cost of the project is also considerably less than the weight-averaged unit costs of other recommended strategies in the 2022 State Water Plan. For example, the estimated unit cost of water provided by the Marvin Nichols Reservoir project is generally less than the estimated unit costs of seawater desalination, direct potable reuse, and groundwater desalination projects that were recommended by other regional water planning groups.

Conclusion

At an estimated total capital cost of approximately $4.5 billion (per 2022 State Water Plan, year 2018 dollars), the Marvin Nichols Reservoir will represent a very significant investment by the sponsors developing the project who are responsible for providing water to a large, fast-growing population and regional economy in Texas. Although the total cost to implement the project will be large, the estimated unit cost of the water supply that will be provided by the Marvin Nichols Reservoir is lower than the estimated unit costs of many other water supply strategies recommended in the 2022 State Water Plan.

Based on the estimated costs associated with the universe of water supply projects recommended in the 2022 State Water Plan, there is no indication that the cost of the Marvin Nichols Reservoir project would render the project infeasible.

[7] Region C 2021 Regional Water Plan, Appendix H. Table H.21

[8] The reported unit cost of water for the recommended major reservoir strategy Allens Creek Reservoir was the highest estimated for a new major reservoir in the 2022 State Water Plan at over $2,500 per acre-foot per year.

Directive: Review of Land Acquisition Considerations

Land Considerations Associated with the Marvin Nichols Reservoir

The proposed Marvin Nichols Reservoir project, as described in the 2021 Region C Regional Water Plan and numerous other studies and documents, is planned to store approximately 1.5 million acre-feet of water at a proposed reservoir conservation elevation of 328 feet above mean sea level, inundating approximately 66,103 acres. This reservoir footprint does not include any appurtenant facilities, such as pump stations, water transmission pipeline easements, lake maintenance facilities, a balancing reservoir (if needed), or any improvements adjacent to the lake (roadways, boat ramps, marinas, camping facilities, etc.). In other words, the specified inundation area is just the footprint of the proposed reservoir itself.

Within the proposed reservoir footprint, it has been estimated that construction of the Marvin Nichols Reservoir could impact a large quantity of high-quality habitat acreage as defined by the United States Fish and Wildlife Service. The United States Fish and Wildlife Service has classified some of this acreage as Priority 1 bottomland hardwoods, its highest quality rating.

Preliminary ecological studies conducted in the proposed footprint area for the reservoir estimate that approximately 1,162 acres is open water in the Sulphur River Basin, 10,156 acres is prime bottomland hardwood forested wetlands, 21,444 acres is forested wetlands, 1,405 acres is shrub wetlands, and 1,244 acres is herbaceous wetlands (USACE, 2017). Development in these wetland areas will require compensatory mitigation[9] in accordance with USACE and United States Environmental Protection Agency (EPA) policies.

There is no formula or clear procedure to predict what the total land requirements associated with federal permitting will be. The TWDB acknowledges that previous studies of the project area, under its various configurations and citing regulations in effect at the time, have published varying estimates of potential mitigation ratios. Until the project sponsors conduct a formal wetland assessment and delineation, along with a functional habitat assessment within the proposed project area, a firm estimate of functional capacity units requiring mitigation for USACE will remain unknown.

[9] For unavoidable impacts, compensatory mitigation is required to replace the loss of wetland, stream, and/or other aquatic resource functions and area. The Army Corps of Engineers (or approved state authority) is responsible for determining the appropriate form and amount of compensatory mitigation required. Methods of providing compensatory mitigation include aquatic resource restoration, establishment (creation), enhancement and, in certain circumstances, preservation.

Compensatory Mitigation Considerations

A fundamental precept of the USACE Regulatory Program is the Department of the Army's mitigation policy, 33 CFR § 320.4(r), which applies to all Regulatory Program authorizations, including general permits. When the USACE reviews a project that would require Department of the Army authorization (e.g., 404 Permit), its evaluation typically includes a determination of whether the applicant has taken sufficient measures to mitigate the project's likely adverse impact on the aquatic ecosystem.

In a Memorandum of Agreement signed February 6, 1990, between the USACE and the EPA, mitigation of potential impacts to aquatic resources was defined as a sequential process of avoiding, minimizing, and compensating for adverse impacts to the aquatic ecosystem necessary to meet or exceed requirements of the Clean Water Act.

If the impacts of a proposed project cannot be avoided or sufficiently minimized, the USACE District Engineer will normally require the implementation of all appropriate and practicable compensation as a condition of the permit authorization.

To determine compensation requirements, the USACE currently uses an assessment of overall ecological functionality and importance of habitat and ecosystems impacted and/or lost and mandates mitigation of at least equivalent quality (measured in functional capacity units) (40 CFR § 230.93(f)). Depending on the type and quality of land available in the affected watershed for mitigation and the overall success of the habitat restoration and/or creation efforts of the mitigation, the acreage needed for mitigation could be higher than the 1:1 ratio presently used in the 2021 Region C Regional Water Plan. Based on the high-quality habitat known to exist in the proposed Marvin Nichols Reservoir project area, it is likely that more acreage than the estimated 66,103-acre reservoir footprint will be needed for mitigation purposes[10].

The actual amount of mitigation land that may be required cannot be determined until the federal permitting process on the project is initiated. This is a significant source of uncertainty making it difficult to estimate the full impact of the project.

Conclusion

With an estimated reservoir footprint of 66,103 acres and an unknown, but likely significant, additional acreage requirement associated with USACE's compensatory mitigation requirements, the total land requirements for the reservoir project and related infrastructure will be considerable and will play a significant role in the final cost of the

[10] As part of its feasibility review, the TWDB also reviewed a 2003 study that, based on a prior configuration and footprint of the Marvin Nichols Reservoir site, suggested the potential mitigation land area could be up to multiple times that of the reservoir inundation area. (page 13, The Economic, Fiscal, and Developmental Impacts of the Proposed Marvin Nichols Reservoir Project, Weinstein and Clower 2003).

project and economic impacts. However, at this time there is no indication that the quantity and types of land potentially required to develop this project would render the project infeasible.

Directive: Review of Economic Impacts from Proposed Reservoir Development

Several detailed analyses of potential socioeconomic impacts from the proposed Marvin Nichols Reservoir have been conducted over the past two decades. The most recent assessment, titled “2020 Quantitative Analysis of the Impacts of Marvin Nichols Reservoir” and prepared by Freese and Nichols and Clower & Associates in January 2020, was included in the 2021 Region C Regional Water Plan as Appendix J. This report contained an addendum report titled “Economic, Fiscal, and Developmental Impacts of the Proposed Marvin Nichols Reservoir,” prepared by Clower & Associates in April 2020. Both reports are updates of previous reports included in the 2016 Region C Regional Water Plan.

The “Quantitative Analysis” report provides summaries of impact assessments conducted for land currently classified as grasslands, timbering, and cultivated agriculture, but only for the proposed inundated footprint of the reservoir. The Clower and Associates “Economic, Fiscal, and Developmental Impacts” report evaluated economic and socioeconomic impacts related to construction of the reservoir and raw water transmission pipeline, ongoing operation and maintenance of the reservoir and transmission pipeline, household spending by new permanent and weekend residents, and visitor/tourism spending. These reports concluded that overall impacts to natural and agricultural resources would be minimal, as they impact less than 1 percent of the total acreage area of Region D (Table J.6 in Appendix J, 2021 Region C Regional Water Plan) and that the potential economic impacts associated with increased local labor income during and following construction, new/additional residents (necessitating additional housing), and increased county tax revenue would be substantial and overall beneficial if the Marvin Nichols Reservoir is constructed.

The 2021 Region D Regional Water Plan includes an alternative quantification of impacts from the project which extends beyond the footprint of the reservoir (Trungale, 2014) and characterizes impacts from the project to be significant.

The TWDB notes that the agricultural impacts in the most recently available information referred to above only considered standing timber value within the proposed 66,103-acre footprint of the reservoir. Although the information reviewed meets the requirements for the development of regional water plans, no impacts were considered for timbering-associated services, impacts to beef cattle industry/loss of grazing area, impacts to land needed for compensatory mitigation, or economic losses to hunting in the area, etc. This results in an underestimation of the full magnitude of these economic impacts of the project.

As part of its feasibility review, the TWDB also reviewed a 2002 socioeconomic impact study performed by the Texas Forest Service using 1999 economic data and modeled

several scenarios of potential impacts on the forest industry based on a prior configuration and footprint of the Marvin Nichols Reservoir site. The study used an input-output analysis and stated that the forest industry "would incur significant losses" based on the prior, 1999 reservoir footprint and the associated modeling assumptions. The report provided associated estimates of potential impacts including job loss, lost stumpage, and value lost. (page 8, The Economic Impact of the Marvin Nichols I Reservoir to the Northeast Texas Forest Industry, Texas Forest Service, Texas A&M University, 2002)

Conclusion

It is not possible to identify, anticipate, and quantify every economic impact potentially associated with a large infrastructure project—especially one that is not anticipated to be online until 2050. However, even recognizing the potential limitations and ranges of the currently available planning-level information regarding potential economic impacts of the Marvin Nichols Reservoir recommended in the 2022 State Water Plan, no economic impacts were identified that would specifically render the project infeasible.

Uncertainty

Uncertainty is inherent to any long-term water planning process. Planning factors, such as population projections, water demand projections, water supply, potential water shortages, and implementation of water management strategies, all have associated uncertainties that can be difficult to quantify. In general, uncertainty tends to be greater for longer projection horizons and less for near-term plans.

Re-examining population and water demand projections and developing new regional water plans every five years allows the regional water planning groups to be adaptive to changes and incorporate the most recent and best available information. The following describes some of the uncertainties associated with water planning in Texas.

Uncertainty of Population and Water Demand

A wide range of factors influence the long-range outlook of municipal and non-municipal water demand. Municipal water demand depends on population growth, its distribution, and how much water each resident uses now and in the future. Population growth and its geographic distribution depend on economic and social factors that shift. Per capita water use depends on individual preferences, culture and habits, the weather, efficacy of local conservation ordinances, and the adoption of more water-efficient appliances. Irrigation and livestock demands are strongly influenced by the economy, crop types, government policies, and the weather. Manufacturing, mining, and steam-electric power generation demands are influenced by numerous economic factors, such as price levels of their inputs and outputs, private facility siting decisions, other resources needed for production, technology, markets, and government regulation. These underlying factors

that influence water use are difficult to predict, especially at the local level and over the long term, resulting in inherent uncertainty in water demand projections. While the regional water planning process roots water demand projections in reported data of historical annual water use estimates, data limitations inherently introduce uncertainty into water demand projections.

Uncertainty of Water Supply

Many factors, such as precipitation, temperature, evaporation, and soil moisture conditions, play a role in determining how much water moves in and through Texas' streams, reservoirs, and aquifers (Nielsen-Gammon, 2024). The complex and interrelated nature of these variables can make it difficult to anticipate long-term future water supply. For example, the firm yield of water supply projects may change over time because of the occurrence of new, future droughts of record, as occurred recently in several major river basins in Texas, including the Sulphur River Basin. New droughts of record can reduce the expected firm yield supply of proposed reservoirs as well as that of reservoirs that have already been built.

Uncertainty of Future Water Needs

Long-term water needs (potential shortages), especially under drought conditions, are also difficult to predict due to the multiple uncertainties that affect both supply and demand on which potential supply shortages are based. Higher-than-projected per capita water demand, for example, combined with lower-than-anticipated water supply would result in an even greater potential water shortage than either factor would cause individually.

Uncertainty of Project Implementation

The timely implementation of every recommended water supply project in the 2022 State Water Plan is not a certainty since each one requires action by a sponsor(s) and faces its own unique circumstances. These uncertainties may be related to the expected project supply yield, permitting obstacles, sponsor decision-making, implementation costs and financing, and/or deciding on the most advantageous time to bring a project online. Uncertainty regarding the potential impacts of a project may, in turn, create or magnify uncertainties regarding project permitting and associated sponsor investments. Eventually, some of the recommended strategies in the state water plan may either become infeasible or may be shifted further into the future, replaced, or even abandoned for other reasons.

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