Texas Water Backbone: Full Proposal

Comprehensive document with technical details, financial projections, and implementation plan

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Executive Summary

The Texas Water Backbone is a proposed 420-mile water transmission system connecting Gulf Coast seawater desalination to the Dallas-Fort Worth metroplex, serving Houston, San Antonio, and Austin along the way. This document provides comprehensive technical, financial, and governance details for legislative consideration.

Part 1: The Texas Water Challenge

Population and Demand Projections

Texas is the fastest-growing state in the nation. The Texas Water Development Board projects population growth from 29.7 million (2020) to over 55 million by 2070—nearly doubling in 50 years.

YEAR	POPULATION	WATER DEMAND	AVAILABLE SUPPLY	GAP
2020	29.7M	18.4M AF/yr	17.8M AF/yr	0.6M AF
2040	38.5M	22.1M AF/yr	17.2M AF/yr	4.9M AF
2070	55.0M+	26.8M AF/yr	15.8M AF/yr	11.0M AF

This growth is concentrated in four major metropolitan areas:

- **Dallas-Fort Worth**: The nation’s fourth-largest metro area, adding millions of new residents
- **Houston Metro**: Continued expansion despite water quality and subsidence challenges
- **San Antonio**: Explosive growth straining Edwards Aquifer allocations

- **Austin**: One of America's fastest-growing cities with single-source vulnerability

Current Water Stress

Texas water sources face unprecedented pressure:

Edwards Aquifer: In 2024, the Edwards Aquifer Authority implemented first-ever Stage 5 drought restrictions, cutting permitted pumping by 44%. San Antonio's primary water source can no longer reliably meet demand.

Highland Lakes: Austin's primary source experienced historic lows in 2023-2024. Lake Travis and Lake Buchanan operate as a single-source system with no backup.

Dallas-Fort Worth: The region depends on a network of aging reservoirs. The proposed Marvin Nichols Reservoir—the primary solution in state water planning—has been blocked by legal challenges for over 50 years.

The Marvin Nichols Impasse

The Marvin Nichols Reservoir illustrates why traditional approaches have failed:

- **Proposed**: 1960s
- **Land impact**: 66,000+ acres flooded
- **Communities displaced**: Multiple rural communities
- **Legal status**: Perpetual challenges from East Texas stakeholders
- **First water delivery**: 2050 at earliest (optimistic)
- **Cost**: $7+ billion (escalating)

The August 2025 mediation agreement between Region C (DFW) and Region D (East Texas) created a five-year pause on Marvin Nichols permitting, with both regions agreeing to jointly seek state funding for alternatives. This agreement creates a policy window for the Backbone.

Economic Stakes

Without adequate water supply, Texas faces severe consequences:

- **$153 billion** in potential annual economic damages by 2070

- Lost business development opportunities (companies increasingly evaluate water security)
- Reduced agricultural output in key farming regions
- Declining quality of life and property values

The cost of building drought-proof infrastructure is far less than the cost of water scarcity.

Part 2: The Texas Water Backbone Solution

System Overview

The Texas Water Backbone is a transformative infrastructure project that provides drought-proof water supply without taking a drop from East Texas rivers or aquifers.

Key specifications:

PARAMETER	VALUE
Pipeline Length	420 miles
Pipeline Diameter	96 inches (dual configuration)
Design Capacity	200,000–500,000 AF/year
ASR Buffer Storage	360,000 AF
Primary Source	Gulf Coast seawater desalination
Secondary Sources	Brackish groundwater (inland)
Material	Prestressed Concrete Cylinder Pipe (PCCP)
Design Life	75–100 years

Buffered Network Architecture

Unlike a single continuous pipeline, the Backbone uses a **buffered network architecture**—five hydraulically independent segments connected by aquifer storage and recovery (ASR) buffers.

SEGMENT	ROUTE	DISTANCE	ASR BUFFER
1	Gulf Coast (Freeport) → Victoria	80 miles	75,000 AF
2	Victoria → Gonzales/Carrizo	100 miles	100,000 AF
3	Gonzales → Austin/Highland Lakes	90 miles	75,000 AF
4	Austin → Waco/Temple	80 miles	50,000 AF
5	Waco → DFW Terminus	70 miles	60,000 AF

Benefits of buffered design:

- **Energy efficiency**: 72% lower pumping costs compared to continuous flow
- **Reliability**: 99.95% system availability—segments can be maintained independently
- **Flexibility**: Buffers absorb demand fluctuations and supply variations
- **Resilience**: No single-point failure can disable the entire system

Water Sources

Primary: Seawater Desalination

Gulf Coast desalination facilities produce high-quality drinking water from an unlimited source. The technology is proven globally:

- Tampa Bay Desalination (25 MGD) - Operating since 2007
- Carlsbad Desalination, San Diego (50 MGD) - Operating since 2015
- Israel national system (600 MGD+) - Multiple facilities

Seawater desalination is:

- **Drought-proof**: Ocean water doesn't depend on rainfall

- **Scalable**: Capacity can expand with demand
- **Proven**: No technological breakthroughs required

Secondary: Brackish Groundwater

Texas has over **4.5 billion acre-feet** of brackish groundwater—water too salty for drinking but easily treated. The Backbone is designed to collect treated water from inland desalination plants through connection stubs.

CONFIGURATION	CAPACITY	AVERAGE COST
Seawater only	500,000 AF/yr	$1,400/AF
With brackish	734,000 AF/yr	$1,170/AF

Multi-Use Corridor

The pipeline right-of-way accommodates additional infrastructure:

- **HVDC Transmission**: 3,000–4,000 MW connecting Gulf Coast renewable generation to load centers
- **Dark Fiber**: 144-strand telecommunications backbone
- **Brine Collector**: Parallel pipeline returning concentrate from inland plants to coastal processors
- **Future Options**: Hydrogen pipeline, second water main

Multi-use corridor revenue significantly improves project economics:

ASSET	INVESTMENT	ANNUAL REVENUE	PAYBACK
Dark fiber	$35M	$12M	2.9 years
HVDC transmission	$1.6B	$192M	8.3 years

Part 3: Governance Framework

Texas Backbone Authority

We recommend creating a new independent state agency—the **Texas Backbone Authority (TBA)**—via enabling legislation.

Board composition (9 members):

- 3 appointed by Governor
- 2 appointed by Lieutenant Governor
- 2 appointed by Speaker of the House
- 1 TWDB representative (ex officio)
- 1 TCEQ representative (ex officio)

Terms: 6 years, staggered. Removal: For cause only.

Operating Model

The Authority operates as an infrastructure owner, not a water producer:

1. **Private desalination operators** build and operate Gulf Coast facilities
2. **TBA purchases water** at Cost + 8% margin
3. **TBA transmits water** through the backbone infrastructure
4. **Municipalities purchase water** at infrastructure-sustaining rates

This model:

- Keeps technology risk with experienced private operators
- Provides guaranteed returns that attract investment
- Maintains public ownership of strategic infrastructure
- Allows competitive procurement of operating services

Pricing Framework

Three-tier pricing:

TIER	TRANSACTION	FORMULA
1	Operator → TBA	Operating cost + 8% margin
2	TBA Operations	Pipeline, pumping, ASR, admin
3	TBA → Municipality	Pass-through of Tiers 1 + 2

Municipal rate: ~$1,400/AF (Year 1)

Rate stability mechanisms:

- Annual rate changes capped at ±10% absent extraordinary circumstances
- Multi-year rate smoothing to avoid spikes
- Cost Stabilization Reserve funded by brine profits

Municipal Access Conditions

Access to Backbone water is conditioned on demonstrated commitment to responsible water management—"Fix the pipes to get the water."

TIER	WATER LOSS (GCD)	ALLOCATION ACCESS
Tier 1: Full	< 45 GCD	100%
Tier 2: Standard	45–60 GCD	80%
Tier 3: Conditional	60–75 GCD	60%
Tier 4: Restricted	> 75 GCD	40%
Tier 5: Probationary	> 90 GCD	Emergency only

This ensures new supply creates lasting infrastructure improvements, not just replacement for water lost to leaking pipes.

Part 4: Financial Analysis

Capital Costs

COMPONENT	COST (MILLIONS)
Pipeline materials (dual 96")	$4,000
Trenching and installation	$2,700
Right-of-way acquisition	$400
Pumping stations	$400
Desalination facilities	$2,500
ASR storage systems	$1,100
Engineering and contingency	$2,320
Total	**$11,150**

Operating Costs

COMPONENT	COST/AF
Desalination operations	$700
Operator margin (8%)	$56
Pipeline operations	$200
Pumping energy	$100
ASR operations	$75
Administrative	$75
Total	**~$1,200/AF**

10-Year Cash Flow Projection

YEAR	PRODUCTION	SALES	REVENUE	COSTS	SURPLUS
1	150K AF	100K AF	$170M	$166M	$4M
3	200K AF	155K AF	$227M	$212M	$15M
5	200K AF	170K AF	$255M	$227M	$28M
10	200K AF	195K AF	$333M	$269M	$64M

10-year cumulative surplus: $314 million (funds Phase 1 expansion)

Funding Sources

Texas Water Fund: $6–8 billion (30–40% of $20B fund)

Federal WIFIA: Up to 49% of eligible costs at Treasury rates

Private Investment: $2.5–3.0 billion in desalination operations

Comparison to Alternatives

SOURCE	COST/AF
Edwards Aquifer	$350
Carrizo-Wilcox	$600
Texas Water Backbone	**$1,400**
Vista Ridge Pipeline	$2,000+
New reservoir	$1,800–2,500

Backbone water is **30% cheaper** than the current alternative (Vista Ridge) and **drought-proof**.

Part 5: Environmental Considerations

Brine Management

Desalination produces concentrated brine (approximately twice seawater salinity). The Backbone addresses this through:

Ocean discharge: Brine discharged through diffusers into open Gulf waters (not bays/estuaries), achieving rapid dilution to background levels within 0.5 miles.

Brine valorization: Partnership with Gulf Coast chemical industry (Olin, Dow) to convert brine into industrial feedstock—salt, chlorine, magnesium, potentially lithium.

Marine Ecosystem Protection

Best available technologies minimize marine impact:

- **Intake**: Passive wedgewire screens, <0.5 ft/s velocity
- **Discharge**: Multi-port diffusers for rapid dilution
- **Monitoring**: Continuous salinity monitoring; quarterly biological surveys

Regulatory Compliance

AGENCY	PERMIT
TCEQ	TPDES discharge permit
EPA	NPDES (if federal waters)
Army Corps	Section 404/10 permits
GLO	Submerged lands easement

Estimated NEPA timeline: 2.5 years for programmatic EIS

Part 6: Implementation Timeline

Phase 1: Planning and Permitting (Years 0–3)

- Legislative authorization
- Preliminary engineering
- Environmental review initiation
- ROW identification

Phase 2: Phase 1 Construction (Years 3–7)

- Gulf Coast to San Antonio segment
- First desalination facility
- Initial ASR development
- **First water delivery: Year 5**

Phase 3: Full Build-Out (Years 5–12)

- San Antonio to Austin segment
- Austin to DFW segment
- Additional desalination capacity
- Multi-use corridor completion

Part 7: The Legislative Ask

We request the 89th Texas Legislature to:

1. **Pass enabling legislation** creating the Texas Backbone Authority with powers to develop, finance, and operate water transmission infrastructure.

2. **Authorize Texas Water Fund allocation** of $6–8 billion for initial construction phases.

3. **Direct TWDB** to incorporate the Backbone into regional and state water planning, with priority consideration for funding applications.

4. **Establish coordination requirements** with TCEQ, TWDB, and regional planning groups.

Appendix: Technical Specifications

Pipeline

- Diameter: 96 inches
- Material: Prestressed Concrete Cylinder Pipe (PCCP)
- Design life: 75–100 years
- Standards: AWWA C301/C304

ASR Storage

- Total capacity: 360,000 AF
- Target aquifers: Carrizo-Wilcox (primary), Gulf Coast, Trinity
- Regulatory: TCEQ UIC Class V permits

Desalination

- Initial capacity: 200 MGD
- Technology: Seawater reverse osmosis
- Energy: ~3.5 kWh/kgal
- Product water quality: Exceeds EPA standards

This document is prepared for policy development purposes. All projections require detailed engineering validation.

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