

Project Overview

This project involves designing a water transmission pipeline that originates at Canyon Lake and extends to a planned water treatment plant in San Marcos, TX. The objective is to convey raw surface water to the treatment plant to meet the increasing potable water demand of the growing region at a demand rate of 1100 GPM. The pipeline design incorporates hydraulic principles and engineering considerations to achieve an economical, efficient, and sustainable solution. Overall, the project aims to support residential, commercial, and industrial water needs while enhancing water supply reliability and accessibility in the region.

Meet the Team



Constraints & Standards

Route selection

- Following rural back roads with right-of-way → Easier permitting & access
- Avoid creeks → reduce erosion & flood risk

Hydraulic constraints

- Maintain 1100 GPM flow
- Account for system head (elevation)
- Pump + Tank for pressure stability

Minimize environmental impacts

- Limit disturbance to creeks & habitats
- Use roadway corridors to reduce footprint

Sustainability evaluation

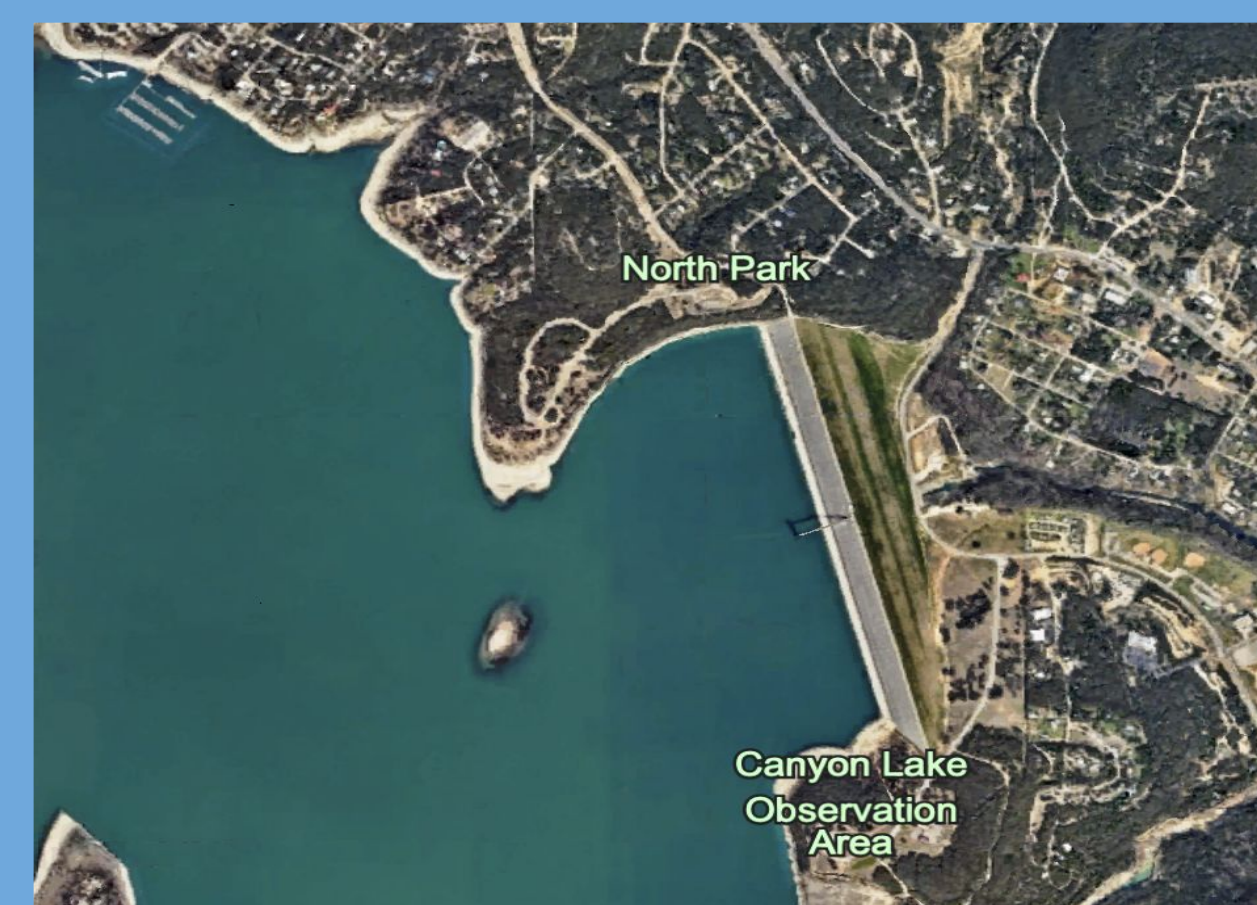
- Assess project performance using Envision framework
- Evaluates long-term impacts, resource use, and system resilience

Alternative Methods

Alternative 1	Alternative 2	Alternative 3	Alternative 4
Components	Components	Components	Components
22 mile route	22 mile route	22 mile route	22 mile route
10" Ductile Iron Pipe (DIP)	10" Ductile Iron Pipe (DIP)	18" HDPE Pipe	10" Ductile Iron Pipe (DIP)
1.5 MGD Holding Tank	Hydraulic Pumps	1.5 MGD Holding Tank	1.5 MGD Holding Tank
Smart Sensor (DAS) System	Smart Sensor (DAS) System	Smart Sensor (DAS) System	Sensorless System
Alternative 1 Drawbacks:	Alternative 2 Drawbacks:	Alternative 3 Drawbacks:	Alternative 4 Drawbacks:
<ul style="list-style-type: none"> • Higher material cost compared to HDPE in both Capital Cost and Life Cycle Cost Analysis • The Ductile Iron Pipe is less flexible overall than the HDPE pipe • The Smart Sensor (DAS) System is a great theory but due to it being new technology there is little history to its performance or life span 	<ul style="list-style-type: none"> • Least hydraulically efficient system requiring the highest pump head • System is strictly pump driven, requirement of having pumps running full time with minimal downtime, increasing long-term cost spent on energy, and maintenance • Highest required horsepower, no. of pumps, leading to increase in potential repair sites 	<ul style="list-style-type: none"> • Higher initial capital cost due to inclusion of elevated tank and smart monitoring system • Requires specialized system integration within pipeline installation increasing construction complexity • HDPE has lower structural stiffness that ductile iron, requiring careful trench support and bedding. 	<ul style="list-style-type: none"> • No live data on pipe health, pipe flow, or overall performance within the system • Inability to verify if system is running at its most optimal standpoint • Increase in likelihood of potential emergency, causing an increase in forecasted maintenance cost
Alternative 1 Advantages:	Alternative 2 Advantages:	Alternative 3 Advantages:	Alternative 4 Advantages:
<ul style="list-style-type: none"> • Ductile Iron Pipe is superior to HDPE in tensile strength and structurally overall • Ductile Iron Pipe has more hydraulic capacity because of the strength to wall thickness ratio making it a more sustainable choice to follow flow requirements without upsizing. • More stable with variable conditions as well as a stronger service life history 	<ul style="list-style-type: none"> • No requirement of additional tank structural design, engineering, planning, construction, for the system leading to reduction capital cost • Fastest construction timeline • Conservative pump driven system design provides concise control of output flow, can be adjusted to accommodate future demands 	<ul style="list-style-type: none"> • HDPE is highly corrosion resistant, reducing long-term maintenance and extending service life • Smooth internal surface leads and large diameter, leading to minimization of frictional losses, improving hydraulic efficiency over long distances 	<ul style="list-style-type: none"> • Reduction in annual cost for licensing and software • Simplicity, reduced technical complexity • Elimination of need for contractors for optic fiber repairs, sensor replacement

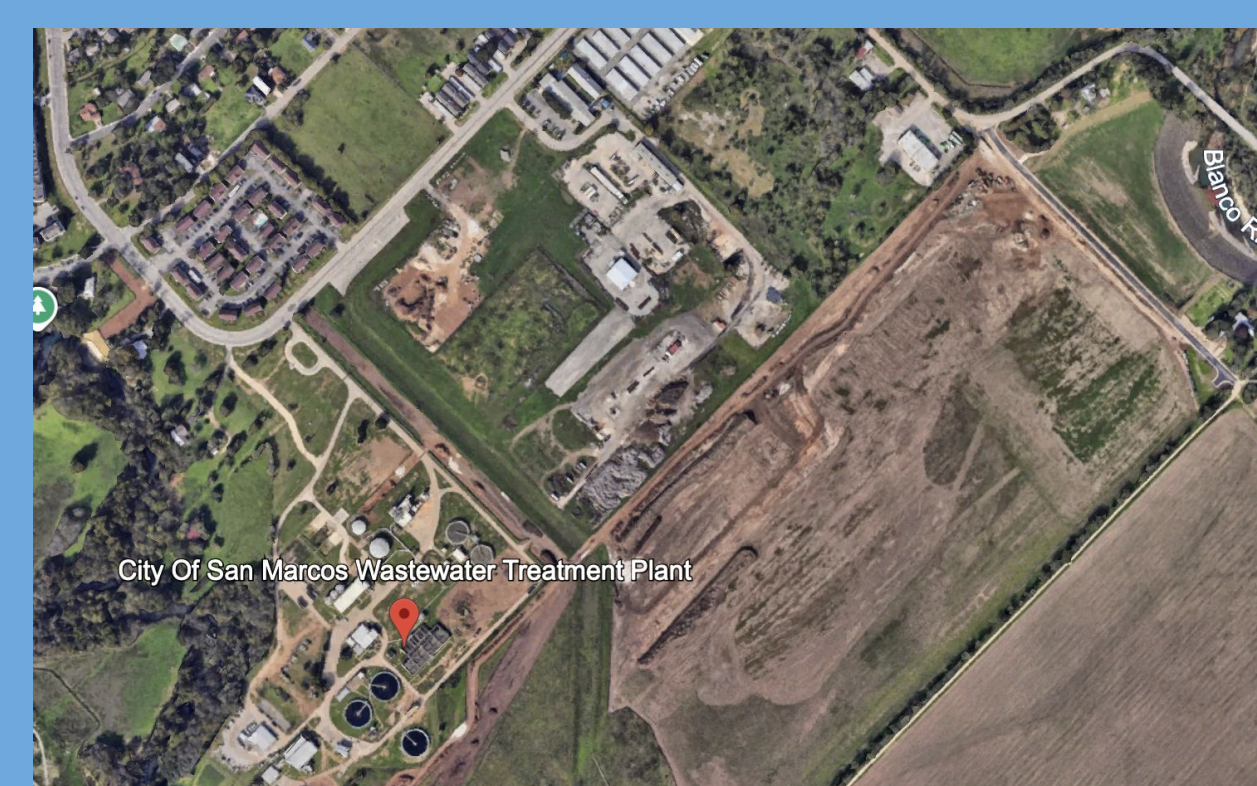
Route Overview

Starting Point



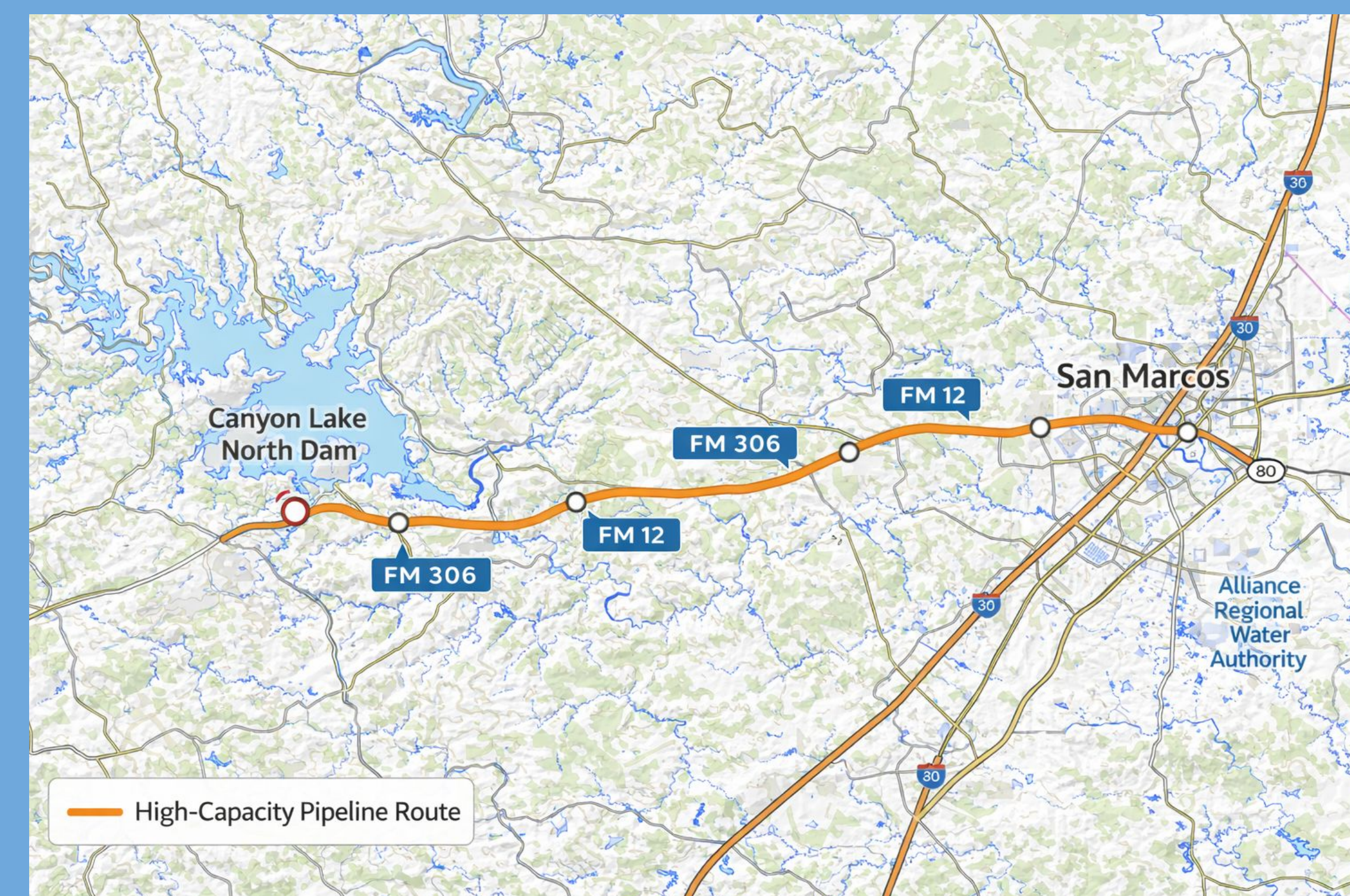
North Park Dam, Canyon Lake
Elevation: 1,002 ft

End Point



City of San Marcos WTP facility
Elevation: 572 ft

Proposed Route



22 mile Proposed route:

- Follows backroads to utilize existing ROW, minimize permitting, and c
- Improved constructibility, easier maintenance access, reduced environmental impact
- Balances cost, accessibility, and hydraulic efficiency better than creek based route

Sustainability



Envision Sustainability Program utilized because the grading scale aligned best with our project components

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Quality of Life	37%	36%	38%	35%
Leadership	47%	38%	47%	44%
Resource Allocation	51%	33%	56%	25%
Natural World	29%	10%	29%	4%
Climate & Resilience	53%	42%	62%	35%
Total %	44%	36%	46%	34%

Cost Analysis

	Total Capital Cost	Total Life Cycle Cost
Alternative 1	\$37,100,000	\$72,400,000
Alternative 2	\$30,900,000	\$84,900,000
Alternative 3	\$28,000,000	\$45,100,000
Alternative 4	\$35,800,000	\$69,900,000

Life-Cycle Cost Analysis (LCCA):

Analysis performed over a 100-year period using a 4% discount rate, incorporating capital cost, annual O&M (with escalation), scheduled rehabilitation (Years 25, 50, 75), and end-of-life replacement (Year 100) to determine total NPV and equivalent annual cost (EUAC).

Capital Cost Analysis:

Analysis using a itemized component-based approach for the fixed 22-mile system, including pipe material, excavation/backfill, installation, pumps, tanks (if applicable), and smart sensors, with engineering, planning, and contingency applied to obtain total project cost.