

C1.04 - Water Supply Project

Carlo Falco, Andrea Ibarra, Colby She



Project Overview

Our team's goal is to design a water supply pipeline from Maxwell to San Marcos Delivery Point 2 (between San Marcos and Kyle) as well as a booster pump station in Maxwell that can provide water from the Carrizo-Wilcox Aquifer to our community.

Background

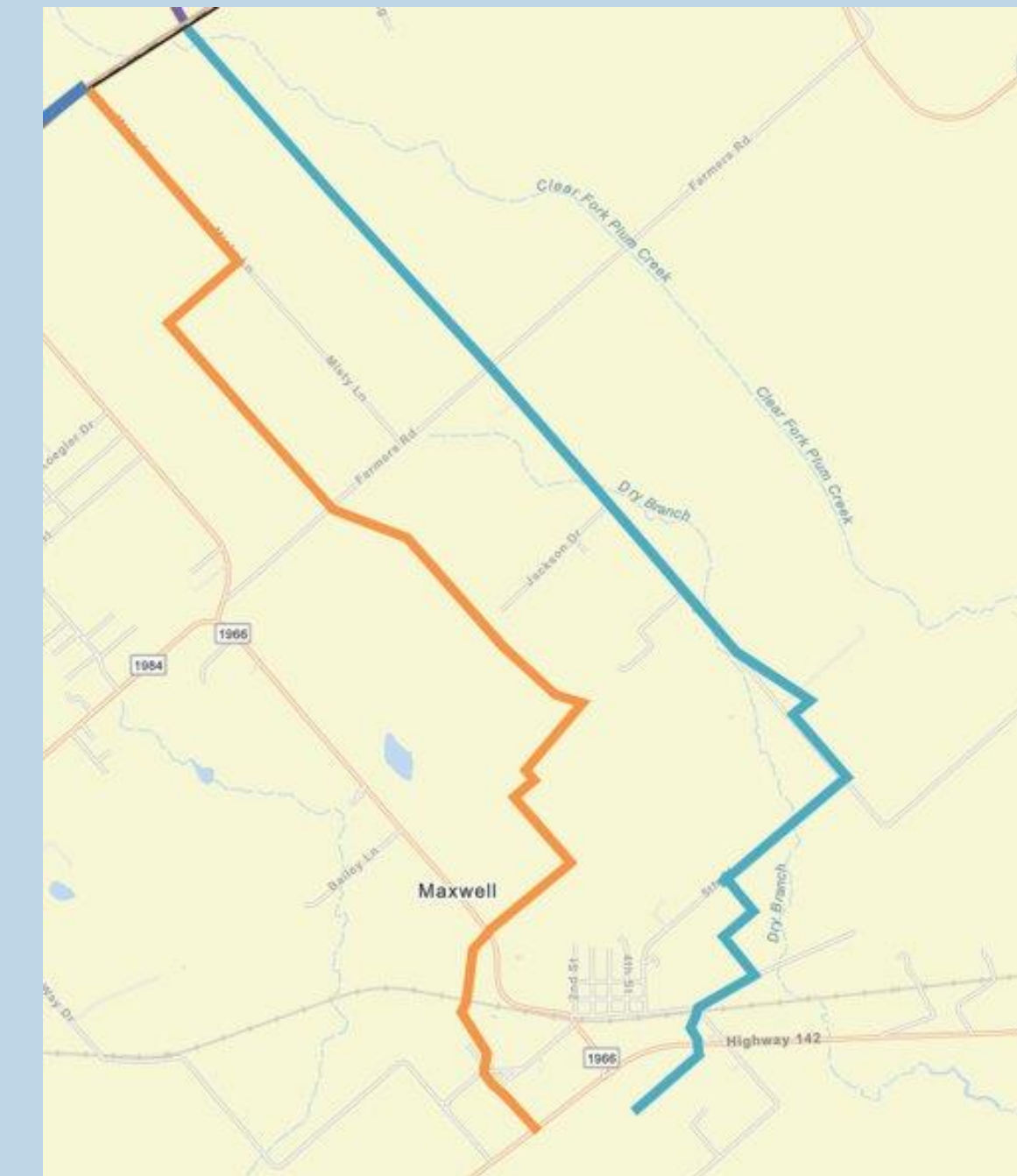
Hays County is experiencing a concerning increase in water demand due to the recent unprecedented growth in population. From 2020 to 2040, the water demand in Hays County is projected to increase by nearly 50%. This, combined with recent drought conditions, has made it obvious how our communities are in dire need of new water facilities that can provide a sustainable supply of water.

Design Considerations

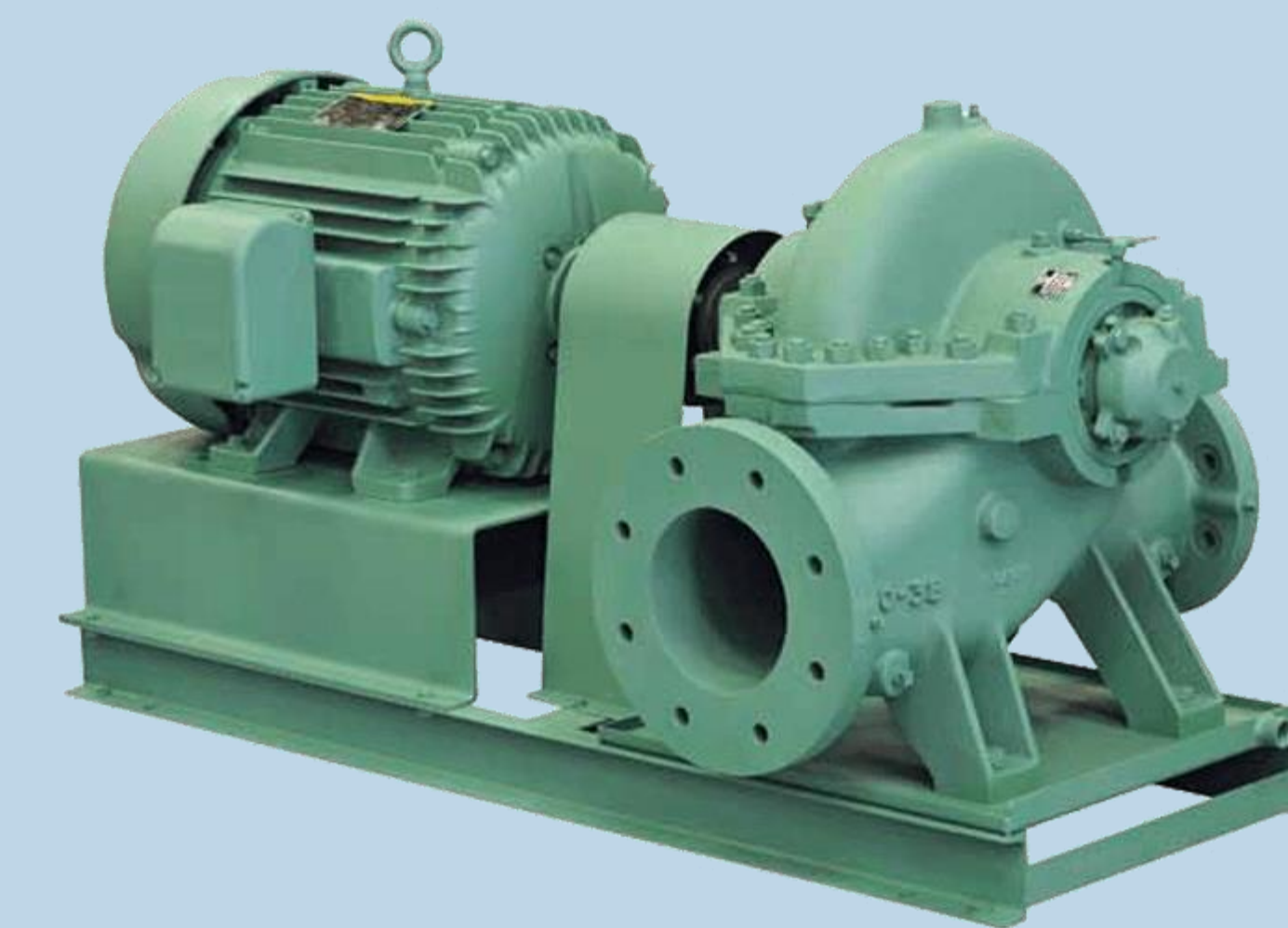
- Design Alternatives
 - Ease of construction
 - Land use
- Sustainability
 - Community quality of life
 - Siting and ecology
- Total Cost
 - Construction
 - Maintenance

Design Alternatives

- Pump configuration: Seven or Four Pumps
- Path configuration: Path 1 (Orange) and Path 2 (Blue)
- Criteria Weighing Matrix utilized to select design
- Ease of Construction, Land Use, Pump Configuration, and Cost considered
- Path 2 with four pumps chosen as design

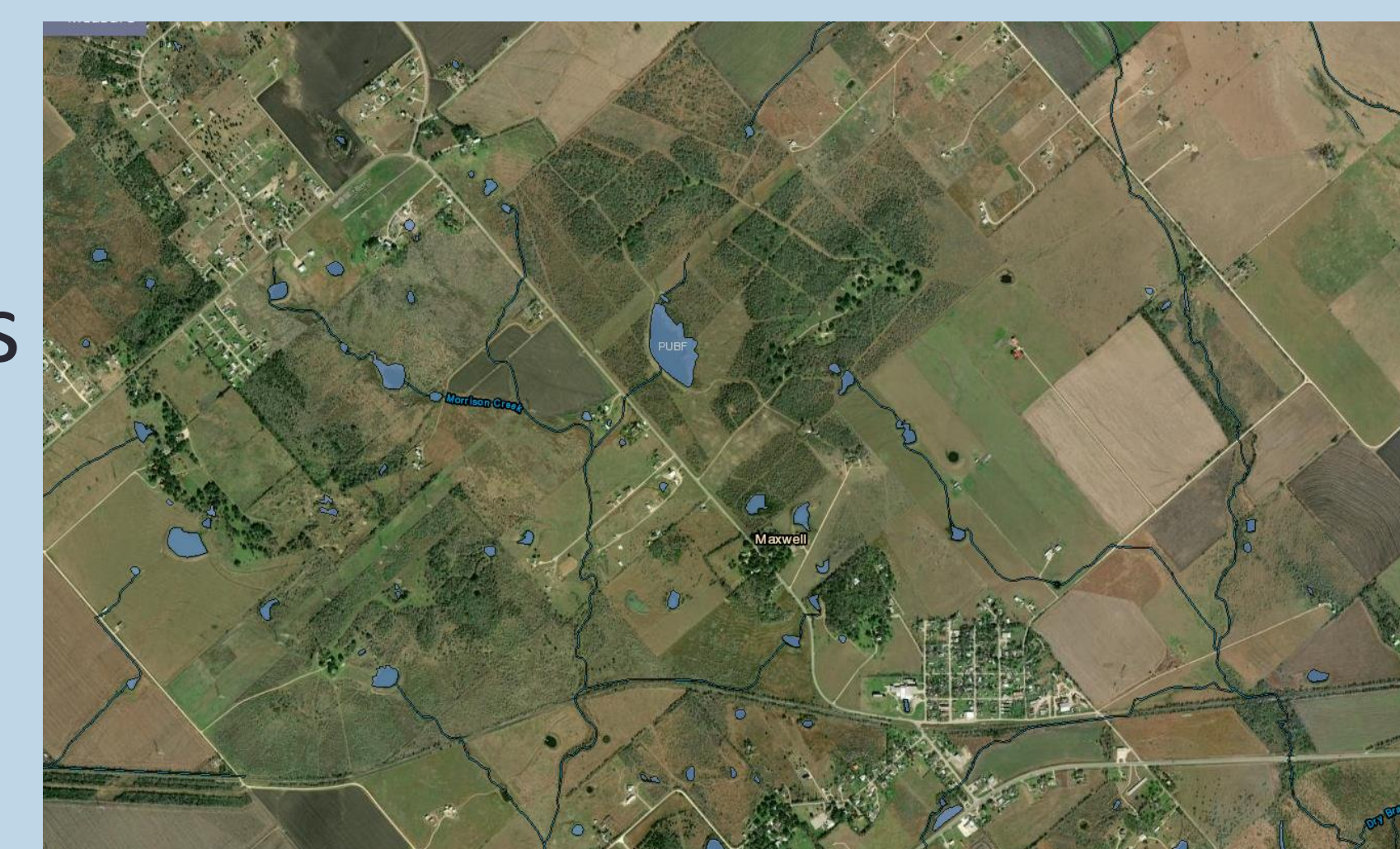


	Ease of Construction	Land Use	Pump Configuration	Cost	Maintenance Cost
Ease of Construction	1	-1	1	1	
Land Use	-1	1	1	0	
Pump Configuration	1	-1	-1	-1	
Cost	-1	-1	1	0	



Sustainability Evaluation

- Project evaluated with Envision Framework
- Sixty-four sustainability and resilience indicators
- 5 categories: Quality of life, Leadership, Resource Allocation, Natural World, Climate and Resilience
- Irrelevant indicators removed for analysis (Light Pollution, Pathfinding, etc.)
- Surpassed required level for accreditation
- Important aspects include improving community wellbeing, and not disturbing ecological areas with construction



Category	Indicator	Score	Target	Weight
QUALITY OF LIFE	QL.1 Improve Community Quality of Life	10	10	1
	QL.2 Establish Sustainable Growth and Development	10	10	1
	QL.3 Enhance Public Health and Safety	10	10	1
	QL.4 Minimize Noise and Vibration	10	10	1
	QL.5 Improve Community Security and Access	10	10	1
	QL.6 Increase Community Mobility and Transportation	10	10	1
	QL.7 Improve Site Accessibility, Safety and Wayfinding	10	10	1
	QL.8 Preserve Historic and Cultural Resources	10	10	1
	QL.9 Preserve Views and Local Character	10	10	1
	QL.10 Extend Useful Life	10	10	1
LEADERSHIP	LD.1 Provide Effective Leadership and Commitment	10	10	1
	LD.2 Establish a Sustainability Management System	10	10	1
	LD.3 Foster Collaboration and Teamwork	10	10	1
	LD.4 Provide for Stakeholder Engagement	10	10	1
	LD.5 Increase Organizational Transparency	10	10	1
	LD.6 Improve Infrastructure Integration	10	10	1
	LD.7 Plan for Long-term Monitoring and Maintenance	10	10	1
	LD.8 Address Conflicting Regulations and Policies	10	10	1
	LD.9 Extend Useful Life	10	10	1
	LD.10	10	10	1
RESOURCE ALLOCATION	RA.1 Reduce Net Embodied Energy	10	10	1
	RA.2 Reduce Net Embodied Carbon	10	10	1
	RA.3 Use Recycled Materials	10	10	1
	RA.4 Use Regional Materials	10	10	1
	RA.5 Reduce Excavated Materials Taken off Site	10	10	1
	RA.6 Provide for Decomposition and Recycling	10	10	1
	RA.7 Reduce Energy Consumption	10	10	1
	RA.8 Use Renewable Energy	10	10	1
	RA.9 Protect Fresh Water Availability Systems	10	10	1
	RA.10 Reduce Potable Water Consumption	10	10	1
NATURAL WORLD	NW.1 Preserve Prime Habitat	10	10	1
	NW.2 Protect Wetlands and Surface Water	10	10	1
	NW.3 Avoid Adverse Geology	10	10	1
	NW.4 Avoid Adverse Seismicity	10	10	1
	NW.5 Avoid Irreversible Development on Steep Slopes	10	10	1
	NW.6 Preserve Greenbelts	10	10	1
	NW.7 Manage Stormwater	10	10	1
	NW.8 Reduce Pesticide and Fertilizer Impacts	10	10	1
	NW.9 Prevent Surface and Groundwater Contamination	10	10	1
	NW.10 Control Invasive Species	10	10	1
CLIMATE AND RESILIENCE	CR.1 Reduce Greenhouse Gas Emissions	10	10	1
	CR.2 Reduce Air Pollutant Emissions	10	10	1
	CR.3 Avoid Traps and Vulnerabilities	10	10	1
	CR.4 Prepare for Long-term Adaptability	10	10	1
	CR.5 Prepare for Short-term Hazards	10	10	1
	CR.6 Manage Heat Island Effects	10	10	1
	CR.7	10	10	1
	CR.8	10	10	1
	CR.9	10	10	1
	CR.10	10	10	1

Capital and Life Cycle Costs

Easements (land)	\$1,883,434.30
Pumps	\$72,000.00
Pipes	\$16,559,281.25
Excavation	\$164,632,854.17
Aggregate	\$2,658,607.60
Total estimate:	\$185,806,177.32

Other costs		
OH & P (15%)	\$27,870,926.60	\$213,677,103.91
Mobilization (5%)	\$10,683,855.20	\$224,360,959.11
Contingency (40%)	\$89,744,383.64	\$314,105,342.75
Subtotal		\$314,105,342.75

Total Maintenance cost estimates:	Adjusted for inflation (4%/yr)
\$22,818.00 per mile	
\$248,913 Per year	
\$2,489,128 10 years	\$3,684,408
\$6,222,821 25 years	\$16,588,796
\$12,445,642 50 years	\$88,447,441
\$24,891,283 100 years	\$1,257,131,771

Next Steps

- Continue to refine construction & maintenance costs
- Develop construction timeline
 - Traffic models and flow control
- Develop Public Outreach & Information Plan

Acknowledgements

- Hannah Leppla, PE; Plummer Associates, INC
- Dr. Yongtao Dong, PE; professor
- Dr. Felipe Gutierrez, PE; professor