Wastewater Reclamation Facility Expansion AZ Water Student Design Competition

Clear Treatment Inc.

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CENE 476
12/08/2023

Purpose

- Design a water reclamation facility expansion for an existing facility
- Population growth: 0.75 MGD to 3 MGD

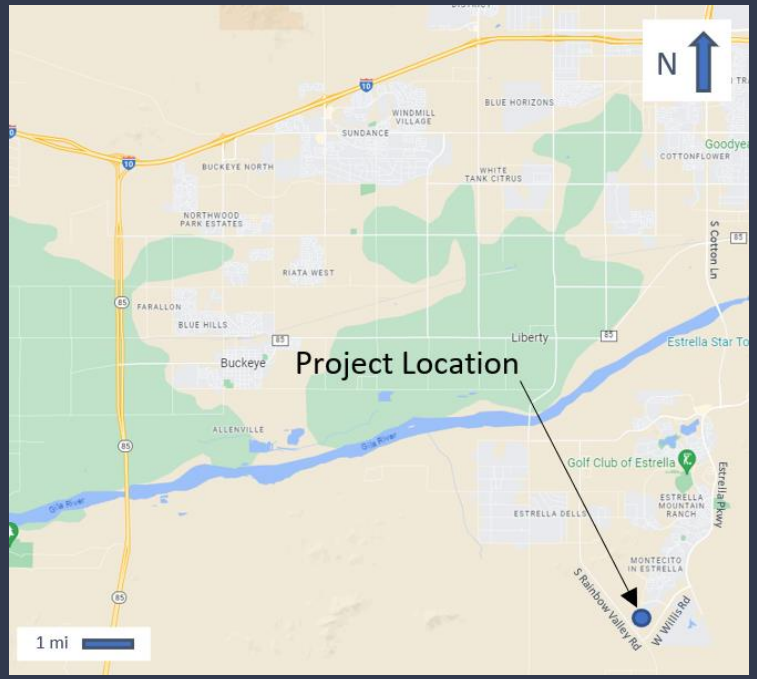


Figure 1: Project Vicinity Map [1]

Client

- City of Goodyear, Rainbow Valley Water Reclamation Facility & Dr. Heiderscheidt

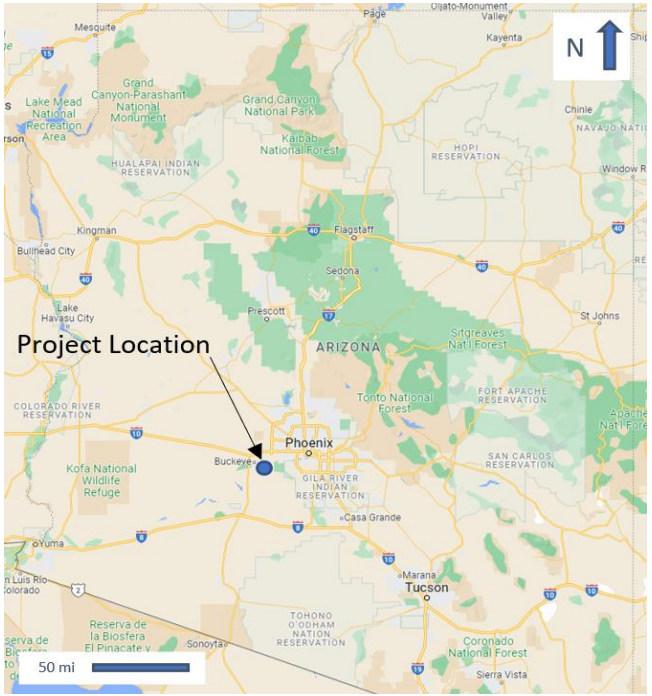


Figure 2: Location Map [1]

Brief Background

- Effluent is non-potable water distributed for irrigation reuse at a golf course
- Water Environment Federation (WEF) requires evaluation of three processes

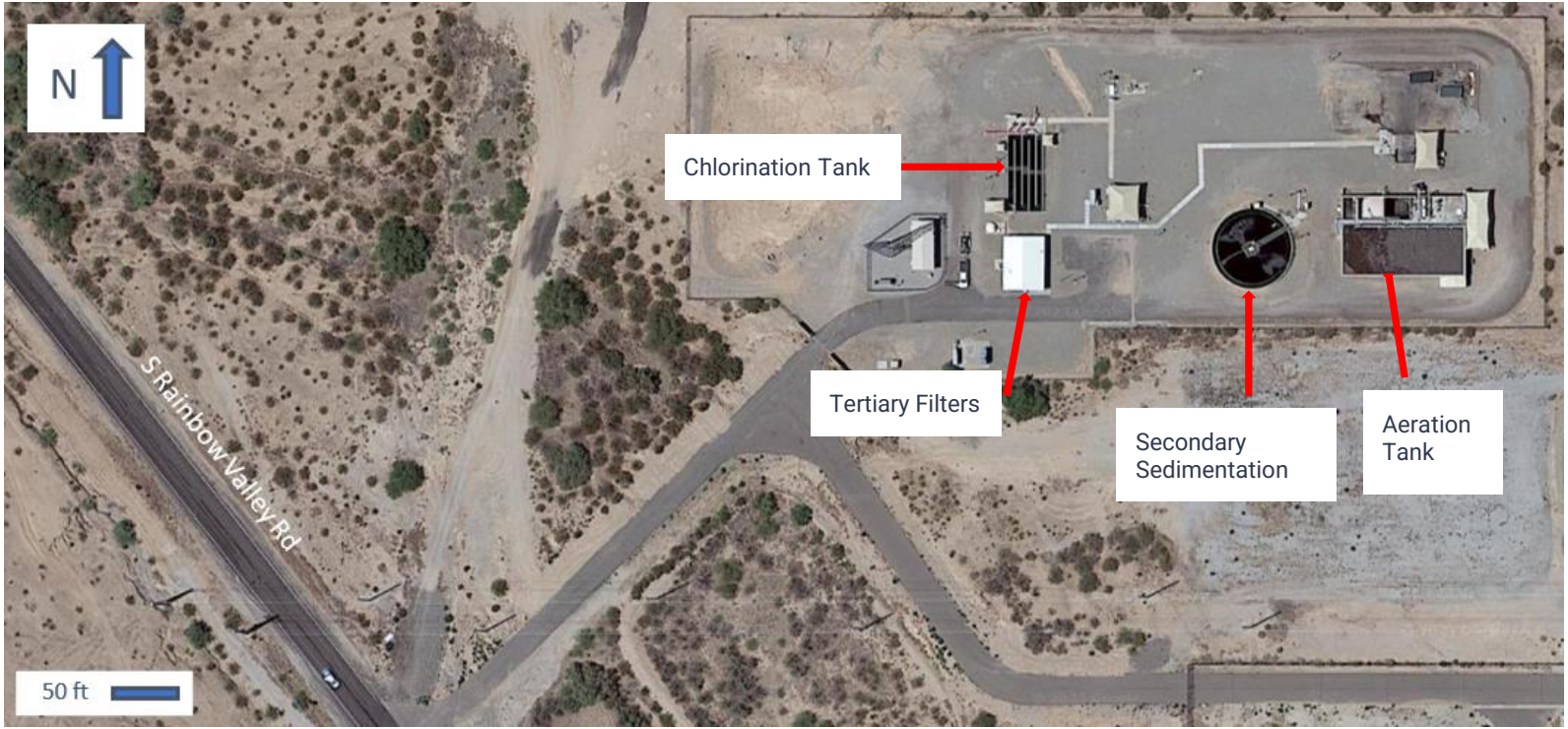


Figure 3: Project Site Map [2]

Task 1: Preliminary Assessment

Task 1.1 WEF Application

- Application due 12/16/2023

Task 1.2 Additional Treatment Research

- Research third treatment alternative

Task 1.3 Research Regulations

- Federal, state, and local regulations

Figure 4: Water Environment Federation [3]

Task 2: Site Assessment

Task 2.1 Site Visit

- Examine existing conditions

Task 2.2 Data Analysis

- Data will be provided

Task 2.3 Determine Topography

- Topographic data will be provided

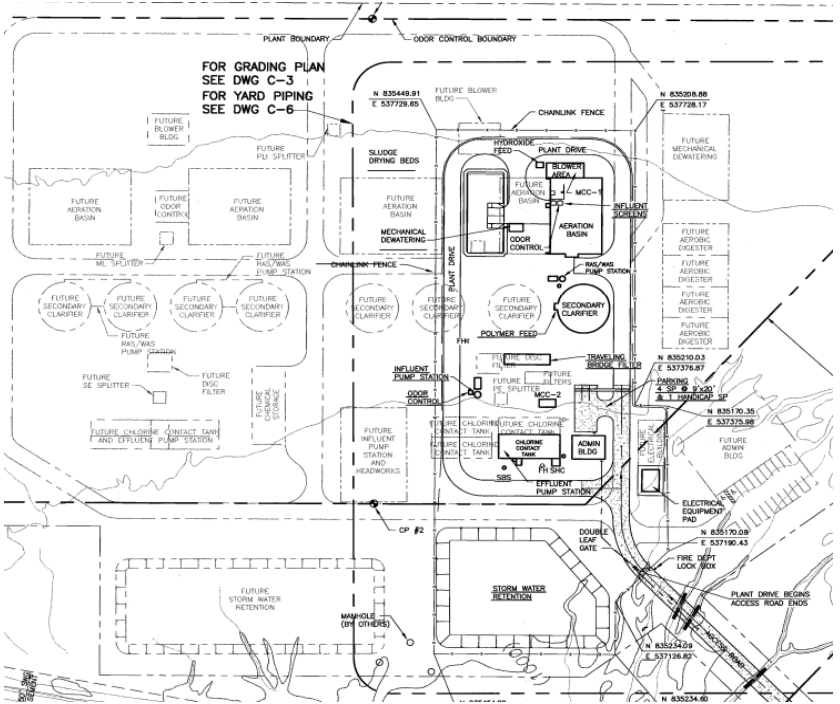


Figure 5: Rainbow Valley Site Plan [4]

Task 3: Treatment Design

Task 3.1 Determine Plant Requirements

Task 3.2 Preliminary Treatment

- Task 3.2.1 Determine Criteria
- Task 3.2.2 Develop Preliminary Treatment Alternatives
- Task 3.2.3 Select Best Alternative

Task 3.3 Primary Treatment

Task 3.4 Secondary Treatment

Task 3.5 Advanced Treatment

Task 3.6 Disinfection

Task 3.7 Solids Management

Figure 6: Wastewater Treatment Facility [5]

Task 4: Final Design

Task 4.1 Site Layout

Task 4.2 Hydraulic Analysis

- Task 4.2.1 System Analysis
- Task 4.2.2 Pump Selection

Task 4.3 Construction Phasing

Task 4.4 Economic Analysis

- Task 4.4.1 Construction Cost
- Task 4.4.2 Maintenance and Operation Cost
- Task 4.4.3 Life Cycle Cost Analysis

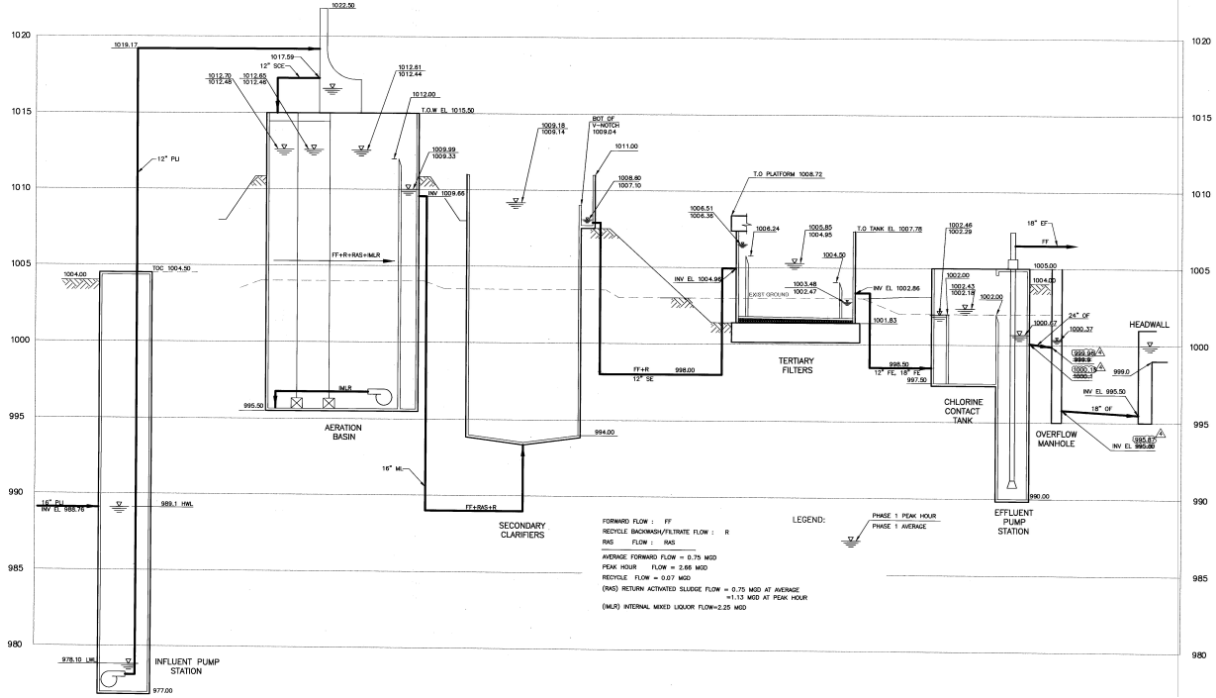


Figure 7: Existing Hydraulic Profile [6]

Task 5: Project Impacts Analysis

Social Impacts

- Examines local community effects

Environmental Impacts

- Odor, noise, and ecological effects

Economic Impacts

- Integrates costs for budget planning

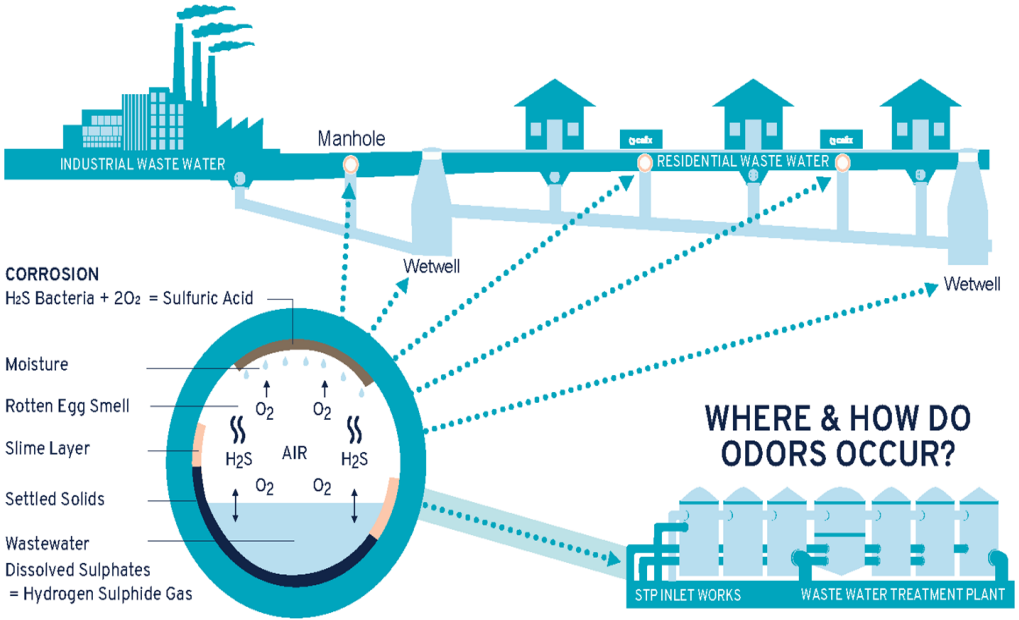


Figure 8: Odor Management [7]

Task 6: Project Deliverables

Task 6.1 30% Deliverable

Task 6.2 60% Deliverable

Task 6.3 90% Deliverable

Task 6.4 100% Deliverable

Task 6.5 Competition Deliverables

- Official entry form
- Competition design report
- Oral presentation

Figure 9: NAU Engineering Building [8]

Task 7: Project Management

Task 7.1 Meetings

- Regular meetings

Task 7.2 Schedule Management

- Project deadlines

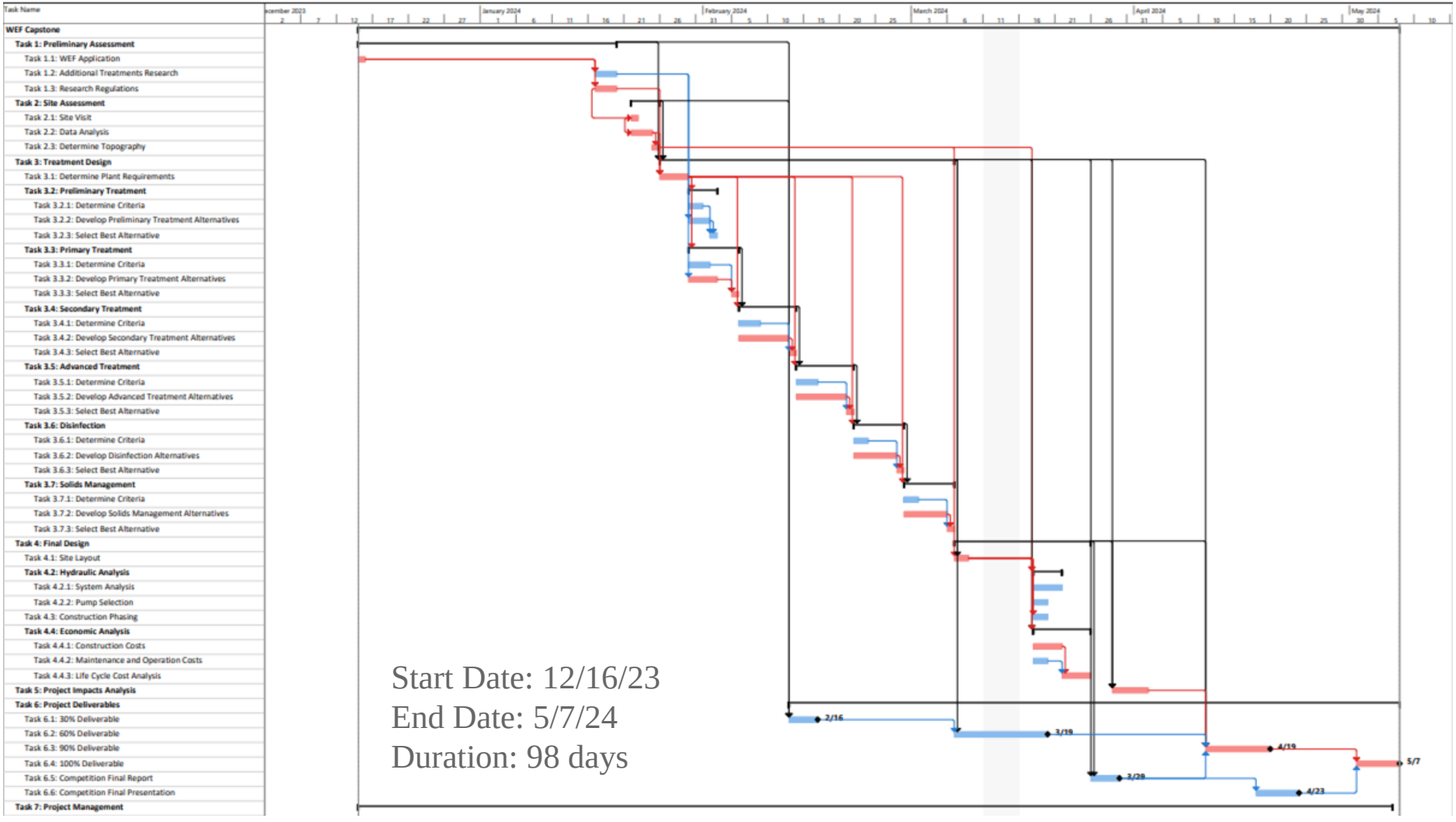
Task 7.3 Resource Management

Figure 10: Rainbow Valley Water Treatment Facility [9]

Exclusions

Figure 11: Goodyear Arizona [10]

- How the expansion will be constructed
- Any lab work
- Transportation of waste or wastewater
- Environmental studies
- Obtaining permits
- Operations of the facility
- Community outreach
- Create construction drawings
- Field survey or sampling work


Task Name
WEF Capstone
Task 1: Preliminary Assessment
Task 1.1: WEF Application
Task 1.2: Additional Treatments Research
Task 1.3: Research Regulations
Task 2: Site Assessment
Task 2.1: Site Visit
Task 2.2: Data Analysis
Task 2.3: Determine Topography
Task 3: Treatment Design
Task 3.1: Determine Plant Requirements
Task 3.2: Preliminary Treatment
Task 3.2.1: Determine Criteria
Task 3.2.2: Develop Preliminary Treatment Alternatives
Task 3.2.3: Select Best Alternative
Task 3.3: Primary Treatment
Task 3.3.1: Determine Criteria
Task 3.3.2: Develop Primary Treatment Alternatives
Task 3.3.3: Select Best Alternative
Task 3.4: Secondary Treatment
Task 3.4.1: Determine Criteria
Task 3.4.2: Develop Secondary Treatment Alternatives
Task 3.4.3: Select Best Alternative
Task 3.5: Advanced Treatment
Task 3.5.1: Determine Criteria
Task 3.5.2: Develop Advanced Treatment Alternatives
Task 3.5.3: Select Best Alternative
Task 3.6: Disinfection
Task 3.6.1: Determine Criteria
Task 3.6.2: Develop Disinfection Alternatives
Task 3.6.3: Select Best Alternative
Task 3.7: Solids Management
Task 3.7.1: Determine Criteria
Task 3.7.2: Develop Solids Management Alternatives
Task 3.7.3: Select Best Alternative
Task 4: Final Design
Task 4.1: Site Layout
Task 4.2: Hydraulic Analysis
Task 4.2.1: System Analysis
Task 4.2.2: Pump Selection
Task 4.3: Construction Phasing
Task 4.4: Economic Analysis
Task 4.4.1: Construction Costs
Task 4.4.2: Maintenance and Operation Costs
Task 4.4.3: Life Cycle Cost Analysis
Task 5: Project Impacts Analysis
Task 6: Project Deliverables
Task 6.1: 30% Deliverable
Task 6.2: 60% Deliverable
Task 6.3: 90% Deliverable
Task 6.4: 100% Deliverable
Task 6.5: Competition Final Report
Task 6.6: Competition Final Presentation
Task 7: Project Management
January 2024
February 2024
March 2024
April 2024
May 2024
2/16
3/19
4/19
5/7
3/29
4/23
Start Date: 12/16/23
End Date: 5/7/24
Duration: 98 days

Staffing

Task	SENG (hr)	ENG (hr)	EIT (hr)	INT (hr)	Total (hr)
Task 1: Preliminary Assessment	1	1	40	35	**77**
Task 2: Site Assessment	3	13	11	5	**32**
Task 3: Treatment Design	24	105	214	67	**410**
Task 4: Final Design	14	45	85	16	**160**
Task 5: Project Impacts Analysis	1	4	0	0	**5**
Task 6: Project Deliverables	20	35	35	31	**121**
Task 7: Project Management	25	30	20	20	**95**
Total Hours	**88**	**233**	**405**	**174**	**900**

Cost of Engineering Services

1.0 Personnel	Classification	Hours	Rate, $/hr	Cost, $
	SENG	88	250	22,000
	ENG	233	190	44,270
	EIT	405	142	57,510
	INT	174	73	12,702
			Personnel Sub-total	**136,482**
2.0 Travel	Classification	Items	Cost Per, $	Cost, $
	Car Rental	3 Days	$34/day	102
	Mileage	2 Trips, 300 Miles Each	$0.40/mi	240
	Hotel	4 Rooms, 1 Night	113/night	452
	Per Diem	6 Persons, 2 Days	$36.75/person/day	441
			Total Sub-total	**1,235**
3.0 Supplies	Classification	Items	Cost Per, $	Cost, $
	Computer Lab	10 days	$100/day	1,000
	3D Printing	500 grams	$0.12/gram	60
			Supplies Sub-total	**1,060**
Total				**138,777**

Citations

[1] Google. (n.d.). Google maps. https://www.google.com/maps/@34.4061183,-110.2637518,6.7z?entry=ttu

[2] Google. (n.d.). Google earth. https://earth.google.com/web/@33.29504528,-112.44927026,306.56596199a,510.45005165d,35y,0h,0t,0r/data=

[3] Mackie, A. (2020, December 21). WEF launches Dei intiatives. California Water Environment Association. https://www.cwea.org/news/wef-launches-dei-intiatives/

[4]"Site Plan", Appendix D_Rainbox WRF Record Drawings, Sheet 9 of 94

[5] CleanTech Water. (2023). Process of Treating Waste in Sewage Treatment Plant. https://www.cleantechwater.co.in/blog/process-treating-waste-sewage-treatment-plant/

[6] Hafiz, S. (2006, April). Rainbow Valley Water Reclamation Facility Phase I. Damon S Williams Associates.

[7] Odor and Corrosion Control | IER Wastewater Treatment Solutions. (2022, August 9). IER | Providing Alternatives for Caustic Soda Wastewater Treatment. https://ierwater.com/solutions/odor-corrosion-control

[8] Northern Arizona University Engineering Building, Northern Arizona University - CEFNS - CS486c - Team HAWC

[9] Good Year, AZ, Rainbow Valley 5mg reservoir and and pump station, Kear Corp Projects

[10] Klimek, Tim. "Top Things to Do in Goodyear, AZ." *TK LUXURY GROUP*, 29 Feb. 2016, tkluxurygroup.com/2016/02/things-to-do-in-goodyear-az/.

Questions?