Alternative Septic System for Single Family Residence

Proposal

ABCC Projects

Spring 2022 Capstone Prep

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Contents

1.0 Project Understanding

1.1 Project Purpose

The purpose of this project is to create a residential wastewater treatment system that also provides irrigation. This is due to the site being too far from the city so connecting to the city's wastewater treatment system is not an option. The best possible system to treat residential wastewater is an alternative residential septic system that can provide irrigation.

This project is needed so that the owners of a 5-acre lot can live there full-time without the excessive need to concern themselves with where their wastewater is going. A home septic system is a great way to fulfill those needs while still being a low-cost option. An on-site waste water treatment system, also known as a Package System, is another way of doing so, albeit more expensive. However, it will produce useful water that can be used for watering plants and will require less of a drainage field to fully dispose of the water.

1.2 Project Background

The site where this project is being planned is a 5-acre site on the outskirts of the city of Dewey-Humboldt, Arizona. The street address is 11800 East Prescott Dells Road, and the GPS coordinates 34° 31' 5.376'' N 112° 16' 43.032'' W.

The following is a map of the 5-acre site.

Figure 1. Topographical View of Site, Client Provided, GIS Survey [1]

The following maps show the location of the site in relation to Dewey-Humboldt, and in the state of Arizona respectively.

Figure 2. Site Location in Dewey-Humboldt, Google Maps

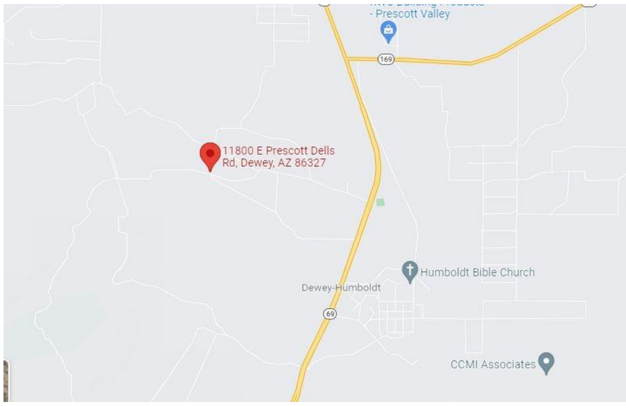
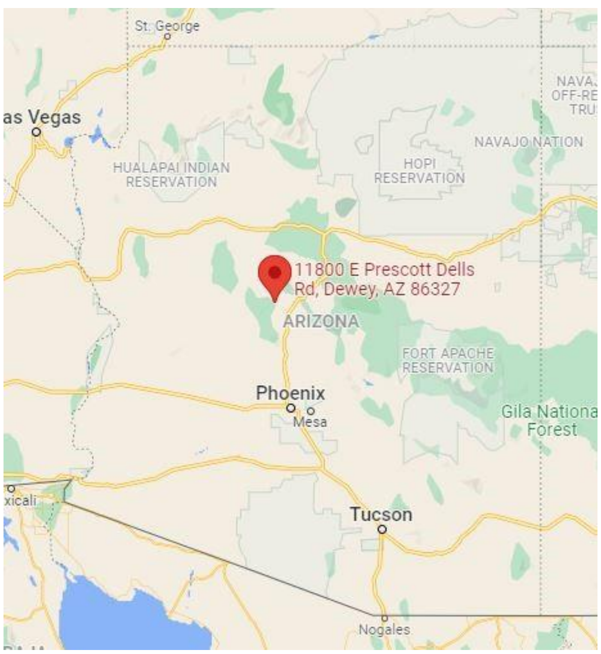


Figure 3. Site Location in Arizona, Google Maps



The site is a currently undeveloped 5-acre plot, recently bought by the client. It exists in a highland desert region of Arizona at 4,350′ elevation and is sparsely vegetated with desert plants and sandstone-sandy soil. The area is known to occasionally experience light snow in the winter months and reach temperatures as high as 90 Fahrenheit in the summer. A small, ephemeral stream borders the north edge of the site.

1.3 Technical Considerations

The technical aspects of this project include geotechnical, hydrology, and wastewater system design.

The design of a septic system requires an understanding of the geotechnical properties along with taking into account the number of bedrooms in the house that a leach field will be built in. The soil qualities, more specifically the soil characterization, will control the size and specifications of the leach field [2].

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A hydrologic analysis will be needed in order to ensure that discharged septic water into the soil will not interfere with local waterways. The nearest major waterway is an unnamed ephemeral wash [2], likely dictated by Arizona Department of Environmental Quality.

The wastewater system design will focus on a conventional septic system with the possibility of alternative uses for the treated wastewater and/or greywater, including irrigation of plants grown on the property [3].

1.4 Potential Challenges

There are many challenges when going through the engineering design process, both logistically and technically. These include some issues with gathering a site topographical map, gaining access to the site for a soil sample, and other issues that stem from lack of site access. Another challenge is meeting the correct regulations for septic systems these are found in the Yavapai City Codes in Title 18 in Chapter 9.

The first major challenge stems from site access. As of the writing of this, the client has been unable to clear ABCC Projects access to the site to perform a topographical mapping and soil sampling. Unless this issue is solved, the final design and assumptions made for infiltration rates may not reflect true values, causing issues when installing the system, potential failure of the system, and potential failure to uphold ADEQ requirements [4].

The second major challenge associated with septic systems is designing around the topography of the site and around nearby contamination hazards.

Since the leach field will be draining treated waste water into the local soils, anything that can be contaminated must be accounted for when choosing the field’s location. Nearby wells from the site and neighboring residences, the local ephemeral stream, and any other water hazards will need to be at least 100 feet between them as to avoid any contamination.

The leach field has some challenges associated with it as well namely in future use of the site The entire field will not be allowed to have any sort of heavy weight on it [2]. This means no vehicles or heavy structures/objects can be placed on it. The land set aside for the leach field will not be useful for any future projects the client may have.

Finally, a major challenge will be on government regulation over the treated waste water. Since the goal of the system is to include the ability for plant irrigation, there are a multitude of regulations from ADEQ and Yavapai county that require certain treatment levels and, from those levels, only particular use of that treated water.

1.5 Stakeholders

The stakeholders of this project include Taylor Layland and the property owners who intend to live on the site. Additional stakeholders include the Town of Dewey-Humboldt, Prescott, Arizona, and Yavapai county, as those are all the seats of regulatory and oversight agencies that will dictate the legal requirements of the project. Arizona Department of Environmental Quality also shares a stake in ensuring that the waste water does not contaminate state land and the ephemeral stream.

2.0 Scope of Services

Task 1: Research and Preparation

Commented [A2]: Include more information on research for different types of alternatives

To conform to all state and county codes, all applied regulations must be determed. It will be followed by research into technology options to meet the client's needs and is up to code.

Commented [A3]: Check spelling

Task 1.1: City and State Regulations

To conform to local codes and regulations, all such standards will require research. The agencies involved include: Yavapai County, Arizona Department of Environmental Quality, the City of Dewey-Humbolt, and the State of Arizona. All of these should include their regulations on the construction and operation of such septic systems.

Task 1.1.1: ADEQ, Yavapai, Dewey-Humboldt Construction Regulations

Task 1.1.2: Operation Regulation

Task 1.2: Technology Options Research

As the last step for the preparation phase, many options for technology to achieve the client's goal of a septic system with irrigation. While code research may not allow certain methods, a variety of technologies will be investigated. It is better to have this done early instead of during the design phase since certain technologies may require soil qualities that will be investigated in the following steps.

Task 2: Site Investigation

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The site investigation is the first task performed after the research and preparation. The first site investigation will be performed and just a visual investigation. On the final site investigation with three subtasks that will be performed next fall over 3 days to gain the technical data below.

Task 2.1: Surveying

Surveying would normally be performed to create a topographical map that will be used for analysis and system design. A topographic map was obtained from GIS with 7-foot contours. Even though a current topographic map is available, a contour map with map 1-to-2-foot contours will be a better representation of what the land looks like.

Normally, NAU Surveying Equipment would be used to create this topographic map. However, existing maps from online sources will instead be used to create a topographic map that will be used for future design alternatives.

Task 2.2: Site Soil Sampling

Site soil sampling will be taken from nearby, public lands that most closely match the site conditions of the soil. Several soil samples will be taken from said similar site and used to compare with online sources, such as the NRCS Soil Survey Maps. Normally, a variety of soil samples would be taken across the site to pick the best spot, but inability to gain site access has caused the above action to be taken.

Task 2.3: On-Site Soil Characterization test

To perform the soil characterization test using the ASTM D5921-96e1, ABCC Projects members would normally dig a hole that is at least 4 feet deep . Perc tests are typically required by government agencies for a septic system to be installed and are considered standard for all math usually done for septic systems. Since this is standard practice, perc test data from nearby developed plots of lands will be used for this site due to lack of site access.

Task 3: Data Analysis

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The data analysis will be broken down into three tasks: creating the topographical map, completing, and analyzing the results of the soil composition test, and completing and analyzing the results of the percolation test. These tests will be performed off site in the soil lab. These calculations will allow all design scenarios to work with similar data and be designed under the same conditions, as well as consider how individual technologies might react with the soil.

Task 3.1: Topographical Map

A topographical map will be made using online sources and imported into AutoCAD for further use in design scenarios.

Task 3.2: Soil Composition Test

Analysis of the soil will be done using ASTM D6913 Particle size distribution [5] of soil using sieve analysis. This will show what the major composition of the soil is and will lay the path for more intricate math involving particular technologies.

Task 3.3: Percolation Test

This task will be done using the ASTM D5857-15 Hydraulic conductivity [6]. This will show how quickly the water moves though the soil and will act as a check system for the perc test done earlier during the site investigation. It will also be useful for any technologies that will interact with hydraulic conductivity differently than how the water from the perc test would.

Task 4: Design Solutions

This step will be the bulk of the project by brainstorming and designing proposed solutions. This task will include design alternatives, a decision matrix, and will lead to a final design recommendation. Since it will include a large amount of AutoCAD/Civil3D work, involve math from earlier data analysis, and involve several design technology options, this step will involve a great deal of time.

Task 4.1: Design Alternatives

This task will take the research performed in task 1.1 and data from Task 3 to create different alternative septic system designs in compliance with Yavapai country standards and ADEQ. It will be most of the work designing the system, and work will be split amongst members by technology to maximize time efficiency. Finally, plans and design alternatives will be discussed amongst all members to ensure accuracy and redundancy.

Task 4.1.1: Final Site Location

This will be determined using the topographic map created in Task 3.1 and using the data collected from the onsite perc test in Task 2.3. For overall simplicity and efficiency, one final leach field and septic tank site will be chosen, and all following design alternatives will use the same chosen sites.

Task 4.1.2: Separate Design Configurations

Each member of the team will both individually and together to create ideas for an alternative septic system design that allows for irrigation. To assist in maximizing time issues, each member will work individually on separate technology options, and once most stages of design are complete, the group will convene to assure accuracy and redundancy, and thus reduce errors. This will require a large amount of AutoCAD/Civil3D work and should result in several final files of finished or mostly finished design plans.

Task 4.2: Design Decision Matrix

In this task each design will be rated using a weighted point system. The system will incorporate several factors such as budget, water quality, ease of operation, and system reliability weighted for importance. The final design with the most points that also completes all criteria and constraints for the project will be chosen for final design.

Task 4.3: Final Design Recommendation

This final recommendation will achieve all the problems, constraints, and criteria, as well as all client needs for the system. It will have graded the highest on the Design Decision Matrix and will have general agreement from members of ABCC Projects individual judgement. If the final design file is not entirely completed by this point due to time constraints, it will be fully completed in this step.

Task 5: Impact Analysis

This task will be an analysis of the economic, social, and environmental impacts of the installation of the septic system. The economic impacts might include the cost of running the system, social impacts would include the requirements of running the system, and the environmental impact of the system on the environment.

Task 6: Installation and Operation

Due to the nature of a Septic System, it will be operated by non-professionals on site, in this case the residents of the site. To ensure the system is installed properly, plan sets for the final recommended design will be created so that any construction or installation group can do the installation. To ensure the system is used properly, an Owners and Operators Manual will be created.

Task 6.1: Installation Plan set

Once the Final Design Recommendation is completed, the AutoCAD/Civil3D files used to make it will be turned into a plan set that will outline installation of the system. This plan set should be readable by any agency that applies to install the system and should be easy to follow.

Task 6.2: Owners and Operators Manual

Since this septic system will be owned and operated by the residents of the site, a guide will be created for the operators so that the system can be run properly. The guide will include actions that should not be taken to prolong the life of the system and avoid

Task 7: Project Management

Project management is an important, recurring step that will occur for the duration of the entire project. It will include planning meetings, keeping a schedule, and ensuring progress, and marking down use of time and physical resources used throughout the project. Keeping records of all these items is important for final reporting as well as concurrent progress planning.

Task 7.1: Meeting Recording

Meetings will occur with the client, with the teaching advisor, and with the grading instructor throughout the course of the project. There should be at least one client meeting, four TA meetings, and as many GI meetings as there are submittals, if not more than that as needed. All meetings will be prefaced with an agenda of tasks and points for the meeting and recorded within a meetings binder.

Task 7.2: Schedule Management

Schedule management will include following the created schedule and Gantt chart and ensuring that it is being completed at the timepoints marked down. Schedule management will also include modifying the schedule as needed to consider time changes, setbacks, or excess progress. It will also keep track of the total hours that ABCC Projects team members spend on this project.

Task 7.3: Resource Management

Keeping track of physical resources will be an important part of managing the project. This task is typically intertwined with schedule management as ABCC Projects member's time is considered a valuable resource as well. Once design plans are made and Task 4 is generally completed, if not at least in its final stages, the cost of physical resources and materials to design the system will be considered at this stage. Additionally, any physical resources required for completion of the project, from access to technology to physical paper use will be catalogued as well.

Task 8: Deliverables

To ensure that the project is progressing in a timely manner, a series of tasks have been created to gauge the completion of the project at several stages. Each of the percentage submittals requires a report and presentation of progress achieved so far, and several milestones have been set up to align with those goals.

Task 8.1: 30% Submittal

For this submittal, the goals to be achieved include having completed the research and preparation process, have visited, surveyed, and sampled the site, and completed all applicable laboratory tests required to understand the soil composition of the site. With these completed, all the required data is now collected so that the design process can begin.

Task 8.1.1: Milestone: Tasks 1-3

Task 8.1.2: 30% Report and Presentation

Task 8.2: 60% Submittal

For this submittal, while the milestone achieved is much lower, having only completed a single main task, it is the largest of tasks that require doing. Task 4 will be concerned with the design of all alternatives for this setup. Since there are many ways of designing the system that include an irrigation setup, there will be several alternatives that take a great deal of time to make. After all of them are created, a design matrix and final recommendation are the major outputs of this Task.

Task 8.2.1: Milestone: Task 4

Task 8.2.2: 60% Report and Presentation

Task 8.3: 90% Submittal

For this submittal, most of the work for this project is complete by this point. The final parts of analyzing the impact of the system of economic, social, and environmental scales will be done, as well as the creation of final plan sets for installations and an Owners and Operators Manual. These final pieces are required for the Septic System to be installed and used properly.

Task 8.3.1: Milestone: Tasks 5-7

Task 8.3.2: 90% Report and Presentation

Task 8.4: Final Submittal

To bring this project to completion, a final submittal, including a final report, website, and presentation of the project is required. At this stage, all the design work is done, and the project has all prior tasks completed. This last step includes taking all the work that has occurred and organizing it into a final presentable form.

Task 8.4.1: Final Report

A final report will be made to give a more detailed view of the process it took to complete the project. Much like the final presentation, the entire project will be outlined in this report. However, unlike the presentation, the report will be written for an entirely technical audience. It will include many details about the project, as well as math, methodology, and figures of detail.

Task 8.4.2: Website

To catalog the process, parts, and members of this project, a website will be created. The website will be worked on throughout the entire project, adding to it as items reach completion. It will act as a permanent way to store and view project details, for both personal portfolio and future reflection.

Task 8.4.3: Presentation

This final presentation will give an overview of the entire process that occurred for this project to come to completion. A general overview with enough detail to be presented to engineers and consulting groups, but simple enough that the client is capable of understanding. All members of ABCC Projects will participate in this presentation.

Exclusions

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The following items will not be performed over the extent of this project. They are tasks that are unnecessary within the extents of designing a Septic System and/or deemed unnecessary by authoritative counsel.

Hydrologic Analysis

A hydrologic analysis is unneeded for two reasons. The first is that the water table below Sedona is deep enough that under EPA Septic System Design there should be no immediate issues. This will be explored and proven within Task 5.3: Environmental Impacts. Second, under Yavapai County, the design criteria for Septic Systems only requires planning around existing structures such as wells, and not distance to the water table.

Water Utilities Planning

Water utilities planning is unnecessary as it is outside of the scope of this project, and because the planned residence will be fed via water storage instead of local municipal water.

System failure environmental impact

While a system failure impact statement and guide could be useful to the owners of the system, it is more plausible to include actions to prevent system failure and steps to take in case of a system failure within the Owners and Operators Guide. Additionally, many such failures require the consultation of a local septic system maintenance agency to properly fix any issues within the system, the impact of which will be analyzed by said agency.

3.0 Project Schedule

The project proposed will use a Gantt Chart to keep on time with all major tasks and ensure progress to the end goal of completion of this project. The Gantt Chart can be found in the appendix (Figure 4).

4.0 Staffing Plan

The staffing plan has been created to show the workload of the four engineers on this project. The roles on this plan are: Senior Engineer (SENG), Engineer (ENG), Lab Technician (LAB), and Engineering Intern (INT). The full staffing plan can be found in the appendix (Table 1).

Work has been divvied up by experience and work type.

The Senior Engineer received a great deal of the work involving looking up codes, working on plan sets, and finally on project management. Their experience in a multitude of projects means that they can easily give good estimates of time and completion progress, as well as keep the group on task. Additionally, they are also in charge of the codes research, as they have searched them up in the past and thus know where to look. They can then give out the important information on the codes and regulations to the rest of the team.

The Engineer will do the bulk of the actual work on this project. Being as experienced as they are, assigning a great deal of the AutoCAD and topographical work is ideal. They will be most busy when the design configurations are being made, as they will be the one making the AutoCAD files, as well as doing the math required to ensure the design is within required parameters.

Commented [A7]: Switch to the EIT/ intern with senior egr having 5-10 hours to cut cost

The Lab technician has the least amount of work over the project. Their goals are to gather data for the Engineer so they can do the required design work. Gathering the survey data as well as taking and testing the soil samples is the majority of their job in this project.

Commented [A8]: Assuming no lab work bc not site access do we need?

The Intern will be mainly aiding the Engineer on most of the tasks they are performing. If the Engineer is doing a task, it is likely the Intern is not far behind, as the extra aid in AutoCAD, technical math, and other tasks will ensure the hardest parts of the project get done in a reasonable amount of time, and so that multiple pairs of eyes on the same task help to reduce errors. It is also a great way for the Intern to learn the process so they may take the Engineer's role someday.

5.0 Cost of Services

The cost of services can be found in appendix items Table 2 through Table 5. The tables show where certain costs have been allocated, as well as profit, pay rates, equipment costs, travel costs, and subcontracting.

Table 2 shows the overall cost of this project.

Table 3 shows the pay breakdown for each team member.

Tables 4 and 5 show the costs of expendable materials and equipment required for the project.

The final cost estimate for this project proposal comes out to $75,485.85.

Commented [A9]: Cut this down

6.0 References

[1] T. Layland, Interviewee, *Professional Engineer.* [Interview]. 26 January 2022.

[2] EPA, "Septic Systems (Onsite/Decentralized Systems)," Environmental Protection Agency, [Online]. Available: https://www.epa.gov/septic. [Accessed 7 Feb 2022].

[3] H. A.-H. a. M. Bino, "Effect of treated grey water reuse in irrigation on soil and plants," *Desalination,* vol. 256, no. 1-3, pp. 115-119, 2010.

[4] W. S. D. o. Health, "Signs of Septic System Failure," Washington State Department of Health, 2022. [Online]. Available: https://doh.wa.gov/community-and-environment/wastewater-management/septic-system/signs-failure. [Accessed 26 January 2022].

[5] ASTM, *D6913/D6913M-17 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.*

[6] ASTM, *D5856-15 Standard Test Method for Measurement of Hydraulic Conductivity of Porous Material Using a Rigid-Wall, Compaction-Mold Permeameter.*

7.0 Appendices

Staffing Time

Hours Sum					
600	Total Hours	138	220	39	203
Task #	Task	SENG	ENG	LAB	INT
1	**Research and Preparation**	**20**	**6**	**0**	**6**
1.1	City and State Regulations	**4**	**0**	**0**	**0**
1.1.1	ADEQ, Yavapai, Dewey-Humboldt Construction Regs	2			
1.1.2	Operation Regulation	2			
1.2	Site Sampling Plan	4			
1.3	Laboratory Access Plan	2			
1.4	Technology Options Research	10	6		6
2	**Site Investigation**	**0**	**10**	**23**	**22**
2.1	Surveying			13	12
2.2	Site Soil Sampling		5	5	5
2.3	On-Site Perc Test		5	5	5
3	**Data Analysis**	**10**	**10**	**16**	**16**
3.1	Topographical Map	10	10		
3.2	Soil Composition Test			10	10
3.3	Percolation Test			6	6
4	**Design Solutions**	**7**	**65**	**0**	**50**
4.1	Design Alternatives	**2**	**60**	**0**	**45**
4.1.1	Final Site Location	2			
4.1.2	Separate Design Configurations		60		45
4.2	Design Decision Matrix	5	5		5
4.3	Final Design Recommendation				
5	**Impact Analysis**	**15**	**15**	**0**	**15**
5.1	Economic	5	5		5
5.2	Social	5	5		5
5.3	Environmental	5	5		5
6	**Installation and Operation**	**30**	**60**	**0**	**40**
6.1	Installation Plan Set	10	30		20
6.2	Owners and Operators Manual	20	30		20
7	**Project Management**	**35**	**0**	**0**	**0**
7.1	Meeting Recording	5			
7.2	Schedule Management	15			
7.3	Resource Management	15			
8	**Deliverables**	**21**	**54**	**0**	**54**
8.1	30%	**5**	**15**	**0**	**15**

					Alternative Septic System
8.1.1.	Milestones: Tasks 1-3		5		5
8.1.2.	Report and Presentation	5	10		10
8.2	60%	**5**	**15**	**0**	**15**
8.2.1.	Milestones: Tasks 4		5		5
8.2.2.	Report and Presentation	5	10		10
8.3	90%	**5**	**15**	**0**	**15**
8.3.1.	Milestones: Tasks 5-7		5		5
8.3.2.	Report and Presentation	5	10		10
8.4	Final Submittal	**6**	**9**	**0**	**9**
8.4.1.	Final Report	2	5		5
8.4.2.	Website	2	2		2
8.4.3.	Presentation	2	2		2

Table 1. Staffing Time

Total Cost Analysis

Client: Taylor Layland

Contact:

Company: ABCC Projects

Total Cost of Project
$75,485.85

Index	Item	Rate ($/hr)	Hours	Subcost	Cost
1	**1.0 Personnel**				**$70,488.00**
2	Senior Engineer (SENG)	$240.00	138	$33,120.00	
3	Engineer (ENG)	$137.00	220	$30,140.00	
4	Lab Technician (LAB)	$50.00	39	$1,950.00	
5	Engineering Intern (INT)	$26.00	203	$5,278.00	
6					
7	**2.0 Travel**				**$135.40**
8	NAU Travel Reimbursement (79.1 miles x 2)	$0.445	158.2	$70.40	
9	Chevy Tahoe SSP, NAU Rental (1 day)			$65.00	
10					
11	**3.0 Supplies**				**$862.45**
12	Expendable Supplies			$250.96	
13	Equipment Usage			$611.49	
14					
15	**4.0 Subcontract**				**$4,000.00**
16	Installation Cost			$4,000.00	

Table 2. Total Cost of Project

Cost Breakdown per Position					
Title	Base Pay ($/hr)	Benefits %	Overhead %	Profit %	Billing Rate
SENG	120	30.00%	40.00%	10.00%	240
ENG	71	60.00%	10.00%	10.00%	137
LAB	23	80.00%	10.00%	10.00%	50
INT	19	20.00%	5.00%	10.00%	26

Table 3. Team Member Cost Breakdown

Supplies List

Total Cost	$250.96

Index	Item	Number	Cost
1	Pens (24pk)	2	$8.99
2	Scratch Notebooks	10	$4.79
3	Survey Notebook (Rite in the Rain)	1	$9.95
4	Soil Sample Bags (280pk)	1	$8.99
5	Sharpies (5pk)	2	$4.99
6	Pencils (24ct)	2	$2.99
7	Printer Ink	2	$50.00
8	Printer Paper (500ct)	2	$5.59
9	Oversized Planset Paper (400ct)	1	$39.00

Table 4. Expendable Supplies List

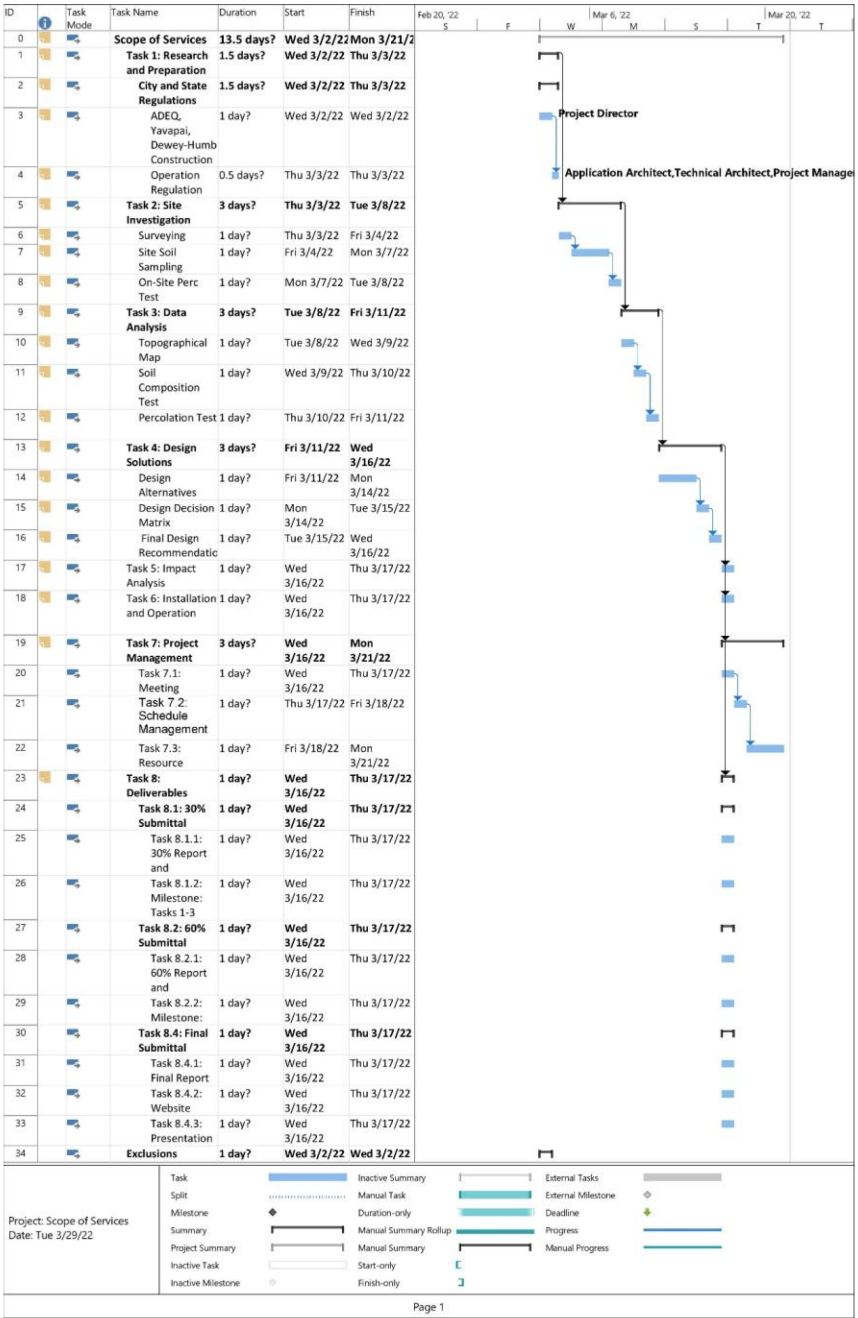
Equipment Use

Total Cost	$611.49

Index	Item	Number	Cost
1	Survey Equipment Rental (1 day)	1	$300.00
2	Website Maker, Adobe Dreamweaver (1 month)	1	$20.99
3	AutoCAD (1 month)	1	$220.00
4	Soil Auger Rental (1 day)	1	$70.50

Table 5. Equipment Costs

Figure 4. Gantt Chart



ID	Task Mode	Task Name	Duration	Start	Finish
0		**Scope of Services**	**13.5 days?**	**Wed 3/2/22**	**Mon 3/21/2**
1		**Task 1: Research and Preparation**	**1.5 days?**	**Wed 3/2/22**	**Thu 3/3/22**
2		**City and State Regulations**	**1.5 days?**	**Wed 3/2/22**	**Thu 3/3/22**
3		ADEQ, Yavapai, Dewey-Humb Construction	1 day?	Wed 3/2/22	Wed 3/2/22
4		Operation Regulation	0.5 days?	Thu 3/3/22	Thu 3/3/22
5		**Task 2: Site Investigation**	**3 days?**	**Thu 3/3/22**	**Tue 3/8/22**
6		Surveying	1 day?	Thu 3/3/22	Fri 3/4/22
7		Site Soil Sampling	1 day?	Fri 3/4/22	Mon 3/7/22
8		On-Site Perc Test	1 day?	Mon 3/7/22	Tue 3/8/22
9		**Task 3: Data Analysis**	**3 days?**	**Tue 3/8/22**	**Fri 3/11/22**
10		Topographical Map	1 day?	Tue 3/8/22	Wed 3/9/22
11		Soil Composition Test	1 day?	Wed 3/9/22	Thu 3/10/22
12		Percolation Test	1 day?	Thu 3/10/22	Fri 3/11/22
13		**Task 4: Design Solutions**	**3 days?**	**Fri 3/11/22**	**Wed 3/16/22**
14		Design Alternatives	1 day?	Fri 3/11/22	Mon 3/14/22
15		Design Decision Matrix	1 day?	Mon 3/14/22	Tue 3/15/22
16		Final Design Recommendatic	1 day?	Tue 3/15/22	Wed 3/16/22
17		Task 5: Impact Analysis	1 day?	Wed 3/16/22	Thu 3/17/22
18		Task 6: Installation and Operation	1 day?	Wed 3/16/22	Thu 3/17/22
19		**Task 7: Project Management**	**3 days?**	**Wed 3/16/22**	**Mon 3/21/22**
20		Task 7.1: Meeting	1 day?	Wed 3/16/22	Thu 3/17/22
21		Task 7.2: Schedule Management	1 day?	Thu 3/17/22	Fri 3/18/22
22		Task 7.3: Resource	1 day?	Fri 3/18/22	Mon 3/21/22
23		**Task 8: Deliverables**	**1 day?**	**Wed 3/16/22**	**Thu 3/17/22**
24		**Task 8.1: 30% Submittal**	**1 day?**	**Wed 3/16/22**	**Thu 3/17/22**
25		Task 8.1.1: 30% Report and	1 day?	Wed 3/16/22	Thu 3/17/22
26		Task 8.1.2: Milestone: Tasks 1-3	1 day?	Wed 3/16/22	Thu 3/17/22
27		**Task 8.2: 60% Submittal**	**1 day?**	**Wed 3/16/22**	**Thu 3/17/22**
28		Task 8.2.1: 60% Report and	1 day?	Wed 3/16/22	Thu 3/17/22
29		Task 8.2.2: Milestone:	1 day?	Wed 3/16/22	Thu 3/17/22
30		**Task 8.4: Final Submittal**	**1 day?**	**Wed 3/16/22**	**Thu 3/17/22**
31		Task 8.4.1: Final Report	1 day?	Wed 3/16/22	Thu 3/17/22
32		Task 8.4.2: Website	1 day?	Wed 3/16/22	Thu 3/17/22
33		Task 8.4.3: Presentation	1 day?	Wed 3/16/22	Thu 3/17/22
34		**Exclusions**	**1 day?**	**Wed 3/2/22**	**Wed 3/2/22**