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CENE 476 Fall 2018

Project Proposal: Water Environment Federation Arizona Water Student Design Competition: Wastewater Facility Design

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In Preparation For:
The Arizona Waters Student Design Competition

1.0 Project Understanding

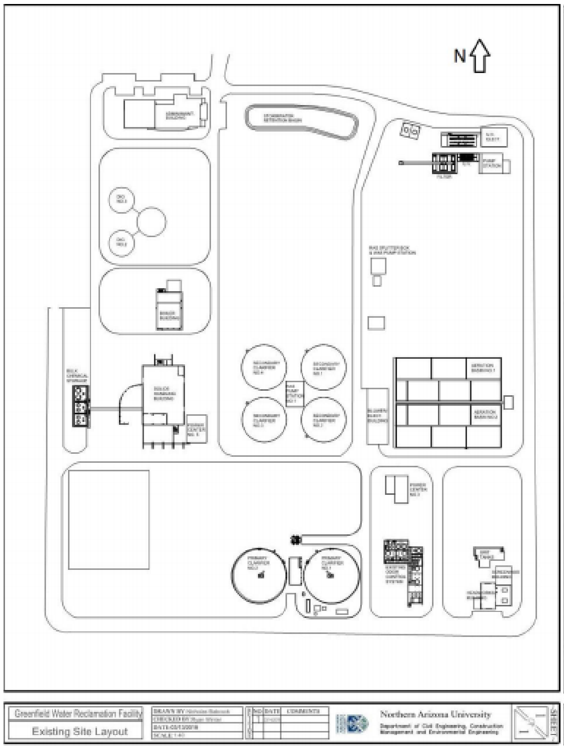
1.1 Project Purpose

The purpose of the project is to design a new or improve an existing wastewater treatment facility (WWTF) in Arizona. In the Arizona competition teams from the universities of Northern Arizona University, Arizona State University and University of Arizona compete against each other and against any other student teams that apply for the competition. The competition provides practical experience relating to environmental water protection and design for a wastewater treatment facility. The judges evaluate the project plans based on project scope, schedule, implementation plan, team member responsibilities and roles, table of contents, understanding of the client's expectations, evaluation of wastewater characteristics, and decision matrix for technology selection [1, 2]. The Arizona Waters Student Design Competition rules and regulations will be released in January 2019

1.2 Project Background

Each year, the Arizona Water Student Design Competition hosts the Arizona universities to compete on the problem statement. The problem statement involves a problem relating to current wastewater design projects located in Arizona [2, 3]. The 2019 WWTF will likely be a redesign on an existing facility or a new design of a WWTF. The release date describing the location and rules is scheduled for January 2019. The project is in Arizona, however the town, conditions of the site, city’s current design for treating wastewater, and size of town have not been specified. The typical information provided by the competition includes the project location, design requirements, analysis requirements, project exclusions, and judging considerations. The team is preparing for any design challenges by creating innovative and conventional wastewater treatment plant designs that can be scaled and modified to meet the needs of the competition and town.

The 2018 Arizona Waters competition designed an expansion for the Greenfield Water Reclamation Facility (GWRF), which serves the Town of Gilbert, City of Mesa, and Queen Creek (Figures 1, 2) [3]. The NAU team won the 2018 Student Design Competition with their final design of the GWRF. The photos of the before and after expansion design can be seen below in Figures 1 and 2.



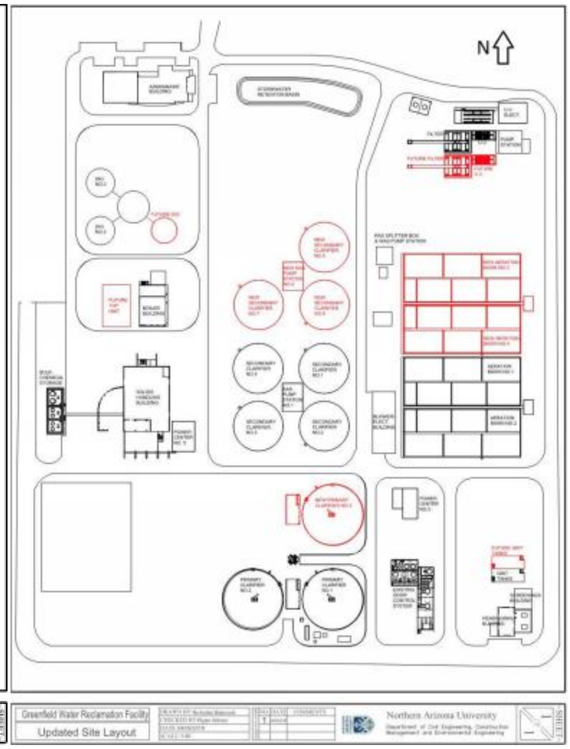


Figure 1: As-builts of existing facility [3]

Figure 2: Proposed improvements [3]

1.3 Technical Considerations

1.3.1 Conventional Design

1.3.1.1 Primary Treatment

Primary treatment is the first phase of wastewater treatment as the effluent enters the plant. Primary treatment processes can include; screening, grit removal, comminutors and grinders. These processes remove any objects or particles that could clog or cause harm to the treatment systems downstream [4].

1.3.1.2 Secondary Treatment

Secondary treatment used biological processes to treat the wastewater for chemicals that are in the effluent. These chemicals can include ammonia, carbon, nitrogen and phosphorus. Secondary treatment processes can include; aerobic treatment, activated sludge tanks, trickling filters, rotating biological contractors, oxidation ponds, constructed wetlands and anerobic treatment. Once this treatment phase is complete, the water can be released in to the environment or ground depending on local regulations [4].

1.3.1.2.1 Advanced Secondary Treatment

Advanced Secondary Treatment or Secondary Clarification disinfects the water of any viruses or bacteria. Secondary clarification can include ultra violet radiation, ozone injection and chlorination. Once the treatment is complete, the water can be released into a surface body of water, discharged into the ground or reused for reclaimed water systems [4].

1.3.2 Innovative Design

1.3.2.1 Designs

There are a variety of innovative systems for each step of the treatment process. The standard primary treatment of coagulation and flocculation can be replaced with electrocoagulation that does not use chemicals to settle particles. There are many new technologies available for secondary treatment including anaerobic, fixed film filters such as rotating biological contactors (RBC), and constructed wetlands. Innovative systems for disinfection include UV disinfection, ozone, and copper ionization. Cooper ionization uses copper electrodes to emit positively charged ions into the water [5]. A combination of innovative and conventional technologies may be used for the final design.

1.3.3 Collection Systems

Collection systems transport the wastewater from its source to the treatment plant. The most common type of collection system is a non-pressurized, gravity fed pipe. When designing the collection system, the team will need information about town demographics from the census bureau [6], terrain, climate, expected usage and all applicable codes and standards for the town [4].

1.3.4 Codes and Specifications

The wastewater treatment plant and collection system need to conform to local, state and federal codes and specifications. The major agencies that control wastewater treatment are the Environmental Protection Agency and the Arizona Department of Environmental Quality. The code can include specifications about acceptable amounts of chemicals, clarity of the water, where the water can be released and how to treat the water [7].

1.4 Potential Challenges

1.4.1 Location

Arizona has an arid and semi-arid climate, but towns located at higher elevations are subject to moderate to severe winter conditions [8]. Because of the varying climates in Arizona the design will have to be altered based on the location of the town. Different unit processes will have to be chosen depending on the location and climate conditions of the town [9].

1.4.2 Population

Population and projected population growth of the town where the project will take place is unknown until the competition releases the project location. The team will utilize US census data to determine the design capacity [6].

1.4.3 Competition Rules

The problem statement for the Arizona Water section of the Water Environment Federation will not be released until January 2019. The team does not yet know the location of the project, the demographics of the town, the rules of the competition, and competition criteria. The competition rules define the limitations of the project, what the teams can design and the specifics of the design [2] [1]. The limitations for the project can include; project budget, plant size, population, location and type of systems that will be implemented in the design. Once the rules of the competition are released the design of the project can be started and correctly set for the competition.

1.5 Stakeholders

The Water Environment Federation will review and rate the project deliverables. The town of the treatment facility is the primary beneficiary. The town is affected by all major aspects of the outcome of this project including location, size, cost, and flow capability. The project affects the county of the city. NAU has stake in the outcome because the team will represent the university at the WEF competition.

2.0 Scope of Services / Research Plan: Required Content

2.1 Task 1.1 Application Process

The team will join the WEF and AZ Water Association. The cost to become student members of WEF and AZ Water will be $20 per year and $15 per year. The AZ Water Student Design Competition application will be completed to be eligible to compete [10, 11].

The team will complete a design entry form for the competition with aide from Dr. Dianne McDonnell, the faculty advisor. An abstract submission form (less than 200 words) will discuss the chosen design. The abstract will be submitted to AZ Water and WEF with the team entry form [2]. The team will receive the project location and the expectations of the competition. The prompt will be analyzed and discussed with technical advisors. The following tasks will be based upon information provided by the design competition guidelines.

2.2 Task 2 Site Assessment/Planning

2.2.1 Task 2.1 Virtual Site Assessment

Conduct base analysis of the project site to determine the best approach for the remainder of the design and analysis. Use online imagery, data and maps for the area to compile into the map and complete some base level analysis. Map topographic features that will have an impact on the location and the layout of the WWTP. These features can include flood plains, rivers, natural channels and other bodies of water, existing slopes, slope reliefs, existing infrastructure and topographical challenges. Generate site map in ARCGIS or AutoCAD using GIS data, Topography Map and location imagery.

2.2.2 Task 2.2 Site Visit

Visually inspect the site, take note of important aspects that were not present on the site map, inspect the town demographics and current wastewater disposal methods.

2.2.3 Task 2.3 Layout Project

One or more WWTF preliminary layouts will be produced during this phase of the project based on information obtained from completing tasks 2.1 and 2.2.

2.3 Task 3 Design

The team will analyze options for each unit process of the wastewater treatment process. Decision matrices will be used to decide the system for each step. Factors to consider will be cost (capital, operational, and maintenance), space requirements, presence of emerging pollutants, flow loads, and climate.

2.3.1 Task 3.1 Design Traditional System

2.3.1.1 Task 3.1.1 Preliminary treatment system

Preliminary treatment is used to remove large inorganic solids from wastewater entering the WWTP. It is important to prevent clogging and equipment damage. The team will create a decision matrix to choose between preliminary treatment options. The matrix will decide between screening options, grit removal options, usage of a grinder pump, and where the collected waste will be disposed of [12].

Equation 1: Velocity [13, 14]

$$V = \frac{Q}{A}$$

Where:

V = Velocity (ft/s)

Q = Flow Rate (ft3/s)

A = Area (ft2)

2.3.1.2 Task 3.1.2 Primary treatment system

Primary treatment is used to settle suspended solids in water. The main task in designing a primary treatment system is designing the sedimentation basin [12]. The design will consider the overflow rate, retention time, and weir loading of the inflow. The use of the removed biosolids will also be determined.

Equation 2: Hydraulic Retention Time [13, 14]

$$HRT = \frac{V}{Q}$$

Where:

HRT = Hydraulic Retention Time (hour)

V = Volume (gal)

Q = Flow (gal/hour)

Equation 3: Mass Removed [13, 14]

$$\frac{mg}{L} removed = \frac{mg}{L} influent - \frac{mg}{L} effluent$$

Equation 4: Mass Rate [12, 13]

$$m_{sludge} = \frac{mg}{L} \times Q$$

m = Mass rate (lb/day)

Q = Flowrate (gal/day)

2.3.1.3 Task 3.1.3 Secondary treatment system

A secondary treatment system is necessary because primary treatment is unable to meet effluent water quality demands [12]. Secondary treatment uses bacteria in the waste to consume organic matter. A decision matrix will be used to pick a type of secondary treatment to remove organic matter. Traditional options for secondary treatment include activated sludge and trickling filters [15].

Equation 5: Sludge Flow Rate [12, 13]

$$Q_{sludge} = \frac{m}{G}$$

Where:

G = Specific Gravity (kg/L)

2.3.1.4 Task 3.1.4: Disinfection

The final treatment step is disinfection. Disinfection is necessary to kill pathogenic bacteria and removal of odors [12]. The traditional method of disinfection of wastewater is chlorination [7].

2.3.1.5 Task 3.1.5: Sludge Treatment

Sludge produced in activated sludge processes must be treated before disposal. The process involves reducing volume, digestion, dewatering, and finally disposal [16] . The team will decide the sludge thickening process and choose between aerobic or anaerobic digestion. The use of disposed sludge will also be determined.

2.3.2 Task 3.2: Design Innovative System

2.3.2.1 Task 3.2.1: Preliminary treatment system

Innovative treatment plants typically employ traditional methods for preliminary treatment however depending on the subsequent treatment, preliminary treatment may not be required.

2.3.2.2 Task 3.2.2: Primary treatment system

Electrocoagulation is an innovative technology that replaces traditional coagulation and flocculation for particle settling. Depending on the secondary treatment, this process may not be necessary [17].

2.3.2.3 Task 3.2.3: Secondary treatment system

Innovative technologies options for secondary treatment include rotating biological contactors, oxidation ponds, wetlands, and anerobic treatment. Constructed wetlands are designed with specific plants and substrates that optimize reoxygenation and treatment of wastewater [18].

2.3.2.4 Task 3.2.4: Disinfection

The team will decide between the use of UV radiation, ozone, or copper ionization [5].

2.3.2.5 Task 3.2.5: Sludge Dewatering

If activated sludge is used, an innovative option for dewatering is the solid stream process [19].

2.3.3 Task 3.3: Decision Matrix

Create a decision matrix to decide between innovative and traditional treatment systems. Factors to consider will be cost (capital, operational, and maintenance), space requirements, presence of emerging pollutants, flow loads, and climate.

2.4 Task 4: Economic Analysis of Conventional vs. Innovative Options

2.4.1 Task 4.1: Cost of Design Work

The cost for the design work will be calculated by the projected chargeable hours the team expects to spend on the project. This cost will include the usage of software packages, engineering knowledge, company overhead and markups.

2.4.2 Task 4.2: Cost of Construction

The cost of the unit processes will be determined by the manufactures and the infrastructure in between the processes will be estimated using the technical advisors' experiences and other sources of knowledge.

2.4.3 Task 4.3: Operation Costs

The operations overhead will be based on the cost of salaries, installation of the plant, cost of treating the water and energy costs. This will be determined by analyzing current rate structures in place at difference facilities.

2.4.4 Task 4.4: Maintenance Costs

Maintenance costs will be determined by the expected cost of maintenance from the manufacture modified by the expected use of the product and desired life of the unit. This will be calculated for each process in the plant then summed to generate the total expected cost for maintenance.

2.4.5 Task 4.5: Life Cycle Cost Analysis

Lifetime cost will be determined by the initial construction cost, the manufactures recommended life of the product, the expected use of the unit and the cost to replace the unit. The total cost for the lifetime of the plant will be determined by how long the municipality wants the WWTP to function without replacement. The feasibility of the design will be determined by the budget of the project and the expected lifetime of the plant. If the plant is significantly over budget or does not meet the minimum needed life of the facility it is not feasible.

2.5 Task 5: Website Design

2.5.1 Task 5.1: Team member introduction

The website will introduce each team member with a professional picture, name, role in the project, and contact information.

2.5.2 Task 5.2: Required competition documents

Competition documents will be uploaded to the website and will be found under their noted tab. These documents can include but are not limited to the competition proposal, technical paper, presentation, and rules.

2.5.3 Task 5.3: Project Description and design process

A brief overview of the project description and design process will be provided under the noted link. The summary will include the location of the project, project conditions, classes, and an overview of the conducted research for design alternatives and recommendations.

2.5.4 Task 5.4: Acknowledgements and Partnership

Acknowledgements and partnerships will be recognized at the bottom of the website.

2.6 Task 6: Competition Deliverables

2.6.1 Task 6.1: Competition technical paper

The technical report will follow the competition guidelines and criteria. A cover page, table of contents (TOC), entry form, abstract, summary project team efforts, project description, supporting documents, references, and acknowledgements [2]. [2].

2.6.2 Task 6.2: Competition

2.6.2.1 Task 6.2.1 Oral Presentation

The oral presentation will follow competition guidelines by introducing and describing the design problem, approach evaluation, design solution efforts, and an analysis of recommendations [2].

2.6.2.2 Task 6.2.2: Describe Design Problem

The design problem will follow the provided problem statement to design or improve an existing wastewater treatment plant (WWTP) in Arizona. An evaluation of historic data of the site should be utilized to determine the design or redesign of a WWTP.

2.6.2.3 Task 6.2.3: Approach Evaluation

The approach evaluation will organize design considerations to help analyze the current problem for designing or redesigning a WWTP. The evaluation will support outcome solutions, processes, recommendations, impacts, and limitations.

2.6.2.4 Task 6.2.4: Design efforts

The design efforts will be evaluated based on the decision matrix. The decision matrix will consist of different design alternatives that will fulfill the regulations, location of the facility, and capacity requirements. The design effort will also analyze a cost analysis, social and environmental impacts, and efficiency enhancements.

2.6.2.5 Task 6.2.5: Recommendations

Recommendations will be presented based on the how they were made and how the design will be utilized to optimize the treatment process.

2.7 Task 7: Final Presentation

The team will present the entire project to a panel of professors and professionals at NAU for review. The presentation is important to explain the context of the project, the reasoning behind the design, and the requirements of design. The presentation will include background information on the project, the project scope, the schedule, the staffing hours, a cost analysis, and detailed description of the chosen design.

2.8 Task 8: Project Management

2.8.1 Task 8.1 Meetings

The meetings the team will need to conduct are Technical Advisor Meetings, Client Meetings, Team Meetings and Grading Instructor Meetings

2.8.2 Task 8.2 Meeting Minutes

Meeting minutes for every meeting will be recorded and used for reference in later meetings and documents.

2.8.3 Task 8.3 Reports

There will be 3 major reports due throughout the semester, these reports are the 30% Report, 60% Report, and the Final Report.

2.8.4 Project Limitations

2.8.4.1 Challenges

2.8.4.1.1 Travel Constraint

Project might be located far away from NAU, in southern Arizona. If this is to be the case, the team would have limited opportunities to travel to the project site due to workload in other classes and extracurricular activities. This would impact design process since it will be difficult to identify all site features and constraints in just one or two visits.

2.8.4.2 Exclusions

2.8.4.2.1 Environmental impact Study

The team will not be conducting an environmental impact study because there is not enough time and we do not have the funding to do so. An environmental impact study will have to be completed before the WWTP is constructed.

2.8.4.2.2 Construction Documents

Construction documents will not be generated because the team will not be conducting the amount of analysis needed to create the full plan set. A full plan set would also require aspects, like grading, drainage and structural building design, that the team is not conducting.

2.8.4.2.3 Operations and Maintenance Manuals

Operation and maintenance manuals are being excluded because the team does not have the knowledge to generate these documents. O&M manuals are being excluded because a majority of that information comes from manufacture information.

2.8.4.2.4 National Pollutant Discharge Elimination System Permitting

The team will not be applying for the permits needed to discharge the treated water in to the environment and the associated testing application. This also includes the permits to start construction of the WWTP.

2.8.4.2.5 Contracting Documents

The teams will not be soliciting bids from contractors to conduct the construction of the plant and the installation of the manufactured processes. This includes materials for the site needed to construct the plant.

3.0 Project Schedule

3.1 Schedule Overview Milestones

The design team will comply with schedule developed when competition rules are released. For the purposes of this report, a generated schedule is created assuming that competition guidelines will be released on 13th of January 2019. The main project status updates (PSU) includes site assessment, design and economic analysis, final design, and competition deliverables. The PSU's are scheduled to be completed within 3-week intervals starting from the day the competition guidelines will be released.

Attached is a Gantt chart that outlines the proposed schedule, from when the competition guidelines are released to the end of semester. There are five milestones, the first four are PSU's and the final milestone is the competition deliverables. The milestone tasks are highlighted in yellow on the Gantt chart.

3.1.1 PSU 1 – Site Assessment

The PSU 1 will be completed by January 31, 2019 and will include relevant information that will have impact on the WWTF design. It will include precipitation data of the area, current population and projected population in 2039, topographic maps, information about existing water treatment facilities, and existing sources of pollution along with qualitative engineering analysis.

3.1.2 PSU 2 – Design through Primary Treatment and Economic Analysis

The PSU 2 will be completed by February 21, 2019 and will include a complete design of the preliminary and primary unit processes. It will include all hand calculations, results generated by the specialized software, and preliminary CAD drawing.

3.1.3 PSU 3- Final Design Consideration

The PSU 3 will be completed by March 14, 2019 and will include the final design considerations for the preliminary, primary, secondary, and disinfection treatment for both traditional and innovative designs.

3.1.4 PSU 4 – Final Chosen Design with Costs

The PSU 4 will be completed by April 4, 2019 and will include the decision matrix and final economic analysis. The decision matrix will be based on the economic analysis. The decision matrix will be utilized to determine the design elements of the facility.

3.1.5 Competition Deliverables

The deliverables required by the competition will be completed by April 30th, 2019. The predecessors to this milestone include the competition technical paper, the competition presentation, the design efforts, and recommendations. This will allow time for final edits prior to the competition date.

4.0 Staffing

The senior engineer is a licensed professional engineer with 20+ years of experience in wastewater design. The professional engineer is a person who has recently passed their professional engineering (PE) exam and has 10+ years of engineering experience. They have relevant experience in the waste water design field and can make design decisions. They are tasked with supervising EIT's and interns. The engineer in training (EIT) is a recently graduated engineer who has passed the fundamentals of engineering exam (FE) and has 2+ years of engineering experience. The intern is a current engineering student in their third or fourth year of undergraduate studies with little experience in the field of engineering.

4.1 Team Qualifications

Katie Dougherty is a fourth-year civil engineering student. She has experience with interning as a project engineer and as a civil engineer at The Whiting – Turner Contracting Company and Kimley – Horn.

Hadley Habeck is a fifth-year environmental engineering student. She has experience as a maintenance intern at Arizona Department of Transportation (ADOT) and as a research intern in a water quality laboratory.

Artem Lezhniuk is a fourth-year civil engineering student. He has experience working as a land development intern in Pender Engineering Company. He has passed his FE exam and has served in US Army.

Hunter Stacy is a 5th year civil engineering student. He has experience as an intern with Northern Arizona University's Utility Services Department. In this position he gained experience with surveying, GIS, AutoCAD, plan review and has analyzed utility distribution systems

Table 1. Staffing Analysis

Task	Staff (hr)				Total Task Hours
	Senior Engineer	Professional Engineer	EIT	Intern	
1.0 Application Process					
1.1 Become Members	1	2	1	1	4
1.2 Apply for Competition	1	2	1	1	4
2.0 Site Assessment / Planning					
2.1 Virtual Site Assessment	1	3	4	4	12
2.2 Site Visit	2	2	2	2	8
2.3 Layout Project	2	3	2	2	9
3.0 Design					
3.1 Traditional System					
3.1.1 Preliminary Treatment System	6	8	8	8	30
3.1.2 Primary Treatment System	6	8	8	8	30
3.1.3 Secondery Treatment System	6	8	8	8	30
3.1.4 Disinfection System	6	8	8	8	30
3.1.5 Sludge Treatment System	6	8	8	8	30
3.2 Inovative Systems					
3.2.1 Preliminary Treatment System	6	8	8	8	30
3.2.2 Primary Treatment System	6	8	8	8	30
3.2.3 Secondery Treatment System	6	8	8	8	30
3.2.4 Disinfection System	6	8	8	8	30
3.2.5 Sludge Dewatering	6	8	8	8	30
4.0 Economic Analysis					
4.1 Traditional System Cost	6	8	8	6	28
4.2 Inovative System Cost	6	8	8	6	28
5.0 Decision Martix					
5.0 Matrix Design and Decision	10	10	10	8	38
6.0 Website Design					
6.1 Team Member Page	2	4	4	3	13
6.2 Required Documentation	1	4	4	3	12
6.3 Project Description and Design	3	4	4	3	14
6.4 Acknowledgement and Partnership	2	4	4	3	13
7.0 Competition Deliverables					
7.1 Technical Paper	8	11	11	8	38
7.2 Oral Presentation	4	4	4	4	16
7.3 Design Efforts	2	2	2	2	8
7.4 Recommendations	2	2	2	2	8
8.0 Final Presentation					
8.0 Final Presentation	2	2	2	2	8
9.0 Project Management					
9.1 Meetings	7	14	14	10	45
9.2 Meeting Minutes	2	2	8	10	22
9.3 Reports	40	40	40	40	160
Staff Total	**164**	**211**	**215**	**200**	**788**

The accumulated task hours are 788, split between the four positions. The senior engineer will work 164 hours, which is less than the other positions because they are also responsible for tasks associated with running the engineering firm such as meeting potential clients. The professional engineer will work 211 hours and will primarily devote their time to this project, while also assisting on other projects. The engineer in training will work a total of 215 hours and will only devote their time to this project. Finally, the intern will work 200 hours as they rotate between multiple tasks within the project.

5.0 Cost of Engineering Services

Personnel base pay rates have been assigned based on market average values. The hourly rate was determined by dividing the average annual salary for each position by yearly work hours. Since benefits received by employees are the same, they are worth a different percentage of base pay for each pay grade. Base pay and benefits received by employees make up their actual pay. See Table 2 for details.

Table 2. Personnel Billing Rates

Presonnel Billing Rates					
Title	Base Pay Rate ($/hr)	Benefits % of Base Pay	Actual Pay Rate ($/hr)	Profit %	Billing Rate ($/hr)
Senior Engineer	70.00	30	91.00	5	95.55
Project Engineer	40.00	50	60.00	5	63.00
EIT	30.00	55	46.50	5	48.83
Intern	16.50	10	18.15	5	19.06

Overhead costs consist of costs of utilities, equipment amortization rate, office rent, supplies and other consumables. See Table 3 for details. The office rent was determined by taking the average cost per square foot of office space, that number was multiplied by an average small office to gen an approximate monthly rent of $3000. The utilities costs were based off of NAU's utility bills and the monthly cost for the smaller buildings. The office supplies cost was determined by factoring the cost of software packages, physical office supplies, computers, furniture, and other office essentials. The vehicle cost took in to account the payment/lease for 2 vehicles, the fuel for the vehicles, maintenance, and insurance for the vehicles. The administration cost was determined by factoring licensing costs, insurance costs, professional development cost, continuing education cost, professional society membership dues, non-inhouse management and business fees and other fees associated with running a business. The profit was determined by the team as to what we would like to see in profit each month as a small engineering firm.

Table 3. Overhead Costs

Overhead Costs					
Source	Cost ($/month)	Cost ($/day)	Cost ($/hr)	% of Overhead Being Charged out	Overhead for Project
Office Rent	3000	107.14	13.39	70.00	4275.00
Utilities	500	17.86	2.23	70.00	712.50
Supplies	1500	53.57	6.70	70.00	2137.50
Vehicles	7500	267.86	33.48	70.00	10687.50
Administration	5000	178.57	22.32	70.00	7125.00
Profit	5000	178.57	22.32	70.00	7125.00
Total	**22500**	**750.00**	**93.75**	**70.00**	**29925.00**

Total cost of services performed by different team members are summed up in Table 4. They are computed by multiplying hourly rates for corresponding employees by projected number of hours it will take given employee to finish the project.

Table 4. Cost of Engineering Services

Cost of Engineering Services			
Title	Hourly Rate ($)	Hours Spent on Project	Cost of Servies ($)
Senior Engineer	95.55	164	15670.20
Project Engineer	63.00	211	13293.00
EIT	48.83	215	10497.38
Intern	19.06	200	3811.50
			43272.08

The total project bid cost displays the total overhead cost and engineering services, which equate to $73,197.08. The total project costs can be found in Table 5.

Table 5. Project Bid Cost

Project Bid Cost	
Category	Cost Charged to Project
Overhead	$ 29,925.00
Engineering Services	$ 43,272.08
Total Cost for Bid	$ 73,197.08

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