Groundwater mapping
Project ID: CEEn_2018CPST_DR_001

by

SEA
Anelle Concepción
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A Capstone Statement of Work

Submitted to

Fidel Perez
INDRHI-Instituto Nacional de Recursos Hidráulicos

Department of Civil and Environmental Engineering
Brigham Young University

October 8, 2018

Introduction

PROJECT TITLE: Groundwater Mapping
PROJECT ID: CEEn_2018CPST_DR_001
PROJECT SPONSOR: **INDRHI**
TEAM NAME: SEA

This document will outline the scope of work for Brigham Young University's Capstone Groundwater Mapping project in the Dominican Republic. A proposed work plan and schedule will be established, as well as the required resources and budget for the project. This report will also outline the anticipated deliverables of the project, including: a study of geology and hydrogeology in the Dominican Republic, collection, review, and analysis of groundwater and geologic data, input of data to a groundwater mapping application being developed by Steve Evans (Tethys software), and the development of a well database and animated maps of an area in the Dominican Republic. The overall objective of this project is to develop a useful database of current well and groundwater data in the Dominican Republic.

As the project team is not a team of licensed engineers, the expected performance standards for the Groundwater Mapping project are also outlined in this document. It should be noted that project results cannot be construed as work performed by licensed professionals and cannot be used as "stamped deliverables" without first being reviewed, approved and stamped by a qualified and relevant licensed professional engineer. A statement of qualification for each team member is also included in this report.

Proposed Work Plan

The purpose of this project is to study geology and hydrogeology of the Dominican Republic. First, data for the project will be collected and reviewed. Aquifer boundary shapefiles, well locations, and water level measurements for the project location in the Dominican Republic will be researched and collected. The collected data will then be imported to the groundwater mapping application (Tethys) that is being developed by Steve Evans. The data will be analyzed to look for data gaps and outliers/bad data and to experiment with interpolation options. Lastly, the team will develop a well database and animated maps for the Dominican Republic which include water levels, drawdown, and aquifer depletion.

The majority of the project work will be completed at Brigham Young University (BYU) in Provo, Utah using Tethys software and other computer programs. In January, the Capstone team will travel to the Dominican Republic to visit the site and collect additional necessary data. Then, the team will return to BYU to complete the mapping application. The project will be completed by April 2019.

Exit criteria that will signal the successful completion of the project will include a PowerPoint presentation in front of our fellow faculty and students. We will prepare a poster which can be viewed at anytime by interested parties and will be displayed in the Engineering Building for review. We will also present exclusively to our sponsors, namely INDRHI, on the completed project and its capabilities.

Schedule

October 8 - November 4
Have weekly meetings every Monday
Translate and summarize reports sent to team by Dominican Republic team
Explore and familiarize the team with Tethys
Research the geology and hydrogeology of the Dominican Republic
Submit regular status reports

November 5 - December 2
Have weekly meetings every Monday
Research the geology and hydrogeology of the Dominican Republic
Collect well and aquifer data
Review collected data
Submit regular status reports

December 3 - December 16
Have weekly meetings every Monday
Import data to groundwater mapping application
Submit regular status reports

January 7 - January 24
Have weekly meetings every Monday
Analyze data in groundwater mapping application for errors
Submit regular status reports

January 25 - February 3
Visit the Dominican Republic site to gather extra data and pictures

February 4 - March 3
Have weekly meetings every Monday
Develop well database and animated maps
Submit regular status reports

March 4 - March 31
Have weekly meetings every Monday
Finalize well database and animated maps
Write final report and conclusions on database and animated maps
Submit regular status reports

April 1 - April 17
Have weekly meetings every Monday
Finalize final report

Create project poster
Present capstone project
Submit regular status reports

Facilities, Tools, Data and Equipment

For this project, we will need access to a computer in order to execute all levels of the project. We will need groundwater, land use and soil type data, to accomplish the mapping of the groundwater data to the Groundwater Level Mapping Tool and to execute further plans of possibly creating a functioning groundwater model of the site. In addition to these tools, we will need access at all times to the Tethys server in order to access the Groundwater Level Mapping Tool. Another vital tool includes access to the internet in order to search for additional needed data and to connect to the shared Google folder, which enables us to collaborate as a team.

Project Budget

October 8 - November 4 **Project hours: 12**
Have weekly meetings every Monday (4)
Translate and summarize reports sent to team by Dominican Republic team (3)
Explore and familiarize the team with Tethys (2)
Research the geology and hydrogeology of the Dominican Republic (2)
Submit regular status reports (1)

November 5 - December 2 **Project hours: 11**
Have weekly meetings every Monday (4)
Research the geology and hydrogeology of the Dominican Republic (3)
Collect well and aquifer data (2)
Review collected data (1)
Submit regular status reports (1)

December 3 - December 16 **Project hours: 23**
Have weekly meetings every Monday (2)
Import data to groundwater mapping application (20)
Submit regular status reports (1)

January 7 - January 24 **Project hours: 19**
Have weekly meetings every Monday (3)
Analyze data in groundwater mapping application for errors (15)
Submit regular status reports (1)

January 25 - February 3 **Project hours: 30**
Visit the Dominican Republic site to gather extra data and pictures (30)

February 4 - March 3 **Project hours: 55**
Have weekly meetings every Monday (4)
Develop well database and animated maps (50)
Submit regular status reports (1)

March 4 - March 31 **Project hours: 60**
Have weekly meetings every Monday (4)
Finalize well database and animated maps (40)
Write final report and conclusions on database and animated maps (15)
Submit regular status reports (1)

April 1 - April 17 **Project hours: 23**
Have weekly meetings every Monday (3)
Finalize final report (10)
Create project poster (8)

Present capstone project (1)
Submit regular status reports (1)

Project Budget Totals:

233 Man Hours
??? Computational Hours

Deliverables

Our team will deliver a useful tool to INDRHI, which can be used to visualize and analyze the groundwater data available in the Dominican Republic. We hope that this product will enable engineers in the country to undertake future development projects and to aid in the responsible use of groundwater. To demonstrate our efforts and progress on the project, we will deliver short monthly status reports to our sponsors and faculty advisors outlining challenges we have encountered, how we are handling said challenges, our current progress in overcoming the challenge and an update on our progress/schedule.

We intend to deliver a final report with design alternatives for the project that take into consideration economic and environmental circumstances. In addition, we will present a final report in the form of a PowerPoint presentation and poster in front of our faculty, peers, and other investors. In addition to the presentation we will host for the faculty and students, we will present and be held accountable to our sponsors.

Performance Standards

Team will provide work for this Capstone project "as is" using best practices and with best effort. Project results cannot be construed as work performed by licensed professionals and cannot be used as "stamped deliverables" without first being reviewed, approved and stamped by a qualified and relevant license professional engineer.

Statement of Qualification

The following personnel are part of the team that will perform the work described in this document: Emily Andrus, Shanisa Butt, and Anelle Concepción. Each team member is an undergraduate civil engineering student at Brigham Young University. Through their coursework at BYU, each team member is familiar with basic hydrologic and geologic principles. Resumes for each team member can be found in Appendix A.

Dr. Jim Nelson and Dr. Norm Jones, professors at Brigham Young University, are acting as consultants and mentors for the project team. Dr. Nelson has expertise and experience in hydrologic modeling and in the area of the Dominican Republic where the project will take place. Dr. Jones specializes in groundwater modeling and online modeling software.

Appendix A

EMILY ANDRUS

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Education

BS Civil and Environmental Engineering — April 2019

Brigham Young University — Provo, UT

- GPA: 3.56/4.00
- Club Involvement: Society of Women Engineers, American Society of Civil Engineers, Institute of Transportation Engineers

Engineering and Global Experience

Intern — June 2018-August 2018

Kittelson & Associates — Boise, ID

- Worked on 14 projects in 12 weeks that included transportation planning, operations, bike and pedestrian connectivity, and design
- Wrote and reviewed professional documents including memos, reports, traffic impact studies, and client presentations
- Interacted and interviewed with members of the firm 2-3 times weekly
- Coordinated with multiple (up to 6) project teams at any given time, followed up with project managers as needed

Teaching Assistant-Introduction to Transportation Engineering — January 2018-April 2018

Brigham Young University — Provo, UT

- Taught basic transportation principles and calculations to students, such as signal warrants, stopping sight distance, geometric curves, traffic stream characteristics, travel demand modeling etc.
- Prepared and taught review material for test preparation every 3 weeks
- Graded 50+ students' homework and assignments

Global Engineering Outreach — September 2017-May 2018

Brigham Young University — Provo, UT and Porcón, Peru

- Researched, designed, and implemented a sustainable fruit preservation process in Porcón, Peru
- Communicated regularly with people in Peru to align goals and understand social and cultural constraints
- Traveled to Peru in May of 2018 to implement project

Other Experience

Scheduling Secretary — February 2017-April 2018

Brigham Young University — Provo, UT

- Scheduled 5 major theaters, 60+ other rooms, classrooms, studios and their resources
- Coordinated with a team of 20+ people by email and phone to schedule available resources

Full-time Volunteer Representative — June 2015-December 2016

The Church of Jesus Christ of Latter-day Saints — Minneapolis, MN

- Trained and taught other volunteer representatives in topics such as leadership, communication, teaching skills, goal-setting etc.
- Learned, taught, and communicated in Spanish

Skills & Interests

- Proficient in Microsoft Office Suite, Synchro, and ArcGIS; some experience in AutoCAD

SHANISA BUTT

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EDUCATION AND TRAINING

2019 **Bachelor of Science:** Civil and Environmental Engineering
Brigham Young University — Provo, UT, United States
Emphasis in Transportation
Minor in Family Life
GPA: 3.69/4.00
>Passed the Fundamentals of Engineering Exam (March 2018)
>Related coursework: Mechanics-Statics, Mechanics-Materials, Mechanics-Dynamics, Foundations of Global Leadership, Engr Drafts w/ CAD Apps, Engineering Measurements (GIS and Surveying), Introduction to Transportation
>Clubs: American Society of Civil Engineers, Institute of Transportation Engineers

EXPERIENCE

04/2018 to Current **Traffic Intern**
City of Orem Public Works — Orem, UT
>Install traffic analysis devices and collect car traffic data in the city of Orem
>Analyze traffic data to create reports of average traffic behavior
>Conduct pedestrian signal repairs

01/2018 to Current **Research Assistant in Civil Engineering Transportation Pedestrian Studies**
Brigham Young University — Provo, UT
>Collaborate with head Professor and assist in data collection for literature reviews
>Determine suitable locations for camera placement, install cameras, and analyze collected data

08/2015 to Current **Teachers Assistant for Statics**
Brigham Young University — Provo, UT
>Entrusted with the education and assistance of at least 50-200 students per semester
>Taught students how to understand, visualize, and solve homework problems; Evaluated and explained difficult concepts
>Graded homework assignments and input homework grades online
>Educated students on organization and clear technical writing skills
>Led two-hour review sessions with students in preparation for exams

05/2016 to 11/2016 **Full Time Missionary**
The Church of Jesus Christ of Latter Day Saints — Detroit, Michigan
>Shared brief messages with strangers when invited to do so and helped people in need with house work or other needed tasks
>Maintained a strict schedule to attend and direct monthly meetings and lessons on time and to be organized in my work
>Played piano at weekly meetings

08/2014 to 05/2015 **College Freshman Mentorship with Women in Engineering**
Brigham Young University — Provo, UT
>Built model of Greenplex city using 3-D printing to communicate the idea of a self-sustaining city
>Used problem solving skills to implement model improvements, address unanticipated model construction issues, and improve functionality
>Collected materials and reported progress to the professor weekly to jointly discuss new ideas for a new Greenplex layout

SKILLS AND INTERESTS

- Excel programming / Microsoft Word
- Intro. to 3-D Modeling with Fusion 360
- Speed studies / Turn counts
- Problem solving
- Time management
- Individual home design and repair
- Model building
- Traveling

Anelle Concepción

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Education

B.S. Civil Engineering, *Brigham Young University* — **April 2019**, Provo, UT

- Minor in Mathematics
- GPA: 3.27
- Scholarship, BYU Alumni Association
- Relevant Coursework: Groundwater Modeling, Hydrologic Modeling, Geo-Environmental Engineering, Structural Analysis, Fluid Mechanics, AutoCAD & Revit Modeling, ArcGIS & Surveying
- Member of Women in Engineering & Technology and both the local and national ASCE

Experience

Technical Support & Documentation, *Aquaveo* — **January 2018-Present**, Provo, UT

- Evaluate and repair 2-3 groundwater, surface-water, and watershed models each week for accuracy and effectiveness.
- Prepare 7-10 technical documents each week outlining how to best utilize the software.
- Communicate effectively with a global clientele to understand their needs and exceed their expectations.

Intern, *Phillippi Engineering, Inc.* — **May 2017-August 2017**, Vacaville, CA

- Calculate elevation grading for 3-4 land development projects per week, including correct placement of storm drain, sewer, potable and non-potable water systems.
- Model 3-4 site plans using Civil 3D and deliver executables to a surveying crew for construction staking each week.
- Visit sites as needed to ensure accuracy of site data.

Computing Specialist, *BYU Office of Information Technology* — **July 2016-April 2017**, Provo, UT

- Troubleshoot and resolve 15-25 cases per day pertaining to errors customers encountered while using BYU software products.
- Assist 1-2 customers per week with computing issues via walk-in appointments.
- Edit 5-10 knowledge base articles per week to reflect the most effective and up to date solutions to issues.

Missionary, *The Church of Jesus Christ of Latter Day Saints* — **June 2014-December 2015**, New Mexico & Texas

- Train 10-15 missionaries monthly on proper conduct and networking strategies to maximize effectiveness of the team.
- Network with at least 20-30 people daily to build clientele in order to maintain the assigned area.
- Learn how to communicate and work effectively with anybody in order to produce positive outcomes.

Skills

- Basic surveying skills
- Training in: ArcGIS, AutoCAD, and Revit (Modeling software)
- Proficient in: Civil 3D, WMS, GMS, and SMS (Modeling software)
- Can read, write and speak Spanish