REVISIONS TO DRAWINGS

NUMBER	DATE	SHEET NO.	EXPLANATION	DRAWN BY	NOTES
1	04/08/16	T1,A1,A2, A3, & A4	RELOCATED PROJECT LOCATION MAP, ADDED GEOGRAPHICAL LOCATION, SEPARATED WELL PLAN & WELL SECTION DRAWINGS, ADDED PROJECT SPECIFICATIONS	EB	CHANGES MADE ACCORDING TO EWB USA REVIEW
2	04/24/16	T1,A1,A2, A3, & A4	REVISIONS IN PREPARATION FOR TAC SUBMISSION	EF	CHANGES MADE ACCORDING TO EWB USA REVIEW
3	05/01/16	T1,A1,A2, A3,A4&A5	REVISIONS IN PREPARATION FOR TAC REVIEW	EF	CHANGES MADE ACCORDING TO EWB USA REVIEW

PROJECT DATA

PROJECT TYPE: WATER SUPPLY

PROJECT LOCATION: SIMWATACHELA, ZAMBIA

NGO CONTRACTED DRILLING COMPANY: OVERLAND MISSIONS

SPONSORING NGO: SIMWATACHELA SUSTAINABLE ARTS AND AGRICULTURE PROGRAM

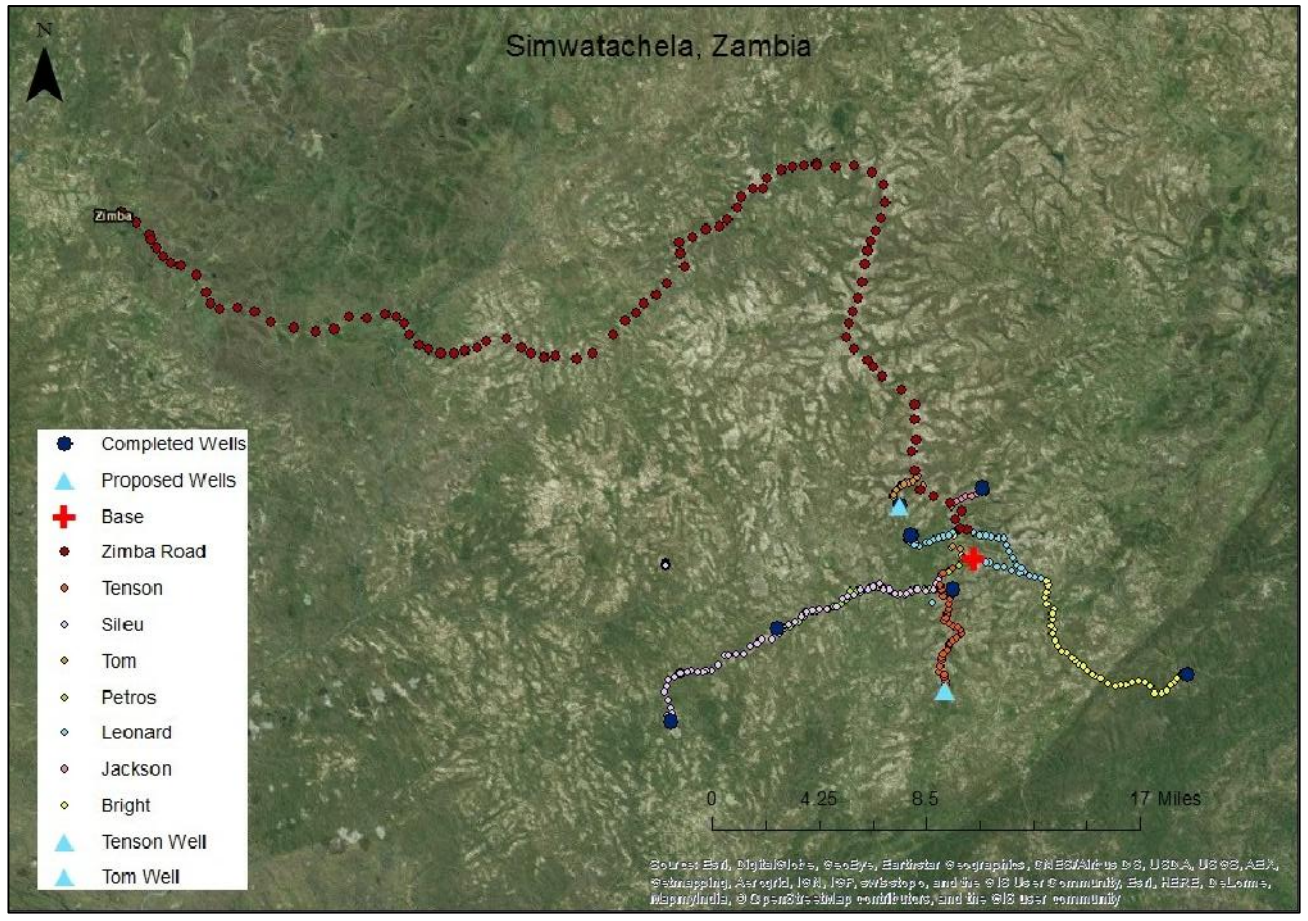
EWB CHAPTER: MISSISSIPPI STATE UNIVERSITY

ADDITIONAL CONSULTATION: BROWN, MITCHELL, AND ALEXANDER, INC.

SHEET INDEX

WATER SUPPLY PROJECT FOR

SIMWATACHELA, ZAMBIA



VICINITY MAP

N.T.S.

N

525

REVISION	BY	DATE
3	EF	05/01/16
2	EF	04/16/16
1	EB	04/08/16

DRAWING PREPARED BY:

MISSISSIPPI STATE UNIVERSITY EWB CHAPTER

DRILLING COMPANY

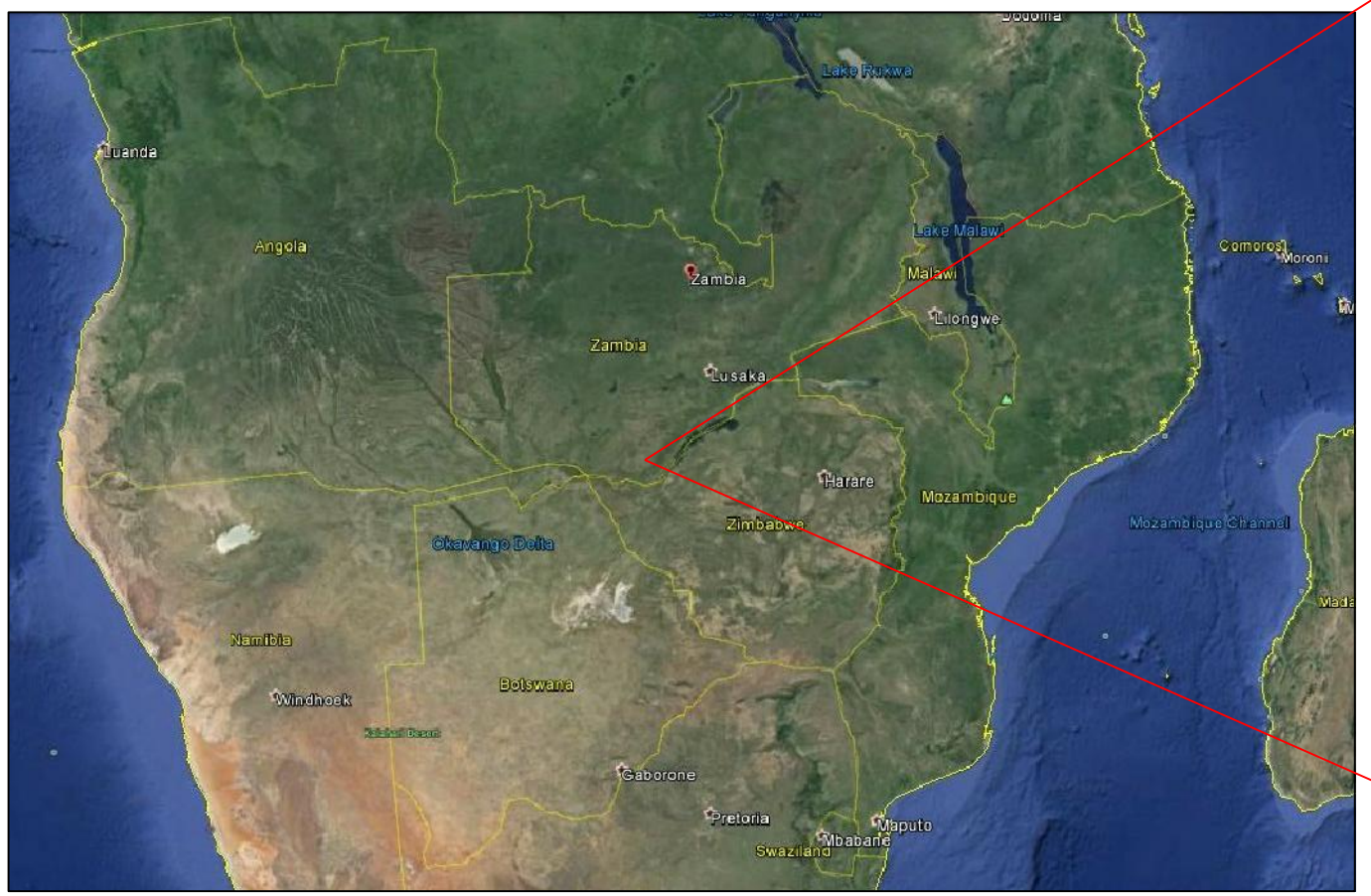
OVERLAND MISSIONS

TITLE SHEET & VICINITY MAP

Drawn By	EB
Checked By	LW, EF, DT
Date	03/16/2016
Scale	N.T.S.

SHEET T1

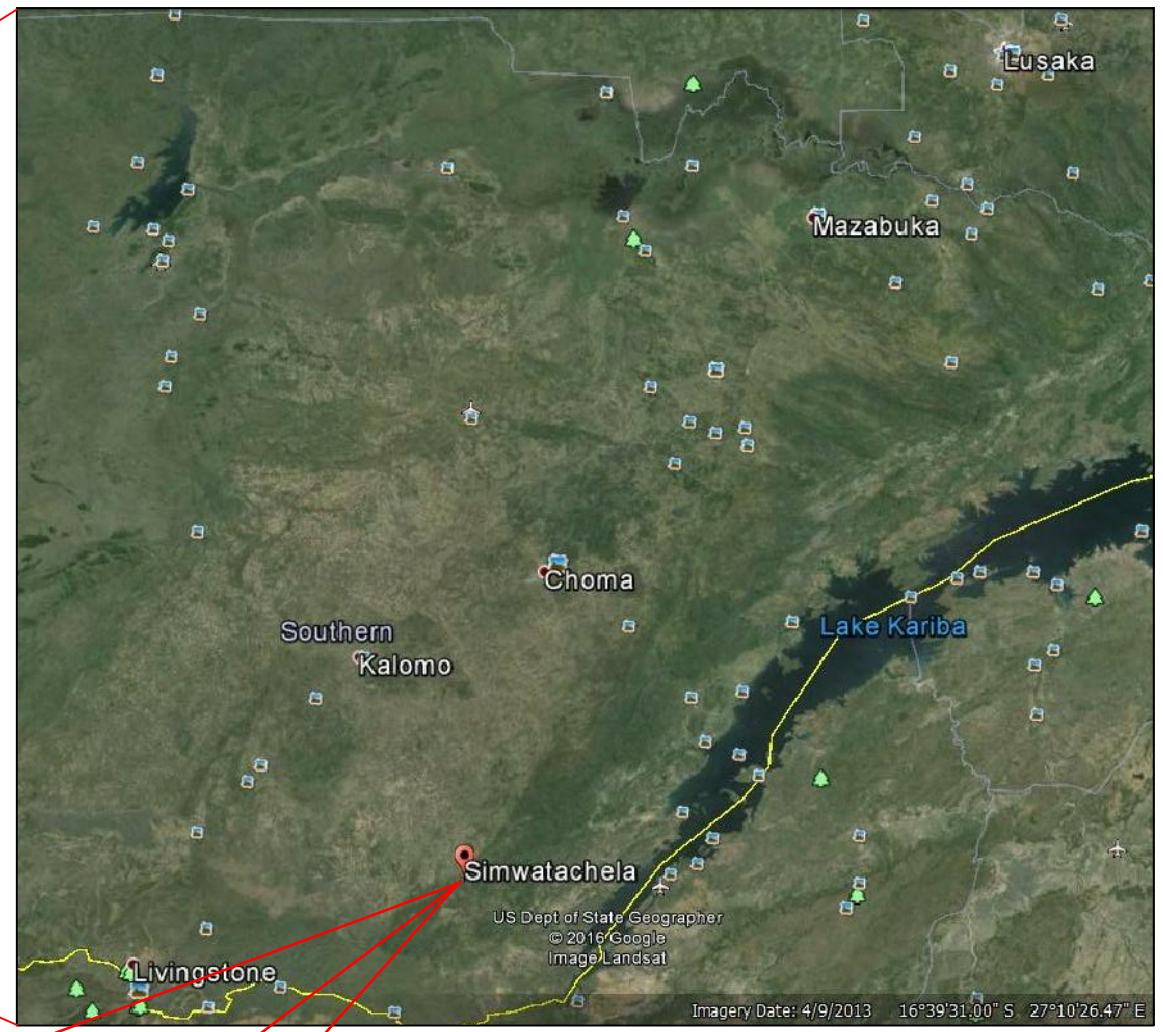
SIMWATACHELA, ZAMBIA



GEOGRAPHICAL LOCATION

N.T.S.

N



Simwatachela, Zambia

PROJECT LOCATION

N.T.S.

N

3	EF	05/01/16
2	EF	04/16/16
1	EB	04/08/16
REVISION	BY	DATE

525

DRAWING PREPARED BY:

MISSISSIPPI STATE UNIVERSITY EWB CHAPTER

DRILLING COMPANY:

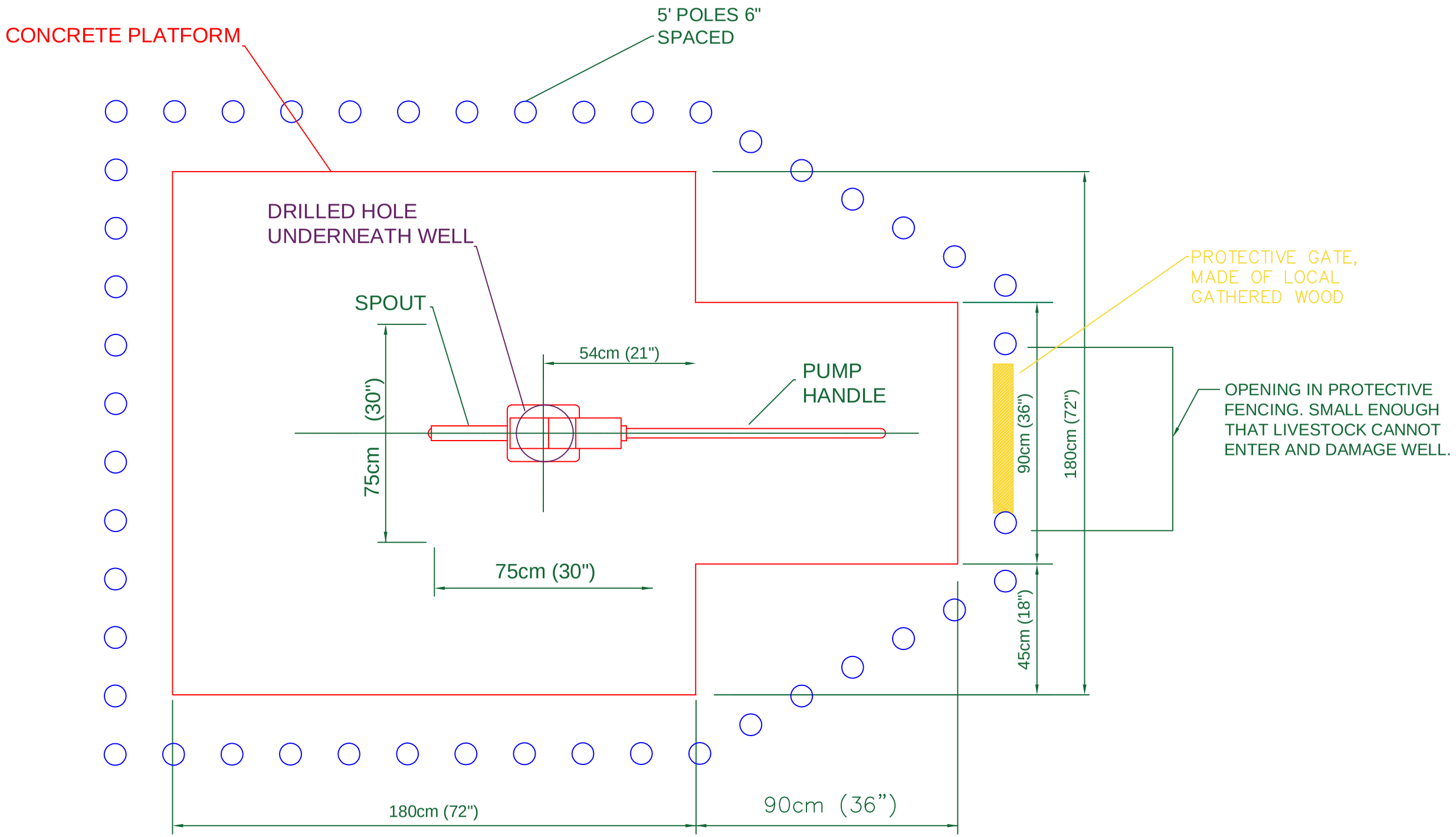
OVERLAND MISSIONS

PROPOSED LOCATION MAPS

Drawn By	EB
Checked By	LW, EF, DT
Date	05/01/2016
Scale	N.T.S.

SHEET

A1



WELL PLAN

N.T.S.

525

REVISION	BY	DATE
3	EF	05/01/16
1	EB	04/08/16

Drawing Prepared by:

Mississippi State University Chapter of EWB

Drilling Company:

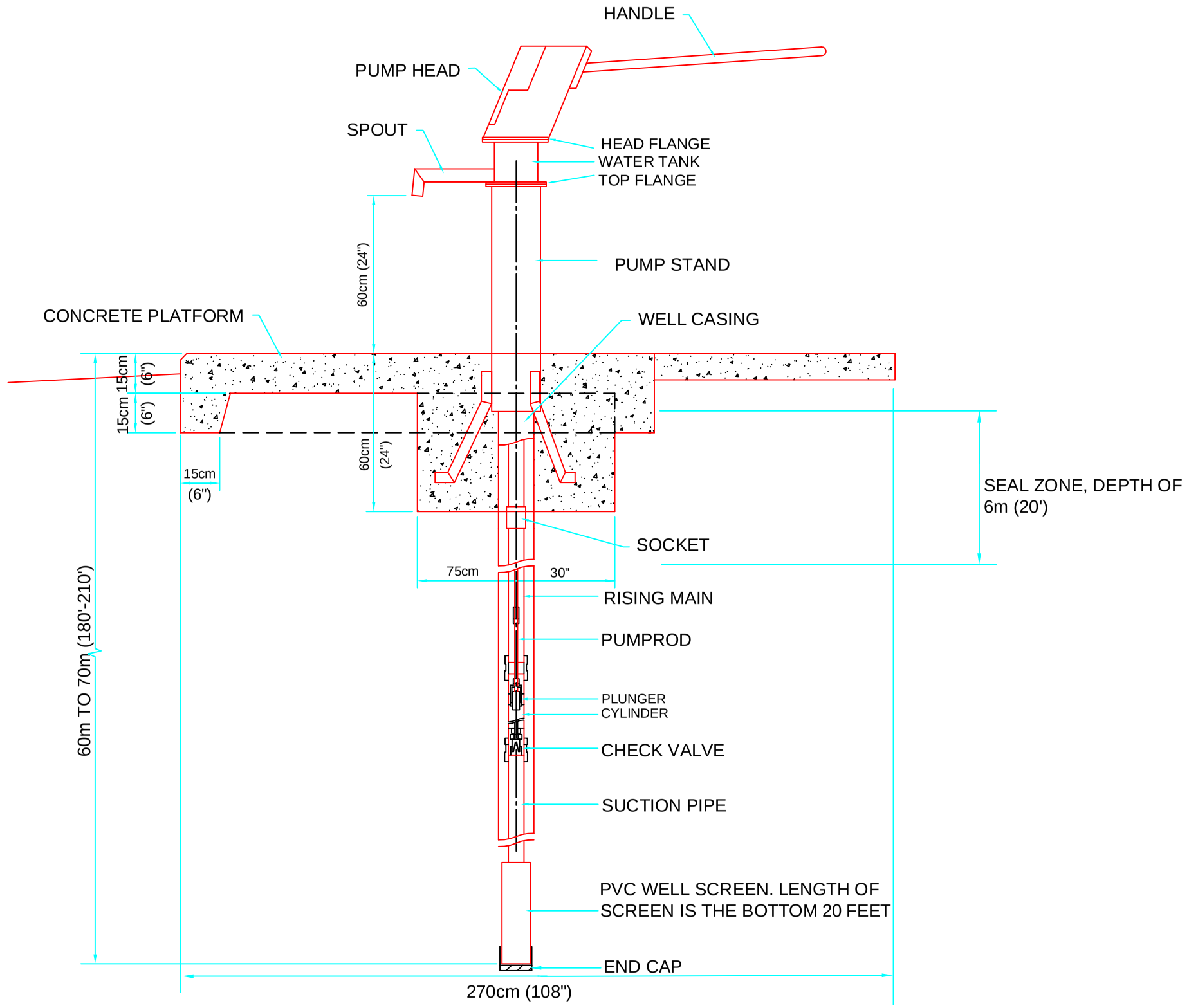
OVERLAND MISSIONS

PUMP PLAN VIEW

DRAWN BY	EB & EF
CHECKED BY	LW
Date	4/14/16
Scale	**N.T.S.**

SHEET

A2



WELL SECTION-ELEVATION

N.T.S.

525

REVISION	BY	DATE
3	EF	05/01/16
2	EF	04/16/16
1	EB	04/08/16

DRAWING PREPARED BY:

MISSISSIPPI STATE UNIVERSITY EWB CHAPTER

DRILLING COMPANY:

OVERLAND MISSIONS

WELL SECTION VIEW

Drawn By	EB
Checked By	LW, EF, DT
Date	03/16/2016
Scale	N.T.S.

SHEET

A3

PROJECT SPECIFICATIONS

-Concrete will be mixed on site with gravel, sand and other large aggregates provided by the community members. Cement is provided by the contractors.

-3:1 gravel to cement ratio. Available fine aggregate, in this case sand, added as necessary during mixing. Water is added on site based on professional judgement and supervision of EWB members.

-Concrete will cure 3 days before form is removed and 7 days before the wells are used.

-Casing is PVC material at 6 inches in diameter. The bottom 20 feet of the casing will be screened to provide filtering. Casing is installed in 10 foot sections attached together securely using PVC glue.

-The hole is drilled with a diameter of 8 inches, leaving a spacing of one inch between the casing and outer diameter of the hole on either side. The open space is filled with a gravel pack layer, consisting of fine gravel 2-6mm in diameter, approximately 25 feet deep to provide support and extra filtration. The pack is installed continuously following the completion of the casing installation.

-The concrete base is installed following installation of the hand pump components. The dimensions of the base are included in drawing A3.

-A protective fence is constructed by the community members. Materials are local and include large sticks and logs at least 5 inches in diameter and at least 5 feet tall, spaced 6 inches apart.

-The well will be monitored throughout its use and the EWB-MSU team will be back in the future for a final monitoring trip. The community members will report any issues and have been instructed on community maintenance.

525

REVISION	BY	DATE
3	EF	05/01/16
2	EF	04/16/16
1	EB	04/08/16

DRAWING PROVIDED BY:

MISSISSIPPI STATE UNIVERSITY EWB CHAPTER

DRILLING BY:

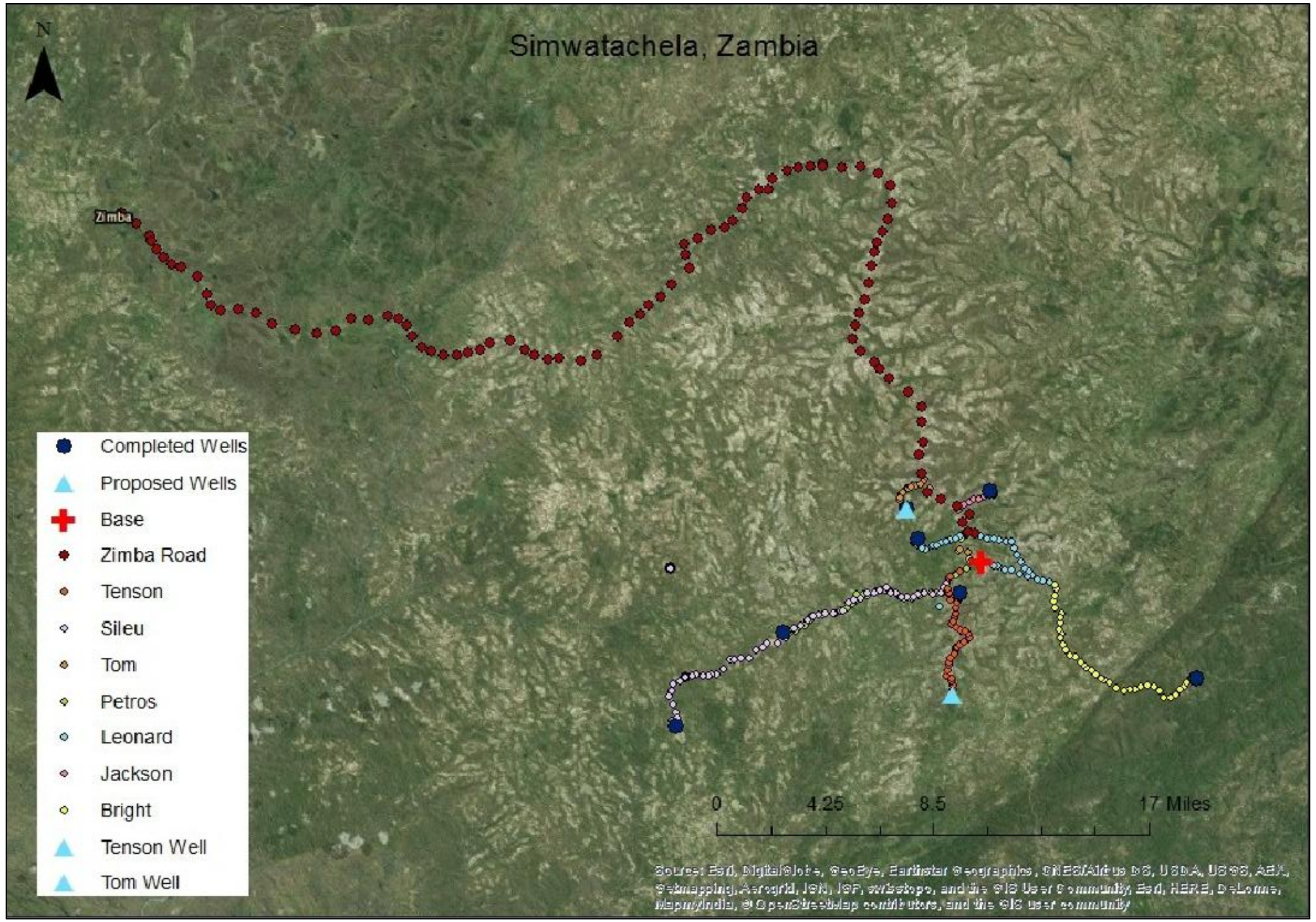
OVERLAND MISSIONS

PROJECT SPECIFICATIONS

Drawn By	EB
Checked By	LW, EF, DT
Date	03/16/2016
Scale	N.T.S.

SHEET

A4



525

REVISION	BY	DATE

DRAWING PROVIDED BY:

MISSISSIPPI STATE UNIVERSITY EWB CHAPTER

DRILLING BY:

OVERLAND MISSIONS

WELL LOCATIONS

Drawn By	EF
Checked By	LW, DT
Date	05/01/2016
Scale	N.T.S.

SHEET

A5

525 – Pre-Implementation Report

Community:	Simwatachela
Country:	Zambia
Chapter:	Mississippi State University
Project ID(s):	9071
Submittal Date:	04/17/16
Authors:	Emily Farrar, Laura Wilson, Cassidy Downs, Erin Wynn, Jonathan Dowell, Emily Denney, David Bridges, Eric Blackmon

Acknowledgements

The Project Leads and Mentor Team acknowledge that:
(Please initial each line item to acknowledge that each line item has been completed.)

X The chapter reviewed the accompanying 525 – Pre-Implementation Report Instructions for accurate completion of this report.

X The PMEL lead has reviewed the 901B – Program Impact and Monitoring Report Template and is prepared to update the report during the upcoming trip. The chapter acknowledges that the completed 901B is required with the eventual submittal of the 526 – Post-Implementation Report.

X The PMEL lead acknowledges that the 905 – Program Logic Framework is required as an appendix to the 901 and 901B reports.

X The project monitoring indicators were selected at the post-assessment phase and documented in the 522 – Post-Assessment Report. The PMEL lead is prepared to gather updated results for the monitoring indicators on this trip and those results will be included in the 526 post-implementation report.

X The team has included the Signed 903 – Implementation Agreement as an appendix to this report.

X The 600 – Health and Safety Plan Part I and Part II are submitted as separate documents with this report.

X The most current contact information is updated in this report and all other reports included with this submittal.

X Any new or additional member to the Mentor Team has included their resume, 404 – Mentor Statement of Intent, and 408 – Application to become a Professional Mentor for an EWB-USA Project.

We, the project team leadership confirm that the above information and tasks have been completed and that this report presents a complete design which meets the normal engineering standard of care for this type of facility.

Laura Wilson	Laura Wilson	3/19/16
Project Lead Printed Name	Project Lead Signature	Date
DUANE WILSON	Duane O. Wilson	3/19/16
Mentor Printed Name	Mentor Signature	Date

Or

Faculty Advisor Printed Name	Faculty Advisor Signature	Date

I have reviewed the subject project. I am qualified by education and experience to design this type of project. In my best engineering judgement, this report does its best to develop a complete and comprehensive design. The design presented within this report meets my standard of quality and is ready for review by the Technical Advisory Committee.

DUANE WILSON	Duane O. Wilson	3/19/16
REIC Printed Name	REIC Signature	Date

Table of Contents

Part I –Administrative Information

1.0 Contact Information

Correspondence regarding report reviews will be sent to the emails listed below.

Project Title	Name	Email	Phone	Chapter Name or Organization Name	Travel
Project Lead	Laura Wilson	lw794@msstate.edu	228.223.6017	MSU EWB	
Additional Project Lead (if applicable)	Emily Farrar	emf119@msstate.edu	228.343.4560	MSU EWB	X
President	Emily Farrar	emf119@msstate.edu	228.343.4560	MSU EWB	X
Responsible Engineer in Charge	Dennis Truax	truax@cee.msstate.edu	662.325.7187	MSU EWB	X
Traveling Mentor	Duane Wilson	duane.o.wilson@chemours.com	228.342.2723	MSU EWB	X
Faculty Advisor (if applicable)	Dennis Truax	truax@cee.msstate.edu	662.325.7187	MSU EWB	X
Planning, Monitoring, Evaluation and Learning (PMEL) Lead	David Bridges	dab425@msstate.edu	662.706.3327	MSU EWB	X

2.0 Budget

Insert the 508 - EWB-USA Trip Budget Worksheet into this section of the report only including financials pertaining to this trip. Please provide explanation if required below. If it is desired to include further budget details for this trip please include in an appendix to this report.

DIRECT COSTS	
Travel + Logistics	
Airfare, 8 people @ $2,500	$20,000
Food + Lodging	$2,000
Other Travel Expenses (ex: Rental Vehicle, Taxis/Drivers, Exit Fees/Visas, Inoculations/Medical Exams, Insurance)	$4,000
Sub-Total*	**$26,000**
Labor	
In-Country Logistical Support	$100
Local Skilled labor	included in contract
Sub-Total*	**$100**
EWB-USA HQ (this section is auto-calculated based on trip type)	
Program Quality Assurance/Quality Control + Infrastructure*	$4,900
Less EWB-USA HQ Subsidy*	$3,690
Owed by Chapter Sub-Total*	**$1,210**
Project Materials + Equipment (itemized, as appropriate)	
Mark II Hand Operated Wells	$7500
Cement and Well Head Protection	$500
Safety Equipment	$50
Total Contract with Overland/SRR (includes labor and supplies for four wells)	$30,500
Sub-Total*	**$30,550**
Misc. (details required)	
Sub-Total*	**$0**
TOTAL DIRECT COST*	**$57,860**
IN-KIND CONTRIBUTIONS	
Community In-Kind Contributions to Project Costs	
Labor	$100
Materials	$200
Logistics	$200
Sub-Total*	**$500**
TOTAL IN-KIND CONTRIBUTIONS*	**$500**
FUNDS RAISED	
Funds Raised for Project + Grants Received	
Cash from community (EWB-USA requires a minimum 5% contribution)	**$2,500**
Total $ in Project Fund at EWB-USA HQ	$6,915

Total $ in Project Fund at University	$2,998
Penetron Grant Award	$8,000
AIChE Grant Award	$5,000
Total*	**$22,913**
Funds Raised for Chapter	
Total $ in Chapter General Fund at EWB-USA HQ	$1,445
Total $ in Chapter General Fund at University	$1,450
Total*	**$2,895**

3.0 Project Discipline(s)

Check the specific project discipline(s) addressed in this report. Check all that apply.

Water Supply (Project Type)
__x_ Source Development (Project Discipline)
_____ Water Storage
_____ Water Distribution
_____ Water Treatment
__x_ Water Pump

Sanitation
_____ Latrine
_____ Gray Water System
_____ Black Water System
_____ Solid Waste Management

Structures
_____ Bridge
_____ Building
_____ Retaining Wall

Civil Works
_____ Roads
_____ Drainage
_____ Dams

Energy
_____ Fuel
_____ Electricity

Agriculture
_____ Irrigation Pump
_____ Irrigation Line
_____ Water Storage
_____ Soil Improvement
_____ Fish Farm
_____ Crop Processing Equipment

4.0 Number of People Impacted

Number of People Directly Affected: _____4000_____
(the population that experiences the typical, inevitable and predictable outcomes of our work)

Number of People Indirectly Affected: ____1500_____
(the population that experiences the reasonable and probable outcomes of our work)

5.0 Professional Mentor Resume(s)

Include resumes (2 pages maximum) of all members of the Professional Mentor Team (REIC, Faculty Advisor, Traveling Mentor) in this section here. Please see the 405 – Mentor Qualifications document for the requirements for the Responsible Engineer in Charge (REIC) and overall Professional Mentor Team.

DENNIS D. TRUAX, PH.D., P.E., BCEE, F.ASCE
Department of Civil and Environmental Engineering, Mississippi State University
Box 9546, 501 Hardy Road, Mississippi State, Mississippi 39762-9546
Tel - 662.325.7187, Fax - 662.325.7189, E-mail - truax@cee.msstate.edu

PROFESSIONAL PREPARATION

Virginia Polytechnic Institute & State University	Civil Engineering	B.S., 1976
Mississippi State University	Civil/Environmental Engineering	M.S., 1978
Mississippi State University	Civil/Environmental Engineering	Ph.D., 1986

WORKSHOPS:

Risk Assessment and Decision Making, U.S.EPA Workshop, Atlanta, GA, 1989
USEPA Teleconference on Stormwater Management, Hosted by the Mississippi State Univ., 2005
FEMA Webcast on Hazard Mitigation Planning, Alliance of Hazardous Materials Professionals of Mississippi, 2011
Harvard Academic Management Development Program, Graduate School of Education, Harvard University; 2007

APPOINTMENTS

Mississippi State University	J. T. White Chair, Head, and Professor	2006-present
Mississippi State University	Professor	1996-2006
Aeration Technologies international (ATi)	Principal & V.P for Engineering	1999-2006
Aeration Systems Design (ASD), LLC	Principal and Engineering Director	1997-1999
Mississippi State University	Associate Professor	1991-1996
Camp, Dresser & McKee (CDM), Inc.,	Project Consulting Engineer	1988-1990
Mississippi State University	Assistant Professor	1986-1991
Mississippi State University	Instructor	1980-1986

PUBLICATIONS

Individually and collaboratively worked for forty-six externally-funded research projects for a variety of federal and state agencies and private entities. These efforts were supported through over eleven million dollars in externally-funding, leading to over 100 papers and reference documents, 115 technical and professional papers and posters presented, fifty reports and project summaries, and a book as briefly summariced below:

Shindala, A., D.D. Truax, and K. Jin, Development of a Water Quality Model for the Upper Tennessee-Tombigbee Waterway; Vol. 1, 2, & 3, Tombigbee River Valley Water Management District, WRRI, Mississippi State Univ., June 1991

Truax, D., D. Minnis, and D. Jackson, "Environmental Justice By Preventing Pollution at the Mississippi Band of Choctaw Indians' Reservation", Project Report USEPA X 826040-01-0, December 1999.

Truax, D., Evaluation of the Water Supply and Treatment at Ömerli Reservoir, Prepared for the Istanbul Water and Sewerage Administration (ISKI) through a grant from the U.S. Agency for International Development (USAID), June 2006

Counce, R. M., Jubin, R. T., Lewis, B. E , Birdwell, J. F., Truax, D. D., Martin, J. L., Magbanua Jr., B. S., Lindner, J. S., and Smith, L. T., Estimating the Transport and Fate of Dispersed WMD Materials in Urban Sanitary Wastewater and Stormwater Treatment and Handling Systems, SERRI Project Report, Science and Technology Initiative of the Science and Technology Directorate, U.S. Department of Homeland Security, September 2008

Stroble, M. F. and Truax, D. D., "Evaluating Life-Cycle Cost and Carbon Footprint of Competitive Construction Materials," Proceedings of the American Society of Engineering Education Annual Conference, Austin, TX, June 14-17, 2009

Day, A. and Truax, D.D. Nutrient Management in On-Site Wastewater Treatment, VDM Verlag, ISBN 9783639236552, 2010.

Dey, A., Truax, D.D., Magbanua, B.S. Jr., "Optimization of Operating Parameters of Intermittent Aeration type Activated Sludge Process for Nitrogen Removal: A Simulation-based Approach," J. Water Environment Federation, 83:7, 636-642, July 2011.

Heitzman, M., Timm, D., Takle, E. Herzmann, D., and Truax, D., Developing MEPDG Climate Data Input Files for Mississippi, Final Report, FHWA/MS-DOT-RD-11-232, Mississippi Department of Transportation, Jackson MS, July 2011.

El-adaway, I. and Truax, D. D., "Problem-Based-Learning and Learning-Through-Service for Sustainability Education", 2012 Construction Research Congress, American Society of Civil Engineers, Indiana, United States, pp. 2111-2119, 2012

El-adaway, I. and Truax, D. D., "Using Innovative Teaching Pedagogies in Undergraduate Teaching", 2012 American Society of Engineering Education - Southeastern Section Conference, Mississippi, 2012.

El-adaway, I. and Truax, D. D., and 23 Undergraduate Students, "Managing the LEED Analysis for the New Civil and Environmental Engineering Complex at Mississippi State University", Journal of Management in Engineering, American Society of Civil Engineers, posted ahead of print on January 7 2013, doi: 10.1061/(ASCE)ME.1943-5479.0000171.

El-adaway, Islam and Dennis Truax, "A Case Study for Mentoring and Coaching Undergraduate Students at Mississippi State University in Sustainable Construction using an Active Learning Approach", Journal of Management in Engineering, American Society of Civil Engineers (in review).

SYNERGISTIC ACTIVITIES

Designed and taught classes in the Department of Civil & Environmental Engineering's undergraduate and graduate program related to general environmental engineering issues, water resources and environmental engineering management, water and wastewater treatment, surface water quality modeling, stormwater management, environmental chemistry, unit operations and processes, hazardous waste management, industrial waste treatment, solid waste management, residuals management, project management, leadership development, and general civil engineering

Science Advisor Review Panel, US EPA SBIR Program (Phases I and II) in the areas of Water Treatment, Wastewater Treatment, Hazardous Waste Management, P3, Solid Waste Management, and Stormwater Management

ENGINEERING REGISTRATION AND CERTIFICATION

Board Certified Environmental Engineer (BCEE) - Water and Wastewater Engineering, American Academy of Environmental Engineers and Scientist, #88-10050; 1989

Professional Engineer (P.E.), Mississippi, #08116; 1980

HONORS & AWARDS

Hearin-Hess Professor of Engineering, College of Engineering, Mississippi State University; three times between 1993 and 1996

Civil Engineer of the Year, Mississippi Section of the American Society of Civil Engineers; 1995

R. M. Scholtes Civil Engineering Teaching Award, Department of Civil Engineering, Mississippi State University; 1997

National Director, American Society of Civil Engineers; 2001 - 2004

Bagley College of Engineering Academy of Fellows, Mississippi State University; 2005

Mississippi Board of Licensure for Professional Engineers and Surveyors; Appointed by the Governor; 2005-06, 2010-13

Phi Kappa Phi, national academic honorary; Member, 2008

National Judge, ACEC Engineering Design Excellence Award, 2013

AFFILIATIONS

American Academy of Environmental Engineers and Scientists - Diplomate

American Society of Civil Engineers – Fellow

American Society of Engineering Educators - Member

American Water Works Association – Life Member

National Council of Examiners for Engineering and Surveying – Board Member

National Society of Professional Engineers - Member

Water Environment Federation - Member

Duane Ogden Wilson
Chemours

Tel. 228.342.2723 Email. Duane.o.wilson@chemours.com

Current Position/Title Of Employment: Project Manager and Public Affairs Manager

Education: Mississippi State University, Chemical Engineering and Business, B.S. 1980

Major Employments:

- Leader of the design team for a major portion of the Line 2 TiO2 plant expansion in 1989
    - Led flow sheet development, design, and construction for $70 million of the overall $156 million investment in DuPont TiO2 plant expansion. Work involves design for safe operation of highly hazardous chemical plant expansion.
- Led design group at DeLisle plant and oversaw all capital work for 10 years, typically overseeing $20 million to $40 million annual capital budget.
- Played a key role in the Post-Katrina DeLisle site rebuild, including identification of asset write-off from the storm's destruction, and procurement efforts for the $113 million re-build project.
- Negotiated long-term lease with the Port of Gulfport. Negotiated a 30 year lease with three 10 year extensions.
- Leading the Port of Gulfport new facilities project as negotiated in the above lease. This project is an $86 million dollar project providing 15 new concrete silos with state-of-the-art measuring and metering systems to store 200,000 tons of Ilmenite ore for use at the Chemours DeLisle site. Involvement included leading the scope development and nowoverseeing design and construction.

Major Achievements/Awards:

- Past Board President of the Boys and Girls Club in Pass Christian
- Served as President of the Boys and Girls Club of the Gulf Coast – oversaw non-profit organization with a $3 million budget, 5 units, and serves 1,500 children daily in after school and summer programs.
- Boys and Girls Club Volunteer of the Year
- President's Volunteer Service Award recipient
- Engineering Pathway leader for Pathways2Possibilities 8th grade career expo, exposing 3,000 8th graders to career opportunities over a two-day event.
- Graduate of Leadership Gulf Coast
- Served on Leadership Gulf Coast Board of Trustees

5.1 Names and Qualifications of Designers

Name	Student or Professional	Qualifications	Work Done
Dennis Truax	Professional	PE in Civil Engineering, PhD in Civil Engineering, 11 years of experience in consulting	Calculations and preliminary drawings of well
Laura Wilson	Student	Senior level student in civil engineering	Preliminary drawings of well
Chris Williams	Professional	PE in Civil Engineering, 10 years of experience as a project engineer	Well drawings
Bill Mitchell	Professional	PE in Civil Engineering, 41 years of experience in civil engineering and construction management	Supervised and checked all drawings and calculations
Eric Blackmon	Student	Junior level student in civil engineering, Associates of Applied Degree in Architectural Engineering Technology, 7 years of experience as an AutoCAD draftsman	Revised and checked well drawings

Part II – Pre-Assessment Report

1.0 Executive Summary

The Mississippi State University chapter of Engineers Without Borders is currently working on a water supply project in Simwatachela, Zambia (Project # 9071). The chapter is planning its third installation trip for summer 2016.

The chapter has worked on the design of five deep encased wells installed in the community of Simwatachela with the goal of providing clean drinking water to the area. In summer 2014, our chapter successfully installed two wells in Simwatachela, Zambia in collaboration with Overland Missions, an NGO contracted to provide well drilling and pump installation services. The wells are named for the headsmen in the areas of implementation and are referred to as Leonard and Jackson in the report and records. We again completed three more wells during the summer of 2015. These are named in the same manner and are referred to as Bright, Petros, and Sileu. While in country in 2015, our chapter also assisted with the repair of a well, referred to as Siboli Cikolo and this repair is also included in the map. One of the wells required a drilling rig larger than Overland Mission has so we also partnered with SRR Drilling as well. SRR is a commercial well-drilling company. During the next installation trip, the chapter plans to install four more wells in collaboration with SRR Drilling and Overland Missions. The chapter is asking the TAC for the approval of this installation for the beginning of August 2016.

The goal of our project is to provide the community of Simwatachela, a large community in Zambia, with clean drinking water, in the hope that it will improve the quality of life in the village. The area suffers from illness and hunger due to the lack of access to clean drinking water, thereby stunting economic growth. During the past two trips to Simwatachela, the team successfully installed five wells and repaired one. While drilling in 2015, the team encountered technical difficulties and had to postpone the installation of the well named for Tom. During summer 2015, the team also assessed one new site (Tenson) where our chapter plans to install a well during the upcoming implementation trip. We attempted to identify another location for drilling; however, the site chosen to assess was determined to be capable of funding a well for themselves. The community owned cars and solar panels, both of which are more expensive than a well. Because of a recent allocation of additional funds, the chapter has decided to drill an additional two wells on the next implementation trip. Therefore, a total of four wells will be installed this summer.

The two definite sites proposed for implementation are Tom and Tenson. The sites are both located in Simwatachela and are in need of a reliable drinking water source. Tom's site has a large ravine that pools with water during the rainy season, so selection on final placement of the well was carefully considered. The well site has clusters of housing spaced evenly around it and has large agricultural fields and gardens in proximity. Photos of the site are included in Appendix C and areas of interest that contribute to well selection are marked on the map in the appendix. Tenson's site is similar in structure, however, the pooling of water is not an issue. Agricultural fields are located near the site and clusters of housing surround it. The well site selection criteria used for all site selection in the project is included in Appendix E. This criteria includes items such as the proximity of the wells to latrines, groundwater surfaces, agricultural fields, roads, etc. Appendix F shows possibilities for the two additional wells the chapter has decided to install. Working together with SSAAP, the sites have been identified and will be narrowed down to the two most in need by the representative of SSAAP currently located in the

village. Although the sites are not determined officially, contact will be made with SSAAP until the team returns to the village and the sites will be determined before travel to the country.

Located in the southern region of Zambia, Simwatachela is home to approximately 4,000 people (1,000 men, 1,750 women, and 1,250 children). The community covers thousands of acres and is in need of multiple wells to provide clean water to its people. The water that the community currently consumes is often polluted, leading to disease and hunger, especially during the long dry season. The hand dug wells that are currently in place provide little amount of extremely polluted water. The NGO operating in the area, Simwatachela Sustainable Arts and Agriculture Program (SSAAP), works with the community on sustainability education and will have a representative in-country during implementation in 2016 and after the team leaves. In past trips, SSAAP has provided an important role in helping to identify and establish the community groups who will be responsible for the project. Community leaders have signed the community agreement forms during the assessment trip, and members of the community are involved in the construction process to ensure a higher level of ownership and responsibility.

Through pump tests, the design for the project was proved successful during the first two implementation trips. Our chapter plans to implement the same design on the third implementation trip. The facilities consist of Mark II hand operated wells that are 50-70 meter deep and have a diameter of 8 inches. This design will be successfully utilized for the four new wells to be installed. The drawings are shown in Section 3.3 and detailed designs are attached in the design plan submittal.

In addition to the work with Overland Missions and SRR Drilling, the chapter will work to promote the active involvement of the local community. The community of Simwatachela will be involved in the construction process as well so that they feel a higher degree of ownership of the wells; their specific tasks include assisting in the laying of the concrete foundation and the installation of a protective fence.

The chapter has worked with SSAAP on a sustainability plan. SSAAP has helped the community establish committees for different aspects of community growth. Each committee was given land and seeds in order to grow crops to sell and raise funds for their focus on the community. During the dry season when agriculture income is lacking, local artisans create and sell artwork to bring in necessary funds. These committees include a borehole committee and the chapter will focus on working with the individuals involved with this committee.

Long term operation and maintenance will be the responsibility of the borehole committee. This committee will use the means stated above to raise the necessary funds to keeps the facilities in operation. The chapter will work with the chosen contractor, Overland Missions and SRR, and will instruct the community on the basic upkeep of the facilities. For major repairs, the chapter feels it best for the community to hire skilled professionals to ensure the longest operational life possible for the facilities. The possibility of hiring a skilled professional to repair anything necessary has been included in the information provided to the community and members keep a budget available for such an event.

2.0 Facility Design

2.1 Description of the Proposed Facility

As with the first and second implementation trip, the team is working with Overland Missions and SRR on the design and implementation of the facilities. Based on the success of the facilities implemented on the first and second implementation trips for the project, the team will be implementing four eight-inch diameter hand pumped wells. The wells will be around 50-70 meters deep and will be pumped with a Mark II hand pump. The bottom 6 meters of the well will be screened PVC, and the top 6 meters of the well will be sealed. The locations of the facilities to be implemented are named in the report by the headsmen of the area of implementation. The new sites include: Tenson and Tom and two additional sites to be determined. The locations and photos of these sites are included in Appendix C and D of the report. The site designated as “Tom” in last year’s report will be the second well to be installed this year. Due to unforeseen issues with a rock layer at the first attempted site, the drill rig was lodged in the rock and a larger drill rig will be needed for successful drilling. A map of the current sites and proposed sites are included in the Appendix.

2.2 Description of Design and Design Calculations

The sites selected for implementation have been assessed and deemed viable for installation. Working with Overland Missions and previous data from construction in the area, the chapter characterized the aquifer system and assessed the water needs of the community.

The aquifers in the locations proposed for installation are 30 to 70 meters below the surface. A hydrology study conducted for the area is included in Appendix I. Previous work in the area has shown that water is typically encountered at 40-60 meters and has sufficient artesian pressures to support a well. After water is reached, the well is typically drilled 20-30 meters passed the ground water. Overland and SRR have had success in multiple regions of the community and the previous installations of the MSU-EWB chapter reached water at 40-60 meters. The well logs from the previous wells installed are included in Appendix H and help show the water characteristics in the area. Each well is expected to serve 400-600 people and the water demand for each well is projected to be about 5,000 to 8,400 liters per capita per day (Lpcd). This is assuming a maximum water use of 14 Lpcd. The historic data of wells in the region, including the chapter’s previous wells, indicate that the facilities will be capable of pumping between 15 to 20 liters per minute. In order to ensure that the facilities are capable of handling this demand, a pump test will be conducted. Pump tests for the previously installed facilities have concluded that the facilities will meet the needs of the community. One of the pump tests conducted produced 32 gallons of water a minute for three hours, which is one of the best pump tests that Overland has ever seen. Pump tests at the remaining wells average 20 gallons of water a minute and a survey of the previously installed wells has shown that each well has been successful in providing water to the community year-round. EWB-MSU team members asked about the availability of water from each well on a regular basis and each reported no days that the well was not operational and no repairs other than regular lubrication.

PVC is the chosen material for the well casing and screen. The water quality in the area is reportedly corrosive and has an elevated iron concentration. This was confirmed when testing the installed wells. The PVC is resistant to this corrosion. The bore holes will be 8 inches in diameter and the well casing will be 6 inches in diameter. The Mark II hand operated system is the chosen system for the installation and was successful for the chapter's previous installations.

This system is available in-country and is familiar to members of the community because of previously installed wells in adjacent regions. With the installation of the chapter's first wells, the community has gained even more knowledge of the facilities and is even more aptly prepared to care for the wells. The design allows exchange of parts because spare parts are readily available in towns nearby. At least two individuals in each community receiving a well possess the skills required to inspect and repair the pumps should something go wrong.

Detailed design parameters for specific components are described below:

a. Well Casing:
- In designing the well casing, the team selected PVC pipe as the best material for the project. PVC is lightweight and easy to work with and transport. It is also resistant to the corrosion possible because of the elevated iron levels in the area. This allows a longer life and less maintenance for the facilities.
- The diameter of the casing is a consideration for design and is based on standards for well depth and type. Based on the expected depths of the available aquifer, the casing will need to be 30-70 meters. Based on this depth, the facilities will be about 6 inches (15 centimeters) in diameter.
- Wall thickness of the casing is another important factor to consider and is based on standards for well depth and diameter. These standards suggest a thickness of about 8-10 US Standard Gauge, or about 0.40 centimeters.

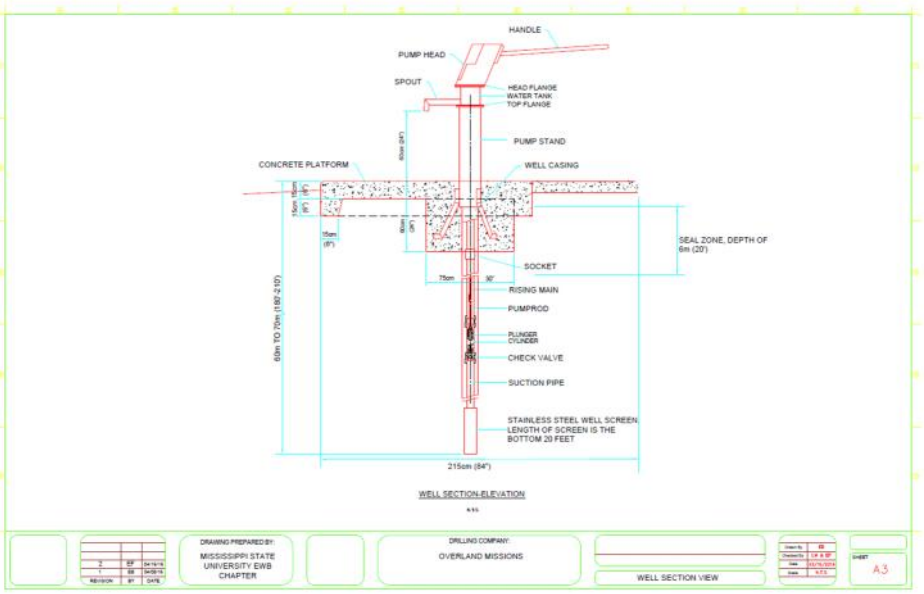
b. Screen: The material chosen for the well screen is PVC as it is lightweight and easy to use and transport and is resistant to corrosion. Based on the pump type and depth of the wells, the bottom 6 meters will be screened.

c. Riser Pipe and Connecting Rods: The riser pipes and connecting rods will be composed of stainless steel because it is strong and durable for excessive use. The diameter of the pipes will be around 3 centimeters and the diameter of the connecting rods will be about 1.3 centimeters.

2.3 Drawings

Figure 2.3.1 shows a drawing of the typical well installation. This design has been implemented in the previous two implementation trips and has been proved successful. The drawing includes the wellhead protection pad and fencing. Table 2.3.1 shows the dimension schedule for the facilities.

2.3.1



The drawing is shown at a larger scale and in more detail in the project design plan submittal.

Table 2.3.1 Component Dimensions

Component	Dimensions	
	SI	English
Well Diameter	15 cm	6 in
Hole Diameter	20 cm	8 in
Well Depth	30-70 m	100-230 ft
Concrete Depth	30 cm	12 in
Concrete Width	2.4 m	8 ft
Screen Depth	6 m	20 ft
Seal Zone	6 m	20 ft

2.4 524 – Draft Design Report Comments

Chapter	Mississippi State University
Project community location	Simwatachela, Zambia
Project title	Water Supply, Wells pumps

Travel Dates – Trip Length	
Date of review	04/26/2016
EWB-USA Project Engineer	Chris Brandewie
Chapter attendees on the call	
PM Decision	Hold
Required Follow-up	All items below
Project Submittal Rating	1

Chapter Contact Information:

Project Title	Name	Email	Phone	Chapter Name or Organization Name
Project Lead	Laura Wilson	lw794@msstate.edu	228.223.6017	MSU EWB
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Responsible Engineer in Charge	Dennis Truax	truax@cee.msstate.edu	662.325.7187	MSU EWB
Traveling Mentor	Duane Wilson	duane.o.wilson@chemours.com	228.342.2723	MSU EWB
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Planning, Monitoring, Evaluation and Learning (PMEL) Lead	David Bridges	dab425@msstate.edu	662.706.3327	MSU EWB

Comments:

No.	EWB-USA PM Comment	Chapter Response
1	The Drawings looked pretty good, I suggest making another sheet that shows the site map for each well location and reference to where they are within the vicinity map with the location of the wells listed clearly. Also please make sure the dwgs are either within the report file or one file for all dwgs, not separate files for each sheet.	

	Kinda surprised Denis is not listed as Fac adv- Please provide some indication that he (and REIC) has reviewed the dwgs and report, and include his signature in the next version of your report.	
2 Sec 1.0	The template had a column "travel" please put that column back in and indicate with an x who is traveling.	The column has been added in.
3 Sec 2.0	Budget: This section should shed light to my main question. Please provide the number of wells listed at the price of $35,050. Also please provide the contract with OM.	The specifics of the number of wells has been added to the budget sheet and the contracts with both drillers is included in Appendix F.
4 Sec 3.0	Please explain the water distribution involved in your project. I didn't see any component of that. Please show distribution on site maps.	The checking of the distribution was a mistake. Because the water is used by the community, we marked distribution. However, we are not installing any distribution technology.
5 Sec 5.0	Resume: Image quality is low, hard to read This comment below was provided to you in an email 14 April 5. Resumes look funny - Dr. Denis's work experience and design experience is not listed. Duanes Resume - "leader of design team for major portion of Line 2 expansion..." gives no context to what the line is: electric line? water supply line? waste water drainage? Also there is no work history, getting a BS in 1980, indicated a long career but I can not tell from the slim resume what he has done for all that time.	This has been fixed.
Part II		
6 Sec 1.0	5 wells previously drilled. OK show all and give them a meaning full labels (include proposed or year built.)	The years of implementation are included in the report. The map has been corrected because Tom's well was unable to be installed. Tom's well

	Map shows 7 Navy blue dots. The report goes back and forth between 4 and 2 wells will be drilled "During summer 2014, the team assessed five new sites and identified three new sites where our chapter plans to install wells during the upcoming implementation trip." Cant follow. "The NGO operating in the area, Simwatachela Sustainable Arts and Agriculture Program (SSAAP), works with the community on sustainability education and will have a representative in-country during implementation in 2015 and after the team leaves." 2016? Please have your reports checked before resubmission.	is now a light blue proposed well dot. The repaired well is included on the map because it was repaired because of the EWB-MSU project. We have fixed the issue with the varying number of wells. Due to unforeseen grants and additional funding, the chapter has decided to implement 4 wells instead of 2 and some of the changes in the report were overlooked. The year has been corrected.
7	Please provide the well installation logs for the 5 wells drilled. This should give the reviewers an idea of the geology and allow them to understand the wells in this region better. Also be sure to log the well as it is drilled. I didn't see this activity in the MI St responsibilities.	The logs are included in Appendix H.
8 Sec 1.0	The Well Location Selection Criteria should be discusse in Ex Sum and maybe the facility design, did not see any reference to App E. Please describe the well site locations all 2 (or all 4) of them. Is there a regional hydrology study? Provide in App if you have one.	The selection criteria is now referenced in the report. Photographs of the sites are included and additional description of them has been added in section 1.0 of Part II of the report. A regional hydrology study has been provided in Appendix I.

9 Sec	Overland Mission is described as an NGO then in the next paragraph they are contractors. Make sure this is consistent and if there is some way they are both, explain that in the report clearly.	The report has been updated. Overland Missions is a non-profit organization with a well-drilling division that serves as the contractor for this project.
10 Sec 2.1	4 – 8 inch wells Please explain why we are talking about 4 wells then also 2 wells. Put clues into budget like $35K per 2 wells….. Usually the cost to drill wells are based on depth. How were these amounts determined? Provide contract with OM.	The cost of the contractors is not on a per depth basis. The maximum depth drilled before determining the hole is dry is 70 feet and certain allowances are made for dry holes. The contracts outline the information further and are now included.
11 Sec 2.2	How far past encountering GW will you direct OM to drill? They are probably making money based on depth so they will want to stop short if they can. Pump test. 2.1 The bottom 6 meters of the well will be screened with stainless steel, and the top 6 2.2 PVC is the chosen material for the well casing and screen. Dwgs show PVC This is making me nervous that you have still not determined what material you are using or that there has been no review of the report before submission.	The drillers will drill approximately 20-30 meters passed GW. We have corrected the material mistake and are using Schedule 60 PVC.
12 Sec 2.3	Give a name to your table Table 2.3.1	The letters were just to organize the components but have been removed to prevent confusion. The table is named.

	C Well Depth 70 - 100 m this is significantly deeper (and more costly) than 50-70m. Have you ordered enough well installation materials? E Concrete Width 2.4 m ≠ dwgs A, B, C – G Do these letters refer to one of the drawings?	
13 Sec 2.4	For your 525 include this very 524.5 review notes file with your responses in the right column as the instructions explain. Please follow.	It has been included.
14 Sec 5.0	Let call this Table 5 Add bottom row with total costs. "..(4 wells)" see why it is hard to understand if this project is 2 or 4 or even 3 wells Not priced per foot? $15K/per well drilled? Or for both? Still $34700 ≠ $35,050 as shown in Budget sec 2.0 Discuss contract with OM and provide the detailed contract in the Appendices.	The discrepancies have been corrected.
15 6.0	"…The amount collected per the schedule above will be 50 Kwatcha." What schedule? Did I miss it. At this point in the report there are 16 pages above. Make this references clearly understood. This quote above again makes me worried that not much review was done of this report before submission.	The "schedule" referred to the information immediately above the statement. This wording has been corrected to stop any confusion.
16 App E	Well Siting Criteria This should be mentioned in your Ex Sum and details presented in Sec 2.2 This section mentions many things that should be included in both (or all 4)	The well siting criteria has been referenced in the report. The community proximity is worded that way to show that no one group of villagers will have better access to the

	site location maps such as: Latrines, bathing facilities, animal pens, roads, etc. D. Community Proximity: Each well will be located near the population centroid for the community. Skip one sentence and then the previous sentence seems to be contradicted. However, no well will be installed in close proximity to any single community population group. This is not at all clear. Please provide a population map to help explain.	wells than others. A detailed population map is not available but the wells are as centrally located as possible to provide maximum service. We have added additional markings on the maps for the locations desired (latrines, etc.).

Next Steps Comments:

No.	EWB-USA PM Comment	Chapter Response
1	Fix all items identified above, resubmit 525 report and dwg set ASAP.	
2		

Chapter Questions:

No.	Chapter Question	EWB-USA PE Response
1		
2		

3.0 Project Ownership

The village of Simwatachela, Africa is governed as a chiefdom. Chief Simwatachela owns all of the land and distributes it to members within the community. The implemented wells in the community will ultimately be functioning on property owned by Chief Simwatachela but managed and used by the local families. On the previous installation trip, the team met with Chief Simwatachela, and the team was permitted to continue with the building and implementation of the project. The meeting allowed goals of the project to be discussed, although previous meetings had taken place on prior implementation trips. A lasting relationship with the team and the locals was also important to Chief Simwatachela. SSAAP also operates on land in the village. The

program was granted land from village headsmen in 2008. SSAAP has operated in-country since assigned the land.

Due to ownership in the community, Chief Simwatachela owns all of the project facilities. The responsibilities for upkeep and management of the project and SSAAP are given to the headsmen of the village. The community and Chief Simwatachela have given the chapter permission to continue with the project in the granted land.

SSAAP and the chapter will function in the operation and installation of the wells; however the community will solely be responsible for ownership and operation for the majority of the time. Cooperation with SSAAP and the community was important to identify the groups responsible for the operation. Agreement forms were signed by the local headsmen chosen for the management of the wells. The headsmen are aware of their assigned duties for the upkeep of the well and have been educated on their role in the process. The founder of SSAAP, Heather Cummings, has been in country and will be in country during and after the future implementation. SSAAP has established different community committees to involve the community in the project to ensure the sustainability of the wells. These communities include a borehole committee, “Cikuju Committee”, responsible for repairing and collecting the funds necessary for facility upkeep.

4.0 Construction Plan

The responsibilities of the chapter during the implementation of the facilities will include basic construction support (i.e. digging and laying concrete), organizing community efforts, and monitoring and testing the system after installation. The chapter team will also assist in any other tasks assigned by the contractors and help maintain communication between the contractors and local community. All skilled labor will be provided by Overland Missions, the in-country contractors. This includes all drilling and installation activities. The contractors will also be responsible for onsite mobilization and providing all necessary construction equipment. It is important that the community members are involved in the construction process so that they feel a higher degree of ownership of the wells. The members of the borehole committee and the headsmen will be especially involved in the process. The community will help with the concrete preparation and lying and will be responsible for the construction of the protective fence around the installed facilities.

5.0 Materials List and Cost Estimate

Table 5: Materials List and Cost Estimate

Material	Cost	
	US Dollars (US$)	**Kwacha (K)**
Drill, Develop, and Case an 8-inch well Install a Mark II Hand-Operated Wells (4 wells)	7,500 (each well)	82,500
Cement and Well Head Protection	350	1,900
Local Skilled Labor (Drilling support, transportation)	2,000	11,000
Total	30,350	95,400

6.0 Operation and Maintenance

The operation and maintenance of the facility is the most critical component of the facility's sustainability. The following outline lists the responsibilities of each party to ensure the long term success of each facility and proper maintenance of the wells.

Simwatachela responsibilities:

- Pay for all of the costs to operate and maintain the water supply project. The cost is estimated to be $500 per year or 2700 Kwatcha.
- Monetary resources will be collected from the community for operations and repairs periodically as well as annually.
- The amount collected will be 50 Kwatcha.
- The position/committee responsible for identifying maintenance needs is the Borehole Committee.
- This position/committee has been appointed by SSAAP.
- This position/committee will serve in this role for the lifetime of the wells.
- The position/committee responsible for performing maintenance is the Borehole Committee or local professionals.
- This local professionals chosen for this position/committee will be appointed by SSAAP.
- This position/committee will serve in this role for the lifetime of the wells.

SSAAP responsibilities:

- Provide ongoing support to Simwatachela for a minimum of 10 years after construction is complete, as needed.
- Assist with additional monitoring activities as identified by MSU chapter of EWB-USA as long as the program is active for the EWB-USA chapter.

MSU chapter of EWB-USA responsibilities:

- Develop a detailed operation and maintenance manual for the community, including applicable photos and local language as appropriate. The manual will include a maintenance schedule and anticipated costs.
- Provide monitoring and evaluation of the water supply project for a period of not less than one year post-construction and as long as the program is active.
- Perform repairs to the project that are the result of errors in the design until they are corrected.
- Logging the drilling activities and completed wells in a well log and testing the recording the quality of the wells.

In addition to the responsibilities listed above:

- Coordination of transportation for travel team members of MSU chapter of EWB-USA will be provided by Gibson and SSAAP.
- Coordination of translation services for travel team members of MSU chapter of EWB-USA will be provided by Gibson and SSAAP.

- Scheduling of community-provided labor will be provided by MSU and SSAAP. This included 10 community workers for 6 hours per day at the construction site.
- Procurement of construction materials before MSU chapter of EWB-USA arrives for construction will be provided by the borehole committee and SSAAP.
- Transportation of materials will be funded by MSU-EWB.

7.0 Sustainability

7.1 Background

When planning the implementation and future of the project, the chapter focused on sustainability issues. These issues include ownership within the community and maintenance of the wells. If the community is unable to make necessary repairs or is unable to use the technology correctly, the project will not be sustainable. Because the community is involved in construction of the project, and members of the community are familiar with the design and are able to inspect and repair the wells, the facilities are easy to operate and maintain.

7.2 Organizational Capacity of the Community

With the support of SSAAP, the community has become more organized and equipped to support a project like the installation of wells. Through the committees in place throughout the community, Simwatachela has identified individuals responsible for specific aspects of community growth. These individuals work in groups and with the help of SSAAP, are able to support the projects tasked to them. Specifically, the borehole committee is comprised of individuals throughout the community and is responsible for the upkeep of the facilities. This includes the physical maintenance that the individuals are capable of, as well as the financial support needed for professional repairs that may be necessary

7.3 Financial Capacity of the Community

The financial support of the facilities are the responsibility of the individuals of each borehole committee. These individuals raise funds through agriculture and other trades. The committee can also raise funds through the microloan program in place in the community through SSAAP. The committee can apply for a loan and if it can assure to SSAAP that the loan will be repaid, the loan may be used to fund any necessary immediate repairs. Other than the borehole committee, individuals around the community have the opportunity to contribute to the facility's funds. The members of the community can contribute a portion of their personal incomes to support the maintenance of the wells near their homes.

7.4 Technical Capacity of the Community

With the help of SSAAP and Overland Missions, the chapter has ensured that the community is able to support the facilities from a technical standpoint. The group has instructed the community members on the proper maintenance of the facilities and on the signs that the facilities may need professional repair. The community members understand that the facilities will only be successful if they care for the facilities and ensure that they are operating properly. The individuals have been instructed to seek maintenance if the facilities are not producing the usual flow of water or if the water quality is not ideal. Overland Missions will remain in the area and has agreed to monitor the success of the wells and the ability of the community to maintain them. SSAAP will also have a representative in-country and will also ensure that the community is living up to the agreement. On the upcoming implementation trip, the team will monitor the success of the previously installed facilities and will speak with the community members on maintenance activities of the past year.

7.5 Education

In order to educate the community on the operation and maintenance of the wells, the chapter will continue working with SSAAP. The program will have a representative in-country during the installation, and the representative will continue working with the community after the installation is complete. SSAAP currently works on education programs within the community; including hygiene and life skills. The program has installed different methods of ensuring sustainability through education. Community surveys are currently used to monitor the effects of the implemented projects, including a survey specifically for wells. This survey is included in Appendix F.

8.0 Site Assessment Activities

The team plans to install four wells on the upcoming implementation trip, one at Tenson's location and one at Tom's location and two at locations to be determined. The two sites assessed on previous trips were assessed for feasibility of installation. The following objectives were used to assess a potential site:

1. Find locations based on the presence of surface water and the geological layout of the landscape.
2. Speak with community members on the history of water use in the region. Were there any wells installed in the past? Had any other organization canvased the area for well locations in the past?
3. Determine the best location based on population distribution or other factors such as the proximity to a school or public gathering place.

More detailed criteria is included in Appendix E. Tom's well was originally scheduled for installation on the second implementation trip; however, during installation the drill rig was unable

to break through a rocky layer and became stuck. The team plans to return to the location with a more powerful rig on the third implementation trip. The site for Tenson's well was assessed during the second implementation trip.

Appendices

Appendix A – Signed 903 - Implementation Agreement

(Required)

Document 903
IMPLEMENTATION AGREEMENT

EWB-USA projects are most successful when there is a three-way partnership between each of the entities listed below. Each partner has specific skills and expertise, which together, contribute to a more sustainable project over the long-term.

- **Community** – Simwatachela Borehole Committee
- **Local Partner Organization**– Simwatachela Sustainable Arts and Agriculture Program (SSAAP)
- **Mississippi State University Engineers Without Borders**

This contract is between the Mississippi State University chapter of Engineers Without Borders, USA, Simwatachela, Zambia, and SSAAP for the purpose of setting guidelines for the water supply project. Additional roles and responsibilities identified by any party to the agreement may be added at the discretion of all parties to the agreement. This document must be signed by all parties in order to begin construction of the Water Supply project. The roles and responsibilities agreed to in the previously-signed Project Agreement remain in effect in addition to the commitments outlined below.

PRE-CONSTRUCTION PHASE

Simwatachela responsibilities:

- Provide 5% of the capital construction cost in cash before construction begins.
- Provide written confirmation that the land required for the project implementation is owned by the community before construction begins. Alternatively, in lieu of ownership, the community can provide written confirmation that it has a permanent easement to use the property.
- Provide written confirmation that it has the legal right to use the water supply that is being developed in this project.
- Commit 10 workers for 6 hours per day to the construction site.
- Provide the name of the community representative responsible for organizing the in-kind labor.
- Provide the following list of equipment and tools for construction:
    - The community will contribute any equipment available, but are not required to contribute any.

SSAAP responsibilities:

- Provide 5% of the capital construction cost in cash before construction begins.

- Provide the following list of equipment and tools required for construction:
    - SSAAP will contribute any equipment available, but is not required to contribute any.

Mississippi State University chapter of EWB-USA responsibilities:

- Provide 90 % of the capital construction cost in cash before construction begins.
- Provide qualified representatives of the design team during construction for observation or oversight.
- Communicate the requirements of site preparation prior to the chapter arriving for construction. This will be communicated to the community and the local partner two months prior to construction, or earlier as determined by the project needs.
- Provide the following list of equipment and tools required for construction:
    - MSU-EWB will use materials through the hired contractor.
    - Safety gear for everyone will be provided by MSU-EWB. This includes:
        1. Safety goggles
        2. Hard hats
        3. Boots
- Provide the following materials for construction:
    - Construction materials will be provided through the hired contractor.

POST-CONSTRUCTION/OPERATIONS AND MAINTENANCE PHASE

Simwatachela responsibilities:

- Pay for 100% of the costs to operate and maintain the project, Water Supply. This cost is estimated to be $500 per year, 2,700 Kwatcha.
- Monetary resources will be collected from the community for operations and repairs:
    - Periodically, annually
- The amount collected per the schedule above will be: 50 Kwatcha
- The position/committee responsible for identifying maintenance needs is: Borehole Committee
- This position/committee has been:
    - Appointed by SSAAP
- This position/committee will serve in this role for the lifetime of the wells.
- The position/committee responsible for performing maintenance is: the Borehole Committee or local professionals
- This position/committee will be:
    - Appointed by SSAAP (professionals hired by the borehole committee)
- This position/committee will serve in this role for the lifetime of the wells.

SSAAP responsibilities:

- Provide ongoing support to Simwatachela for a minimum of 10 years after construction is complete, as needed.

- Assist with additional monitoring activities as identified by MSU chapter of EWB-USA as long as the program is active for the EWB-USA chapter.

MSU chapter of EWB-USA responsibilities:

- Develop a detailed operation and maintenance manual for the community (including applicable photos and local language, as appropriate). The manual will include a maintenance schedule and anticipated costs.
- Provide monitoring and evaluation of the water supply project for a period of not less than one year post-construction and as long as the program is active.
- Perform repairs to the project that are the result of errors in the design until they are corrected.

In addition to the responsibilities listed above, indicate the responsible party for each of the following:

- Coordination of transportation for travel team members of MSU chapter of EWB-USA will be provided by Gibson and SSAAP.
- Coordination of translation services for travel team members of MSU chapter of EWB-USA will be provided by Gibson and SSAAP.
- Scheduling of community-provided labor will be provided by MSU and SSAAP. This includes 10 community workers for 6 hours per day at the construction site.
- Procurement of construction materials before MSU chapter of EWB-USA arrives for construction will be provided by the borehole committee and SSAAP.
- Transportation of materials will be funded by MSU-EWB.

On behalf of, and acting with the authority of the residents of Simwatachela the NGO/local municipal partner Simwatachela Sustainable Arts and Agriculture Program and the Mississippi State University chapter of EWB-USA, the under-signed agree to abide by the above conditions.

Signature Date

Printed Name

Position in MSU chapter of EWB-USA

Signature Date

Printed Name

Position in the Borehole Committee

Signature	Date
Printed Name	
Position in SSAAP	

1. Tom Signed Agreement

- Procurement of construction materials before MSU chapter of EWB-USA arrives for construction will be provided by the borehole committee and SSAAP.
- Transportation of materials will be funded by MSU-EWB.

On behalf of, and acting with the authority of the residents of Simwatachela the NGO/local municipal partner Simwatachela Sustainable Arts and Agriculture Program and the Mississippi State University chapter of EWB-USA, the under-signed agree to abide by the above conditions.

Signature — Date: 08 Aug 14

Printed Name: Dennis D. Truax

Position in MSU chapter of EWB-USA: Faculty Advisor

Signature — Date: 08 Aug 14

Printed Name: Sikanyangu Mandanda

Position in the Borehole Committee: Brother

Signature — Date: 13 Aug. 2014

Printed Name: Heather Cumming

Position in SSAAP: Executive Director / Founder

"TOM"

Page 4 of 4

2. Tenson Signed Agreement

- Procurement of construction materials before MSU chapter of EWB-USA arrives for construction will be provided by the borehole committee and SSAAP.
- Transportation of materials will be funded by MSU-EWB.

On behalf of, and acting with the authority of the residents of Simwatachela the NGO/local municipal partner Simwatachela Sustainable Arts and Agriculture Program and the Mississippi State University chapter of EWB-USA, the under-signed agree to abide by the above conditions.

Signature — Date: 07 Aug 15

Printed Name: Dennis D. Truax

Position in MSU chapter of EWB-USA: Faculty Advisor

Signature — Date: 07/08/2015

Printed Name: Tenson Mukonka

Position in the Borehole Committee: Contact

Signature — Date: 7 Aug. 2015

Printed Name: Heather Cumming

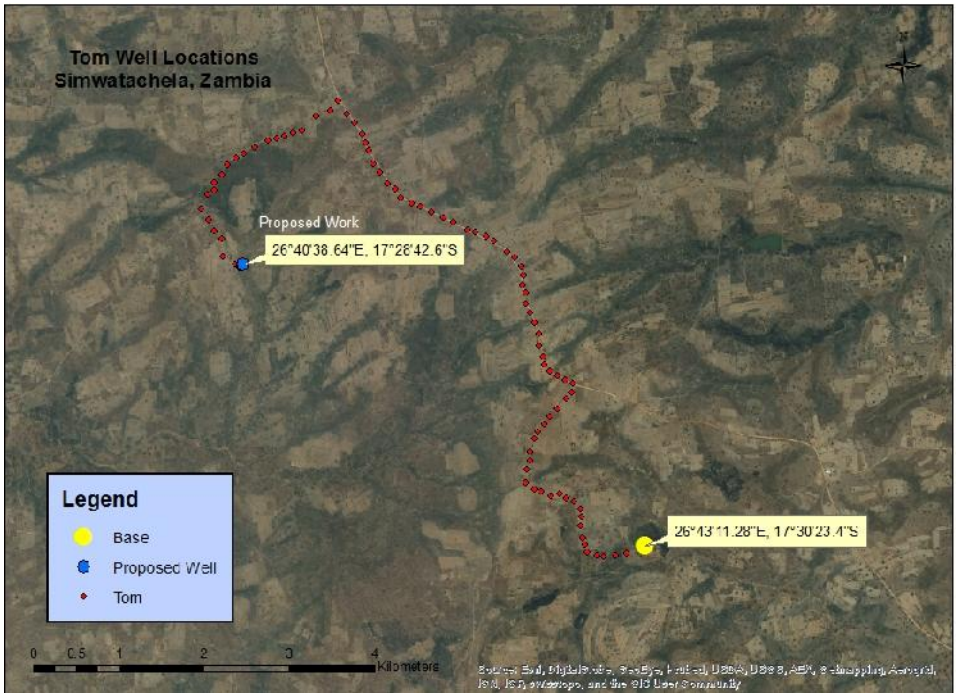
Position in SSAAP: Executive Director

Appendix B – Additional Information to Support Design

Appendix C- Proposed Well Locations

1. Tom

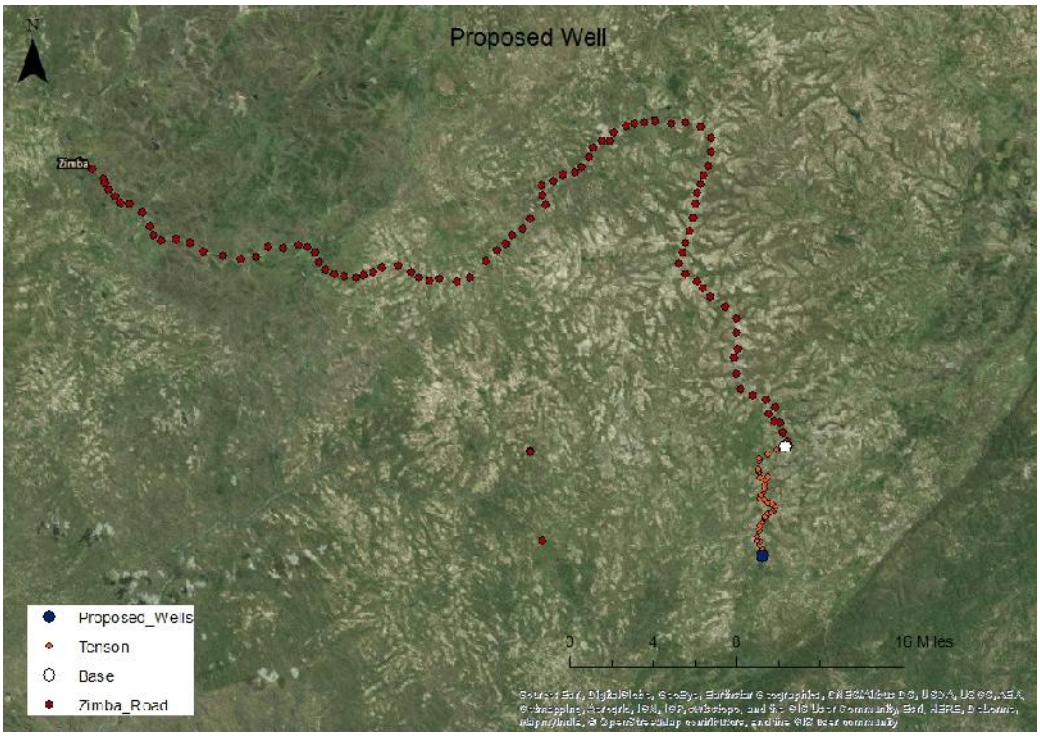
Proposed Location



Aerial View

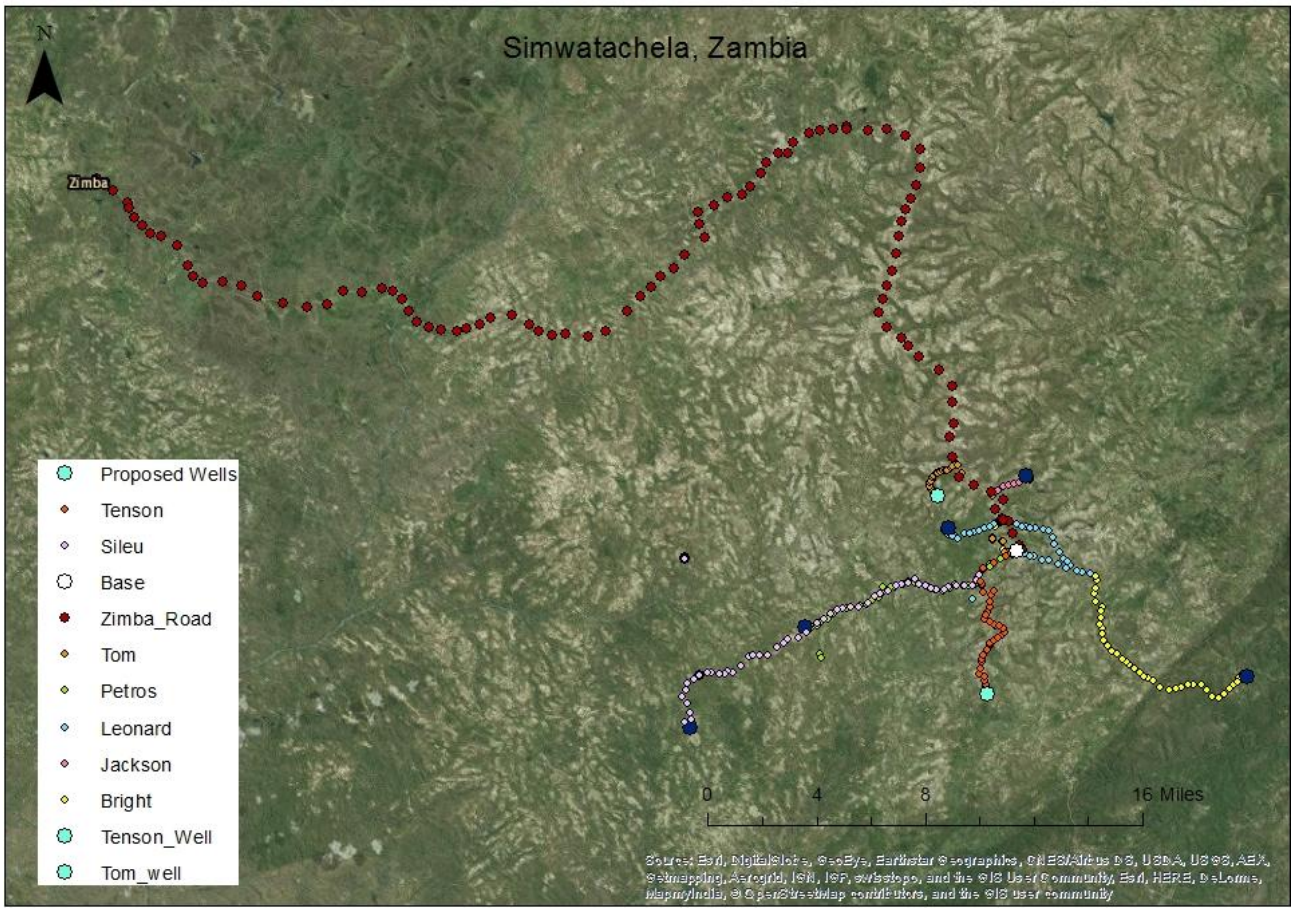
2. Tenson

Proposed Location



Aerial View

3. All Current and Proposed Locations



Appendix D- Photo Documentation

1. Tom Well Location

Field located north of well location

Field located south of well location

2. Tenson Well Location

Current water source for Tenson's community

Proposed site for Tenson's well

Appendix E: Well Siting Criteria

Mississippi State University
Engineers Without Borders Student Chapter
Simwatachela, Zambia, Water Supply Project

Siting Criteria for Potable Water Wells

Several criteria are used to evaluate the suitability of prospective sites for potable water wells which will be installed as part of the Chapter's water supply project in southern Zambia. Each of these is used in an effort to minimize water supply contamination and insure the pump and other above ground structures are safe.

A. Community Structures: The minimum distance from community and residential "structures" will be required. A minimum distance from on-site wastewater disposal systems is required. In this area, this constitutes privy pits and associated structures. Similarly, solids waste is disposed locally and this consists of dug pits with routine covering of materials placed in these pits, with some burning of materials. A reasonable distance from bathing facilities is required as water from these structures is routinely discharged to the ground adjacent to them. Further, as a variety of human activities occur in residents, cooking areas, food storage areas, and animal pens, a distance from these community structures is needed. Therefore, given the potential for surface and subsurface migration of contaminants is a real possibility,

   - A community protective well radius of 100 meters (300 feet) has been establishing as a buffer or setback distance between the potable water well and any structure in the community, including, privy pits, houses, cooking structures, animal pens, schools, etc.

B. Areas Subject to Standing Water: Wells will not be constructed in areas subject to flowing or standing water during any part of the year. Such water has the potential of infiltrating the well even if provision such as those specified in our well construction contract (e.g., pad, fencing, solid casing except for screen at bottom, sealing the annular space outside of the well casing, grouted of the pump stem, etc.). If intrusion were to occur, water quality could be degraded. Therefore,

   - No well will be installed within 30 meters 100 feet of a river, bottom of a valley or raven, swale, depression, or similar areas where flowing or standing water can be expected at any time during the year.

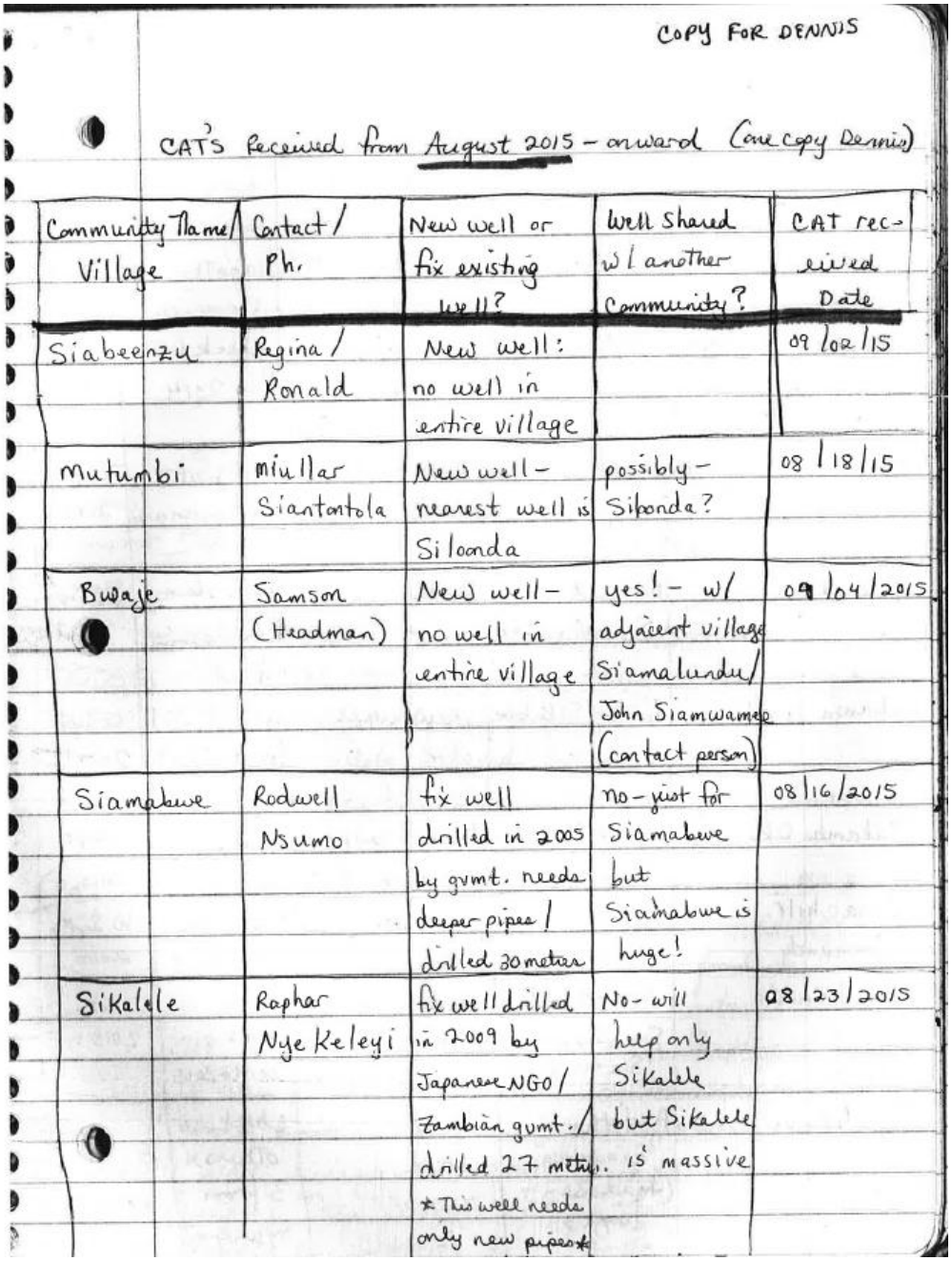
C. Setback from Roadways and Paths: To reduce the potential for damage to the pump and other above ground components of the installation, a setback is required from roads traveled by vehicles and pedestrians as well as established paths used by large animals. Further, isolation will help reduce the potential for non-residents finding and using the pump as a source of parts for other pumps. Therefore,

- All wells will be located at least 25 meters (75 feet) from any and all roads or established paths used by vehicles, pedestrians, or large animals. Further, consideration to extend this distance will be given if the well would be located in areas subject to road drainage.

D. Community Proximity: Finally, though not directly related to well protection, it should be noted that politically it is generally undesirable to locate a well too close to any single community cluster. The communities being served consist of extended family clusters distributed over several hectare. Each cluster can have between 20 and 200 adults and children. A tribal community consists of between three and seven clusters. "Favoring" one cluster by placing a well near it, places all other clusters at a disadvantage. However, not considering the number of people in a cluster can result in a significant number of people having to travel large distances because of the location of a small group. Therefore, to optimize access to the potable water supply being developed,

- Each well will be located near the population centroid for the community. This will be equidistant from all families except for slight adjustment towards significantly large population groups. However, no well will be installed in close proximity to any single community population group to prevent any hostility or false sense of ownership in one single group.

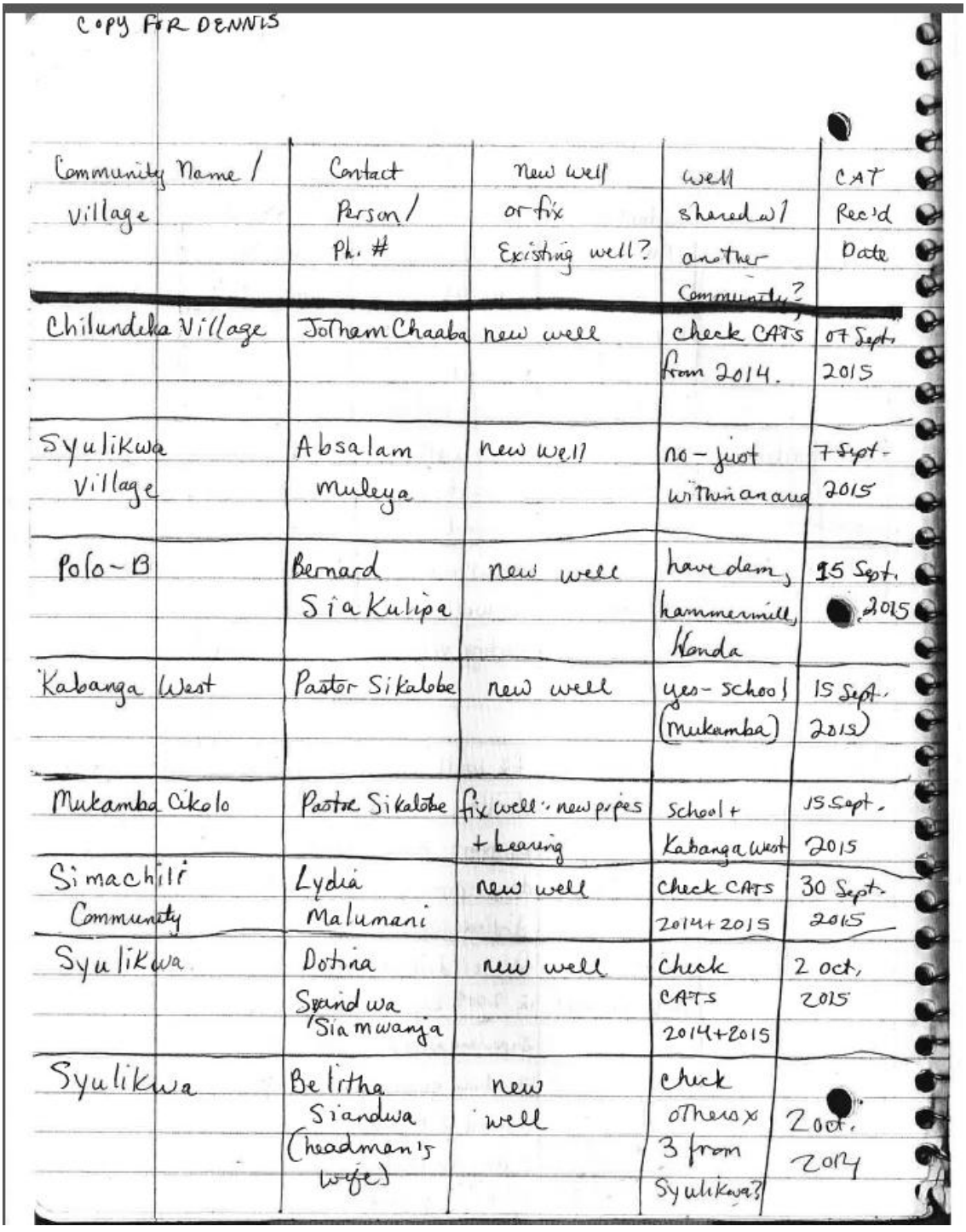
Appendix F: Additional Well Sites



COPY FOR DENNIS

CAT's Received from August 2015 – onward (Can copy Dennis)

Community Name/ Village	Contact / Ph.	New well or fix existing well?	Well Shared w/ another Community?	CAT received Date
Siabeenzu	Regina / Ronald	New well: no well in entire village		09/02/15
Mutumbi	miullar Siantantola	New well – nearest well is Siloanda	possibly – Siponda?	08/18/15
Bwaje	Samson (Headman)	New well – no well in entire village	yes! – w/ adjacent village Siamalundu/ John Siamwameo (contact person)	09/04/2015
Siamabeve	Rodwell Nsumo	fix well drilled in 2005 by gvmt. needs deeper pipes / drilled 30 meters	no – just for Siamabeve but Siamabeve is huge!	08/16/2015
Sikalele	Raphar Nye Keleyi	fix well drilled in 2009 by Japanese NGO / Zambian gvmt. / drilled 27 meters * This well needs only new pipes*	No – will help only Sikalele but Sikalele is massive	08/23/2015



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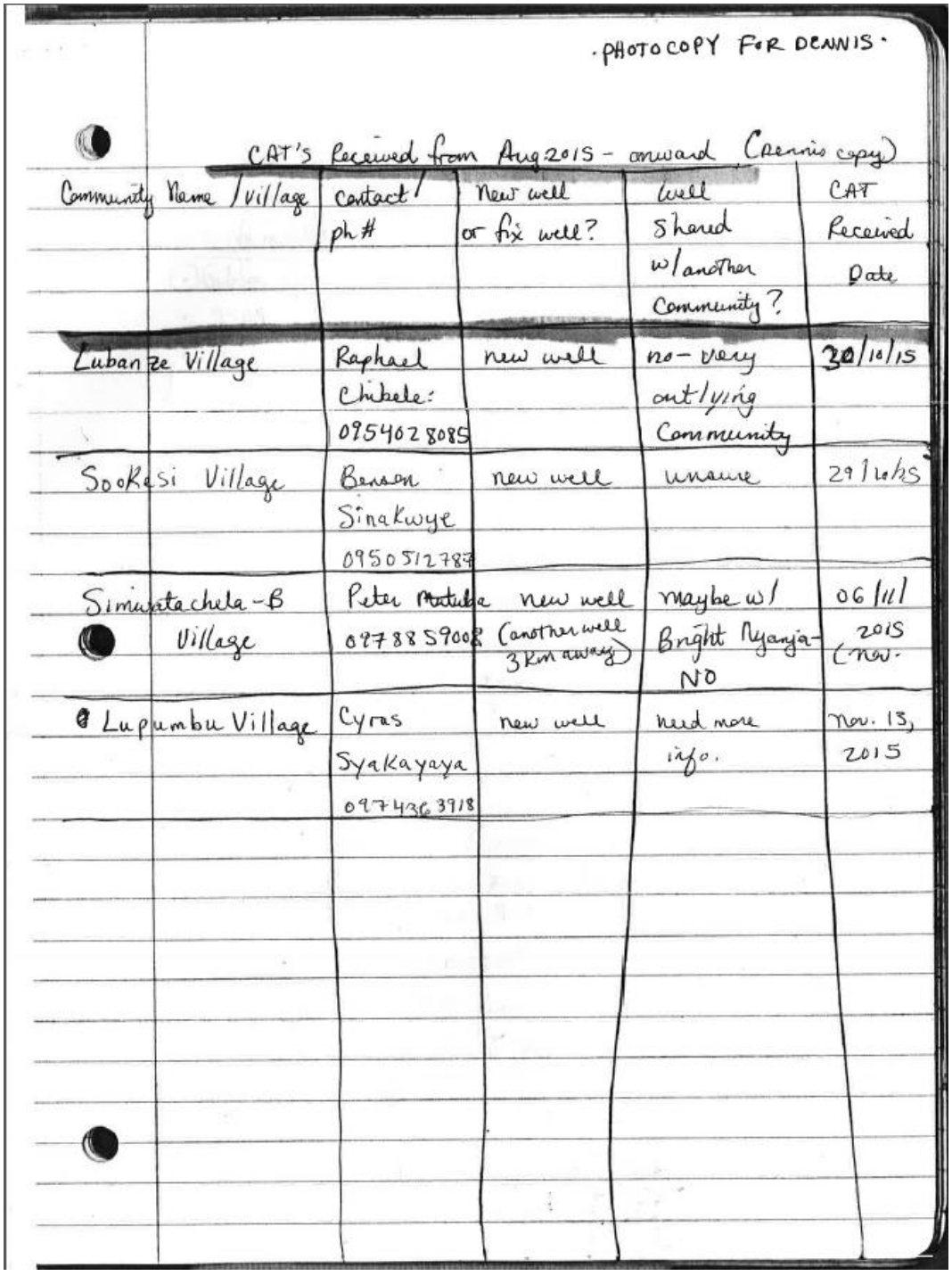
Community Name / Village	Contact Person / Ph. #	New well or fix Existing well?	Well shared w/ another Community?	CAT Rec'd Date
Chilundika Village	Jotham Chaaba	new well	check CATS from 2014.	07 Sept. 2015
Syulikwa Village	Absalam Muleya	new well	no – just within ananu	7 Sept. 2015
Polo-B	Bernard Sia Kulipa	new well	have dam, hammermill, Konda	15 Sept. 2015
Kabanga West	Pastor Sikalobe	new well	yes – school (Mukamba)	15 Sept. 2015
Mukamba Cikolo	Pastor Sikalobe	fix well: new pipes + bearing	school + Kabanga West	15 Sept. 2015
Simachili Community	Lydia Malumani	new well	check CATS 2014+2015	30 Sept. 2015
Syulikwa	Dotina Siandwa Siamwanja	new well	check CATS 2014+2015	2 oct, 2015
Syulikwa	Belitha Siandwa (headman's wife)	new well	check others x 3 from Syulikwa?	2 Oct. 2014



·PHOTOCOPY FOR DENNIS·

CAT's Received from Aug 2015 - onward (Dennis copy)

Community Name / Village	Contact / ph #	New well or fix well?	Well Shared w/ another Community?	CAT Received Date
Lubanze Village	Raphael Chibele: 0954028085	new well	no - very out lying Community	30/10/15
Sookesi Village	Benson Sinakwye 0950512787	new well	unsure	29/10/15
Simwatachela-B Village	Peter Matuba 0978859008	new well (another well 3 km away)	maybe w/ Bright Nyanja- NO	06/11/ 2015 (Nov.
Lupumbu Village	Cyras Syakayaya 0974363718	new well	need more info.	Nov. 13, 2015

Notes Summary

Community Name/Village	Contact	New Well or Fix?	Well Shared With Another Community?	Application Received
Siabeenzu	Regina/ Ronald	New		9/2/2015
Mutumbi	Miullar Siantontola	New	Possibly Sibonde	8/18/2015
Bwaje	Samson	New	Siamalunda	9/4/2015
Siamabwe	Rondwell Nsumo	Fix		8/16/2015
Sikalele	Raphar Nyekeleyi	Fix		8/23/2015
Chilundela	Jothem Chaaba	New		9/7/2015
Syulikwa	Absalam Mueya	New		9/7/2015
Polo-B	Bernard Siakulipa	New		9/15/2015
Kabanga West	Pastor Sikalobe	New	Yes-school	9/15/2015
Mukamba Cikolo	Pastor Sikalobe	Fix: new pipes and bearing	School and Kabanga West	9/15/2015
Simachili	Lydia Malumani	New		9/30/2015
Syulikwa	Dotina Siamwanja	New		10/2/2015
Syulikwa	Belitha Siandwa	New		10/2/2015
Lubanze	Raphael Chibele	New	Very Outlying	10/30/2015
Sookesi	Benson Sinakwye	New		6/29/2015
Simwatachela B	Peter Matuba	New	Maybe with Bright Nyanja	6/11/2015
Lupambu	Cyrus Syakayaya	New		11/13/2015

Appendix G- Community Well Survey

Monitoring and Evaluation Tool (M&E)
SSAAP: Zambia and Sierra Leone
www.ssaap.org

Name of Group/Community/School:

Location:

Date:

Country:

Do you have a well provided by SSAAP?

Has it been maintained?

What are the needs for upkeep?

Who is up-keeping and maintaining the well?

What problems are arising from the well?

What is your community doing in an attempt to fix the problems?

Do you have a borehole provided by SSAAP?

Has it been maintained?

What are the needs for upkeep?

Who is up-keeping and maintaining the borehole?

What problems are arising from the borehole?

What is your community doing in an attempt to fix the problems?

Does your school have a hygiene and sanitation program with SSAAP?

Have you been given a hand-washing station at your school?

Has the hand-washing station been maintained?

What is the school doing to maintain the hand-washing system?

Name of person filling out form_____

Role in project _____

Contact phone _____

Appendix H- Well Logs

1. Leonard

2. Jackson

3. Bright

4. Petros

5. Sileu

Appendix I: Hydrology Study