Project Proposal

Nitrate Removal in Domestic Single Family-Style Well Drinking-Water Delivery Systems

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Engineering Your World

April 30, 2013

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Dr. Wilbert Odem,

The proposal attached to this letter is in response to the Request for Proposal (RFP) dated August 28, 2013 regarding nitrate removal in domestic single family-style well drinking-water delivery systems. In the proposal you will find information compiled from reliable, technical sources providing valuable data toward the project.

Please Contact Everest Consulting Company LLC (ECC), with any questions regarding the attached proposal for and nitrate removal in domestic single family-style well drinking-water delivery system

Regards,

Kenton Mills Zachary Raymond-Becker

Enclosure

1.0 Purpose

The client Bero Engineering LLC is a firm that specializes in environmental engineering and human health risk assessment. The client, Bero Engineering LLC, is requesting proposals for an add-on system that removes nitrate from contaminated drinking water in domestic single family-style well water delivery systems. The add-on system is required to remove concentrations of nitrate above 10 mg/L down to or below acceptable drinking standards. The add-on system will be evaluated in terms of both its effectiveness in removing nitrate from drinking water from contaminated groundwater and in its ability to integrate with existing domestic single family-style well water delivery systems.

2.0 Project Description

Agricultural activities have been shown to cause nitrate contamination in shallow groundwater aquifers as shown by a recent nationwide study. The study shows that concentrations of nitrate over 1 mg/L or 1 ppm indicate human activity[1]. Citizens who employ a private well drinking-water delivery system who live in areas with nearby agricultural activity are in danger of the negative health effects, especially in infants, associated with nitrate contaminated groundwater. The EPA is Responsible for determining safe levels of nitrate at which no health effects are likely, as informed by the Safe Drinking Water Act which calls for Maximum Contaminant Level (MCL) of 10 mg/L nitrate as nitrogen.

2.1 The Nitrogen Cycle Nitrate

Nitrogen is the most abundant element in the atmosphere as it comprises 80% of air[2]. Gaseous nitrogen is found in many forms, the major ones being N_2, N_2O, NO, NO_2, NO_3 and NH_3. Some of these gases readily react with rain water, or surface water, to produce nitrate and ammonium ions. These ions become part of the soil layer, eventually permeating through into groundwater aquifers creating a natural background concentration of nitrate and ammonium ions. The most notable ion, in this case, is nitrate, an anion NO_3^-. As nitrate leaves the atmosphere it can be converted back into elemental nitrogen (N_2) through a process known as de-nitrification. This may take place in the soil by denitrifying bacteria that reduce nitrate[3]. As conversion takes place, nitrogen is ejected back into the atmosphere as to complete the nitrogen cycle.

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[1] Dubrovsky, N.M., et al. (2010). The quality of our Nation's waters—Nutrients in the Nation's streams and groundwater, 1992–2004: *U.S. Geological Survey Circular 1350*

[2] Haller, L., McCarthy, P., OBrian, T., Riehle, J., & Stuhldreher, T. (1999). Nitrate pollution of groundwater. Retrieved 3/20/2013 from http://www.reopure.com/nitratinfo.html

[3] Denitrifying Bacteria. *Encyclopedia Britannica*. Retrieved 2/12/13 from http://www.britannica.com/EBchecked/topic/157733/denitrifying-bacteria

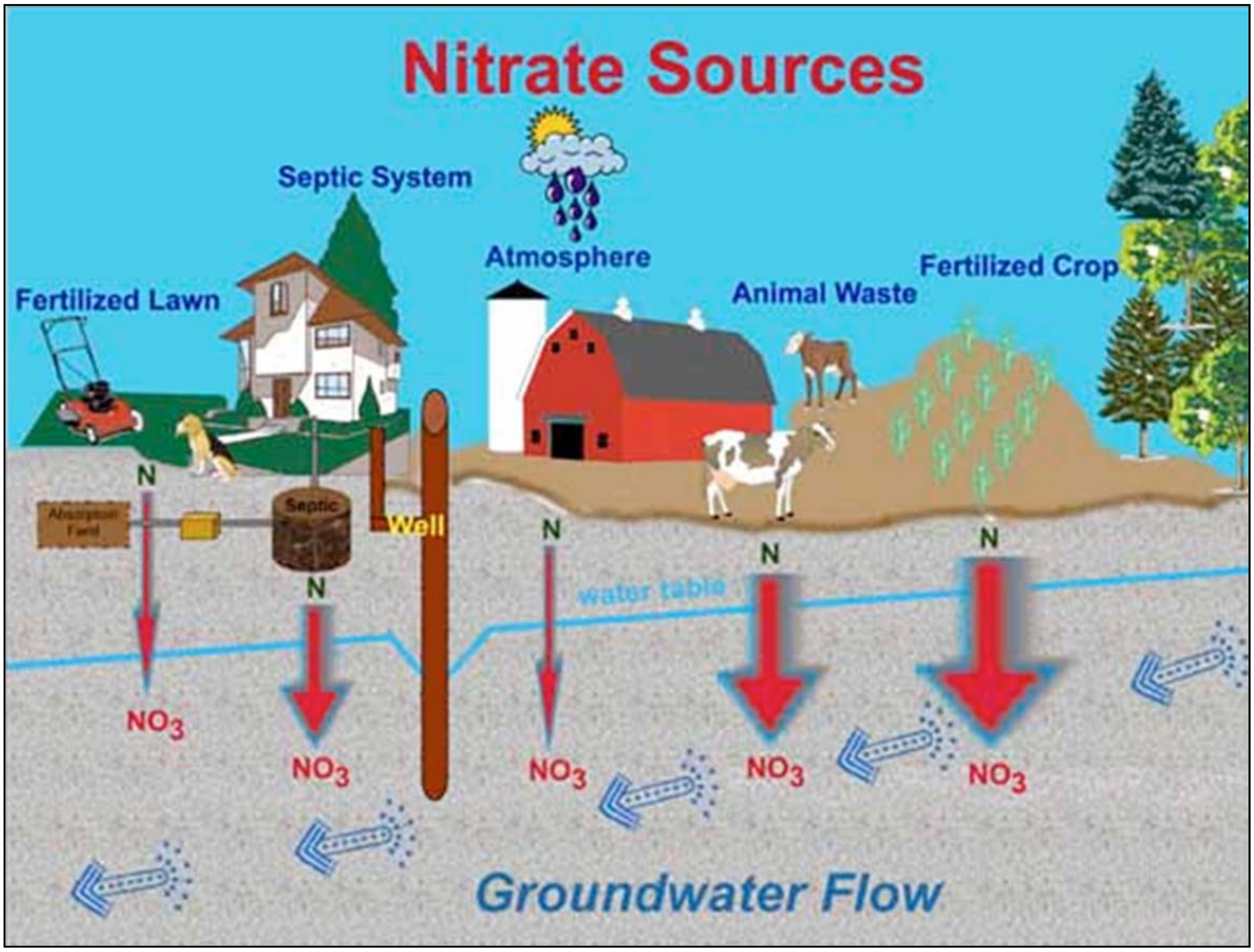

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FIGURE 1: SOURCES OF NITRATE IN GROUND WATER IN AREAS OF AGRICULTURAL ACTIVITY

Described in are some sources of groundwater contamination in agricultural areas[8]. The sizes of the red arrows in Figure 1 are proportional to the severity of the sources contribution to nitrate contamination in groundwater. Although nitrate contamination isn't limited to agricultural activity, the fate and transport of nitrate affects domestic single family style well drinking-water delivery systems. As seen in Figure 1, sources for nitrate contamination include leaking septic tanks, ineffective septic leach fields, surface water runoff containing chemical fertilizers and pesticides, animal manure, and erosion of natural deposits.[5] Wastewater treatment facilities that do not specifically remove nitrogen can lead to excess levels of nitrate in surface or groundwater. Some nitrate also enters water from the atmosphere, which carries nitrogen-

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[4] Portage (2013). Retrieved 4/25/2013 from http://www.co.portage.wi.us/groundwater/undrstnd/no3.htm

[5] *Basic information about nitrate in drinking water*. (n.d.). Retrieved 4/25/2013 from http://water.epa.gov/drink/contaminants/basicinformation/nitrate.cfm

containing compounds derived from automobiles, coal-fired generating units and other sources[6].

2.2 *Variance of Nitrate Contamination*

Groundwater harvested in the United States of America from domestic single family style well drinking-water delivery systems may be contaminated by nitrate. A large portion of the United States of America uses groundwater as its main source of drinking water. Groundwater availability varies geographically, but many places have aquifers that can supply fresh drinking water to single family households. Nitrogen contamination is more of a problem in shallow aquifers; therefor it is necessary to be aware of aquifers in the United States that would be more at risk for nitrogen contamination[6]. Figure 2 shows areas within the Unite States of America that are at risk for shallow ground water nitrate contamination.

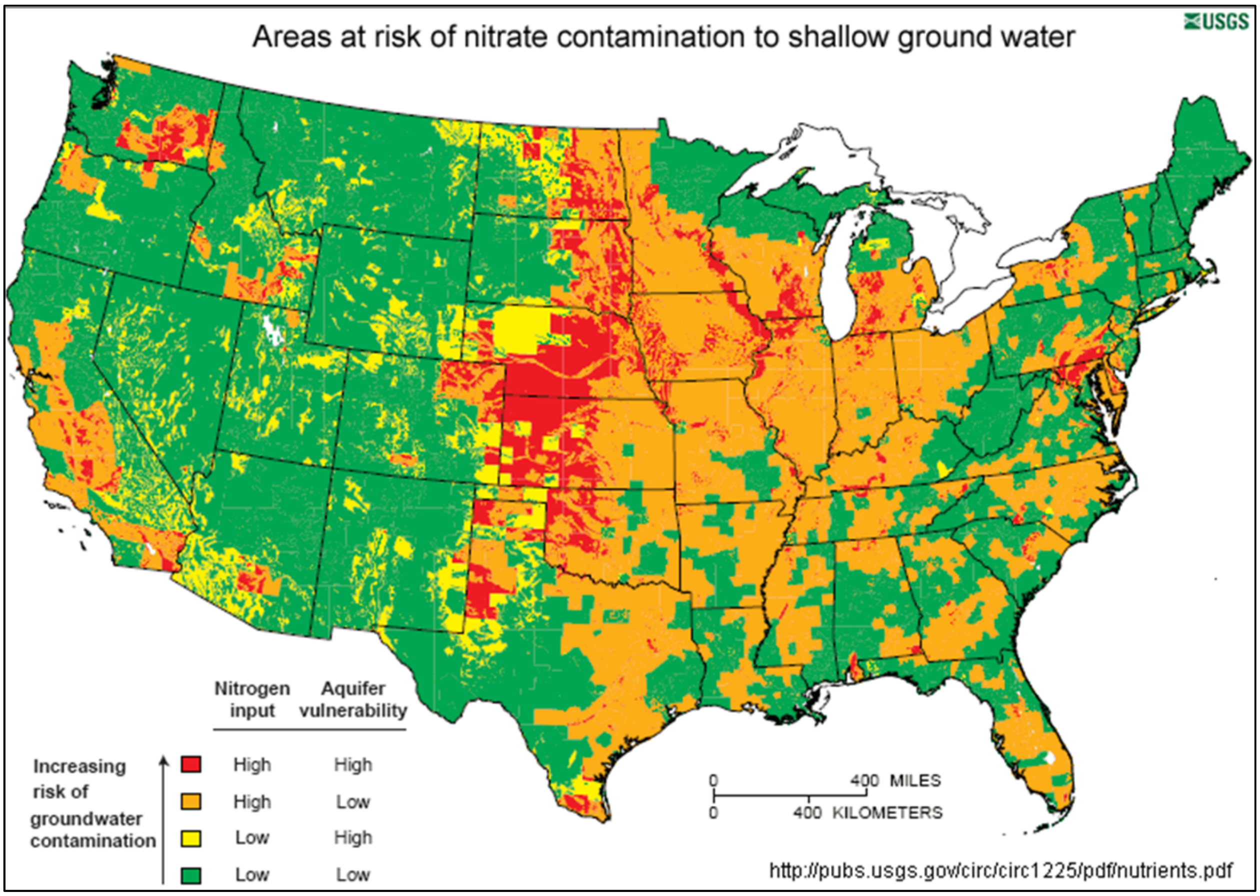

FIGURE 2: AREAS OF THE UNITED STATES WITH THE HIGHEST RISK FOR CONTAMINATION OF SHALLOW GROUNDWATER BY NITRATE

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[6] Perlman, H. *Nitrate and Water.* (06 Mar 2012) Accessed: 21 Apr 2013. <http://ga.water.usgs.gov/edu/nitrogen.html>.

The United States Geological Survey (USGS) study developed the map seen in Figure 2. The map shows areas of the United States with risk for nitrate contamination of shallow groundwater. Local variations in land use, irrigation practices, aquifer type, and rainfall can result in nitrate concentrations that do not conform to risk patterns shown at national scale[6].

2.3 Nitrate Contamination

Single family households that ingest nitrate at a concentration above 10 mg/L or ppm are considered to be at risk by the EPA. Undetectable to our senses, nitrate has no color, taste or smell at concentrations observed in drinking water supplies. Nitrate does not cause discoloration of plumbing fixtures and does not affect laundering or other non-potable domestic water uses. Nitrates present in a water supply can be indication of other contaminants in that source of water[7].

Pure water contains nothing but the essential chemical H_2O. Drinking water sourced from groundwater usually carries a certain amount of minerals acquired from its source, treatment, storage, distribution, and household plumbing conditions. Geologic, hydrogeologic, and land-use conditions may vary nitrate contamination. The variability of nitrate contamination sources may lead to a variety of nitrate co-contaminants. The co-contaminants may pose a greater risk to human health beyond nitrate itself[8]. Understanding the occurrence of these co-contaminants has implications for synergistic effects and remediation methods that would be appropriate to address all contaminants, which are beyond the scope of this proposal.

Common organic and inorganic drinking water contaminants considered in this project will be based on an evaluation of the occurrence of common groundwater contaminants in areas where agricultural activity is present. Table 1 on the next page shows common contaminants found in drinking water. The contaminants in Table 1 are the only possible contaminants in conjunction with nitrate that will be considered for this project.

[7] DeSilva, Francis J. "Nitrate Removal by Ion Exchange." *Water & Wastes Digest*. (2003): 9-11,30. Print.

[8] Nitrate Contamination in California Groundwater (2002). Lawrence Livermore National Laboratory. Retrieved 02/12/2012 from http://www.swrcb.ca.gov/gama/docs/llnl_nitrate_wp_ucrl-151454.pdf

TABLE 1 COMMON DRINKING WATER CONTAMINANTS

Constituent	Source	Significance
Bicarbonate/Carbonate	Dissolved rocks such as limestone and dolomite	Produce alkalinity
Boron	Dissolved from igneous & sedimentary rocks	Low toxicity to mammals; toxic to insects
Bromide	Present in high concentrations in some brines	Low concentrations in fresh water in not known to endanger human health
Calcium	Dissolved from most soils and rocks	Causes hardness as $CaCO_3$
Chloride	Dissolved from rocks and soils; present in sewage and natural brines	When combined with Ca^{2+} and Mg^{2+}, increases corrosivity of water
Fluoride	Contained in most hot and warm springs	Reduces incidence of tooth decay but may cause mottling of teeth
Iron	Dissolved from most rocks and soils; may also be derived from iron pipes, pumps and other equipment	Oxidizes when exposed to air; excessive iron may also interfere with the efficient operation of exchange-silicate water softeners
Magnesium	Dissolved from most soils and rocks	Causes hardness as $MgCO_3$
Manganese	Dissolved from some rocks and soils; high concentrations often associated with high iron content and with acidic waters	May interfere with the efficient operation of exchange-silicate water softeners
Potassium	Dissolved from most rocks; also found in brines and sewage	Deposits of potassium nitrate may form in contact with atmosphere
Phosphate	Dissolved from some rocks and soils, usually at low concentrations	Essential for plant growth; may form nitrides or sulfides
Silica	Dissolved from most rocks and soils, usually at low concentrations	Form hard scale in pipes and boilers
Sodium	Dissolved from most rocks; also found in brines and sewage	Sodium salts may cause foaming in boilers
Sulfate	Dissolved from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds	Sulfate in water containing calcium forms hard scale; concentrations above 250 mg/L may have laxative effect; domestic water supplies containing 1000 mg/L sulfate can be used for drinking

2.4 *Impacts due to Nitrate Contamination*

Approximately 15% of Americans who live in the United States rely on a personal water supply to provide drinking-water for their household. The majority of domestic single family-style wells draw from groundwater as their primary source of drinking water. The USGS estimated 98% of self-supplied drinking water is from groundwater wells[9]. Furthermore, the USGS documented nitrate levels above MCL under SDWA in over 20% of shallow drinking water wells in agriculture areas of the United States[10].

In the environment, excess nitrate can cause an overabundance of aquatic plants and algae. The profusion of these organisms, in turn, can clog water intakes, consume dissolved oxygen as they decompose, and block light beneath the water surface. Eventually, eutrophication can occur in lakes and reservoirs leading to fish kills as a result of the oxygen deficit[6]. The oxygen deficits have been nicknamed dead zones because everything biological dies.

In humans, too much nitrate can cause a restriction of oxygen transport in the blood stream. Infants younger than 6 months of age lack the enzyme necessary to remedy the condition thereby acquiring “blue baby syndrome” [11]. Pregnant woman and children less than 1 year of age should never drink water contaminated with nitrate. Nitrate has also been shown to cause shortness of breath in some adults with weakened respiratory systems.

2.5 *Regulations Related To Nitrate Contamination*

Water suppliers must notify their customers no more than 24 hours after excess nitrate has been detected[6]. Safety precautions, such as providing alternate drinking water supplies, are required to prevent serious risks to public health. Due to the lack of public water supply in rural areas, private, single family rural water users do not have the privilege of notification when their rural well-water does not meet MCL and poses a threat to human health.

Under jurisdiction of the EPA, any activity relating to the quality of groundwater and its use in public domain is regulated by a number of laws. EPA’s groundwater protection activities are shown on the next page.[12]

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[9] Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A. (2009). Estimated use of water in the United States in 2005: *U.S. Geological Survey Circular 1344*

[10] Stewart, S. State of Oregon Department of Environmental Quality, Water Quality Division. (2012). *Nitrate in drinking water* (11-WQ-012)

[11] *US EPA Basic Information about Nitrates*. (2012, March 6). Retrieved from http://water.epa.gov/drink/contaminants/basicinformation/nitrate.cfm

[12] Gallagher, J. U.S. Environmental Protection Agency, Office of Water. (1999). *Citizen's guide to groundwater protection* (440/6-90-004)

- **The Safe Drinking Water Act**

  The Safe Drinking Water Act (SDWA): set standards for maximum limits of contaminates in drinking water; regulates underground disposal of wastes in deep wells; designates areas that rely on a single aquifer for their water supply; and establishes a nationwide program to encourage states to protect public water supply.

- **The Resource Conservation and Recovery Act**

  The Resource Conservation and Recovery Act (RCRA): regulates the storage; transport; treatment; and disposal of solid and hazardous wastes to prevent contaminants from leaching into groundwater from municipal landfills, underground storage tanks, surface impoundments, and hazardous waste disposal facilities.

- **The Comprehensive Environmental Response Compensation and Liability Act**

  The Comprehensive Environmental Response, Compensation, and Liability Act (CECLA) authorize the government to clean up contamination caused by chemical spills or hazardous waste. Sites that could (or already do) pose threats to the environment are in violation of laws set by CECLA. For example the CECLA "community right-to-know" program authorizes citizens to sue site owners or liable parties who are responsible for environmental harm.

- **The Federal Insecticide, Fungicide, and Rodenticide Act**

  The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) authorize EPA to control the availability and use of pesticides that have the ability to leach into groundwater.

- **Toxic Substance Control Act**

  The Toxic Substances Control Act (TSCA) authorizes EPA to control the manufacture, use, storage, distribution, and disposal of toxic chemical that have the potential to leach into groundwater.

- **The Clean Water Act**

  The Clean Water Act (CWA) authorizes EPA to make grants to the states for the development of groundwater protection strategies and authorizes a number of programs to prevent water pollution from a variety of potential sources.

The above water regulations are intended to control potential sources of groundwater contamination nationwide. The implementation of these programs must be through states in cooperation with local governments. Federal laws have provided general protection activities for human and environmental health. Often, domestic single family style well drinking-water delivery systems are absolved from maintaining federal regulation standards therefore posing excess human health risk from lack of adequate monitoring.

3.0 Stakeholders

The nitrate removal in domestic single family style well drinking-water delivery systems project has 4 stakeholders. The first stakeholder is Bero Engineering LLC, who has supplied the opportunity to generate this proposal in response to their RFP. The outcome of this project will be patented under a Bero Engineering LLC. The second stakeholder is any potential manufacturer of the final design. The third stakeholder is any potential installer of the final design. The fourth and final stakeholder is the population inflicted by nitrate contamination in drinking water delivered by a private well.

4.0 Current Conditions

The current conditions are generalizations to help the project serve the largest number of people with groundwater nitrate contamination. The current conditions are listed below:

- The nitrate removal add-on system will be intended for areas where any activity has contributed to nitrate contaminated groundwater.
- Current groundwater contamination due to nitrate is above the SDWA MCL of 10 mg/L NO_3-N.
- The add-on system will be design for a single well serving a single family household with an onsite well, pump and transmission lines to the main dwelling.
- The groundwater at the single family household is assumed to be contaminated with at least 20 mg/L NO_3-N using Hatch® method 8039.
- The well generates water at a rate of least 280 gallons per day.
- Average pumping rate of 0.2 gal/min[13].

5.0 Technical Constraints

The technical constraints for the design of the nitrate removal add-on system are listed below:

- The final product must not require an on-grid power source
- The size of the final product must be easily moved and operated by one person
- The final design must be a cost effective method for nitrate removal for a single family household
- The final design must require limited maintenance and able to be performed by a homeowner
- The final design will be required to treat a minimum flow rate of 0.2 gpm
- The final design must integrate with current domestic single family style well drinking-water delivery systems

[13] *Average water use*. (n.d.). Retrieved 4/25/2013 from http://www.rwcc.com.au/save-water/average-water-use/

6.0 Scope of Services

The following Scope of Services will be completed by the Everest Consulting Company LLC (ECC) team and shows the breakdown of tasks required.

Task 1 – Project Management

1.1 Project Meetings with Client

Project development meetings will help develop the problem statement, and provide input during the design. Attendees will include the owner of Bero Engineering and the ECC team who are working on the project.

Deliverables: Project Problem Statement, Meeting Minutes

1.2 Technical Coordination Meetings

Technical coordination meetings will be the primary source for identifying and resolving project issues. ECC will facilitate technical meetings throughout the course of the 4 month project with Dr. Terry Baxter who will serve as technical advisor.

Deliverable: Meeting Notes

1.3 Team Meetings

Team meetings will be the primary source for reviewing the status of the project.

Deliverable: Meetings Notes, Updates to Timeline, Project Agenda

Task 2 – Proposal Development

2.1 Project Description

The ECC team will prepare a clear and concise description of the proposed project. The project description will be submitted to Dr. Terry Baxter and Dr. Bridget Bero for approval before work further work on the project begins. This document serves as the project description.

Deliverable: Project Description

2.2 Dynamic Timeline

The ECC team will prepare a detailed project schedule including duration of tasks, expected deadlines, and milestones. The dynamic timeline will track the progression of the project.

Deliverable: Gantt Chart

2.3 Staffing Plan

A staffing plan will be designed by the ECC team to work with the dynamic timeline. The staffing plan will assign deliverables to the ECC project team.

Deliverable: Staffing Plan

2.4 Cost of Engineering Services

A budget will be developed to ensure the expenses of the project are within the stakeholders grasp and are acceptable to the client.

Deliverable: Cost of Engineering Services

Task 3 – Preliminary Engineering

3.1 Single Well Household Delivery System Research

Available data related to domestic households supplied by a single well in rural agriculture rich regions will be reviewed by the ECC team. The data will be compiled and analyzed to determine system operating requirements. This ensures the add-on nitrate removal system join together with common well to house drinking water delivery systems.

Deliverable: Add-On System Requirements

3.2 Nitrate Removal Technology Research

Available data, case studies, and journal articles related to nitrate removal technology with a focus on in small systems will be reviewed.

Deliverable: Literature Review of Nitrate Removal Technologies

3.3 Nitrate Removal Technology Feasibility

The feasibility of the nitrate removal technology will be assessed by the ECC team and Dr. Terry Baxter to generate criteria for a decision matrix to help determine the most feasible technology option.

Deliverables: Technology Feasibility and Preliminary Decision Matrix Criteria

3.4 Preliminary Decision Matrix

A decision matrix will be developed to evaluate treatment technology options, and evaluate feasibility of treatment technology.

Deliverables: Decision Matrix

Task 4 – Design Alternatives

4.1 Develop and Present Design Alternatives

At least two design alternatives will be developed for the removal of nitrate in rural water systems. The design alternatives will take into consideration current conditions and technical constraints as described in sections 4 & 5. Upon careful examination of the listed items, ECC will present the information to the project client and technical advisor.

Deliverable: Design Alternatives Presentation

4.2 Evaluate Design Alternatives

The ECC team will evaluate design alternatives using criteria developed from the technical constraints. Each criterion will be weighted with respect to importance of that criterion.

Deliverable: Decision Matrix with Final Design Recommendations

Task 5 – Implement Nitrate Removal Technology

5.1 Develop and Evaluate Standard Operating Conditions

The bench scale and final product will be designed to operate under standard conditions identified in Task 3.1. Sampling and testing of recommendations from Task 4.2 will be evaluated in a research laboratory. Based on the outputs from the trials, an experimental design matrix will made. The objective will be to choose the most preferable nitrate removal technology.

Deliverable: Optimized Operating Conditions Memo

5.2 Construct a Bench Scale Model

Construction of one or more bench models to perform removal of nitrate on a bench scale will be used to help identify unforeseen areas of improvement relating to final design. The bench scale model will also be used to confirm that the technology remove the necessary amount of nitrate from drinking at the required flow.

Deliverable: AutoCAD Drawings, Bench Scale Model

5.3 Data Collection Using Optimized Operating Conditions

Utilizing optimized operating conditions, standardized data will be collected to aid in the performance evaluation of the bench scale model. By standardizing data, performance data can be applied to full scale models.

Deliverable: Standardized Excel Spreadsheet of Bench Scale Model Performance

5.4 Evaluation of Bench Scale Model

The standardized data will be analyzed. The analyzed data standardized excel spreadsheet data of the bench scale model will be the authority to apply fundamental relationships to a full scale model.

Deliverable: Bench Scale Model Evaluation Memo

5.5 Review Standardized Data with Technical Advisor

The performance evaluation of the bench scale model will be reviewed with the technical advisor to validate operating conditions and competence of bench scale model as it applies to the boundaries of this project.

Deliverable: Meeting Minutes

5.6 Review Standardized Data with Client

Standardized data from the bench scale model performance evaluation will be reviewed with Bero Engineering LLC to ensure contractual agreements are met. Bero Engineering LLC will critique the results from the bench scale model data collection and make suggestions as needed.

Deliverable: Meeting Minutes

Task 6 – Final Design

6.1 Scale Up Calculations

Review the standardized data from the bench scale model and scale the data up to determine the final design size, construction cost, and installation cost.

6.2 Construct Final Design

Construction of final design will take place after appropriate review standardized data, performance evaluation, and standardized data review from the bench scale evaluation and review. The final design will be constructed with necessary scale up requirements and suggested improvements to the bench scale model.

Deliverable: Final Product

6.3 Test Final Design

Implementing optimized operating conditions, the final design will be evaluated and compared to bench scale nitrate removal performance. Standardized data will be recorded and tabulated for future evaluation.

Deliverable: Standardized Tabulated Performance Values for Final Design

Task 7 – Operating Guide

7.1 Develop Standard Operating Protocol

An operating guide will be designed to help homeowners operate their nitrate removal system safely and effectively.

Deliverable: Operating Documentation for the Final Design

7.2 Develop Standard Maintenance and Repair Protocol

Standard maintenance and repair protocol will be compiled into a technical document with the intention of helping homeowners get a long life out of their nitrate removal system.

Deliverable: Technical Documentation on Maintenance and Repair of the Final Design

Task 8 – Final Design Report and Presentation

8.1 Develop Website

The website will be intended to be used as a tool to effectively communicate the progress of the nitrate removal system design.

Deliverable: Project Website

8.2 Compose Final Design Report

The final design report will present the approach, methods, results, analysis, and conclusion of the nitrate removal system design.

Deliverable: Final Design Report

8.3 Prepare Presentation

The final design and final design components will be displayed through a presentation.

Deliverable: Final Design Presentation

7.0 Timeline

The dynamic timeline depicts estimated time-use with respect to individual tasks. Design of the system must be completed by December 2013. Presentation of the system is in the form of a final bench scale design.

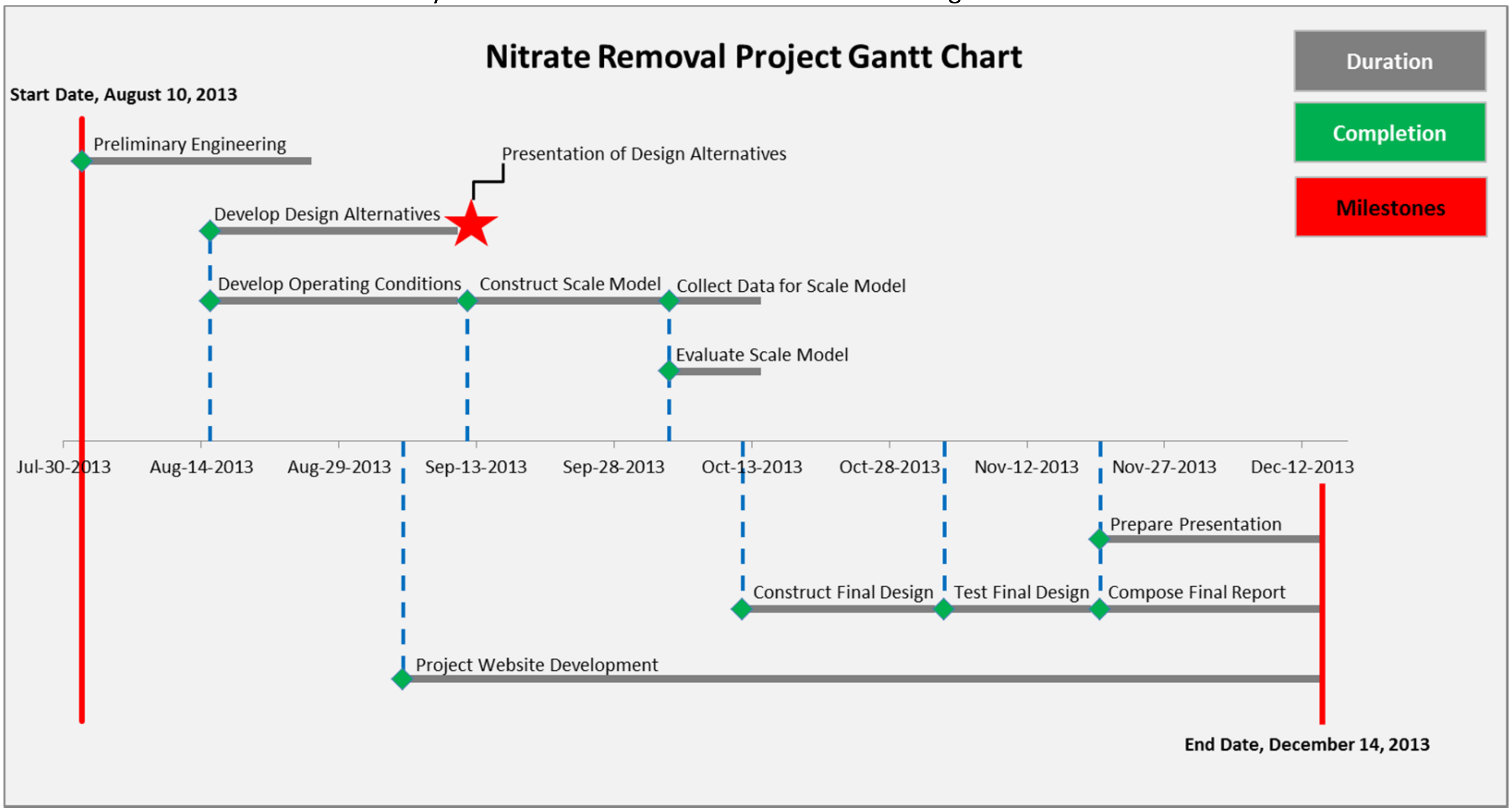

FIGURE 3: GANTT CHART

8.0 Cost of Engineering Services

The budget for the nitrate removal add-on system is subject to change as new aspects of the project become apparent. Each of the engineers on the ECC team will cost Bero Engineering LLC $45.00 per hour for all services in addition to the applicable $45 per hour engineering fee (i.e., designing, laboratory testing). Fees associated with bench scale and full scale design construction will be billed to Bero Engineering LLC as materials are purchased. Table 2 below shows the required hours to complete each task and subtask as well as the associated costs.

TABLE 2: COST OF ENGINEERING SERVICES

Task #	Subtask	Commitment Hours		Total Hours	Cost to Client
		Kenton	Zach		
1 - Project Management	1.1 Meetings with Client	6	6	12	$1,080.00
	1.2 Meetings with Technical Advisor	7.5	7.5	15	$1,350.00
	1.3 Team Meetings	2	2	4	$360.00
	Task 1 Hours	15.5	15.5	31	$2,790.00
2 - Proposal Development	2.1 Project Description	8	8	16	$1,440.00
	2.2 Ganett Chart	0	4	4	$360.00
	2.3 Staffing Plan	4	0	4	$360.00
	2.4 Budget	3	3	6	$540.00
	Task 2 Hours	15	15	30	$2,700.00
3 - Preliminary Engineering	3.1 Single Well to House Delivery System Research	8	8	16	$1,440.00
	3.2 Nitrate Removal Technology Research	12	8	20	$1,800.00
	3.3 Nitrate Removal Technology Feasibility	5	8	13	$1,170.00
	3.4 Preliminary Decision Matrix	4	4	8	$720.00
	Task 3 Hours	29	28	57	$5,130.00
4 - Design Alternatives	4.1 Develop Design Alternatives	15	15	30	$2,700.00
	4.2 Present Design Alternatives	5	5	10	$900.00
	Task 4 Hours	20	20	40	$3,600.00
5 - Implement Nitrate Removal Technology	5.1 Develop & Evaluate Standard Operating Conditions	4	5	9	$810.00
	5.2 Construct Bench Scale Model	5	4	9	$810.00
	5.3 Data Collection Using Experimental Protocols	15	15	30	$2,700.00
	5.4 Evaluation of Bench Scale Model	6	6	12	$1,080.00
	5.5 Review Standardized Data with Technical Advisor	3	3	6	$540.00
	5.6 Review Standardized Data with Client	2.5	2.5	5	$450.00
	Task 5 Hours	35.5	35.5	71	$6,390.00
6 - Final Design	6.1 Scale-Up Calculations	5	5	10	$900.00
	6.2 Construct Final Design	15	15	30	$2,700.00
	6.3 Test Final Design	6	6	12	$1,080.00
	Task 6 Hours	26	26	52	$4,680.00
7 - Operating Guide	7.1 Develop Standard Operating Protocol	2	6	8	$720.00
	7.2 Develop Standard Maintenance and Repair Protocol	6	2	8	$720.00
	Task 7 Hours	8	8	16	$1,440.00
8 - Final Design Report and Presentation	8.1 Develop Website	4	10	14	$1,260.00
	8.2 Compose Final Design Report	8	8	16	$1,440.00
	8.3 Prepare Presentation	2.5	2.5	5	$450.00
	Task 8 Hours	14.5	20.5	35	$3,150.00
Total		**163.5**	**168.5**	**332**	**$29,880.0**