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Memorandum

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Subject	**Town of Orleans, MA** **Water Quality and Wastewater Planning** **Task Number 3.c. – NT Demonstration Projects** **Technical Memorandum on Outline for Preliminary Engineering Work Plan for Permeable Reactive Barriers**
Project Number	60476644
From	Thomas Parece, P.E., AECOM Project Manager
Date	December 23, 2015

1. Background

a. This technical memorandum presents the outline for the Preliminary Engineering Work Plan for Permeable Reactive Barriers with a brief description of the content to be included in each section.

2. Preliminary Engineering Work Plan Contents

a. Section 1 - Introduction

(1) Introduce the scope of the project and problem statement.

(2) Site Setting and Groundwater Conditions - Provide a brief overview of the project background, sources of nitrate to groundwater, and selection of a combination of traditional wastewater and non-traditional wastewater treatment technologies, including permeable reactive barriers (PRBs).

(3) Demonstration Test Objectives for PRBs and expected benefits.

b. Section 2 - Selection of Demonstration Test Location(s)

(1) Nitrate Sources and Distribution - Summarize existing data regarding nitrate in groundwater, relative concentrations vertically and spatially, travel time, and mass flux/loading rates.

(2) PRB Demonstration Test Location Selection - Provide an overview of evaluation of potential sites for the Demonstration Test and rationale for selection for performing the Demonstration Test. The Final Technical Memorandum on Site Characterization for Permeable Reactive Barriers will be included as an appendix.

(3) Current Site Use and Features of Selected sites - Describe current site features and use for the selected Demonstration Test PRB locations and implications for design and installation.

c. Section 3 - Basis of Design

(1) PRB Treatment Process Description - Brief overview of biological treatment of nitrate and how this process can be enhanced in-situ within a PRB. Discussion will include how the presence of ammonia or other compounds may affect the nitrate treatment.

(2) Hydrogeologic, Geochemical, and Nitrogen Considerations for Remediation

a) Identify the available data regarding hydrogeology, geochemistry and nitrogen in the vicinity of the Demonstration Test location(s).

b) Present investigation data collected/to be collected by AECOM to support the Preliminary Engineering work plan.

c) Summarize hydrogeologic conditions including depth to groundwater, soil classifications from soil borings, groundwater flow direction(s), hydraulic conductivity, hydraulic gradient, groundwater velocity, and location target depth. If data is not available at the time of the submittal, placeholders will be provided to indicate what data is being collected and how it will be used.

d) Summarize geochemical conditions.

e) Summarize nitrogen concentrations and flux.

(3) Bench Scale Treatability Testing - Summarize observations from literature and bench scale and field scale tests conducted at other sites or in the literature using potential treatment amendments on similar soil types (for example, other locations on Cape Cod).

(4) Permitting

a) Describe the Massachusetts Department of Environmental Protection (MassDEP) Underground Injection Control (UIC) Program, which is responsible for regulating placement of fluids underground, including requirements of the UIC Program specifically related to the PRB Demonstration Test. The UIC permit application, if necessary, will be included as an appendix to the Preliminary Engineering work plan.

b) Coordination with regulatory agencies for concurrence.

d. Section 4 - Demonstration Test Design

(1) Design components and critical assumptions for planning and implementing the PRB Demonstration Test(s).

(2) Extent of Demonstration Test. Identify proposed areas (footprint) and vertical intervals for the PRB Demonstration Test for proposed location(s).

(3) PRB Demonstration Test Amendments and Systems - Identify amendment substrates and systems that could be applied for the PRB Demonstration Tests and rationale for selection.

(4) Substrate Delivery Wells and/or Points - Description of how treatment systems/amendment(s) will be applied to install the demonstration PRB, including evaluation of injection wells and direct-push injection methods and spacing.

(5) Application Dosage and Volume - Identify proposed dosage and volume to be applied to the subsurface for the PRB Demonstration Test. Design considerations will include PRB test volume, soil porosity and grain size analysis, geochemical and contaminant flux demand, groundwater velocity, and amendment characteristics.

(6) Health and Safety and Site Security - Identify the health and safety and security considerations in order to maintain safe work environments for treatment workers, the public, and the environment.

(7) Field Injection Activities - Summarize the procedure for the field application for PRB installation, including logistics, shipping and storage of amendment(s), injection system preparation, and injection monitoring activities.

e. Section 5 - PRB Demonstration Test Performance Monitoring

(1) Develop an environmental sampling and analysis plan in order to collect sufficient data for evaluation of the PRB Demonstration Test and utilize this data for design of full-scale PRBs. Details will be included on PRB Demonstration monitoring locations, sampling frequency, and field and laboratory analyses.

(2) Discuss potential secondary environmental impacts (i.e., increased concentration of metals in groundwater near the PRB) that will be evaluated during Performance Monitoring for the Demonstration Test.

(3) Provide basis for evaluation of major objectives.

(4) Discuss anticipated short-term and long term water quality monitoring / trends.

f. Section 6 - Schedule and Coordination

(1) Sequence of major activities identified as part of the Demonstration Test phase. Major tasks will include:

a) Monitoring and/or injection well installation, including additional soil characterization.

b) Pre-treatment baseline groundwater sampling and laboratory analysis.

c) System construction/placement of treatment amendments in the subsurface.

d) Post-treatment groundwater sampling and laboratory analysis.

e) Presentation of performance monitoring results at selected milestones.

(2) Subcontractors - Identify the responsibilities expected to be fulfilled by subcontractors. Subcontractors anticipated for implementing the Demonstration Project for PRBs include an environmental drilling firm, an injection/system subcontractor, and an analytical laboratory.

(3) Waste Handling and Disposal - Overview on disposal of any waste generated during Demonstration Test field activities, including for purge water from monitoring well sampling, soil cuttings from well installation, and other wastes generated by PRB installation activities.

(4) Cost Estimate

a) Planning level cost estimate of PRB Demonstration Test.

- Baseline Assessment.
- System Construction and Implementation.
- Performance Monitoring.

b) Evaluation of funding sources.

c) Discuss how PRB costs and nitrogen reduction efficiency will be applied to the Adaptive Management Plan.