

MEMO

Date **August 16, 2019**
To **Nevada Environmental Response Trust**
From **John Pekala, Scott Warner, and Chris Ritchie**
Copy to **Nevada Division of Environmental Protection
United States Environmental Protection Agency**
Subject **In-Situ Bioelectrochemical Laboratory-Scale
Treatability Study Monthly Progress Report**

TASK PROGRESS UPDATE: JUNE 2019

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Ramboll US Corporation (Ramboll) has prepared this memorandum which summarizes Ramboll's progress during June 2019 toward successfully implementing the In-Situ Bioelectrochemical Laboratory-Scale Treatability Study for the remediation of perchlorate in water.

TASK M24 – IN-SITU BIOELECTROCHEMICAL LABORATORY-SCALE TREATABILITY STUDY

- Task Leaders – Scott Warner / Chris Ritchie
- Current Status
 - Microcosm Batch Testing: The second round of microcosms outlined in the March 2019 progress update continued through June. Microcosm samples are scheduled to be analyzed in August, and associated data will be provided in subsequent progress reports.
 - Column Testing: The second stage of column testing outlined in the April 2019 progress update continued through June. The soil columns, which were supplemented with vitamin B12 on May 15, 2019, were further supplemented with molybdate on June 11, 2019. The addition of molybdate is intended to eliminate micro-nutrient limitations since perchlorate reductase enzymes require molybdenum. No significant decrease in perchlorate effluent concentrations has been observed since the addition of the vitamin B12 and molybdate; monitoring will continue into July.
 - Sand Tank Testing: The sand tank (depicted as Figure 1) was operated as a flow-through system throughout the month of June. The approximate flow rate of the system, ranging from 720 to 750 mL/day, resulted in a water residence time (i.e., time that influent water remained in the tank system) of approximately two weeks. After completion of the first two-week residence time, the analytical results of water samples collected along the flow path indicated complete reduction of the influent perchlorate concentration of 66 mg/L within the first approximately 12 inches of the sand tank, regardless of sample depth. Additionally, considerable reduction from the influent perchlorate concentration was observed in the soil-free influent head tank (see location on Figure 1), indicating the potential presence of perchlorate-reducing bacteria in this zone. Operation of the sand tank will continue into July, and the production of substrates within the sand tank environment, including dissolved acetate and dissolved hydrogen, will be investigated along the flow path. Objectives during July will be to confirm the initial successful

perchlorate-reduction results, evaluate the effects of increased flow rates, and evaluate the presence and distribution of secondary reactants from the treatment process.

- Schedule and Progress Updates
 - Bench-scale testing has been extended to further evaluate microcosms, columns, and the sand tank and is expected to continue through September 2019.
 - Modifications to the treatability study work plan are currently being prepared to obtain site-specific design parameters through a focused assessment of Site microbial conditions and implementation of a small-scale bioelectrochemical field test based in part on the initial successful results from the sand tank testing. A modification (Treatability/Pilot Study Modification No. 11) to support the microbial assessment and small scale field test will be submitted in August 2019 for review and approval. This modification will contain a summary of bench-scale testing done to-date to support an incremental stage small-scale field test.
 - Pending completion of bench-scale testing and the small scale field test, a report will be prepared to present NERT's conclusions on the technology. At that time, a work plan addendum proposing a more comprehensive field test may be prepared if supported by the results.
- Health and Safety
 - There were no safety incidents during June 2019.

ATTACHMENTS

Figure 1: Sand Tank Schematic Showing Sampling Port Numerical IDs

Figure 2: Perchlorate Concentrations in Sand Tank Operated Under Flow-Through Conditions

In-Situ Bioelectrochemical Laboratory-Scale Treatability Study Progress Update

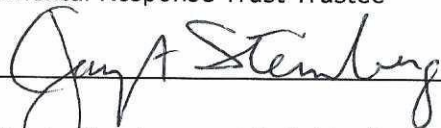
Nevada Environmental Response Trust Site (Former Tronox LLC Site) Henderson, Nevada

Nevada Environmental Response Trust (NERT) Representative Certification

I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the system(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Signature:  Not Individually, but Solely
as President of the Trustee

Name: Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Title: Solely as President and not individually

Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 8/16/19

In-Situ Bioelectrochemical Laboratory-Scale Treatability Study Progress Update

**Nevada Environmental Response Trust
Site (Former Tronox LLC Site)
Henderson, Nevada**

Responsible Certified Environmental Manager (CEM) for this project

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

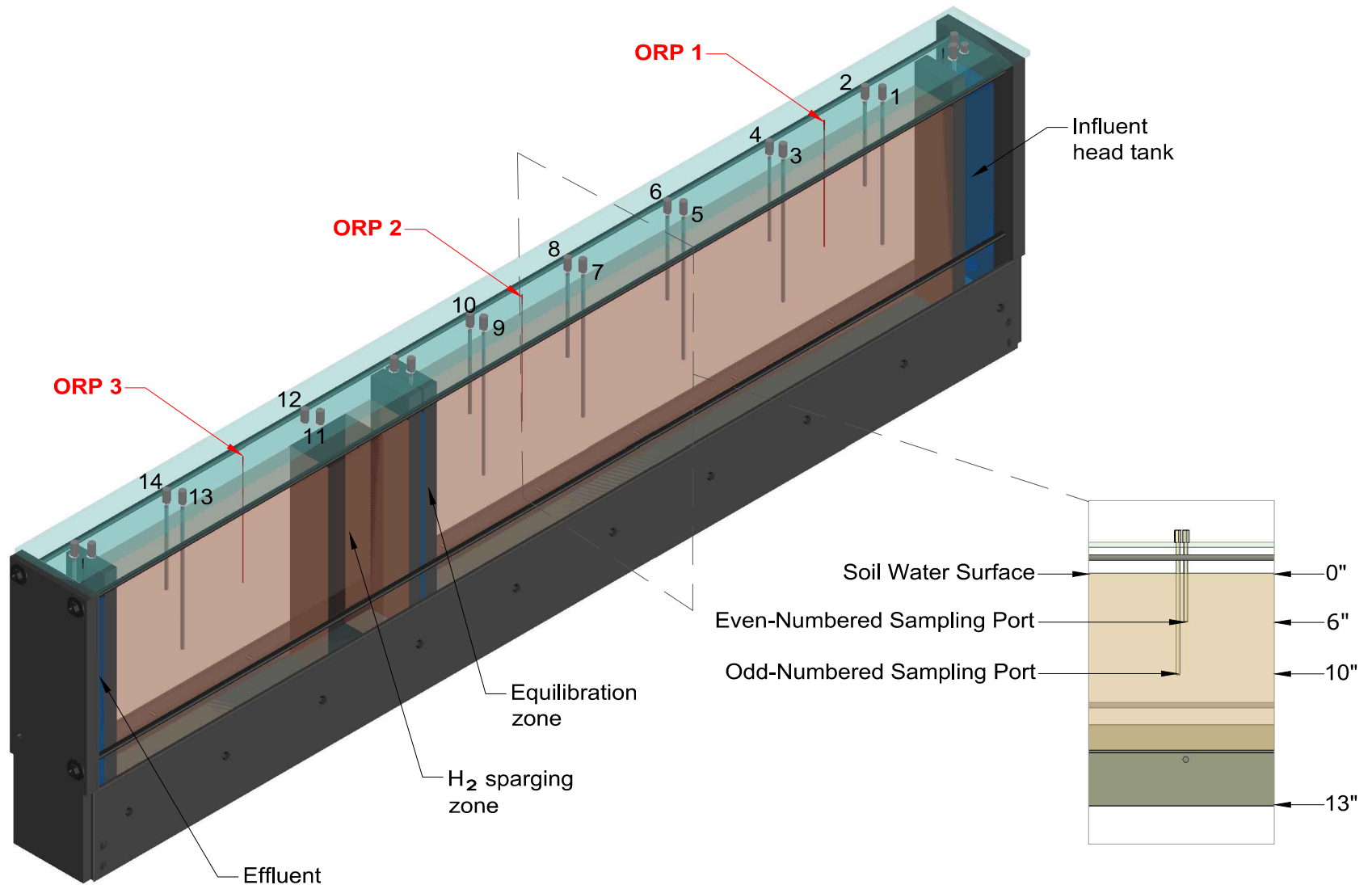


**John M. Pekala, PG
Principal**

8/16/2019

Date

Certified Environmental Manager
Ramboll US Corporation
CEM Certificate Number: 2347
CEM Expiration Date: September 20, 2020

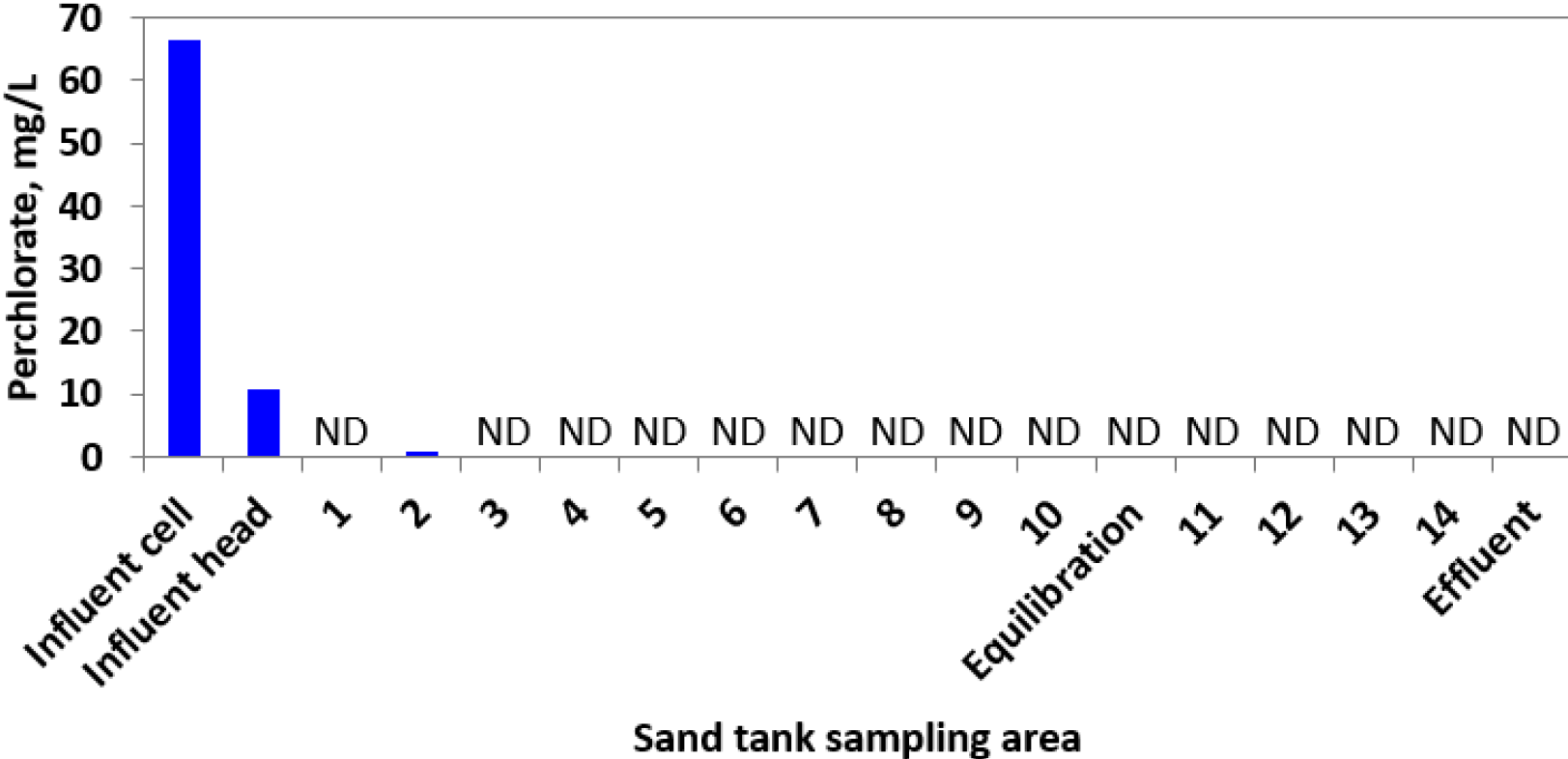


Sand Tank Schematic Showing Sampling Port Numerical IDs

Nevada Environmental Response Trust
Henderson, Nevada

FIGURE

1



Notes:
-Numerical sample IDs shown correspond to sampling port IDs presented in Figure 1.
-"ND" = Not detected above 0.0125 mg/L.



Perchlorate Concentrations in Sand Tank Operated Under Flow-Through Conditions
Nevada Environmental Response Trust
Henderson, Nevada

Figure
2