OFFICE OF THE NEVADA ENVIRONMENTAL RESPONSE TRUST TRUSTEE

Le Petomane XXVII, Inc., Not Individually, But Solely as the Nevada Environmental Response Trust Trustee

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December 16, 2021

Dr. Weiquan Dong, P.E.
Bureau of Industrial Site Cleanup
Nevada Division of Environmental Protection
375 E. Warm Springs Road, Suite 200
Las Vegas, Nevada 89119

RE: Response to NDEP Comments - Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Work Plan Addendum
Nevada Environmental Response Trust
Henderson, Nevada

Dear Dr. Dong:

The Nevada Environmental Response Trust (NERT or Trust) is pleased to present the attached responses addressing technical comments provided by NDEP in the Las Vegas Wash ZVI-Enhanced Bioremediation Work Plan Addendum approval letter dated November 10, 2021. Given the nature of the comments, the Trust deemed providing responses now, as opposed to incorporating responses into final project reporting, would be appropriate.

With respect to the implementation of the study, there is no change in schedule from what was presented to NDEP via email on November 29, 2021.

If you have any questions or concerns regarding this matter, feel to contact me at (702) 960-4301 or at brian.loffman@lepetomaneinc.com.

Office of the Nevada Environmental Response Trust

Brian K. Loffman, CEM
Senior Program Manager
CEM Certification Number: 2265, exp. 9/21/22

Attachment A – Response to NDEP Comments

Cc (via NERT Sharefile Distribution):

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James Dotchin, NDEP, Chief, Bureau of Industrial Site Cleanup
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Steven Linder, U.S. Environmental Protection Agency, Region 9
Mark Duffy, U.S. Environmental Protection Agency, Region 9
William Frier, U.S. Environmental Protection Agency, Region 9
Jay Steinberg, as President of the Nevada Environmental Response Trust Trustee and not individually

Andrew Steinberg, as Vice President of the Nevada Environmental Response Trust Trustee and not individually
Stephen Clough, Nevada Environmental Response Trust
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ATTACHMENT A
Response to NDEP Comments

NDEP Comment	Response to Comment
1. Table 4-5: Summary of Groundwater Analytical Results in Transect 1A Page 4-8. In the initial Tetra Tech analysis performed in 2019 the total dissolved solids (TDS) in the semi consolidated UMCf were present at concentrations up to 3,900 mg/L. It was therefore concluded that the TDS was unlikely to be toxic to perchlorate reducing bacteria. However, in Table 4-5, TDS in the UMCf in Transect 1A was reported as being as high at 71,000 mg/L. It should pay an attention that there may be toxic effects on bacteria at this TDS concentration.	Table 4-5 presents a summary of groundwater analytical results in Transect 1A showing the range, average, and median concentrations of analytical parameters as measured in the alluvium and UMCf. Table 4-6 presents the full groundwater analytical results and further divides the UMCf into the *UMCf (mudflat sediments)* and the *UMCf (saline lake sediments)*. This is an important distinction for two reasons: 1) the deeper saline lake sediments contain much higher concentrations of TDS than the shallower mudflat sediments (generally an order of magnitude higher), and 2) the saline lake sediments generally do not contain perchlorate above the groundwater screening level of 0.015 mg/L. (Refer to subsurface cross-sections depicting the mudflat and saline lake sediments in Figures 4-3, 4-4, 4-5, and 4-6.). Phase 2 testing of ZVI-enhanced bioremediation in the UMCf was designed to specifically target the mudflat sediments for these reasons. However, we agree that TDS concentrations can have a negative effect on perchlorate-reducing bacteria. We will collect and evaluate additional TDS data in the test areas as part of the pre-construction activities and, as discussed further below in response to Comment #4, the biological inoculum will be grown under site-specific conditions including having TDS levels equivalent to those expected in the field and will therefore be acclimated to these conditions.
2. Appendix F. Transect 1A Bench Scale Report. TDS was not measured directly on the groundwater sample used for this study. Conductivity was measured at 8.9 mS/cm which can be converted to 5,690 mg/L which is lower than the lower end of the range measured for the UMCf in Transect 1A. Therefore, the water used in this study was different from the TDS that will be encountered in the field. Please bear this in mind during the field implementation.	As noted, specific conductance (aka "conductivity") is used as a surrogate measurement of TDS. This was done during bench-scale testing due to limited sample volumes available in the microcosms. With respect to the TDS concentrations expected in the field, as discussed in our response to Comment #1, the *UMCf (mudflat sediments)* generally have TDS concentrations an order of magnitude lower than the deeper *UMCf (saline lake sediments)*. Only the alluvium and *UMCF (mudflat sediments)* are being targeted for ZVI-enhanced bioremediation field testing. As presented in Table 4-6, TDS concentrations in the 3 groundwater samples from within the saline lake sediments ranged from 60,000 to 71,000 mg/L while TDS concentrations in 9 of 10 groundwater samples from within the mudflat sediments ranged from 6,000 to 7,800 mg/L. The one groundwater sample from within the mudflat sediments outside of this range was from LVWPS-MW112B, which is

NDEP Comment	Response to Comment
	located in the northeast corner of the Transect 1A Study Area. The TDS concentration in LVWPS-MW112B was 46,000 mg/L, which is considered not representative of the mudflat sediments as characterized by the other 9 of 10 samples. Therefore, this location was excluded from consideration for field testing.
3. Section 7.6.2: Tests 2a, 2b and 2c - Discontinuous Boring Array Wall - p.7-20. It is stated in Section 7.6.1 that the sand/gravel/ZVI mixture to be emplaced using one pass trenching will have a hydraulic conductivity and porosity of 30 ft/day and 0.3, respectively, which are greater than those of the native materials through which groundwater will flow, rather than around the PRB. However, in Section 7.6.2 it is stated that for the discontinuous barriers, boreholes will be filled with a mixture containing 50% sand and 50% ZVI. Since no gravel is incorporated into this mixture it seems that the porosity and hydraulic conductivity may be lower than the native materials. Please consider this potential effect during the field implementation.	Agreed. The hydraulic conductivity and porosity are critical parameters for understanding performance of the field test. The design total porosity and hydraulic conductivity of the ZVI backfill will be greater than those of the surrounding native materials for both emplacement methods. The design total porosity and hydraulic conductivity for each of the three ZVI backfill mixtures (10%, 30% and 50% ZVI by weight) will be refined as part of the pre-construction activities. While the ZVI content is fixed at this point, we do have control over the particle size of sand which will be used in the ZVI backfill. These will be chosen to maximize the porosity and hydraulic conductivity for each mix. As noted, this will be important in the ZVI borings which have the higher ZVI content and will contain no gravel. Testing performed as part of construction quality control will be used to define the actual total porosity and hydraulic conductivity of the ZVI backfill materials.
4. Section 7.6.3 Inoculum and Nutrient Injection Design p. 7 21 and Appendix I - Injection Well Design and Injection Procedures. Section 7.6.3 acknowledges that the inoculum may be sensitive to exposure to oxygen. The inoculum may be sensitive to other things in the site groundwater. It may be advisable for SiREM to acclimate the inoculum in site groundwater before sending.	Agreed. Ramboll, through direct collaboration with SiREM Labs, intends to grow the inoculum under conditions as close as possible to those that will be encountered in the field. This includes controlling dissolved oxygen, oxidation-reduction potential, contaminant concentrations, and TDS concentrations in addition to growing the inoculum using hydrogen as an electron donor. SiREM has extensive experience developing and maintaining site-specific and functional-specific microbial cultures explicitly for site remediation.