

TECHNICAL MEMORANDUM

To: Nevada Environmental Response Trust

Cc: Nevada Division of Environmental Protection
United States Environmental Protection Agency

From: Dana Grady

Date: April 30, 2024

Subject: Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Monthly Progress Report

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this memorandum to summarize Tetra Tech's progress during March 2024 toward successfully implementing the Las Vegas Wash Zero-Valent Iron (ZVI)-Enhanced Bioremediation Treatability Study.

Task Progress Update: March 2024

Task M18 – Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

- Current Status –

The Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study is being conducted to evaluate the effectiveness of ZVI-enhanced bioremediation of perchlorate-contaminated groundwater that has migrated downgradient of the NERT site toward the Las Vegas Wash. The general treatability study layout, including locations of the continuous and discontinuous ZVI walls and associated injection well and monitoring well network, is presented on Figures 1, 2a, and 2b. Well construction details are provided in Table 1. The construction phase of the treatability study was completed on April 24, 2023 and the performance monitoring phase is ongoing.

- Performance Monitoring – The performance monitoring program included a pre-construction, baseline groundwater sampling event completed in October 2022 prior to installation of the continuous and discontinuous ZVI walls and performance monitoring network. Following construction of the ZVI walls, installation of the performance monitoring network, and injection of biological inoculum and nutrient solution (completed in February through April 2023), the performance monitoring program began in May 2023 and is ongoing. The performance monitoring program is being implemented in accordance with the NDEP-approved Work Plan Addendum, which includes monthly synoptic gauging events to evaluate hydrologic changes over time and groundwater sampling events approximately one month after completion of the construction phase and quarterly thereafter for a total of 16 months. The latest monthly synoptic gauging event was conducted from March 18 to March 20, 2024. The Month 1 groundwater performance monitoring event was completed in May 2023, followed by quarterly performance

- monitoring events in August 2023, November/December 2023, and February 2024. Available draft groundwater analytical results from the baseline sampling event, and the subsequent monitoring events performed in May 2023, August 2023, and November/December 2023 were presented in previous monthly progress reports. The most recent quarterly performance monitoring event was conducted from February 19, 2024 through February 28, 2024, which is approximately 10 months after completion of the construction phase. In addition, Bio-Trap[®] samplers were installed in twenty-three monitoring wells on February 26, 2024. Approximately 30 days after deployment, the Bio-Trap[®] samplers along with a groundwater grab sample were collected from each of the monitoring wells and submitted for laboratory analysis of microbial parameters listed in the NDEP-approved Work Plan Addendum. The analytical results from the Bio-Trap[®] samplers and groundwater grab samples will be used to evaluate the microbial community within each test area. Results from the February 2024 sampling event will be summarized in future monthly progress reports once all laboratory data have been received.
- Monthly Synoptic Monitoring – Monthly synoptic monitoring is being performed to evaluate any changes in horizontal and vertical gradients, assess for potential groundwater mounding upgradient of the ZVI reactive zone, assess hydraulic effects of seasonal precipitation, and evaluate potential non-uniform flow. Results of the March 2024 monthly synoptic monitoring event do not indicate any significant changes to groundwater elevations in monitoring wells located upgradient, within, and downgradient of ZVI reactive zones.
 - **Schedule and Progress Updates**
 - Groundwater levels will continue to be measured on a monthly basis for the duration of the treatability study. The next monthly synoptic event is scheduled for April 15 to 17, 2024.
 - Groundwater samples will continue to be collected on a quarterly basis to generate time-series data to evaluate the treatment effectiveness of the ZVI installations with respect to the design performance criteria. The next quarterly groundwater sampling event is planned for May 20 through May 24, 2024.
 - **Health and Safety**
 - There were no health and safety incidents related to Task M18 during March 2024.

CERTIFICATION

Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Monthly Progress Report

**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 systems(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, not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee



Signature: _____, not individually, but solely in his representative capacity as Vice President of the Nevada Environmental Response Trust Trustee

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

Title: Solely as Vice 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: 4-30-24

CERTIFICATION

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 prepared 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. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.

Description of Services Provided: Prepared Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Monthly Progress Report.



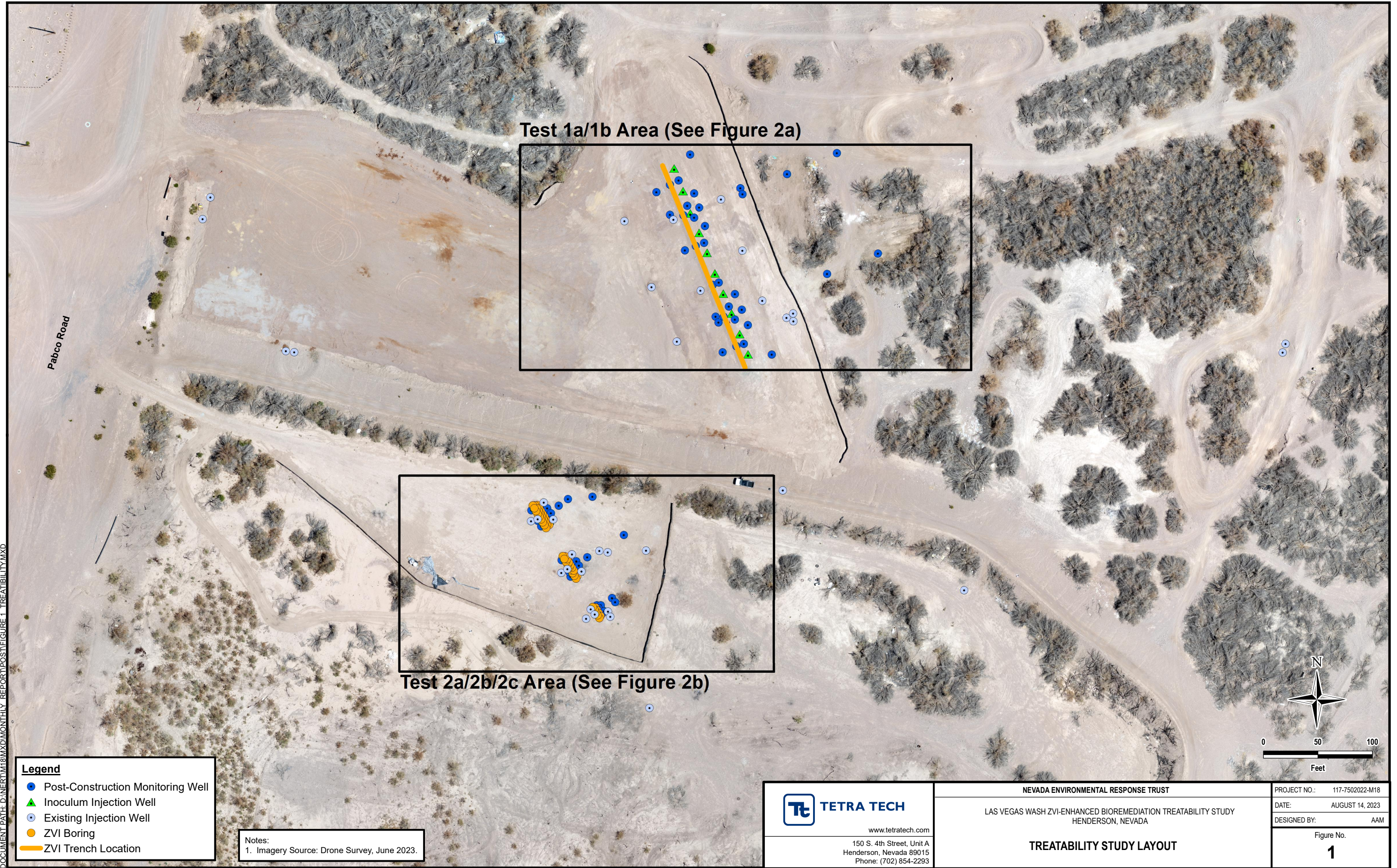
Christopher Hayes, CEM
Environmental Engineer
Tetra Tech, Inc.

April 30, 2024

Date

Nevada CEM Certificate Number: EM2499
Nevada CEM Expiration Date: December 15, 2024

Figures



DOCUMENT PATH: D:\NERT\18\18\MONTHLY REPORT\POST\FIGURE 1_TREATABILITY.MXD

Legend	
	Post-Construction Monitoring Well
	Inoculum Injection Well
	Existing Injection Well
	ZVI Boring
	ZVI Trench Location

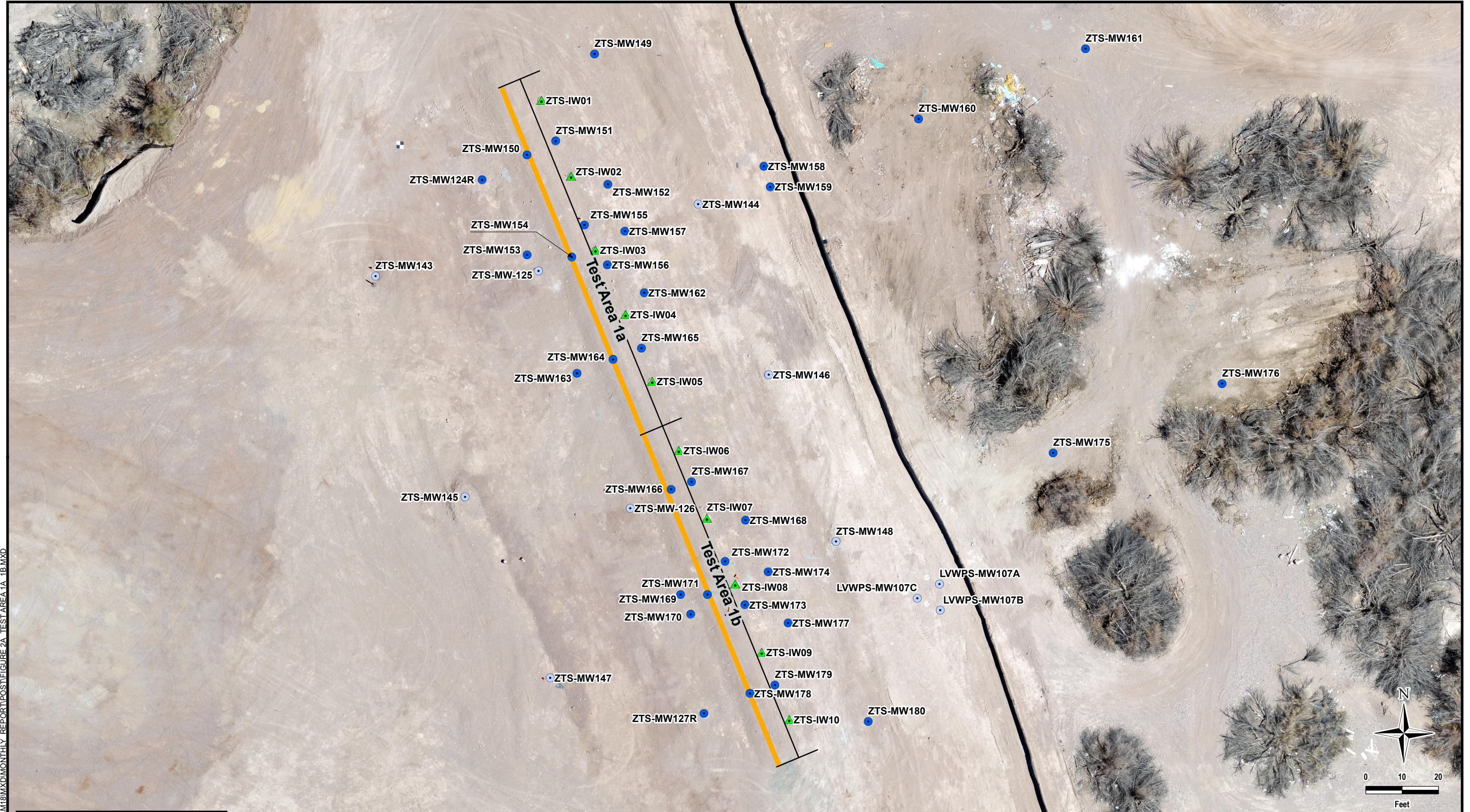
Notes:
 1. Imagery Source: Drone Survey, June 2023.

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 Phone: (702) 854-2293

NEVADA ENVIRONMENTAL RESPONSE TRUST
 LAS VEGAS WASH ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY
 HENDERSON, NEVADA

TREATABILITY STUDY LAYOUT

PROJECT NO.:	117-7502022-M18
DATE:	AUGUST 14, 2023
DESIGNED BY:	AAM
Figure No.	1



DOCUMENT PATH: D:\NERT\M18\MXD\MONTHLY REPORT\POST\FIGURE 2A TEST AREA 1A 1B.MXD

Legend

- Post-Construction Monitoring Well
- ▲ Inoculum Injection Well
- Existing Monitoring Well
- ZVI Trench Location

Notes:
 1. Imagery Source: Drone Survey, June 2023.

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 LAS VEGAS WASH ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY
 HENDERSON, NEVADA

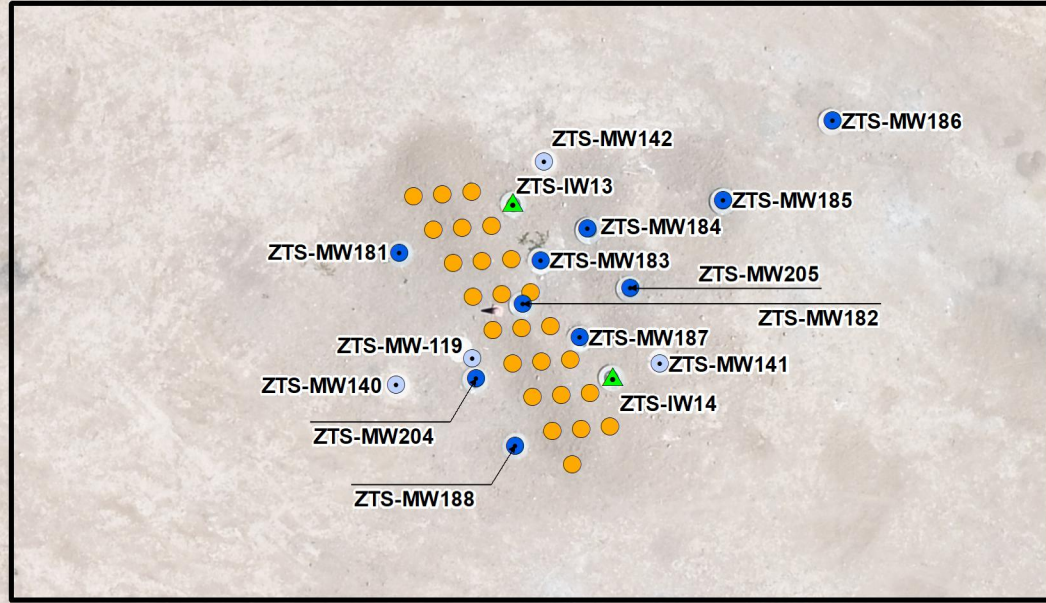
TEST AREA 1a/1b LAYOUT

PROJECT NO.: 117-7502022-M18
 DATE: AUGUST 14, 2023
 DESIGNED BY: AAM

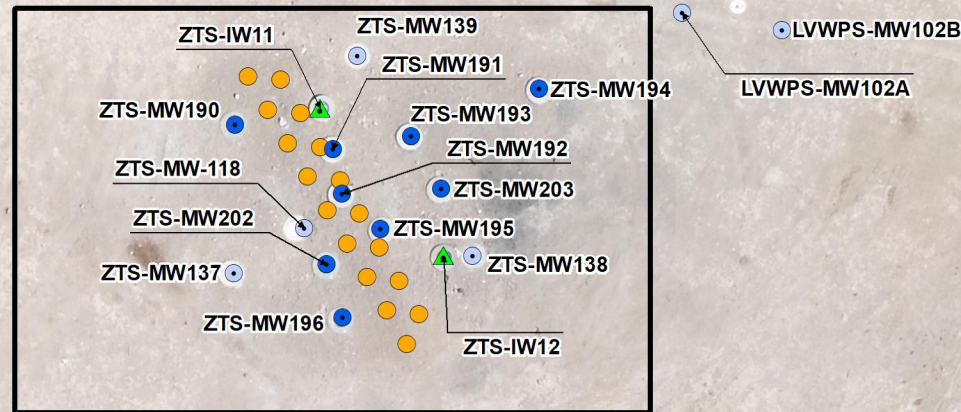
Figure No.
2a

DOCUMENT PATH: D:\NERT\M18\MXD\MONTHLY REPORT\POST\FIGURE 2B TEST AREA 2A 2B 2C.MXD

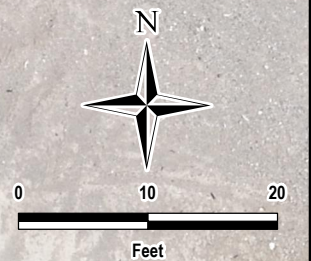
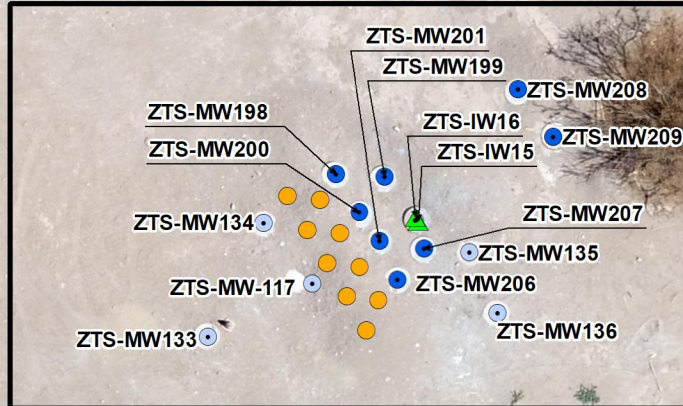
Test 2c Area (Borings ZTS-BH01 through ZTS-BH25)



Test 2a Area (Borings ZTS-BH26 through ZTS-BH42)



Test 2b Area (Borings ZTS-BH43 through ZTS-BH51)



Legend

- Post-Construction Monitoring Well
- ▲ Inoculum Injection Well
- ZVI Boring
- Existing Monitoring Well

Notes:
1. Imagery Source: Drone Survey, June 2023.

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NEVADA ENVIRONMENTAL RESPONSE TRUST
LAS VEGAS WASH ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY
HENDERSON, NEVADA

PROJECT NO.: 117-7502022-M18
DATE: AUGUST 14, 2023
DESIGNED BY: AAM

TEST AREA 2a/2b/2c LAYOUT

Figure No.
2b

Tables

Table 1
Well Construction Details
 Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

Well ID	Screened Lithology	Northing	Easting	Ground Surface Elevation	Top of Casing Elevation	Depth to Water ¹	Groundwater Elevation	Casing Material	Slot Size	Filter Pack Gradation	Nominal Borehole Diameter	Borehole Total Depth	Well Diameter	Nominal Screen Length	Well Total Depth	Bottom of Screen	Top of Screen
				feet amsl	feet amsl	ft bTOC	amsl		inches		inches	feet bgs	inches	feet	feet bgs	feet bgs	feet bgs
Injection Wells																	
ZTS-IW01	Alluvium	26732954.69	833038.19	1545.73	1545.62	NM	NM	Schedule 40 PVC	0.020	#3	6	40.0	2	15.0	36.0	35.5	20.8
ZTS-IW02	Alluvium	26732933.88	833046.37	1545.63	1545.70	NM	NM	Schedule 40 PVC	0.020	#3	6	37.5	2	15.0	35.5	35.0	20.3
ZTS-IW03	Alluvium	26732913.63	833053.06	1546.39	1546.35	NM	NM	Schedule 40 PVC	0.020	#3	6	40.0	2	15.0	36.0	35.5	20.8
ZTS-IW04	Alluvium	26732895.95	833061.35	1545.81	1545.64	NM	NM	Schedule 40 PVC	0.020	#3	6	38.0	2	15.0	36.0	35.5	20.8
ZTS-IW05	Alluvium	26732877.62	833068.66	1546.34	1546.32	NM	NM	Schedule 40 PVC	0.020	#3	6	37.5	2	15.0	36.0	35.5	20.8
ZTS-IW06	Alluvium	26732858.63	833075.96	1547.14	1546.96	NM	NM	Schedule 40 PVC	0.020	#3	6	35.0	2	15.0	35.0	34.5	19.8
ZTS-IW07	Alluvium	26732840.03	833083.70	1547.73	1547.48	NM	NM	Schedule 40 PVC	0.020	#3	6	30.0	2	5.0	27.5	27.0	22.3
ZTS-IW08	Alluvium	26732822.00	833091.44	1547.88	1547.75	NM	NM	Schedule 40 PVC	0.020	#3	6	31.0	2	5.0	27.5	27.0	22.3
ZTS-IW09	Alluvium	26732803.17	833098.78	1548.14	1548.30	NM	NM	Schedule 40 PVC	0.020	#3	6	27.0	2	5.0	26.5	26.0	21.3
ZTS-IW10	Alluvium	26732784.72	833106.32	1548.63	1548.48	NM	NM	Schedule 40 PVC	0.020	#3	6	25.0	2	5.0	25.0	24.5	19.8
ZTS-IW11	Alluvium	26732597.13	832941.47	1547.80	1547.86	NM	NM	Schedule 40 PVC	0.020	#3	6	25.0	2	5.0	23.5	23.0	18.3
ZTS-IW12	Alluvium	26732585.78	832951.00	1547.51	1547.54	NM	NM	Schedule 40 PVC	0.020	#3	6	26.0	2	5.0	25.0	24.5	19.8
ZTS-IW13	Alluvium	26732645.58	832916.08	1547.54	1547.64	NM	NM	Schedule 40 PVC	0.020	#3	6	30.0	2	10.0	29.5	29.0	19.3
ZTS-IW14	Alluvium	26732632.18	832923.75	1547.50	1547.55	NM	NM	Schedule 40 PVC	0.020	#3	6	30.0	2	10.0	27.3	26.8	17.1
ZTS-IW15	UMCf	26732551.24	832973.58	1547.33	1547.34	NM	NM	Schedule 40 PVC	0.010	#2/16	10	68.0	2	15.0	46.5	46.0	26.3
ZTS-IW16	UMCf	26732551.53	832973.34	1547.37	1547.44	NM	NM	Schedule 40 PVC	0.010	#2/16			2	20.0	67.5	67.0	52.3

Notes
 amsl - above mean sea level
 bgs - below ground surface
 bTOC - below top of casing
 NM - not measured
 PVC - polyvinyl chloride
 UMCf - Upper Muddy Creek formation
 Semi-Cons - Semi-Consolidated
 1. Depth to water collected on May 16-17, 2023.