



NEVADA DIVISION OF  
**ENVIRONMENTAL  
PROTECTION**

**STATE OF NEVADA**  
Department of Conservation & Natural Resources  
Brian Sandoval, Governor  
Bradley Crowell, Director  
Greg Lovato, Administrator

1 June 2018

Harry Van Den Berg  
AECOM  
1220 Avenida Acaso  
Camarillo, CA 93012

Re: **Technical Memorandum: RI Modification: Data Gap Investigation Plan Phase 1  
Groundwater Monitoring Well Installation**  
Nevada Division of Environmental Protection (NDEP) Response to:

Dated: May 31, 2018

Dear Mr. Van Den Berg,

The NDEP has received and reviewed the above-identified Deliverable and finds that the document is acceptable.

Please contact the undersigned with any questions at [jcarltonparker@ndep.nv.gov](mailto:jcarltonparker@ndep.nv.gov) or 702-486-2850 x228.

Sincerely,

Carlton Parker, P.G.  
Bureau of Industrial Site Cleanup  
NDEP-Las Vegas City Office

CP:cp

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**Project name:**  
NDEP

**Project ref:**  
60477365

**From:**  
Sally Bilodeau and Harry Van Den Berg  
**Date:**  
May 31, 2018

**To:**  
NDEP: Carlton Parker, J.D. Dotchin

# Technical Memorandum

**Subject:** RI Modification: Data Gap Investigation Plan Phase I Groundwater Monitoring Well Installation

This technical memorandum presents AECOM's recommended Remedial Investigation (RI) Modification to the approved Data Gap Investigation Plan (DGIP) Phase I Groundwater Monitoring Well Installation dated May 2017. This RI Modification was developed based on discussions with Ramboll regarding the procedures used for installing the other monitoring wells for the RI.

## **DGIP Phase I Groundwater Monitoring Well Installation Scope Modification**

The following modifications will be made to the well installation procedures so the wells will be installed and developed in the same manner as the other RI wells:

- 1) The boreholes will be 8 inches in diameter instead of the 12-inch diameter specified in the DGIP. This change will decrease the volume of soil removed from the well without significantly affecting the functionality of the well.
- 2) The well development will be expanded to include removing 7 to 10 borehole volumes of water if the well has sufficient recharge to provide that volume of water over a four-hour period. The other aspects of well development described in the DGIP will not be changed.
- 3) Backfill of the boring to the desired well depth will be by pouring bentonite chips into the well bore instead of using tremmie pipe placement of bentonite slurry. The expected volume of bentonite chips needed to fill the borehole will be calculated and checked against the actual volume placed in the borehole. Placement of chips will be slow and gradual to prevent bridging of the bentonite chips.
- 4) The total depth of each borehole will be 90 feet below ground surface to provide additional data on the deeper lithology for the RI. The filter pack depths have also been modified. These scope details were contained in DGIP Table 2 which has been revised and is attached.

Upon your approval these modifications will be applied to the Phase I Groundwater Well Installation.

**Attachment:** Table 2 Proposed Phase I Groundwater Monitoring Wells

**Table 2**  
**Proposed Phase I Groundwater Monitoring Wells**  
 NERT RI - Downgradient Study Area  
 Henderson, Nevada

Proposed New Well	Pilot Boring Depth in feet bgs <sup>(1)</sup>	Well Depth in feet bgs	Well Diameter	Well Screen in feet bgs	Sand Pack Interval in feet bgs	Rationale Based on Perchlorate Concentrations Detected in Groundwater and Surface Water Samples Obtained April and May 2016	Geology and Approximate Distance from Pertinent Features
NERT5.91S1	90	50	4"	40 - 50	38 - 50	Determine perchlorate concentrations between COH2B1 (total well depth of 67 feet bgs and 5,600 µg/L) and WMW5.5S (total well depth of 38.3 feet bgs and 3,200 µg/L) to further characterize this area of perchlorate impact east of the seep well field. Surface water concentrations are 15 to 17 µg/L.	This well is in alluvium overlying the Muddy Creek formation 1,000 feet east northeast from well COH2B1 and 1,900 feet west southwest of well WMW5.5S. It is 450 feet west of a paleochannel identified by Ed Krish (2015).
NERT5.49S1	90	40	4"	30 - 40	28 - 40	Determine concentrations between WMW5.58S1 (total well depth of 40.95 feet bgs and 510 µg/L) and WMW5.5S (total well depth of 38.3 feet bgs and 3,200 µg/L). There is a significant drop off of concentration. This is an area identified as a paleochannel and there is a layer of coarse grained sediment, wash gravels, present. Placing a well in this area will help evaluate the significance of the wash gravels and further characterize perchlorate impacts. Surface water concentrations are 19 to 23 µg/L.	This well is in alluvium overlying the Muddy Creek formation 570 feet southeast from well WMW5.58S1 and 350 feet west northwest of well WMW5.5S. It is on a paleochannel identified by BRC (2007) and 250 feet northwest of a paleochannel identified by Ed Krish (2015).
NERT5.11S1	90	45	4"	35 - 45	33 - 45	Determine concentrations between proposed wells NERT5.49S1 and NERT4.93S1. Surface water concentrations are 19 to 23 µg/L.	This well is in alluvium overlying the Muddy Creek formation 1,700 feet northeast from proposed well NERT5.49S1 and 800 feet west southwest of proposed well NERT4.93S1. It is 380 feet west of a paleochannel identified by Ed Krish (2015).
NERT4.93S1	90	50	4"	40 - 50	38 - 50	Determine concentrations between MW-13 (total well depth of 49.4 feet bgs at 3,800 µg/L) and WMW4.9S (total well depth of 46.75 feet bgs at 270 µg/L) to obtain additional data on the paleochannel and perchlorate impacts in the area. Surface water concentrations are 15 to 23 µg/L.	This well is in alluvium overlying the Muddy Creek formation 470 feet northwest from well MW-13 and 500 feet southwest of well WMW4.9S. It is 400 feet east of a paleochannel identified by Ed Krish (2015).
NERT4.71S1	90	50	4"	40 - 50	38 - 50	Determine concentrations between WMW4.9S (total well depth of 46.75 feet bgs at 270 µg/L) and proposed well NERT4.9-51S1 to obtain additional data on the paleochannel and perchlorate impacts in the area. Surface water concentrations are 15 to 44 µg/L.	This well is in alluvium overlying the Muddy Creek formation 65 feet northeast from well WMW4.9S and 1100 feet west southwest of proposed well NERT4.51S1. It is on a paleochannel identified by Northgate (2010), 150 feet northeast of a paleochannel identified by Ed Krish (2015), and 500 feet southwest of a paleochannel identified by BRC (2007).
NERT4.51S1	90	50	4"	40 - 50	38 - 50	Determine concentrations between proposed well NERT4.71S1 and LNDMW1 (total well depth of 61 feet bgs at 1,900 µg/L) to obtain additional data on the paleochannel and perchlorate impacts in the area. Surface water concentrations increase from 15 to 44 µg/L in this area.	This well is in alluvium overlying the Muddy Creek formation 1,150 feet east northeast of proposed well NERT4.71S1 and 1,000 feet west southwest of well LNDMW1. It is 600 feet northeast of a paleochannel identified by BRC (2007).
NERT4.38N1	90	55	4"	45 - 55	43 - 55	Determine concentrations west of LNDMW2 (total well depth of 55.05 feet bgs at 1,500 µg/L) to further characterize perchlorate concentrations on the north side of LVW. Surface water concentrations increase from 15 to 44 µg/L in this area.	This well is in alluvium overlying the Thumb formation. It is 450 feet west from well LNDMW2 and 1,900 feet east northeast of well WMW4.9N.
NERT4.21N1	90	55	4"	45 - 55	43 - 55	Determine concentrations southeast of LNDMW2 (total well depth of 55.05 feet bgs at 1,500 µg/L) to further characterize perchlorate impacts on the north side of LVW. Surface water concentrations increase from 15 to 44 µg/L in this area.	This well is in alluvium overlying the Thumb formation 450 feet southeast from well LNDMW2 and 100 feet southeast of proposed well NERT4.38N1. This well is 1,400 feet southwest of a mapped fault within the Frenchman Fault zone.
NERT3.80S1	90	60	4"	50 - 60	48 - 60	Determine concentrations between LNDMW1 (total well depth of 61 feet bgs at 1,900 µg/L) and WMW3.5S (total well depth of 59.8 feet bgs at 1,400 µg/L) on the south side of LVW to further characterize perchlorate impacts in the area. This well may also provide additional data regarding faulting in the area. Surface water concentrations are 35 to 50 µg/L.	This well is in alluvium overlying the Thumb formation. It is 2,550 feet east northeast from well LNDMW1 and 70 feet southwest of proposed well NERT3.65S1. It is between the projected traces of two mapped faults within the Frenchman Fault zone.
NERT3.65S1	90	60	4"	50 - 60	48 - 60	Determine concentrations southwest of WMW3.5S (total well depth of 59.8 feet bgs at 1,400 µg/L) near Three Kids Weir to further characterize perchlorate impacts in the area. This well may also provide additional data regarding faulting in the area. Surface water concentrations in LVW are 26 to 35 µg/L and there is a seep in this area (KM67) with a concentration of 1,400 µg/L.	This well is in alluvium over the Thumb formation. It is 500 feet south of the KM67 seep and is 25 feet southwest of well WMW3.5S. It is within Frenchman Fault zone as documented in the Demonstration Weir (Three Kids Weir) geotechnical report (GES, 2003).

µg/L = micrograms per liter  
 bgs = below ground surface

<sup>(1)</sup> Borehole depth is conform to other NERT off site RI wells and to provide stratigraphic information

The pilot borehole will be 8 inches in diameter and sealed with bentonite from the total depth to a depth one foot below the planned well screen.

Well casing is 4 inch schedule 40 PVC and well screen size is 0.02 inches

Sand Pack size is No. 3

AECOM will collect and analyze 1 unsaturated zone and 5 saturated zone samples for physical properties grain-size distribution (ASTM-D422 or D446M), moisture content (ASTM-D2216) and Atterberg Limits (ASTM D4318). Test where lithologic change is observed. Default boreholes for the saturated samples are NERT3.65S1, NERT4.21N1, NERT4.51S1, NERT4.93S1, NERT 5.49S1. The default borehole for the unsaturated sample is NERT4.51S1.

Soil samples may be collected for chemical analysis for NERT from depths of 10, 20, 30, 40, 50, 60, 70, 80 and 90 feet bgs.

Soil samples will be tested for perchlorate, chlorate, total chromium and moisture content.

Approximately 20% of the soil samples may be tested by NERT for physical properties: Atterberg limits (ASTM D4318), USCS Classification (ASTM D2487), grain size distribution (ASTM D422/D4464 combined or ASTM 4464 laser method), porosity (ASTM D425 modified), bulk density (ASTM D2937), and fraction organic carbon (foc)(Walkley Black).

Approximately 5% of the samples may be selected for vertical permeability testing by NERT.