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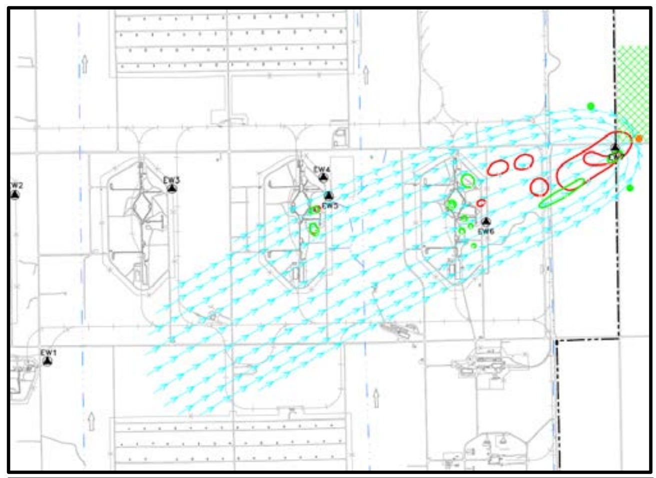
2016 ANNUAL GROUNDWATER MONITORING AND SUBSURFACE INJECTION REPORT

REMEDIAL ACTION OPERATION GROUNDWATER TREATMENT FACILITY AT OU1 AND GROUNDWATER MONITORING AT OU1/OU3

Cornhusker Army Ammunition Plant
Grand Island, Nebraska



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Acronyms and Abbreviations

<	less than
>	greater than
±	plus or minus
°C	degrees Celsius
µg/L	micrograms per liter
1,1,2-TCA	1,1,2-trichloroethane
1,2-DCA	1,2-dichloroethane
2-Am-DNT	2-amino-4,6-dinitrotoluene
4-Am-DNT	4-amino-2,6-dinitrotoluene
Bay West	Bay West LLC
bgs	below ground surface
BTOC	below top of casing
BW–URS	Bay West and URS Group Inc.
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHAAP	Cornhusker Army Ammunition Plant
CO_2	carbon dioxide
CoC	chain of custody
CPNRD	Central Platte Natural Resources District
DI	deionized
DNX	di-nitroso-RDX
DO	dissolved oxygen
DOC	dissolved organic carbon
DQCR	Daily Quality Control Report
EA	EA Engineering, Science, and Technology
EW	extraction well
Fe^{2+}	ferrous iron
Fe^{3+}	ferric iron
Freon® 113	1,1,2-trichloro-1,2,2-trifluoroethane

ft/ft	foot per foot or feet per foot
GAC	granular activated carbon
GHB	general head boundary
gpm	gallons per minute
GPS	global positioning system
GWTF	groundwater treatment facility
HAL	Health Advisory Level
HE	high explosives
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ICF KE	ICF Kaiser Engineers
ID	identification
IDW	investigation-derived waste
J	estimated qualifier
LL	load line
lpm	liters per minute
LTM	long-term monitoring
MCL	Maximum Contaminant Level
MEC	munitions and explosives of concern
mg/L	milligrams per liter
MKM	MKM Engineers, Inc.
MNA	monitored natural attenuation
MNX	mono-nitroso-RDX
MODFLOW	Modular Three-Dimensional Finite-Difference Groundwater Flow Model
MS/MSD	matrix spike/matrix spike duplicate
msl	mean sea level
mV	millivolts
NAC	Nebraska Administrative Code
NDEQ	Nebraska Department of Environmental Quality
NEDNR	Nebraska Department of Natural Resources
NPDES	National Pollutant Discharge Elimination System
NRL	no reporting limit

O&M	operations and maintenance
ORP	oxidation/reduction potential
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PEEWC	previously excavated explosives wastewater cesspool
PES	Plains Environmental Services
PF	Panowicz Farms
PID	photoionization detector
PIKA	PIKA Inc.
PVC	polyvinyl chloride
QC	quality control
RAO	remedial action operation
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RL	reporting limit
ROD	Record of Decision
RPD	relative percent difference
RSK-175	Robert S. Kerr Environmental Research Laboratory Method 175
SCFS	sample collection field sheet
SM	standard method
SOP	standard operating procedure
TAL	TestAmerica Laboratory
tetryl	2,4,6- trinitrophenylmethylnitramine
TKN	total Kjeldahl nitrogen
TNT	2,4,6-trinitrotoluene
TNX	tri-nitroso-RDX
TPH-DRO	total petroleum hydrocarbon-diesel range organics
U	nondetect qualifier
U.S.	United States
UFP-QAPP	Uniform Federal Policy–Quality Assurance Project Plan
UIC	Underground Injection Control
UJ	estimated nondetect qualifier

URS	URS Group, Inc.
URSGWCFS	URS Greiner Woodward-Clyde Federal Services
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Center
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
VMODFLOW	Visual MODFLOW
VOC	volatile organic compound
W-C	Woodward-Clyde
WES	Waterways Experiment Station
WJE	Watkins-Johnson Environmental, Inc.

1.1 PROJECT WORK AUTHORITY

The United States (U.S.) Army Corps of Engineers (USACE) has contracted Bay West LLC (Bay West) and URS Group, Inc. (URS) to complete the Remedial Action Operation (RAO) at the Groundwater Treatment Facility (GWTF) at Operable Unit (OU) 1 and Groundwater Monitoring at OU1 (groundwater explosives plume) and OU3 (volatile organic compound [VOC] plume at the Shop Area) at the Cornhusker Army Ammunition Plant (CHAAP) near Grand Island, Nebraska. Work for this assignment is being performed under Bay West's Contract Number W9128F-10-D-0004, Delivery Order 0002.

1.2 PROJECT PURPOSE AND OBJECTIVE

The project purpose is to complete objectives as stated in the USACE Statement of Objectives dated October 29, 2013. Objectives of the RAO GWTF at OU1 and Groundwater Monitoring at OU1 and OU3 project include: operate and maintain the groundwater extraction/ collection/treatment system at the GWTF for the groundwater explosives plume (OU1), continue subsurface injections to accelerate groundwater contaminant clean up at OU1, and continue annual groundwater monitoring at OU1 and OU3. The work is being completed under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) with regulatory oversight from the U.S. Environmental Protection Agency (USEPA) Region 7 and the Nebraska Department of Environmental Quality (NDEQ).

The GWTF operation at OU1 and groundwater monitoring at OU1 are being performed in accordance with the OU1 Record of Decision (ROD) (USAEC 1994) and the subsequent OU1 ROD Amendment (URSGWCFS 2001b). The groundwater monitoring at OU3 is being performed in accordance with the OU3 ROD (USACE 1999).

The subsurface injection activities are a voluntary action being completed by USACE to reduce OU1 explosives concentrations to below the established project cleanup goals. These activities are being completed to decrease the overall site remediation time frame by supplementing the current groundwater pump and treat system using subsurface injections of amendment, enhancing anaerobic in situ bioremediation processes, and cometabolically biodegrading the OU1 explosives contaminants of concern (i.e., 2,4,6-trinitrotoluene [TNT] and hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]) in on-post groundwater explosives plumes at the Load Line (LL) 1 and LL2 primary source areas, near extraction wells (denoted as EW) EW5 and EW6. These primary source areas are found at previous melt/pour facilities (Building 10) and the previously excavated explosives wastewater cesspools (PEEWCs).

1.3 GENERAL PROJECT DESCRIPTION AND SCOPE

1.3.1 Groundwater Treatment Facility

For the OU1 RAO at the GWTF, the groundwater collection/extraction/treatment system was operated and maintained in accordance with the Groundwater Recovery and Treatment System

Operation and Maintenance Manual, Revision 5.1 (EA 2005). GWTF samples were collected from operational extraction wells, granular activated carbon (GAC) treatment system influent, lead GAC vessel effluent, lag GAC vessel effluent, and GWTF effluent. Sampling was performed to assess overall GWTF performance and verify that concentrations of explosives compounds in GWTF effluent were in conformance with State of Nebraska requirements for discharge into Silver Creek.

1.3.2 Subsurface Injection

The 2016 OU1 RAO subsurface injection design followed design strategies similar to those previously implemented at the LL1 and LL2 source areas in 2014 and 2015. The 2016 OU1 RAO subsurface injection design was based on groundwater monitoring results from August 2015 and the direct push groundwater monitoring results completed in February 2016. Historic subsurface injection activities at LL1 and LL2 focused on the source areas with high explosives (HE) concentrations (greater than [>] 20 micrograms per liter [µg/L] RDX and/or TNT) that were found in the shallow water table northeast of Building 10 and at the PEEWCs. These HE concentrations support the previous interpretation of continuous source areas at these locations; however, the term "continuous" is primarily used in a historic context, as the current ability of these areas to act as a continuous source of explosives contamination has been diminished to "residual" sources due to the implementation of the subsurface injection program (2007 to present). Elevated explosives (RDX and TNT) concentrations detected at both load line source areas are a result of residual sources, previously in the vadose zone, that are now in contact with groundwater due to recent high groundwater level conditions (2007 through 2015), causing dissolution and desorption of explosives (BW-URS 2015). This interpretation is further supported by information presented in the CHAAP Remedial Investigation Report (ICF KE 1996), which indicated that former cesspools were excavated in these areas but that, at many locations, excavations were terminated at the water table 10 to 15 feet below ground surface (bgs), and remediation action levels for soil were not achieved at the vertical limits of the excavations.

Based on the previous overall success of the Wesblend 66-10 treatment zones, Wesblend 66-10 was the only amendment used for the 2016 OU1 RAO injection project at CHAAP. Wesblend 66-10 was used to maintain and expand existing anaerobic treatment zones and create anaerobic treatment zones for the explosives-contaminated groundwater to pass through for treatment. The amendment concentrate was mixed with water and injected at 600 locations in the most contaminated areas of the on-post groundwater plumes at LL1 and LL2 in the spring of 2016.

Additionally, prior to subsurface injection activities being completed in 2016, a groundwater investigation/sampling event was completed to fill existing data gaps within the downgradient explosives plumes (i.e., areas between EW6 and EW7). Twenty-five pre-injection groundwater sampling locations were completed in 2016 to verify current explosive plume interpretations, improve contaminant fate and transport modeling accuracy, and help direct RAO injection activities completed in 2016. Subsurface injection and pre-injection groundwater investigation sampling field activities are further discussed in **Section 2**.

1.3.3 OU1/OU3 Groundwater Sampling and Analysis

The OU1/OU3 groundwater sampling event included completion of a site-wide water level measurement round and sampling of 55 on-post monitoring wells (includes Decant Station), 16 on-post piezometers, and 22 off-post monitoring wells at OU1. Two additional on-post wells were planned to be sampled but had insufficient water to sample or were dry (see **Section 2**).

OU1 groundwater samples were analyzed for explosives at on- and off-post wells and laboratory monitored natural attenuation (MNA) parameters at on-post wells only. MNA parameters included: alkalinity, ammonia, nitrate/nitrite, sulfate, sulfide, total Kjeldahl nitrogen (TKN), dissolved organic carbon (DOC), methane, and ferrous iron (Fe^{2+}). Beginning in 2016, MNA parameters were not collected at off-post monitoring wells due to explosives concentrations being below Health Advisory Levels (HALs) since 2014 at all off-post wells. The recommendation was included in the Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2017). The RDX degradation product mono-nitroso-RDX (MNX) was added and has been included in the explosives analyte list since March 2004.

For the OU3 portion of the August 2016 sampling event, groundwater samples were collected from six OU3 Shop Area wells (SHGW02, SHGW03, SHGW04, SAMW1, G0069, and G0053). Groundwater samples were analyzed for VOCs and for select laboratory MNA parameters including alkalinity, nitrate/nitrite, sulfate, dissolved gases (methane, ethane, and ethene), and Fe^{2+}. Groundwater from three wells (G0069, SHGW03, and SHGW04) was also sampled and analyzed for total petroleum hydrocarbons-diesel range organics (TPH-DRO). This analyte was added to the monitoring program in 2004 following a soil removal action where diesel-contaminated soil was removed from an area where a leaking aboveground storage tank had been. In 2013, four OU3 Shop Area wells were approved for a three-year sampling frequency and were scheduled to be sampled in 2016 (BW-URS 2014a).

Water quality field parameters including dissolved oxygen (DO), oxidation/reduction potential (ORP), temperature, pH, conductivity, and turbidity were measured at OU1 and OU3 monitoring wells and piezometers during well purging and prior to groundwater sample collection. TestAmerica Laboratory, Inc. (TAL) in Arvada, Colorado, completed all laboratory analyses for OU1 and OU3 samples.

1.3.4 Monitoring Well Installation and Abandonments

The 2016 monitoring well installation and abandonment event (completed between November 10 and 15, 2016) included the installation of one OU1 on-post monitoring well (G0121) at LL2 and the abandonment of two OU1 on-post monitoring wells (G0016 at LL3 and G0028 at LL5).

The 2016 monitoring well installation and abandonment activities were completed following the pre-injection groundwater investigation sampling event (February), subsurface injection event (April), and the annual groundwater sampling event (August). Following the annual sampling event, recommendations were provided to USACE to complete one well installation at LL2 to provide an additional permanent monitoring location to monitor explosives concentrations and migration trends over time and to help monitor the performance of the 2016 subsurface injections completed within the vicinity. Following installation activities, G0121 was sampled for explosives only (including MNX).

The two monitoring wells abandoned were recommended and approved for removal from the CHAAP OU1 Annual Groundwater Monitoring program in the March 2013 Annual Report (BW-URS 2014a) due to all explosives concentrations being below the HALs since 2004 or longer. All monitoring well installation and abandonment activities were documented in the Final 2016 Monitoring Well Installation and Abandonment Technical Memorandum (provided in **Appendix G**), and are additionally included in this report.

1.4 SITE DESCRIPTION

1.4.1 Facility Description and History

CHAAP is on an 11,936-acre tract approximately 2 miles west of Grand Island, Nebraska (**Figure 1-1**). CHAAP was constructed and became fully operational in 1942 as a U.S. government-owned, contractor-operated facility.

CHAAP, shown on **Figure 1-2**, includes five former load lines, LL1 through LL5. Other former sites include the Administration Base Housing Area, two Magazine Areas, the Fuze Line, storage and dock facilities, Shop Area, Nitrate Area, CHAAP-05 Open Burning/Open Detonation Burning Grounds, Abandoned Burning Grounds, Sanitary Landfill, and Pistol Range Burning Grounds.

Currently, activities at CHAAP are limited to groundwater remediation at the active GWTF; leasing property for agriculture; leasing buildings for storage and limited manufacturing; wildlife management; and minor maintenance of the grounds, roads, and leased facilities. The majority of CHAAP property has been transferred to the public over the past 8 to 17 years. No property transfers occurred in 2016.

The area surrounding CHAAP is primarily rural and agricultural, with the City of Grand Island (population approximately 50,000) directly east of the plant.

1.4.2 Load Line Areas Description and History

LL1, LL2, LL3, and LL4 were primarily used as load, assemble, and pack facilities, and LL5 produced micro-gravel mines. LL1 through LL5 are shown on **Figure 1-2**. Production at CHAAP began with the pouring of the first 1,000-pound bomb at LL3 on November 11, 1942. Loading operations ceased on August 14, 1945, after production of 330,562 1,000-pound bombs; 20,698 2,000-pound bombs; 6,951,205 90-pound and 1,506,373 50-pound fragmentation bombs; 11,476,545 105-millimeter (mm) projectiles; 677,380 boosters; and 6,234,850 supplementary charges.

During the period from September 1945 to February 1950, the plant was declared surplus and then placed in standby status under the control of the Ordnance Corps, U.S. Army. Use of the buildings was primarily for grain storage, except for the Nitrate Area, which was used to manufacture fertilizer until April 1948.

In April 1950, CHAAP again became an active installation with the rehabilitation of LL1 and applicable operations for the production of 3.5-inch HE rockets. In December 1950, LL2, LL3, and LL4; the Fuze Line; storage and dock facilities; the administration area; and all appurtenant utilities were rehabilitated. LL1 began production in January 1951 when the first HE rocket warheads were poured at the plant. These warheads were then combined with pre-assembled, pre-loaded rocket motors that were delivered to the plant as motor units. Production totals for the period between 1951 and 1954 were: 21,413,244 HE anti-tank and practice 3.5-inch rockets; 1,162,828 HE 4.5-inch rockets; 14,000,000 M404A1 and A2 fuzes; and 1,253,499 155mm HE projectiles. In January 1966, production of bombs began and, in 1967, the production of a new end product, the Micro-Gravel Mine XM45, began at LL5. The plant was laid away in 1974 but maintained in a high state of readiness until January 1989 when the plant was declared in excess.

From 1987 to 1988, the U.S. Army completed an incineration project designed to excavate and treat soils beneath the unlined leach pits and cesspools at the CHAAP load lines. The purpose of the project was to remove the soil sources of explosives contamination. The project reduced the explosives contamination at these source areas; however, explosives concentrations remained above action levels at 29 of the 58 excavation locations due to excavations terminating at or just below the water table. Excavations were completed between 10 and 15 feet bgs, and in some cases excavations extended up to 5 feet below the water table. Because action levels were not achieved at all excavation locations, some may represent continuous source areas.

An on-post groundwater extraction and treatment system was constructed in the summer of 1998, and full-time operation began in December 1998. The groundwater extraction system included EW1 through EW6, with a total extraction rate of 750 gallons per minute (gpm). Based on the recommendations of the OU1 ROD Amendment (URSGWCFS 2001b), an additional extraction well (EW7) was installed in March 2000. Additionally in 2000, pumping at EW1, EW2, and EW3 was discontinued due to nondetection of explosive compounds; however, the overall flow rate to the GWTF was maintained at 750 gpm with EW7 operational. The GWTF treats groundwater for explosives using GAC absorption technology for treatment, then discharges the treated water to the two on-post drainage canals leading to Silver Creek. The most recent National Pollutant Discharge Elimination System (NPDES) Permit for CHAAP requires semiannual sampling of the GWTF. Current practice is to sample the GWTF quarterly in the interest of acquiring more frequent data that documents GAC performance and compliance with treatment standards.

The ROD Amendment also included the implementation of MNA for the off-post distal plume. The MNA alternative replaced off-post extraction and treatment originally planned for the distal plume. The long-term monitoring (LTM) program and MNA details are presented in annual reports, most recently the Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2017).

Between 2000 and 2005, thermal decomposition, demolition, and 5X certification of LL1, LL2, LL3, and LL5 were completed by MKM Engineers, Inc. (MKM) (2004, 2005a, 2005b). Thermal decomposition, demolition, and 5X certification of LL4 were completed by PIKA Inc. (PIKA) (formerly MKM) in 2006 (PIKA 2007). 5X certification is defined as the decontamination of property, facilities, equipment, and soils so that they are free of any explosives hazards and can be released for general use or to the general public (MKM 2004). Thermal decomposition and demolition activities included burning and removal of all buildings and their floor slabs; however, concrete foundations and footers were left in place. MKM/PIKA sampled soils underneath the load line floor slabs for explosives, performed electromagnetic geophysical investigations, and completed munitions and explosives of concern (MEC) clearance.

Soils were sampled as part of the 5X certification process to determine if explosives concentrations were >10 percent by weight. Soils with explosives concentrations >10 percent by weight were mixed with adjacent clean soils until explosives concentrations were less than (<) 10 percent. Explosives-contaminated soil investigations and soil excavations at LL1, LL2, and LL3 were completed in 2006 and at LL4 in 2007. Soil with explosives concentrations above the CHAAP industrial risk soil remediation levels was excavated and disposed at an approved off-site disposal facility. The CHAAP industrial risk soil remediation levels were determined and described in the CHAAP OU3 and OU4 RODs. All property within the fenced areas at LL1, LL2, LL3, LL4, and LL5 has been 5X certified; therefore, MEC support and 5X certification activities are not required during on-post intrusive field activity.

Under the direction of USACE, the OU1 RAO subsurface injection project began in the spring of 2007 and continued through 2016. The purpose of this project is to enhance anaerobic in situ bioremediation processes and cometabolically degrade TNT and RDX at the primary source areas near EW1, EW4, EW5, and EW6. Subsurface injection program results and recommendations are submitted annually in the subsurface injection annual reports (2007 through 2013), and more recently in the Final 2014 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2015) and the Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2017). Based on the explosive mass reduction trends and model-predicted results from 2007 to 2009, it was determined that additional injection activities would be beneficial within the load line source areas in LL1 and LL2. As a result, pumping was reduced and eventually discontinued at EW4, EW5, and EW6 to allow source treatment via subsurface injection. To maintain hydraulic control and plume capture at the former CHAAP boundary, the pumping rate at EW7 was increased to 500 gpm and remained at or near that pumping rate from July 2009 until November 2015, when the pumping rate was reduced to 450 gpm. This reduction in pumping rate was recommended in the Final 2014 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2015) based on groundwater modeling that demonstrated a decreased pumping rate was appropriate and will continue to provide hydraulic control of the on-post plume, based on the reduction in plume size/width since the initiation of subsurface injections.

Additional RAO activities have been completed at the Decant Station, just north of LL4. The Decant Station was primarily used for decanting explosives-contaminated 1,1,2-trichloro-1,2,2-trifluoroethane (Freon® 113) through cotton filters into clean receiving drums. Spills or leaks during storage and/or filtering were likely to have caused the explosives contamination at the Decant Station. Under the direction of USACE, subsurface injection activities were performed in 2006 (pilot study), 2007, 2010, 2012, and 2014. Groundwater investigations were performed in 2009, 2010, and 2012. The 2012 investigation results and subsurface injection summary were presented in the 2012 Decant Station Groundwater Investigation and Additional Subsurface Injection Final Letter Report (BW-URS 2013). All Decant Station groundwater monitoring is included in the OU1 groundwater monitoring program. The groundwater monitoring program and MNA details are presented in the annual reports.

1.4.3 Topography, Surface Features, and Environmental Setting

CHAAP is situated within the alluvial plain of the Platte River basin. Most of the ground surface within the OU1 RAO Load Line Treatment Area is relatively flat, with an elevation range from about 1,895 feet above mean sea level (msl) (at the northeast corner of LL1) to 1,917 feet above msl (at the southwest corner of LL4). Silver Creek drains a small area on the west and north sides of the facility. Large drainage ditches on the east side of LL1 and LL2 flow from south to north and drain surface water to Silver Creek. Groundwater flow direction is generally toward the northeast within the OU1 RAO Load Line Treatment Area (see **Section 3.2**).

At LL1 through LL5, few site features remain that are related to former site activities, with the exceptions of asphalt and gravel access roads and extraction well buildings associated with the groundwater extraction system (i.e., EW1 through EW6). Load line properties have been sold to the public and redeveloped, including the removal of former site features, modification to existing utility configurations, and conversion to strictly agricultural cropland. Only LL3, purchased by Hornady Manufacturing, has been developed to support manufacturing, research and development, and storage processes, which included the construction of multiple buildings, utility modifications (i.e., electric, natural gas, and supply water), and fencing/access restrictions. Additionally, multiple irrigation wells and center pivot systems have been installed on the agricultural cropland where fertilizer applications are likely conducted. Where undeveloped, the load lines support a grass-dominated vegetation community with minimal trees and shrubs.

1.4.4 Geologic Setting

The general geology summarized here was interpreted from soil boring logs completed during the installation of on- and off-post monitoring wells (WJE 1993, W-C 1999) as well as regional data from the Soil Survey for Hall County (USDA 2004). In general, the geologic units underlying the CHAAP study area include (in descending order from the surface) the following:

- Alluvial silty clay and topsoil near the ground surface (from ground surface to about 5 feet deep).
- Alluvial sands and gravels of the Grand Island Formation (approximately 50 to 60 feet thick).
- A low-permeability, alluvial silty clay unit of the Fullerton Formation (approximately 5 to 15 feet thick) (also referred to as the “blue clay” unit in previous reports [WJE 1993]).
- Alluvial sands and gravels of the Holdrege Formation (reported to be up to 200 feet thick).

These geologic units are laterally extensive across the CHAAP facility.

1.4.5 Hydrogeologic Setting

The following sections summarize the hydrogeologic setting at CHAAP.

1.4.5.1 Grand Island Formation Aquifer

Shallow groundwater underlying CHAAP occurs as an unconfined water table aquifer within the alluvial sands and gravels of the Grand Island Formation. In 2016, the total saturated thickness of the water table aquifer in the OU1 RAO Load Line Treatment Area averaged about 43 to 55 feet. Hydraulic conductivity values average 300 to 400 feet per day (URS 2001). Current groundwater elevations and gradients are discussed in **Section 3**.

The Grand Island Formation aquifer is used regionally as a water supply source for irrigation and potable water. Locally, there are a number of active irrigation wells in the vicinity of the on-post plume (NEDNR 2015) (shown on **Figure 2-1a**). However, historical contaminant migration data and plume geometry indicate irrigation wells have not significantly impacted the groundwater flow over time and the on-post plume remains inside the capture zone of EW7. Irrigation wells are also shown on various figures in **Sections 5** and **9**. In the vicinity of the off-post plume, all private domestic water is supplied by the City of Grand Island. On-post institutional controls prohibit the use of groundwater as a potable water source.

1.4.5.2 Fullerton Formation Aquitard

The underlying Fullerton clay unit is a relatively low-permeability unit that appears to act as a barrier to groundwater flow (i.e., aquitard) in the CHAAP study area. Justification for this interpretation includes:

- The presence of head differences across the Fullerton clay unit, as measured between the Grand Island Formation aquifer and the underlying Holdrege Formation aquifer at locations with nested monitoring wells installed (i.e., one monitoring well screened within each formation).
- The absence of contamination below the Fullerton clay unit at locations where contamination is present at the base of the Grand Island Formation aquifer.

1.4.5.3 Holdrege Formation Aquifer

The sands and gravels of the Holdrege Formation exist as a confined aquifer unit, confined by the overlying Fullerton clay unit within the OU1 RAO Load Line Treatment Area. Based on historic annual water level data from the deep monitoring wells, the Holdrege Formation is not hydraulically connected to the overlying Grand Island Formation. No explosives contamination has been detected in the wells screened in this deeper aquifer unit.

1.5 GROUNDWATER CLEANUP GOALS

HALs for explosives were established as cleanup goals for CHAAP in the OU1 ROD (USAEC 1994) and the subsequent OU1 ROD Amendment (URSGWCFS 2001b). Federal Maximum Contaminant Levels (MCLs) were established as cleanup goals for 1,2-dichloroethane (1,2-DCA) and 1,1,2-trichloroethane (1,1,2-TCA) in the OU3 ROD (USACE 1999). Chemical data collected for the OU1 RAO at the GWTF were compared to established CHAAP NPDES Permit discharge limits and the USEPA HALs for drinking water, per the CHAAP OU1 ROD Amendment. Chemical data collected at OU1/OU3 were compared to the CHAAP cleanup goals (USEPA HALs and MCLs for drinking water), per the CHAAP OU1 ROD Amendment, the OU3 ROD, and the additional screening levels (USEPA Regional Screening Levels for Tapwater) as listed in the 2014 Final Uniform Federal Policy–Quality Assurance Project Plan (UFP-QAPP) (BW-URS 2014c).

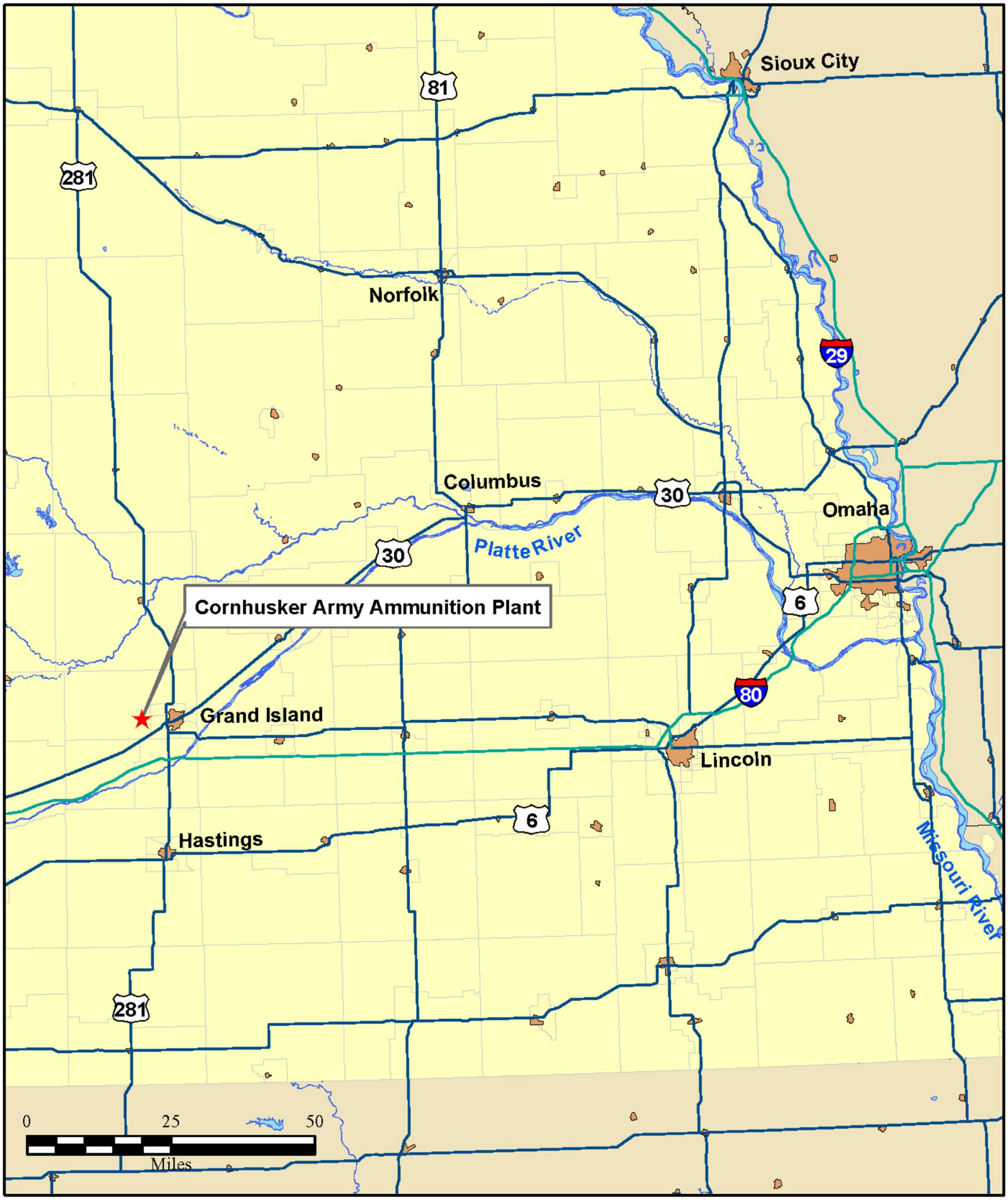
RDX, TNT, and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) were selected for the OU1 chemicals of concern because of their historic use, frequency of occurrence, magnitude of detected concentrations, and potential adverse health effects. 1,2-DCA and 1,1,2-TCA were selected for the OU3 chemicals of concern because of the historic concentrations reported at the Shop Area exceeding the MCLs established in 40 Code of Federal Regulations (CFR) 141, Subpart G (CFR 2012) for these compounds. TPH-DRO was also selected for the OU3 discussion because of the TPH-DRO detections at the Shop Area.

1.6 2016 ANNUAL REPORT ORGANIZATION

This 2016 Annual Report is organized as follows:

- **Section 1 – Introduction** presents the project work authority, project purpose and objectives, general project description and general scope, site description and site history, general setting, and groundwater cleanup goals.
- **Section 2 – Field Activities** describes the field activities completed in 2016 including OU1 GWTF influent and effluent sampling, subsurface injection (including pre-injection groundwater investigation sampling activities), OU1 and OU3 Shop Area groundwater sampling, monitoring well installation and abandonments, investigation-derived waste (IDW) management, field documentation, and field reporting.
- **Section 3 – Hydrogeologic Investigation Results** presents the hydrogeologic results and gradients from the water level measurements, and field water quality parameters collected during sampling activities at OU1 and OU3 Shop Area.
- **Section 4 – Laboratory Results and Data Quality Review** presents the summary of 2016 groundwater analytical results collected for influent and effluent sampling at GWTF, the pre-injection groundwater investigation summary, and the OU1 and OU3 Shop Area annual sampling event and overall data review and validation results.

- **Section 5 – Nature and Extent of Contamination** presents the interpreted nature and extent of groundwater contamination for OU1 on-post (pre-injection and post-injection), OU1 off-post, and OU3 Shop Area.
- **Section 6 – Natural Attenuation Evaluation** presents the overall evaluation of the natural attenuation for OU1 and OU3 Shop Area. This section presents evaluation methodology, water quality parameter averages and trends, and the degradation processes and rates.
- **Section 7 – Groundwater Flow and Contaminant Fate and Transport Modeling Evaluation** presents the results of the groundwater flow model recalibrations and model-predicted capture zones. This section also presents the updated contaminant fate and transport model and a comparison between the 2015 and 2016 mass estimations to determine the overall mass reduction for RDX and TNT. Long-term modeling results and mass estimations are also presented to predict the site remediation time frames.
- **Section 8 – Institutional Controls Review** presents the 2016 OU1 on-post and off-post and the OU3 on-post institutional controls in place for CHAAP.
- **Section 9 – Conclusions and Recommendations** presents the conclusions of the OU1 GWTF results, OU1 2016 injection activities (including pre-injection groundwater investigation sampling), OU1/OU3 annual sampling results, and optimization of groundwater modeling and monitoring program, and provides recommendations for 2017.
- **Section 10 – References** provides references used to develop this 2016 Annual Report.



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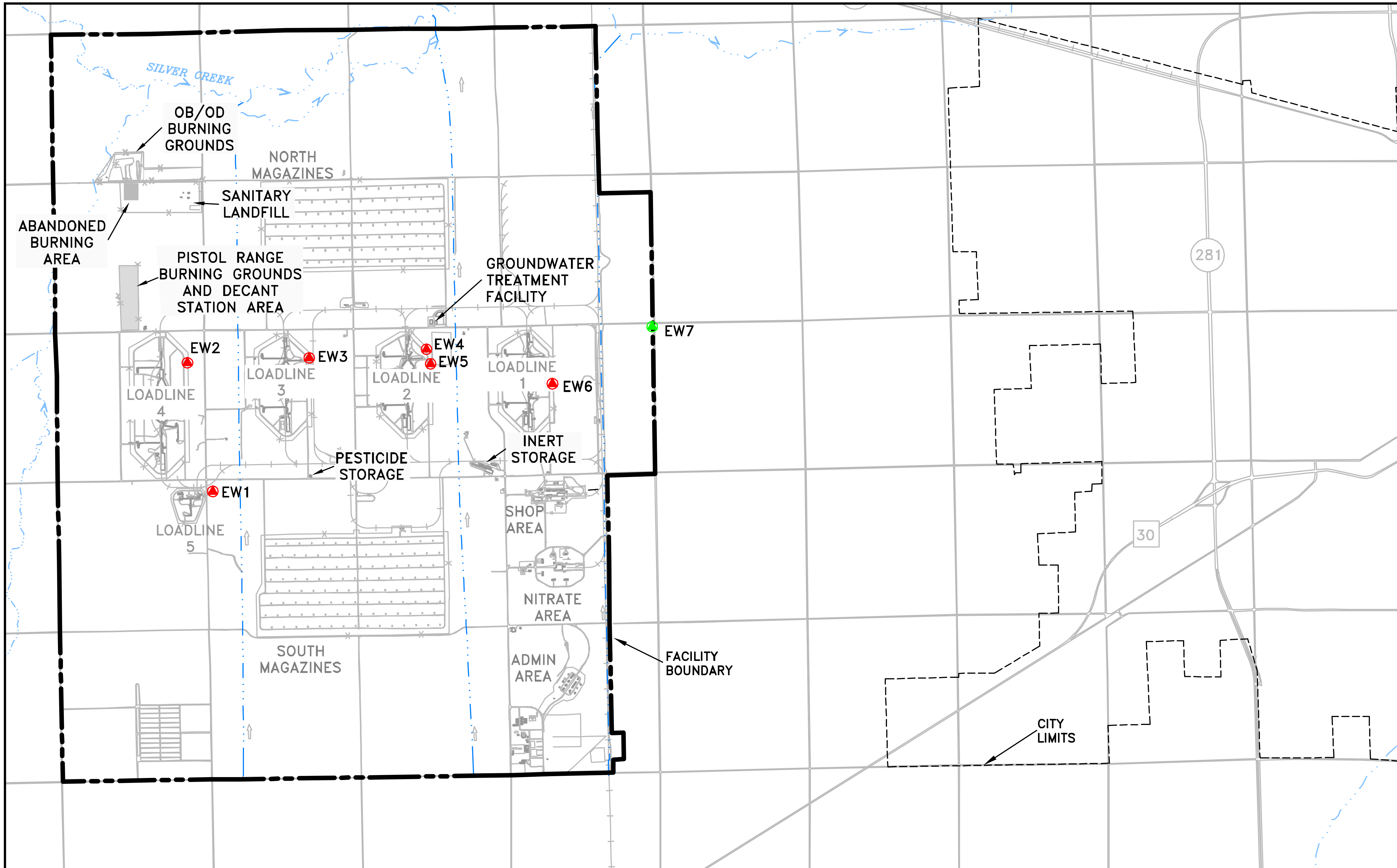
FACILITY LOCATION MAP
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/02/16	PROJECT NO. 16170837	FIG. NO. 1-1
CHK'D. BY: CSA	DATE: 09/02/16		

February 02, 2017 2:54:00 p.m.
Drawing: T:\CHAAP\16170837\27\1-1.dwg



LEGEND:

- ROADS
- FENCE
- FACILITY BOUNDARY
- SURFACE DRAINAGE
- DRAINAGE DITCH FLOW DIRECTION
- GRAND ISLAND CITY LIMITS
- ABANDONED BURNING GROUNDS, SANITARY LANDFILL, AND PISTOL RANGE BURNING GROUNDS
- INACTIVE GROUNDWATER EXTRACTION WELL
- ACTIVE GROUNDWATER EXTRACTION WELL
- 281 STATE ROUTE
- 30 U.S. ROUTE

August 24, 2017 2:05:51 p.m.
Drawing: T:\CHAAP\60526870\6\1-2.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

SITE LOCATION MAP
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/02/16	PROJECT NO. 16170837	FIG. NO. 1-2
CHK'D. BY: CSA	DATE: 09/02/16		

2.1 SUMMARY OF FIELD ACTIVITIES

This section summarizes the 2016 field activities for the RAO GWTF at OU1, subsurface injection (including pre-injection groundwater investigation), groundwater monitoring at OU1/OU3, and monitoring well installation and abandonments at CHAAP. All field activities were completed in accordance with field protocols and standard operating procedures (SOPs) presented in the Remediation Action Operation, Groundwater Treatment Facility at OU1 and Groundwater Monitoring at OU1/OU3 Final Uniform Federal Policy–Quality Assurance Project Plan (BW-URS 2014c).

Field activities completed for GWTF operation and maintenance (O&M) (January 1 through December 31, 2016) included:

- Routine GWTF O&M activities, including building and grounds maintenance. Work performed included:
  - Operating the GWTF with groundwater extraction occurring exclusively from EW7, at an average pumping rate of approximately 447 gpm from January 1 through December 31, 2016.
  - Weekly routine maintenance activities such as eye wash station inspection/testing, sludge thickener inspection, air compressor inspection, and exercising GAC system valves.
  - Lubricating equipment in accordance with manufacturer’s recommendations.
  - Weekly inspections of extraction well pump houses.
  - Assessing EW7 performance by calculating the specific capacity for this well on a monthly basis.
  - Monthly fire extinguisher inspections.
  - Monthly data collection for the cathodic protection system.
  - Quarterly GWTF sampling (January, April, July, and October). GWTF sampling (collecting and analyzing water samples from the GAC system influent, lead GAC vessel effluent, lag GAC vessel effluent, and GWTF effluent).
  - Quarterly maintenance of the air drier and two air compressors used for GWTF operation by a manufacturer’s (Ingersoll Rand) authorized service technician.
  - Semiannual inspections of the filter press. Filter cake is removed from the filter press on an as-needed basis, based on results of the inspections. Filter cake is placed in 55-gallon, open top, steel drums. The filter cake is then manifested, transported off-site, and disposed of as a non-Department of Transportation regulated waste by Safety-Kleen Systems, Inc., a Division of Clean Harbors, Inc. In 2016, six 55-gallon drums of filter cake were disposed of in this manner. Waste records and manifests are maintained at the project site.
  - Semiannual inspections of the GWTF control panels.
  - Inspection and maintenance of the two effluent canals, as needed.

- Mowing and weed control in the area proximal to the GWTF and extraction well pump houses during the growing season; snow removal, as needed, during the winter months.
- Annual testing, maintenance, and certification (where required) of various facility components (e.g., HVAC, fire extinguishers).
- Miscellaneous repairs to the roof of the GWTF.
- Annual GWTF inspection by a Certified Industrial Hygienist.
- Documented all field activities.

- Non-routine GWTF O&M activities, which included:
  - Replacing the 25 horsepower motor for the EW7 extraction well pump. A temporary motor was previously installed on this pump in December 2016 when the pump and motor failed.
  - Troubleshooting two failed communication modules that were both original equipment (circa 1998) and no longer manufactured or supported (i.e., repaired). Failed equipment was located in the EW7 well house control panel and the spare parts inventory. Determined identical communications modules were also present in control panels for deactivated extraction wells EW1 through EW6, with four of the modules still functional. Replaced the failed communication module in the EW7 well house control panel with one of the operational modules. Placed the remaining three functional communication modules in the spare parts inventory.
  - Documented all field activities.

Field activities completed during 2016 subsurface injection (February 22 through April 26, 2016) included:

- Collected 25 direct push groundwater samples for explosives analysis at 25 data gap locations during the pre-injection groundwater investigation.
- Completed 600 subsurface injection points along 42 transects to maintain and expand existing anaerobic treatment zones and create new anaerobic reducing treatment zones to expedite the remediation of OU1 explosives contaminated groundwater.
- Documented all field activities.

Field activities completed during the annual groundwater monitoring event at OU1 and OU3 (August 3 through August 16, 2016) included:

- Collected and analyzed one source-water sample (used for decontamination and other general field activities) for explosives (including MNX) and VOCs (including Freon® 113).
- Measured OU1 water levels at 54 off-post monitoring wells, 62 on-post monitoring wells, 16 on-post piezometers, one on-post extraction well, and 12 on-post observation wells.
- Measured OU1 field water quality parameters during well purging.
- Collected and analyzed OU1 groundwater samples from 22 off-post monitoring wells, 55 on-post monitoring wells, and 16 on-post piezometers.

- Measured OU3 water levels at eight on-post monitoring wells.
- Measured OU3 field water quality parameters during well purging.
- Collected and analyzed OU3 groundwater samples from six Shop Area monitoring wells.
- Documented all field activities.

Field activities completed during the monitoring well installation and abandonment at OU1 (November 10 through November 30, 2016) included:

- Installation, completion, and development of one monitoring well (G0121).
- Abandonment of two OU on-post monitoring wells (G0016 and G0028).
- Collected and analyzed groundwater sample for explosives only (including MNX) at G0121.
- Collected soil characterization sample for G0121.
- Documented all field activities.

2.2 GROUNDWATER TREATMENT FACILITY

The operational up-time for the GWTF in 2016 was approximately 92.6 percent. The primary sources of down-time were associated with routine GAC vessel backwash events and monthly specific capacity determinations (255 hours, scheduled); storm-related power outages (99 hours, unscheduled); and failed communications modules in both the EW7 well house control panel and the CHAAP spare parts inventory (298 hours, unscheduled). While operational, the average pumping rate from January 1 through December 31, 2016 was 447 gpm, with all flow originating at EW7. The total volume of groundwater pumped by the GWTF in 2016 was 217 million gallons. Based on GWTF analytical results from the GAC treatment system, no GAC change out events were required or performed in 2016.

With the exception of the failed communications modules, all of the activities described previously have routinely occurred at the GWTF since the facility was brought on-line. From a historic perspective, neither scheduled nor unscheduled GWTF shutdowns have had an adverse effect on the overall ability of the groundwater extraction system to maintain hydraulic control of the on-post explosives plume. This is supported by both declining plume size and declining explosives concentrations across the plume since GWTF start-up, with all explosives concentrations below the HALs in all sampled off-post monitoring wells downgradient of EW7 during the last three annual groundwater monitoring events (August 2014, August 2015, and August 2016).

Analytical results from GWTF system effluent samples (**Section 4.1.1**) demonstrated that all explosives compound analytical results from the four quarterly GWTF effluent sampling events were below the corresponding levels of detection. The only explosives compound that exceeds its corresponding HAL in GWTF influent is TNT. The maximum TNT influent concentration detected during the year was 11 µg/L. The highest detected RDX concentration detected during the year was 0.97 µg/L, or slightly less than one-half its HAL (2 µg/L). Analytical results from the four quarterly GWTF sampling events demonstrate the GAC treatment system operated effectively and reliably throughout the 2016 calendar year. A lead GAC vessel carbon change-out event was not required or completed during the year.

EW7 Performance Evaluation

EW7 performance, in terms of specific capacity, continued the declining trend observed in recent years, as first reported in the Final 2014 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2015). Average specific capacities since 2009, the year the pumping rate at EW7 was increased from 260 gpm to 500 gpm, are shown below.

Year	**2009**[a]	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**[b]	**2016**
Average EW7 Specific Capacity (gpm per foot of drawdown)	50.2	48.1	47.0	46.3	43.8	39.1	36.3	34.5

[a]EW7 pumping rate was set at 500 gpm in July 2009. Average specific capacity for 2009 is a 6-month average (July through December).
[b]EW7 pumping rate was reduced to 450 gpm in November 2015. Average specific capacity for 2015 is for all 12 months.

As reported in **Section 3.1.1**, groundwater elevations in on-post wells rose by an average of approximately 0.3 foot between the August 2015 and August 2016 annual groundwater gauging events. However, groundwater elevations at well locations within the cone of depression created by EW7 declined by values ranging from approximately 0.5 to 2.0 feet. This localized decline is attributed to the effects of long-term pumping/dewatering at EW7.

In previous annual reports for the site (e.g., Final 2014 Annual Groundwater Monitoring and Subsurface Injection Report [BW-URS 2015], Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report [BW-URS 2017]), declines in EW7 specific capacity over time were attributed to declining well and/or aquifer performance proximal to EW7 and declining groundwater elevations proximal EW7. Declines in specific capacity due to declining well and/or aquifer performance can occur for a number of reasons, such as: 1) biological and/or inorganic precipitates forming on the well screen or within the formation, closing off flow paths; and 2) formation fines being transported toward the well with groundwater flow and subsequently filtered out by the sand pack and/or the formation itself, thereby reducing flow into the well. Declines in specific capacity attributable to declining groundwater elevations are the result of less head pressure above the well screen to support flow into the screen.

Both declining well/aquifer performance and declining groundwater elevations are believed to contribute to declining specific capacity at EW7. For example, between 2009 and 2012, groundwater elevations at the site first rose by approximately 1 foot, then declined by approximately the same value. During this time, the average specific capacity at EW7 declined by approximately 4 gpm per foot of drawdown. This decline in specific capacity, at relatively constant groundwater elevations, can be attributed to declining well and/or aquifer performance. Between 2012 and 2014, groundwater elevations declined by approximately 6 feet across the site. During this time, the average specific capacity at EW7 declined by approximately 7 gpm per foot of drawdown. In 2015, groundwater elevations increased by approximately 1 to 3 feet across the site. As discussed previously, in 2016, groundwater elevations were relatively stable across the site, rising by approximately 0.3 foot but declining within the EW7 cone of depression.

Under generally rising groundwater level conditions, the average specific capacity at EW7 declined by approximately 4.5 gpm per foot of drawdown during this time. This decline can, in all likelihood, be attributed to declining well/aquifer performance.

As discussed in the Final 2014 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2015), three unique extraction well rehabilitation programs were performed on EW7 in 2013 and 2014, none of which had a significant effect on restoring specific capacity. This information, along with 2015 and 2016 data demonstrating that the specific capacity at EW7 continued to decline under increasing water level conditions, suggest that continued degradation in EW7 well performance should be anticipated and that well rehabilitation is not effective at restoring these ongoing specific capacity losses. Groundwater elevations proximal to EW7 and the specific capacity at EW7 will be closely monitored as part of routine GWTF O&M. If it appears the ability of EW7 to produce the amount of flow required to maintain hydraulic control of the explosives plume has the potential to be compromised, the installation of a replacement or supplemental well may become necessary.

2.3 SUBSURFACE INJECTION ACTIVITIES

2.3.1 Utility Locates

Bay West/URS (BW-URS) obtained utility clearances prior to the start of intrusive direct push sampling and subsurface injection activities. The Nebraska One Call Diggers Hotline was contacted for utility clearances, which were requested a minimum of 48 hours prior to intrusive work. All identified underground utilities were marked with flagging, stakes, and/or paint. Utility locate tasks were documented in field logbooks to aid in subsequent clearance work. No intrusive work was completed within 5 feet of a marked utility.

2.3.2 Pre-Injection Groundwater Investigation Sampling Activities

A total of 25 direct push groundwater samples were collected from 25 locations within LL1 and LL2, and between EW6 and EW7 (LL1-DP136 through LL1-DP146, LL2-DP110 through LL2-DP117, and EW7-DP40 through EW7-DP45, respectively), as shown on **Figures 2-1a**, **2-1b**, and **2-1c**. These pre-injection groundwater investigation samples were collected for screening-level data to fill data gaps at locations without permanent monitoring wells identified at LL1 and LL2, and between EW6 and EW7. Direct push data were used to supplement the nature and extent of explosives evaluations and are included in the contaminant fate and transport model to more accurately predict remediation time frames (further discussed in **Sections 5** and **7**). Direct push groundwater samples were collected from the core of the explosives plume (i.e., the shallow or shallow-intermediate intervals) within the aquifer. Final sample depths were selected based on historical groundwater sampling data.

All new direct push locations were sited using predetermined horizontal coordinates and a global positioning system (GPS) unit to ensure completion in their planned locations. At the conclusion of the sampling activity, all final sampling locations were surveyed together and referenced to previously surveyed locations. Surveyed ground surface elevations for direct push sample locations are provided in **Table 2-1**.

All direct push groundwater sampling locations were completed using a Geoprobe® rig (model 7720DT). Direct push activities were completed by Plains Environmental Services (PES) of Salina, Kansas, with full-time oversight by BW-URS. Copies of Nebraska well drilling contractor licenses for PES and URS are provided in **Appendix A**. All direct push sampling equipment was properly decontaminated using a Liquinox wash or nonphosphate equivalent and triple-rinsed with deionized (DI) water between each direct push location, in accordance with SOP 7, Equipment and Personnel Decontamination (BW-URS 2014c). All direct push groundwater sampling locations were abandoned with hydrated granular bentonite upon completion, in accordance with SOP 4, Boring and Monitoring Well Abandonment (BW-URS 2014c).

Groundwater samples were collected by driving direct push rods and a retractable, 4-foot-long, four-slot (0.004-inch) stainless steel screen (Geoprobe screen point sampler SP15) with an expendable drive point to the target depth. While the sampler was driven to this depth, it remained a water-tight system, preventing formation water from entering the screen. Once the drive rods were advanced to the target depth, they were retracted and the screen was exposed. Groundwater samples were collected through the SP15 sampler.

Direct push groundwater samples were collected from the screened interval using a Geotech Geopump™ peristaltic pump and a check valve. Prior to groundwater sample collection, approximately 2 to 3 gallons were purged at each sampling location. Purge rates were typically 0.5 to 1.0 liter per minute (lpm). Once a sufficient volume of water was removed from the rods, groundwater samples were placed in appropriately labeled sample containers, packed in coolers with wet ice (4 degrees Celsius [°C]), and shipped to TAL via Federal Express. Quality control (QC) (duplicates) and matrix spike/matrix spike duplicate (MS/MSD) samples were collected at a 5-percent rate (i.e., one per 20 samples collected) for explosives. Direct push groundwater samples were analyzed for explosives only (including MNX) (USEPA Method 8330A). Direct push groundwater sample locations, sample identification (ID) numbers, sample screened intervals, sample collection dates, QC locations, and sample parameters are provided in **Table 2-1**. Direct push groundwater investigation sample collection field sheets (SCFSs) are provided in **Appendix B**.

2.3.3 Injection Point Layout

All direct push subsurface injection locations were sited using predetermined horizontal coordinates and a GPS unit to ensure completion in their planned locations. Additionally, injection transects location accuracies were checked using measurement distances from professionally surveyed monitoring wells. All final transect locations were vertically surveyed and referenced to previously surveyed locations (i.e., monitoring wells).

2.3.4 Subsurface Injection Design

The 2016 subsurface injection design was based on the following data:

- 2016 pre-injection groundwater investigation and 2015 OU1 groundwater monitoring results
- 2015 groundwater flow directions and velocities from the groundwater flow model recalibration
- 2015 model-predicted extraction well capture zones from the groundwater flow model recalibration
- 2016 hydrogen demand and amendment injection quantity calculations

In general, the 2016 subsurface injection locations were placed in areas with the highest explosives concentrations in groundwater (i.e., one location in LL2 with RDX concentrations >20 µg/L, and general coverage of concentration areas that were >2 µg/L). The 2016 subsurface injection activities were generally completed at two areas at CHAAP, including the LL1 source area explosive plumes and the LL2 source areas and slightly downgradient explosive plumes. Additional subsurface injection locations were completed at discrete areas between LL1 and LL2 (i.e., direct push locations near monitoring wells G0084 and G0085) that indicated RDX concentrations >2 µg/L. The LL1 and LL2 source areas (former melt pour facilities Buildings 9 and 10, and PEEWCs) and slightly downgradient were targeted in 2016 based on the explosives concentrations (RDX and/or TNT >2 µg/L) observed during the August 2015 annual groundwater monitoring event and the February 2016 direct push pre-injection groundwater investigation event (see **Figures 2-1a**, **2-1b**, and **2-1c**). At LL1, explosives concentrations >2 µg/L were identified in the shallow water table northeast of former Building 10 and the PEEWCs, which supports the previous interpretation of residual source areas at these locations. At the LL2 source area and slightly downgradient, explosives concentrations have been reduced over time due to previous subsurface injection events; however, concentrations >2 µg/L, including an area >20 µg/L in the southern explosives plume, remain at LL2. The residual source areas have been targeted during annual subsurface injection events, which began in 2007. Injection work completed between 2007 and 2015, including several years of injection work under higher groundwater elevation conditions, has reduced both the explosives contaminant mass in the residual source areas and the ability of these areas to act as residual sources in the future.

To sufficiently address the OU1 groundwater explosives plumes at and between LL1 and LL2, 600 subsurface injections placed along 42 transects were completed within these areas. The 2016 subsurface injection design focused most injection efforts on the completion of closely spaced injection transects directly within the presumed source areas and slightly downgradient at LL1 and LL2. These closely spaced injection transects were staggered so that injection points were oriented in a grid-type pattern to more effectively treat residual source areas within the saturated zone. Injection transects completed near these residual source areas were approximately 40 to 60 feet apart and installed between previously completed injection transects within and downgradient of the LL1 and LL2 source areas (see **Figures 2-1a** through **2-1c**). New injection transects were installed between previously completed injection transects to reduce the horizontal spacing between injection transects and more effectively treat the residual source areas. Remaining injection efforts completed outside residual source areas (i.e., between LL1 and LL2, and northern LL1 near monitoring well G0093) were designed with wider transects due to plume sizes. Based on historical data and groundwater samples collected vertically throughout the shallow aquifer, the interpreted vertical extent of OU1 on-post explosive plume (RDX and/or TNT >2 µg/L) at and between LL1 and LL2 source areas and slightly downgradient extends approximately 15 to 20 feet below the current water table. Subsurface injection depths were completed throughout this interpreted vertical extent of explosives contamination within the shallow aquifer, with increased quantities of amendment injected near the water table (source area) and within the core of the explosives plume (downgradient area) (see **Table 2-2**). Injection points within the LL1 and LL2 source areas and slightly downgradient were completed at depths ranging from approximately 11 to 31 feet bgs to 16 to 36 feet bgs. Between LL1 and LL2 (near monitoring wells G0084 and G0085), injection points were completed from approximately 18 to 38 feet bgs (see **Table 2-3**). Based on the dispersion of mixed amendment in the subsurface, the vertical distribution of amendment results in an approximately 25-foot-thick vertical injection. Injection depths for specific transects were adjusted slightly in the field based on select water level measurements collected prior to injection activities (see **Section 2.3.4.4**). Additionally, in 2016 (as completed in 2011 through 2015), all injection transects within and between LL1 and LL2 were installed throughout the interpreted vertical extent of the explosives plumes and slightly above the water table. Amendment injected just above the water table and into the current vadose zone allows for continual treatment of the source areas during rising water level conditions (or seasonal fluctuations).

Wesblend 66-10 (manufactured by Westway Inc.), a food-grade carbon source, was selected as the 2016 groundwater amendment at CHAAP. A 9.8-percent by volume mixture of Wesblend 66-10 was used at LL1 and LL2 in 2016; the same percentage was used from 2010 through 2015. Wesblend 66-10 is a combination of blackstrap molasses mixed with whey, hydrolyzed vegetable oil (soybean oil refining byproduct), and cornsteep (a fermentation byproduct containing lactate and B vitamins). This mixture consisted of approximately 80 percent molasses/whey, 10 percent vegetable oil, and 10 percent cornsteep. This mixture was modified for 2010 injection activities to increase the amount of molasses sugars from 66 Brix to 85 Brix. (Brix is a measurement of the fraction of sugar per 100 parts aqueous solution.) This increased the ratio of sugar to water to increase amendment longevity and treatment zone lifespan. The modified Wesblend 66-10 (with 85 Brix) was used again in 2016. Wesblend 66-10 treatment zones are expected to last up to 24 months.

Final injection locations, injection point spacing, injection depths, amendment percentage, and overall injection transect orientation were determined by taking into account all of the data and factors above. Injection transects were designed to create treatment areas for explosives-contaminated groundwater to flow through. The 2016 subsurface injection activities were completed from April 4 to April 25, 2016. The 2016 OU1 RAO injection locations are shown on **Figures 2-1a** through **2-1c**. For visual interpretation of the 2016 injection transect placement and orientation, the previous groundwater explosives plumes (August 2015/February 2016, further discussed in **Section 5**) are provided on **Figures 2-1a** through **2-1c**. Additionally, **Figures 2-1a** through **2-1c** provide the groundwater flow pathlines (August 2015) and geologic cross-sections lines for the OU1 RAO Load Line Treatment Area (i.e., LL1 and LL2). Geologic cross-sections A-A', B-B', C-C', D-D', E-E', and F-F' (**Figures 2-2** through **2-7** respectively) illustrate the relationships among the various geologic units underlying the OU1 RAO Load Line Treatment Area.

The following sections describe the requirements for subsurface injection permits, as well as the amendment handling, mixing, and injection methods. Subsurface injection activities were completed in accordance with SOP 8, Subsurface Injection (BW-URS 2014c).

2.3.4.1 Subsurface Injection Permit

Underground injection is regulated by the NDEQ. Therefore, all underground injection activities performed in Nebraska must meet the requirements of Nebraska Administrative Code (NAC) Title 122, Chapter 6 (NAC 2002). Dr. Steve Fischbein, the 2006 Underground Injection Control (UIC) Program Coordinator for NDEQ, was consulted in November 2006, and he indicated that an application for a Class V Injection Permit was not necessary due to the federal status of CHAAP. Although the permit was not required, the OU1 RAO Subsurface Injection Work Plan Addendum (BW-URS 2007) with updated details is annually submitted to NDEQ before subsurface injections are completed. On April 2, 2016, the 2016 UIC Program Coordinator Nancy Harris was provided the Work Plan Addendum and a brief summary of 2016 subsurface injection details.

2.3.4.2 Amendment Shipping, Handling, and Storage

Amendment used for subsurface injection at CHAAP was delivered to the site in bulk quantities and arrived in 6,000-gallon tankers. Fourteen tankers of Wesblend 66-10 (a total of 640,340 pounds) were delivered to CHAAP during the 2016 OU1 RAO project. Bulk amendment was stored in plastic storage tanks at the GWTF. The amendment remained in the plastic tanks until it was mixed with water for injection**.**

Mixtures of amendment and water (injection solution) were transferred to the injection sites by 4,000- and 5,000-gallon water trucks operated by Panowicz Farms (PF). Injection solution was transferred from the water trucks to four 3,000-gallon plastic holding tanks at the injection sites.

Wesblend 66-10 can be stored for several weeks. According to Westway Inc., Wesblend 66-10 is an aqueous solution (not a suspension) and will therefore remain homogeneous during prolonged storage periods. Bulk amendment was commonly mixed and injected within 1 week of its arrival.

2.3.4.3 Amendment Mixing

Amendment concentrate was mixed with water using batch mixing techniques. A Dayton® trash pump was used to transfer the amendment from the plastic tanks into the batch mixing tank. Amendment concentrate was measured by pumping the concentrate through inline flow meters to deliver a known volume of amendment into the water truck tanks. Once the water truck tanks had the desired volume of amendment, the remaining volume was filled with water from an irrigation well owned and operated by PF. The amendment concentrate was mixed with water to achieve the desired percent concentrate of solution in the two water truck tanks. A mixture of 9.8 percent by volume Wesblend 66-10 at LL1 and LL2 was used for the 2016 OU1 RAO subsurface injection project.

2.3.4.4 Pre-Injection Water Level Measurement

A pre-injection water level measurement round was completed prior to the direct push groundwater investigation sampling (February 2016), providing current water level conditions to assist the direct push sampling activities and the design for the following subsurface injection event (April 2016). The pre-injection groundwater levels were measured at 43 monitoring wells and eight piezometers at LL1, LL2, and between EW6 and EW 7 on February 22, 2016. Water levels were measured at the surveyed reference point found on the top of the polyvinyl chloride (PVC) well casings using an electronic water level meter. Site-wide water level measurement locations (including the pre-injection water level measurement locations) are provided in **Table 2-4**. Water level measurements (including pre-injection water level measurement data) are further discussed in **Section 3**.

All water level measurement equipment was properly decontaminated with a Liquinox wash or nonphosphate equivalent and triple-rinsed with DI water between each well location, in accordance with SOP 7, Equipment and Personnel Decontamination (BW-URS 2014c). Water level measurements followed the procedures outlined in SOP 2, Water Level Measurement (BW-URS 2014c). All pre-injection water level measurements were recorded in the field logbook.

2.3.4.5 Direct Push Injection

Direct push technology was used to inject the injection solution into the subsurface via direct push points along transects, as shown on **Figures 2-1a** through **2-1c**. A summary of direct push injection locations, including transect ID numbers, amendment percentages, injection point spacing, number of injection points, injection transect lengths, injection interval thicknesses, required volume of amendment mixture per point and transect, and volume of amendment mixture per transect and interval is presented in **Table 2-2**.

All direct push subsurface injections were completed using Geoprobe® rigs (models 6620DT and 7720DT). Direct push activities were completed by PES of Salina, Kansas, with full-time oversight by BW-URS. Copies of Nebraska well drilling contractor licenses for PES and URS are provided in **Appendix A**. All direct push injection equipment was properly decontaminated using a Liquinox wash or nonphosphate equivalent and triple-rinsed with DI water between each direct push location, in accordance with SOP 7, Equipment and Personnel Decontamination (BW-URS 2014c). All direct push subsurface injection borings were abandoned with hydrated granular bentonite upon completion, in accordance with SOP 4, Boring and Monitoring Well Abandonment (BW-URS 2014c).

Direct push injection used 1.5-inch inner diameter direct push rods that were advanced to the target depth using a combination of the static weight of the carrier vehicle and its hydraulic hammer percussion. Once this depth was reached, the rods were pulled up slightly to open the disposable injection drive tip. The direct push rig was disconnected from the rod assembly, and a delivery hose was connected from an injection manifold outlet to an adapter attached to the end of the direct push rod. After confirming that all pressurized connections were secure, a Davey® Model 5290 self-priming firefighter pump powered with a 9-horsepower Honda motor was used to pump the injection solution from the plastic mix tanks, through a series of hoses connected to the metered manifold system, and finally into the ground through adapters attached to the direct push drive rods. Injection pressures, flow rates, and volumes were monitored closely for each injection interval.

Two six-valve manifold systems with flow meters allowed for injection of up to 12 points simultaneously. The manifold systems with flow meters were used to ensure that accurate volumes of mixed amendment were injected per interval at each location. Three direct push rigs were utilized during the 2016 injection season to keep up with the high volume pumping capacity of the injection system.

Injections completed at and between LL1 and LL2 were completed directly within the respective source areas. Injection was completed throughout the saturated zone from about 2 to 5 feet below the contaminated zone up to 3 to 5 feet above the water table, providing a vertical amendment distribution of approximately 25 feet. Injection zones extended into the current vadose zone to allow for continual treatment of the source areas during rising water level conditions (or seasonal fluctuations). Vertical injection intervals were spaced every 5 feet, coinciding with the removal of 5-foot-long direct push rod segments. After a predetermined volume of solution was injected into a specific subsurface interval, the rods were raised to the next interval and drive rods were removed, as necessary. The injection solution was then injected into the next interval, and the procedure was repeated until the desired volume of solution was injected throughout the entire thickness of the treatment zone. Increased quantities of amendment were injected near the water table and within the core of the explosives plume to better address higher explosives concentrations. Injection points were then sealed with bentonite pellets. A summary of all 600 injection points, including transect point ID numbers, dates completed, ground surface elevations, number of injection intervals, starting and stopping injection depths, starting and stopping flow meter readings, and total volume of mixture injected (in gallons) is presented in **Table 2-3**. Subsurface injection daily summary field sheets are provided in **Appendix B**.

2.3.4.6 Load Line 1 Injection

Direct push subsurface injections were completed at 252 points from April 4 through April 12, 2016, at LL1 (see **Figures 2-1a** and **2-1b**). A total of 18 injection transects were installed at LL1. Twelve transects were installed in the LL1 source areas and slightly downgradient, and six transects were installed in proximity to monitoring wells G0084 and G0093. Locations were chosen to address the northern and southern portions of the groundwater explosives plume where explosives were detected in the August 2015 groundwater sampling event and in the February 2016 direct push groundwater sampling event. All targeted plume concentrations were >2 µg/L RDX and/or TNT. Subsurface injection transects were installed using 15-foot spacing between each point, at a concentration of 9.8 percent by volume of Wesblend 66-10 (see **Tables 2-2** and **2-3**).

2.3.4.7 Load Line 2 Injection

Direct push subsurface injections were completed at 348 points from April 12 through April 25, 2016, at LL2 (see **Figures 2-1a** and **2-1c**). A total of 24 injection transects were installed at LL2. Twenty-two transects were installed in the LL2 source areas and slightly downgradient, and two transects were installed farther downgradient in proximity to monitoring well G0085. Locations were chosen to address the portions of the groundwater explosives plume where the highest concentrations of explosives were detected during the August 2015/February 2016 groundwater sampling events. All targeted plume concentrations were >2 µg/L RDX and/or TNT, including an interpreted RDX plume >20 µg/L in the LL2 southern explosives plume. Subsurface injection transects were installed using 15-foot spacing between each point and at a concentration of 9.8 percent by volume of Wesblend 66-10 (see **Tables 2-2** and **2-3**).

2.4 GROUNDWATER MONITORING AT OU1 AND OU3

The following sections summarize the site-wide water level measurements and groundwater purging and sampling activities at OU1 and OU3.

2.4.1 Groundwater Level Measurement

Prior to the annual groundwater sampling event in August 2016, an OU1/OU3 site-wide water level measurement round was completed at 152 off- and on-post wells and piezometers. Water levels were measured at existing monitoring wells, existing piezometers, an existing extraction well, and existing observation wells (associated with extraction wells) to determine groundwater elevations, hydraulic gradients, and groundwater flow directions. Water levels were measured at the surveyed reference point found on the top of the PVC well casings using an electronic water level meter. During the water level round, locations were measured over 1 to 2 days to minimize the effects of water table fluctuations. Water level measurement locations are provided in **Table 2-4**.

The annual site-wide groundwater levels at OU1 were measured at 54 off-post monitoring wells, 61 on-post monitoring wells, 16 on-post piezometers, one on-post extraction well, and 12 on-post observation wells on August 1 and 2, 2016. One off-post well and one on-post well were found to be dry, and two off-post wells had an obstruction (buried under debris); therefore, no water level measurements were collected at these four locations. The two off-post wells buried under debris are part of a three-well cluster (NW030, NW031, and NW032), from one of which (NW031) a water level measurement was obtained in August 2016. However, the three-well cluster was removed from the OU1 monitoring program in 2013 and is approved for abandonment as described in the March 2013 Annual Sampling Event for the Long-term Monitoring Program Final Report (BW-URS 2014a). OU3 groundwater levels were measured at eight monitoring wells on August 2, 2016. OU1 and OU3 groundwater level elevations and interpreted water table figures are presented and discussed in **Section 3**.

All water level measurement equipment was properly decontaminated with a Liquinox wash or nonphosphate equivalent and triple-rinsed with DI water between each well location, in accordance with SOP 7, Equipment and Personnel Decontamination (BW-URS 2014c). Water level measurements followed the procedures outlined in SOP 2, Water Level Measurement (BW-URS 2014c). All measurements at OU1 and OU3 were recorded in the field logbook.

2.4.2 Monitoring Well/Piezometer Purging and Water Quality Parameter Measurement

Prior to purging, the static water level was measured at each well, and the well volume was calculated and recorded on an SCFS. The monitoring wells and piezometers were purged with stainless steel ProActive Monsoon® submersible pumps. The ProActive Monsoon® pump with new disposable tubing was lowered to the middle of the screened interval prior to purging. Modified low-flow purging techniques were attempted at each monitoring well and piezometer location, maintaining < 0.3 foot of water level drawdown at a pumping rate of 0.5 lpm or less. Field water quality parameters, including DO, temperature, pH, conductivity, and ORP were measured at OU1 and OU3 monitoring wells and piezometers using a YSI 556 MPS water quality probe fitted with a flow-through cell. Turbidity was measured with a LaMotte 2020 turbidity meter. Fe^{2+} was measured using a HACH DR820 colorimeter. Purging continued until field water quality parameters stabilized (i.e., three consecutive readings) within criteria ranges specified in SOP 3, Monitoring Well and Piezometer Groundwater Sampling (BW-URS 2014c) and as stated below.

- pH plus or minus (±) 0.2 units
- Specific conductance ± 3 percent of previous readings
- DO ± 10 percent of previous readings
- ORP ± 20 millivolts (mV)
- Turbidity less than or equal to 5 nephelometric turbidity units or 10 percent of previous readings, whichever is greater
- Temperature ± 10 percent of previous readings

The measurements were recorded on water SCFS and are included in **Appendix B**. Final field water quality parameter measurement results are presented in **Section 3.4**.

Field instrumentation was calibrated using manufacturer guidelines prior to shipment to the site. The water quality probes were recalibrated once per week, and calibration was verified each day with certified standards. Results of calibration checks were recorded in the field logbook.

2.4.3 Groundwater Sampling

The following sections summarize groundwater sampling activities at OU1 and OU3.

2.4.3.1 Source Water Sampling

All source water used for decontamination activities during the August 2016 groundwater sampling event was DI water provided by Culligan® of Grand Island, Nebraska. Decontamination procedures included a nonphosphate soap scrub/wash, followed by a triple rinse with DI water. A source water sample was collected and shipped to TAL for analysis of explosives (including MNX) by USEPA Method 8330A and VOCs (including Freon® 113) by USEPA Method 8260B/5030B. No explosive compounds or VOCs were detected in the source water sample.

2.4.3.2 OU1 (Groundwater Explosives Plume) Groundwater Sampling

Groundwater samples were collected at OU1 from 22 off-post monitoring wells, 55 on-post monitoring wells, and 16 on-post piezometers from August 2 to August 16, 2016. As discussed in **Section 1.3.3**, two additional monitoring wells (on-post wells G0048 and G0079) were planned to be sampled but were dry or had insufficient water amounts to collect samples. Additionally, as discussed in **Section 1.3.4**, one OU1 on-post monitoring well (G0121) was installed in November 2016 and sampled for explosives only (including MNX) on November 30, 2016. Well installation details for the new well are provided in the Final 2016 Monitoring Well Installation and Abandonment Technical Memorandum (**Appendix G**).

A summary of the OU1 on-post and off-post sampling locations is presented in **Tables 2-5** and **2-6**, respectively, and shown on **Figure 2-8**. After purging was completed, sample containers were filled from the discharge line at a rate of 0.5 lpm or less. All samples were collected and analyzed for explosives (including MNX) and laboratory MNA parameters (on-post wells only): alkalinity, ammonia, nitrate/nitrite, sulfate, sulfide, TKN, DOC, and methane.

Groundwater samples were placed in appropriately labeled sample containers, packed in coolers with wet ice (4°C), and shipped to TAL via Federal Express. QC (duplicates) and MS/MSD samples were collected at a 5-percent rate (i.e., one per 20 samples collected) for all parameters (**Tables 2-5** and **2-6**).

2.4.3.3 OU3 (Shop Area) Groundwater Sampling

Groundwater samples were collected at the OU3 Shop Area from six monitoring wells on August 15, 2016. **Table 2-7** presents a summary of the OU3 Shop Area locations sampled, and the locations are shown on **Figure 2-9**. Purging was completed at all wells, and the sample containers were filled from the discharge line at a rate of 0.5 lpm or less. All samples were collected and analyzed for VOCs (including Freon® 113) and laboratory MNA parameters: nitrate/nitrite, sulfate, and dissolved gases (methane, ethane, and ethene). Groundwater samples were collected and analyzed for TPH-DRO at three wells (SHGW03, SHGW04, and G0069).

Groundwater samples were placed in appropriately labeled sample containers, packed in coolers with wet ice (4°C), and shipped to TAL via Federal Express. One field duplicate sample was collected at OU3 and analyzed for all parameters. The QC sample identification (ID) number is shown in **Table 2-7**.

2.4.4 Monitoring Well Installation and Abandonment Activities

In November 2016, one OU1 on-post monitoring well was installed in the LL2 source area to provide a permanent annual monitoring location to measure explosives plume concentrations and migration trends over time, and to help monitor the performance of the 2016 subsurface injections completed within the vicinity (April 2016). Monitoring well G0121 was installed within the LL2 southern explosives plume where RDX and TNT concentrations >2 µg/L were verified during the pre-injection groundwater investigation sampling event (February 2016). Following the monitoring well installation and development activities, G0121 was purged and sampled on November 30, 2016 for explosives only (including MNX). Details of this well installation and its location are shown in **Table 2-8** and on **Figure 2-10**, respectively.

Additionally, two OU1 on-post monitoring wells, G0016 (at LL3) and G0028 (at LL5), were abandoned on November 10, 2016. The two monitoring wells were recommended and approved for removal from the CHAAP Annual Groundwater Monitoring program in the March 2013 Annual Sampling Event for the Long-Term Monitoring Program Final Report (BW-URS 2014a). At the two monitoring wells, explosives concentrations have been below the HALs since 2004 or longer. Well abandonment details and locations are shown in **Table 2-9** and on **Figure 2-11**, respectively.

Monitoring well installation and abandonments were completed by O'Malley Drilling, a certified well drilling contractor licensed in the state of Nebraska, with full-time oversight by URS. Complete details of the monitoring well installation and abandonment activities, including drilling contractor licenses for O'Malley Drilling and URS, approved Water Well Registration (NEDNR Form 145) and Notice of Water Well Decommissioning forms, completed field forms, and analytical data are provided in the Final 2016 Monitoring Well Installation and Abandonment Technical Memorandum (**Appendix G**). G0121 sampling results are included in both Laboratory Results and Data Quality Review and Nature and Extent of Contamination section discussions (see **Sections 4** and **5**, respectively).

2.4.5 Investigation-Derived Waste Disposal Procedures

IDW from the February 2016 and August 2016 sampling events and November 2016 monitoring well installation and abandonment activities consisted of purge, decontamination, and development water, as well as soil from the soil boring for the new monitoring well. IDW disposal was completed in accordance with NDEQ IDW procedures as outlined in the 2014 Final UFP-QAPP (BW-URS 2014c). IDW procedures were as follows:

- A visual inspection of the IDW was conducted for evidence of potential contamination (i.e., discoloration, sheen, etc.).
- IDW from a direct push location, well, or piezometer within the limits of the current groundwater explosives plume was containerized.

- IDW from a well or piezometer outside the limits of the current groundwater explosives plume was containerized and field-screened using a photoionization detector (PID). All PID results were <5 parts per million above background; therefore, IDW was disposed on the ground surface at the sampling site.
- All containerized water from wells and piezometers within the current groundwater explosives plume was transported daily to the CHAAP GWTF (operated by Bay West) and discharged into the floor sump for treatment through the existing GAC treatment system.
- Soil from the monitoring well soil boring was containerized in one 55-gallon drum. Containerized soil was characterized by collecting one composite soil sample from the drum of IDW. The characterization sample was analyzed for explosives only (USEPA Method 8330A), with all sample results nondetect. Based on these results, soil was returned to the monitoring well installation site and distributed evenly over the ground.

2.5 FIELD DOCUMENTATION, SAMPLE IDENTIFICATION, SAMPLE HANDLING, AND SHIPPING

Observations and data collected during the 2016 field activities were documented to provide a permanent record of all completed activities. The observations and data collected during field activities were recorded with waterproof ink in a permanently bound, waterproof logbook with consecutively numbered pages.

Samples collected during the 2016 GWTF sampling events, 2016 pre-injection groundwater investigation event, 2016 OU1/OU3 groundwater sampling activities, and 2016 monitoring well installation and abandonment activities were given discrete ID codes. Each ID code included the site name/number, sample collection method, sample location number, and sample depth.

Samples were collected in laboratory-provided containers. Sample ID labels were attached to each sample container and completed using waterproof, permanent ink. The labels were completed with the sampler's name, sample ID number, date and time of sample collection, preservation type, analyses requested, and sampling matrix. Sample containers were placed into coolers, packed with wet ice, and made ready for shipment. The chain-of-custody (CoC) forms were included in each cooler. A copy of each CoC was maintained to document sample handling between the field and the laboratory. Sample coolers were shipped to TAL during each sampling event. All samples were shipped via FedEx priority overnight delivery.

All field documentation, sample ID, sample handling, and shipping procedures were completed in accordance with SOP 6, Sample ID, Handling, Documentation, Shipping, and Tracking (BW-URS 2014c).

2.6 REPORTING

2.6.1 Daily Quality Control Reports

Daily Quality Control Reports (DQCRs) were completed for each day of fieldwork associated with the pre-injection groundwater investigation and subsurface injection activities, the annual OU1/OU3 groundwater monitoring event, and monitoring well installation and abandonment activities. DQCRs include a summary of daily field activities, safety activities, quality assurance/QC activities pertaining to all features of work, problems encountered in the field, and any corrective actions that were taken to correct these problems. It was the responsibility of the BW-URS Field Managers to complete the DQCRs. Copies of the completed DQCRs are provided in **Appendix B**.

2.6.2 Weekly Progress Reports

Weekly progress reports were completed throughout the duration of the field activities. Weekly reports for GWTF O&M were prepared independent of weekly reports for the pre-injection groundwater investigation, subsurface injection activities, the annual OU1/OU3 groundwater monitoring event, and monitoring well installation and abandonment activities. Weekly progress reports were submitted to the USACE Project Manager. The weekly reports included a summary of all work performed in a particular week including mobilization, site preparation, site access, surveying, direct push sampling and injection, GWTF O&M (including GWTF sampling), OU1/OU3 annual water level rounds and groundwater sampling, well installation and abandonment activities, and demobilization actions. These weekly reports also included a summary of the problems encountered, deviations from the scope of work, percentage of work performed, and records of conversations or other correspondence among CHAAP team members. Copies of the weekly progress reports are provided in **Appendix B**.

2.6.3 Photographic Documentation

A photographic record of site activities and progress was maintained throughout the course of the 2016 subsurface injection and sampling field activities. Pertinent photographs were compiled, described, and presented in a photographic log of 2016 fieldwork activities. This photographic log is provided in **Appendix C**.

TABLE 2-1
PRE-INJECTION GROUNDWATER INVESTIGATION SAMPLES COLLECTED
2016 ANNUAL REPORT

Sample Location ID	Ground Elevation (feet amsl)[1]	Screened Interval (feet bgs)	Sample ID	Sample Date	Analytical Parameters: Explosives[2]	Analytical Parameters: Field Duplicate Samples[3]	Analytical Parameters: MS/MSD Samples[4]
Between EW6 and EW7							
EW7-DP40	1898.12	31.0 - 35.0	EW7-DP40-35	2/22/2016	X		
EW7-DP41	1897.44	31.0 - 35.0	EW7-DP41-35	2/22/2016	X		
EW7-DP42	1896.46	31.0 - 35.0	EW7-DP42-35	2/22/2016	X		X
EW7-DP43	1896.84	31.0 - 35.0	EW7-DP43-35	2/22/2016	X		
EW7-DP44	1897.92	31.0 - 35.0	EW7-DP44-35	2/23/2016	X		
EW7-DP45	1899.58	31.0 - 35.0	EW7-DP45-35	2/23/2016	X		
Load Line 1							
LL1-DP136	1896.83	22.0 - 26.0	LL1-DP136-26	2/24/2016	X		X
LL1-DP137	1895.11	18.0 - 22.0	LL1-DP137-22	2/24/2016	X		
LL1-DP138	1893.95	18.0 - 22.0	LL1-DP138-22	2/23/2016	X		
LL1-DP139	1895.32	18.0 - 22.0	LL1-DP139-22	2/23/2016	X		
LL1-DP140	1897.58	18.0 - 22.0	LL1-DP140-22	2/23/2016	X		
LL1-DP141	1899.67	18.0 - 22.0	LL1-DP141-22	2/23/2016	X		
LL1-DP142	1899.44	18.0 - 22.0	LL1-DP142-22	2/23/2016	X		
LL1-DP143	1901.61	26.0 - 30.0	LL1-DP143-30	2/24/2016	X		
LL1-DP144	1903.92	26.0 - 30.0	LL1-DP144-30	2/24/2016	X	X	
LL1-DP145	1904.30	26.0 - 30.0	LL1-DP145-30	2/24/2016	X		
LL1-DP146	1906.72	26.0 - 30.0	LL1-DP146-30	2/24/2016	X		
Load Line 2							
LL2-DP110	1906.61	26.0 - 30.0	LL2-DP110-30	2/24/2016	X		
LL2-DP111	1906.77	31.0 - 35.0	LL2-DP111-35	2/25/2016	X		
LL2-DP112	1903.98	21.0 - 25.0	LL2-DP112-25	2/25/2016	X	X	
LL2-DP113	1908.34	21.0 - 25.0	LL2-DP113-25	2/25/2016	X		
LL2-DP114	1907.11	21.0 - 25.0	LL2-DP114-25	2/25/2016	X		
LL2-DP115	1906.44	21.0 - 25.0	LL2-DP115-25	2/25/2016	X		
LL2-DP116	1904.73	21.0 - 25.0	LL2-DP116-25	2/25/2016	X		
LL2-DP117	1906.17	21.0 - 25.0	LL2-DP117-25	2/25/2016	X		
				Totals	**25**	**2**	**2**

Notes:

[1]Elevation datum based on National Geodetic Vertical Datum of 1929.

[2]Explosives (+MNX) analysis (SW846 Method 8330A) only completed.

[3]Field duplicate samples were collected at a rate of 5% (1 per 20 samples collected) for explosives only.

[4]MS/MSD samples were collected at a rate of 5% (1 per 20 samples collected) for explosives only.

% = percent
amsl = above mean sea level
bgs = below ground surface
DP = direct push
EW = extraction well
ID = identification number
MNX = mono-nitroso-RDX
MS/MSD = matrix spike/matrix spike duplicate
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

TABLE 2-2
SUBSURFACE INJECTION LOCATIONS
2016 ANNUAL REPORT

Injection Transect ID	Percent Amendment (by Volume)	Point Spacings (ft)	Number of Injection Points	Injection Transect Length (ft)	Injection Interval Thickness (ft)	Required Volume of Mixture Per Point (gal)	Actual Volume of Mixture Injected Per Transect (gal)	Required Volume of Mixture Per 5-Foot Interval (gal)
Load Line 1								
LL1-T112	9.8 % WB66-10	15	24	345	25	1000	24000	B
LL1-T113	9.8 % WB66-10	15	24	345	25	1000	24000	B
LL1-T114	9.8 % WB66-10	15	24	345	25	1000	24000	B
LL1-T115	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T116	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T117	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T118	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T119	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T120	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T121	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T122	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T123	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T124	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T125	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T126	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL1-T127	9.8 % WB66-10	15	12	165	25	1000	12000	B
LL1-T128	9.8 % WB66-10	15	18	255	25	1000	18000	B
LL1-T129	9.8 % WB66-10	15	6	75	25	1000	6000	B
		Load Line 1 Totals	**252**	**3510**	**25**	**1000**	**252000**	
Load Line 2								
LL2-T101	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T102	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T103	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T104	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T105	9.8 % WB66-10	15	18	255	25	1000	18000	A
LL2-T106	9.8 % WB66-10	15	24	345	25	1000	24000	A
LL2-T107	9.8 % WB66-10	15	24	345	25	1000	24000	A
LL2-T108	9.8 % WB66-10	15	24	345	25	1000	24000	A
LL2-T109	9.8 % WB66-10	15	18	255	25	1000	18000	A
LL2-T110	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T111	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T112	9.8 % WB66-10	15	12	165	25	1000	12000	A

TABLE 2-2
SUBSURFACE INJECTION LOCATIONS
2016 ANNUAL REPORT

Injection Transect ID	Percent Amendment (by Volume)	Point Spacings (ft)	Number of Injection Points	Injection Transect Length (ft)	Injection Interval Thickness (ft)	Required Volume of Mixture Per Point (gal)	Actual Volume of Mixture Injected Per Transect (gal)	Required Volume of Mixture Per 5-Foot Interval (gal)
LL2-T113	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T114	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T115	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T116	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T117	9.8 % WB66-10	15	12	165	25	1000	12000	A
LL2-T118	9.8 % WB66-10	15	12	165	25	1000	12000	B
LL2-T119	9.8 % WB66-10	15	12	165	25	1000	12000	B
LL2-T120	9.8 % WB66-10	15	12	165	25	1000	12000	B
LL2-T121	9.8 % WB66-10	15	12	165	25	1000	12000	B
LL2-T122	9.8 % WB66-10	15	12	165	25	1000	12000	B
LL2-T123	9.8 % WB66-10	15	18	255	25	1000	18000	B
LL2-T124	9.8 % WB66-10	15	18	255	25	1000	18000	B
Load Line 2 Totals			**348**	**4860**	**25**	**1000**	**348000**	
Overall Totals			**600**	**8370**	**25**	**1000**	**600000**	

Notes:

% = percent

bgs = below ground surface

ft = feet

gal = gallons

ID = identification number

LL = Load Line

T = transect

WB 66-10 = Wesblend 66 with 10% oil

Amendment mixture was injected vertically at 5-foot intervals. Volume of mixed amendment per vertical interval (from shallow to deep) was as follows: A) Source Area - 300 gallons, 300 gallons, 200 gallons,100 gallons, and 100 gallons; and B) Downgradient Area - 200 gallons, 300 gallons, 300 gallons, 100 gallons, and 100 gallons.

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
2016 ANNUAL REPORT

Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
Load Line 1 Injection Transects								
LL1-T112 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T112-1	4/6/2016	1897	5	31	11	30	1030	1000
LL1-T112-2	4/6/2016	1897	5	31	11	4020	5020	1000
LL1-T112-3	4/6/2016	1897	5	31	11	4030	5030	1000
LL1-T112-4	4/6/2016	1897	5	31	11	4020	5020	1000
LL1-T112-5	4/6/2016	1897	5	31	11	4060	5060	1000
LL1-T112-6	4/6/2016	1897	5	31	11	4040	5040	1000
LL1-T112-7	4/6/2016	1897	5	31	11	1030	2030	1000
LL1-T112-8	4/6/2016	1897	5	31	11	5020	6020	1000
LL1-T112-9	4/6/2016	1897	5	31	11	5030	6030	1000
LL1-T112-10	4/6/2016	1897	5	31	11	5020	6020	1000
LL1-T112-11	4/6/2016	1897	5	31	11	5060	6060	1000
LL1-T112-12	4/6/2016	1897	5	31	11	5040	6040	1000
LL1-T112-13	4/6/2016	1897	5	31	11	5050	6050	1000
LL1-T112-14	4/6/2016	1897	5	31	11	5030	6030	1000
LL1-T112-15	4/6/2016	1897	5	31	11	5020	6020	1000
LL1-T112-16	4/6/2016	1897	5	31	11	5050	6050	1000
LL1-T112-17	4/6/2016	1897	5	31	11	5050	6050	1000
LL1-T112-18	4/6/2016	1897	5	31	11	50540	51540	1000
LL1-T112-19	4/6/2016	1897	5	31	11	4050	5050	1000
LL1-T112-20	4/6/2016	1897	5	31	11	4030	5030	1000
LL1-T112-21	4/6/2016	1897	5	31	11	4020	5020	1000
LL1-T112-22	4/6/2016	1897	5	31	11	4050	5050	1000
LL1-T112-23	4/6/2016	1897	5	31	11	4050	5050	1000
LL1-T112-24	4/6/2016	1897	5	31	11	49540	50540	1000
			LL1-T112 Total Points:		**24**	**LL1-T112 Total Gallons:**		**24,000**
LL1-T113 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T113-1	4/5/2016	1898	5	31	11	53860	54860	1000
LL1-T113-2	4/5/2016	1898	5	31	11	2020	3020	1000
LL1-T113-3	4/5/2016	1898	5	31	11	2030	3030	1000
LL1-T113-4	4/5/2016	1898	5	31	11	2020	3020	1000
LL1-T113-5	4/5/2016	1898	5	31	11	2060	3060	1000
LL1-T113-6	4/5/2016	1898	5	31	11	2040	3040	1000
LL1-T113-7	4/5/2016	1898	5	31	11	3040	4040	1000
LL1-T113-8	4/5/2016	1898	5	31	11	3060	4060	1000
LL1-T113-9	4/5/2016	1898	5	31	11	3020	4020	1000
LL1-T113-10	4/5/2016	1898	5	31	11	3030	4030	1000
LL1-T113-11	4/5/2016	1898	5	31	11	3020	4020	1000
LL1-T113-12	4/5/2016	1898	5	31	11	54860	55860	1000
LL1-T113-13	4/5/2016	1898	5	31	11	3050	4050	1000
LL1-T113-14	4/5/2016	1898	5	31	11	3030	4030	1000
LL1-T113-15	4/5/2016	1898	5	31	11	3020	4020	1000
LL1-T113-16	4/5/2016	1898	5	31	11	3050	4050	1000
LL1-T113-17	4/5/2016	1898	5	31	11	3050	4050	1000
LL1-T113-18	4/5/2016	1898	5	31	11	48540	49540	1000
LL1-T113-19	4/5/2016	1898	5	31	11	2050	3050	1000
LL1-T113-20	4/5/2016	1898	5	31	11	2030	3030	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
2016 ANNUAL REPORT

Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL1-T113-21	4/5/2016	1898	5	31	11	2020	3020	1000
LL1-T113-22	4/5/2016	1898	5	31	11	2050	3050	1000
LL1-T113-23	4/5/2016	1898	5	31	11	2050	3050	1000
LL1-T113-24	4/5/2016	1898	5	31	11	47540	48540	1000
			LL1-T113 Total Points:		**24**	**LL1-T113 Total Gallons:**		**24,000**
LL1-T114 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T114-1	4/4/2016	1898	5	31	11	51860	52860	1000
LL1-T114-2	4/4/2016	1898	5	31	11	20	1020	1000
LL1-T114-3	4/4/2016	1898	5	31	11	30	1030	1000
LL1-T114-4	4/4/2016	1898	5	31	11	20	1020	1000
LL1-T114-5	4/4/2016	1898	5	31	11	60	1060	1000
LL1-T114-6	4/4/2016	1898	5	31	11	40	1040	1000
LL1-T114-7	4/5/2016	1898	5	31	11	52860	53860	1000
LL1-T114-8	4/5/2016	1898	5	31	11	1020	2020	1000
LL1-T114-9	4/5/2016	1898	5	31	11	1030	2030	1000
LL1-T114-10	4/5/2016	1898	5	31	11	1020	2020	1000
LL1-T114-11	4/5/2016	1898	5	31	11	1060	2060	1000
LL1-T114-12	4/5/2016	1898	5	31	11	1040	2040	1000
LL1-T114-13	4/5/2016	1898	5	31	11	1050	2050	1000
LL1-T114-14	4/5/2016	1898	5	31	11	1030	2030	1000
LL1-T114-15	4/5/2016	1898	5	31	11	1020	2020	1000
LL1-T114-16	4/5/2016	1898	5	31	11	1050	2050	1000
LL1-T114-17	4/5/2016	1898	5	31	11	1050	2050	1000
LL1-T114-18	4/5/2016	1898	5	31	11	46540	47540	1000
LL1-T114-19	4/4/2016	1898	5	31	11	50	1050	1000
LL1-T114-20	4/4/2016	1898	5	31	11	30	1030	1000
LL1-T114-21	4/4/2016	1898	5	31	11	20	1020	1000
LL1-T114-22	4/4/2016	1898	5	31	11	50	1050	1000
LL1-T114-23	4/4/2016	1898	5	31	11	50	1050	1000
LL1-T114-24	4/4/2016	1898	5	31	11	45540	46540	1000
			LL1-T114 Total Points:		**24**	**LL1-T114 Total Gallons:**		**24,000**
LL1-T115 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T115-1	4/8-4/9/2016	1899	5	33	13	9030	10030	1000
LL1-T115-2	4/8-4/9/2016	1899	5	33	13	13020	14020	1000
LL1-T115-3	4/8-4/9/2016	1899	5	33	13	13030	14030	1000
LL1-T115-4	4/8-4/9/2016	1899	5	33	13	13020	14020	1000
LL1-T115-5	4/8-4/9/2016	1899	5	33	13	13060	14060	1000
LL1-T115-6	4/8-4/9/2016	1899	5	33	13	13040	14040	1000
LL1-T115-7	4/8/2016	1899	5	33	13	8030	9030	1000
LL1-T115-8	4/8/2016	1899	5	33	13	12020	13020	1000
LL1-T115-9	4/8/2016	1899	5	33	13	12030	13030	1000
LL1-T115-10	4/8/2016	1899	5	33	13	12020	13020	1000
LL1-T115-11	4/8/2016	1899	5	33	13	12060	13060	1000
LL1-T115-12	4/8/2016	1899	5	33	13	12040	13040	1000
			LL1-T115 Total Points:		**12**	**LL1-T115 Total Gallons:**		**12,000**
LL1-T116 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T116-1	4/7/2016	1898	5	33	13	6030	7030	1000
LL1-T116-2	4/7/2016	1898	5	33	13	10020	11020	1000

TABLE 2-3
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL1-T116-3	4/7/2016	1898	5	33	13	10030	11030	1000
LL1-T116-4	4/7/2016	1898	5	33	13	10020	11020	1000
LL1-T116-5	4/7/2016	1898	5	33	13	10060	11060	1000
LL1-T116-6	4/7/2016	1898	5	33	13	10040	11040	1000
LL1-T116-7	4/8/2016	1898	5	33	13	7030	8030	1000
LL1-T116-8	4/8/2016	1898	5	33	13	11020	12020	1000
LL1-T116-9	4/8/2016	1898	5	33	13	11030	12030	1000
LL1-T116-10	4/8/2016	1898	5	33	13	11020	12020	1000
LL1-T116-11	4/8/2016	1898	5	33	13	11060	12060	1000
LL1-T116-12	4/8/2016	1898	5	33	13	11040	12040	1000
			LL1-T116 Total Points:		**12**	**LL1-T116 Total Gallons:**		**12,000**
LL1-T117 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T117-1	4/7/2016	1899	5	33	13	5030	6030	1000
LL1-T117-2	4/7/2016	1899	5	33	13	9020	10020	1000
LL1-T117-3	4/7/2016	1899	5	33	13	9030	10030	1000
LL1-T117-4	4/7/2016	1899	5	33	13	9020	10020	1000
LL1-T117-5	4/7/2016	1899	5	33	13	9060	10060	1000
LL1-T117-6	4/7/2016	1899	5	33	13	9040	10040	1000
LL1-T117-7	4/7/2016	1899	5	33	13	4030	5030	1000
LL1-T117-8	4/7/2016	1899	5	33	13	8020	9020	1000
LL1-T117-9	4/7/2016	1899	5	33	13	8030	9030	1000
LL1-T117-10	4/7/2016	1899	5	33	13	8020	9020	1000
LL1-T117-11	4/7/2016	1899	5	33	13	8060	9060	1000
LL1-T117-12	4/7/2016	1899	5	33	13	8040	9040	1000
			LL1-T117 Total Points:		**12**	**LL1-T117 Total Gallons:**		**12,000**
LL1-T118 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T118-1	4/6-4/7/2016	1900	5	33	13	3030	4030	1000
LL1-T118-2	4/6-4/7/2016	1900	5	33	13	7020	8020	1000
LL1-T118-3	4/6-4/7/2016	1900	5	33	13	7030	8030	1000
LL1-T118-4	4/6-4/7/2016	1900	5	33	13	7020	8020	1000
LL1-T118-5	4/6-4/7/2016	1900	5	33	13	7060	8060	1000
LL1-T118-6	4/6-4/7/2016	1900	5	33	13	7040	8040	1000
LL1-T118-7	4/6/2016	1900	5	33	13	2030	3030	1000
LL1-T118-8	4/6/2016	1900	5	33	13	6020	7020	1000
LL1-T118-9	4/6/2016	1900	5	33	13	6030	7030	1000
LL1-T118-10	4/6/2016	1900	5	33	13	6020	7020	1000
LL1-T118-11	4/6/2016	1900	5	33	13	6060	7060	1000
LL1-T118-12	4/6/2016	1900	5	33	13	6040	7040	1000
			LL1-T118 Total Points:		**12**	**LL1-T118 Total Gallons:**		**12,000**
LL1-T119 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T119-1	4/8/2016	1899	5	33	13	10050	11050	1000
LL1-T119-2	4/8/2016	1899	5	33	13	10030	11030	1000
LL1-T119-3	4/8/2016	1899	5	33	13	10020	11020	1000
LL1-T119-4	4/8/2016	1899	5	33	13	10050	11050	1000
LL1-T119-5	4/8/2016	1899	5	33	13	10050	11050	1000
LL1-T119-6	4/8/2016	1899	5	33	13	55550	56550	1000
LL1-T119-7	4/8/2016	1899	5	33	13	11050	12050	1000
LL1-T119-8	4/8/2016	1899	5	33	13	11030	12030	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL1-T119-9	4/8/2016	1899	5	33	13	11020	12020	1000
LL1-T119-10	4/8/2016	1899	5	33	13	11050	12050	1000
LL1-T119-11	4/8/2016	1899	5	33	13	11050	12050	1000
LL1-T119-12	4/8/2016	1899	5	33	13	56550	57550	1000
LL1-T119 Total Points:					**12**	**LL1-T119 Total Gallons:**		**12,000**
LL1-T120 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T120-1	4/7/2016	1899	5	33	13	8050	9050	1000
LL1-T120-2	4/7/2016	1899	5	33	13	8030	9030	1000
LL1-T120-3	4/7/2016	1899	5	33	13	8020	9020	1000
LL1-T120-4	4/7/2016	1899	5	33	13	8050	9050	1000
LL1-T120-5	4/7/2016	1899	5	33	13	8050	9050	1000
LL1-T120-6	4/7/2016	1899	5	33	13	53550	54550	1000
LL1-T120-7	4/7/2016	1899	5	33	13	9050	10050	1000
LL1-T120-8	4/7/2016	1899	5	33	13	9030	10030	1000
LL1-T120-9	4/7/2016	1899	5	33	13	9020	10020	1000
LL1-T120-10	4/7/2016	1899	5	33	13	9050	10050	1000
LL1-T120-11	4/7/2016	1899	5	33	13	9050	10050	1000
LL1-T120-12	4/7/2016	1899	5	33	13	51550	52550	1000
LL1-T120 Total Points:					**12**	**LL1-T120 Total Gallons:**		**12,000**
LL1-T121 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T121-1	4/6/2016	1900	5	33	13	6050	7050	1000
LL1-T121-2	4/6/2016	1900	5	33	13	6030	7030	1000
LL1-T121-3	4/6/2016	1900	5	33	13	6020	7020	1000
LL1-T121-4	4/6/2016	1900	5	33	13	6050	7050	1000
LL1-T121-5	4/6/2016	1900	5	33	13	6050	7050	1000
LL1-T121-6	4/6/2016	1900	5	33	13	51550	52550	1000
LL1-T121-7	4/7/2016	1900	5	33	13	7050	8050	1000
LL1-T121-8	4/7/2016	1900	5	33	13	7030	8030	1000
LL1-T121-9	4/7/2016	1900	5	33	13	7020	8020	1000
LL1-T121-10	4/7/2016	1900	5	33	13	7050	8050	1000
LL1-T121-11	4/7/2016	1900	5	33	13	7050	8050	1000
LL1-T121-12	4/7/2016	1900	5	33	13	52550	53550	1000
LL1-T121 Total Points:					**12**	**LL1-T121 Total Gallons:**		**12,000**
LL1-T122 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T122-1	4/10/2016	1899	5	33	13	17040	18040	1000
LL1-T122-2	4/10/2016	1899	5	33	13	17060	18060	1000
LL1-T122-3	4/10/2016	1899	5	33	13	17020	18020	1000
LL1-T122-4	4/10/2016	1899	5	33	13	17030	18030	1000
LL1-T122-5	4/10/2016	1899	5	33	13	17020	18020	1000
LL1-T122-6	4/10/2016	1899	5	33	13	13030	14030	1000
LL1-T122-7	4/9/2016	1899	5	33	13	16040	17040	1000
LL1-T122-8	4/9/2016	1899	5	33	13	16060	17060	1000
LL1-T122-9	4/9/2016	1899	5	33	13	16020	17020	1000
LL1-T122-10	4/9/2016	1899	5	33	13	16030	17030	1000
LL1-T122-11	4/9/2016	1899	5	33	13	16020	17020	1000
LL1-T122-12	4/9/2016	1899	5	33	13	12030	13030	1000
LL1-T122 Total Points:					**12**	**LL1-T122 Total Gallons:**		**12,000**
LL1-T123 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								

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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL1-T123-1	4/10-4/11/2016	1898	5	33	13	16050	17050	1000
LL1-T123-2	4/10-4/11/2016	1898	5	33	13	16030	17030	1000
LL1-T123-3	4/10-4/11/2016	1898	5	33	13	16020	17020	1000
LL1-T123-4	4/10-4/11/2016	1898	5	33	13	16050	17050	1000
LL1-T123-5	4/10-4/11/2016	1898	5	33	13	16050	17050	1000
LL1-T123-6	4/10-4/11/2016	1898	5	33	13	61550	62550	1000
LL1-T123-7	4/10/2016	1898	5	33	13	18040	19040	1000
LL1-T123-8	4/10/2016	1898	5	33	13	18060	19060	1000
LL1-T123-9	4/10/2016	1898	5	33	13	18020	19020	1000
LL1-T123-10	4/10/2016	1898	5	33	13	18030	19030	1000
LL1-T123-11	4/10/2016	1898	5	33	13	18020	19020	1000
LL1-T123-12	4/10/2016	1898	5	33	13	14030	15030	1000
			LL1-T123 Total Points:		**12**	**LL1-T123 Total Gallons:**		**12,000**
LL1-T124 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T124-1	4/10/2016	1899	5	33	13	15050	16050	1000
LL1-T124-2	4/10/2016	1899	5	33	13	15030	16030	1000
LL1-T124-3	4/10/2016	1899	5	33	13	15020	16020	1000
LL1-T124-4	4/10/2016	1899	5	33	13	15050	16050	1000
LL1-T124-5	4/10/2016	1899	5	33	13	15050	16050	1000
LL1-T124-6	4/10/2016	1899	5	33	13	60550	61550	1000
LL1-T124-7	4/9-4/10/2016	1899	5	33	13	14050	15050	1000
LL1-T124-8	4/9-4/10/2016	1899	5	33	13	14030	15030	1000
LL1-T124-9	4/9-4/10/2016	1899	5	33	13	14020	15020	1000
LL1-T124-10	4/9-4/10/2016	1899	5	33	13	14050	15050	1000
LL1-T124-11	4/9-4/10/2016	1899	5	33	13	14050	15050	1000
LL1-T124-12	4/9-4/10/2016	1899	5	33	13	59550	60550	1000
			LL1-T124 Total Points:		**12**	**LL1-T124 Total Gallons:**		**12,000**
LL1-T125 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T125-1	4/9/2016	1897	5	33	13	13050	14050	1000
LL1-T125-2	4/9/2016	1897	5	33	13	13030	14030	1000
LL1-T125-3	4/9/2016	1897	5	33	13	13020	14020	1000
LL1-T125-4	4/9/2016	1897	5	33	13	13050	14050	1000
LL1-T125-5	4/9/2016	1897	5	33	13	13050	14050	1000
LL1-T125-6	4/9/2016	1897	5	33	13	58550	59550	1000
LL1-T125-7	4/9/2016	1897	5	33	13	12050	13050	1000
LL1-T125-8	4/9/2016	1897	5	33	13	12030	13030	1000
LL1-T125-9	4/9/2016	1897	5	33	13	12020	13020	1000
LL1-T125-10	4/9/2016	1897	5	33	13	12050	13050	1000
LL1-T125-11	4/9/2016	1897	5	33	13	12050	13050	1000
LL1-T125-12	4/9/2016	1897	5	33	13	57550	58550	1000
			LL1-T125 Total Points:		**12**	**LL1-T125 Total Gallons:**		**12,000**
LL1-T126 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T126-1	4/9/2016	1899	5	33	13	15040	16040	1000
LL1-T126-2	4/9/2016	1899	5	33	13	15060	16060	1000
LL1-T126-3	4/9/2016	1899	5	33	13	15020	16020	1000
LL1-T126-4	4/9/2016	1899	5	33	13	15030	16030	1000
LL1-T126-5	4/9/2016	1899	5	33	13	15020	16020	1000
LL1-T126-6	4/9/2016	1899	5	33	13	11030	12030	1000

TABLE 2-3
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL1-T126-7	4/9/2016	1899	5	33	13	14040	15040	1000
LL1-T126-8	4/9/2016	1899	5	33	13	14060	15060	1000
LL1-T126-9	4/9/2016	1899	5	33	13	14020	15020	1000
LL1-T126-10	4/9/2016	1899	5	33	13	14030	15030	1000
LL1-T126-11	4/9/2016	1899	5	33	13	14020	15020	1000
LL1-T126-12	4/9/2016	1899	5	33	13	10030	11030	1000
			LL1-T126 Total Points:		**12**	**LL1-T126 Total Gallons:**		**12,000**
LL1-T127 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T127-1	4/11/2016	1905	5	38	18	19040	20040	1000
LL1-T127-2	4/11/2016	1905	5	38	18	19060	20060	1000
LL1-T127-3	4/11/2016	1905	5	38	18	19020	20020	1000
LL1-T127-4	4/11/2016	1905	5	38	18	19030	20030	1000
LL1-T127-5	4/11/2016	1905	5	38	18	19020	20020	1000
LL1-T127-6	4/11/2016	1905	5	38	18	15030	16030	1000
LL1-T127-7	4/11/2016	1905	5	38	18	62550	63550	1000
LL1-T127-8	4/11/2016	1905	5	38	18	17050	18050	1000
LL1-T127-9	4/11/2016	1905	5	38	18	17050	18050	1000
LL1-T127-10	4/11/2016	1905	5	38	18	17020	18020	1000
LL1-T127-11	4/11/2016	1905	5	38	18	17030	18030	1000
LL1-T127-12	4/11/2016	1905	5	38	18	17050	18050	1000
			LL1-T127 Total Points:		**12**	**LL1-T27 Total Gallons:**		**12,000**
LL1-T128 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T128-1	4/11/2016	1904	5	38	18	20040	21040	1000
LL1-T128-2	4/11/2016	1904	5	38	18	20060	21060	1000
LL1-T128-3	4/11/2016	1904	5	38	18	20020	21020	1000
LL1-T128-4	4/11/2016	1904	5	38	18	20030	21030	1000
LL1-T128-5	4/11/2016	1904	5	38	18	20020	21020	1000
LL1-T128-6	4/11/2016	1904	5	38	18	16030	17030	1000
LL1-T128-7	4/11/2016	1904	5	38	18	63550	64550	1000
LL1-T128-8	4/11/2016	1904	5	38	18	18050	19050	1000
LL1-T128-9	4/11/2016	1904	5	38	18	18050	19050	1000
LL1-T128-10	4/11/2016	1904	5	38	18	18020	19020	1000
LL1-T128-11	4/11/2016	1904	5	38	18	18050	19050	1000
LL1-T128-12	4/11/2016	1904	5	38	18	18050	19050	1000
LL1-T128-13	4/11-4/12/2016	1904	5	38	18	64550	65550	1000
LL1-T128-14	4/11-4/12/2016	1904	5	38	18	19050	20050	1000
LL1-T128-15	4/11-4/12/2016	1904	5	38	18	19050	20050	1000
LL1-T128-16	4/11-4/12/2016	1904	5	38	18	19020	20020	1000
LL1-T128-17	4/11-4/12/2016	1904	5	38	18	19050	20050	1000
LL1-T128-18	4/11-4/12/2016	1904	5	38	18	19050	20050	1000
			LL1-T128 Total Points:		**18**	**LL1-T27 Total Gallons:**		**18,000**
LL1-T129 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL1-T129-1	4/11/2016	1904	5	38	18	21040	22040	1000
LL1-T129-2	4/11/2016	1904	5	38	18	21060	22060	1000
LL1-T129-3	4/11/2016	1904	5	38	18	21020	22020	1000
LL1-T129-4	4/11/2016	1904	5	38	18	21030	22030	1000
LL1-T129-5	4/11/2016	1904	5	38	18	21020	22020	1000
LL1-T129-6	4/11/2016	1904	5	38	18	17030	18030	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
			LL1-T129 Total Points:		6	LL1-T128 Total Gallons:		6,000
			Load Line 1 Total Points:		252	LL1 Total Gallons:		252,000
Load Line 2 Injection Transects								
LL2-T101 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T101-1	4/25/2016	1906	5	35	15	48050	49050	1000
LL2-T101-2	4/25/2016	1906	5	35	15	48050	49050	1000
LL2-T101-3	4/25/2016	1906	5	35	15	48020	49020	1000
LL2-T101-4	4/25/2016	1906	5	35	15	48050	49050	1000
LL2-T101-5	4/25/2016	1906	5	35	15	48050	49050	1000
LL2-T101-6	4/25/2016	1906	5	35	15	93550	94550	1000
LL2-T101-7	4/25/2016	1906	5	35	15	49050	50050	1000
LL2-T101-8	4/25/2016	1906	5	35	15	49050	50050	1000
LL2-T101-9	4/25/2016	1906	5	35	15	49020	50020	1000
LL2-T101-10	4/25/2016	1906	5	35	15	49050	50050	1000
LL2-T101-11	4/25/2016	1906	5	35	15	49050	50050	1000
LL2-T101-12	4/25/2016	1906	5	35	15	94550	95550	1000
			LL2-T101 Total Points:		12	LL2-T101 Total Gallons:		12,000
LL2-T102 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T102-1	4/24/2016	1906	5	35	15	46050	47050	1000
LL2-T102-2	4/24/2016	1906	5	35	15	46050	47050	1000
LL2-T102-3	4/24/2016	1906	5	35	15	46020	47020	1000
LL2-T102-4	4/24/2016	1906	5	35	15	46050	47050	1000
LL2-T102-5	4/24/2016	1906	5	35	15	46050	47050	1000
LL2-T102-6	4/24/2016	1906	5	35	15	91550	92550	1000
LL2-T102-7	4/25/2016	1906	5	35	15	47050	48050	1000
LL2-T102-8	4/25/2016	1906	5	35	15	47050	48050	1000
LL2-T102-9	4/25/2016	1906	5	35	15	47020	48020	1000
LL2-T102-10	4/25/2016	1906	5	35	15	47050	48050	1000
LL2-T102-11	4/25/2016	1906	5	35	15	47050	48050	1000
LL2-T102-12	4/25/2016	1906	5	35	15	92550	93550	1000
			LL2-T102 Total Points:		12	LL2-T102 Total Gallons:		12,000
LL2-T103 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T103-1	4/24/2016	1906	5	35	15	44050	45050	1000
LL2-T103-2	4/24/2016	1906	5	35	15	44050	45050	1000
LL2-T103-3	4/24/2016	1906	5	35	15	44020	45020	1000
LL2-T103-4	4/24/2016	1906	5	35	15	44050	45050	1000
LL2-T103-5	4/24/2016	1906	5	35	15	44050	45050	1000
LL2-T103-6	4/24/2016	1906	5	35	15	89550	90550	1000
LL2-T103-7	4/24/2016	1906	5	35	15	45050	46050	1000
LL2-T103-8	4/24/2016	1906	5	35	15	45050	46050	1000
LL2-T103-9	4/24/2016	1906	5	35	15	45020	46020	1000
LL2-T103-10	4/24/2016	1906	5	35	15	45050	46050	1000
LL2-T103-11	4/24/2016	1906	5	35	15	45050	46050	1000
LL2-T103-12	4/24/2016	1906	5	35	15	90550	91550	1000
			LL2-T103 Total Points:		12	LL2-T103 Total Gallons:		12,000
LL2-T104 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T104-1	4/24-4/25/2016	1905	5	34	14	6330	7330	1000
LL2-T104-2	4/24-4/25/2016	1905	5	34	14	48020	49020	1000

TABLE 2-3
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL2-T104-3	4/24-4/25/2016	1905	5	34	14	48030	49030	1000
LL2-T104-4	4/24-4/25/2016	1905	5	34	14	48020	49020	1000
LL2-T104-5	4/24-4/25/2016	1905	5	34	14	48060	49060	1000
LL2-T104-6	4/24-4/25/2016	1905	5	34	14	48040	49040	1000
LL2-T104-7	4/25/2016	1905	5	34	14	5330	6330	1000
LL2-T104-8	4/25/2016	1905	5	34	14	47020	48020	1000
LL2-T104-9	4/25/2016	1905	5	34	14	47030	48030	1000
LL2-T104-10	4/25/2016	1905	5	34	14	47020	48020	1000
LL2-T104-11	4/25/2016	1905	5	34	14	47060	48060	1000
LL2-T104-12	4/25/2016	1905	5	34	14	47040	48040	1000
			LL2-T104 Total Points:		**12**	**LL2-T104 Total Gallons:**		**12,000**
LL2-T105 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T105-1	4/25/2016	1905	5	34	14	49040	50040	1000
LL2-T105-2	4/25/2016	1905	5	34	14	49060	50060	1000
LL2-T105-3	4/25/2016	1905	5	34	14	49020	50020	1000
LL2-T105-4	4/25/2016	1905	5	34	14	49030	50030	1000
LL2-T105-5	4/25/2016	1905	5	34	14	49020	50020	1000
LL2-T105-6	4/25/2016	1905	5	34	14	7330	8330	1000
LL2-T105-7	4/25/2016	1905	5	34	14	46040	47040	1000
LL2-T105-8	4/25/2016	1905	5	34	14	46060	47060	1000
LL2-T105-9	4/25/2016	1905	5	34	14	46020	47020	1000
LL2-T105-10	4/25/2016	1905	5	34	14	46030	47030	1000
LL2-T105-11	4/25/2016	1905	5	34	14	46020	47020	1000
LL2-T105-12	4/25/2016	1905	5	34	14	4330	5330	1000
LL2-T105-13	4/25/2016	1905	5	34	14	45040	46040	1000
LL2-T105-14	4/25/2016	1905	5	34	14	45060	46060	1000
LL2-T105-15	4/25/2016	1905	5	34	14	45020	46020	1000
LL2-T105-16	4/25/2016	1905	5	34	14	45030	46030	1000
LL2-T105-17	4/25/2016	1905	5	34	14	45020	46020	1000
LL2-T105-18	4/25/2016	1905	5	34	14	3330	4330	1000
			LL2-T105 Total Points:		**18**	**LL2-T105 Total Gallons:**		**18,000**
LL2-T106 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T106-1	4/22/2016	1906	5	34	14	35030	36030	1000
LL2-T106-2	4/22/2016	1906	5	34	14	39020	40020	1000
LL2-T106-3	4/22/2016	1906	5	34	14	39030	40030	1000
LL2-T106-4	4/22/2016	1906	5	34	14	39020	40020	1000
LL2-T106-5	4/22/2016	1906	5	34	14	39060	40060	1000
LL2-T106-6	4/22/2016	1906	5	34	14	39040	40040	1000
LL2-T106-7	4/22/2016	1906	5	34	14	36030	37030	1000
LL2-T106-8	4/22/2016	1906	5	34	14	40020	41020	1000
LL2-T106-9	4/22/2016	1906	5	34	14	40030	41030	1000
LL2-T106-10	4/22/2016	1906	5	34	14	40020	41020	1000
LL2-T106-11	4/22/2016	1906	5	34	14	40060	41060	1000
LL2-T106-12	4/22/2016	1906	5	34	14	40040	41040	1000
LL2-T106-13	4/22-4/23/2016	1906	5	34	14	37030	38030	1000
LL2-T106-14	4/22-4/23/2016	1906	5	34	14	41020	42020	1000
LL2-T106-15	4/22-4/23/2016	1906	5	34	14	41030	42030	1000
LL2-T106-16	4/22-4/23/2016	1906	5	34	14	41020	42020	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL2-T106-17	4/22-4/23/2016	1906	5	34	14	41060	42060	1000
LL2-T106-18	4/22-4/23/2016	1906	5	34	14	41040	42040	1000
LL2-T106-19	4/23/2016	1906	5	34	14	330	1330	1000
LL2-T106-20	4/23/2016	1906	5	34	14	42020	43020	1000
LL2-T106-21	4/23/2016	1906	5	34	14	42030	43030	1000
LL2-T106-22	4/23/2016	1906	5	34	14	42020	43020	1000
LL2-T106-23	4/23/2016	1906	5	34	14	42060	43060	1000
LL2-T106-24	4/23/2016	1906	5	34	14	42040	43040	1000
			LL2-T106 Total Points:		**24**	**LL2-T106 Total Gallons:**		**24,000**
LL2-T107 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T107-1	4/21-4/22/2016	1906	5	34	14	37040	38040	1000
LL2-T107-2	4/21-4/22/2016	1906	5	34	14	37060	38060	1000
LL2-T107-3	4/21-4/22/2016	1906	5	34	14	37020	38020	1000
LL2-T107-4	4/21-4/22/2016	1906	5	34	14	37030	38030	1000
LL2-T107-5	4/21-4/22/2016	1906	5	34	14	37020	38020	1000
LL2-T107-6	4/21-4/22/2016	1906	5	34	14	33030	34030	1000
LL2-T107-7	4/22/2016	1906	5	34	14	38040	39040	1000
LL2-T107-8	4/22/2016	1906	5	34	14	38060	39060	1000
LL2-T107-9	4/22/2016	1906	5	34	14	38020	39020	1000
LL2-T107-10	4/22/2016	1906	5	34	14	38030	39030	1000
LL2-T107-11	4/22/2016	1906	5	34	14	38020	39020	1000
LL2-T107-12	4/22/2016	1906	5	34	14	34030	35030	1000
LL2-T107-13	4/23/2016	1906	5	34	14	44040	45040	1000
LL2-T107-14	4/23/2016	1906	5	34	14	44060	45060	1000
LL2-T107-15	4/23/2016	1906	5	34	14	44020	45020	1000
LL2-T107-16	4/23/2016	1906	5	34	14	44030	45030	1000
LL2-T107-17	4/23/2016	1906	5	34	14	44020	45020	1000
LL2-T107-18	4/23/2016	1906	5	34	14	2330	3330	1000
LL2-T107-19	4/23/2016	1906	5	34	14	43040	44040	1000
LL2-T107-20	4/23/2016	1906	5	34	14	43060	44060	1000
LL2-T107-21	4/23/2016	1906	5	34	14	43020	44020	1000
LL2-T107-22	4/23/2016	1906	5	34	14	43030	44030	1000
LL2-T107-23	4/23/2016	1906	5	34	14	43020	44020	1000
LL2-T107-24	4/23/2016	1906	5	34	14	1330	2330	1000
			LL2-T107 Total Points:		**24**	**LL2-T107 Total Gallons:**		**24,000**
LL2-T108 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T108-1	4/21/2016	1906	5	34	14	32030	33030	1000
LL2-T108-2	4/21/2016	1906	5	34	14	36020	37020	1000
LL2-T108-3	4/21/2016	1906	5	34	14	36030	37030	1000
LL2-T108-4	4/21/2016	1906	5	34	14	36020	37020	1000
LL2-T108-5	4/21/2016	1906	5	34	14	36060	37060	1000
LL2-T108-6	4/21/2016	1906	5	34	14	36040	37040	1000
LL2-T108-7	4/20/2016	1906	5	34	14	31040	32040	1000
LL2-T108-8	4/20/2016	1906	5	34	14	31060	32060	1000
LL2-T108-9	4/20/2016	1906	5	34	14	31020	32020	1000
LL2-T108-10	4/20/2016	1906	5	34	14	31030	32030	1000
LL2-T108-11	4/20/2016	1906	5	34	14	31020	32020	1000
LL2-T108-12	4/20/2016	1906	5	34	14	27030	28030	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL2-T108-13	4/20/2016	1906	5	34	14	29030	30030	1000
LL2-T108-14	4/20/2016	1906	5	34	14	33020	34020	1000
LL2-T108-15	4/20/2016	1906	5	34	14	33030	34030	1000
LL2-T108-16	4/20/2016	1906	5	34	14	33020	34020	1000
LL2-T108-17	4/20/2016	1906	5	34	14	33060	34060	1000
LL2-T108-18	4/20/2016	1906	5	34	14	33040	34040	1000
LL2-T108-19	4/20/2016	1906	5	34	14	32040	33040	1000
LL2-T108-20	4/20/2016	1906	5	34	14	32060	33060	1000
LL2-T108-21	4/20/2016	1906	5	34	14	32020	33020	1000
LL2-T108-22	4/20/2016	1906	5	34	14	32030	33030	1000
LL2-T108-23	4/20/2016	1906	5	34	14	32020	33020	1000
LL2-T108-24	4/20/2016	1906	5	34	14	28030	29030	1000
			LL2-T108 Total Points:		**24**	**LL2-T108 Total Gallons:**		**24,000**
LL2-T109 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T109-1	4/21/2016	1907	5	34	14	34040	35040	1000
LL2-T109-2	4/21/2016	1907	5	34	14	34060	35060	1000
LL2-T109-3	4/21/2016	1907	5	34	14	34020	35020	1000
LL2-T109-4	4/21/2016	1907	5	34	14	34030	35030	1000
LL2-T109-5	4/21/2016	1907	5	34	14	34020	35020	1000
LL2-T109-6	4/21/2016	1907	5	34	14	30030	31030	1000
LL2-T109-7	4/21/2016	1907	5	34	14	31030	32030	1000
LL2-T109-8	4/21/2016	1907	5	34	14	35020	36020	1000
LL2-T109-9	4/21/2016	1907	5	34	14	35030	36030	1000
LL2-T109-10	4/21/2016	1907	5	34	14	35020	36020	1000
LL2-T109-11	4/21/2016	1907	5	34	14	35060	36060	1000
LL2-T109-12	4/21/2016	1907	5	34	14	35040	36040	1000
LL2-T109-13	4/19-4/20/2016	1907	5	34	14	30040	31040	1000
LL2-T109-14	4/19-4/20/2016	1907	5	34	14	30060	31060	1000
LL2-T109-15	4/19-4/20/2016	1907	5	34	14	30020	31020	1000
LL2-T109-16	4/19-4/20/2016	1907	5	34	14	30030	31030	1000
LL2-T109-17	4/19-4/20/2016	1907	5	34	14	30020	31020	1000
LL2-T109-18	4/19-4/20/2016	1907	5	34	14	26030	27030	1000
			LL2-T109 Total Points:		**18**	**LL2-T109 Total Gallons:**		**18,000**
LL2-T110 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T110-1	4/20/2016	1907	5	36	16	29050	30050	1000
LL2-T110-2	4/20/2016	1907	5	36	16	29050	30050	1000
LL2-T110-3	4/20/2016	1907	5	36	16	29020	30020	1000
LL2-T110-4	4/20/2016	1907	5	36	16	29050	30050	1000
LL2-T110-5	4/20/2016	1907	5	36	16	29050	30050	1000
LL2-T110-6	4/20/2016	1907	5	36	16	74550	75550	1000
LL2-T110-7	4/19/2016	1907	5	36	16	28050	29050	1000
LL2-T110-8	4/19/2016	1907	5	36	16	28050	29050	1000
LL2-T110-9	4/19/2016	1907	5	36	16	28020	29020	1000
LL2-T110-10	4/19/2016	1907	5	36	16	28050	29050	1000
LL2-T110-11	4/19/2016	1907	5	36	16	28050	29050	1000
LL2-T110-12	4/19/2016	1907	5	36	16	73550	74550	1000
			LL2-T110 Total Points:		**12**	**LL2-T110 Total Gallons:**		**12,000**
LL2-T111 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL2-T111-1	4/20/2016	1907	5	36	16	75550	76550	1000
LL2-T111-2	4/20/2016	1907	5	36	16	30050	31050	1000
LL2-T111-3	4/20/2016	1907	5	36	16	30050	31050	1000
LL2-T111-4	4/20/2016	1907	5	36	16	30020	31020	1000
LL2-T111-5	4/20/2016	1907	5	36	16	30050	31050	1000
LL2-T111-6	4/20/2016	1907	5	36	16	30050	31050	1000
LL2-T111-7	4/20/2016	1907	5	36	16	76550	77550	1000
LL2-T111-8	4/20/2016	1907	5	36	16	31050	32050	1000
LL2-T111-9	4/20/2016	1907	5	36	16	31050	32050	1000
LL2-T111-10	4/20/2016	1907	5	36	16	31020	32020	1000
LL2-T111-11	4/20/2016	1907	5	36	16	31050	32050	1000
LL2-T111-12	4/20/2016	1907	5	36	16	31050	32050	1000
			LL2-T111 Total Points:		**12**	**LL2-T111 Total Gallons:**		**12,000**
LL2-T112 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T112-1	4/21/2016	1906	5	36	16	78550	79550	1000
LL2-T112-2	4/21/2016	1906	5	36	16	33050	34050	1000
LL2-T112-3	4/21/2016	1906	5	36	16	33050	34050	1000
LL2-T112-4	4/21/2016	1906	5	36	16	33020	34020	1000
LL2-T112-5	4/21/2016	1906	5	36	16	33050	34050	1000
LL2-T112-6	4/21/2016	1906	5	36	16	33050	34050	1000
LL2-T112-7	4/20-4/21/2016	1906	5	36	16	77550	78550	1000
LL2-T112-8	4/20-4/21/2016	1906	5	36	16	32050	33050	1000
LL2-T112-9	4/20-4/21/2016	1906	5	36	16	32050	33050	1000
LL2-T112-10	4/20-4/21/2016	1906	5	36	16	32020	33020	1000
LL2-T112-11	4/20-4/21/2016	1906	5	36	16	32050	33050	1000
LL2-T112-12	4/20-4/21/2016	1906	5	36	16	32050	33050	1000
			LL2-T112 Total Points:		**12**	**LL2-T112 Total Gallons:**		**12,000**
LL2-T113 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T113-1	4/21/2016	1906	5	36	16	34050	35050	1000
LL2-T113-2	4/21/2016	1906	5	36	16	34050	35050	1000
LL2-T113-3	4/21/2016	1906	5	36	16	34020	35020	1000
LL2-T113-4	4/21/2016	1906	5	36	16	34050	35050	1000
LL2-T113-5	4/21/2016	1906	5	36	16	34050	35050	1000
LL2-T113-6	4/21/2016	1906	5	36	16	79550	80550	1000
LL2-T113-7	4/21/2016	1906	5	36	16	35050	36050	1000
LL2-T113-8	4/21/2016	1906	5	36	16	35050	36050	1000
LL2-T113-9	4/21/2016	1906	5	36	16	35020	36020	1000
LL2-T113-10	4/21/2016	1906	5	36	16	35050	36050	1000
LL2-T113-11	4/21/2016	1906	5	36	16	35050	36050	1000
LL2-T113-12	4/21/2016	1906	5	36	16	80550	81550	1000
			LL2-T113 Total Points:		**12**	**LL2-T113 Total Gallons:**		**12,000**
LL2-T114 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T114-1	4/22/2016	1907	5	36	16	82550	83550	1000
LL2-T114-2	4/22/2016	1907	5	36	16	37050	38050	1000
LL2-T114-3	4/22/2016	1907	5	36	16	37050	38050	1000
LL2-T114-4	4/22/2016	1907	5	36	16	37020	38020	1000
LL2-T114-5	4/22/2016	1907	5	36	16	37050	38050	1000
LL2-T114-6	4/22/2016	1907	5	36	16	37050	38050	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
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Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL2-T114-7	4/22/2016	1907	5	36	16	81550	82550	1000
LL2-T114-8	4/22/2016	1907	5	36	16	36050	37050	1000
LL2-T114-9	4/22/2016	1907	5	36	16	36050	37050	1000
LL2-T114-10	4/22/2016	1907	5	36	16	36020	37020	1000
LL2-T114-11	4/22/2016	1907	5	36	16	36050	37050	1000
LL2-T114-12	4/22/2016	1907	5	36	16	36050	37050	1000
			LL2-T114 Total Points:		**12**	**LL2-T114 Total Gallons:**		**12,000**
LL2-T115 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T115-1	4/22/2016	1906	5	36	16	83550	84550	1000
LL2-T115-2	4/22/2016	1906	5	36	16	38050	39050	1000
LL2-T115-3	4/22/2016	1906	5	36	16	38050	39050	1000
LL2-T115-4	4/22/2016	1906	5	36	16	38020	39020	1000
LL2-T115-5	4/22/2016	1906	5	36	16	38050	39050	1000
LL2-T115-6	4/22/2016	1906	5	36	16	38050	39050	1000
LL2-T115-7	4/22/2016	1906	5	36	16	84550	85550	1000
LL2-T115-8	4/22/2016	1906	5	36	16	39050	40050	1000
LL2-T115-9	4/22/2016	1906	5	36	16	39050	40050	1000
LL2-T115-10	4/22/2016	1906	5	36	16	39020	40020	1000
LL2-T115-11	4/22/2016	1906	5	36	16	39050	40050	1000
LL2-T115-12	4/22/2016	1906	5	36	16	39050	40050	1000
			LL2-T115 Total Points:		**12**	**LL2-T115 Total Gallons:**		**12,000**
LL2-T116 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T116-1	4/23/2016	1907	5	36	16	86550	87550	1000
LL2-T116-2	4/23/2016	1907	5	36	16	41050	42050	1000
LL2-T116-3	4/23/2016	1907	5	36	16	41050	42050	1000
LL2-T116-4	4/23/2016	1907	5	36	16	41020	42020	1000
LL2-T116-5	4/23/2016	1907	5	36	16	41050	42050	1000
LL2-T116-6	4/23/2016	1907	5	36	16	41050	42050	1000
LL2-T116-7	4/23/2016	1907	5	36	16	85550	86550	1000
LL2-T116-8	4/23/2016	1907	5	36	16	40050	41050	1000
LL2-T116-9	4/23/2016	1907	5	36	16	40050	41050	1000
LL2-T116-10	4/23/2016	1907	5	36	16	40020	41020	1000
LL2-T116-11	4/23/2016	1907	5	36	16	40050	41050	1000
LL2-T116-12	4/23/2016	1907	5	36	16	40050	41050	1000
			LL2-T116 Total Points:		**12**	**LL2-T116 Total Gallons:**		**12,000**
LL2-T117 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T117-1	4/23/2016	1907	5	36	16	87550	88550	1000
LL2-T117-2	4/23/2016	1907	5	36	16	42050	43050	1000
LL2-T117-3	4/23/2016	1907	5	36	16	42050	43050	1000
LL2-T117-4	4/23/2016	1907	5	36	16	42020	43020	1000
LL2-T117-5	4/23/2016	1907	5	36	16	42050	43050	1000
LL2-T117-6	4/23/2016	1907	5	36	16	42050	43050	1000
LL2-T117-7	4/23-4/24/2016	1907	5	36	16	88550	89550	1000
LL2-T117-8	4/23-4/24/2016	1907	5	36	16	43050	44050	1000
LL2-T117-9	4/23-4/24/2016	1907	5	36	16	43050	44050	1000
LL2-T117-10	4/23-4/24/2016	1907	5	36	16	43020	44020	1000
LL2-T117-11	4/23-4/24/2016	1907	5	36	16	43050	44050	1000
LL2-T117-12	4/23-4/24/2016	1907	5	36	16	43050	44050	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
2016 ANNUAL REPORT

Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
			LL2-T117 Total Points:		**12**	**LL2-T117 Total Gallons:**		**12,000**
LL2-T118 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T118-1	4/13/2016	1904	5	36	16	21030	22030	1000
LL2-T118-2	4/13/2016	1904	5	36	16	25020	26020	1000
LL2-T118-3	4/13/2016	1904	5	36	16	25030	26030	1000
LL2-T118-4	4/13/2016	1904	5	36	16	25020	26020	1000
LL2-T118-5	4/13/2016	1904	5	36	16	25060	26060	1000
LL2-T118-6	4/13/2016	1904	5	36	16	25040	26040	1000
LL2-T118-7	4/13/2016	1904	5	36	16	23050	24050	1000
LL2-T118-8	4/13/2016	1904	5	36	16	23050	24050	1000
LL2-T118-9	4/13/2016	1904	5	36	16	23020	24020	1000
LL2-T118-10	4/13/2016	1904	5	36	16	23050	24050	1000
LL2-T118-11	4/13/2016	1904	5	36	16	23050	24050	1000
LL2-T118-12	4/13/2016	1904	5	36	16	68550	69550	1000
			LL2-T118 Total Points:		**12**	**LL2-T118 Total Gallons:**		**12,000**
LL2-T119 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T119-1	4/19/2016	1905	5	36	16	24030	25030	1000
LL2-T119-2	4/19/2016	1905	5	36	16	28020	29020	1000
LL2-T119-3	4/19/2016	1905	5	36	16	28030	29030	1000
LL2-T119-4	4/19/2016	1905	5	36	16	28020	29020	1000
LL2-T119-5	4/19/2016	1905	5	36	16	28060	29060	1000
LL2-T119-6	4/19/2016	1905	5	36	16	28030	29030	1000
LL2-T119-7	4/18-4/19/2016	1905	5	36	16	23030	24030	1000
LL2-T119-8	4/18-4/19/2016	1905	5	36	16	27020	28020	1000
LL2-T119-9	4/18-4/19/2016	1905	5	36	16	27030	28030	1000
LL2-T119-10	4/18-4/19/2016	1905	5	36	16	27020	28020	1000
LL2-T119-11	4/18-4/19/2016	1905	5	36	16	27060	28060	1000
LL2-T119-12	4/18-4/19/2016	1905	5	36	16	27040	28040	1000
			LL2-T119 Total Points:		**12**	**LL2-T119 Total Gallons:**		**12,000**
LL2-T120 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T120-1	4/18/2016	1905	5	36	16	26040	27040	1000
LL2-T120-2	4/18/2016	1905	5	36	16	26060	27060	1000
LL2-T120-3	4/18/2016	1905	5	36	16	26020	27020	1000
LL2-T120-4	4/18/2016	1905	5	36	16	26030	27030	1000
LL2-T120-5	4/18/2016	1905	5	36	16	26020	27020	1000
LL2-T120-6	4/18/2016	1905	5	36	16	23030	24030	1000
LL2-T120-7	4/19/2016	1905	5	36	16	29040	30040	1000
LL2-T120-8	4/19/2016	1905	5	36	16	29060	30060	1000
LL2-T120-9	4/19/2016	1905	5	36	16	29020	30020	1000
LL2-T120-10	4/19/2016	1905	5	36	16	29030	30030	1000
LL2-T120-11	4/19/2016	1905	5	36	16	29020	30020	1000
LL2-T120-12	4/19/2016	1905	5	36	16	25030	26030	1000
			LL2-T120 Total Points:		**12**	**LL2-T120 Total Gallons:**		**12,000**
LL2-T121 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T121-1	4/18/2016	1905	5	36	16	69550	70550	1000
LL2-T121-2	4/18/2016	1905	5	36	16	24050	25050	1000
LL2-T121-3	4/18/2016	1905	5	36	16	24050	25050	1000
LL2-T121-4	4/18/2016	1905	5	36	16	24020	25020	1000

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
2016 ANNUAL REPORT

Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL2-T121-5	4/18/2016	1905	5	36	16	24050	25050	1000
LL2-T121-6	4/18/2016	1905	5	36	16	24050	25050	1000
LL2-T121-7	4/18/2016	1905	5	36	16	70550	71550	1000
LL2-T121-8	4/18/2016	1905	5	36	16	25050	26050	1000
LL2-T121-9	4/18/2016	1905	5	36	16	25050	26050	1000
LL2-T121-10	4/18/2016	1905	5	36	16	25020	26020	1000
LL2-T121-11	4/18/2016	1905	5	36	16	25050	26050	1000
LL2-T121-12	4/18/2016	1905	5	36	16	25050	26050	1000
			LL2-T121 Total Points:		**12**	**LL2-T121 Total Gallons:**		**12,000**
LL2-T122 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T122-1	4/19/2016	1904	5	36	16	72550	73550	1000
LL2-T122-2	4/19/2016	1904	5	36	16	27050	28050	1000
LL2-T122-3	4/19/2016	1904	5	36	16	27050	28050	1000
LL2-T122-4	4/19/2016	1904	5	36	16	27020	28020	1000
LL2-T122-5	4/19/2016	1904	5	36	16	27050	28050	1000
LL2-T122-6	4/19/2016	1904	5	36	16	27050	28050	1000
LL2-T122-7	4/19/2016	1904	5	36	16	71550	72550	1000
LL2-T122-8	4/19/2016	1904	5	36	16	26050	27050	1000
LL2-T122-9	4/19/2016	1904	5	36	16	26050	27050	1000
LL2-T122-10	4/19/2016	1904	5	36	16	26020	27020	1000
LL2-T122-11	4/19/2016	1904	5	36	16	26050	27050	1000
LL2-T122-12	4/19/2016	1904	5	36	16	26050	27050	1000
			LL2-T122 Total Points:		**12**	**LL2-T122 Total Gallons:**		**12,000**
LL2-T123 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T123-1	4/12-4/13/2016	1907	5	38	18	22050	23050	1000
LL2-T123-2	4/12-4/13/2016	1907	5	38	18	22050	23050	1000
LL2-T123-3	4/12-4/13/2016	1907	5	38	18	22020	23020	1000
LL2-T123-4	4/12-4/13/2016	1907	5	38	18	22050	23050	1000
LL2-T123-5	4/12-4/13/2016	1907	5	38	18	22050	23050	1000
LL2-T123-6	4/12-4/13/2016	1907	5	38	18	67550	68550	1000
LL2-T123-7	4/12/2016	1907	5	38	18	21050	22050	1000
LL2-T123-8	4/12/2016	1907	5	38	18	21050	22050	1000
LL2-T123-9	4/12/2016	1907	5	38	18	21020	22020	1000
LL2-T123-10	4/12/2016	1907	5	38	18	21050	22050	1000
LL2-T123-11	4/12/2016	1907	5	38	18	21050	22050	1000
LL2-T123-12	4/12/2016	1907	5	38	18	66550	67550	1000
LL2-T123-13	4/12/2016	1907	5	38	18	20050	21050	1000
LL2-T123-14	4/12/2016	1907	5	38	18	20050	21050	1000
LL2-T123-15	4/12/2016	1907	5	38	18	20020	21020	1000
LL2-T123-16	4/12/2016	1907	5	38	18	20050	21050	1000
LL2-T123-17	4/12/2016	1907	5	38	18	20050	21050	1000
LL2-T123-18	4/12/2016	1907	5	38	18	65550	66550	1000
			LL2-T123 Total Points:		**18**	**LL2-T123 Total Gallons:**		**18,000**

TABLE 2-3
SUBSURFACE INJECTION SUMMARY
2016 ANNUAL REPORT

Injection Transect Point ID	Date(s)	Ground Elevation[1] (feet amsl)	Number of Intervals	Starting Depth (feet bgs)	Ending Depth (feet bgs)	Meter Start	Meter End	Total Volume (gal)
LL2-T124 (Wesblend 66-10 9.8% by volume – 1000 gallons per point – 15-foot point spacing)								
LL2-T124-1	4/12/2016	1904	5	38	18	18030	19030	1000
LL2-T124-2	4/12/2016	1904	5	38	18	22020	23020	1000
LL2-T124-3	4/12/2016	1904	5	38	18	22030	23030	1000
LL2-T124-4	4/12/2016	1904	5	38	18	22020	23020	1000
LL2-T124-5	4/12/2016	1904	5	38	18	22060	23060	1000
LL2-T124-6	4/12/2016	1904	5	38	18	22040	23040	1000
LL2-T124-7	4/12/2016	1904	5	38	18	19030	20030	1000
LL2-T124-8	4/12/2016	1904	5	38	18	23020	24020	1000
LL2-T124-9	4/12/2016	1904	5	38	18	23030	24030	1000
LL2-T124-10	4/12/2016	1904	5	38	18	23020	24020	1000
LL2-T124-11	4/12/2016	1904	5	38	18	23060	24060	1000
LL2-T124-12	4/12/2016	1904	5	38	18	23040	24040	1000
LL2-T124-13	4/12/2016	1904	5	38	18	20030	21030	1000
LL2-T124-14	4/12/2016	1904	5	38	18	24020	25020	1000
LL2-T124-15	4/12/2016	1904	5	38	18	24030	25030	1000
LL2-T124-16	4/12/2016	1904	5	38	18	24020	25020	1000
LL2-T124-17	4/12/2016	1904	5	38	18	24060	25060	1000
LL2-T124-18	4/12/2016	1904	5	38	18	24040	25040	1000
				LL2-T124 Total Points:	**18**		**LL2-T124 Total Gallons:**	**18,000**
				Load Line 2 Total Points:	**348**		**LL2 Total Gallons:**	**348,000**

Notes:

[1]Elevation datum based on National Geodetic Vertical Datum of 1929.

% = percent

amsl = above mean sea level

bgs= below ground surface

gal = gallon

ID = identification number

LL = Load Line

T = transect

Load Line 1 Total Points:	**252**
Load Line 2 Total Points:	**348**
Overall Total Points:	**600**
Load Line 1 Total Gallons:	**252,000**
Load Line 2 Total Gallons:	**348,000**
Overall Total Gallons:	**600,000**

TABLE 2-4
WATER LEVEL MEASUREMENT LOCATIONS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
OU1 Off-Post Monitoring Wells				
NW020	1898.51	15-25	1895.78	27.88
NW021	1898.76	37-42	1895.9	45.20
NW022	1898.68	59-64	1896.0	66.58
NW030	1890.41	10-20	1890.0	20.42
NW031	1890.65	32-37	1890.0	37.84
NW032	1890.40	57-62	1890.0	62.54
NW050	1887.20	10-20	NA	20.14
NW051	1887.38	30-35	NA	34.52
NW052	1886.77	55-60	NA	60.73
NW060	1889.18	10-20	NA	20.05
NW061	1888.80	40-45	NA	45.34
NW062	1888.97	58-63	NA	63.14
NW070	1884.77	10-20	NA	20.68
NW071	1884.59	55-60	NA	60.16
NW080	1885.28	8-18	1882.31	21.06
NW081R	1884.85	35-45	1882.08	47.75
NW082R	1884.86	46-56	1882.08	59.49
NW100	1883.37	10-20	NA	20.11
NW101	1883.55	35-40	NA	40.72
NW102	1883.46	55-60	NA	59.65
NW120	1877.31	10-20	NA	NA
NW121	1877.22	53-58	NA	57.44
NW122	1877.16	83-88	NA	87.38
NW130R	1871.09	8-18	NA	17.92
NW131R	1871.17	33-38	NA	38.22
NW132R	1871.33	52-57	NA	57.42
CA210	1888.15	5-15	NA	16.83
CA211	1888.22	30-40	NA	42.89
CA212	1888.17	54-64	NA	66.98
CA213	1888.07	77-87	NA	89.81
CA240	1885.83	5-15	NA	17.72
CA241	1885.23	27-37	NA	39.74
CA242	1885.65	51-61	NA	63.57
CA250	1877.21	5-15	NA	15.04
CA251	1877.25	30-40	NA	40.05
CA252	1877.14	48-58	NA	57.35
CA253	1881.77	74-84	NA	86.65
CA270	1871.06	5-15	NA	14.92
CA271	1870.30	28-38	NA	37.77
CA272	1870.29	46-56	NA	55.75
CA273	1871.24	73-83	NA	84.57
CA280	1878.22	7-17	NA	18.58
CA281	1878.23	31-41	NA	43.66
CA282	1877.91	54-64	NA	68.06
CA290R	1867.50	8-18	NA	18.29
CA291R	1867.49	27-37	NA	37.47
CA292R	1867.34	48-58	NA	56.98
CA310	1869.66	5-15	NA	17.49
CA311	1869.51	30-40	NA	42.23
CA312	1869.18	48-58	NA	60.2

TABLE 2-4
WATER LEVEL MEASUREMENT LOCATIONS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
CA313	1868.94	73-83	NA	86.28
CA322	1867.07	47-57	NA	57.52
CA330	1866.15	8-18	NA	20.28
CA331	1866.12	29-34	NA	36.84
CA332	1866.31	44-54	NA	56.09
CA342	1864.43	45-55	NA	57.85
CA343	1864.30	70-80	NA	83.3
OU1 On-Post Monitoring Wells				
G0016	1910.64	14-29	1908.10	31.88
G0017	1910.60	16-31	1907.9	33.87
G0018	1906.26	18-33	1903.5	35.88
G0021	1900.64	19-34	1897.99	37.07
G0022	1899.16	18-33	1896.4	34.94
G0023	1901.71	19-34	1899.0	35.87
G0024	1896.00	16-31	1893.1	33.37
G0028	1918.35	22-37	NA	39.60
G0044	1918.95	11-26	NA	28.26
G0045	1910.10	45-55	1908.30	58.54
G0048	1900.80	6-16	1899.0	17.90
G0049	1901.28	46-56	1899.3	58.36
G0063	1910.75	3-18	1908.54	21.02
G0066R	1909.49	20-30	1907.5	32.36
G0067	1901.47	5-20	1899.6	22.49
G0070	1901.31	75-80	1898.8	82.73
G0075	1901.22	25-35	1899.2	37.73
G0076	1901.02	54-64	1898.9	65.29
G0077	1896.38	25-35	1893.9	37.69
G0078	1896.34	50-60	1894.1	62.85
G0079	1901.42	8-18	1899.0	19.61
G0080	1899.38	25-35	1896.8	37.80
G0081	1901.60	28-38	1899.1	41.30
G0082	1901.17	28-38	1898.7	41.05
G0083	1897.86	21-31	1895.4	33.47
G0084	1906.97	20-30	1904.6	32.88
G0085	1905.79	20-30	1903.5	32.98
G0086	1897.25	28-38	1895.8	40.25
G0087	1898.00	25-35	1895.7	37.51
G0088	1898.44	25-35	1896.0	37.42
G0089	1899.75	25-35	1897.3	37.96
G0090	1899.90	25-35	1897.3	37.84
G0091	1896.88	20-30	1894.8	31.88
G0092	1897.02	40-50	1894.7	52.80
G0093	1899.47	20-30	1897.14	32.11
G0094	1903.72	15-25	1901.47	27.48
G0095	1910.24	15-25	1908.6	27.07
G0096	1905.94	15-25	1903.3	27.94
G0097	1903.62	15-25	1901.1	27.79
G0098	1903.23	15-25	1900.6	27.83
G0099	1903.36	15-25	1900.7	27.44
G0100	1910.46	15-25	1907.8	27.84
G0101	1910.64	15-25	1907.9	27.92

TABLE 2-4
WATER LEVEL MEASUREMENT LOCATIONS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
G0102	1912.20	15-25	1908.91	28.16
G0103	1912.31	14-24	1908.92	28.23
G0104	1911.55	15-25	1908.74	28.03
G0105	1911.41	15-25	1908.28	28.16
G0106	1912.15	15-25	1909.29	28.04
G0107	1911.38	15-25	1908.36	28.31
G0108	1902.84	15-25	1900.2	27.78
G0109	1901.24	15-25	1898.9	27.68
G0110	1901.91	15-25	1899.0	28.29
G0111	1911.94	15-25	1909.6	27.54
G0112	1901.06	15-25	1898.02	27.95
G0113	1903.06	15-25	1900.11	28.01
G0114	1901.92	15-25	1899.19	27.03
G0115	1908.41	20-30	1906.57	32.20
G0116	1904.19	20-30	1901.86	33.21
G0117	1905.50	20-30	1902.73	32.02
G0118	1901.28	15-25	1898.66	27.59
G0119	1909.16	20-30	1906.29	32.39
G0120	1904.91	20-30	1902.3	32.34
G0121	1909.10	20-30	1902.95	33.45
PZ001	1918.60	10-30	NA	32.89
PZ004	1916.69	10-30	NA	32.9
PZ005	1916.09	10-30	NA	32.91
PZ007	1909.49	10-30	1907.5	32.84
PZ009	1907.02	10-30	1904.9	32.88
PZ010	1907.31	10-30	1905.3	33.23
PZ011	1906.56	10-30	1904.9	32.80
PZ012	1906.92	10-30	1904.7	32.83
PZ013	1905.29	10-30	1902.3	32.87
PZ014	1905.21	10-30	1903.1	32.86
PZ015	1901.71	10-30	1899.6	32.84
PZ016	1901.62	10-30	1899.4	32.78
PZ017R	1895.17	10-30	1892.9	32.39
PZ018	1896.88	10-30	1894.7	31.92
PZ019	1901.30	10-30	1898.9	32.30
PZ020	1899.25	10-30	1897.0	32.35
EW7	1895.95	15-55	1894.0	NA
EW4-OW4A	1909.85	31-51	NA	52.93
EW4-OW4B	1910.11	31-51	NA	53.44
EW4-OW4C	1909.91	31-51	NA	53.20
EW5-OW5A	1907.88	29-59	NA	60.80
EW5-OW5B	1908.38	29-59	NA	60.99
EW5-OW5C	1908.11	29-59	NA	60.90
EW6-OW6A	1902.68	29-54	NA	55.96
EW6-OW6B	1902.70	29-54	NA	56.64
EW6-OW6C	1902.96	29-54	NA	56.71
EW7-OW7A	1896.19	25-50	NA	52.83
EW7-OW7B	1896.53	25-50	NA	52.25
EW7-OW7C	1894.48	25-50	NA	56.05

TABLE 2-4
WATER LEVEL MEASUREMENT LOCATIONS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
OU3 On-Post Monitoring Wells				
G0050	1902.29	NA	1900.6	25.24
G0051	1902.22	NA	1900.4	25.45
G0053	1902.88	NA	1901.1	25.08
G0069	1900.02	NA	1898.1	25.22
SAMW1	1899.91	NA	1899.91	22.17
SHGW02	1902.50	6-21	1902.5	24.18
SHGW03	1901.33	6-21	1901.33	23.72
SHGW04	1899.82	16-21	1899.82	23.02

Notes:

[1]Elevation datum based on National Geodetic Vertical Datum of 1929.

amsl = above mean sea level

bgs = below ground surface

btoc= below top of casing

ft = feet

ID = identification number

NA = not available

OU = Operable Unit

PZ = piezometer

TABLE 2-5
OU1 ON-POST GROUNDWATER MONITORING WELLS AND PIEZOMETERS SAMPLED
2016 ANNUAL REPORT

Well Number	Sample Date	Explosives (including MNX)	Field MNA Parameters[1]	Laboratory MNA Parameters[2]	Field MS/MSD Sample ID[3]	Field QC Sample ID[3]
G0017	8/8/2016	X	X	X		
G0022	8/16/2016	X	X	X		G0222-16A
G0023	8/15/2016	X	X	X		
G0024	8/9/2016	X	X	X		
G0044	8/8/2016	X	X	X		
G0045	8/8/2016	X	X	X		
G0048			Dry[4]			
G0049	8/15/2016	X	X	X		
G0066R	8/8/2016	X	X	X		
G0067	8/16/2016	X	X	X		
G0070	8/10/2016	X	X	X	G0070-16A MS/MSD	
G0075	8/10/2016	X	X	X		
G0076	8/10/2016	X	X	X		
G0077	8/9/2016	X	X	X		
G0078	8/9/2016	X	X	X		
G0079			Dry[4]			
G0080	8/16/2016	X	X	X		
G0081	8/11/2016	X	X	X		
G0082	8/12/2016	X	X	X		
G0083	8/16/2016	X	X	X		
G0084	8/9/2016	X	X	X		
G0085	8/15/2016	X	X	X		G0285-16A
G0086	8/11/2016	X	X	X		
G0087	8/9/2016	X	X	X		
G0088	8/16/2016	X	X	X		
G0089	8/8/2016	X	X	X		
G0090	8/12/2016	X	X	X		
G0091	8/16/2016	X	X	X		
G0092	8/16/2016	X	X	X		
G0093	8/15/2016	X	X	X		
G0094	8/12/2016	X	X	X		
G0095	8/4/2016	X	X	X		
G0096	8/10/2016	X	X	X		
G0097	8/8/2016	X	X	X		
G0098	8/15/2016	X	X	X		
G0099	8/11/2016	X	X	X		
G0100	8/4/2016	X	X	X		
G0101	8/4/2016	X	X	X		
G0102	8/12/2016	X	X	X	G0102-16A MS/MSD	
G0103	8/8/2016	X	X	X		
G0104	8/12/2016	X	X	X		
G0105	8/3/2016	X	X	X		
G0106	8/3/2016	X	X	X		
G0107	8/3/2016	X	X	X		
G0108	8/9/2016	X	X	X		
G0109	8/16/2016	X	X	X		
G0110	8/16/2016	X	X	X		
G0111	8/4/2016	X	X	X		

TABLE 2-5
OU1 ON-POST GROUNDWATER MONITORING WELLS AND PIEZOMETERS SAMPLED
2016 ANNUAL REPORT

Well Number	Sample Date	Explosives (including MNX)	Field MNA Parameters[1]	Laboratory MNA Parameters[2]	Field MS/MSD Sample ID[3]	Field QC Sample ID[3]
G0112	8/10/2016	X	X	X		
G0113	8/10/2016	X	X	X		
G0114	8/15/2016	X	X	X		
G0115	8/4/2016	X	X	X		
G0116	8/5/2016	X	X	X		
G0117	8/10/2016	X	X	X		
G0118	8/16/2016	X	X	X		
G0119	8/10/2016	X	X	X		
G0120	8/9/2016	X	X	X		
G0121*	11/30/2016	X	X			
PZ001	8/4/2016	X	X	X	PZ001-16A MS/MSD	
PZ004	8/4/2016	X	X	X		
PZ005	8/8/2016	X	X	X		
PZ007	8/5/2015	X	X	X	PZ007-16A MS/MSD	
PZ009	8/5/2016	X	X	X		
PZ010	8/5/2016	X	X	X		
PZ011	8/8/2016	X	X	X		
PZ012	8/8/2016	X	X	X		
PZ013	8/9/2016	X	X	X		
PZ014	8/9/2016	X	X	X		
PZ015	8/12/2016	X	X	X		
PZ016	8/12/2016	X	X	X		
PZ017R	8/9/2016	X	X	X		PZ021-16A
PZ018	8/9/2016	X	X	X		
PZ019	8/10/2016	X	X	X		
PZ020	8/12/2016	X	X	X		

Notes:

*Monitoing well G0121 was installed in November 2016 and sampled for explosives (inlcuding MNX) and field MNA parameters only.

[1]Field MNA parameters included: dissolved oxygen, oxidation/reduction potential, ferrous iron, specific conductance, turbidity, pH, and temperature.

[2]Laboratory MNA parameters included: methane, total Kjeldahl nitrogen, nitrate/nitrite, ammonia, sulfate, sulfide, dissolved organic carbon, and alkalinity.

[3]QC duplicate and MS/MSD samples were analyzed for the full suite of laboratory parameters.

[4]Well not sampled due to insufficient water amount to collect.

DUP = duplicate sample

ID = identification number

MNX = mono-nitroso-RDX

MS/MSD = matrix spike/matrix spike duplicate

MNA = monitored natural attenuation

OU = Operable Unit

QC = quality control

TABLE 2-6
OU1 OFF-POST GROUNDWATER MONITORING WELLS SAMPLED
2016 ANNUAL REPORT

Well Number	Sample Date	Explosives (including MNX)	Field MNA Parameters[1]	Laboratory MNA Parameters[2]	Field MS/MSD Sample ID[3]	Field QC Sample ID[3]
NW020	8/5/2016	X	X			
NW021	8/5/2016	X	X			NW023-16A
NW022	8/5/2016	X	X			
NW080	8/4/2016	X	X			
NW081R	8/4/2016	X	X			
NW082R	8/4/2016	X	X		NW082R-16A MS/MSD	
CA270	8/3/2016	X	X			
CA271	8/3/2016	X	X			
CA272	8/3/2016	X	X			
CA273	8/3/2016	X	X			
CA290R	8/3/2016	X	X			
CA291R	8/3/2016	X	X			
CA292R	8/3/2016	X	X			
CA310	8/2/2016	X	X			
CA311	8/2/2016	X	X			
CA312	8/2/2016	X	X			CA314-16A
CA313	8/2/2016	X	X			
CA330	8/2/2016	X	X		CA330-16A MS/MSD	
CA331	8/2/2016	X	X			
CA332	8/2/2016	X	X			
CA342	8/3/2016	X	X			
CA343	8/3/2016	X	X			

Notes:

[1]Field MNA parameters included: dissolved oxygen, oxidation/reduction potential, ferrous iron, specific conductance, turbidity, pH, and temperature.

[2]Laboratory MNA parameters included: methane, total Kjeldahl nitrogen, nitrate/nitrite, ammonia, sulfate, sulfide, dissolved organic carbon, and alkalinity. Laboratory MNA parameters were not collected at Off-Post wells in 2016.

[3]QC duplicate sample as analyzed for the full suite of laboratory parameters.

[4]Well not sampled due to insufficient water amount to collect.

DUP = duplicate sample

ID = identification number

MNX = mono-nitroso-RDX

MS/MSD = matrix spike/matrix spike duplicate

MNA = monitored natural attenuation

OU = Operable Unit

QC = quality control

TABLE 2-7
OU3 SHOP AREA GROUNDWATER MONITORING WELLS SAMPLED
2016 ANNUAL REPORT

Well Number	Sample Date	VOCs (including Freon® 113)	TPH-DRO	Field MNA Parameters[1]	Laboratory MNA Parameters[2]	Field MS/MSD Sample ID[3]	Field QC Sample ID[3]
G0053	8/15/2016	X		X	X		
G0069	8/15/2016	X	X	X	X		
SAMW1	8/15/2016	X		X	X		
SHGW02	8/15/2016	X		X	X		SHGW05-16A
SHGW03	8/15/2016	X	X	X	X		
SHGW04	8/15/2016	X	X	X	X		

Notes:

[1]Field MNA parameters included: dissolved oxygen, oxidation/reduction potential, ferrous iron, specific conductance, turbidity, pH, and temperature.

[2]Laboratory MNA parameters included: methane, ethane, ethene, nitrate/nitrite, sulfate, and alkalinity.

[3]QC duplicate and MS/MSD samples were analyzed for the full suite of laboratory parameters.

DUP = duplicate sample

Freon® 113 = 1,1,2-trichloro-1,2,2-trifluoroethane

ID = identification number

MS/MSD = matrix spike/matrix spike duplicate

MNA = monitored natural attenuation

QC = quality control

TPH-DRO = total petroleum hydrocarbons-diesel range organics

VOC = volatile organic compound

TABLE 2-8
MONITORING WELL INSTALLATION LOCATION AND CONSTRUCTION DETAILS
2016 ANNUAL REPORT

Monitoring Well Location ID	Approximate Screened Interval (feet bgs)	Screened Interval Formation	Property Ownership	Coordinates[1]		Technical Rationale
				Northing	Easting	
On-Post Monitoring Well Installation Locations						
G0121	20-30	Top GI Fm.	Panowicz Farms	401466.488	2058976.45	Monitor explosives concentrations at LL2 source areas and performance of RAO subsurface injections.

Notes:

All monitoring wells will be installed with 2-inch diameter PVC, 10 slot (0.010-inch) wire wrapped continuous slotted well screens.

All monitoring wells will be installed with aboveground completions.

[1]Horizontal Coordinates are in Nebraska State Plane, North American Datum of 1983.

bgs = below ground surface

ID = identification

LL = Load Line

RAO = Remedial Action Operation

Top GI FM. = Top of the Grand Island Formation (Shallow Well Depths)

TABLE 2-9
MONITORING WELL ABANDONMENT LOCATIONS
2016 ANNUAL REPORT

Monitoring Well Location ID	Property Ownership	Cluster or Single Well Location	Casing Diameter	Approximate Screened Interval (feet bgs)	Approximate Well Depth (feet btoc)	Coordinates[1]	
						Northing	Easting
On-Post Monitoring Well Abandonment Locations							
G0016	Panowicz Farms	Single	4-inch	14-29	32	403026.63	2055233.57
G0028	Heritage Disposal and Storage	Single	4-inch	22-37	40	397547.62	2051579.6

Notes:

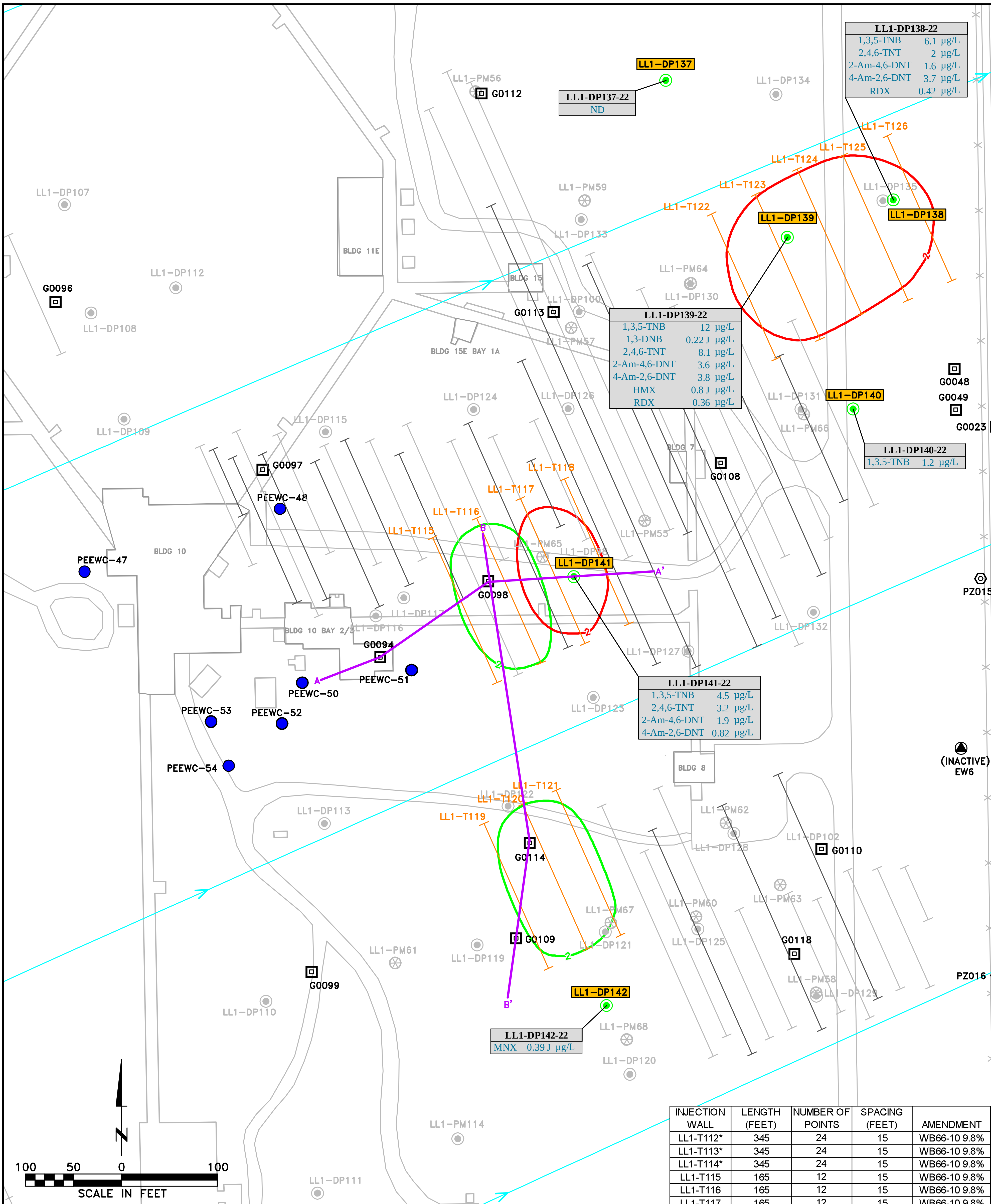
[1]Horizontal coordinates are in Nebraska State Plane, North American Datum of 1983.

bgs = below ground surface

btoc = below top of casing

ID = identification

LL2-DP110-30 2,4,6-TNT 1.4 µg/L 2-Am-4,6-DNT 2.6 µg/L 4-Am-2,6-DNT 1.8 µg/L HMX 0.55 µg/L RDX 0.72 µg/L
LL1-DP146-30 2-Am-4,6-DNT 0.69 µg/L 4-Am-2,6-DNT 0.93 µg/L HMX 3.6 µg/L RDX 6.5 µg/L
LL1-DP145-30 2-Am-4,6-DNT 0.32 J µg/L 4-Am-2,6-DNT 0.16 J µg/L HMX 0.78 µg/L RDX 0.71 µg/L
LL1-DP144-30 HMX 1.3 µg/L
LL1-DP143-30 HMX 1.4 µg/L RDX 0.1 µg/L
LL1-DP136-26 HMX 2.9 µg/L RDX 1.2 µg/L
LL2-DP111-35 1,3,5-TNB 0.29 J µg/L 2,4,6-TNT 0.45 µg/L 2-Am-4,6-DNT 0.94 µg/L 4-Am-2,6-DNT 0.94 µg/L HMX 3.6 µg/L RDX 2.1 µg/L
EW7-DP44-35 1,3,5-TNB 22 µg/L 2,4,6-TNT 4.6 µg/L 2-Am-4,6-DNT 1.8 µg/L 4-Am-2,6-DNT 1.8 µg/L RDX 0.2 J µg/L
EW7-DP45-35 1,3,5-TNB 1.1 µg/L 2,4,6-TNT 0.14 µg/L 2-Am-4,6-DNT 0.12 µg/L HMX 1.1 µg/L RDX 1.7 µg/L
EW7-DP42-35 1,3,5-TNB 55 µg/L 2,4,6-TNT 11 µg/L 2,4-DNT 0.21 J µg/L 2-Am-4,6-DNT 3 µg/L 4-Am-2,6-DNT 1.9 µg/L HMX 0.5 J µg/L RDX 0.38 µg/L
EW7-DP40-35 1,3,5-TNB 110 µg/L 1,3-DNB 0.1 J µg/L 2,4,6-TNT 25 µg/L 2,4-DNT 0.24 J µg/L 2-Am-4,6-DNT 3.1 µg/L 4-Am-2,6-DNT 2.3 µg/L RDX 0.61 J µg/L
EW7-DP43-35 1,3,5-TNB 2.9 µg/L 2,4,6-TNT 2.1 µg/L 2-Am-4,6-DNT 1.2 µg/L 4-Am-2,6-DNT 1.2 µg/L HMX 0.74 J µg/L RDX 2.2 µg/L
EW7-DP41-35 1,3,5-TNB 3.3 µg/L 2,4,6-TNT 1.4 µg/L 2-Am-4,6-DNT 1 µg/L 4-Am-2,6-DNT 0.53 µg/L HMX 0.48 µg/L RDX 0.87 µg/L
13th STREET
COUNTY ROAD 24
NORTH 80th ROAD
3rd AVENUE
ALDA ROAD
G0018
G0021
G0083
G0080
G0087
G0086
G0088
G0022
G0093
G0085
G0084
G0089
G0081
G0082
G0090
G0067
G0120
G0116
G0117
G0024 G0077 G0078
G0079 G0075 G0076 G0070
PZ009
PZ010
PZ013
PZ014
PZ020
PZ017R
PZ018
PZ019
EW4 (INACTIVE)
EW7 (ACTIVE)
NW020 NW021 NW022
EW7-DP39
EW7-DP38
EW7-DP35
EW7-DP36
EW7-DP37
LL1-DP136
LL1-DP143
LL1-DP144
LL1-DP145
LL1-DP146
LL2-DP110
LL2-DP111
EW7-DP40
EW7-DP41
EW7-DP42
EW7-DP43
EW7-DP44
EW7-DP45
LL1-T113
LL1-T112
LL1-T114
LL1-T129
LL1-T128
LL1-T127
LL2-T124
LL2-T123
G-130593
G-123999
LEACH PIT
SEE FIGURE 2-1c
SEE FIGURE 2-1b
LEGEND
LL1-DP137 2016 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (FEBRUARY)
G0015 2015 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)
2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
BLDG 14 FORMER SITE FEATURES
ADVECTIVE PARTICLE TRANSPORT FLOWPATH (EW7 AT 450 GPM)
FENCE
SURFACE DRAINAGE
LL2-DP116 EXPLOSIVES DIRECT PUSH GROUNDWATER SAMPLING RESULTS – FEBRUARY 2016
CROSS SECTION LINE
EW3 (INACTIVE) EXTRACTION WELL
G0015 ON-POST GROUNDWATER MONITORING WELL
PZ007 ON-POST PIEZOMETER
EW7-DP35 2015 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH)
LL1-DP01 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01 PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
ACTIVE IRRIGATION WELL
2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) AUGUST 2015/FEBRUARY 2016
20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20µg/L) AUGUST 2015/FEBRUARY 2016
2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) AUGUST 2015/FEBRUARY 2016
20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) AUGUST 2015/FEBRUARY 2016
N
300 150 0 300
SCALE IN FEET
Bay West
Customer-Focused Environmental & Industrial Solutions
URS
OU1 2015/2016 EXTENT OF EXPLOSIVES PLUME AND 2016 SUBSURFACE INJECTION LOCATIONS LOAD LINE 1 AND LOAD LINE 2 CORNHUSKER ARMY AMMUNITION PLANT
DRN. BY: DPG
DATE: 09/02/16
PROJECT NO. 16170837
FIG. NO. 2–1a
CHK'D. BY: CSA
REVISION: 0
January 11, 2017 3:18:19 p.m.
Drawing: T:\CHAAP\16170837\27\2-1a.dwg



INJECTION WALL	LENGTH (FEET)	NUMBER OF POINTS	SPACING (FEET)	AMENDMENT
LL1-T112*	345	24	15	WB66-10 9.8%
LL1-T113*	345	24	15	WB66-10 9.8%
LL1-T114*	345	24	15	WB66-10 9.8%
LL1-T115	165	12	15	WB66-10 9.8%
LL1-T116	165	12	15	WB66-10 9.8%
LL1-T117	165	12	15	WB66-10 9.8%
LL1-T118	165	12	15	WB66-10 9.8%
LL1-T119	165	12	15	WB66-10 9.8%
LL1-T120	165	12	15	WB66-10 9.8%
LL1-T121	165	12	15	WB66-10 9.8%
LL1-T122	165	12	15	WB66-10 9.8%
LL1-T123	165	12	15	WB66-10 9.8%
LL1-T124	165	12	15	WB66-10 9.8%
LL1-T125	165	12	15	WB66-10 9.8%
LL1-T126	165	12	15	WB66-10 9.8%
LL1-T127*	165	12	15	WB66-10 9.8%
LL1-T128*	255	18	15	WB66-10 9.8%
LL1-T129*	75	6	15	WB66-10 9.8%
LL1 TOTAL	3510	252	WB66-10=WESBLEND 66-10	

*LL1-T112, 113, 114, 127, 128, and 129 are shown on Figure 2-1a

LEGEND

LL1-DP137 2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION (FEBRUARY)

G0015 2015 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)

2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 450 GPM)

FENCE

SURFACE DRAINAGE

PEEWC-52 APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)

LL2-DP116 EXPLOSIVES DIRECT PUSH GROUNDWATER SAMPLING RESULTS – FEBRUARY 2016

CROSS SECTION LINE

EW3 (INACTIVE) EXTRACTION WELL

G0015 ON-POST GROUNDWATER MONITORING WELL

PZ007 ON-POST PIEZOMETER

LL1-DP01 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)

LL1-PM01 PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2μg/L) AUGUST 2015/ FEBRUARY 2016

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) AUGUST 2015/ FEBRUARY 2016

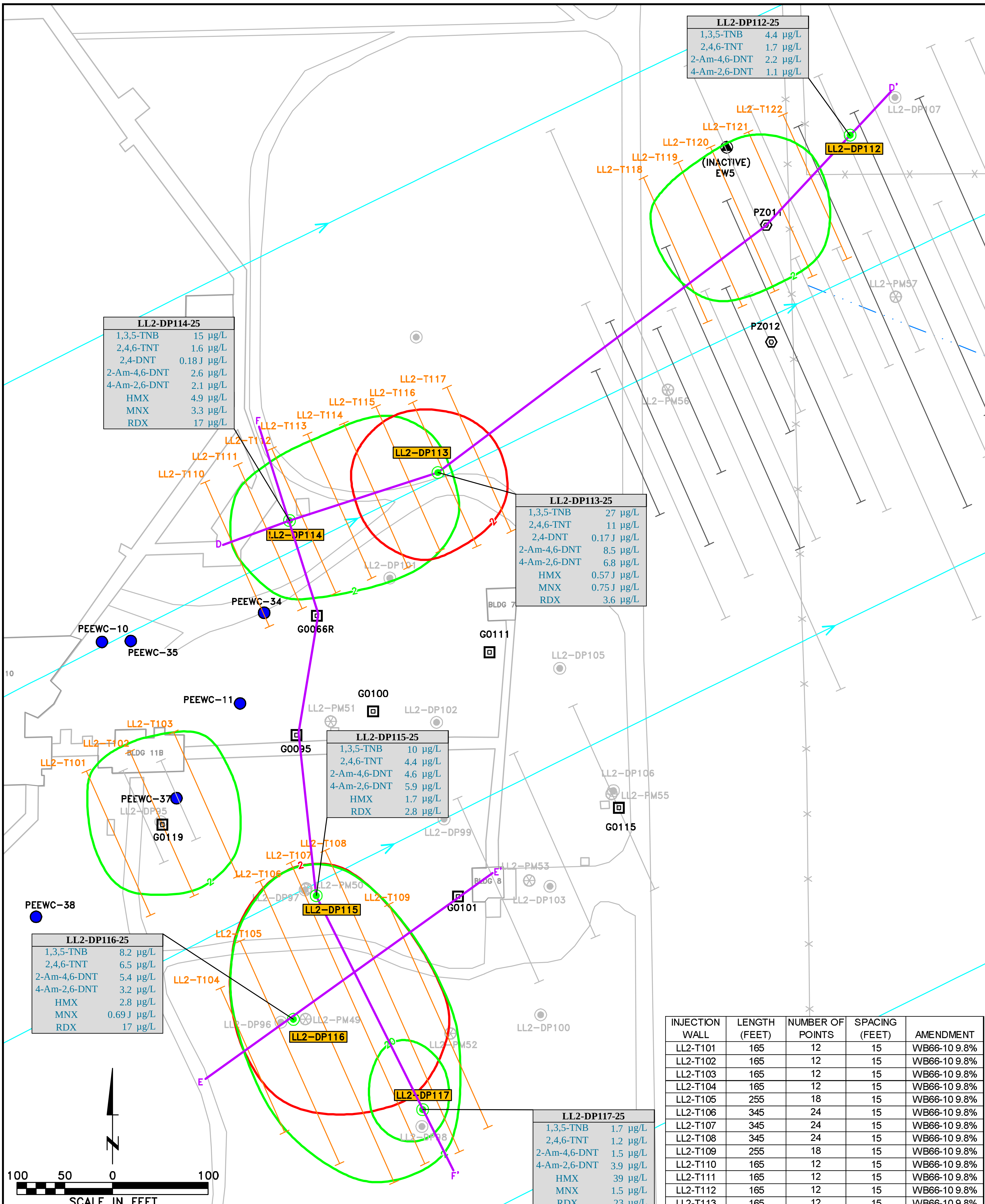
January 11, 2017 3:20:06 p.m.
Drawing: T:\CHAAP\16170837\27\2-1a.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions

URS

LOAD LINE 1 SUBSURFACE INJECTION LOCATIONS 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/02/16	PROJECT NO. 16170837	FIG. NO. 2-1b
CHK'D. BY: CSA	REVISION: 0		



LEGEND

LL2-DP110 2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION (FEBRUARY)

G0015 2015 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)

2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 450 GPM)

FENCE

SURFACE DRAINAGE

PEEWC-52 APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)

LL2-DP116 EXPLOSIVES DIRECT PUSH GROUNDWATER SAMPLING RESULTS – FEBRUARY 2016

CROSS SECTION LINE

EW3 (INACTIVE) EXTRACTION WELL

G0015 ON–POST GROUNDWATER MONITORING WELL

PZ007 ON–POST PIEZOMETER

LL1–DP01 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)

LL1–PM01 PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) AUGUST 2015/ FEBRUARY 2016

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) AUGUST 2015/ FEBRUARY 2016

20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) AUGUST 2015/ FEBRUARY 2016

INJECTION WALL	LENGTH (FEET)	NUMBER OF POINTS	SPACING (FEET)	AMENDMENT
LL2-T101	165	12	15	WB66-10 9.8%
LL2-T102	165	12	15	WB66-10 9.8%
LL2-T103	165	12	15	WB66-10 9.8%
LL2-T104	165	12	15	WB66-10 9.8%
LL2-T105	255	18	15	WB66-10 9.8%
LL2-T106	345	24	15	WB66-10 9.8%
LL2-T107	345	24	15	WB66-10 9.8%
LL2-T108	345	24	15	WB66-10 9.8%
LL2-T109	255	18	15	WB66-10 9.8%
LL2-T110	165	12	15	WB66-10 9.8%
LL2-T111	165	12	15	WB66-10 9.8%
LL2-T112	165	12	15	WB66-10 9.8%
LL2-T113	165	12	15	WB66-10 9.8%
LL2-T114	165	12	15	WB66-10 9.8%
LL2-T115	165	12	15	WB66-10 9.8%
LL2-T116	165	12	15	WB66-10 9.8%
LL2-T117	165	12	15	WB66-10 9.8%
LL2-T118	165	12	15	WB66-10 9.8%
LL2-T119	165	12	15	WB66-10 9.8%
LL2-T120	165	12	15	WB66-10 9.8%
LL2-T121	165	12	15	WB66-10 9.8%
LL2-T122	165	12	15	WB66-10 9.8%
LL2-T123*	255	18	15	WB66-10 9.8%
LL2-T124*	255	18	15	WB66-10 9.8%
LL2 TOTAL	4860	348	WB66-10=WESBLEND 66-10	

*LL2-123 and 124 are shown on Figure 2-1a

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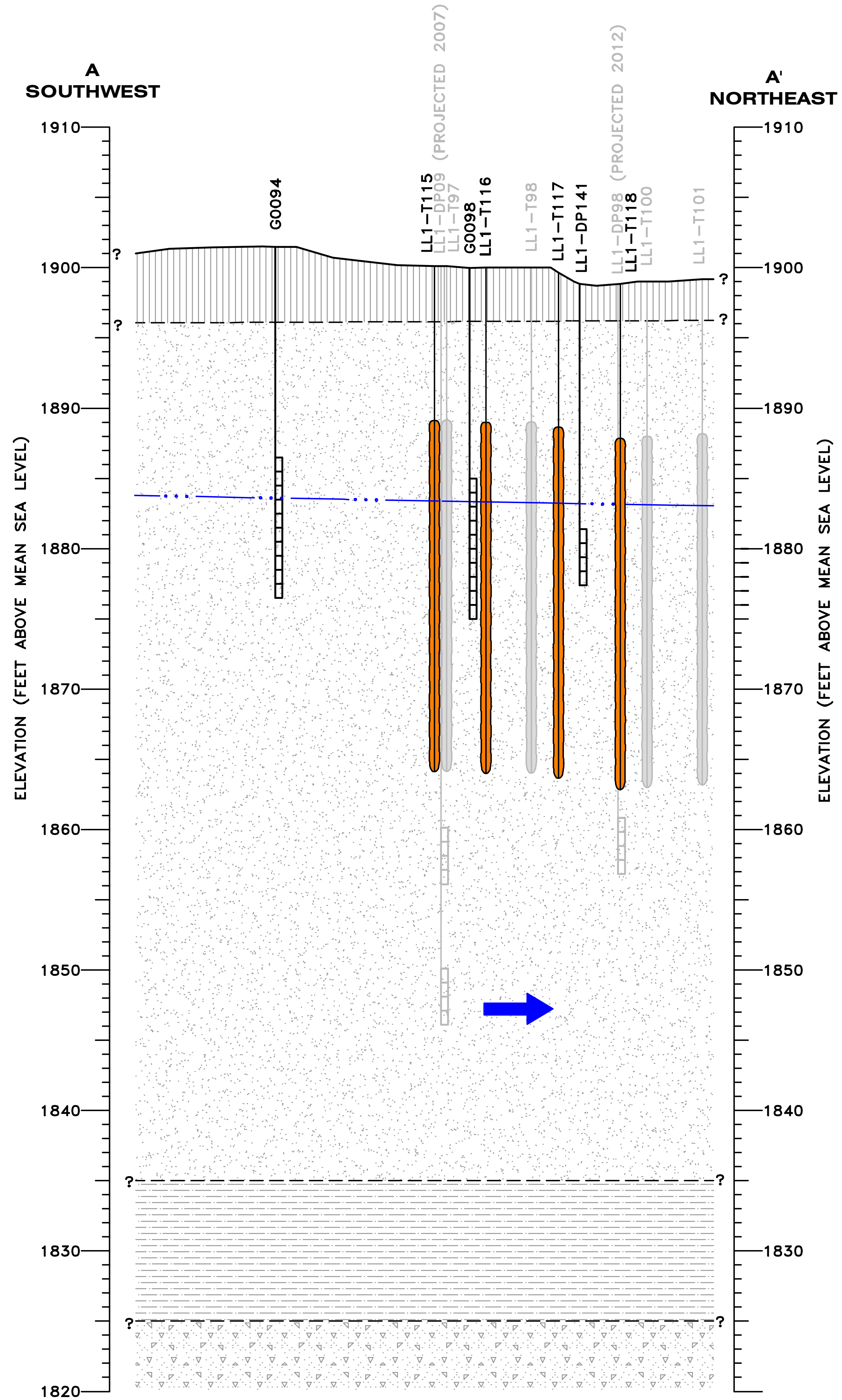
LOAD LINE 2 SUBSURFACE INJECTION LOCATIONS 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/02/16	PROJECT NO. 16170837	FIG. NO. 2–1c
CHK'D. BY: CSA	REVISION: 0		

January 11, 2017 3:21:01 p.m.
Drawing: T:\CHAAP\16170837\27\2–1a.dwg



LEGEND:

TOPSOIL AND FILL (CLAY AND SILT)

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL – PALEOVALLEY FILL AQUIFER)

WATER TABLE–FEBRUARY 2016

GENERAL DIRECTION OF GROUNDWATER FLOW

?–––––? DASHED WHERE INFERRED

SCREEN INTERVAL 2016

SCREEN INTERVAL 2012 (AND PRIOR)

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2016

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2015

VERTICAL SCALE

10 5 0 10

HORIZONTAL SCALE

100 50 0 100

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GEOLOGIC CROSS–SECTION A–A'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/13/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	2–2

January 11, 2017 3:37:54 p.m.
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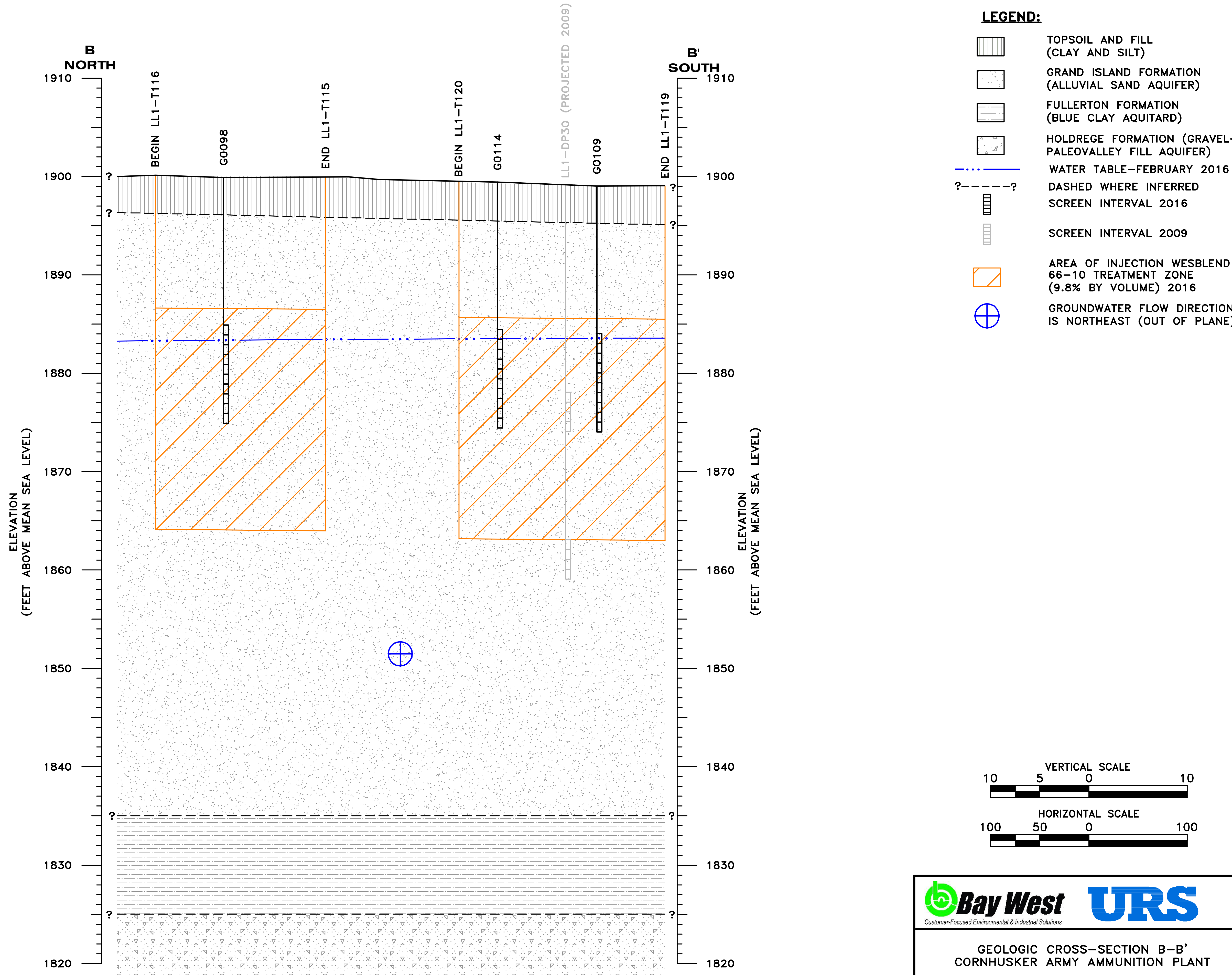

January 18, 2017 10:03:52 a.m.
Drawing: T:\CHAAP\16170837\27\2-2.dwg

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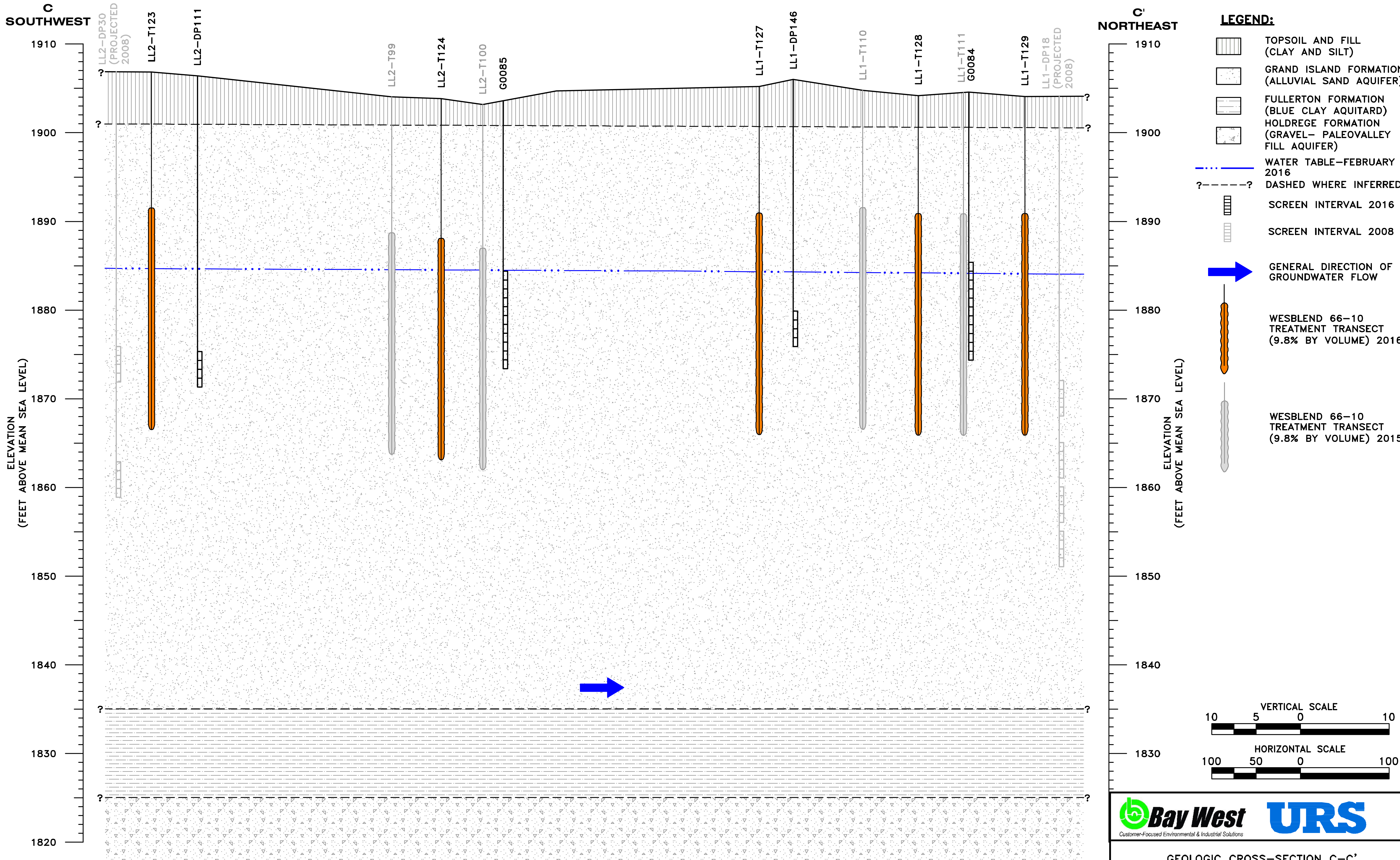
GEOLOGIC CROSS-SECTION B-B'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/13/16	PROJECT NO. 16170837	FIG. NO. 2-3
CHK'D. BY: CA	REVISION: 0		



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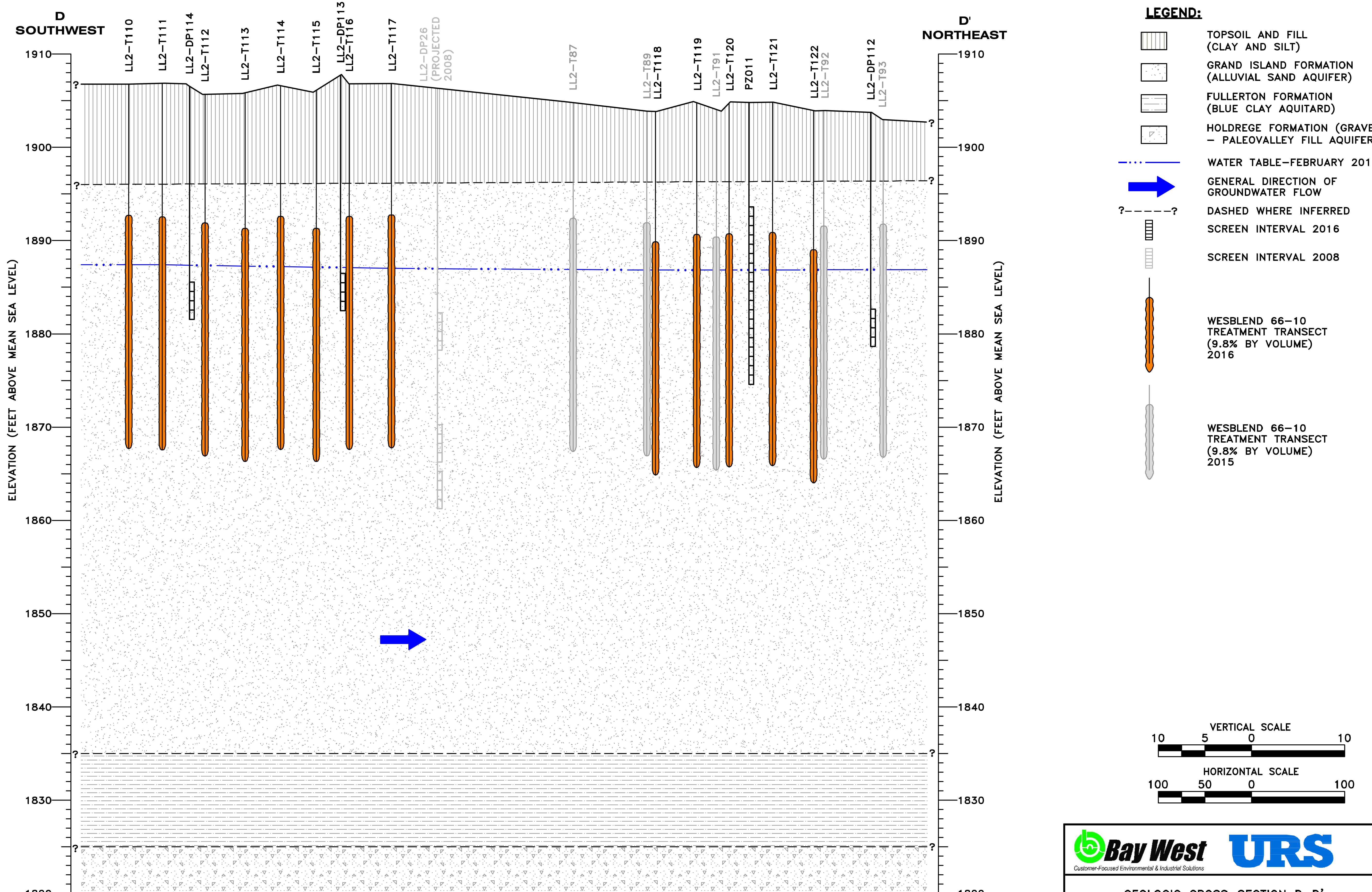
GEOLOGIC CROSS-SECTION C-C'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/16/16	PROJECT NO. 16170837	FIG. NO. 2-4
CHK'D. BY: CA	REVISION: 0		

January 25, 2017 9:35:44 a.m.
Drawing: T:\CHAAP\16170837\27\2-4.dwg



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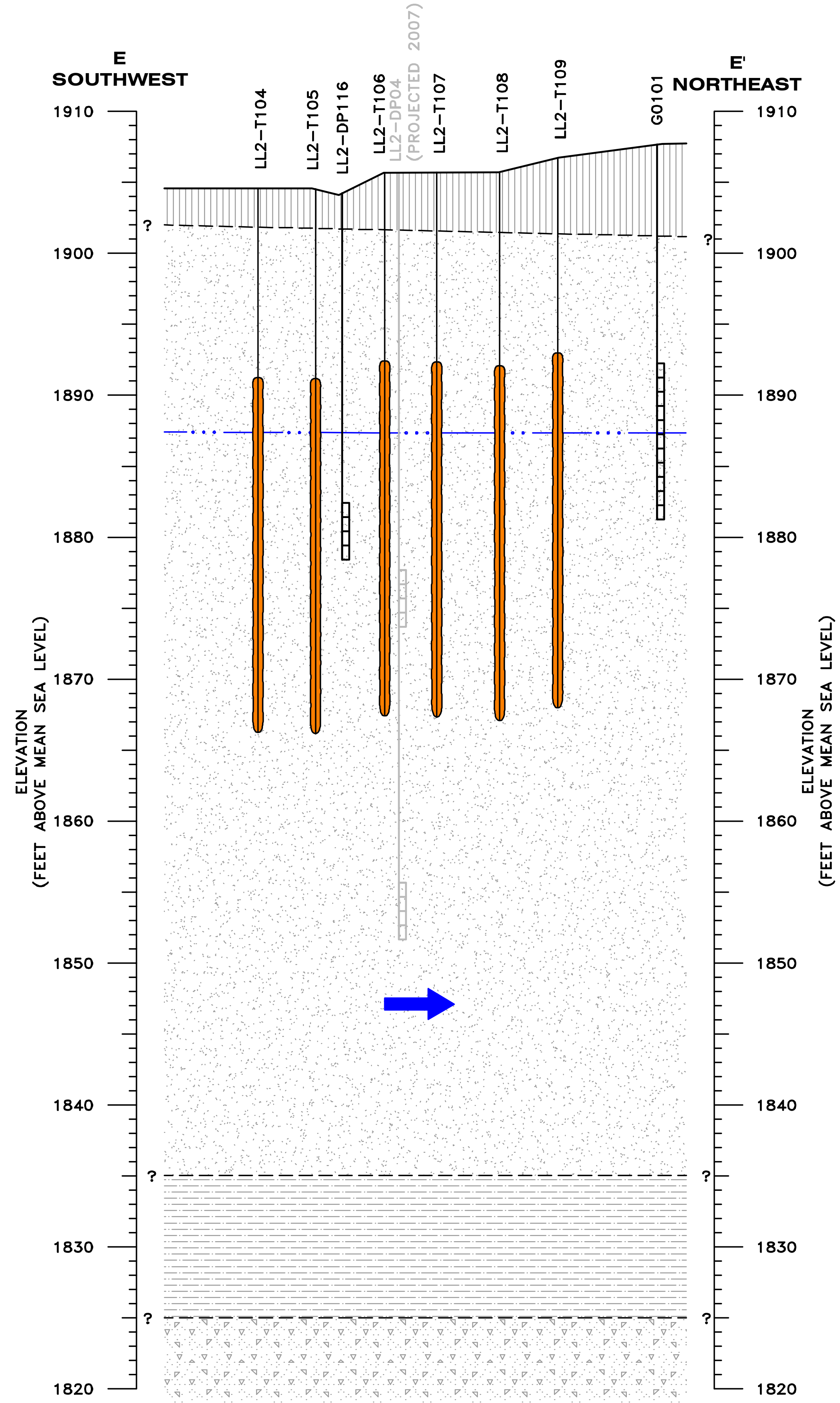
GEOLOGIC CROSS–SECTION D–D'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/16/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	2–5

January 11, 2017 3:59:59 p.m.
Drawing: T:\CHAAP\16170837\27\2-4.dwg



LEGEND:

TOPSOIL AND FILL (CLAY AND SILT)

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL–PALEOVALLEY FILL AQUIFER)

WATER TABLE–FEBRUARY 2016

?– – – – –? DASHED WHERE INFERRED

SCREEN INTERVAL 2016

SCREEN INTERVAL 2007

GENERAL DIRECTION OF GROUNDWATER FLOW

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2016

VERTICAL SCALE
10 5 0 10

HORIZONTAL SCALE
100 50 0 100

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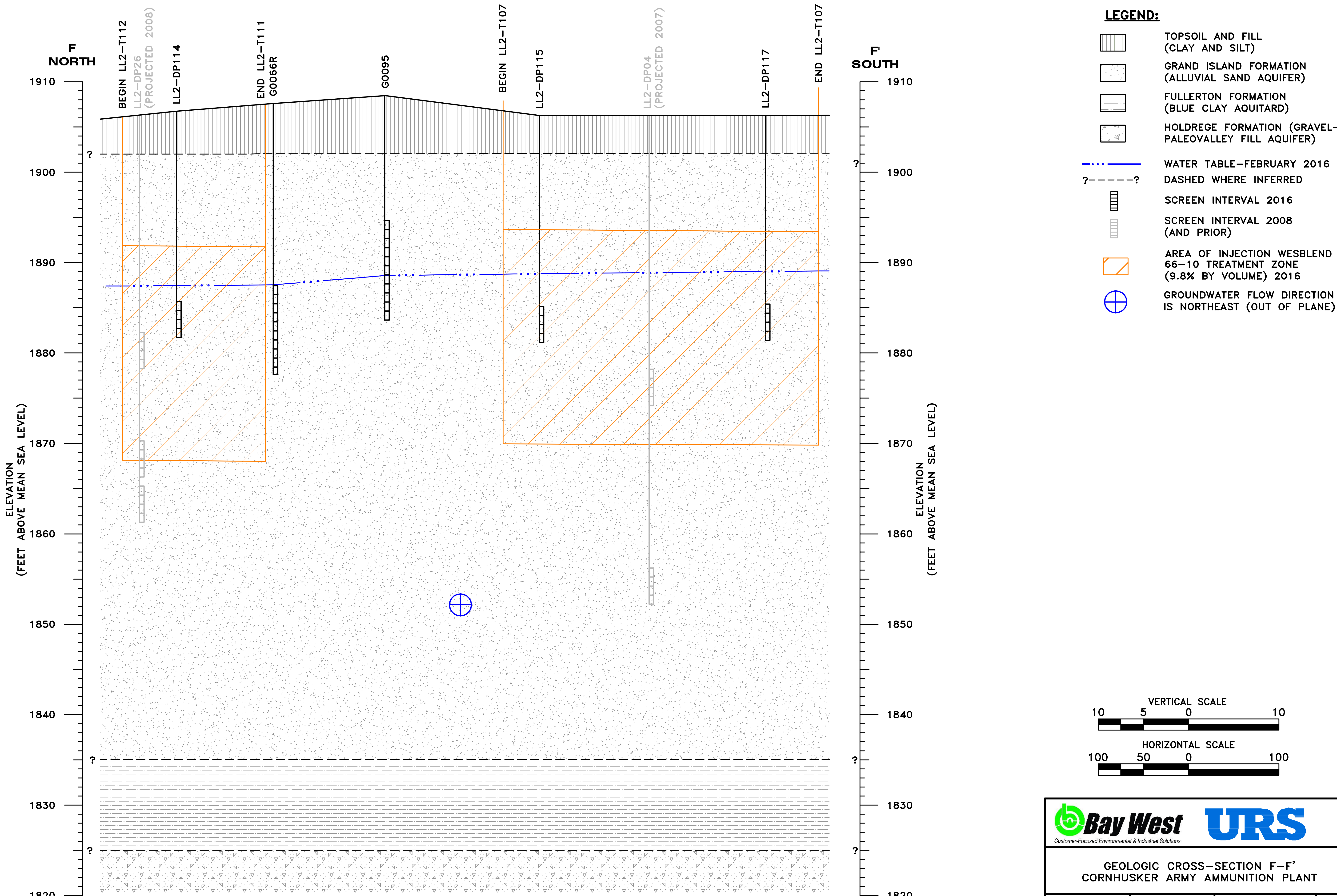
GEOLOGIC CROSS–SECTION E–E'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/16/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	2–6

January 19, 2017 4:09:34 p.m.
Drawing: T:\CHAAP\16170837\27\2-4.dwg



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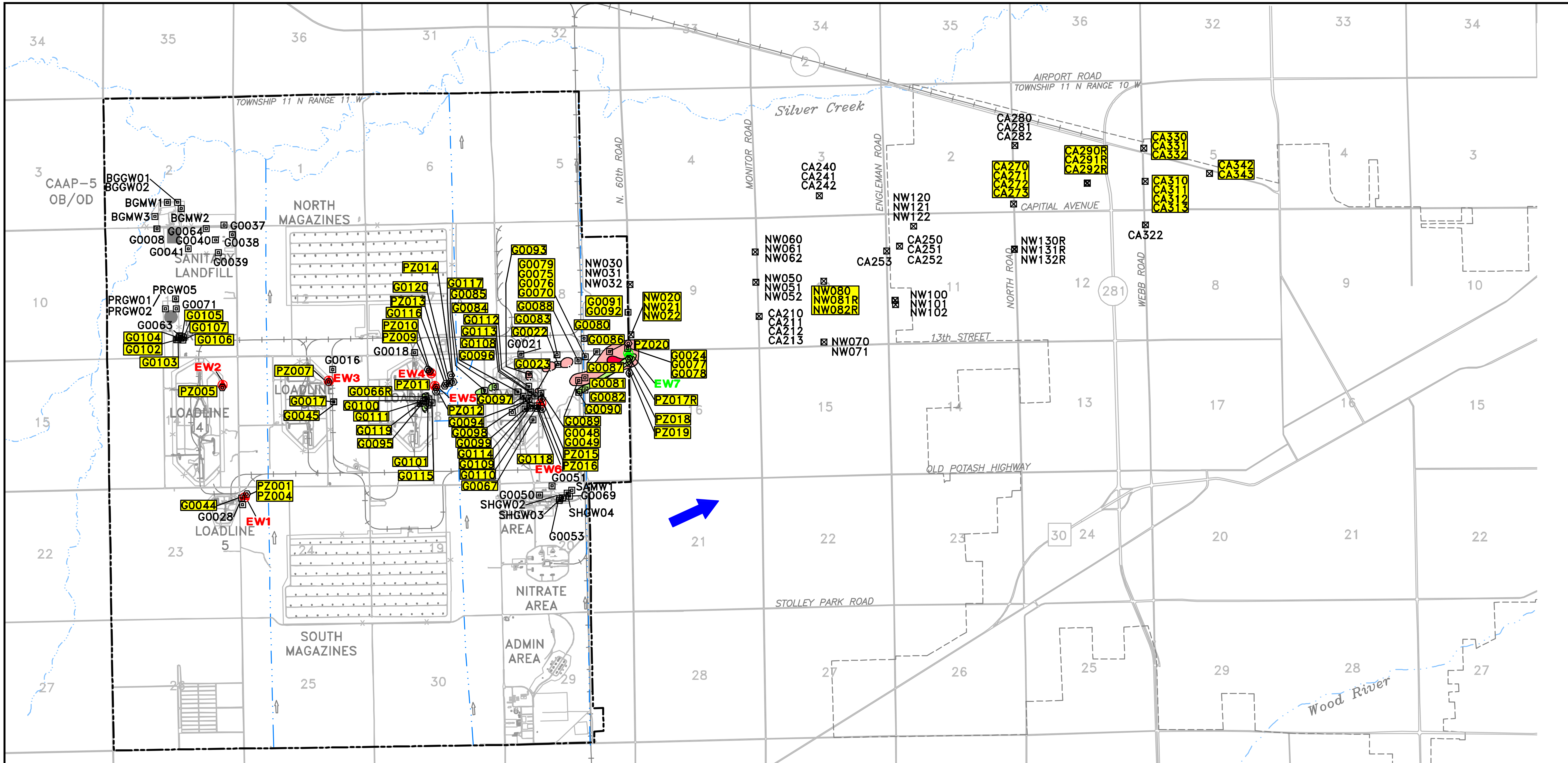
GEOLOGIC CROSS-SECTION F-F'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/16/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	2-7

January 18, 2017 10:05:33 a.m.
Drawing: T:\CHAAP\16170837\27\2-4.dwg



LEGEND:

ON-POST GROUNDWATER MONITORING WELL

OFF-POST GROUNDWATER MONITORING WELL

ON-POST PIEZOMETER

INACTIVE GROUNDWATER EXTRACTION WELL

ACTIVE GROUNDWATER EXTRACTION WELL

G0029 2016 OU1 GROUNDWATER SAMPLING LOCATIONS

GENERAL GROUNDWATER FLOW DIRECTION

ROADS

FACILITY BOUNDARY

GRAND ISLAND CITY LIMITS

SURFACE DRAINAGE

281 STATE ROUTE

30 U.S. ROUTE

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) AUGUST 2015/FEBRUARY 2016

20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20µg/L) AUGUST 2015/FEBRUARY 2016

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) AUGUST 2015/FEBRUARY 2016

20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) AUGUST 2015/FEBRUARY 2016

N

0 4000 8000

SCALE FEET

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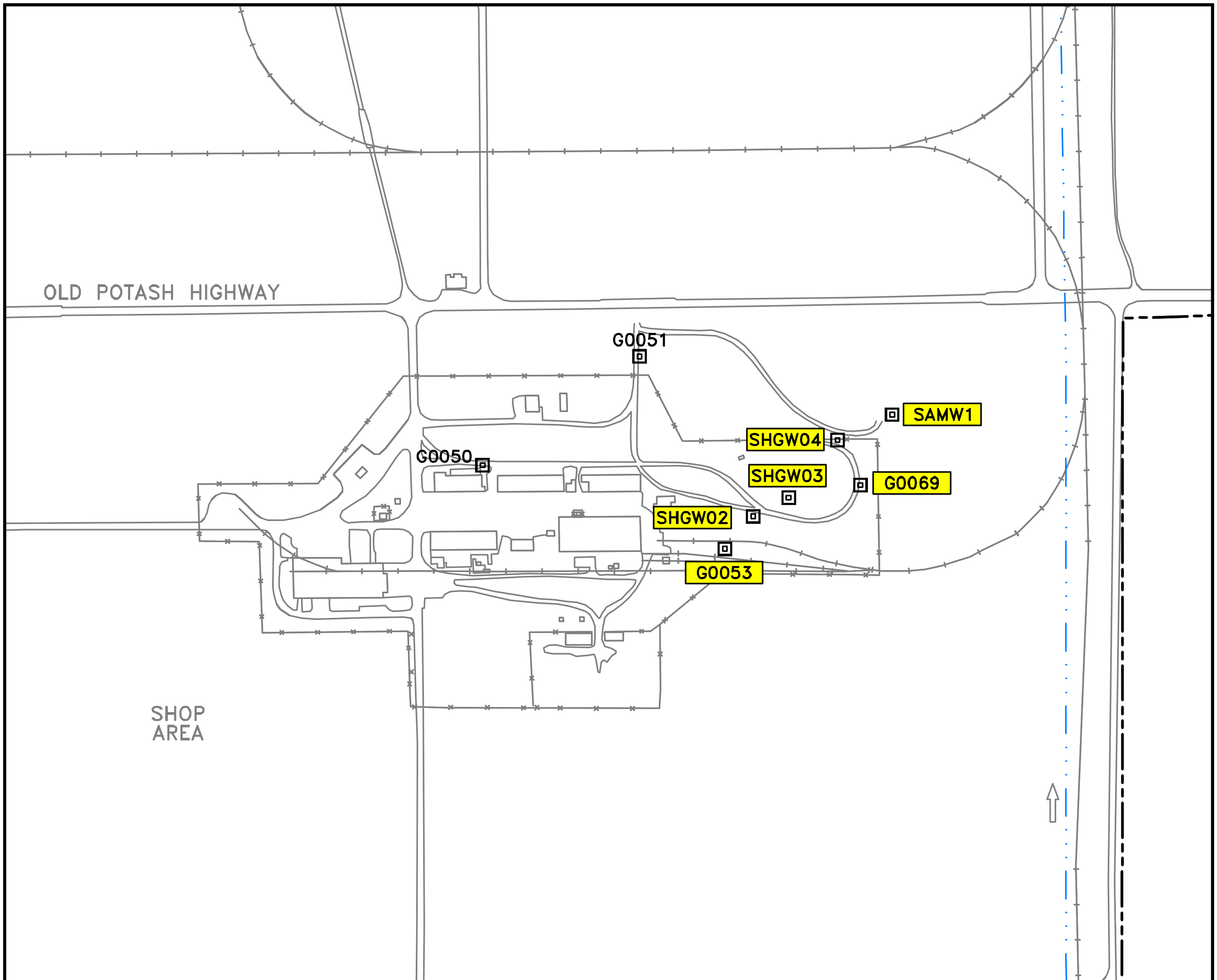
WELL SAMPLING LOCATION MAP 2016
OFF-POST/ON-POST (OU1)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/02/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DC	DATE: 09/02/16	16170837	2-8

November 23, 2016 1:37:29 p.m.
Drawing: T:\CHAAP\16170837\27\2-8.dwg



LEGEND:

⊡ ON–POST GROUNDWATER MONITORING WELL

AUGUST 2015,VOC CONCENTRATIONS ARE LESS THAN MCLs
(1,2–DCA MCL IS 5 µg/L)

SHGW02 2016 OU3 GROUNDWATER SAMPLING LOCATION

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,2–DCA = 1,2–DICHLOROETHANE
MCL = MAXIMUM CONTAMINANT LEVEL
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND

0 500 1000
SCALE FEET

N

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WELL SAMPLING LOCATION MAP 2016
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/29/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 10/29/15	16170837	2–9

January 11, 2017 4:13:46 p.m.
Drawing: T:\CHAAP\16170837\27\2–9.dwg

LEGEND:

ON–POST GROUNDWATER MONITORING WELL

OFF–POST GROUNDWATER MONITORING WELL

ON–POST PIEZOMETER

DIRECT PUSH GROUNDWATER SAMPLE LOCATIONS (FEBRUARY 2016)

G0121 MONITORING WELL INSTALLED IN NOVEMBER 2016

ACTIVE GROUNDWATER EXTRACTION WELL

INACTIVE GROUNDWATER EXTRACTION WELL

ROADS

FACILITY BOUNDARY

SURFACE DRAINAGE

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST 2016

20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST 2016

2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST 2016

20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST 2016

2016 TREATMENT TRANSECT LOCATION

ADVECTIVE PARTICLE TRANSPORT FLOWPATH – AUGUST 2016 (EW7 AT 450 GPM)

N

0 600 1200

SCALE FEET

January 11, 2017 4:14:35 p.m.
Drawing: T:\CHAAP\16170837\27\2–10.dwg

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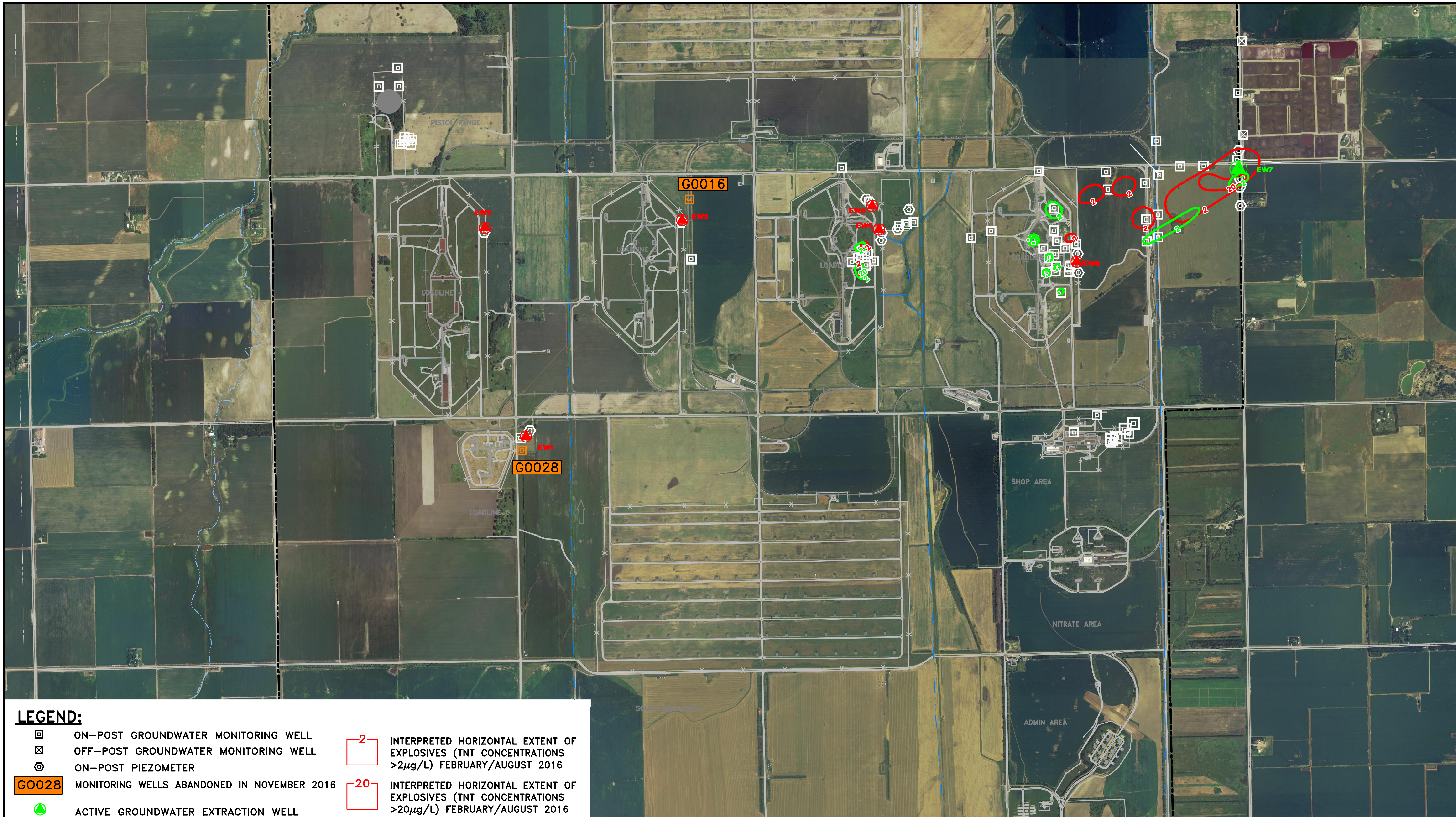
2016 MONITORING WELL INSTALLATION LOCATION MAP
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/11/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DC	DATE: 10/11/16	16170837	2–10



LEGEND:

⊡	ON–POST GROUNDWATER MONITORING WELL
⊠	OFF–POST GROUNDWATER MONITORING WELL
◎	ON–POST PIEZOMETER
G0028	MONITORING WELLS ABANDONED IN NOVEMBER 2016
▲ (green)	ACTIVE GROUNDWATER EXTRACTION WELL
▲ (red)	INACTIVE GROUNDWATER EXTRACTION WELL
——	ROADS
–·–·–	FACILITY BOUNDARY
– – –	GRAND ISLAND CITY LIMITS
··–··	SURFACE DRAINAGE
2 (red)	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST 2016
20 (red)	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST 2016
2 (green)	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST 2016
20 (green)	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST 2016

N

2000 1000 0 2000

SCALE IN FEET

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2016 MONITORING WELL ABANDONMENT LOCATION MAP

CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/11/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DC	DATE: 10/11/16	16170747	2–11

December 14, 2016 3:56:36 p.m.
Drawing: T:\CHAAP\16170837\27\2–11.dwg

3.1 GROUNDWATER LEVELS

The following sections summarize the August 2016 site-wide groundwater measurement data at OU1 and OU3. Groundwater measurements were also collected at select monitoring wells for pre-injection groundwater investigation and subsurface injection activities (February/April 2016) and are included in **Table 3-1** but not discussed in the following sections. These water level measurements were used to select appropriate sampling and injection intervals.

3.1.1 OU1 (Groundwater Explosives Plume) Water Level Round

OU1 groundwater levels were measured at all off-post monitoring wells and all on-post monitoring wells and piezometers on August 1 and 2, 2016. Select shallow and shallow-intermediate monitoring well levels were used to construct the OU1 water table elevation map, shown as **Figure 3-1**. Groundwater level measurements were completed in as short a time period as practical to minimize the effects of water table fluctuations. OU1 off-post and on-post water levels are presented in **Table 3-1**. **Table 3-1** also includes groundwater levels at one on-post extraction well and 12 associated observation wells used for site-wide water level interpretation. The depth to groundwater ranged from 8.08 to 21.69 feet below top of casing (BTOC) in off-post monitoring wells and 15.93 to 23.75 feet BTOC in on-post wells.

Water levels remained nearly unchanged, with only an approximate increase of 0.22 foot at off-post wells and 0.3 foot at on-post wells from August 2015 to August 2016. In August 2015, several off-post monitoring wells at the northeast distal end showed signs of decreased water level measurements due to the influence of road and sewer construction activities (dewatering). In August 2016, these specific wells did not indicate dewatering effects but indicated increases of approximately 1 to 2 feet since August 2015, and returning to static water level conditions.

Overall, August 2016 water level measurements continued the increasing trend in groundwater elevations that were observed in 2015, though the increase was minimal. A trend of decreasing water levels were observed from March 2012 to August 2014 during a period of lower precipitation, ending the observed increasing trend from March 2006 to March 2011 during higher seasonal precipitation. A trend of decreasing water levels was observed from March 2000 through March 2005. These trends in groundwater elevations can best be seen in graphical form on **Figure 3-2**, which shows groundwater elevations of two groups of monitoring wells from March 2000 to August 2016. The first group of monitoring wells was selected from shallow on-post G00 wells and on-post piezometers that are in line with the groundwater flow direction spanning the on-post area (from G0044 to G0024). The second group of monitoring wells selected is from the off-post area and include shallow NW monitoring wells (except well cluster NW080) and shallow CA monitoring wells (except well cluster CA210).

Two of the OU1 monitoring wells were found to be dry during the 2016 groundwater sampling event. During the 2015 sampling event, three wells were found to be dry, and in 2014, five wells were dry. These are increases from 2009 to 2012, when no wells were dry. During the 2008 event, three wells were found to be dry, which is a decrease from 2006 and 2007 sampling events when 11 wells were found to be dry.

In 2016, monitoring wells and piezometers within the influence of active extraction well EW7 exhibited an average decrease in water level of 0.5 to 2 feet because of dewatering effects from the extraction well (i.e., cone of depression drawdown effects). This localized decrease in water level has also been observed in previous water level measurement rounds (since 2001) due to the consistent pumping of EW7.

3.1.2 OU3 (Shop Area) Water Level Round

OU3 groundwater levels were measured at eight monitoring wells in the Shop Area on August 2, 2016. Water levels measured at all eight shallow monitoring wells, which are outside the influence of EW7 and the OU1 injection activities, were used to construct the Shop Area water table map (**Figure 3-3**). The water levels for August 2016 are presented in **Table 3-1**. The depth to shallow groundwater ranged from 16.08 to 18.50 feet BTOC. Groundwater levels at OU3 decreased (between 0.04 and 0.20 foot) in August 2016, which is a relatively minor decrease from August 2015 (as opposed to the 1- to 2-foot increase between 2015 and 2014). A decreasing trend was observed in March 2012 through August 2014, returning to the increasing trend from March 2006 to March 2011, which followed a decreasing trend from March 2000 to March 2005.

3.2 HYDRAULIC GRADIENTS

The following sections summarize August 2016 hydraulic gradients at OU1 and OU3.

3.2.1 OU1 (Groundwater Explosives Plume) Hydraulic Gradients

Figure 3-1 presents an interpreted water table elevation map based on the August 2016 OU1 water level data from wells screened at or near the water table surface. The water table map indicates groundwater generally flows to the northeast from CHAAP toward the City of Grand Island. Local horizontal hydraulic gradients were calculated using water level elevations from the OU1 off-post monitoring wells. An average horizontal hydraulic gradient of about 0.001 foot per foot (ft/ft) was calculated from August 2016 groundwater data. The average horizontal gradients and flow directions derived from August 2016 sampling data were similar to those measured from December 1996 through August 2015.

Well clusters at the axis of the historic groundwater explosives plume showed minor hydraulic head differences between wells screened in the top of the Grand Island Formation and those screened in the middle or base of the Grand Island Formation (i.e., wells G0024/G0078, G0091/G0092, NW020/NW022, NW050/NW052, CA250/CA252, CA270/CA272, CA290R/CA292R, and CA310/CA312). The head differences varied: wells G0024/G0078, CA270/CA272, and CA290R/CA292R exhibited downward gradients averaging 0.0011 ft/ft; and wells G0091/G0092, NW020/NW022, NW050/NW052, CA250/CA252, and CA310/CA312 exhibited an upward gradient averaging 0.0026 ft/ft.

Minor hydraulic head differences were measured in the well clusters with wells screened within the Grand Island Formation and the Holdrege Formation (i.e., wells NW120/NW122,

CA211/CA213, CA270/CA273, CA310/CA313, CA342/CA343). The head differences varied: wells NW120/NW122, CA211/CA213, and CA270/CA273 exhibited upward gradients averaging 0.009 ft/ft; CA310/CA313 and CA342/CA343 exhibit a downward gradient of 0.0038 ft/ft. Overall, the 2016 average vertical gradient between the Grand Island and Holdrege Formations is upward. The slight downward vertical gradient at wells CA310/CA313 is consistent with historical vertical gradients calculated at this well cluster.

Based on water levels measured in the deep monitoring wells (i.e., NW122, CA213, CA273, CA313, and CA343), the general groundwater flow direction in the underlying Holdrege Formation aquifer has maintained a northeasterly component similar to the overlying Grand Island Formation aquifer. However, an accurate estimate of the hydraulic gradient cannot be made because the current deep well spacing does not support a three-point calculation.

3.2.2 OU3 (Shop Area) Hydraulic Gradients

Figure 3-3 presents an interpreted water table elevation map based on the August 2016 OU3 water level data. The water table map indicates groundwater flows to the northeast. Local horizontal hydraulic gradients were calculated using water level elevations from selected OU3 monitoring wells. An average horizontal hydraulic gradient of about 0.001 ft/ft to the northeast was calculated from the August 2016 groundwater data. This average horizontal gradient and flow direction were similar to those measured in previous events.

3.3 GROUNDWATER FLOW VELOCITIES

Assuming an estimated effective porosity of 20 percent, the average linear groundwater flow velocity for the shallow Grand Island Formation aquifer in the OU1 RAO Load Line Treatment Area in August 2016 (EW7 at 450 gpm) ranged from 700 to 1,200 feet per year inside the EW7 capture zone to 500 to 650 feet per year outside the EW7 capture zone.

3.4 FIELD WATER QUALITY PARAMETERS

Field water quality parameter measurements were determined at the time of sample collection in August 2016. Field water quality parameter measurements included ORP, DO, pH, conductivity, temperature, turbidity, and Fe^{2+}. All field results were recorded on the SCFSs (included in **Appendix B** for OU1 and OU3). OU1 on-post and off-post monitoring well field water quality parameter measurements are presented in **Tables 3-2** and **3-3**, respectively. OU3 monitoring well field water quality parameter measurements are presented in **Table 3-4**. **Table 3-5** summarizes OU1 field water quality parameter concentration ranges for on-post and off-post groundwater.

TABLE 3-1
WATER LEVEL MEASUREMENTS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location ID	Top of Casing Elevation[1] (ft amsl)	Ground Elevation[1] (ft amsl)	Approximate Screened Interval (ft bgs)	Well Depth (ft btoc)	Pre-Injection Water Levels			August Water Levels		
					Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft above msl)	Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft amsl)
Off-Post Wells										
CA210	1888.15	NA	5-15	16.83				8-1-16	Dry	Dry
CA211	1888.22	NA	30-40	42.90				8-1-16	17.12	1871.10
CA212	1888.17	NA	54-64	67.00				8-1-16	17.08	1871.09
CA213	1888.07	NA	77-87	89.80				8-1-16	17.22	1870.85
CA240	1885.83	NA	5-15	17.72				8-1-16	17.08	1868.75
CA241	1885.23	NA	27-37	39.74				8-1-16	16.36	1868.87
CA242	1885.65	NA	51-61	63.59				8-1-16	16.82	1868.83
CA250	1877.21	NA	5-15	15.06				8-1-16	10.25	1866.96
CA251	1877.25	NA	30-40	40.06				8-1-16	10.3	1866.95
CA252	1877.14	NA	48-58	57.42				8-1-16	10.19	1866.95
CA253	1881.77	NA	74-84	86.59				8-1-16	14.56	1867.21
CA270	1871.06	NA	5-15	15.25				8-1-16	9.09	1861.97
CA271	1870.30	NA	28-38	37.78				8-1-16	8.29	1862.01
CA272	1870.29	NA	46-56	55.70				8-1-16	8.28	1862.01
CA273	1871.24	NA	73-83	84.50				8-1-16	10.62	1860.62
CA280	1878.22	NA	7-17	15.7				8-1-16	14.91	1863.31
CA281	1878.23	NA	31-41	43.70				8-1-16	15.68	1862.55
CA282	1877.91	NA	54-64	68.08				8-1-16	15.42	1862.49
CA290R	1867.50	NA	8-18	18.31				8-1-16	8.72	1858.78
CA291R	1867.49	NA	27-37	37.50				8-1-16	8.08	1859.41
CA292R	1867.34	NA	48-58	56.98				8-1-16	8.55	1858.79
CA310	1869.66	NA	5-15	17.50				8-1-16	15.41	1854.25
CA311	1869.51	NA	30-40	42.25				8-1-16	15.79	1853.72
CA312	1869.18	NA	48-58	60.22				8-1-16	15.38	1853.80
CA313	1868.94	NA	73-83	86.23				8-1-16	14.6	1854.34
CA322	1867.07	NA	47-57	57.52				8-1-16	12.5	1854.57
CA330	1866.15	NA	8-18	20.27				8-1-16	11.59	1854.56
CA331	1866.12	NA	29-34	36.84				8-1-16	11.51	1854.61
CA332	1866.31	NA	44-54	56.10				8-1-16	11.7	1854.61
CA342	1864.43	NA	45-55	57.83				8-1-16	14.57	1849.86

TABLE 3-1
WATER LEVEL MEASUREMENTS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location ID	Top of Casing Elevation[1] (ft amsl)	Ground Elevation[1] (ft amsl)	Approximate Screened Interval (ft bgs)	Well Depth (ft btoc)	Pre-Injection Water Levels			August Water Levels		
					Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft above msl)	Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft amsl)
CA343	1864.30	NA	70-80	83.34				8-1-16	14.28	1850.02
NW020	1898.51	1895.78	15-25	27.93				8-1-16	21.43	1877.08
NW021	1898.76	1895.9	37-42	45.74				8-1-16	21.69	1877.07
NW022	1898.68	1896.0	59-64	66.57				8-1-16	21.61	1877.07
NW030	1890.41	1890.0	10-20	20.41				8-1-16	NM	NM
NW031	1890.65	1890.0	32-37	37.84				8-1-16	13.58	1877.07
NW032	1890.40	1890.0	57-62	62.50				8-1-16	NM	NM
NW050	1887.20	NA	10-20	20.14				8-1-16	15.71	1871.49
NW051	1887.38	NA	30-35	34.56				8-1-16	15.92	1871.46
NW052	1886.77	NA	55-60	60.79				8-1-16	15.29	1871.48
NW060	1889.18	NA	10-20	20.08				8-1-16	17.28	1871.90
NW061	1888.80	NA	40-45	45.35				8-1-16	17.26	1871.54
NW062	1888.97	NA	58-63	63.15				8-1-16	17.31	1871.66
NW070	1884.77	NA	10-20	20.60				8-1-16	13.48	1871.29
NW071	1884.59	NA	55-60	60.17				8-1-16	13.31	1871.28
NW080	1885.28	1882.31	8-18	21.39				8-1-16	16.26	1869.02
NW081R	1884.85	1882.08	35-45	47.76				8-1-16	15.81	1869.04
NW082R	1884.86	1882.08	46-56	59.50				8-1-16	15.8	1869.06
NW100	1883.37	NA	10-20	20.10				8-1-16	15.31	1868.06
NW101	1883.55	NA	35-40	40.71				8-1-16	15.41	1868.14
NW102	1883.46	NA	55-60	59.61				8-1-16	15.32	1868.14
NW120	1877.31	NA	10-20	NM				8-1-16	11.35	1865.96
NW121	1877.22	NA	53-58	57.37				8-1-16	11.15	1866.07
NW122	1877.16	NA	83-88	87.40				8-1-16	11.35	1865.81
NW130R	1871.09	NA	8-18	17.92				8-1-16	8.33	1862.76
NW131R	1871.17	NA	33-38	38.20				8-1-16	8.42	1862.75
NW132R	1871.33	NA	52-57	57.40				8-1-16	8.61	1862.72

TABLE 3-1
WATER LEVEL MEASUREMENTS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location ID	Top of Casing Elevation[1] (ft amsl)	Ground Elevation[1] (ft amsl)	Approximate Screened Interval (ft bgs)	Well Depth (ft btoc)	Pre-Injection Water Levels			August Water Levels		
					Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft above msl)	Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft amsl)
Between EW6 and EW7										
G0022	1899.16	1896.4	18-33	34.95				8-2-16	17.52	1881.64
G0024	1896.00	1893.1	16-31	33.28	2/22/2016	Dry	Dry	8-2-16	19.76	1876.24
G0070	1901.31	1898.8	75-80	82.70	2/22/2016	22.26	1879.05	8-2-16	21.38	1879.93
G0075	1901.22	1899.2	25-35	37.70	2/22/2016	22.22	1879.00	8-2-16	21.33	1879.89
G0076	1901.02	1898.9	54-64	65.30	2/22/2016	22.02	1879.00	8-2-16	21.11	1879.91
G0077	1896.38	1893.9	25-35	37.70	2/22/2016	20.67	1875.71	8-2-16	20.08	1876.30
G0078	1896.34	1894.1	50-60	62.81	2/22/2016	20.62	1875.72	8-2-16	20.04	1876.30
G0079	1901.42	1899.0	8-18	19.62	2/22/2016	Dry	Dry	8-2-16	Dry	Dry
G0080	1899.38	1896.8	25-35	37.80				8-2-16	19.65	1879.73
G0081	1901.60	1899.1	28-38	41.30	2/22/2016	22.12	1879.48	8-2-16	21.56	1880.04
G0082	1901.17	1898.7	28-38	41.06	2/22/2016	18.50	1882.67	8-2-16	21.08	1880.09
G0083	1897.86	1895.4	21-31	33.45	2/22/2016	17.30	1880.56	8-2-16	16.26	1881.60
G0086	1897.25	1895.8	28-38	40.28	2/22/2016	19.80	1877.45	8-2-16	19.02	1878.23
G0087	1898.00	1895.7	25-35	37.53	2/22/2016	19.85	1878.15	8-2-16	18.97	1879.03
G0088	1898.44	1896.0	25-35	37.40	2/22/2016	18.97	1879.47	8-2-16	18.07	1880.37
G0089	1899.75	1897.3	25-35	37.93	2/22/2016	19.94	1879.81	8-2-16	19.36	1880.39
G0090	1899.90	1897.3	25-35	37.85	2/22/2016	19.85	1880.05	8-2-16	19.56	1880.34
G0091	1896.88	1894.8	20-30	31.84				8-2-16	18.96	1877.92
G0092	1897.02	1894.7	40-50	52.77				8-2-16	19.14	1877.88
PZ017R	1895.17	1892.9	10-30	31.40	2/22/2016	19.34	1875.83	8-2-16	18.75	1876.42
PZ018	1896.88	1894.7	10-30	31.91	2/22/2016	20.60	1876.28	8-2-16	19.94	1876.94
PZ019	1901.30	1898.9	10-30	32.25	2/22/2016	24.32	1876.98	8-2-16	23.75	1877.55
PZ020	1899.25	1897.0	10-30	32.34				8-2-16	22.57	1876.68
EW7	1895.95	1894.0	15-55	NM				8-1-16	31.95	1864.00
EW7 - OW7A	1896.19	NA	25-50	52.84				8-1-16	21.40	1874.79
EW7 - OW7B	1896.53	NA	25-50	52.23				8-1-16	22.32	1874.21
EW7 - OW7C	1894.48	NA	25-50	55.60				8-1-16	20.68	1873.80

TABLE 3-1
WATER LEVEL MEASUREMENTS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location ID	Top of Casing Elevation[1] (ft amsl)	Ground Elevation[1] (ft amsl)	Approximate Screened Interval (ft bgs)	Well Depth (ft btoc)	Pre-Injection Water Levels			August Water Levels		
					Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft above msl)	Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft amsl)
Load Line 1										
G0021	1900.64	1898.0	19-34	36.02				8-1-16	16.82	1883.82
G0023	1901.71	1899.0	19-34	35.81	2/22/2016	35.83	1865.88	8-1-16	19.37	1882.34
G0048	1900.80	1899.0	6-16	17.89	2/22/2016	17.91	1882.89	8-1-16	17.33	1883.47
G0049	1901.28	1899.3	46-56	58.28	2/22/2016	18.84	1882.44	8-1-16	18.91	1882.37
G0067	1901.47	1899.6	5-20	22.43	2/22/2016	17.90	1883.57	8-1-16	19.61	1881.86
G0084	1906.97	1904.6	20-30	32.87	2/22/2016	22.68	1884.29	8-1-16	21.70	1885.27
G0093	1899.47	1897.14	20-30	32.09	2/22/2016	20.79	1878.68	8-1-16	15.93	1883.54
G0094	1903.72	1901.47	15-25	27.44	2/22/2016	20.23	1883.49	8-1-16	20.23	1883.49
G0096	1905.94	1903.3	15-25	27.93	2/22/2016	22.34	1883.60	8-1-16	21.80	1884.14
G0097	1903.62	1901.1	15-25	27.77	2/22/2016	20.10	1883.52	8-1-16	19.72	1883.90
G0098	1903.23	1900.6	15-25	27.83	2/22/2016	19.97	1883.26	8-1-16	19.93	1883.30
G0099	1903.36	1900.7	15-25	27.41	2/22/2016	19.90	1883.46	8-1-16	20.00	1883.36
G0108	1902.84	1900.2	15-25	27.68	2/22/2016	18.92	1883.92	8-1-16	19.91	1882.93
G0109	1901.24	1898.9	15-25	27.65	2/22/2016	17.72	1883.52	8-1-16	18.25	1882.99
G0110	1901.91	1899.0	15-25	28.24	2/22/2016	18.91	1883.00	8-1-16	19.51	1882.40
G0112	1901.06	1898.02	15-25	27.89	2/22/2016	18.12	1882.94	8-1-16	17.60	1883.46
G0113	1903.06	1900.11	15-25	27.98	2/22/2016	19.94	1883.12	8-1-16	19.74	1883.32
G0114	1901.92	1899.19	15-25	27.01	2/22/2016	18.50	1883.42	8-1-16	18.91	1883.01
G0118	1901.28	1898.66	15-25	27.59	2/22/2016	18.75	1882.53	8-1-16	19.05	1882.23
PZ015	1901.71	1899.6	10-30	32.83	2/22/2016	19.50	1882.21	8-1-16	19.36	1882.35
PZ016	1901.62	1899.4	10-30	32.73	2/22/2016	18.85	1882.77	8-1-16	19.99	1881.63
EW6-OW6A	1902.68	NA	29-54	58.93				8-1-16	20.56	1882.12
EW6-OW6B	1902.70	NA	29-54	56.59				8-1-16	20.6	1882.10
EW6-OW6C	1902.96	NA	29-54	56.69				8-1-16	20.87	1882.09

TABLE 3-1
WATER LEVEL MEASUREMENTS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location ID	Top of Casing Elevation[1] (ft amsl)	Ground Elevation[1] (ft amsl)	Approximate Screened Interval (ft bgs)	Well Depth (ft btoc)	Pre-Injection Water Levels			August Water Levels		
					Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft above msl)	Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft amsl)
Load Line 2										
G0018	1906.26	1903.5	18-33	35.85				8-2-16	18.02	1888.24
G0066R	1909.49	1907.5	20-30	32.55	2/22/2016	21.64	1887.85	8-1-16	21.15	1888.34
G0085	1905.79	1903.5	20-30	32.93				8-1-16	19.62	1886.17
G0095	1910.24	1908.6	15-25	27.06	2/22/2016	21.65	1888.59	8-1-16	21.12	1889.12
G0100	1910.46	1907.8	15-25	27.78	2/22/2016	22.64	1887.82	8-1-16	22.14	1888.32
G0101	1910.64	1907.9	15-25	27.89	2/22/2016	22.86	1887.78	8-1-16	22.37	1888.27
G0111	1911.94	1909.6	15-25	27.51	2/22/2016	24.28	1887.66	8-1-16	23.72	1888.22
G0115	1908.41	1906.57	20-30	32.21	2/22/2016	20.73	1887.68	8-1-16	20.16	1888.25
G0116	1904.19	1901.86	20-30	33.14				8-1-16	17.77	1886.42
G0117	1905.50	1902.73	20-30	32.01	2/22/2016	18.71	1886.79	8-1-16	17.89	1887.61
G0119	1909.16	1906.29	20-30	32.39	2/22/2016	21.08	1888.08	8-1-16	20.67	1888.49
G0120	1904.91	1902.3	20-30	32.34				8-1-16	16.81	1888.10
PZ009	1907.02	1904.9	10-30	32.86				8-1-16	19.05	1887.97
PZ010	1907.31	1905.30	10-30	32.83				8-1-16	19.31	1888.00
PZ011	1906.56	1904.90	10-30	32.84	2/22/2016	19.43	1887.13	8-1-16	18.65	1887.91
PZ012	1906.92	1904.70	10-30	32.79	2/22/2016	19.78	1887.14	8-1-16	18.99	1887.93
PZ013	1905.29	1902.30	10-30	32.88	2/22/2016	18.57	1886.72	8-1-16	17.64	1887.65
PZ014	1905.21	1903.10	10-30	32.84				8-1-16	17.89	1887.32
EW4-OW4A	1909.85	NA	31-51	54.93				8-2-16	21.97	1887.88
EW4-OW4B	1910.11	NA	31-51	53.43				8-2-16	22.29	1887.82
EW4-OW4C	1909.91	NA	31-51	53.18				8-2-16	22.32	1887.59
EW5-OW5A	1907.88	NA	29-59	60.79				8-1-16	19.98	1887.90
EW5-OW5B	1908.38	NA	29-59	61.00				8-1-16	20.51	1887.87
EW5-OW5C	1908.11	NA	29-59	60.90				8-1-16	20.26	1887.85

TABLE 3-1
WATER LEVEL MEASUREMENTS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location ID	Top of Casing Elevation[1] (ft amsl)	Ground Elevation[1] (ft amsl)	Approximate Screened Interval (ft bgs)	Well Depth (ft btoc)	Pre-Injection Water Levels			August Water Levels		
					Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft above msl)	Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft amsl)
Load Line 3										
G0016	1910.64	1908.10	14-29	31.85				8-1-16	19.91	1890.73
G0017	1910.60	1907.9	16-31	33.90				8-1-16	18.52	1892.08
G0045	1910.10	1908.30	45-55	58.52				8-1-16	18.09	1892.01
PZ007	1909.49	1907.50	10-30	32.82				8-2-16	17.84	1891.65
Load Line 4										
PZ005	1916.09	NA	10-30	32.88				8-1-16	20.32	1895.77
Load Line 5										
PZ001	1918.60	NA	10-30	32.88				8-2-16	21.91	1896.69
PZ004	1916.69	NA	10-30	32.90				8-2-16	20.10	1896.59
G0028	1918.35	NA	22-37	39.59				8-2-16	21.20	1897.15
G0044	1918.95	NA	11-26	28.28				8-2-16	21.95	1897.00
Decant Station										
G0063	1910.75	1908.54	3-18	21.01				8-2-16	15.26	1895.49
G0102	1912.20	1908.91	14-24	28.15				8-1-16	16.65	1895.55
G0103	1912.31	1908.92	14-24	28.18				8-1-16	16.77	1895.54
G0104	1911.55	1908.74	15-25	28.02				8-1-16	16.08	1895.47
G0105	1911.41	1908.28	15-25	28.16				8-1-16	16.09	1895.32
G0106	1912.15	1909.29	15-25	28.02				8-1-16	16.75	1895.40
G0107	1911.38	1908.36	15-25	28.28				8-1-16	16.08	1895.30

TABLE 3-1
WATER LEVEL MEASUREMENTS OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location ID	Top of Casing Elevation[1] (ft amsl)	Ground Elevation[1] (ft amsl)	Approximate Screened Interval (ft bgs)	Well Depth (ft btoc)	Pre-Injection Water Levels			August Water Levels		
					Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft above msl)	Date Measured	Depth to Water (ft btoc)	Water Level Elevation[1] (ft amsl)
Shop Area										
G0050	1902.29	1900.6	NA	25.24				8-2-16	17.18	1885.11
G0051	1902.22	1900.4	NA	25.45				8-2-16	17.96	1884.26
G0053	1902.88	1901.1	NA	25.12				8-2-16	18.50	1884.38
G0069	1900.02	1898.10	NA	25.24				8-2-16	16.18	1883.84
SAMW1	1899.91	1899.91	NA	22.16				8-2-16	16.25	1883.66
SHGW02	1902.50	1902.50	6-21	24.10				8-2-16	18.25	1884.25
SHGW03	1901.33	1901.33	6-21	23.68				8-2-16	17.18	1884.15
SHGW04	1899.82	1899.82	16-21	23.02				8-2-16	16.08	1883.74

Notes:

[1]Elevation datum based on National Geodetic Vertical Datum of 1929.

amsl = above mean sea level

bgs = below ground surface

btoc = below top of casing

EW = Extraction Well

ft = feet

ID = identification number

NA = not available

NM = not measured

PZ = piezometer

TABLE 3-2
FIELD WATER QUALITY PARAMETERS
OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

Well Number	Sample Date	pH	Temperature (°C)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Ferrous Iron (mg/L)
G0017	8/8/2016	6.86	13.49	0.999	0.69	-293.4	6.68	0.27
G0022	8/16/2016	6.78	13.17	0.501	0.46	109.5	1.69	0.09
G0023	8/15/2016	6.24	15.89	0.737	0.49	-18.2	5.00	7.15
G0024	8/9/2016	6.68	15.21	0.576	9.01	132.8	3.67	0.07
G0044	8/8/2016	6.99	11.92	0.903	3.59	-182.6	0.82	0.28
G0045	8/8/2016	7.05	14.62	1.991	0.55	-91.9	9.6	0.67
G0048				Dry[1]				
G0049	8/15/2016	7.07	15.14	0.752	0.26	-58.3	2.31	0.54
G0066R	8/16/2016	6.10	15.88	1.165	0.39	-65.9	1.92	>15
G0067	8/16/2016	6.46	15.70	0.427	4.23	69.9	2.67	0.02
G0070	8/10/2016	7.15	16.01	0.390	1.48	30.0	0.77	ND
G0075	8/10/2016	6.78	12.93	0.624	1.22	119.8	0.33	ND
G0076	8/10/2016	6.82	13.73	0.837	0.61	-30.9	0.98	1.11
G0077	8/9/2016	6.76	12.82	0.819	1.10	104.7	0.13	ND
G0078	8/9/2016	7.12	14.14	0.958	0.29	-21.4	5.63	0.62
G0079				Dry[1]				
G0080	8/16/2016	6.52	12.48	0.414	4.18	127.2	0.33	0.14
G0081	8/11/2016	6.49	12.42	0.707	0.36	77.3	0.77	ND
G0082	8/12/2016	6.56	13.56	0.587	0.20	43.3	0.29	0.04
G0083	8/16/2016	6.77	13.30	0.755	0.44	111.8	2.62	0.05
G0084	8/9/2016	6.00	14.78	0.932	0.45	-77.6	7.00	2.62
G0085	8/15/2016	6.44	13.30	0.702	0.35	-62.5	4.52	3.27
G0086	8/11/2016	6.74	11.71	0.594	0.30	35.8	0.43	ND
G0087	8/9/2016	6.76	14.02	0.448	0.63	86.8	2.53	0.10
G0088	8/16/2016	6.76	12.52	0.515	0.40	98.6	0.53	0.24
G0089	8/8/2016	6.43	13.80	0.676	0.19	-221.7	1.08	0.19
G0090	8/12/2016	6.65	15.19	0.532	5.11	47.1	1.88	0.09
G0091	8/16/2016	6.73	11.42	0.782	6.71	151.5	0.21	ND
G0092	8/16/2016	7.13	11.13	0.746	0.92	101.4	0.32	0.01
G0093	8/15/2016	5.98	15.74	0.404	0.26	-20.1	4.68	1.93
G0094	8/12/2016	5.92	13.72	0.438	0.52	-30.6	2.15	2.67
G0095	8/17/2016	6.43	15.35	0.706	0.49	-59.6	3.46	7.25
G0096	8/10/2016	6.53	15.31	0.713	0.32	41.9	1.32	0.08
G0097	8/16/2016	5.96	15.59	0.781	1.02	12.7	2.16	5.2
G0098	8/15/2016	6.14	16.18	0.499	0.46	-55.5	6.91	12.90
G0099	8/11/2016	5.95	17.16	0.465	0.37	-5.6	3.29	2.28
G0100	8/17/2016	6.44	14.49	0.705	0.33	-47.6	3.62	10.20
G0101	8/17/2016	6.59	15.71	1.229	0.25	16.2	3.01	1.92
G0102	8/12/2016	6.90	11.75	1.717	1.31	-34.9	1.69	2.13
G0103	8/8/2016	5.93	11.55	1.528	0.37	-309.1	3.93	ND
G0104	8/12/2016	6.82	11.23	1.725	0.29	-182.5	0.43	1.38
G0105	8/3/2016	7.05	15.22	2.184	0.50	-220.9	1.31	1.29
G0106	8/3/2016	7.07	15.41	1.999	0.37	20.2	5.00	1.50
G0107	8/3/2016	6.95	14.63	2.081	0.41	-79.8	3.60	1.90
G0108	8/9/2016	6.13	15.06	0.819	0.90	-68.8	3.01	2.69

TABLE 3-2
FIELD WATER QUALITY PARAMETERS
OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

Well Number	Sample Date	pH	Temperature (°C)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Ferrous Iron (mg/L)
G0109	8/16/2016	6.37	16.15	0.404	0.36	-34.7	3.92	8.10
G0110	8/16/2016	6.14	13.77	0.742	0.29	-79.3	1.03	6.46
G0111	8/17/2016	6.44	13.43	0.798	0.50	-35.8	4.32	7.80
G0112	8/10/2016	6.28	18.52	0.598	0.36	39.2	3.70	1.19
G0113	8/10/2016	6.45	18.90	1.299	1.69	-98.4	5.01	15.80
G0114	8/15/2016	6.37	15.55	0.527	0.23	-75.3	4.89	7.58
G0115	8/17/2016	6.46	15.70	1.169	6.39	-72.1	3.72	13.9
G0116	8/5/2016	5.13	13.64	1.610	3.21	-4.6	NS	NS
G0117	8/10/2016	6.38	15.52	1.605	0.64	-105.9	0.48	>15
G0118	8/16/2016	6.28	16.32	0.926	0.70	-64.1	1.66	>15
G0119	8/10/2016	6.38	14.62	1.703	0.68	-97.3	0.71	8.40
G0120	8/9/2016	6.21	13.56	1.869	0.84	-69.6	2.16	11.50
G0121*	11/30/2016	6.19	9.99	1.909	0.84	-76.5	7.68	0.29
PZ001	8/4/2016	7.13	12.42	2.282	0.73	3.0	0.76	0.53
PZ004	8/4/2016	7.08	11.93	2.147	1.67	31.5	0.38	0.30
PZ005	8/8/2016	6.78	12.89	2.085	1.68	53.1	4.15	0.64
PZ007	8/4/2016	7.19	14.38	1.859	2.22	2.3	1.96	0.46
PZ009	8/5/2016	6.89	13.84	1.143	1.07	25.6	2.10	0.11
PZ010	8/5/2016	6.57	13.59	0.849	2.50	-12.6	2.99	0.81
PZ011	8/8/2016	6.32	13.68	1.381	0.18	-213.1	3.98	6.14
PZ012	8/8/2016	6.38	14.23	1.685	0.19	-278.1	17.21	5.58
PZ013	8/9/2016	6.41	15.73	1.737	1.02	-54.0	4.36	2.33
PZ014	8/9/2016	6.81	15.74	1.957	0.30	-58.7	0.01	1.61
PZ015	8/12/2016	6.21	13.25	0.494	0.42	55.0	4.88	0.57
PZ016	8/12/2016	6.62	14.25	0.549	0.32	-23.9	4.11	1.59
PZ017R	8/9/2016	6.42	12.72	0.612	4.52	90.5	0.22	ND
PZ018	8/9/2016	6.55	13.28	0.653	0.96	77.0	0.17	ND
PZ019	8/10/2016	6.15	12.59	0.667	9.18	171.9	1.03	ND
PZ020	8/12/2016	6.82	14.16	0.807	4.34	64.4	4.89	0.09

Notes:

*Monitoing well G0121 was installed in November 2016 and sampled for explosives (inlcuding MNX) and field MNA parameters only.

[1]Well not sampled due to insufficient water amount to collect.

Field water quality parameters for all wells were measured using a YSI 556 MPS equipped with a flow-through cell with the exception of turbidity and ferrous iron. Turbidity was measured using a LaMotte turbidity meter (2020). Ferrous iron was measured using a HACH colorimeter (DR/820).

°C = degrees Celsius

DO = dissolved oxygen

mg/L = milligrams per liter

MPS = multiprobe system

mS/cm = milliSiemens per centimeter

mV = millivolts

NS = not sampled

ND = nondetect

NTU = nephelometric turbidity units

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 3-3
FIELD WATER QUALITY PARAMETERS
OU1 OFF-POST MONITORING WELLS
2016 ANNUAL REPORT

Well Number	Sample Date	pH	Temperature (°C)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Ferrous Iron (mg/L)
NW020	8/5/2016	6.11	12.01	0.713	5.29	195.7	0.10	ND
NW021	8/5/2016	6.74	13.81	0.800	0.38	139.2	0.71	ND
NW022	8/5/2016	7.10	13.94	0.974	0.32	-45.3	1.88	0.30
NW080	8/4/2016	6.35	14.49	1.106	9.72	173.9	0.18	ND
NW081R	8/4/2016	6.53	13.44	0.893	2.35	173.9	0.42	ND
NW082R	8/4/2016	6.60	12.76	0.831	0.35	151.9	0.29	0.07
CA270	8/3/2016	6.66	21.89	1.011	0.96	193.4	1.03	ND
CA271	8/3/2016	6.31	17.88	0.722	5.71	195.5	2.59	ND
CA272	8/3/2016	6.42	17.99	0.766	4.39	200.9	0.21	0.01
CA273	8/3/2016	7.27	17.68	0.459	0.36	-40.9	0.80	0.63
CA290R	8/3/2016	6.70	19.13	0.774	5.75	164.4	0.37	ND
CA291R	8/3/2016	6.70	15.42	0.472	3.63	179.6	0.25	0.03
CA292R	8/3/2016	6.80	15.51	0.528	0.64	168.3	1.03	ND
CA310	8/2/2016	6.63	14.87	1.08	5.98	116.90	1.10	ND
CA311	8/2/2016	6.73	16.50	0.686	2.52	78.3	1.55	ND
CA312	8/2/2016	6.71	15.20	0.498	1.91	70.4	2.11	0.04
CA313	8/2/2016	7.29	14.13	0.291	0.23	-12.8	4.40	0.24
CA330	8/2/2016	6.73	19.28	1.216	5.08	181.3	0.04	ND
CA331	8/2/2016	6.58	15.51	0.647	1.37	172.6	1.87	ND
CA332	8/2/2016	6.62	14.25	0.502	1.70	151.8	0.31	ND
CA342	8/3/2016	6.74	14.21	0.584	1.19	204.5	2.36	0.11
CA343	8/3/2016	6.95	13.41	0.578	0.83	133.2	0.01	0.05

Notes:

Field water quality parameters for all wells were measured using a YSI 556 MPS equipped with a flow-through cell with the exception of turbidity and ferrous iron. Turbidity was measured using a LaMotte turbidity meter (2020). Ferrous iron was measured using a HACH colorimeter (DR/820).

°C = degrees Celsius

DO = dissolved oxygen

mg/L = milligrams per liter

MPS = multiprobe system

mS/cm = milliSiemens per centimeter

mV = millivolts

ND = nondetect

NTU = nephelometric turbidity units

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 3-4
FIELD WATER QUALITY PARAMETERS
OU3 SHOP AREA MONITORING WELLS
2016 ANNUAL REPORT

Well Number	Sample Date	pH	Temperature (°C)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Ferrous Iron (mg/L)
G0053	8/15/2016	5.63	14.78	0.230	0.96	171.6	1.23	0.13
G0069	8/15/2016	6.19	14.05	0.251	2.13	132.2	0.73	ND
SAMW1	8/15/2016	6.12	13.59	0.341	6.81	177.6	0.55	0.01
SHGW02	8/15/2016	5.86	15.85	0.359	0.25	-41.0	4.88	2.58
SHGW03	8/15/2016	6.08	14.70	0.362	0.31	-104.2	2.77	3.01
SHGW04	8/15/2016	6.06	12.80	0.317	1.57	158.5	0.44	ND

Notes:

Field water quality parameters for all wells were measured using a YSI 556 MPS equipped with a flow-through cell with the exception of turbidity and ferrous iron. Turbidity was measured using a LaMotte turbidity meter (2020). Ferrous iron was measured using a HACH colorimeter (DR/820).

°C = degrees Celsius

DO = dissolved oxygen

mg/L = milligrams per liter

MPS = multiprobe system

mS/cm = milliSiemens per centimeter

mV = millivolts

NTU = nephelometric turbidity units

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 3-5
FIELD WATER QUALITY PARAMETER RANGES
OU1 ON-POST AND OFF-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

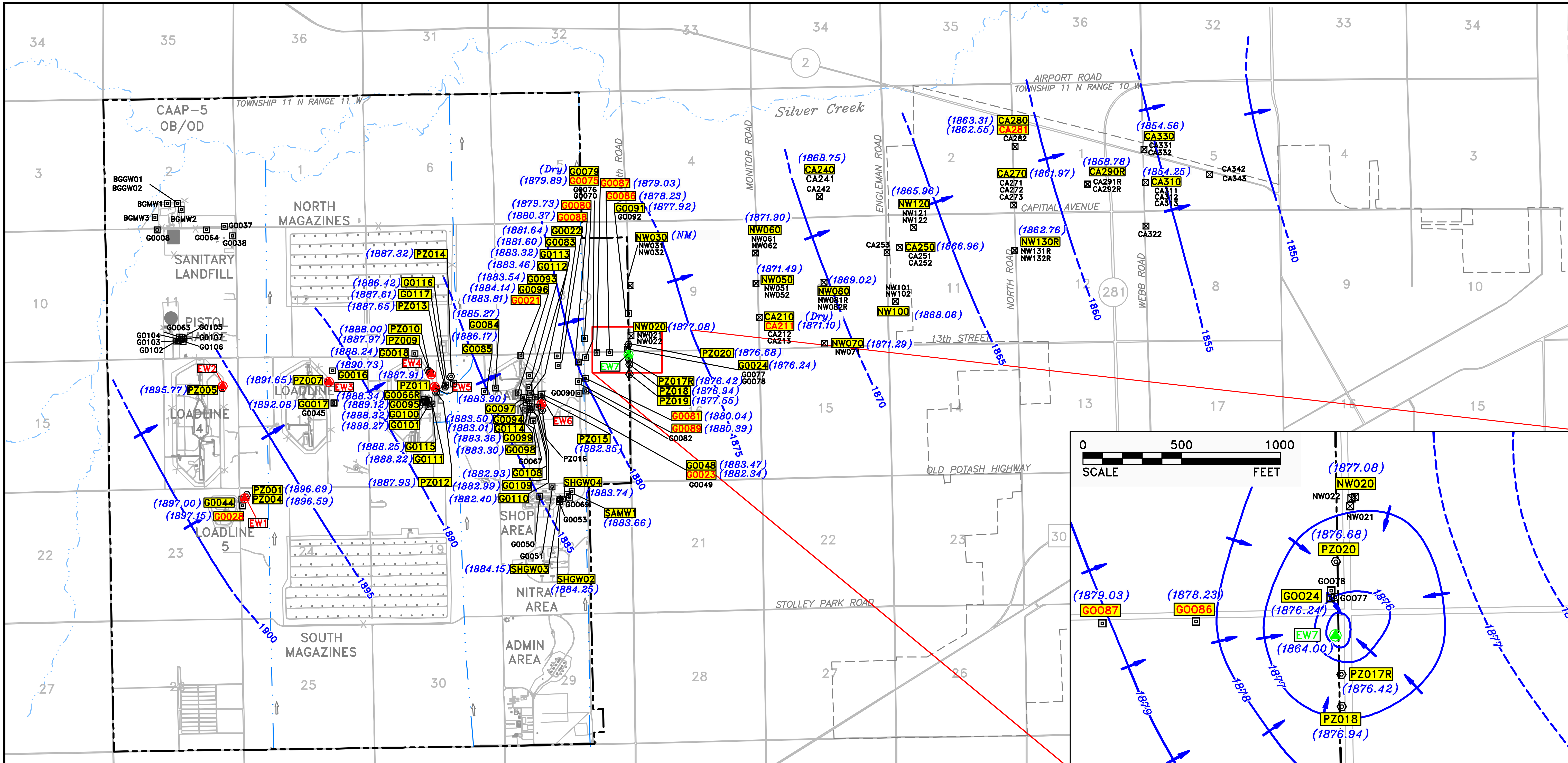
On-Post Wells

Water Quality Parameters (Units)	Measurement Range
ORP (mV)	-309.1 to 171.9
Dissolved Oxygen (mg/L)	0.18 to 9.01
pH	5.13 to 7.19
Specific Conductance (mS/cm)	0.390 to 2.282
Temperature (°C)	9.99 to 18.9
Ferrous Iron (mg/L)	ND to >15
Turbidity (NTU)	0.01 to 17.21

Off-Post Wells

Water Quality Parameters (Units)	Measurement Range
ORP (mV)	-45.3 to 204.5
Dissolved Oxygen (mg/L)	0.23 to 9.72
pH	6.11 to 7.29
Specific Conductance (mS/cm)	0.291 to 1.216
Temperature (°C)	12.01 to 21.89
Ferrous Iron (mg/L)	ND to 0.63
Turbidity (NTU)	ND to 4.40

Notes:
°C = degrees Celsius
mg/L = milligrams per liter
mS/cm = milliSiemens per centimeter
mV = millivolts
ND = nondetect (below instrument detection limit)
NTU = nephelometric turbidity units
ORP = oxidation/reduction potential
OU = Operable Unit



LEGEND:

⊡	ON-POST GROUNDWATER MONITORING WELL
⊠	OFF-POST GROUNDWATER MONITORING WELL
⊚	ON-POST PIEZOMETER
▲ (red)	INACTIVE GROUNDWATER EXTRACTION WELL
▲ (green)	ACTIVE GROUNDWATER EXTRACTION WELL
G0029	SHALLOW WATER TABLE SURFACE WELLS MEASURED TO CONSTRUCT THE MAP (TOP GRAND ISLAND FORMATION)
G0033	SHALLOW-INTERMEDIATE WELLS MEASURED TO CONSTRUCT THE MAP (MIDDLE GRAND ISLAND FORMATION)
	ROADS
	FACILITY BOUNDARY
	GRAND ISLAND CITY LIMITS
	SURFACE DRAINAGE
—1890—	WATER TABLE ELEVATION CONTOURS – AUGUST 2016 (FT ABOVE MEAN SEA LEVEL)
	INFERRED WATER TABLE ELEVATION CONTOURS – AUGUST 2016 (FT ABOVE MEAN SEA LEVEL)
→	INTERPRETED GROUNDWATER FLOW DIRECTION
1	SECTION NUMBER
NM	NOT MEASURED

N

SCALE 0 4000 8000 FEET

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WATER TABLE ELEVATION MAP – AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/06/16	PROJECT NO. 16170837	FIG. NO. 3-1
CHK'D. BY: DC	DATE: 09/06/16		

June 26, 2017 9:28:31 a.m.
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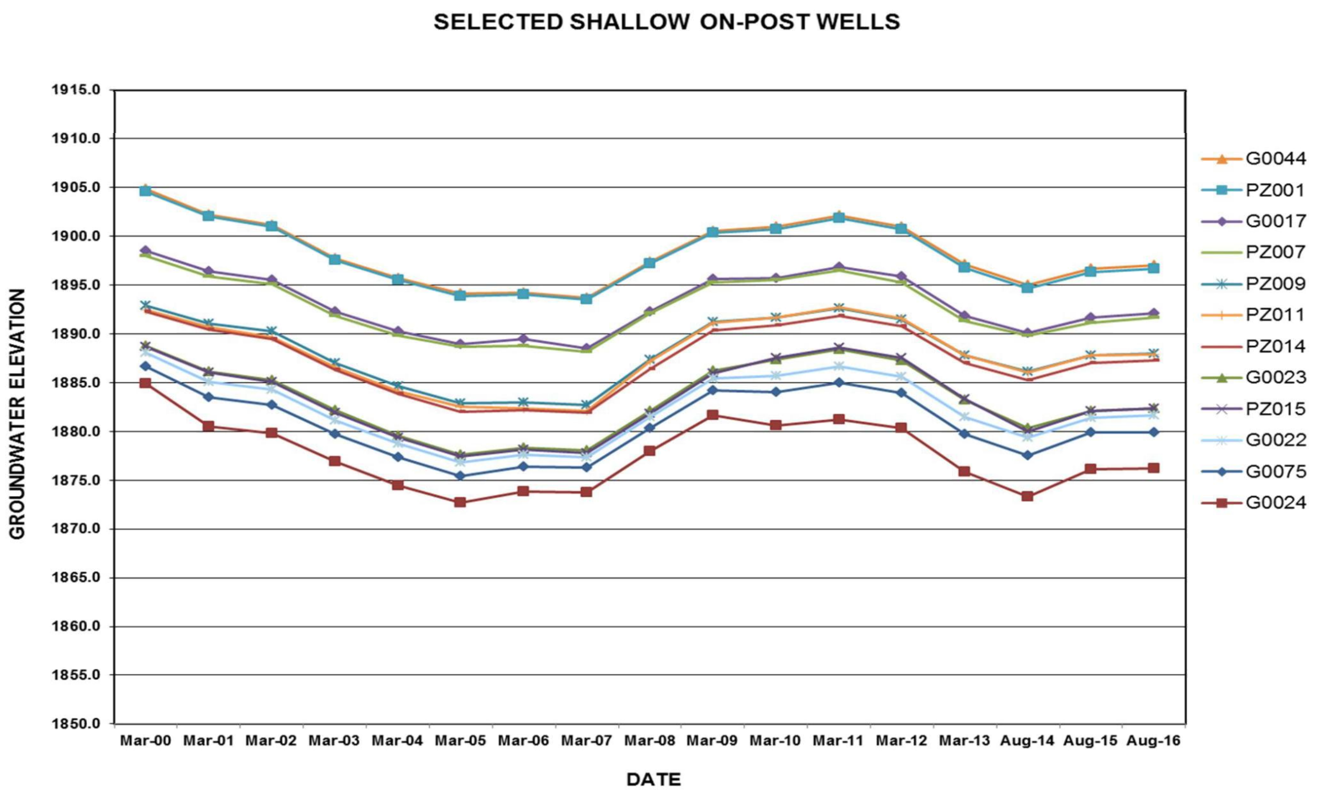

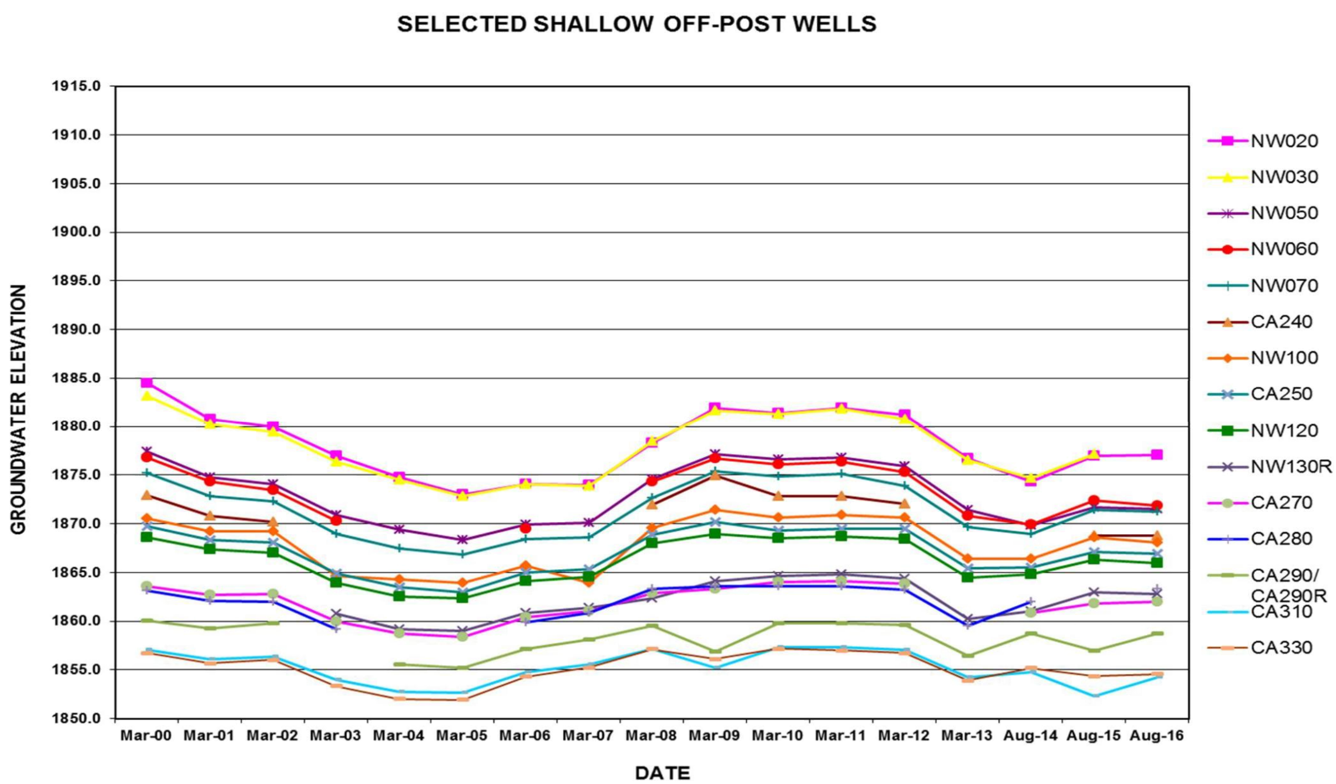

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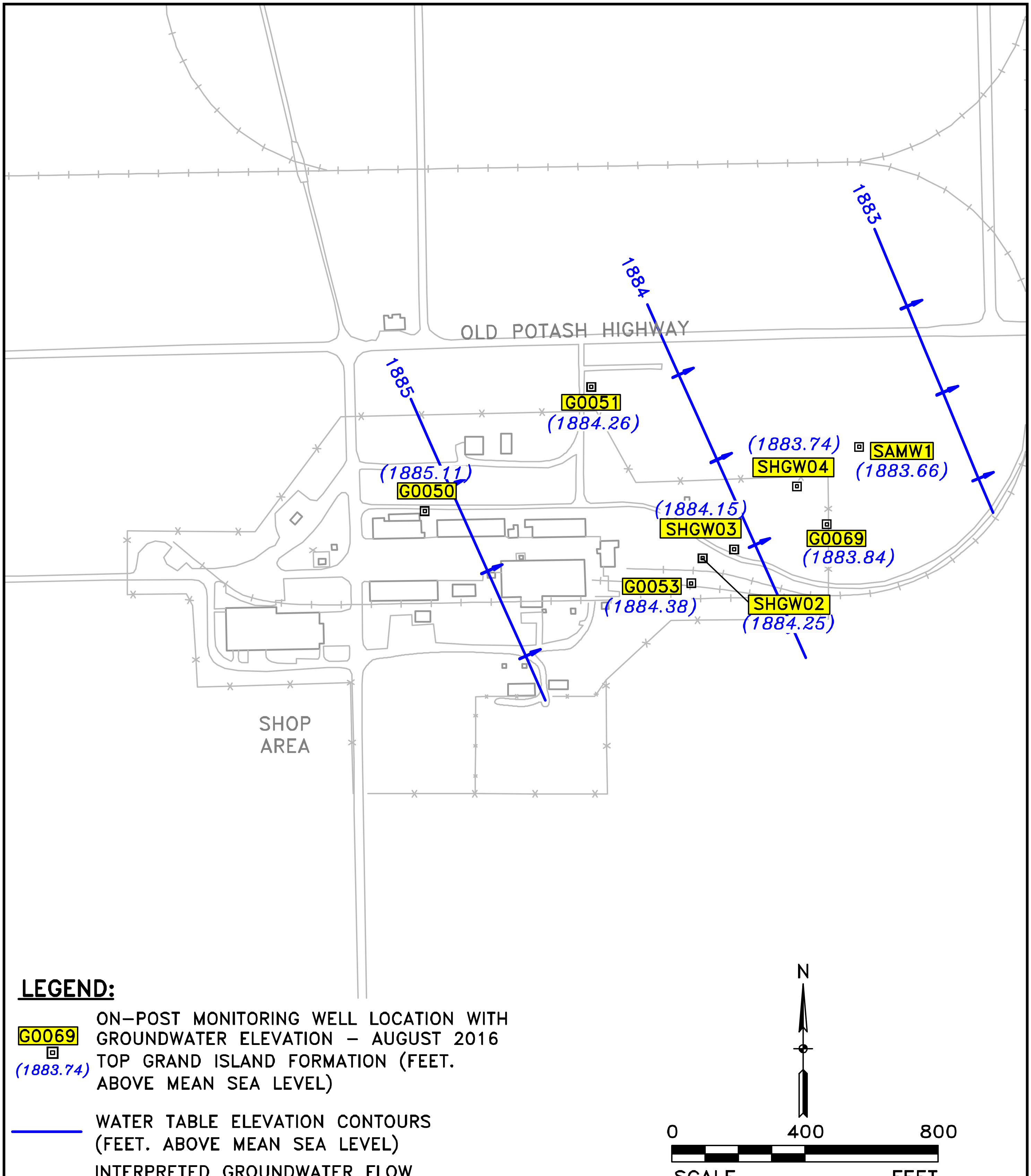
GROUNDWATER ELEVATION TRENDS IN SELECTED SHALLOW MONITORING WELLS
MARCH 2000 TO AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/02/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/02/16	16170837	3-2

December 07, 2016 10:17:18 a.m.
Drawing: T:\CHAAP\16170837\27\3-2.dwg



LEGEND:

G0069 (1883.74) — ON-POST MONITORING WELL LOCATION WITH GROUNDWATER ELEVATION – AUGUST 2016 TOP GRAND ISLAND FORMATION (FEET. ABOVE MEAN SEA LEVEL)

WATER TABLE ELEVATION CONTOURS (FEET. ABOVE MEAN SEA LEVEL)

INTERPRETED GROUNDWATER FLOW DIRECTION

ROADS

FENCES

BUILDINGS

OU — OPERABLE UNIT

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WATER TABLE ELEVATION MAP – AUGUST 2016
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/06/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/06/16	16170837	3–3

December 07, 2016 10:17:54 a.m.
Drawing: T:\CHAAP\16170837\27\3-3.dwg

4.1 SUMMARY OF ANALYTICAL RESULTS

Groundwater samples for OU1 GWTF were analyzed in accordance with the 2014 Final UFP-QAPP (BW-URS 2014c) for various compounds depending on sample location. GAC vessel influent, lead GAC vessel effluent, lag GAC vessel effluent, and GWTF effluent were analyzed for four explosives compounds (RDX, TNT, HMX, and 2,4,6-trinitrophenylmethylnitramine [tetryl] (USEPA Method 8330A). Additionally, GAC system influent and GWTF effluent were analyzed for two VOCs (trichloroethene and 1,1,2-trichloro-1,2,2-trifluoroethane) (USEPA 8260B/5030B), total suspended solids (USEPA 2540D), and pH (USEPA Method 9040B). The GWTF effluent was also analyzed for selenium (USEPA 6010C). All laboratory analyses were completed by TAL.

Groundwater samples for the OU1 pre-injection groundwater investigation sampling event were analyzed in accordance with the 2014 Final UFP-QAPP (BW-URS 2014c) for explosives only, including MNX (USEPA Method 8330A). Groundwater samples for the OU1 annual sampling event were analyzed in accordance with the 2014 Final UFP-QAPP (BW-URS 2014c) for explosives including MNX (USEPA Method 8330A); and laboratory MNA parameters (on-post wells only): alkalinity (standard method [SM] 2320B, calculated from bicarbonate), ammonia (USEPA Method 350.1), nitrate/nitrite (USEPA Method 353.2), sulfate (USEPA Method 9056A, as ion concentrations), sulfide (USEPA Method 9034), TKN (USEPA Method 351.2), DOC (USEPA Method 9060), carbon dioxide (CO_2) (back calculation from SM 2320B), and methane (Robert S. Kerr Environmental Research Laboratory Method 175 [RSK-175]) by TAL.

Groundwater samples for the OU3 Shop Area annual sampling event were analyzed in accordance with the 2014 Final UFP-QAPP (BW-URS 2014c) for VOCs including Freon® 113 (USEPA 8260B/5030B), TPH-DRO (USEPA 8015B); and laboratory MNA parameters: alkalinity, nitrate/nitrite, sulfate, and methane, ethane, ethene (RSK-175) by TAL. A summary of all analytical results for 2016 GWTF sampling and 2016 pre-injection groundwater investigation and annual groundwater samples collected for OU1/OU3 from CHAAP on-post monitoring wells, on-post piezometers, and off-post monitoring wells are discussed below. Current and historic OU1/OU3 analytical data from annual sampling events (not including GWTF and pre-injection groundwater investigations) are presented in **Appendix E**.

4.1.1 Chemicals Reported in Groundwater Samples Collected at GWTF

Table 4-1 summarizes GWTF analytical results from the four sampling events completed in 2016. With respect to explosives compounds, RDX, HMX, and TNT were detected in all influent samples to the GAC treatment system; tetryl was not detected in any of the influent samples. The maximum RDX, HMX, and TNT influent concentrations during the four sampling events were 0.97 µg/L (April), 0.81 **J** µg/L (July), and 11 µg/L (January), respectively. All influent RDX and HMX concentrations were below the HALs of 2 and 400 µg/L, respectively. With respect to GWTF effluent, all RDX, HMX, TNT, and tetryl concentrations were below the corresponding level of detection during all four sampling events. These results demonstrate excellent removal efficiency by the GAC system.

4.1.2 Chemicals Reported in Groundwater Samples Collected at OU1 (Groundwater Explosives Plume)

Tables 4-2 (pre-injection groundwater investigation samples), **4-3** (on-post wells from the annual sampling event), and **4-4** (off-post wells from the annual sampling event) summarize the explosives compounds detected in groundwater at OU1. The primary explosives compounds detected in groundwater collected from OU1 were RDX, HMX, and TNT. Additionally, the explosives breakdown products MNX, 1,3,5-trinitrobenzene, 2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene (2-Am-DNT), 2-nitrotoluene, 4-nitrotoluene, 3-nitrotoluene, nitrobenzene, and 4-amino-2,6-dinitrotoluene (4-Am-DNT) were detected. **Table 4-5** summarizes the frequency of detections, concentration ranges, and detections above HALs for explosives compounds detected during the August/November 2016 OU1 annual sampling event at CHAAP. The nature and extent of explosives in groundwater, including a summary of HAL exceedances, is provided in **Section 5**. **Tables 4-6** (on-post wells) and **4-7** (off-post wells) summarize the laboratory natural attenuation parameters detected in groundwater at OU1 (off-post wells were not analyzed for laboratory natural attenuation parameters in 2016). Field duplicate sample pairs were collected to assess both field and laboratory precision. Six field duplicate samples (two during the pre-injection groundwater investigation event, four during the annual sampling event) were collected and submitted to the laboratory for analysis. Analytical results for the OU1 field duplicate sample pairs are presented in **Table 4-10a**.

4.1.3 Chemicals Reported in Groundwater Samples Collected at OU3 (Shop Area)

Table 4-8 summarizes the VOCs and TPH-DRO detected in groundwater at OU3 from the annual sampling event. The nature and extent of VOCs and TPH-DRO in groundwater, including a summary of MCL exceedances, is provided in **Section 5**. VOCs detected in groundwater at OU3 were 1,1,2-trichloroethane, 1,2-DCA, 2-butanone, 2-hexanone, acetone, benzene, chloroethane, cyclohexane, ethyl benzene, isopropylbenzene, vinyl chloride, and xylenes (total). TPH-DRO was also detected at the three wells sampled for this analysis. **Table 4-9** summarizes the laboratory natural attenuation parameters detected in the groundwater at OU3. Field duplicate sample pairs were collected to assess both field and laboratory precision. One field duplicate sample was collected and submitted to the laboratory for analysis. Analytical results for the OU3 field duplicate sample pair are presented in **Table 4-10b**.

4.2 DATA QUALITY REVIEW/VALIDATION PROCESS

Analytical data were reviewed and verified by Bay West in accordance with the 2014 Final UFP-QAPP (BW-URS 2014c). The data review process included evaluations of the following elements, as required, including validation of raw data by a Bay West chemist. The validation software ADR.NET was used to supplement the manual validation.

- Laboratory case narrative/cooler receipt form
- Sample documentation
- Sample preservation and holding time compliance

- Instrument performance check (tuning)
- Initial calibration
- Initial calibration verification second source
- Continuing calibration verification
- Internal standards
- Blank samples
- Laboratory control samples
- Surrogate compounds
- MS/MSDs
- Field duplicates
- Sensitivity
- Additional qualifications, including professional judgment
- Completeness

4.3 ANALYTICAL RESULTS VERIFICATION

The laboratory data reports and complete ADR.NET and data verification reports are provided in **Appendix D** for the GWTF sampling events and the pre-injection groundwater investigation and annual OU1/OU3 groundwater monitoring events. Qualifications applied to the analytical results based on the data review findings are included in **Table 4-1** for the GWTF and summarized in **Table 4-11** for samples associated with the pre-injection groundwater investigation and the annual groundwater monitoring event.

General trends regarding the data validation are as follows:

- The 8330A explosive analyses reported recoveries of the surrogate 1,2-dinitrobenzene outside of recovery criteria in a number of analyses. Both positive and nondetected results were qualified as estimated during validation when the surrogate recoveries were biased low; however, only detected results were qualified when the surrogate recoveries were biased high.
- The 8330A explosive analyses reported positive concentrations of analytes that exceeded the 40-percent relative percent difference (RPD) criterion between the primary and confirmatory columns. These results were qualified as estimated during validation.
- The 8330A explosive analyses reported high RPDs in selected field duplicate pairs. These results were qualified as estimated during validation.
- Low recoveries in the 8330A laboratory control samples and MS/MSDs required qualifications of several compounds during the 8330A Explosive analyses.

- Occasional method blank contamination was observed for 8330A explosives analysis. Results less than five times the blank concentration were flagged "U" as nondetected.
- An exceeded holding time in the 8260B VOC analysis required qualification of all VOCs in a trip blank sample.
- MS/MSD recoveries in the TKN analyses were often biased low. Positive and nondetected results were qualified as estimated for these analyses when the fortified samples did not meet recovery criteria.
- Several parent sample results for ammonia, nitrate-nitrite as nitrogen, and sulfate and were qualified due to matrix spike results outside of the required criteria. The parent sample nondetected and detected results were qualified when MS/MSD recoveries were biased low; however, only the detected results were qualified when the MS/MSD recoveries were biased high. Qualifications of these results follow the guidelines in the Department of Defense Quality Systems Manual for Environmental Laboratories.
- Field duplicate pairs for ammonia reported a high RPD in field duplicate pair. These results were qualified as estimated during validation.
- In the RSK-175 analysis, methane results for several samples were qualified "J" or "UJ" as estimated due to headspace in the volatile organic analysis vials, pH > 2 and high RPD in a field duplicate pair.
- Occasional method blank contamination was observed for DOC. Results less than five times the blank concentration were flagged "U" as nondetected.

4.4 CONCLUSIONS OF DATA AND QUALITY REVIEW

The analytical data for both GWTF system samples and samples collected for the pre-injection groundwater investigation and annual groundwater monitoring events were found to be acceptable for their intended use based on the data validation and the automated data review. Completeness, defined to be the percentage of analytical results judged to be valid, including estimated data, was 100 percent for the 2016 annual sampling event. No analytical data were rejected during the data validation. Generally, good precision was noted in the field duplicate samples for analytes reported above the laboratory limits of quantitation.

TABLE 4-1
SUMMARY OF GWTF ANALYTICAL RESULTS FROM TREATMENT SYSTEM SAMPLES
2016 ANNUAL REPORT

Sample ID (Sample Location) / Date Sampled			SP-E1 (GWTF Effluent) 1/27/2016					SP-S2 (GWTF Influent [EW7 Conc.]) 1/27/2016					SP-S6 (Effluent from Lead GAC Vessel)[3] 1/27/2016					SP-S8 (Effluent from Lag GAC Vessel)[3] 1/27/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20	1.2	J	0.79	1.6	3.0	2.1	J	0.79	1.6	3.0										
Trichloroethene (µg/L)	Report	5	<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0										
2,4,6-Trinitrotoluene (µg/L)	Report	Report	<	U	0.076	0.21	0.40	11		0.077	0.21	0.16	0.61		0.075	0.21	0.41	<	U	0.075	0.21	0.41
HMX (µg/L)	200	400	<	U	0.092	0.21	0.42	<	U	0.094	0.21	0.43	<	U	0.090	0.21	0.41	<	U	0.091	0.21	0.41
RDX (µg/L)	50	100	<	U	0.055	0.13	0.21	0.72		0.056	0.13	0.21	0.20	J	0.054	0.12	0.21	<	U	0.054	0.12	0.21
Tetryl (µg/L)	None	None	<	U	0.084	0.21	0.25	<	U	0.085	0.21	0.26	<	U	0.082	0.21	0.25	<	U	0.082	0.21	0.25
Selenium (µg/L)	5	20	9.9	J	4.9	19	22															
Total Suspended Solids (mg/L)	500[1]	500[1]						1.2	J	1.1	2.8	4.0										
pH (pH units)	6.5[2]	9.0[2]	7.30		0.100	0.100	0.100	7.09		0.100	0.100	0.100										

Sample ID (Sample Location) / Date Sampled			SP-E11 (Duplicate of SP-E1) 1/27/2016					SP-S22 (Duplicate of SP-S2) 1/27/2016					Trip Blank 827 1/27/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20						2.2	J	0.79	1.6	3.0	<	U	0.79	1.6	3.0
Trichloroethene (µg/L)	Report	5						<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0
2,4,6-Trinitrotoluene (µg/L)	Report	Report						11		0.075	0.21	0.42					
HMX (µg/L)	200	400						<	U	0.091	0.21	0.42					
RDX (µg/L)	50	100						0.74		0.054	0.12	0.21					
Tetryl (µg/L)	None	None						<	UJ	0.085	0.21	0.26					
Selenium (µg/L)	5	20	<	U	4.9	19	22										
Total Suspended Solids (mg/L)	500[1]	500[1]						<	U	1.1	2.8	4.0					
pH (pH units)	6.5[2]	9.0[2]						7.08		0.100	0.100	0.100					

Notes:

[1]The value provided for Total Suspended Solids is the PAL.
[2]Values provided for pH are the minimum and maximum.
[3]Lead and Lag GAC vessels are first and second GAC vessels piped in series for groundwater treatment.

Blank/empty cells indicate analysis for the corresponding parameter was not required or performed.
Treatment Objectives:
Report = No numerical objective. Parameter analysis and reporting are required and performed.

< = less than LOD
µg/L = micrograms per liter
DL = detection limit
GAC = granular active carbon
GWTF = groundwater treatment facility
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
J = estimated
LOD = limit of detection

LOQ = limit of quantification
mg/L = milligrams per liter
PAL = project action limit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
tetryl = 2,4,6-trinitrophenylmethylnitramine
U = nondetect

TABLE 4-1
SUMMARY OF GWTF ANALYTICAL RESULTS FROM TREATMENT SYSTEM SAMPLES
2016 ANNUAL REPORT

Sample ID (Sample Location) / Date Sampled			SP-E1 (GWTF Effluent) 4/27/2016					SP-S2 (GWTF Influent [EW7 Conc.]) 4/27/2016					SP-S6 (Effluent from Lead GAC Vessel)[3] 4/27/2016					SP-S8 (Effluent from Lag GAC Vessel)[3] 4/27/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20	1.1	J	0.79	1.6	3.0	1.7	J	0.79	1.6	3.0										
Trichloroethene (µg/L)	Report	5	<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0										
2,4,6-Trinitrotoluene (µg/L)	Report	Report	<	U	0.076	0.21	0.42	7.5		0.075	0.21	0.41	0.62		0.075	0.21	0.42	<	U	0.076	0.21	0.42
HMX (µg/L)	200	400	<	U	0.092	0.21	0.42	0.66		0.091	0.21	0.41	<	U	0.091	0.21	0.42	<	U	0.092	0.21	0.42
RDX (µg/L)	50	100	<	U	0.055	0.13	0.21	0.97		0.054	0.12	0.21	<	U	0.054	0.12	0.21	<	U	0.055	0.13	0.21
Tetryl (µg/L)	None	None	<	U	0.083	0.21	0.25	<	U	0.082	0.21	0.25	<	U	0.082	0.21	0.25	<	U	0.083	0.21	0.25
Selenium (µg/L)	5	20	<	U	4.9	19	22															
Total Suspended Solids (mg/L)	500[1]	500[1]						1.2	J	1.1	2.8	4.0										
pH (pH units)	6.5[2]	9.0[2]	7.23		0.100	0.100	0.100	7.13		0.100	0.100	0.100										

Sample ID (Sample Location) / Date Sampled			SP-E11 (Duplicate of SP-E1) 4/27/2016					SP-S22 (Duplicate of SP-S2) 4/27/2016					Trip Blank 840 4/27/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20						1.6	J	0.79	1.6	3.0	<	U	0.79	1.6	3.0
Trichloroethene (µg/L)	Report	5						<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0
2,4,6-Trinitrotoluene (µg/L)	Report	Report						7.7		0.075	0.21	0.41					
HMX (µg/L)	200	400						0.73		0.091	0.21	0.41					
RDX (µg/L)	50	100						1.0		0.054	0.12	0.21					
Tetryl (µg/L)	None	None						<	U	0.082	0.21	0.25					
Selenium (µg/L)	5	20	<	U	4.9	19	22										
Total Suspended Solids (mg/L)	500[1]	500[1]						<	U	1.1	2.8	4.0					
pH (pH units)	6.5[2]	9.0[2]						7.23		0.100	0.100	0.100					

Notes:

[1]The value provided for Total Suspended Solids is the PAL.
[2]Values provided for pH are the minimum and maximum.
[3]Lead and Lag GAC vessels are first and second GAC vessels piped in series for groundwater treatment.

Blank/empty cells indicate analysis for the corresponding parameter was not required or performed.
Treatment Objectives:
Report = No numerical objective. Parameter analysis and reporting are required and performed.

< = less than LOD
µg/L = micrograms per liter
DL = detection limit
GAC = granular active carbon
GWTF = groundwater treatment facility
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
J = estimated
LOD = limit of detection
LOQ = limit of quantification
mg/L = milligrams per liter
PAL = project action limit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
tetryl = 2,4,6-trinitrophenylmethylnitramine
U = nondetect

TABLE 4-1
SUMMARY OF GWTF ANALYTICAL RESULTS FROM TREATMENT SYSTEM SAMPLES
2016 ANNUAL REPORT

Sample ID (Sample Location) / Date Sampled			SP-E1 (GWTF Effluent) 7/27/2016					SP-S2 (GWTF Influent [EW7 Conc.]) 7/27/2016					SP-S6 (Effluent from Lead GAC Vessel)[3] 7/27/2016					SP-S8 (Effluent from Lag GAC Vessel)[3] 7/27/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20	1.6	J	0.79	1.6	3.0	1.6	J	0.79	1.6	3.0										
Trichloroethene (µg/L)	Report	5	<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0										
2,4,6-Trinitrotoluene (µg/L)	Report	Report	<	U	0.080	0.22	0.42	9.0		0.080	0.22	0.44	0.51		0.079	0.22	0.44	<	U	0.079	0.22	0.44
HMX (µg/L)	200	400	<	U	0.097	0.22	0.42	0.81	J	0.097	0.22	0.44	<	U	0.095	0.22	0.44	<	U	0.096	0.22	0.44
RDX (µg/L)	50	100	<	U	0.058	0.13	0.22	0.83	J	0.058	0.13	0.22	0.30	U	0.057	0.13	0.22	<	U	0.057	0.13	0.22
Tetryl (µg/L)	None	None	<	U	0.088	0.22	0.27	<	U	0.088	0.22	0.27	<	U	0.086	0.22	0.26	<	U	0.087	0.22	0.26
Selenium (µg/L)	5	20	<	U	4.9	19	22															
Total Suspended Solids (mg/L)	500[1]	500[1]						2.8	U	1.1	2.8	4.0										
pH (pH units)	6.5[2]	9.0[2]	7.10		0.100	0.100	0.100	7.13		0.100	0.100	0.100										

Sample ID (Sample Location) / Date Sampled			SP-E11 (Duplicate of SP-E1) 7/27/2016					SP-S22 (Duplicate of SP-S2) 7/27/2016					Trip Blank 853 7/27/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20						1.8	J	0.79	1.6	3.0	<	U	0.79	1.6	3.0
Trichloroethene (µg/L)	Report	5						<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0
2,4,6-Trinitrotoluene (µg/L)	Report	Report						9.1		0.079	0.22	0.44					
HMX (µg/L)	200	400						0.81		0.096	0.22	0.44					
RDX (µg/L)	50	100						0.74		0.057	0.13	0.22					
Tetryl (µg/L)	None	None						<	U	0.087	0.22	0.26					
Selenium (µg/L)	5	20	<	U	4.9	19	22										
Total Suspended Solids (mg/L)	500[1]	500[1]						<	U	1.1	2.8	4.0					
pH (pH units)	6.5[2]	9.0[2]						7.09		0.100	0.100	0.100					

Notes:

[1]The value provided for Total Suspended Solids is the PAL.
[2]Values provided for pH are the minimum and maximum.
[3]Lead and Lag GAC vessels are first and second GAC vessels piped in series for groundwater treatment.

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Treatment Objectives:
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< = less than LOD
µg/L = micrograms per liter
DL = detection limit
GAC = granular active carbon
GWTF = groundwater treatment facility
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
J = estimated
LOD = limit of detection
LOQ = limit of quantification
mg/L = milligrams per liter
PAL = project action limit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
tetryl = 2,4,6-trinitrophenylmethylnitramine
U = nondetect

TABLE 4-1
SUMMARY OF GWTF ANALYTICAL RESULTS FROM TREATMENT SYSTEM SAMPLES
2016 ANNUAL REPORT

Sample ID (Sample Location) / Date Sampled			SP-E1 (GWTF Effluent) 10/26/2016					SP-S2 (GWTF Influent [EW7 Conc.]) 10/26/2016					SP-S6 (Effluent from Lead GAC Vessel)[3] 10/26/2016					SP-S8 (Effluent from Lag GAC Vessel)[3] 10/26/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20	1.4	J	0.79	1.6	3.0	1.4	J	0.79	1.6	3.0										
Trichloroethene (µg/L)	Report	5	<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0										
2,4,6-Trinitrotoluene (µg/L)	Report	Report	<	U	0.080	0.22	0.44	9.2		0.083	0.23	0.46	0.89		0.080	0.22	0.44	<	U	0.081	0.22	0.45
HMX (µg/L)	200	400	<	U	0.097	0.22	0.44	1.0	J	0.10	0.23	0.46	<	U	0.097	0.22	0.44	<	U	0.098	0.22	0.45
RDX (µg/L)	50	100	<	U	0.058	0.13	0.22	0.96	J	0.060	0.14	0.23	0.39	U	0.058	0.13	0.22	<	U	0.059	0.13	0.22
Tetryl (µg/L)	None	None	<	U	0.088	0.22	0.27	<	U	0.091	0.23	0.27	<	U	0088	0.22	0.27	<	U	0.089	0.22	0.27
Selenium (µg/L)	5	20	<	U	4.9	19	22															
Total Suspended Solids (mg/L)	500[1]	500[1]						2.8	U	1.1	2.8	4.0										
pH (pH units)	6.5[2]	9.0[2]	7.20		0.100	0.100	0.100	7.40		0.100	0.100	0.100										

Sample ID (Sample Location) / Date Sampled			SP-E11 (Duplicate of SP-E1) 10/26/2016					SP-S22 (Duplicate of SP-S2) 10/26/2016					Trip Blank 866 10/26/2016				
Analyte (units)	Treatment Objectives Average	Treatment Objectives Maximum	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ	Result	Qual	DL	LOD	LOQ
Trichlorotrifluoroethane (µg/L)	Report	20						1.5	J	0.79	1.6	3.0	<	U	0.79	1.6	3.0
Trichloroethene (µg/L)	Report	5						<	U	0.16	0.40	1.0	<	U	0.16	0.40	1.0
2,4,6-Trinitrotoluene (µg/L)	Report	Report						9.3		0.085	0.23	0.47					
HMX (µg/L)	200	400						0.91		0.10	0.23	0.47					
RDX (µg/L)	50	100						0.78		0.061	0.14	0.23					
Tetryl (µg/L)	None	None						<	U	0.093	0.23	0.28					
Selenium (µg/L)	5	20	<	U	4.9	19	22										
Total Suspended Solids (mg/L)	500[1]	500[1]						1.2	J	1.1	2.8	4.0					
pH (pH units)	6.5[2]	9.0[2]						7.40		0.100	0.100	0.100					

Notes:

[1]The value provided for Total Suspended Solids is the PAL.
[2]Values provided for pH are the minimum and maximum.
[3]Lead and Lag GAC vessels are first and second GAC vessels piped in series for groundwater treatment.

Blank/empty cells indicate analysis for the corresponding parameter was not required or performed.
Treatment Objectives:
Report = No numerical objective. Parameter analysis and reporting are required and performed.

< = less than LOD
µg/L = micrograms per liter
DL = detection limit
GAC = granular active carbon
GWTF = groundwater treatment facility
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
J = estimated
LOD = limit of detection

LOQ = limit of quantification
mg/L = milligrams per liter
PAL = project action limit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
tetryl = 2,4,6-trinitrophenylmethylnitramine
U = nondetect

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	EW7-DP40-35					EW7-DP41-35					EW7-DP42-35				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/22/2016					2/22/2016					2/22/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	110	2.1	4.1	10	J	3.3	0.21	0.42	1		55	1.1	2.1	5.3	
1,3-Dinitrobenzene	NA	0.1	0.091	0.21	0.41	J	<	0.092	0.21	0.42		<	0.094	0.21	0.42	U
2,4,6-Trinitrotoluene	2	25	0.075	0.21	0.41	J	1.4	0.075	0.21	0.42		11	0.077	0.21	0.42	
2,4-Dinitrotoluene	NA	0.24	0.086	0.21	0.41	J	<	0.087	0.21	0.42		0.21	0.089	0.21	0.42	J
2-Amino-4,6-dinitrotoluene	NA	3.1	0.052	0.12	0.21	J	1	0.053	0.13	0.21		3	0.054	0.13	0.21	
4-Amino-2,6-dinitrotoluene	NA	2.3	0.06	0.12	0.21	J	0.53	0.06	0.13	0.21	J	1.9	0.061	0.13	0.21	
HMX	400	1	0.09	0.21	0.41	J	0.48	0.091	0.21	0.42		0.5	0.093	0.21	0.42	J
MNX	NA	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U	<	0.38	0.5	2.1	U
RDX	2	0.61	0.054	0.12	0.21	J	0.87	0.055	0.13	0.21		0.38	0.055	0.13	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	EW7-DP43-35					EW7-DP44-35					EW7-DP45-35				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/22/2016					2/23/2016					2/23/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	2.9	0.21	0.42	1.1		22	0.21	0.43	1.1		1.1	0.21	0.42	1	
1,3-Dinitrobenzene	NA	<	0.094	0.21	0.42	U	<	0.094	0.21	0.43	U	<	0.093	0.21	0.42	U
2,4,6-Trinitrotoluene	2	2.1	0.077	0.21	0.42		4.6	0.077	0.21	0.43		0.14	0.076	0.21	0.42	J
2,4-Dinitrotoluene	NA	<	0.089	0.21	0.42	U	<	0.089	0.21	0.43	U	<	0.088	0.21	0.42	U
2-Amino-4,6-dinitrotoluene	NA	1.2	0.054	0.13	0.21		1.8	0.054	0.13	0.21		0.12	0.053	0.13	0.21	J
4-Amino-2,6-dinitrotoluene	NA	1.2	0.061	0.13	0.21		1.8	0.061	0.13	0.21		<	0.06	0.13	0.21	U
HMX	400	0.74	0.093	0.21	0.42	J	<	0.093	0.21	0.43	U	1.1	0.092	0.21	0.42	
MNX	NA	<	0.38	0.5	2.1	U	<	0.38	0.5	2.1	U	<	0.37	0.5	2.1	U
RDX	2	2.2	0.055	0.13	0.21		0.2	0.056	0.13	0.21	J	1.7	0.055	0.13	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	LL1-DP136-26					LL1-DP138-22					LL1-DP139-22				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/24/2016					2/23/2016					2/23/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.21	0.42	1	U	6.1	0.21	0.42	1		12	0.21	0.41	1	
1,3-Dinitrobenzene	NA	<	0.092	0.21	0.42	U	<	0.092	0.21	0.42	U	0.22	0.092	0.21	0.41	J
2,4,6-Trinitrotoluene	2	<	0.075	0.21	0.42	U	2	0.075	0.21	0.42		8.1	0.075	0.21	0.41	
2,4-Dinitrotoluene	NA	<	0.087	0.21	0.42	U	<	0.087	0.21	0.42	U	<	0.087	0.21	0.41	U
2-Amino-4,6-dinitrotoluene	NA	<	0.053	0.12	0.21	UJ	1.6	0.053	0.12	0.21		3.6	0.052	0.12	0.21	
4-Amino-2,6-dinitrotoluene	NA	<	0.06	0.12	0.21	UJ	3.7	0.06	0.12	0.21		3.8	0.06	0.12	0.21	
HMX	400	2.9	0.091	0.21	0.42		<	0.091	0.21	0.42	U	0.8	0.091	0.21	0.41	J
MNX	NA	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U
RDX	2	1.2	0.054	0.12	0.21		0.42	0.054	0.12	0.21		0.36	0.054	0.12	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	LL1-DP140-22					LL1-DP141-22					LL1-DP142-22				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/23/2016					2/23/2016					2/23/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	1.2	0.21	0.42	1		4.5	0.21	0.42	1	J	<	0.21	0.42	1	
1,3-Dinitrobenzene	NA	<	0.093	0.21	0.42	U	<	0.092	0.21	0.42	U	<	0.092	0.21	0.42	
2,4,6-Trinitrotoluene	2	<	0.076	0.21	0.42	U	3.2	0.075	0.21	0.42	J	<	0.075	0.21	0.42	
2,4-Dinitrotoluene	NA	<	0.088	0.21	0.42	U	<	0.087	0.21	0.42	U	<	0.087	0.21	0.42	
2-Amino-4,6-dinitrotoluene	NA	<	0.053	0.13	0.21	U	1.9	0.053	0.12	0.21	J	<	0.053	0.12	0.21	
4-Amino-2,6-dinitrotoluene	NA	<	0.06	0.13	0.21	U	0.82	0.06	0.12	0.21	J	<	0.06	0.12	0.21	
HMX	400	<	0.092	0.21	0.42	U	<	0.091	0.21	0.42	U	<	0.091	0.21	0.42	
MNX	NA	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U	0.39	0.37	0.5	2.1	J
RDX	2	<	0.055	0.13	0.21	U	<	0.054	0.12	0.21	U	<	0.054	0.12	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	LL1-DP143-30					LL1-DP144-30					LL1-DP145-30				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/24/2016					2/24/2016					2/24/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.21	0.41	1	U	<	0.21	0.41	1	U	<	0.21	0.41	1	U
1,3-Dinitrobenzene	NA	<	0.091	0.21	0.41	U	<	0.092	0.21	0.41	U	<	0.092	0.21	0.41	U
2,4,6-Trinitrotoluene	2	<	0.075	0.21	0.41	U	<	0.075	0.21	0.41	U	<	0.075	0.21	0.41	U
2,4-Dinitrotoluene	NA	<	0.086	0.21	0.41	U	<	0.087	0.21	0.41	U	<	0.087	0.21	0.41	U
2-Amino-4,6-dinitrotoluene	NA	<	0.052	0.12	0.21	U	<	0.052	0.12	0.21	U	0.32	0.052	0.12	0.21	J
4-Amino-2,6-dinitrotoluene	NA	<	0.059	0.12	0.21	U	<	0.06	0.12	0.21	U	0.16	0.06	0.12	0.21	J
HMX	400	1.4	0.09	0.21	0.41		1.3	0.091	0.21	0.41		0.78	0.091	0.21	0.41	
MNX	NA	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U
RDX	2	0.10	0.054	0.12	0.21	J	<	0.054	0.12	0.21	U	0.71	0.054	0.12	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	LL1-DP146-30					LL2-DP110-30					LL2-DP111-35				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/24/2016					2/25/2016					2/25/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.21	0.42	1	U	<	0.21	0.42	1	U	0.29	0.21	0.42	1	J
1,3-Dinitrobenzene	NA	<	0.092	0.21	0.42	U	<	0.092	0.21	0.42	U	<	0.093	0.21	0.42	U
2,4,6-Trinitrotoluene	2	<	0.075	0.21	0.42	U	1.4	0.075	0.21	0.42		0.45	0.076	0.21	0.42	
2,4-Dinitrotoluene	NA	<	0.087	0.21	0.42	U	<	0.087	0.21	0.42	U	<	0.087	0.21	0.42	U
2-Amino-4,6-dinitrotoluene	NA	0.69	0.053	0.13	0.21		2.6	0.053	0.13	0.21		0.94	0.053	0.13	0.21	
4-Amino-2,6-dinitrotoluene	NA	0.93	0.06	0.13	0.21		1.8	0.06	0.13	0.21		0.94	0.06	0.13	0.21	
HMX	400	3.6	0.091	0.21	0.42		0.55	0.091	0.21	0.42		3.6	0.091	0.21	0.42	
MNX	NA	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U
RDX	2	6.5	0.055	0.13	0.21		0.72	0.054	0.13	0.21		2.1	0.055	0.13	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	LL2-DP112-25					LL2-DP113-25					LL2-DP114-25				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/25/2016					2/25/2016					2/25/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	4.4	0.2	0.41	1		27	0.4	0.81	2	U	15	0.21	0.42	1	
1,3-Dinitrobenzene	NA	<	0.09	0.2	0.41	U	<	0.09	0.2	0.4	U	<	0.092	0.21	0.42	U
2,4,6-Trinitrotoluene	2	1.7	0.074	0.2	0.41	J	11	0.073	0.2	0.4		1.6	0.075	0.21	0.42	
2,4-Dinitrotoluene	NA	<	0.085	0.2	0.41	U	0.17	0.085	0.2	0.4	J	0.18	0.087	0.21	0.42	J
2-Amino-4,6-dinitrotoluene	NA	2.2	0.052	0.12	0.2	J	8.5	0.051	0.12	0.2		2.6	0.053	0.12	0.21	
4-Amino-2,6-dinitrotoluene	NA	1.1	0.059	0.12	0.2	J	6.8	0.058	0.12	0.2		2.1	0.06	0.12	0.21	
HMX	400	<	0.089	0.2	0.41	J	0.57	0.089	0.2	0.4	J	4.9	0.091	0.21	0.42	
MNX	NA	<	0.37	0.5	2	U	0.75	0.36	0.5	2	J	3.3	0.37	0.5	2.1	
RDX	2	<	0.053	0.12	0.2	U	3.6	0.053	0.12	0.2		17	0.054	0.12	0.21	

Notes:

[shaded box] Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-2
SUMMARY OF EXPLOSIVES DETECTED, PRE-INJECTION GROUNDWATER INVESTIGATION LOCATIONS
2016 ANNUAL REPORT

FIELD ID	CHAAP	LL2-DP115-25					LL2-DP116-25					LL2-DP117-25				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	2/25/2016					2/25/2016					2/25/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	10	0.21	0.41	1		8.2	0.21	0.41	1		1.7	0.21	0.41	1	
1,3-Dinitrobenzene	NA	<	0.092	0.21	0.41	U	<	0.092	0.21	0.41	U	<	0.092	0.21	0.41	U
2,4,6-Trinitrotoluene	2	4.4	0.075	0.21	0.41		6.5	0.075	0.21	0.41		1.2	0.075	0.21	0.41	
2,4-Dinitrotoluene	NA	<	0.087	0.21	0.41	U	<	0.086	0.21	0.41	U	<	0.087	0.21	0.41	U
2-Amino-4,6-dinitrotoluene	NA	4.6	0.053	0.12	0.21		5.4	0.052	0.12	0.21		1.5	0.052	0.12	0.21	
4-Amino-2,6-dinitrotoluene	NA	5.9	0.06	0.12	0.21		3.2	0.06	0.12	0.21		3.9	0.06	0.12	0.21	
HMX	400	1.7	0.091	0.21	0.41		2.8	0.09	0.21	0.41		39	0.36	0.83	1.7	
MNX	NA	<	0.37	0.5	2.1	U	0.69	0.37	0.5	2.1	J	1.5	0.37	0.5	2.1	J
RDX	2	2.8	0.054	0.12	0.21		17	0.054	0.12	0.21		23	0.054	0.12	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0022-16A					G0024-16A					G0044-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/16/2016					8/9/2016					8/8/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	0.48	0.24	0.49	1.2	J	<	0.21	0.43	1.1	U	<	0.21	0.43	1.1	U
1,3-Dinitrobenzene	NA	<	0.11	0.24	0.49	U	<	0.095	0.21	0.43	U	<	0.095	0.21	0.43	U
2,4,6-Trinitrotoluene	2	1.6	0.088	0.24	0.49		<	0.077	0.21	0.43	U	<	0.077	0.21	0.43	U
2,4-Dinitrotoluene	NA	<	0.1	0.24	0.49	U	<	0.09	0.21	0.43	U	0.09	0.09	0.21	0.43	J
2-Amino-4,6-dinitrotoluene	NA	2.6	0.062	0.15	0.24		0.95	0.054	0.13	0.21		<	0.054	0.13	0.21	U
2-Nitrotoluene	NA	<	0.1	0.24	0.49	U	<	0.091	0.21	0.43	U	<	0.092	0.21	0.43	U
4-Amino-2,6-dinitrotoluene	NA	3.1	0.07	0.15	0.24		1	0.062	0.13	0.21		<	0.062	0.13	0.21	U
HMX	400	0.91	0.11	0.24	0.49	J	<	0.094	0.21	0.43	U	0.57	0.094	0.21	0.43	
MNX	NA	<	0.44	0.44	2.4	U	<	0.38	0.38	2.1	U	<	0.38	0.38	2.1	U
Nitrobenzene	NA	<	0.11	0.24	0.49	U	<	0.097	0.21	0.43	U	<	0.097	0.21	0.43	U
RDX	2	1.1	0.064	0.15	0.24		<	0.056	0.13	0.21	U	0.6	0.056	0.13	0.21	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0066R-16A					G0067-16A					G0075-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/8/2016					8/16/2016					8/10/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	2.2	4.4	11	U	<	0.22	0.43	1.1	U	<	0.22	0.44	1.1	U
1,3-Dinitrobenzene	NA	<	0.99	2.2	4.4	U	<	0.096	0.22	0.43	U	<	0.097	0.22	0.44	U
2,4,6-Trinitrotoluene	2	<	0.81	2.2	4.4	U	<	0.078	0.22	0.43	U	<	0.079	0.22	0.44	U
2,4-Dinitrotoluene	NA	<	0.93	2.2	4.4	U	<	0.09	0.22	0.43	U	<	0.092	0.22	0.44	U
2-Amino-4,6-dinitrotoluene	NA	<	0.56	1.3	2.2	U	<	0.055	0.13	0.22	U	0.077	0.055	0.13	0.22	J
2-Nitrotoluene	NA	<	0.95	2.2	4.4	U	<	0.092	0.22	0.43	U	<	0.093	0.22	0.44	U
4-Amino-2,6-dinitrotoluene	NA	<	0.64	1.3	2.2	U	<	0.062	0.13	0.22	U	0.16	0.063	0.13	0.22	J
HMX	400	<	0.97	2.2	4.4	U	<	0.094	0.22	0.43	U	0.53	0.096	0.22	0.44	J
MNX	NA	<	4	4	22	U	<	0.39	0.39	2.2	U	<	0.39	0.39	2.2	U
Nitrobenzene	NA	<	1	2.2	4.4	U	<	0.098	0.22	0.43	U	<	0.099	0.22	0.44	U
RDX	2	0.72	0.58	1.3	2.2	J	2	0.056	0.13	0.22		0.2	0.057	0.13	0.22	J

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0077-16A					G0080-16A					G0081-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/9/2016					8/16/2016					8/11/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	3.4	0.22	0.44	1.1		<	0.22	0.44	1.1	U	21	0.22	0.43	1.1	
1,3-Dinitrobenzene	NA	<	0.098	0.22	0.44	U	<	0.098	0.22	0.44	U	<	0.095	0.22	0.43	U
2,4,6-Trinitrotoluene	2	5.3	0.08	0.22	0.44		<	0.08	0.22	0.44	U	<	0.078	0.22	0.43	U
2,4-Dinitrotoluene	NA	<	0.092	0.22	0.44	U	<	0.093	0.22	0.44	U	<	0.09	0.22	0.43	U
2-Amino-4,6-dinitrotoluene	NA	3.5	0.056	0.13	0.22		0.24	0.056	0.13	0.22		2.9	0.055	0.13	0.22	
2-Nitrotoluene	NA	<	0.094	0.22	0.44	U	<	0.095	0.22	0.44	U	<	0.092	0.22	0.43	U
4-Amino-2,6-dinitrotoluene	NA	3.9	0.064	0.13	0.22		<	0.064	0.13	0.22	U	2.6	0.062	0.13	0.22	
HMX	400	0.58	0.096	0.22	0.44		<	0.097	0.22	0.44	U	<	0.094	0.22	0.43	U
MNX	NA	<	0.39	0.39	2.2	U	<	0.4	0.4	2.2	U	<	0.39	0.39	2.2	U
Nitrobenzene	NA	<	0.1	0.22	0.44	U	<	0.1	0.22	0.44	U	<	0.098	0.22	0.43	U
RDX	2	1.3	0.058	0.13	0.22		0.26	0.058	0.13	0.22	J	0.5	0.056	0.13	0.22	J

Notes:

[shaded box] Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0082-16A					G0084-16A					G0085-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/12/2016					8/9/2016					8/15/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	0.23	0.22	0.44	1.1	J	<	0.23	0.46	1.1	U	<	0.23	0.46	1.1	U
1,3-Dinitrobenzene	NA	<	0.098	0.22	0.44	U	<	0.1	0.23	0.46	U	<	0.1	0.23	0.46	U
2,4,6-Trinitrotoluene	2	<	0.08	0.22	0.44	U	<	0.082	0.23	0.46	U	<	0.083	0.23	0.46	U
2,4-Dinitrotoluene	NA	<	0.093	0.22	0.44	U	0.13	0.095	0.23	0.46	J	<	0.096	0.23	0.46	U
2-Amino-4,6-dinitrotoluene	NA	1	0.056	0.13	0.22		0.56	0.058	0.14	0.23	J	<	0.058	0.14	0.23	U
2-Nitrotoluene	NA	<	0.095	0.22	0.44	U	<	0.097	0.23	0.46	U	<	0.098	0.23	0.46	U
4-Amino-2,6-dinitrotoluene	NA	1.3	0.064	0.13	0.22		<	0.066	0.14	0.23	U	<	0.066	0.14	0.23	U
HMX	400	1.1	0.097	0.22	0.44	J	<	0.1	0.23	0.46	U	<	0.1	0.23	0.46	U
MNX	NA	<	0.4	0.4	2.2	U	<	0.41	0.41	2.3	U	<	0.41	0.41	2.3	U
Nitrobenzene	NA	<	0.1	0.22	0.44	U	<	0.1	0.23	0.46	U	<	0.1	0.23	0.46	U
RDX	2	2.7	0.058	0.13	0.22		<	0.06	0.14	0.23	U	1.9	0.06	0.14	0.23	J

Notes:

Concentrations exceed CHAAP HALs (shaded)

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0086-16A					G0088-16A					G0089-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/11/2016					8/16/2016					8/8/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	11	0.22	0.44	1.1		8.2	0.21	0.43	1.1		12	0.26	0.52	1.3	
1,3-Dinitrobenzene	NA	<	0.098	0.22	0.44	U	<	0.095	0.21	0.43	U	<	0.11	0.26	0.52	U
2,4,6-Trinitrotoluene	2	<	0.08	0.22	0.44	U	1.1	0.078	0.21	0.43		8.6	0.094	0.26	0.52	
2,4-Dinitrotoluene	NA	<	0.093	0.22	0.44	U	<	0.09	0.21	0.43	U	<	0.11	0.26	0.52	U
2-Amino-4,6-dinitrotoluene	NA	1.2	0.056	0.13	0.22		0.98	0.054	0.13	0.21		1.9	0.065	0.15	0.26	
2-Nitrotoluene	NA	<	0.095	0.22	0.44	U	<	0.092	0.21	0.43	U	<	0.11	0.26	0.52	U
4-Amino-2,6-dinitrotoluene	NA	<	0.064	0.13	0.22	U	0.82	0.062	0.13	0.21		2.2	0.075	0.15	0.26	
HMX	400	0.6	0.097	0.22	0.44		0.32	0.094	0.21	0.43	J	<	0.11	0.26	0.52	U
MNX	NA	<	0.4	0.4	2.2	U	<	0.38	0.38	2.1	U	<	0.46	0.46	2.6	U
Nitrobenzene	NA	<	0.1	0.22	0.44	U	<	0.098	0.21	0.43	U	<	0.12	0.26	0.52	U
RDX	2	0.66	0.058	0.13	0.22		0.32	0.056	0.13	0.21		1.4	0.068	0.15	0.26	

Notes:

(shaded box) Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0090-16A					G0091-16A					G0092-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/12/2016					8/16/2016					8/16/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	0.25	0.22	0.44	1.1	J	<	0.22	0.44	1.1	U	<	0.22	0.44	1.1	U
1,3-Dinitrobenzene	NA	<	0.098	0.22	0.44	U	<	0.098	0.22	0.44	U	<	0.097	0.22	0.44	U
2,4,6-Trinitrotoluene	2	0.6	0.08	0.22	0.44	J	0.13	0.08	0.22	0.44	J	<	0.08	0.22	0.44	U
2,4-Dinitrotoluene	NA	<	0.092	0.22	0.44	U	<	0.092	0.22	0.44	U	<	0.092	0.22	0.44	U
2-Amino-4,6-dinitrotoluene	NA	0.48	0.056	0.13	0.22		0.26	0.056	0.13	0.22	J	<	0.056	0.13	0.22	U
2-Nitrotoluene	NA	<	0.094	0.22	0.44	U	<	0.094	0.22	0.44	U	<	0.094	0.22	0.44	U
4-Amino-2,6-dinitrotoluene	NA	<	0.064	0.13	0.22	U	0.15	0.064	0.13	0.22	J	<	0.063	0.13	0.22	U
HMX	400	0.63	0.097	0.22	0.44	J	<	0.097	0.22	0.44	U	0.2	0.096	0.22	0.44	J
MNX	NA	<	0.4	0.4	2.2	U	<	0.4	0.4	2.2	U	<	0.39	0.39	2.2	U
Nitrobenzene	NA	<	0.1	0.22	0.44	U	<	0.1	0.22	0.44	U	<	0.1	0.22	0.44	U
RDX	2	2.5	0.058	0.13	0.22		0.82	0.058	0.13	0.22		0.17	0.057	0.13	0.22	J

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0093-16A					G0094-16A					G0096-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/15/2016					8/12/2016					8/10/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.22	0.44	1.1	U	<	0.23	0.46	1.2	U	3.8	0.22	0.45	1.1	
1,3-Dinitrobenzene	NA	<	0.099	0.22	0.44	U	<	0.1	0.23	0.46	U	<	0.099	0.22	0.45	U
2,4,6-Trinitrotoluene	2	<	0.08	0.22	0.44	U	0.39	0.084	0.23	0.46	J	0.41	0.081	0.22	0.45	J
2,4-Dinitrotoluene	NA	<	0.093	0.22	0.44	U	0.11	0.097	0.23	0.46	J	<	0.093	0.22	0.45	U
2-Amino-4,6-dinitrotoluene	NA	5.6	0.056	0.13	0.22		2.3	0.059	0.14	0.23		0.82	0.057	0.13	0.22	
2-Nitrotoluene	NA	<	0.095	0.22	0.44	U	0.24	0.099	0.23	0.46	J	<	0.095	0.22	0.45	U
4-Amino-2,6-dinitrotoluene	NA	6.5	0.064	0.13	0.22	J	<	0.067	0.14	0.23	U	1.6	0.064	0.13	0.22	J
HMX	400	<	0.097	0.22	0.44	U	<	0.1	0.23	0.46	U	5.9	0.098	0.22	0.45	
MNX	NA	<	0.4	0.4	2.2	U	<	0.42	0.42	2.3	U	1.3	0.4		2.2	J
Nitrobenzene	NA	<	0.1	0.22	0.44	U	<	0.11	0.23	0.46	U	<	0.1	0.22	0.45	U
RDX	2	14	0.058	0.13	0.22		9.7	0.061	0.14	0.23		32	0.29	0.67	1.1	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0097-16A					G0099-16A					G0100-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/8/2016					8/11/2016					8/4/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.46	0.91	2.3	U	<	0.22	0.43	1.1	U	2.8	0.22	0.44	1.1	
1,3-Dinitrobenzene	NA	0.29	0.2	0.46	0.91	J	<	0.096	0.22	0.43	U	<	0.097	0.22	0.44	U
2,4,6-Trinitrotoluene	2	1.5	0.16	0.46	0.91		<	0.078	0.22	0.43	U	1.1	0.079	0.22	0.44	
2,4-Dinitrotoluene	NA	0.73	0.19	0.46	0.91	J	<	0.09	0.22	0.43	U	0.17	0.092	0.22	0.44	J
2-Amino-4,6-dinitrotoluene	NA	7.7	0.12	0.27	0.46		0.22	0.055	0.13	0.22	J	2.3	0.055	0.13	0.22	
2-Nitrotoluene	NA	<	0.19	0.46	0.91	U	<	0.092	0.22	0.43	U	<	0.093	0.22	0.44	U
4-Amino-2,6-dinitrotoluene	NA	6.8	0.13	0.27	0.46	J	<	0.062	0.13	0.22	U	<	0.063	0.13	0.22	U
HMX	400	9.9	0.2	0.46	0.91		<	0.094	0.22	0.43	U	1.2	0.096	0.22	0.44	J
MNX	NA	<	0.82	0.82	4.6	U	<	0.39	0.39	2.2	U	4.5	0.39		2.2	J
Nitrobenzene	NA	0.45	0.21	0.46	0.91	J	<	0.098	0.22	0.43	U	<	0.099	0.22	0.44	J
RDX	2	0.75	0.12	0.27	0.46	J	3.1	0.056	0.13	0.22		<	0.057	0.13	0.22	U

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0101-16A					G0102-16A					G0104-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/4/2016					8/12/2016					8/12/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.22	0.44	1.1	U	<	0.22	0.44	1.1	U	<	0.22	0.44	1.1	U
1,3-Dinitrobenzene	NA	<	0.097	0.22	0.44	U	<	0.098	0.22	0.44	U	<	0.097	0.22	0.44	U
2,4,6-Trinitrotoluene	2	<	0.079	0.22	0.44	U	<	0.08	0.22	0.44	U	<	0.079	0.22	0.44	U
2,4-Dinitrotoluene	NA	<	0.091	0.22	0.44	U	<	0.093	0.22	0.44	UJ	<	0.092	0.22	0.44	U
2-Amino-4,6-dinitrotoluene	NA	0.56	0.055	0.13	0.22		<	0.056	0.13	0.22	UJ	<	0.055	0.13	0.22	U
2-Nitrotoluene	NA	<	0.093	0.22	0.44	U	<	0.095	0.22	0.44	UJ	0.15	0.094	0.22	0.44	J
4-Amino-2,6-dinitrotoluene	NA	2.6	0.063	0.13	0.22	J	<	0.064	0.13	0.22	UJ	<	0.063	0.13	0.22	U
HMX	400	3.9	0.096	0.22	0.44	J	<	0.097	0.22	0.44	U	<	0.096	0.22	0.44	U
MNX	NA	<	0.39	0.39	2.2	U	<	0.4	0.4	2.2	U	0.62	0.39		2.2	J
Nitrobenzene	NA	<	0.099	0.22	0.44	U	<	0.1	0.22	0.44	U	<	0.1	0.22	0.44	U
RDX	2	1.6	0.057	0.13	0.22		0.47	0.058	0.13	0.22		<	0.057	0.13	0.22	U

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0105-16A					G0108-16A					G0109-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/3/2016					8/9/2016					8/16/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.22	0.43	1.1	U	<	0.22	0.43	1.1	U	<	0.22	0.44	1.1	U
1,3-Dinitrobenzene	NA	<	0.096	0.22	0.43	U	<	0.096	0.22	0.43	U	<	0.098	0.22	0.44	U
2,4,6-Trinitrotoluene	2	<	0.078	0.22	0.43	U	<	0.078	0.22	0.43	U	<	0.08	0.22	0.44	U
2,4-Dinitrotoluene	NA	<	0.091	0.22	0.43	U	0.16	0.09	0.22	0.43	J	<	0.092	0.22	0.44	U
2-Amino-4,6-dinitrotoluene	NA	<	0.055	0.13	0.22	U	<	0.055	0.13	0.22	U	<	0.056	0.13	0.22	U
2-Nitrotoluene	NA	<	0.093	0.22	0.43	U	0.45	0.092	0.22	0.43	J	<	0.094	0.22	0.44	U
4-Amino-2,6-dinitrotoluene	NA	<	0.063	0.13	0.22	U	<	0.062	0.13	0.22	U	<	0.064	0.13	0.22	U
HMX	400	<	0.095	0.22	0.43	U	<	0.094	0.22	0.43	U	0.98	0.097	0.22	0.44	
MNX	NA	1.7	0.39		2.2	J	<	0.39	0.39	2.2	U	<	0.39	0.39	2.2	U
Nitrobenzene	NA	<	0.099	0.22	0.43	U	<	0.098	0.22	0.43	U	<	0.1	0.22	0.44	U
RDX	2	<	0.057	0.13	0.22	U	<	0.056	0.13	0.22	U	1.2	0.058	0.13	0.22	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0110-16A					G0112-16A					G0113-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/16/2016					8/10/2016					8/10/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.22	0.43	1.1	U	<	0.26	0.52	1.3	U	<	0.22	0.45	1.1	U
1,3-Dinitrobenzene	NA	<	0.096	0.22	0.43	U	<	0.11	0.26	0.52	U	<	0.099	0.22	0.45	U
2,4,6-Trinitrotoluene	2	<	0.078	0.22	0.43	U	0.14	0.093	0.26	0.52	J	<	0.081	0.22	0.45	U
2,4-Dinitrotoluene	NA	<	0.09	0.22	0.43	U	<	0.11	0.26	0.52	U	<	0.094	0.22	0.45	U
2-Amino-4,6-dinitrotoluene	NA	<	0.055	0.13	0.22	U	0.16	0.065	0.15	0.26	J	<	0.057	0.13	0.22	U
2-Nitrotoluene	NA	<	0.092	0.22	0.43	U	<	0.11	0.26	0.52	U	<	0.096	0.22	0.45	U
4-Amino-2,6-dinitrotoluene	NA	<	0.062	0.13	0.22	U	0.13	0.074	0.15	0.26	J	<	0.064	0.13	0.22	U
HMX	400	<	0.094	0.22	0.43	U	<	0.11	0.26	0.52	U	0.47	0.098	0.22	0.45	J
MNX	NA	1.7	0.39		2.2	J	<	0.46	0.46	2.6	U	<	4	4	22	U
Nitrobenzene	NA	<	0.098	0.22	0.43	U	<	0.12	0.26	0.52	U	<	0.1	0.22	0.45	U
RDX	2	<	0.056	0.13	0.22	U	0.25	0.067	0.15	0.26	J	<	0.058	0.13	0.22	U

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0114-16A					G0115-16A					G0119-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/15/2016					8/4/2016					8/10/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.26	0.52	1.3	U	<	0.23	0.46	1.2	U	<	0.22	0.44	1.1	U
1,3-Dinitrobenzene	NA	<	0.12	0.26	0.52	U	<	0.1	0.23	0.46	U	<	0.097	0.22	0.44	U
2,4,6-Trinitrotoluene	2	<	0.095	0.26	0.52	U	<	0.084	0.23	0.46	U	<	0.079	0.22	0.44	U
2,4-Dinitrotoluene	NA	<	0.11	0.26	0.52	U	<	0.097	0.23	0.46	U	<	0.092	0.22	0.44	U
2-Amino-4,6-dinitrotoluene	NA	<	0.066	0.16	0.26	U	<	0.059	0.14	0.23	U	<	0.056	0.13	0.22	U
2-Nitrotoluene	NA	<	0.11	0.26	0.52	U	<	0.099	0.23	0.46	U	<	0.094	0.22	0.44	U
4-Amino-2,6-dinitrotoluene	NA	<	0.076	0.16	0.26	U	<	0.067	0.14	0.23	U	<	0.063	0.13	0.22	U
HMX	400	<	0.11	0.26	0.52	U	<	0.1	0.23	0.46	U	2.5	0.096	0.22	0.44	J
MNX	NA	<	0.47	0.47	2.6	U	<	0.83	0.83	4.6	U	<	3.9	3.9	22	U
Nitrobenzene	NA	<	0.12	0.26	0.52	U	0.26	0.11	0.23	0.46	J	0.39	0.1	0.22	0.44	J
RDX	2	3.2	0.069	0.16	0.26	J	<	0.061	0.14	0.23	U	<	0.057	0.13	0.22	U

Notes:

[shaded box] Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	G0120-16A					G0121-16A					PZ005-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/9/2016					11/30/2016					8/8/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.24	0.49	1.2	U	<	2.1	4.2	10	U	<	0.23	0.47	1.2	U
1,3-Dinitrobenzene	NA	<	0.11	0.24	0.49	U	<	0.92	2.1	4.2	U	<	0.1	0.23	0.47	U
2,4,6-Trinitrotoluene	2	<	0.088	0.24	0.49	U	<	0.75	2.1	4.2	U	<	0.084	0.23	0.47	U
2,4-Dinitrotoluene	NA	<	0.1	0.24	0.49	U	<	0.87	2.1	4.2	U	<	0.097	0.23	0.47	U
2-Amino-4,6-dinitrotoluene	NA	14	0.062	0.15	0.24		<	0.53	1.3	2.1	U	0.19	0.059	0.14	0.23	J
2-Nitrotoluene	NA	<	0.1	0.24	0.49	U	<	0.89	2.1	4.2	U	<	0.099	0.23	0.47	U
4-Amino-2,6-dinitrotoluene	NA	8.6	0.07	0.15	0.24		<	0.60	1.3	2.1	U	<	0.067	0.14	0.23	U
HMX	400	0.4	0.11	0.24	0.49	J	14	0.91	2.1	4.2	J	<	0.1	0.23	0.47	U
MNX	NA	<	0.44	0.44	2.4	U	<	0.37	0.37	2.1	U	<	0.42	0.42	2.3	U
Nitrobenzene	NA	<	0.11	0.24	0.49	U	<	0.95	2.1	4.2	U	<	0.11	0.23	0.47	U
RDX	2	<	0.064	0.15	0.24	U	2.2	0.054	0.13	0.21	J	<	0.061	0.14	0.23	U

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	PZ009-16A					PZ011-16A					PZ012-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/8/2016					8/8/2016					8/8/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	1.3	0.25	0.5	1.3		<	1.1	2.2	5.5	U	<	1.1	2.2	5.4	U
1,3-Dinitrobenzene	NA	<	0.11	0.25	0.5	U	<	0.49	1.1	2.2	U	<	0.48	1.1	2.2	U
2,4,6-Trinitrotoluene	2	0.61	0.091	0.25	0.5		<	0.4	1.1	2.2	U	<	0.39	1.1	2.2	U
2,4-Dinitrotoluene	NA	<	0.1	0.25	0.5	U	<	0.46	1.1	2.2	U	<	0.45	1.1	2.2	U
2-Amino-4,6-dinitrotoluene	NA	0.49	0.063	0.15	0.25		<	0.28	0.66	1.1	U	<	0.27	0.65	1.1	U
2-Nitrotoluene	NA	<	0.11	0.25	0.5	U	<	0.47	1.1	2.2	U	<	0.46	1.1	2.2	U
4-Amino-2,6-dinitrotoluene	NA	0.44	0.072	0.15	0.25		<	0.32	0.66	1.1	U	<	0.31	0.65	1.1	U
HMX	400	<	0.11	0.25	0.5	U	<	0.48	1.1	2.2	U	<	0.47	1.1	2.2	U
MNX	NA	<	0.45	0.45	2.5	U	<	2	2	11	U	8.8	1.9		11	J
Nitrobenzene	NA	<	0.11	0.25	0.5	U	<	0.5	1.1	2.2	U	<	0.49	1.1	2.2	U
RDX	2	<	0.065	0.15	0.25	U	1.6	0.29	0.66	1.1		<	0.28	0.65	1.1	U

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	PZ013-16A					PZ017R-16A					PZ018-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/9/2016					8/9/2016					8/9/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
1,3,5-Trinitrobenzene	NA	<	0.21	0.42	1.1	U	11	0.22	0.43	1.1		0.65	0.21	0.43	1.1	J
1,3-Dinitrobenzene	NA	<	0.094	0.21	0.42	U	<	0.096	0.22	0.43	U	<	0.095	0.21	0.43	U
2,4,6-Trinitrotoluene	2	<	0.076	0.21	0.42	U	22	0.078	0.22	0.43		0.47	0.077	0.21	0.43	J
2,4-Dinitrotoluene	NA	<	0.088	0.21	0.42	U	<	0.091	0.22	0.43	U	<	0.09	0.21	0.43	U
2-Amino-4,6-dinitrotoluene	NA	<	0.054	0.13	0.21	U	3	0.055	0.13	0.22		0.096	0.054	0.13	0.21	J
2-Nitrotoluene	NA	<	0.09	0.21	0.42	U	<	0.092	0.22	0.43	U	<	0.091	0.21	0.43	U
4-Amino-2,6-dinitrotoluene	NA	<	0.061	0.13	0.21	U	<	0.062	0.13	0.22	U	<	0.062	0.13	0.21	U
HMX	400	1.7	0.092	0.21	0.42	J	1.6	0.095	0.22	0.43		<	0.094	0.21	0.43	U
MNX	NA	<	0.38	0.38	2.1	U	<	0.39	0.39	2.2	U	<	0.38	0.38	2.1	U
Nitrobenzene	NA	1.5	0.096	0.21	0.42		<	0.098	0.22	0.43	U	<	0.097	0.21	0.43	U
RDX	2	0.082	0.055	0.13	0.21	J	3.4	0.057	0.13	0.22		0.098	0.056	0.13	0.21	J

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-3
SUMMARY OF EXPLOSIVES DETECTED, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	CHAAP	PZ020-16A				
METHOD	HALs	SW846 8330A				
SAMPLE DATE	(µg/L)	8/12/2016				
		Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)						
1,3,5-Trinitrobenzene	NA	3.6	0.23	0.47	1.2	
1,3-Dinitrobenzene	NA	<	0.1	0.23	0.47	U
2,4,6-Trinitrotoluene	2	4.3	0.085	0.23	0.47	
2,4-Dinitrotoluene	NA	<	0.098	0.23	0.47	U
2-Amino-4,6-dinitrotoluene	NA	2.5	0.059	0.14	0.23	
2-Nitrotoluene	NA	<	0.1	0.23	0.47	U
4-Amino-2,6-dinitrotoluene	NA	2.3	0.068	0.14	0.23	
HMX	400	<	0.1	0.23	0.47	U
MNX	NA	<	0.42	0.42	2.3	U
Nitrobenzene	NA	<	0.11	0.23	0.47	U
RDX	2	0.52	0.061	0.14	0.23	

Notes:

Concentrations exceed CHAAP HALs

< = less than LOQ

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

MNX = mono-nitroso-RX

NA = not available

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-4
SUMMARY OF EXPLOSIVES DETECTED, OU1 OFF-POST MONITORING WELLS
2016 ANNUAL REPORT

FIELD ID	CHAAP	NW020-16A					NW021-16A					CA271-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/5/2016					8/5/2016					8/3/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
2,4,6-Trinitrotoluene	2	0.36	0.079	0.22	0.44	J	<	0.078	0.22	0.43	U	<	0.081	0.22	0.45	U
2-Amino-4,6-dinitrotoluene	NA	0.85	0.055	0.13	0.22		4.3	0.055	0.13	0.22		<	0.057	0.13	0.22	U
4-Amino-2,6-dinitrotoluene	NA	0.35	0.063	0.13	0.22		2	0.062	0.13	0.22		<	0.065	0.13	0.22	U
HMX	400	<	0.095	0.22	0.44	U	<	0.094	0.22	0.43	U	<	0.098	0.22	0.45	U
RDX	2	<	0.057	0.13	0.22	U	0.35	0.056	0.13	0.22		0.26	0.058	0.13	0.22	U
Tetryl	NA	<	0.086	0.22	0.26	U	4.7	0.085	0.22	0.26		<	0.089	0.22	0.27	U

Notes:
< = less than LOQ
µg/L = micrograms per liter
CHAAP = Cornhusker Army Ammunition Plant
HAL = health advisory level
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification number
J = estimated
LOQ = limit of quantification
NA = not available
OU = Operable Unit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
U = nondetect
USEPA = United States Environmental Protection Agency

TABLE 4-4
SUMMARY OF EXPLOSIVES DETECTED, OU1 OFF-POST MONITORING WELLS
2016 ANNUAL REPORT

FIELD ID	CHAAP	CA272-16A					CA292R-16A					CA311-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/3/2016					8/3/2016					8/2/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
2,4,6-Trinitrotoluene	2	<	0.081	0.22	0.45	U	<	0.079	0.22	0.44	U	<	0.075	0.21	0.41	U
2-Amino-4,6-dinitrotoluene	NA	<	0.056	0.13	0.22	U	<	0.055	0.13	0.22	U	<	0.053	0.12	0.21	U
4-Amino-2,6-dinitrotoluene	NA	<	0.064	0.13	0.22	U	<	0.063	0.13	0.22	U	<	0.06	0.12	0.21	U
HMX	400	0.52	0.097	0.22	0.45		0.5	0.096	0.22	0.44		<	0.091	0.21	0.41	U
RDX	2	0.58	0.058	0.13	0.22		0.56	0.057	0.13	0.22		0.57	0.054	0.12	0.21	
Tetryl	NA	<	0.088	0.22	0.27	U	<	0.087	0.22	0.26	U	<	0.082	0.21	0.25	U

Notes:
< = less than LOQ
µg/L = micrograms per liter
CHAAP = Cornhusker Army Ammunition Plant
HAL = health advisory level
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification number
J = estimated
LOQ = limit of quantification
NA = not available
OU = Operable Unit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
U = nondetect
USEPA = United States Environmental Protection Agency

TABLE 4-4
SUMMARY OF EXPLOSIVES DETECTED, OU1 OFF-POST MONITORING WELLS
2016 ANNUAL REPORT

FIELD ID	CHAAP	CA312-16A					CA342-16A					CA343-16A				
METHOD	HALs	SW846 8330A					SW846 8330A					SW846 8330A				
SAMPLE DATE	(µg/L)	8/2/2016					8/3/2016					8/3/2016				
		Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
EXPLOSIVES (USEPA Method 8330A) (µg/L)																
2,4,6-Trinitrotoluene	2	<	0.076	0.21	0.42	U	<	0.076	0.21	0.42	U	<	0.076	0.21	0.42	U
2-Amino-4,6-dinitrotoluene	NA	<	0.053	0.13	0.21	U	<	0.053	0.13	0.21	U	<	0.053	0.13	0.21	U
4-Amino-2,6-dinitrotoluene	NA	<	0.06	0.13	0.21	U	<	0.061	0.13	0.21	U	<	0.06	0.13	0.21	U
HMX	400	0.23	0.091	0.21	0.42	J	<	0.092	0.21	0.42	U	<	0.092	0.21	0.42	U
RDX	2	0.47	0.055	0.13	0.21		0.89	0.055	0.13	0.21		0.46	0.055	0.13	0.21	
Tetryl	NA	<	0.083	0.21	0.25	U	<	0.084	0.21	0.25	U	<	0.083	0.21	0.25	U

Notes:
< = less than LOQ
µg/L = micrograms per liter
CHAAP = Cornhusker Army Ammunition Plant
HAL = health advisory level
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification number
J = estimated
LOQ = limit of quantification
NA = not available
OU = Operable Unit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
U = nondetect
USEPA = United States Environmental Protection Agency

TABLE 4-5
FREQUENCY OF DETECTIONS AND CONCENTRATION RANGES FOR EXPLOSIVES AT OU1
2016 ANNUAL REPORT

On-Post Wells

Compound Detected	CHAAP HALs	Detections above HALs	Frequency of Detects[1]	Concentration Range (µg/L)
1,3,5-Trinitrobenzene	NA	-	16/72	0.23 to 12
2,4,6-Trinitrotoluene	2	4	17/72	0.13 to 22
2,4-Dinitrotoluene	NA	-	8/72	0.09 to 0.73
2-Amino-4,6-dinitrotoluene	NA	-	29/72	0.077 to 14
2-Nitrotoluene	NA	-	5/72	0.15 to 0.45
4-Amino-2,6-dinitrotoluene	NA	-	19/72	0.13 to 8.6
HMX	400	0	21/72	0.092 to 9.9
MNX	NA	-	8/72	0.38 to 22
RDX	2	9	33/72	0.06 to 32

Off-Post Wells

Compound Detected	CHAAP HALs	Detections above HALs	Frequency of Detects[1]	Concentration Range (µg/L)
2,4,6-Trinitrotoluene	2	0	1/22	0.36
2-Amino-4,6-dinitrotoluene	NA	-	2/22	0.85 and 4.3
4-Amino-2,6-dinitrotoluene	NA	-	2/22	0.35 and 2
HMX	400	0	3/22	0.23 to 0.52
RDX	2	0	8/22	0.26 to 0.89
Tetryl	NA	-	1/22	4.7

Notes:

[1]Includes 22 off-post monitoring wells, 56 on-post monitoring wells, and 16 on-post piezometers.

Field quality control samples (field duplicates, matrix spike/matrix spike duplicates), pre-injection groundwater investigation samples (25 in February 2016), and GWTF samples are not included.

µg/L = micrograms per liter

CHAAP = Cornhusker Army Ammunition Plant

HAL = health advisory level

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

MNX = mono-nitroso-RDX

NA = not available

OU = Operable Unit

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0017-16A					G0022-16A					G0023-16A				
SAMPLE DATE	8/8/2016					8/16/2016					8/15/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	9600	0.22	0.8	5		220	0.22	0.8	5		26000	0.65	2.4	15	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	0.63	0.18	0.5	1	J	<	0.18	0.5	1	U	6.6	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	0.14	0.022	0.05	0.1		<	0.022	0.05	0.1	U	4.2	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	0.23	0.019	0.05	0.1		13	0.19	0.5	1		0.019	0.019	0.05	0.1	J
Alkalinity SM 2320B (mg/L)	450	1.1	3.2	5		300	1.1	3.2	5		520	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	200	1.1	3.2	5		133	1.1	3.2	5		231	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	350	2.3	5	50		64	0.23	0.5	5		23	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	14	0.79	1.9	4		<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	6.6	0.16	0.5	1		3.1	0.16	0.5	1		16	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0024-16A					G0044-16A					G0045-16A				
SAMPLE DATE	8/9/2016					8/8/2016					8/8/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	<	0.22	0.8	5	U	<	0.22	0.8	5	U	2	0.22	0.8	5	J
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	0.19	0.18	0.5	1	J	2.6	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	<	0.022	0.05	0.1	U	<	0.022	0.05	0.1	U	3.6	0.022	0.05	0.1	J
Nitrate/Nitrite USEPA 353.2 (mg/L)	21	0.19	0.5	1		1.8	0.019	0.05	0.1		0.042	0.019	0.05	0.1	J
Alkalinity SM 2320B (mg/L)	150	1.1	3.2	5		390	1.1	3.2	5		410	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	67	1.1	3.2	5		173	1.1	3.2	5		182	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	97	0.23	0.5	5		300	2.3	5	50		1100	2.3	5	50	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	5.4	0.16	0.5	1		3.4	0.16	0.5	1		5.1	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research
Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0048-15A					G0049-16A					G0066R-16A				
SAMPLE DATE						8/15/2016					8/8/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)						360	0.22	0.8	5		19000	0.44	1.6	10	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)						2.2	0.18	0.5	1		9.9	0.36	1	2	
Ammonia USEPA 350.1 (mg/L)						2	0.022	0.05	0.1		6.6	0.044	0.1	0.2	
Nitrate/Nitrite USEPA 353.2 (mg/L)			**No 2016 Sample**			<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	UJ
Alkalinity SM 2320B (mg/L)			**Well Dry**			300	1.1	3.2	5		800	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]						133	1.1	3.2	5		356	1.1	3.2	5.0	
Sulfate USEPA 9056A (mg/L)						260	1.2	2.5	25		32	0.23	0.5	5	
Sulfide SM 9034 (mg/L)						<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)						3.2	0.16	0.5	1		300	1.1	3.5	7	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0067-16A					G0070-16A					G0075-16A				
SAMPLE DATE	8/16/2016					8/10/2016					8/10/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	0.91	0.22	0.8	5	J	0.69	0.22	0.8	5	J	990	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	UJ	<	0.18	0.5	1	UJ	<	0.18	0.5	1	U
Ammonia USEPA 350.1 (mg/L)	<	0.022	0.05	0.1	U	0.027	0.022	0.05	0.1	J	0.024	0.022	0.05	0.1	J
Nitrate/Nitrite USEPA 353.2 (mg/L)	11	0.095	0.25	0.5	J	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	230	1.1	3.2	5		200	1.1	3.2	5		260	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	102	1.1	3.2	5		89	1.1	3.2	5		116	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	76	0.23	0.5	5		33	0.23	0.5	5		120	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	2.8	0.16	0.5	1		1	0.16	0.5	1		2.6	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0076-16A					G0077-16A					G0078-16A				
SAMPLE DATE	8/10/2016					8/9/2016					8/9/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	83	0.22	0.8	5		120	0.22	0.8	5		170	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	0.44	0.18	0.5	1	J	<	0.18	0.5	1	U	1.7	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	0.37	0.022	0.05	0.1		<	0.022	0.05	0.1	U	0.062	0.022	0.05	0.1	J
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	19	0.19	0.5	1		<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	300	1.1	3.2	5		300	1.1	3.2	5		340	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	133	1.1	3.2	5		133	1.1	3.2	5		151	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	210	1.2	2.5	25		110	0.23	0.5	5		260	1.2	2.5	25	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	2.8	0.16	0.5	1		3.8	0.16	0.5	1		2.5	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research
Laboratory

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0079-15A					G0080-16A					G0081-16A				
SAMPLE DATE						8/16/2016					8/11/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)						8.9	0.22	0.8	5		11000	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)						0.23	0.18	0.5	1	J	0.77	0.18	0.5	1	J
Ammonia USEPA 350.1 (mg/L)						<	0.022	0.05	0.1	U	0.59	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)			**No 2016 Sample**			1.8	0.019	0.05	0.1		1.3	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)			**Well Dry**			190	1.1	3.2	5		400	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]						84	1.1	3.2	5		178	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)						110	0.23	0.5	5		57	0.23	0.5	5	
Sulfide SM 9034 (mg/L)						<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)						3.2	0.16	0.5	1		5.6	0.16	0.5	1	

Notes:
[1]Carbon dioxide back calculated from alkalinity SM 2320B.
< = less than LOQ
µg/L = micrograms per liter
ID = identification number
J = estimated
LOQ = limit of quantification
mg/L = milligrams per liter
MNA = monitored natural attenuation
OU = Operable Unit
Qual = qualifier
RSK = Robert S. Kerr Environmental Research Laboratory
SM = Standard Method
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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0082-16A					G0083-16A					G0084-16A				
SAMPLE DATE	8/12/2016					8/16/2016					8/9/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	2900	0.22	0.8	5		6.4	0.22	0.8	5		17000	0.44	1.6	10	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	2.1	0.18	0.5	1	J	14	0.36	1	2	
Ammonia USEPA 350.1 (mg/L)	0.081	0.022	0.05	0.1	J	2.4	0.022	0.05	0.1		9	0.11	0.25	0.5	
Nitrate/Nitrite USEPA 353.2 (mg/L)	2.3	0.019	0.05	0.1		0.96	0.019	0.05	0.1		<	0.19	0.5	1	U
Alkalinity SM 2320B (mg/L)	300	1.1	3.2	5		320	1.1	3.2	5		400	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	133	1.1	3.2	5		142	1.1	3.2	5		178	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	93	0.23	0.5	5		150	0.23	0.5	5		23	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	4	0.16	0.5	1		2.5	0.16	0.5	1		150	0.78	2.5	5	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0085-16A					G0086-16A					G0087-16A				
SAMPLE DATE	8/15/2016					8/11/2016					8/9/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	19000	0.44	1.6	10		180	0.22	0.8	5		17	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	4.3	0.18	0.5	1		<	0.18	0.5	1	UJ	0.29	0.18	0.5	1	J
Ammonia USEPA 350.1 (mg/L)	3.2	0.11	0.25	0.5		<	0.022	0.05	0.1	U	<	0.022	0.05	0.1	U
Nitrate/Nitrite USEPA 353.2 (mg/L)	0.62	0.019	0.05	0.1		3.8	0.019	0.05	0.1		0.32	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)	460	1.1	3.2	5		240	1.1	3.2	5		210	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	204	1.1	3.2	5		107	1.1	3.2	5		93	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	62	0.23	0.5	5		130	0.23	0.5	5		56	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	30	0.16	0.5	1		2.4	0.16	0.5	1		2.5	0.16	0.5	1	

Notes:
[1]Carbon dioxide back calculated from alkalinity SM 2320B.
< = less than LOQ
µg/L = micrograms per liter
ID = identification number
J = estimated
LOQ = limit of quantification
mg/L = milligrams per liter
MNA = monitored natural attenuation
OU = Operable Unit
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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0088-16A					G0089-16A					G0090-16A				
SAMPLE DATE	8/16/2016					8/8/2016					8/12/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	140	0.22	0.8	5		6400	0.22	0.8	5		580	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	1	0.18	0.5	1		<	0.18	0.5	1	U
Ammonia USEPA 350.1 (mg/L)	0.025	0.022	0.05	0.1	J	0.12	0.022	0.05	0.1		<	0.022	0.05	0.1	U
Nitrate/Nitrite USEPA 353.2 (mg/L)	3.8	0.019	0.05	0.1		3.6	0.019	0.05	0.1		7.6	0.095	0.25	0.5	
Alkalinity SM 2320B (mg/L)	260	1.1	3.2	5		380	1.1	3.2	5		270	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	116	1.1	3.2	5		169	1.1	3.2	5		120	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	130	0.23	0.5	5		66	0.23	0.5	5		75	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	2.7	0.16	0.5	1		5.8	0.16	0.5	1		3.2	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0091-16A					G0092-16A					G0093-16A				
SAMPLE DATE	8/16/2016					8/16/2016					8/15/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	<	0.22	0.8	5	U	0.96	0.22	0.8	5	J	6000	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	<	0.18	0.5	1	U	5.7	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	<	0.022	0.05	0.1	U	<	0.022	0.05	0.1	U	1.2	0.11	0.25	0.5	
Nitrate/Nitrite USEPA 353.2 (mg/L)	48	0.19	0.5	1		2.7	0.019	0.05	0.1		3.7	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)	310	1.1	3.2	5		350	1.1	3.2	5		210	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	138	1.1	3.2	5		156	1.1	3.2	5		93	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	130	0.23	0.5	5		270	1.2	2.5	25		31	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	3.4	0.16	0.5	1		2.7	0.16	0.5	1		110	0.46	1.5	2.9	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0094-16A					G0095-16A					G0096-16A				
SAMPLE DATE	8/12/2016					8/10/2016					8/10/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	20000	0.44	1.6	10		19000	0.44	1.6	10		8000	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	7.9	0.18	0.5	1		3.4	0.18	0.5	1		<	0.18	0.5	1	U
Ammonia USEPA 350.1 (mg/L)	6.8	0.11	0.25	0.5		2.5	0.022	0.05	0.1		0.25	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	0.41	0.019	0.05	0.1		<	0.019	0.05	0.1	U	27	0.19	0.5	1	
Alkalinity SM 2320B (mg/L)	230	1.1	3.2	5		490	1.1	3.2	5		240	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	102	1.1	3.2	5		218	1.1	3.2	5		107	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	49	0.23	0.5	5		93	0.23	0.5	5		49	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	0.8	0.79	1.9	4	J
Dissolved Organic Carbon SM 9060A (mg/L)	9.5	0.16	0.5	1		6.3	0.16	0.5	1		6.1	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0097-16A					G0098-16A					G0099-16A				
SAMPLE DATE	8/8/2016					8/15/2016					8/11/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	12000	0.22	0.8	5		20000	0.44	1.6	10		11000	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	3.5	0.18	0.5	1		2.9	0.18	0.5	1		3.2	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	1.4	0.022	0.05	0.1		1.7	0.022	0.05	0.1		3.2	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	18	0.19	0.5	1		<	0.019	0.05	0.1	U	3	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)	360	1.1	3.2	5		330	1.1	3.2	5		220	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	160	1.1	3.2	5		147	1.1	3.2	5		98	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	100	0.23	0.5	5		21	0.23	0.5	5		30	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	20	0.16	0.5	1		8.1	0.16	0.5	1		5.6	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

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Qual = qualifier

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0100-16A					G0101-16A					G0102-16A				
SAMPLE DATE	8/4/2016					8/4/2016					8/12/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	13000	0.44	1.6	10		14000	0.22	0.8	5		2.6	0.22	0.8	5	J
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	4.8	0.18	0.5	1		1.2	0.18	0.5	1		0.32	0.18	0.5	1	J
Ammonia USEPA 350.1 (mg/L)	3.8	0.022	0.05	0.1		1.4	0.022	0.05	0.1		0.066	0.022	0.05	0.1	J
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	22	0.38	1	2		<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	620	1.1	3.2	5		<	1.1	3.2	5	U	400	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	276	1.1	3.2	5		<	1.1	3.2	5		178	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	20	0.23	0.5	5		370	1.2	2.5	25		1100	2.3	5	50	J
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	6.3	0.16	0.5	1		10	0.16	0.5	1		4	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0103-16A					G0104-16A					G0105-16A				
SAMPLE DATE	8/8/2016					8/12/2016					8/3/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	24	0.22	0.8	5		3100	0.22	0.8	5		1700	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	8.7	0.36	1	2		1.6	0.18	0.5	1		4.8	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	6.7	0.11	0.25	0.5		1.4	0.022	0.05	0.1		4.1	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	490	1.1	3.2	5		550	1.1	3.2	5		730	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	218	1.1	3.2	5.0		244	1.1	3.2	5		324	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	670	2.3	5	50		920	2.3	5	50		840	2.3	5	50	
Sulfide SM 9034 (mg/L)	11	0.79	1.9	4		1.6	0.79	1.9	4	J	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	260	0.93	3	6		6.5	0.16	0.5	1		8.5	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0106-16A					G0107-16A					G0108-16A				
SAMPLE DATE	8/3/2016					8/3/2016					8/9/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	35	0.22	0.8	5		7300	0.22	0.8	5		18000	0.44	1.6	10	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	0.78	0.18	0.5	1	J	1.4	0.18	0.5	1		3	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	0.1	0.022	0.05	0.1		0.62	0.022	0.05	0.1		0.81	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	0.031	0.019	0.05	0.1	J	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	410	1.1	3.2	5		540	1.1	3.2	5		420	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	182	1.1	3.2	5		240	1.1	3.2	5		187	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	9400	23	50	500		9200	23	50	500		15	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	0.8	0.79	1.9	4	J
Dissolved Organic Carbon SM 9060A (mg/L)	3.8	0.16	0.5	1		5.1	0.16	0.5	1		17	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

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SM = Standard Method

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0109-16A					G0110-16A					G0111-16A				
SAMPLE DATE	8/16/2016					8/16/2016					8/4/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	14000	0.22	0.8	5		17000	0.65	2.4	15		12000	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	1.5	0.18	0.5	1		2.9	0.18	0.5	1		2.4	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	1.3	0.022	0.05	0.1		1.8	0.022	0.05	0.1		0.91	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	2.4	0.019	0.05	0.1		<	0.019	0.05	0.1	U	0.18	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)	200	1.1	3.2	5		580	1.1	3.2	5		650	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	89	1.1	3.2	5		258	1.1	3.2	5		289	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	77	0.23	0.5	5		23	0.23	0.5	5		56	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	3.6	0.16	0.5	1		11	0.16	0.5	1		7.1	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0112-16A					G0113-16A					G0114-16A				
SAMPLE DATE	8/10/2016					8/10/2016					8/15/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	11000	0.22	0.8	5		21000	0.44	1.6	10		18000	0.44	1.6	10	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	0.44	0.18	0.5	1	J	19	0.9	2.5	5		3.4	0.18	0.5	1	
Ammonia USEPA 350.1 (mg/L)	0.49	0.022	0.05	0.1		11	0.11	0.25	0.5		2.9	0.11	0.25	0.5	
Nitrate/Nitrite USEPA 353.2 (mg/L)	8.3	0.019	0.05	0.1		<	0.019	0.05	0.1	U	0.29	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)	210	1.1	3.2	5		660	1.1	3.2	5		320	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	93	1.1	3.2	5		293	1.1	3.2	5		142	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	63	0.23	0.5	5		11	2.3	5	50	J	33	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	1.1	0.79	1.9	4	J	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	3.4	0.16	0.5	1		150	0.78	2.5	5		17	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0115-16A					G0116-16A					G0117-16A				
SAMPLE DATE	8/4/2016					8/5/2016					8/10/2016				
	Result	Qual	DL	LOD	LOQ	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	23000	0.44	1.6	10		13000	0.22	0.8	5		25000	0.44	1.6	10	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	8.1	0.18	0.5	1		63	1.8	5	10		19	0.36	1	2	
Ammonia USEPA 350.1 (mg/L)	4.6	0.044	0.1	0.2		42	0.44	1	2		16	0.11	0.25	0.5	
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	760	1.1	3.2	5		680	1.1	3.2	5		800	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	338	1.1	3.2	5		302	1.1	3.2	5		356	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	98	0.23	0.5	5		12	4.6	10	100	J	130	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	14	0.16	0.5	1		560	1.9	6	12		13	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0118-16A					G0119-16A					G0120-16A				
SAMPLE DATE	8/16/2016					8/10/2016					8/9/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	14000	0.22	0.8	5		15000	0.44	1.6	10		21000	0.44	1.6	10	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	7.1	0.18	0.5	1		7.3	0.36	1	2		23	0.9	2.5	5	
Ammonia USEPA 350.1 (mg/L)	2.8	0.11	0.25	0.5		2.9	0.022	0.05	0.1		20	0.22	0.5	1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	800	1.1	3.2	5		910	1.1	3.2	5		1000	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	356	1.1	3.2	5		404	1.1	3.2	5		444	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	13	0.23	0.5	5		31	0.23	0.5	5		110	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	26	0.16	0.5	1		250	0.93	3	6		31	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	G0121-16A					PZ001-16A					PZ004-16A				
SAMPLE DATE						8/4/2016					8/4/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)						75	0.22	0.8	5		160	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)						0.27	0.18	0.5	1	J	0.19	0.18	0.5	1	J
Ammonia USEPA 350.1 (mg/L)						0.032	0.022	0.05	0.1	J	0.076	0.022	0.05	0.1	J
Nitrate/Nitrite USEPA 353.2 (mg/L)	**No 2016 Sample**					2.1	0.019	0.05	0.1		0.57	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)						560	1.1	3.2	5		550	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]						249	1.1	3.2	5		244	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)						1100	2.3	5	50	J	960	2.3	5	50	
Sulfide SM 9034 (mg/L)						<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)						6.3	0.16	0.5	1		6.2	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

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TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	PZ005-16A					PZ007-16A					PZ009-16A				
SAMPLE DATE	8/8/2016					8/4/2016					8/8/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	<	0.22	0.8	5	U	0.41	0.22	0.8	5	J	2.1	0.22	0.8	5	J
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	0.39	0.18	0.5	1	J	<	0.18	0.5	1	U
Ammonia USEPA 350.1 (mg/L)	<	0.022	0.05	0.1	U	0.028	0.022	0.05	0.1	J	0.039	0.022	0.05	0.1	J
Nitrate/Nitrite USEPA 353.2 (mg/L)	2.7	0.019	0.05	0.1		0.66	0.019	0.05	0.1		0.43	0.019	0.05	0.1	
Alkalinity SM 2320B (mg/L)	570	1.1	3.2	5		400	1.1	3.2	5		470	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	253	1.1	3.2	5.0		178	1.1	3.2	5		209	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	1100	2.3	5	50		680	2.3	5	50	J	350	1.2	2.5	25	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	6.8	0.16	0.5	1		3.5	0.16	0.5	1		4.1	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	PZ010-16A					PZ011-16A					PZ012-16A				
SAMPLE DATE	8/5/2016					8/8/2016					8/8/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	5500	0.22	0.8	5		17000	0.65	2.4	15		22000	0.65	2.4	15	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	0.79	0.18	0.5	1	J	5.8	0.18	0.5	1		12	0.36	1	2	
Ammonia USEPA 350.1 (mg/L)	0.4	0.022	0.05	0.1		5.5	0.044	0.1	0.2		9.9	0.11	0.25	0.5	
Nitrate/Nitrite USEPA 353.2 (mg/L)	6.7	0.019	0.05	0.1		<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U
Alkalinity SM 2320B (mg/L)	470	1.1	3.2	5		930	1.1	3.2	5		1100	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	209	1.1	3.2	5		413	1.1	3.2	5.0		489	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	140	0.23	0.5	5		98	0.23	0.5	5		130	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	3.5	0.16	0.5	1		12	0.16	0.5	1		24	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research
Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	PZ013-16A					PZ014-16A					PZ015-16A				
SAMPLE DATE	8/9/2016					8/9/2016					8/12/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	14000	0.22	0.8	5		1300	0.22	0.8	5		6300	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	3.8	0.18	0.5	1		0.77	0.18	0.5	1	J	<	0.18	0.5	1	U
Ammonia USEPA 350.1 (mg/L)	1.3	0.022	0.05	0.1		0.055	0.022	0.05	0.1	J	0.43	0.022	0.05	0.1	
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	1.8	0.019	0.05	0.1		20	0.19	0.5	1	
Alkalinity SM 2320B (mg/L)	1000	1.1	3.2	5		760	1.1	3.2	5		180	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	444	1.1	3.2	5		338	1.1	3.2	5		80	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	170	0.23	0.5	5		580	1.2	2.5	25		82	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	13	0.16	0.5	1		6.4	0.16	0.5	1		4.8	0.16	0.5	1	

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320B.

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

OU = Operable Unit

Qual = qualifier

RSK = Robert S. Kerr Environmental Research
Laboratory

SM = Standard Method

U = nondetect

USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	PZ016-16A					PZ017R-16A					PZ018-16A				
SAMPLE DATE	8/12/2016					8/9/2016					8/9/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	4500	0.22	0.8	5		410	0.22	0.8	5		2100	0.22	0.8	5	
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	0.91	0.18	0.5	1	J	<	0.18	0.5	1	U	<	0.18	0.5	1	U
Ammonia USEPA 350.1 (mg/L)	0.59	0.022	0.05	0.1		0.024	0.022	0.05	0.1	J	<	0.022	0.05	0.1	U
Nitrate/Nitrite USEPA 353.2 (mg/L)	0.3	0.019	0.05	0.1		36	0.19	0.5	1		27	0.19	0.5	1	
Alkalinity SM 2320B (mg/L)	280	1.1	3.2	5		150	1.1	3.2	5		210	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	124	1.1	3.2	5		67	1.1	3.2	5		93	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	110	0.23	0.5	5		53	0.23	0.5	5		64	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	5.1	0.16	0.5	1		2.6	0.16	0.5	1		3.3	0.16	0.5	1	

Notes:
[1]Carbon dioxide back calculated from alkalinity SM 2320B.
< = less than LOQ
µg/L = micrograms per liter
ID = identification number
J = estimated
LOQ = limit of quantification
mg/L = milligrams per liter
MNA = monitored natural attenuation
OU = Operable Unit
Qual = qualifier
RSK = Robert S. Kerr Environmental Research
Laboratory
SM = Standard Method
U = nondetect
USEPA = United States Environmental Protection Agency

TABLE 4-6
SUMMARY OF LABORATORY MNA PARAMETERS, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

FIELD ID	PZ019-16A					PZ020-16A				
SAMPLE DATE	8/10/2016					8/12/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS										
Methane RSK-175 (µg/L)	<	0.22	0.8	5	U	0.52	0.22	0.8	5	J
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	<	0.18	0.5	1	U
Ammonia USEPA 350.1 (mg/L)	<	0.022	0.05	0.1	U	<	0.022	0.05	0.1	U
Nitrate/Nitrite USEPA 353.2 (mg/L)	74	0.19	0.5	1		35	0.38	1	2	
Alkalinity SM 2320B (mg/L)	43	1.1	3.2	5		310	1.1	3.2	5	
Carbon Dioxide SM 2320B (mg/L)[1]	19	1.1	3.2	5		138	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	46	0.23	0.5	5		150	0.23	0.5	5	
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U
Dissolved Organic Carbon SM 9060A (mg/L)	2.2	0.16	0.5	1		4.8	0.16	0.5	1	

Notes:
[1]Carbon dioxide back calculated from alkalinity SM 2320B.
< = less than LOQ
µg/L = micrograms per liter
ID = identification number
J = estimated
LOQ = limit of quantification
mg/L = milligrams per liter
MNA = monitored natural attenuation
OU = Operable Unit
Qual = qualifier
RSK = Robert S. Kerr Environmental Research Laboratory
SM = Standard Method
U = nondetect
USEPA = United States Environmental Protection Agency

TABLE 4-7
SUMMARY OF LABORATORY MNA PARAMETERS
OU1 OFF-POST MONITORING WELLS
2016 ANNUAL REPORT

No 2016 MNA Samples Collected for OU1 Off-Post Monitoring Wells

TABLE 4-8
SUMMARY OF VOCs AND TPH-DRO DETECTED
OU3 SHOP AREA MONITORING WELLS
2016 ANNUAL REPORT

FIELD ID		G0069-16A					SHGW02-16A				
SAMPLE DATE	MCLs	8/15/2016					8/15/2016				
	(µg/L)	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
VOLATILE ORGANIC COMPOUNDS (Method 8260B) (µg/L)											
1,1,2-Trichloroethane	5	<	0.32	0.8	1	U	2.1	0.32	0.8	1	
1,2-Dichloroethane	5	<	0.13	0.4	1	U	7.9	0.13	0.4	1	
2-Butanone (MEK)	NA	<	1.8	4	6	U	35	1.8	4	6	
2-Hexanone	NA	<	1.4	4	5	U	60	1.4	4	5	
Acetone	NA	<	1.9	6.4	10	U	21	1.9	6.4	10	
Benzene	5	<	0.16	0.4	1	U	<	0.16	0.4	1	U
Chloroethane	NA	<	0.41	1.6	2	U	0.76	0.41	1.6	2	J
Cyclohexane	NA	<	0.28	0.8	2	U	<	0.28	0.8	2	U
Ethyl Benzene	700	<	0.16	0.4	1	U	<	0.16	0.4	1	U
Isopropylbenzene	NA	<	0.19	0.4	1	U	<	0.19	0.4	1	U
Vinyl Chloride	2	<	0.1	0.2	1.5	U	0.46	0.1	0.2	1.5	J
Xylenes, Total	10000	<	0.19	0.8	2	U	<	0.19	0.8	2	U
TOTAL PETROLEUM HYDROCARBONS (Method 8015B) (mg/L)	PAL[1] (mg/L)										
Diesel Range Organics	10	0.27	0.031	0.12	0.24		NS				

Notes:

[shaded box] Concentrations exceed MCLs

[1]TPH-DRO is screened against Nebraska PAL (NDEQ 2009).

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MCL = maximum contaminant level

NA = not available

NS = not sampled

PAL = project action limit

Qual = qualifier

TPH-DRO = total petroleum hydrocarbon-diesel range organic

U = nondetect

TABLE 4-8
SUMMARY OF VOCs AND TPH-DRO DETECTED
OU3 SHOP AREA MONITORING WELLS
2016 ANNUAL REPORT

FIELD ID		SHGW03-16A					SHGW04-16A				
SAMPLE DATE	MCLs	8/15/2016					8/15/2016				
	(µg/L)	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
VOLATILE ORGANIC COMPOUNDS (Method 8260B) (µg/L)											
1,1,2-Trichloroethane	5	<	0.32	0.8	1	U	<	0.32	0.8	1	U
1,2-Dichloroethane	5	0.59	0.13	0.4	1	J	<	0.13	0.4	1	U
2-Butanone (MEK)	NA	4.1	1.8	4	6	J	<	1.8	4	6	U
2-Hexanone	NA	<	1.4	4	5	U	<	1.4	4	5	U
Acetone	NA	3.7	1.9	6.4	10	J	2.4	1.9	6.4	10	J
Benzene	5	0.56	0.16	0.4	1	J	<	0.16	0.4	1	U
Chloroethane	NA	<	0.41	1.6	2	U	<	0.41	1.6	2	U
Cyclohexane	NA	0.4	0.28	0.8	2	J	<	0.28	0.8	2	U
Ethyl Benzene	700	2.2	0.16	0.4	1		<	0.16	0.4	1	U
Isopropylbenzene	NA	0.29	0.19	0.4	1	J	<	0.19	0.4	1	U
Vinyl Chloride	2	<	0.1	0.2	1.5	U	<	0.1	0.2	1.5	U
Xylenes, Total	10000	4.1	0.19	0.8	2		<	0.19	0.8	2	U
TOTAL PETROLEUM HYDROCARBONS (Method 8015B) (mg/L)	PAL[1] (mg/L)										
Diesel Range Organics	10	5.5	0.031	0.11	0.24		0.95	0.031	0.12	0.24	

Notes:

(shaded) Concentrations exceed MCLs

[1]TPH-DRO is screened against Nebraska PAL (NDEQ 2009).

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MCL = maximum contaminant level

NA = not available

NS = not sampled

PAL = project action limit

Qual = qualifier

TPH-DRO = total petroleum hydrocarbon-diesel range organic

U = nondetect

TABLE 4-9
SUMMARY OF LABORATORY MNA PARAMETERS
OU3 SHOP AREA MONITORING WELLS
2016 ANNUAL REPORT

FIELD ID	G0053-16A					G0069-16A					SAMW1-16A				
SAMPLE DATE	8/15/2016					8/15/2016					8/15/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	<	0.22	0.8	5	U	180	0.22	0.8	5		<	0.22	0.8	5	U
Ethane RSK-175 (µg/L)	<	0.57	1.5	5	U	<	0.57	1.5	5	U	<	0.57	1.5	5	U
Ethene RSK-175 (µg/L)	<	0.4	1.4	5	U	<	0.4	1.4	5	U	<	0.4	1.4	5	U
Nitrate/Nitrite USEPA 353.2 (mg/L)	12	0.095	0.25	0.5		1.1	0.019	0.05	0.1		18	0.19	0.5	1	
Alkalinity USEPA 2320B (mg/L)	83	1.1	3.2	5		150	1.1	3.2	5		100	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	18	0.23	0.5	5	J	24	0.23	0.5	5		28	0.23	0.5	5	

Notes:

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

U = nondetect

USEPA = U.S. Environmental Protection Agency

TABLE 4-9
SUMMARY OF LABORATORY MNA PARAMETERS
OU3 SHOP AREA MONITORING WELLS
2016 ANNUAL REPORT

FIELD ID	SHGW02-16A					SHGW03-16A					SHGW04-16A				
SAMPLE DATE	8/15/2016					8/15/2016					8/15/2016				
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual
LABORATORY MNA PARAMETERS															
Methane RSK-175 (µg/L)	20000	0.44	1.6	10		3700	0.22	0.8	5		390	0.22	0.8	5	
Ethane RSK-175 (µg/L)	<	0.57	1.5	5	U	<	0.57	1.5	5	U	<	0.57	1.5	5	U
Ethene RSK-175 (µg/L)	<	0.4	1.4	5	U	<	0.4	1.4	5	U	<	0.4	1.4	5	U
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U	0.56	0.019	0.05	0.1	
Alkalinity USEPA 2320B (mg/L)	260	1.1	3.2	5		230	1.1	3.2	5		200	1.1	3.2	5	
Sulfate USEPA 9056A (mg/L)	9.6	0.23	0.5	5		12	0.23	0.5	5		30	0.23	0.5	5	

Notes:

< = less than LOQ

µg/L = micrograms per liter

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

Qual = qualifier

RSK = Robert S. Kerr Environmental Research Laboratory

U = nondetect

USEPA = U.S. Environmental Protection Agency

TABLE 4-10a
SUMMARY OF OU1 FIELD DUPLICATE SAMPLE PAIRS
2016 ANNUAL REPORT

WELL NUMBER	LL1-DP144											LL2-DP112										
FIELD ID	LL1-DP144-30					LL1-DP644-30						LL2-DP112-25					LL2-DP612-25					
SAMPLE DATE	2/24/2016					2/24/2016						2/25/2016					2/25/2016					
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD
EXPLOSIVES (USEPA Method 8330A) (µg/L)																						
1,3,5-Trinitrobenzene	<	0.21	0.41	1	U	<	0.21	0.41	1	U		4.4	0.21	0.43	1.1		4.4	0.2	0.41	1		0
1,3-Dinitrobenzene	<	0.092	0.21	0.41	U	<	0.092	0.21	0.41	U		<	0.094	0.21	0.43	U	<	0.09	0.2	0.41	U	
2,4,6-Trinitrotoluene	<	0.075	0.21	0.41	U	<	0.075	0.21	0.41	U		1.7	0.077	0.21	0.43	J	1.7	0.074	0.2	0.41	J	0
2,4-Dinitrotoluene	<	0.087	0.21	0.41	U	<	0.087	0.21	0.41	U		<	0.089	0.21	0.43	U	<	0.085	0.2	0.41	U	
2,6-Dinitrotoluene	<	0.067	0.21	0.21	U	<	0.067	0.21	0.21	U		<	0.069	0.21	0.21	U	<	0.066	0.2	0.2	U	
2-Amino-4,6-dinitrotoluene	<	0.052	0.12	0.21	U	<	0.052	0.12	0.21	U		2.2	0.054	0.13	0.21	J	2.2	0.052	0.12	0.2	J	0
2-Nitrotoluene	<	0.088	0.21	0.41	U	<	0.088	0.21	0.41	U		<	0.091	0.21	0.43	U	<	0.087	0.2	0.41	U	
3-Nitrotoluene	<	0.086	0.21	0.41	U	<	0.086	0.21	0.41	U		<	0.089	0.21	0.43	U	<	0.085	0.2	0.41	U	
4-Amino-2,6-dinitrotoluene	<	0.06	0.12	0.21	U	<	0.06	0.12	0.21	U		1.1	0.061	0.13	0.21	J	1.1	0.059	0.12	0.2	J	0
4-Nitrotoluene	<	0.21	0.41	1	U	<	0.21	0.41	1	U		<	0.21	0.43	1.1	U	<	0.2	0.41	1	U	
HMX	1.3	0.091	0.21	0.41		1.3	0.091	0.21	0.41		0	<	0.093	0.21	0.43	U	0.35	0.089	0.2	0.41	J	<2X
MNX	<	0.37	0.5	2.1	U	<	0.37	0.5	2.1	U		<	0.38	0.5	2.1	U	<	0.37	0.5	2	U	
Nitrobenzene	<	0.094	0.21	0.41	U	<	0.094	0.21	0.41	U		<	0.097	0.21	0.43	U	<	0.093	0.2	0.41	U	
RDX	<	0.054	0.12	0.21	U	<	0.054	0.12	0.21	U		<	0.056	0.13	0.21	U	<	0.053	0.12	0.2	U	
Tetryl	<	0.082	0.21	0.25	U	<	0.082	0.21	0.25	U		<	0.084	0.21	0.26	U	<	0.081	0.2	0.24	U	
LABORATORY MNA PARAMETERS																						
Methane RSK-175 (µg/L)	Not Measured											Not Measured										
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)																						
Ammonia USEPA 350.1 (mg/L)																						
Nitrate/Nitrite USEPA 353.2 (mg/L)																						
Alkalinity SM 2320B (mg/L)																						
Carbon Dioxide SM 2320B (mg/L)[1]																						
Sulfate USEPA 9056A (mg/L)																						
Sulfide SM 9034 (mg/L)																						
Dissolved Organic Carbon SM 9060A (mg/L)																						

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320.
(shaded box) field duplicate RPD > 25 or >2X the LOQ
< = less than LOQ
µg/L = micrograms per liter
DUP = duplicate sample
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification number
J = estimated
LOQ = limit of quantification
mg/L = milligrams per liter
MNA = monitored natural attenuation
MNX = mono-nitroso-RDX
OU = Operable Unit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
RPD = relative percent difference
RSK = Robert S. Kerr Environmental Research Laboratory
SM = Standard Method
U = nondetect
UJ = estimated nondetect
USEPA = United States Environmental Protection Agency
X = times

TABLE 4-10a
SUMMARY OF OU1 FIELD DUPLICATE SAMPLE PAIRS
2016 ANNUAL REPORT

WELL NUMBER	G0022											G0085										
FIELD ID	G0022-16A					G0222-16A(DUP)						G0085-16A					G0285-16A(DUP)					
SAMPLE DATE	8/16/2016					8/16/2016						8/15/2016					8/15/2016					
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD
EXPLOSIVES (USEPA Method 8330A) (µg/L)																						
1,3,5-Trinitrobenzene	0.48	0.24	0.49	1.2	J	0.51	0.23	0.46	1.2	J	<2X	<	0.23	0.46	1.1	U	<	0.26	0.52	1.3	U	
1,3-Dinitrobenzene	<	0.11	0.24	0.49	U	<	0.1	0.23	0.46	U		<	0.1	0.23	0.46	U	<	0.12	0.26	0.52	U	
2,4,6-Trinitrotoluene	1.6	0.088	0.24	0.49		1.7	0.084	0.23	0.46		<2X	<	0.083	0.23	0.46	U	<	0.094	0.26	0.52	U	
2,4-Dinitrotoluene	<	0.1	0.24	0.49	U	<	0.097	0.23	0.46	U		<	0.096	0.23	0.46	U	<	0.11	0.26	0.52	U	
2,6-Dinitrotoluene	<	0.079	0.24	0.24	U	<	0.074	0.23	0.23	U		<	0.074	0.23	0.23	U	<	0.084	0.26	0.26	U	
2-Amino-4,6-dinitrotoluene	2.6	0.062	0.15	0.24		2.4	0.059	0.14	0.23		<2X	<	0.058	0.14	0.23	U	<	0.066	0.16	0.26	U	
2-Nitrotoluene	<	0.1	0.24	0.49	U	<	0.099	0.23	0.46	U		<	0.098	0.23	0.46	U	<	0.11	0.26	0.52	U	
3-Nitrotoluene	<	0.1	0.24	0.49	U	<	0.096	0.23	0.46	U		<	0.096	0.23	0.46	U	<	0.11	0.26	0.52	U	
4-Amino-2,6-dinitrotoluene	3.1	0.07	0.15	0.24		2.8	0.067	0.14	0.23		<2X	<	0.066	0.14	0.23	U	<	0.075	0.16	0.26	U	
4-Nitrotoluene	<	0.24	0.49	1.2	U	<	0.23	0.46	1.2	U		<	0.23	0.46	1.1	U	<	0.26	0.52	1.3	U	
HMX	0.91	0.11	0.24	0.49	J	1.3	0.1	0.23	0.46		<2X	<	0.1	0.23	0.46	U	<	0.11	0.26	0.52	U	
MNX	<	0.44	0.44	2.4	U	<	0.41	0.41	2.3	U		<	0.41	0.41	2.3	U	<	0.47	0.47	2.6	U	
Nitrobenzene	<	0.11	0.24	0.49	U	<	0.11	0.23	0.46	U		<	0.1	0.23	0.46	U	<	0.12	0.26	0.52	U	
RDX	1.1	0.064	0.15	0.24		1	0.06	0.14	0.23		<2X	1.9	0.06	0.14	0.23	J	1.8	0.068	0.16	0.26	J	5
Tetryl	<	0.097	0.24	0.29	U	<	0.092	0.23	0.28	U		<	0.091	0.23	0.28	U	<	0.1	0.26	0.31	U	
LABORATORY MNA PARAMETERS																						
Methane RSK-175 (µg/L)	220	0.22	0.8	5		230	0.22	0.8	5		<2X	19000	0.44	1.6	10		18000	0.44	1.6	10		5
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	<	0.18	0.5	1	U		4.3	0.18	0.5	1		4.4	0.18	0.5	1		<2X
Ammonia USEPA 350.1 (mg/L)	<	0.022	0.05	0.1	U	<	0.022	0.05	0.1	U		3.2	0.11	0.25	0.5		3.2	0.11	0.25	0.5		0
Nitrate/Nitrite USEPA 353.2 (mg/L)	13	0.19	0.5	1		13	0.038	0.1	0.2		0	0.62	0.019	0.05	0.1		0.59	0.019	0.05	0.1		5
Alkalinity SM 2320B (mg/L)	300	1.1	3.2	5		310	1.1	3.2	5		<2X	460	1.1	3.2	5		460	1.1	3.2	5		0
Carbon Dioxide SM 2320B (mg/L)[1]	133	1.1	3.2	5		138	1.1	3.2	5		<2X	204	1.1	3.2	5		204	1.1	3.2	5		0
Sulfate USEPA 9056A (mg/L)	64	0.23	0.5	5		65	0.23	0.5	5		2	62	0.23	0.5	5		61	0.23	0.5	5		2
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U		<	0.79	1.9	4	U	<	0.79	1.9	4	U	
Dissolved Organic Carbon SM 9060A (mg/L)	3.1	0.16	0.5	1		3	0.16	0.5	1		<2X	30	0.16	0.5	1		30	0.16	0.5	1		0

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320.
field duplicate RPD > 25 or >2X the LOQ
< = less than LOQ
µg/L = micrograms per liter
DUP = duplicate sample
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification number
J = estimated

LOQ = limit of quantification
mg/L = milligrams per liter
MNA = monitored natural attenuation
MNX = mono-nitroso-RDX
OU = Operable Unit
Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

RPD = relative percent difference
RSK = Robert S. Kerr Environmental Research Laboratory
SM = Standard Method
U = nondetect
UJ = estimated nondetect
USEPA = United States Environmental Protection Agency
X = times

TABLE 4-10a
SUMMARY OF OU1 FIELD DUPLICATE SAMPLE PAIRS
2016 ANNUAL REPORT

WELL NUMBER	PZ017R											NW021										
FIELD ID	PZ017R-16A					PZ021-16A(DUP)						NW021-16A					NW023-16A(DUP)					
SAMPLE DATE	8/9/2016					8/9/2016						8/5/2016					8/5/2016					
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD
EXPLOSIVES (USEPA Method 8330A) (µg/L)																						
1,3,5-Trinitrobenzene	11	0.22	0.43	1.1		13	0.21	0.43	1.1		17	<	0.22	0.43	1.1	U	<	0.22	0.43	1.1	U	
1,3-Dinitrobenzene	<	0.096	0.22	0.43	U	<	0.095	0.21	0.43	U		<	0.096	0.22	0.43	U	<	0.095	0.22	0.43	U	
2,4,6-Trinitrotoluene	22	0.078	0.22	0.43		<	0.077	0.21	0.43	U		<	0.078	0.22	0.43	U	<	0.078	0.22	0.43	U	
2,4-Dinitrotoluene	<	0.091	0.22	0.43	U	<	0.09	0.21	0.43	U		<	0.09	0.22	0.43	U	<	0.09	0.22	0.43	U	
2,6-Dinitrotoluene	<	0.07	0.22	0.22	U	<	0.069	0.21	0.21	U		<	0.069	0.22	0.22	U	<	0.069	0.22	0.22	U	
2-Amino-4,6-dinitrotoluene	3	0.055	0.13	0.22		3.5	0.054	0.13	0.21		15	4.3	0.055	0.13	0.22		4.3	0.055	0.13	0.22		0
2-Nitrotoluene	<	0.092	0.22	0.43	U	0.11	0.091	0.21	0.43	J	<2X	<	0.092	0.22	0.43	U	<	0.092	0.22	0.43	U	
3-Nitrotoluene	<	0.09	0.22	0.43	U	<	0.089	0.21	0.43	U		<	0.09	0.22	0.43	U	<	0.09	0.22	0.43	U	
4-Amino-2,6-dinitrotoluene	<	0.062	0.13	0.22	U	3.9	0.062	0.13	0.21		<2X	2	0.062	0.13	0.22		2	0.062	0.13	0.22		0
4-Nitrotoluene	<	0.22	0.43	1.1	U	<	0.21	0.43	1.1	U		<	0.22	0.43	1.1	U	<	0.22	0.43	1.1	U	
HMX	1.6	0.095	0.22	0.43		2.3	0.094	0.21	0.43		36	<	0.094	0.22	0.43	U	<	0.094	0.22	0.43	U	
MNX	<	0.39	0.39	2.2	U	<	0.38	0.38	2.1	U		<	0.4	0.4	2.2	U	<	0.39	0.39	2.2	U	
Nitrobenzene	<	0.098	0.22	0.43	U	<	0.097	0.21	0.43	U		<	0.098	0.22	0.43	U	<	0.098	0.22	0.43	U	
RDX	3.4	0.057	0.13	0.22		4.1	0.056	0.13	0.21		19	0.35	0.056	0.13	0.22		0.26	0.056	0.13	0.22	J	<2X
Tetryl	<	0.086	0.22	0.26	U	<	0.085	0.21	0.26	U		4.7	0.085	0.22	0.26		<	0.085	0.22	0.26	U	<2X
LABORATORY MNA PARAMETERS																						
Methane RSK-175 (µg/L)	410	0.22	0.8	5		380	0.22	0.8	5		8											
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)	<	0.18	0.5	1	U	<	0.18	0.5	1	U												
Ammonia USEPA 350.1 (mg/L)	0.024	0.022	0.05	0.1	J	0.073	0.022	0.05	0.1	J	<2X											
Nitrate/Nitrite USEPA 353.2 (mg/L)	36	0.19	0.5	1		37	0.19	0.5	1		3											
Alkalinity SM 2320B (mg/L)	150	1.1	3.2	5		150	1.1	3.2	5		0			Not Measured					Not Measured			
Carbon Dioxide SM 2320B (mg/L)[1]	67	1.1	3.2	5		67	1.1	3.2	5		0											
Sulfate USEPA 9056A (mg/L)	53	0.23	0.5	5		53	0.23	0.5	5		0											
Sulfide SM 9034 (mg/L)	<	0.79	1.9	4	U	<	0.79	1.9	4	U												
Dissolved Organic Carbon SM 9060A (mg/L)	2.6	0.16	0.5	1		2.6	0.16	0.5	1		0											

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320.
field duplicate RPD > 25 or >2X the LOQ
< = less than LOQ
µg/L = micrograms per liter
DUP = duplicate sample
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification number
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LOQ = limit of quantification
mg/L = milligrams per liter
MNA = monitored natural attenuation
MNX = mono-nitroso-RDX
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Qual = qualifier
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
RPD = relative percent difference
RSK = Robert S. Kerr Environmental Research Laboratory
SM = Standard Method
U = nondetect
UJ = estimated nondetect
USEPA = United States Environmental Protection Agency
X = times

TABLE 4-10a
SUMMARY OF OU1 FIELD DUPLICATE SAMPLE PAIRS
2016 ANNUAL REPORT

WELL NUMBER	CA312										
FIELD ID	CA312-16A					CA314-16A(DUP)					
SAMPLE DATE	8/2/2016					8/2/2016					
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD
EXPLOSIVES (USEPA Method 8330A) (µg/L)											
1,3,5-Trinitrobenzene	<	0.21	0.42	1	U	<	0.21	0.41	1	U	
1,3-Dinitrobenzene	<	0.093	0.21	0.42	U	<	0.092	0.21	0.41	U	
2,4,6-Trinitrotoluene	<	0.076	0.21	0.42	U	<	0.075	0.21	0.41	U	
2,4-Dinitrotoluene	<	0.087	0.21	0.42	U	<	0.087	0.21	0.41	U	
2,6-Dinitrotoluene	<	0.067	0.21	0.21	U	<	0.067	0.21	0.21	U	
2-Amino-4,6-dinitrotoluene	<	0.053	0.13	0.21	U	<	0.052	0.12	0.21	U	
2-Nitrotoluene	<	0.089	0.21	0.42	U	<	0.088	0.21	0.41	U	
3-Nitrotoluene	<	0.087	0.21	0.42	U	<	0.086	0.21	0.41	U	
4-Amino-2,6-dinitrotoluene	<	0.06	0.13	0.21	U	<	0.06	0.12	0.21	U	
4-Nitrotoluene	<	0.21	0.42	1	U	<	0.21	0.41	1	U	
HMX	0.23	0.091	0.21	0.42	J	0.29	0.091	0.21	0.41	J	<2X
MNX	<	0.37	0.37	2.1	U	<	0.37	0.37	2.1	U	
Nitrobenzene	<	0.095	0.21	0.42	U	<	0.094	0.21	0.41	U	
RDX	0.47	0.055	0.13	0.21		0.5	0.054	0.12	0.21		<2X
Tetryl	<	0.083	0.21	0.25	U	<	0.082	0.21	0.25	U	
LABORATORY MNA PARAMETERS											
Methane RSK-175 (µg/L)											
Total Kjeldahl Nitrogen USEPA 351.2 (mg/L)											
Ammonia USEPA 350.1 (mg/L)											
Nitrate/Nitrite USEPA 353.2 (mg/L)											
Alkalinity SM 2320B (mg/L)	Not Measured					Not Measured					
Carbon Dioxide SM 2320B (mg/L)[1]											
Sulfate USEPA 9056A (mg/L)											
Sulfide SM 9034 (mg/L)											
Dissolved Organic Carbon SM 9060A (mg/L)											

Notes:

[1]Carbon dioxide back calculated from alkalinity SM 2320.

field duplicate RPD > 25 or >2X the LOQ

< = less than LOQ

µg/L = micrograms per liter

DUP = duplicate sample

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

MNX = mono-nitroso-RDX

OU = Operable Unit

Qual = qualifier

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

RPD = relative percent difference

RSK = Robert S. Kerr Environmental Research Laboratory

SM = Standard Method

U = nondetect

UJ = estimated nondetect

USEPA = United States Environmental Protection Agency

X = times

TABLE 4-10b
SUMMARY OF OU3 FIELD DUPLICATE SAMPLE PAIR
2016 ANNUAL REPORT

WELL NUMBER	SHGW02										
FIELD ID	SHGW02-16A					SHGW05-16A(DUP)					
SAMPLE DATE	8/15/2016					8/15/2016					
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD
VOLATILE ORGANIC COMPOUNDS (Method 8260B) (µg/L)											
1,1,1-Trichloroethane	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
1,1,2,2-Tetrachloroethane	<	0.2	0.8	1	U	<	0.2	0.8	1	U	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon® 113)	<	0.79	1.6	3	U	<	0.79	1.6	3	U	
1,1,2-Trichloroethane	2.1	0.32	0.8	1		2.1	0.32	0.8	1		
1,1-Dichloroethane	<	0.16	0.8	1	U	<	0.16	0.8	1	U	
1,1-Dichloroethene	<	0.14	0.8	1	U	<	0.14	0.8	1	U	
1,2,3-Trichlorobenzene	<	0.18	0.8	1	U	<	0.18	0.8	1	U	
1,2,4-Trichlorobenzene	<	0.32	0.8	1	U	<	0.32	0.8	1	U	
1,2-Dibromo-3-Chloropropane	<	0.81	1.6	5	U	<	0.81	1.6	5	U	
1,2-Dibromoethane	<	0.18	0.4	1	U	<	0.18	0.4	1	U	
1,2-Dichlorobenzene	<	0.13	0.4	1	U	<	0.13	0.4	1	U	
1,2-Dichloroethane	7.9	0.13	0.4	1		8	0.13	0.4	1		1
1,2-Dichloropropane	<	0.13	0.4	1	U	<	0.13	0.4	1	U	
1,3-Dichlorobenzene	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
1,4-Dichlorobenzene	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
2-Butanone (MEK)	35	1.8	4	6		46	1.8	4	6		27
2-Hexanone	60	1.4	4	5		74	1.4	4	5		21
4-Methyl-2-Pentanone (MIBK)	<	1	3.2	5	U	<	1	3.2	5	U	
Acetone	21	1.9	6.4	10		28	1.9	6.4	10		<2X
Benzene	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
Bromochloromethane	<	0.1	0.2	1	U	<	0.1	0.2	1	U	
Bromodichloromethane	<	0.17	0.4	1	U	<	0.17	0.4	1	U	
Bromoform	<	0.19	0.4	1	U	<	0.19	0.4	1	U	
Bromomethane	<	0.21	0.8	2	U	<	0.21	0.8	2	U	
Carbon Disulfide	<	0.45	1.6	2	U	<	0.45	1.6	2	U	
Carbon Tetrachloride	<	0.19	0.4	2	U	<	0.19	0.4	2	U	
Chlorobenzene	<	0.17	0.4	1	U	<	0.17	0.4	1	U	
Chloroethane	0.76	0.41	1.6	2	J	0.93	0.41	1.6	2	J	<2X
Chloroform	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
Chloromethane	<	0.3	0.8	2	U	<	0.3	0.8	2	U	
Cis-1,2-Dichloroethene	<	0.15	0.4	1	U	<	0.15	0.4	1	U	
Cis-1,3-Dichloropropene	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
Cyclohexane	<	0.28	0.8	2	U	<	0.28	0.8	2	U	
Dibromochloromethane	<	0.17	0.4	1	U	<	0.17	0.4	1	U	
Dichlorodifluoromethane	<	0.31	0.8	2	U	<	0.31	0.8	2	U	
Ethyl Benzene	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
Isopropylbenzene	<	0.19	0.4	1	U	<	0.19	0.4	1	U	
Methyl Acetate	<	1.6	4	5	U	<	1.6	4	5	U	
Methyl Cyclohexane	<	0.25	0.8	5	U	<	0.25	0.8	5	U	
Methyl Tert-Butyl Ether (Mtbe)	<	0.36	0.8	2	U	<	0.36	0.8	2	U	
Methylene Chloride	<	0.32	0.8	5	U	<	0.32	0.8	5	U	
Styrene	<	0.17	0.4	1	U	<	0.17	0.4	1	U	
Tetrachloroethylene (Pce)	<	0.2	0.4	1	U	<	0.2	0.4	1	U	

TABLE 4-10b
SUMMARY OF OU3 FIELD DUPLICATE SAMPLE PAIR
2016 ANNUAL REPORT

WELL NUMBER	SHGW02										
FIELD ID	SHGW02-16A					SHGW05-16A(DUP)					
SAMPLE DATE	8/15/2016					8/15/2016					
	Result	DL	LOD	LOQ	Qual	Result	DL	LOD	LOQ	Qual	RPD
Toluene	<	0.17	0.4	1	U	<	0.17	0.4	1	U	
Trans-1,2-Dichloroethene	<	0.15	0.4	1	U	<	0.15	0.4	1	U	
Trans-1,3-Dichloropropene	<	0.19	0.4	1	U	<	0.19	0.4	1	U	
Trichloroethene	<	0.16	0.4	1	U	<	0.16	0.4	1	U	
Trichlorofluoromethane	<	0.29	0.8	2	U	<	0.29	0.8	2	U	
Vinyl Chloride	0.46	0.1	0.2	1.5	J	0.44	0.1	0.2	1.5	J	<2X
Xylenes, Total	<	0.19	0.8	2	U	<	0.19	0.8	2	U	
LABORATORY MNA PARAMETERS											
Methane RSK-175 (µg/L)	20000	0.44	1.6	10		14000	0.44	1.6	10		35
Ethane RSK-175 (µg/L)	<	0.57	1.5	5	U	<	0.57	1.5	5	U	
Ethene RSK-175 (µg/L)	<	0.4	1.4	5	U	<	0.4	1.4	5	U	
Nitrate/Nitrite USEPA 353.2 (mg/L)	<	0.019	0.05	0.1	U	<	0.019	0.05	0.1	U	
Alkalinity SM 2320B (mg/L)	260	1.1	3.2	5		260	1.1	3.2	5		0
Sulfate USEPA 9034A (mg/L)	9.6	0.23	0.5	5		9.3	0.23	0.5	5		<2X

Notes:

field duplicate RPD > 25 or >2X the LOQ

< = less than LOQ

µg/L = micrograms per liter

DUP = duplicate sample

ID = identification number

J = estimated

LOQ = limit of quantification

mg/L = milligrams per liter

MNA = monitored natural attenuation

Qual = qualifier

RPD = relative percent difference

RSK = Robert S. Kerr Environmental Research Laboratory

U = nondetect

USEPA = United States Environmental Protection Agency

X = times

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86528	CA271-15A	Nitrate/Nitrite	Nitrate/Nitrite	J	LOQ	Detected less than LOQ
86528	TB080316	VOCs	Methylene chloride	U	MB Contamination	Blank Contamination
86528	TB080316	VOCs	All VOCs	J/UJ	Holding Time	Holding Time Exceedance
86528	SOURCE2016	VOCs	Toluene	J	LOQ	Detected less than LOQ
86528	CA271-16A	Explosives	RDX	U	MB Contamination	Blank Contamination
86528	CA272-16A	Explosives	HMX, RDX	J	Surrogate	Low surrogate recovery
86528	CA272-16A	Explosives	All other explosives	UJ	Surrogate	Low surrogate recovery
86528	CA272-16A	Explosives	RDX	U	MB Contamination	Blank Contamination
86528	CA311-16A	Explosives	RDX	U	MB Contamination	Blank Contamination
86528	CA314-16A	Explosives	HMX	J	LOQ	Detected less than LOQ
86528	CA314-16A	Explosives	RDX	U	MB Contamination	Blank Contamination
86528	CA330-16A	Explosives	2-amino-4,6-dinitrotoluene	J	MS	Low MS recovery
86594	G0100-16A	Explosives	2,4-dinitrotoluene, HMX	J	LOQ	Detected less than LOQ
86594	G0100-16A	Explosives	MNX, HMX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86594	G0105-16A	Explosives	MNX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86594	G0105-16A	Explosives	MNX	J	Detected less than LOQ	High surrogate recovery
86594	G0101-16A	Explosives	4-amino-2,6-dinitrotoluene	J	LOQ	Detected less than LOQ
86594	G0101-16A	Explosives	4-amino-2,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86594	G0115-16A	Explosives	Nitrobenzene	J	LOQ	Detected less than LOQ
86594	G0115-16A	Explosives	Nitrobenzene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86594	PZ007-16A	RSK-175	Methane	J	LOQ	Detected less than LOQ
86594	PZ007-16A	Ammonia, TKN	Ammonia, TKN	J	LOQ	Detected less than LOQ
86594	PZ007-16A	Sulfate	Sulfate	J	MS/MSD	Low MS/MSD recoveries
86669	NW020-16A	Explosives	2,4,6-trinitrotoluene	J	LOQ	Detected less than LOQ
86669	NW020-16A	Explosives	2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86669	NW022-16A	Explosives	All explosives	UJ	Surrogate	Low surrogate recovery
86669	NW023-16A	Explosives	RDX	J	LOQ	Detected less than LOQ

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86669	NW023-16A	Explosives	RDX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86669	NW023-16A	Explosives	2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene	J	Field duplicate	High RPDs in field duplicate pair
86669	PZ001-16A	Ammonia, TKN	Ammonia, TKN	J	LOQ	Detected less than LOQ
86669	PZ004-16A	Ammonia, TKN, Sulfate	Ammonia, TKN	J	LOQ	Detected less than LOQ
86669	G0116-16A	Explosives	All explosives	UJ	Surrogate	Low surrogate recovery
86669	G0116-16A	RSK-175	Methane	J	VOA vial	Headspace with bubble > 6mm
86669	PZ009-16A	RSK-175	Methane	J	LOQ	Detected less than LOQ
86669	PZ009-16A	Ammonia	Ammonia	J	LOQ	Detected less than LOQ
86669	PZ010-16A	TKN	TKN	J	LOQ	Detected less than LOQ
86730	G0017-16A	TKN	TKN	J	LOQ	Detected less than LOQ
86730	G0017-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	G0045-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	G0045-16A	RSK-175	Methane	J	LOQ	Detected less than LOQ
86730	G0045-16A	Nitrate/Nitrite	Nitrate/Nitrite	J	LOQ	Detected less than LOQ
86730	G0045-16A	Ammonia	Ammonia	J	MS/MSD	High MS/MSD Recoveries
86730	PZ005-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	PZ005-16A	Explosives	2-amino-4,6-dinitrotoluene	J	LOQ	Detected less than LOQ
86730	G0066R-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	G0066R-16A	RSK-175	Methane	J	Calibration Range	Concentration > calibration range
86730	G0066R-16A	Explosives	RDX	J	LOQ	Detected less than LOQ
86730	G0066R-16A	Explosives	RDX	J	Surrogate	High surrogate recovery
86730	G0066R-16A	Explosives	RDX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86730	G0066R-16A	Nitrate/Nitrite	Nitrate/Nitrite	J	MS/MSD	Low MS/MSD recoveries
86730	PZ011-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	PZ011-16A	Explosives	RDX	J	Surrogate	High surrogate recovery
86730	PZ012-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	PZ012-16A	RSK-175	Methane	J	Calibration Range	Concentration > calibration range
86730	PZ012-16A	Explosives	MNX	J	Column RPD	Difference between the two HPLC columns exceeded 40%

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SDG	Sample ID	Analysis	Analyte(s)	Data Validation Qualifier	Area of Quality Concern	Comments
86730	G0103-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	G0103-16A	RSK-175	Methane	J	Calibration Range	Concentration > calibration range
86730	G0044-16A	RSK-175	Methane	J	Preservation	pH > 2
86730	G0044-16A	Explosives	2,4-dinitrotoluene	J	LOQ	Detected less than LOQ
86730	G0044-16A	TKN	TKN	J	LOQ	Detected less than LOQ
86730	G0044-16A	TKN	TKN	J	MS/MSD	Low MS recovery, high RPD
86738	G0097-16A	Explosives	1,3-dinitrobenzene, 2,4-dinitrotoluene, Nitrobenzene	J	LOQ	Detected less than LOQ
86738	G0097-16A	Explosives	1,3-dinitrobenzene, 2,4,6-trinitrotoluene, 2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, Nitrobenzene, HMX	J	Surrogate	High surrogate recovery
86738	G0097-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86738	G0097-16A	Explosives	Nitrobenzene, 4-amino-2,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86738	PZ021-16A	Explosives	2-nitrotoluene	U	Method blank	Method Blank contamination
86738	PZ021-16A	Explosives	HMX, 2,4,6-trinitrotoluene, 4-amino-2,6-dinitrotoluene	J	Field duplicate	High RPDs in field duplicate pair
86738	PZ021-16A	Ammonia	Ammonia	J	LOQ	Detected less than LOQ
86738	PZ017R-16A	Explosives	HMX, 2,4,6-trinitrotoluene, 4-amino-2,6-dinitrotoluene	J	Field duplicate	High RPDs in field duplicate pair
86738	PZ017R-16A	Explosives	All explosives	J/UJ	Surrogate	Low surrogate recovery
86738	PZ017R-16A	Ammonia	Ammonia	J	LOQ, Field duplicate	Detected less than LOQ, High RPD in field duplicate pair
86738	G0120-16A	Explosives	HMX	J	LOQ	Detected less than LOQ
86738	G0120-16A	Explosives	2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX	J	Surrogate	High surrogate recovery
86738	G0120-16A	Explosives	HMX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86738	G0087-16A	TKN	TKN	J	LOQ	Detected less than LOQ
86738	G0084-16A	Explosives	2,4-dinitroluene	J	LOQ	Detected less than LOQ
86738	G0084-16A	Explosives	2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene	J	Surrogate	High surrogate recovery

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86738	G0084-16A	Explosives	2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene,	J	LOQ, Field duplicate	Detected less than LOQ, High RPDs in field duplicate pair
86738	G0108-16A	Explosives	2,4-dinitrotoluene	J	LOQ	Detected less than LOQ
86738	G0108-16A	Explosives	2,4-dinitrotoluene, 2-nitrotoluene	J	Surrogate, Column RPD	High surrogate recovery, Difference between the two HPLC columns exceeded 40%
86738	G0108-16A	Sulfide	Sulfide	J	LOQ	Detected less than LOQ
86773	G0112-16A	Explosives	RDX	J	Method blank	Method Blank contamination
86773	G0112-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86773	G0112-16A	Explosives	2,4,6-trinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86773	G0112-16A	TKN, Sulfide	Nitrogen, Ammonia	J	LOQ	Detected less than LOQ
86773	PZ019-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	G0075-16A	Explosives	2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene	J	LOQ	Detected less than LOQ
86773	G0075-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86773	G0075-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86773	G0075-16A	Explosives	2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86773	G0075-16A	Ammonia	Ammonia	J	LOQ	Detected less than LOQ
86773	G0117-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	G0119-16A	Explosives	Nitrobenzene	J	LOQ	Detected less than LOQ

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86773	G0119-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86773	G0119-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	G0119-16A	Explosives	HMX, Nitrobenzene	J	Surrogate	High surrogate recovery
86773	G0119-16A	Explosives	HMX, Nitrobenzene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86773	G0078-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	G0078-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86773	G0078-16A	Ammonia	Ammonia	J	LOQ	Detected less than LOQ
86773	PZ018-16A	Explosives	1,3,5-trinitrobenzene, 2-amino-4,6-dinitrotoluene	J	LOQ	Detected less than LOQ
86773	PZ018-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86773	PZ018-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86773	PZ018-16A	Explosives	1,3,5-trinitrobenzene, 2-amino-4,6-dinitrotoluene	J	LOQ	Detected less than LOQ
86773	PZ018-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86773	PZ018-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86773	PZ018-16A	Explosives	1,3,5-trinitrobenzene, 2-amino-4,6-dinitrotouene, 4-amino-2,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86773	G0070-16A	RSK-175	Methane	J	LOQ	Detected less than LOQ

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86773	G0070-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	G0070-16A	Explosives	1,3,5-trinitrotoluene	J	MS/MSD	High MS recovery, high RPD
86773	G0070-16A	Ammonia	Ammonia	J	LOQ	Detected less than LOQ
86773	G0070-16A	DOC	DOC	U	Method blank	Method Blank contamination
86773	G0076-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	G0076-16A	TKN	TKN	J	LOQ	Detected less than LOQ
86773	PZ013-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86773	PZ013-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	PZ013-16A	Explosives	HMX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86773	PZ014-16A	Explosives	2,4-dinitrotolune, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	PZ014-16A	Ammonia, TKN	Ammonia, TKN	J	LOQ	Detected less than LOQ
86773	G0096-16A	Explosives	2,4-dinitrotoluene 2,5-Dinitrotoluene 2-amino-4,6-dinitrotoluene 2-nitrotoluene 3-nitrotoluene 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86773	G0096-16A	Explosives	2,4,6-trinitrotoluene, 4-amino-2,6-dinitrotoluene	J	LOQ	Detected less than LOQ

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86773	G0096-16A	Explosives	4-amino-2,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86773	G0096-16A	Explosives	All explosives except for RDX	J/UJ	Surrogate	Low surrogate recovery
86773	G0096-16A	Sulfide	Sulfide	J	LOQ	Detected less than LOQ
86773	G0113-16A	Explosives	2,4-dinitrotoluene 2,5-Dinitrotoluene 2-amino-4,6-dinitrotoluene 2-nitrotoluene 3-nitrotoluene 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86773	G0113-16A	Explosives	HMX	UJ	Surrogate	High surrogate recovery
86773	G0113-16A	Explosives	2,4-dinitrotoluene 2,5-Dinitrotoluene 2-amino-4,6-dinitrotoluene 2-nitrotoluene 3-nitrotoluene 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86905	G0086-16A	Explosives	All explosives	J/UJ	Surrogate	Low surrogate recovery
86905	G0086-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0086-16A	TKN	TKN	UJ	MS/MSD	Low MS/MSD recoveries
86905	G0081-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0081-16A	Explosives	RDX	J	Column RPD	High surrogate recovery, Difference between the two HPLC columns exceeded 40%
86905	G0081-16A	TKN	TKN	J	LOQ	Detected less than LOQ
86905	G0094-16A	Explosives	2,4,6-trinitrotoluene, 2,4-dinitrotoluene	J	LOQ	Detected less than LOQ
86905	G0094-16A	Explosives	2-nitrotoluene	U	Method blank	Method Blank contamination
86905	G0094-16A	Explosives	2,4,6-trinitrotoluene, 2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, RDX	J	Surrogate	High surrogate recovery
86905	G0094-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0094-16A	Explosives	2,4,6-trinitrotoluene, 2,4-dinitrotoluene	j	Column RPD	Difference between the two HPLC columns exceeded 40%
86905	PZ015-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0102-16A	RSK-175	Methane	J	LOQ	Detected less than LOQ

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86905	G0102-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J	Field duplicate	High RPD in field duplicate pair
86905	G0102-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0102-16A	Ammonia, TKN	Ammonia, TKN	J	LOQ	Detected less than LOQ
86905	G0102-16A	Ammonia	Ammonia	J	MS/MSD	High MS/MSD Recoveries
86905	G0102-16A	TKN	TKN	J	MS/MSD	Low MS/MSD recoveries
86905	G0104-16A	Explosives	MNX	J	LOQ	Detected less than LOQ
86905	G0104-16A	Explosives	2-nitrotoluene	U	Method blank	Method Blank contamination
86905	G0104-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0104-16A	Explosives	MNX	J	Column RPD	High surrogate recovery, Difference between the two HPLC columns exceeded 40%
86905	PZ016-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	PZ012-16A	RSK-175	Methane	J	LOQ	Detected less than LOQ
86905	PZ012-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0099-16A	Explosives	2-amino-4,6-dinitrotoluene, RDX	J	Surrogate	High surrogate recoveries
86905	G0099-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0099-16A	Explosives	2-amino-4,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86905	G0090-16A	Explosives	1,3,5-trinitrobenzene	J	LOQ	Detected less than LOQ
86905	G0090-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0090-16A	Explosives	HMX, 2,4,6-trinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86905	G0082-16A	Explosives	1,3,5-trinitrobenzene	J	LOQ	Detected less than LOQ
86905	G0082-16A	Explosives	4-amino-2,6-dinitrotoluene	UJ	LCS	Low LCS recovery
86905	G0082-16A	Explosives	HMX, 2,4,6-trinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86905	G0082-16A	Ammonia	Ammonia	J	LOQ	Detected less than LOQ
86943	G0285-16A	Explosives	RDX	U	Method blank	Method Blank contamination
86943	G0085-16A	Explosives	RDX	J	LOQ	Detected less than LOQ
86943	G0085-16A	Explosives	RDX	J	Surrogate, Column RPD	High surrogate recovery, Difference between the two HPLC columns exceeded 40%

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86943	G0093-16A	Explosives	4-amino-2,6-dinitrotoluene	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86943	G0114-16A	Explosives	RDX	J	LOQ, Column RPD	Detected less than LOQ, Difference between the two HPLC columns exceeded 40%
86974	G0067-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86974	G0067-16A	TKN	TKN	UJ	MS/MSD	Low MS/MSD recoveries
86974	G0118-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86974	SHGW02-16A	VOCs	Chloroethane, Vinyl chloride	J	LOQ	Detected less than LOQ
86974	SHGW02-16A	RSK-175	Methane	J	Field duplicate	High RPD in field duplicate pair
86974	SHGW05-16A	VOCs	Chloroethane, Vinyl chloride	J	LOQ	Detected less than LOQ
86974	SHGW05-16A	RSK-175	Methane	J	Field duplicate	High RPD in field duplicate pair
86974	SHGW04-16A	VOCs	Acetone	U	Method blank	Method Blank contamination
86974	G0069-16A	VOCs	1,2-dichloroethane, 2-butanone, Benzene, Cyclohexane, Isopropylbenzene	J	LOQ	Detected less than LOQ
86974	G0069-16A	Sulfate	Sulfate	J	MS/MSD	High MS/MSD Recoveries
86974	SHGW03-16A	VOCs	Acetone	U	Method blank	Method Blank contamination
86974	G0022-16A	Explosives	1,3,5-trinitrobenzene, HMX	J	LOQ	Detected less than LOQ
86974	G0022-16A	Explosives	RDX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86974	G0022-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86974	G0222-16A	Explosives	1,3,5-trinitrobenzene	J	LOQ	Detected less than LOQ

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SDG	Sample ID	Analysis	Analyte(s)	Data Validation Qualifier	Area of Quality Concern	Comments
86974	G0222-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86974	G0080-16A	Explosives	RDX	J	LOQ, Column RPD	Detected less than LOQ, Difference between the two HPLC columns exceeded 40%
86974	G0080-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86974	G0080-16A	TKN	TKN	J	LOQ	Less than LOQ
86974	G0080-16A	Explosives	RDX	J	LOQ, Column RPD	Detected less than LOQ, Difference between the two HPLC columns exceeded 40%
86974	G0080-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86974	G0080-16A	Ammonia	Ammonia	J	LOQ	Less than LOQ
86974	G0091-16A	Explosives	2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene	J	LOQ, Column RPD	Detected less than LOQ, Difference between the two HPLC columns exceeded 40%
86974	G0091-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	J/UJ	LCS	Low LCS recoveries
86974	G0092-16A	Explosives	HMX, RDX	J	Column RPD	Difference between the two HPLC columns exceeded 40%
86974	G0092-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries

TABLE 4-11
SUMMARY OF QUALIFIERS
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SDG	Sample ID	Analysis	Analyte(s)	Data Validation Qualifier	Area of Quality Concern	Comments
86974	G0109-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86974	G0083-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86974	G0083-16A	TKN	TKN	J	MS/MSD	Low MS/MSD recoveries
86974	G0098-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86974	G0023-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86974	G0023-16A	Nitrate/Nitrite	Nitrate/Nitrite	J	LOQ	Less than LOQ
86974	G0110-16A	Explosives	2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene	UJ	LCS	Low LCS recoveries
86974	G0110-16A	Explosives	MNX	J	Surrogate	Low surrogate recovery

TABLE 4-11
SUMMARY OF QUALIFIERS
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SDG	Sample ID	Analysis	Analyte(s)	Data Validation Qualifier	Area of Quality Concern	Comments

Notes:

% = percent
DOC = dissolved organic carbon
HPLC = High Performance Liquid Chromatography
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazoci
ID = identification number
J = estimated
LCS = laboratory control sample
LOQ = limit of quantitation
MB = method blank
MNX = mono-nitroso-RDX
MS = matrix spike
MSD = matrix spike duplicate
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = reporting limit
RPD = relative percent difference
RSK = Robert S. Kerr Environmental Research Laboratory
SDG = sample delivery group
TKN = Total Kjeldahl Nitrogen
U = nondetect
UJ = estimated nondetect
VOC = volatile organic compound

This section describes the nature and extent of contamination for OU1 (Groundwater Explosives Plume) and OU3 (Shop Area). Based on historical reporting efforts, the nature and extent of the OU1 on-post area, OU1 off-post area, and OU3 are presented separately in this section. Additionally, the nature and extent of the OU1 on-post source areas are discussed separately from the remaining OU1 on-post area, to help evaluate the overall performance of the 2016 subsurface injection activities completed in April 2016. The nature and extent of contamination at CHAAP is presented in the following subsections:

- OU1 On-Post in 2016
  - OU1 On-Post Source Areas in 2015/2016 (pre-injection)
  - OU1 On-Post Source Areas in 2016 (post-injection)
- OU1 Off-Post in 2016
- OU3 Shop Area in 2016

5.1 OU1 HEALTH ADVISORY LEVELS AND OU3 MAXIMUM CONTAMINANT LEVELS

RDX, HMX, and TNT were selected for the OU1 nature and extent discussion because of their frequency of occurrence, magnitude of detected concentrations, and potential adverse health effects as indicated in the OU1 ROD and ROD Amendment. 1,2-DCA and 1,1,2-TCA were selected for the OU3 nature and extent discussion because of the historic concentrations reported at SHGW02 exceeding the MCLs established in 40 CFR 141, Subpart G (CFR 2012) for these compounds. TPH-DRO was also selected for the OU3 nature and extent discussion because of the TPH-DRO detections at wells G0069, SHGW03, and SHGW04. No HAL or MCL has been established for TPH-DRO; however, concentrations will be compared to the Nebraska risk-based concentration (10 milligrams per liter [mg/L]) for groundwater as presented in the Risk-Based Corrective Action at Petroleum Release Sites, Tier 1/Tier 2 Assessments and Reports (NDEQ 2009). HALs for explosives (USEPA 2012) were established as regulatory action levels for CHAAP in the OU1 ROD (USAEC 1994) and the subsequent OU1 ROD Amendment (URSGWCFS 2001b). MCLs were established as regulatory action levels for 1,2-DCA and 1,1,2-TCA in the OU3 ROD (USACE 1999). The nature and extent discussions generally focus on contaminant concentrations above the HALs and MCLs. These levels are:

- 2 µg/L for RDX and TNT
- 400 µg/L for HMX
- 5 µg/L for 1,2-DCA and 1,1,2-TCA

Explosive compound HMX has not been detected above the HAL of 400 µg/L in any groundwater monitoring sampling event; therefore, it is only discussed in terms of maximum concentration detected throughout this nature and extent section.

5.2 OU1 ON-POST (2016)

The OU1 on-post groundwater explosives plumes consist primarily of RDX and TNT. The 2016 OU1 on-post nature and extent of explosives were determined using sampling data collected during the pre-injection groundwater investigation sampling event in February 2016 (sampling data provided on **Figures 2-1a**, **2-1b**, and **2-1c**) and the annual sampling event in August 2016. As previously discussed, one OU1 monitoring well (G0121) was installed and sampled in November 2016. These data are included in the 2016 explosive plumes discussions. The August/November 2016 on-post plumes (RDX and TNT, RDX only, and TNT only) are shown on **Figures 5-1**, **5-2**, and **5-14**, respectively.

The August/November 2016 nature and extent discussion generally focuses on explosives concentrations (RDX and TNT) above the HALs (2 µg/L), key explosives breakdown compounds, and the approximate shape and thickness of the post-injection groundwater explosives plumes. Groundwater explosives plumes in the OU1 on-post area are found solely in the shallow aquifer (i.e., shallow and shallow-intermediate portions of the Grand Island Formation). Therefore, the following on-post nature and extent discussions focus on the shallow groundwater. The interpreted August/November 2016 horizontal extent of explosives (RDX and/or TNT >2 µg/L) for the OU1 on-post area is shown on **Figure 5-1**.

The overall on-post groundwater explosives plume between the former facility boundary and LL2 was interpreted to be multiple small plumes with discontinuities across an area of approximately 1.7 miles long and a maximum of approximately 720 feet wide (near the former facility boundary). Following the 2016 subsurface injection event, the highest explosives plume concentrations were detected at various areas within LL1, LL2, and near EW7. Maximum concentrations detected during the August/November 2016 groundwater sampling event included 32 µg/L RDX at monitoring well G0096 in the source areas of LL1, 14 µg/L HMX at monitoring well G0121 in the source area of LL2, and 22 µg/L TNT at piezometer PZ017R south of EW7 near the former facility boundary (**Figures 5-1**, **5-2**, and **5-14**). No explosives concentrations were detected above the HALs in monitoring wells and piezometers at LL3, LL4, LL5, and the Decant Station. Based on the extent and magnitude of historic RDX and TNT detections in the on- and off-post plumes, previous RDX plume maps for August 2014, March 2012, March 2010, March 2008, March 2006, March 2004, March 2002, March 2000, June 1998, December 1996, and July 1994 are shown for comparison on **Figures 5-3** through **5-13**, respectively; and previous TNT plume maps for August 2014, March 2012, March 2010, March 2008, March 2006, March 2004, March 2002, March 2000, and June 1998 are shown on **Figures 5-15** through **5-23**, respectively.

From 1993 to the present, explosives concentrations have, in general, shown a significant declining trend throughout the on-post area (**Figure 5-24**). The greatest decline in explosives concentrations occurred within the load line source areas from 2007 to present (during subsurface injection activities). Examples of monitoring wells and piezometers that have shown significant decline in explosives concentrations within the source areas since 2007 include G0023 and PZ015 (directly within the LL1 source area), and G0066/G0066R, PZ011, and PZ013 (directly within and slightly downgradient from the LL2 source area). Source area explosives concentrations are further discussed in **Sections 5.2.1** and **5.2.2**. Significant declines in explosives concentrations have also occurred near EW7 (at the facility's eastern boundary) since March 2000 (i.e., when EW7 began operation). Examples of monitoring wells that have shown a significant decline in explosives concentrations since 2000 include monitoring wells G0024 and G0077, which are approximately 100 feet north of EW7 and screened in the mid-Grand Island Formation, and the NW020 cluster, which is off-post, just outside the former facility boundary. These declining explosives concentration trends can best be seen in **Appendix E**, which presents the historical explosives concentrations in graphical form for each on-post and off-post monitoring well and piezometer.

Figure 5-24 presents on-post RDX and TNT concentrations and water level elevation data from select wells. These data indicate that from 1999 to 2007 the on-post RDX and TNT concentrations generally increased as the water elevation increased. Conversely, as the water table decreased, RDX and TNT concentrations decreased. This trend (as shown on **Figure 5-24** RDX and TNT average lines) is likely attributed to high water levels being in contact with residual sources causing dissolution of explosives and being greater than dilution-reducing effects. However, 2007 through 2013 data indicate that RDX and TNT concentrations generally decreased (with exception to isolated years with slight increases), even though the water elevation increased. This trend can be attributed to the completion of subsurface injection activities that began in 2007. Fluctuating water levels observed in wells screened at shallow to shallow-intermediate depths between 2007 and 2016 were taken into account during the subsurface injection design. In general, water levels were measured at monitoring wells adjacent to injection locations so the injection depths could be adjusted ensuring injections were completed throughout the entire contaminated saturated thickness (as discussed in **Section 2.3**).

The RDX breakdown product MNX has been included in the explosives analyte list for on-post groundwater monitoring wells since 2004. In 2016, MNX was detected in 8 on-post monitoring wells. TNT breakdown products, including 2-Am-DNT and/or 4-Am-DNT, were detected in 29 on-post monitoring wells and piezometers sampled (**Figure 5-1**). As previously stated in **Section 5.1**, HMX has not been detected above its HAL at any of the off-post or on-post locations during any of the groundwater monitoring events. The following subsections further discuss nature and extent of explosives within the source areas at LL1 and LL2, and the area between EW6 and EW7.

5.2.1 OU1 On-Post Source Areas 2015/2016 (Pre-Injection)

For the OU1 on-post source areas (LL1 and LL2) and the area between EW6 and EW7, this section describes the nature and extent of explosives detected in groundwater during the August 2015 Annual Groundwater Sampling Event and the additional pre-injection groundwater investigation sampling event completed in February 2016. As previously discussed, a pre-injection groundwater investigation was recommended to be completed to address data gaps in the OU1 explosives plume as documented in the Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2017). The data gaps identified in LL1, LL2, and between EW6 and EW7 were investigated using direct push groundwater sampling technology for the purpose of updating and improving explosives plume interpretations, improving the contaminant modeling accuracy and remediation timeframe estimates, and helping to direct the 2016 subsurface injection field event (completed in April). The 2015/2016 (pre-injection) on-post source area nature and extent is being presented here as rationale for the 2016 subsurface injection design and for comparison to the 2016 (post-injection) on-post source area nature and extent. The interpreted 2015/2016 (pre-injection) horizontal extent of explosives (RDX and/or TNT >2 µg/L) for the on-post source areas and between EW6 and EW7 are shown on **Figures 5-25a** through **5-25c**. The interpreted 2015/2016 (pre-injection) vertical extent of explosives (RDX and/or TNT >2 µg/L) for the on-post source areas along cross-sections A-A', B-B', C-C', D-D', E-E', and F-F' are shown on **Figures 5-26**, **5-27**, **5-28**, **5-29**, **5-30**, and **5-31** respectively.

5.2.1.1 Load Line 1 Source Area 2015/2016 (Pre-Injection)

The 2015/2016 (pre-injection) groundwater explosives plume at the LL1 source area and adjacent upgradient (west) and cross-gradient (north) LL1 areas with residual explosive concentrations (i.e., near monitoring wells G0084 and G0093, respectively) consisted primarily of RDX and TNT. The 2015/2016 (pre-injection) groundwater explosives plumes for RDX and/or TNT at the LL1 source area (interpreted from August 2015 and February 2016 groundwater sampling results) are shown on **Figures 5-25a** and **5-25b**. These 2015/2016 (pre-injection) results were used to interpret the nature and extent of RDX and TNT at the LL1 source areas as documented in the Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2017) and the pre-injection groundwater sampling results completed in February 2016, discussed within this report. The downgradient extent of the LL1 source area was interpreted based on previous sampling results and is described in **Section 5.2.1.3**.

Within LL1, the RDX and TNT plumes are shown with isoconcentration lines at 2 µg/L (see **Figures 5-25a** and **5-25b**). The plumes exceeding 2 µg/L at LL1 were interpreted to be in three separate areas of LL1 (north **Figure 5-25a**, central **Figure 5-25b**, and west **Figure-25a**) that extend to the northeast. These three areas of plumes at LL1 varied in size from approximately 360 feet wide by 280 feet long (TNT plume in north area, surrounding monitoring well G0093), approximately 140 feet wide by 90 feet long to 220 feet wide by 200 feet long (RDX and TNT plumes in central source area, at G0098 and LL1-DP139, respectively), and approximately 270 feet wide by 340 feet long (RDX plume in west area, surrounding G0084). The highest RDX concentration was 12 µg/L at monitoring well G0084, and the highest TNT concentration was 9.9 µg/L at monitoring well G0093. These results, and others within the LL1 source area, support the interpretation that residual sources previously in the vadose zone have come in contact with groundwater.

The vertical extent of explosives at LL1 was interpreted based on 2015/2016 (pre-injection) groundwater samples and historic groundwater samples collected vertically throughout the aquifer. Results indicate that the groundwater explosives plume (RDX and/or TNT >2 µg/L) along cross-sections A-A' and B-B' at LL1 source areas (as shown on **Figures 5-26** and **5-27**, respectively) and along cross-section C-C’ (near G0084, as shown on **Figure 5-28**) extends approximately 15 to 20 feet below the water table. Cross-section C-C’ depicts areas of field activities completed in both the western upgradient portion of LL1 (near G0084) and the eastern downgradient portions of LL2 (near G0085).

5.2.1.2 Load Line 2 Source Area 2015/2016 (Pre-Injection)

The 2015/2016 (pre-injection) groundwater explosives plume at the LL2 source area and slightly downgradient consisted primarily of RDX and TNT. The 2015/2016 (pre-injection) groundwater explosives plumes for RDX and TNT at the LL2 source area and slightly downgradient (interpreted from August 2015/February 2016 groundwater sampling results) are shown on **Figures 5-25a** and **5-25c**. These results were used to interpret the nature and extent of RDX and/or TNT at the LL2 source area and slightly downgradient as documented in the Final 2015 Groundwater Monitoring and Subsurface Injection Annual Report (BW-URS 2017) and the pre-injection groundwater sampling results completed in February 2016, discussed within this report.

Within LL2, the RDX and TNT plumes are shown with isoconcentration lines at 2 µg/L and 20 µg/L (see **Figures 5-25a** and **5-25c**). The plumes exceeding 2 µg/L RDX and/or TNT at LL2 were interpreted to be in two separate areas (the source area [**Figure 5-26c**] and slightly downgradient near EW5 [PZ011, **Figure 5-25c**], and farther downgradient near G0085 [**Figure 5-25a**]). These two areas have plumes varying in size from approximately 170 feet wide by 165 feet long (RDX plume around G0119), approximately 350 feet wide by 220 feet long (RDX and TNT plumes upgradient of G0101) in the LL2 source area, to approximately 250 feet wide by 400 feet long farther downgradient (RDX plume near G0085). The only explosives plume >20 µg/L (RDX) was identified at February 2016 direct push location LL2-DP117 and is approximately 100 feet wide by 100 feet long. The highest RDX concentration within the interpreted LL2 plumes was 25 µg/L at direct push location LL2-DP117, and the highest TNT concentration within the interpreted LL2 plumes was 11 µg/L at direct push location LL2-DP113, north of monitoring well G0111. These results continue to support the interpretation that residual sources previously in the vadose zone have come in contact with groundwater.

The vertical extent of explosives at LL2 was interpreted based on August 2015/February 2016 groundwater samples and historic groundwater samples collected vertically throughout the aquifer. Results indicate that the groundwater explosives plume (RDX and/or TNT >2 µg/L) along cross-sections C-C’ (near G0085, as shown on **Figure 5-28**) D-D', E-E', and F-F' at LL2 (as shown on **Figures 5-29** through **5-31**) extends from the LL2 source area and downgradient approximately 15 to 20 feet below the water table.

5.2.1.3 Between EW6 and EW7 2015/2016 (Pre-Injection)

The 2015/2016 (pre-injection) groundwater explosives plumes at the area between EW6 and EW7 consisted primarily of RDX and TNT. The 2015/2016 (pre-injection) groundwater explosives plumes for RDX and/or TNT between EW6 and EW7, interpreted from August 2015 and February 2016 groundwater sampling results and historic investigation and performance groundwater sampling results (completed prior to 2016) are shown on **Figure 5-25a**. These results were used to interpret the nature and extent of RDX and TNT between EW6 and EW7 as documented in the Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2017), the Final 2008 through 2012 Subsurface Injection Annual Reports, and the pre-injection groundwater sampling results completed in February 2016, discussed within this report.

Between EW6 and EW7, the RDX and TNT plumes are shown with isoconcentration lines at 2 and 20 µg/L (see **Figure 5-25a**). The plumes exceeding 2 µg/L between EW6 and EW7 were interpreted to be in two separate areas (west and east) downgradient of LL1 that extend to the northeast towards EW7. These two areas of plumes varied in size from approximately 350 feet wide by 570 feet long (TNT plumes with discontinuities, near monitoring well G0022) to approximately 1,000 feet wide and over 3,000 feet long (continuous RDX and TNT plumes, downgradient of EW6 and stretching to EW7 at the former facility boundary). One TNT plume >20 µg/L was interpreted to be near EW7. The >20 µg/L TNT plume ranged from 350 to 200 feet wide by 1,100 feet long (up-gradient and just west of EW7). The highest TNT concentration between EW6 and EW7 was 25 µg/L at direct push location EW7-DP40 (upgradient of EW7), and the highest RDX concentration between EW6 and EW7 was 6.3 µg/L at monitoring well G0090. Due to the limited monitoring locations and dated investigation results between the EW6 and EW7 area, the data gaps present in the explosives plumes between EW6 and EW7 were addressed in March 2015, and again in February 2016 via the advancement of several direct push borings and the collection of groundwater samples.

5.2.2 OU1 On-Post Source Areas 2016 (Post-Injection)

This section describes the OU1 on-post source areas (LL1 and LL2) and the area between EW6 and EW7 nature and extent of explosives detected in groundwater during the August 2016 annual groundwater sampling event, as well as the November 2016 sampling results from the newly installed monitoring well G0121 in LL2 (see **Section 2.4**). This 2016 on-post source area nature and extent discussion provides a comparison to the 2015/2016 (pre-injection) on-post nature and extent to help evaluate the overall performance of the 2016 subsurface injection activities completed in April 2016. Overall, the August/November 2016 results indicated that the general groundwater explosives plume shape, thickness, and concentrations changed significantly within the injection treatment zones, including several on-post areas of explosives concentrations falling below 2 µg/L for the first time. Additionally, the nature and extent of explosives detected between EW6 and EW7 is described following the August/November 2016 annual groundwater sampling event. The 2016 horizontal extents of explosives (RDX and TNT >2 µg/L) for the on-post source areas and between EW6 and EW7 are shown on **Figure 5-32a** through **5-32c**. The 2016 vertical extent of explosives (RDX and/or TNT >2 µg/L) for the LL1 and LL2 on-post source areas along cross-sections A-A', B-B', C-C', D-D', E-E', and F-F' are shown on **Figure 5-33** through **Figure 5-38**, respectively.

Following the 2016 subsurface injection event, where screening data from the February 2016 pre-injection groundwater investigation locations (via direct push sampling) were used to help direct the 2016 subsurface injections, explosives plumes were interpreted based on August/November 2016 sampling data from monitoring wells proximal to injection areas. However, at areas of direct push sampling that included subsurface injection in 2016 but didn’t have permanent monitoring wells proximal for sampling results in August/November 2016, interpreted explosive plumes were not adjusted and remain as “data pending” data gaps. This method for data presentation is conservative in that concentration reductions achieved as a result of the 2016 injection program are not illustrated in the figures in areas where data from August/November 2016 were not available.

5.2.2.1 Load Line 1 Source Area 2016 (Post-Injection)

The August/November 2016 groundwater explosives plume at the LL1 source area consisted primarily of RDX and TNT. The August/November 2016 groundwater sampling results for RDX and/or TNT at the LL1 source area are shown on **Figures 5-32a** and **5-32b**. These results were used to interpret the nature and extent of RDX and/or TNT at the LL1 source area.

Of the 17 monitoring wells and two piezometers sampled in August 2016 at LL1, a total of four monitoring wells (G0093, G0084, G0098, and G0114) are within the 2016 injection treatment zones at LL1. Declines in explosives concentrations (RDX and/or TNT) were observed in all 2016 injection treatment zones at LL1 except at monitoring well G0093, in the LL1 north explosives plume. Explosives concentrations at monitoring well G0093 in August 2015 were 1.7 µg/L and 9.9 µg/L (RDX and TNT, respectively). Following the 2016 subsurface injection activities, the RDX concentration at well G0093 increased to 14 µg/L, but TNT declined to nondetect. Based on these results, it appears that subsurface injection activities may have mobilized RDX at this location. The 2016 subsurface injection transects for the interpreted plume at G0093, had spacing of approximately 100 feet apart (compared to other areas of 2016 subsurface injection, with more focused, closer-spaced transects of 40 to 60 feet apart), which may have mobilized RDX. However, at G0093, TNT concentrations decreased and TNT explosives breakdown products were present indicating that explosives degradation had occurred. Outside of the 2016 injection treatment zones at LL1, 8 of the 13 monitoring wells and two piezometers showed decreasing RDX and TNT concentrations or remained nondetect in August 2016.

The interpreted vertical extent of explosives in groundwater (RDX and/or TNT >2 µg/L) is illustrated along cross-sections A-A', B-B', and C-C' at LL1 (as shown on **Figures 5-33**, **5-34**, and **5-35**, respectively). Results indicated that the groundwater explosives plume (RDX and/or TNT >2 µg/L) at LL1 extended approximately 15 to 20 feet below the water table.

In August 2016, the highest concentrations of RDX detected at LL1 was at well G0096 (32 µg/L) and the highest TNT concentration detected at LL1 was at well G0097 (1.5 µg/L), both in the LL1 western source area, upgradient from the 2016 injection treatment zones. The maximum TNT concentration detected in August 2016 was lower than the maximum concentration detected in August 2015 (TNT = 9.9 µg/L at G0093). The maximum RDX concentration detected in August 2016 was higher than the maximum RDX concentration detected in August 2015 (RDX = 12 µg/L at G0084); however, G0096 wasn’t in the 2016 treatment areas. Explosives concentrations (RDX and TNT) decreased at three of the four monitoring well locations in the LL1 treatment areas, two of which fell below the HALs (shown on **Table 5-1**).

In August 2016, RDX concentrations increased to above its HAL at three monitoring wells in LL1 (G0094, G0096, and G0099) that were below HALs in August 2015. At these wells, limited subsurface injections were completed in 2014 or prior and no subsurface injections were completed in 2015 or 2016. It is interpreted at these three wells, due to rising water levels (2014 to 2016) and limited past subsurface injection activities, dissolution and desorption of explosives trapped in the vadose during periods of lower water levels (i.e., 2012 to 2014) has occurred.

Although RDX concentrations have increased above its HAL in 2016 at these wells, RDX concentrations are still significantly lower than prior to treatments. RDX concentrations prior to treatments/2016: G0094-2,300 µg/L/9.7 µg/L; G0096-230 µg/L/32 µg/L; G0099-1,000 µg/L/3.1 µg/L.

RDX breakdown product MNX was detected in two (G0096 and G0110) of the 17 monitoring wells and piezometers at LL1 that were sampled in August 2016. The presence of MNX indicates that RDX degradation had occurred. The absence of MNX at the remaining 15 monitoring wells and piezometers (three within the 2016 injection treatment zones) may be attributed to its short half-life in a highly anaerobic environment; however, RDX concentrations decreased (likely due to degradation and/or dissolution) or remained nondetect in 9 of the 17 monitoring wells and piezometers where MNX was absent. The maximum concentration for MNX of 1.7 J µg/L was detected at monitoring well G0110, indicating RDX degradation is occurring at the well location. TNT breakdown products 2-Am-DNT and/or 4-Am-DNT were detected at seven (G0084, G0093, G0094, G0096, G0097, G0099, and G0112) of the 17 monitoring wells and piezometers at LL1 that were sampled in August 2016, one of which was within the 2016 injection treatment zones, indicating TNT degradation had occurred. TNT concentrations decreased or remained nondetect in six of the seven monitoring wells with TNT breakdown products present, and 9 of 10 monitoring wells and piezometers that didn't have TNT breakdown products in 2016. The maximum concentrations for TNT breakdown products 2-Am-DNT and 4-Am-DNT were 7.7 µg/L and 6.8 µg/L, respectively, at monitoring well G0097. Overall, RDX and TNT degradation products were detected in LL1 and the LL1 source areas during the August 2016 sampling event, indicating explosives degradation had occurred.

5.2.2.2 Load Line 2 Source Area 2016 (Post-Injection)

The August/November 2016 groundwater explosives plumes at the LL2 source area and slightly downgradient consisted primarily of RDX. The August/November 2016 groundwater sampling results for RDX and TNT at the LL2 source area and downgradient are shown on **Figures 5-32a** and **5-32c**, respectively. These results were used to interpret the nature and extent of RDX and/or TNT at the LL2 source area and slightly downgradient.

Of the 12 monitoring wells and six piezometers sampled in August/November 2016 at LL2, three monitoring wells and one piezometer (G0085, G0119, G0121, and PZ011) are within the 2016 injection treatment zones at LL2 (source and downgradient areas). Declines in explosives concentrations (RDX and/or TNT) were observed in all 2016 injection treatment zones at LL2. Outside of the 2016 injection treatment area at LL2, 10 of the 14 wells and piezometers showed decreasing RDX and TNT concentrations or remained nondetect in August/November 2016.

The interpreted vertical extent of explosives in groundwater (RDX and/or TNT >2 µg/L) is illustrated along cross-sections C-C', D-D', E-E', and F-F' at LL2 (source and downgradient areas) (as shown on **Figures 5-35** through **5-38**). Results indicated that the groundwater explosives plume (RDX and/or TNT >2 µg/L) at LL2 extended approximately 15 to 20 feet below the water table.

In August/November 2016, the highest concentrations of RDX and TNT detected at LL2 were at G0121 (RDX = 2.2 µg/L) and at G0100 (TNT = 1.1 µg/L). The 2016 maximum concentrations were lower than the maximum 2015 concentrations (RDX = 8.9 µg/L at PZ011, TNT = 1.5 µg/L at PZ012). August/November 2016 explosives concentrations (RDX and/or TNT) decreased at both monitoring wells and piezometers in the LL2 treatment areas, both of which declined below the HALs (shown on **Table 5-1**).

RDX breakdown product MNX was detected in two (G0100 and PZ012) of the 18 monitoring wells and piezometers at LL2 that were sampled in August/November 2016, neither of which were within the 2016 injection treatment zones at LL2. The absence of MNX at the remaining 16 monitoring wells and piezometers (including two within the 2016 injection treatment zones) may be attributed to its short half-life in a highly anaerobic environment. However, RDX concentrations declined (likely due to degradation and/or dissolution) or remained nondetect in 16 of the 18 monitoring wells and piezometers in 2016 at LL2, including both wells in the 2016 injection treatment zones. The maximum concentration for MNX of 8.8 µg/L was detected at PZ012, sidegradient of 2016 injection treatment zones at LL2. TNT breakdown products 2-Am-DNT and/or 4-Am-DNT were detected at 4 of the 18 monitoring wells and piezometers at LL2 that were sampled in August/November 2016, none of which were within the 2016 injection treatment zones, indicating TNT degradation had occurred. TNT concentrations declined or remained nondetect in 10 of the 14 monitoring wells and piezometers in 2016. The maximum concentrations for TNT breakdown products 2-Am-DNT and 4-Am-DNT were 14 µg/L and 8.6 µg/L, respectively, at monitoring well G0120. Overall, RDX and TNT degradation products were detected in the LL2 source areas and downgradient during the August/November 2016 sampling event, indicating explosives degradation had occurred.

5.2.2.3 Between EW6 and EW7 2016 (Post-Injection)

The 2016 groundwater explosives plumes between EW6 and EW7 consisted primarily of RDX and TNT. The August 2016 groundwater sampling results for RDX and/or TNT concentrations between EW6 and EW7 are shown on **Figure 5-32a** and were used to interpret the nature and extent of the RDX and TNT plumes.

Sixteen monitoring wells and four piezometers were sampled in August 2016 at the area between EW6 and EW7. Generally, decreases in explosives concentrations (RDX and/or TNT) were observed in most monitoring wells and piezometers sampled in August 2016 between EW6 and EW7. Any increases observed in RDX and/or TNT concentrations were not considered significant.

In the August 2016 sampling event, the highest concentrations of RDX and TNT detected between EW6 and EW7 were both at PZ017R (RDX = 3.4 µg/L and TNT = 22 µg/L), adjacent to EW7. These 2016 maximum concentrations were lower than the 2015 maximum concentrations (RDX = 6.3 µg/L at G0090, TNT = 24 µg/L at PZ017R) between EW6 and EW7.

5.3 OU1 OFF-POST (2016)

The OU1 off-post groundwater explosives plume has historically consisted of RDX, TNT, and HMX. Maximum concentrations detected in off-post wells during the August 2016 groundwater sampling event included 0.89 µg/L RDX at monitoring well CA342, 0.36 µg/L TNT at monitoring well NW020, and 0.50 µg/L HMX at monitoring well CA292R (**Figures 5-2**, **5-14**, and **5-39**).

5.3.1 OU1 Off-Post Horizontal Extent

Based on the August 2016 analytical data, all off-post monitoring wells sampled had explosives concentrations below the HALs, indicating the groundwater explosives plume is no longer present at these locations, as first occurred in the August 2014 sampling event. Although all off-post wells are currently below the HALs, it is interpreted that the on-post plume does extend slightly into the off-post area just east, northeast of EW7. However, current groundwater flow and contaminant fate and transport modeling indicates that EW7 maintains capture of the small off-post plume. The interpreted continuation of the explosives plume emanating from on-post can be seen on **Figure 5-39** (horizontal distribution).

Historically, the off-post explosives plume has been significantly different, consisting of one continuous plume starting at the former facility boundary near EW7 and extending to the northeast, terminating in the City of Grand Island near the intersection of Highway 2 and Webb Road. In March 2002, the off-post groundwater explosives plume measured approximately 4.5 miles long and 1,600 feet wide. In March 2004, analytical results indicated a discontinuity approximately 4,000 feet long had formed near the area of an operating feedlot (downgradient of EW7), where RDX+TNT concentrations dropped below 2 µg/L. Since March 2004, this discontinuity has continued to expand and others have formed due to on-post plume containment (i.e., no influx of explosives from the on-post plume) and natural attenuation processes. The historic horizontal and vertical nature and extent of OU1 off-post explosives plume, including concentrations exceeding HALs, is further discussed in the March 2013 Annual Sampling Event Final Report (BW-URS 2014a).

The primary compounds of concern (i.e., compounds with historic concentrations exceeding their corresponding HAL) in the off-post groundwater explosives plume are RDX and TNT. The RDX plume map (illustrating only August 2016 RDX plume and concentrations for on- and off-post sample results) is shown on **Figure 5-2**. No off-post RDX detections were above its HAL in August 2016. RDX breakdown product MNX was not detected at any off-post monitoring wells.

In August 2016, TNT was not detected above the HAL at any of the off-post wells, as shown on **Figure 5-14**. TNT breakdown products 2-Am-DNT and/or 4-Am-DNT were detected in off-post wells near the former boundary (i.e., monitoring wells NW020 and NW021). The historic horizontal extent of TNT in the off-post plume has not extended beyond the feedlot (downgradient of EW7). TNT is less mobile than RDX and, therefore, did not migrate as far downgradient. Further discussions regarding the off-post explosives plume downgradient from the feedlot will focus on RDX concentrations and trends.

Based on the extent and magnitude of historic RDX detections in the off-post plume, previous RDX plume maps for August 2014, March 2012, March 2010, March 2008, March 2006, March 2004, March 2002, March 2000, June 1998, December 1996, and July 1994 are shown for comparison on **Figures 5-3** through **5-13**, respectively. **Table 5-2** summarizes the highest historical OU1 off-post explosives concentrations detected from 1984 to 2016. The data indicate that the maximum RDX concentrations downgradient of the feedlot have declined over time from 1984 (>100 µg/L) and 1994 (28 µg/L) to the present (0.89 µg/L). Maximum TNT concentrations declined significantly from 1984 (>350 µg/L) to 1994 (23 µg/L). Since then, TNT concentrations near the feedlot area have declined, ranging from 34.9 µg/L in 1999 to 0.35 µg/L in 2016 at NW020 (**Table 5-2** and **Figures 5-2** through **5-13**, **Figures 5-14** through **5-23**, and **5-39**). In 2014, RDX concentrations decreased below the HAL at off-post well cluster CA310 and remained below the HAL at all other off-post monitoring wells sampled. In 2016, the highest RDX concentration detected was at well CA312 = 0.89 µg/L. Declining concentrations observed in the off-post groundwater explosives plume are directly related to continuous pumping at EW7 (providing containment both horizontally and vertically of the on-post groundwater explosives plume) and natural attenuation processes.

In general, RDX concentrations have steadily declined (with only nominal fluctuation) at OU1 off-post monitoring wells from 1994 to 2016 due to EW7 maintaining hydraulic containment of the on-post explosives plume and the successful natural attenuation of explosives compounds off-post (all concentrations remaining below HALs since 2014). For example, RDX concentrations have decreased from 1994 to 2016 at the well locations listed below (**Figure 5-40**):

- NW081/NW081R (from 17 µg/L to nondetect)
- CA251 (from 28 µg/L to nondetect [2013])
- CA272 (from 15 µg/L to 0.58 µg/L)
- CA292/CA292R (from 5.85 µg/L to 0.56 µg/L)

Figure 5-40 presents off-post RDX concentrations and water level elevation data from select monitoring wells. These data generally indicate that off-post RDX concentrations closer to the CHAAP boundary (i.e., monitoring wells NW081/NW081R and CA251, approximately 1.5 miles and 2.2 miles, respectively) were less impacted by fluctuating water levels. RDX concentrations in these wells have steadily declined over-time as a result of on-post sources being contained and natural attenuation processes. Off-post RDX concentrations farther downgradient from the CHAAP boundary (i.e., monitoring wells CA272 and CA292/CA292R, approximately 3.2 miles and 3.7 miles, respectively) were more impacted by fluctuating water levels. Data collected from these wells indicate that, as the water level elevation decreased, RDX concentrations increased (i.e., less dilution), and as the water table increased, RDX concentrations decreased (i.e., more dilution).

5.3.2 OU1 Off-Post Vertical Extent

The vertical extent of the OU1 off-post explosives plume interpreted from 2016 data is shown on geologic cross-section G-G' (**Figure 5-41**). As mentioned previously, all off-post monitoring wells sampled in August 2016 had explosives concentrations below the HALs (since August 2014), indicating the groundwater explosives plume is no longer present at these locations. Although all off-post wells are currently below the HALs, it is interpreted that the on-post plume does extend slightly into the off-post area just east, northeast of EW7. The explosives off-post plume, near the former facility boundary, was detected at an on-post well at approximate depths of 25 to 35 feet bgs (i.e., from the water table to 15 feet below the water table at monitoring well G0077). The vertical extent of RDX and/or TNT concentrations >2 µg/L near the feedlot has significantly decreased from 2000 to 2016 (see **Figure 5-41**).

Contrasts in hydraulic properties consistent throughout the site between the Grand Island Formation (alluvial sand aquifer) and Fullerton Formation (alluvial clay aquitard) have continued to prevent the vertical migration of groundwater contamination from the Grand Island Formation to the underlying aquifer, as explosives compounds have not been historically detected in the deep aquifer (Holdrege Formation). The Fullerton Formation appears to act as a natural barrier, retarding the vertical migration of explosives to the underlying Holdrege Formation (gravel-paleovalley fill aquifer). However, during the August 2016 annual sampling event, a low level concentration of RDX (0.46 µg/L) was detected at the distal end monitoring well CA343, screened in the Holdredge Formation. Due to the previous trace detection being reported at well CA343 in August 2015, some minor vertical migration may have occurred near the distal end; however, only at very low detections below HALs. Since the historical evidence of well CA343 being 'nondetect' for over 25 years, and all off-post explosives concentrations being below HALs since 2014, further evaluation of the off-post distal end will be completed following future annual sampling events. The declining concentrations observed in the off-post groundwater explosives plume are directly related to continuous pumping at EW7 (providing containment both horizontally and vertically of the on-post groundwater explosives plume).

5.4 OU3 (SHOP AREA) NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

The following sections summarize nature and extent of groundwater contamination at OU3 Shop Area locations.

The OU3 Shop Area groundwater VOC plume (defined as VOC MCL exceedances) has consisted primarily of 1,1,2-TCA; however, detections of benzene, 1,2-DCA, and vinyl chloride have periodically exceeded their respective MCLs at OU3. The MCL for 1,1,2-TCA, benzene, and 1,2-DCA is 5 µg/L and the MCL for vinyl chloride is 2 µg/L. It should be noted that both 1,2-DCA and vinyl chloride are breakdown products of 1,1,2-TCA. In 2013, four downgradient monitoring wells (G0053, G0069, SAMW1, and SHGW04) were recommended and approved to change sampling frequency from annually, to every 3 years, due to no historic MCL exceedances at these wells. Monitoring wells SHGW02 and SHGW03 will continue to be sampled annually, based on historic MCL exceedances at these wells. All six OU3 Shop Area wells were sampled during the August 2016 groundwater monitoring event.

During the August 2016 groundwater sampling event, 1,1,2-TCA was not detected above the MCL at OU3. The 1,1,2-TCA concentration at SHGW02 decreased from 47 µg/L in 2008 to 2.1 in 2016 (an increase from nondetect in 2015), and 1,1,2-TCA has been below its MCL since 2010. The concentration of breakdown product 1,2-DCA also decreased, from 27 µg/L in 2008 to 7.9 µg/L in 2016 (an increase from 3.3 µg/L in 2015), at monitoring well SHGW02. All VOC detections (besides 1,2-DCA) were below the MCLs in 2016, as shown on **Figure 5-42**.

The 1,1,2-TCA concentrations have shown a declining trend from 2001 to present (e.g., 88 µg/L to 2.1 µg/L, respectively). Additionally, benzene has not been detected above the MCL since 2003 and vinyl chloride has not been detected above the MCL since 2000. These observed declining VOC concentrations are likely the result of natural attenuation and periodic subsurface injections completed at OU3 in 2007 and 2009 (BW-URS 2008, BW-URS 2010).

The OU3 groundwater VOC plume has typically been limited to monitoring well SHGW02; however, during the March 2000 groundwater sampling event, VOC concentrations at both monitoring wells SHGW02 (1,1,2-TCA) and SHGW03 (1,1,2-TCA, 1,2-DCA, and vinyl chloride) exceeded the MCLs. Since 2001, the VOC plume has not been detected at downgradient well SHGW03. As such, other than in 2000, the VOC plume has been limited to groundwater immediately proximal to SHGW02. In 2012 and 2013, no OU3 groundwater VOC plume was present. The 2014, 2012, 2010, 2008, 2006, 2004, 2002, and 2000 interpreted VOC plumes are shown on **Figures 5-43** through **5-50**, respectively, for comparison purposes. Historical VOC concentrations for OU3 Shop Area wells are presented in **Appendix E**.

Due to diesel-contaminated soil removal actions at OU3, TPH-DRO was added to the groundwater monitoring parameters list at wells G0069, SHGW03, and SHGW04 beginning in 2004 and has continued through 2016. Since 2004, variable TPH-DRO concentrations have been observed in groundwater in these three wells at OU3, and all detections have been below the project action limit of 10 mg/L (NDEQ 2009) since 2005. In 2016 at G0069, SHGW03, and SHGW04 the TPH-DRO concentrations were 0.27 mg/L, 5.5 mg/L, and 0.95 mg/L, respectively. **Figures 5-42** through **5-48** present the TPH-DRO concentrations for years 2016, 2014, 2012, 2010, 2008, 2006, and 2004, respectively. Historical TPH-DRO concentrations for OU3 Shop Area wells are presented in **Appendix E**.

TABLE 5-1
RDX AND TNT CONCENTRATION TRENDS FOR 2016 INJECTION TREATMENT ZONES, OU1 ON-POST MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

	TNT (µg/L)			RDX (µg/L)		
Monitoring Location[1]	**8/2015**	**8/2016**	**%D**	**8/2015**	**8/2016**	**%D**
Load Line 1						
G0084	ND	ND	-	12	ND	-100%
G0093	9.9	ND	-100%	1.7	14	724%
G0098	ND	ND	-	3.7	ND	-100%
G0114	ND	ND	-	9.5	3.2	-66%
LOAD LINE 1 AVERAGE	**2.5**	**ND**	**-100%**	**6.7**	**4.3**	**-36%**
Load Line 2						
G0085	ND	ND	-	7.0	1.9	-73%
G0119	ND	ND	-	4.0	ND	-100%
PZ011	1.5	ND	-100%	8.9	1.6	-82%
G0121*	6.5	ND	-100%	17	2.2	-87%
LOAD LINE 2 AVERAGE	**2.0**	**ND**	**ND**	**9.2**	**1.4**	**-85%**
OU1 RAO OVERALL AVERAGE	**2.2**	**ND**	**-100%**	**8.0**	**2.9**	**-64%**

Notes:

– = percentage not calculated

*Pre-injection sample data for monitoring well G0121 was obtained from direct push location LL2-DP116 (sampled February 2016). G0121 was installed and sampled in November 2016.

[1] Monitoring well and piezometer locations were selected based on 2015 and 2016 sampling results within 2016 injection treatment zones.

% = percent

%D = percent difference

µg/L = micrograms per liter

ND = nondetect

OU1 RAO = Operable Unit 1 Remedial Action Operation

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

TNT = 2,4,6-trinitrotoluene

TABLE 5-2
HIGHEST HISTORICAL OU1 OFF-POST EXPLOSIVES PLUME CONCENTRATIONS
2016 ANNUAL REPORT

	Highest Off-Post Concentrations									
Compound Detected (µg/L)	**Aug 2016**	**Aug 2015**	**Aug 2014**	**Mar 2013**	**Mar 2012**	**Mar 2011**	**Mar 2010**	**Mar 2009**	**Mar 2008**	**Mar 2007**
RDX	0.89	1.6	1.6	2.1	2.2	2.4	2.5	4.2	4.9	6.6
2,4,6-Trinitrotoluene	0.36	0.29	0.41	0.7	0.88	1.1	1.7	3.1	4.1	3.3
HMX	0.52	0.85	0.79	1.7	2	2.2 (2.9)*	2.7	3.3 (4.7)*	3.2	3.4
1,3,5-Trinitrobenzene	ND	ND	0.32	0.5	0.38	0.37	0.28	ND	0.74	1
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND (0.19)*	ND	ND	ND
2-Amino-4,6-dinitrotoluene	4.3	2.3	5.5	6.5	5.9	7.3	8.9	7.6	9.3	9.5 (12)*
4-Amino-2,6-dinitrotoluene	2.0	0.85	3.7	3.6	3	3.2 (5.9)*	3.4 (4.9)*	4.2 (7.5)*	6.2	4.6 (6.6)*

Notes:

* Concentrations measured in feed lot well clusters (installed May 1998 and December 1999) were often higher than other off-post locations and are shown in parentheses.

µg/L = micrograms per liter

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

NA = not analyzed

ND = not detected

OU = Operable Unit

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

TABLE 5-2
HIGHEST HISTORICAL OU1 OFF-POST EXPLOSIVES PLUME CONCENTRATIONS
2016 ANNUAL REPORT

	Highest Off-Post Concentrations									
Compound Detected (µg/L)	**Mar 2006**	**Mar 2005**	**Mar 2004**	**Mar 2003**	**Mar 2002**	**Mar 2001**	**Mar 2000**	**Mar 1999**	**Jun 1998**	**Oct 1997**
RDX	8.4	8.3	11	9.4	11 (19)*	8.3 (12)*	12 (16)*	12.4 (12.0)*	10.7 (13.5)*	11.3
2,4,6-Trinitrotoluene	5	5.8	6.8	11	13	19 (24)*	25 (17)*	34.9	22.3	22.8
HMX	3.8	3.6	4.1	4.3	4.8 (8.4)*	4.1 (5.8)*	4.8 (6.6)*	3.8 (5.9)*	4.3 (14.8)*	4.07
1,3,5-Trinitrobenzene	1.1	0.86	1.4	ND	1.2	0.63	0.77	0.793	ND	1.24
2,4-Dinitrotoluene	ND (0.67)*	ND (0.85)*	0.17 (1.4)*	ND (1.9)*	ND (2.9)*	ND (3.6)*	ND (2.8)*	ND (2.4)*	3.78	0.753
2-Amino-4,6-dinitrotoluene	9.4 (14)*	3.8 (18)*	4.6 (28)*	2.6 (35)*	4.5 (49)*	5.5 (65)*	8.9 (56)*	9.15 (42)*	8.0 (53.4)*	10.4
4-Amino-2,6-dinitrotoluene	6.4 (8.8)*	3.5 (11)*	3.6 (15)*	3.0 (21)*	3.1 (35)*	4.2 (45)*	6.4 (42)*	6.26 (33)*	5.9 (49.4)*	7.15

Notes:

* Concentrations measured in feed lot well clusters (installed May 1998 and December 1999) were often higher than other off-post locations and are shown in parentheses.

µg/L = micrograms per liter

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

NA = not analyzed

ND = not detected

OU = Operable Unit

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

TABLE 5-2
HIGHEST HISTORICAL OU1 OFF-POST EXPLOSIVES PLUME CONCENTRATIONS
2016 ANNUAL REPORT

	Highest Off-Post Concentrations		
Compound Detected (µg/L)	**Dec 1996**	**Jul 1994**	**Dec 1984**
RDX	13.6	28	>100
2,4,6-Trinitrotoluene	30	23	>350
HMX	4.9	9.54	NA
1,3,5-Trinitrobenzene	1.2	1.54	NA
2,4-Dinitrotoluene	0.78	0.311	NA
2-Amino-4,6-dinitrotoluene	13	12	NA
4-Amino-2,6-dinitrotoluene	10.8	NA	NA

Notes:

* Concentrations measured in feed lot well clusters (installed May 1998 and December 1999) were often higher than other off-post locations and are shown in parentheses.

µg/L = micrograms per liter

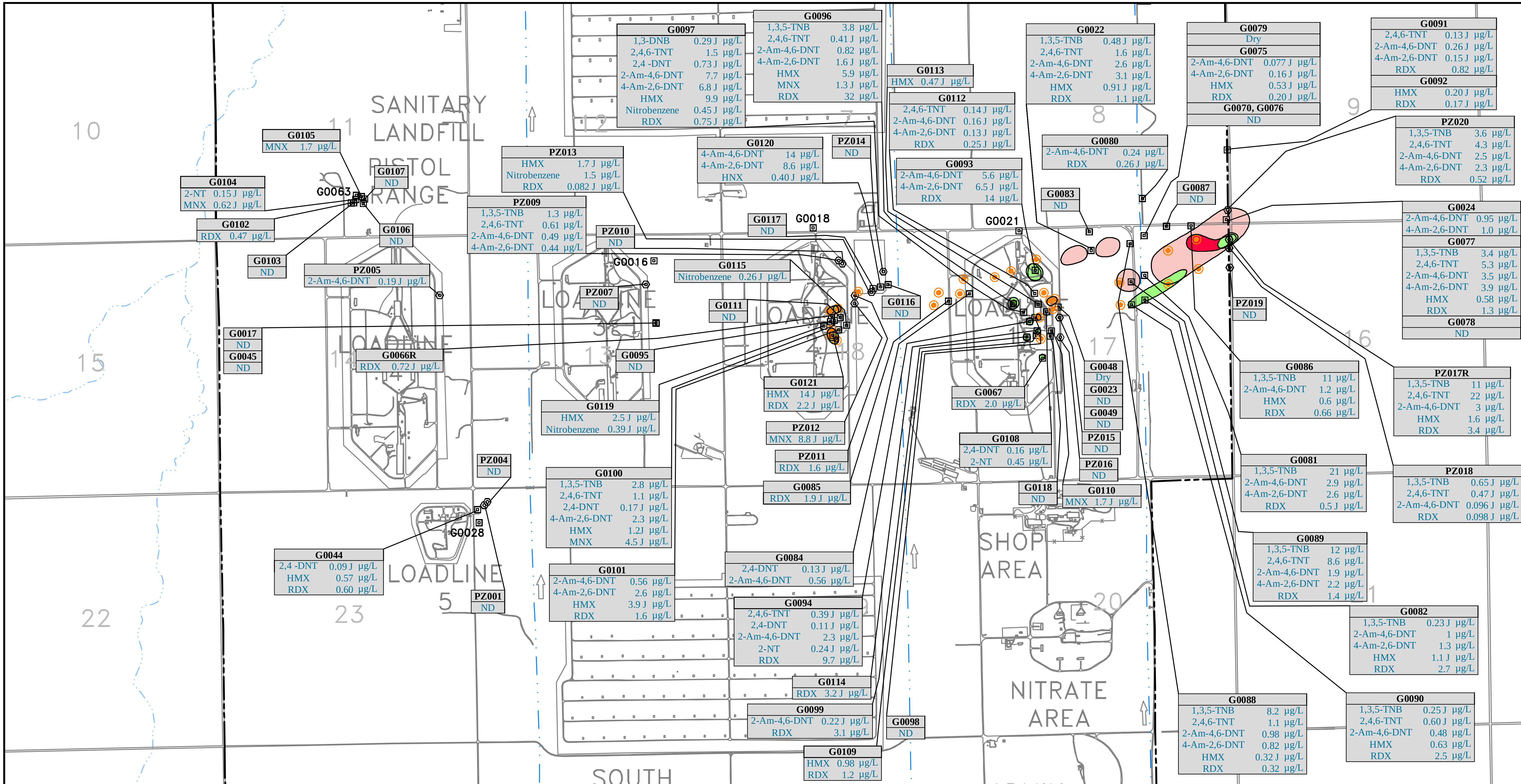
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

NA = not analyzed

ND = not detected

OU = Operable Unit

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine



LEGEND:

- FACILITY BOUNDARY
- GRAND ISLAND CITY LIMITS
- DRAINAGE DITCH FLOW DIRECTION
- SURFACE DRAINAGE
- 1 SECTION NUMBER
- ON-POST GROUNDWATER MONITORING WELL
- ON-POST PIEZOMETER
- DIRECT PUSH GROUNDWATER SAMPLE LOCATION – FEBRUARY 2016
- PZ016 EXPLOSIVES GROUNDWATER SAMPLING RESULTS – AUGUST 2016
- 2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >2µg/L) – AUGUST 2016
- 20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >20µg/L) – AUGUST 2016
- 2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) – AUGUST 2016
- 20 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) – AUGUST 2016

1,3,5–TNB = 1,3,5–TRINITROBENZENE
2–AM–4,6–DNT = 2–AMINO–4,6–DINITROTOLUENE
2,4,6–TNT = 2,4,6–TRINITROTOLUENE
2,6–DNT = 2,6–DINITROTOLUENE
2–NT = 2–NITROTOLUENE
3–NT = 3–NITROTOLUENE
4–AM–4,6–DNT = 4–AMINO–2,6–DINITROTOLUENE
HMX = OCTAHYDRO–1,3,5,7–TETRANITRO–1,3,5,7–TETRAZOCINE
J = ESTIMATED QUALIFIER
MNX = MONO–NITROSO–RDX
ND = NONDETECT
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
µg/L = MICROGRAMS PER LITER

N

0 2000 4000
SCALE FEET

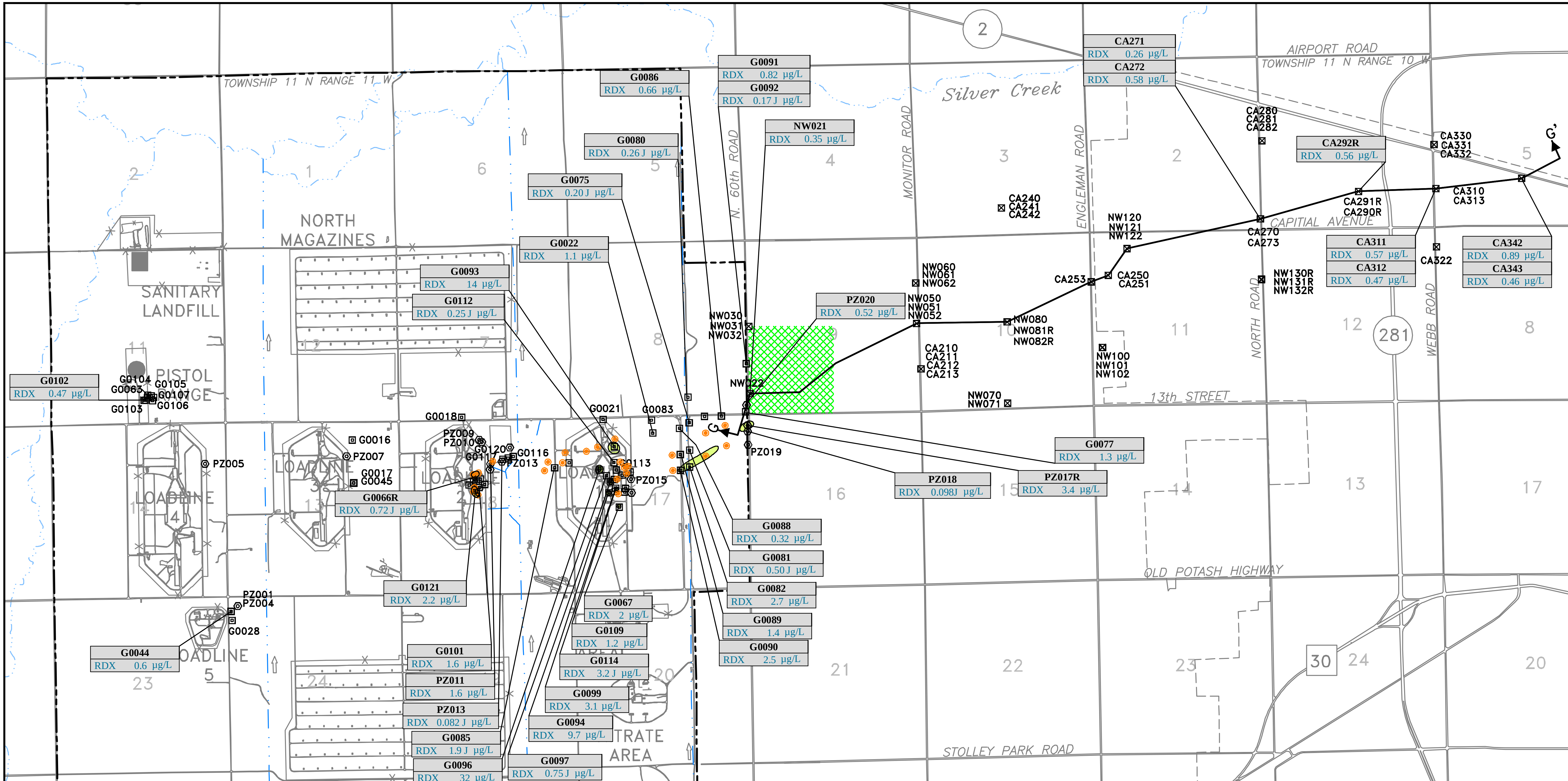
NOTE:
EXPLOSIVES PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.

Bay West — Customer-Focused Environmental & Industrial Solutions
URS

ON–POST EXPLOSIVES PLUME (OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/13/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/13/16	16170837	5–1

June 29, 2017 9:22:38 a.m.
Drawing: T:\CHAAP\16170837\27\5–1.dwg



LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER
DIRECT PUSH GROUNDWATER SAMPLE LOCATION (FEBRUARY 2016)

D D' GEOLOGIC CROSS SECTION
2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)–AUGUST 2016
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L)–AUGUST 2016
FEEDLOT AREA
PZ015 DETECTED RDX CONCENTRATIONS – FEBRUARY/AUGUST 2016

J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. RDX PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR RDX OR THE WELL WAS NOT SAMPLED.

N

0 3000 6000
SCALE FEET

Bay West Customer-Focused Environmental & Industrial Solutions
URS

RDX PLUME
(OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/12/16	PROJECT NO. 16170837	FIG. NO. 5–2
CHK'D. BY: DW	DATE: 10/12/16		

June 29, 2017 9:25:50 a.m.
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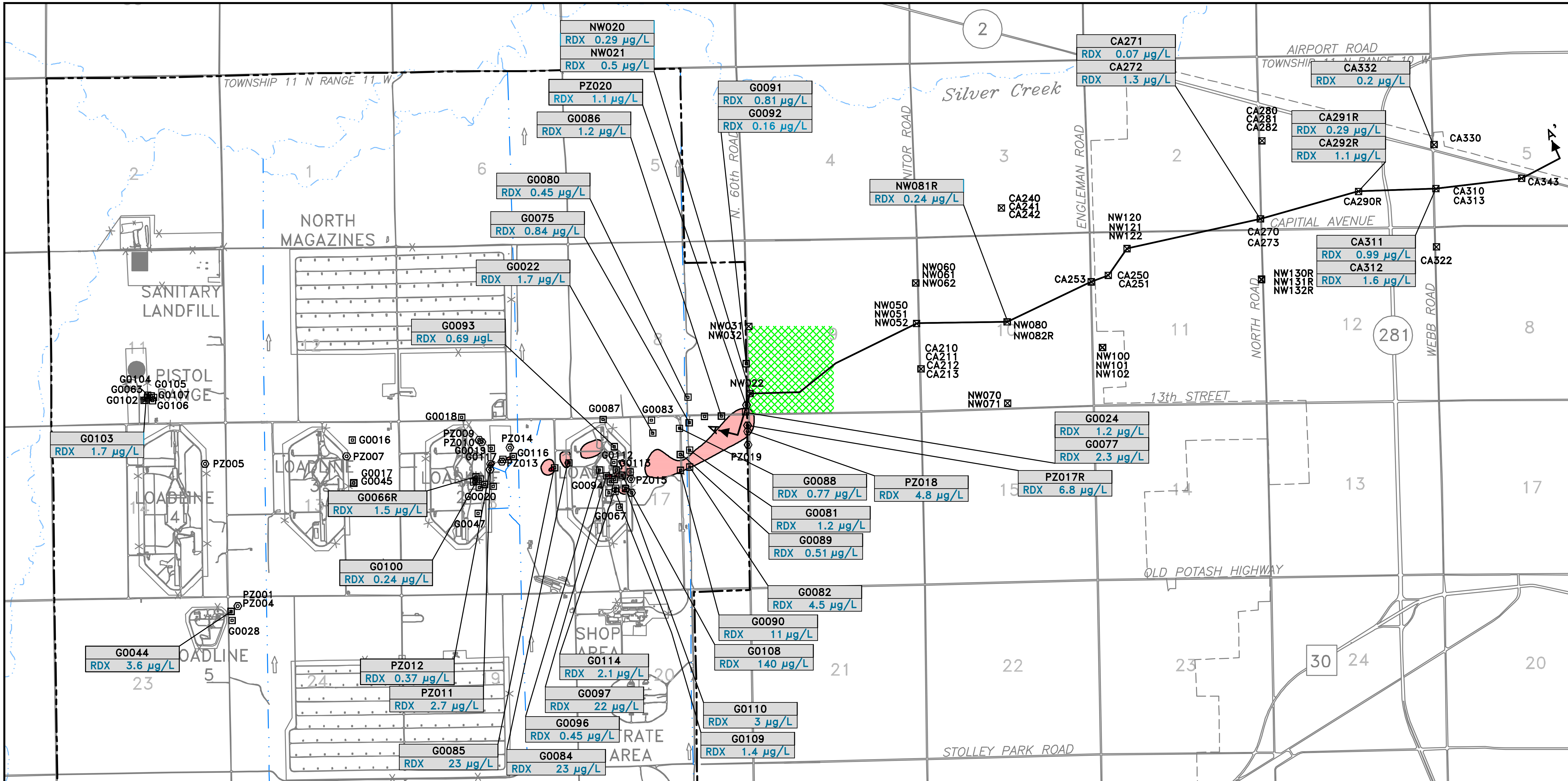

LEGEND:

	FACILITY BOUNDARY
	GRAND ISLAND CITY LIMITS
	DRAINAGE DITCH FLOW DIRECTION
	SURFACE DRAINAGE
1	SECTION NUMBER
	ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211	OFF–POST GROUNDWATER MONITORING WELL
	ON–POST PIEZOMETER
A A'	GEOLOGIC CROSS SECTION
2	HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)–AUGUST 2014
20	HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) – AUGUST 2014
	FEEDLOT AREA
PZ015	DETECTED RDX CONCENTRATIONS – AUGUST 2014

J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. RDX PLUME BASED ON 2014 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR RDX OR THE WELL WAS NOT SAMPLED.

N

SCALE 0 3000 6000 FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

RDX PLUME
(OU1) AUGUST 2014
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–3

December 29, 2015 8:21:27 a.m.
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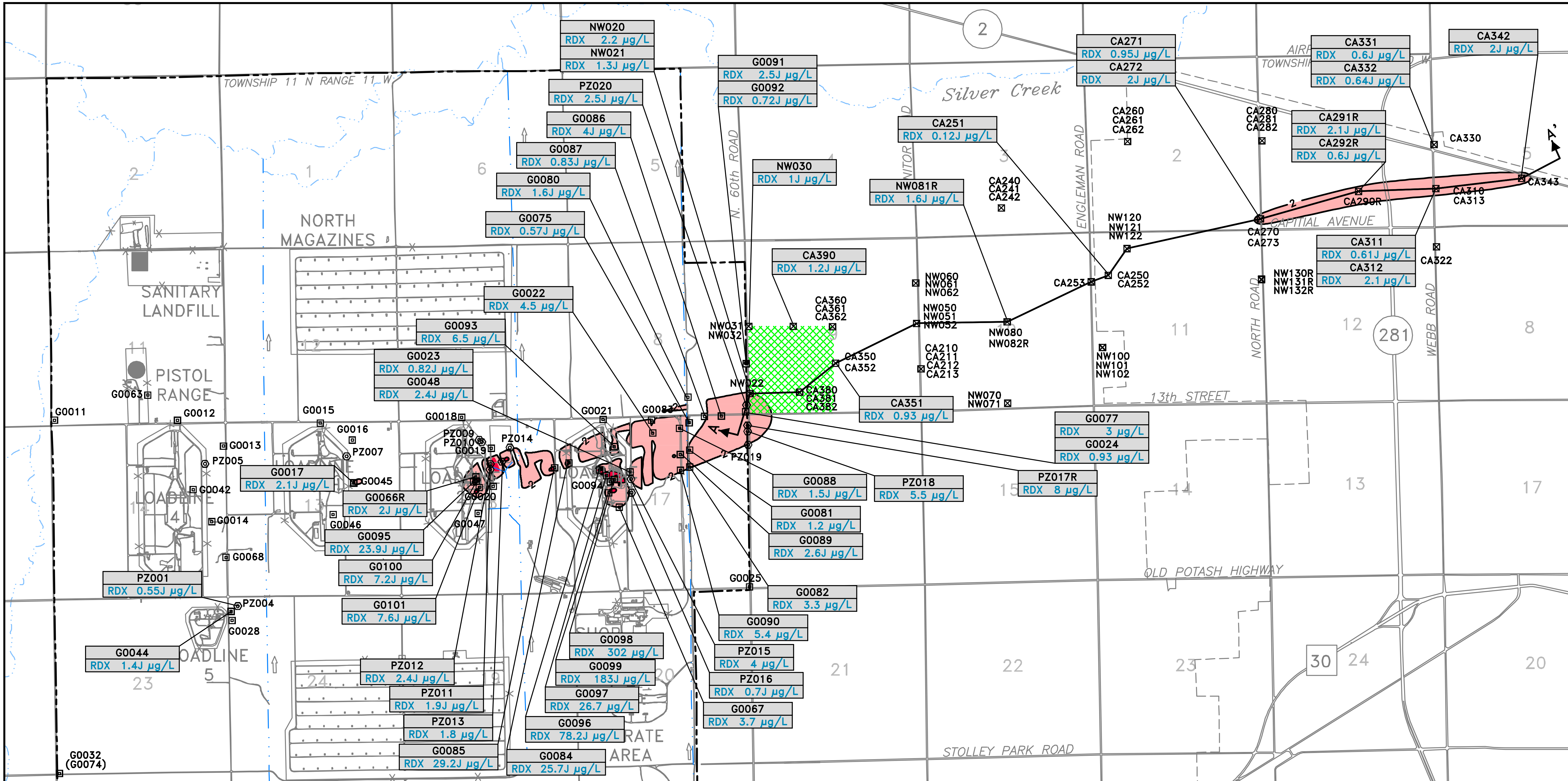

LEGEND:

	FACILITY BOUNDARY
	GRAND ISLAND CITY LIMITS
	DRAINAGE DITCH FLOW DIRECTION
	SURFACE DRAINAGE
1	SECTION NUMBER
	ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211	OFF–POST GROUNDWATER MONITORING WELL
	ON–POST PIEZOMETER
A A'	GEOLOGIC CROSS SECTION
2	HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)–MARCH 2012
20	HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) – MARCH 2012
200	HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >200µg/L) – MARCH 2012
	FEEDLOT AREA
PZ015	DETECTED RDX CONCENTRATIONS – MARCH 2012

J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. RDX PLUME BASED ON 2012 LTM RESULTS AND 2012 OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
3. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR RDX OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

Bay West URS

RDX PLUME
(OU1) MARCH 2012
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO. 16170837	FIG. NO. 5–4
CHK'D. BY: RPC	DATE: 09/25/15		

December 29, 2015 8:22:00 a.m.
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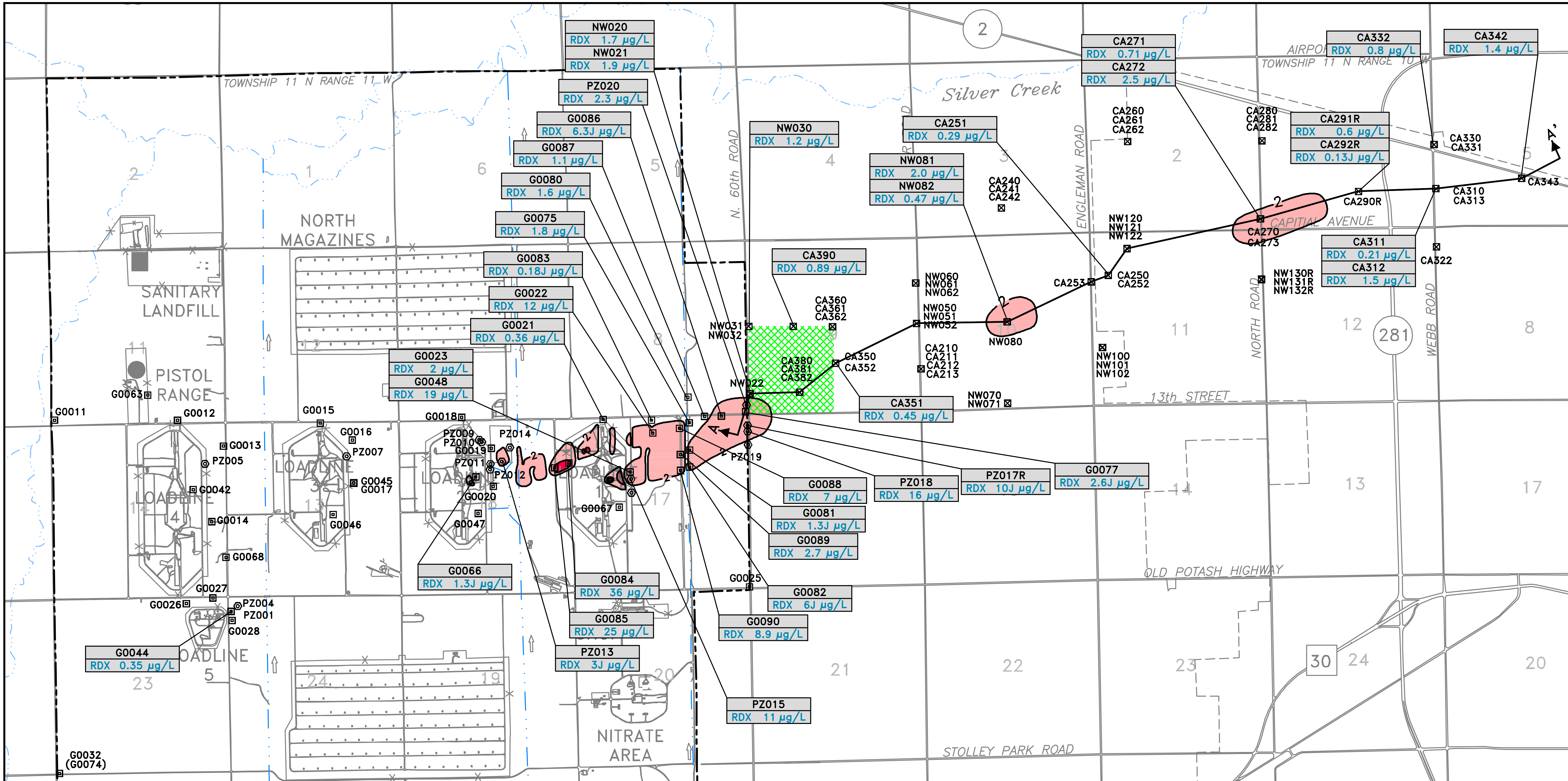

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER
A A' GEOLOGIC CROSS SECTION

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)–MARCH 2010
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) – MARCH 2010
200 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >200µg/L) – MARCH 2010
FEEDLOT AREA
PZ015 DETECTED RDX CONCENTRATIONS – MARCH 2010

J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. RDX PLUME BASED ON 2010 LTM RESULTS AND 2010 OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
3. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR RDX OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

RDX PLUME
(OU1) MARCH 2010
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–5

December 29, 2015 8:22:36 a.m.
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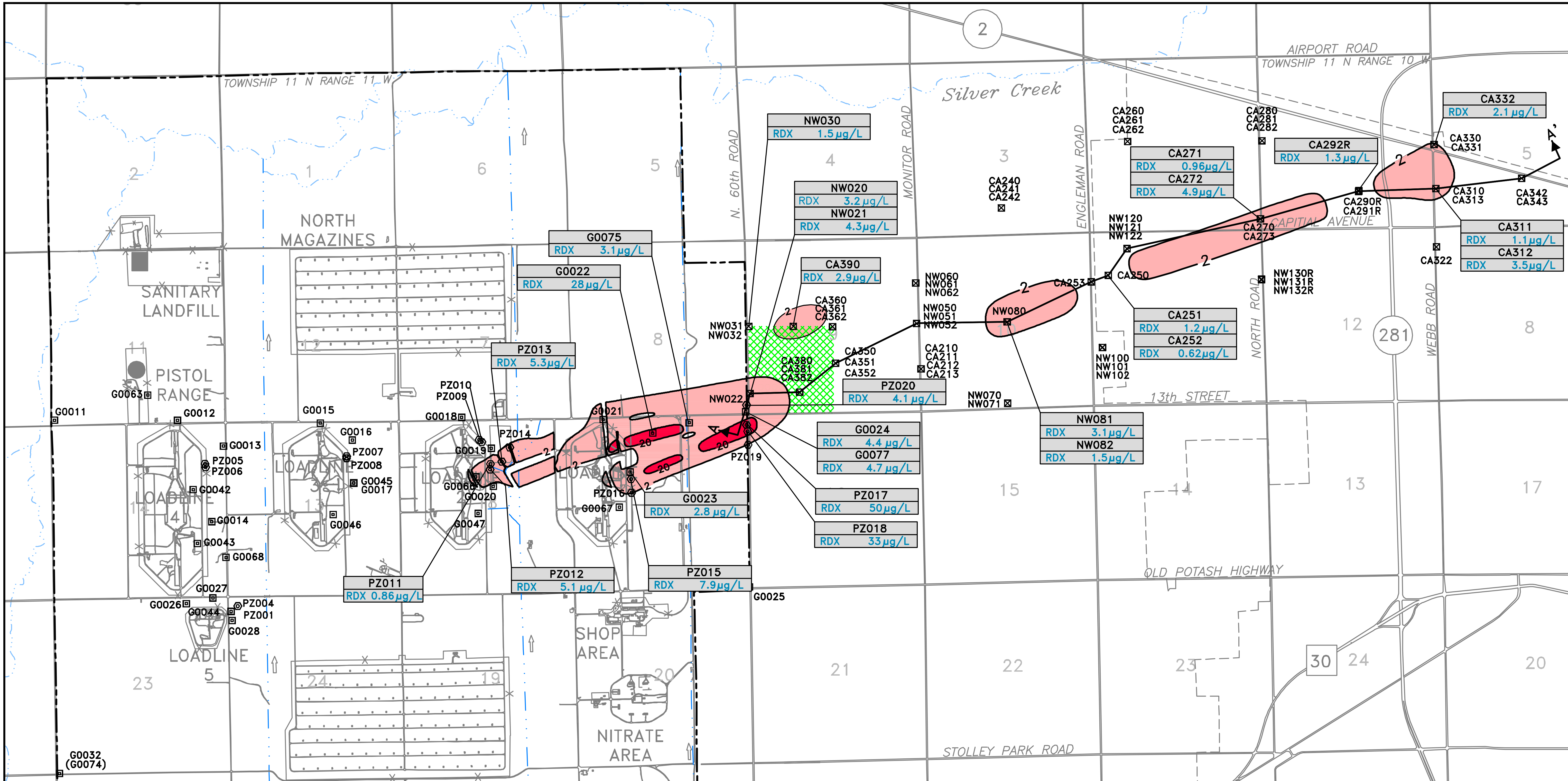

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER
A A' GEOLOGIC CROSS SECTION

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)-MARCH 2008
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) – MARCH 2008
FEEDLOT AREA
PZ015 DETECTED RDX CONCENTRATIONS – MARCH 2008

J = ESTIMATED QUALIFIER
LTM = LONG-TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. RDX PLUME BASED ON 2008 LTM RESULTS AND 2008 OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
3. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON-DETECT" FOR RDX OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

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Customer-Focused Environmental & Industrial Solutions

URS

RDX PLUME
(OU1) MARCH 2008
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5-6

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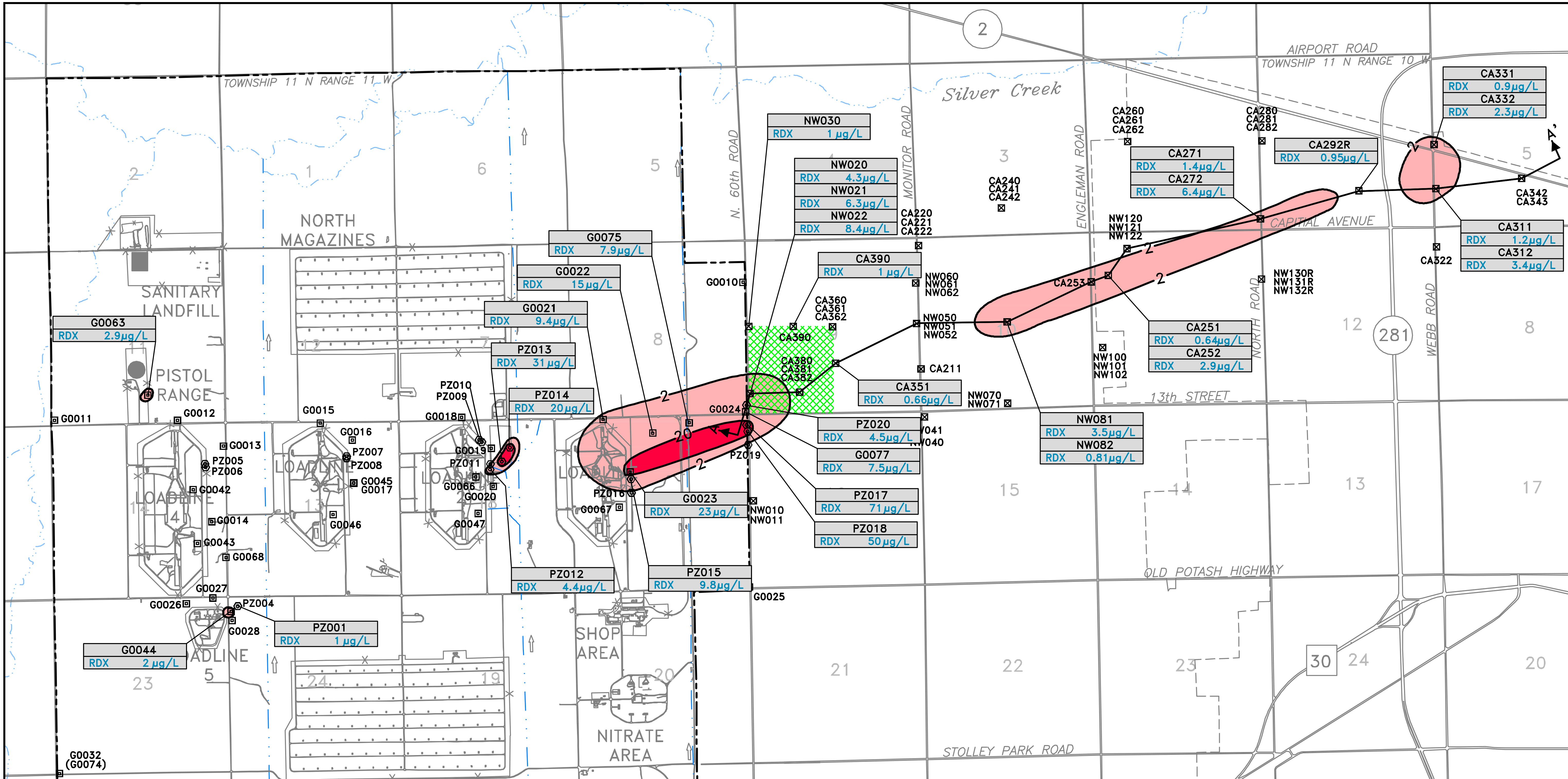

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER
A A' GEOLOGIC CROSS SECTION

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2μg/L)-MARCH 2006
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20μg/L) - MARCH 2006
FEEDLOT AREA

J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
μg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS MAP. IT IS TO THE SOUTH OF THE SOUTH MAGAZINE AREA AND NO EXPLOSIVES WERE DETECTED.

2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON-DETECT" FOR RDX OR THE WELL WAS DRY.

N

SCALE 0 3000 6000 FEET

December 29, 2015 8:23:41 a.m.
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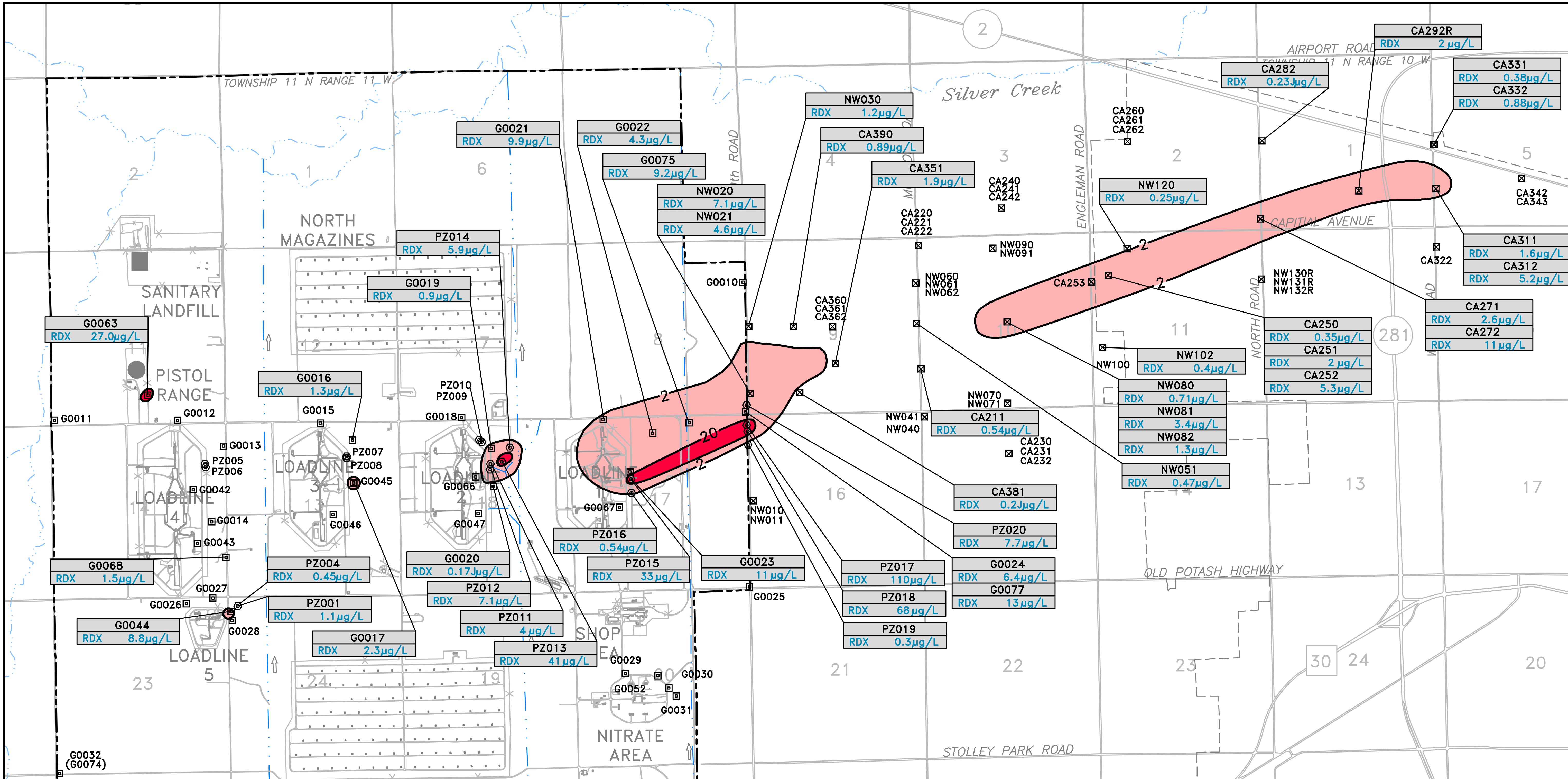
Bay West URS

RDX PLUME
(OU1) MARCH 2006
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO. 16170837	FIG. NO. 5-7
CHK'D. BY: RPC	DATE: 09/25/15		



LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)-MARCH 2004

20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) - MARCH 2004

J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS MAP. IT IS TO THE SOUTH OF THE SOUTH MAGAZINE AREA AND NO EXPLOSIVES WERE DETECTED.

2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON-DETECT" FOR RDX OR THE WELL WAS DRY.

N

SCALE 0 3000 6000 FEET

Bay West
Customer-Focused Environmental & Industrial Solutions

URS

RDX PLUME
(OU1) MARCH 2004
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5-8

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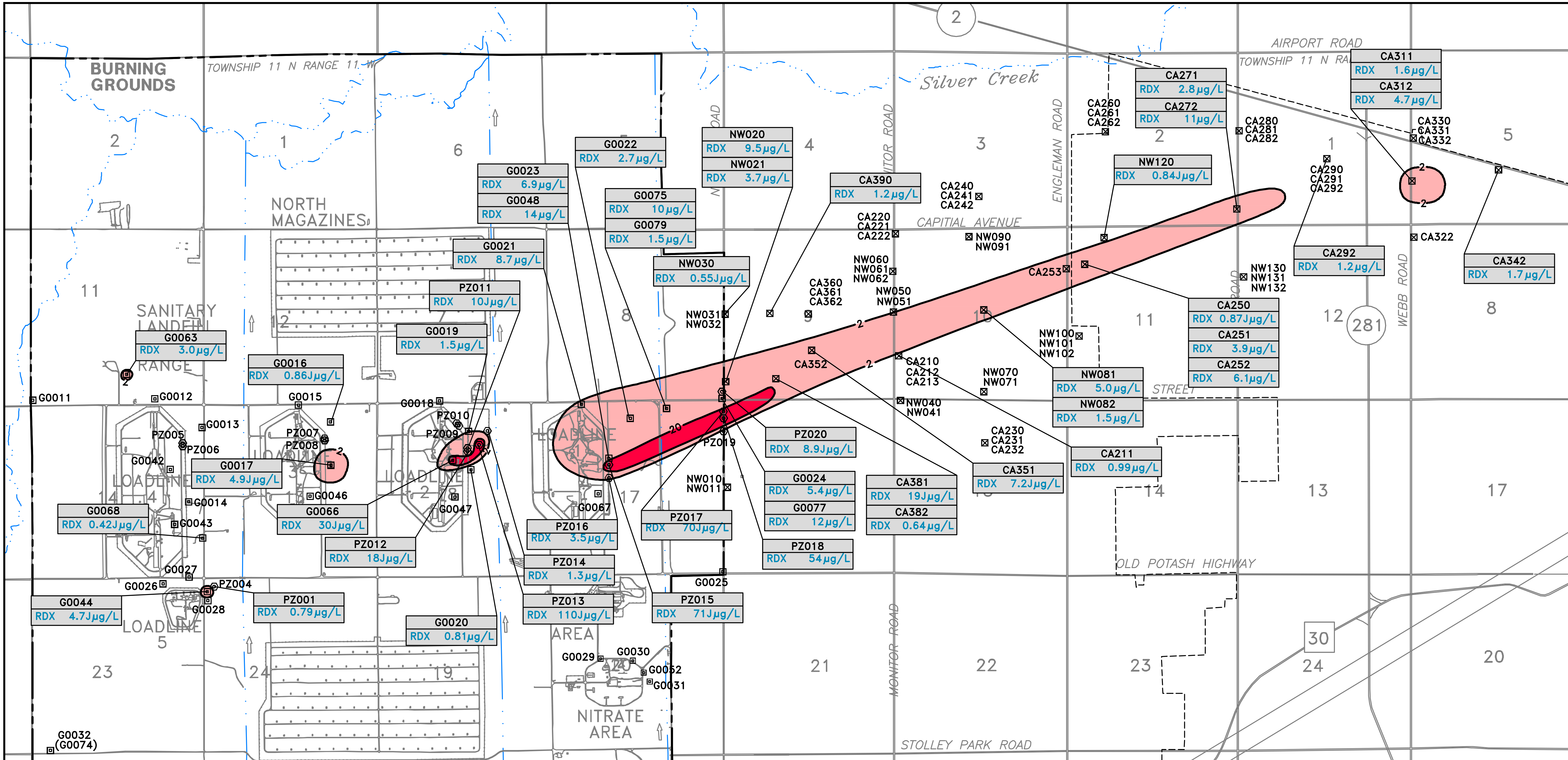

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
ON–POST PIEZOMETER

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)–MARCH 2002
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) – MARCH 2002

J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR RDX.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

RDX PLUME
(OU1) MARCH 2002
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–9

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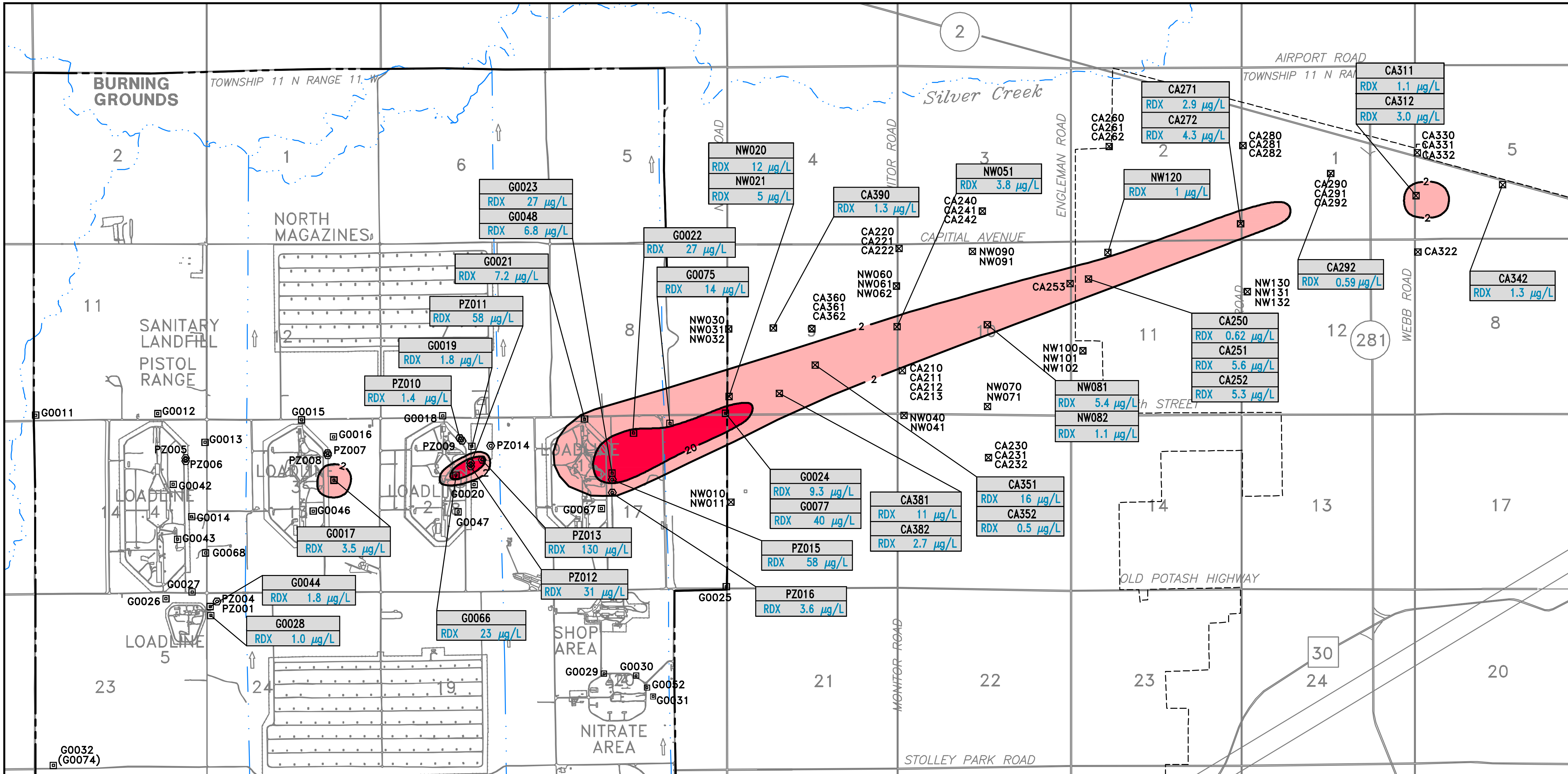

LEGEND:

- FACILITY BOUNDARY
- GRAND ISLAND CITY LIMITS
- DRAINAGE DITCH FLOW DIRECTION
- SURFACE DRAINAGE
- 1 SECTION NUMBER
- ON–POST GROUNDWATER MONITORING WELL
- NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
- ON–POST PIEZOMETER
- 2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2μg/L)–MARCH 2000
- 20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20μg/L) – MARCH 2000

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
2. ALL MONITORING WELLS WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NONDETECT" FOR RDX.

J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
μg/L = MICROGRAMS PER LITER

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

RDX PLUME
(OU1) MARCH 2000
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–10

December 29, 2015 8:25:23 a.m.
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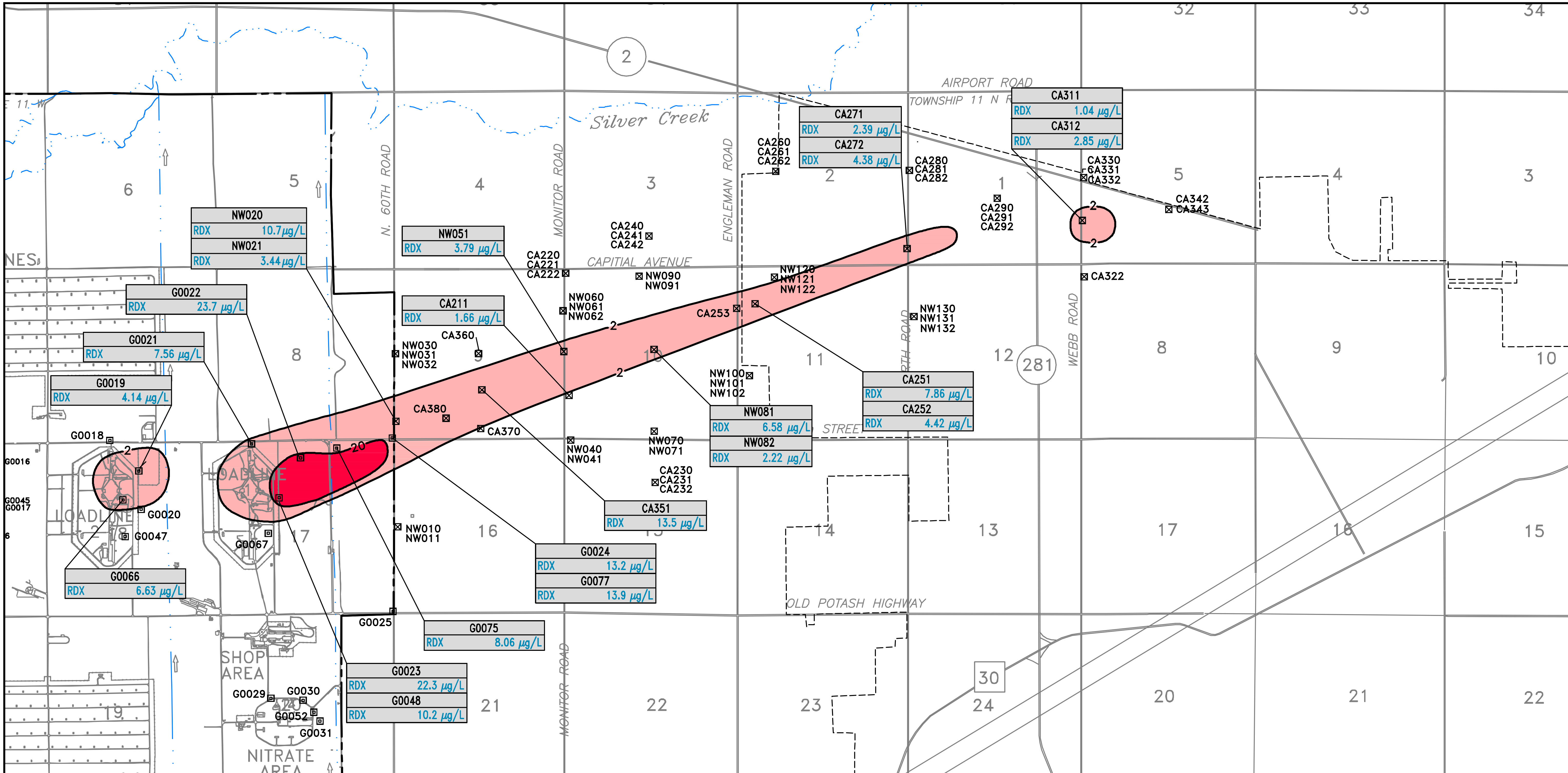

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)-MARCH 1998
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) - MARCH 1998

J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. ALL MONITORING WELLS WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NONDETECT" FOR RDX.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

OFF-POST RDX PLUME
(OU1) JUNE 1998
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5-11

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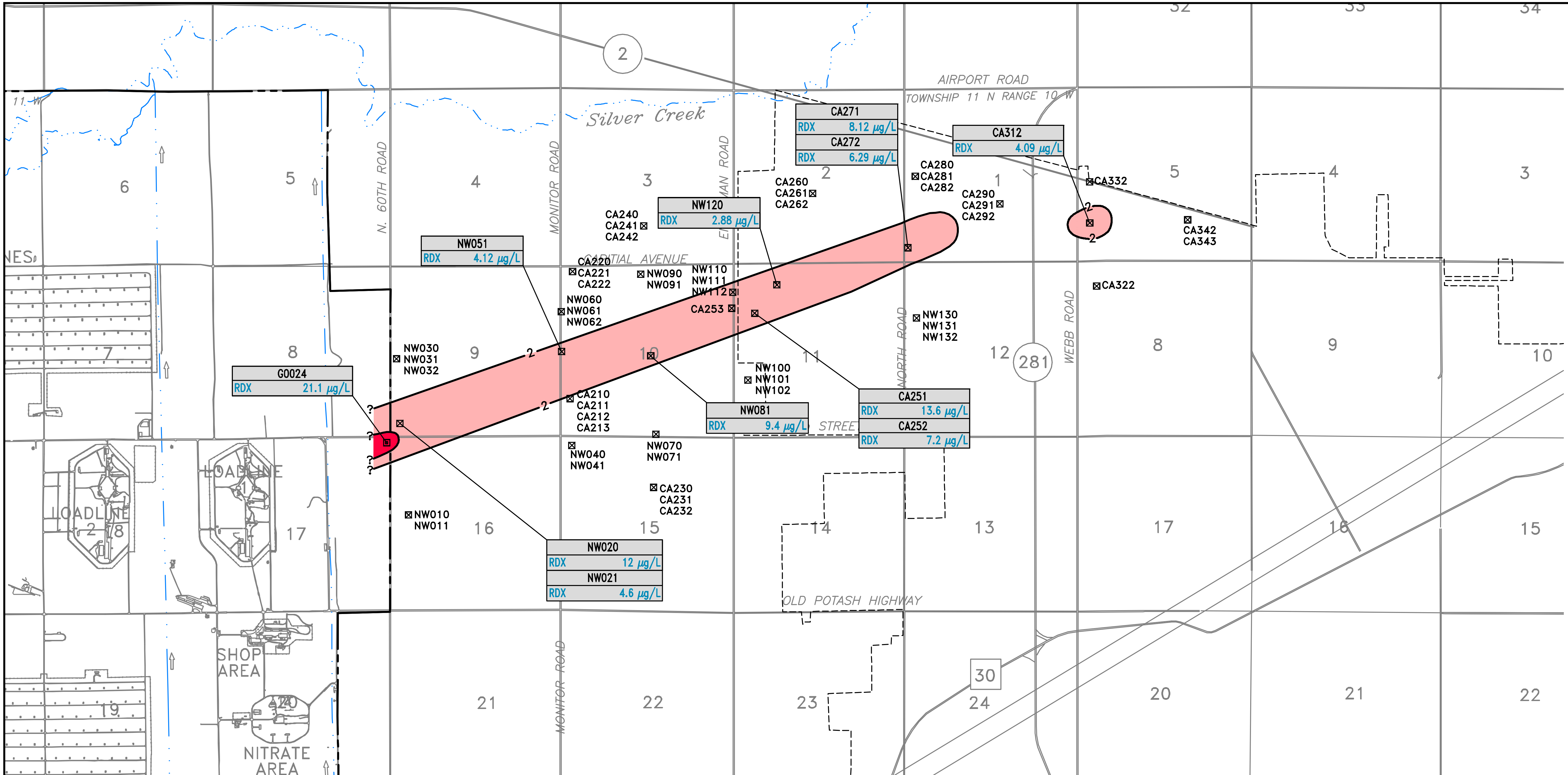

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)–MARCH 1996
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) – MARCH 1996

J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. ALL OFF–POST MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR RDX OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

OFF–POST RDX PLUME
(OU1) DECEMBER 1996
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–12

December 29, 2015 8:26:39 a.m.
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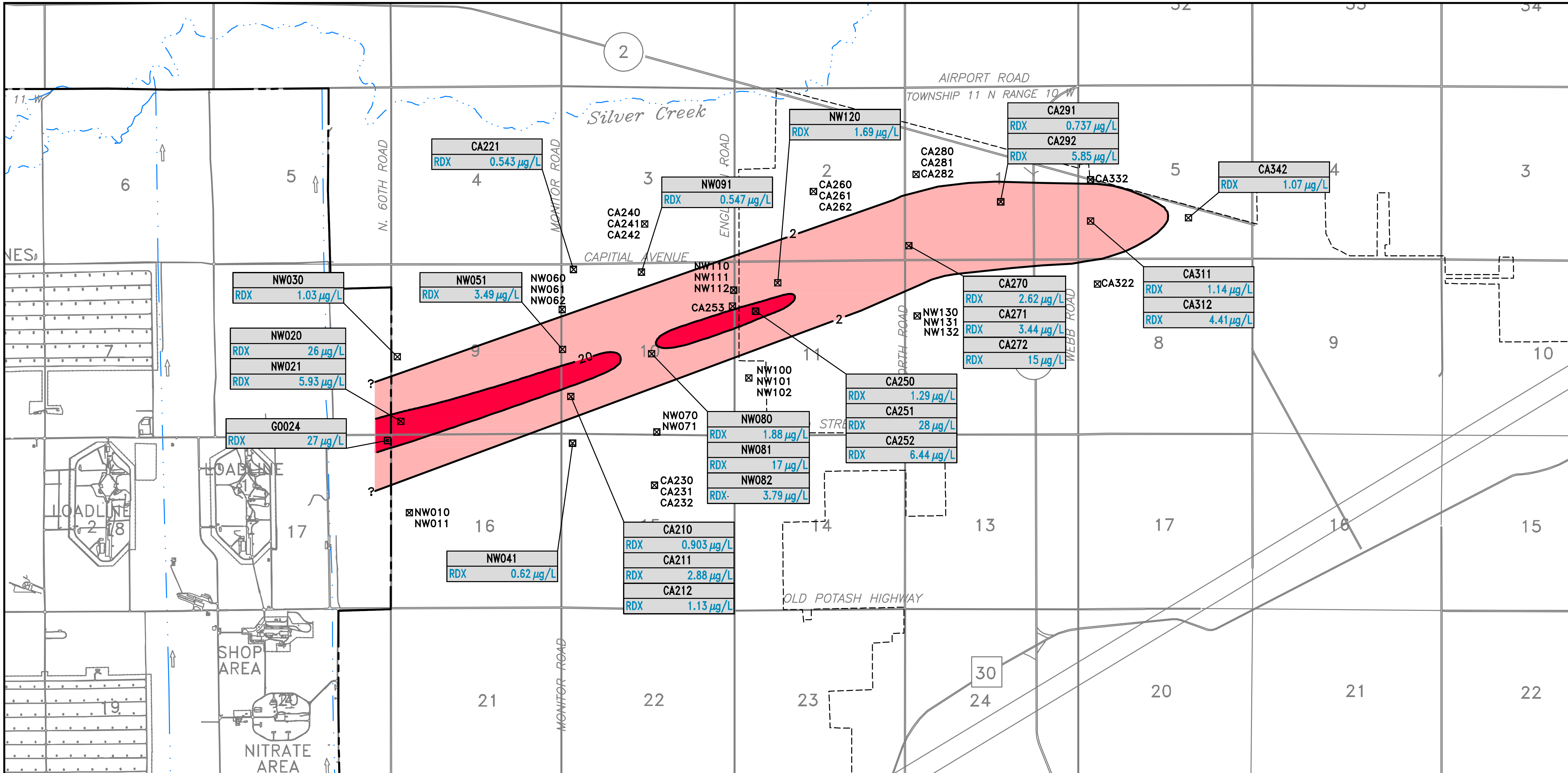

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL

2 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >2µg/L)—MARCH 1994
20 HORIZONTAL EXTENT OF RDX (CONCENTRATIONS >20µg/L) – MARCH 1994

J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. ALL OFF-POST MONITORING WELLS WERE SAMPLED AND ANALYZED FOR RDX. DETECTED RDX CONCENTRATIONS ARE SHOWN. ALL OTHER OFF-POST WELLS WERE "NONDETECT" FOR RDX.

SCALE 0 3000 6000 FEET

N

Bay West — Customer-Focused Environmental & Industrial Solutions
URS

OFF-POST RDX PLUME (OU1) JULY 1994
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5-13

December 29, 2015 8:27:13 a.m.
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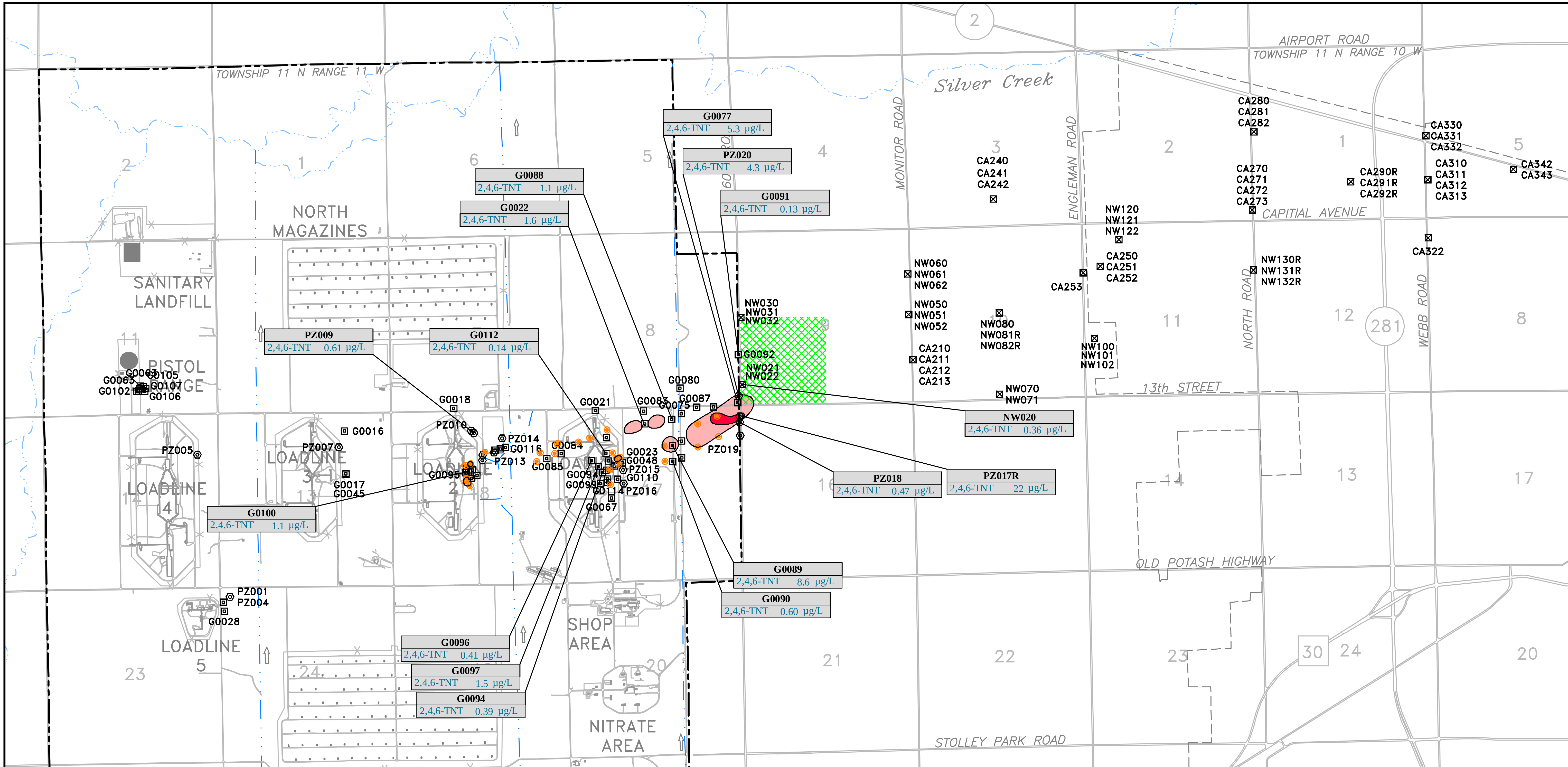


LEGEND:

FACILITY BOUNDARY

GRAND ISLAND CITY LIMITS

DRAINAGE DITCH FLOW DIRECTION

SURFACE DRAINAGE

1 SECTION NUMBER

ON–POST GROUNDWATER MONITORING WELL

NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

ON–POST PIEZOMETER

DIRECT PUSH GROUNDWATER SAMPLE LOCATION – (FEBRUARY 2016)

PZ015 DETECTED 2,4,6–TNT CONCENTRATIONS – FEBERARY/AUGUST 2016

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – AUGUST 2016

20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – AUGUST 2016

FEEDLOT AREA

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
µg/L = MICROGRAMS PER LITER

NOTE:
1. TNT PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR TNT OR THE WELL WAS NOT SAMPLED.

N

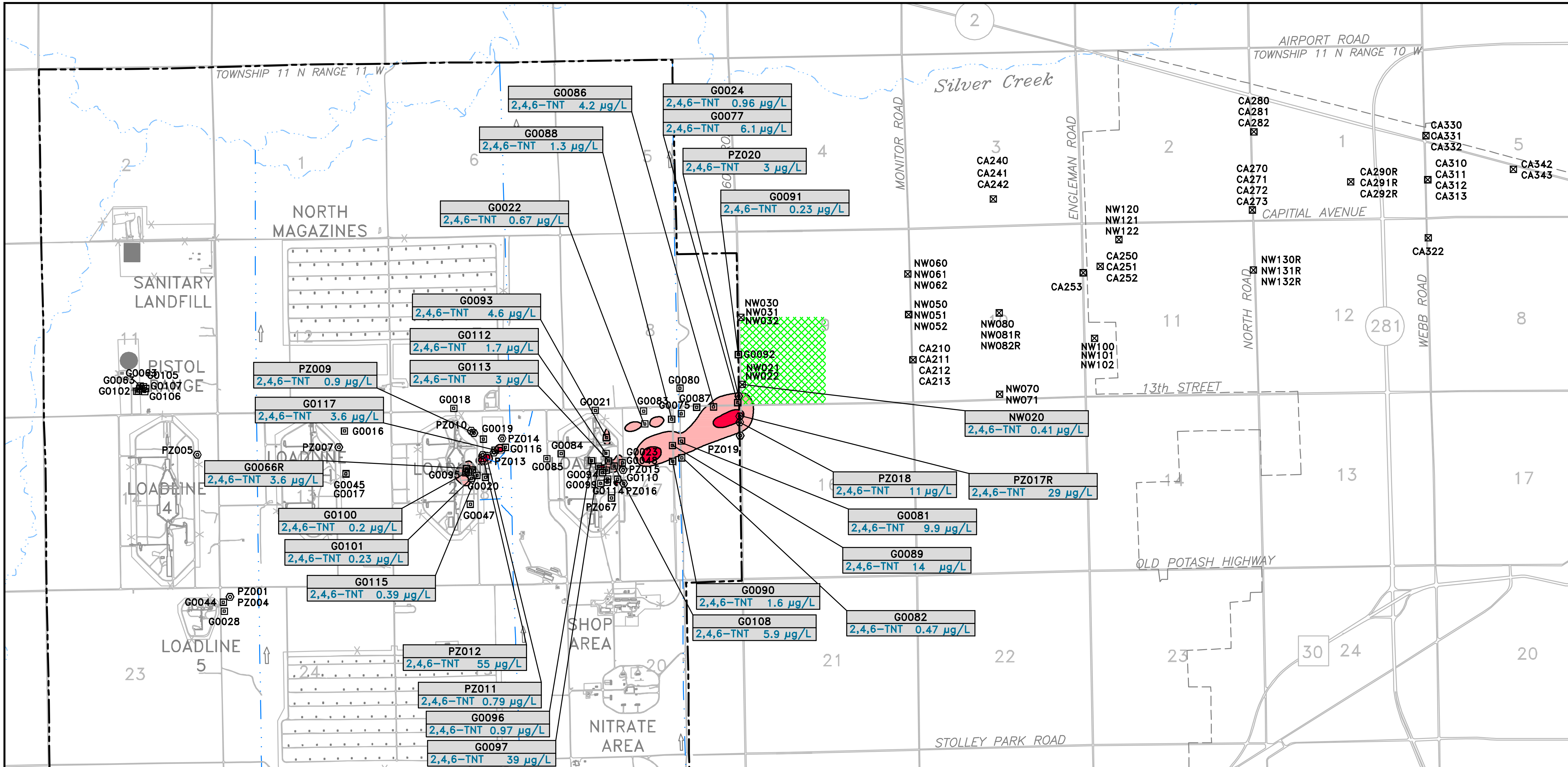
0 3000 6000
SCALE FEET

Bay West URS

TNT PLUME
(OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/13/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/13/16	16170837	5–14

January 19, 2017 4:25:25 p.m.
Drawing: T:\CHAAP\16170837\27\5–14.dwg



LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
ON–POST PIEZOMETER
PZ015 DETECTED 2,4,6–TNT CONCENTRATIONS – AUGUST 2014

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – AUGUST 2014
20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – AUGUST 2014
FEEDLOT AREA

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
µg/L = MICROGRAMS PER LITER

NOTE:
1. TNT PLUME BASED ON 2014 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR TNT OR THE WELL WAS NOT SAMPLED.

N

0 3000 6000
SCALE FEET

Bay West Customer-Focused Environmental & Industrial Solutions URS

TNT PLUME
(OU1) AUGUST 2014
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–15

December 29, 2015 8:28:20 a.m.
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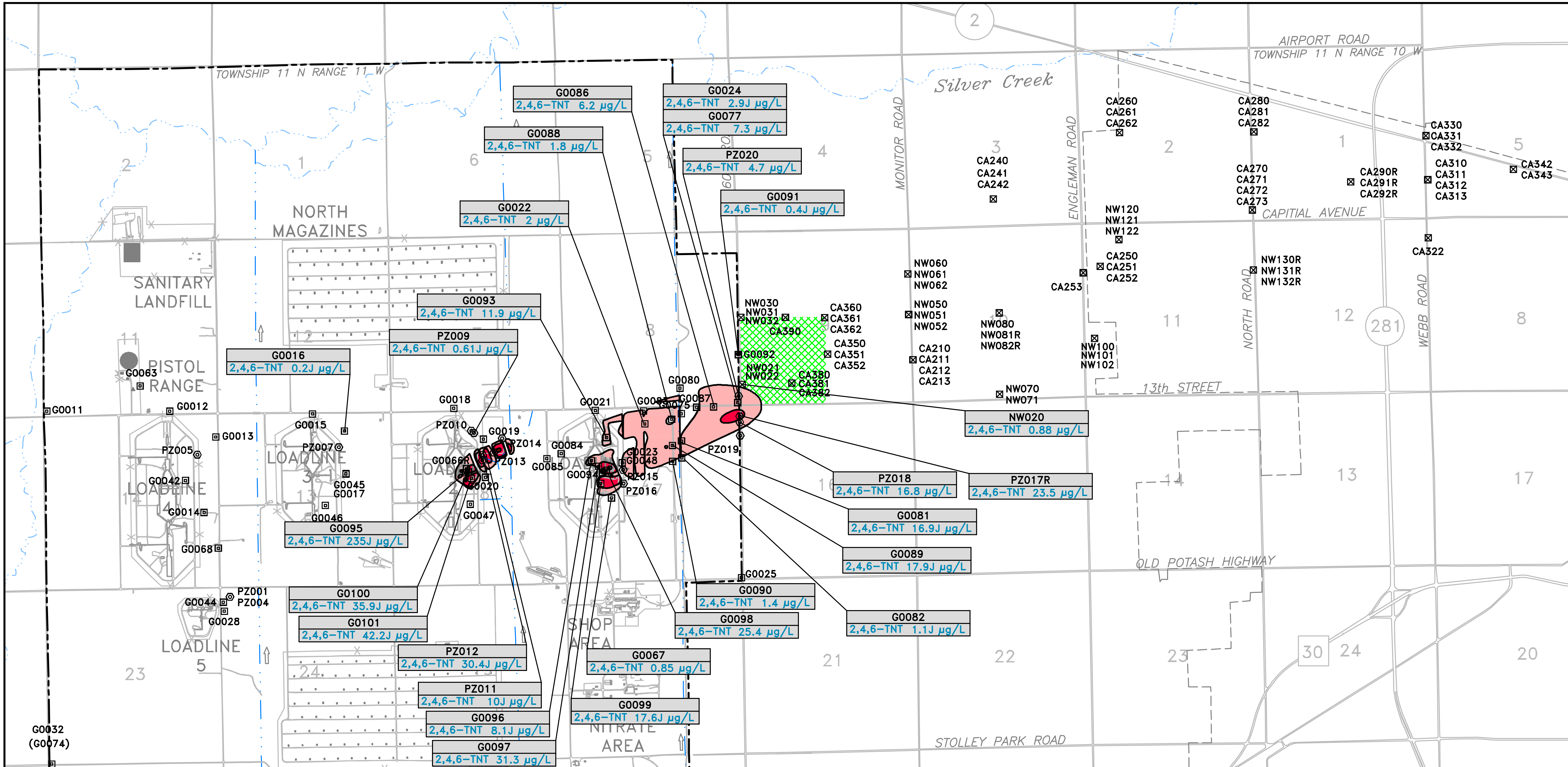

LEGEND:

FACILITY BOUNDARY

GRAND ISLAND CITY LIMITS

DRAINAGE DITCH FLOW DIRECTION

SURFACE DRAINAGE

1 SECTION NUMBER

ON–POST GROUNDWATER MONITORING WELL

NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

ON–POST PIEZOMETER

PZ015 DETECTED 2,4,6–TNT CONCENTRATIONS – MARCH 2012

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – MARCH 2012

20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – MARCH 2012

200 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200µg/L) – MARCH 2012

FEEDLOT AREA

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
µg/L = MICROGRAMS PER LITER

NOTE:
1. TNT PLUME BASED ON 2012 LTM RESULTS AND 2012 OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
3. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR TNT OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

TNT PLUME
(OU1) MARCH 2012
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–16

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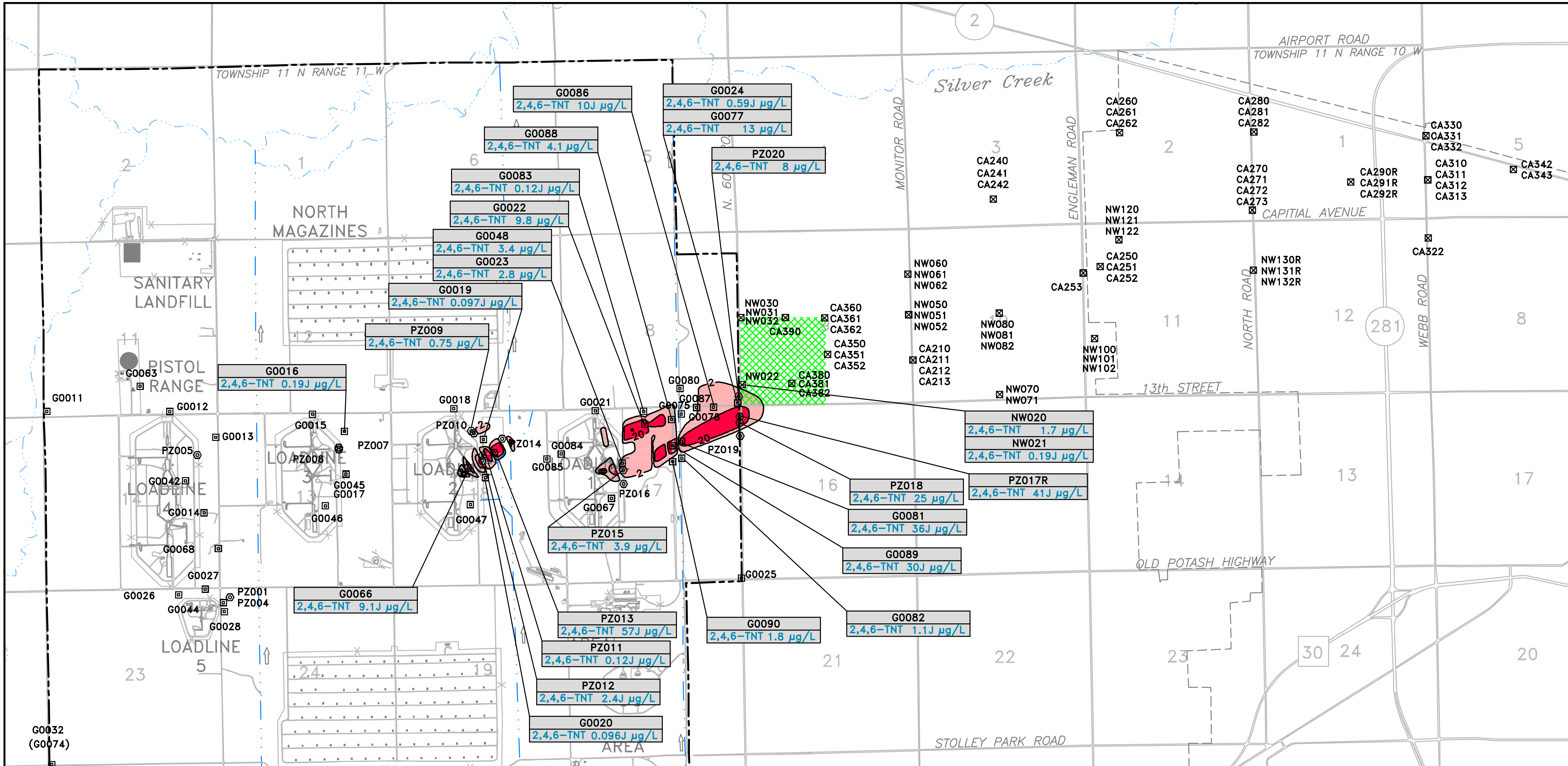

LEGEND:

FACILITY BOUNDARY

GRAND ISLAND CITY LIMITS

DRAINAGE DITCH FLOW DIRECTION

SURFACE DRAINAGE

1 SECTION NUMBER

ON–POST GROUNDWATER MONITORING WELL

NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

ON–POST PIEZOMETER

PZ015 DETECTED 2,4,6–TNT CONCENTRATIONS – MARCH 2010

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – MARCH 2010

20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – MARCH 2010

200 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200µg/L) – MARCH 2010

FEEDLOT AREA

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
µg/L = MICROGRAMS PER LITER

NOTE:
1. TNT PLUME BASED ON 2010 LTM RESULTS AND 2010 OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
3. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR TNT OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

TNT PLUME
(OU1) MARCH 2010
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–17

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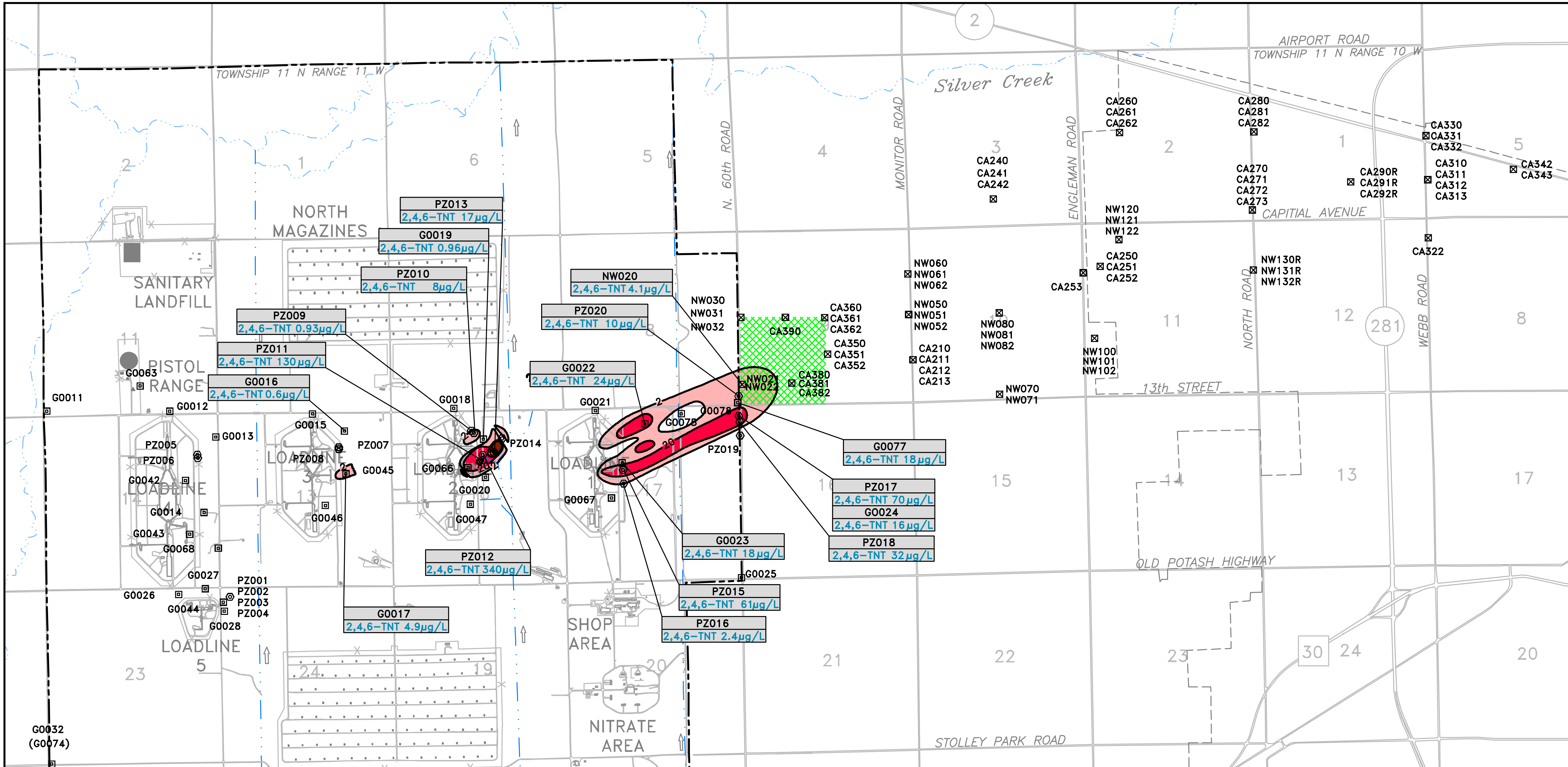

LEGEND:

- FACILITY BOUNDARY
- GRAND ISLAND CITY LIMITS
- DRAINAGE DITCH FLOW DIRECTION
- SURFACE DRAINAGE
- 1 SECTION NUMBER
- ON-POST GROUNDWATER MONITORING WELL
- NW082 OR CA211 — OFF-POST GROUNDWATER MONITORING WELL
- ON-POST PIEZOMETER
- PZ015 — DETECTED 2,4,6-TNT CONCENTRATIONS – MARCH 2008
- 2 — HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – MARCH 2008
- 20 — HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – MARCH 2008
- 200 — HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200µg/L) – MARCH 2008
- FEEDLOT AREA

2,4,6-TNT = 2,4,6-TRINITROTOLUENE
J = ESTIMATED QUALIFIER
LTM = LONG-TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
µg/L = MICROGRAMS PER LITER

NOTE:

1. TNT PLUME BASED ON 2008 LTM RESULTS AND 2008 OU1 RAO GROUNDWATER INVESTIGATION RESULTS.
2. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
3. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON-DETECT" FOR TNT OR THE WELL WAS DRY.

0 3000 6000
SCALE FEET
N

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

TNT PLUME
(OU1) MARCH 2008
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–18

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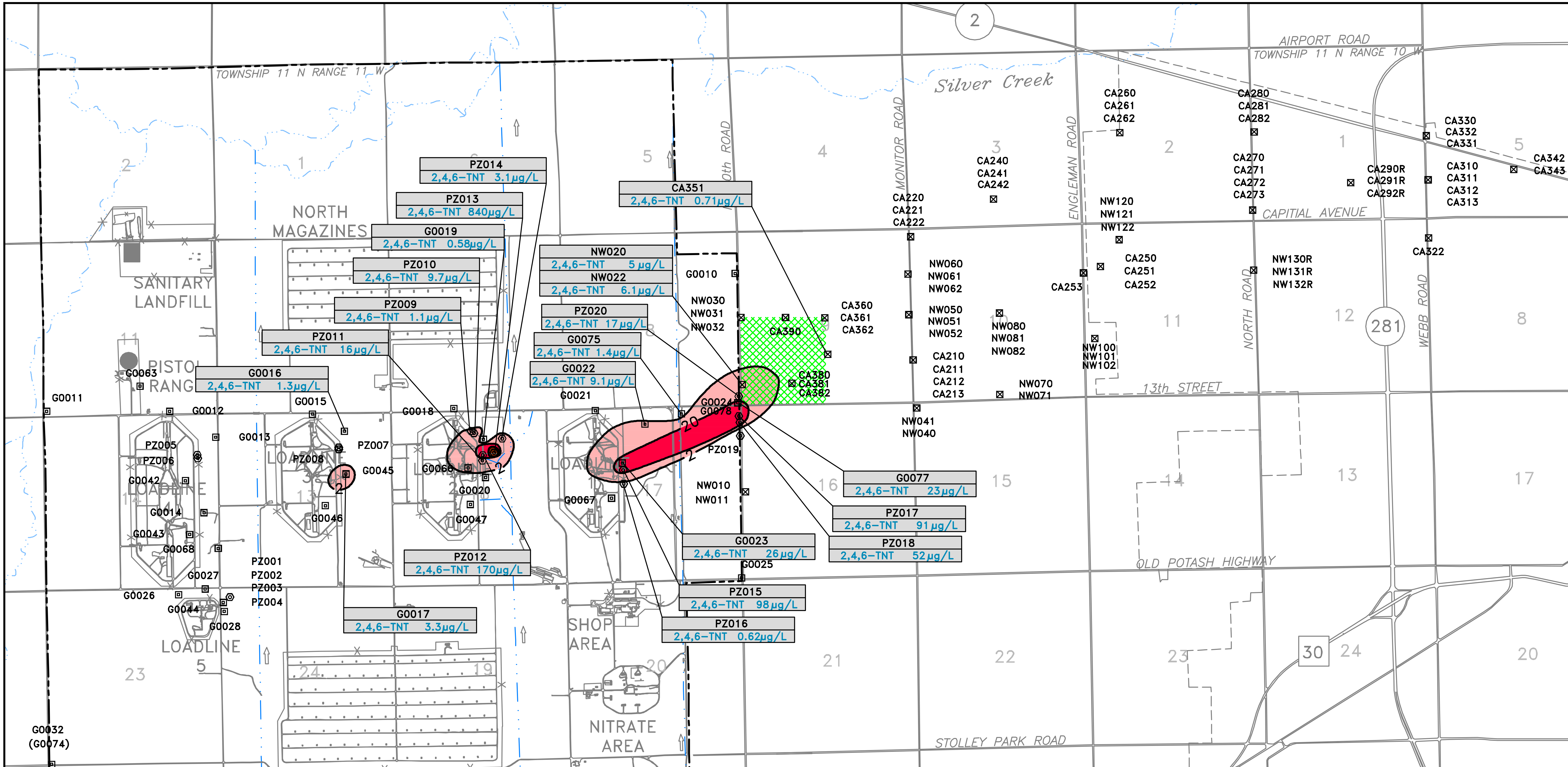

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
ON–POST PIEZOMETER

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – MARCH 2006
20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – MARCH 2006
200 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200µg/L) – MARCH 2006
FEEDLOT AREA

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
LTM = LONG–TERM MONITORING
OU = OPERABLE UNIT
RAO = REMEDIAL ACTION OPERATION
µg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS MAP. IT IS TO THE SOUTH OF THE SOUTH MAGAZINE AREA AND NO EXPLOSIVES WERE DETECTED.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NONDETECT" FOR TNT OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

TNT PLUME
(OU1) MARCH 2006
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–19

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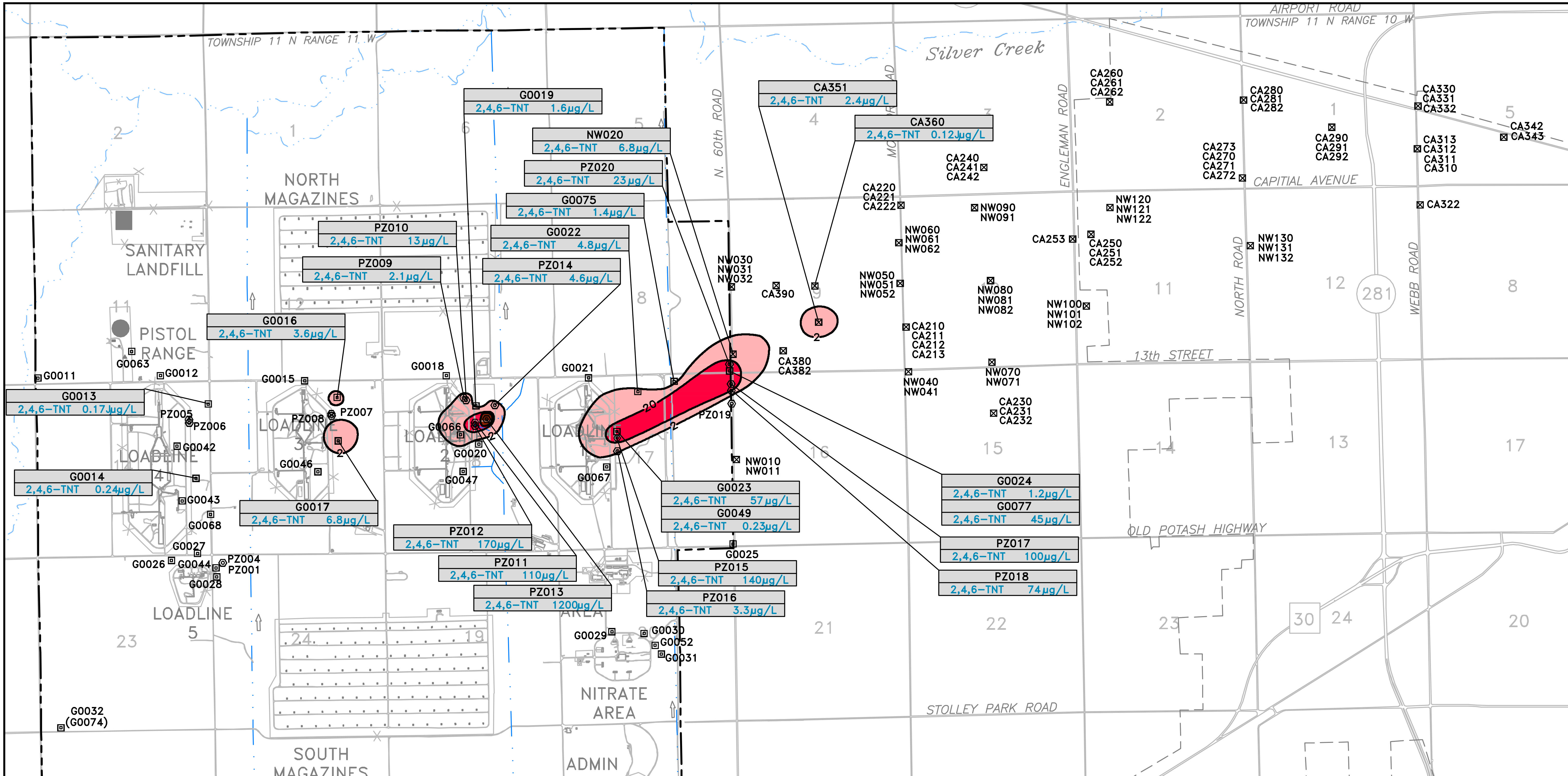

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
ON–POST PIEZOMETER

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2μg/L) – MARCH 2004
20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20μg/L) – MARCH 2004
200 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200μg/L) – MARCH 2004

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
μg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NONDETECT" FOR TNT.

N

SCALE 0 3000 6000 FEET

Bay West — Customer-Focused Environmental & Industrial Solutions
URS

TNT PLUME
(OU1) MARCH 2004
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–20

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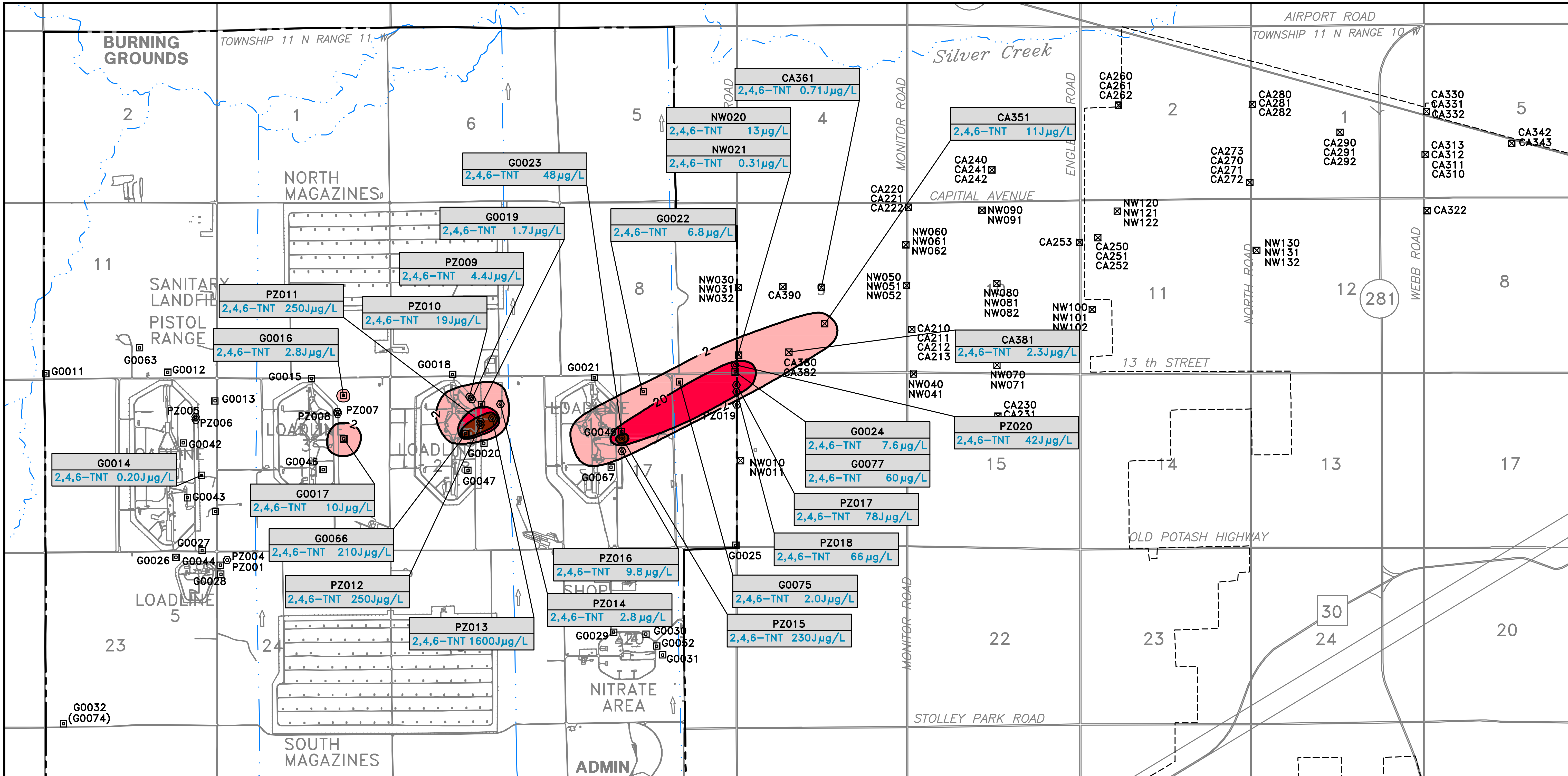

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
ON–POST PIEZOMETER

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – MARCH 2002
20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – MARCH 2002
200 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200µg/L) – MARCH 2002

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NONDETECT" FOR TNT.

N

0 3000 6000
SCALE FEET

Bay West Customer-Focused Environmental & Industrial Solutions URS

TNT PLUME
(OU1) MARCH 2002
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–21

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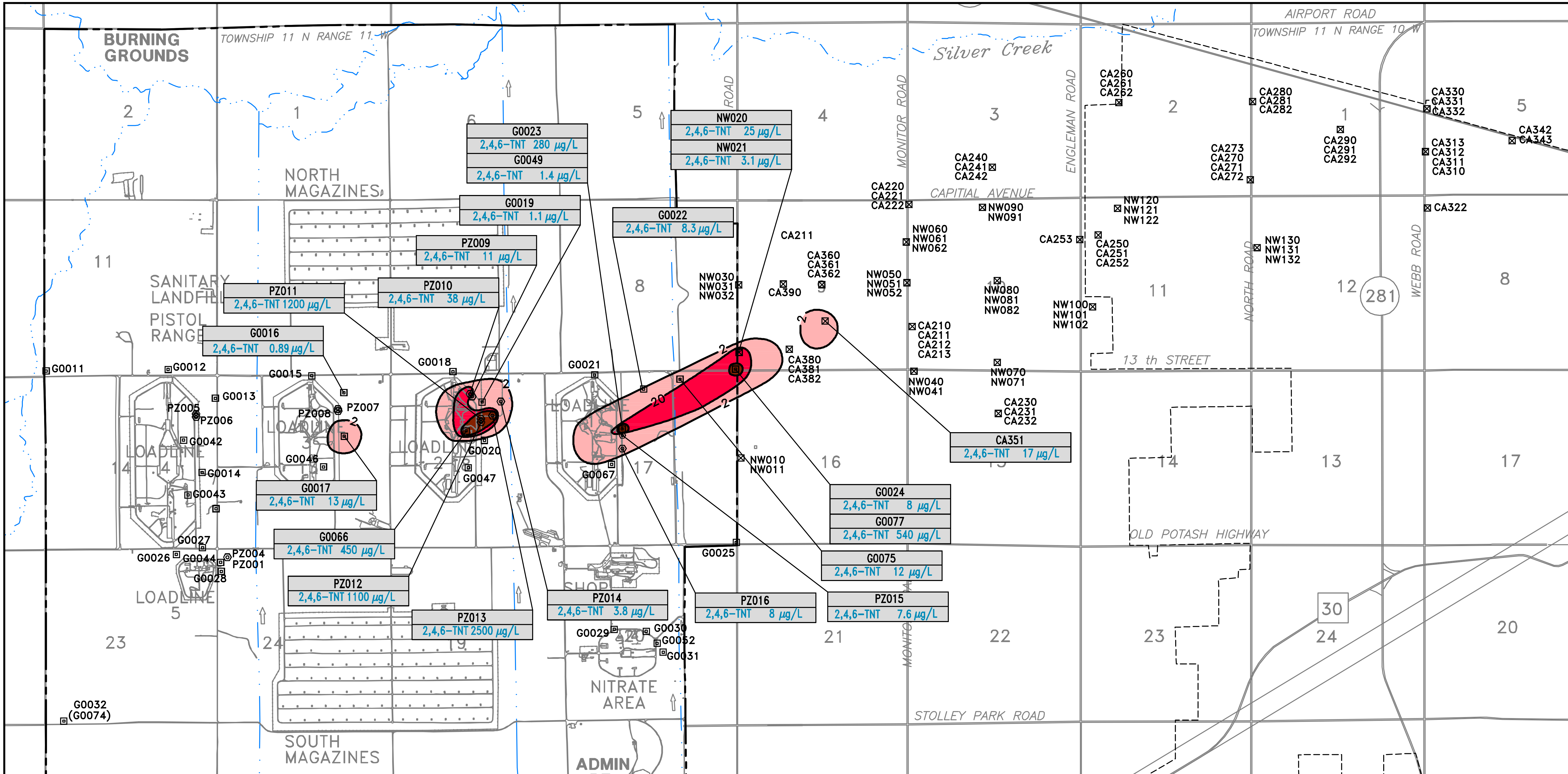

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – MARCH 2000
20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – MARCH 2000
200 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200µg/L) – MARCH 2000

2,4,6-TNT = 2,4,6-TRINITROTOLUENE
J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON-DETECT" FOR TNT OR THE WELL WAS DRY.

N
0 3000 6000
SCALE FEET

Bay West Customer-Focused Environmental & Industrial Solutions
URS

TNT PLUME
(OU1) MARCH 2000
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO. 16170837	FIG. NO. 5–22
CHK'D. BY: RPC	DATE: 09/25/15		

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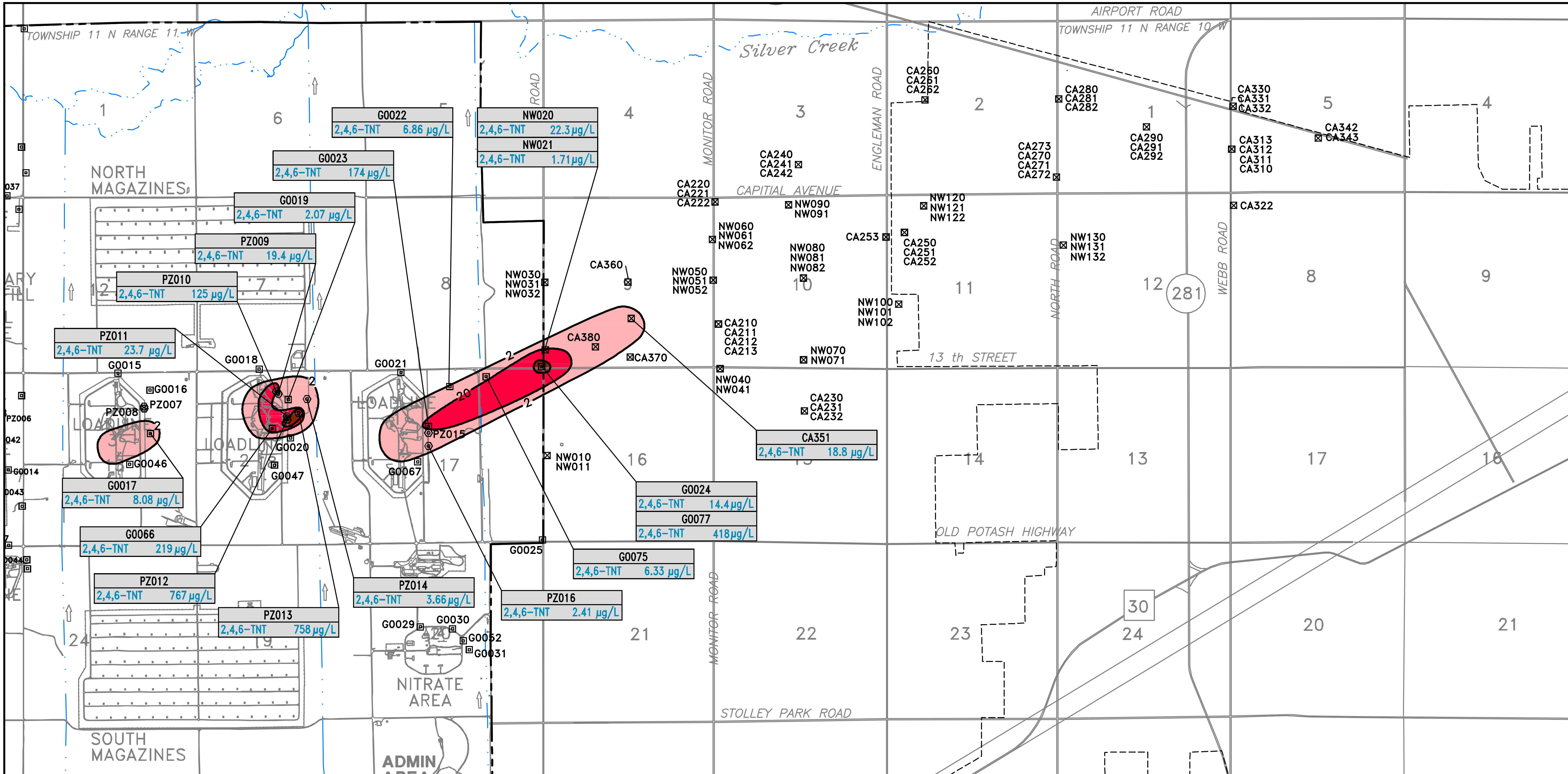

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
ON–POST PIEZOMETER

2 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >2µg/L) – MARCH 1998
20 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >20µg/L) – MARCH 1998
200 HORIZONTAL EXTENT OF TNT (CONCENTRATIONS >200µg/L) – MARCH 1998

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
J = ESTIMATED QUALIFIER
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER

NOTE:
1. G0033 IS NOT ANNOTATED ON THIS FIGURE. NO EXPLOSIVES WERE DETECTED.
2. ALL MONITORING WELLS SHOWN WERE SAMPLED AND ANALYZED FOR TNT. DETECTED TNT CONCENTRATIONS ARE SHOWN. ALL OTHER WELLS WERE "NON–DETECT" FOR TNT OR THE WELL WAS DRY.

N

0 3000 6000
SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

TNT PLUME
(OU1) JUNE 1998
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–23

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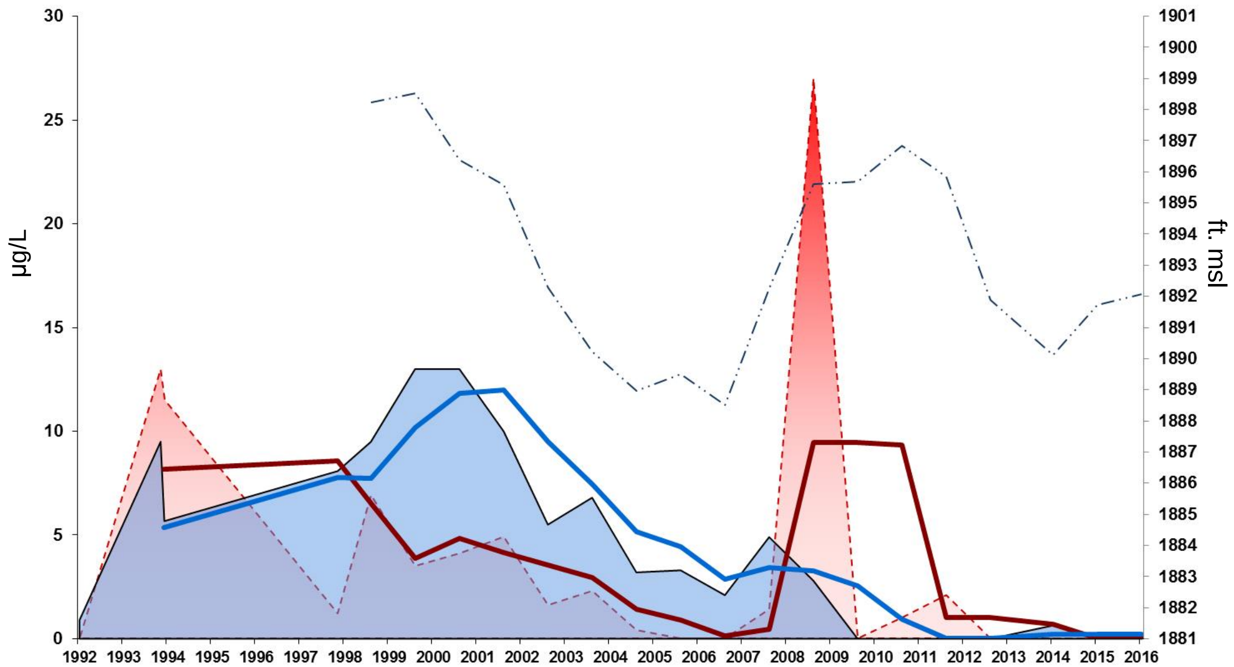
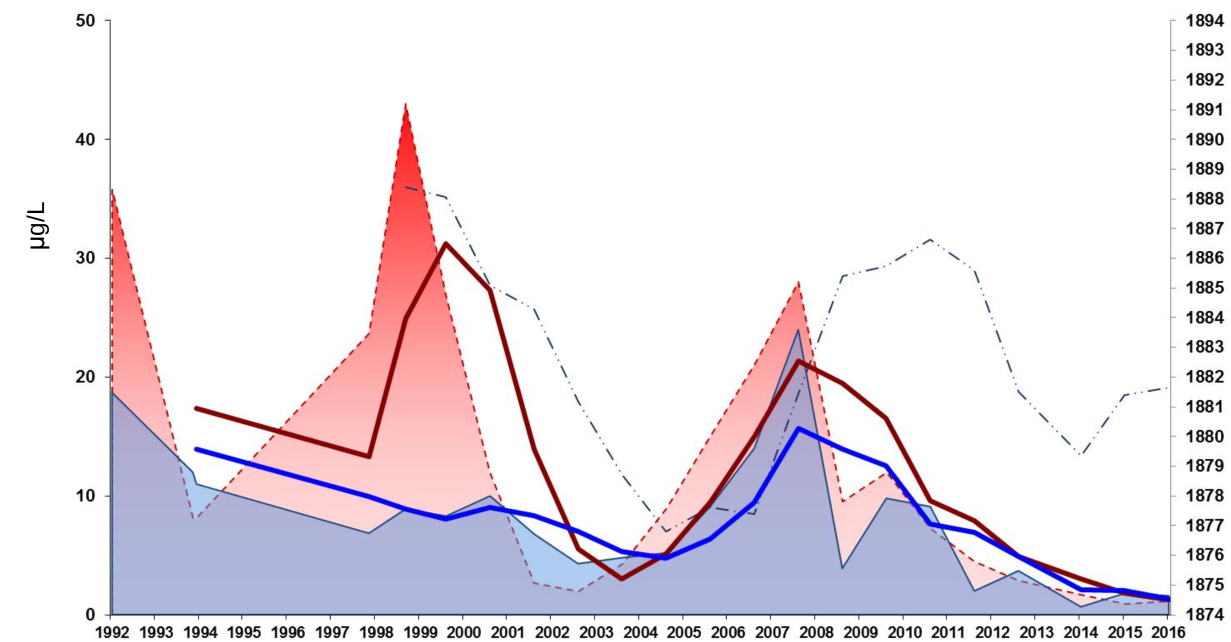
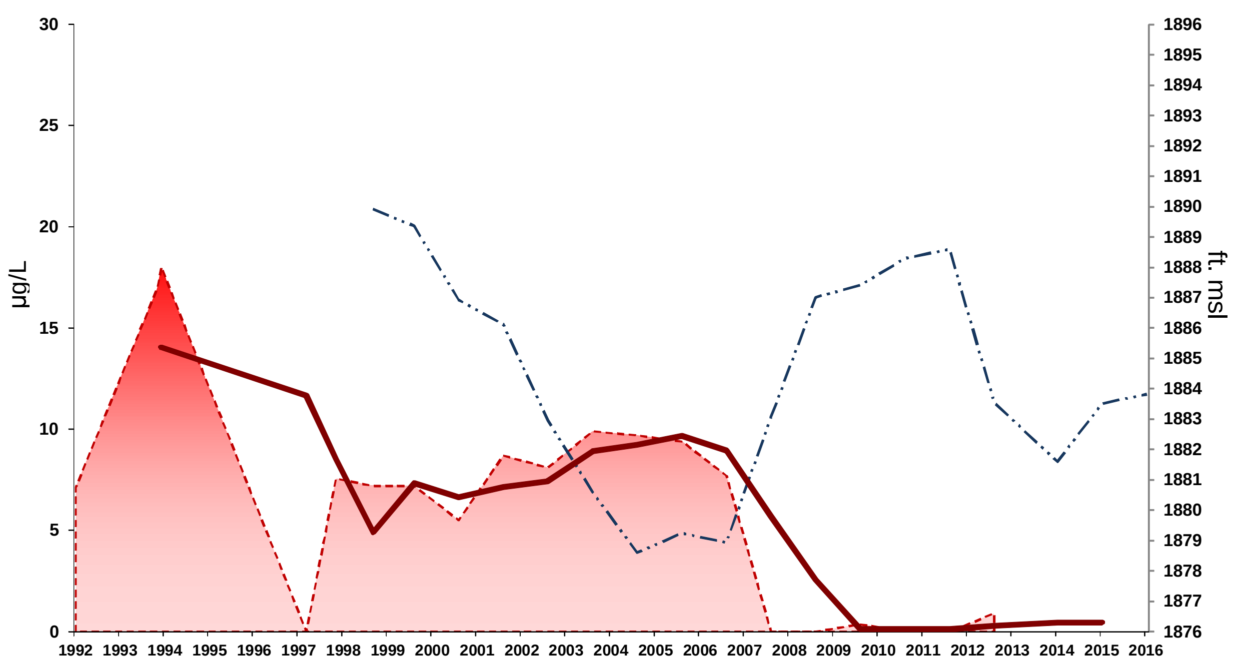
RDX AND TNT CONCENTRATION
ON-POST WELL G0017



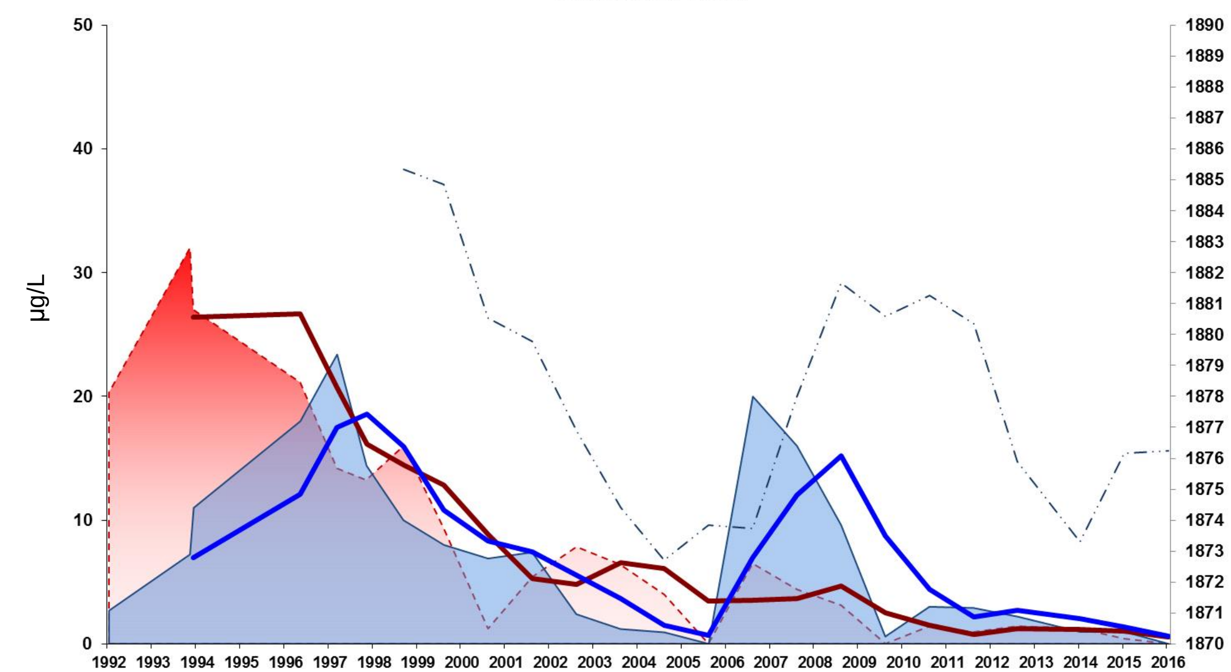
RDX AND TNT CONCENTRATION
ON-POST WELL G0022



RDX CONCENTRATION
ON-POST WELL G0021



RDX AND TNT CONCENTRATION
ON-POST WELL G0024



LEGEND:

RDX

TNT

3 POINT MOVING AVG. (RDX)

3 POINT MOVING AVG. (TNT)

LTM WATER LEVEL (ft. msl)

NOTE:
TNT IS NONDETECT IN WELL G0021

February 27, 2017 9:25:13 a.m.
Drawing: T:\CHAAP\16170837\27\5-24.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions

URS

RDX AND TNT CONCENTRATION TRENDS IN
SELECTED ON-POST MONITORING WELLS (OU1)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	5-24


SEE FIGURE 5-25c
SEE FIGURE 5-25b
13th STREET
LEGEND
LL1-DP137 2016 DIRECT PUSH GROUNDWATER SAMPLING LOCATION
G0015 2015 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)
(12.6) TNT CONCENTRATION
(12.6) RDX CONCENTRATION
(ND) NON DETECT (AUGUST 2015, FEBRUARY 2016)
(NS) NOT SAMPLED (AUGUST 2015, FEBRUARY 2016)
2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
BLDG 14 FORMER SITE FEATURES
ADVECTIVE PARTICLE TRANSPORT FLOWPATH (EW7 AT 450 GPM)
FENCE
SURFACE DRAINAGE
CROSS SECTION LINE
EW3 (INACTIVE) EXTRACTION WELL
G0015 ON-POST GROUNDWATER MONITORING WELL
PZ007 ON-POST PIEZOMETER
EW7-DP35 2015 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH)
LL1-DP01 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01 PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
ACTIVE IRRIGATION WELL
2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) AUGUST 2015/FEBRUARY 2016
20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20µg/L) AUGUST 2015/FEBRUARY 2016
2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) AUGUST 2015/FEBRUARY 2016
20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) AUGUST 2015/FEBRUARY 2016
300 150 0 300
SCALE IN FEET
Bay West
Customer-Focused Environmental & Industrial Solutions
URS
OU1 2015/2016 (PRE-INJECTION) EXTENT OF EXPLOSIVES PLUME
LOAD LINE 1 AND LOAD LINE 2 AND BETWEEN EW6 AND EW7
CORNHUSKER ARMY AMMUNITION PLANT
DRN. BY: DPG
DATE: 09/08/16
PROJECT NO. 16170837
FIG. NO. 5-25a
CHK'D. BY: CSA
REVISION: 0
April 14, 2017 10:03:44 a.m.
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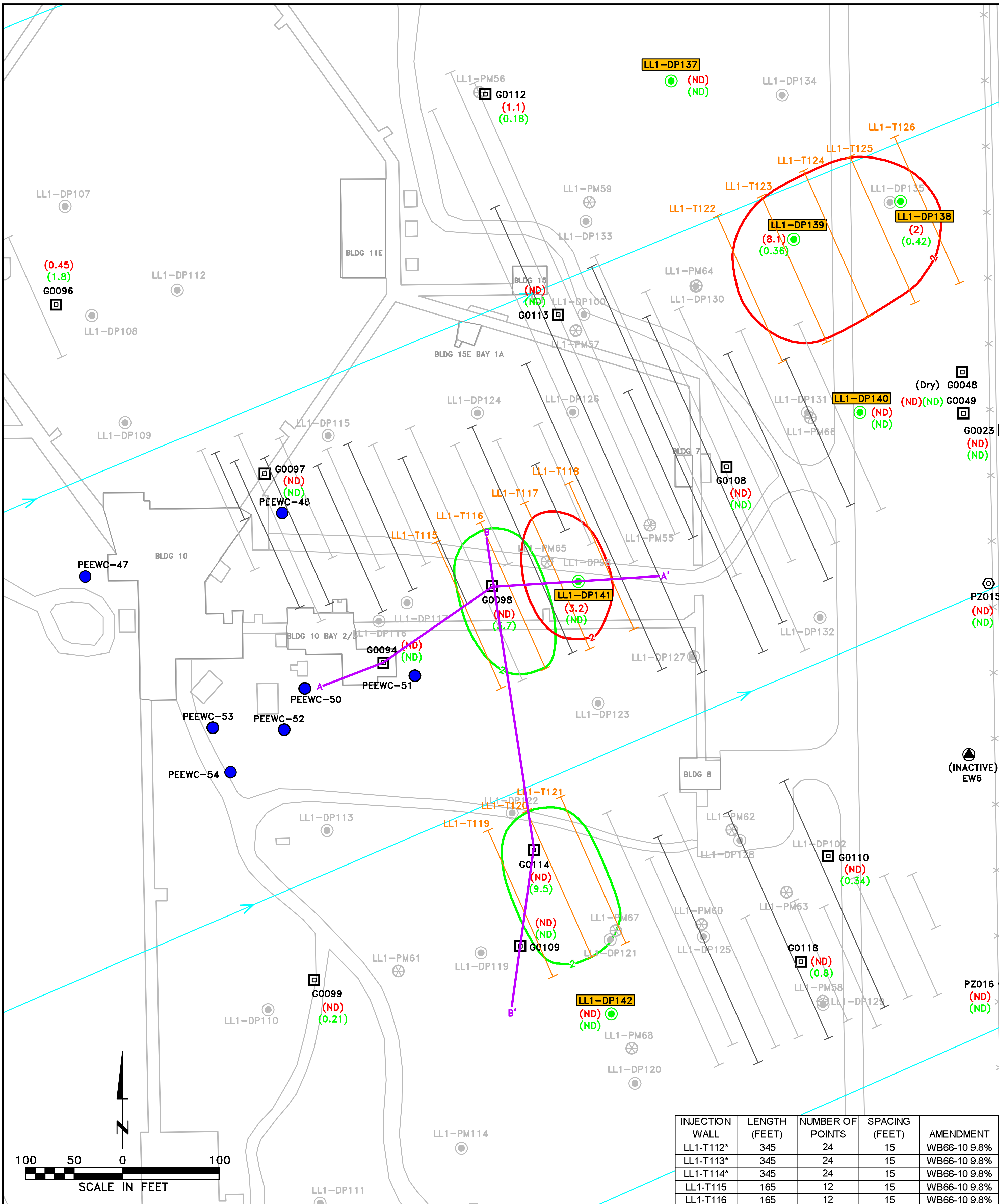

INJECTION WALL	LENGTH (FEET)	NUMBER OF POINTS	SPACING (FEET)	AMENDMENT
LL1-T112*	345	24	15	WB66-10 9.8%
LL1-T113*	345	24	15	WB66-10 9.8%
LL1-T114*	345	24	15	WB66-10 9.8%
LL1-T115	165	12	15	WB66-10 9.8%
LL1-T116	165	12	15	WB66-10 9.8%
LL1-T117	165	12	15	WB66-10 9.8%
LL1-T118	165	12	15	WB66-10 9.8%
LL1-T119	165	12	15	WB66-10 9.8%
LL1-T120	165	12	15	WB66-10 9.8%
LL1-T121	165	12	15	WB66-10 9.8%
LL1-T122	165	12	15	WB66-10 9.8%
LL1-T123	165	12	15	WB66-10 9.8%
LL1-T124	165	12	15	WB66-10 9.8%
LL1-T125	165	12	15	WB66-10 9.8%
LL1-T126	165	12	15	WB66-10 9.8%
LL1-T127*	165	12	15	WB66-10 9.8%
LL1-T128*	255	18	15	WB66-10 9.8%
LL1-T129*	75	6	15	WB66-10 9.8%
LL1 TOTAL	3510	252	WB66-10=WESBLEND 66-10	

*LL1-T112, 113, 114, 127, 128, and 129 are shown on Figure 10-1a

LEGEND

LL1-DP137 — 2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION

G0015 — 2015 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)

(61) — TNT CONCENTRATION (AUGUST 2015, FEBRUARY 2016)

(61) — RDX CONCENTRATION (AUGUST 2015, FEBRUARY 2016)

(ND) — NON DETECT

2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 450 GPM)

FENCE

SURFACE DRAINAGE

PEEWC-52 — APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)

CROSS SECTION LINE

EW3 (INACTIVE) — EXTRACTION WELL

G0015 — ON-POST GROUNDWATER MONITORING WELL

PZ007 — ON-POST PIEZOMETER

LL1-DP01 — DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)

LL1-PM01 — PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)

2 — INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2μg/L) AUGUST 2015/FEBRUARY 2016

2 — INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) AUGUST 2015/FEBRUARY 2016

April 14, 2017 10:04:53 a.m.
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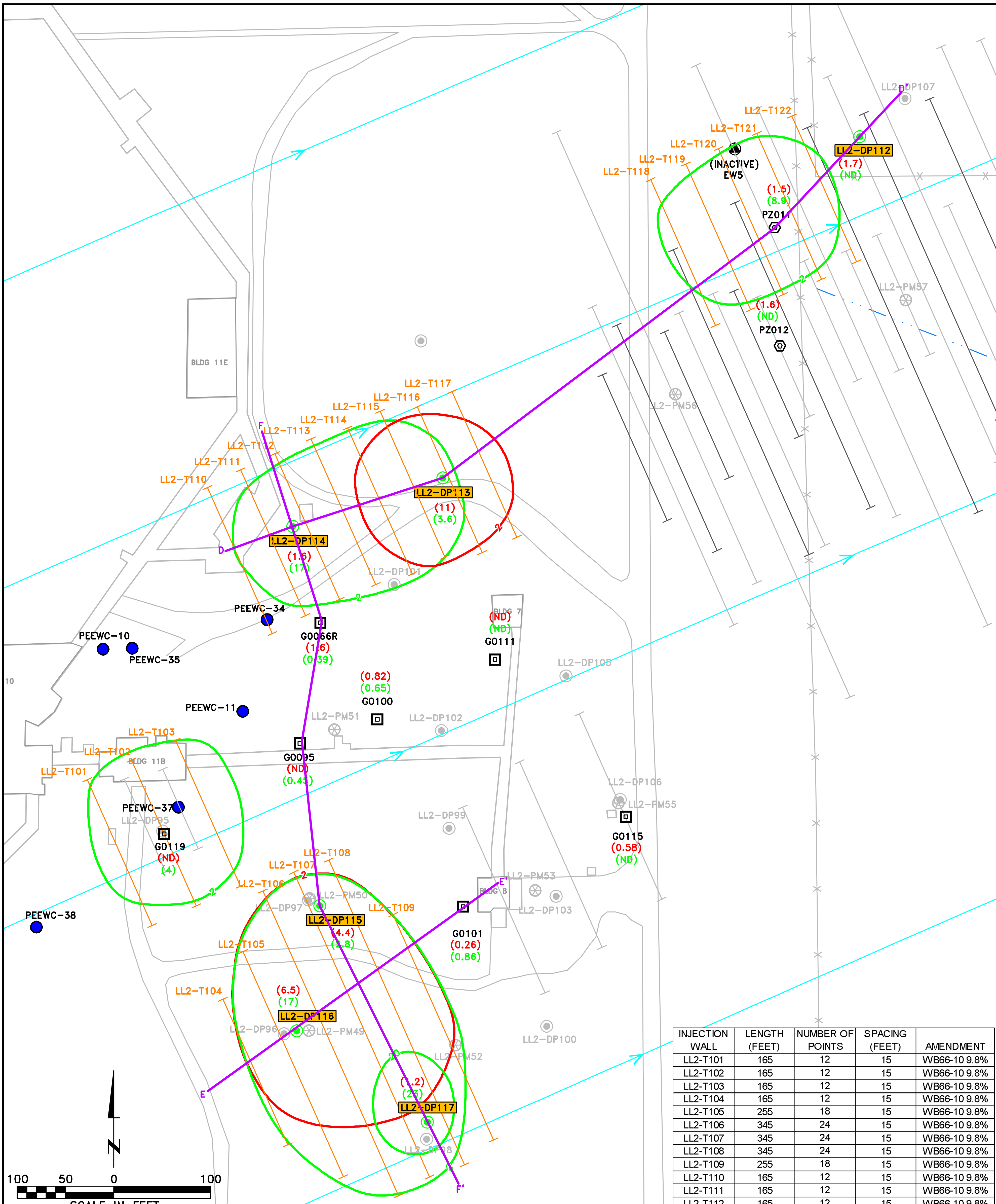
OU1 2015/2016 (PRE-INJECTION) EXTENT OF EXPLOSIVE PLUME LOAD LINE 1
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/08/16	PROJECT NO. 16170837	FIG. NO. 5-25b
CHK'D. BY: CSA	REVISION: 0		



INJECTION WALL	LENGTH (FEET)	NUMBER OF POINTS	SPACING (FEET)	AMENDMENT
LL2-T101	165	12	15	WB66-10 9.8%
LL2-T102	165	12	15	WB66-10 9.8%
LL2-T103	165	12	15	WB66-10 9.8%
LL2-T104	165	12	15	WB66-10 9.8%
LL2-T105	255	18	15	WB66-10 9.8%
LL2-T106	345	24	15	WB66-10 9.8%
LL2-T107	345	24	15	WB66-10 9.8%
LL2-T108	345	24	15	WB66-10 9.8%
LL2-T109	255	18	15	WB66-10 9.8%
LL2-T110	165	12	15	WB66-10 9.8%
LL2-T111	165	12	15	WB66-10 9.8%
LL2-T112	165	12	15	WB66-10 9.8%
LL2-T113	165	12	15	WB66-10 9.8%
LL2-T114	165	12	15	WB66-10 9.8%
LL2-T115	165	12	15	WB66-10 9.8%
LL2-T116	165	12	15	WB66-10 9.8%
LL2-T117	165	12	15	WB66-10 9.8%
LL2-T118	165	12	15	WB66-10 9.8%
LL2-T119	165	12	15	WB66-10 9.8%
LL2-T120	165	12	15	WB66-10 9.8%
LL2-T121	165	12	15	WB66-10 9.8%
LL2-T122	165	12	15	WB66-10 9.8%
LL2-T123*	255	18	15	WB66-10 9.8%
LL2-T124*	255	18	15	WB66-10 9.8%
LL2 TOTAL	4860	348	WB66-10=WESBLEND 66-10	

*LL2-123 and 124 are shown on Figure 10-1a

LEGEND

LL2-DP110 — 2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION

G0015 — 2015 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)

(61) — TNT CONCENTRATION (AUGUST 2015, FEBRUARY 2016)

(61) — RDX CONCENTRATION (AUGUST 2015, FEBRUARY 2016)

(ND) — NON DETECT

2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)

ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 450 GPM)

FENCE

SURFACE DRAINAGE

PEEWC-52 — APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)

CROSS SECTION LINE

EW3 (INACTIVE) — EXTRACTION WELL

G0015 — ON-POST GROUNDWATER MONITORING WELL

PZ007 — ON-POST PIEZOMETER

LL1-DP01 — DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)

LL1-PM01 — PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)

2 — INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2μg/L) AUGUST 2015/FEBRUARY 2016

2 — INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) AUGUST 2015/FEBRUARY 2016

20 — INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20μg/L) AUGUST 2015/FEBRUARY 2016

April 14, 2017 10:05:19 a.m.
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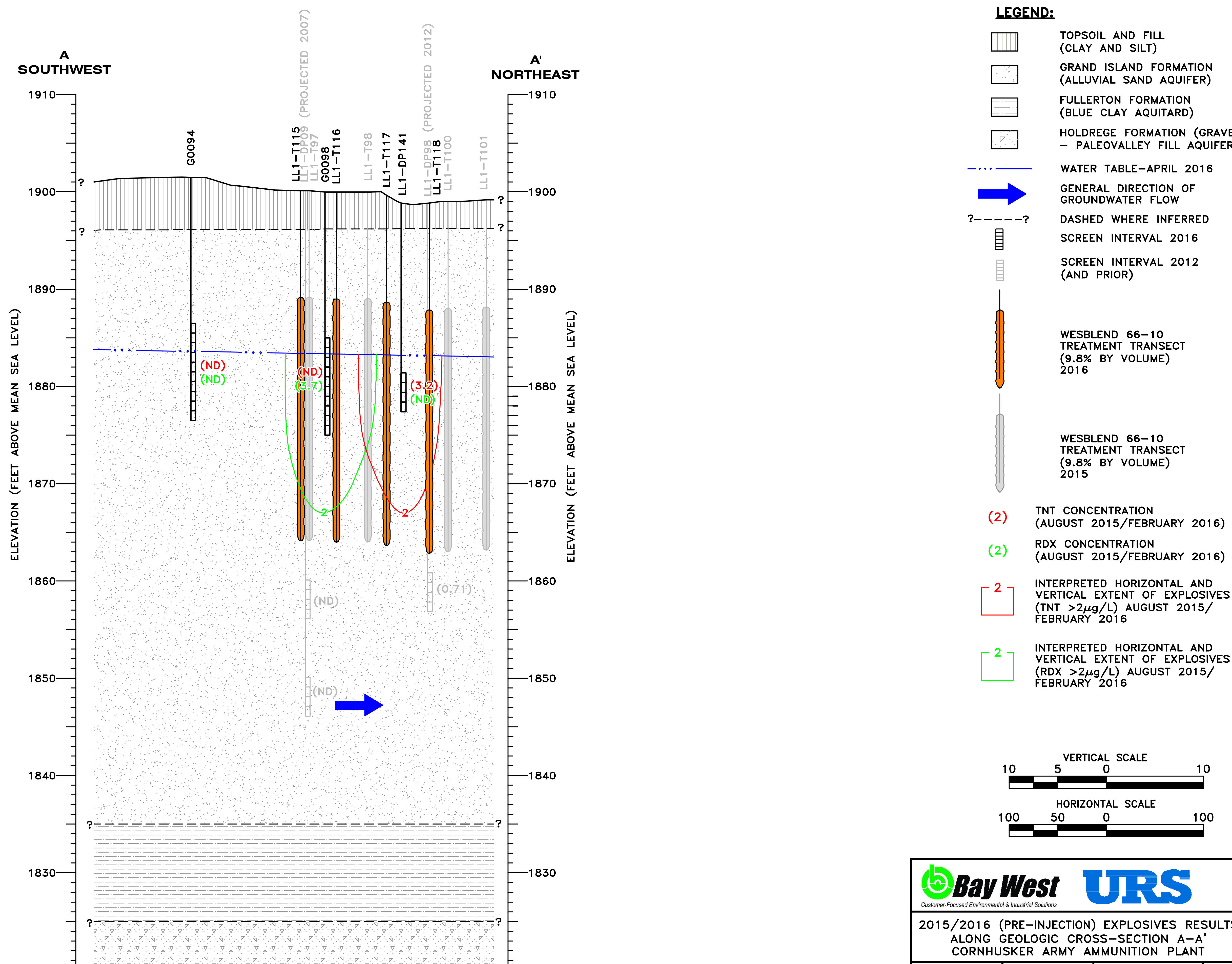
OU1 2015/2016 (PRE-INJECTION) EXTENT OF EXPLOSIVE PLUME LOAD LINE 2
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/08/16	PROJECT NO. 16170837	FIG. NO. 5-25c
CHK'D. BY: CSA	REVISION: 0		



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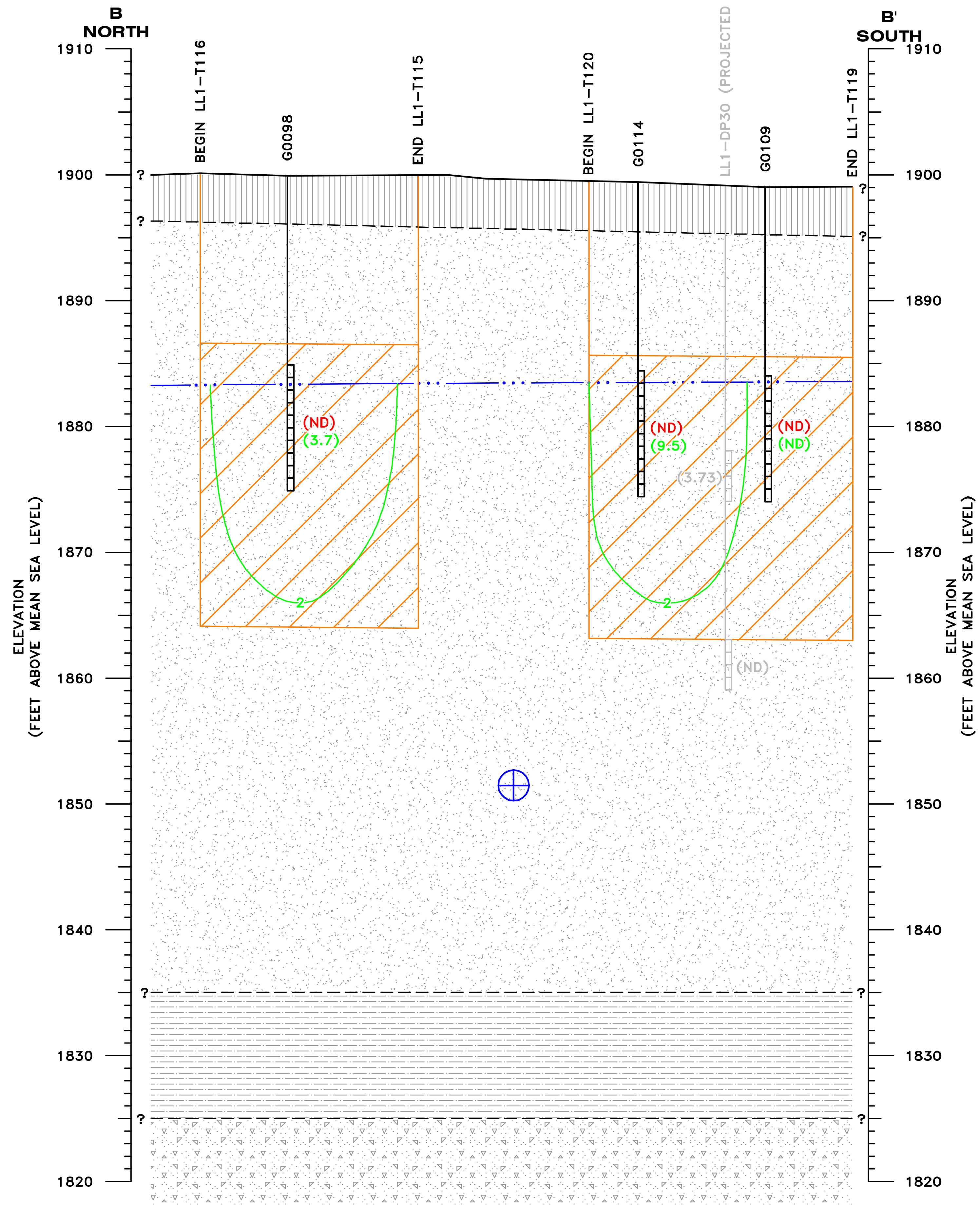
2015/2016 (PRE-INJECTION) EXPLOSIVES RESULTS ALONG GEOLOGIC CROSS-SECTION A-A' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	5-26

April 14, 2017 10:08:53 a.m.
Drawing: T:\CHAAP\16170837\27\2-2.dwg



LEGEND:

- TOPSOIL AND FILL (CLAY AND SILT)
- GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)
- FULLERTON FORMATION (BLUE CLAY AQUITARD)
- HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)
- WATER TABLE-FEBRUARY 2016
- ?------? DASHED WHERE INFERRED
- SCREEN INTERVAL 2016
- SCREEN INTERVAL 2009
- AREA OF INJECTION WESBLEND 66-10 TREATMENT ZONE (9.8% BY VOLUME) 2016
- GROUNDWATER FLOW DIRECTION IS NORTHEAST (OUT OF PLANE)
- (2) TNT CONCENTRATION (AUGUST 2015/FEBRUARY 2016)
- (2) RDX CONCENTRATION (AUGUST 2015/FEBRUARY 2016)
- 2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (TNT >2μg/L) AUGUST 2015/ FEBRUARY 2016
- 2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (RDX >2μg/L) AUGUST 2015/ FEBRUARY 2016

VERTICAL SCALE
10 5 0 10

HORIZONTAL SCALE
100 50 0 100

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2015/2016 (PRE-INJECTION) EXPLOSIVES RESULTS ALONG GEOLOGIC CROSS-SECTION B-B' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 9/13/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	5-27

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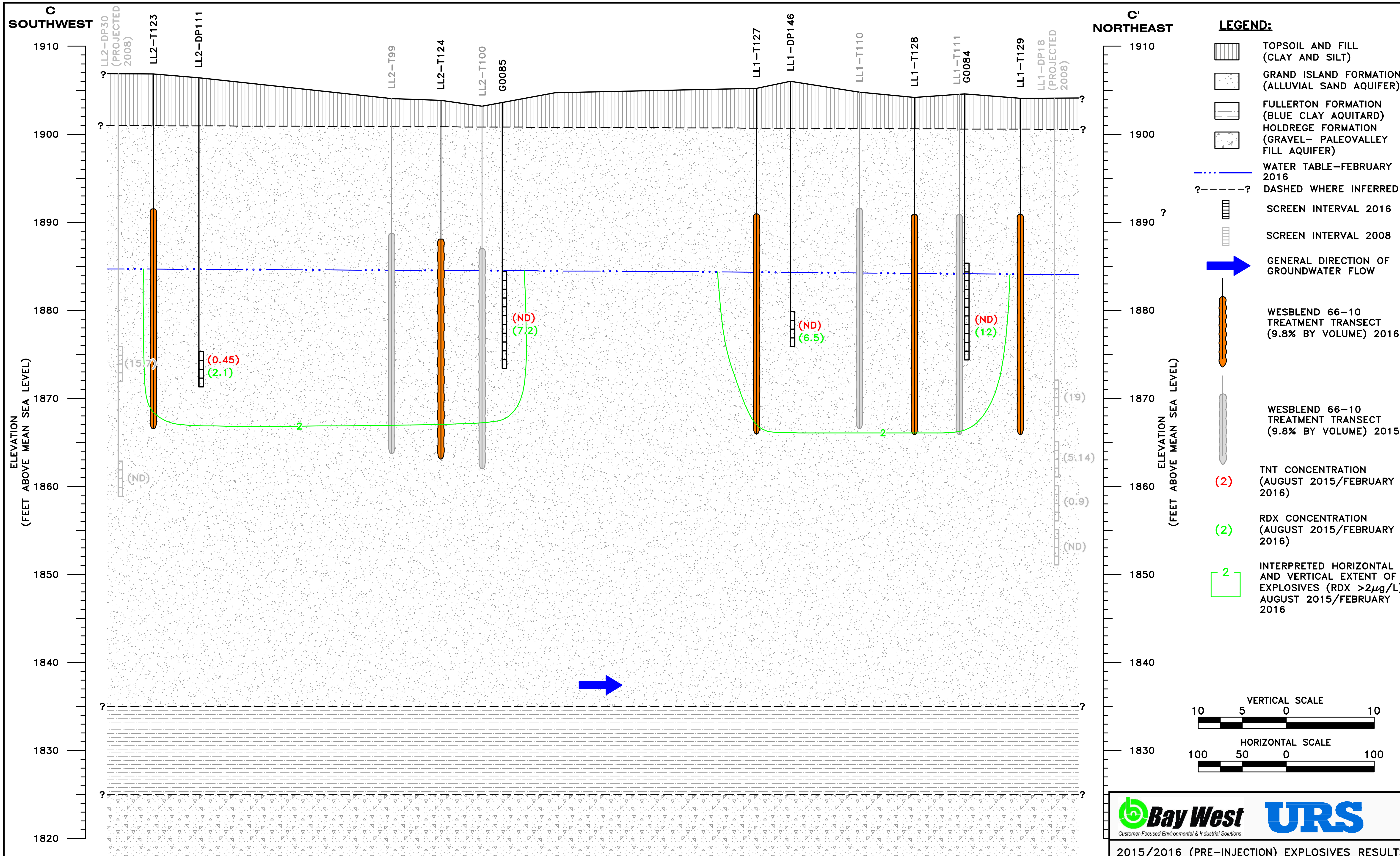

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2015/2016 (PRE–INJECTION) EXPLOSIVES RESULTS
ALONG GEOLOGIC CROSS–SECTION C–C'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/29/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	5–28

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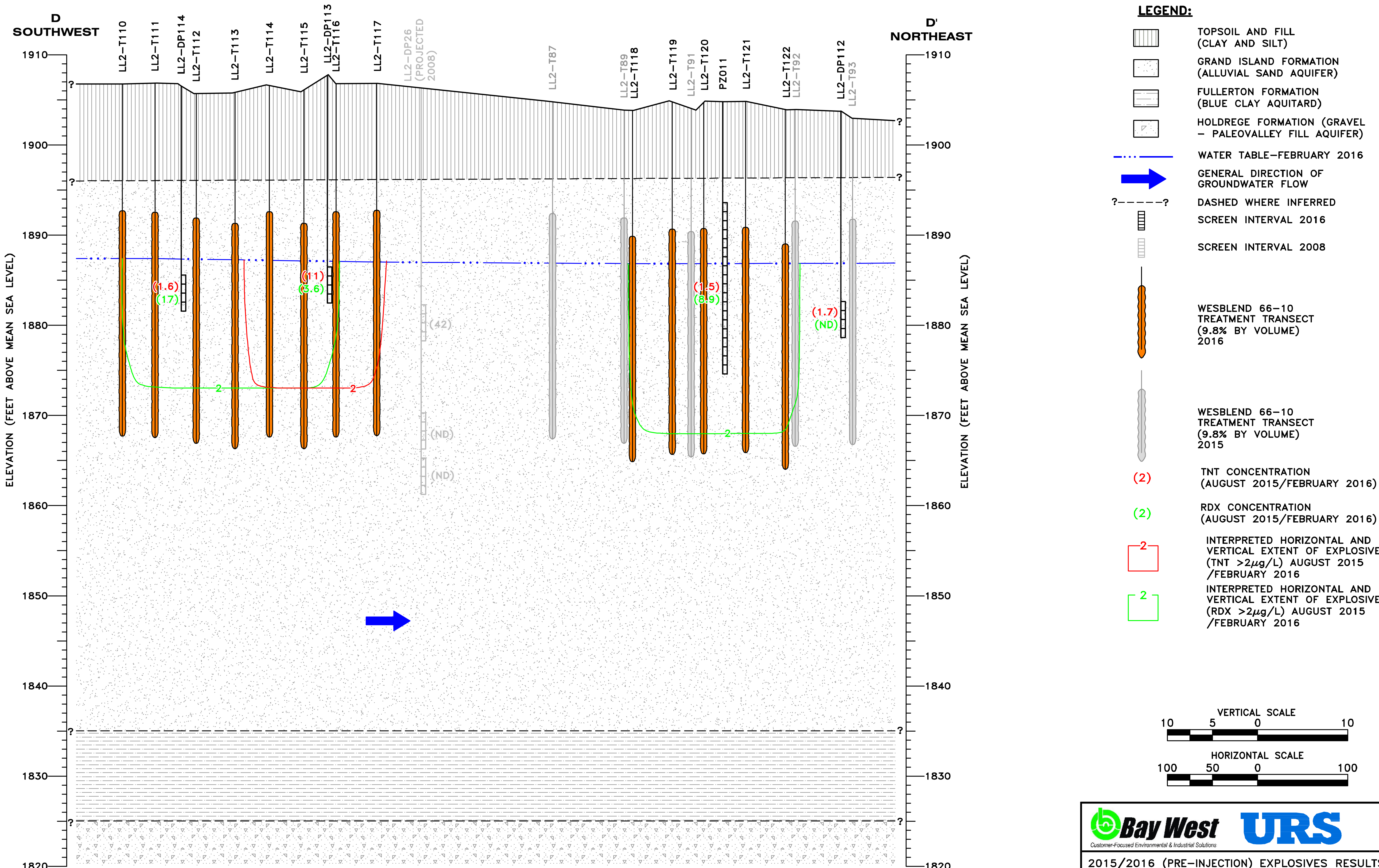

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2015/2016 (PRE-INJECTION) EXPLOSIVES RESULTS ALONG GEOLOGIC CROSS-SECTION D-D' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO. 16170837	FIG. NO. 5-29
CHK'D. BY: CA	REVISION: 0		

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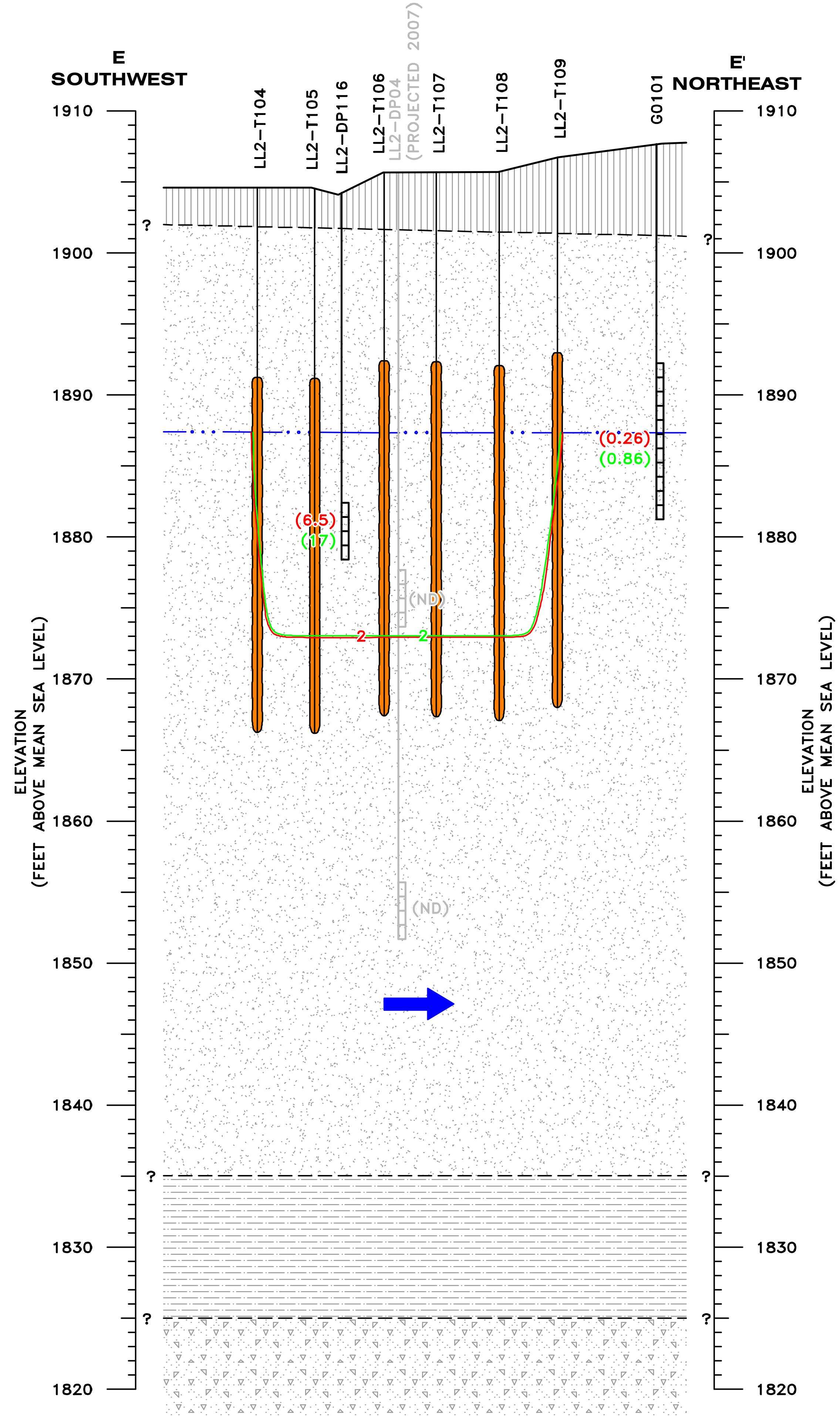
Drawing: T:\CHAAP\16170837\27\2-4.dwg



LEGEND:

TOPSOIL AND FILL (CLAY AND SILT)

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL–PALEOVALLEY FILL AQUIFER)

WATER TABLE–FEBRUARY 2016

?––––––? DASHED WHERE INFERRED

SCREEN INTERVAL 2016

SCREEN INTERVAL 2007

GENERAL DIRECTION OF GROUNDWATER FLOW

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2016

(2) TNT CONCENTRATION (AUGUST 2015/FEBRUARY 2016)

(2) RDX CONCENTRATION (AUGUST 2015/FEBRUARY 2016)

2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (TNT >2μg/L) AUGUST 2015 /FEBRUARY 2016

2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (RDX >2μg/L) AUGUST 2015 /FEBRUARY 2016

VERTICAL SCALE

10 5 0 10

HORIZONTAL SCALE

100 50 0 100

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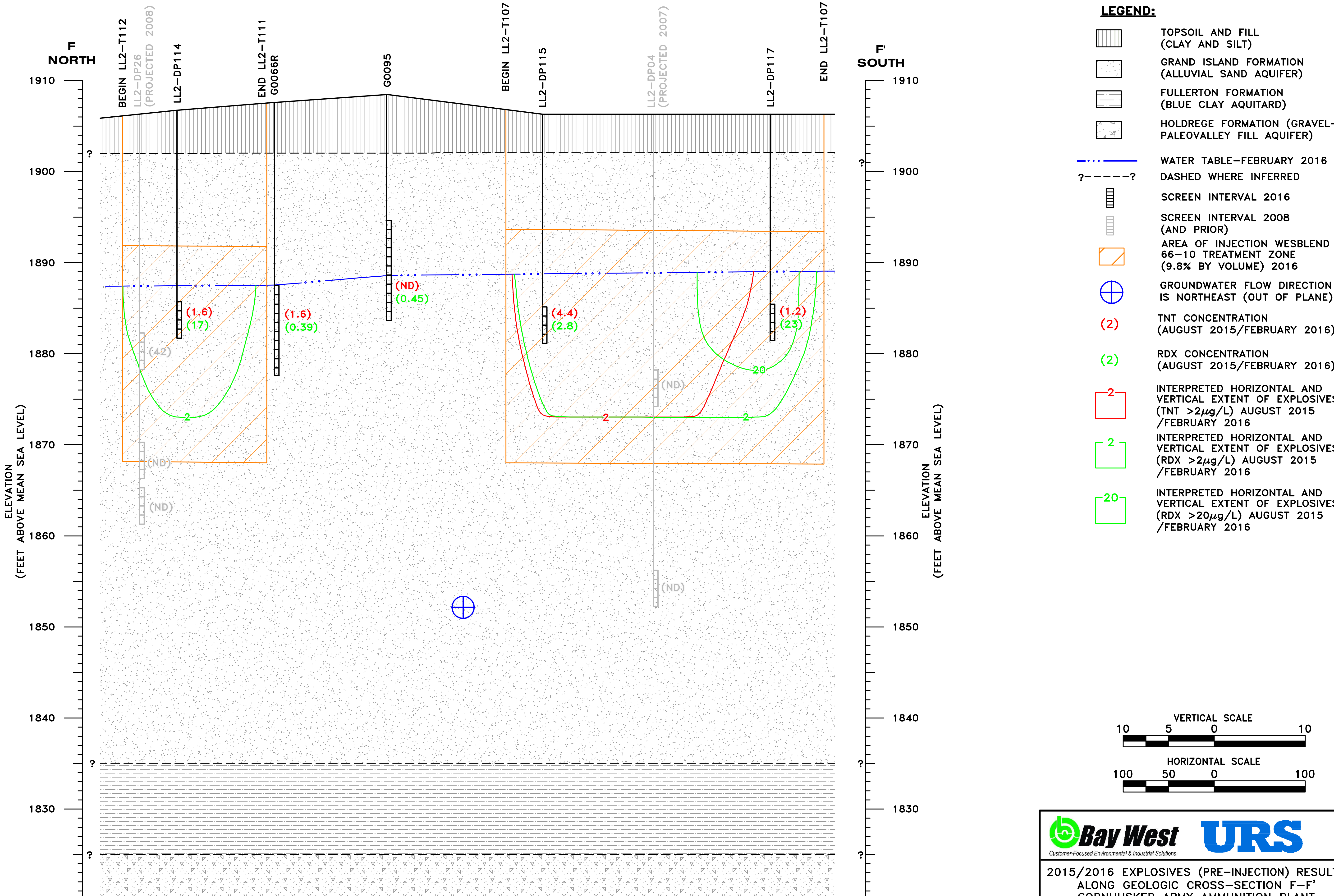
2015/2016 EXPLOSIVES (PRE–INJECTION) RESULTS ALONG GEOLOGIC CROSS–SECTION E–E' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO. 16170837	FIG. NO. 5–30
CHK'D. BY: CA	REVISION: 0		

April 14, 2017 10:21:06 a.m.
Drawing: T:\CHAAP\16170837\27\2–4.dwg



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2015/2016 EXPLOSIVES (PRE-INJECTION) RESULTS ALONG GEOLOGIC CROSS-SECTION F-F'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO. 16170837	FIG. NO. 5-31
CHK'D. BY: CA	REVISION: 0		

April 14, 2017 10:21:52 a.m.
Drawing: T:\CHAAP\16170837\27\2-4.dwg

SEE FIGURE 5-32c
SEE FIGURE 5-32b
13th STREET
COUNTY ROAD 24
NORTH ROAD
3rd AVENUE
LEGEND
LL1-DP137 2016 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (FEBRUARY)
G0015 2016 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)
G0121 2016 OU1 GROUNDWATER SAMPLING LOCATIONS (NOVEMBER)
(12.6) TNT CONCENTRATION
(12.6) RDX CONCENTRATION
(ND) NON DETECT
(NS) NOT SAMPLED
2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
BLDG 14 FORMER SITE FEATURES
ADVECTIVE PARTICLE TRANSPORT FLOWPATH (EW7 AT 450 GPM)
FENCE
SURFACE DRAINAGE
CROSS SECTION LINE
EW3 (INACTIVE) EXTRACTION WELL
G0015 ON-POST GROUNDWATER MONITORING WELL
PZ007 ON-POST PIEZOMETER
EW7-DP35 2015 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH)
LL1-DP01 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01 PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
ACTIVE IRRIGATION WELL
2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
NOTE: EXPLOSIVES PLUMES INTERPRETED VIA-PRE-INJECTION INVESTIGATION SAMPLING DATA (i.e. FEBRUARY 2016) WITHOUT PROXIMAL (OR FOLLOW-UP) POST-INJECTION SAMPLING DATA, CONSERVATIVELY WERE NOT ADJUSTED.
300 150 0 300
SCALE IN FEET
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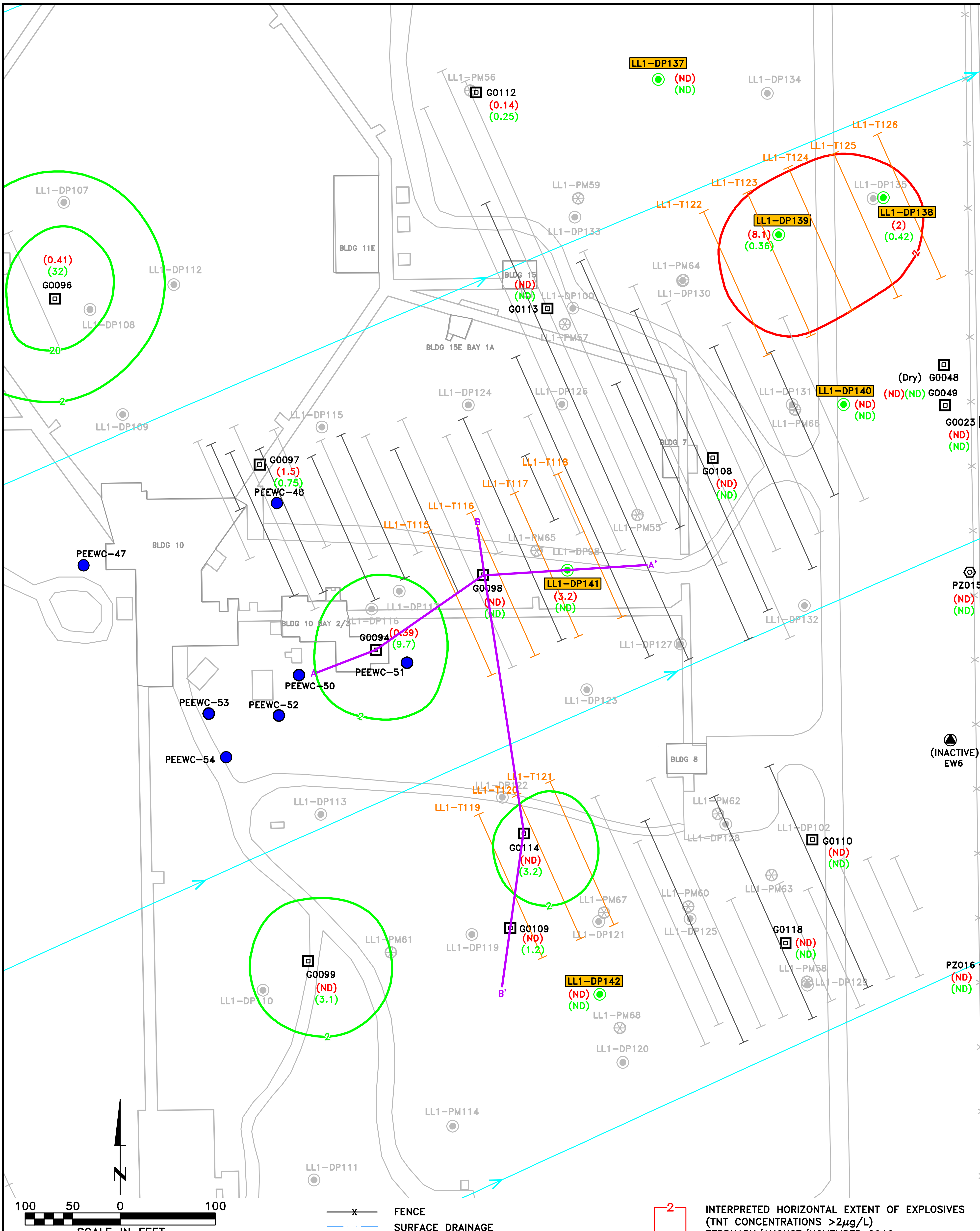
OU1 2016 (POST-INJECTION) EXTENT OF EXPLOSIVES PLUME
LOAD LINE 1 AND LOAD LINE 2 AND BETWEEN EW6 AND EW7
CORNHUSKER ARMY AMMUNITION PLANT
DRN. BY: DPG
DATE: 10/03/16
PROJECT NO. 16170837
FIG. NO. 5-32a
CHK'D. BY: CSA
REVISION: 0
April 18, 2017 3:56:05 p.m.
Drawing: T:\CHAAP\16170837\27\5-32a.dwg



LEGEND

LL1-DP137	2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION (FEBRUARY)
G0015	2016 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)
G0121	2016 OU1 GROUNDWATER SAMPLING LOCATIONS (NOVEMBER)
(61)	TNT CONCENTRATION
(61)	RDX CONCENTRATION
(ND)	NON DETECT
	2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 450 GPM)
	FENCE
	SURFACE DRAINAGE
PEEWC-52	APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)
	CROSS SECTION LINE
EW3 (INACTIVE)	EXTRACTION WELL
G0015	ON-POST GROUNDWATER MONITORING WELL
PZ007	ON-POST PIEZOMETER
LL1-DP01	DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01	PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
2	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
2	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
20	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST/NOVEMBER 2016

NOTE: EXPLOSIVES PLUMES INTERPRETED VIA-PRE-INJECTION INVESTIGATION SAMPLING DATA (i.e. FEBRUARY 2016) WITHOUT PROXIMAL (OR FOLLOW-UP) POST-INJECTION SAMPLING DATA, CONSERVATIVELY WERE NOT ADJUSTED.

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OU1 2016 (POST-INJECTION) EXTENT OF EXPLOSIVES PLUME
LOAD LINE 1
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/03/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CSA	REVISION: 0	16170837	5-32b

April 18, 2017 3:55:42 p.m.
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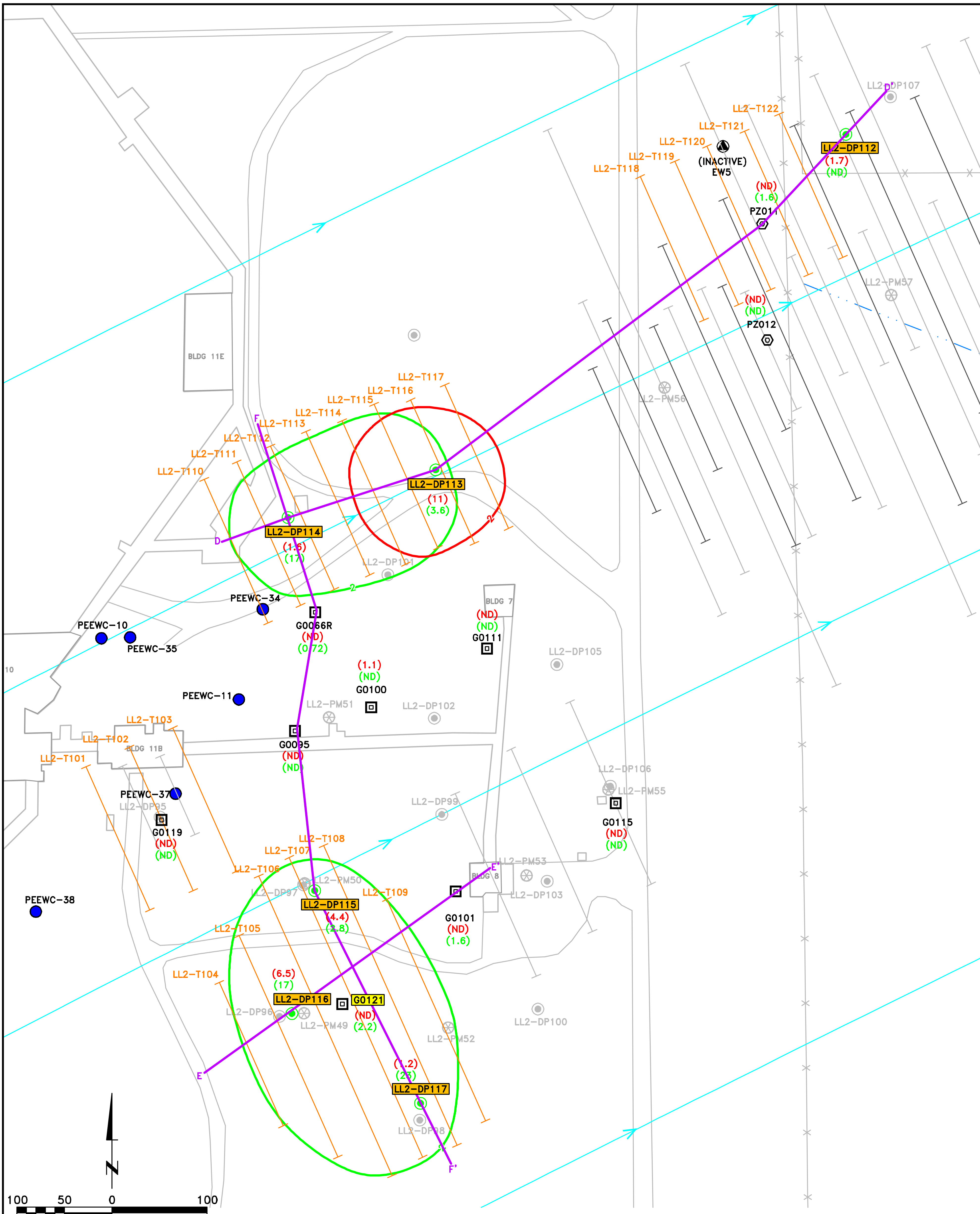

LEGEND

LL2-DP110	2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION (FEBRUARY)
G0015	2016 OU1 GROUNDWATER SAMPLING LOCATIONS (AUGUST)
G0121	2016 OU1 GROUNDWATER SAMPLING LOCATIONS (NOVEMBER)
(61)	TNT CONCENTRATION
(61)	RDX CONCENTRATION
(ND)	NON DETECT
	2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 450 GPM)
	FENCE
	SURFACE DRAINAGE
PEEWC-52	APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)
	CROSS SECTION LINE
EW3 (INACTIVE)	EXTRACTION WELL
G0015	ON-POST GROUNDWATER MONITORING WELL
PZ007	ON-POST PIEZOMETER
LL1-DP01	DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01	PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
2 (red)	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016
2 (green)	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016

NOTE: EXPLOSIVES PLUMES INTERPRETED VIA-PRE-INJECTION INVESTIGATION SAMPLING DATA (i.e. FEBRUARY 2016) WITHOUT PROXIMAL (OR FOLLOW-UP) POST-INJECTION SAMPLING DATA, CONSERVATIVELY WERE NOT ADJUSTED.

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OU1 2016 (POST-INJECTION) EXTENT OF EXPLOSIVES PLUME
LOAD LINE 2
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/03/16	PROJECT NO. 16170837	FIG. NO. 5-32c
CHK'D. BY: CSA	REVISION: 0		

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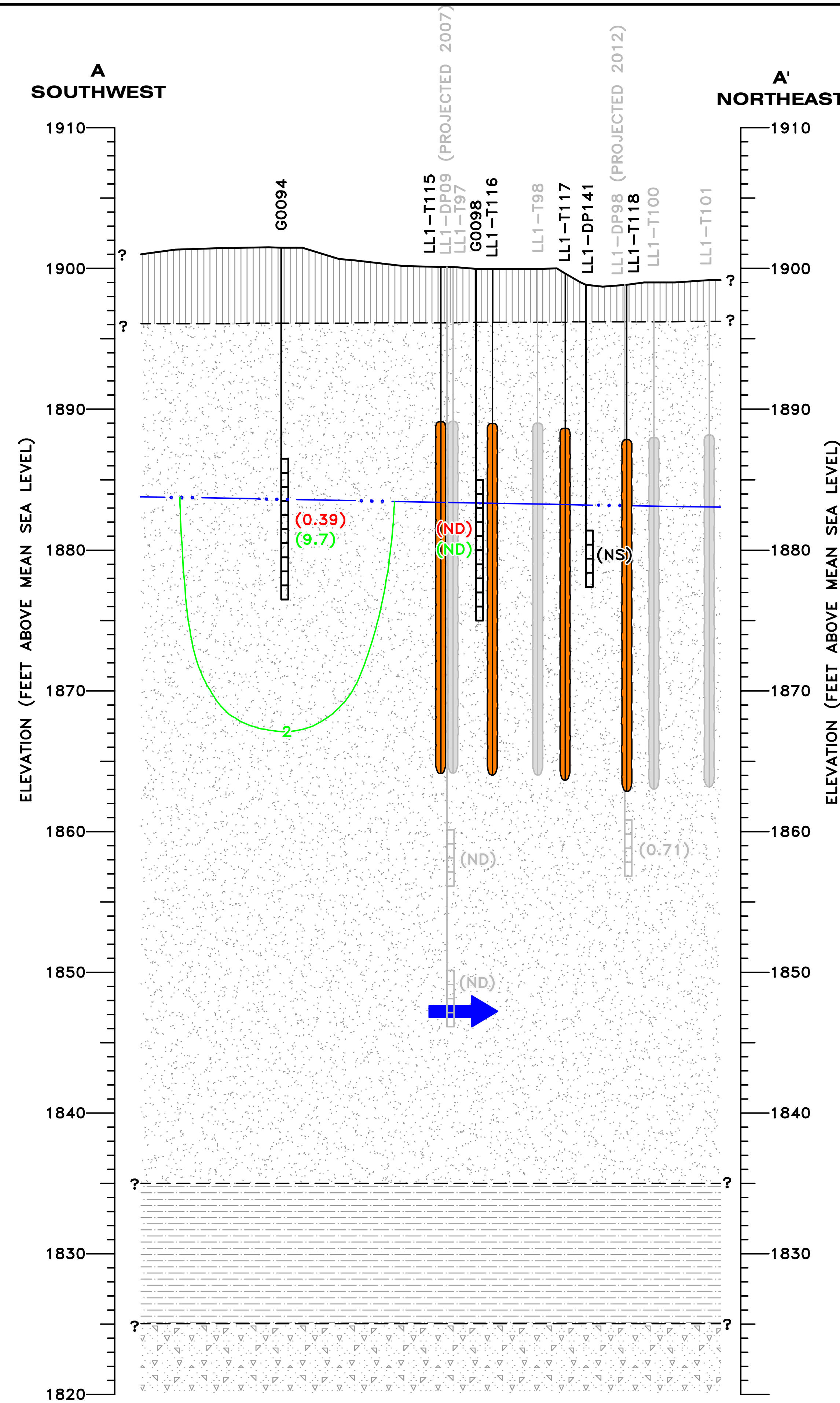

LEGEND:

TOPSOIL AND FILL (CLAY AND SILT)

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL – PALEOVALLEY FILL AQUIFER)

WATER TABLE–APRIL 2016

GENERAL DIRECTION OF GROUNDWATER FLOW

?–––––? DASHED WHERE INFERRED

SCREEN INTERVAL 2016

SCREEN INTERVAL 2012 (AND PRIOR)

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2016

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2015

ND NON DETECT
NS NOT SAMPLED

(2) TNT CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)

(2) RDX CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)

2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (TNT>2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016

2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (RDX >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016

NOTE: EXPLOSIVES PLUMES INTERPRETED VIA–PRE–INJECTION INVESTIGATION SAMPLING DATA (i.e. FEBRUARY 2016) WITHOUT PROXIMAL (OR FOLLOW–UP) POST–INJECTION SAMPLING DATA, CONSERVATIVELY WERE NOT ADJUSTED.

VERTICAL SCALE
10 5 0 10

HORIZONTAL SCALE
100 50 0 100

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2016 EXPLOSIVES (POST–INJECTION) RESULTS ALONG GEOLOGIC CROSS–SECTION A–A' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO. 16170837	FIG. NO. 5-33
CHK'D. BY: CA	REVISION: 0		

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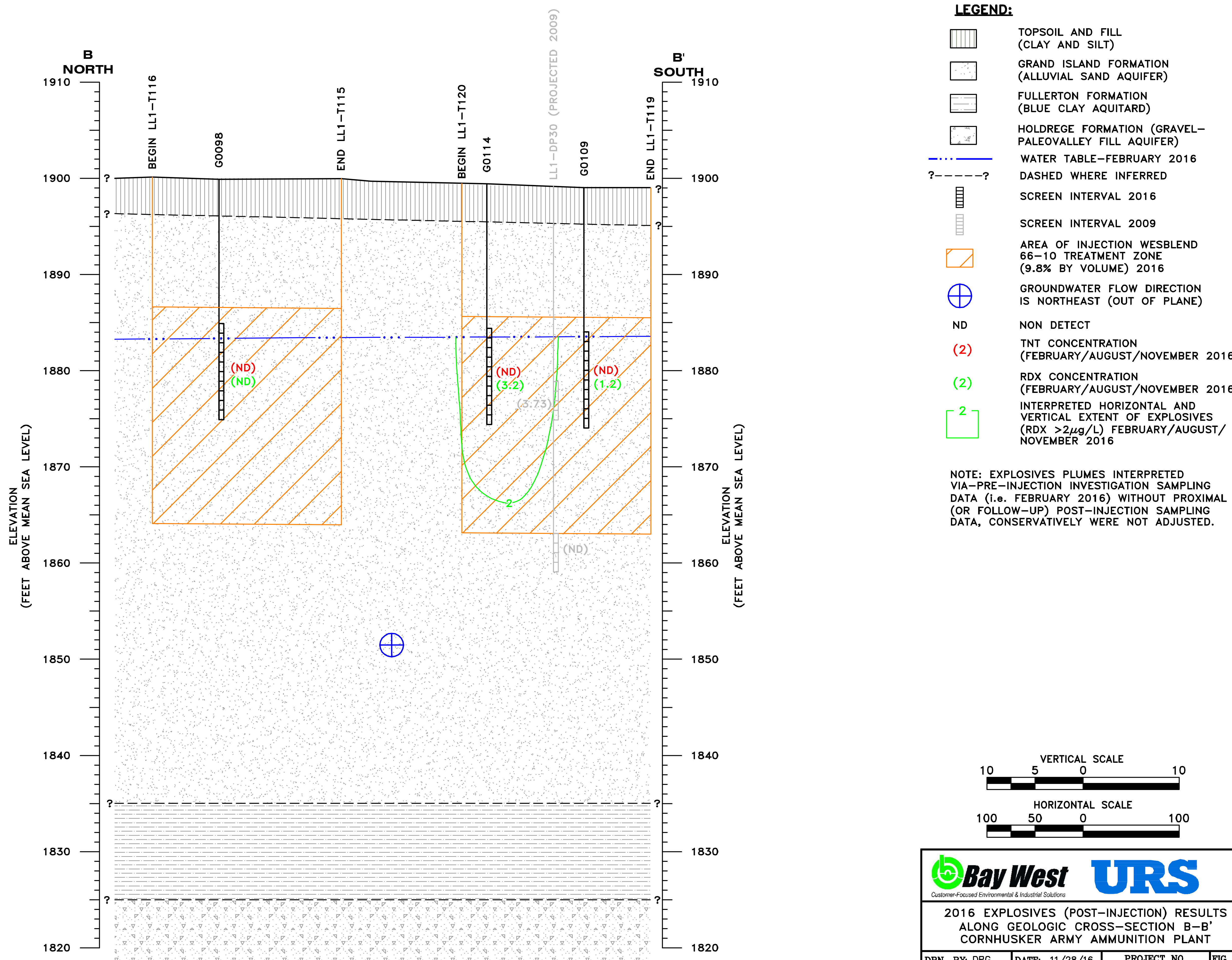

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2016 EXPLOSIVES (POST-INJECTION) RESULTS ALONG GEOLOGIC CROSS-SECTION B-B' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO. 16170837	FIG. NO. 5-34
CHK'D. BY: CA	REVISION: 0		

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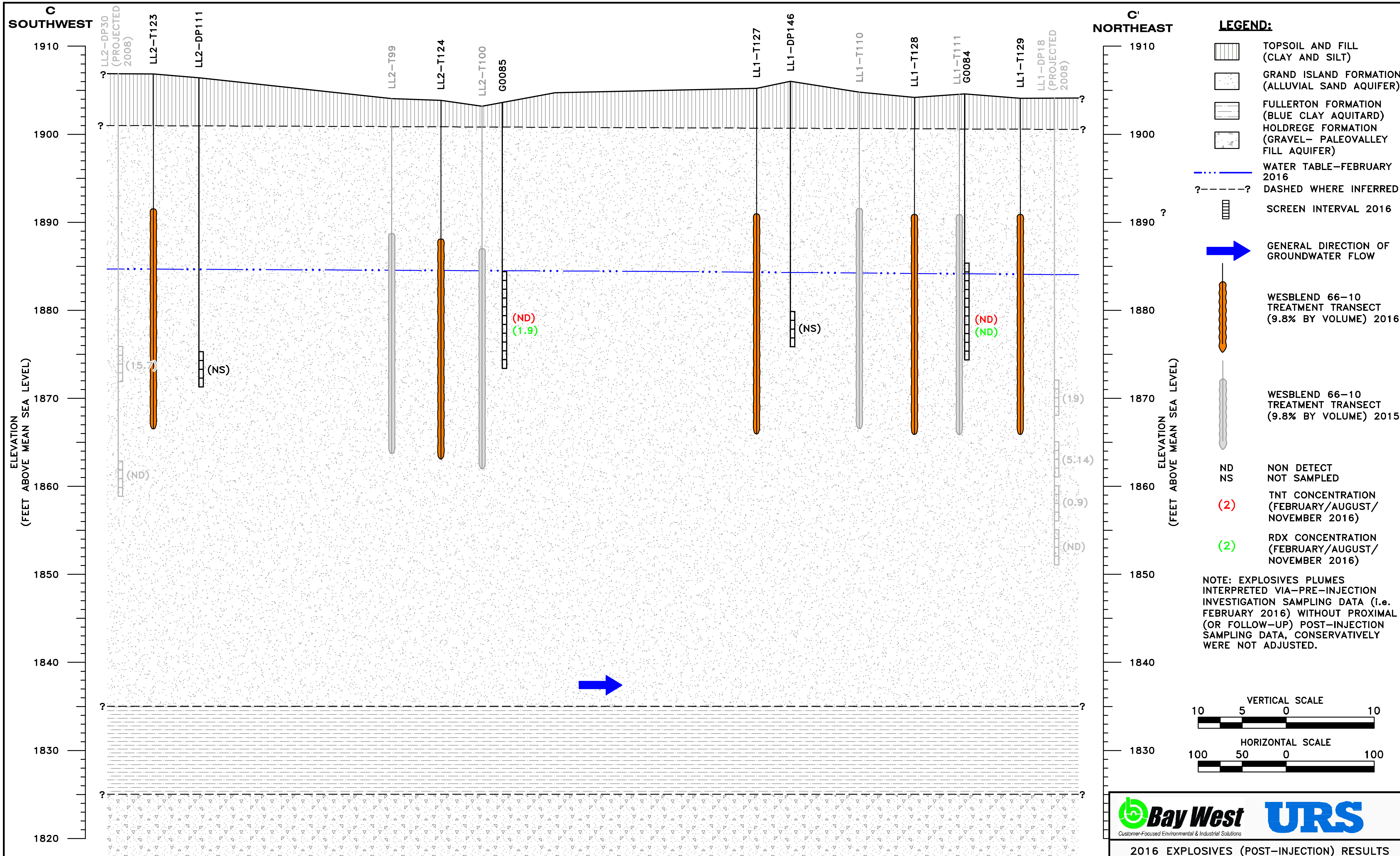

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2016 EXPLOSIVES (POST-INJECTION) RESULTS ALONG GEOLOGIC CROSS-SECTION C-C' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/29/16	PROJECT NO. 16170837	FIG. NO. 5-35
CHK'D. BY: CA	REVISION: 0		

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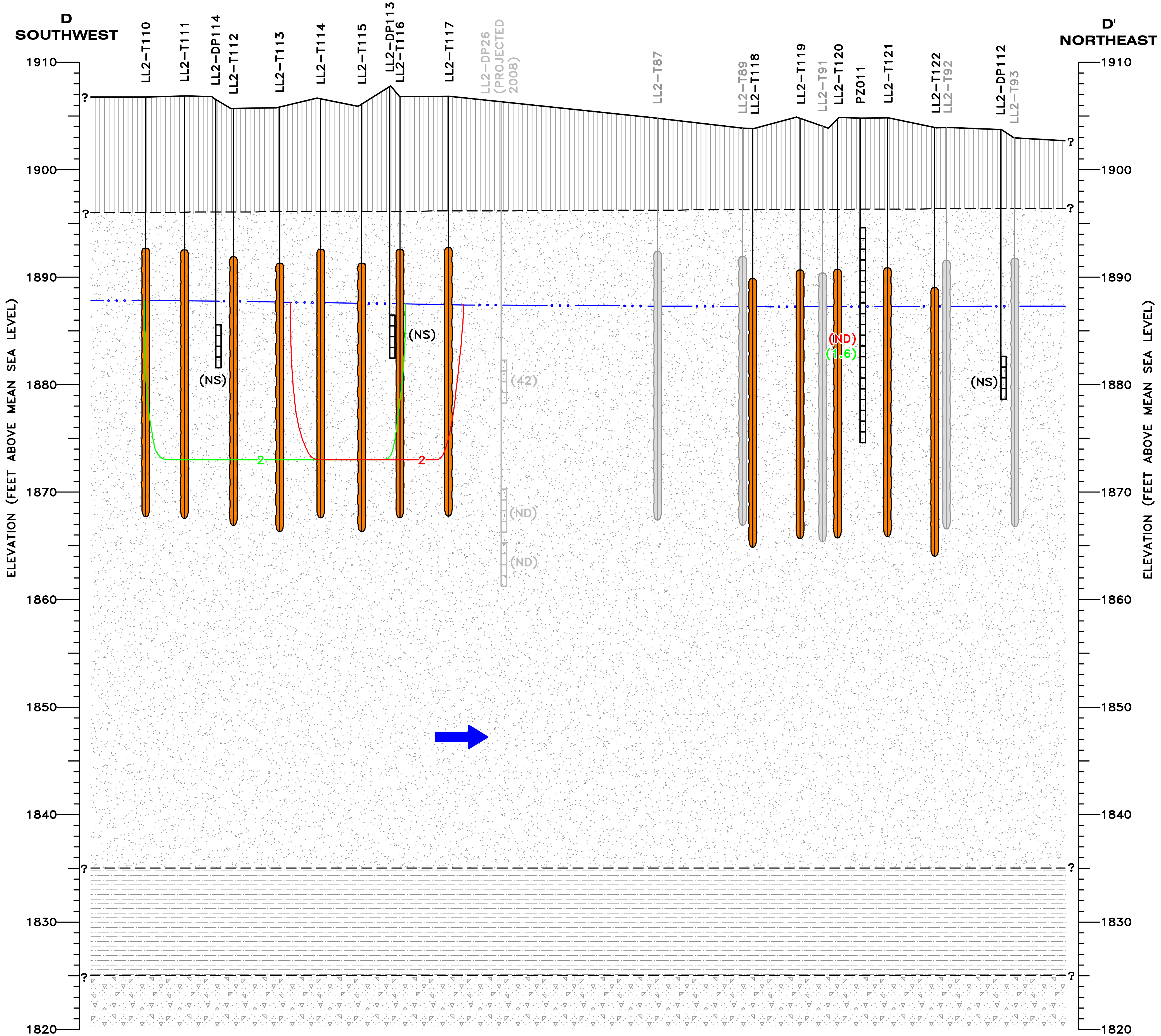

LEGEND:

TOPSOIL AND FILL (CLAY AND SILT)

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL – PALEOVALLEY FILL AQUIFER)

WATER TABLE–FEBRUARY 2016

GENERAL DIRECTION OF GROUNDWATER FLOW

?-----? DASHED WHERE INFERRED

SCREEN INTERVAL 2016

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2016

WESBLEND 66–10 TREATMENT TRANSECT (9.8% BY VOLUME) 2015

ND NON DETECT

NS NOT SAMPLED

(2) TNT CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)

(2) RDX CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)

2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (TNT >2μg/L) FEBRUARY/AUGUST/ NOVEMBER 2016

2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (RDX >2μg/L) FEBRUARY/AUGUST/ NOVEMBER 2016

NOTE: EXPLOSIVES PLUMES INTERPRETED VIA–PRE–INJECTION INVESTIGATION SAMPLING DATA (i.e. FEBRUARY 2016) WITHOUT PROXIMAL (OR FOLLOW–UP) POST–INJECTION SAMPLING DATA, CONSERVATIVELY WERE NOT ADJUSTED.

VERTICAL SCALE
10 5 0 10

HORIZONTAL SCALE
100 50 0 100

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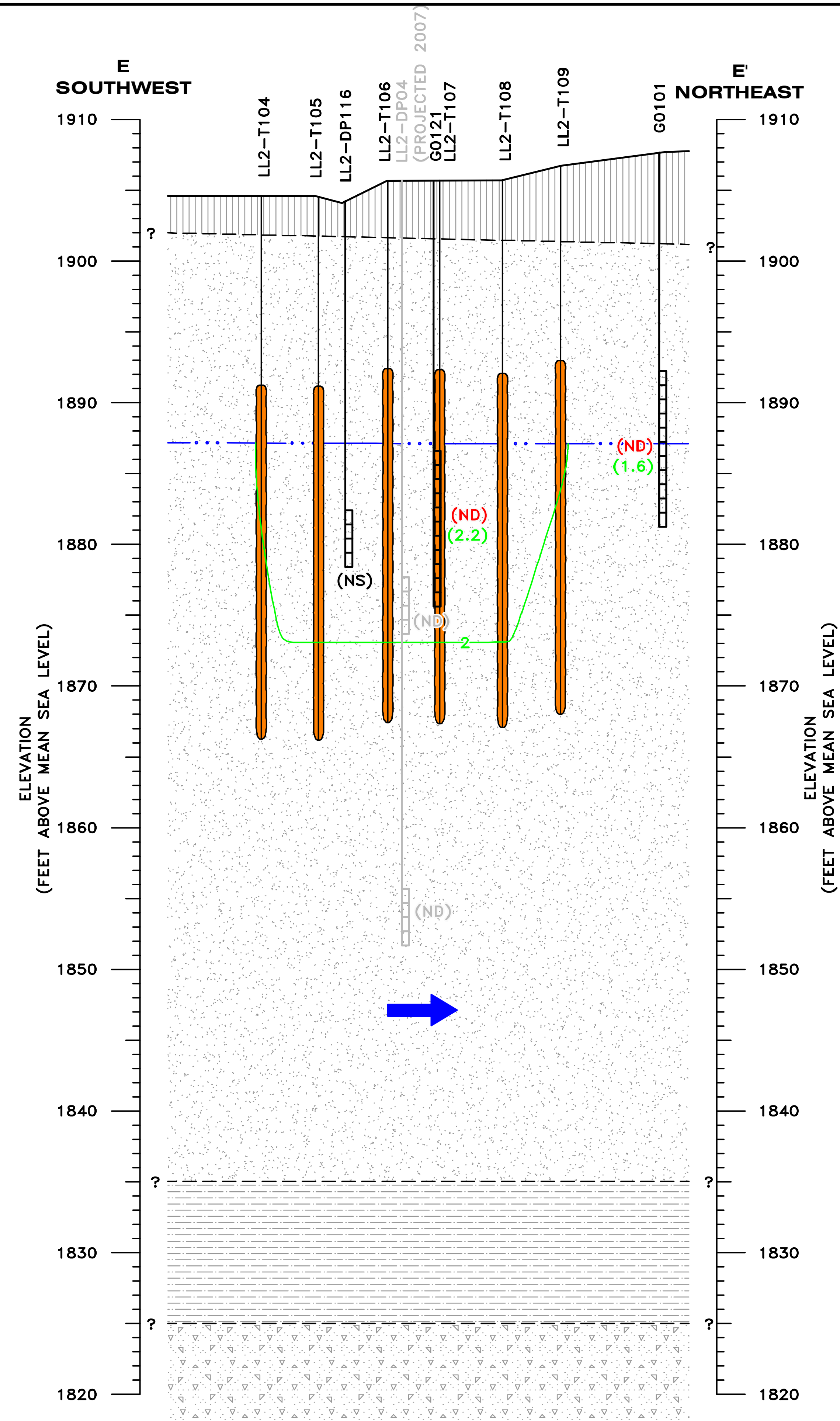
2016 EXPLOSIVES (POST–INJECTION) RESULTS ALONG GEOLOGIC CROSS–SECTION D–D' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO. 16170837	FIG. NO. 5–36
CHK'D. BY: CA	REVISION: 0		

April 18, 2017 3:58:40 p.m.
Drawing: T:\CHAAP\16170837\27\5-35.dwg



LEGEND:

- TOPSOIL AND FILL (CLAY AND SILT)
- GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)
- FULLERTON FORMATION (BLUE CLAY AQUITARD)
- HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)
- WATER TABLE-FEBRUARY 2016
- ?-----? DASHED WHERE INFERRED
- SCREEN INTERVAL 2016
- GENERAL DIRECTION OF GROUNDWATER FLOW
- WESBLEND 66-10 TREATMENT TRANSECT (9.8% BY VOLUME) 2016
- ND NON DETECT
- NS NOT SAMPLED
- (2) TNT CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)
- (2) RDX CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)
- 2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (RDX >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016

NOTE: EXPLOSIVES PLUMES INTERPRETED VIA-PRE-INJECTION INVESTIGATION SAMPLING DATA (i.e. FEBRUARY 2016) WITHOUT PROXIMAL (OR FOLLOW-UP) POST-INJECTION SAMPLING DATA, CONSERVATIVELY WERE NOT ADJUSTED.

VERTICAL SCALE
10 5 0 10

HORIZONTAL SCALE
100 50 0 100

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2016 EXPLOSIVES (POST-INJECTION) RESULTS
ALONG GEOLOGIC CROSS-SECTION E-E'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	5-37

April 18, 2017 3:59:02 p.m.
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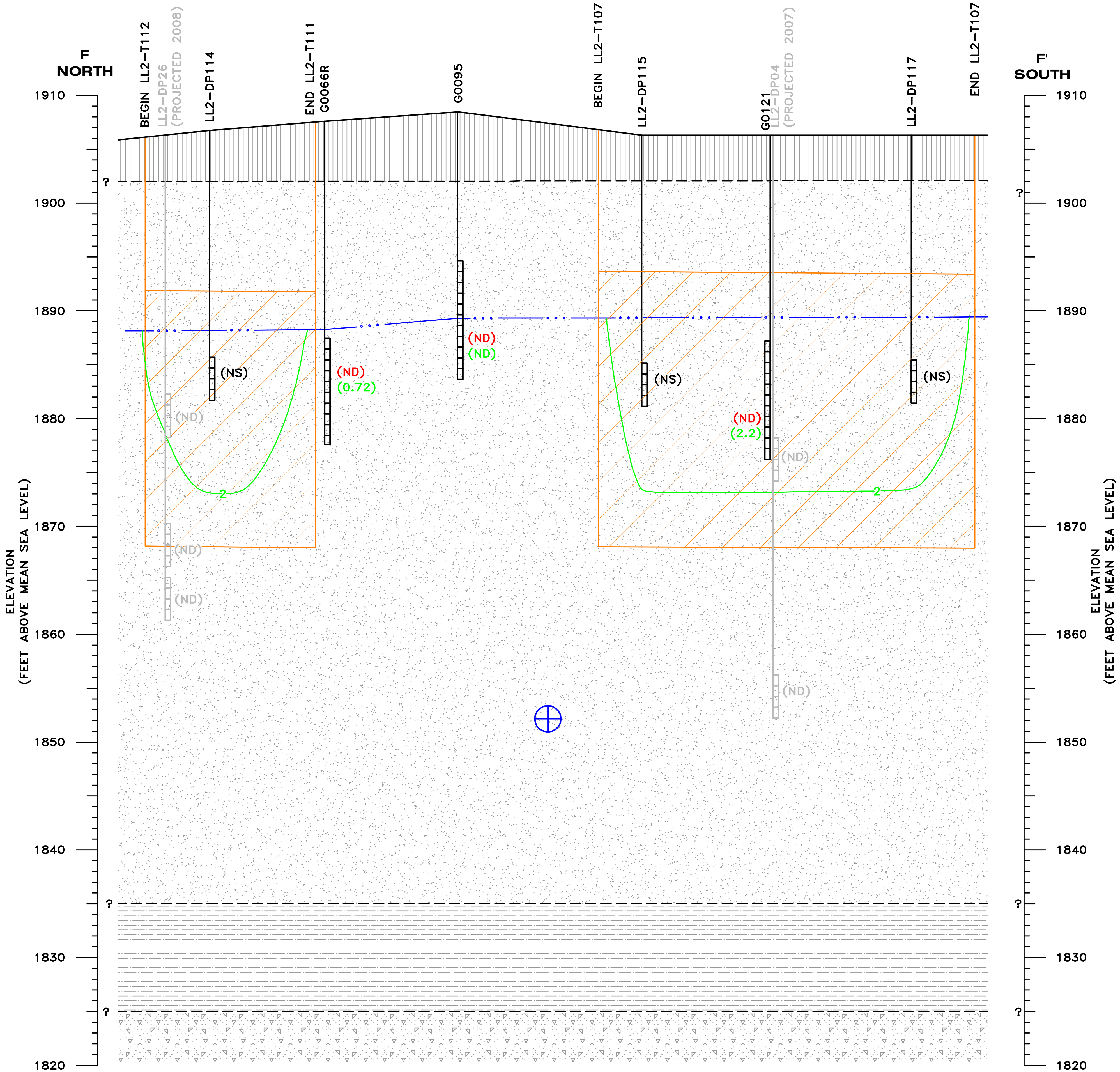

LEGEND:

TOPSOIL AND FILL (CLAY AND SILT)

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)

WATER TABLE–FEBRUARY 2016

?------? DASHED WHERE INFERRED

SCREEN INTERVAL 2016

AREA OF INJECTION WESBLEND 66-10 TREATMENT ZONE (9.8% BY VOLUME) 2016

GROUNDWATER FLOW DIRECTION IS NORTHEAST (OUT OF PLANE)

ND NON DETECT

NS NOT SAMPLED

(2) TNT CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)

(2) RDX CONCENTRATION (FEBRUARY/AUGUST/NOVEMBER 2016)

2 INTERPRETED HORIZONTAL AND VERTICAL EXTENT OF EXPLOSIVES (RDX >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016

NOTE: EXPLOSIVES PLUMES INTERPRETED VIA-PRE-INJECTION INVESTIGATION SAMPLING DATA (i.e. FEBRUARY 2016) WITHOUT PROXIMAL (OR FOLLOW-UP) POST-INJECTION SAMPLING DATA, CONSERVATIVELY WERE NOT ADJUSTED.

VERTICAL SCALE
10 5 0 10

HORIZONTAL SCALE
100 50 0 100

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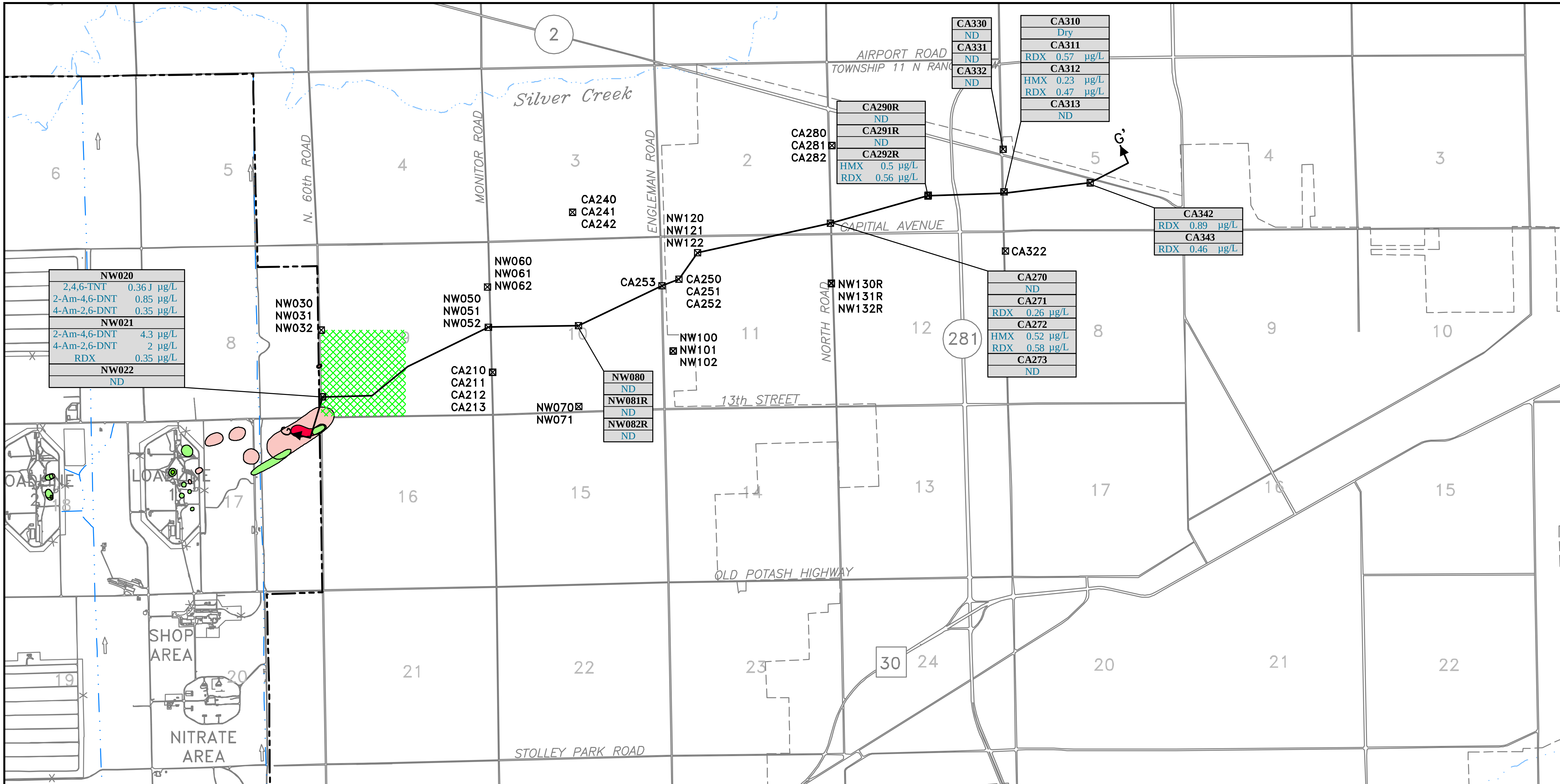
2016 EXPLOSIVES (POST-INJECTION) RESULTS ALONG GEOLOGIC CROSS-SECTION F-F' CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 11/28/16	PROJECT NO.	FIG. NO.
CHK'D. BY: CA	REVISION: 0	16170837	5-38

April 18, 2017 3:59:24 p.m.
Drawing: T:\CHAAP\16170837\27\5-35.dwg



LEGEND:

FACILITY BOUNDARY

GRAND ISLAND CITY LIMITS

DRAINAGE DITCH FLOW DIRECTION

SURFACE DRAINAGE

1 SECTION NUMBER

NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL

PZ016 EXPLOSIVES GROUNDWATER SAMPLING RESULTS – AUGUST 2016

G G' GEOLOGIC CROSS-SECTION

2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >2µg/L) – AUGUST 2016

20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >20µg/L) – AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) – AUGUST 2016

20 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) – AUGUST 2016

FEEDLOT AREA

1,3,5-TNB = 1,3,5-TRINITROBENZENE
2-AM-4,6-DNT = 2-AMINO-4,6-DINITROTOLUENE
2,4,6-TNT = 2,4,6-TRINITROTOLUENE
4-AM-4,6-DNT = 4-AMINO-2,6-DINITROTOLUENE
HMX = OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE
J = ESTIMATED QUALIFIER
LTM = LONG-TERM MONITORING
ND = NONDETECT
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE: EXPLOSIVES PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.

N

0 3000 6000
SCALE FEET

January 12, 2017 10:42:39 a.m.
Drawing: T:\CHAAP\16170837\27\5-39.dwg

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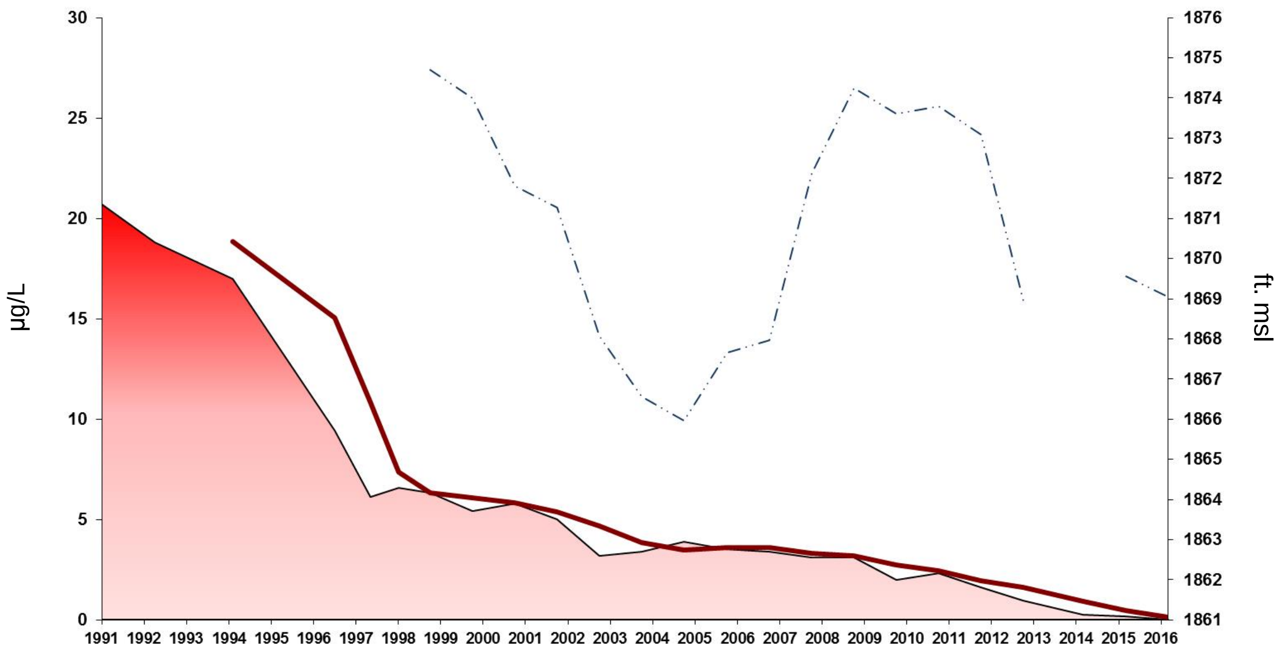
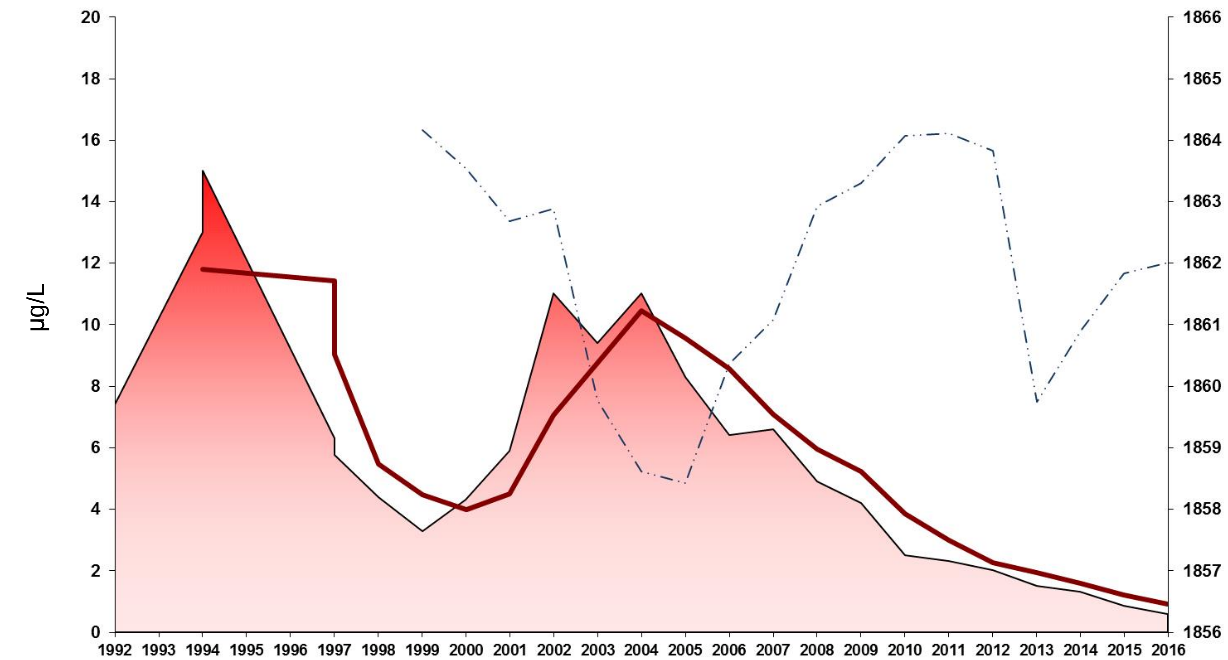
OFF-POST EXPLOSIVES PLUME
(OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/13/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/13/16	16170837	5-39

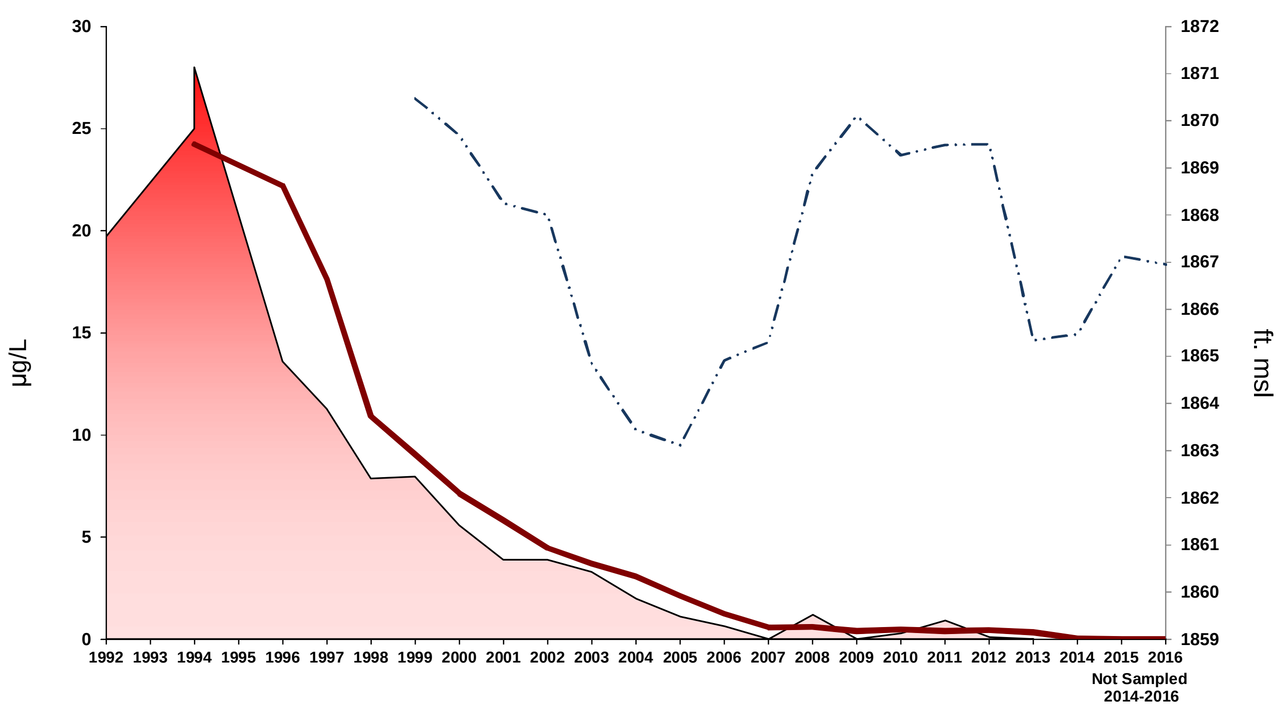
RDX CONCENTRATION
OFF-POST WELL NW081/NW081R



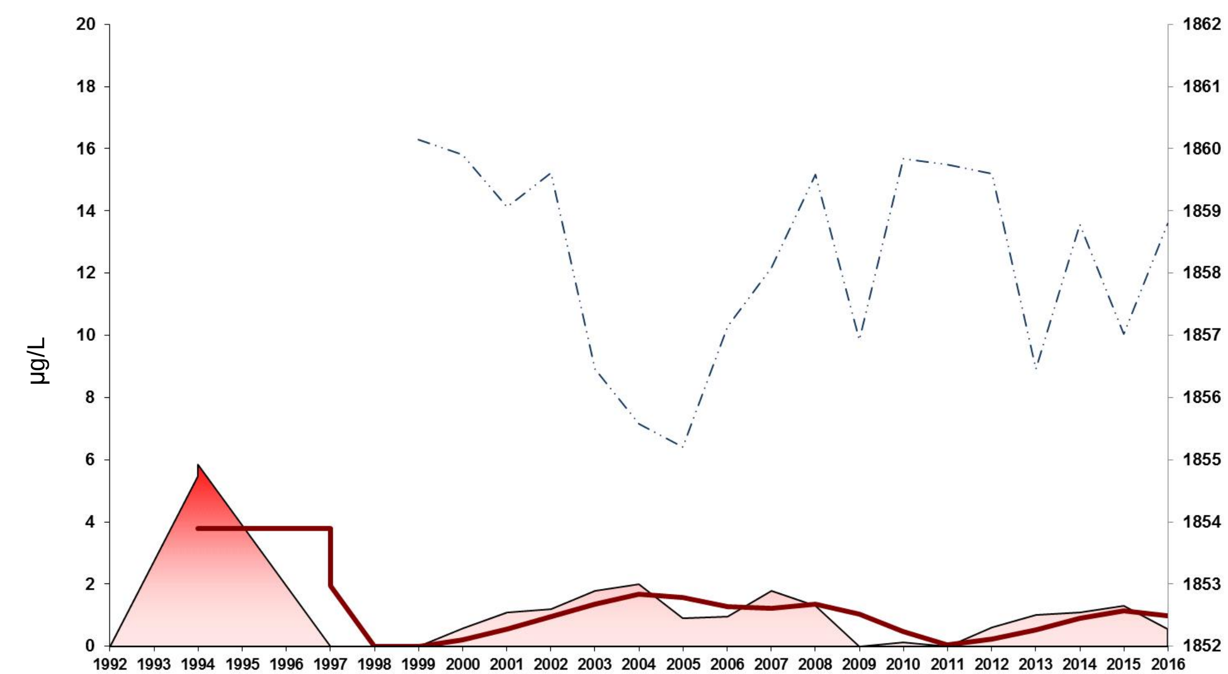
RDX CONCENTRATION
OFF-POST WELL CA272



RDX CONCENTRATION
OFF-POST WELL CA251



RDX CONCENTRATION
OFF-POST WELL CA292/CA292R



LEGEND:

RDX

3 POINT MOVING AVERAGE (RDX)

LTM WATER LEVEL (ft. msl)

NOTE:

TNT IS NONDETECT IN THE SELECTED WELLS

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RDX CONCENTRATION TRENDS IN SELECTED OFF-POST MONITORING WELLS (OU1)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	5-40

January 12, 2017 1:33:14 p.m.
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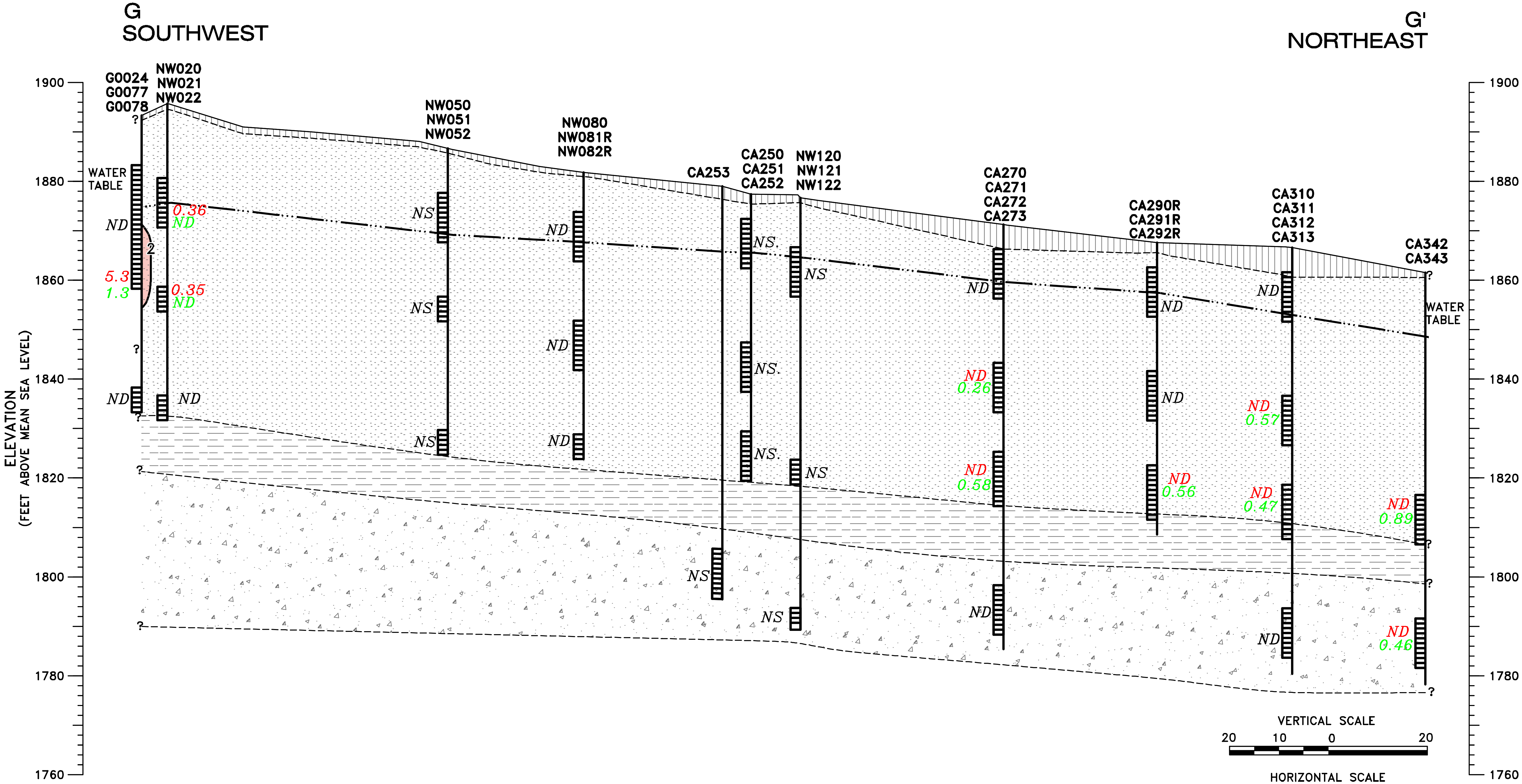

NOTE: VERTICAL EXAGGERATION IS 100:1

LEGEND:

61 MONITORING WELL SCREEN INTERVAL WITH AUGUST 2016 TOTAL TARGET CLEANUP EXPLOSIVES CONCENTRATION (e.g., 2,4,6-TNT AND RDX)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)

WATER TABLE-AUGUST 2016

2 INTERPRETED VERTICAL AND HORIZONTAL EXTENT OF EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >2μg/L)

1.4 RDX CONCENTRATION
1.4 TNT CONCENTRATION

2,4,6-TNT = 2,4,6-TRINITROTOLUENE
ND = NONDETECT
NS = NOT SAMPLED
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
μg/L = MICROGRAMS PER LITER

January 12, 2017 10:45:34 a.m.
Drawing: T:\CHAAP\16170837\27\5-41.dwg

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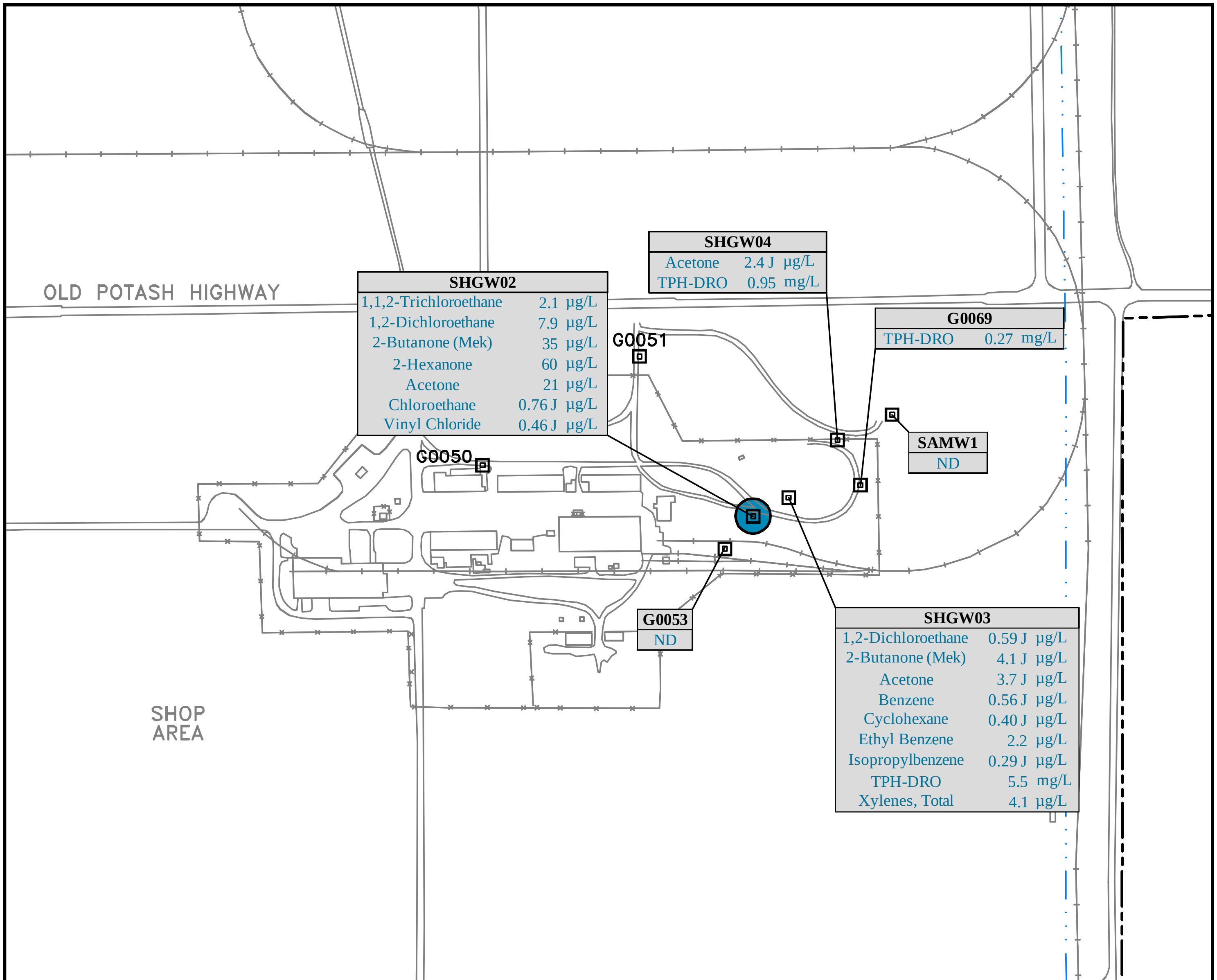
TOTAL EXPLOSIVES CONCENTRATIONS
ALONG GEOLOGIC CROSS-SECTION G-G'
(OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	5-41



LEGEND:

ON-POST GROUNDWATER MONITORING WELL

VOC CONCENTRATIONS > MCL
(1,2-DCA MCL IS 5 μg/L)

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,2-DCA = 1,2-DICHLOROETHANE
J = ESTIMATED QUALIFIER
MCL = MAXIMUM CONTAINANT LEVEL
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND
TPH-DRO = TOTAL PETROLEUM
HYDROCARBON-DIESEL RANGE ORGANICS

0 500 1000
SCALE FEET

N

December 15, 2016 3:43:12 p.m.
Drawing: T:\CHAAP\16170837\27\5-42.dwg

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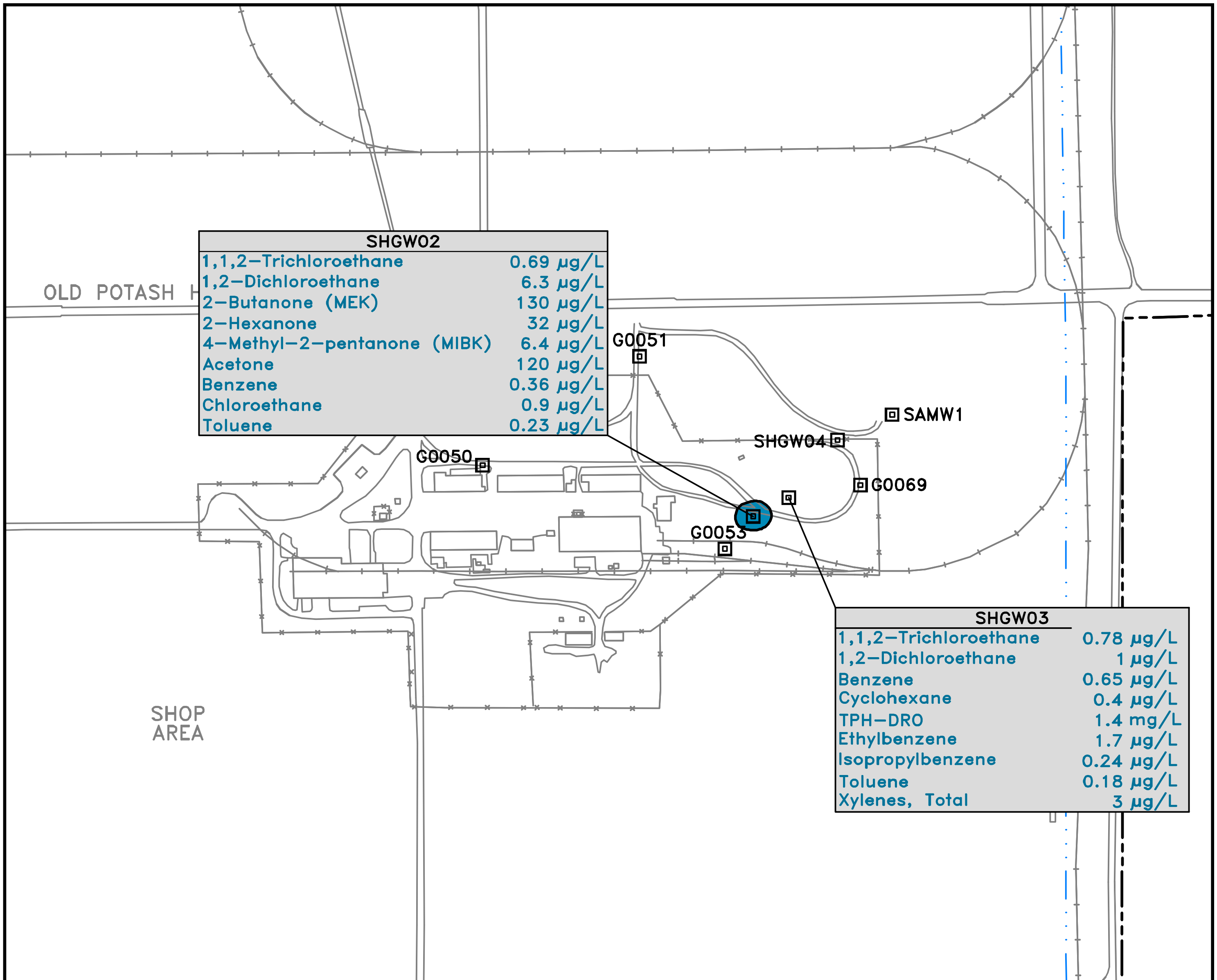
VOC PLUME
SHOP AREA (OU3) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	5-42



LEGEND:

ON–POST GROUNDWATER MONITORING WELL

VOC CONCENTRATIONS > MCL
(1,2–DCA MCL IS 5 µg/L)

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,2–DCA = 1,2–DICHLOROETHANE
J = ESTIMATED QUALIFIER
MCL = MAXIMUM CONTAMINANT LEVEL
Mg/L = MILLIGRAMS PER LITER
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND
TPH–DRO = TOTAL PETROLEUM HYDROCARBON–DIESEL RANGE ORGANICS

0 500 1000
SCALE FEET

December 07, 2016 11:16:36 a.m.
Drawing: T:\CHAAP\16170837\27\5–43.dwg

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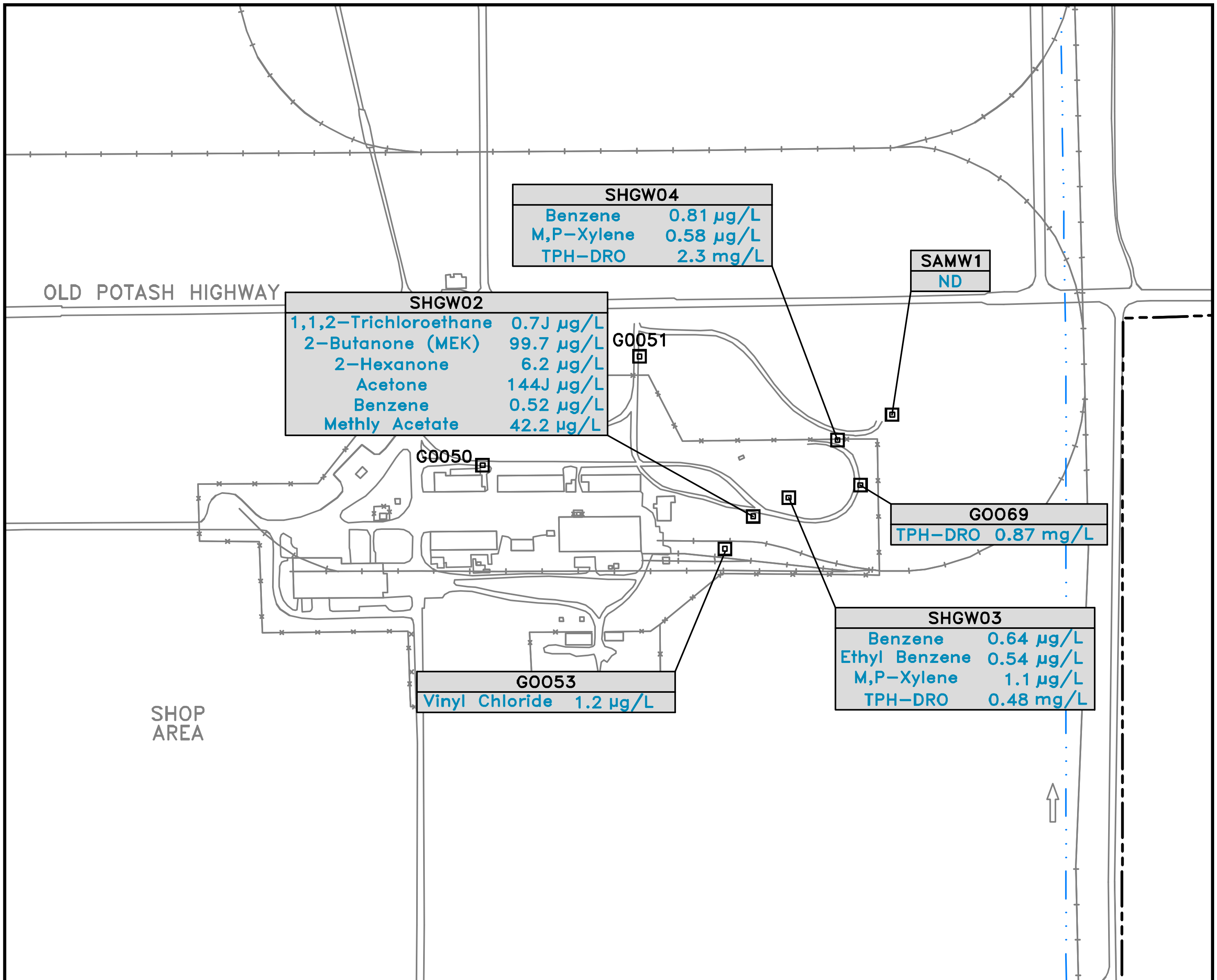
VOC PLUME
SHOP AREA (OU3) AUGUST 2014
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–43



LEGEND:

ON–POST GROUNDWATER MONITORING WELL

VOC CONCENTRATIONS ARE LESS THAN MAXIMUM CONTAMINANT LEVEL (MCL) (1,1,2–TCA MCL IS 5 µg/L)

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,1,2–TCA = 1,1,2–TRICHLOROETHANE
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND
TPH–DRO = TOTAL PETROLEUM HYDROCARBON–DIESEL RANGE ORGANICS

0 500 1000

SCALE FEET

N

December 07, 2016 11:17:41 a.m.
Drawing: T:\CHAAP\16170837\27\5–44.dwg

Bay West
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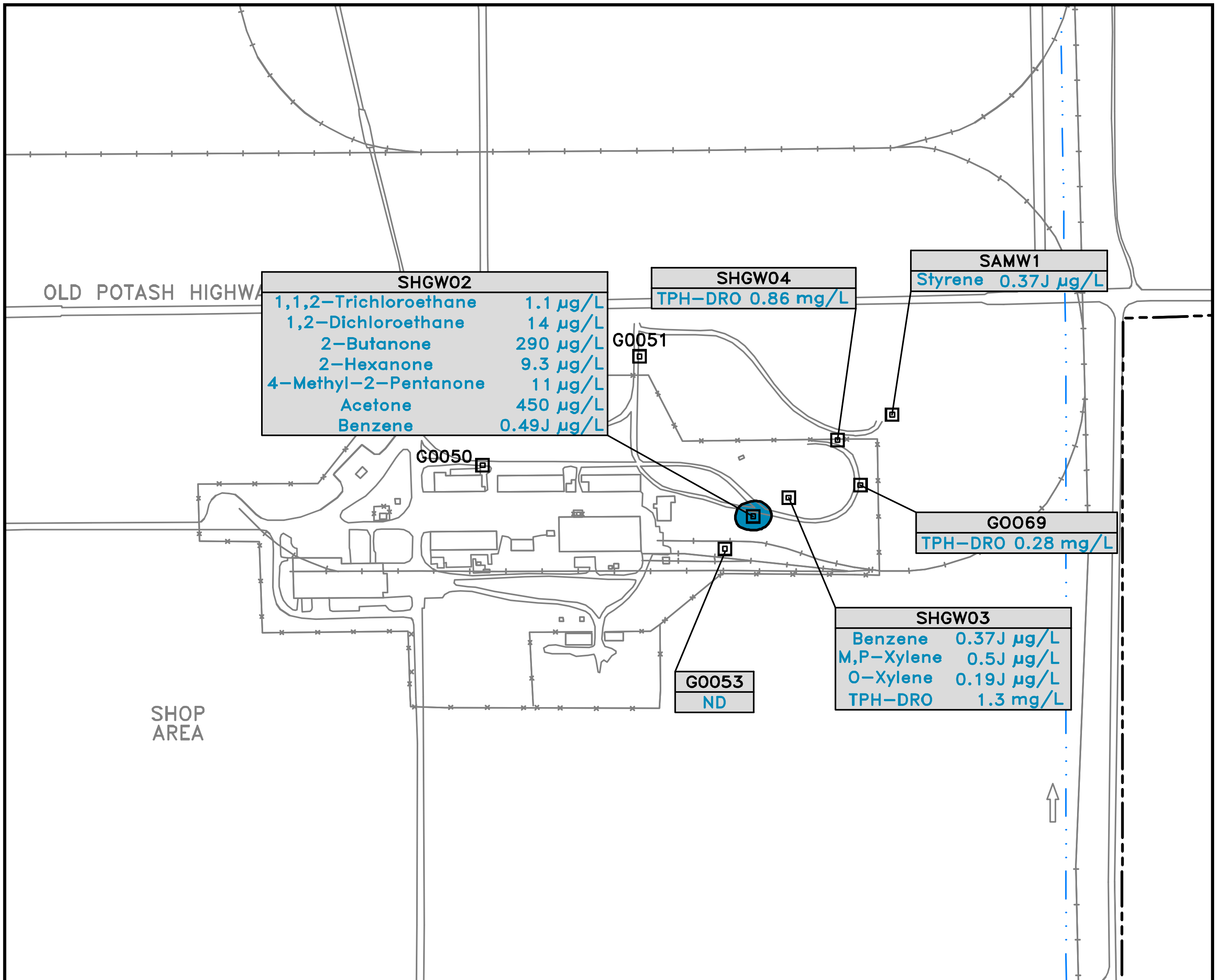
VOC PLUME
SHOP AREA (OU3) MARCH 2012
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–44



LEGEND:

ON-POST GROUNDWATER MONITORING WELL

VOC CONCENTRATION > MAXIMUM CONTAMINANT LEVEL (MCL) (1,2-DCA MCL IS 5 µg/L)

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,2-DCA = 1,2-DICHLOROETHANE
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND
TPH-DRO = TOTAL PETROLEUM HYDROCARBON-DIESEL RANGE ORGANICS

0 500 1000
SCALE FEET

N

Bay West
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VOC PLUME
SHOP AREA (OU3) MARCH 2010
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5-45

December 07, 2016 11:18:40 a.m.
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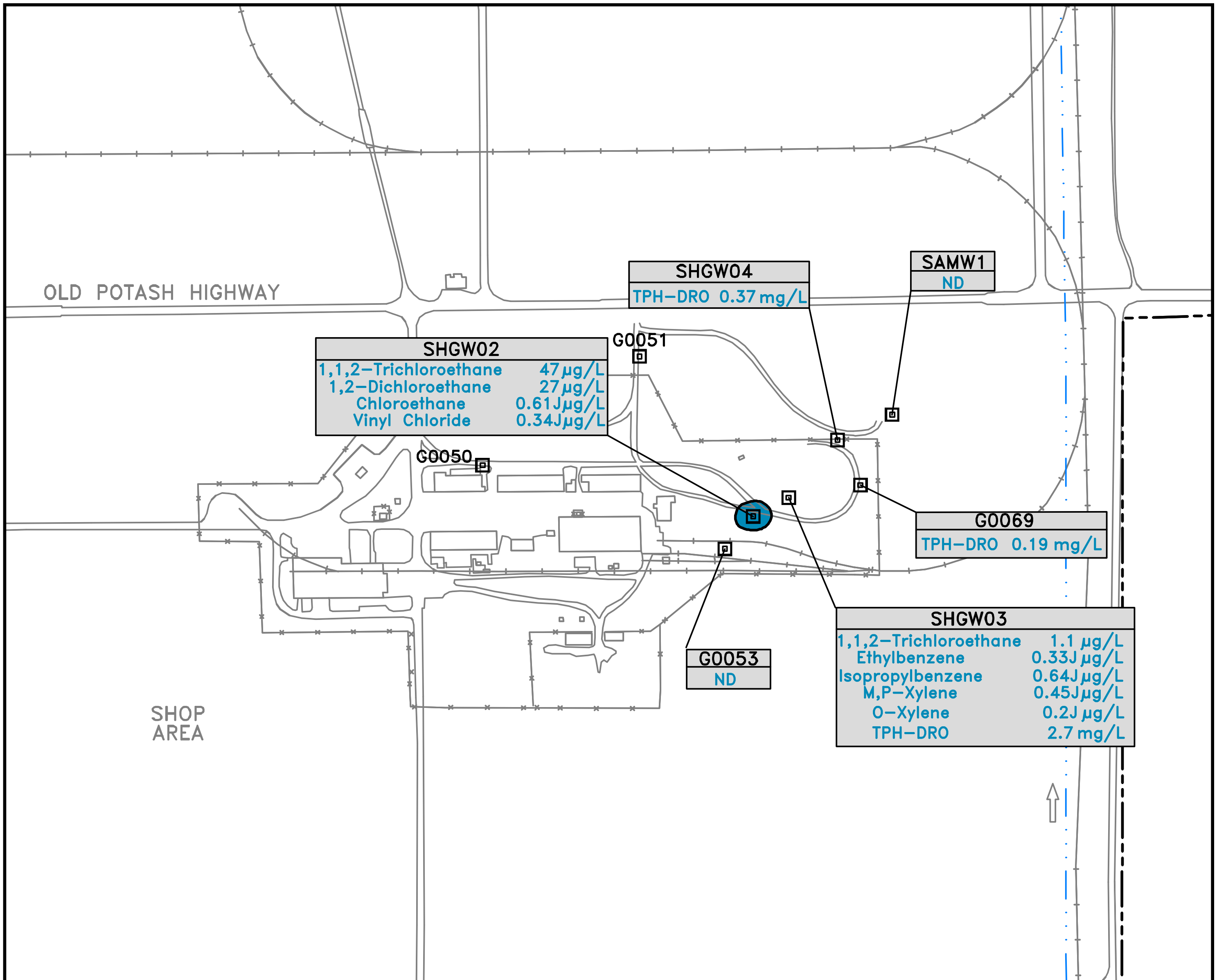


LEGEND:

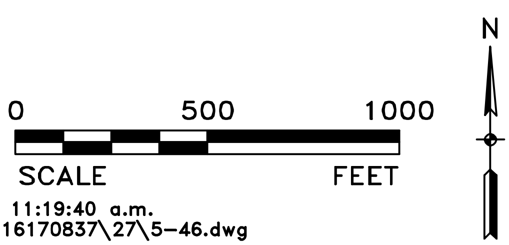
ON–POST GROUNDWATER MONITORING WELL

VOC CONCENTRATION > MAXIMUM CONTAMINANT LEVEL (MCL) (1,1,2–TCA MCL IS 5 µg/L)

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,1,2–TCA = 1,1,2–TRICHLOROETHANE
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND
TPH–DRO = TOTAL PETROLEUM HYDROCARBON–DIESEL RANGE ORGANICS



December 07, 2016 11:19:40 a.m.
Drawing: T:\CHAAP\16170837\27\5–46.dwg

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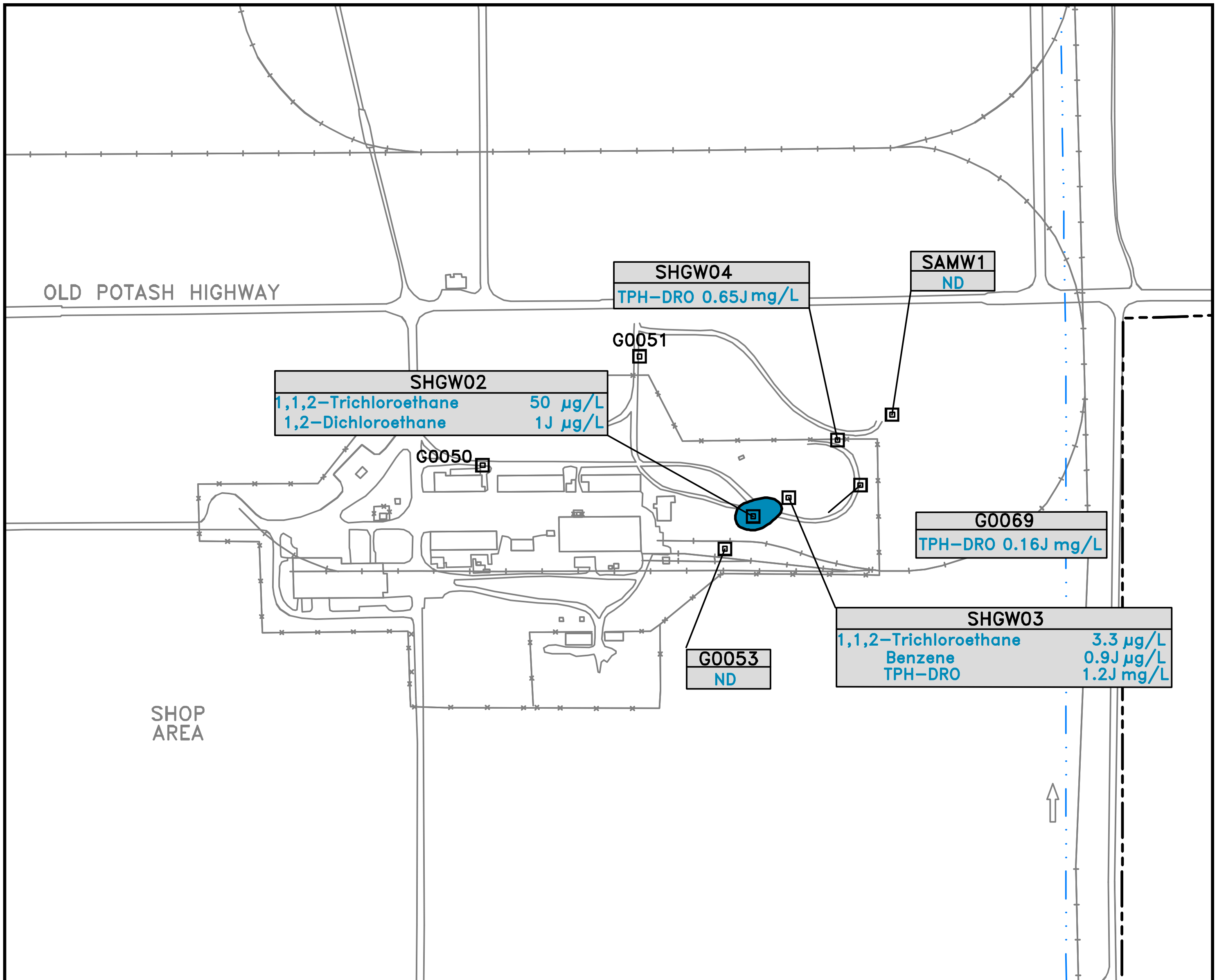
VOC PLUME
SHOP AREA (OU3) MARCH 2008
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–46



LEGEND:

ON–POST GROUNDWATER MONITORING WELL

VOC CONCENTRATION > MAXIMUM CONTAMINANT LEVEL (MCL) (1,1,2–TCA MCL IS 5 µg/L)

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,1,2–TCA = 1,1,2–TRICHLOROETHANE
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND
TPH–DRO = TOTAL PETROLEUM HYDROCARBON–DIESEL RANGE ORGANICS

0 500 1000
SCALE FEET

N

December 07, 2016 11:20:36 a.m.
Drawing: T:\CHAAP\16170837\27\5–47.dwg

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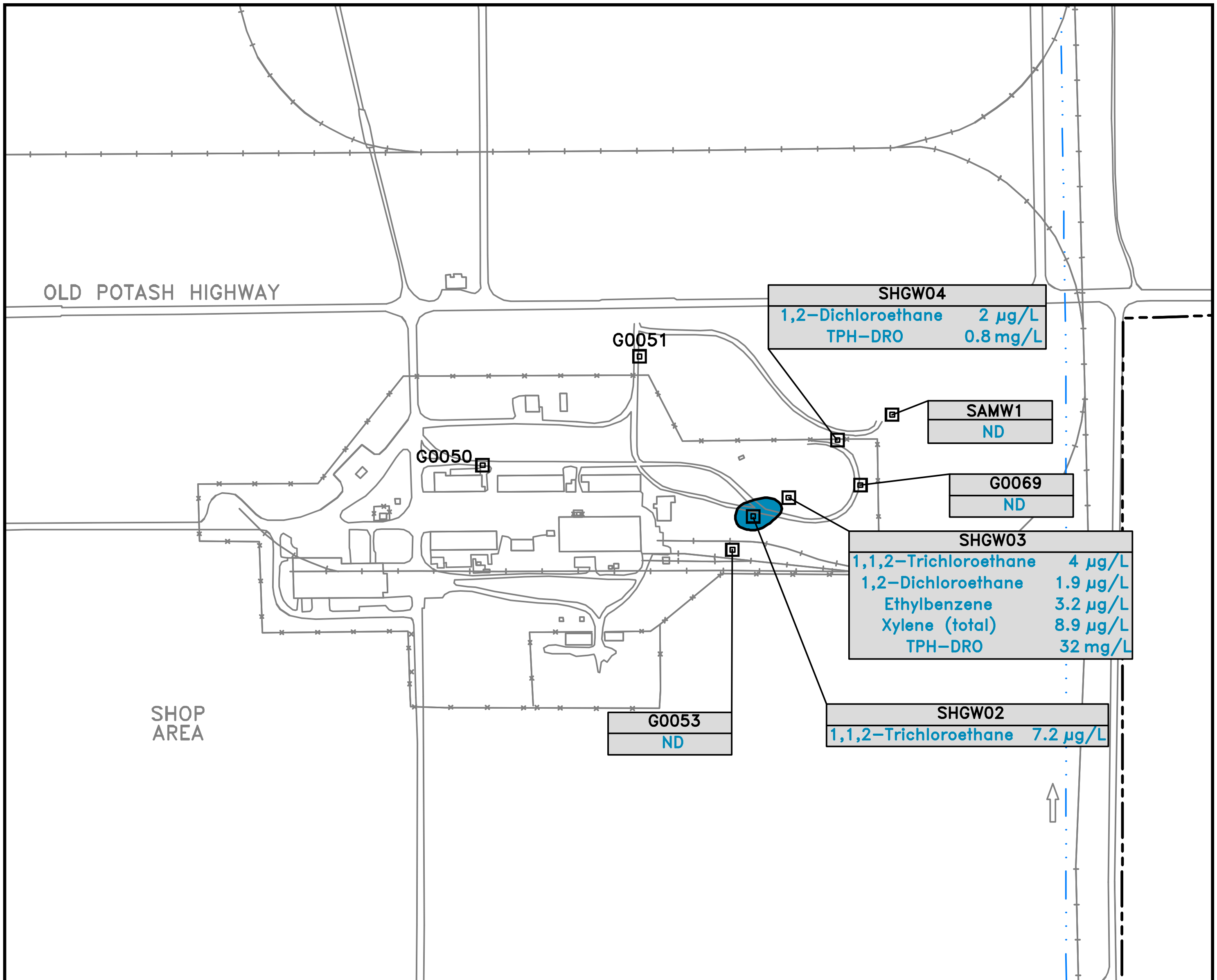
VOC PLUME
SHOP AREA (OU3) MARCH 2006
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–47



LEGEND:

ON–POST GROUNDWATER MONITORING WELL

VOC CONCENTRATION > MAXIMUM CONTAMINANT LEVEL (MCL) (1,1,2–TCA MCL IS 5 µg/L)

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,1,2–TCA = 1,1,2–TRICHLOROETHANE
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND
TPH–DRO = TOTAL PETROLEUM HYDROCARBON–DIESEL RANGE ORGANICS

0 500 1000

SCALE FEET

N

December 07, 2016 11:21:28 a.m.
Drawing: T:\CHAAP\16170837\27\5–48.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions

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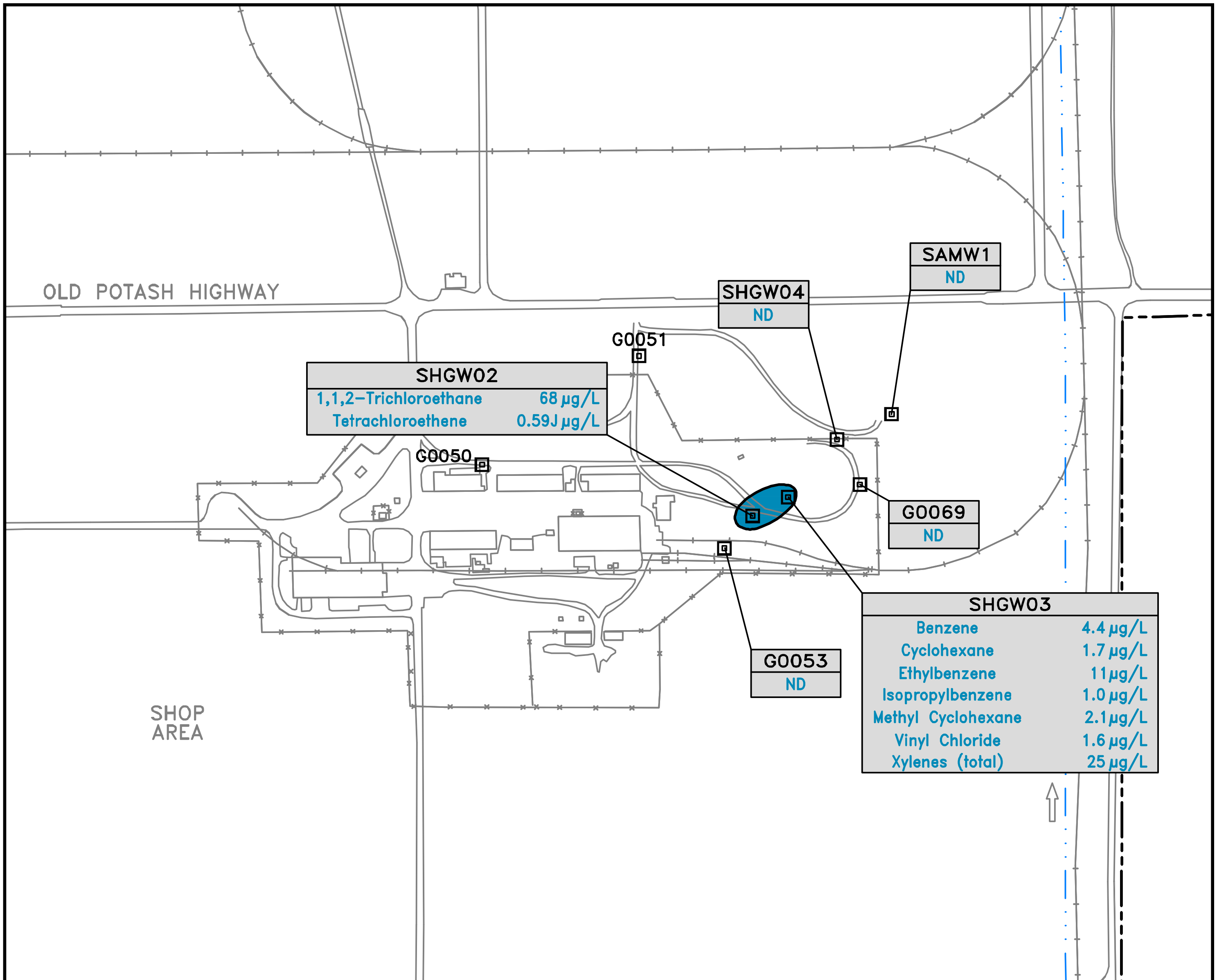
VOC PLUME
SHOP AREA (OU3) MARCH 2004
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–48



LEGEND:

- ON-POST GROUNDWATER MONITORING WELL
- VOC CONCENTRATION > MAXIMUM CONTAMINANT LEVEL (MCL) (1,1,2-TCA MCL IS 5 µg/L)
- FACILITY BOUNDARY
- DRAINAGE DITCH FLOW DIRECTION

1,1,2-TCA = 1,1,2-TRICHLOROETHANE
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND

0 500 1000
SCALE FEET

N

December 07, 2016 11:22:36 a.m.
Drawing: T:\CHAAP\16170837\27\5-49.dwg

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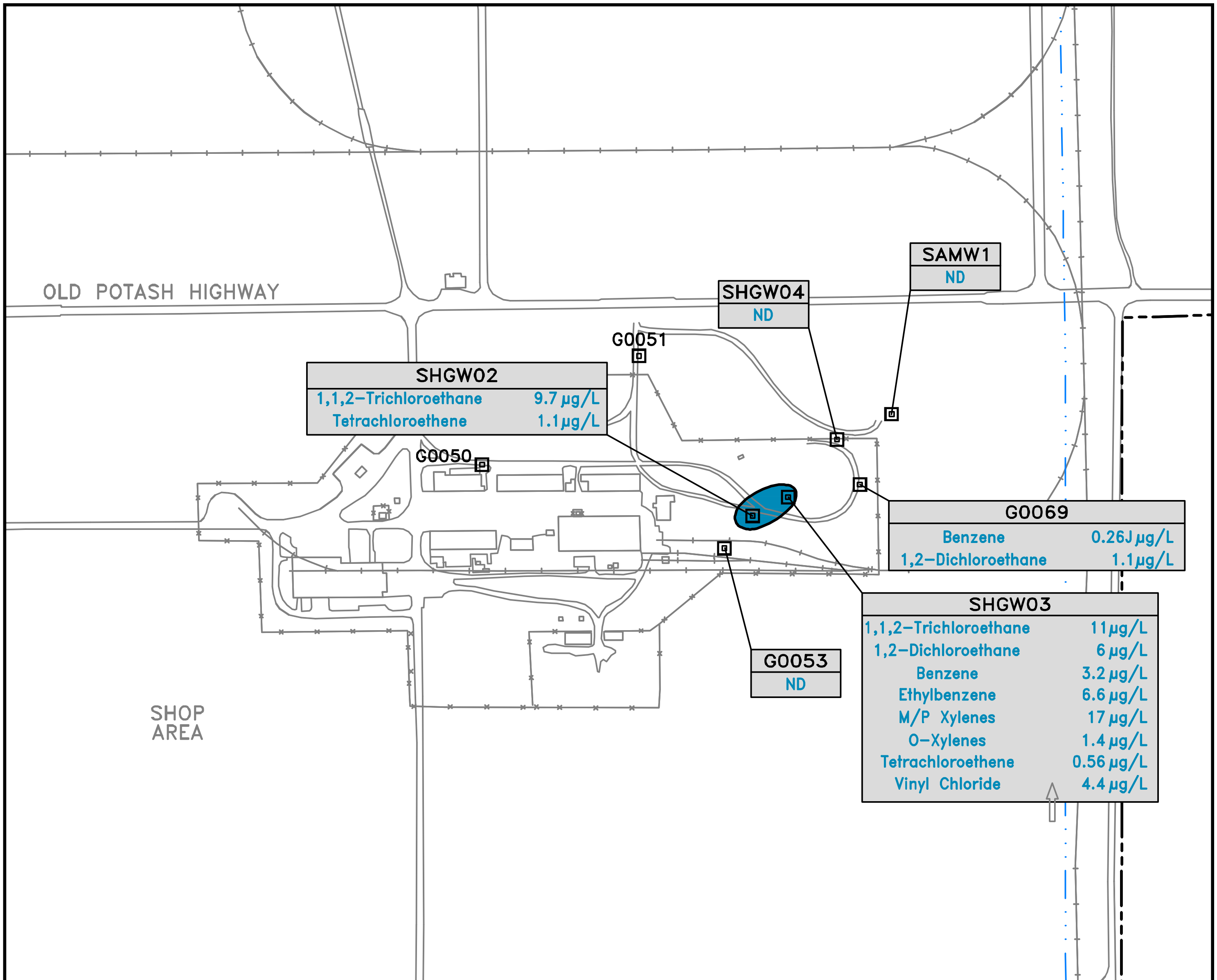
VOC PLUME
SHOP AREA (OU3) MARCH 2002
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO. 16170837	FIG. NO. 5-49
CHK'D. BY: RPC	DATE: 09/25/15		



LEGEND:

- ON–POST GROUNDWATER MONITORING WELL
- VOC CONCENTRATION > MAXIMUM CONTAMINANT LEVEL (MCL) (1,1,2–TCA MCL IS 5 µg/L) (VINYL CHLORIDE MCL IS 2 µg/L)
- FACILITY BOUNDARY
- DRAINAGE DITCH FLOW DIRECTION

1,1,2–TCA = 1,1,2–TRICHLOROETHANE
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
ND = NONDETECT
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND

0 500 1000
SCALE FEET

N

Bay West — Customer-Focused Environmental & Industrial Solutions
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VOC PLUME
SHOP AREA (OU3) MARCH 2000
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/25/15	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/25/15	16170837	5–50

December 07, 2016 11:23:29 a.m.
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The selected remedies in place at CHAAP include groundwater extraction and treatment from OU1 on-post explosives source areas, MNA of the OU1 off-post explosives plume and the OU3 Shop Area 1,1,2-TCA plume, and institutional controls/actions designed to prevent drinking water exposure to contaminated groundwater at OU1 and OU3. This section evaluates the MNA remedy at OU1 and OU3.

In addition to the OU1 on-post groundwater treatment system, the OU1 RAO Subsurface Injection Program (a voluntary action) began in the spring of 2007 and continued through 2016. The purpose of this project is to enhance anaerobic in situ bioremediation processes and cometabolically biodegrade TNT and RDX at the on-post source areas. This section also evaluates MNA parameters within the subsurface injection treatment zones.

The natural attenuation evaluation at CHAAP is being implemented in accordance with the protocols presented in the USEPA Office of Solid Waste and Emergency Response (OSWER) Directive "Use of Monitored Natural Attenuation at Superfund, RCRA, Corrective Action, and Underground Storage Tank Sites" (USEPA 1999) and "Draft Protocol for Evaluating, Selecting, and Implementing Monitored Natural Attenuation at Explosives-Contaminated Sites" (USACE WES 1999).

USEPA describes MNA as "the reliance on natural attenuation processes to achieve site-specific remediation objectives within a time frame that is reasonable." The natural attenuation processes are further described as "a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater." The mechanisms by which natural attenuation may be achieved include "biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants" (USEPA 1999).

6.1 NATURAL ATTENUATION EVALUATION METHODOLOGY

Natural attenuation can be an effective remedial option for contaminants in groundwater at CHAAP if it can be demonstrated that attenuation processes are occurring at a rate sufficient to protect human health and the environment. Institutional controls are in effect at CHAAP to protect human health and the environment until contaminant concentrations throughout the plume areas are at or below the cleanup levels (HALs and MCLs). Institutional controls are discussed in **Section 8** of this report. There are three lines of evidence that may be used to support remediation through the use of MNA (USEPA 1999). The first is historical data that demonstrate decreasing contaminant mass or concentration over time. The second is hydrogeologic and geochemical data that indirectly demonstrate that natural attenuation processes are occurring at the site. The third is data from field or laboratory studies that directly demonstrate the presence of specific natural attenuation processes at the site. Evaluation of the MNA remedy at CHAAP entails the collection of data to support all three lines of evidence. The natural attenuation demonstration at CHAAP includes:

- Completing long-term groundwater monitoring in support of natural attenuation by monitoring key natural attenuation water quality parameters and explosives concentrations over time.
- Identifying significant natural attenuation processes occurring at the site, especially those processes that may be facilitating anaerobic degradation of both the OU1 explosives plume and the OU3 VOC plume.
- Determining the rates at which the natural attenuation processes are reducing contaminant concentrations.

A thorough knowledge of site characteristics is required to fully evaluate the potential for remediation through MNA. The site characteristics must be carefully analyzed to develop a conceptual model of the geochemical and microbiological processes that may be occurring. Site characterization data collected at CHAAP to evaluate MNA include:

- Topography and geology
- Sorption–desorption rates
- Hydraulic conductivity of the aquifer(s)
- Depth to groundwater, groundwater gradients, direction of flow, flow rate, and recharge rate
- Contaminant composition, location, and concentration, as well as the total mass of contaminant present
- Physical and chemical properties of contaminants including degradation products
- Groundwater quality parameters
    - Temperature
    - pH
    - DOC
    - ORP
    - Conductivity
    - Alkalinity
- Microbial respiratory parameters
    - DO
    - Nitrate/Nitrite, TKN, and Ammonia
    - Fe^{2+}
    - Sulfate/Sulfide
    - Methane
    - CO_2

Groundwater quality parameters and microbial respiratory parameters are monitored for evidence of microbiological activity in the subsurface. Indirect evidence of microbial respiration may be observed by comparing the concentrations of respiratory substrates and respiratory products inside the contaminated area with the concentrations from areas outside the contaminated area. Microbial degradation processes proceed in an order of preference based on the amount of energy yielded by the reaction. The preference, in decreasing order, is for denitrification, ferric iron (Fe^{3+}) reduction to Fe^{2+}, sulfate reduction, and methanogenesis (Bouwer 1994). CO_2 is produced through mineralization of the contaminants, regardless of the respiratory substrate used. Increased levels of CO_2 may also lead to increased alkalinity concentrations in groundwater that is undergoing biodegradation. Because Fe^{3+} is insoluble, groundwater is monitored for increased levels of Fe^{2+}. During methanogenesis, CO_2 is used as the terminal electron acceptor for microbial respiration. Concentrations of other respiratory substrates should generally decrease in groundwater that is undergoing microbial degradation activity. For anaerobic biodegradation, DO concentrations should be depressed and ORP should change from positive to negative in groundwater within and immediately downgradient of the plume. For anaerobic microbial activity, respiratory substrates such as nitrate and sulfate should trend toward lower concentrations while concentrations of respiratory products such as Fe^{2+}, sulfide, and methane should generally increase. According to the USACE Waterways Experiment Station (USACE WES 1999), TNT degradation can occur under a wide range ORP values of 0 to –150, DO concentrations <1.0 mg/L, sulfate concentrations <20 mg/L, and DOC concentrations >20 mg/L are favorable for anaerobic biodegradation. RDX is quickly mineralized under highly anaerobic conditions.

6.2 NATURAL ATTENUATION WATER QUALITY PARAMETER RESULTS

Tables 6-1 through **6-5** present key MNA water quality parameter data collected in 2016 for OU1 off-post and on-post and OU3 Shop Area, including laboratory and field parameters. Due to all OU1 off-post explosives concentrations naturally attenuating to below HALs (since 2014), the recommendation to discontinue the collection of laboratory water quality parameters for MNA at all OU1 off-post wells in 2016 was documented in the Final 2015 Annual Groundwater Monitoring and Subsurface Injection Report (BW-URS 2017). As explosives concentrations are below project goals in off-post wells, laboratory analysis of groundwater samples collected from OU1 off-post is limited to explosives compounds to document the presence/absence of ‘rebounding’. Field water quality parameters are also measured and recorded at the time of sample collection. MNA evaluation for OU1 off-post wells are still included in Section 6 for historic and comparison purposes only. **Tables 6-1** through **6-5** also show the historical data for 2009 through 2016, as well as the averages of these same parameters from 2009 through 2016. OU3 wasn’t included in the 2011 groundwater sampling event. Beginning in 2007, the first year of OU1 RAO subsurface injections, changes in water quality parameter results were observed between data collected from monitoring wells that are within RAO treatment areas and wells that are outside of RAO treatment areas. **Table 6-2** presents data that were collected from OU1 monitoring wells outside of the OU1 RAO treatment area and **Table 6-3** presents data collected from OU1 monitoring wells within the treatment area. **Table 6-4** presents data that were collected from OU3 monitoring wells outside of the treatment area and **Table 6-5** presents data collected from OU3 monitoring wells in the treatment area. The 2016 OU1 laboratory MNA water quality parameter results (excluding off-post) are shown on **Figures 6-1a** through **6-1e**. The 2016 OU3 laboratory MNA water quality parameter results (shown on **Figure 6-8**) were used to help identify anaerobic degradation processes commonly occurring at groundwater contamination sites. These degradation processes are reported by both Wiedemeier, et al. (1996) and USACE WES (1999).

Figures 6-2a, **6-3a**, **6-4a**, **6-5a**, **6-6a**, and **6-7a** present interpreted site-wide isoconcentrations of ORP, DO, nitrate/nitrite, Fe^{2+}, methane, and CO_2, respectively, in shallow groundwater using the averaged results of the last seven groundwater sampling events. **Figures 6-2b**, **6-3b**, **6-4b**, **6-5b**, **6-6b**, and **6-7b** present the same parameters plotted along a cross-section down the center of the historic OU1 off-post explosives plume, and **Figures 6-2c**, **6-3c**, **6-4c**, **6-5c**, **6-6c**, and **6-7c** present the parameters plotted along a cross-section for the OU1 on-post, using the averaged results of the last seven groundwater sampling events, which minimizes the impact of measurement variations from year to year. **Figures 6-9** through **6-13** present interpreted OU3 Shop Area isoconcentrations of ORP, DO, nitrate/nitrite, Fe^{2+}, and methane, respectively, in shallow groundwater using the averaged results of the last seven groundwater sampling events.

6.2.1 OU1 (Groundwater Explosives Plume) Averages and Trends

For comparison purposes, the OU1 data have been evaluated and separated into two basic groups: off-post and background data, and on-post and RAO treatment area data. Data averages and trends for the off-post feedlot, east of CHAAP (**Figures 6-1a** through **6-1e**), were not evaluated in 2016, due to abandonment of monitoring wells completed in December 2013 (BW-URS 2014b). However, historic parameter readings and averages for feedlot wells are still shown on **Table 6-1**.

6.2.1.1 Off-Post and Background Averages and Trends

Off-post and background data trends over the past seven groundwater sampling events are described in this section as part of the overall conceptual model of off-post conditions. Due to explosives concentrations being below the HALs for 5 years or longer, or the feedlot property owner not renewing the access lease, 48 off-post monitoring wells (includes 10 feedlot wells) were removed from the monitoring program in 2013, and were not sampled in 2014 through 2016. Additionally, as previously stated, no collection of laboratory water quality parameters for MNA at OU1 off-post monitoring wells was completed in 2016, due to all off-post explosives concentrations being below HALs (since 2014). Only field water quality parameters for MNA were measured during the sampling activities at the remaining off-post wells. However, historic parameter readings and averages for these wells are still shown on **Table 6-1**. The seven-year average values are cited to minimize the impact of variations in measurements from year to year. In addition, the 2016 data are examined for possible changes in historic trends. Overall, off-post and background averages and trends indicate that the highly aerobic/oxygenated environment with high levels of nitrate/nitrite and sulfate and low levels of Fe^{2+} and methane is not conducive to microbial degradation. General off-post and background data trends include:

- The seven-year average ORP values within the Grand Island Formation aquifer at OU1 off-post monitoring wells were lower at the base of the aquifer than at the water table and shallow-intermediate depths. The seven-year average ORP values were 137.8 mV in shallow wells, 131.4 mV in shallow-intermediate wells, and 97.0 mV in intermediate wells (**Table 6-1**). Average ORP values measured in 2016 were higher than the seven-year average values for shallow, shallow-intermediate wells, and intermediate wells with ORP values of 170.9 mV, 156.5 mV, and 128.9 mV, respectively (**Table 6-1**).
- DO concentrations within the Grand Island Formation aquifer at OU1 off-post monitoring wells generally declined with depth in the aquifer. The seven-year average DO concentrations were 5.50 mg/L in shallow wells, 2.60 mg/L in shallow-intermediate wells, and 1.03 mg/L in intermediate wells (**Table 6-1**). This trend of lower concentrations at depth continued for the 2016 data, in which the shallow, shallow-intermediate, and intermediate DO values averaged 5.46 mg/L, 2.66 mg/L, and 1.50 mg/L, respectively (**Table 6-1**).
- The seven-year average nitrate/nitrite concentrations within the Grand Island Formation aquifer at OU1 off-post and background wells were generally higher at shallow to shallow-intermediate locations than at deeper depths. The seven-year average nitrate/nitrite concentrations were 18.5 mg/L in shallow wells, 18.2 mg/L in shallow-intermediate wells, and 11.4 mg/L in intermediate wells (**Table 6-1**). Off-post wells were not sampled for nitrate/nitrite in 2016.
- The seven-year average Fe^{2+} concentrations within the Grand Island Formation aquifer at OU1 off-post monitoring wells were overall low but generally higher at the intermediate portion of the aquifer than at the shallow and shallow-intermediate depths. The seven-year average Fe^{2+} concentrations were 0.19 mg/L in shallow wells, 0.10 mg/L in shallow-intermediate wells, and 0.31 mg/L in intermediate wells (**Table 6-1**). Fe^{2+} concentrations in 2016 remained low with slightly higher concentrations in the deeper portions of the aquifer, with detected average Fe^{2+} concentrations of ND, 0.03 mg/L, and 0.07 mg/L for shallow, shallow-intermediate, and intermediate wells, respectively (**Table 6-1**).
- The seven-year average sulfate concentrations within the Grand Island Formation aquifer at OU1 off-post monitoring wells were generally higher at the shallow-intermediate portions of the aquifer than at the shallow and intermediate depths, although the differences between zonal averages are fairly small. The seven-year average sulfate concentrations were 77 mg/L in shallow wells, 85 mg/L in shallow-intermediate wells, and 77 mg/L in intermediate wells (**Table 6-1**). Off-post wells were not sampled for sulfate in 2016.
- The seven-year average methane concentrations within the Grand Island Formation at OU1 off-post wells were generally higher at shallow-intermediate depths and the base of the aquifer than at the water table. The seven-year average methane concentrations were 1.6 μg/L in shallow wells, 25 μg/L in shallow-intermediate wells, and 11 μg/L in intermediate wells (**Table 6-1**). Off-post wells were not sampled for methane in 2016. Although seven-year average concentrations for methane data were calculated for each interval, methane was limited in detections observed during annual sampling events. The low number of methane detections is typically observed each year because methanogenesis is one of the last biodegradation processes to occur.

- The seven-year average CO_2 concentrations in OU1 off-post wells generally increased with depth. The seven-year average concentrations were 80 mg/L in shallow wells, 83 mg/L in shallow-intermediate wells, and 92 mg/L in intermediate wells (**Table 6-1**). Off-post wells were not sampled for CO_2 in 2016.
- Most seven-year average natural attenuation parameter concentrations were lower within the deeper Holdrege Formation aquifer than in the three measured intervals of the Grand Island Formation. In the Holdrege Formation, the average ORP value was 14.7 mV, the average DO concentration was 0.47 mg/L, the average nitrate/nitrite concentration was 2.2 mg/L, and the average sulfate concentration was 35.1 mg/L. The average Fe^{2+} concentration was 0.31 mg/L, which continued the similar seven-year average trend of higher values deeper within the Grand Island and Holdrege Formations. The average methane concentration of 8.6 µg/L was higher in comparison to the shallow portion of the Grand Island Formation and the average CO_2 concentration of 79 mg/L was similar in comparison to the shallow and shallow-intermediate portions of the Grand Island Formation (**Table 6-1**).

6.2.1.2 On-Post and RAO Treatment Area Averages and Trends

In 2013, 19 on-post monitoring wells were removed from the monitoring program due to explosives concentrations being below the HALs for 5 years or longer and were not sampled in 2016. However, historic parameter readings and averages for these wells are still shown in **Tables 6-2** and **6-3**. In 2016, concentrations of water quality and microbial respiratory parameters at on-post wells in OU1 RAO treatment areas were generally different than the on-post wells that were not in treatment areas. The most significant differences were seen at the load line source areas. Differences observed in source areas can be attributed to the 2007 through 2016 OU1 RAO subsurface injections. The average values for both pre-injection and post injection data were cited to minimize the impact of variations in measurements from year to year. The on-post data trends include:

- ORP values near LL1, LL2, LL3, LL4, and LL5 averaged <100 mV and were generally lower than surrounding areas, where average ORP values were >100 mV (**Figure 6-2a**). Data presented in **Tables 6-2** and **6-3** indicate that ORP values were significantly lower in OU1 on-post wells within the RAO treatment areas. The pre-treatment seven-year average ORP values were 88.9 mV in the shallow wells, 99.0 mV in shallow-intermediate wells, and 43.0 mV in intermediate wells. The post-treatment seven-year average ORP values were –51.5 mV in shallow wells, 68.5 mV in shallow-intermediate wells, and –15.3 mV in intermediate wells (**Table 6-3**). The lower post-treatment ORP values indicate a more reducing environment is present. The observed ORP values are well within the range necessary for the abiotic degradation of TNT (+500 mV to –150 mV), and are sufficient to degrade RDX, considering RDX nitroso derivatives are formed under both aerobic and anaerobic conditions (USACE WES 1999). These trends in ORP values can be attributed to previous subsurface injections.
- DO concentrations near and directly downgradient from LL1, LL2, LL3, LL4, and LL5 were generally <2 mg/L and lower than other site-wide concentrations that were >2 mg/L (see **Figures 6-3a** and **6-3c**). The pre-treatment seven-year average DO concentrations were

1.75 mg/L in shallow wells, 0.34 mg/L in shallow-intermediate wells, and 0.13 mg/L in intermediate wells. The post-treatment seven-year average DO concentrations were 0.95 mg/L in shallow wells, 1.05 mg/L in shallow-intermediate wells, and 0.31 mg/L in intermediate wells (**Table 6-3**). Since the shallow portion of the aquifer at CHAAP is typically aerobic, the lower post-treatment DO concentration in the shallow aquifer can be attributed to previous subsurface injections.

- On-post nitrate/nitrite concentrations of 1 to 10 mg/L in shallow groundwater were generally lower than other site-wide concentrations, which were mostly >10 mg/L (**Figures 6-4a** and **6-4c**). Monitoring wells within the RAO treatment areas exhibited lower nitrate/nitrite concentrations. The pre-treatment seven-year average nitrate/nitrite concentrations were 4.1 mg/L in shallow wells, 4.4 mg/L in shallow intermediate wells, and 0.02 mg/L in intermediate wells. The post-treatment seven-year average nitrate/nitrite concentrations were 1.7 mg/L in shallow wells, 3.0 mg/L in shallow-intermediate wells, and 0.03 mg/L in intermediate wells (**Table 6-3**). These changes in nitrate/nitrite can be attributed to previous subsurface injections.
- On-post Fe^{2+} concentrations were generally <1 mg/L except in isolated areas north of LL4 and downgradient of LL1, LL2, and LL3 (**Figures 6-5a** and **6-5c**). Higher Fe^{2+} concentrations were detected in wells within the RAO treatment areas (**Tables 6-2** and **6-3**). The pre-treatment seven-year average Fe^{2+} concentrations were 0.19 mg/L in shallow wells, 0.18 mg/L in shallow-intermediate wells, and 0.32 mg/L in intermediate wells. The post-treatment seven-year average Fe^{2+} concentrations were 3.44 mg/L in shallow wells, 0.20 mg/L in shallow-intermediate wells, and 1.12 mg/L in intermediate wells (**Table 6-3**). This general increasing trend indicates that Fe^{3+} reduction processes have occurred as a result of previous subsurface injections.
- Sulfate concentrations on-post varied, but averaged >100 mg/L in shallow on-post wells. The pre-treatment seven-year average sulfate concentrations were 212 mg/L in shallow wells, 44 mg/L in shallow-intermediate wells, and 279 mg/L in intermediate wells. The post-treatment seven-year average sulfate concentrations were 310 mg/L in shallow wells, 76 mg/L in shallow-intermediate wells, and 448 mg/L in intermediate wells, which are higher compared to the pretreatment averages (**Table 6-3**). Sulfate concentrations at CHAAP are predominantly influenced by the geology and geochemistry variances across the site with higher concentrations observed near LL3, LL4, LL5, and Pistol Range areas (**Figure 6-1b**). seven-year averages for sulfate concentrations in upgradient (i.e., west/southwestern-most) shallow on-post wells generally ranged from 696 mg/L to 3,075 mg/L and were significantly higher than in downgradient shallow on-post, which were <200 mg/L (**Tables 6-2** and **6-3**).
- On-post methane concentrations, generally >10 µg/L, were observed in shallow wells downgradient of LL1, LL2, LL3, and LL5 (**Figures 6-6a** and **6-6c**). Significantly higher methane concentrations were observed in wells within the RAO treatment areas. The pre-treatment seven-year average methane concentrations were 0.17 µg/L in shallow wells, 3.3 µg/L in shallow-intermediate wells, and 0.57 µg/L in intermediate wells. The post-treatment seven-year average methane concentrations were 7,668 µg/L in shallow wells, 1,761 µg/L in shallow-intermediate wells, and 783 µg/L in intermediate wells (**Table 6-3**).

Increased post-treatment methane concentrations suggest that methanogenesis is occurring near these areas, which can be attributed to previous subsurface injections.

- CO_2 concentrations were >100 mg/L in shallow on-post wells near LL2, LL3, LL4, and LL5, and were generally higher than concentrations at off-post wells (**Figures 6-7a** and **6-7c**). Concentrations of CO_2 in LL1 shallow wells were generally similar to off-post wells, with the exception of the feedlot area wells. The pre-treatment seven-year average CO_2 concentrations were 134 mg/L in shallow wells, 88 mg/L in shallow-intermediate wells, and 128 mg/L in intermediate wells. The post-treatment seven-year average CO_2 concentrations were 201 mg/L in shallow wells, 118 mg/L in shallow-intermediate wells, and 148 mg/L in intermediate wells (**Table 6-3**). CO_2 is a by-product of aerobic and anaerobic degradation; therefore, elevated CO_2 concentrations indicate that microbial activity has been stimulated in the RAO treatment areas.

6.2.2 OU3 (Shop Area) Averages and Trends

Natural attenuation trends at OU3 were evaluated by two separate comparisons. The first comparison was made between data collected from OU3 Shop Area monitoring wells (**Table 6-4**) and data collected from OU1 shallow on-post monitoring wells (**Table 6-2**). All of the shallow on-post monitoring wells used for this comparison were outside of RAO treatment areas. A second comparison was made between pre- and post-treatment data collected from OU3 Shop Area monitoring wells within the RAO treatment area (**Table 6-5**). Of the six OU3 wells, two are within the treatment area and the remaining four are outside of the treatment area (**Figures 6-8** through **6-13**). Beginning in 2014, only the two wells within the treatment area were part of the annual sampling activities, due to historic VOC concentrations detected above MCLs. The remaining four wells, with no historic MCL exceedances, were placed on a three-year sampling frequency and were sampled in 2016. OU3 was not included in the 2011 groundwater sampling event. OU3 was inadvertently closed in the government's tracking system. The site was added back into the system in 2012, and groundwater sampling resumed in March 2012. Data trends include:

- ORP values were higher in OU3 monitoring wells than in OU1 on-post monitoring wells. For wells outside the RAO treatment areas, the seven-year average ORP value at OU3 was 149.0 mV (**Table 6-4**), and OU1 shallow wells averaged 68.0 mV (**Table 6-2**). Monitoring wells within the OU3 treatment area had lower ORP values. The pre-treatment seven-year average ORP value was 22.0 mV, and the post-treatment seven-year average was -4.6 mV (**Table 6-5**). These trends indicate that previously completed injections only slightly impacted ORP values.
- DO concentrations were lower in OU3 monitoring wells than in OU1 on-post monitoring wells. For wells outside the RAO treatment areas, the seven-year average DO concentration at OU3 was 2.44 mg/L (**Table 6-4**), and OU1 shallow wells averaged 3.19 mg/L (**Table 6-2**). Monitoring wells within the OU3 treatment area had lower DO concentrations. The pre-treatment seven-year average DO concentration was 0.78 mg/L, and the post-treatment seven-year average was 0.56 mg/L (**Table 6-5**). These trends indicate that previously

completed injections did not significantly impact DO values, because anaerobic conditions already existed at OU3 prior to RAO groundwater treatments.

- Nitrate/nitrite concentrations were lower in OU3 monitoring wells than in OU1 on-post monitoring wells. For wells outside the RAO treatment areas, the seven-year average nitrate/nitrite concentration at OU3 was 5.8 mg/L (**Table 6-4**), and OU1 shallow wells averaged 8.5 mg/L (**Table 6-2**). Monitoring wells within the OU3 treatment area had similar nitrate/nitrite concentrations. The pre-treatment seven-year average nitrate/nitrite concentration was 3.3 mg/L, and the post-treatment seven-year average was 0.19 mg/L (**Table 6-5**). Previously completed injections did decrease nitrate/nitrite concentrations.
- Fe^{2+} concentrations were similar in OU3 monitoring wells and OU1 on-post monitoring wells. For wells outside the RAO treatment areas, the seven-year average Fe^{2+} concentration at OU3 was 0.27 mg/L (**Table 6-4**), and OU1 shallow wells averaged 0.87 mg/L (**Table 6-2**). Monitoring wells within the OU3 treatment area had higher Fe^{2+} concentrations. The pre-treatment seven-year average Fe^{2+} concentration was 2.74 mg/L, and the post-treatment seven-year average was 5.45 mg/L (**Table 6-5**). These trends indicate that Fe^{3+} reduction processes were enhanced due to the RAO groundwater treatments at OU3.
- Sulfate concentrations were significantly lower in OU3 monitoring wells than in OU1 on-post monitoring wells. For wells outside the RAO treatment areas, the seven-year average sulfate concentration at OU3 was 31 mg/L (**Table 6-4**), and OU1 shallow wells averaged 408 mg/L (**Table 6-2**). Monitoring wells within the OU3 treatment area had sulfate concentrations that were similar to OU3 wells outside of the treatment area. The pre-treatment seven-year average sulfate concentration was 26 mg/L, and the post-treatment seven-year average was 17 mg/L (**Table 6-5**). These trends indicate that sulfate reduction is not a key component of either natural or enhanced contaminant attenuation.
- Methane, ethane, and ethene were analyzed in 2007 through 2016, except during 2011. Methane concentrations were significantly higher in OU3 monitoring wells than in OU1 shallow on-post monitoring wells. The seven-year average methane concentration at OU3 wells outside the RAO treatment areas was 130 µg/L (**Table 6-4**), and OU1 shallow wells averaged 25.2 µg/L (**Table 6-2**). Monitoring wells within the OU3 treatment area had higher methane concentrations. The pre-treatment seven-year average methane concentration was 49 µg/L, and the post-treatment seven-year average was 8,003 µg/L (**Table 6-5**). In addition to significant increases in methane concentrations, ethane concentrations increased from 0.85 µg/L to 2.6 µg/L. These results indicate that methanogenesis is occurring in this treatment area, which can be attributed to previous subsurface injections. Ethene has not been detected in any OU3 monitoring wells.

6.3 DEGRADATION PROCESSES IDENTIFICATION

The following sections summarize degradation processes at OU1 and OU3.

6.3.1 OU1 (Groundwater Explosives Plume) Degradation Processes

TNT and RDX are the two primary contaminants of concern in the OU1 groundwater explosives plume at CHAAP due to the relatively low HAL of 2 µg/L for each compound. The historical data indicate groundwater chemical conditions are favorable for anaerobic degradation of TNT and RDX within the OU1 explosives plumes, especially in the feedlot area and within the previously completed subsurface injection treatment zones. In 2007 through 2016, OU1 RAO subsurface injections were completed in the explosives source areas to expedite degradation processes.

Degradation of TNT may occur through abiotic reduction if site conditions are suitable, or through microbial degradation (USACE WES 1999). Microbial reduction of TNT may occur under both aerobic and anaerobic conditions. Two of the most prevalent transformation products, 2-Am-DNT and 4-Am-DNT, are produced by both the abiotic and microbial degradation mechanisms. According to USACE WES (1999), “These two monoamino transformation products are produced abiotically under a wide range of pH (5 to 7) and oxidation/reduction conditions (+500 mV to –150 mV).” Microbial biodegradation of TNT occurs through the enzymatic action of a variety of “‘nonspecific’ nicotinamide dinucleotide phosphate dependent nitroreductases” (McFarlan and Yao 2002). These biological processes do not use TNT directly as a primary respiratory substrate, but rather degrade TNT through the cometabolic reduction of nitro groups to amino groups (Suthersan 2002). Certain cometabolic reactions can occur in cases where enzymatic activities are not confined to specific substrates. The enzymes are able to act on a range of closely related molecules. In this case, the nitroreductases are able to reduce different molecules containing nitro functional groups. In 2016, TNT degradation products 2-Am-DNT and 4-Am-DNT were present in samples collected in the OU1 on-post source areas and the off-post wells near the feedlot area (see **Tables 4-3** and **4-4**).

Biodegradation of RDX may occur under both aerobic and anaerobic conditions; however, CHAAP historical data indicate that RDX biodegradation best occurs under highly anaerobic groundwater conditions and is recalcitrant under aerobic conditions. Several microorganisms can biodegrade RDX anaerobically, although the pathways for degradation are not always known. One pathway that has been characterized is the use of Type I nitroreductase enzyme by enteric bacteria. Enzymatic activity of these bacteria reduces the nitro groups on RDX to form nitroso derivatives (Roberts and Kotharu 2004). The nitroso derivatives of RDX include MNX, di-nitroso-RDX (DNX), and tri-nitroso-RDX (TNX). RDX degradation products MNX, DNX, and TNX were detected by Spalding (1998) in the feedlot area. Spalding’s (1998) report was included as Appendix F to the March 1999 Annual Report (URSGWCFS 1999).

As stated previously, degradation processes proceed in the following order: denitrification, Fe^{3+} reduction to Fe^{2+}, sulfate reduction, and methanogenesis (Bouwer 1994). The historical data indicate that denitrification is the main degradation process occurring in the feedlot area and the Load Lines. Denitrification will occur at ORP values as high as 740 mV (Bouwer 1994). Other degradation processes (e.g., Fe^{3+} reduction, sulfate reduction, and methanogenesis) may also be occurring in the feedlot area and load lines, but to a lesser extent.

The conditions favoring denitrification for OU1 at CHAAP include:

- Abundant supply of nitrate in the aquifer from fertilizer applications site-wide and urea at the feedlot.
- Historically high DOC content in the aquifer underlying the feedlot.
- Anaerobic/reducing conditions historically documented in groundwater underlying the feedlot, with seven-year average ORP values ranging from –37.5 to 39 mV and seven-year average DO values ranging from 0.25 mg/L to 0.71 mg/L at the different well depth intervals (see **Table 6-1**).
- For shallow groundwater at on-post subsurface injection treatment zones, anaerobic/reducing conditions with high DOC concentrations have been established/maintained as indicated by pre-treatment/post-treatment seven-year averages (ORP: 88.9/–51.5 mV, DO: 1.75/ 0.95 mg/L, DOC: 2.6/124.5 mg/L) (see **Table 6-3**).

6.3.2 OU3 (Shop Area) Degradation Processes

The compounds 1,1,2-TCA, 1,2-DCA, benzene, and vinyl chloride are the four primary contaminants of concern at OU3 because they have been detected in the past at concentrations above their respective MCLs. The VOC 1,2-DCA is a breakdown product of 1,1,2-TCA. In 2012, 2013, and 2015, no VOC concentrations were detected above the corresponding MCLs; however, in 2014 and again in 2016, only 1,2-DCA was detected at SHGW02 at concentrations above its MCL. In August 2016, neither 1,1,2-TCA nor benzene were detected at the six OU3 Shop Area wells at concentrations above their respective MCLs (see **Table 4-8**). Consistent with the revised OU3 sampling program, MNA data were collected at all six Shop Area wells in 2016. Degradation processes were evaluated as part of the MNA demonstration to comply with the selected remedy at OU3.

The VOC 1,1,2-TCA is a chlorinated aliphatic hydrocarbon that may undergo biodegradation by three different mechanisms: reductive dehalogenation, electron donor reactions, and cometabolism. The most important mechanism is reductive dehalogenation. In this process, the chlorinated aliphatic hydrocarbon is used as an electron acceptor. A chlorine atom is removed and replaced by a hydrogen atom (USEPA 1998). Reductive dehalogenation is most effective and most rapid under sulfate-reducing and methanogenic conditions. It may also occur under nitrate- and iron-reducing conditions. Because the chlorinated aliphatic hydrocarbon is not used as the source of carbon in this reaction, an alternative supply of organic carbon must exist for microbial growth. The other contaminant of concern, benzene (along with other petroleum hydrocarbons that have been observed at OU3), could be used as the source for this organic carbon. Reductive dehalogenation could potentially result in degradation of all three contaminants of concern at OU3.

In electron donor reactions, some chlorinated aliphatic hydrocarbons may be utilized as a respiratory substrate for oxidation/reduction reactions. Electron donor reactions typically require reduced chlorinated aliphatic hydrocarbons, such as vinyl chloride. Therefore, it is unlikely that this degradation mechanism is significantly affecting concentrations of 1,1,2-TCA at CHAAP.

However, vinyl chloride is a degradation product of 1,1,2-TCA and has been observed at CHAAP in 2000, 2002, 2003, 2008, 2010, 2012, and 2016. The electron donor reaction may therefore be significant in reducing concentrations of 1,1,2-TCA degradation products.

Cometabolic degradation is primarily observed under aerobic conditions, although it also may occur under anaerobic conditions. Cometabolic reactions occur when an enzyme or co-factor, produced for other purposes, also acts on chlorinated aliphatic hydrocarbons. In fact, these reactions can have a detrimental effect on the microbe that produced the enzyme or co-factor (USEPA 1998).

As noted above, microbial degradation of benzene and other petroleum hydrocarbons may also potentially occur through reductive dehalogenation reactions after DO has been depleted. These reactions are a subset of the larger set of electron acceptor reactions, which may occur under aerobic or anaerobic conditions. Electron acceptor reactions result in metabolism of the petroleum hydrocarbons, producing CO_2. When DO has been depleted, microbial degradation of petroleum hydrocarbons may proceed using nitrate, Fe^{3+}, sulfate, and CO_2 (methanogenesis) preferentially, in that order, as electron acceptors.

The MNA data indicate that denitrification, Fe^{3+} reduction, and methanogenesis are the dominant processes occurring for degradation of the VOC plume, along with cometabolism with petroleum hydrocarbons as a carbon source. VOC degradation products 1,2-DCA and vinyl chloride have been previously detected in samples collected at OU3. Conditions favoring natural attenuation for OU3 at CHAAP include:

- Low ORP values at wells in and immediately downgradient of the 1,2-DCA plume support a reducing environment for chlorinated solvents.
- Low DO concentrations at wells in and immediately downgradient of the 1,2-DCA plume are favorable for reductive dechlorination of chlorinated solvents (USEPA 1998).
- Higher methane concentrations at wells in and immediately downgradient of the 1,2-DCA plume indicate that methanogenesis is occurring.

6.4 DEGRADATION RATES

The following sections summarize degradation rates for OU1 and OU3.

6.4.1 OU1 (Groundwater Explosives Plume) Degradation Rates

As part of the initial natural attenuation evaluation at CHAAP, a groundwater contaminant fate and transport model was completed by URS in 2001 (URSGWCFS 2001a). For the modeling evaluations, first-order decay rates were estimated for RDX, TNT, and HMX. Decay rate constants represent loss of contaminant mass due to biotic decay processes (e.g., biodegradation) and abiotic decay processes (e.g., hydrolysis and evaporation). To coincide with the CHAAP five-year review process, these decay rates were updated in 2005 (EA-URS 2005), in 2010 (BW-URS 2011), and in 2015 (BW-URS 2017). In 2015, decay rates were updated using groundwater analytical data up through the August 2015 groundwater sampling event. The 2015 decay rates were estimated using the following three methods:

- Graves (1995) using single well estimates and concentrations over time.
- Graves (1995) using multiple well estimates and concentrations along the groundwater flow path.
- Buscheck and Alcantar (1995) using multiple well estimates and concentrations along the groundwater flow path.

Decay rate constants were converted into degradation half-lives. Methodology, data, and calculations used to estimate the 2015 degradation half-lives are included in Appendix G of the Final 2015 Groundwater Annual Monitoring and Subsurface Injection Report (BW-URS 2017). Half-lives were estimated for three separate geographic areas based on the spatial relationship between the explosives plume and the load line source areas, feedlot, and distal plume area.

The historical and most current estimated average half-lives are as follows:

- LL1 (Source Areas):
  - 2001 – RDX: 5.7 years, TNT: 5.7 years, HMX: 7.2 years
  - 2005 – RDX: 5.5 years, TNT: 3.9 years, HMX: 4.3 years
  - 2010 – RDX: 4.3 years, TNT: 2.7 years, HMX: 3.1 years
  - 2015 – RDX: 4.0 years, TNT: 3.1 years, HMX: 2.7 years
- Feedlot (Off-Post):
  - 2001 – RDX: 4.3 years, TNT: 2.5 years, HMX: 0.6 years
  - 2005 – RDX: 1.7 years, TNT: 1.1 years, HMX: 2.0 years
  - 2010 – RDX: 3.6 years, TNT: 2.4 years, HMX: 5.6 years
  - 2015 – RDX: 2.2 years, TNT: 2.6 years, HMX: 4.9 years
- Distal Plume (Off-Post):
  - 2001 – RDX: 8.9 years, HMX: 8.0 years
  - 2005 – RDX: 2.9 years, HMX: 4.9 years
  - 2010 – RDX: 4.1 years, HMX: 5.1 years
  - 2015 – RDX: 3.9 years, HMX: 6.5 years

The 2015 half-life estimates for the OU1 explosives plume were found to be similar to the 2001, 2005, and 2010 half-life estimations. The 2015 LL1 data were similar to the 2010 LL1 data, but both 2015 and 2010 half-lives were slightly lower than 2005 and 2001, likely due to influences from subsurface injections. Off-post half-lives are similar to the 2010 data, due to the off-post concentration values remaining low (0.13 μg/L to 1.6 μg/L). Since the installation of EW7 in 2000, the on-post sources have been contained, eliminating the continuous influx of explosives-contaminated groundwater into the off-post plume. The off-post plume concentrations have continued to decline over the past 15 years and the remaining low explosives concentrations are asymptotic (i.e., explosives degradation rates are limited by low concentrations remaining in the aquifer). Currently, all explosives concentrations are below the HALs at the feedlot and distal plume area. Based on the overall concentration trends observed at the feedlot and the distal plume area, degradation continues to occur but at a slightly lower rate.

Additionally, the 2015 estimated average half-lives are within the range of published literature values (USACE WES 1997, 1998, 1999). The published half-life values for subsurface environments similar to CHAAP range from 1 to 10 years.

The calculated half-lives are used with the CHAAP groundwater contaminant fate and transport model (see **Section 7**) to help predict site remediation (i.e., all explosives concentrations below the HALs) time frames. Based on the most recent version of the groundwater model, the current estimated site remediation time frame from August 2016 for CHAAP is approximately 9 to 13 years (see **Section 7**). This time frame estimate could be reduced with additional subsurface injections in the residual source areas and downgradient. The contaminant concentrations, half-life values, and residual source area concentrations that were used in the contaminant fate and transport model to predict these site remediation time frames, are provided in **Section 7**.

6.4.2 OU3 (Shop Area 1,1,2-TCA Plume) Degradation Rates

The first-order decay rate was estimated for the OU3 1,1,2-TCA concentration using data up through the August 2015 sampling event (BW-URS 2017). The decay rate was estimated using the single well method (Graves 1995). The decay rate constant was then converted into a degradation half-life. The estimated half-life calculated for the OU3 1,1,2-TCA concentration was 2.1 years. The half-life estimate for the OU3 1,1,2-TCA concentration was within the range of published literature values for 1,1,2-TCA (Howard, et al. 1991). Data and calculations used to estimate the degradation half-life for the OU3 1,1,2-TCA concentration are included in Appendix G of the Final 2015 Groundwater Monitoring and Subsurface Injection Annual Report (BW-URS 2017).

From a historical perspective, a decay rate and associated half-life estimate has not been calculated for 1,2-DCA, a 1,1,2-TCA breakdown product. As discussed in **Section 6.3.2**, 1,2-DCA is periodically detected at a concentration above its MCL at SHGW02. Over the last five years, the 1,2-DCA concentration was below its MCL in 2012, 2013, and 2015, and above its MCL in 2014 and 2016. Considering the variability of the 1,2-DCA concentration at SHGW02, the efficacy of estimating a decay rate and half-life for 1,2-DCA and the associated benefits should be assessed the next time new decay rates and half-lives are estimated for all other chemicals of concern at CHAAP.

6.5 NATURAL ATTENUATION SUMMARIES

The following sections summarize natural attenuation processes at OU1 and OU3.

6.5.1 OU1 (Groundwater Explosives Plume) Natural Attenuation Summary

This evaluation indicates that natural attenuation of explosives in groundwater is occurring for OU1. The key elements that support the necessary lines of evidence for the use of the MNA remedy at OU1 include:

- RDX and TNT concentrations in off-post monitoring wells have decreased steadily over time, with all detections being below corresponding HALs since 2014.
- Explosives degradation products are present, including RDX degradation products MNX, DNX, and TNX (Spalding 1998) and TNT breakdown products 2-Am-DNT and 4-Am-DNT.
- Significant denitrification is occurring in areas near the load lines and the feedlot area, which is facilitating explosives degradation in the groundwater plume as it migrates through these areas. The feedlot area subsurface zone is functioning as an in-situ anaerobic/reducing treatment cell by virtue of contributing nitrate to the shallow aquifer.
- Other anaerobic degradation processes (e.g., Fe^{3+} reduction, sulfate reduction, and methanogenesis) are also occurring in on-post areas near the load lines and in the feedlot area, but to a lesser extent.

6.5.2 OU3 (Shop Area) Natural Attenuation Summary

This evaluation indicates that natural attenuation of VOCs in groundwater is occurring at OU3. The key elements that support the necessary lines of evidence for the use of the MNA remedy at OU3 include:

- The VOC 1,1,2-TCA was detected at well SHGW02 in 2016, but at a concentration below its MCL. The 1,1,2-TCA concentration at SHGW02 has been below its MCL since 2010. The VOCs historically detected at concentrations above MCLs have only been detected at wells SHGW02 and SHGW03. This indicates the previous contaminant source area is relatively small.
- The 1,1,2-TCA degradation product 1,2-DCA has been historically detected in wells G0069, SHGW02, SHGW03, and SHGW04, indicating that degradation was occurring. In 2016, 1,2-DCA was detected at a concentration above its MCL (5 µg/L) at well SHGW02, but was below its MCL at downgradient well SHGW03, and has been since 2000. Another 1,1,2-TCA degradation product, vinyl chloride, has been detected in wells SHGW02, SHGW03, and G0053 but has been below its MCL (2 µg/L) since 2000. A trace concentration of vinyl chloride was detected only at well SHGW02 in 2016.
- Benzene was detected in trace concentrations at SHGW03 in 2016 but was below its MCL (5 µg/L). Historically, benzene has been detected only in wells G0069 in 2000; SHGW02 in 2010, 2012, and 2014; and SHGW03 in years 2000 through 2014, except for years 2004 and 2008, with the 2003 detection being the only one above its MCL.
- Petroleum hydrocarbon compounds are present in wells G0069, SHGW03, and SHGW04, providing a source of nutrient organic carbon for microbial reductive dehalogenation.

- Low DO concentrations exist within and downgradient of the 1,2-DCA plume area, which is favorable for reductive dehalogenation of chlorinated solvents (Wiedemeier, et al. 1996; USEPA 1998).
- Low ORP values within and downgradient of the 1,2-DCA plume area indicate that a reducing environment exists, supporting reductive dehalogenation of chlorinated solvents (Wiedemeier, et al. 1996).
- High methane values exist within and downgradient of the 1,2-DCA plume area, indicating that methanogenesis is occurring.
- 1,1,2-TCA and 1,2-DCA were not detected above MCLs downgradient of SHGW02, in wells SHGW03, G0069, SHGW04, or SAMW1, indicating that the VOC plume is not migrating beyond the OU3 boundary.

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	ORP (mV)								DO (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
NW020	154.3	146.5	129.1	117.8	65.1	188.3	195.7	**142.4**	3.80	4.85	3.54	2.54	4.03	3.18	5.29	**3.89**
NW030	127.8	133.8	83.9	160.0	NS	NS	NS	**126.4**	6.18	6.27	6.29	6.42	NS	NS	NS	**6.29**
NW050	125.6	136.2	123.9	166.4	NS	NS	NS	**138.0**	10.19	8.33	5.82	4.31	NS	NS	NS	**7.16**
NW060	111.9	138.0	141.0	200.5	NS	NS	NS	**147.9**	9.68	11.38	10.06	9.09	NS	NS	NS	**10.05**
NW070	50.3	84.8	50.9	142.3	NS	NS	NS	**82.1**	0.90	0.16	0.28	0.35	NS	NS	NS	**0.42**
NW080	141.5	103.0	181.7	160.4	Dry	179.9	173.9	**156.7**	11.38	7.55	8.82	9.01	Dry	7.92	9.72	**9.07**
NW100	159.4	149.0	189.7	174.2	NS	NS	NS	**168.1**	12.26	9.80	9.38	8.54	NS	NS	NS	**10.00**
NW120	144.5	135.4	171.5	NS	NS	NS	NS	**150.5**	5.79	5.19	3.71	NS	NS	NS	NS	**4.90**
NW130R	166.2	52.8	135.5	197.9	NS	NS	NS	**138.1**	6.29	6.08	5.14	8.20	NS	NS	NS	**6.43**
CA210	150.1	13.7	89.9	Dry	NS	NS	NS	**84.6**	0.52	1.51	0.73	Dry	NS	NS	NS	**0.92**
CA240	175.6	217.4	168.8	Dry	NS	NS	NS	**187.3**	10.72	10.79	10.17	Dry	NS	NS	NS	**10.56**
CA250	84.5	135.0	123.1	136.7	NS	NS	NS	**119.8**	9.29	8.53	8.75	7.81	NS	NS	NS	**8.60**
CA260	NS	NS	85.0	92.7	Aban	Aban	Aban	**88.9**	NS	NS	4.58	3.25	Aban	Aban	Aban	**3.92**
CA270	121.6	162.0	190.0	Dry	105.1	193.1	193.4	**160.9**	4.98	3.40	1.96	Dry	1.5	1.37	0.96	**2.36**
CA280	166.5	141.7	199.5	Dry	NS	NS	NS	**169.2**	2.5	4.67	2.68	Dry	NS	NS	NS	**3.28**
CA290R	163.1	147.9	107.2	196.3	53.1	147.9	164.4	**140.0**	4.97	3.07	2.74	1.75	4.09	2.18	5.75	**3.51**
CA310	178.6	136.2	83.0	169.9	106.9	Dry	116.9	**131.9**	1.92	1.92	2.90	5.31	4.35	Dry	5.98	**3.73**
CA330	176.4	133.0	57.8	205.8	111.2	165.7	181.3	**147.3**	2.89	4.50	4.67	3.59	2.89	3.28	5.08	**3.84**
Average	**141.1**	**127.4**	**128.4**	**163.1**	**88.3**	**175.0**	**170.9**	**137.8**	**6.13**	**5.76**	**5.12**	**5.40**	**3.37**	**3.59**	**5.46**	**5.50**
Shallow Feedlot Wells																
CA350	137.2	193.9	187.8	108.0	Aban	Aban	Aban	**156.7**	0.63	0.20	1.40	0.74	Aban	Aban	Aban	**0.74**
CA360	-77.2	-190.6	-109.1	190.4	Aban	Aban	Aban	**-46.6**	0.35	0.11	0.13	0.29	Aban	Aban	Aban	**0.22**
CA380	-124.9	-123.5	-65.8	-66.3	Aban	Aban	Aban	**-95.1**	0.48	0.13	0.25	0.34	Aban	Aban	Aban	**0.30**
CA390	105.8	167.7	80.0	210.8	Aban	Aban	Aban	**141.1**	3.15	1.46	0.72	0.99	Aban	Aban	Aban	**1.58**
Average	**10.2**	**11.9**	**23.2**	**110.7**	**N/A**	**N/A**	**N/A**	**39.0**	**1.15**	**0.48**	**0.63**	**0.59**	**N/A**	**N/A**	**N/A**	**0.71**
Shallow-Intermediate Wells																
NW021	137.7	155.4	48.9	119.7	44.2	182.3	139.2	**118.2**	0.10	0.18	0.25	0.14	0.33	0.38	0.38	**0.25**
NW031	41.5	55.2	21.0	53.1	NS	NS	NS	**42.7**	0.17	1.04	0.14	0.36	NS	NS	NS	**0.43**
NW051	115.4	167.0	134.3	179.4	NS	NS	NS	**149.0**	1.29	0.49	0.19	0.35	NS	NS	NS	**0.58**
NW061	99.6	171.4	161.3	151.1	NS	NS	NS	**145.9**	0.14	0.33	0.41	0.91	NS	NS	NS	**0.45**
NW071	-57.1	93.0	90.2	157.6	NS	NS	NS	**70.9**	0.79	0.57	0.95	1.42	NS	NS	NS	**0.93**
NW081R	126.4	108.4	137.4	155.8	61.2	172.3	173.9	**133.6**	2.08	1.89	2.20	1.90	1.79	1.75	2.35	**1.99**
NW101	144.8	138.5	188.3	180.2	NS	NS	NS	**163.0**	0.34	0.14	0.31	0.22	NS	NS	NS	**0.25**
NW131R	162.1	82.3	157.1	219.1	NS	NS	NS	**155.2**	4.84	4.52	4.93	4.54	NS	NS	NS	**4.71**
CA211	129.9	23.2	179.2	177.2	NS	NS	NS	**127.4**	0.50	1.91	1.68	0.73	NS	NS	NS	**1.21**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	ORP (mV)								DO (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
CA241	170.7	170.5	136.1	191.5	NS	NS	NS	**167.2**	5.09	5.88	6.61	6.12	NS	NS	NS	**5.93**
CA251	110.4	132.3	131.8	179.8	NS	NS	NS	**138.6**	5.77	5.11	5.04	6.45	NS	NS	NS	**5.59**
CA261	NS	NS	104.70	51.90	Aban	Aban	Aban	**78.3**	NS	NS	6.48	6.50	Aban	Aban	Aban	**6.49**
CA271	128.9	161.2	170.7	211.3	71.9	182.8	195.5	**160.3**	6.81	5.63	5.81	6.19	5.91	5.16	5.71	**5.89**
CA281	174.9	135.1	143.9	185.0	NS	NS	NS	**159.7**	1.00	1.32	5.15	1.99	NS	NS	NS	**2.37**
CA291R	156.9	145.9	129.7	200.1	62.2	154.3	179.6	**147.0**	4.64	1.97	1.99	2.47	2.18	2.70	3.63	**2.80**
CA311	167.9	123.3	96.0	147.6	86.5	161.5	78.3	**123.0**	0.50	0.81	1.13	2.19	2.90	1.99	2.52	**1.72**
CA331	181.5	161.5	85.3	185.9	131.0	161.0	172.6	**154.1**	2.32	3.04	2.50	3.14	3.19	2.53	1.37	**2.58**
Average	**124.5**	**126.5**	**124.5**	**161.5**	**76.2**	**169.0**	**156.5**	**131.4**	**2.27**	**2.18**	**2.69**	**2.68**	**2.72**	**2.42**	**2.66**	**2.60**
Shallow-Intermediate Feedlot Wells																
CA351	83.6	120.6	173.2	120.6	Aban	Aban	Aban	**124.5**	0.70	0.67	0.69	0.52	Aban	Aban	Aban	**0.65**
CA361	-110.8	-162.1	-174.6	161.0	Aban	Aban	Aban	**-71.6**	0.38	0.14	0.13	0.20	Aban	Aban	Aban	**0.21**
CA381	-127.3	-143.4	-163.5	-2.6	Aban	Aban	Aban	**-109.2**	0.30	0.10	0.20	0.33	Aban	Aban	Aban	**0.23**
Average	**-51.5**	**-61.6**	**-55.0**	**93.0**	**N/A**	**N/A**	**N/A**	**-18.8**	**0.46**	**0.30**	**0.34**	**0.35**	**N/A**	**N/A**	**N/A**	**0.36**
Intermediate Wells																
NW022	-27.2	-45.9	-55.1	-40.1	-4.3	12.1	-45.3	**-29.4**	0.04	0.27	0.22	0.09	0.37	0.27	0.32	**0.23**
NW032	-74.7	-78.0	-91.2	-71.8	NS	NS	NS	**-78.9**	0.05	0.27	0.17	0.15	NS	NS	NS	**0.16**
NW052	-25.1	-45.1	-30.8	-34.5	NS	NS	NS	**-33.9**	0.29	0.19	0.16	0.36	NS	NS	NS	**0.25**
NW062	-56.8	-60.8	-72.0	133.1	NS	NS	NS	**-14.1**	0.01	0.22	0.34	0.17	NS	NS	NS	**0.19**
NW082R	121.9	110.0	138.9	155.5	82.0	166.8	151.9	**132.4**	0.39	0.21	0.18	0.22	0.26	0.41	0.35	**0.29**
NW102	122.2	80.7	130.2	154.6	NS	NS	NS	**121.9**	0.44	0.09	0.42	0.22	NS	NS	NS	**0.29**
NW121	134.7	93.7	47.3	253.9	NS	NS	NS	**132.4**	0.28	0.22	0.23	0.13	NS	NS	NS	**0.22**
NW132R	152.6	96.7	160.1	243.1	NS	NS	NS	**163.1**	5.16	1.30	1.45	1.07	NS	NS	NS	**2.25**
CA212	114.8	37.9	162.4	187.4	NS	NS	NS	**125.6**	0.16	0.30	0.41	0.16	NS	NS	NS	**0.26**
CA242	157.6	72.0	108.4	129.9	NS	NS	NS	**117.0**	0.08	0.46	0.27	0.31	NS	NS	NS	**0.28**
CA252	103.8	123.5	122.4	176.3	NS	NS	NS	**131.5**	0.12	0.13	0.48	0.83	NS	NS	NS	**0.39**
CA262	NS	NS	105.00	157.20	Aban	Aban	Aban	**131.1**	NS	NS	2.36	2.34	Aban	Aban	Aban	**2.35**
CA272	117.4	126.5	155.8	195.4	80.2	176.6	200.9	**150.4**	3.88	3.41	3.40	4.03	4.05	3.41	4.39	**3.80**
CA282	157.4	121.9	142.9	177.8	NS	NS	NS	**150.0**	1.87	1.86	1.46	1.87	NS	NS	NS	**1.77**
CA292R	139.6	105.2	117.1	197.1	59.1	152.1	168.3	**134.1**	0.31	0.16	0.16	0.09	0.28	1.13	0.64	**0.40**
CA312	108.3	112.4	108.8	156.5	89.1	159.6	70.4	**115.0**	0.78	0.80	1.15	2.36	2.58	1.19	1.91	**1.54**
CA322	116.6	130.2	91.1	141.9	NS	NS	NS	**120.0**	3.21	1.70	1.27	1.28	NS	NS	NS	**1.87**
CA332	175.8	147.2	110.0	180.7	120.3	155.7	151.8	**148.8**	1.01	0.83	0.81	1.74	1.44	1.42	1.70	**1.28**
CA342	104.1	110.3	74.5	197.4	74.3	123.5	204.5	**126.9**	2.87	1.71	1.29	1.62	2.21	1.11	1.19	**1.71**
Average	**91.3**	**68.8**	**80.3**	**141.7**	**71.5**	**135.2**	**128.9**	**97.0**	**1.16**	**0.79**	**0.85**	**1.00**	**1.60**	**1.28**	**1.50**	**1.03**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	ORP (mV)								DO (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Feedlot Wells																
CA352	2.3	-14.6	-26.7	92.1	Aban	Aban	Aban	**13.3**	0.73	0.22	0.36	0.18	Aban	Aban	Aban	**0.37**
CA362	-100.0	-106.7	-139.7	116.2	Aban	Aban	Aban	**-57.6**	0.25	0.13	0.13	0.13	Aban	Aban	Aban	**0.16**
CA382	-94.4	-84.8	-91.5	-1.6	Aban	Aban	Aban	**-68.1**	0.38	0.11	0.19	0.19	Aban	Aban	Aban	**0.22**
Average	**-64.0**	**-68.7**	**-86.0**	**68.9**	**N/A**	**N/A**	**N/A**	**-37.5**	**0.45**	**0.15**	**0.23**	**0.17**	**N/A**	**N/A**	**N/A**	**0.25**
Deep Wells																
NW122	-69.3	-68.0	-77.7	60.4	NS	NS	NS	**-38.7**	0.03	0.24	0.30	0.15	NS	NS	NS	**0.18**
CA213	-29.2	23.8	122.2	183.9	NS	NS	NS	**75.2**	0.17	0.19	0.28	0.22	NS	NS	NS	**0.22**
CA253	-34.4	-52.1	-69.4	-62.7	NS	NS	NS	**-54.7**	0.04	0.16	0.52	0.29	NS	NS	NS	**0.25**
CA273	-46.1	-63.1	106.1	64.9	-58.8	16.0	-40.9	**-3.1**	0.26	0.23	0.30	0.12	0.48	0.58	0.36	**0.33**
CA313	12.5	-27.6	-28.6	-25.6	74.7	55.8	-12.8	**6.9**	0.03	0.09	0.19	0.37	0.39	0.63	0.23	**0.28**
CA343	103.8	78.6	55.8	198.8	1.9	145.1	133.2	**102.5**	0.71	0.82	1.05	0.68	1.06	0.87	0.83	**0.86**
Average	**-10.5**	**-18.1**	**18.1**	**70.0**	**5.9**	**72.3**	**26.5**	**14.7**	**0.21**	**0.29**	**0.44**	**0.31**	**0.64**	**0.69**	**0.47**	**0.35**

Notes:
Dry: well could not be sampled due to lack of water

μg/L = micrograms per liter	mV = millivolts
Aban = Abandoned	N/A = not applicable
Avg = average	ND = nondetect
DO = dissolved oxygen	NS = not sampled
DOC = dissolved organic carbon	ORP = oxidation/reduction potential
mg/L = milligrams per liter	OU = Operable Unit
MNA = monitored natural attenuation	TKN = Total Kjeldahl Nitrogen
mS/cm = milliSiemens per centimeter	

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Nitrate/Nitrite (mg/L)								Ammonia (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
NW020	38.0	31.0	13.3	7.7	26.0	32.0	NS	**24.7**	0.066	ND	ND	0.458	0.056	ND	NS	**0.097**
NW030	22.0	19.5	26.5	22.2	NS	NS	NS	**22.6**	0.027	ND	ND	0.207	NS	NS	NS	**0.059**
NW050	37.0	40.4	38.1	1.8	NS	NS	NS	**29.3**	0.078	ND	ND	1.93	NS	NS	NS	**0.502**
NW060	4.4	5.63	10.4	2.9	NS	NS	NS	**5.8**	0.082	ND	ND	1.64	NS	NS	NS	**0.431**
NW070	33.0	23.4	30.0	25.0	NS	NS	NS	**27.9**	ND	ND	ND	0.287	NS	NS	NS	**0.072**
NW080	32.0	15.9	27.8	27.6	Dry	43	NS	**29.3**	0.036	ND	ND	0.385	Dry	ND	NS	**0.084**
NW100	8.7	24.5	39.0	50.1	NS	NS	NS	**30.6**	0.036	ND	0.175	0.311	NS	NS	NS	**0.131**
NW120	9.5	9.69	9.5	NS	NS	NS	NS	**9.6**	ND	ND	ND	NS	NS	NS	NS	**ND**
NW130R	1.6	3.65	1.2	3.8	NS	NS	NS	**2.5**	0.110	0.051	ND	ND	NS	NS	NS	**0.040**
CA210	25.0	19.2	21.9	Dry	NS	NS	NS	**22.0**	0.130	0.745	ND	Dry	NS	NS	NS	**0.292**
CA240	69.0	77.6	66.7	Dry	NS	NS	NS	**71.1**	0.038	ND	0.0929	Dry	NS	NS	NS	**0.044**
CA250	6.9	7.62	10.5	6.6	NS	NS	NS	**7.9**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA260	NS	NS	11.5	1.7	Aban	Aban	Aban	**6.6**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
CA270	6.5	10.1	9.1	Dry	9.3	11.0	NS	**9.2**	ND	ND	0.187	Dry	0.059	ND	NS	**0.049**
CA280	6.9	3.3	4.8	Dry	NS	NS	NS	**5.0**	ND	ND	ND	Dry	NS	NS	NS	**ND**
CA290R	7.3	6.6	4.6	4.6	7.1	8.3	NS	**6.4**	0.051	ND	0.13	0.13	0.17	0.04	NS	**0.087**
CA310	5.2	11.3	19.2	10.9	17.0	Dry	NS	**12.7**	ND	0.0878	ND	ND	0.033	Dry	NS	**0.024**
CA330	9.3	10.0	10.3	9.7	8.7	6.0	NS	**9.0**	ND	0.0407	ND	ND	0.040	ND	NS	**0.013**
Average	**19.0**	**18.8**	**19.7**	**13.4**	**13.6**	**20.1**	**N/A**	**18.5**	**0.065**	**0.231**	**0.146**	**0.669**	**0.072**	**0.040**	**N/A**	**0.107**
Shallow Feedlot Wells																
CA350	0.27	0.31	0.509	ND	Aban	Aban	Aban	**0.27**	0.087	ND	0.208	1.24	Aban	Aban	Aban	**0.384**
CA360	0.8	0.0863	3.280	ND	Aban	Aban	Aban	**1.04**	54.0	117	53.1	90.3	Aban	Aban	Aban	**78.60**
CA380	ND	0.131	0.463	ND	Aban	Aban	Aban	**0.15**	87.0	101	69.2	54.5	Aban	Aban	Aban	**77.93**
CA390	18.0	12.1	15.1	15.4	Aban	Aban	Aban	**15.2**	0.14	ND	ND	0.175	Aban	Aban	Aban	**0.079**
Average	**6.4**	**3.2**	**4.8**	**15.4**	**N/A**	**N/A**	**N/A**	**4.2**	**35.31**	**109.0**	**40.84**	**36.55**	**N/A**	**N/A**	**N/A**	**39.25**
Shallow-Intermediate Wells																
NW021	4.7	2.22	1.2	1.1	1.2	2.8	NS	**2.2**	ND	ND	ND	0.6	ND	ND	NS	**0.098**
NW031	0.44	0.567	0.192	0.819	NS	NS	NS	**0.5**	0.026	ND	ND	0.5	NS	NS	NS	**0.123**
NW051	24.0	15.3	23.2	1.5	NS	NS	NS	**16.0**	0.10	ND	ND	1.3	NS	NS	NS	**0.350**
NW061	2.6	4.93	1.4	1.0	NS	NS	NS	**2.5**	0.910	1.550	1.930	2.4	NS	NS	NS	**1.708**
NW071	22.0	21.9	21.8	27.4	NS	NS	NS	**23.3**	1.20	ND	0.092	0.160	NS	NS	NS	**0.363**
NW081R	34.0	32.4	28.0	26.6	38	36	NS	**32.5**	0.057	ND	0.156	0.257	0.032	ND	NS	**0.084**
NW101	39.0	43.8	39.2	42.7	NS	NS	NS	**41.2**	1.20	2.920	3.860	4.0	NS	NS	NS	**2.995**
NW131R	18.0	16.6	19.1	15.6	NS	NS	NS	**17.3**	ND	0.051	ND	0.257	NS	NS	NS	**0.077**
CA211	37.0	41.5	36.9	32.7	NS	NS	NS	**37.0**	0.059	ND	ND	0.3	NS	NS	NS	**0.093**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Nitrate/Nitrite (mg/L)								Ammonia (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
CA241	24.0	20.8	24.0	22.5	NS	NS	NS	**22.8**	0.087	ND	0.733	ND	NS	NS	NS	**0.205**
CA251	35.0	23.5	24.2	21.5	NS	NS	NS	**26.1**	0.088	ND	ND	0.3	NS	NS	NS	**0.085**
CA261	NS	NS	27.30	23.3	Aban	Aban	NS	**25.3**	NS	NS	ND	ND	Aban	Aban	NS	**ND**
CA271	16.0	17.8	17.3	12.7	12.0	18.0	NS	**15.6**	ND	ND	0.110	ND	0.039	ND	NS	**0.025**
CA281	17.0	15.0	14.3	ND	NS	NS	NS	**11.6**	0.076	ND	ND	ND	NS	NS	NS	**0.019**
CA291R	16.0	11.6	11.2	13.5	13.0	13.0	NS	**13.1**	0.089	ND	0.152	ND	0.054	0.044	NS	**0.057**
CA311	9.3	10.2	9.4	9.8	11.0	11.0	NS	**10.1**	ND	0.0489	ND	ND	0.046	0.039	NS	**0.022**
CA331	13.0	11.4	12.6	14.0	13.0	8.6	NS	**12.1**	ND	0.0484	ND	ND	0.026	ND	NS	**0.012**
Average	**19.5**	**18.1**	**18.3**	**16.7**	**14.7**	**14.9**	**N/A**	**18.2**	**0.354**	**0.924**	**1.005**	**1.003**	**0.039**	**0.042**	**N/A**	**0.371**
Shallow-Intermediate Feedlot Wells																
CA351	1.6	1.38	0.3	0.115	Aban	Aban	Aban	**0.8**	0.53	0.494	0.956	2.39	Aban	Aban	Aban	**1.09**
CA361	ND	ND	ND	ND	Aban	Aban	Aban	**ND**	71.0	73.1	54.5	56.6	Aban	Aban	Aban	**63.80**
CA381	ND	0.116	ND	ND	Aban	Aban	Aban	**0.03**	44.0	56.2	47.7	28.7	Aban	Aban	Aban	**44.15**
Average	**0.5**	**0.5**	**0.1**	**0.04**	**N/A**	**N/A**	**N/A**	**0.3**	**38.5**	**43.3**	**34.4**	**29.2**	**N/A**	**N/A**	**N/A**	**36.35**
Intermediate Wells																
NW022	ND	ND	ND	ND	ND	ND	NS	**ND**	0.024	ND	ND	0.77	0.061	0.033	NS	**0.148**
NW032	ND	ND	ND	ND	NS	NS	NS	**ND**	0.083	ND	ND	0.29	NS	NS	NS	**0.093**
NW052	ND	ND	ND	0.08	NS	NS	NS	**0.02**	0.10	ND	ND	1.97	NS	NS	NS	**0.518**
NW062	ND	ND	ND	0.20	NS	NS	NS	**0.05**	0.089	ND	ND	1.36	NS	NS	NS	**0.362**
NW082R	28.0	26.6	21.0	27	38	35	NS	**29.3**	0.036	ND	0.094	ND	0.04	0.19	NS	**0.060**
NW102	37.0	34.5	28.5	28	NS	NS	NS	**32.0**	0.068	ND	0.192	0.679	NS	NS	NS	**0.235**
NW121	1.5	0.99	0.99	1.42	NS	NS	NS	**1.2**	ND	ND	ND	0.280	NS	NS	NS	**0.070**
NW132R	22.0	34.0	33.0	28.0	NS	NS	NS	**29.3**	0.051	ND	ND	0.251	NS	NS	NS	**0.076**
CA212	12.0	23.3	31.9	17.3	NS	NS	NS	**21.1**	0.075	ND	ND	ND	NS	NS	NS	**0.019**
CA242	0.5	2.03	1.5	2.97	NS	NS	NS	**1.8**	0.037	ND	ND	ND	NS	NS	NS	**0.009**
CA252	13.0	8.4	13.3	14.9	NS	NS	NS	**12.4**	0.070	ND	ND	0.250	NS	NS	NS	**0.080**
CA262	NS	NS	12.8	13.4	Aban	Aban	Aban	**13.1**	NS	NS	ND	0.304	Aban	Aban	Aban	**0.152**
CA272	23.0	23.0	23.6	1.01	27.0	23.0	NS	**20.1**	ND	ND	0.098	ND	0.025	ND	ND	**0.018**
CA282	15.0	13.6	11	0.72	NS	NS	NS	**10.0**	0.030	ND	ND	0.458	NS	NS	NS	**0.122**
CA292R	1.1	0.3	1.55	5.4	0.10	13.0	NS	**3.6**	0.065	ND	0.196	ND	0.03	ND	ND	**0.042**
CA312	9.5	9.6	8.0	1.1	15.0	14.0	NS	**9.5**	0.065	0.043	0.122	ND	ND	0.19	NS	**0.070**
CA322	12.0	14.7	11.5	ND	NS	NS	NS	**9.6**	ND	0.0	ND	ND	NS	NS	NS	**0.012**
CA332	14.0	10.2	9.6	11.6	11.0	10.0	NS	**11.1**	ND	0.0	ND	ND	0.066	ND	NS	**0.017**
CA342	14.0	12.4	11.9	15.2	15.0	12.0	NS	**13.4**	ND	0.0358	ND	ND	0.022	ND	NS	**0.010**
Average	**11.3**	**11.9**	**11.6**	**8.9**	**15.2**	**15.3**	**N/A**	**11.4**	**0.044**	**0.009**	**0.037**	**0.348**	**0.035**	**0.059**	**N/A**	**0.111**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Nitrate/Nitrite (mg/L)								Ammonia (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Feedlot Wells																
CA352	ND	ND	ND	1.6	Aban	Aban	Aban	**0.4**	0.10	ND	0.203	1.190	Aban	Aban	Aban	**0.373**
CA362	ND	0.40	ND	ND	Aban	Aban	Aban	**0.1**	17.0	16.7	7.05	5.38	Aban	Aban	Aban	**11.53**
CA382	ND	0.08	ND	ND	Aban	Aban	Aban	**0.02**	0.27	0.43	0.272	0.926	Aban	Aban	Aban	**0.475**
Average	**ND**	**0.16**	**ND**	**0.53**	**N/A**	**N/A**	**N/A**	**0.2**	**5.789**	**5.710**	**2.508**	**2.499**	**N/A**	**N/A**	**N/A**	**4.127**
Deep Wells																
NW122	ND	ND	0.2	ND	NS	NS	NS	**0.1**	ND	ND	ND	0.32	NS	NS	NS	**0.080**
CA213	0.90	1.0	0.78	1.93	NS	NS	NS	**1.2**	0.052	ND	ND	0.898	NS	NS	NS	**0.238**
CA253	ND	ND	ND	ND	NS	NS	NS	**ND**	0.086	ND	0.293	0.338	NS	NS	NS	**0.179**
CA273	ND	0.0	0.153	ND	ND	ND	NS	**0.03**	0.110	0.283	ND	ND	0.087	0.11	NS	**0.098**
CA313	ND	ND	ND	ND	ND	ND	NS	**ND**	0.096	0.135	ND	ND	0.10	0.15	NS	**0.080**
CA343	13.0	13.4	18.1	15.5	11.0	1.4	NS	**12.1**	ND	ND	ND	ND	ND	ND	NS	**ND**
Average	**2.3**	**2.4**	**3.2**	**2.9**	**3.7**	**0.5**	**N/A**	**2.2**	**0.057**	**0.070**	**0.049**	**0.259**	**0.062**	**0.087**	**N/A**	**0.113**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	TKN (mg/L)								DOC (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
NW020	ND	ND	ND	ND	ND	ND	NS	**ND**	3.70	4.39	2.59	3.31	3.80	3.20	NS	**3.50**
NW030	ND	ND	ND	ND	NS	NS	NS	**ND**	1.60	2.53	ND	2.23	NS	NS	NS	**1.59**
NW050	ND	ND	ND	0.14	NS	NS	NS	**0.03**	2.50	3.42	3.24	5.82	NS	NS	NS	**3.75**
NW060	ND	ND	2.39	0.99	NS	NS	NS	**0.85**	1.40	2.04	ND	2.51	NS	NS	NS	**1.49**
NW070	ND	ND	ND	0.88	NS	NS	NS	**0.22**	5.30	7.05	6.06	6.02	NS	NS	NS	**6.11**
NW080	ND	ND	ND	ND	Dry	ND	NS	**ND**	2.60	3.5	2.74	3.38	Dry	3.30	NS	**3.10**
NW100	ND	ND	ND	1.63	NS	NS	NS	**0.41**	1.60	3.68	3.32	4.28	NS	NS	NS	**3.22**
NW120	ND	ND	ND	NS	NS	NS	NS	**ND**	2.00	2.5	2.25	NS	NS	NS	NS	**2.25**
NW130R	0.94	ND	3.03	1.64	NS	NS	NS	**1.40**	6.60	2.87	8.24	8.96	NS	NS	NS	**6.67**
CA210	ND	2.67	ND	Dry	NS	NS	NS	**0.89**	8.90	15.2	12.3	Dry	NS	NS	NS	**12.13**
CA240	ND	ND	ND	Dry	NS	NS	NS	**ND**	1.30	2.24	1.59	Dry	NS	NS	NS	**1.71**
CA250	ND	ND	1.56	0.65	NS	NS	NS	**0.55**	2.10	3.04	2.64	2.93	NS	NS	NS	**2.68**
CA260	NS	NS	ND	ND	Aban	Aban	Aban	**ND**	NS	NS	3.13	3.47	Aban	Aban	Aban	**3.30**
CA270	ND	ND	ND	Dry	0.25	ND	NS	**0.05**	2.70	4.88	4.54	Dry	6.40	4.30	NS	**4.56**
CA280	ND	ND	ND	Dry	NS	NS	NS	**ND**	1.40	1.86	1.85	Dry	NS	NS	NS	**1.70**
CA290R	ND	ND	ND	ND	ND	ND	NS	**ND**	2.20	3.22	3.24	3.24	3.30	2.80	NS	**3.00**
CA310	0.58	0.687	ND	ND	ND	Dry	NS	**0.25**	4.60	6.18	5.35	3.61	3.40	Dry	NS	**4.63**
CA330	ND	ND	ND	ND	ND	ND	NS	**ND**	2.30	2.39	2.19	2.45	2.30	2.00	NS	**2.27**
Average	**0.76**	**1.68**	**2.33**	**0.99**	**0.25**	**ND**	**N/A**	**0.26**	**3.11**	**4.18**	**4.08**	**4.02**	**3.84**	**3.12**	**N/A**	**3.76**
Shallow Feedlot Wells																
CA350	1.10	1.67	1.85	2.29	Aban	Aban	Aban	**1.73**	8.90	13.4	9.37	10.4	Aban	Aban	Aban	**10.52**
CA360	52.0	121.0	69.5	166	Aban	Aban	Aban	**102.13**	67.0	132.0	62.3	84.5	Aban	Aban	Aban	**86.45**
CA380	98.0	92.1	90.5	95.9	Aban	Aban	Aban	**94.13**	59.0	63.9	48.8	30.3	Aban	Aban	Aban	**50.50**
CA390	0.59	0.858	1.93	2.4	Aban	Aban	Aban	**1.44**	10.0	12.6	10.5	10.4	Aban	Aban	Aban	**10.88**
Average	**37.92**	**53.91**	**40.95**	**66.64**	**N/A**	**N/A**	**N/A**	**49.85**	**36.23**	**55.48**	**32.74**	**33.90**	**N/A**	**N/A**	**N/A**	**39.59**
Shallow-Intermediate Wells																
NW021	ND	ND	ND	ND	ND	ND	NS	**ND**	1.90	2.79	ND	2.20	2.20	2.40	NS	**1.92**
NW031	0.27	ND	ND	1.16	NS	NS	NS	**0.36**	1.90	2.68	2.85	2.44	NS	NS	NS	**2.47**
NW051	ND	1.26	1.88	1.48	NS	NS	NS	**1.16**	9.80	8.56	6.82	10.1	NS	NS	NS	**8.82**
NW061	1.30	1.87	5.57	5.80	NS	NS	NS	**3.64**	3.20	4.64	5.32	6.28	NS	NS	NS	**4.86**
NW071	ND	ND	ND	ND	NS	NS	NS	**ND**	2.20	3.12	2.63	4.35	NS	NS	NS	**3.08**
NW081R	ND	ND	ND	0.43	ND	ND	NS	**0.07**	3.50	4.72	6.00	4.64	5.0	4.40	NS	**4.71**
NW101	ND	ND	3.84	1.42	NS	NS	NS	**1.32**	12.0	14.7	8.34	9.06	NS	NS	NS	**11.03**
NW131R	ND	ND	0.881	0.814	NS	NS	NS	**0.42**	1.70	2.40	1.60	3.93	NS	NS	NS	**2.41**
CA211	ND	ND	ND	ND	NS	NS	NS	**ND**	5.20	7.18	5.47	6.56	NS	NS	NS	**6.10**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	TKN (mg/L)								DOC (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
CA241	ND	ND	ND	0.172	NS	NS	NS	**0.04**	1.30	2.05	1.61	2.31	NS	NS	NS	**1.82**
CA251	ND	ND	ND	0.847	NS	NS	NS	**0.21**	2.50	3.25	2.50	3.27	NS	NS	NS	**2.88**
CA261	NS	NS	ND	0.05	Aban	Aban	Aban	**0.02**	NS	NS	2.11	3.07	Aban	Aban	Aban	**2.59**
CA271	ND	ND	ND	ND	ND	ND	NS	**ND**	1.80	2.71	1.93	2.50	2.10	2.0	NS	**2.17**
CA281	ND	ND	ND	ND	NS	NS	NS	**ND**	1.60	2.06	4.45	2.11	NS	NS	NS	**2.56**
CA291R	ND	ND	ND	ND	ND	ND	NS	**ND**	1.40	2.05	1.69	2.38	2.10	2.10	NS	**1.95**
CA311	ND	ND	ND	ND	ND	ND	NS	**ND**	1.20	2.01	1.26	2.22	1.70	1.70	NS	**1.68**
CA331	ND	ND	ND	ND	ND	ND	NS	**ND**	1.20	1.88	4.23	2.24	1.30	1.40	NS	**2.04**
Average	**0.79**	**1.57**	**3.04**	**1.35**	**ND**	**ND**	**N/A**	**0.43**	**3.28**	**4.18**	**3.68**	**4.10**	**2.40**	**2.33**	**N/A**	**3.71**
Shallow-Intermediate Feedlot Wells																
CA351	1.70	1.55	2.43	4.19	Aban	Aban	Aban	**2.47**	7.70	7.34	7.99	7.44	Aban	Aban	Aban	**7.62**
CA361	87.0	80.8	74.8	113.0	Aban	Aban	Aban	**88.90**	150	124.0	102.0	84.6	Aban	Aban	Aban	**115.15**
CA381	56.0	53.9	76.0	47.4	Aban	Aban	Aban	**58.33**	64.0	49.8	71.0	25.6	Aban	Aban	Aban	**52.60**
Average	**48.23**	**45.42**	**51.08**	**54.86**	**N/A**	**N/A**	**N/A**	**49.90**	**73.90**	**60.38**	**60.33**	**39.21**	**N/A**	**N/A**	**N/A**	**58.46**
Intermediate Wells																
NW022	0.20	ND	2.84	ND	ND	ND	NS	**0.51**	1.40	2.48	ND	2.55	2.90	2.40	NS	**1.96**
NW032	0.19	ND	ND	1.06	NS	NS	NS	**0.31**	1.80	2.60	ND	2.27	NS	NS	NS	**1.67**
NW052	1.60	1.49	2.95	ND	NS	NS	NS	**1.51**	13.0	11.7	8.22	7.86	NS	NS	NS	**10.2**
NW062	ND	0.52	3.56	0.58	NS	NS	NS	**1.16**	1.70	2.62	2.03	2.83	NS	NS	NS	**2.30**
NW082R	ND	ND	ND	0.45	ND	ND	NS	**0.08**	3.20	4.41	4.28	4.84	3.70	4.20	NS	**4.11**
NW102	ND	0.77	ND	ND	NS	NS	NS	**0.19**	4.70	10.2	6.44	5.06	NS	NS	NS	**6.60**
NW121	0.41	0.79	ND	1.31	NS	NS	NS	**0.63**	3.30	5.31	4.86	4.55	NS	NS	NS	**4.51**
NW132R	ND	ND	ND	ND	NS	NS	NS	**ND**	7.70	3.37	3.48	4.26	NS	NS	NS	**4.70**
CA212	ND	ND	ND	0.059	NS	NS	NS	**0.01**	2.0	3.39	3.23	5.05	NS	NS	NS	**3.42**
CA242	ND	ND	ND	0.24	NS	NS	NS	**0.06**	1.20	1.89	1.30	2.24	NS	NS	NS	**1.66**
CA252	ND	0.42	ND	0.12	NS	NS	NS	**0.13**	2.60	3.32	3.15	3.68	NS	NS	NS	**3.19**
CA262	NS	NS	ND	ND	Aban	Aban	Aban	**ND**	NS	NS	ND	2.04	Aban	Aban	Aban	**1.02**
CA272	ND	ND	ND	ND	ND	ND	ND	**ND**	1.30	2.31	1.56	2.45	2.10	2.0	ND	**1.67**
CA282	ND	ND	ND	ND	NS	NS	NS	**ND**	1.10	1.86	1.07	2.07	NS	NS	NS	**1.53**
CA292R	0.12	0.37	ND	ND	ND	ND	ND	**0.07**	0.43	1.15	0.52	1.62	1.70	1.50	ND	**0.99**
CA312	ND	ND	0.34	ND	ND	ND	NS	**0.06**	1.0	1.87	0.93	1.98	1.50	1.40	NS	**1.45**
CA322	ND	ND	ND	ND	NS	NS	NS	**ND**	1.20	1.58	ND	1.93	NS	NS	NS	**1.18**
CA332	ND	ND	ND	ND	ND	ND	NS	**ND**	1.0	1.93	3.46	2.16	1.70	1.20	NS	**1.91**
CA342	ND	ND	ND	ND	ND	ND	NS	**ND**	1.30	2.07	3.88	2.52	1.70	1.70	NS	**2.20**
Average	**0.14**	**0.24**	**0.51**	**0.20**	**ND**	**ND**	**ND**	**0.25**	**2.77**	**3.56**	**2.55**	**3.26**	**2.19**	**2.06**	**ND**	**2.96**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	TKN (mg/L)								DOC (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Feedlot Wells																
CA352	0.86	0.94	ND	2.24	Aban	Aban	Aban	**1.01**	6.50	6.66	6.88	7.85	Aban	Aban	Aban	**6.97**
CA362	18.0	16.4	12.7	10.6	Aban	Aban	Aban	**14.4**	14.0	18.3	9.49	4.46	Aban	Aban	Aban	**11.56**
CA382	1.20	0.85	3.16	1.40	Aban	Aban	Aban	**1.65**	6.30	5.11	6.06	2.52	Aban	Aban	Aban	**5.00**
Average	**6.69**	**6.06**	**5.29**	**4.75**	**N/A**	**N/A**	**N/A**	**5.70**	**8.93**	**10.02**	**7.48**	**4.94**	**N/A**	**N/A**	**N/A**	**7.84**
Deep Wells																
NW122	0.16	ND	ND	0.96	NS	NS	NS	**0.28**	0.55	1.43	ND	1.61	NS	NS	NS	**0.90**
CA213	ND	ND	ND	0.30	NS	NS	NS	**0.08**	1.10	1.94	ND	2.56	NS	NS	NS	**1.40**
CA253	0.34	0.37	ND	0.62	NS	NS	NS	**0.33**	1.10	2.12	1.65	2.71	NS	NS	NS	**1.90**
CA273	0.15	0.44	ND	ND	ND	0.24	NS	**0.14**	0.48	1.42	ND	1.41	0.86	0.87	NS	**0.84**
CA313	0.24	ND	ND	ND	ND	0.25	NS	**0.08**	0.35	1.76	ND	1.24	0.57	0.64	NS	**0.76**
CA343	ND	ND	ND	ND	ND	ND	NS	**ND**	1.30	1.96	3.54	2.00	1.50	1.50	NS	**1.97**
Average	**0.15**	**0.14**	**ND**	**0.31**	**ND**	**0.16**	**N/A**	**0.15**	**0.81**	**1.77**	**0.87**	**1.92**	**0.98**	**1.00**	**N/A**	**1.29**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	Carbon Dioxide (mg/L)								Methane (µg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
NW020	110	109	102	147	102	98	NS	**111**	ND	ND	ND	12.0	ND	ND	NS	**2.0**
NW030	93	78	80	82	NS	NS	NS	**83**	ND	ND	ND	2.0	NS	NS	NS	**0.5**
NW050	120	87	57	45	NS	NS	NS	**77**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW060	17	14	17	34	NS	NS	NS	**20**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW070	75	119	59	71	NS	NS	NS	**81**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW080	82	88	52	67	Dry	53	NS	**68**	ND	ND	ND	ND	Dry	ND	NS	**ND**
NW100	15	17	14	13	NS	NS	NS	**15**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW120	61	54	81	NS	NS	NS	NS	**65**	ND	ND	ND	NS	NS	NS	NS	**ND**
NW130R	76	78	63	64	NS	NS	NS	**70**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA210	140	141	138	Dry	NS	NS	NS	**140**	3.8	4.9	5.5	Dry	NS	NS	NS	**4.7**
CA240	12	12	10	Dry	NS	NS	NS	**11**	ND	ND	ND	Dry	NS	NS	NS	**ND**
CA250	65	66	72	71	NS	NS	NS	**69**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA260	NS	NS	48	96	Aban	Aban	Aban	**72**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
CA270	70	75	74	Dry	58	80	NS	**71**	ND	ND	ND	Dry	ND	ND	NS	**ND**
CA280	50	29	44	Dry	NS	NS	NS	**41**	ND	ND	0.5	Dry	NS	NS	NS	**0.2**
CA290R	150	174	185	185	164	142	NS	**167**	ND	ND	ND	ND	0.44	ND	NS	**ND**
CA310	160	161	137	120	142	Dry	NS	**144**	3.9	ND	ND	ND	ND	Dry	NS	**0.8**
CA330	170	122	129	144	124	133	NS	**137**	ND	ND	ND	ND	ND	ND	NS	**ND**
Average	**86**	**84**	**76**	**88**	**118**	**101**	**N/A**	**80**	**3.9**	**4.9**	**3.0**	**7.0**	**0.4**	**ND**	**N/A**	**0.5**
Shallow Feedlot Wells																
CA350	190	242	233	138	Aban	Aban	Aban	**201**	22	ND	12	63	Aban	Aban	Aban	**24**
CA360	320	622	280	582	Aban	Aban	Aban	**451**	9600	5700	3000	6000	Aban	Aban	Aban	**6075**
CA380	350	324	273	346	Aban	Aban	Aban	**323**	4800	3400	1600	1800	Aban	Aban	Aban	**2900**
CA390	140	127	160	153	Aban	Aban	Aban	**145**	0.73	ND	4	5.2	Aban	Aban	Aban	**2.5**
Average	**250**	**329**	**237**	**305**	**N/A**	**N/A**	**N/A**	**280**	**3606**	**4550**	**1154**	**1967**	**N/A**	**N/A**	**N/A**	**2250**
Shallow-Intermediate Wells																
NW021	120	136	131	209	124	133	NS	**142**	ND	23	200	450	480	43	NS	**199**
NW031	140	149	151	128	NS	NS	NS	**142**	1.3	ND	0.78	2	NS	NS	NS	**1.0**
NW051	140	136	137	142	NS	NS	NS	**139**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW061	110	101	110	122	NS	NS	NS	**111**	8.4	9	25	59	NS	NS	NS	**25**
NW071	54	52	51	58	NS	NS	NS	**54**	1200	ND	0.52	ND	NS	NS	NS	**300**
NW081R	92	97	96	96	89	93	NS	**94**	ND	ND	ND	ND	ND	ND	NS	**ND**
NW101	84	88	58	64	NS	NS	NS	**74**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW131R	44	39	39	49	NS	NS	NS	**43**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA211	88	116	97	107	NS	NS	NS	**102**	ND	ND	ND	ND	NS	NS	NS	**ND**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Carbon Dioxide (mg/L)								Methane (µg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
CA241	52	50	54	51	NS	NS	NS	**52**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA251	68	75	75	76	NS	NS	NS	**73**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA261	NS	NS	40	49	Aban	Aban	Aban	**44**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
CA271	50	59	142	53	62	49	NS	**69**	ND	ND	ND	ND	ND	ND	NS	**ND**
CA281	32	32	35	35	NS	NS	NS	**33**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA291R	64	72	75	75	67	58	NS	**68**	ND	ND	ND	ND	ND	ND	NS	**ND**
CA311	87	87	85	85	80	98	NS	**87**	ND	ND	ND	ND	ND	ND	NS	**ND**
CA331	77	84	73	73	84	89	NS	**80**	ND	ND	ND	ND	ND	ND	NS	**ND**
Average	**81**	**86**	**85**	**87**	**84**	**87**	**N/A**	**83**	**403**	**16**	**57**	**170**	**ND**	**ND**	**N/A**	**31**
Shallow-Intermediate Feedlot Wells																
CA351	160	140	147	218	Aban	Aban	Aban	**166**	20	7.1	9.9	33	Aban	Aban	Aban	**18**
CA361	550	551	462	533	Aban	Aban	Aban	**524**	15000	6400	4500	21000	Aban	Aban	Aban	**11725**
CA381	330	256	329	253	Aban	Aban	Aban	**292**	5400	1000	1500	260	Aban	Aban	Aban	**2040**
Average	**347**	**316**	**313**	**335**	**N/A**	**N/A**	**N/A**	**327**	**6807**	**2469**	**2003**	**7098**	**N/A**	**N/A**	**N/A**	**4594**
Intermediate Wells																
NW022	130	153	136	218	160	151	NS	**158**	0.61	ND	16	140	320	370	NS	**141**
NW032	130	153	138	130	NS	NS	NS	**138**	2.1	ND	0.91	3	NS	NS	NS	**1.5**
NW052	190	193	146	168	NS	NS	NS	**174**	110	15	12	23	NS	NS	NS	**40**
NW062	110	110	99	107	NS	NS	NS	**107**	60	24	17	13	NS	NS	NS	**29**
NW082R	95	90	89	90	76	84	NS	**87**	1.9	ND	0.8	2.8	1.2	5.2	NS	**2.0**
NW102	52	73	61	49	NS	NS	NS	**59**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW121	110	143	152	111	NS	NS	NS	**129**	ND	ND	ND	ND	NS	NS	NS	**ND**
NW132R	49	48	43	53	NS	NS	NS	**48**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA212	86	84	109	93	NS	NS	NS	**93**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA242	110	112	99	98	NS	NS	NS	**105**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA252	87	97	96	100	NS	NS	NS	**95**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA262	NS	NS	84	91	Aban	Aban	Aban	**88**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
CA272	54	50	67	49	49	58	NS	**54**	ND	ND	ND	ND	ND	ND	NS	**ND**
CA282	54	59	56	51	NS	NS	NS	**55**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA292R	84	79	68	73	58	62	NS	**71**	0.74	ND	ND	ND	ND	ND	NS	**0.12**
CA312	72	60	61	62	58	62	NS	**63**	ND	ND	ND	ND	ND	ND	NS	**ND**
CA322	77	75	60	64	NS	NS	NS	**69**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA332	63	63	65	58	62	62	NS	**62**	ND	ND	ND	ND	ND	ND	NS	**ND**
CA342	88	90	79	84	107	93	NS	**90**	ND	ND	ND	ND	ND	ND	NS	**ND**
Average	**91**	**96**	**90**	**92**	**81**	**82**	**N/A**	**92**	**10**	**2.2**	**2.5**	**10**	**46**	**54**	**N/A**	**11**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	Carbon Dioxide (mg/L)								Methane (µg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Feedlot Wells																
CA352	150	140	142	142	Aban	Aban	Aban	**144**	53	21	24	56	Aban	Aban	Aban	**39**
CA362	190	176	149	156	Aban	Aban	Aban	**168**	1100	2000	200	130	Aban	Aban	Aban	**858**
CA382	150	127	127	92	Aban	Aban	Aban	**124**	350	10	70	4	Aban	Aban	Aban	**109**
Average	**163**	**148**	**139**	**130**	**N/A**	**N/A**	**N/A**	**145**	**501**	**677**	**98**	**63**	**N/A**	**N/A**	**N/A**	**335**
Deep Wells																
NW122	83	85	76	82	NS	NS	NS	**82**	69	24	26	28	NS	NS	NS	**37**
CA213	60	56	65	60	NS	NS	NS	**60**	2.2	ND	0.7	ND	NS	NS	NS	**0.7**
CA253	84	81	80	84	NS	NS	NS	**82**	19.0	10	9	5.8	NS	NS	NS	**11.1**
CA273	80	81	70	78	76	80	NS	**77**	ND	ND	ND	ND	1.1	ND	NS	**0.2**
CA313	88	78	80	82	76	76	NS	**80**	0.63	ND	ND	ND	1.2	1.1	NS	**0.5**
CA343	100	112	84	71	93	98	NS	**93**	0.60	ND	ND	14.0	1.6	ND	NS	**2.7**
Average	**83**	**82**	**76**	**76**	**81**	**84**	**N/A**	**79**	**15**	**5.7**	**6.0**	**8.0**	**1.3**	**0.4**	**N/A**	**8.6**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	Alkalinity (mg/L)								Ferrous Iron (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
NW020	250	245	230	330	230	220	NS	**251**	ND	ND	0.08	ND	0.10	0.05	ND	**0.03**
NW030	210	175	180	185	NS	NS	NS	**188**	0.19	1.09	2.02	0.51	NS	NS	NS	**0.95**
NW050	270	195	128	102	NS	NS	NS	**174**	0.19	ND	0.03	0.01	NS	NS	NS	**0.06**
NW060	39	32.5	38	76	NS	NS	NS	**46**	ND	ND	0.33	0.48	NS	NS	NS	**0.20**
NW070	170	268	132	160	NS	NS	NS	**183**	0.05	ND	0.30	0.68	NS	NS	NS	**0.26**
NW080	190	198	118	150	Dry	120	NS	**155**	0.06	0.07	0.01	0.03	Dry	ND	ND	**0.03**
NW100	35	37.5	32	30	NS	NS	NS	**34**	0.19	ND	0.05	0.11	NS	NS	NS	**0.09**
NW120	140	122	182	NS	NS	NS	NS	**148**	0.05	0.23	0.12	NS	NS	NS	NS	**0.13**
NW130R	170	175	142	145	NS	NS	NS	**158**	0.87	0.09	0.29	0.08	NS	NS	NS	**0.33**
CA210	320	318	310	Dry	NS	NS	NS	**316**	0.08	0.67	0.71	Dry	NS	NS	NS	**0.49**
CA240	27	27.5	22	Dry	NS	NS	NS	**25**	ND	0.01	0.03	Dry	NS	NS	NS	**0.01**
CA250	150	148	161	160	NS	NS	NS	**155**	0.05	ND	ND	0.01	NS	NS	NS	**0.02**
CA260	NS	NS	107	215	Aban	Aban	Aban	**161**	NS	NS	0.22	0.06	Aban	Aban	Aban	**0.14**
CA270	160	168	167	Dry	130	180	NS	**161**	0.66	0.05	0.03	Dry	0.01	0.03	ND	**0.13**
CA280	110	65	100	Dry	NS	NS	NS	**92**	ND	ND	ND	Dry	NS	NS	NS	**ND**
CA290R	330	392	417	417	370	320	NS	**374**	0.60	1.86	ND	ND	ND	ND	ND	**0.35**
CA310	370	362	309	270	320	Dry	NS	**326**	0.02	0.39	0.22	0.20	0.02	Dry	ND	**0.14**
CA330	390	275	291	325	280	300	NS	**310**	0.13	0.14	ND	0.11	0.02	0.02	ND	**0.06**
Average	**196**	**188**	**170**	**197**	**266**	**228**	**N/A**	**181**	**0.24**	**0.46**	**0.32**	**0.21**	**0.04**	**0.03**	**ND**	**0.19**
Shallow Feedlot Wells																
CA350	430	545	525	310	Aban	Aban	Aban	**453**	1.34	0.35	0.32	0.08	Aban	Aban	Aban	**0.52**
CA360	730	1400	630	1310	Aban	Aban	Aban	**1018**	5.04	8.92	1.97	2.53	Aban	Aban	Aban	**4.62**
CA380	800	728	615	779	Aban	Aban	Aban	**731**	6.08	9.20	2.97	1.56	Aban	Aban	Aban	**4.95**
CA390	320	285	360	345	Aban	Aban	Aban	**328**	0.03	ND	ND	0.04	Aban	Aban	Aban	**0.02**
Average	**570**	**740**	**533**	**686**	**N/A**	**N/A**	**N/A**	**632**	**3.12**	**6.16**	**1.75**	**1.05**	**N/A**	**N/A**	**N/A**	**2.53**
Shallow-Intermediate Wells																
NW021	260	305	295	470	280	300	NS	**318**	0.03	0.12	0.12	ND	0.10	0.30	ND	**0.10**
NW031	320	335	340	287	NS	NS	NS	**321**	0.34	0.21	0.24	0.15	NS	NS	NS	**0.24**
NW051	320	305	308	320	NS	NS	NS	**313**	0.34	ND	0.01	0.08	NS	NS	NS	**0.11**
NW061	250	228	248	275	NS	NS	NS	**250**	ND	ND	ND	0.13	NS	NS	NS	**0.03**
NW071	120	118	114	130	NS	NS	NS	**121**	0.10	0.08	0.13	0.88	NS	NS	NS	**0.30**
NW081R	210	218	215	215	200	210	NS	**211**	0.07	0.29	0.08	0.06	ND	ND	ND	**0.07**
NW101	190	198	131	145	NS	NS	NS	**166**	0.19	0.04	0.02	0.12	NS	NS	NS	**0.09**
NW131R	100	87.5	88	110	NS	NS	NS	**96**	0.01	ND	0.04	0.09	NS	NS	NS	**0.04**
CA211	200	262	219	240	NS	NS	NS	**230**	ND	0.16	ND	ND	NS	NS	NS	**0.04**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Alkalinity (mg/L)								Ferrous Iron (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
CA241	120	112	122	115	NS	NS	NS	**117**	ND	ND	0.03	ND	NS	NS	NS	**0.01**
CA251	150	168	168	170	NS	NS	NS	**164**	ND	ND	ND	ND	NS	NS	NS	**ND**
CA261	NS	NS	91.0	110	Aban	Aban	Aban	**101**	NS	NS	ND	0.04	Aban	Aban	Aban	**0.02**
CA271	110	132	319	120	140	110	NS	**155**	0.12	0.06	0.52	ND	0.05	0.50	ND	**0.18**
CA281	74	72.5	79	70	NS	NS	NS	**74**	0.01	ND	NS	ND	NS	NS	NS	**0.003**
CA291R	150	162	169	190	150	130	NS	**159**	1.0	0.46	0.34	ND	0.02	0.10	0.03	**0.28**
CA311	200	195	191	230	180	220	NS	**203**	ND	0.02	0.32	0.06	0.05	0.01	ND	**0.07**
CA331	180	188	165	220	190	200	NS	**191**	0.26	0.09	ND	0.05	0.01	0.02	ND	**0.06**
Average	**185**	**193**	**192**	**201**	**190**	**195**	**N/A**	**188**	**0.23**	**0.15**	**0.17**	**0.17**	**0.05**	**0.19**	**0.03**	**0.10**
Shallow-Intermediate Feedlot Wells																
CA351	370	315	330	490	Aban	Aban	Aban	**376**	0.34	0.16	0.43	ND	Aban	Aban	Aban	**0.23**
CA361	1200	1240	1040	1200	Aban	Aban	Aban	**1170**	5.90	5.06	3.18	1.89	Aban	Aban	Aban	**4.01**
CA381	760	575	740	569	Aban	Aban	Aban	**661**	4.48	8.56	3.19	1.96	Aban	Aban	Aban	**4.55**
Average	**777**	**710**	**703**	**753**	**N/A**	**N/A**	**N/A**	**736**	**3.57**	**4.59**	**2.27**	**1.28**	**N/A**	**N/A**	**N/A**	**2.93**
Intermediate Wells																
NW022	300	345	305	490	360	340	NS	**357**	0.35	0.55	0.69	0.53	0.24	1.02	0.30	**0.53**
NW032	300	345	310	292	NS	NS	NS	**312**	1.15	1.21	1.08	1.15	NS	NS	NS	**1.15**
NW052	430	435	328	378	NS	NS	NS	**393**	2.27	1.72	0.05	1.93	NS	NS	NS	**1.49**
NW062	240	248	222	241	NS	NS	NS	**238**	0.88	1.19	1.26	0.77	NS	NS	NS	**1.03**
NW082R	220	202	200	202	170	190	NS	**197**	0.22	0.02	ND	1.00	0.02	0.10	0.07	**0.20**
NW102	120	165	137	110	NS	NS	NS	**133**	0.08	0.13	0.02	0.14	NS	NS	NS	**0.09**
NW121	250	322	342	250	NS	NS	NS	**291**	0.97	0.07	ND	0.09	NS	NS	NS	**0.28**
NW132R	110	108	97.5	120	NS	NS	NS	**109**	0.51	ND	0.24	ND	NS	NS	NS	**0.19**
CA212	200	188	246	210	NS	NS	NS	**211**	ND	ND	ND	0.40	NS	NS	NS	**0.10**
CA242	240	252	222	220	NS	NS	NS	**234**	0.02	0.04	0.01	0.04	NS	NS	NS	**0.03**
CA252	200	218	215	225	NS	NS	NS	**215**	ND	ND	0.14	ND	ND	NS	NS	**0.03**
CA262	NS	NS	189.0	205	Aban	Aban	Aban	**197**	NS	NS	ND	0.03	Aban	Aban	Aban	**0.02**
CA272	120	112	151	110	110	130	NS	**122**	0.12	0.01	0.46	ND	0.03	0.04	ND	**0.09**
CA282	120	132	125	115	NS	NS	NS	**123**	0.01	ND	0.04	0.01	NS	NS	NS	**0.02**
CA292R	190	178	153	165	130	140	NS	**159**	0.46	0.26	0.08	ND	0.07	ND	ND	**0.12**
CA312	160	135	137	140	130	140	NS	**140**	0.07	0.08	0.40	ND	ND	ND	0.04	**0.08**
CA322	170	168	134	145	NS	NS	NS	**154**	0.22	0.05	0.02	0.05	NS	NS	NS	**0.09**
CA332	140	142	146	130	140	140	NS	**140**	0.17	0.09	0.01	0.04	0.11	0.05	ND	**0.07**
CA342	200	202	177	190	240	210	NS	**203**	0.28	0.13	0.87	0.29	0.01	0.05	0.11	**0.25**
Average	**206**	**217**	**202**	**207**	**183**	**184**	**N/A**	**207**	**0.43**	**0.31**	**0.28**	**0.34**	**0.06**	**0.18**	**0.07**	**0.31**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Alkalinity (mg/L)								Ferrous Iron (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Feedlot Wells																
CA352	330	315	320	320	Aban	Aban	Aban	**321**	1.86	1.54	2.19	1.56	Aban	Aban	Aban	**1.79**
CA362	440	395	335	350	Aban	Aban	Aban	**380**	5.2	4.24	1.97	2.08	Aban	Aban	Aban	**3.36**
CA382	330	285	285	206	Aban	Aban	Aban	**277**	4.08	5.46	2.62	1.56	Aban	Aban	Aban	**3.43**
Average	**367**	**332**	**313**	**292**	**N/A**	**N/A**	**N/A**	**326**	**3.70**	**3.75**	**2.26**	**1.73**	**N/A**	**N/A**	**N/A**	**2.86**
Deep Wells																
NW122	190	192	170	185	NS	NS	NS	**184**	ND	1.15	0.04	1.36	NS	NS	NS	**0.64**
CA213	140	125	146	136	NS	NS	NS	**137**	0.23	1.09	1.59	0.98	NS	NS	NS	**0.97**
CA253	190	182	181	190	NS	NS	NS	**186**	1.44	1.78	0.12	1.36	NS	NS	NS	**1.18**
CA273	180	182	158	175	170	180	NS	**174**	1.40	4.6	1.74	1.01	0.53	0.23	0.63	**1.45**
CA313	200	175	179	185	170	170	NS	**180**	0.52	1.64	1.01	0.18	0.06	0.21	0.24	**0.55**
CA343	240	252	189	160	210	220	NS	**212**	0.02	0.08	0.16	ND	0.13	ND	0.05	**0.06**
Average	**190**	**185**	**171**	**172**	**183**	**190**	**N/A**	**179**	**0.60**	**1.72**	**0.78**	**0.82**	**0.24**	**0.15**	**0.31**	**0.81**

Notes:
Dry: well could not be sampled due to lack of water

µg/L = micrograms per liter	mV = millivolts
Aban = Abandoned	N/A = not applicable
Avg = average	ND = nondetect
DO = dissolved oxygen	NS = not sampled
DOC = dissolved organic carbon	ORP = oxidation/reduction potential
mg/L = milligrams per liter	OU = Operable Unit
MNA = monitored natural attenuation	TKN = Total Kjeldahl Nitrogen
mS/cm = milliSiemens per centimeter	

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Sulfate (mg/L)								Sulfide (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
NW020	49.0	66.4	68.4	63.4	78.0	79.0	NS	**67.4**	ND	0.40	0.20	ND	ND	ND	NS	**0.10**
NW030	55.0	65.6	66.8	67.9	NS	NS	NS	**63.8**	ND	0.20	0.40	0.40	NS	NS	NS	**0.25**
NW050	50.0	43.8	43.4	48.2	NS	NS	NS	**46.4**	ND	0.20	0.20	ND	NS	NS	NS	**0.10**
NW060	15.0	11.2	15.0	19.4	NS	NS	NS	**15.2**	ND	0.20	0.40	0.20	NS	NS	NS	**0.20**
NW070	81.0	77.9	77.6	16.1	NS	NS	NS	**63.2**	ND	ND	0.40	ND	NS	NS	NS	**0.10**
NW080	81.0	109.0	94.4	18.0	Dry	99.0	NS	**80.3**	0.9	0.20	0.40	0.20	Dry	ND	NS	**0.33**
NW100	27.0	38.6	44.1	48.3	NS	NS	NS	**39.5**	ND	0.20	0.40	0.40	NS	NS	NS	**0.25**
NW120	110.0	89.1	87.2	NS	NS	NS	NS	**95.4**	ND	0.20	0.40	NS	NS	NS	NS	**0.20**
NW130R	230.0	198.0	275.0	19.5	NS	NS	NS	**180.6**	ND	0.20	0.40	0.20	NS	NS	NS	**0.20**
CA210	110.0	107.0	144.0	Dry	NS	NS	NS	**120.3**	ND	0.20	0.80	Dry	NS	NS	NS	**0.33**
CA240	77.0	75.6	79.3	Dry	NS	NS	NS	**77.3**	ND	0.20	0.20	Dry	NS	NS	NS	**0.13**
CA250	42.0	51.1	88.7	16.4	NS	NS	NS	**49.6**	ND	0.40	0.40	0.20	NS	NS	NS	**0.25**
CA260	NS	NS	132.0	132.0	Aban	Aban	Aban	**132.0**	NS	NS	0.20	ND	Aban	Aban	Aban	**0.10**
CA270	65.0	75.5	75.5	Dry	230.0	120.0	NS	**113.2**	ND	0.20	0.40	Dry	ND	ND	NS	**0.12**
CA280	52.0	19.4	46.4	Dry	NS	NS	NS	**39.3**	ND	0.20	0.40	Dry	NS	NS	NS	**0.20**
CA290R	50.0	45.6	59.0	59.0	75.0	56.0	NS	**57.4**	ND	0.20	0.40	0.40	8.0	ND	NS	**1.50**
CA310	150.0	205.0	89.0	97.8	130.0	Dry	NS	**134.4**	ND	0.20	0.20	0.20	ND	Dry	NS	**0.12**
CA330	44.0	37.4	34.5	38.8	64.0	36.0	NS	**42.5**	ND	0.20	0.20	0.20	ND	ND	NS	**0.10**
Average	**75.8**	**77.4**	**84.5**	**49.6**	**115.4**	**ND**	**N/A**	**78.8**	**0.86**	**0.23**	**0.36**	**0.27**	**8.00**	**ND**	**N/A**	**0.25**
Shallow Feedlot Wells																
CA350	82.0	135.0	74.2	134.0	Aban	Aban	Aban	**106.3**	0.96	0.20	2.4	12.0	Aban	Aban	Aban	**3.89**
CA360	38.0	2.0	33.0	137.0	Aban	Aban	Aban	**52.5**	ND	1.0	0.40	0.80	Aban	Aban	Aban	**0.55**
CA380	27.0	49.5	53.7	76.2	Aban	Aban	Aban	**51.6**	ND	0.40	0.60	0.60	Aban	Aban	Aban	**0.40**
CA390	170.0	176.0	153.0	161.0	Aban	Aban	Aban	**165.0**	ND	0.20	0.80	0.20	Aban	Aban	Aban	**0.30**
Average	**79.3**	**90.6**	**78.5**	**127.1**	**N/A**	**N/A**	**N/A**	**93.9**	**0.96**	**0.45**	**1.05**	**3.40**	**N/A**	**N/A**	**N/A**	**1.29**
Shallow-Intermediate Wells																
NW021	98.0	29.7	144.0	135.0	220.0	170.0	NS	**132.8**	ND	0.40	0.20	0.20	ND	ND	NS	**0.13**
NW031	210.0	252.0	240.0	237.0	NS	NS	NS	**234.8**	ND	0.20	1.20	0.20	NS	NS	NS	**0.40**
NW051	140.0	133.0	123.0	123.0	NS	NS	NS	**129.8**	ND	0.20	0.60	ND	NS	NS	NS	**0.20**
NW061	61.0	67.4	71.4	78.1	NS	NS	NS	**69.5**	ND	0.20	0.40	0.20	NS	NS	NS	**0.20**
NW071	44.0	52.0	ND	64.2	NS	NS	NS	**40.1**	ND	0.20	0.20	0.20	NS	NS	NS	**0.15**
NW081R	80.0	87.2	87.9	18.3	89.0	85.0	NS	**74.6**	3.2	0.20	0.60	0.20	ND	ND	NS	**0.70**
NW101	84.0	89.5	78.4	78.4	NS	NS	NS	**82.6**	ND	0.20	0.40	ND	NS	NS	NS	**0.15**
NW131R	120.0	139.0	136.0	23.4	NS	NS	NS	**104.6**	ND	0.40	0.40	0.40	NS	NS	NS	**0.30**
CA211	100.0	116.0	107.0	109.0	NS	NS	NS	**108.0**	ND	0.20	0.20	0.20	NS	NS	NS	**0.15**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
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Well Number	Sulfate (mg/L)								Sulfide (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
CA241	54.0	54.8	57.9	60.4	NS	NS	NS	**56.8**	ND	0.20	0.20	ND	NS	NS	NS	**0.10**
CA251	75.0	60.8	64.6	70.4	NS	NS	NS	**67.7**	ND	0.20	0.40	0.20	NS	NS	NS	**0.20**
CA261	NS	NS	57.3	76.3	Aban	Aban	Aban	**66.8**	NS	NS	0.20	0.20	Aban	Aban	NS	**0.20**
CA271	86.0	97.8	96.9	96.1	84.0	91.0	NS	**92.0**	ND	0.20	0.40	0.20	ND	ND	NS	**0.13**
CA281	62.0	63.6	60.5	71.5	NS	NS	NS	**64.4**	ND	0.20	0.20	0.20	NS	NS	NS	**0.15**
CA291R	56.0	59.0	55.2	68.5	69.0	57.0	NS	**60.8**	ND	0.20	0.40	0.20	ND	0.80	NS	**0.27**
CA311	49.0	57.9	63.2	69.8	67.0	86.0	NS	**65.5**	ND	0.40	ND	0.20	ND	0.80	NS	**0.23**
CA331	42.0	39.5	42.0	45.4	37.0	41.0	NS	**41.2**	ND	0.20	0.40	0.40	ND	ND	NS	**0.17**
Average	**85.1**	**87.5**	**92.8**	**83.8**	**ND**	**ND**	**N/A**	**87.7**	**3.20**	**0.24**	**0.40**	**0.23**	**ND**	**ND**	**N/A**	**0.23**
Shallow-Intermediate Feedlot Wells																
CA351	78.0	86.9	83.7	101.0	Aban	Aban	Aban	**87.4**	ND	0.20	0.20	ND	Aban	Aban	Aban	**0.10**
CA361	1.1	21.4	38.9	75.3	Aban	Aban	Aban	**34.2**	ND	1.20	0.80	1.20	Aban	Aban	Aban	**0.80**
CA381	72.0	19.0	125.0	114.0	Aban	Aban	Aban	**82.5**	ND	0.20	0.60	0.401	Aban	Aban	Aban	**0.30**
Average	**50.4**	**42.4**	**82.5**	**96.8**	**N/A**	**N/A**	**N/A**	**68.0**	**ND**	**0.53**	**0.53**	**0.53**	**N/A**	**N/A**	**N/A**	**0.40**
Intermediate Wells																
NW022	140.0	37.9	197.0	212.0	220.0	240.0	NS	**174.5**	ND	0.20	0.20	0.20	0.96	ND	NS	**0.26**
NW032	200.0	248.0	243.0	249.0	NS	NS	NS	**235.0**	ND	0.20	0.20	ND	NS	NS	NS	**0.10**
NW052	64.0	146.0	117.0	142.0	NS	NS	NS	**117.3**	ND	0.40	0.40	ND	NS	NS	NS	**0.20**
NW062	50.0	61.1	66.5	75.7	NS	NS	NS	**63.3**	ND	0.20	0.40	0.80	NS	NS	NS	**0.35**
NW082R	72.0	82.1	77.8	19.7	100.0	81.0	NS	**72.1**	ND	0.20	0.40	0.20	ND	ND	NS	**0.13**
NW102	64.0	84.2	68.6	53.6	NS	NS	NS	**67.6**	ND	0.20	0.20	0.20	NS	NS	NS	**0.15**
NW121	84.0	67.2	53.6	51.2	NS	NS	NS	**64.0**	ND	0.20	0.40	0.40	NS	NS	NS	**0.25**
NW132R	70.0	63.7	73.0	62.8	NS	NS	NS	**67.4**	ND	0.20	0.40	0.20	NS	NS	NS	**0.20**
CA212	64.0	74.3	88.1	96.0	NS	NS	NS	**80.6**	ND	0.20	0.20	0.20	NS	NS	NS	**0.15**
CA242	58.0	66.0	73.4	72.6	NS	NS	NS	**67.5**	ND	0.40	0.40	0.40	NS	NS	NS	**0.30**
CA252	76.0	62.0	76.6	71.0	NS	NS	NS	**71.4**	ND	0.20	0.20	0.40	NS	NS	NS	**0.20**
CA262	NS	NS	69.8	74.7	Aban	Aban	Aban	**72.3**	NS	NS	0.20	0.20	Aban	Aban	Aban	**0.20**
CA272	55.0	66.7	70.3	68.6	72.0	73.0	NS	**67.6**	ND	0.20	0.40	0.40	ND	ND	NS	**0.17**
CA282	45.0	45.4	42.8	54.4	NS	NS	NS	**46.9**	ND	0.20	0.20	0.20	NS	NS	NS	**0.15**
CA292R	21.0	19.6	22.3	36.8	70.0	55.0	NS	**37.5**	ND	0.20	0.20	0.40	ND	ND	NS	**0.13**
CA312	44.0	47.2	46.7	64.9	63.0	65.0	NS	**55.1**	ND	0.20	0.20	0.20	ND	ND	NS	**0.10**
CA322	44.1	48.4	51.6	NS	NS	NS	NS	**48.0**	0.20	0.40	0.20	NS	NS	NS	NS	**0.27**
CA332	41.8	42.0	44.0	36.0	36.0	46.0	NS	**41.0**	0.20	0.20	0.20	ND	ND	ND	NS	**0.10**
CA342	65.2	59.4	54.4	59.0	59.0	61.0	NS	**59.7**	0.40	0.20	0.401	0.80	0.80	ND	NS	**0.43**
Average	**69.9**	**73.4**	**80.9**	**83.3**	**88.6**	**88.7**	**N/A**	**79.4**	**0.04**	**0.23**	**0.28**	**0.29**	**0.25**	**ND**	**N/A**	**0.20**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	Sulfate (mg/L)								Sulfide (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Feedlot Wells																
CA352	81.0	90.4	94.1	77.1	Aban	Aban	Aban	**85.7**	ND	0.20	0.80	0.20	Aban	Aban	Aban	**0.30**
CA362	53.0	66.1	103.0	128.0	Aban	Aban	Aban	**87.5**	ND	0.40	0.20	0.80	Aban	Aban	Aban	**0.35**
CA382	68.0	76.7	66.6	53.0	Aban	Aban	Aban	**66.1**	ND	ND	0.20	0.20	Aban	Aban	Aban	**0.10**
Average	**67.3**	**77.7**	**87.9**	**86.0**	**N/A**	**N/A**	**N/A**	**79.8**	**ND**	**0.20**	**0.40**	**0.40**	**N/A**	**N/A**	**N/A**	**0.25**
Deep Wells																
NW122	22.0	23.2	24.0	24.7	NS	NS	NS	**23.5**	ND	0.20	0.40	0.20	NS	NS	NS	**0.20**
CA213	49.0	53.6	53.3	54.4	NS	NS	NS	**52.6**	ND	0.20	0.20	ND	NS	NS	NS	**0.10**
CA253	41.0	47.1	50.1	52.5	NS	NS	NS	**47.7**	ND	0.20	0.40	ND	NS	NS	NS	**0.15**
CA273	25.0	26.8	30.8	28.9	28.0	27.0	NS	**27.8**	ND	0.40	0.40	0.20	ND	ND	NS	**0.17**
CA313	12.0	13.1	13.4	13.6	11.0	15.0	NS	**13.0**	ND	0.20	0.20	0.40	ND	0.80	NS	**0.27**
CA343	46.0	44.1	43.7	43.4	52.0	47.0	NS	**46.0**	ND	0.20	0.20	0.20	0.96	ND	NS	**0.26**
Average	**32.5**	**34.7**	**35.9**	**36.3**	**30.3**	**29.7**	**N/A**	**35.1**	**ND**	**0.23**	**0.30**	**0.17**	**0.32**	**0.27**	**N/A**	**0.19**

Notes:
Dry: well could not be sampled due to lack of water

µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter

mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	pH								Specific Conductance (mS/cm)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
NW020	6.61	6.62	6.75	6.66	6.68	6.41	6.11	**6.55**	0.965	0.851	0.791	0.617	0.895	0.937	0.713	**0.824**
NW030	6.71	6.65	6.71	6.54	NS	NS	NS	**6.65**	0.772	0.699	0.873	0.647	NS	NS	NS	**0.748**
NW050	6.60	6.65	6.35	6.46	NS	NS	NS	**6.52**	0.916	0.785	0.794	0.682	NS	NS	NS	**0.794**
NW060	6.46	6.40	6.32	5.47	NS	NS	NS	**6.16**	0.173	0.157	0.396	0.239	NS	NS	NS	**0.241**
NW070	7.30	7.29	7.15	7.43	NS	NS	NS	**7.29**	0.908	0.837	1.221	0.726	NS	NS	NS	**0.923**
NW080	6.37	6.49	6.42	6.53	Dry	6.29	6.35	**6.41**	0.951	0.933	0.967	0.830	Dry	1.194	1.106	**0.997**
NW100	5.99	6.04	6.03	6.04	NS	NS	NS	**6.03**	0.278	0.462	0.667	0.633	NS	NS	NS	**0.510**
NW120	6.43	6.48	6.37	NS	NS	NS	NS	**6.43**	0.832	0.674	0.725	NS	NS	NS	NS	**0.744**
NW130R	6.89	6.43	7.12	6.27	NS	NS	NS	**6.68**	0.926	0.856	1.154	0.822	NS	NS	NS	**0.940**
CA210	6.40	7.23	6.49	Dry	NS	NS	NS	**6.71**	1.469	1.464	1.459	Dry	NS	NS	NS	**1.464**
CA240	6.03	6.13	6.10	Dry	NS	NS	NS	**6.09**	0.799	0.926	0.905	Dry	NS	NS	NS	**0.877**
CA250	6.77	6.70	6.58	6.77	NS	NS	NS	**6.71**	0.565	0.606	0.862	0.756	NS	NS	NS	**0.697**
CA260	NS	NS	6.58	6.22	Aban	Aban	Aban	**6.40**	NS	NS	0.688	0.805	Aban	Aban	Aban	**0.747**
CA270	6.52	6.56	6.49	Dry	6.6	6.49	6.66	**6.56**	0.669	0.711	0.964	Dry	0.926	0.891	1.011	**0.862**
CA280	6.57	6.32	6.70	Dry	NS	NS	NS	**6.53**	0.615	0.666	0.625	Dry	NS	NS	NS	**0.635**
CA290R	6.56	6.62	6.55	5.48	6.65	6.38	6.70	**6.42**	0.882	0.934	1.423	0.973	1.055	0.982	0.774	**1.003**
CA310	6.76	6.80	6.87	6.91	6.77	Dry	6.63	**6.79**	1.245	1.525	1.625	0.888	1.007	Dry	1.080	**1.228**
CA330	6.70	6.89	6.65	6.88	6.74	6.68	6.73	**6.75**	0.975	0.791	0.907	0.813	1.199	1.057	1.216	**0.994**
Average	**6.57**	**6.61**	**6.57**	**6.44**	**6.69**	**6.45**	**6.53**	**6.54**	**0.820**	**0.816**	**0.947**	**0.725**	**1.016**	**1.012**	**0.983**	**0.846**
Shallow Feedlot Wells																
CA350	6.45	6.24	6.26	5.87	Aban	Aban	Aban	**6.21**	1.194	1.619	1.459	0.903	Aban	Aban	Aban	**1.294**
CA360	6.86	6.98	6.94	6.80	Aban	Aban	Aban	**6.90**	1.610	3.514	1.735	2.840	Aban	Aban	Aban	**2.425**
CA380	6.73	6.69	6.53	6.46	Aban	Aban	Aban	**6.60**	2.015	2.416	2.087	1.593	Aban	Aban	Aban	**2.028**
CA390	6.63	6.65	6.71	6.63	Aban	Aban	Aban	**6.66**	1.369	1.308	1.207	1.138	Aban	Aban	Aban	**1.256**
Average	**6.67**	**6.64**	**6.61**	**6.44**	**N/A**	**N/A**	**N/A**	**6.59**	**1.547**	**2.214**	**1.622**	**1.619**	**N/A**	**N/A**	**N/A**	**1.750**
Shallow-Intermediate Wells																
NW021	6.86	6.87	6.97	6.84	6.99	6.91	6.74	**6.88**	0.833	0.870	0.995	0.749	0.750	0.982	0.800	**0.854**
NW031	7.47	7.47	7.45	7.17	NS	NS	NS	**7.39**	1.055	1.084	1.182	0.970	NS	NS	NS	**1.073**
NW051	6.62	6.58	6.59	6.68	NS	NS	NS	**6.62**	1.431	1.223	1.362	1.231	NS	NS	NS	**1.312**
NW061	6.83	6.86	6.78	6.31	NS	NS	NS	**6.70**	0.765	0.776	1.007	0.796	NS	NS	NS	**0.836**
NW071	6.60	6.61	6.53	6.98	NS	NS	NS	**6.68**	0.653	0.656	1.055	0.609	NS	NS	NS	**0.743**
NW081R	6.45	6.56	6.48	6.71	6.63	6.64	6.53	**6.57**	1.089	1.126	1.244	0.920	0.945	1.107	0.893	**1.046**
NW101	6.60	6.74	6.56	6.72	NS	NS	NS	**6.66**	1.138	1.140	1.022	0.861	NS	NS	NS	**1.040**
NW131R	6.31	6.31	6.32	5.95	NS	NS	NS	**6.22**	0.735	0.785	0.958	0.700	NS	NS	NS	**0.795**
CA211	6.48	6.93	6.45	5.58	NS	NS	NS	**6.36**	1.155	0.996	1.370	1.067	NS	NS	NS	**1.147**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	pH								Specific Conductance (mS/cm)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
CA241	6.50	6.59	6.52	6.58	NS	NS	NS	**6.55**	0.598	0.604	0.661	0.542	NS	NS	NS	**0.601**
CA251	6.49	6.58	6.61	6.60	NS	NS	NS	**6.57**	1.015	0.769	0.869	0.803	NS	NS	NS	**0.864**
CA261	NS	NS	6.30	6.66	Aban	Aban	Aban	**6.48**	NS	NS	0.66	0.635	Aban	Aban	Aban	**0.646**
CA271	6.35	6.43	6.33	5.56	6.48	6.38	6.31	**6.26**	0.799	0.811	1.113	0.779	0.619	0.774	0.722	**0.802**
CA281	6.13	6.14	6.11	6.22	NS	NS	NS	**6.15**	0.561	0.534	0.535	0.487	NS	NS	NS	**0.529**
CA291R	6.60	6.61	6.59	5.41	6.75	6.52	6.70	**6.45**	0.698	0.676	1.002	0.762	0.698	0.669	0.472	**0.711**
CA311	6.72	6.77	6.72	6.80	6.82	6.76	6.73	**6.76**	0.741	0.824	1.321	0.755	0.716	0.894	0.686	**0.848**
CA331	6.55	6.61	6.40	6.71	6.66	6.61	6.58	**6.59**	0.825	0.849	0.847	0.781	0.757	0.922	0.647	**0.804**
Average	**6.60**	**6.67**	**6.57**	**6.44**	**6.72**	**6.64**	**6.60**	**6.58**	**0.881**	**0.858**	**1.012**	**0.791**	**0.748**	**0.891**	**0.703**	**0.862**
Shallow-Intermediate Feedlot Wells																
CA351	6.63	6.60	6.64	6.29	Aban	Aban	Aban	**6.54**	1.003	0.949	1.018	0.788	Aban	Aban	Aban	**0.940**
CA361	7.06	7.06	6.93	7.07	Aban	Aban	Aban	**7.03**	3.094	3.128	2.746	2.743	Aban	Aban	Aban	**2.928**
CA381	6.89	6.86	6.77	6.39	Aban	Aban	Aban	**6.73**	2.062	2.091	2.529	1.524	Aban	Aban	Aban	**2.052**
Average	**6.86**	**6.84**	**6.78**	**6.58**	**N/A**	**N/A**	**N/A**	**6.77**	**2.053**	**2.056**	**2.098**	**1.685**	**N/A**	**N/A**	**N/A**	**1.973**
Intermediate Wells																
NW022	7.23	7.24	7.26	7.20	7.35	7.34	7.10	**7.25**	0.907	0.981	1.119	0.962	1.020	1.212	0.974	**1.025**
NW032	7.34	7.32	7.29	7.16	NS	NS	NS	**7.28**	0.995	1.050	1.185	0.951	NS	NS	NS	**1.045**
NW052	6.83	6.90	6.80	7.00	NS	NS	NS	**6.88**	1.201	1.370	1.164	1.061	NS	NS	NS	**1.199**
NW062	7.02	7.05	7.03	5.95	NS	NS	NS	**6.76**	0.644	0.652	0.879	0.654	NS	NS	NS	**0.707**
NW082R	6.67	6.69	6.68	6.84	6.74	6.67	6.60	**6.70**	0.983	1.051	1.107	0.928	0.840	1.041	0.831	**0.969**
NW102	6.54	6.64	6.64	6.81	NS	NS	NS	**6.66**	0.858	1.109	0.877	0.611	NS	NS	NS	**0.864**
NW121	7.14	7.09	7.04	6.40	NS	NS	NS	**6.92**	0.940	0.968	1.027	0.892	NS	NS	NS	**0.957**
NW132R	6.71	6.41	6.42	5.85	NS	NS	NS	**6.35**	0.679	0.793	1.113	0.768	NS	NS	NS	**0.838**
CA212	6.99	6.97	6.85	5.93	NS	NS	NS	**6.69**	0.700	0.785	1.220	0.875	NS	NS	NS	**0.895**
CA242	7.05	7.07	6.98	7.19	NS	NS	NS	**7.07**	0.612	0.634	0.647	0.572	NS	NS	NS	**0.616**
CA252	6.73	6.87	6.68	6.76	NS	NS	NS	**6.76**	0.921	0.788	1.042	0.895	NS	NS	NS	**0.912**
CA262	NS	NS	7.03	6.19	Aban	Aban	Aban	**6.61**	NS	NS	0.68	0.656	Aban	Aban	Aban	**0.667**
CA272	6.51	6.49	6.41	5.79	6.48	6.38	6.42	**6.35**	0.753	0.768	1.141	0.829	0.706	0.848	0.766	**0.830**
CA282	6.62	6.67	6.67	6.77	NS	NS	NS	**6.68**	0.525	0.489	0.491	0.471	NS	NS	NS	**0.494**
CA292R	7.10	7.16	7.05	5.78	6.70	6.71	6.80	**6.76**	0.404	0.390	0.711	0.562	0.720	0.650	0.528	**0.566**
CA312	6.68	6.72	6.62	6.74	6.72	6.71	6.71	**6.70**	0.616	0.649	0.927	0.635	0.623	0.724	0.498	**0.667**
CA322	6.58	6.78	6.66	6.85	NS	NS	NS	**6.72**	0.660	0.663	0.940	0.562	NS	NS	NS	**0.706**
CA332	6.59	6.62	6.60	6.72	6.71	6.64	6.62	**6.64**	0.582	0.574	0.618	0.595	0.552	0.623	0.502	**0.578**
CA342	6.65	6.73	6.69	5.67	6.51	6.75	6.74	**6.53**	0.731	0.713	1.238	0.792	0.877	0.781	0.584	**0.817**
Average	**6.83**	**6.86**	**6.81**	**6.51**	**6.74**	**6.74**	**6.71**	**6.75**	**0.762**	**0.802**	**0.954**	**0.751**	**0.763**	**0.840**	**0.669**	**0.808**

TABLE 6-1
SUMMARY OF OU1 OFF-POST MNA PARAMETERS
2016 ANNUAL REPORT

Well Number	pH								Specific Conductance (mS/cm)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Feedlot Wells																
CA352	6.79	6.84	6.81	6.54	Aban	Aban	Aban	**6.75**	0.930	0.855	1.031	1.024	Aban	Aban	Aban	**0.960**
CA362	7.04	7.03	7.03	7.00	Aban	Aban	Aban	**7.03**	1.032	1.154	1.025	0.890	Aban	Aban	Aban	**1.025**
CA382	7.08	7.03	6.91	6.66	Aban	Aban	Aban	**6.92**	0.756	0.748	0.793	0.540	Aban	Aban	Aban	**0.709**
Average	**6.97**	**6.97**	**6.92**	**6.73**	**N/A**	**N/A**	**N/A**	**6.90**	**0.906**	**0.919**	**0.950**	**0.818**	**N/A**	**N/A**	**N/A**	**0.898**
Deep Wells																
NW122	7.14	7.15	7.05	6.22	NS	NS	NS	**6.89**	0.482	0.428	0.461	0.420	NS	NS	NS	**0.448**
CA213	7.67	7.78	7.80	6.63	NS	NS	NS	**7.47**	0.484	0.463	0.705	0.467	NS	NS	NS	**0.530**
CA253	6.95	7.16	7.08	7.24	NS	NS	NS	**7.11**	0.553	0.560	0.627	0.550	NS	NS	NS	**0.573**
CA273	7.25	7.29	7.22	6.51	7.13	7.08	7.27	**7.11**	0.439	0.437	0.865	0.486	0.426	0.453	0.459	**0.518**
CA313	7.23	7.30	7.14	7.29	7.31	7.25	7.29	**7.26**	0.428	0.435	0.706	0.357	0.360	0.392	0.291	**0.446**
CA343	6.95	7.01	6.94	5.72	6.89	7.05	6.95	**6.79**	0.793	0.759	1.398	0.787	0.760	0.764	0.578	**0.877**
Average	**7.20**	**7.28**	**7.21**	**6.60**	**7.11**	**7.13**	**7.17**	**7.10**	**0.530**	**0.514**	**0.794**	**0.511**	**0.515**	**0.536**	**0.443**	**0.565**

Notes:

Dry: well could not be sampled due to lack of water

µg/L = micrograms per liter	mV = millivolts
Aban = Abandoned	N/A = not applicable
Avg = average	ND = nondetect
DO = dissolved oxygen	NS = not sampled
DOC = dissolved organic carbon	ORP = oxidation/reduction potential
mg/L = milligrams per liter	OU = Operable Unit
MNA = monitored natural attenuation	TKN = Total Kjeldahl Nitrogen
mS/cm = milliSiemens per centimeter	

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	ORP (mV)								DO (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0011	-49.5	-74.9	-85.9	-42.6	Aban	Aban	Aban	**-63.2**	0.46	0.09	0.31	0.20	Aban	Aban	Aban	**0.27**
G0012	-21.4	-25.6	-54.2	-13.4	Aban	Aban	Aban	**-28.7**	0.40	1.13	0.49	0.49	Aban	Aban	Aban	**0.63**
G0013	NS	NS	NS	-22.30	Aban	Aban	Aban	**-22.3**	NS	NS	NS	0.16	Aban	Aban	Aban	**0.16**
G0014	NS	NS	-0.50	3.9	Aban	Aban	Aban	**1.7**	NS	NS	0.17	0.25	Aban	Aban	Aban	**0.21**
G0015	45.2	25.1	60.4	62.5	Aban	Aban	Aban	**48.3**	0.64	1.10	1.53	1.76	Aban	Aban	Aban	**1.26**
G0016	198.5	96.1	172.8	181.1	NS	NS	NS	**162.1**	3.03	7.04	4.18	4.18	NS	NS	NS	**4.61**
G0018	195.1	87.1	86	144.4	NS	NS	NS	**128.2**	0.79	2.24	0.29	0.38	NS	NS	NS	**0.93**
G0024	160.6	115.1	99.2	165.1	82.1	197.9	132.8	**136.1**	6.98	6.09	8.01	6.30	5.71	6.16	9.01	**6.89**
G0025	NS	NS	136.00	192.0	Aban	Aban	Aban	**164.0**	NS	NS	6.40	6.35	Aban	Aban	Aban	**6.38**
G0033	NS	NS	124.30	173.0	Aban	Aban	Aban	**148.7**	NS	NS	8.53	8.80	Aban	Aban	Aban	**8.67**
G0042	NS	NS	NS	140.70	Aban	Aban	Aban	**140.7**	NS	NS	NS	2.37	Aban	Aban	Aban	**2.37**
G0044	66.7	-50.4	-27	-207.1	-88.7	3.5	-182.6	**-69.4**	4.01	4.01	3.51	0.60	1.18	4.33	3.59	**3.03**
G0046	67.6	117.9	43.7	54.3	Aban	Aban	Aban	**70.9**	3.51	3.01	2.79	0.92	Aban	Aban	Aban	**2.56**
G0047	17.2	91	145.8	157.8	NS	Aban	Aban	**103.0**	4.71	2.89	4.89	3.17	NS	Aban	Aban	**3.92**
G0067	109.3	80.6	88.8	129.9	Dry	162.7	82.9	**109.0**	6.59	5.70	6.10	3.68	Dry	4.77	5.53	**5.40**
G0068	NS	NS	92.40	27.1	Aban	Aban	Aban	**59.8**	NS	NS	5.62	4.70	Aban	Aban	Aban	**5.16**
G0091	NS	117.40	130.5	157.6	116.2	197.0	93.8	**135.4**	NS	3.50	5.33	4.78	4.81	5.06	5.57	**4.84**
G0102	NS	NS	NS	-31.9	-39.6	-195.8	-34.9	**-75.6**	NS	NS	NS	0.4	0.48	0.70	1.31	**0.71**
PZ005	NS	NS	NS	26.80	25.3	20.4	53.1	**31.4**	NS	NS	NS	0.91	1.60	3.28	1.68	**1.87**
PZ007	-25.9	-27.5	-42.9	-10.8	6.5	-23.2	2.3	**-17.4**	3.67	2.93	2.79	2.09	2.28	3.28	2.22	**2.75**
PZ009	15.8	-89.5	53.6	102.1	-4.0	10.8	25.6	**16.3**	1.54	0.23	0.20	1.31	0.99	3.33	1.07	**1.24**
PZ017R	143.80	145.6	119.2	136.6	104.6	135.4	90.5	**125.1**	5.55	2.72	5.20	1.77	1.12	2.38	4.52	**3.32**
PZ018	116.1	132.8	112.9	131	106.3	122.3	77.0	**114.1**	1.41	1.68	2.42	6.54	0.26	1.14	0.96	**2.06**
PZ019	127.8	129.7	136	167.8	112.7	169.3	171.9	**145.0**	7.84	4.13	6.54	5.40	3.06	7.60	9.18	**6.25**
PZ020	157.4	159.7	106.2	152.1	116.1	203.1	64.4	**137.0**	4.65	5.08	5.50	4.72	2.38	2.80	4.34	**4.21**
Average	**82.8**	**60.6**	**71.3**	**79.1**	**48.9**	**83.6**	**48.1**	**68.0**	**3.49**	**3.15**	**3.85**	**2.89**	**2.17**	**3.74**	**4.08**	**3.19**
Shallow-Intermediate Wells																
G0026	141.8	Aban	Aban	Aban	Aban	Aban	Aban	**141.8**	0.31	Aban	Aban	Aban	Aban	Aban	Aban	**0.31**
G0027	-84.6	Aban	Aban	Aban	Aban	Aban	Aban	**-84.6**	0.23	Aban	Aban	Aban	Aban	Aban	Aban	**0.23**
G0028	-62.1	-69.7	-67.4	-7.1	NS	NS	NS	**-51.6**	0.24	0.12	0.20	0.40	NS	NS	NS	**0.24**
G0032/74	NS	NS	122.00	203.2	Aban	Aban	Aban	**162.6**	NS	NS	0.29	0.32	Aban	Aban	Aban	**0.31**
G0077	162.1	146.8	88.6	162.9	64.5	187.5	104.70	**131.0**	6.50	3.57	3.18	1.84	0.95	1.19	1.10	**2.62**
G0086	153.10	143.4	138.6	77.7	109.1	119.4	35.8	**111.0**	0.13	0.12	0.34	0.37	0.25	0.30	0.30	**0.26**
G0087	165.10	77.2	116.1	97.2	94.1	106.3	86.8	**106.1**	0.08	0.29	0.26	0.37	0.49	0.35	0.63	**0.35**
G0092	NS	-62.10	-54.4	142.9	66.2	170.4	105.8	**61.5**	NS	0.23	0.14	0.15	0.25	0.55	2.15	**0.58**
Average	**79.2**	**47.1**	**57.3**	**112.8**	**83.5**	**145.9**	**83.3**	**72.2**	**1.25**	**0.87**	**0.74**	**0.58**	**0.49**	**0.60**	**1.05**	**0.61**

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	ORP (mV)								DO (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Wells																
G0078	-8.7	-24.7	-66.4	30.2	-25.8	-9.6	-21.4	**-18.1**	0.12	0.55	0.31	0.14	0.28	0.23	0.29	**0.27**
Deep Wells																
G0070	-47.7	-38.8	-16.7	56.4	6.3	12.3	30.0	**0.26**	0.63	0.33	0.30	0.23	1.06	0.25	1.48	**0.61**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Nitrate/Nitrite (mg/L)								Ammonia (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0011	ND	ND	ND	ND	Aban	Aban	Aban	**ND**	ND	ND	ND	0.867	Aban	Aban	Aban	**0.217**
G0012	0.03	0.0832	ND	ND	Aban	Aban	Aban	**0.03**	0.042	0.179	0.187	0.195	Aban	Aban	Aban	**0.151**
G0013	NS	NS	NS	ND	Aban	Aban	Aban	**ND**	NS	NS	NS	0.72	Aban	Aban	Aban	**0.715**
G0014	NS	NS	ND	1.12	Aban	Aban	Aban	**0.56**	NS	NS	0.19	2.45	Aban	Aban	Aban	**1.319**
G0015	ND	0.0727	0.035	0.223	Aban	Aban	Aban	**0.08**	ND	ND	ND	0.281	Aban	Aban	Aban	**0.070**
G0016	1.20	2.1	2.35	1.7	NS	NS	NS	**1.84**	ND	ND	ND	0.944	NS	NS	NS	**0.236**
G0018	6.10	5.32	6.3	6.5	NS	NS	NS	**6.06**	0.5	0.621	1.51	1.0	NS	NS	NS	**0.913**
G0024	4.1	27.3	28.7	26	18.0	17.0	21.0	**20.29**	0.048	ND	0.308	0.236	0.044	ND	ND	**0.091**
G0025	NS	NS	2.86	1.5	Aban	Aban	Aban	**2.20**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0033	NS	NS	46.10	2	Aban	Aban	Aban	**23.82**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0042	NS	NS	NS	2.90	Aban	Aban	Aban	**2.90**	NS	NS	NS	1.14	Aban	Aban	Aban	**1.140**
G0044	1.10	1.66	2.4	2.0	7.6	2.7	1.8	**2.74**	ND	ND	ND	ND	0.039	ND	ND	**0.006**
G0046	1.80	3.75	2.0	2	Aban	Aban	Aban	**2.46**	0.04	ND	0.177	0.324	Aban	Aban	Aban	**0.136**
G0047	ND	0.208	0.35	0.42	NS	Aban	Aban	**0.25**	0.028	ND	ND	0.427	NS	Aban	Aban	**0.114**
G0067	5.3	14.2	9.7	8.5	Dry	9.3	11.0	**9.66**	0.035	ND	ND	0.444	Dry	ND	ND	**0.080**
G0068	NS	NS	0.68	0.558	Aban	Aban	Aban	**0.62**	NS	NS	ND	0.83	Aban	Aban	Aban	**0.414**
G0091	NS	21.50	26	23	34	37	48	**31.57**	NS	ND	ND	0.03	0.03	ND	ND	**0.009**
G0102	NS	NS	NS	0.01	ND	ND	ND	**0.004**	NS	NS	NS	0.3	0.079	0.086	0.066	**0.137**
PZ005	NS	NS	NS	0.21	0.320	1.4	2.7	**1.16**	NS	NS	NS	1.41	0.031	0.023	ND	**0.366**
PZ007	0.44	0.29	0.503	0.454	1.2	0.54	0.66	**0.58**	0.04	ND	ND	0.552	0.04	0.033	0.028	**0.099**
PZ009	0.34	0.0568	0.037	0.651	0.069	1.8	0.43	**0.48**	0.20	0.334	ND	0.477	0.10	ND	0.039	**0.164**
PZ017R	59.0	23.3	22.2	18.9	17.0	19.0	36.0	**27.91**	0.17	0.194	ND	0.606	0.14	0.037	0.024	**0.167**
PZ018	18.0	12.3	9.3	9.0	10.0	25.0	27.0	**15.81**	0.15	ND	ND	0.612	0.025	0.023	ND	**0.116**
PZ019	25.0	19.2	19.3	25.9	30.0	93.0	74.0	**40.91**	0.071	ND	ND	0.55	0.30	ND	ND	**0.132**
PZ020	22.0	23.3	17.1	20.8	12.0	18.0	35.0	**21.17**	ND	ND	ND	0.3	ND	ND	ND	**0.043**
Average	**9.03**	**9.10**	**9.33**	**6.16**	**11.84**	**18.73**	**21.47**	**8.52**	**0.083**	**0.078**	**0.113**	**0.589**	**0.075**	**0.017**	**0.013**	**0.273**
Shallow-Intermediate Wells																
G0026	6.5	Aban	Aban	Aban	Aban	Aban	Aban	**6.5**	ND	Aban	Aban	Aban	Aban	Aban	Aban	**ND**
G0027	ND	Aban	Aban	Aban	Aban	Aban	Aban	**ND**	0.057	Aban	Aban	Aban	Aban	Aban	Aban	**0.057**
G0028	ND	ND	ND	0.258	NS	NS	NS	**0.1**	ND	ND	ND	ND	NS	NS	NS	**ND**
G0032/74	NS	NS	19.50	ND	Aban	Aban	Aban	**9.8**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0077	23	16.2	14	15	15	18	19	**17.2**	ND	ND	ND	0.447	0.022	0.048	ND	**0.074**
G0086	4.70	3.87	1.8	2.4	2.1	4.2	3.8	**3.3**	0.05	ND	0.198	ND	0.024	0.041	ND	**0.045**
G0087	ND	ND	ND	ND	0.97	1.5	0.32	**0.4**	0.04	ND	0.196	0.467	0.025	ND	ND	**0.104**
G0092	NS	0.05	1.140	1.4	1.3	1.0	2.7	**1.3**	NS	ND	0.16	0.415	0.034	ND	ND	**0.102**
Average	**5.70**	**4.02**	**6.06**	**3.18**	**4.84**	**6.18**	**6.46**	**4.8**	**0.026**	**ND**	**0.092**	**0.222**	**0.026**	**0.022**	**ND**	**0.048**

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Nitrate/Nitrite (mg/L)								Ammonia (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Wells																
G0078	ND	ND	ND	ND	ND	ND	ND	**ND**	0.046	0.239	0.188	0.569	0.10	0.10	ND	**0.177**
Deep Wells																
G0070	0.025	ND	ND	ND	ND	ND	ND	**0.004**	0.064	0.231	0.244	0.244	0.027	0.065	0.027	**0.129**

Notes:

Dry: well could not be sampled due to lack of water

µg/L = micrograms per liter

Aban = Abandoned

Avg = average

DO = dissolved oxygen

DOC = dissolved organic carbon

mg/L = milligrams per liter

MNA = monitored natural attenuation

mS/cm = milliSiemens per centimeter

mV = millivolts

N/A = not applicable

ND = nondetect

NS = not sampled

ORP = oxidation/reduction potential

OU = Operable Unit

TKN = Total Kjeldahl Nitrogen

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	TKN (mg/L)								DOC (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0011	0.67	0.974	ND	ND	Aban	Aban	Aban	**0.41**	4.3	4.06	3.54	4.4	Aban	Aban	Aban	**4.09**
G0012	0.33	0.363	ND	1.07	Aban	Aban	Aban	**0.44**	3.3	4.36	3.93	5.11	Aban	Aban	Aban	**4.18**
G0013	NS	NS	NS	1.22	Aban	Aban	Aban	**1.22**	NS	NS	NS	5.48	Aban	Aban	Aban	**5.48**
G0014	NS	NS	3.48	0.95	Aban	Aban	Aban	**2.22**	NS	NS	ND	4.77	Aban	Aban	Aban	**2.39**
G0015	0.34	ND	ND	ND	Aban	Aban	Aban	**0.09**	3.1	3.43	3.28	2.51	Aban	Aban	Aban	**3.08**
G0016	0.27	ND	ND	ND	NS	NS	NS	**0.07**	3.6	3.86	4.03	3.40	NS	NS	NS	**3.72**
G0018	0.48	1.14	ND	ND	NS	NS	NS	**0.41**	4.0	4.27	4.0	3.45	NS	NS	NS	**3.93**
G0024	1.3	ND	ND	0.547	ND	ND	ND	**0.26**	12	6.89	6.50	4.63	4.70	6.20	5.40	**6.62**
G0025	NS	NS	ND	ND	Aban	Aban	Aban	**ND**	NS	NS	ND	2.14	Aban	Aban	Aban	**1.07**
G0033	NS	NS	ND	0.20	Aban	Aban	Aban	**0.10**	NS	NS	2.44	3.85	Aban	Aban	Aban	**3.15**
G0042	NS	NS	NS	0.07	Aban	Aban	Aban	**0.07**	NS	NS	NS	2.96	Aban	Aban	Aban	**2.96**
G0044	0.28	ND	ND	0.178	ND	ND	0.19	**0.09**	3.0	4.88	3.68	5.31	3.60	3.50	3.40	**3.91**
G0046	ND	0.52	1.59	0.1	Aban	Aban	Aban	**0.54**	4.1	5.14	4.92	4.12	Aban	Aban	Aban	**4.57**
G0047	0.23	0.249	ND	1.6	NS	Aban	Aban	**0.52**	1.9	2.83	2.99	2.33	NS	Aban	Aban	**2.51**
G0067	0.38	ND	ND	0.0639	Dry	ND	ND	**0.07**	3.6	2.34	ND	2.72	Dry	3.20	2.80	**2.44**
G0068	NS	NS	2.25	0.3	Aban	Aban	Aban	**1.27**	NS	NS	5.96	4.53	Aban	Aban	Aban	**5.25**
G0091	NS	ND	ND	ND	ND	ND	ND	**ND**	NS	3.86	4.2	3.18	3.0	3.0	3.40	**3.45**
G0102	NS	NS	NS	ND	ND	ND	0.32	**0.08**	NS	NS	NS	3.60	4.0	4.0	4.0	**3.90**
PZ005	NS	NS	NS	0.95	0.250	0.47	ND	**0.42**	NS	NS	NS	4.26	2.90	7.10	6.80	**5.27**
PZ007	ND	0.294	ND	0.118	ND	0.57	0.39	**0.20**	3.1	4.1	3.29	3.75	3.10	3.40	3.50	**3.46**
PZ009	0.38	0.497	ND	ND	ND	ND	ND	**0.13**	2.7	3.93	4.11	3.15	3.00	2.90	4.10	**3.41**
PZ017R	ND	ND	ND	ND	ND	ND	ND	**ND**	2.30	2.77	ND	2.27	2.70	2.40	2.60	**2.15**
PZ018	ND	ND	ND	ND	ND	ND	ND	**ND**	2.0	2.44	2.29	2.23	2.30	2.30	3.30	**2.41**
PZ019	ND	ND	ND	ND	ND	ND	ND	**ND**	1.3	1.83	ND	1.84	1.90	1.70	2.20	**1.54**
PZ020	ND	ND	ND	ND	ND	ND	ND	**ND**	3.8	4.81	ND	3.37	3.37	3.50	4.80	**3.38**
Average	**0.29**	**0.24**	**0.35**	**0.29**	**0.02**	**0.09**	**0.08**	**0.34**	**3.63**	**3.87**	**2.82**	**3.58**	**3.14**	**3.60**	**3.86**	**3.53**
Shallow-Intermediate Wells																
G0026	1.0	Aban	Aban	Aban	Aban	Aban	Aban	**1.00**	5.9	Aban	Aban	Aban	Aban	Aban	Aban	**5.90**
G0027	0.36	Aban	Aban	Aban	Aban	Aban	Aban	**0.36**	6	Aban	Aban	Aban	Aban	Aban	Aban	**6.00**
G0028	0.59	0.454	ND	1.36	NS	NS	NS	**0.60**	6.8	7.67	7.2	8.49	NS	NS	NS	**7.53**
G0032/74	NS	NS	ND	ND	Aban	Aban	Aban	**ND**	NS	NS	5.74	6.24	Aban	Aban	Aban	**5.99**
G0077	ND	ND	ND	ND	ND	ND	ND	**ND**	4.9	4.51	ND	3.33	3.0	4.0	3.8	**3.36**
G0086	ND	ND	1.9	ND	ND	ND	ND	**0.27**	2.0	2.64	2.47	2.84	2.4	2.4	2.4	**2.45**
G0087	0.26	ND	ND	ND	ND	1.40	0.29	**0.28**	2.10	2.87	2.77	3.05	2.8	2.7	2.5	**2.68**
G0092	NS	ND	ND	ND	ND	ND	ND	**ND**	NS	2.69	3.05	2.20	2.2	2.3	2.7	**2.52**
Average	**0.37**	**0.09**	**0.32**	**0.23**	**0.00**	**0.35**	**0.07**	**0.27**	**4.62**	**4.08**	**3.53**	**4.36**	**2.60**	**2.85**	**2.85**	**4.6**

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
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Well Number	TKN (mg/L)								DOC (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Wells																
G0078	0.12	ND	ND	ND	ND	ND	1.7	**0.26**	1.30	2.17	2.52	2.66	2.40	2.40	2.50	**2.28**
Deep Wells																
G0070	ND	ND	ND	ND	ND	ND	ND	**ND**	0.50	1.20	ND	ND	0.83	0.97	1.0	**0.64**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Carbon Dioxide (mg/L)								Methane (µg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0011	182	179	178	178	Aban	Aban	Aban	**179**	0.42	ND	ND	ND	Aban	Aban	Aban	**0.11**
G0012	191	184	164	180	Aban	Aban	Aban	**180**	2.8	ND	0.43	0.70	Aban	Aban	Aban	**0.98**
G0013	NS	NS	NS	169	Aban	Aban	Aban	**169**	NS	NS	NS	ND	Aban	Aban	Aban	**ND**
G0014	NS	NS	173	186	Aban	Aban	Aban	**180**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0015	142	151	136	164	Aban	Aban	Aban	**148**	ND	ND	ND	0.37	Aban	Aban	Aban	**0.09**
G0016	178	158	182	182	NS	NS	NS	**175**	ND	ND	ND	ND	NS	NS	NS	**ND**
G0018	173	153	167	156	NS	NS	NS	**162**	0.74	ND	2.20	ND	NS	NS	NS	**0.74**
G0024	44	100	133	173	98	93	67	**101**	ND	ND	16.0	ND	ND	ND	ND	**2.29**
G0025	NS	NS	38	38	Aban	Aban	Aban	**38**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0033	NS	NS	84	87	Aban	Aban	Aban	**86**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0042	NS	NS	NS	232	Aban	Aban	Aban	**232**	NS	NS	NS	ND	Aban	Aban	Aban	**ND**
G0044	191	202	182	213	240	200	173	**200**	ND	ND	ND	ND	ND	ND	ND	**ND**
G0046	178	204	209	217	Aban	Aban	Aban	**202**	ND	ND	ND	ND	Aban	Aban	Aban	**ND**
G0047	138	129	158	167	NS	Aban	Aban	**148**	0.38	ND	4.50	ND	NS	Aban	Aban	**1.22**
G0067	49	118	76	93	Dry	84	102	**87**	ND	ND	ND	ND	Dry	ND	0.91	**0.15**
G0068	NS	NS	213	202	Aban	Aban	Aban	**208**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0091	NS	102	89	119	120	120	138	**115**	NS	ND	ND	ND	ND	ND	ND	**ND**
G0102	NS	NS	NS	191	173	169	178	**178**	NS	NS	NS	ND	2.40	2.30	2.60	**1.83**
PZ005	NS	NS	NS	174	182	236	253	**211**	NS	NS	NS	ND	ND	ND	ND	**ND**
PZ007	196	207	222	169	173	173	178	**188**	ND	ND	0.98	ND	1.50	ND	0.41	**0.41**
PZ009	169	207	164	163	164	191	209	**181**	0.29	ND	ND	ND	1.80	0.71	2.10	**0.70**
PZ017R	44	64	44	80	76	71	67	**64**	0.26	ND	ND	9.50	590	260	410	**181.4**
PZ018	76	87	76	89	89	76	93	**84**	ND	ND	ND	62	ND	910	2100	**438.9**
PZ019	35	33	36	53	44	23	19	**35**	ND	ND	ND	ND	ND	ND	ND	**ND**
PZ020	156	144	222	158	138	129	138	**155**	ND	ND	ND	ND	4.10	4.60	0.52	**1.32**
Average	**134**	**142**	**140**	**153**	**136**	**130**	**135**	**148**	**0.31**	**ND**	**1.15**	**2.90**	**54.53**	**98.13**	**209.71**	**25.20**
Shallow-Intermediate Wells																
G0026	191	Aban	Aban	Aban	Aban	Aban	Aban	**191**	ND	Aban	Aban	Aban	Aban	Aban	Aban	**Aban**
G0027	178	Aban	Aban	Aban	Aban	Aban	Aban	**178**	ND	Aban	Aban	Aban	Aban	Aban	Aban	**ND**
G0028	209	242	211	216	NS	NS	NS	**219**	0.71	ND	ND	ND	NS	NS	NS	**0.18**
G0032/74	NS	NS	180	182	Aban	Aban	Aban	**181**	NS	NS	ND	ND	Aban	Aban	Aban	**ND**
G0077	160	118	147	193	120	129	133	**143**	ND	ND	ND	4.40	66	29	120	**31.34**
G0086	102	100	104	119	111	102	107	**107**	690	200	400	930	920	390	180	**530.0**
G0087	93	69	80	101	107	93	93	**91**	3600	240	40	13	ND	2.5	17	**558.9**
G0092	NS	153	107	171	147	147	156	**147**	NS	ND	ND	ND	1.10	1.20	0.96	**0.54**
Average	**156**	**136**	**138**	**164**	**121**	**118**	**122**	**157**	**715.12**	**88.0**	**73.33**	**157.90**	**246.78**	**105.68**	**79.49**	**160.14**

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Carbon Dioxide (mg/L)								Methane (µg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Wells																
G0078	129	122	129	153	147	151	151	**140**	1.2	ND	27	27	110	150	170	**69.31**
Deep Wells																
G0070	84	78	89	89	93	89	89	**87**	0.28	ND	9.1	9.1	0.57	0.61	0.69	**2.91**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Alkalinity (mg/L)								Ferrous Iron (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0011	410	402	400	400	Aban	Aban	Aban	**403**	4.88	4.06	6.01	8.28	Aban	Aban	Aban	**5.81**
G0012	430	415	370	405	Aban	Aban	Aban	**405**	1.39	1.83	4.92	1.73	Aban	Aban	Aban	**2.47**
G0013	NS	NS	NS	380	Aban	Aban	Aban	**380**	NS	NS	NS	5.94	Aban	Aban	Aban	**5.94**
G0014	NS	NS	390	418	Aban	Aban	Aban	**404**	NS	NS	0.34	0.54	Aban	Aban	Aban	**0.44**
G0015	320	340	305	368	Aban	Aban	Aban	**333**	0.75	0.39	1.37	0.14	Aban	Aban	Aban	**0.66**
G0016	400	355	410	410	NS	NS	NS	**394**	0.05	0.13	ND	0.16	NS	NS	NS	**0.09**
G0018	390	345	375	350	NS	NS	NS	**365**	0.09	0.11	0.16	0.13	NS	NS	NS	**0.12**
G0024	99	225	300	390	220	210	150	**228**	0.25	0.28	0.03	0.13	0.05	0.02	0.07	**0.12**
G0025	NS	NS	85	85	Aban	Aban	Aban	**85**	NS	NS	0.40	0.41	Aban	Aban	Aban	**0.41**
G0033	NS	NS	190	195	Aban	Aban	Aban	**193**	NS	NS	0.07	0.05	Aban	Aban	Aban	**0.06**
G0042	NS	NS	NS	523	Aban	Aban	Aban	**523**	NS	NS	NS	0.05	Aban	Aban	Aban	**0.05**
G0044	430	455	410	480	540	450	390	**451**	0.53	0.19	ND	0.13	0.18	0.04	0.28	**0.19**
G0046	400	458	470	488	Aban	Aban	Aban	**454**	0.29	ND	0.38	0.12	Aban	Aban	Aban	**0.20**
G0047	310	290	355	375	NS	Aban	Aban	**333**	ND	0.11	0.03	0.34	NS	Aban	Aban	**0.12**
G0067	110	265	170	209	Dry	190	230	**196**	0.07	ND	0.32	2.54	Dry	0.76	0.02	**0.62**
G0068	NS	NS	480	455	Aban	Aban	Aban	**468**	NS	NS	0.12	0.07	Aban	Aban	Aban	**0.10**
G0091	NS	230	200	268	270	270	310	**258**	NS	0.06	ND	0.31	0.01	ND	NS	**0.08**
G0102	NS	NS	NS	430	390	380	400	**400**	NS	NS	NS	2.21	2.12	2.20	2.13	**2.17**
PZ005	NS	NS	NS	391	410	530	570	**475**	NS	NS	NS	0.39	ND	0.17	0.64	**0.30**
PZ007	440	465	500	380	390	390	400	**424**	1.20	0.93	1.34	0.98	1.35	0.84	0.46	**1.01**
PZ009	380	465	370	366	370	430	470	**407**	0.24	1.19	0.24	0.02	0.25	0.45	0.11	**0.36**
PZ017R	100	145	100	180	170	160	150	**144**	0.01	0.04	0.33	0.01	0.02	ND	ND	**0.06**
PZ018	170	195	172	200	200	170	210	**188**	0.02	0.01	0.27	0.38	0.03	0.01	ND	**0.10**
PZ019	79	75	80	120	98	51	43	**78**	0.08	ND	0.50	0.30	0.02	ND	ND	**0.13**
PZ020	350	325	500	355	310	290	310	**349**	0.39	0.02	0.03	0.19	ND	ND	0.09	**0.10**
Average	**301**	**321**	**316**	**345**	**306**	**293**	**303**	**333**	**0.64**	**0.55**	**0.80**	**1.02**	**0.37**	**0.37**	**0.35**	**0.87**
Shallow-Intermediate Wells																
G0026	430	Aban	Aban	Aban	Aban	Aban	Aban	**430**	0.93	Aban	Aban	Aban	Aban	Aban	Aban	**0.93**
G0027	400	Aban	Aban	Aban	Aban	Aban	Aban	**400**	0.71	Aban	Aban	Aban	Aban	Aban	Aban	**0.71**
G0028	470	545	475	485	NS	NS	NS	**494**	1.32	0.94	1.35	1.73	NS	NS	NS	**1.34**
G0032/74	NS	NS	405	410	Aban	Aban	Aban	**408**	NS	NS	0.53	0.15	Aban	Aban	Aban	**0.34**
G0077	360	265	330	435	270	290	300	**321**	0.09	0.10	ND	0.11	ND	0.05	ND	**0.05**
G0086	230	225	235	268	250	230	240	**240**	0.69	0.09	0.03	0.06	ND	0.01	ND	**0.13**
G0087	210	155	180	228	240	210	210	**205**	0.30	0.10	0.32	0.38	0.05	0.07	0.10	**0.19**
G0092	NS	345	240	385	330	330	350	**330**	NS	0.21	0.54	0.36	0.04	0.04	0.02	**0.20**
Average	**350**	**307**	**311**	**369**	**273**	**265**	**275**	**353**	**0.67**	**0.29**	**0.46**	**0.47**	**0.02**	**0.04**	**0.03**	**0.49**

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Alkalinity (mg/L)								Ferrous Iron (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Wells																
G0078	290	275	290	344	330	340	340	**316**	2.37	2.09	0.76	0.37	0.38	0.46	0.62	**1.01**
Deep Wells																
G0070	190	175	200	200	210	200	200	**196**	0.52	0.78	0.85	1.02	0.35	0.41	ND	**0.56**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Sulfate (mg/L)								Sulfide (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0011	1200	1050	1200	1260	Aban	Aban	Aban	**1178**	ND	0.20	0.20	0.20	Aban	Aban	Aban	**0.15**
G0012	840	853	974	1240	Aban	Aban	Aban	**977**	ND	0.40	0.20	ND	Aban	Aban	Aban	**0.15**
G0013	NS	NS	NS	1060	Aban	Aban	Aban	**1060**	NS	NS	NS	ND	Aban	Aban	Aban	**ND**
G0014	NS	NS	999	892	Aban	Aban	Aban	**946**	NS	NS	0.20	ND	Aban	Aban	Aban	**0.10**
G0015	460	527	433	392	Aban	Aban	Aban	**453**	ND	0.20	0.20	0.20	Aban	Aban	Aban	**0.15**
G0016	410	527	422	333	NS	NS	NS	**423**	ND	0.40	0.40	0.20	NS	NS	NS	**0.25**
G0018	480	484	535	37.3	NS	NS	NS	**384**	ND	0.20	0.20	ND	NS	NS	NS	**0.10**
G0024	17	70.8	86	80	86	100	97	**77**	1.8	0.20	0.60	ND	0.80	ND	ND	**0.49**
G0025	NS	NS	19.2	19	Aban	Aban	Aban	**19**	NS	NS	0.40	0.20	Aban	Aban	Aban	**0.30**
G0033	NS	NS	68.4	65	Aban	Aban	Aban	**67**	NS	NS	0.40	0.20	Aban	Aban	Aban	**0.30**
G0042	NS	NS	NS	336	Aban	Aban	Aban	**336**	NS	NS	NS	ND	Aban	Aban	Aban	**ND**
G0044	390	555	579	713	400	270	300	**458**	ND	0.20	0.6	0.401	ND	ND	ND	**0.17**
G0046	640	26.1	498	363	Aban	Aban	Aban	**382**	ND	0.20	0.4	ND	Aban	Aban	Aban	**0.15**
G0047	210	264	211	153	NS	Aban	Aban	**210**	4.3	0.40	0.4	0.2	NS	Aban	Aban	**1.33**
G0067	31	61.3	57	67	Dry	76	76	**61**	ND	0.20	0.4	0.401	Dry	0.80	ND	**0.30**
G0068	NS	NS	178	82	Aban	Aban	Aban	**130**	NS	NS	0.40	0.2	Aban	Aban	Aban	**0.30**
G0091	NS	128	114	132	110	110	130	**121**	NS	ND	0.60	ND	ND	ND	ND	**0.10**
G0102	NS	NS	NS	987	1100	980	1100	**1042**	NS	NS	NS	ND	ND	ND	ND	**ND**
PZ005	NS	NS	NS	726	370	710	1100	**727**	NS	NS	NS	0.20	ND	ND	ND	**0.05**
PZ007	560	566	587	562	610	570	680	**591**	ND	0.20	0.20	ND	ND	ND	ND	**0.06**
PZ009	340	476	498	27.1	250	260	350	**314**	ND	ND	1.20	0.20	ND	ND	ND	**0.20**
PZ017R	36	45.6	43	53	56	52	53	**48**	ND	0.20	0.40	0.20	ND	ND	ND	**0.11**
PZ018	51	71.4	69	63	66	62	64	**64**	ND	ND	0.60	0.20	ND	ND	ND	**0.11**
PZ019	29	38.7	33	35	48	29	46	**37**	ND	0.20	0.20	0.20	1.3	ND	ND	**0.27**
PZ020	85	78.6	80	82	88	100	150	**95**	4.3	0.20	0.40	ND	ND	ND	ND	**0.70**
Average	**361**	**343**	**366**	**390**	**289**	**277**	**346**	**408**	**0.65**	**0.20**	**0.41**	**0.13**	**0.19**	**0.07**	**ND**	**0.23**
Shallow-Intermediate Wells																
G0026	1600	Aban	Aban	Aban	Aban	Aban	Aban	**1600**	ND	Aban	Aban	Aban	Aban	Aban	Aban	**ND**
G0027	1300	Aban	Aban	Aban	Aban	Aban	Aban	**1300**	ND	Aban	Aban	Aban	Aban	Aban	Aban	**ND**
G0028	1300	1440	1390	1350	NS	NS	NS	**1370**	ND	1.0	0.4	0.2	NS	NS	NS	**0.40**
G0032/74	NS	NS	928	901	Aban	Aban	Aban	**915**	NS	NS	0.40	0.2	Aban	Aban	Aban	**0.30**
G0077	86	85.4	77	72	71	100	110	**86**	ND	0.40	0.40	ND	0.96	ND	ND	**0.25**
G0086	61	75	73.1	80	99	110	130	**90**	5.50	0.40	0.60	0.401	ND	ND	ND	**0.99**
G0087	34	60.6	53	48	71	64	56	**55**	3.20	0.20	0.60	0.2	ND	ND	ND	**0.60**
G0092	NS	229	218	223	200	260	270	**233**	NS	0.20	0.40	ND	ND	ND	ND	**0.10**
Average	**730**	**378**	**456**	**446**	**110**	**134**	**142**	**706**	**1.45**	**0.44**	**0.47**	**0.17**	**0.24**	**ND**	**ND**	**0.33**

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
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Well Number	Sulfate (mg/L)								Sulfide (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Wells																
G0078	120	168	189	21.6	240	270	260	**181**	ND	ND	0.6	0.2	1.4	ND	ND	**0.31**
Deep Wells																
G0070	23	27.6	29	29	29	35	ND	**25**	ND	0.2	0.2	0.2	ND	ND	33	**4.80**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	pH								Specific Conductance (mS/cm)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0011	6.97	7.15	7.16	6.94	Aban	Aban	Aban	**7.06**	2.498	2.512	2.705	2.391	Aban	Aban	Aban	**2.527**
G0012	6.88	6.92	7.01	6.83	Aban	Aban	Aban	**6.91**	2.493	2.229	2.624	2.384	Aban	Aban	Aban	**2.433**
G0013	NS	NS	NS	6.76	Aban	Aban	Aban	**6.76**	NS	NS	NS	4.401	Aban	Aban	Aban	**4.401**
G0014	NS	NS	7.07	7.22	Aban	Aban	Aban	**7.15**	NS	NS	2.44	2.023	Aban	Aban	Aban	**2.230**
G0015	7.36	7.33	7.36	6.83	Aban	Aban	Aban	**7.22**	2.433	1.598	1.663	1.314	Aban	Aban	Aban	**1.752**
G0016	7.10	7.11	7.10	6.55	NS	NS	NS	**6.97**	1.352	1.676	1.491	1.294	NS	NS	NS	**1.453**
G0018	7.09	7.04	7.17	6.37	NS	NS	NS	**6.92**	1.603	1.656	2.006	1.495	NS	NS	NS	**1.690**
G0024	6.46	6.93	6.95	6.40	6.93	6.92	6.68	**6.75**	0.302	0.811	1.327	0.918	0.695	0.953	0.576	**0.797**
G0025	NS	NS	6.40	5.94	Aban	Aban	Aban	**6.17**	NS	NS	0.397	0.197	Aban	Aban	Aban	**0.297**
G0033	NS	NS	6.75	6.56	Aban	Aban	Aban	**6.66**	NS	NS	1.10	0.738	Aban	Aban	Aban	**0.919**
G0042	NS	NS	NS	7.09	Aban	Aban	Aban	**7.09**	NS	NS	NS	1.272	Aban	Aban	Aban	**1.272**
G0044	6.75	6.86	6.97	6.67	7.03	7.03	6.99	**6.90**	1.509	1.770	1.920	2.179	1.839	1.486	0.903	**1.658**
G0046	7.08	7.00	7.10	6.55	Aban	Aban	Aban	**6.93**	1.998	1.980	1.783	1.549	Aban	Aban	Aban	**1.828**
G0047	6.92	6.99	6.96	6.81	NS	Aban	Aban	**6.92**	1.037	1.120	1.094	0.883	NS	Aban	Aban	**1.034**
G0067	6.18	6.47	6.49	6.61	Dry	5.82	6.34	**6.32**	0.360	0.584	0.534	0.523	Dry	0.660	0.484	**0.524**
G0068	NS	NS	6.89	7.36	Aban	Aban	Aban	**7.13**	NS	NS	1.28	0.954	Aban	Aban	Aban	**1.116**
G0091	NS	6.83	6.84	6.15	6.94	6.71	6.85	**6.72**	NS	0.987	1.131	0.930	0.847	1.109	1.017	**1.004**
G0102	NS	NS	NS	6.7	6.96	7.04	6.90	**6.90**	NS	NS	NS	2.121	1.912	2.545	1.717	**2.074**
PZ005	NS	NS	NS	7.15	7.06	6.89	6.78	**6.97**	NS	NS	NS	1.850	1.519	2.359	2.085	**1.953**
PZ007	7.20	7.13	7.12	6.64	7.07	7.15	7.19	**7.07**	1.859	1.945	1.838	1.621	1.733	1.911	1.859	**1.824**
PZ009	7.02	7.20	7.16	6.48	6.98	7.09	6.89	**6.97**	1.401	1.610	1.639	1.089	1.199	1.284	1.143	**1.338**
PZ017R	6.50	6.51	6.47	6.37	6.71	6.67	6.42	**6.52**	0.562	0.619	0.618	0.521	0.516	0.643	0.612	**0.584**
PZ018	6.69	6.72	6.76	6.55	6.78	6.70	6.55	**6.68**	0.623	0.655	0.799	0.562	0.527	0.733	0.653	**0.650**
PZ019	6.32	6.33	6.24	6.11	6.52	6.41	6.15	**6.30**	0.471	0.507	0.543	0.483	0.453	1.003	0.667	**0.590**
PZ020	6.85	6.91	7.02	6.31	6.84	6.51	6.82	**6.75**	1.034	0.970	1.268	0.912	0.906	0.964	0.807	**0.980**
Average	**7.29**	**6.91**	**6.90**	**6.64**	**6.89**	**6.75**	**6.71**	**6.83**	**1.346**	**1.366**	**1.438**	**1.384**	**1.104**	**1.304**	**1.044**	**1.477**
Shallow-Intermediate Wells																
G0026	7.27	Aban	Aban	Aban	Aban	Aban	Aban	**7.27**	3.457	Aban	Aban	Aban	Aban	Aban	Aban	**3.457**
G0027	7.54	Aban	Aban	Aban	Aban	Aban	Aban	**7.54**	3.120	Aban	Aban	Aban	Aban	Aban	Aban	**3.120**
G0028	7.39	7.40	7.19	7.02	NS	NS	NS	**7.25**	3.267	3.282	3.220	2.990	NS	NS	NS	**3.190**
G0032/74	NS	NS	7.13	6.94	Aban	Aban	Aban	**7.04**	NS	NS	2.64	2.196	Aban	Aban	Aban	**2.416**
G0077	6.92	6.95	6.88	6.35	6.94	6.88	6.76	**6.81**	1.074	0.857	1.159	0.817	0.716	1.006	0.819	**0.921**
G0086	6.84	6.86	6.78	6.62	6.88	6.93	6.74	**6.81**	0.673	0.589	0.801	0.691	0.635	0.782	0.594	**0.681**
G0087	6.73	6.62	6.65	6.59	6.79	6.87	6.76	**6.72**	0.654	0.447	0.740	0.517	0.577	0.612	0.448	**0.571**
G0092	NS	7.46	7.56	6.94	7.55	7.42	7.25	**7.36**	NS	1.102	1.256	1.055	0.906	1.194	0.899	**1.069**
Average	**7.12**	**7.06**	**7.03**	**6.74**	**7.04**	**7.03**	**6.88**	**7.10**	**2.041**	**1.255**	**1.635**	**1.378**	**0.709**	**0.899**	**0.690**	**1.229**

TABLE 6-2
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	pH								Specific Conductance (mS/cm)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Intermediate Wells																
G0078	7.26	7.34	7.26	6.75	7.28	7.25	7.12	**7.18**	0.875	0.940	1.307	1.023	0.985	1.207	0.958	**1.042**
Deep Wells																
G0070	7.16	7.21	7.12	6.35	7.22	7.14	7.15	**7.05**	0.405	0.421	0.440	0.420	0.407	0.490	0.390	**0.425**

Notes:
Dry: well could not be sampled due to lack of water
µg/L = micrograms per liter
Aban = Abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = milliSiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
TKN = Total Kjeldahl Nitrogen

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	ORP (mV)									DO (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Areas																		
G0017	**102.0**	-324.2	-352.2	-346.8	-321.1	-321.3	-311.4	-293.4	**-324.3**	**1.64**	0.34	0.05	0.44	0.08	0.22	0.65	0.69	**0.35**
G0019	**105.0**	78.9	-60.5	89.0	36.0	NS	Aban	Aban	**35.9**	**3.35**	8.04	0.58	0.94	2.91	NS	Aban	Aban	**3.12**
G0020	**64.0**	-58.9	70.5	149.6	164.3	NS	Aban	Aban	**81.4**	**1.17**	1.81	2.03	2.85	3.83	NS	Aban	Aban	**2.63**
G0021	**111.0**	-55.6	-80.3	-48.1	-50.2	NS	NS	NS	**-58.6**	**1.08**	0.01	0.22	0.78	0.59	NS	NS	NS	**0.40**
G0022	**124.0**	148.5	33.7	156.1	111.5	98.1	113.3	109.5	**110.1**	**3.88**	0.04	0.79	0.44	2.28	1.04	0.49	0.46	**0.79**
G0023	**124.0**	31.9	-76.7	-63.5	-66.7	-58.8	-36.3	-18.2	**-41.2**	**1.54**	0.44	0.30	0.19	0.77	0.45	0.34	0.49	**0.43**
G0048	**118.0**	81.1	-79.4	-73.8	Dry	Dry	Dry	Dry	**-24.0**	**6.84**	12.50	0.20	0.34	Dry	Dry	Dry	Dry	**4.35**
G0063	**72.0**	76.9	-62.0	-36.1	7.4	NS	NS	NS	**-3.5**	**0.77**	0.98	0.20	0.51	1.73	NS	NS	NS	**0.86**
G0066R	**126.0**	51.4	-25.1	-97.6	81.7	-30.1	-11.7	-65.9	**-13.9**	**1.08**	0.60	0.31	0.37	0.17	0.89	0.94	0.39	**0.52**
G0079	**89.0**	134.5	61.4	107.1	Dry	Dry	Dry	Dry	**101.0**	**3.16**	1.85	0.38	2.60	Dry	Dry	Dry	Dry	**1.61**
G0083	**N/A**	151.3	62.5	94.9	86.3	99.8	116.9	111.8	**103.4**	**N/A**	0.08	0.18	0.21	0.48	0.60	0.62	0.44	**0.37**
G0084	**N/A**	31.6	96.7	55.8	168.1	64.7	-56.7	-77.6	**40.4**	**N/A**	6.58	1.16	5.39	4.53	4.49	2.31	0.45	**3.56**
G0085	**N/A**	-116.8	-85.9	-27.8	38.1	66.7	-22.1	-62.5	**-30.0**	**N/A**	1.31	0.34	0.78	1.02	2.52	1.37	0.35	**1.10**
G0093	**N/A**	NS	87.9	34.1	89.2	146.7	122.7	-20.1	**76.8**	**N/A**	NS	0.23	0.30	0.59	0.62	0.48	0.26	**0.41**
G0094	**N/A**	NS	50.0	52.5	36.1	-29.4	-53.6	-30.6	**4.2**	**N/A**	NS	0.39	0.92	0.07	0.63	0.47	0.52	**0.50**
G0095	**N/A**	NS	-47.1	-4.7	-92.0	-92.5	-100.4	-59.6	**-66.1**	**N/A**	NS	1.02	0.45	0.43	0.71	0.55	0.49	**0.61**
G0096	**N/A**	NS	NS	66.0	83.1	-40.1	-43.9	41.9	**21.4**	**N/A**	NS	NS	5.66	0.51	0.56	0.56	0.32	**1.52**
G0097	**N/A**	NS	NS	138.4	41.9	-35.2	-61.8	12.7	**19.2**	**N/A**	NS	NS	5.05	0.90	0.57	0.44	1.02	**1.60**
G0098	**N/A**	NS	NS	40.1	-44.3	-68.0	46.7	-55.5	**-16.2**	**N/A**	NS	NS	0.31	0.10	0.62	0.37	0.46	**0.37**
G0099	**N/A**	NS	NS	13.6	-54.9	-98.6	-79.2	-5.6	**-44.9**	**N/A**	NS	NS	0.60	0.53	0.78	0.39	0.37	**0.53**
G0100	**N/A**	NS	NS	13.5	-76.4	-78.1	-83.0	-47.6	**-54.3**	**N/A**	NS	NS	0.25	0.18	0.86	0.57	0.33	**0.44**
G0101	**N/A**	NS	NS	55.1	5.2	-5.5	29.7	16.2	**20.1**	**N/A**	NS	NS	0.30	0.48	2.03	0.47	0.25	**0.71**
G0103	**N/A**	NS	NS	NS	-89.6	-270.0	-282.1	-309.1	**-237.7**	**N/A**	NS	NS	NS	0.29	0.47	0.33	0.37	**0.37**
G0104	**N/A**	NS	NS	NS	-97.4	-275.9	-351.3	-182.5	**-226.8**	**N/A**	NS	NS	NS	0.44	0.39	1.23	0.29	**0.59**
G0105	**N/A**	NS	NS	NS	-318.2	-210.4	-358.7	-220.9	**-277.1**	**N/A**	NS	NS	NS	0.34	0.35	0.33	0.50	**0.38**
G0106	**N/A**	NS	NS	NS	-177.4	7.0	3.6	20.2	**-36.7**	**N/A**	NS	NS	NS	0.42	0.80	0.80	0.37	**0.60**
G0107	**N/A**	NS	NS	NS	-195.7	-80.2	-178.6	-79.8	**-133.6**	**N/A**	NS	NS	NS	0.19	0.39	1.01	0.41	**0.50**
G0108	**N/A**	NS	NS	NS	36.9	-45.5	-44.7	-68.8	**-30.5**	**N/A**	NS	NS	NS	0.13	1.06	0.49	0.90	**0.65**
G0109	**N/A**	NS	NS	NS	-75.5	-99.0	-59.8	-34.7	**-67.3**	**N/A**	NS	NS	NS	0.26	0.79	0.44	0.36	**0.46**
G0110	**N/A**	NS	NS	NS	-73.8	-32.3	13.8	-79.3	**-42.9**	**N/A**	NS	NS	NS	0.72	0.66	0.45	0.29	**0.53**
G0111	**N/A**	NS	NS	NS	-86.3	-44.9	-46.9	-35.8	**-53.5**	**N/A**	NS	NS	NS	0.29	2.85	0.68	0.50	**1.08**
G0112	**N/A**	NS	NS	NS	NS	28.1	13.6	39.2	**27.0**	**N/A**	NS	NS	NS	NS	0.49	0.49	0.36	**0.45**
G0113	**N/A**	NS	NS	NS	NS	128.2	-44.7	-98.4	**-5.0**	**N/A**	NS	NS	NS	NS	0.97	0.48	1.69	**1.05**
G0114	**N/A**	NS	NS	NS	NS	-116.4	-63.0	-75.3	**-84.9**	**N/A**	NS	NS	NS	NS	0.67	0.41	0.23	**0.44**
G0115	**N/A**	NS	NS	NS	NS	-98.2	-72.1	-72.1	**-80.8**	**N/A**	NS	NS	NS	NS	0.90	0.59	0.39	**0.63**
G0116	**N/A**	NS	NS	NS	NS	20.4	24.6	-4.6	**13.5**	**N/A**	NS	NS	NS	NS	1.96	3.21	3.21	**2.79**
G0117	**N/A**	NS	NS	NS	NS	-112.5	-99.9	-105.9	**-106.1**	**N/A**	NS	NS	NS	NS	1.18	0.96	0.64	**0.93**
G0118	**N/A**	NS	NS	NS	NS	NS	-11.0	-64.1	**-37.6**	**N/A**	NS	NS	NS	NS	NS	0.54	0.70	**0.62**

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	ORP (mV)									DO (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
G0119	**N/A**	NS	NS	NS	NS	NS	-40.8	-97.3	**-69.1**	**N/A**	NS	NS	NS	NS	NS	0.70	0.68	**0.69**
G0120	**N/A**	NS	NS	NS	NS	NS	-99.5	-69.6	**-84.6**	**N/A**	NS	NS	NS	NS	NS	0.69	0.84	**0.77**
PZ001	**-3.0**	10.5	-43.7	-13.0	-181.4	-75.2	-2.2	3.0	**-43.1**	**0.93**	1.87	0.41	1.68	0.31	0.31	2.39	0.73	**1.10**
PZ004	**-37.0**	4.6	-9.4	-33.1	-54.8	-200.9	-5.4	31.5	**-38.2**	**0.62**	0.60	0.36	0.71	0.37	0.37	2.23	1.67	**0.90**
PZ010	**91.0**	-279.4	-285.3	-284.9	-212.4	-295.1	-97.7	-12.6	**-209.6**	**1.55**	0.41	0.19	0.31	0.11	0.11	0.69	2.50	**0.62**
PZ011	**111.0**	-207.6	-114.9	-95.9	30.8	-22.3	-76.9	-213.1	**-100.0**	**0.13**	0.32	0.20	0.28	0.19	0.19	0.94	0.18	**0.33**
PZ012	**89.0**	-252.3	-250.3	-118.1	-138.2	-112.0	-146.5	-278.1	**-185.1**	**0.14**	0.85	0.61	0.49	0.19	0.19	0.89	0.19	**0.49**
PZ013	**91.0**	-169.3	-385.6	-212.7	-144.0	-154.3	-65.4	-54.0	**-169.3**	**0.12**	0.41	0.13	0.20	0.11	0.11	0.62	1.02	**0.37**
PZ014	**57.0**	-199.1	-172.2	-54.5	11.0	-44.1	-21.3	-58.7	**-77.0**	**1.48**	0.36	0.15	0.37	0.19	0.19	0.69	0.30	**0.32**
PZ015	**130.0**	8.8	-128.1	-53.2	-85.3	-80.6	83.2	55.0	**-28.6**	**0.73**	10.91	0.22	0.18	0.46	0.46	0.49	0.42	**1.88**
PZ016	**125.0**	-148.1	-72.7	-57.4	-44.6	-86.9	-51.6	-23.9	**-69.3**	**3.11**	0.42	0.28	0.20	0.22	0.22	0.41	0.32	**0.30**
Average	**88.9**	**-45.5**	**-74.7**	**-17.9**	**-43.5**	**-66.4**	**-58.4**	**-58.9**	**-51.4**	**1.75**	**2.31**	**0.44**	**1.10**	**0.72**	**0.84**	**0.80**	**0.64**	**0.95**
Shallow-Intermediate Wells in RAO Treatment Areas																		
G0075	**99.0**	-37.5	-39.2	32.8	112.4	79.9	123.9	119.8	**56.0**	**0.34**	0.07	0.09	0.55	0.35	0.39	0.42	1.22	**0.44**
G0080	**N/A**	40.5	24.6	73.9	37.1	81.9	46.7	79.7	**54.9**	**N/A**	0.21	0.52	1.29	0.36	3.68	1.65	3.67	**1.63**
G0081	**N/A**	55.6	92.4	81.7	103.4	43.9	211.5	77.3	**95.1**	**N/A**	0.11	0.15	0.28	0.09	0.23	1.56	0.36	**0.40**
G0082	**N/A**	65.7	72.7	83.9	80.9	84.3	205.9	43.3	**91.0**	**N/A**	0.13	0.19	0.18	0.09	0.80	1.31	0.20	**0.41**
G0088	**N/A**	91.8	48.2	67.8	65.0	66.1	177.2	47.5	**80.5**	**N/A**	0.57	0.28	0.24	0.27	0.45	0.41	0.28	**0.36**
G0089	**N/A**	112.8	107	63.1	95.1	85	212.4	-221.7	**64.8**	**N/A**	1.54	0.39	0.20	0.30	0.42	1.39	0.19	**0.63**
G0090	**N/A**	93.9	78.3	91.2	86.3	76.6	205	47.1	**96.9**	**N/A**	4.36	3.25	3.83	0.65	3.85	3.26	5.11	**3.47**
Average	**99.0**	**60.4**	**54.9**	**70.6**	**82.9**	**74.0**	**168.9**	**27.6**	**77.0**	**0.34**	**1.00**	**0.70**	**0.94**	**0.30**	**1.40**	**1.43**	**1.58**	**1.05**
Intermediate Wells in RAO Treatment Areas																		
G0045	**79.0**	96.3	53.9	74.8	198.1	-4.9	-6.2	-91.9	**45.7**	**0.13**	0.31	0.20	0.26	0.10	0.40	0.48	0.55	**0.33**
G0049	**103.0**	-66.1	-96.2	-62.4	-82.7	-81.7	-73.1	-58.3	**-74.4**	**0.14**	0.45	0.13	0.28	0.31	0.36	0.27	0.26	**0.29**
G0076	**-53.0**	-41.1	-66.6	-23.8	51.3	-8.1	-1.5	-30.9	**-17.2**	**0.11**	0.33	0.10	0.38	0.15	0.31	0.27	0.61	**0.31**
Average	**43.0**	**-3.6**	**-36.3**	**-3.8**	**55.6**	**-31.6**	**-26.9**	**-60.4**	**-15.3**	**0.13**	**0.36**	**0.14**	**0.31**	**0.19**	**0.36**	**0.34**	**0.47**	**0.31**

Notes:

Dry: well could not be sampled due to lack of water.

µg/L = micrograms per liter
Aban = abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter

mS/cm = milliSiemens per centimeter
mV = millivolts
MNA = monitored natural attenuation
N/A = not applicable
ND = nondetect
NS = not sampled

ORP = oxidation/reduction potential
OU = Operable Unit
R = rejected; data rejected based on professional judgment
RAO = Remedial Action Operation
TKN = total Kjeldahl nitrogen

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Nitrate/Nitrite (mg/L)									Ammonia (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Areas																		
G0017	**0.98**	0.16	0.249	0.0426	0.024	ND	ND	0.23	**0.10**	**0.06**	1.7	0.204	ND	1.42	0.15	0.088	0.14	**0.53**
G0019	**0.94**	0.58	0.324	0.419	0.803	NS	Aban	Aban	**0.53**	**0.13**	ND	ND	ND	ND	NS	Aban	Aban	**ND**
G0020	**0.21**	ND	0.253	0.528	1.29	NS	Aban	Aban	**0.52**	**0.35**	ND	ND	ND	0.671	NS	Aban	Aban	**0.17**
G0021	**6.2**	0.063	ND	ND	1.61	NS	NS	NS	**0.42**	**2.28**	2.2	2.46	3.25	2.19	NS	NS	NS	**2.53**
G0022	**6.0**	21.0	5.43	6.84	6.61	3.0	1.50	13.0	**8.20**	**0.04**	0.063	ND	ND	0.705	0.042	0.06	ND	**0.12**
G0023	**5.2**	2.10	0.249	ND	ND	ND	ND	0.019	**0.34**	**0.56**	0.14	1.05	0.898	1.53	1.90	2.0	4.2	**1.67**
G0048	**8.0**	8.80	0.245	ND	Dry	Dry	Dry	Dry	**3.02**	**0.07**	0.055	0.479	0.774	Dry	Dry	Dry	Dry	**0.44**
G0063	**1.4**	0.21	ND	ND	0.0796	NS	NS	NS	**0.07**	**0.10**	ND	0.308	0.349	0.604	NS	NS	NS	**0.32**
G0066R	**15**	16.0	1.99	0.058	ND	0.051	0.048	ND	**2.59**	**4.68**	1.8	0.277	0.872	4.77	2.1	2.5	6.6	**2.70**
G0079	**7.8**	0.87	1.16	1.85	Dry	Dry	Dry	Dry	**1.29**	**0.05**	0.04	ND	ND	Dry	Dry	Dry	Dry	**0.01**
G0083	**N/A**	ND	ND	ND	0.716	0.53	0.062	0.96	**0.32**	**N/A**	4.9	7.58	5.38	3.37	2.30	2.50	2.40	**4.06**
G0084	**N/A**	3.30	5.56	8.77	6.15	7.5	1.4	ND	**4.67**	**N/A**	0.071	ND	ND	0.157	ND	1.4	9.0	**1.52**
G0085	**N/A**	7.70	4.58	9.27	9.9	14	5.2	0.62	**7.32**	**N/A**	0.11	ND	ND	ND	ND	1.1	3.2	**0.63**
G0093	**N/A**	NS	1.72	0.789	0.7	ND	0.25	3.7	**1.19**	**N/A**	NS	ND	ND	0.731	0.045	0.064	1.2	**0.34**
G0094	**N/A**	NS	0.533	0.0751	ND	ND	ND	0.41	**0.17**	**N/A**	NS	0.273	7.4	10.2	6.6	5.6	6.8	**6.14**
G0095	**N/A**	NS	3.2	5.16	ND	0.035	0.11	ND	**1.41**	**N/A**	NS	ND	1.13	0.852	0.92	0.55	2.5	**0.99**
G0096	**N/A**	NS	NS	4.26	1.73	0.14	0.40	27	**6.71**	**N/A**	NS	NS	ND	0.416	2.1	1.0	0.25	**0.75**
G0097	**N/A**	NS	NS	11.0	1.95	0.95	ND	18.0	**6.38**	**N/A**	NS	NS	ND	0.313	0.56	2.7	1.4	**0.99**
G0098	**N/A**	NS	NS	39.6	0.143	ND	0.39	ND	**8.03**	**N/A**	NS	NS	0.299	0.96	1.8	1.0	1.7	**1.15**
G0099	**N/A**	NS	NS	0.276	ND	ND	ND	3.0	**0.66**	**N/A**	NS	NS	0.828	4.7	2.9	3.5	3.2	**3.03**
G0100	**N/A**	NS	NS	0.961	ND	0.02	ND	ND	**0.20**	**N/A**	NS	NS	0.138	0.845	2.1	2.2	3.8	**1.82**
G0101	**N/A**	NS	NS	0.352	ND	ND	11.0	22.0	**6.67**	**N/A**	NS	NS	0.133	0.724	0.16	0.29	1.4	**0.54**
G0103	**N/A**	NS	NS	NS	ND	ND	ND	ND	**ND**	**N/A**	NS	NS	NS	6.31	11.0	12	6.7	**9.00**
G0104	**N/A**	NS	NS	NS	ND	ND	ND	ND	**ND**	**N/A**	NS	NS	NS	1.37	2.3	2.0	1.4	**1.77**
G0105	**N/A**	NS	NS	NS	ND	ND	ND	ND	**ND**	**N/A**	NS	NS	NS	1.36	1.2	3.8	4.1	**2.62**
G0106	**N/A**	NS	NS	NS	0.009	0.071	ND	0.031	**0.03**	**N/A**	NS	NS	NS	0.845	0.076	0.069	0.10	**0.27**
G0107	**N/A**	NS	NS	NS	ND	ND	ND	ND	**ND**	**N/A**	NS	NS	NS	0.937	0.35	0.91	0.62	**0.70**
G0108	**N/A**	NS	NS	NS	3.03	ND	ND	ND	**0.76**	**N/A**	NS	NS	NS	0.675	0.085	0.074	0.81	**0.41**
G0109	**N/A**	NS	NS	NS	ND	1.2	0.58	2.40	**1.05**	**N/A**	NS	NS	NS	3.57	1.70	1.60	1.30	**2.04**
G0110	**N/A**	NS	NS	NS	0.253	ND	0.77	ND	**0.26**	**N/A**	NS	NS	NS	1.23	1.30	1.50	1.80	**1.46**
G0111	**N/A**	NS	NS	NS	ND	ND	ND	0.18	**0.05**	**N/A**	NS	NS	NS	2.61	2	1.3	0.91	**1.71**
G0112	**N/A**	NS	NS	NS	NS	0.35	3.5	8.30	**4.05**	**N/A**	NS	NS	NS	NS	0.56	0.89	0.49	**0.65**
G0113	**N/A**	NS	NS	NS	NS	0.11	ND	ND	**0.04**	**N/A**	NS	NS	NS	NS	13.0	16.0	11.0	**13.33**
G0114	**N/A**	NS	NS	NS	NS	0.062	0.52	0.29	**0.29**	**N/A**	NS	NS	NS	NS	0.69	1.5	2.9	**1.70**
G0115	**N/A**	NS	NS	NS	NS	0.019	0.20	ND	**0.07**	**N/A**	NS	NS	NS	NS	0.94	5.6	4.6	**3.71**
G0116	**N/A**	NS	NS	NS	NS	ND	ND	ND	**ND**	**N/A**	NS	NS	NS	NS	42	59	42	**47.67**
G0117	**N/A**	NS	NS	NS	NS	0.057	ND	ND	**0.02**	**N/A**	NS	NS	NS	NS	4.4	8.5	16	**9.63**
G0118	**N/A**	NS	NS	NS	NS	NS	ND	ND	**ND**	**N/A**	NS	NS	NS	NS	NS	0.19	2.8	**1.50**

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
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Well Number	Nitrate/Nitrite (mg/L)									Ammonia (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
G0119	**N/A**	NS	NS	NS	NS	NS	ND	ND	**ND**	**N/A**	NS	NS	NS	NS	NS	0.63	2.9	**1.77**
G0120	**N/A**	NS	NS	NS	NS	NS	ND	ND	**ND**	**N/A**	NS	NS	NS	NS	NS	21	20	**20.50**
PZ001	**1.4**	1.8	0.081	1.35	0.32	1.20	6.20	2.10	**1.86**	**0.04**	0.091	ND	ND	0.058	0.084	0.059	0.032	**0.05**
PZ004	**0.30**	0.069	0.047	1.39	1.25	1.0	0.88	0.57	**0.74**	**0.12**	0.071	ND	ND	0.663	0.15	0.076	0.076	**0.15**
PZ010	**1.0**	0.09	0.277	0.177	0.0616	ND	2.2	6.7	**1.36**	**ND**	15.0	8.69	9.92	6.10	4.7	1.9	0.4	**6.67**
PZ011	**1.4**	ND	0.204	0.251	0.432	ND	ND	ND	**0.13**	**2.81**	3.9	2.51	2.05	1.83	1.8	3.2	5.5	**2.97**
PZ012	**1.8**	6.4	3.13	4.89	2.85	0.78	ND	ND	**2.58**	**2.88**	1.0	1.84	1.57	2.05	3.1	12.0	9.9	**4.49**
PZ013	**5.4**	1.7	0.242	1.60	0.197	0.07	ND	ND	**0.54**	**11.3**	3.5	1.34	2.10	5.31	2.1	1.4	1.3	**2.44**
PZ014	**0.52**	ND	0.027	ND	0.0188	ND	ND	1.8	**0.26**	**0.04**	0.071	ND	ND	1.16	0.41	0.3	0.055	**0.29**
PZ015	**7.0**	2.5	0.092	0.141	ND	ND	18.0	20.0	**5.82**	**0.91**	0.096	5.68	3.01	3.32	1.3	0.64	0.43	**2.07**
PZ016	**6.7**	2.1	3.03	2.3	0.144	ND	ND	0.30	**1.12**	**0.03**	1.0	0.964	0.811	1.7	0.45	0.46	0.59	**0.85**
Average	**4.1**	**3.43**	**1.30**	**3.30**	**1.06**	**0.78**	**1.24**	**3.06**	**1.67**	**1.39**	**1.63**	**1.35**	**1.32**	**2.01**	**2.98**	**4.26**	**4.34**	**3.49**
Shallow-Intermediate Wells i																		
RAO Treatment Areas																		
G0075	**4.4**	ND	0.081	ND	ND	1.4	ND	ND	**0.21**	**0.03**	0.045	ND	ND	0.65	0.038	0.039	0.024	**0.11**
G0080	**N/A**	3.3	2.56	1.1	1.71	2.9	1.9	1.8	**2.18**	**N/A**	0.041	ND	ND	0.659	ND	0.26	ND	**0.14**
G0081	**N/A**	2.4	0.996	0.99	1.12	2.3	1.1	1.3	**1.46**	**N/A**	1.9	1.99	1.17	1.24	0.85	0.69	0.59	**1.20**
G0082	**N/A**	5	6.82	4.48	3.19	5.5	3.3	2.3	**4.37**	**N/A**	ND	ND	0.186	0.395	0.023	0.072	0.08	**0.11**
G0088	**N/A**	3.7	0.692	ND	1.57	4.1	1.1	3.8	**2.14**	**N/A**	0.068	ND	ND	0.987	ND	ND	0.025	**0.15**
G0089	**N/A**	6.4	3.11	4.55	4.45	2.4	3.4	3.6	**3.99**	**N/A**	0.15	0.206	0.351	0.999	0.20	0.16	0.12	**0.31**
G0090	**N/A**	8.5	7.82	7.99	ND	9.1	5.4	7.6	**6.63**	**N/A**	0.033	ND	ND	3.33	ND	ND	ND	**0.48**
Average	**4.4**	**4.19**	**3.15**	**2.73**	**1.72**	**3.96**	**2.31**	**2.91**	**3.00**	**0.03**	**0.32**	**0.31**	**0.24**	**1.18**	**0.16**	**0.17**	**0.12**	**0.36**
Intermediate Wells in RAO																		
Treatment Areas																		
G0045	**0.02**	0.03	ND	ND	0.0323	0.45	ND	0.042	**0.08**	**5.53**	7.3	8.22	5.25	5.47	6.7	9.6	3.6	**6.59**
G0049	**0.04**	ND	0.03	ND	ND	ND	ND	ND	**0.004**	**0.39**	0.61	0.579	1.58	1.52	2.0	2.5	2.0	**1.54**
G0076	**0.01**	ND	ND	ND	ND	ND	ND	ND	**ND**	**1.67**	0.74	0.783	0.882	0.506	0.5	0.42	0.37	**0.60**
Average	**0.02**	**0.01**	**0.01**	**ND**	**0.011**	**0.15**	**ND**	**0.01**	**0.03**	**2.53**	**2.88**	**3.19**	**2.57**	**2.50**	**3.07**	**4.17**	**1.99**	**2.91**

Notes:

Dry: well could not be sampled due to lack of water.

μg/L = micrograms per liter
Aban = abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter

mS/cm = milliSiemens per centimeter
mV = millivolts
MNA = monitored natural attenuation
N/A = not applicable
ND = nondetect
NS = not sampled

ORP = oxidation/reduction potential
OU = Operable Unit
R = rejected; data rejected based on professional judgment
RAO = Remedial Action Operation
TKN = total Kjeldahl nitrogen

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
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Well Number	TKN (mg/L)									DOC (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Areas																		
G0017	**0.40**	1.10	1.72	2.05	0.62	0.66	0.45	0.63	**1.03**	**3.6**	220.0	864.0	673.0	58.40	36.0	12.0	6.6	**267.14**
G0019	**0.23**	0.24	0.42	ND	0.50	NS	Aban	Aban	**0.29**	**2.6**	1.90	4.47	3.59	19.80	NS	Aban	Aban	**7.44**
G0020	**0.51**	0.14	ND	ND	1.07	NS	Aban	Aban	**0.30**	**1.2**	1.60	2.54	2.31	1.81	NS	Aban	Aban	**2.07**
G0021	**2.57**	2.60	2.67	3.83	2.32	NS	NS	NS	**2.86**	**1.5**	ND	2.46	2.69	2.92	NS	NS	NS	**2.02**
G0022	**0.37**	ND	ND	ND	ND	ND	ND	ND	**ND**	**1.4**	2.20	2.92	2.88	2.61	2.0	1.8	3.1	**2.50**
G0023	**0.82**	0.78	2.03	2.43	2.72	2.50	3.0	6.60	**2.87**	**1.8**	3.80	6.06	4.23	7.12	14.0	13.0	16.0	**9.17**
G0048	**0.20**	ND	1.44	ND	Dry	Dry	Dry	Dry	**0.48**	**1.3**	ND	8.09	3.77	Dry	Dry	Dry	Dry	**3.95**
G0063	**0.59**	0.56	0.51	ND	0.37	NS	NS	NS	**0.36**	**3.8**	4.50	5.10	4.04	4.58	NS	NS	NS	**4.56**
G0066R	**7.70**	ND	1.26	2.54	8.43	1.20	2.20	9.90	**3.65**	**2.1**	4.20	9.75	9.42	6.95	4.7	4.6	300.0	**48.52**
G0079	**0.06**	ND	ND	ND	Dry	Dry	Dry	Dry	**ND**	**1.8**	2.0	2.57	ND	Dry	Dry	Dry	Dry	**1.52**
G0083	**N/A**	5.80	8.94	9.10	5.35	1.20	1.70	2.10	**4.88**	**N/A**	1.90	3.36	3.27	2.55	2.7	2.6	2.5	**2.70**
G0084	**N/A**	ND	ND	ND	0.07	ND	2.60	14.0	**2.38**	**N/A**	ND	2.26	2.86	2.19	2.4	23.0	150.0	**26.10**
G0085	**N/A**	ND	0.42	0.18	ND	ND	4.30	4.30	**1.31**	**N/A**	4.10	2.74	2.61	3.68	2.8	250.0	30.0	**42.28**
G0093	**N/A**	NS	0.44	ND	ND	ND	0.37	5.70	**1.09**	**N/A**	NS	2.41	2.64	2.70	2.0	2.0	110.0	**20.29**
G0094	**N/A**	NS	0.76	33.30	17.80	5.60	5.60	7.90	**11.83**	**N/A**	NS	15.40	693.0	8.5	8.2	8.9	9.5	**123.92**
G0095	**N/A**	NS	0.55	1.85	5.47	0.92	1.70	3.40	**2.32**	**N/A**	NS	3.50	23.1	13.0	5.3	5.5	6.3	**9.45**
G0096	**N/A**	NS	NS	ND	1.12	1.20	1.0	ND	**0.66**	**N/A**	NS	NS	2.17	3.92	3.0	2.2	6.1	**3.48**
G0097	**N/A**	NS	NS	ND	1.95	1.90	4.90	3.50	**2.45**	**N/A**	NS	NS	3.65	40.20	44.0	140.0	20.0	**49.57**
G0098	**N/A**	NS	NS	ND	4.44	3.90	2.10	2.90	**2.67**	**N/A**	NS	NS	8.11	12.60	130.0	8.3	8.1	**33.42**
G0099	**N/A**	NS	NS	7.64	19.40	2.20	2.90	3.20	**7.07**	**N/A**	NS	NS	370.0	246.0	4.9	5.9	5.6	**126.48**
G0100	**N/A**	NS	NS	ND	1.93	2.0	2.20	4.80	**2.19**	**N/A**	NS	NS	5.74	6.06	9.2	4.1	6.3	**6.28**
G0101	**N/A**	NS	NS	ND	1.53	0.49	1.20	1.20	**0.88**	**N/A**	NS	NS	3.02	2.64	3.5	6.6	10.0	**5.15**
G0103	**N/A**	NS	NS	NS	41.30	12.0	13.0	8.70	**18.75**	**N/A**	NS	NS	NS	428	260	210.0	260.0	**289.50**
G0104	**N/A**	NS	NS	NS	2.92	2.70	2.0	1.60	**2.31**	**N/A**	NS	NS	NS	9.2	91	8.9	6.5	**28.90**
G0105	**N/A**	NS	NS	NS	3.21	1.0	2.60	4.80	**2.90**	**N/A**	NS	NS	NS	5.9	9.6	12.0	8.5	**9.01**
G0106	**N/A**	NS	NS	NS	0.71	0.78	0.67	0.78	**0.74**	**N/A**	NS	NS	NS	4.3	3.6	4.7	3.8	**4.11**
G0107	**N/A**	NS	NS	NS	1.02	0.39	0.98	1.40	**0.95**	**N/A**	NS	NS	NS	4.9	4.2	13.0	5.1	**6.79**
G0108	**N/A**	NS	NS	NS	1.89	0.64	2.10	3.0	**1.91**	**N/A**	NS	NS	NS	2.1	51.0	83.0	17.0	**38.28**
G0109	**N/A**	NS	NS	NS	10.40	ND	1.10	1.50	**3.25**	**N/A**	NS	NS	NS	13	3.8	3.1	3.6	**5.93**
G0110	**N/A**	NS	NS	NS	0.19	ND	2.20	2.90	**1.32**	**N/A**	NS	NS	NS	4.2	5.4	9.0	11.0	**7.40**
G0111	**N/A**	NS	NS	NS	8.02	1.90	2.20	2.40	**3.63**	**N/A**	NS	NS	NS	40	4.6	7.8	7.1	**14.83**
G0112	**N/A**	NS	NS	NS	NS	0.55	0.78	0.44	**0.59**	**N/A**	NS	NS	NS	NS	3.9	3.6	3.4	**3.63**
G0113	**N/A**	NS	NS	NS	NS	62.0	28.0	19.0	**36.33**	**N/A**	NS	NS	NS	NS	3400	630.0	150.0	**1393.33**
G0114	**N/A**	NS	NS	NS	NS	1.20	1.90	3.40	**2.17**	**N/A**	NS	NS	NS	NS	9.5	7.1	17.0	**11.20**
G0115	**N/A**	NS	NS	NS	NS	3.90	7.10	8.10	**6.37**	**N/A**	NS	NS	NS	NS	99	19.0	14.0	**44.0**
G0116	**N/A**	NS	NS	NS	NS	130.0	58.0	63.0	**83.67**	**N/A**	NS	NS	NS	NS	6900	1200.0	560.0	**2886.67**
G0117	**N/A**	NS	NS	NS	NS	6.30	8.30	19.0	**11.20**	**N/A**	NS	NS	NS	NS	250	37.0	13.0	**100.0**
G0118	**N/A**	NS	NS	NS	NS	NS	1.60	7.10	**4.35**	**N/A**	NS	NS	NS	NS	NS	49.0	26.0	**37.50**

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
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Well Number	TKN (mg/L)									DOC (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
G0119	**N/A**	NS	NS	NS	NS	NS	1.10	7.30	**4.20**	**N/A**	NS	NS	NS	NS	NS	4.7	250.0	**127.35**
G0120	**N/A**	NS	NS	NS	NS	NS	19.0	23.0	**21.0**	**N/A**	NS	NS	NS	NS	NS	96.0	31.0	**63.50**
PZ001	**0.09**	0.44	0.48	ND	0.30	0.37	0.33	0.27	**0.31**	**5.8**	5.0	6.42	5.26	6.10	7.0	6.3	6.3	**6.05**
PZ004	**0.13**	0.34	0.40	ND	0.64	ND	0.59	0.19	**0.31**	**3.9**	5.5	5.64	5.28	5.46	5.70	5.6	6.5	**5.67**
PZ010	**0.29**	30.0	15.0	22.80	18.60	6.80	2.70	0.79	**13.81**	**3.2**	420.0	72.50	29.50	9.49	10.0	3.6	3.5	**78.37**
PZ011	**3.29**	5.50	3.10	3.72	4.82	1.80	5.0	5.80	**4.25**	**2.3**	6.0	5.57	6.90	6.72	12.0	140.0	12.0	**27.03**
PZ012	**3.80**	2.20	3.22	3.14	5.62	2.60	15.0	12.0	**6.25**	**2.3**	24.0	5.62	5.16	3.84	21.0	260.0	24.0	**49.09**
PZ013	**10.13**	4.70	4.52	6.96	1.19	3.30	3.10	3.80	**3.94**	**4.8**	5.8	72.50	7.71	9.51	5.80	8.2	13.0	**17.50**
PZ014	**0.09**	0.34	0.92	ND	1.19	0.71	0.47	0.77	**0.63**	**1.5**	2.6	7.52	5.28	4.59	3.30	4.3	6.4	**4.86**
PZ015	**1.13**	0.32	9.88	6.16	6.55	1.40	0.64	ND	**3.56**	**1.9**	ND	237	7.15	8.19	7.60	5.3	4.8	**38.58**
PZ016	**0.34**	2.40	1.17	ND	5.22	0.57	0.63	0.91	**1.56**	**1.8**	5.5	4.02	3.98	3.79	5.30	4.8	5.1	**4.64**
Average	**1.72**	**2.61**	**2.39**	**3.41**	**4.97**	**6.62**	**5.05**	**6.33**	**5.96**	**2.6**	**32.75**	**54.18**	**61.37**	**26.78**	**286.20**	**77.36**	**50.20**	**124.52**
Shallow-Intermediate Wells in RAO Treatment Areas																		
G0075	**0.37**	ND	ND	ND	ND	ND	0.35	ND	**0.05**	**1.60**	2.40	2.94	ND	3.30	2.80	2.60	2.60	**2.38**
G0080	**N/A**	ND	ND	ND	0.191	0.20	ND	0.23	**0.09**	**N/A**	1.40	2.23	ND	2.11	2.90	2.30	3.20	**2.02**
G0081	**N/A**	2.10	2.61	ND	1.35	0.39	0.89	0.77	**1.16**	**N/A**	1.70	2.62	3.67	3.11	3.80	4.60	5.60	**3.59**
G0082	**N/A**	ND	ND	ND	0.141	ND	ND	ND	**0.02**	**N/A**	1.80	2.52	2.83	2.64	2.80	3.70	4.0	**2.90**
G0088	**N/A**	0.21	ND	1.50	0.389	ND	ND	ND	**0.30**	**N/A**	1.90	2.46	2.44	2.17	2.50	2.30	2.70	**2.35**
G0089	**N/A**	ND	0.396	ND	ND	0.25	0.42	1.0	**0.30**	**N/A**	2.0	2.74	2.97	3.31	4.30	3.60	5.80	**3.53**
G0090	**N/A**	ND	0.5	ND	7.30	ND	ND	ND	**1.11**	**N/A**	2.10	2.61	2.72	8.18	3.0	3.50	3.20	**3.62**
Average	**0.37**	**0.33**	**0.50**	**0.21**	**1.34**	**0.12**	**0.24**	**0.29**	**0.43**	**1.6**	**1.90**	**2.59**	**2.09**	**3.55**	**3.16**	**3.23**	**3.87**	**2.91**
Intermediate Wells in RAO Treatment Areas																		
G0045	**6.17**	8.30	7.64	7.71	6.77	4.90	4.90	2.60	**6.12**	**3.8**	5.0	5.50	5.77	5.88	5.20	5.20	5.10	**5.38**
G0049	**0.41**	1.20	0.791	3.0	3.83	1.40	2.30	2.20	**2.10**	**1.4**	2.60	2.96	4.26	4.99	5.40	9.30	3.20	**4.67**
G0076	**1.90**	ND	1.13	2.82	0.959	0.21	0.26	0.44	**0.81**	**1.0**	1.30	2.77	2.69	6.44	2.60	2.40	2.80	**3.00**
Average	**2.83**	**3.17**	**3.19**	**4.51**	**5.30**	**2.17**	**2.49**	**1.75**	**3.01**	**2.1**	**2.97**	**3.74**	**4.24**	**5.77**	**4.40**	**5.63**	**3.70**	**4.35**

Notes:

Dry: well could not be sampled due to lack of water.

μg/L = micrograms per liter
Aban = abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter

mS/cm = milliSiemens per centimeter
mV = millivolts
MNA = monitored natural attenuation
N/A = not applicable
ND = nondetect
NS = not sampled

ORP = oxidation/reduction potential
OU = Operable Unit
R = rejected; data rejected based on professional judgment
RAO = Remedial Action Operation
TKN = total Kjeldahl nitrogen

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Carbon Dioxide (mg/L)									Methane (µg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Areas																		
G0017	**164**	290	256	338	205	227	204	200	**246**	**0.1**	4900	2100	3800	2400	10000	7800	9600	**5800**
G0019	**160**	160	189	156	187	NS	Aban	Aban	**173**	**ND**	ND	160	210	160	NS	Aban	Aban	**133**
G0020	**123**	130	127	124	144	NS	Aban	Aban	**131**	**0.1**	1.6	ND	1.8	ND	NS	Aban	Aban	**1**
G0021	**122**	160	153	133	153	NS	NS	NS	**150**	**0.1**	3500	290	110	110	NS	NS	NS	**1003**
G0022	**93**	120	122	107	140	120	107	133	**121**	**ND**	5800	1900	620	440	390	310	220	**1383**
G0023	**85**	120	136	80	157	191	200	231	**159**	**ND**	3100	7400	3400	5200	22000	12000	26000	**11300**
G0048	**73**	82	140	142	NS	NS	Dry	Dry	**121**	**ND**	0.2	4600	2100	Dry	Dry	Dry	Dry	**2233**
G0063	**182**	190	211	169	182	NS	NS	NS	**188**	**1.5**	27	32	38	ND	NS	NS	NS	**24**
G0066R	**132**	160	224	249	262	200	213	356	**238**	**0.6**	1300	ND	4400	4900	20000	16000	19000	**9371**
G0079	**108**	71	71	93	NS	NS	Dry	Dry	**78**	**ND**	960	23	4.2	Dry	Dry	Dry	Dry	**329**
G0083	**N/A**	130	153	151	122	142	133	142	**139**	**N/A**	1500	620	120	38	19	14	6.4	**331**
G0084	**N/A**	91	87	102	101	107	151	178	**117**	**N/A**	0.4	200	ND	12	51	270	17000	**2505**
G0085	**N/A**	140	100	111	191	133	173	204	**150**	**N/A**	7500	2000	200	2400	1300	5300	19000	**5386**
G0093	**N/A**	NS	136	111	109	111	102	93	**111**	**N/A**	NS	850.00	830	630	ND	2400	6000	**1785**
G0094	**N/A**	NS	73	20	104	71	89	102	**77**	**N/A**	NS	2000	7600	11000	19000	18000	20000	**12933**
G0095	**N/A**	NS	113	193	278	156	204	218	**194**	**N/A**	NS	ND	2900	3100	16000	12000	19000	**8833**
G0096	**N/A**	NS	NS	84	103	98	89	107	**96**	**N/A**	NS	NS	ND	5700	6000	10000	8000	**5940**
G0097	**N/A**	NS	NS	36	154	200	289	160	**168**	**N/A**	NS	NS	7.40	1700	9900	15000	12000	**7721**
G0098	**N/A**	NS	NS	87	171	218	120	147	**149**	**N/A**	NS	NS	4500	9300	16000	14000	20000	**12760**
G0099	**N/A**	NS	NS	76	351	76	89	98	**138**	**N/A**	NS	NS	4100	1800	12000	14000	11000	**8580**
G0100	**N/A**	NS	NS	164	343	267	271	276	**264**	**N/A**	NS	NS	2200	14000	18000	8500	13000	**11140**
G0101	**N/A**	NS	NS	131	151	191	204	ND	**136**	**N/A**	NS	NS	3600	360	6100	9800	14000	**6772**
G0103	**N/A**	NS	NS	NS	178	173	218	218	**197**	**N/A**	NS	NS	NS	8.0	11	11	24	**14**
G0104	**N/A**	NS	NS	NS	269	311	213	244	**259**	**N/A**	NS	NS	NS	10	320	1500	3100	**1233**
G0105	**N/A**	NS	NS	NS	273	271	373	324	**311**	**N/A**	NS	NS	NS	460	160	1200	1700	**880**
G0106	**N/A**	NS	NS	NS	173	173	191	182	**180**	**N/A**	NS	NS	NS	2.30	6.3	12	35	**14**
G0107	**N/A**	NS	NS	NS	182	200	338	240	**240**	**N/A**	NS	NS	NS	1200	13000	5500	7300	**6750**
G0108	**N/A**	NS	NS	NS	40	98	196	187	**130**	**N/A**	NS	NS	NS	3000	14000	16000	18000	**12750**
G0109	**N/A**	NS	NS	NS	244	98	89	89	**130**	**N/A**	NS	NS	NS	21000	18000	13000	14000	**16500**
G0110	**N/A**	NS	NS	NS	112	182	182	258	**184**	**N/A**	NS	NS	NS	6900	14000	16000	17000	**13475**
G0111	**N/A**	NS	NS	NS	542	231	258	289	**330**	**N/A**	NS	NS	NS	10000	8000	11000	12000	**10250**
G0112	**N/A**	NS	NS	NS	NS	NS	98	93	**96**	**N/A**	NS	NS	NS	NS	9200	12000	11000	**10733**
G0113	**N/A**	NS	NS	NS	NS	NS	240	293	**267**	**N/A**	NS	NS	NS	NS	4100	17000	21000	**14033**
G0114	**N/A**	NS	NS	NS	NS	NS	111	142	**127**	**N/A**	NS	NS	NS	NS	17000	12000	18000	**15667**
G0115	**N/A**	NS	NS	NS	NS	NS	324	338	**331**	**N/A**	NS	NS	NS	NS	18000	21000	23000	**20667**
G0116	**N/A**	NS	NS	NS	NS	NS	293	302	**298**	**N/A**	NS	NS	NS	NS	9600	14000	13000	**12200**
G0117	**N/A**	NS	NS	NS	NS	NS	444	356	**400**	**N/A**	NS	NS	NS	NS	19000	10000	25000	**18000**
G0118	**N/A**	NS	NS	NS	NS	NS	244	356	**300**	**N/A**	NS	NS	NS	NS	NS	12000	14000	**13000**

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	**Carbon Dioxide (mg/L)**									**Methane (µg/L)**								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
G0119	**N/A**	NS	NS	NS	NS	NS	169	404	**287**	**N/A**	NS	NS	NS	NS	NS	9900	15000	**12450**
G0120	**N/A**	NS	NS	NS	NS	NS	489	444	**467**	**N/A**	NS	NS	NS	NS	NS	18000	21000	**19500**
PZ001	**205**	210	202	209	227	222	244	249	**223**	**0.1**	220	230	100	72	150	55	75	**129**
PZ004	**198**	220	251	211	209	218	222	244	**225**	**0.1**	67	48	100	51	250	37	160	**102**
PZ010	**166**	230	193	213	233	240	240	209	**223**	**ND**	9500	7300	6700	6300	17000	7700	5500	**8571**
PZ011	**140**	220	191	191	240	320	404	413	**283**	**0.2**	11000	4200	9700	18000	20000	12000	17000	**13129**
PZ012	**136**	200	153	178	237	298	409	489	**280**	**0.1**	12000	4100	8700	10000	17000	16000	22000	**12829**
PZ013	**148**	220	216	182	222	280	364	444	**276**	**0.2**	18000	6100	7700	14000	19000	15000	14000	**13400**
PZ014	**163**	190	260	244	236	227	231	338	**246**	**0.1**	980	8000	1900	3400	3500	1500	1300	**2940**
PZ015	**75**	77	132	98	132	164	93	80	**111**	**ND**	ND	9400	4400	3200	14000	7600	6300	**6414**
PZ016	**81**	110	109	104	118	133	120	124	**117**	**ND**	2800	3900	5200	220	5100	5200	4500	**3846**
Average	**134**	**160**	**160**	**145**	**197**	**187**	**220**	**232**	**201**	**0.17**	**3780**	**2618**	**2750**	**4239**	**9929**	**9316**	**12066**	**7668**
Shallow-Intermediate Wells in RAO Treatment Areas																		
G0075	**88**	91	136	133	104	111	98	116	**113**	**3.3**	180	530	1100	910	980	400	990	**727**
G0080	**N/A**	110	113	120	137	76	107	84	**107**	**N/A**	2900	190	300	200	9.1	100	8.9	**530**
G0081	**N/A**	120	104	124	133	124	156	178	**134**	**N/A**	230	900	1900	3400	7000	11000	11000	**5061**
G0082	**N/A**	110	100	111	122	111	129	133	**117**	**N/A**	850	440	1300	2900	770	2200	2900	**1623**
G0088	**N/A**	120	109	107	109	102	102	116	**109**	**N/A**	340.00	1500	300	950	360	320	140	**559**
G0089	**N/A**	110	107	116	104	133	133	169	**125**	**N/A**	360.00	960	760	2000	8200	5000	6400	**3383**
G0090	**N/A**	120	91	118	130	138	142	120	**123**	**N/A**	ND	ND	39	350	250	1900	580	**446**
Average	**88**	**112**	**109**	**118**	**120**	**114**	**124**	**131**	**118**	**3.3**	**694**	**646**	**814**	**1530**	**2510**	**2989**	**3146**	**1761**
Intermediate Wells in RAO Treatment Areas																		
G0045	**172**	180	165	182	186	164	173	182	**176**	**1.3**	18	ND	1	ND	3	1.8	2.0	**4**
G0049	**106**	120	96	120	142	169	156	133	**134**	**ND**	4	17	40	3000	6600	2700	360	**1817**
G0076	**105**	120	153	142	144	138	111	133	**135**	**0.4**	2.7	220	730	1600	750	310	83	**528**
Average	**128**	**140**	**138**	**148**	**158**	**157**	**147**	**150**	**148**	**0.57**	**8**	**79**	**257**	**1533**	**2451**	**1004**	**148**	**783**

Notes:

Dry: well could not be sampled due to lack of water.

µg/L = micrograms per liter
Aban = abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter

mS/cm = milliSiemens per centimeter
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TKN = total Kjeldahl nitrogen

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Alkalinity (mg/L)									Ferrous Iron (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Areas																		
G0017	**374**	660	575	760	462	510	460	450	**554**	**0.14**	6.38	NS	NS	1.64	0.46	0.45	0.27	**1.84**
G0019	**362**	350	425	350	420	NS	Aban	Aban	**386**	**0.10**	0.23	0.16	ND	0.28	NS	Aban	Aban	**0.17**
G0020	**282**	290	285	280	325	NS	Aban	Aban	**295**	**0.22**	0.38	0.08	ND	0.17	NS	Aban	Aban	**0.16**
G0021	**279**	360	345	300	344	NS	NS	NS	**337**	**0.09**	1.03	1.05	0.97	1.8	NS	NS	NS	**1.21**
G0022	**213**	270	275	240	315	270	240	300	**273**	**0.10**	ND	0.07	0.01	0.22	ND	1.67	0.07	**0.29**
G0023	**194**	280	305	180	354	430	450	520	**360**	**0.09**	0.06	4.50	2.97	5.18	1.96	6.46	7.15	**4.04**
G0048	**167**	190	315	320	Dry	Dry	Dry	Dry	**275**	**0.26**	0.04	8.68	4.85	Dry	Dry	Dry	Dry	**4.52**
G0063	**412**	440	475	380	410	NS	NS	NS	**426**	**0.11**	0.08	0.79	0.54	0.34	NS	NS	NS	**0.44**
G0066R	**299**	370	505	560	590	450	480	800	**536**	**0.37**	1.34	0.27	6.53	6.53	3.23	2.45	16.0	**5.19**
G0079	**239**	160	160	210	Dry	Dry	Dry	Dry	**177**	**0.21**	ND	0.1	0.28	Dry	Dry	Dry	Dry	**0.13**
G0083	**N/A**	310	345	340	275	320	300	320	**316**	**N/A**	0.07	0.07	0.03	0.81	ND	0.35	0.05	**0.20**
G0084	**N/A**	210	195	230	227	240	340	400	**263**	**N/A**	0.14	ND	0.14	0.53	0.74	2.71	2.62	**0.98**
G0085	**N/A**	320	225	250	430	300	390	460	**339**	**N/A**	0.50	0.18	0.19	0.47	0.6	5.58	3.27	**1.54**
G0093	**N/A**	NS	305	250	246	250	230	210	**249**	**N/A**	NS	0.12	0.24	1.23	0.66	2.54	1.93	**1.12**
G0094	**N/A**	NS	165	46	234	160	200	230	**173**	**N/A**	NS	0.31	15.0	1.96	7.66	5.68	2.67	**5.55**
G0095	**N/A**	NS	255	435	625	350	460	490	**436**	**N/A**	NS	0.02	2.19	7.2	5.68	4.96	7.25	**4.55**
G0096	**N/A**	NS	NS	190	231	220	200	240	**216**	**N/A**	NS	NS	0.12	0.12	2.5	3.16	0.08	**1.20**
G0097	**N/A**	NS	NS	80	346	450	650	360	**377**	**N/A**	NS	NS	0.08	0.08	3.87	10.20	5.2	**3.89**
G0098	**N/A**	NS	NS	195	385	490	270	330	**334**	**N/A**	NS	NS	0.87	1.68	8.06	5.36	12.9	**5.77**
G0099	**N/A**	NS	NS	170	790	170	200	220	**310**	**N/A**	NS	NS	15.0	9.81	6.48	10.48	2.28	**8.81**
G0100	**N/A**	NS	NS	370	772	600	610	620	**594**	**N/A**	NS	NS	0.90	8.25	6.58	2.46	10.2	**5.68**
G0101	**N/A**	NS	NS	295	340	430	460	ND	**305**	**N/A**	NS	NS	0.23	2.81	2.74	1.27	1.92	**1.79**
G0103	**N/A**	NS	NS	NS	400	390	490	490	**443**	**N/A**	NS	NS	NS	8.07	10.68	NA	2.15	**6.97**
G0104	**N/A**	NS	NS	NS	605	700	480	550	**584**	**N/A**	NS	NS	NS	9.80	3.14	1.37	1.38	**3.92**
G0105	**N/A**	NS	NS	NS	615	610	840	730	**699**	**N/A**	NS	NS	NS	1.30	0.6	ND	1.29	**0.80**
G0106	**N/A**	NS	NS	NS	390	390	430	410	**405**	**N/A**	NS	NS	NS	1.02	ND	0.88	1.5	**0.85**
G0107	**N/A**	NS	NS	NS	410	450	760	540	**540**	**N/A**	NS	NS	NS	0.86	ND	0.43	1.9	**0.80**
G0108	**N/A**	NS	NS	NS	90	220	440	420	**293**	**N/A**	NS	NS	NS	0.17	5.22	2.95	2.69	**2.76**
G0109	**N/A**	NS	NS	NS	550	220	200	200	**293**	**N/A**	NS	NS	NS	6.09	1.84	15.0	3.12	**6.51**
G0110	**N/A**	NS	NS	NS	252	410	410	580	**413**	**N/A**	NS	NS	NS	2.69	3.25	2.99	6.5	**3.85**
G0111	**N/A**	NS	NS	NS	1220	520	580	650	**743**	**N/A**	NS	NS	NS	8.31	6.6	2.90	7.8	**6.40**
G0112	**N/A**	NS	NS	NS	NS	260	220	210	**230**	**N/A**	NS	NS	NS	NS	6.03	1.67	1.19	**2.96**
G0113	**N/A**	NS	NS	NS	NS	R	540	660	**600**	**N/A**	NS	NS	NS	NS	NS	3.12	15.8	**9.46**
G0114	**N/A**	NS	NS	NS	NS	310	250	320	**293**	**N/A**	NS	NS	NS	NS	4.44	3.94	7.58	**5.32**
G0115	**N/A**	NS	NS	NS	NS	620	730	760	**703**	**N/A**	NS	NS	NS	NS	2.51	2.36	13.9	**6.26**
G0116	**N/A**	NS	NS	NS	NS	930	660	680	**757**	**N/A**	NS	NS	NS	NS	NS	NS	NS	**N/A**
G0117	**N/A**	NS	NS	NS	NS	810	1000	800	**870**	**N/A**	NS	NS	NS	NS	2.91	5.30	15.0	**7.74**
G0118	**N/A**	NS	NS	NS	NS	NS	550	800	**675**	**N/A**	NS	NS	NS	NS	NS	4.82	10.65	**7.74**

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	Alkalinity (mg/L)									Ferrous Iron (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
G0119	**N/A**	NS	NS	NS	NS	NS	380	910	**645**	**N/A**	NS	NS	NS	NS	NS	1.91	8.40	**5.16**
G0120	**N/A**	NS	NS	NS	NS	NS	1100	1000	**1050**	**N/A**	NS	NS	NS	NS	NS	1.48	11.5	**6.49**
PZ001	**428**	470	455	470	510	500	550	560	**502**	**0.32**	0.71	0.64	0.49	0.51	0.46	0.57	0.53	**0.56**
PZ004	**451**	490	565	475	470	490	500	550	**506**	**0.70**	1.03	0.91	0.83	0.43	0.72	0.64	0.30	**0.69**
PZ010	**375**	530	435	480	525	540	540	470	**503**	**0.11**	5.10	6.5	4.68	2.54	2.51	3.40	0.81	**3.65**
PZ011	**316**	510	430	430	540	720	910	930	**639**	**0.13**	3.14	2.54	2.62	2.36	1.77	3.72	6.14	**3.18**
PZ012	**311**	460	345	400	533	670	920	1100	**633**	**0.11**	0.60	0.42	0.56	1.36	1.61	1.71	5.58	**1.69**
PZ013	**338**	500	485	410	500	630	820	1000	**621**	**0.09**	2.51	7.0	2.16	1.98	2.29	10.96	2.33	**4.18**
PZ014	**370**	440	585	550	530	510	520	760	**556**	**0.09**	1.06	2.24	1.68	1.86	1.76	1.92	1.61	**1.73**
PZ015	**169**	180	298	220	298	370	210	180	**251**	**0.11**	0.01	15.0	7.40	3.19	1.82	0.58	0.57	**4.08**
PZ016	**183**	250	245	235	265	300	270	280	**264**	**0.18**	2.66	2.34	2.20	2.09	2.92	2.43	1.59	**2.32**
Average	**303**	**365**	**360**	**326**	**443**	**441**	**494**	**523**	**454**	**0.19**	**1.23**	**2.25**	**2.46**	**2.78**	**3.01**	**3.48**	**4.90**	**3.44**
Shallow-Intermediate Wells in RAO Treatment Areas																		
G0075	**200**	210	305	300	234	250	220	260	**254**	**0.18**	0.97	0.48	0.23	0.13	ND	ND	ND	**0.26**
G0080	**N/A**	260	255	270	308	170	240	190	**242**	**N/A**	ND	0.06	ND	0.09	ND	0.07	0.11	**0.05**
G0081	**N/A**	260	235	280	300	280	350	400	**301**	**N/A**	0.02	0.01	0.03	0.13	0.05	0.02	ND	**0.04**
G0082	**N/A**	250	225	250	275	250	290	300	**263**	**N/A**	ND	ND	ND	0.1	1.07	ND	0.04	**0.17**
G0088	**N/A**	280	245	240	245	230	230	260	**247**	**N/A**	0.40	0.44	0.1	0.15	1.16	0.05	0.26	**0.37**
G0089	**N/A**	240	240	260	235	300	300	380	**279**	**N/A**	0.22	0.05	0.12	0.29	1.1	ND	0.19	**0.28**
G0090	**N/A**	280	205	265	292	310	320	270	**277**	**N/A**	0.13	0.09	0.07	0.28	1.24	ND	0.09	**0.27**
Average	**200**	**254**	**244**	**266**	**270**	**256**	**279**	**294**	**266**	**0.18**	**0.25**	**0.16**	**0.08**	**0.17**	**0.66**	**0.02**	**0.10**	**0.20**
Intermediate Wells in RAO Treatment Areas																		
G0045	**391**	410	372	410	419	370	390	410	**397**	**0.15**	0.07	0.16	ND	0.22	ND	ND	0.67	**0.16**
G0049	**242**	270	215	270	320	380	350	300	**301**	**0.11**	3.12	3.6	2.49	2.27	2.91	0.75	0.54	**2.24**
G0076	**232**	270	345	320	325	310	250	300	**303**	**0.71**	0.69	0.94	0.84	1.11	1.13	1.00	1.11	**0.97**
Average	**288**	**317**	**311**	**333**	**355**	**353**	**330**	**337**	**334**	**0.32**	**1.29**	**1.57**	**1.11**	**1.20**	**1.35**	**0.58**	**0.77**	**1.12**

Notes:

Dry: well could not be sampled due to lack of water.

μg/L = micrograms per liter
Aban = abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter

mS/cm = milliSiemens per centimeter
mV = millivolts
MNA = monitored natural attenuation
N/A = not applicable
ND = nondetect
NS = not sampled

ORP = oxidation/reduction potential
OU = Operable Unit
R = rejected; data rejected based on professional judgment
RAO = Remedial Action Operation
TKN = total Kjeldahl nitrogen

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
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Well Number	Sulfate (mg/L)									Sulfide (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Areas																		
G0017	**471**	45	73.8	439	544	330	410	350	**313**	**ND**	34	12	56.2	22	21	24	14	**26.17**
G0019	**108**	110	300	298	240	NS	Aban	Aban	**237**	**ND**	2.1	0.2	0.6	0.2	NS	Aban	Aban	**0.78**
G0020	**112**	160	189	174	137	NS	Aban	Aban	**165**	**0.30**	2.2	0.2	0.4	0.401	NS	Aban	Aban	**0.80**
G0021	**89**	150	137	154	25.3	NS	NS	NS	**117**	**0.20**	ND	0.2	0.4	ND	NS	NS	NS	**0.15**
G0022	**30**	53	56.9	60	51	48	58	64	**56**	**ND**	ND	ND	0.6	0.2	ND	ND	ND	**0.11**
G0023	**50**	43	42.2	53	18	16	22	23	**31**	**0.20**	5.9	0.2	0.6	ND	ND	ND	ND	**0.96**
G0048	**40**	48	8.5	34.9	Dry	Dry	Dry	Dry	**30**	**0.80**	5.4	0.2	2	Dry	Dry	Dry	Dry	**2.53**
G0063	**1030**	1200	1260	1260	1250	NS	NS	NS	**1243**	**0.30**	ND	0.2	0.4	0.2	NS	NS	NS	**0.20**
G0066R	**37**	110	136	59.8	50	91	130	32	**87**	**0.20**	5.6	0.2	0.8	ND	ND	ND	ND	**0.94**
G0079	**33**	25	30.5	41	Dry	Dry	Dry	Dry	**32**	**0.70**	5.8	ND	0.4	Dry	Dry	Dry	Dry	**2.07**
G0083	**N/A**	140	96.7	140	34	170	210	150	**134**	**N/A**	0.96	0.2	0.6	ND	ND	ND	ND	**0.25**
G0084	**N/A**	44	68.2	45	46	42	53	23	**46**	**N/A**	1.1	0.4	0.8	0.802	ND	ND	ND	**0.44**
G0085	**N/A**	60	84.8	72	63	65	94	62	**72**	**N/A**	4	0.2	0.6	ND	ND	ND	ND	**0.69**
G0093	**N/A**	NS	58.4	57	56	110	85	31	**66**	**N/A**	NS	0.20	0.4	ND	1.4	ND	ND	**0.33**
G0094	**N/A**	NS	25.6	22	4	15.0	31	49	**24**	**N/A**	NS	0.20	1.2	ND	0.96	ND	ND	**0.39**
G0095	**N/A**	NS	184	63	1.4	20.0	25	93	**64**	**N/A**	NS	0.60	0.2	0.401	ND	ND	ND	**0.20**
G0096	**N/A**	NS	NS	43.6	20	25	40	49	**36**	**N/A**	NS	NS	1.00	ND	ND	ND	0.8	**0.36**
G0097	**N/A**	NS	NS	127.0	29	14	9	100	**56**	**N/A**	NS	NS	0.60	ND	ND	ND	ND	**0.12**
G0098	**N/A**	NS	NS	24.6	8	4.9	55	21	**23**	**N/A**	NS	NS	0.60	4.01	0.96	ND	ND	**1.11**
G0099	**N/A**	NS	NS	21.1	ND	61	51	30	**33**	**N/A**	NS	NS	1.60	ND	1.1	ND	ND	**0.54**
G0100	**N/A**	NS	NS	84.8	37	20	28	20	**38**	**N/A**	NS	NS	ND	0.801	ND	ND	ND	**0.16**
G0101	**N/A**	NS	NS	156	255	63	180	370	**205**	**N/A**	NS	NS	1.00	ND	ND	ND	ND	**0.20**
G0103	**N/A**	NS	NS	NS	744	890	480	670	**696**	**N/A**	NS	NS	NS	ND	15	29	11	**13.75**
G0104	**N/A**	NS	NS	NS	852	730	910	920	**853**	**N/A**	NS	NS	NS	0.80	2.4	6.1	1.6	**2.73**
G0105	**N/A**	NS	NS	NS	733	740	640	840	**738**	**N/A**	NS	NS	NS	24.00	2.2	20	ND	**11.55**
G0106	**N/A**	NS	NS	NS	1070	930	900	9400	**3075**	**N/A**	NS	NS	NS	ND	1.3	ND	ND	**0.33**
G0107	**N/A**	NS	NS	NS	1050	950	660	9200	**2965**	**N/A**	NS	NS	NS	0.40	ND	3.5	ND	**0.98**
G0108	**N/A**	NS	NS	NS	18.8	16	2.2	0.8	**9**	**N/A**	NS	NS	NS	0.20	ND	1.1	15	**4.08**
G0109	**N/A**	NS	NS	NS	1.1	42.0	65	77	**46**	**N/A**	NS	NS	NS	ND	ND	0.80	ND	**0.20**
G0110	**N/A**	NS	NS	NS	23.6	31	38	23	**29**	**N/A**	NS	NS	NS	2.00	ND	ND	ND	**0.50**
G0111	**N/A**	NS	NS	NS	82.6	80	110	56	**82**	**N/A**	NS	NS	NS	0.40	ND	ND	ND	**0.10**
G0112	**N/A**	NS	NS	NS	NS	26	54	63	**48**	**N/A**	NS	NS	NS	NS	ND	ND	1.1	**0.37**
G0113	**N/A**	NS	NS	NS	NS	330	33	11	**125**	**N/A**	NS	NS	NS	NS	ND	1.3	ND	**0.43**
G0114	**N/A**	NS	NS	NS	NS	20	54	33	**36**	**N/A**	NS	NS	NS	NS	ND	ND	ND	**ND**
G0115	**N/A**	NS	NS	NS	NS	11	54	98	**54**	**N/A**	NS	NS	NS	NS	ND	0.80	ND	**0.27**
G0116	**N/A**	NS	NS	NS	NS	560	8.9	12	**194**	**N/A**	NS	NS	NS	NS	0.80	ND	ND	**0.27**
G0117	**N/A**	NS	NS	NS	NS	20	11	130	**54**	**N/A**	NS	NS	NS	NS	ND	ND	ND	**ND**
G0118	**N/A**	NS	NS	NS	NS	NS	8.2	13	**11**	**N/A**	NS	NS	NS	NS	NS	ND	ND	**ND**

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
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Well Number	Sulfate (mg/L)									Sulfide (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
G0119	**N/A**	NS	NS	NS	NS	NS	380	31	**206**	**N/A**	NS	NS	NS	NS	NS	ND	ND	**ND**
G0120	**N/A**	NS	NS	NS	NS	NS	36	110	**73**	**N/A**	NS	NS	NS	NS	NS	ND	ND	**ND**
PZ001	**605**	810	1050	890	911	1300	1000	1100	**1009**	**ND**	ND	0.2	0.4	0.2	ND	ND	ND	**0.11**
PZ004	**601**	820	826	879	778	970	870	960	**872**	**0.30**	ND	0.2	0.4	0.2	ND	ND	ND	**0.11**
PZ010	**193**	11	61	78.5	199	200	190	140	**126**	**0.50**	13	0.2	2.0	7.01	8.2	ND	ND	**4.34**
PZ011	**178**	180	232	179	124	45	80	98	**134**	**0.20**	2.1	0.2	0.8	0.601	ND	ND	ND	**0.53**
PZ012	**101**	130	176	143	56	95	160	130	**127**	**0.20**	9.4	0.2	3.21	1.4	1.4	1.4	ND	**2.43**
PZ013	**142**	160	104	221	191	250	220	170	**188**	**0.7**	6.5	0.4	1.4	3.41	5.9	0.96	ND	**2.65**
PZ014	**123**	230	95.6	150	136	200	310	580	**243**	**ND**	6	0.4	0.6	ND	ND	ND	ND	**1.00**
PZ015	**33**	18	13	20.6	28	28	82	82	**39**	**ND**	ND	0.2	1	ND	ND	ND	ND	**0.17**
PZ016	**43**	52	57.4	53	48	24	81	110	**61**	**ND**	ND	0.4	0.8	0.401	0.8	ND	ND	**0.34**
Average	**212**	**209**	**215**	**195**	**261**	**240**	**207**	**617**	**310**	**0.24**	**4.73**	**0.70**	**2.63**	**1.84**	**1.59**	**2.07**	**1.01**	**1.77**
Shallow-Intermediate Wells in RAO Treatment Areas																		
G0075	**44**	79	76	92	20	87	110	120	**83**	**ND**	0.37	0.2	0.4	ND	ND	ND	ND	**0.14**
G0080	**N/A**	94	112	112	99	42	86	110	**94**	**N/A**	6.2	0.2	0.4	ND	ND	ND	ND	**0.97**
G0081	**N/A**	55	95	65	64	62	66	57	**66**	**N/A**	4.6	0.2	0.4	0.401	ND	ND	ND	**0.80**
G0082	**N/A**	70	86	82	19	57	50	93	**65**	**N/A**	ND	0.2	0.6	0.401	ND	ND	ND	**0.17**
G0088	**N/A**	64	84	113	22	98	140	130	**93**	**N/A**	1.20	0.4	0.6	ND	ND	ND	ND	**0.31**
G0089	**N/A**	56	65	61	68	63	72	66	**64**	**N/A**	ND	0.2	0.4	0.2	ND	ND	ND	**0.11**
G0090	**N/A**	82	85	81	28	76	60	75	**70**	**N/A**	ND	0.4	0.4	0.2	ND	ND	ND	**0.14**
Average	**44**	**71**	**86**	**86**	**46**	**69**	**83**	**93**	**76**	**ND**	**1.77**	**0.26**	**0.46**	**0.17**	**ND**	**ND**	**ND**	**0.38**
Intermediate Wells in RAO Treatment Areas																		
G0045	**695**	1100	1030	1020	1040	1100	1100	1100	**1070**	**ND**	ND	0.4	0.8	0.2	ND	ND	ND	**0.20**
G0049	**87**	160	199	120	103	140	150	260	**162**	**0.20**	ND	0.2	0.4	ND	ND	2.1	ND	**0.39**
G0076	**56**	100	76	83	18	130	170	210	**112**	**ND**	ND	ND	0.4	0.2	ND	ND	ND	**0.09**
Average	**279**	**453**	**435**	**408**	**387**	**457**	**473**	**523**	**448**	**0.07**	**ND**	**0.20**	**0.53**	**0.13**	**0.00**	**0.70**	**ND**	**0.22**

Notes:

Dry: well could not be sampled due to lack of water.

μg/L = micrograms per liter
Aban = abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter
mS/cm = milliSiemens per centimeter
mV = millivolts
MNA = monitored natural attenuation
N/A = not applicable
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TKN = total Kjeldahl nitrogen

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	pH									Specific Conductance (mS/cm)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Areas																		
G0017	**7.10**	6.48	7.12	7.03	6.53	6.99	7.24	6.86	**6.89**	**1.440**	1.560	1.927	2.033	1.899	1.599	1.689	0.999	**1.672**
G0019	**7.17**	6.92	6.90	6.92	6.59	NS	Aban	Aban	**6.83**	**0.810**	0.836	1.501	1.381	1.169	NS	Aban	Aban	**1.222**
G0020	**7.03**	6.99	7.05	6.94	6.81	NS	Aban	Aban	**6.95**	**0.718**	0.916	0.952	0.919	0.793	NS	Aban	Aban	**0.895**
G0021	**7.27**	7.30	7.32	7.09	6.98	NS	NS	NS	**7.17**	**0.706**	1.080	0.911	0.962	0.798	NS	NS	NS	**0.938**
G0022	**6.96**	6.93	6.84	6.77	6.80	6.95	6.72	6.39	**6.77**	**0.484**	0.832	0.665	0.816	0.649	0.667	0.635	0.698	**0.709**
G0023	**6.86**	6.62	6.63	6.74	6.37	6.41	6.15	6.24	**6.45**	**0.516**	0.673	0.713	0.617	0.679	0.901	1.015	0.737	**0.762**
G0048	**6.93**	6.60	6.53	6.66	Dry	Dry	Dry	Dry	**6.60**	**0.422**	0.521	0.734	0.711	Dry	Dry	Dry	Dry	**0.655**
G0063	**6.97**	6.81	6.80	6.88	6.73	NS	NS	NS	**6.81**	**2.318**	1.805	2.764	2.801	2.441	NS	NS	NS	**2.453**
G0066R	**6.89**	6.41	6.56	6.58	6.58	6.30	6.42	6.05	**6.41**	**0.710**	1.051	1.185	1.285	1.285	1.016	1.194	1.411	**1.204**
G0079	**6.99**	6.51	6.67	6.62	Dry	Dry	Dry	Dry	**6.60**	**0.532**	0.372	0.413	0.492	Dry	Dry	Dry	Dry	**0.426**
G0083	**N/A**	7.03	6.72	6.69	6.49	6.73	6.72	6.77	**6.74**	**N/A**	0.985	0.893	1.160	0.813	0.966	0.996	0.755	**0.938**
G0084	**N/A**	6.75	6.67	6.70	6.45	6.36	6.43	6.00	**6.48**	**N/A**	0.516	0.592	0.594	0.561	0.636	0.780	0.932	**0.659**
G0085	**N/A**	6.79	6.70	6.88	6.75	6.95	5.74	6.44	**6.61**	**N/A**	0.894	0.730	0.702	0.695	0.869	1.294	0.702	**0.841**
G0093	**N/A**	NS	6.87	6.85	6.60	6.59	6.43	5.98	**6.55**	**N/A**	NS	0.661	0.625	0.537	0.777	0.655	0.404	**0.610**
G0094	**N/A**	NS	6.34	4.69	6.17	6.00	5.97	5.92	**5.85**	**N/A**	NS	0.400	1.325	0.562	0.359	0.519	0.438	**0.601**
G0095	**N/A**	NS	6.83	6.29	6.16	6.54	6.48	6.54	**6.47**	**N/A**	NS	0.928	1.005	1.077	0.762	1.096	1.017	**0.981**
G0096	**N/A**	NS	NS	6.82	6.82	6.40	6.50	6.53	**6.61**	**N/A**	NS	NS	0.513	0.469	0.483	0.533	0.713	**0.542**
G0097	**N/A**	NS	NS	6.08	6.08	6.11	5.78	5.78	**5.97**	**N/A**	NS	NS	0.691	0.740	0.964	1.424	0.903	**0.944**
G0098	**N/A**	NS	NS	6.20	6.46	6.25	5.96	6.14	**6.20**	**N/A**	NS	NS	1.040	0.763	1.030	0.707	0.499	**0.808**
G0099	**N/A**	NS	NS	5.31	5.92	6.46	6.13	5.95	**5.95**	**N/A**	NS	NS	1.153	1.410	0.546	0.645	0.465	**0.844**
G0100	**N/A**	NS	NS	6.34	6.43	6.44	6.46	6.28	**6.39**	**N/A**	NS	NS	0.962	1.054	1.250	1.297	1.013	**1.115**
G0101	**N/A**	NS	NS	6.48	6.27	6.48	6.79	6.62	**6.53**	**N/A**	NS	NS	0.861	1.037	0.096	1.316	1.693	**1.001**
G0103	**N/A**	NS	NS	NS	5.70	5.89	6.00	5.93	**5.88**	**N/A**	NS	NS	NS	2.271	2.074	2.430	1.528	**2.076**
G0104	**N/A**	NS	NS	NS	6.52	6.55	6.73	6.82	**6.66**	**N/A**	NS	NS	NS	2.159	2.387	2.542	1.725	**2.203**
G0105	**N/A**	NS	NS	NS	7.00	7.03	6.98	7.05	**7.02**	**N/A**	NS	NS	NS	2.095	2.673	2.673	2.184	**2.406**
G0106	**N/A**	NS	NS	NS	6.92	6.93	7.24	7.07	**7.04**	**N/A**	NS	NS	NS	2.193	2.339	2.303	1.999	**2.209**
G0107	**N/A**	NS	NS	NS	7.06	6.85	6.90	6.95	**6.94**	**N/A**	NS	NS	NS	2.229	2.511	2.512	2.081	**2.333**
G0108	**N/A**	NS	NS	NS	5.91	5.79	5.75	6.13	**5.90**	**N/A**	NS	NS	NS	0.263	0.631	1.078	0.819	**0.698**
G0109	**N/A**	NS	NS	NS	6.21	6.52	6.31	6.25	**6.32**	**N/A**	NS	NS	NS	0.836	0.596	0.622	0.456	**0.628**
G0110	**N/A**	NS	NS	NS	6.41	6.26	6.01	6.12	**6.20**	**N/A**	NS	NS	NS	0.513	0.846	0.953	0.745	**0.764**
G0111	**N/A**	NS	NS	NS	6.23	6.52	6.50	6.22	**6.37**	**N/A**	NS	NS	NS	1.235	1.143	1.339	1.012	**1.182**
G0112	**N/A**	NS	NS	NS	NS	6.23	6.26	6.28	**6.26**	**N/A**	NS	NS	NS	NS	0.462	0.630	0.598	**0.563**
G0113	**N/A**	NS	NS	NS	NS	4.15	5.23	6.45	**5.28**	**N/A**	NS	NS	NS	NS	NS	1.984	1.299	**1.642**
G0114	**N/A**	NS	NS	NS	NS	6.56	6.22	6.37	**6.38**	**N/A**	NS	NS	NS	NS	0.772	0.779	0.527	**0.693**
G0115	**N/A**	NS	NS	NS	NS	6.19	6.49	6.54	**6.41**	**N/A**	NS	NS	NS	NS	1.399	1.682	1.351	**1.477**
G0116	**N/A**	NS	NS	NS	NS	4.80	5.18	5.13	**5.04**	**N/A**	NS	NS	NS	NS	NS	2.400	1.610	**2.005**
G0117	**N/A**	NS	NS	NS	NS	6.39	6.38	6.38	**6.38**	**N/A**	NS	NS	NS	NS	1.826	1.916	1.605	**1.782**
G0118	**N/A**	NS	NS	NS	NS	NS	5.77	6.32	**6.05**	**N/A**	NS	NS	NS	NS	NS	1.186	1.200	**1.193**

TABLE 6-3
SUMMARY OF OU1 ON-POST MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREAS
2016 ANNUAL REPORT

Well Number	pH									Specific Conductance (mS/cm)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
G0119	**N/A**	NS	NS	NS	NS	NS	6.75	6.38	**6.57**	**N/A**	NS	NS	NS	NS	NS	1.557	1.703	**1.630**
G0120	**N/A**	NS	NS	NS	NS	NS	6.31	6.21	**6.26**	**N/A**	NS	NS	NS	NS	NS	1.995	1.869	**1.932**
PZ001	**7.19**	6.92	7.02	6.97	6.77	7.14	7.07	7.13	**7.00**	**1.976**	2.414	2.655	2.452	2.335	2.813	2.939	2.282	**2.556**
PZ004	**7.14**	6.89	6.96	6.83	7.41	7.18	7.00	7.08	**7.05**	**1.888**	2.425	2.297	2.450	2.218	2.432	2.673	2.147	**2.377**
PZ010	**7.19**	5.66	6.51	6.74	6.04	6.79	6.99	6.57	**6.47**	**1.032**	1.339	1.074	1.319	1.288	1.417	1.409	0.849	**1.242**
PZ011	**7.09**	6.61	6.64	6.67	6.03	6.24	6.20	6.32	**6.39**	**0.931**	1.344	1.315	1.331	1.116	1.448	2.027	1.381	**1.423**
PZ012	**7.09**	6.74	6.81	6.81	6.16	6.26	6.25	6.38	**6.49**	**0.779**	1.138	1.196	1.124	0.925	1.577	2.297	1.685	**1.420**
PZ013	**7.04**	6.92	6.50	6.81	6.24	6.78	6.38	6.41	**6.58**	**0.879**	1.255	1.380	1.296	1.182	1.589	1.911	1.737	**1.479**
PZ014	**7.14**	7.03	6.71	6.83	6.24	6.83	6.62	6.81	**6.72**	**0.847**	1.285	1.365	1.237	1.183	1.304	1.472	1.957	**1.400**
PZ015	**6.68**	6.58	5.85	6.18	6.50	6.45	6.20	6.21	**6.28**	**0.431**	0.397	0.848	0.587	0.608	0.780	0.787	0.494	**0.643**
PZ016	**6.88**	6.70	6.59	6.62	6.60	6.40	6.67	6.62	**6.60**	**0.471**	0.645	0.601	0.761	0.566	0.596	0.703	0.549	**0.632**
Average	**7.03**	**6.74**	**6.73**	**6.58**	**6.47**	**6.42**	**6.38**	**6.39**	**6.46**	**0.942**	**1.104**	**1.148**	**1.136**	**1.175**	**1.225**	**1.456**	**1.181**	**1.253**
Shallow-Intermediate Wells ir RAO Treatment Areas																		
G0075	**6.97**	6.70	6.90	6.81	6.10	6.86	6.54	6.48	**6.63**	**0.485**	0.550	0.685	0.779	0.633	0.637	0.731	0.624	**0.663**
G0080	**N/A**	6.76	6.91	6.92	6.71	6.80	6.82	6.65	**6.80**	**N/A**	0.647	0.739	0.789	0.724	0.413	0.706	0.517	**0.648**
G0081	**N/A**	6.83	6.74	6.54	5.93	6.65	6.44	6.49	**6.52**	**N/A**	0.611	0.673	0.727	0.675	0.675	0.881	0.707	**0.707**
G0082	**N/A**	6.77	6.78	6.77	6.06	6.72	6.42	6.56	**6.58**	**N/A**	0.616	0.674	0.690	0.683	0.632	0.701	0.587	**0.655**
G0088	**N/A**	6.64	6.82	6.70	6.69	6.82	6.86	6.89	**6.77**	**N/A**	0.710	0.720	0.947	0.646	0.709	0.836	0.637	**0.744**
G0089	**N/A**	6.59	6.68	6.60	6.45	6.65	6.54	6.43	**6.56**	**N/A**	0.641	0.670	0.915	0.587	0.773	0.799	0.676	**0.723**
G0090	**N/A**	6.76	6.82	6.77	6.91	6.78	6.61	6.65	**6.76**	**N/A**	0.761	0.742	1.022	0.693	0.787	0.821	0.532	**0.765**
Average	**6.97**	**6.72**	**6.81**	**6.73**	**6.41**	**6.75**	**6.60**	**6.59**	**6.66**	**0.485**	**0.648**	**0.700**	**0.838**	**0.663**	**0.661**	**0.782**	**0.611**	**0.701**
Intermediate Wells in RAO Treatment Areas																		
G0045	**7.16**	7.09	7.17	7.13	6.55	7.15	7.01	7.05	**7.02**	**2.132**	2.480	2.539	2.473	2.381	2.604	2.577	1.991	**2.435**
G0049	**7.12**	6.77	6.80	6.81	6.75	6.99	6.82	7.07	**6.86**	**0.613**	0.907	0.891	0.930	0.815	0.998	1.065	0.752	**0.908**
G0076	**7.23**	7.14	7.19	6.95	6.20	6.85	6.87	6.82	**6.86**	**0.551**	0.694	0.800	0.781	0.748	0.775	0.958	0.837	**0.799**
Average	**7.17**	**7.00**	**7.05**	**6.96**	**6.50**	**7.00**	**6.90**	**6.98**	**6.91**	**1.099**	**1.360**	**1.410**	**1.395**	**1.315**	**1.459**	**1.533**	**1.193**	**1.381**

Notes:

Dry: well could not be sampled due to lack of water.

µg/L = micrograms per liter
Aban = abandoned
Avg = average
DO = dissolved oxygen
DOC = dissolved organic carbon
mg/L = milligrams per liter

mS/cm = milliSiemens per centimeter
mV = millivolts
MNA = monitored natural attenuation
N/A = not applicable
ND = nondetect
NS = not sampled

ORP = oxidation/reduction potential
OU = Operable Unit
R = rejected; data rejected based on professional judgment
RAO = Remedial Action Operation
TKN = total Kjeldahl nitrogen

TABLE 6-4
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	ORP (mV)								DO (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0053	188.6	NS	119.8	187.6	NS	NS	171.6	**166.9**	1.90	NS	0.93	1.44	NS	NS	0.96	**1.31**
G0069	199.2	NS	161.1	47.2	NS	NS	132.2	**134.9**	5.66	NS	3.00	0.27	NS	NS	2.13	**2.77**
SAMW1	185.8	NS	127.5	176.1	NS	NS	177.6	**166.8**	5.18	NS	4.04	1.08	NS	NS	6.81	**4.28**
SHGW04	194.6	NS	92.0	65.3	NS	NS	158.5	**127.6**	2.75	NS	0.97	0.39	NS	NS	1.57	**1.42**
Average	**192.1**	**N/A**	**125.1**	**119.1**	**N/A**	**N/A**	**160.0**	**149.0**	**3.87**	**N/A**	**2.24**	**0.80**	**N/A**	**N/A**	**2.87**	**2.44**

Notes:

µg/L = micrograms per liter

Avg = average

DO = dissolved oxygen

mg/L = milligrams per liter

MNA = monitored natural attenuation

mS/cm = millisiemens per centimeter

mV = millivolts

N/A = not applicable

ND = nondetect

NS = not sampled

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 6-4
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	Nitrate/Nitrite (mg/L)								Alkalinity (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0053	9.80	NS	6.88	5.5	NS	NS	12.0	**8.5**	110	NS	130	140	NS	NS	83	**116**
G0069	3.30	NS	0.111	2.86	NS	NS	1.1	**1.8**	150	NS	80	230	NS	NS	150	**153**
SAMW1	2.30	NS	1.71	20.8	NS	NS	18.0	**10.7**	130	NS	140	140	NS	NS	100	**128**
SHGW04	6.0	NS	ND	1.66	NS	NS	0.56	**2.1**	140	NS	240	230	NS	NS	200	**203**
Average	**5.4**	**N/A**	**2.2**	**7.7**	**N/A**	**N/A**	**7.9**	**5.8**	**133**	**N/A**	**148**	**185**	**N/A**	**N/A**	**133**	**150**

Notes:

µg/L = micrograms per liter

Avg = average

DO = dissolved oxygen

mg/L = milligrams per liter

MNA = monitored natural attenuation

mS/cm = millisiemens per centimeter

mV = millivolts

N/A = not applicable

ND = nondetect

NS = not sampled

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 6-4
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	Ferrous Iron (mg/L)								Sulfate (mg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0053	0.35	NS	0.04	ND	NS	NS	0.13	**0.13**	16	NS	19.5	22.7	NS	NS	18.0	**19.1**
G0069	0.26	NS	0.71	0.63	NS	NS	ND	**0.40**	33	NS	37.4	29.7	NS	NS	24.0	**31.0**
SAMW1	0.14	NS	0.45	0.09	NS	NS	0.01	**0.17**	22	NS	39.1	29.2	NS	NS	28.0	**29.6**
SHGW04	0.14	NS	0.86	0.09	NS	NS	0.44	**0.38**	70	NS	42.3	30.6	NS	NS	30.0	**43.2**
Average	**0.22**	**N/A**	**0.52**	**0.20**	**N/A**	**N/A**	**0.15**	**0.27**	**35.3**	**N/A**	**34.6**	**28.1**	**N/A**	**N/A**	**25.0**	**30.7**

Notes:

µg/L = micrograms per liter

Avg = average

DO = dissolved oxygen

mg/L = milligrams per liter

MNA = monitored natural attenuation

mS/cm = millisiemens per centimeter

mV = millivolts

N/A = not applicable

ND = nondetect

NS = not sampled

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 6-4
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	pH								Specific Conductance (mS/cm)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0053	5.92	NS	5.78	5.79	NS	NS	5.63	**5.78**	0.334	NS	0.377	0.329	NS	NS	0.230	**0.318**
G0069	6.38	NS	5.91	5.91	NS	NS	6.19	**6.10**	0.371	NS	0.359	0.519	NS	NS	0.251	**0.375**
SAMW1	6.28	NS	6.29	6.13	NS	NS	6.12	**6.21**	0.325	NS	0.415	0.499	NS	NS	0.341	**0.395**
SHGW04	6.01	NS	6.13	6.02	NS	NS	6.06	**6.06**	0.476	NS	0.662	0.502	NS	NS	0.317	**0.489**
Average	**6.15**	**N/A**	**6.03**	**5.96**	**N/A**	**N/A**	**6.00**	**6.03**	**0.377**	**N/A**	**0.453**	**0.462**	**N/A**	**N/A**	**0.285**	**0.394**

Notes:

µg/L = micrograms per liter

Avg = average

DO = dissolved oxygen

mg/L = milligrams per liter

MNA = monitored natural attenuation

mS/cm = millisiemens per centimeter

mV = millivolts

N/A = not applicable

ND = nondetect

NS = not sampled

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 6-4
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	Methane (µg/L)								Ethane (µg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells																
G0053	79.0	NS	1200	59.0	NS	NS	ND	**334.5**	ND	NS	ND	ND	NS	NS	ND	**ND**
G0069	16.0	NS	ND	48.0	NS	NS	180.0	**61.0**	ND	NS	ND	ND	NS	NS	ND	**ND**
SAMW1	1.6	NS	0.58	ND	NS	NS	ND	**0.5**	ND	NS	ND	ND	NS	NS	ND	**ND**
SHGW04	19.0	NS	68.0	14.0	NS	NS	390.0	**122.8**	ND	NS	ND	ND	NS	NS	ND	**ND**
Average	**28.9**	**N/A**	**317.1**	**30.3**	**N/A**	**N/A**	**142.5**	**129.7**	**ND**	**N/A**	**ND**	**ND**	**N/A**	**N/A**	**ND**	**ND**

Notes:

µg/L = micrograms per liter

Avg = average

DO = dissolved oxygen

mg/L = milligrams per liter

MNA = monitored natural attenuation

mS/cm = millisiemens per centimeter

mV = millivolts

N/A = not applicable

ND = nondetect

NS = not sampled

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 6-4
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS OUTSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	Ethene (µg/L)							
	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Avg
Shallow Wells								
G0053	ND	NS	ND	ND	NS	NS	ND	**ND**
G0069	ND	NS	ND	ND	NS	NS	ND	**ND**
SAMW1	ND	NS	ND	ND	NS	NS	ND	**ND**
SHGW04	ND	NS	ND	ND	NS	NS	ND	**ND**
Average	**ND**	**N/A**	**ND**	**ND**	**N/A**	**N/A**	**ND**	**ND**

Notes:

µg/L = micrograms per liter

Avg = average

DO = dissolved oxygen

mg/L = milligrams per liter

MNA = monitored natural attenuation

mS/cm = millisiemens per centimeter

mV = millivolts

N/A = not applicable

ND = nondetect

NS = not sampled

ORP = oxidation/reduction potential

OU = Operable Unit

TABLE 6-5
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	ORP (mV)									DO (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Area																		
SHGW02	**93.0**	37.7	NS	-7.3	-47.6	215.8	-12.0	-41.0	**24.3**	**1.36**	1.06	NS	0.48	0.70	0.78	0.45	0.25	**0.62**
SHGW03	**-49.0**	-6.5	NS	-17.7	14.9	-39.4	-48.2	-104.2	**-33.5**	**0.20**	0.37	NS	1.65	0.14	0.29	0.27	0.31	**0.51**
Average	**22.0**	**15.6**	**N/A**	**-12.5**	**-16.4**	**88.2**	**-30.1**	**-72.6**	**-4.6**	**0.78**	**0.72**	**N/A**	**1.07**	**0.42**	**0.54**	**0.36**	**0.28**	**0.56**

Notes:
µg/L = micrograms per liter
Avg = average
DO = dissolved oxygen
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = millisiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
RAO = Remedial Action Operation

TABLE 6-5
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	Nitrate/Nitrite (mg/L)									Alkalinity (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Area																		
SHGW02	**3.7**	ND	NS	ND	ND	ND	ND	ND	**ND**	**180**	350	NS	180	205	270	240	260	**251**
SHGW03	**2.8**	2.0	NS	0.271	ND	ND	ND	ND	**0.38**	**198**	190	NS	145	190	250	230	230	**206**
Average	**3.3**	**1.0**	**N/A**	**0.14**	**ND**	**ND**	**ND**	**ND**	**0.19**	**189**	**270**	**N/A**	**163**	**198**	**260**	**235**	**245**	**228**

Notes:
µg/L = micrograms per liter
Avg = average
DO = dissolved oxygen
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = millisiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
RAO = Remedial Action Operation

TABLE 6-5
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	Ferrous Iron (mg/L)									Sulfate (mg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Area																		
SHGW02	**0.86**	8.75	NS	15	9.87	3.03	1.34	2.58	**6.76**	**30**	ND	NS	1.9	3.5	ND	2.2	9.6	**2.9**
SHGW03	**4.62**	7.20	NS	7.8	2.02	2.14	2.71	3.01	**4.15**	**21**	120	NS	26.6	8.3	6.4	14	12	**31.2**
Average	**2.74**	**7.98**	**N/A**	**11.40**	**5.95**	**2.59**	**2.03**	**2.80**	**5.45**	**26**	**60.0**	**N/A**	**14.3**	**5.9**	**3.2**	**8.1**	**10.8**	**17.0**

Notes:
μg/L = micrograms per liter
Avg = average
DO = dissolved oxygen
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = millisiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
RAO = Remedial Action Operation

TABLE 6-5
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	pH									Specific Conductance (mS/cm)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Area																		
SHGW02	**6.44**	5.15	NS	5.28	5.62	5.48	5.81	5.86	**5.53**	**0.437**	1.007	NS	0.718	0.473	0.588	0.542	0.359	**0.615**
SHGW03	**6.32**	6.13	NS	6.22	5.83	5.95	6.26	6.08	**6.08**	**0.469**	0.649	NS	0.472	0.441	0.510	0.578	0.362	**0.502**
Average	**6.38**	**5.64**	**N/A**	**5.75**	**5.73**	**5.72**	**6.04**	**5.97**	**5.81**	**0.453**	**0.828**	**N/A**	**0.595**	**0.457**	**0.549**	**0.560**	**0.361**	**0.558**

Notes:
µg/L = micrograms per liter
Avg = average
DO = dissolved oxygen
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = millisiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
RAO = Remedial Action Operation

TABLE 6-5
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

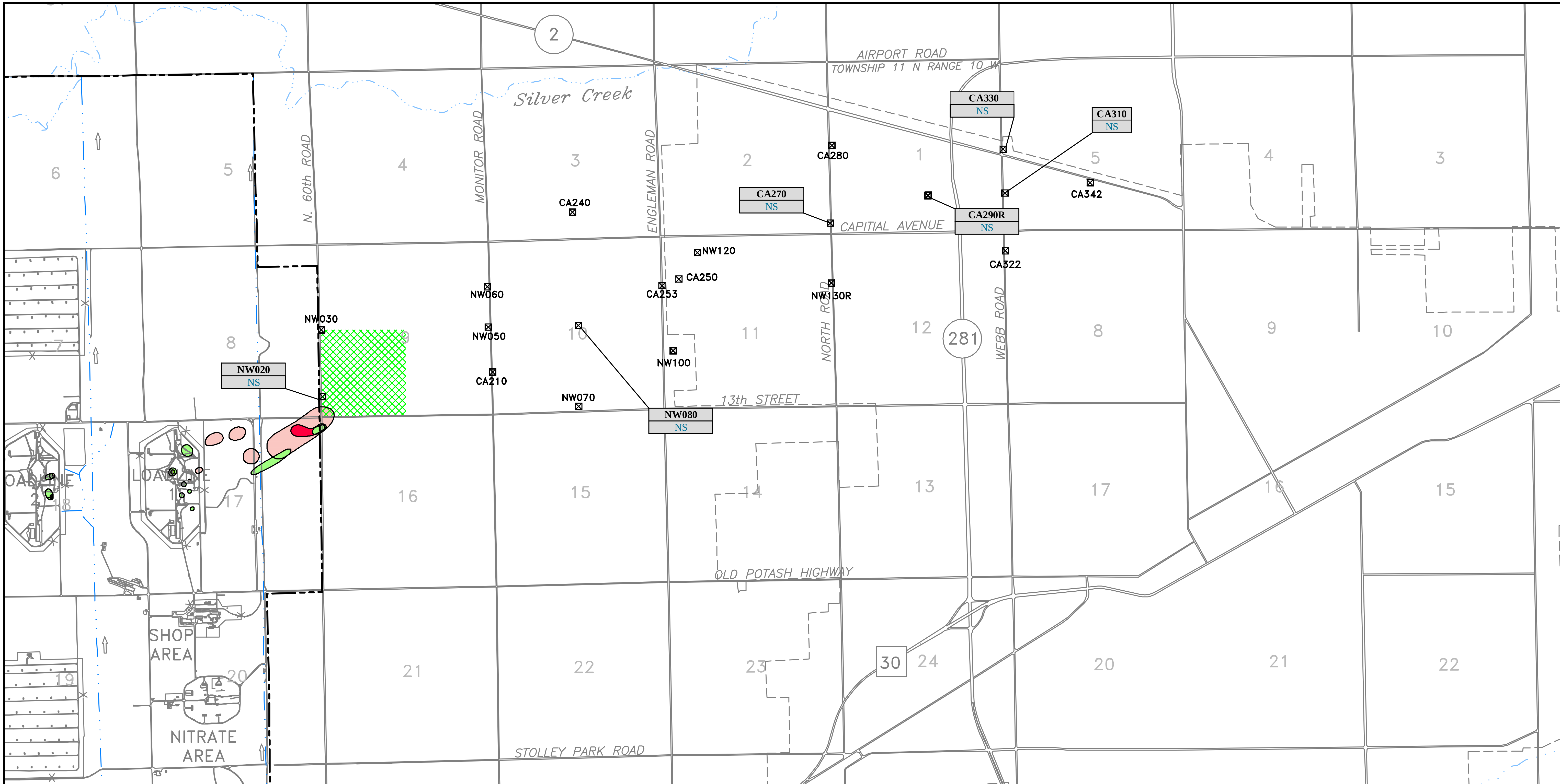
Well Number	Methane (µg/L)									Ethane (µg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Area																		
SHGW02	**73**	18000	NS	2200	4800	12000	18000	20000	**12500**	**0.70**	31	NS	ND	ND	ND	ND	ND	**5.2**
SHGW03	**26**	130	NS	1800	3300	7600	4500	3700	**3505**	**1.0**	ND	NS	ND	ND	ND	ND	ND	**ND**
Average	**49**	**9065**	**N/A**	**2000**	**4050**	**9800**	**11250**	**11850**	**8003**	**0.85**	**15.5**	**N/A**	**ND**	**ND**	**ND**	**ND**	**ND**	**2.6**

Notes:
µg/L = micrograms per liter
Avg = average
DO = dissolved oxygen
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = millisiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
RAO = Remedial Action Operation

TABLE 6-5
SUMMARY OF OU3 SHOP AREA MNA PARAMETERS, WELLS INSIDE RAO TREATMENT AREA
2016 ANNUAL REPORT

Well Number	Ethene (µg/L)								
	Pre-Inj Avg 2001-2007	Mar-10	Mar-11	Mar-12	Mar-13	Aug-14	Aug-15	Aug-16	Post-Inj Avg
Shallow Wells in RAO Treatment Area									
SHGW02	**ND**	ND	NS	ND	ND	ND	ND	ND	**ND**
SHGW03	**ND**	ND	NS	ND	ND	ND	ND	ND	**ND**
Average	**ND**	**ND**	**N/A**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**

Notes:
µg/L = micrograms per liter
Avg = average
DO = dissolved oxygen
mg/L = milligrams per liter
MNA = monitored natural attenuation
mS/cm = millisiemens per centimeter
mV = millivolts
N/A = not applicable
ND = nondetect
NS = not sampled
ORP = oxidation/reduction potential
OU = Operable Unit
RAO = Remedial Action Operation



LEGEND:

FACILITY BOUNDARY

GRAND ISLAND CITY LIMITS

DRAINAGE DITCH FLOW DIRECTION

SURFACE DRAINAGE

1 SECTION NUMBER

NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

PZ015 DETECTED NATURAL ATTENUATION PARAMETERS – AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (2,4,6–TNT CONCENTRATIONS >2μg/L) – AUGUST 2016

20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (2,4,6–TNT CONCENTRATIONS >20μg/L) – AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) – AUGUST 2016

20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >20μg/L) – AUGUST 2016

FEEDLOT AREA

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
MNA = MONITORED NATURAL ATTENUATION
NS = NOT SAMPLED
OU = OPERABLE UNIT
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
μg/L = MICROGRAMS PER LITER

NOTE:
1. IN 2016, MNA PARAMETERS WERE NOT COLLECTED AT OFF–POST WELLS DUE TO EXPLOSIVES BEING BELOW HALs AT ALL WELLS SINCE 2014. ALL OFF–POST WELLS WERE COLLECTED FOR EXPLOSIVES ONLY.
2. EXPLOSIVES PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.

N

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SCALE FEET

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SHALLOW OFF–POST GROUNDWATER NATURAL ATTENUATION PARAMETERS (OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/18/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 10/18/16	16170837	6–1a

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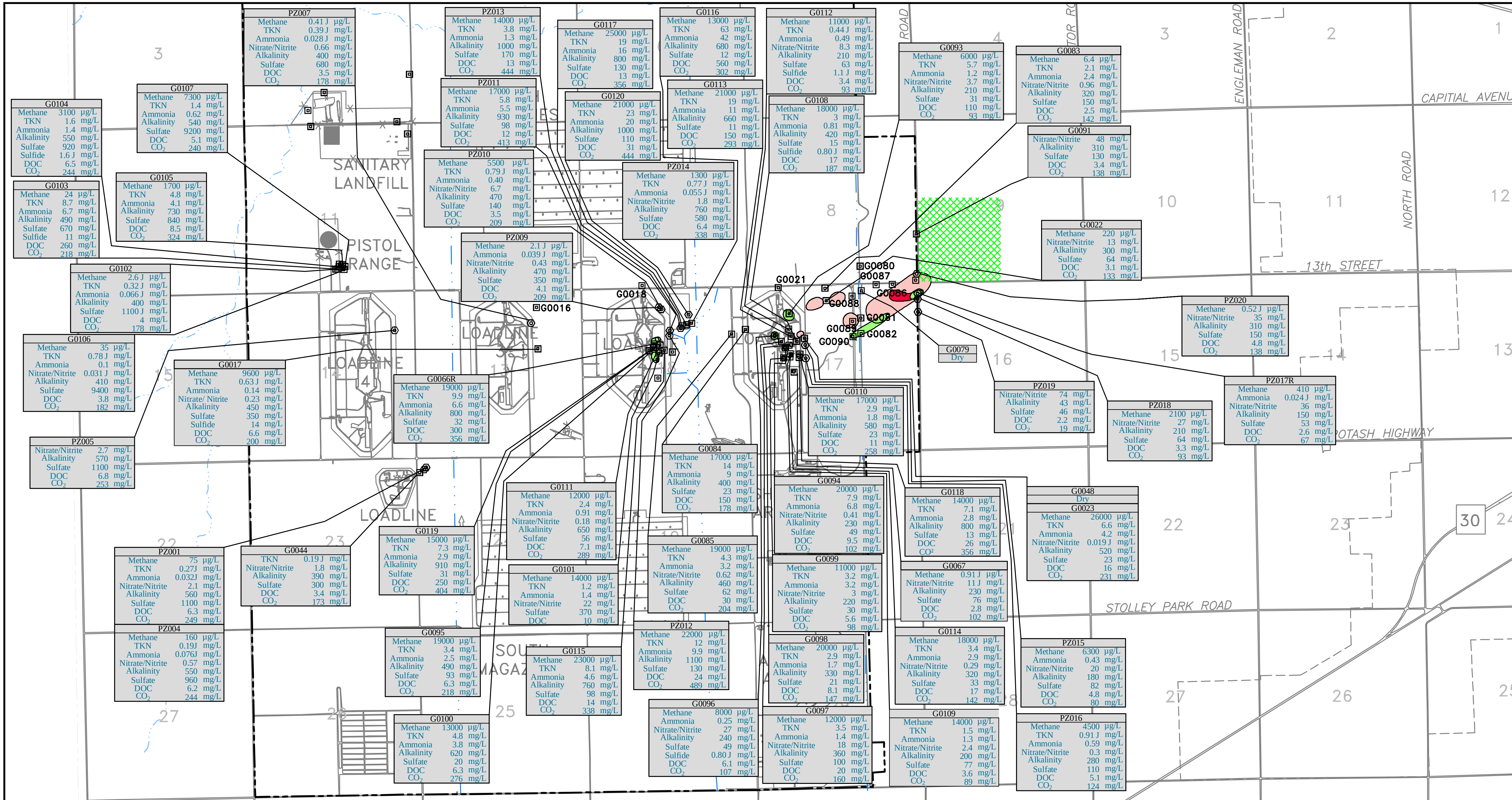

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON–POST GROUNDWATER MONITORING WELL
ON–POST PIEZOMETER
PZ015 DETECTED NATURAL ATTENUATION PARAMETERS – AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (2,4,6–TNT CONCENTRATIONS >2µg/L) – AUGUST 2016
20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (2,4,6–TNT CONCENTRATIONS >20µg/L) – AUGUST 2016
2 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) – AUGUST 2016
20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) – AUGUST 2016
FEEDLOT AREA

2,4,6–TNT = 2,4,6–TRINITROTOLUENE
CO2 = CARBON DIOXIDE
DOC = DISSOLVED ORGANIC CARBON
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
OU = OPERABLE UNIT
RDX = HEXAHYDRO–1,3,5–TRINITRO–1,3,5–TRIAZINE
TKN = TOTAL KJELDAHL NITROGEN
µg/L = MICROGRAMS PER LITER

NOTE: EXPLOSIVES PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.

N

0 3000 6000
SCALE FEET

January 12, 2017 10:58:04 a.m.
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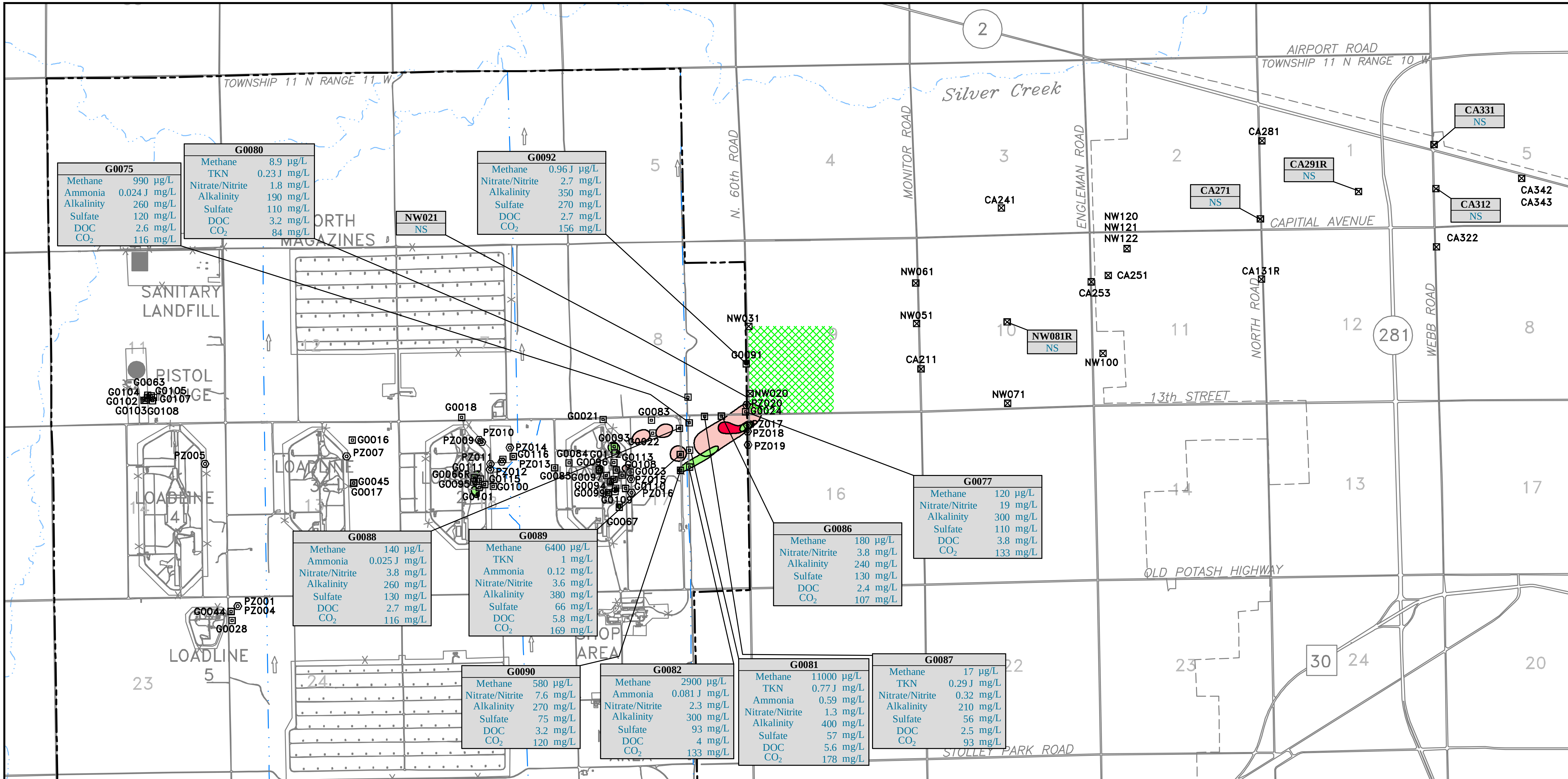
SHALLOW ON–POST GROUNDWATER NATURAL ATTENUATION PARAMETERS (OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/13/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/13/16	16170837	6–1b



LEGEND:

FACILITY BOUNDARY

GRAND ISLAND CITY LIMITS

DRAINAGE DITCH FLOW DIRECTION

SURFACE DRAINAGE

1 SECTION NUMBER

ON-POST GROUNDWATER MONITORING WELL

NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL

ON-POST PIEZOMETER

PZ015 DETECTED NATURAL ATTENUATION PARAMETERS - AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >2µg/L) - AUGUST 2016

20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >20µg/L) - AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) - AUGUST 2016

20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) - AUGUST 2016

FEEDLOT AREA

2,4,6-TNT = 2,4,6-TRINITROTOLUENE
CO2 = CARBON DIOXIDE
DOC = DISSOLVED ORGANIC CARBON
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
NS = NOT SAMPLED
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
TKN = TOTAL KJELDAHL NITROGEN
µg/L = MICROGRAMS PER LITER

NOTE:
1. IN 2016, NA PARAMETERS WERE NOT COLLECTED AT OFF-POST WELLS DUE TO EXPLOSIVES BEING BELOW HALs AT ALL WELLS SINCE 2014. ALL OFF-POST WELLS WERE COLLECTED FOR EXPLOSIVES ONLY.
2. EXPLOSIVES PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.

N

0 3000 6000
SCALE FEET

Bay West
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SHALLOW-INTERMEDIATE GROUNDWATER NATURAL ATTENUATION PARAMETERS (OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/13/16	PROJECT NO. 16170837	FIG. NO. 6-1c
CHK'D. BY: DW	DATE: 10/13/16		

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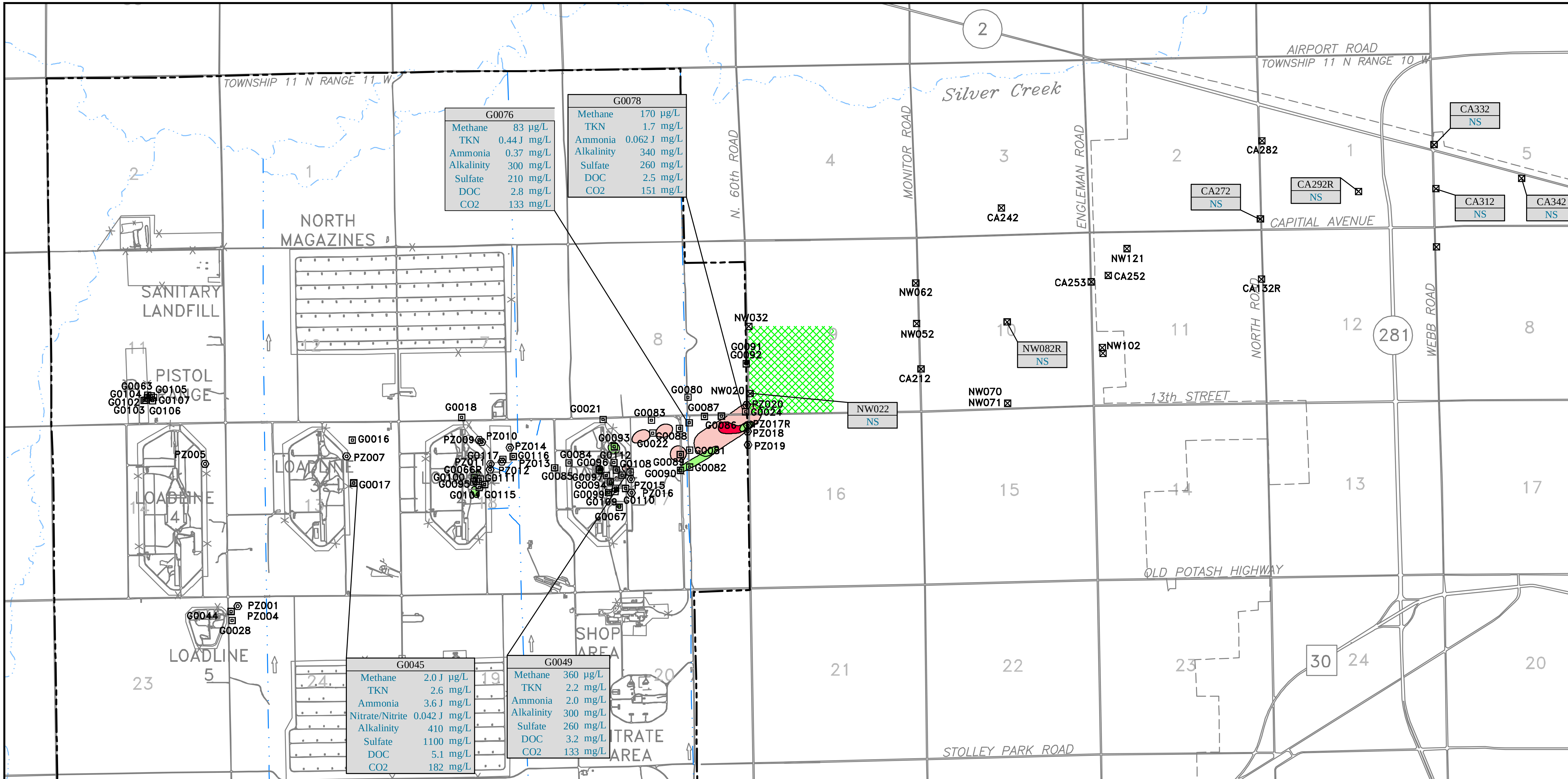

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER
PZ015 DETECTED NATURAL ATTENUATION PARAMETERS – AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >2µg/L) – AUGUST 2016
20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >20µg/L) – AUGUST 2016
2 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) – AUGUST 2016
20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) – AUGUST 2016
FEEDLOT AREA

2,4,6-TNT = 2,4,6-TRINITROTOLUENE
CO2 = CARBON DIOXIDE
DOC = DISSOLVED ORGANIC CARBON
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
NS = NOT SAMPLED
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
TKN = TOTAL KJELDAHL NITROGEN
µg/L = MICROGRAMS PER LITER

NOTE:
1. IN 2016, NA PARAMETERS WERE NOT COLLECTED AT OFF-POST WELLS DUE TO EXPLOSIVES BEING BELOW HALs AT ALL WELLS SINCE 2014. ALL OFF-POST WELLS WERE COLLECTED FOR EXPLOSIVES ONLY.
2. EXPLOSIVES PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.

N
0 3000 6000
SCALE FEET

Bay West URS

INTERMEDIATE GROUNDWATER NATURAL ATTENUATION PARAMETERS (OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/14/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/14/16	16170837	6-1d

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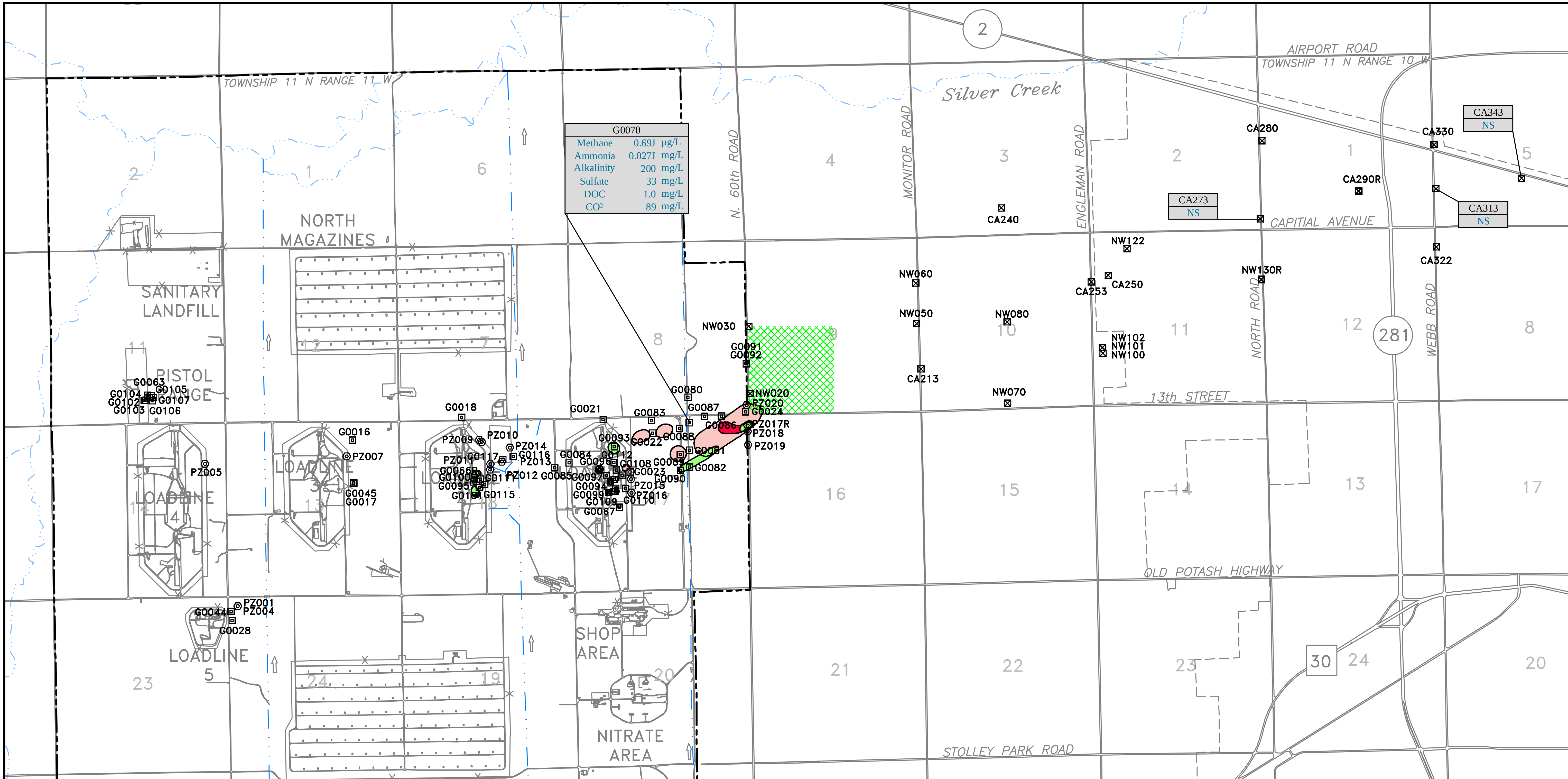

LEGEND:

FACILITY BOUNDARY
GRAND ISLAND CITY LIMITS
DRAINAGE DITCH FLOW DIRECTION
SURFACE DRAINAGE
1 SECTION NUMBER
ON-POST GROUNDWATER MONITORING WELL
NW082 OR CA211 OFF-POST GROUNDWATER MONITORING WELL
ON-POST PIEZOMETER
NW070 DETECTED NATURAL ATTENUATION PARAMETERS – AUGUST 2016

2 HORIZONTAL EXTENT OF TARGET CLEANUP EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >2µg/L) – AUGUST 2016
20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (2,4,6-TNT CONCENTRATIONS >20µg/L) – AUGUST 2016
2 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) – AUGUST 2016
20 HORIZONTAL EXTENT OF TARGET EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) – AUGUST 2016
FEEDLOT AREA

2,4,6-TNT = 2,4,6-TRINITROTOLUENE
CO2 = CARBON DIOXIDE
DOC = DISSOLVED ORGANIC CARBON
J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
NS = NOT SAMPLED
OU = OPERABLE UNIT
RDX = HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE
µg/L = MICROGRAMS PER LITER

NOTE:
1. IN 2016, NA PARAMETERS WERE NOT COLLECTED AT OFF-POST WELLS DUE TO EXPLOSIVES BEING BELOW HALs AT ALL WELLS SINCE 2014. ALL OFF-POST WELLS WERE COLLECTED FOR EXPLOSIVES ONLY.
2. EXPLOSIVES PLUME BASED ON 2016 SAMPLING RESULTS AND HISTORIC OU1 RAO GROUNDWATER INVESTIGATION RESULTS.

N

0 3000 6000
SCALE FEET

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DEEP GROUNDWATER
NATURAL ATTENUATION PARAMETERS
(OU1) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/27/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 10/27/16	16170837	6-1e

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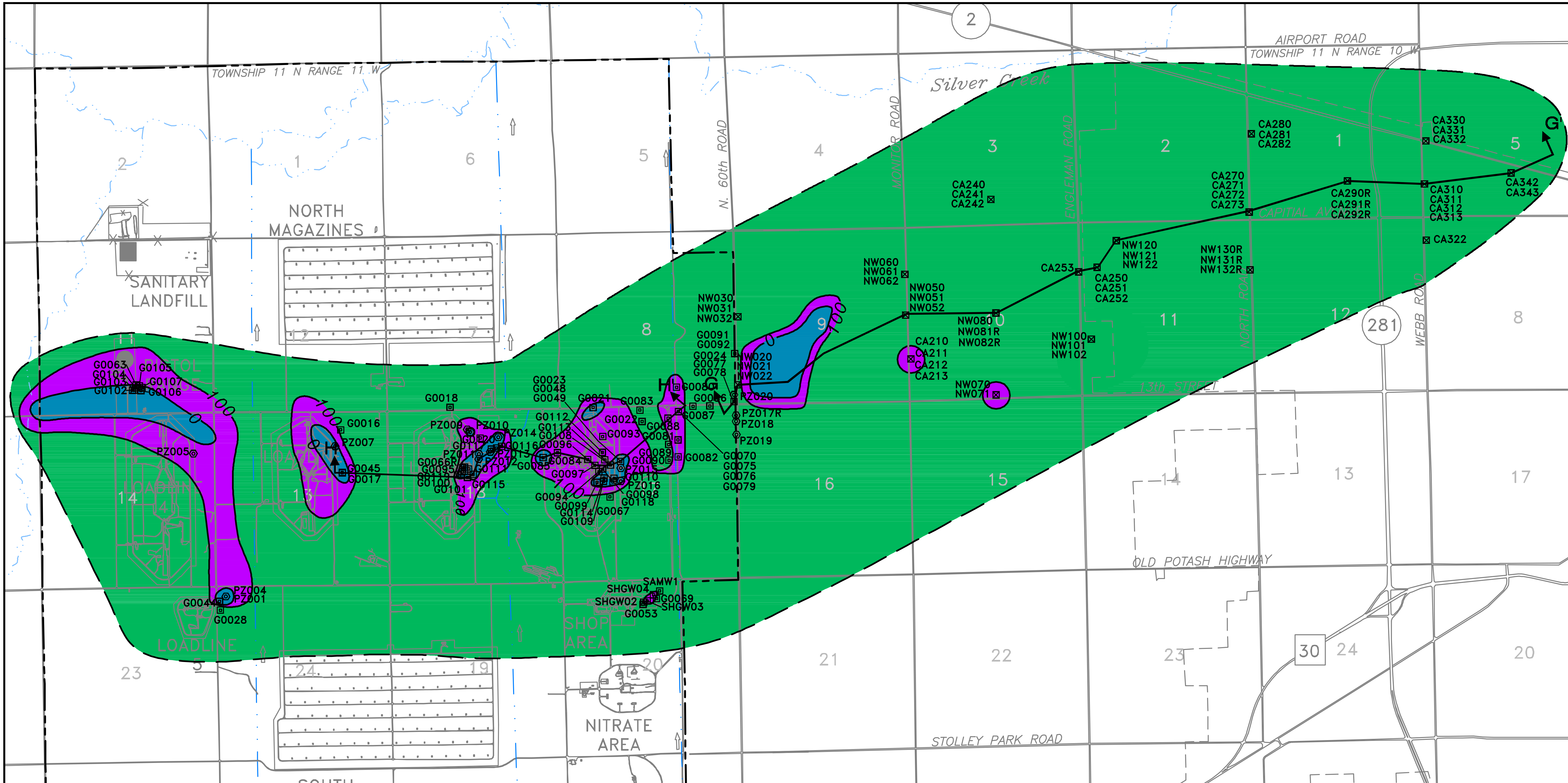

AVERAGE OXIDATION/REDUCTION POTENTIAL

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-1 THROUGH 6-5)

- > 200 millivolts
- 100 TO 200 millivolts
- 0 TO 100 millivolts
- < 0 millivolts

LEGEND:

- G0018 — ON-POST GROUNDWATER MONITORING WELL
- NW082 OR CA211 — OFF-POST GROUNDWATER MONITORING WELL
- PZ016 — ON-POST PIEZOMETER
- 1 — SECTION NUMBER
- G — G' — GEOLOGIC CROSS-SECTION
- — — LIMIT OF DATA INTERPRETATION

N

SCALE: 0 — 3000 — 6000 FEET

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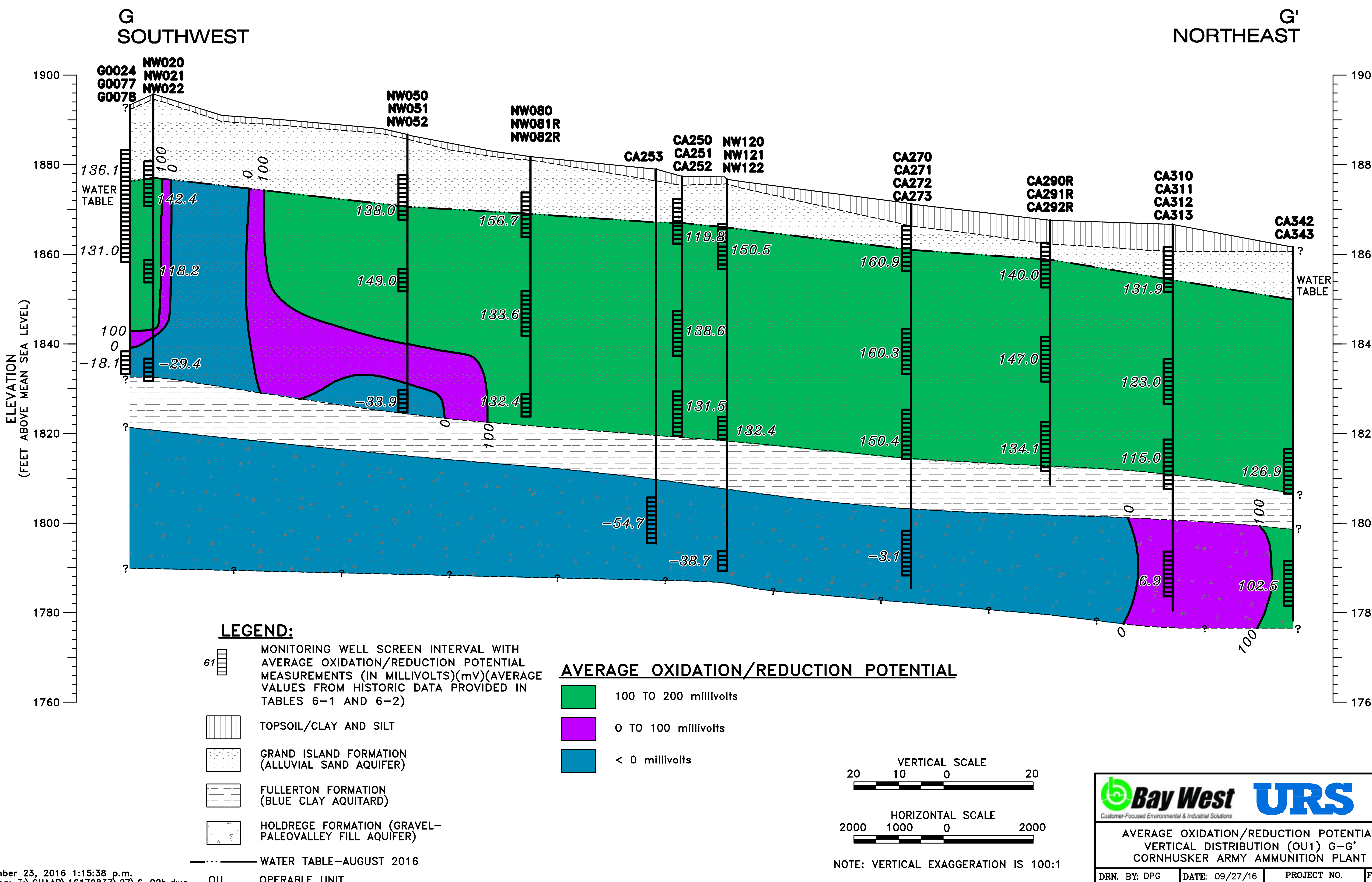
SHALLOW GROUNDWATER
AVERAGE OXIDATION/REDUCTION POTENTIAL
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/15/15	PROJECT NO.	FIG. NO.
CHK'D. BY: DC	DATE: 09/15/15	16170837	6-2a



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AVERAGE OXIDATION/REDUCTION POTENTIAL VERTICAL DISTRIBUTION (OU1) G−G'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/27/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/27/16	16170837	6−2b

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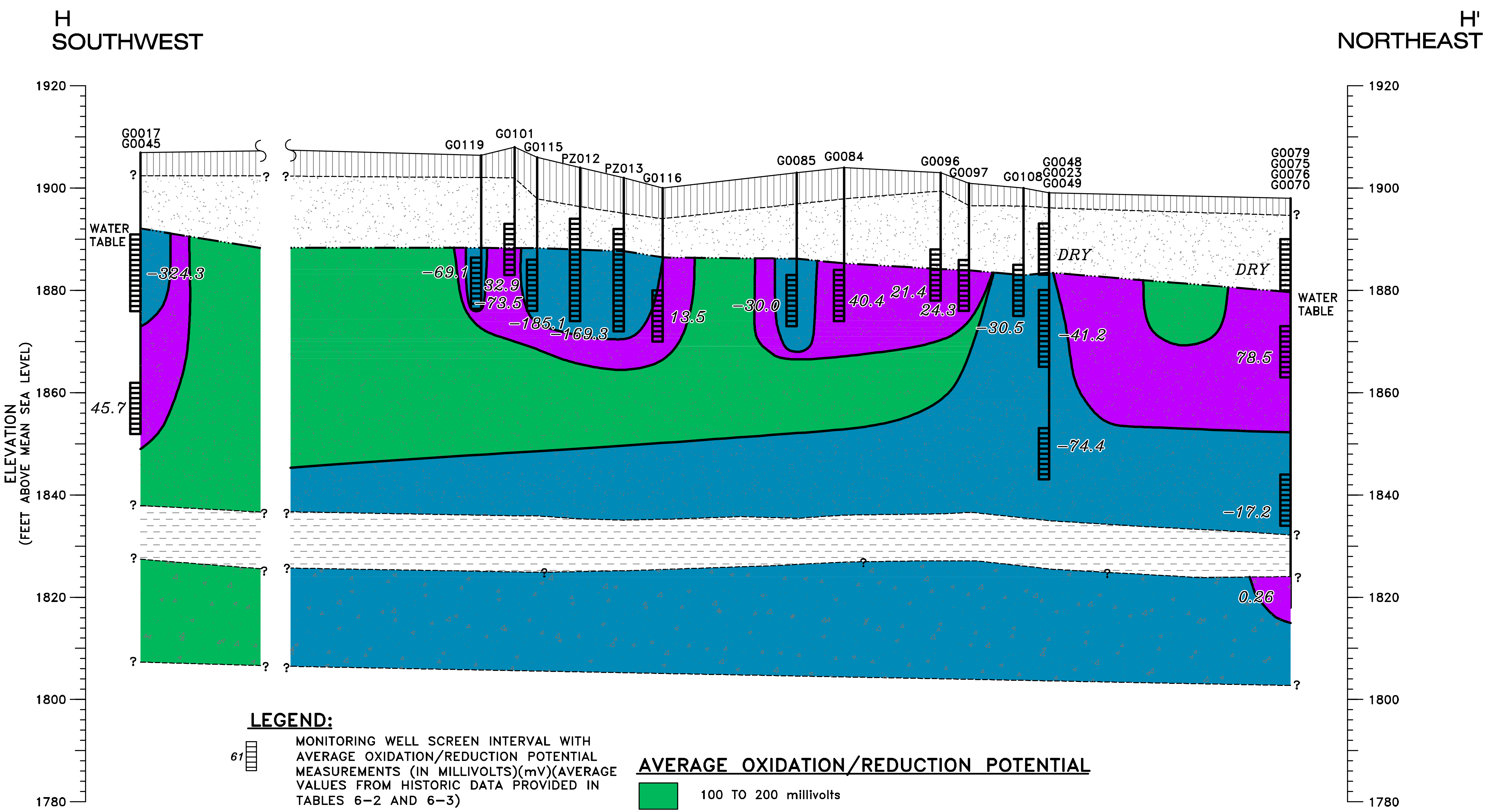

LEGEND:

61 MONITORING WELL SCREEN INTERVAL WITH AVERAGE OXIDATION/REDUCTION POTENTIAL MEASUREMENTS (IN MILLIVOLTS)(mV)(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6−2 AND 6−3)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL−PALEOVALLEY FILL AQUIFER)

WATER TABLE−AUGUST 2016

OU OPERABLE UNIT

AVERAGE OXIDATION/REDUCTION POTENTIAL

100 TO 200 millivolts

0 TO 100 millivolts

< 0 millivolts

VERTICAL SCALE

20 10 0 20

HORIZONTAL SCALE

1000 500 0 1000

NOTE: VERTICAL EXAGGERATION IS 50:1

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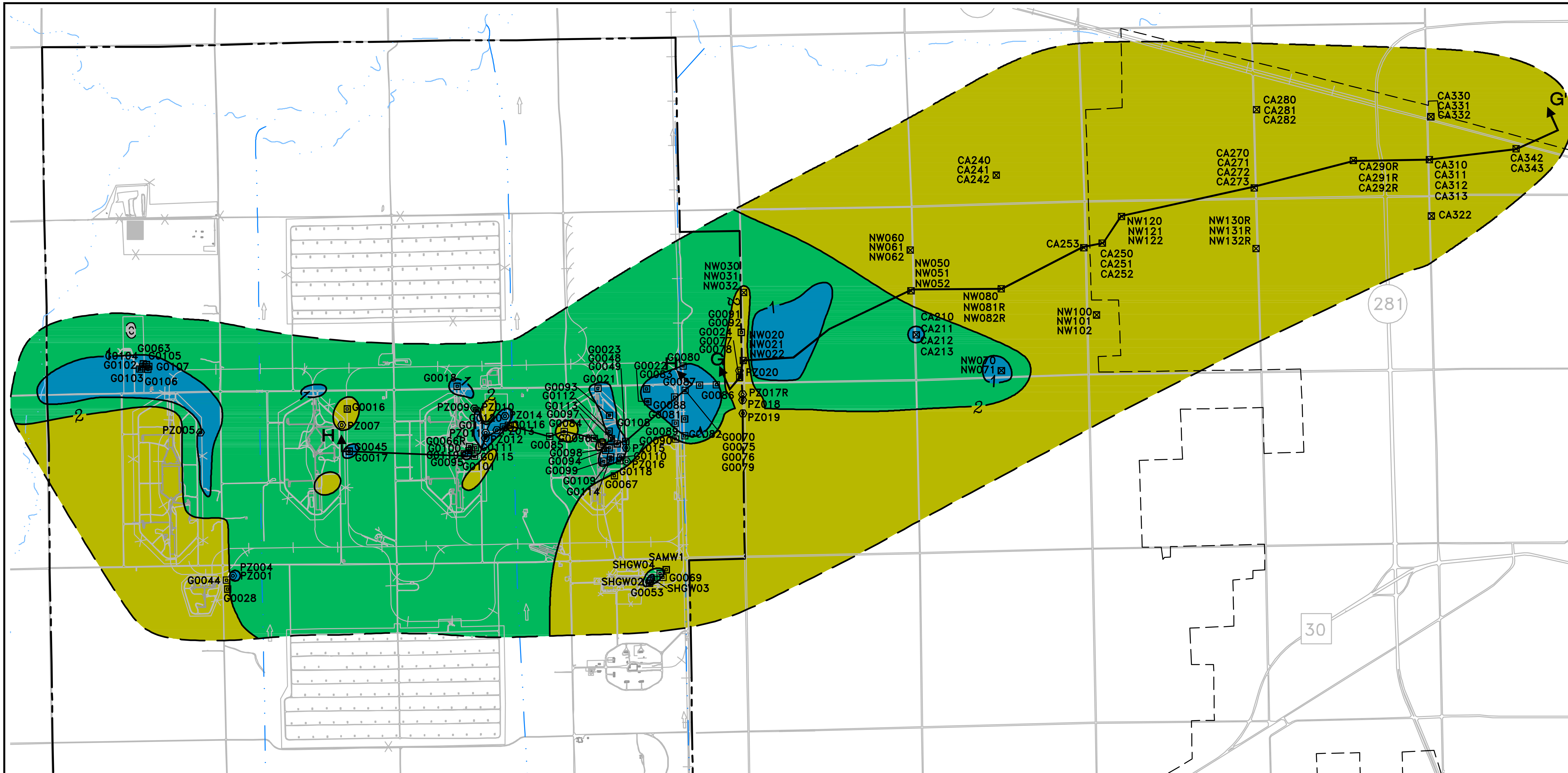
URS

AVERAGE OXIDATION/REDUCTION POTENTIAL VERTICAL DISTRIBUTION (OU1) H−H'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/27/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/27/16	16170837	6−2c



AVERAGE DISSOLVED OXYGEN CONCENTRATIONS

(CONCENTRATIONS ARE AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-1 THROUGH 6-5)

- > 2.0 MILLIGRAMS/LITER
- 1.0 TO 2.0 MILLIGRAMS/LITER
- < 1.0 MILLIGRAMS/LITER

LEGEND:

- G0018 ⊡ ON-POST GROUNDWATER MONITORING WELL
- NW082 OR CA211 ⊠ OFF-POST GROUNDWATER MONITORING WELL
- PZ016 ◎ ON-POST PIEZOMETER
- 1 SECTION NUMBER
- G G' GEOLOGIC CROSS-SECTION
- LIMIT OF DATA INTERPRETATION

N

SCALE 0 3000 6000 FEET

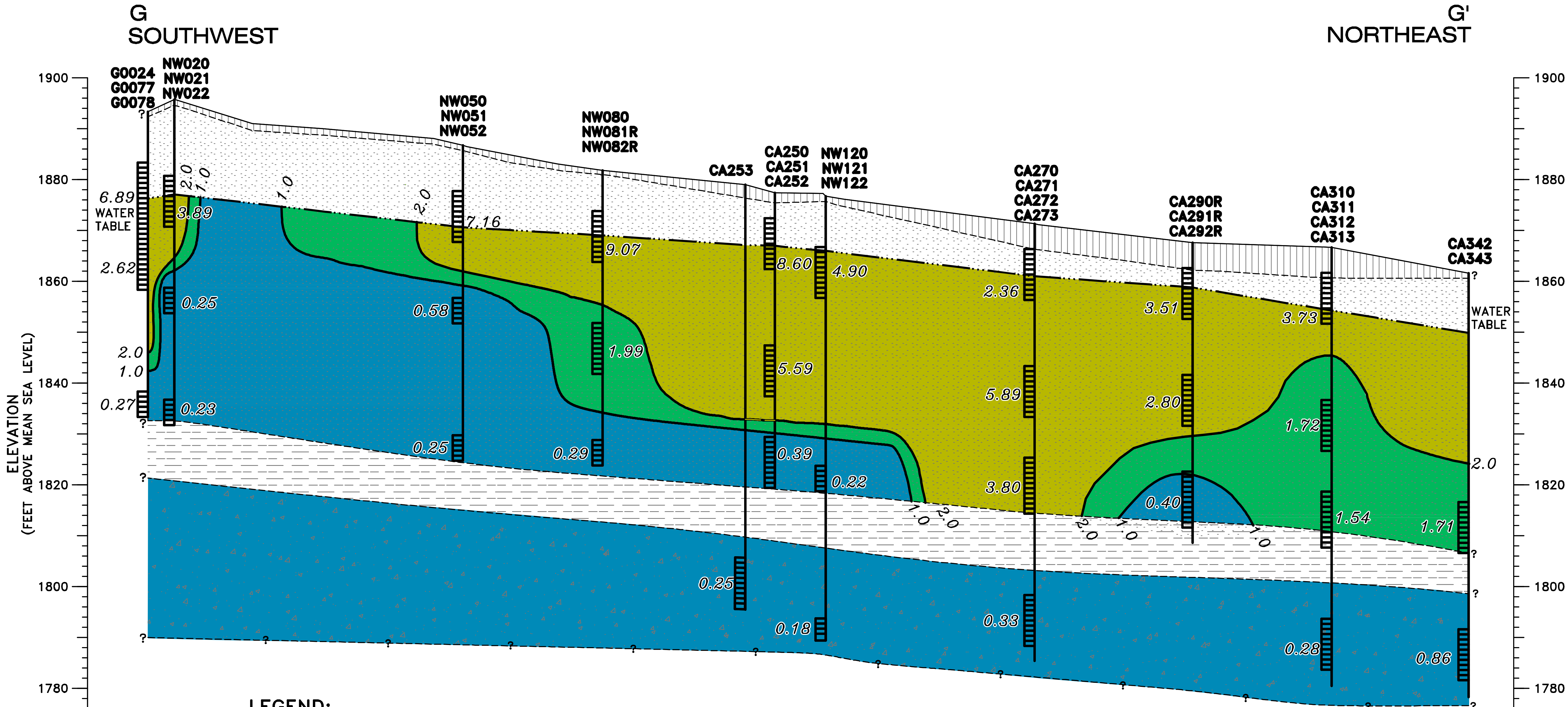
Bay West — Customer-Focused Environmental & Industrial Solutions

URS

SHALLOW GROUNDWATER
AVERAGE DISSOLVED OXYGEN CONCENTRATIONS
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/07/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/07/16	16170837	6-3a

November 23, 2016 1:18:19 p.m.
Drawing: T:\CHAAP\16170837\27\6-03a.dwg



LEGEND:

61 — MONITORING WELL SCREEN INTERVAL WITH AVERAGE DISSOLVED OXYGEN MEASUREMENTS (IN mg/L) (AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-1 AND 6-2)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)

WATER TABLE-AUGUST 2016

OU — OPERABLE UNIT

AVERAGE DISSOLVED OXYGEN CONCENTRATIONS

> 2.0 MILLIGRAMS/LITER

1.0 TO 2.0 MILLIGRAMS/LITER

< 1.0 MILLIGRAMS/LITER

VERTICAL SCALE: 20 10 0 20

HORIZONTAL SCALE: 2000 1000 0 2000

NOTE: VERTICAL EXAGGERATION IS 100:1

Bay West — Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE DISSOLVED OXYGEN
VERTICAL DISTRIBUTION (OU1) G-G'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/27/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/27/16	16170837	6-3b

November 23, 2016 1:19:41 p.m.
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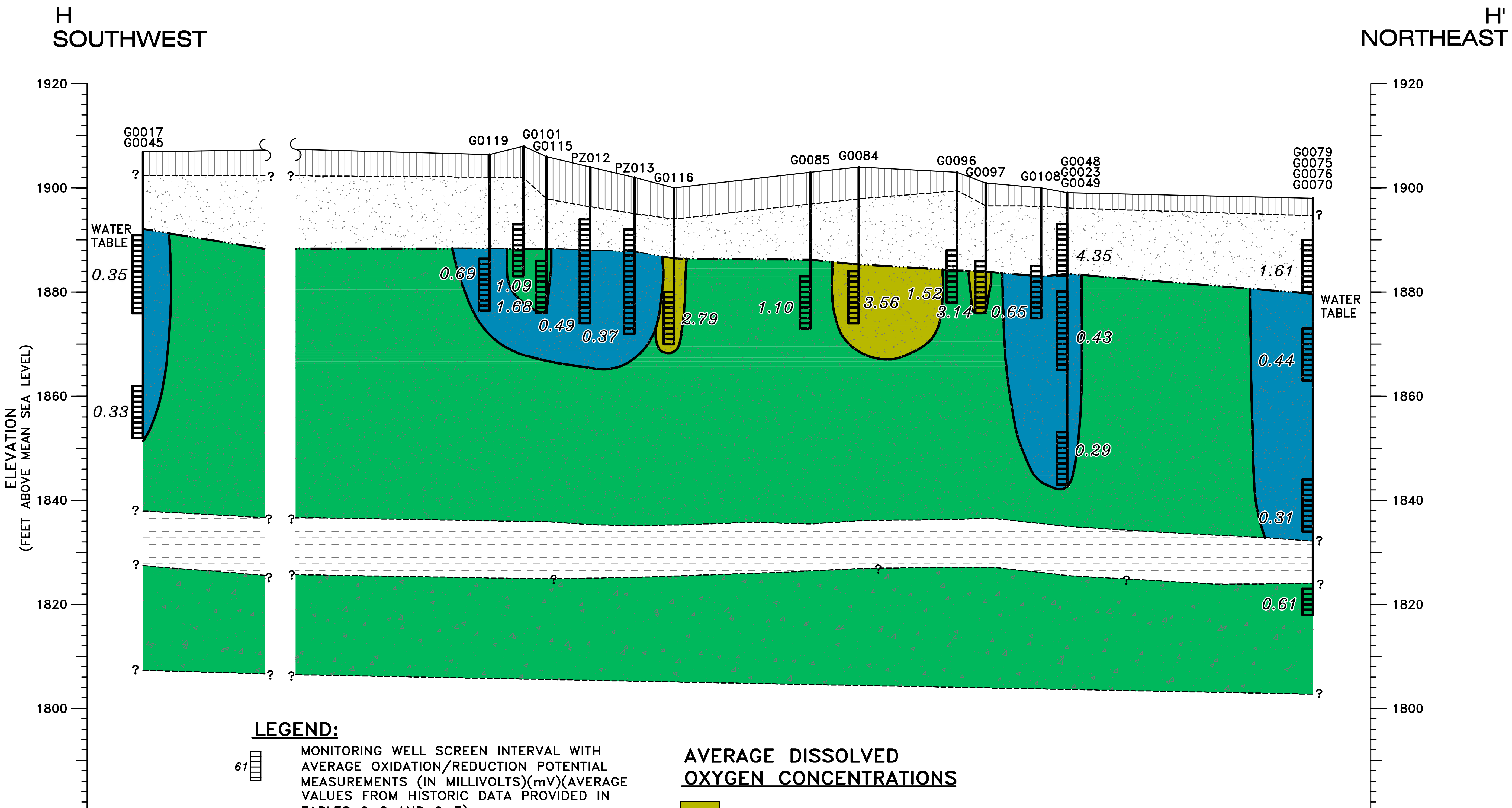

LEGEND:

61 MONITORING WELL SCREEN INTERVAL WITH AVERAGE OXIDATION/REDUCTION POTENTIAL MEASUREMENTS (IN MILLIVOLTS)(mV)(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–2 AND 6–3)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL–PALEOVALLEY FILL AQUIFER)

WATER TABLE–AUGUST 2016

OU OPERABLE UNIT

AVERAGE DISSOLVED OXYGEN CONCENTRATIONS

> 2.0 MILLIGRAMS/LITER

1.0 TO 2.0 MILLIGRAMS/LITER

< 1.0 MILLIGRAMS/LITER

VERTICAL SCALE

20 10 0 20

HORIZONTAL SCALE

1000 500 0 1000

NOTE: VERTICAL EXAGGERATION IS 50:1

November 23, 2016 1:20:48 p.m.
Drawing: T:\CHAAP\16170837\27\6-03c.dwg

Bay West
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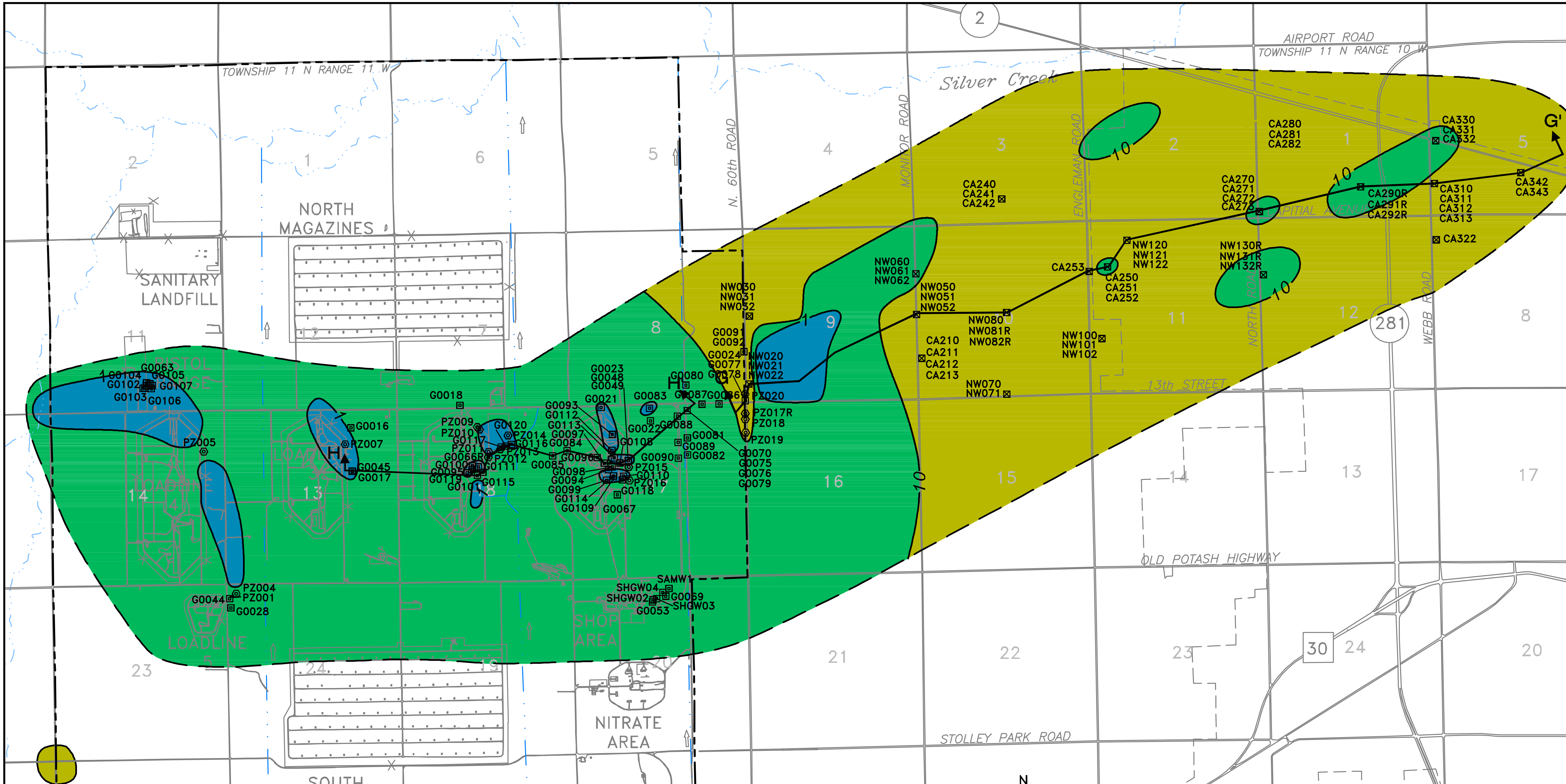
URS

AVERAGE DISSOLVED OXYGEN VERTICAL DISTRIBUTION (OU1) H–H'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6–3c



AVERAGE NITRATE/NITRITE CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–1 THROUGH 6–5)

- > 10 MILLIGRAMS/LITER
- 1 TO 10 MILLIGRAMS/LITER
- < 1 MILLIGRAMS/LITER

LEGEND:

- G0018 ON–POST GROUNDWATER MONITORING WELL
- NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL
- PZ016 ON–POST PIEZOMETER
- 1 SECTION NUMBER
- G G' GEOLOGIC CROSS–SECTION
- LIMIT OF DATA INTERPRETATION

N

0 3000 6000

SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

SHALLOW GROUNDWATER
AVERAGE NITRATE/NITRITE CONCENTRATIONS
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6–4a

November 29, 2016 2:40:27 p.m.
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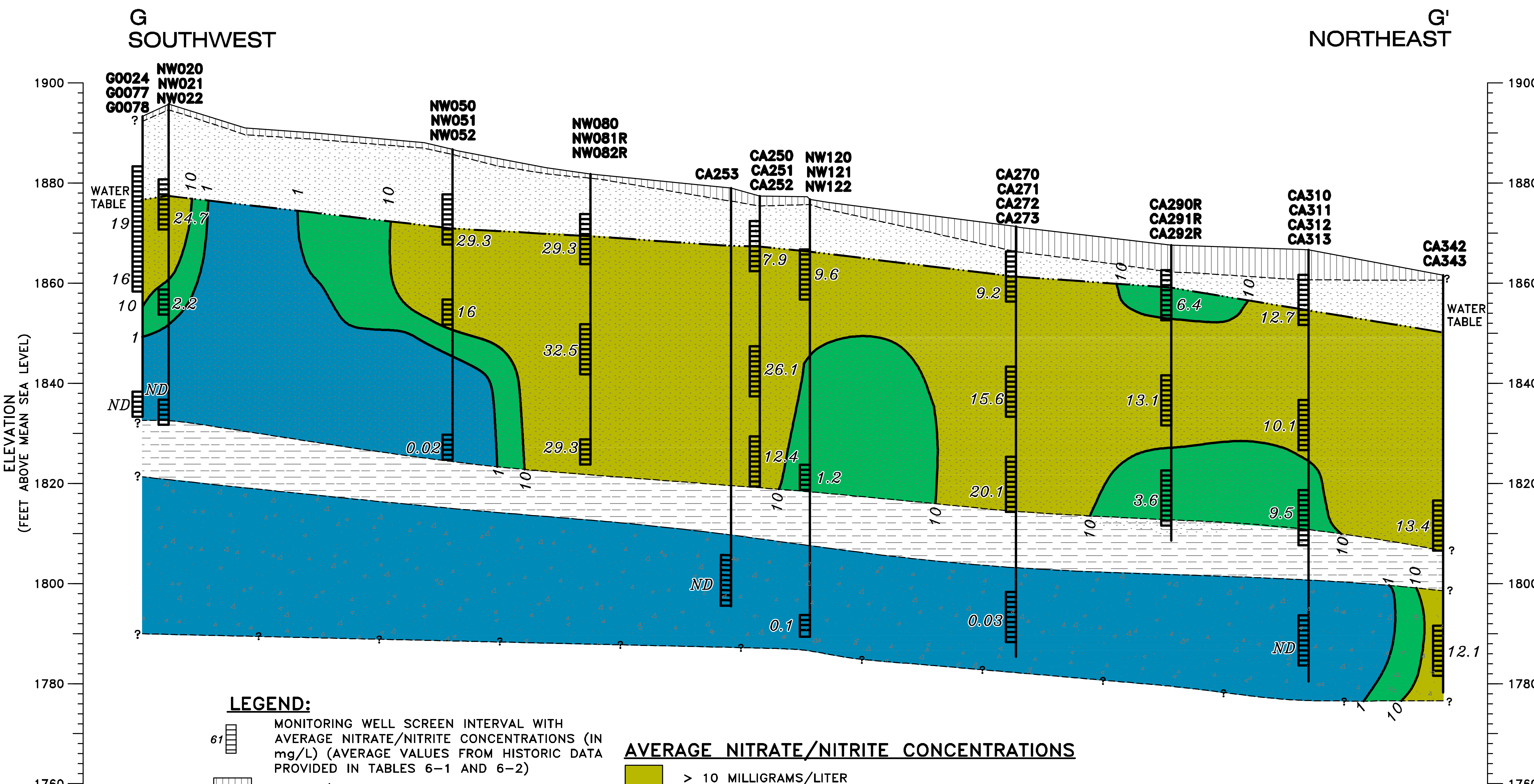


LEGEND:

61 — MONITORING WELL SCREEN INTERVAL WITH AVERAGE NITRATE/NITRITE CONCENTRATIONS (IN mg/L) (AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-1 AND 6-2)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)

WATER TABLE-AUGUST 2016

OU OPERABLE UNIT

ND NON DETECT

AVERAGE NITRATE/NITRITE CONCENTRATIONS

> 10 MILLIGRAMS/LITER

1 TO 10 MILLIGRAMS/LITER

< 1 MILLIGRAMS/LITER

VERTICAL SCALE
20 10 0 20

HORIZONTAL SCALE
2000 1000 0 2000

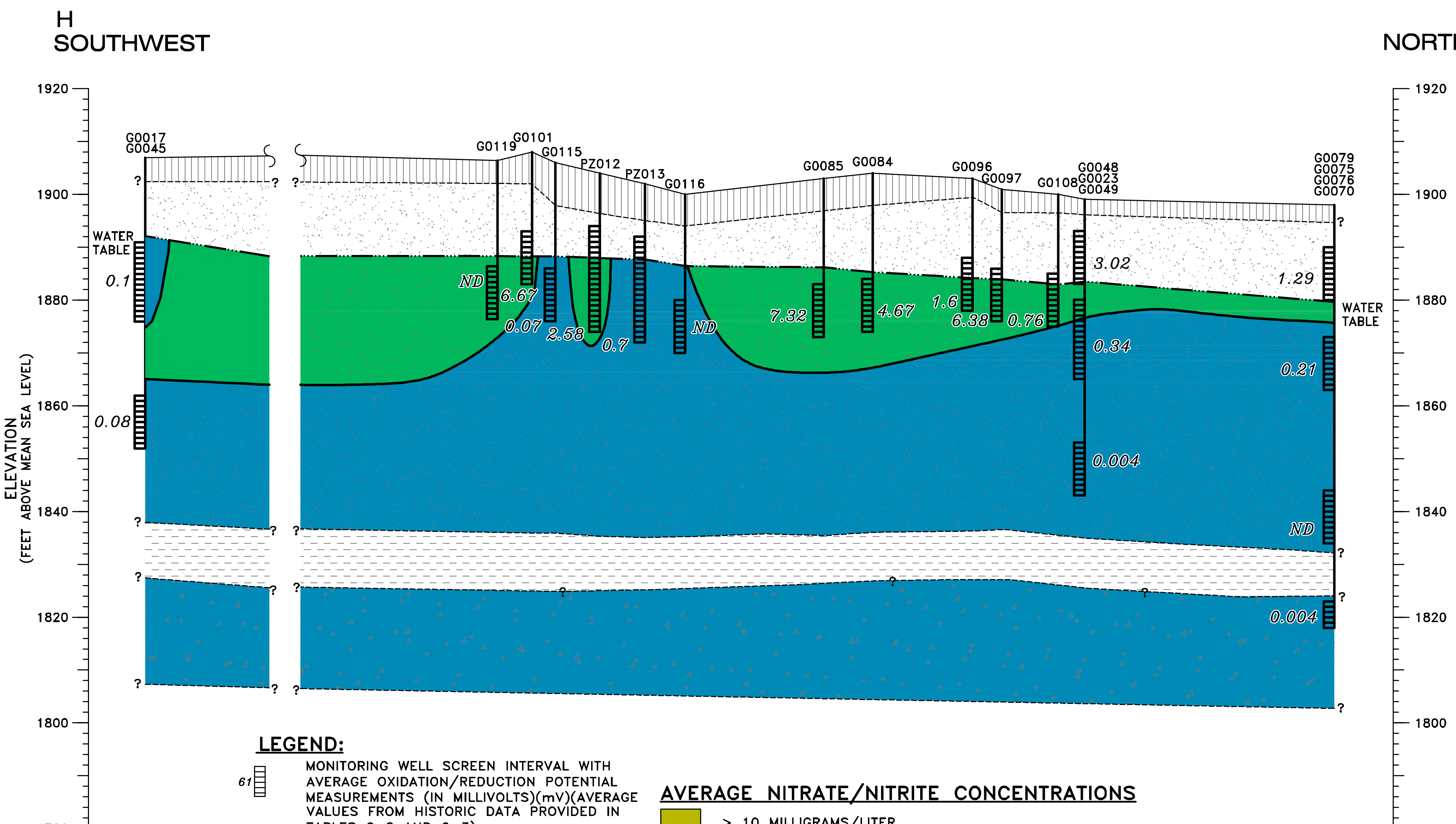
NOTE: VERTICAL EXAGGERATION IS 100:1

November 23, 2016 1:23:18 p.m.
Drawing: T:\CHAAP\16170837\27\6-04b.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE NITRATE/NITRITE
VERTICAL DISTRIBUTION (OU1) G-G'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6-4b



LEGEND:

61 MONITORING WELL SCREEN INTERVAL WITH AVERAGE OXIDATION/REDUCTION POTENTIAL MEASUREMENTS (IN MILLIVOLTS)(mV)(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-2 AND 6-3)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)

WATER TABLE-AUGUST 2016

OU OPERABLE UNIT

AVERAGE NITRATE/NITRITE CONCENTRATIONS

> 10 MILLIGRAMS/LITER

1 TO 10 MILLIGRAMS/LITER

< 1 MILLIGRAMS/LITER

VERTICAL SCALE
20 10 0 20

HORIZONTAL SCALE
1000 500 0 1000

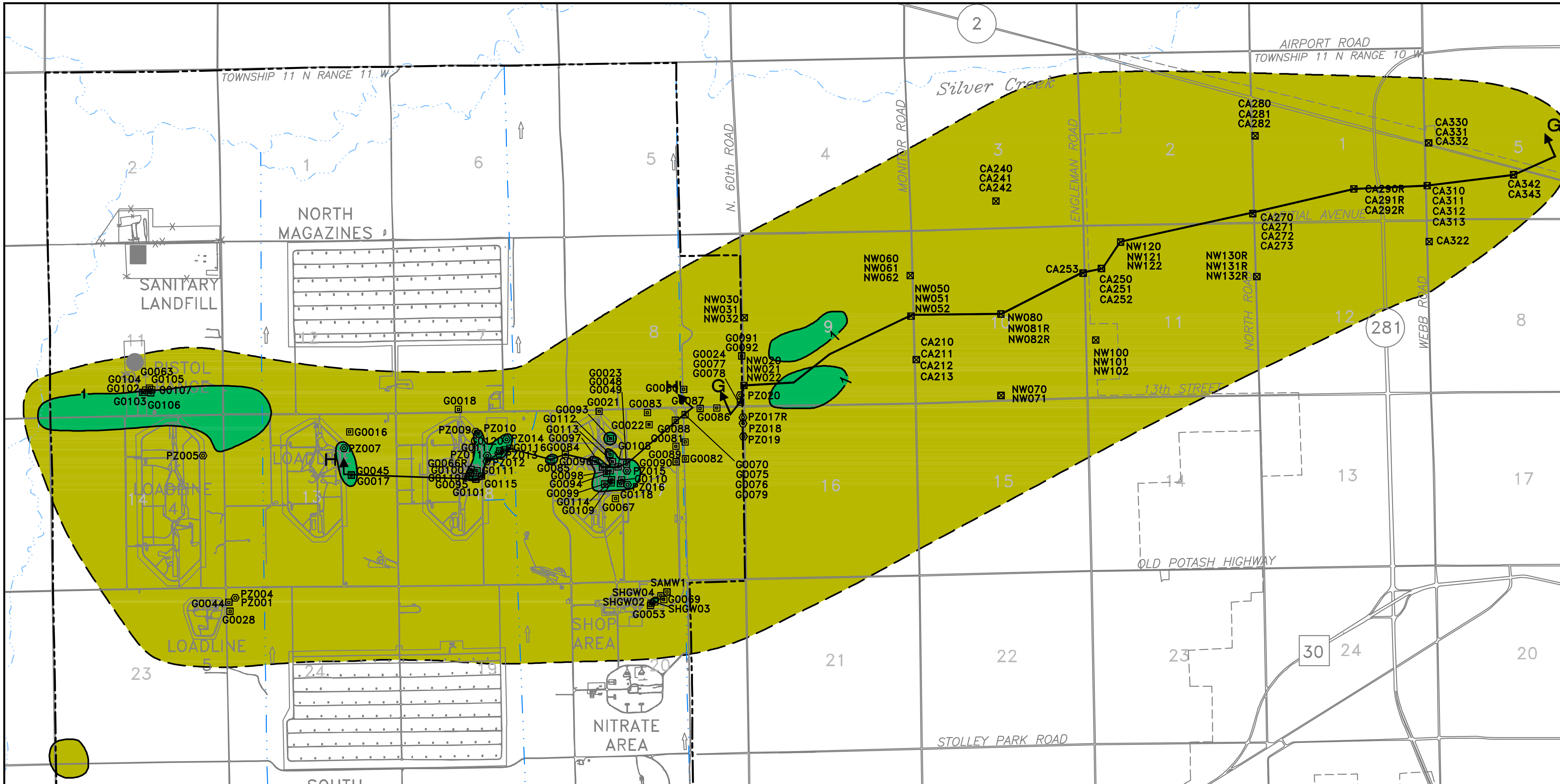
NOTE: VERTICAL EXAGGERATION IS 50:1

November 23, 2016 1:24:24 p.m.
Drawing: T:\CHAAP\16170837\27\6-04c.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE NITRATE/NITRITE VERTICAL DISTRIBUTION (OU1) H-H'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6-4c



AVERAGE FERROUS IRON CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–1 THROUGH 6–5)

1 TO 10 MILLIGRAMS/LITER

< 1.0 MILLIGRAMS/LITER

LEGEND:

G0018 ON–POST GROUNDWATER MONITORING WELL

NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

PZ016 ON–POST PIEZOMETER

1 SECTION NUMBER

G G' GEOLOGIC CROSS–SECTION

LIMIT OF DATA INTERPRETATION

N

0 3000 6000

SCALE FEET

Bay West
Customer-Focused Environmental & Industrial Solutions

URS

SHALLOW GROUNDWATER
AVERAGE FERROUS IRON CONCENTRATIONS
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/07/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 09/07/16	16170837	6–5a

November 23, 2016 1:25:52 p.m.
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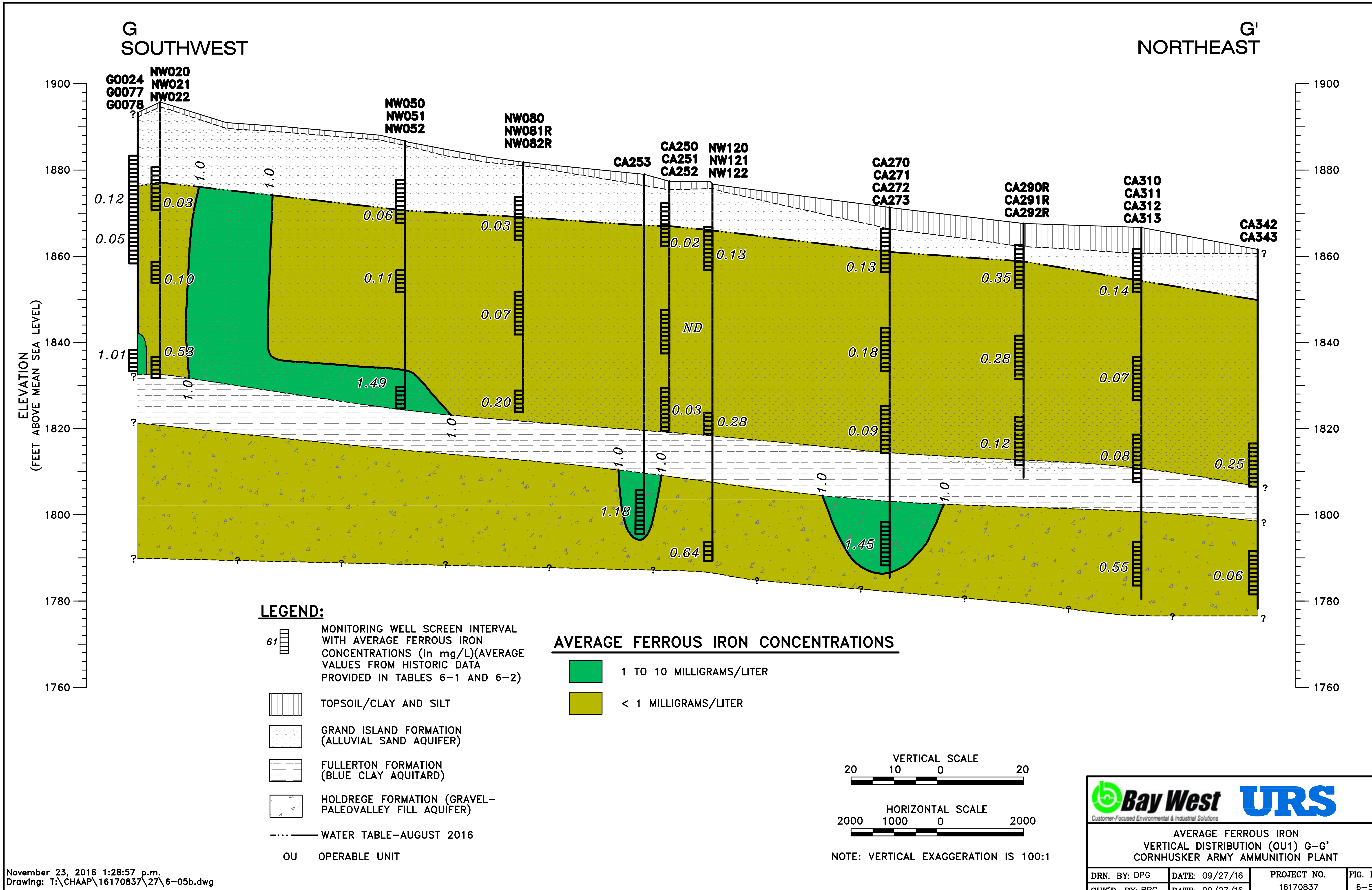
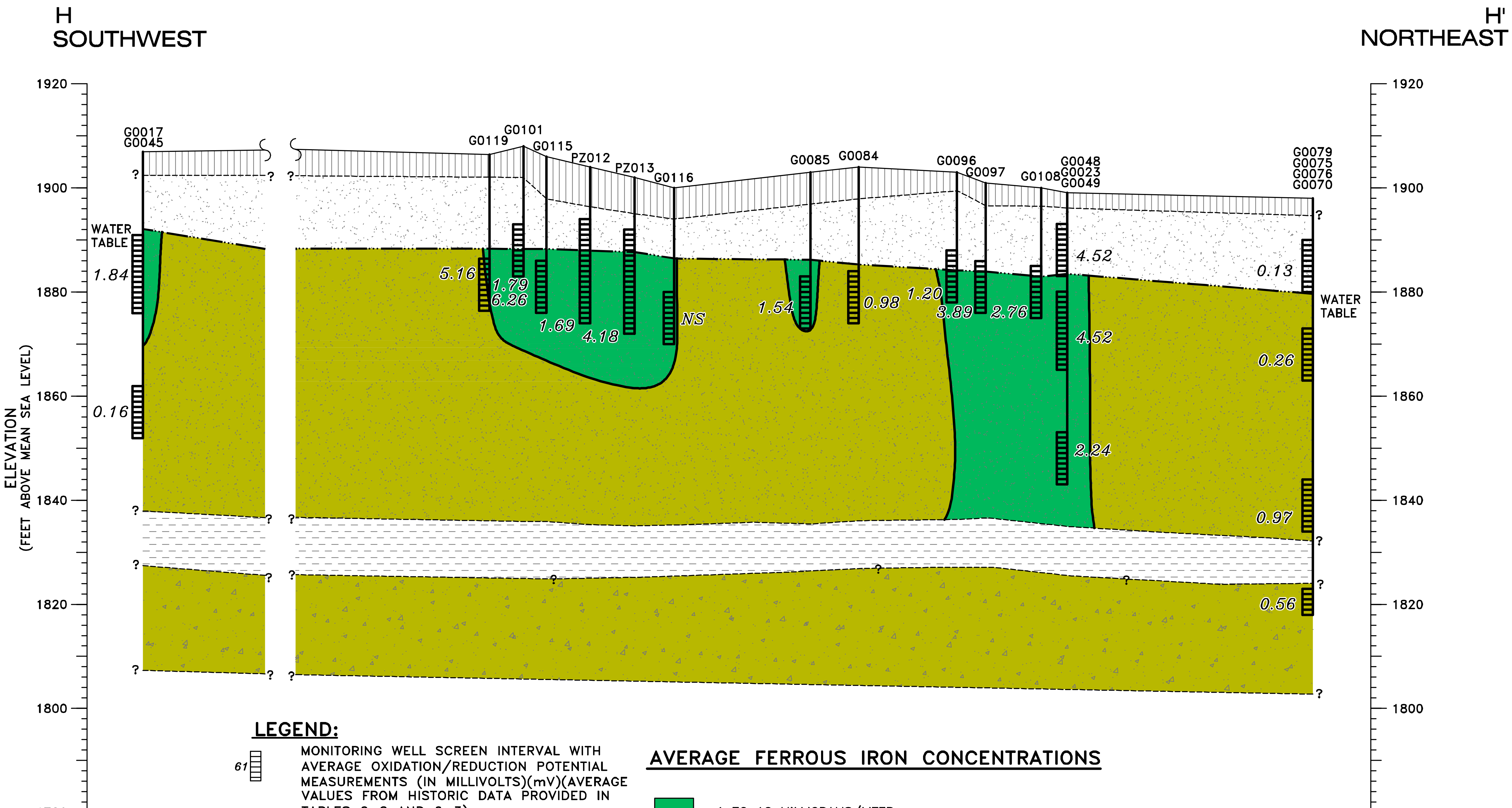


G
SOUTHWEST
G'
NORTHEAST
ELEVATION
(FEET ABOVE MEAN SEA LEVEL)
1900
1880
1860
1840
1820
1800
1780
1760
G0024
G0077
G0078
NW020
NW021
NW022
NW050
NW051
NW052
NW080
NW081R
NW082R
CA253
CA250
CA251
CA252
NW120
NW121
NW122
CA270
CA271
CA272
CA273
CA290R
CA291R
CA292R
CA310
CA311
CA312
CA313
CA342
CA343
0.12
0.05
1.01
0.03
0.10
0.53
1.0
1.49
0.06
0.11
0.03
0.07
0.20
0.02
ND
0.03
1.18
0.13
0.28
0.64
0.13
0.18
0.09
1.45
0.35
0.28
0.12
0.14
0.07
0.08
0.55
0.25
0.06
?
LEGEND:
61
MONITORING WELL SCREEN INTERVAL WITH AVERAGE FERROUS IRON CONCENTRATIONS (in mg/L)(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-1 AND 6-2)
TOPSOIL/CLAY AND SILT
GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)
FULLERTON FORMATION (BLUE CLAY AQUITARD)
HOLDREGE FORMATION (GRAVEL-PALEOVALLEY FILL AQUIFER)
WATER TABLE-AUGUST 2016
OU OPERABLE UNIT
AVERAGE FERROUS IRON CONCENTRATIONS
1 TO 10 MILLIGRAMS/LITER
< 1 MILLIGRAMS/LITER
VERTICAL SCALE
20 10 0 20
HORIZONTAL SCALE
2000 1000 0 2000
NOTE: VERTICAL EXAGGERATION IS 100:1
Bay West
Customer-Focused Environmental & Industrial Solutions
URS
AVERAGE FERROUS IRON VERTICAL DISTRIBUTION (OU1) G-G'
CORNHUSKER ARMY AMMUNITION PLANT
DRN. BY: DPG
DATE: 09/27/16
CHK'D. BY: RPC
DATE: 09/27/16
PROJECT NO. 16170837
FIG. NO. 6-5b
November 23, 2016 1:28:57 p.m.
Drawing: T:\CHAAP\16170837\27\6-05b.dwg



LEGEND:

61 MONITORING WELL SCREEN INTERVAL WITH AVERAGE OXIDATION/REDUCTION POTENTIAL MEASUREMENTS (IN MILLIVOLTS)(mV)(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–2 AND 6–3)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL–PALEOVALLEY FILL AQUIFER)

WATER TABLE–AUGUST 2016

OU OPERABLE UNIT

AVERAGE FERROUS IRON CONCENTRATIONS

1 TO 10 MILLIGRAMS/LITER

< 1 MILLIGRAMS/LITER

VERTICAL SCALE

20 10 0 20

HORIZONTAL SCALE

1000 500 0 1000

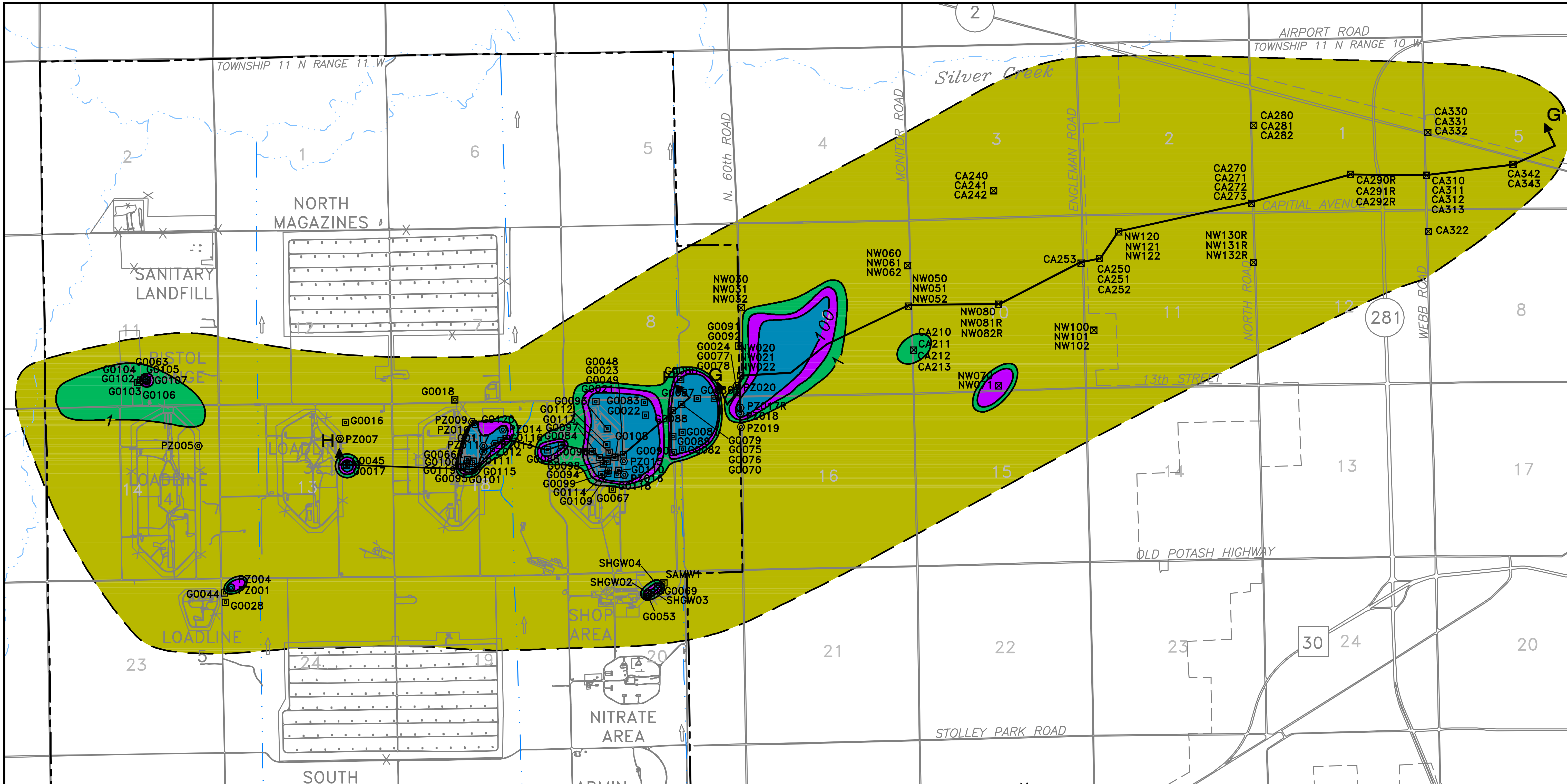
NOTE: VERTICAL EXAGGERATION IS 50:1

January 12, 2017 11:06:48 a.m.
Drawing: T:\CHAAP\16170837\27\6-05c.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE FERROUS IRON VERTICAL DISTRIBUTION (OU1) H–H'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/27/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/27/16	16170837	6–5c



AVERAGE METHANE CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–1 THROUGH 6–5)

- > 100 MICROGRAMS/LITER
- 11 TO 100 MICROGRAMS/LITER
- 1 TO 10 MICROGRAMS/LITER
- < 1.0 MICROGRAMS/LITER

LEGEND:

G0018 ON–POST GROUNDWATER MONITORING WELL

NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

PZ016 ON–POST PIEZOMETER

1 SECTION NUMBER

G G' GEOLOGIC CROSS–SECTION

LIMIT OF DATA INTERPRETATION

OU OPERABLE UNIT

N

0 3000 6000

SCALE FEET

Bay West Customer-Focused Environmental & Industrial Solutions

URS

SHALLOW GROUNDWATER
AVERAGE METHANE CONCENTRATIONS
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6–6a

November 23, 2016 1:31:02 p.m.
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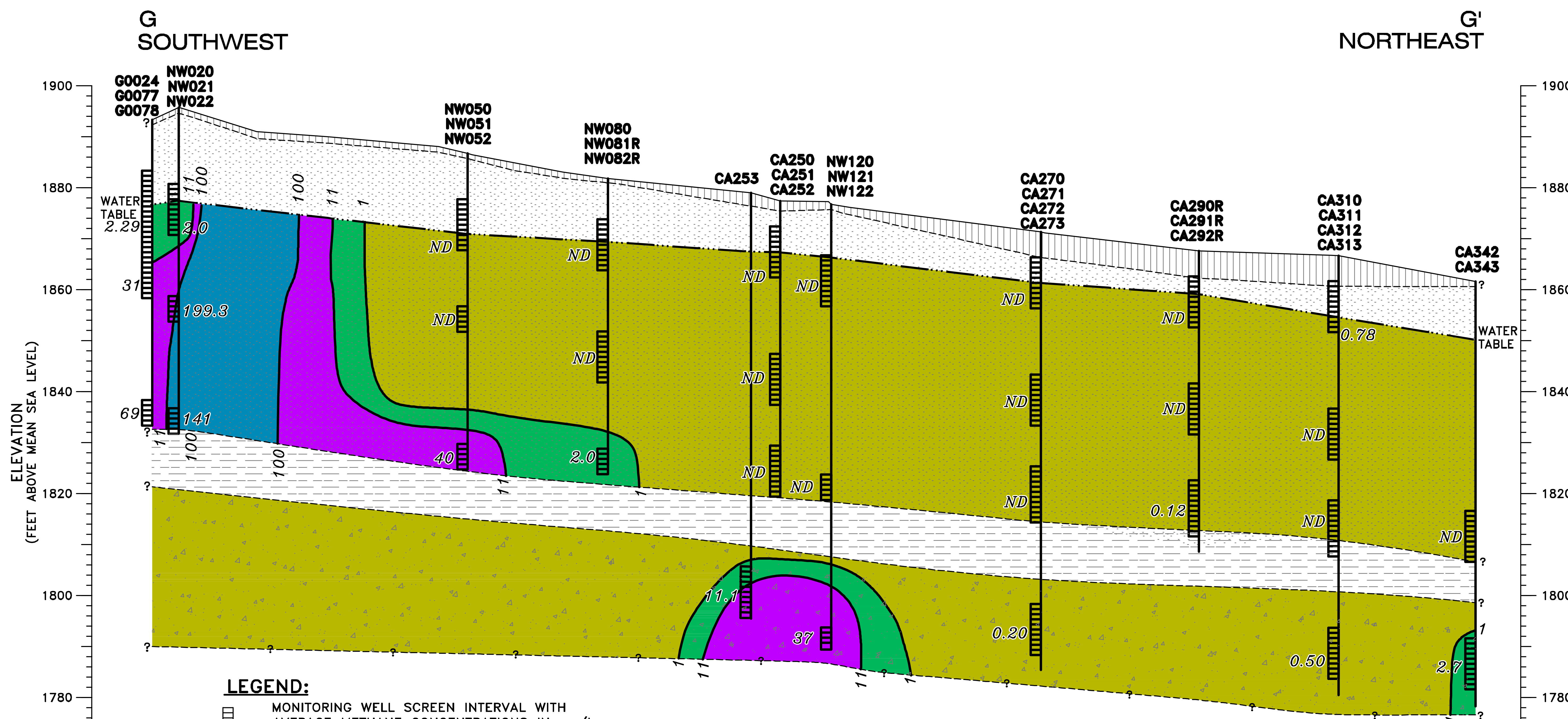


LEGEND:

MONITORING WELL SCREEN INTERVAL WITH AVERAGE METHANE CONCENTRATIONS IN µg/L (VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–1 AND 6–2)

61

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL–PALEOVALLEY FILL AQUIFER)

WATER TABLE–AUGUST 2016

OU OPERABLE UNIT

ND NON DETECT

AVERAGE METHANE CONCENTRATIONS

> 100 MICROGRAMS/LITER

11 TO 100 MICROGRAMS/LITER

1 TO 10 MICROGRAMS/LITER

< 1.0 MICROGRAMS/LITER

VERTICAL SCALE

20 10 0 20

HORIZONTAL SCALE

2000 1000 0 2000

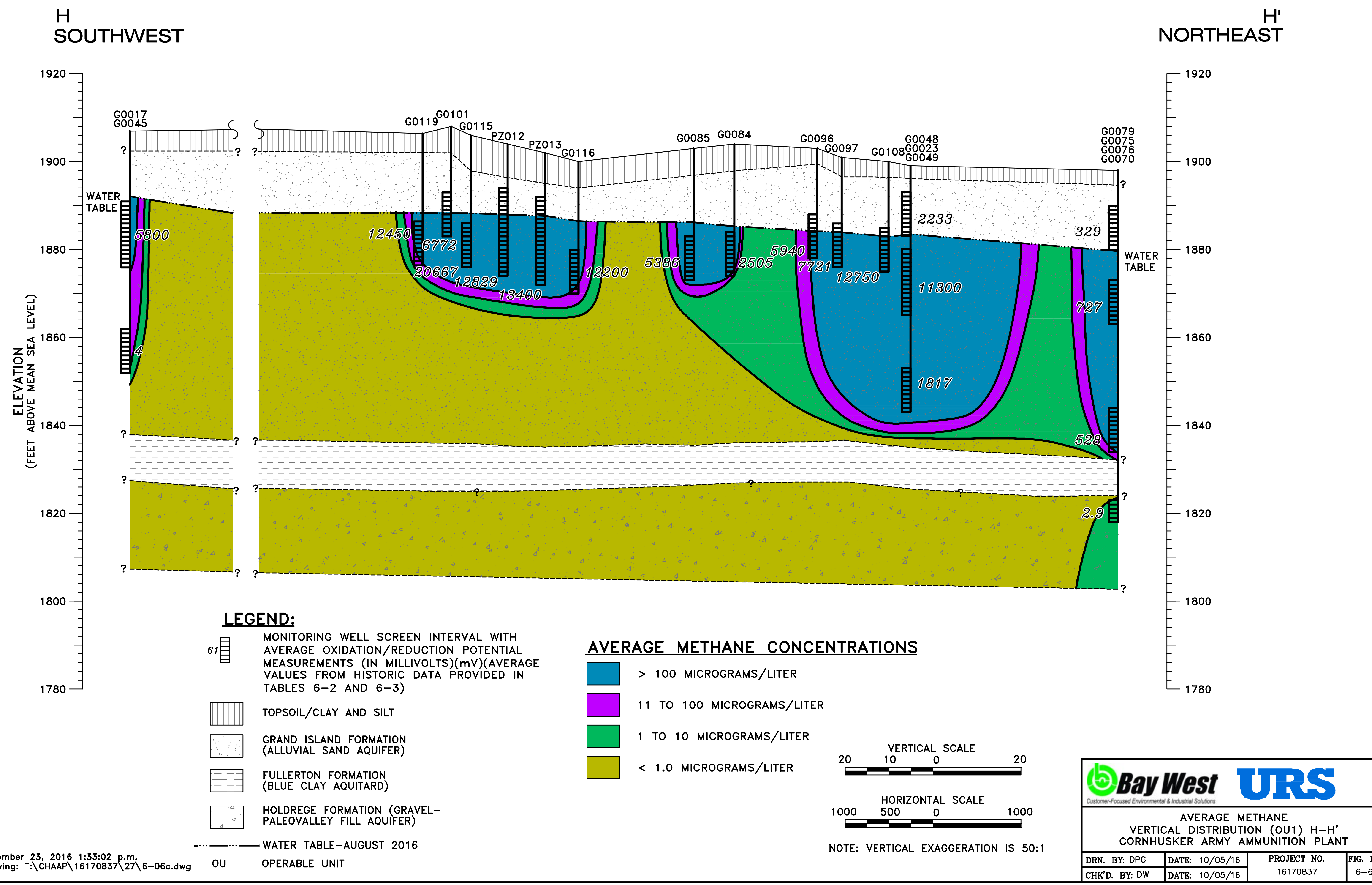
NOTE: VERTICAL EXAGGERATION IS 100:1

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE METHANE
VERTICAL DISTRIBUTION (OU1) G–G'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6–6b

November 23, 2016 1:32:01 p.m.
Drawing: T:\CHAAP\16170837\27\6–06b.dwg

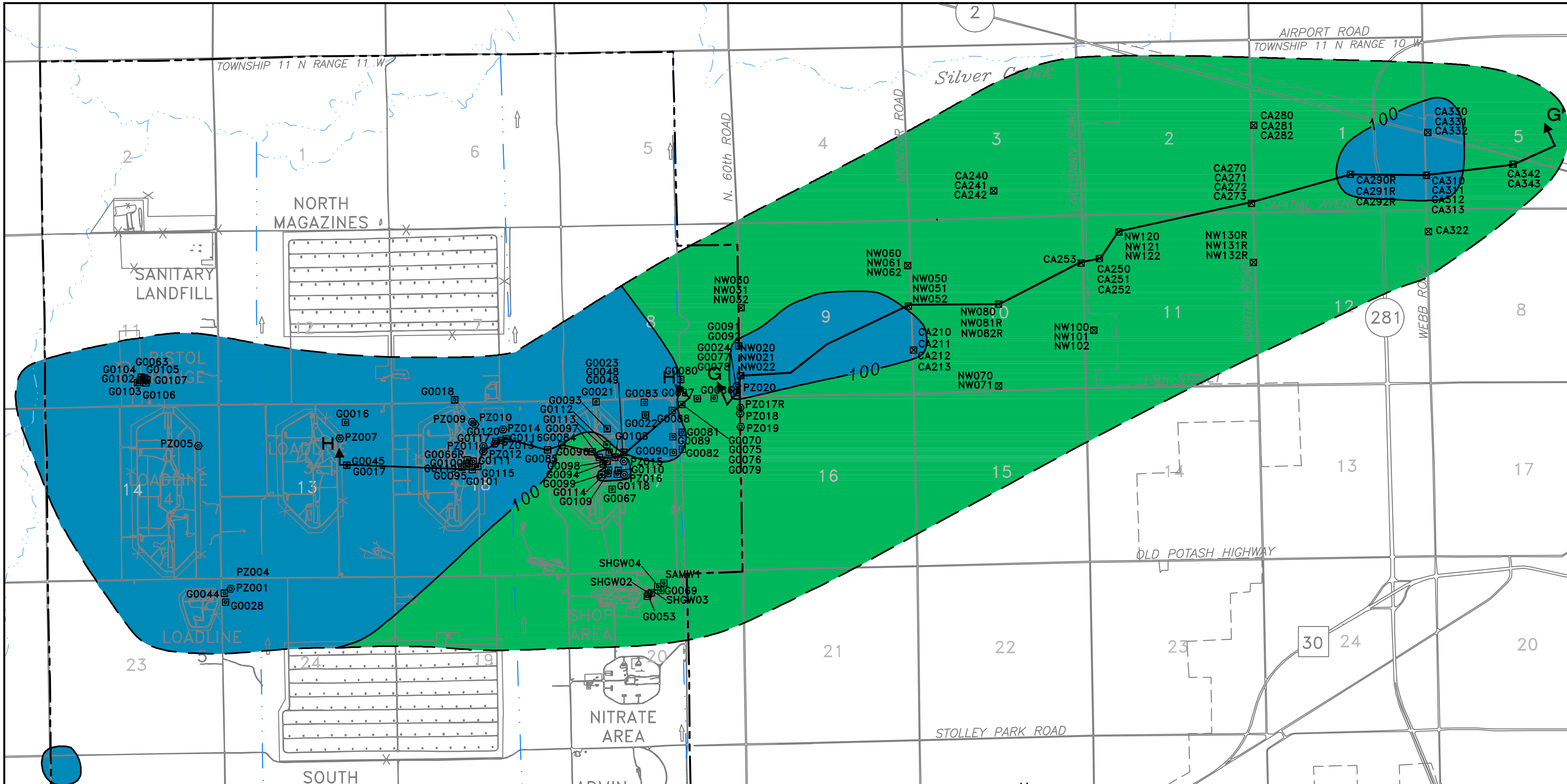


November 23, 2016 1:33:02 p.m.
Drawing: T:\CHAAP\16170837\27\6-06c.dwg

Bay West — Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE METHANE
VERTICAL DISTRIBUTION (OU1) H-H'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6-6c



AVERAGE CARBON DIOXIDE CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–1 THROUGH 6–5)

> 100 MILLIGRAMS/LITER

0 TO 100 MILLIGRAMS/LITER

LEGEND:

G0018 ON–POST GROUNDWATER MONITORING WELL

NW082 OR CA211 OFF–POST GROUNDWATER MONITORING WELL

PZ016 ON–POST PIEZOMETER

1 SECTION NUMBER

G G' GEOLOGIC CROSS–SECTION

LIMIT OF DATA INTERPRETATION

N

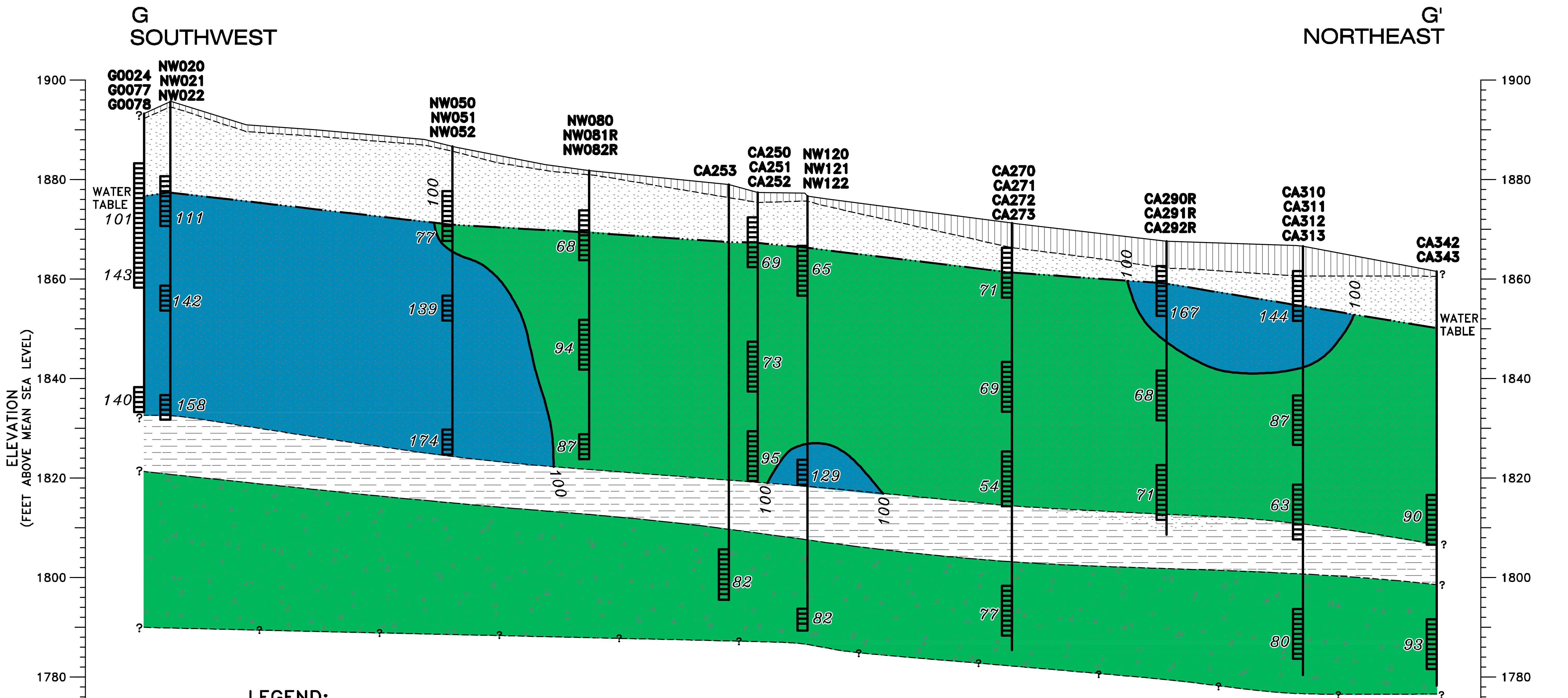
SCALE 0 3000 6000 FEET

November 23, 2016 1:34:15 p.m.
Drawing: T:\CHAAP\16170837\27\6-07a.dwg

Bay West — Customer-Focused Environmental & Industrial Solutions | URS

SHALLOW GROUNDWATER
AVERAGE CARBON DIOXIDE CONCENTRATIONS
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO. 16170837	FIG. NO. 6–7a
CHK'D. BY: DW	DATE: 10/05/16		



LEGEND:

61 — MONITORING WELL SCREEN INTERVAL WITH AVERAGE CARBON DIOXIDE CONCENTRATIONS (IN mg/L)(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–1 AND 6–2)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL–PALEOVALLEY FILL AQUIFER)

WATER TABLE–AUGUST 2016

OU — OPERABLE UNIT

AVERAGE CARBON DIOXIDE CONCENTRATIONS

> 100 MILLIGRAMS/LITER

0 TO 100 MILLIGRAMS/LITER

VERTICAL SCALE
20 10 0 20

HORIZONTAL SCALE
2000 1000 0 2000

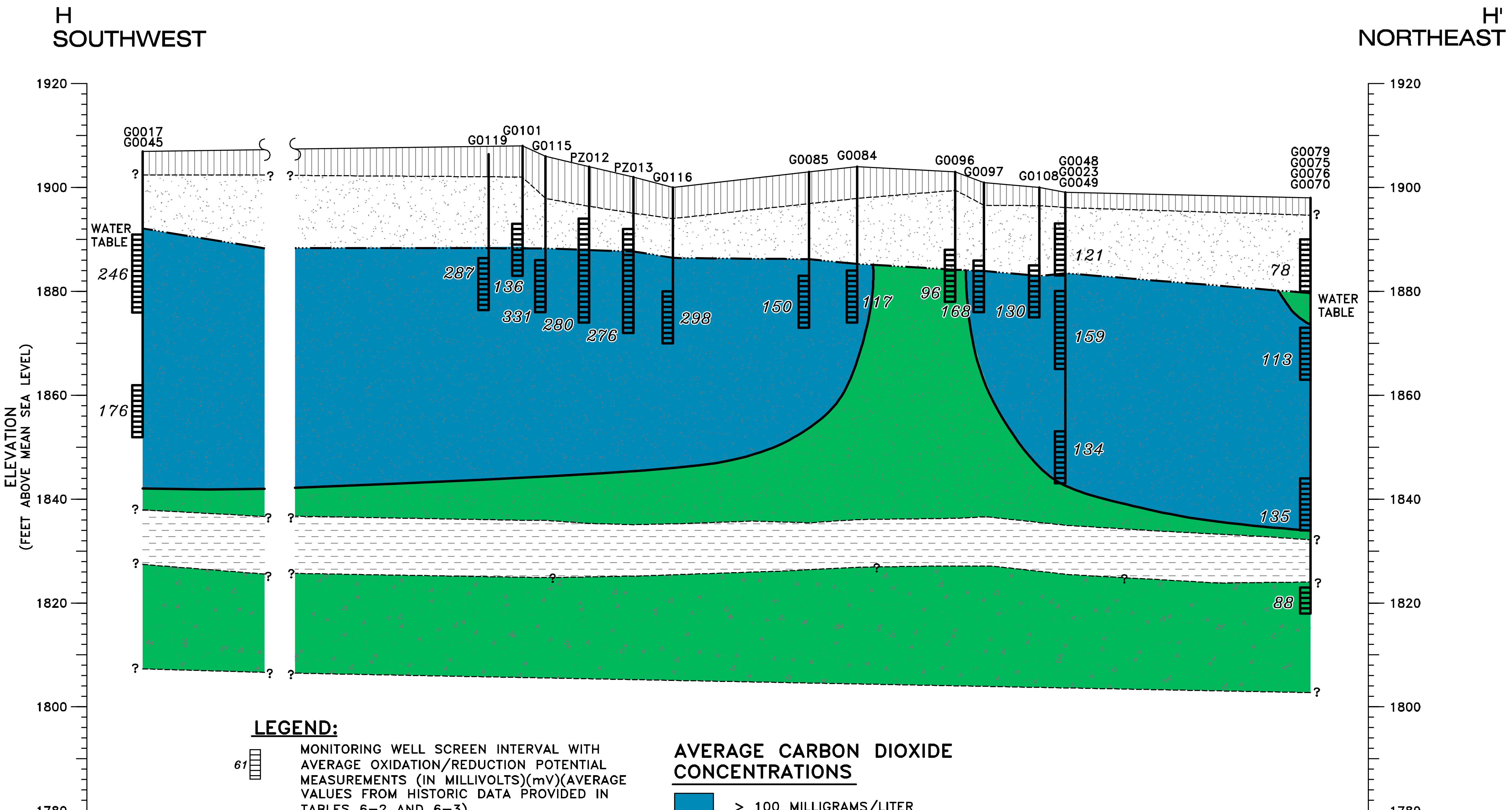
NOTE: VERTICAL EXAGGERATION IS 100:1

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE CARBON DIOXIDE
VERTICAL DISTRIBUTION (OU1) G–G'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6–7b

November 23, 2016 1:35:12 p.m.
Drawing: T:\CHAAP\16170837\27\6–07b.dwg



LEGEND:

61 — MONITORING WELL SCREEN INTERVAL WITH AVERAGE OXIDATION/REDUCTION POTENTIAL MEASUREMENTS (IN MILLIVOLTS)(mV)(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-2 AND 6-3)

TOPSOIL/CLAY AND SILT

GRAND ISLAND FORMATION (ALLUVIAL SAND AQUIFER)

FULLERTON FORMATION (BLUE CLAY AQUITARD)

HOLDREGE FORMATION (GRAVEL–PALEOVALLEY FILL AQUIFER)

WATER TABLE–AUGUST 2016

OU — OPERABLE UNIT

AVERAGE CARBON DIOXIDE CONCENTRATIONS

> 100 MILLIGRAMS/LITER

0 TO 100 MILLIGRAMS/LITER

VERTICAL SCALE
20 10 0 20

HORIZONTAL SCALE
1000 500 0 1000

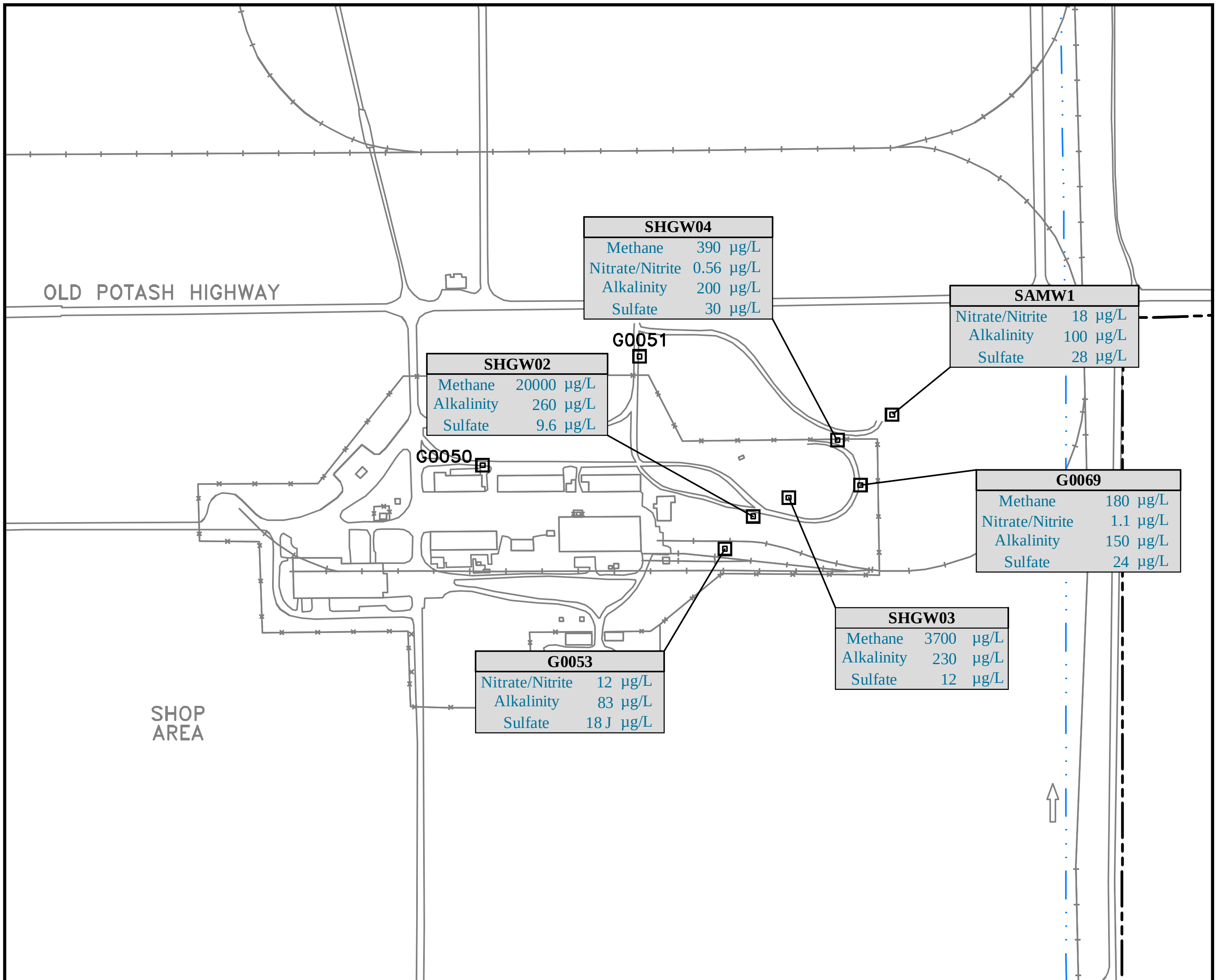
NOTE: VERTICAL EXAGGERATION IS 50:1

November 23, 2016 1:36:06 p.m.
Drawing: T:\CHAAP\16170837\27\6-07c.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

AVERAGE CARBON DIOXIDE
VERTICAL DISTRIBUTION (OU1) H–H'
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6-7c



LEGEND:

- ON–POST GROUNDWATER MONITORING WELL
- FACILITY BOUNDARY
- DRAINAGE DITCH FLOW DIRECTION

J = ESTIMATED QUALIFIER
Mg/L = MILLIGRAMS PER LITER
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER

0 500 1000
SCALE FEET

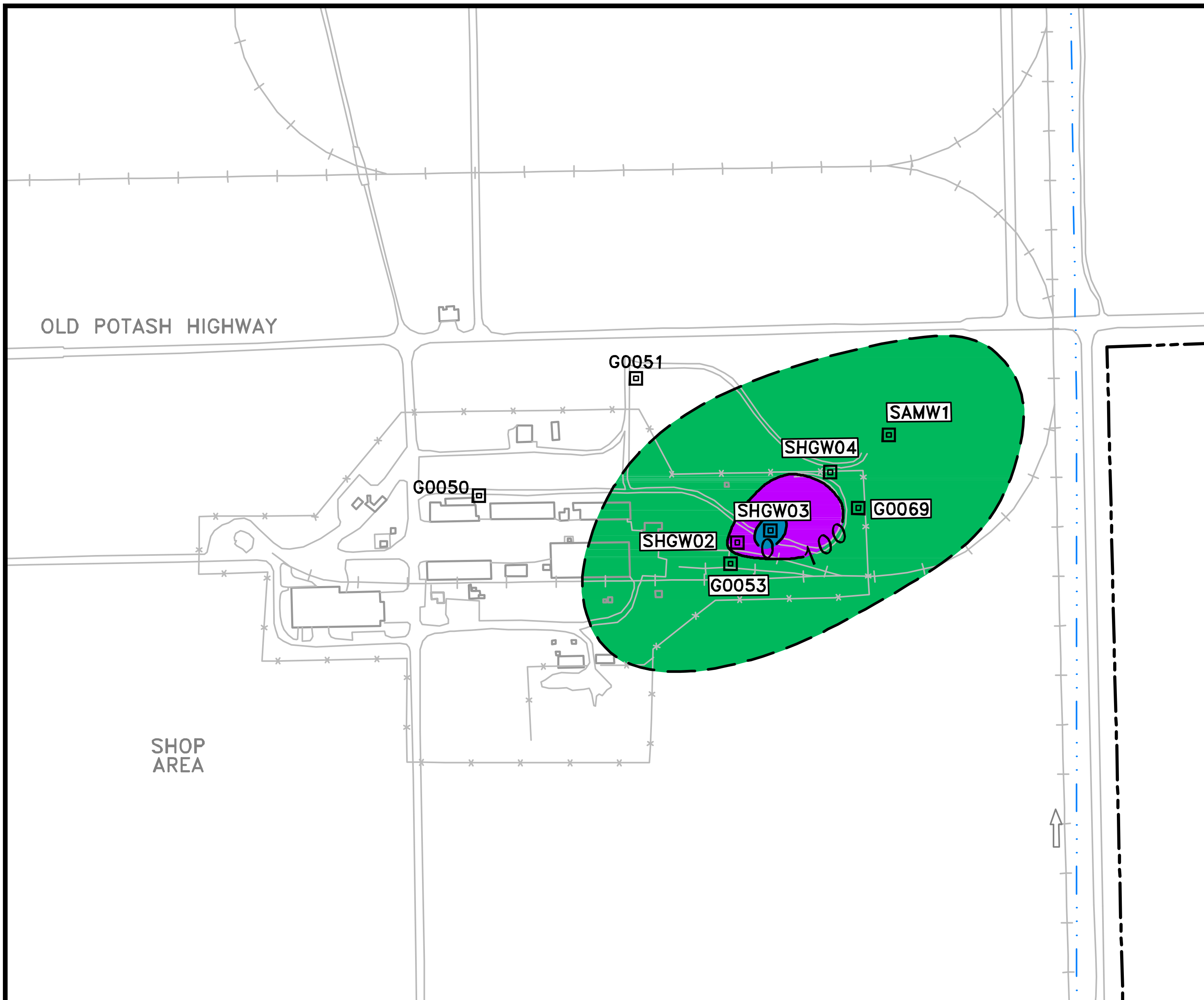
N

February 27, 2017 10:08:18 a.m.
Drawing: T:\CHAAP\16170837\27\6–08.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions
URS

SHALLOW GROUNDWATER NATURAL ATTENUATION PARAMETERS – SHOP AREA (OU3) AUGUST 2016
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6–8



AVERAGE OXIDATION/REDUCTION POTENTIAL

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–4 AND 6–5)

100 TO 200 MILLIVOLTS

0 TO 100 MILLIVOLTS

< 0 MILLIVOLTS

N

0 500 1000

SCALE FEET

LEGEND:

ON–POST GROUNDWATER MONITORING WELL

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

LIMIT OF DATA INTERPRETATION

G0053 WELLS USED FOR INTERPRETATION

OU OPERABLE UNIT

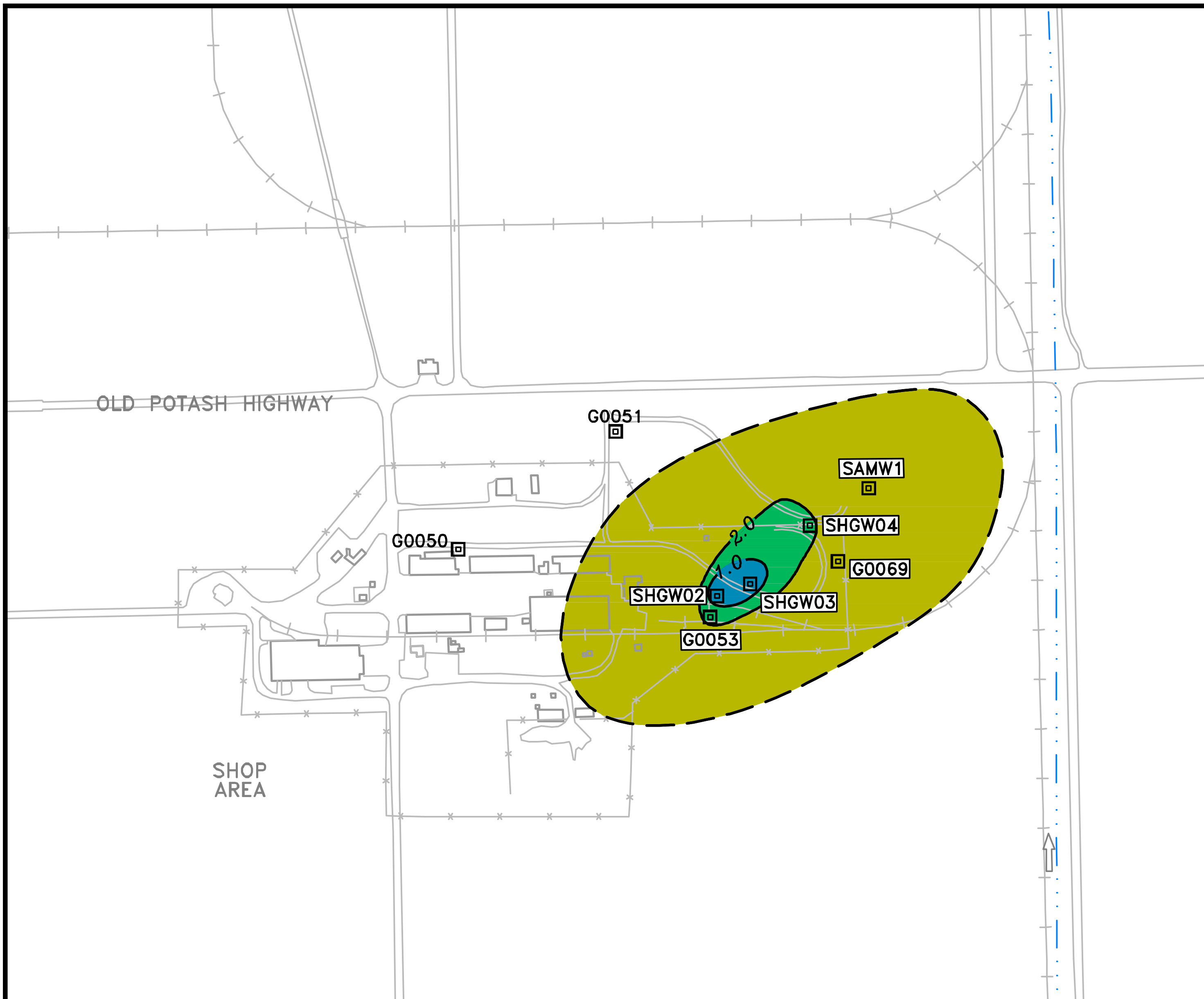
December 07, 2016 10:40:49 a.m.
Drawing: T:\CHAAP\16170837\27\6–09.dwg

Bay West
Customer-Focused Environmental & Industrial Solutions

URS

SHALLOW GROUNDWATER
AVERAGE OXIDATION/REDUCTION POTENTIAL
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/07/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DC	DATE: 09/07/16	16170837	6–9



AVERAGE DISSOLVED OXYGEN CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6–4 AND 6–5)

> 2.0 MILLIGRAMS/LITER

1.0 TO 2.0 MILLIGRAMS/LITER

< 1.0 MILLIGRAMS/LITER

LEGEND:

ON–POST GROUNDWATER MONITORING WELL

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

LIMIT OF DATA INTERPRETATION

G0053 WELLS USED FOR INTERPRETATION

OU OPERABLE UNIT

N

0 500 1000

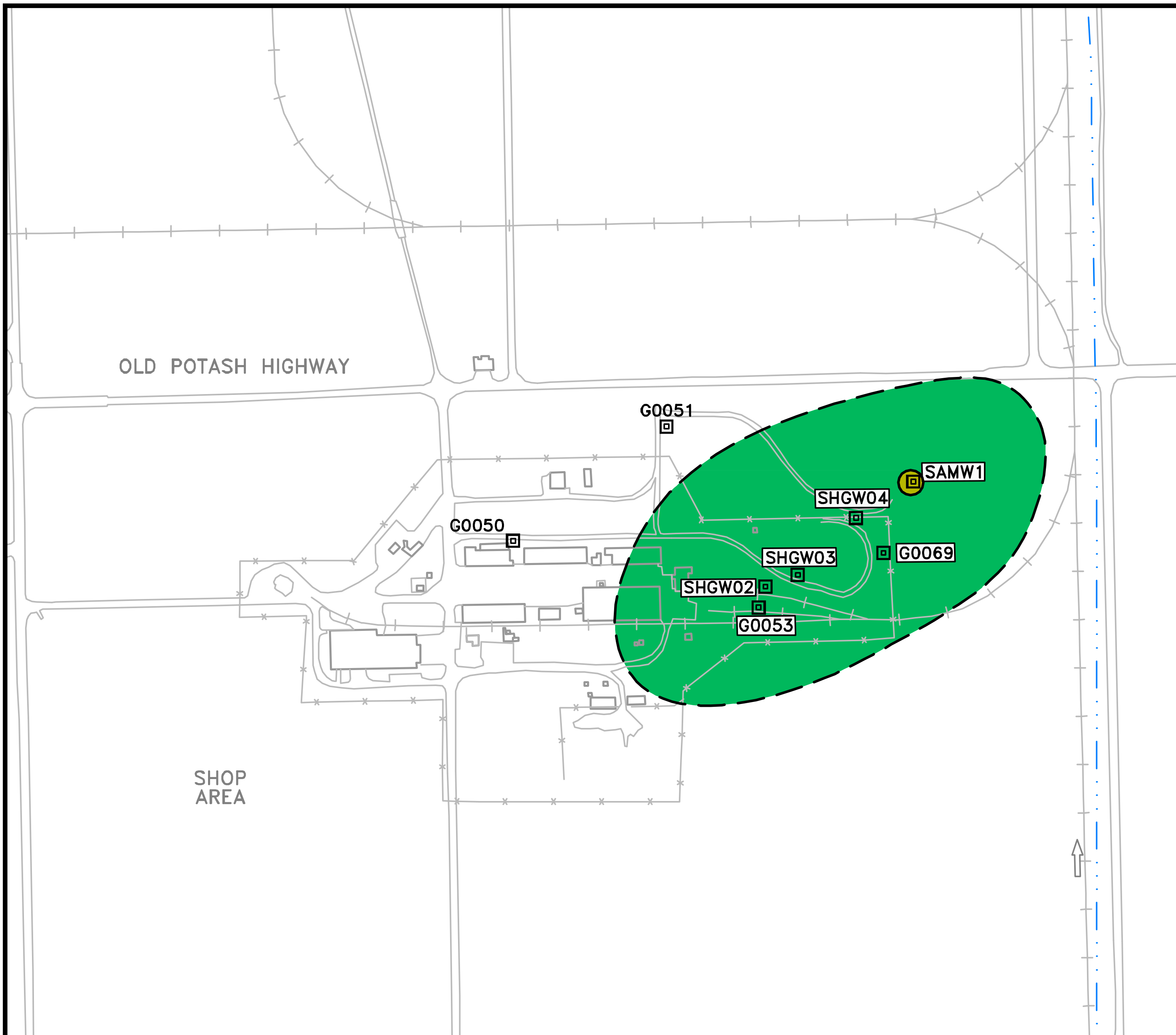
SCALE FEET

Customer-Focused Environmental & Industrial Solutions

SHALLOW GROUNDWATER
AVERAGE DISSOLVED OXYGEN CONCENTRATIONS
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/07/16	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 09/07/16	16170837	6–10

December 14, 2016 3:53:13 p.m.
Drawing: T:\CHAAP\16170837\27\6–10.dwg



AVERAGE NITRATE/NITRITE CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-4 AND 6-5)

> 10 MILLIGRAMS/LITER

1 TO 10 MILLIGRAMS/LITER

LEGEND:

ON-POST GROUNDWATER MONITORING WELL

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

LIMIT OF DATA INTERPRETATION

G0053 WELLS USED FOR INTERPRETATION

OU OPERABLE UNIT

N

0 500 1000

SCALE FEET

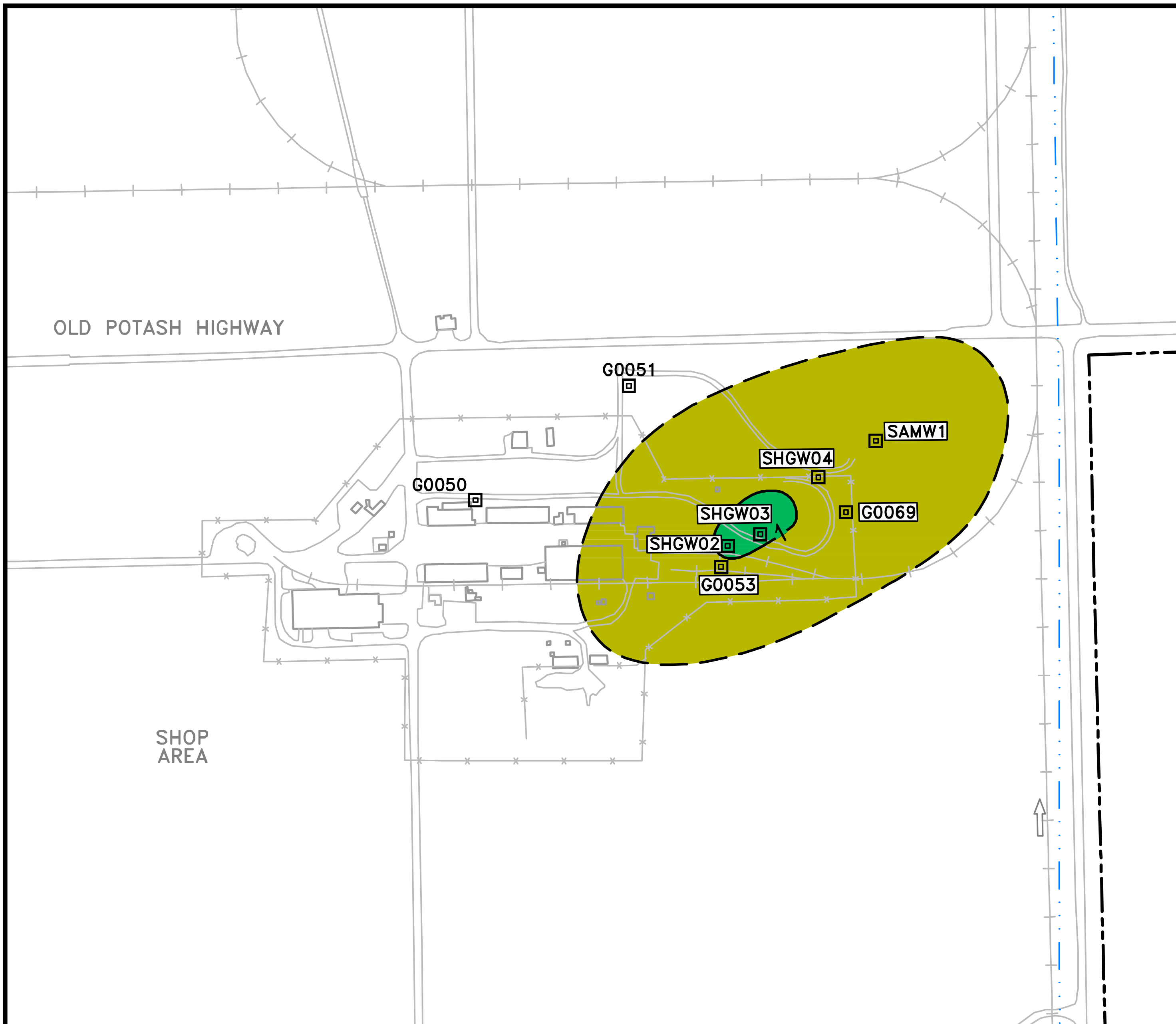
Bay West
Customer-Focused Environmental & Industrial Solutions

URS

SHALLOW GROUNDWATER
AVERAGE NITRATE/NITRITE CONCENTRATIONS
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO. 16170837	FIG. NO. 6-11
CHK'D. BY: DW	DATE: 10/05/16		

December 07, 2016 10:42:14 a.m.
Drawing: T:\CHAAP\16170837\27\6-11.dwg

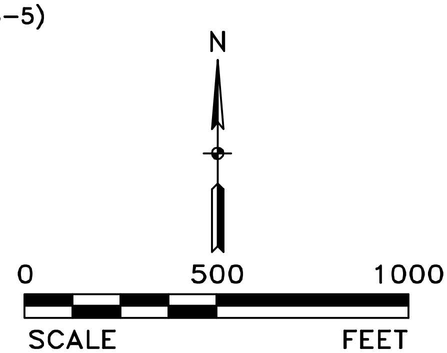


AVERAGE FERROUS IRON CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-4 AND 6-5)

1 TO 10 MILLIGRAMS/LITER

< 1.0 MILLIGRAMS/LITER



LEGEND:

ON-POST GROUNDWATER MONITORING WELL

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

LIMIT OF DATA INTERPRETATION

G0053 WELLS USED FOR INTERPRETATION

OU OPERABLE UNIT

December 07, 2016 10:42:56 a.m.
Drawing: T:\CHAAP\16170837\27\6-12.dwg

Bay West
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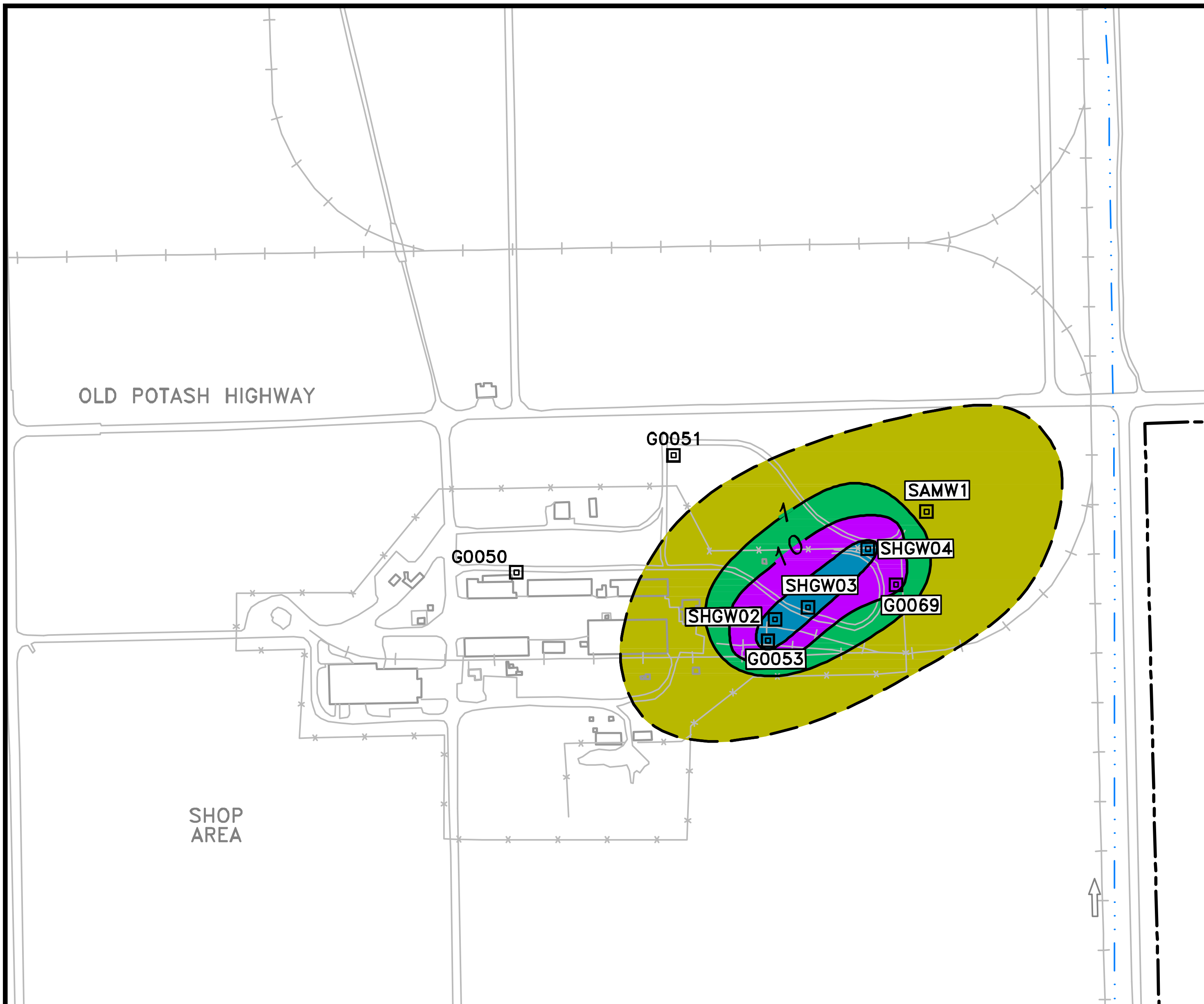
URS

SHALLOW GROUNDWATER
AVERAGE FERROUS IRON CONCENTRATIONS
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 09/07/16	PROJECT NO. 16170837	FIG. NO. 6-12
CHK'D. BY: RPC	DATE: 09/07/16		



AVERAGE METHANE CONCENTRATIONS

(AVERAGE VALUES FROM HISTORIC DATA PROVIDED IN TABLES 6-4 AND 6-5)

> 100 MICROGRAMS/LITER

11 TO 100 MICROGRAMS/LITER

1 TO 10 MICROGRAMS/LITER

< 1 MICROGRAMS/LITER

N

0 500 1000

SCALE FEET

LEGEND:

ON-POST GROUNDWATER MONITORING WELL

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

LIMIT OF DATA INTERPRETATION

G0053 WELLS USED FOR INTERPRETATION

OU OPERABLE UNIT

Customer-Focused Environmental & Industrial Solutions

SHALLOW GROUNDWATER
AVERAGE METHANE CONCENTRATIONS
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 10/05/16	PROJECT NO.	FIG. NO.
CHK'D. BY: DW	DATE: 10/05/16	16170837	6-13

December 07, 2016 10:43:24 a.m.
Drawing: T:\CHAAP\16170837\27\6-13.dwg

7.1 GROUNDWATER FLOW MODELING

The approach, methods, and assumptions used to simulate groundwater flow conditions at CHAAP are discussed in the following sections. A more detailed description of the construction of the groundwater flow model is presented in Groundwater Flow and Contaminant Fate and Transport Modeling, Cornhusker Army Ammunition Plant, Grand Island, Nebraska (URS 2001).

7.1.1 Groundwater Flow Modeling Approach and Methodology

Groundwater flow conditions at the site were simulated using the U.S. Geological Survey (USGS) Modular Three-Dimensional Finite-Difference Groundwater Flow Model (MODFLOW) (McDonald and Harbaugh 1988). The MODFLOW model was constructed using Visual MODFLOW (VMODFLOW) (Guiger and Franz 1995). VMODFLOW is a pre-processor and does not affect the results generated by running MODFLOW.

7.1.2 Project Uses of the Flow Model

The initial groundwater flow model was developed to predict extraction well capture zones using MODPATH, the USGS advective particle tracking model. The current remedial system was optimized for maximum containment of the on-post explosives plume using the groundwater flow model. The groundwater flow model was also used in conjunction with MT3DMS, a numerical contaminant fate and transport model (Zheng and Wang 1999), to simulate baseline contaminant (e.g., RDX and TNT) transport and transport under remedial injection conditions.

The CHAAP groundwater flow model was recalibrated in August 2015 and used to aid in development of the 2016 subsurface injection design. The 2016 subsurface injection design addressed three separate areas of the CHAAP OU1 on-post groundwater explosives plume: the primary explosives source area at LL1, the primary explosives source and slightly downgradient areas at LL2, and areas between LL1 and LL2 with HE concentrations. As stated in **Section 1.2**, the objective of the 2016 OU1 RAO subsurface injection program was to reduce the remaining explosives mass (RDX and TNT) within the OU1 RAO Load Line Treatment Areas. In 2016, 252 of the 600 injection points were completed at LL1 and 348 were completed at LL2. Subsurface injection activities focused on areas where HE concentrations (>2 µg/L for RDX and TNT) were detected during the August 2015 annual groundwater monitoring and February 2016 pre-injection groundwater investigation sampling events. Subsurface injection treatment zones were installed using closely spaced transects, and amendment was generally injected throughout the interpreted vertical extent of explosives contamination, including approximately 3 to 5 feet above the water table to account for rising water level conditions (or seasonal fluctuations). For the purposes of the groundwater flow model recalibration, LL1 and LL2 are grouped with the area between EW6 and EW7 and are collectively referred to as the OU1 RAO on-post area. However, in the contaminant fate and transport section (**Section 7.2**), the load lines are evaluated separately from the rest of the on-post area to determine the amount of mass reduction in the OU1 RAO Load Line Treatment Areas as a result of the 2016 subsurface injection activities.

The groundwater flow model was recalibrated using the August 2016 site-wide water level measurement round. The recalibrated flow model was used to predict the extraction well 25-year time-of-travel capture zones and to verify that EW7 was maintaining hydraulic containment and plume capture. The result of the recalibration is presented in **Section 7.1.5**. Following the groundwater flow model recalibration, the model was used in conjunction with MT3DMS (see **Section 7.2**) to estimate RDX and TNT mass in the OU1 RAO Load Line Treatment Area and in the on-post explosives plume between EW6 and EW7. Performance of the subsurface injection activities was evaluated by calculating percent RDX and TNT mass reduction between the 2015 and 2016 groundwater monitoring events.

7.1.3 Modeling Assumptions

The assumptions for the groundwater flow modeling effort included the following:

- General MODFLOW model code assumptions (listed in Groundwater Flow and Contaminant Fate and Transport Modeling, Cornhusker Army Ammunition Plant, Grand Island, Nebraska [URS 2001]), which include single calculated head values within each individual cell, completely efficient wells/sinks/sources, and uniformly porous aquifer materials.
- Only steady state groundwater flow conditions were modeled. It was assumed that steady state conditions would be achieved relatively quickly.
- Irrigation well pumping was not included in the groundwater flow model simulations. Historical contaminant migration data and plume geometry indicate irrigation wells have not significantly impacted the groundwater flow over time.
- Constant head boundary conditions and general head boundary (GHB) conditions, set along edges of the active model domain, would not significantly influence model results in the local areas of interest.
- Only nonreactive, advective particle transport was simulated by MODPATH.

7.1.4 Model Setup and Input Parameters

A single, multi-layered flow model was used to simulate groundwater flow in the unconfined water table aquifer at CHAAP. The finite-difference grid, model boundary conditions, and hydrogeologic input parameters are described below.

7.1.4.1 Finite-Difference Grid

The finite-difference grid was not changed from the refinements made during the 2015 modeling: small grid spacing in the on-post area to allow for a more detailed portrayal of RDX and TNT concentrations in the MT3DMS contaminant fate and transport model.

7.1.4.2 Model Boundary Conditions

Constant head boundary conditions representing the regional groundwater flow regime influence on local conditions were set along the southwestern and northeastern edges of the model. Constant head boundaries were estimated based on actual water level measurements and were adjusted during the groundwater flow model recalibration. Placement and use of the constant head boundaries followed the same method used in the 2015 version of the model (BW-URS 2017).

GHBs were adjusted along the northwestern and southeastern model borders when the groundwater flow model was recalibrated. The GHBs represent hydrogeologic conditions outside the model boundaries that potentially affect the groundwater flow within the model.

7.1.4.3 Hydrogeologic Input Parameters

Each node of each layer in the model was defined with site-specific hydrogeologic parameters. Model input values were based on geologic and hydrogeologic characteristics of the units, published values typical for each unit, aquifer pumping tests, aquifer slug tests (Dames and Moore 1995) and model calibration, sensitivity analysis, and verification. A full description of the hydrogeologic model input parameters is presented in Groundwater Flow and Contaminant Fate and Transport Modeling, Cornhusker Army Ammunition Plant, Grand Island, Nebraska (URS 2001). These parameters were not changed in the current version of the model except for the following:

- **Horizontal Hydraulic Gradient (*i*).** Average hydraulic gradients were simulated for the alluvial aquifer by varying hydrogeologic parameters, constant head boundary conditions, and GHB conditions. Hydraulic gradients were adjusted for the flow model recalibration using the August 2016 water levels. A potentiometric surface map generated from water levels observed during August 2016 is presented in **Appendix F** as **Figure F-1**.
- **Extraction Well Pumping Rates (*Q*).** The pumping rate for EW7 was updated based on the capture zone evaluation (See **Section 7.1.6**). The 25-year time-of-travel advective particle flowpaths and the 2016 capture zone are presented as **Figure F-2**.

7.1.5 Groundwater Flow Calibrations

The groundwater flow model was calibrated to the August 2016 water levels. Calibration was achieved by changing the model input values previously discussed. Changes included increasing the constant head boundary conditions, adjusting the existing GHBs, adding additional GHBs, and adjusting the pumping rate of the active extraction well. The constant head boundaries and GHB were systematically varied until a best calibration was achieved.

7.1.5.1 Calibrated Groundwater Flow Configuration

The August 2016 water table is shown on **Figure F-1**. In general, groundwater flow direction, hydraulic gradient, and hydraulic head closely matched the interpreted data.

The major sources of calibration error in the model were related to the areas of undefined geology and hydrogeology in the northeast part of the model domain. However, this area was a relatively small portion of the model, several miles from the extraction well system, and did not significantly affect the overall model results. The final aquifer parameter values were set in these areas such that the model results would closely match their respective water level inputs. Conversely, the geologic profile and hydrogeologic parameters around the extraction wells have been fully defined based on several years of investigation and monitoring. Each year, new data are generated and incorporated into the model to better predict groundwater flow conditions and contaminant fate and transport.

7.1.5.2 Calibration Statistics for the August 2016 Water Level Event

The model was calibrated to water levels measured in 77 monitoring wells and piezometers during the August 2016 groundwater monitoring event. The calculated differences between baseline model-estimated water levels and observed water levels are presented in **Table F-1**. A summary of the calibration statistics calculated for each flow regime (i.e., on-post, off-post, and City of Grand Island) is shown in **Table F-2**. The mean absolute differences between observed hydraulic heads and simulated hydraulic heads in each flow regime were as follows:

- On-Post Area: 0.313 foot
- Off-Post Area: 0.06 foot
- City of Grand Island: 0.004 foot
- Overall Model: 0.126 foot

Calibration statistics indicated the recalibrated flow model portrayed the hydrogeologic setting at CHAAP sufficiently to satisfy the data quality objectives of this project. The normalized root mean square was 1.558 percent (the goal was below 5 percent), and the correlation coefficient was 0.998 (a value of 1.0 indicates perfect correlation) between the observed and model-calculated data points.

Average model calibration residuals within 5 percent of the total head variation were considered adequate, given the 38.37-foot head variant across the model area. The calibrated model head residual value for the overall model was 0.328 percent of the total head change, indicating statistically excellent model calibration.

7.1.6 Model-Predicted Capture Zones

The groundwater flow model was calibrated to observed conditions at CHAAP in August 2016, and the 25-year time-of-travel capture zone for EW7 was generated. The August 2016 capture zone was used to verify EW7 continues to provide hydraulic containment of the on-post explosives plume.

As in 2015, the August 2016 CHAAP groundwater recalibrated flow model was used to prepare multiple capture zones using various pumping rates at EW7, including the approximate average 2016 pumping rate of 450 gpm (shown on **Figure F-2**) and reduced pumping rates of 400 gpm, 350 gpm, 300 gpm, and 250 gpm (shown in **Figure F-3**). Each capture zone pathline is subdivided into 25 1-year time-of-travel segments, banded by tick marks. A comparison between these capture zones and the August 2016 horizontal extent of RDX and TNT >2 µg/L verified that a pumping rate minimum of 300 gpm would provide adequate capture of LL1 and the proximity of EW7 while allowing upgradient explosives concentrations at LL2 (also addressed during 2016 subsurface injection activities) to naturally attenuate. Following the 2016 groundwater flow recalibration, recommendations to reduce the EW7 pumping rate to 300 gpm, were provided to CHAAP Project team during the November 2, 2016, annual Project Managers' meeting on-site. Upon stakeholder approval, documented here in this 2016 Annual Report, the EW7 pumping rate will be reduced to 300 gpm.

The EW7 capture zone was also verified previously using two delineation methods, one for a confined aquifer (Todd 1980) and one for an unconfined aquifer (Grubb 1993). Both methods verified that EW7 is maintaining plume capture. Because the pumping rate at EW7 (prior to August 2016) and the solution assumptions have remained largely unchanged since the previous verification in July 2009, the capture zone solutions were not presented in this report. The two solutions are presented in the 2009 OU1 RAO Subsurface Injection Report (BW-URS 2010).

7.2 GROUNDWATER CONTAMINANT FATE AND TRANSPORT MODEL EVALUATION

The objectives of the numerical contaminant fate and transport evaluation were to:

- Estimate the reduction of RDX and TNT mass in the OU1 RAO Treatment Area created by the combined effects of the subsurface injections, extraction well pumping, and natural degradation processes. These mass estimations were used to determine percent mass reduction in the OU1 RAO Treatment Area between August 2015 and August 2016.
- Estimate the reduction of RDX and TNT mass in the OU1 on-post explosives plume between EW6 and EW7 utilizing the additional February 2016 pre-injection groundwater investigation results. These mass estimations were used to determine percent mass reduction in the OU1 on-post explosive plume between August 2015 and August 2016.
- Evaluate the short-term changes (August 2015 to August 2016) in the distribution of the on-post RDX and TNT plumes.

- Evaluate the long-term changes (>20 years) in the distribution of the on-post RDX and TNT, and predict site remediation time frames (see **Section 7.2.6**).

In the short-term evaluations, percent mass reduction estimates for RDX and TNT were made by comparing the August 2015 sampling event conditions and the August 2016 groundwater monitoring event conditions, which includes both the pre-injection groundwater investigation sampling (February) and the annual groundwater monitoring (August) events. Input parameters for each condition were updated using current contaminant concentrations.

Long-term evaluations were completed to predict contaminant fate and transport over time and to estimate long-term percent mass reduction for RDX and TNT. The long-term evaluations were based on current (August 2016) contaminant concentrations, past and current contaminant fate and transport conditions, and current remedial actions (pump and treatment, and subsurface injection).

The approach, methods, and assumptions used to estimate RDX and TNT mass at CHAAP are discussed in the following sections. A more detailed description of the original construction of the fate and transport model is presented in Groundwater Flow and Contaminant Fate and Transport Modeling, Cornhusker Army Ammunition Plant, Grand Island, Nebraska (URS 2001).

7.2.1 Contaminant Fate and Transport Modeling Approach and Methods

Contaminant fate and transport of explosives was simulated using MT3DMS (Zheng and Wang 1999), a three-dimensional, block-centered, finite-difference, numerical transport model. MT3DMS retrieves the hydraulic heads, flow terms, and source sink terms from the MODFLOW groundwater flow model results and calculates chemical concentrations over time. The MT3DMS models were constructed using VMODFLOW. VMODFLOW is a pre- and post-processor and does not affect results generated by running MT3DMS.

The contaminant fate and transport model was used to calculate RDX and TNT mass present at the time of the August 2015 and August 2016 groundwater monitoring events. As previously stated, the August 2016 monitoring data include both the pre-injection groundwater sampling (February) and the annual groundwater monitoring (August) events. Additionally, a conservative estimation for the August 2016 plume concentrations was interpreted for areas with pre-injection sampling data (i.e. February 2016), which were targeted during injection activities (April 2016), but had no proximal (or follow-up) post-injection sampling data. At these locations, the pre- and post-injection concentrations were assumed to be the same. Based on this methodology, results from the fate and transport model overestimate the mass of RDX and TNT in portions of the aquifer in August 2016 and underestimate the mass of RDX and TNT removed from the aquifer between August 2015 and August 2016.

The results generated using the August 2015 model served as the baseline model. A new version of the model was created using the August 2016 groundwater monitoring data. To compare RDX and TNT mass, two versions of the same model were developed. One version represented TNT and RDX concentrations at the time of the August 2015 monitoring event. The other represented TNT and RDX concentrations at the time of the August 2016 monitoring event. The same model grid dimensions, groundwater configurations, and flow parameters used in the groundwater flow model were used in both versions of the transport model.

To obtain the long-term mass estimates, the August 2016 version of the model was set to run for 25 years. Degradation rates observed from 2007 to 2016 were used in the long-term scenario to predict future explosives degradation rates over time.

7.2.2 Modeling Assumptions

MT3DMS uses chemical characteristic input values to calculate contaminant dispersion and degradation and MODFLOW output to calculate advection (i.e., transport). MT3DMS accounts for the effects of sorption/desorption, dispersion, and natural degradation (biotic and abiotic) or other chemical reactions that can be simulated with a first-order decay rate term for the removal of a chemical from the modeled system. The model cannot simulate more complicated chemical reactions, such as precipitation/dissolution based on changing local conditions, the rate of exhaustion of bionutrients based on variable uptake by indigenous microorganisms, or the transformation of a chemical into a degradation by-product.

In general, modeling assumptions followed those presented in Groundwater Flow and Contaminant Fate and Transport Modeling, Cornhusker Army Ammunition Plant, Grand Island, Nebraska (URS 2001). Key assumptions for this modeling effort included the following:

- The steady-state MODFLOW model assumptions, setup, and results are appropriate for the contaminant transport model.
- Irrigation well pumping was not included in the groundwater contaminant fate and transport modeling simulations. Historical contaminant migration data and plume geometry indicate irrigation wells have not significantly impacted contaminant migration patterns over time and would not affect the contaminant mass estimates.
- Dissolved RDX and TNT concentrations measured from the August 2016 groundwater monitoring event were used to interpret isoconcentration maps. These isoconcentration maps were used as model input concentrations.
- Current dissolved concentrations near the source areas at LL1 and LL2 were used as the initial values for residual source concentrations.
- RDX and TNT are subject to adsorption, dispersion, and biodegradation approximated with first-order decay rates as they are transported through the saturated zone.

7.2.3 Contaminant Fate and Transport Model Setup and Input Parameters

The CHAAP contaminant transport model was constructed using the same overall model setup as the MODFLOW groundwater flow model. The groundwater flow components were described in **Section 7.1**. The chemical specific input parameters, which were modified from the previous version of this model, are discussed below.

7.2.3.1 Initial Target Compound Concentrations

Initial RDX and TNT concentrations were entered into VMODFLOW to reflect the August 2015 and August 2016 contaminant concentrations at CHAAP. Initial concentrations were based on the actual RDX and TNT concentrations, as presented in **Section 5**. The August 2015 annual groundwater monitoring event results were used for the August 2015 fate and transport model. The February 2016 pre-injection groundwater investigation results and the August 2016 annual groundwater monitoring event results were used for the August 2016 fate and transport model to better simulate the current site conditions. As discussed in **Section 5**, the February 2016 pre-injection investigation results indicated that RDX and TNT concentrations between EW6 and EW7 were lower than previously interpreted. Further discussion on the 2015 to 2016 mass comparison is provided in **Section 7.2.5**. **Figures F-4** through **F-7** show the August 2015 model input concentrations (for comparison purposes) and August 2016 model input concentrations for RDX and TNT.

Groundwater sampling results indicated that RDX and TNT contamination was present only within the top 15 to 20 feet of groundwater in the OU1 RAO on-post plume area. To simulate this environment, model layers 1 and 2 (out of 3) were assigned the RDX and TNT initial concentrations shown on **Figures F-4** through **F-7**. Layer 3, which represents the bottom 13 feet of the aquifer at CHAAP, was not assigned RDX and TNT initial concentrations (i.e., initial concentrations were input with a value of zero).

Once the initial August 2016 RDX and TNT concentrations were entered into model layers 1 and 2, the model was run to determine the amount of mass and mass reduction in the entire OU1 RAO on-post plume area. To separately evaluate the two on-post areas (OU1 RAO Load Line Treatment Area and OU1 on-post plume area between EW6 and EW7), new, duplicate versions of the models were created. In these new versions of the model, the OU1 RAO on-post plume area between EW6 and EW7 was selected as an active transport zone and allowed to run. Using this modeling technique, it was possible to calculate the amount of mass and mass reduction in just the OU1 RAO Load Line Treatment Area.

7.2.3.2 Residual Source Concentrations

Residual source concentrations are residual sources of contamination that do not move and slowly degrade during the model's run-time. At CHAAP, these locations represent areas where RDX and TNT continue to add contaminant mass to the aquifer (i.e., residual source areas). Based on groundwater contaminant concentration trends near and downgradient of the former melt/pour buildings and PEEWCs at LL1 and LL2, it was interpreted that residual sources remained just to the east of the former locations of these features, and at various locations at LL1. Based on direct push groundwater vertical profile sampling completed in 2007 through 2016, it was interpreted that the residual sources were in the top 10 to 15 feet of the subsurface, and during periods of lower water levels (i.e., more than 15 feet bgs), the residual sources slowly leach into the groundwater through precipitation. It was also interpreted that during the periods of higher water levels (i.e., between 5 and 15 feet bgs), the residual sources came into contact with the groundwater, causing more rapid dissolution and desorption of explosives. The residual source concentrations used in the 2015 version of the model (BW-URS 2017) were adjusted because the 2016 groundwater monitoring events improved source location and concentration data. These new locations and concentrations more accurately represented the site conditions at CHAAP at the time of the 2016 groundwater monitoring events. Based on historic concentrations in the source areas, the residual source concentrations in the model were assigned half-life values of 1.0 years for RDX and TNT if they were in an active injection treatment zone; otherwise they were assigned a half-life of 2.0 year. **Figure F-8** shows the values and locations of the residual source concentrations. **Table F-3** summarizes the values used for each residual source concentration.

7.2.3.3 Contaminant Transport Model Input Parameters

MT3DMS requires the user to define the contaminant model (e.g., RDX and TNT) with a number of site-specific and chemical-specific input parameters and to make some simplifying assumptions based on existing site information. Contaminant fate and transport input values are summarized in **Table F-3** and in Groundwater Flow and Contaminant Fate and Transport Modeling, Cornhusker Army Ammunition Plan, Grand Island, Nebraska (URS 2001). The model input parameters were based on the hydrogeologic characteristics of the model layers, site chemical and geotechnical analyses, and estimates of chemical characteristics from recent literature values. The following input parameters were altered from the previous version of the model:

- **Time (*t*).** MT3DMS used the steady-state, time-independent flow field generated by MODFLOW to simulate contaminant fate and transport over time. For the short-term evaluations, each model was run under steady-state conditions for 1 day to obtain estimated RDX and TNT masses. For the long-term evaluation, the August 2016 model was run under steady state flow conditions for 25 years to obtain estimated RDX and TNT masses over time.
- **Biodegradation Half-life ($t_{1/2}$).** Historical concentration data were used to establish contaminant reduction trends and estimate biodegradation half-lives (URSGWCFS 1999). The methods of Graves (1995) and Buscheck and Alcantar (1995) were used to establish a range of estimated half-lives for RDX and TNT.
  - **Natural Attenuation Half-life.** In the 2007 through 2015 contaminant fate and transport models, assigned half-life values for RDX and TNT were 7.3 and 5.7 years, respectively. Data collected in recent years from the OU1 RAO on-post plume area not impacted by recent subsurface injections indicated that the assigned half-life values were appropriate and therefore, these half-life values were not adjusted in the 2016 contaminant fate and transport model.

- **Treatment Zone Half-life.** To simulate the 2016 treatment zones, representative sections of the model correlating to the injection zone locations were assigned reduced half-life values of 0.12 and 0.19 year for RDX and TNT, respectively. The half-life values were calculated from concentrations (August 2015 versus August 2016) measured at 2016 monitoring locations close to the 2015 injection transects (e.g., 10 feet downgradient). Additionally, locations downgradient from the injection zone were assigned reduced half-life values of 0.92 to 5.85 years for RDX and 0.86 to 2.88 years for TNT. The downgradient half-life values were calculated from historical concentration data collected at downgradient monitoring locations where injections occurred between 2007 and 2015. **Figure F-9** shows the locations of the 2016 treatment zones (including downgradient locations) entered into the model as well as previous (2014 and 2015) treatment zones with half-life values. Treatment zones injected prior to 2014 were set to natural attenuation in the 2016 model, because their effectiveness is likely significantly diminished. This conservative approach was selected, however, it is likely that the residual effects of subsurface injections completed prior to 2014 remain and will help future injections rapidly reestablish highly anaerobic treatment zones in those areas. **Table F-3** presents the half-life values used for the 2016 treatment zones.
- **Feedlot Half-life.** To better simulate the actual aquifer conditions underlying the downgradient feedlot area, half-life values of 3.6 years for RDX and 2.4 years for TNT were assigned to the footprint of the feedlot in all three layers of the 2016 model (see **Figure F-9**).

7.2.4 2016 Contaminant Fate and Transport Model Calibration and Limitations

The contaminant fate and transport model setup and input parameters were calibrated to accurately simulate the extent of the current explosives plume. This effort included qualitative model calibration and understanding the limitations of the model predictions.

7.2.4.1 Contaminant Fate and Transport Model Calibration

The 2016 contaminant fate and transport model was calibrated to August 2016 conditions using real, field-observed values from the August 2016 groundwater monitoring event. The model was then allowed to run for 1 day to reach equilibrium. Model-generated concentration maps for each contaminant were compared to real-world data for accuracy.

7.2.4.2 Contaminant Fate and Transport Model Limitations

Limitations of the contaminant fate and transport model are directly related to the model assumptions presented earlier in this section and in **Appendix F**. These limitations included a single concentration value within each cell, equilibrium-controlled sorption/desorption, and irreversible linear decay rates. The model input parameters are provided in **Table F-3**. The largest limitations for the CHAAP site were:

- Residual source concentrations and dissolved explosive decay rates were estimated model input parameters and not model-calculated over time as the natural attenuation capacity of the aquifer (e.g., assimilative capacity) changed.
- Target explosives calibration was limited to interpreted plumes based on the August 2016 monitoring data and historic trends.

These limitations were compensated for by:

- Conservative mass input at the residual source concentration areas (i.e., likely overestimating mass)
- Conservative initial RDX and TNT concentrations (i.e., likely overestimating mass)
- Chemical- and location-specific degradation rates

7.2.5 2016 Modeling Results / 2015 and 2016 Mass Comparisons

The August 2015 to August 2016 explosives mass estimations and percent reduction for the OU1 RAO Load Line Treatment Areas, the area between EW6 and EW7, and the total area are provided in **Table 7-1**. As discussed in **Section 7.2.1**, based on the methodology used, the fate and transport model likely overestimates the RDX and TNT mass remaining in the aquifer in August 2016 and underestimates the percent RDX and TNT mass reduction between August 2015 and August 2016.

Representative estimates of the explosives mass in the OU1 RAO Load Line Treatment Area at the time of August 2015 monitoring event were 1.6 pounds of RDX and 2.8 pounds of TNT. Representative estimates of the explosives mass at the time of the August 2016 monitoring event were 1.04 pounds of RDX and 2.1 pounds of TNT. This is approximately a 35.0-percent mass reduction of RDX, a 26.3-percent mass reduction of TNT and a 29.5-percent mass reduction of RDX+TNT.

By comparison, representative estimates of the August 2015 explosives mass in the on-post explosives plume between EW6 and EW7 were 2.4 pounds for RDX and 33.5 pounds for TNT. Representative estimates of the explosives mass at the time of the August 2016 sampling event in the same area were 0.76 pounds for RDX and 28.3 pounds for TNT. This is approximately a 68.3-percent mass reduction for RDX, a 15.5-percent mass reduction for TNT, and an 18.9-percent mass reduction for RDX+TNT. This lower percent reduction (relative to those reported in 2015) is due to the further refinement of the explosives plume using data gathered during the February 2016 pre-injection groundwater investigation sampling event. Concentrations were detected at lower levels than assumed before 2015, but the reduction between 2015 and 2016 was smaller than the reduction between 2014 and 2015. The previous high-concentration areas were interpreted to be an overly conservative assumption in the model and so have been modified.

Although a portion of the mass reduction in the injection zone treatment areas can be attributed to natural degradation and extraction well pumping, a majority of the reduction was a result of subsurface injection and bioremediation completed between 2007 and 2016.

7.2.6 Long-Term Modeling Results / Mass Estimations

Following model recalibration and completion of mass estimations, contaminant transport modeling was used to simulate the performance of the subsurface injection treatment zones installed in 2014 to 2016 and to predict long-term contaminant transport conditions. This modeling evaluation was completed with the MT3DMS contaminant fate and transport model. The contaminant fate and transport model was initially set to run for 2 years with treatment zones active and continuous pumping of EW7 at the recommended pumping rate of 300 gpm. In year 2, EW7 was set to inactive in the model (pumping set to 0 gpm) and the treatment zone effects were set to run one additional year (year 3). Based on the model-predicted results after year 3, the treatment zones were set to inactive in the model, EW7 remained off (0 gpm), and the model was run from year 4 to year 13. Contaminant fate and transport modeling simulations for RDX are shown on **Figures F-10** through **F-22**. Modeling simulations for TNT are shown on **Figures F-23** through **F-31**.

Under the above scenario, the model-predicted results indicated that there is no further off-post migration of RDX or TNT, and the on-post RDX and TNT concentrations are reduced to below the HALs in 13 and 9 years, respectively. These remediation times take into consideration no additional years of injections in the residual source areas. Based on August 2016 sampling results, the load line source area concentrations have significantly decreased as the result of subsurface injections.

These model-predicted results indicate that RDX and TNT will not further migrate off-post; therefore, the pump and treatment system may be discontinued around year 3. Shutdown of the pump and treatment system would be based on actual concentrations measured throughout the site and at EW7 over time. Prior to any operational change to the pump and treatment system, a formal document with details of the proposed pump and treatment system changes, and associated field sampling program, would be prepared for Stakeholders approval. Shutdown of the RAO would be followed by several years of groundwater monitoring and MNA for localized areas where explosives concentrations may still exceed the HALs. This generalized scenario coincides with the current CHAAP remediation exit strategy.

TABLE 7-1
EXPLOSIVES MASS ESTIMATIONS AND PERCENT REDUCTIONS
2016 ANNUAL REPORT

August 2015			
Explosives Parameter(s)	**Load Line Treatment Areas (mass in pounds)**	**Area Between EW6 and EW7 (mass in pounds)**	**Total Area (mass in pounds)**
RDX	1.6	2.4	4.0
TNT	2.8	33.5	36.3
RDX+TNT	4.4	35.9	40.3

August 2016					
Explosive Parameter(s)	**Load Line Treatment Areas (mass in pounds)**	**Area Between EW6 and EW7 (mass in pounds)**	**Total Area (mass in pounds)**	**Load Line Treatment Areas (percent reduction since 2015)**	**Area Between EW6 and EW7 (percent reduction since 2015)**
RDX	1.04	0.76	1.80	35.0%	68.3%
TNT	2.1	28.3	30.4	26.3%	15.5%
RDX+TNT	3.1	29.1	32.2	29.5%	18.9%

Notes:

The explosives mass was estimated using the CHAAP groundwater contaminant fate and transport model.

% = percent

CHAAP = Cornhusker Army Ammunition Plant

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

TNT = 2,4,6-trinitrotoluene

8.1 OU1 OFF-POST GROUNDWATER EXPLOSIVES PLUME INSTITUTIONAL CONTROLS

The revised remedy for OU1 was established in the ROD Amendment (URSGWCFS 2001b, dated August 2001 and signed by USEPA on September 26, 2001). The OU1 remedy included institutional controls and actions designed to help prevent exposure to contaminated groundwater until contaminant concentrations throughout the plume area are at or below the cleanup levels (HALs and MCLs) discussed in **Section 5** of this report. As discussed in **Section 5**, explosives concentrations in all off-post wells sampled in August 2016 are below the HALs; however, institutional controls were still reviewed in accordance with the OU1 ROD Amendment. The following sections state the off-post institutional controls and the 2016 review for each control. A summary of the 2016 institutional controls' effectiveness is included in **Table 8-1**.

8.1.1 City Ordinance Institutional Control/Action

The City of Grand Island established an "Overlay Zone" Ordinance that designates an institutional control area in which it is prohibited to drill drinking water supply wells into the explosives plume. Although all off-post explosives plume concentrations are below the HALs, the City of Grand Island continues to monitor and enforce the ordinance by denying plumbing permits to connect residences to private wells near the previous explosives plume. On August 2, 2016, a visual survey was completed of the land parcels near the historic off-post explosives plume (see **Figure 5-39**). The intent of the survey was to verify that no groundwater-impacting construction (e.g., construction requiring plumbing permits) was being completed. This survey was completed from the public right-of-way, and only minor utility work was observed. On October 19, 2016, the City of Grand Island Building Department was contacted, and it was confirmed that there are plumbing permit restrictions for private wells near the previous explosives plume and that no plumbing permits for private well hookups were issued in the past 12 months.

Additionally, upon approval of the Final 2016 Annual Report, the Building Department will be sent updated, georeferenced computer-aided drafting files and a copy of the off-site map with August 2016 concentrations. The Building Department has indicated that the map with current concentrations will be kept on file and will be used in the future to enforce the ordinance.

On January 5, 2006, the Central Platte Natural Resources District (CPNRD) put into effect a suspension on the drilling of new wells and the issuance of permits to construct new wells in Grand Island and surrounding areas (CPNRD 2013). The area covered by this suspension includes 6 to 8 miles along the Platte River throughout the CPNRD, which includes the CHAAP plume area. This suspension is for the installation of all wells including municipal, industrial, and irrigation wells and is still in effect.

8.1.2 Water Supply Institutional Control/Action

The City of Grand Island will continue to supply potable water to all residences in the plume area. On October 19, 2016, the City of Grand Island Building Department was contacted, and it was confirmed that all residences in the historic plume area are currently supplied with water from the City of Grand Island.

8.1.3 Hazard Communication Institutional Control/Action

The Grand Island Independent newspaper will be notified when the annual monitoring report is issued at the conclusion of each annual sampling round. The U.S. Army will issue press releases to the Grand Island Independent newspaper regarding plume locations, concentrations, and associated drinking water hazards when the annual report is completed.

8.2 OU1 ON-POST GROUNDWATER EXPLOSIVES PLUME INSTITUTIONAL CONTROLS

The following sections state the on-post institutional controls and the 2016 review for each control. A summary of the 2016 institutional controls' effectiveness is included in **Table 8-1**.

8.2.1 Deed Restrictions Institutional Control/Action

When property in the vicinity of the plume is excessed, the deed restrictions include: 1) restrictive covenants prohibiting drinking water supply well drilling in the plume vicinity until groundwater is cleaned up to HALs; 2) restrictive covenants prohibiting the use of the property for residential purposes; and 3) right-of-entry to the property by USACE (and their contractors) to perform environmental restoration work. During the August 2016 groundwater sampling event, it was confirmed that drinking water supply wells have not been drilled in the plume vicinity and that none of the excessed property is used for residential purposes.

8.2.2 Hall County Zoning Plan Institutional Control/Action

The Hall County Reuse Plan will enforce excessed CHAAP land designation for agricultural, recreational, and industrial zoning. The Hall County Reuse Plan is still in place and the excessed CHAAP land is being used for agricultural, recreational, and industrial purposes.

8.2.3 Well Drilling Prohibition Institutional Control/Action

Water supply well drilling is prohibited by the U.S. Army within 2,500 feet of the plume area. During the August 2016 groundwater sampling event, it was confirmed that water supply well drilling has not occurred in the plume area.

8.3 OU3 SHOP AREA INSTITUTIONAL CONTROLS

Institutional controls for OU3 were established in the ROD (USACE 1999, dated October 1999 and signed December 1999). The following section states the OU3 institutional controls and the 2016 review for the controls. A summary of the 2016 institutional controls' effectiveness is included in **Table 8-1**.

Deed Restrictions Institutional Control/Action

Deed restrictions have been placed on excessed property, which include prohibiting water supply well drilling and residential use of the property. During the August 2016 groundwater sampling event, it was confirmed that no water supply wells have been installed and the property is not used for residential purposes.

8.4 INSTITUTIONAL CONTROLS REVIEW SUMMARY

The institutional controls established in the OU1 ROD Amendment (URSGWCFS 2001b) for CHAAP are fully operative and effective. Additionally, the institutional controls listed for OU3 are being followed. It can therefore be stated that the overall objective of the institutional controls, to help prevent exposure to contaminated groundwater at CHAAP, has been achieved for 2016.

TABLE 8-1
SUMMARY OF INSTITUTIONAL CONTROLS: 2016 REVIEW
2016 ANNUAL REPORT

Area	August 2001 Institutional Controls Summary	August 2016 Effectiveness Review
OU1 Off-Post Plume		
	City Ordinance that prohibits drinking water supply well drilling in Overlay Zone. Ordinance is enforced through plumbing permits.	No plumbing permits for private well hookups in the Overlay Zone were issued by the City of Grand Island.
	City of Grand Island will continue to provide water supply to all residences in plume area.	The City of Grand Island supplied water to all residences in the plume area.
	Communicate plume locations, concentrations, and drinking water hazards to the public through press releases in the Grand Island Independent newspaper.	U.S. Army submitted press releases regarding plume locations, concentrations, and drinking water hazards to the local newspaper.
OU1 On-Post Plume		
	U.S. Army placed land restrictions on excessed property that:	Excessed land has not been used for residential purposes.
	- prohibit drinking water supply well drilling in plume vicinity	No drinking water supply wells have been drilled in the plume vicinity.
	- prohibit use of property for residential purposes	
	Hall County Reuse Plan designates/zones all excessed CHAAP property as agricultural and industrial use only.	Excessed CHAAP land is only used for agricultural and industrial purposes.
	Water supply well drilling is prohibited in the plume area on U.S. Army property.	Water supply wells have not been drilled in the plume area on U.S. Army property.
OU3 On-Post Area		
	U.S. Army placed land restrictions on excessed property that:	Excessed land has not been used for residential purposes.
	- prohibit drinking water supply well drilling in plume vicinity	No drinking water supply wells have been drilled in the plume vicinity.
	- prohibit use of property for residential purposes	

9.1 2016 CONCLUSIONS

9.1.1 Groundwater Treatment Facility

The GWTF operated effectively and reliably in 2016. The GWTF up-time for 2016 was 92.6 percent. A failed communications module in the EW7 well house control panel and the simultaneous failure of an identical communications module in the spare parts inventory was the biggest contributor to GWTF down-time, accounting for roughly 45.7 percent of the GWTF down-time for the year. Other sources of downtime include: routine carbon vessel backwash events (scheduled); monthly specific capacity measurements (scheduled); and power outages of varying duration (unscheduled).

While operational, the average GWTF pumping rate for the year was 447 gpm, with all flow originating from EW7. This flow is 99.3 percent of the target EW7 pumping rate (450 gpm). The total volume of groundwater pumped during the year was 217 million gallons.

The GAC treatment system operated effectively and reliably for the year, with all effluent explosives compound analytical results from the four quarterly GWTF effluent sampling events below the corresponding levels of detection. RDX concentrations in GWTF influent were below its HAL during all four quarterly sampling events. TNT concentrations in GWTF influent were above its HAL during all four quarterly sampling events, with 11 µg/L the highest influent TNT concentration detected. A lead GAC vessel change out event was not required during the year.

Groundwater elevations generally increased by approximately 0.3 foot in on-post wells, but declined by approximately 0.5 to 2.0 feet in wells located within the cone of depression for EW7. This decline is attributed to the effects of long-term pumping/dewatering at EW7. EW7 performance, in terms of specific capacity, continued a recent trend of producing less flow per foot of drawdown over time. The average EW7 specific capacity in 2016 (34.5 gpm per foot of drawdown) was 1.8 gpm per foot of drawdown less in 2016 than in 2015, which represents a 5-percent decline from the 2015 specific capacity value (36.3 gpm per foot of drawdown). Based on the continued decline in EW7 specific capacity over time, additional monitoring of groundwater elevations and EW7 performance is warranted. If, at some future time, it appears EW7 can no longer support the flow required to maintain hydraulic control, a replacement or supplemental extraction well may be required. Given the number and variety of rehabilitation events completed at EW7 in 2013 and 2014 and associated performance results, it is considered unlikely that additional rehabilitation efforts will be successful in obtaining significant improvements in EW7's specific capacity.

9.1.2 Subsurface Injection

Based on groundwater contaminant concentration trends near and downgradient from the former melt/pour buildings and PEEWCs at LL1 and LL2, it was previously interpreted that residual sources were present just to the east of these buildings. This interpretation was supported by the 2016 pre-injection groundwater investigation date and historic (2011 through 2014) groundwater investigations and performance monitoring data. The residual sources that were previously in the vadose zone have come in contact with the groundwater due to the recent (2007 to 2012) high groundwater level condition. However, following a period of water levels dropping approximately 4 to 6 feet (from 2012 to 2014) resulting in portions of the residual sources returning to the vadose zone, water levels have increased again by approximately 2 to 3 feet in 2015 to 2016. Although the recent increases in water levels observed in 2015 to 2016 are likely resulting in increases in RDX and TNT desorption/dissolution rates, significant decreases in explosives concentrations were observed in 2015 and 2016 during the increasing water levels. The majority of these plume concentration reductions were attributed to explosives degradation occurring within the subsurface injection treatment zones.

In April 2016, most injection points were completed in the presumed source areas at LL1 and at LL2. In these areas, closely spaced injection transects were installed throughout the interpreted vertical extent of explosives contamination directly within the source areas and immediately downgradient to treat source material within the subsurface. Additionally, injections were completed slightly above the water table to allow for continual treatment of the source areas during rising water level conditions (or as the water table fluctuates seasonally). Additional injection points were completed at a higher TNT concentration location at monitoring well G0093 in LL1, and at higher RDX concentration locations detected at monitoring wells G0084 and G0085, between LL1 and LL2. The 2016 subsurface injection design (orientation and placement of treatment zones, injection point spacing, lateral distribution of the injected amendment, volume of the amendment mixture injected per foot, injection thickness, and the type and percentage of amendment) maintained existing and created new effective treatment zones after only 3 to 4 months (August 2016 sampling event).

Based on August 2016 sampling data, the overall performance of Wesblend 66-10 was effective. The Wesblend 66-10 modified mixture that was used from 2010 to 2015 was used again in 2016. The 2016 Wesblend treatment zones are expected to last up to 24 months. In 2016, the aquifer within the load line primary source areas continues to show strong anaerobic reducing conditions (with some areas showing increasing reducing conditions), and explosives concentrations continue to decline, to below 2 µg/L (RDX and/or TNT) for the first time in 2016, in the primary source areas. Additionally, 2016 subsurface injection results show that anaerobic reducing conditions were established at several locations downgradient from the load line primary source areas, and explosive degradation is beginning to occur in these newly establish treatment zones.

Average ORP values and DO concentrations generally remained low at monitoring wells within the treatment zones, indicating an anaerobic and reducing environment has been established.

Denitrification of TNT and RDX has occurred in all treatment zones. Microbial degradation processes proceed in an order of preference based on the amount of energy yielded by the reaction. The preference, in decreasing order, is for denitrification, Fe^{3+} reduction, sulfate reduction, and methanogenesis (Bouwer 1994). Denitrification is the dominant in-situ biodegradation process for explosives degradation at CHAAP due to high nitrate concentrations, likely due to site-wide fertilizer applications and increased DOC concentrations from injected substrates. The other degradation processes also are occurring, but to a lesser extent.

9.1.3 OU1/OU3 Groundwater Monitoring

9.1.3.1 OU1 On- and Off-Post

The August 2016 groundwater sampling results indicate that RDX and TNT concentrations are above the HALs at on-post monitoring wells and piezometers in LL1, LL2, and at the facility eastern boundary (near EW7). No explosive concentrations were detected above HALs at LL3, LL4, LL5, or the Decant Station. Additionally, all off-post monitoring well locations sampled indicate no explosives concentrations were detected above the HALs in 2016, identical to the past two years.

At OU1 on-post locations, declining explosives concentration trends and RDX and TNT breakdown products being present indicate that explosives degradation is occurring. OU1 on-post explosives concentrations declining trends continue due to completed and in place on-post actions (i.e., soil removal, groundwater extraction, and subsurface injection) accounting for a majority of the overall mass reduction in groundwater. The February 2016 pre-injection groundwater investigation sampling successfully identified lower explosives concentrations at existing data gaps at LL1 and LL2, and between EW6 and EW7; however, the sampling also verified areas of higher explosive concentrations on-post at LL1 and LL2, facilitating 2016 subsurface injection activities completed in April.

At OU1 off-post locations, explosives concentration trends continue to decline and remain below HALs in 2016 due to natural attenuation processes (e.g., dispersion, biodegradation, and abiotic degradation), the on-post completed and in place actions (i.e., groundwater extraction), and the biodegradation of explosives occurring beneath and downgradient of the feedlot.

9.1.3.2 OU3 Shop Area

The August 2016 groundwater sampling results at one well (SHGW02) indicate VOC concentrations for compound 1,2-DCA (a breakdown product of 1,1,2-TCA) exceeded its MCL; however, all other compounds were below MCLs, including downgradient well SHGW03. 1,2-DCA was detected above its MCL in 2014 (at SHGW02), but degraded to below MCL in 2015. VOC concentrations have decreased over time and degradation products (i.e., 1,2-DCA) have been/are present. 1,1,2-TCA concentrations have remained below its MCL since 2010. VOC concentration declining trends from degradation are occurring due to anaerobic/reducing conditions being present.

9.1.3.3 Monitoring Well Installations and Abandonment

Following the February 2016 and August 2016 groundwater sampling data analysis, the 2016 monitoring well installation and abandonment field activities for the OU1 monitoring program were completed in November 2016. One monitoring well (G0121) was installed at LL2 and is added to the OU1 Annual Monitoring Program to provide a permanent annual sampling location to measure explosives plume concentrations and migration trends, and to help monitor the performance of subsurface injections completed in the vicinity of this new well. Additionally, two OU1 on-post wells (G0016 and G0028) that were removed from the monitoring program in 2013 were abandoned. Additional 2016 monitoring well installation and abandonment details are provided in the Final 2016 Monitoring Well Installation and Abandonment Technical Memorandum (**Appendix G**).

9.1.3.4 Monitoring Program Optimizations

Currently, 38 monitoring wells (three on-post and 35 off-post) that were removed from the OU1 sampling program in 2013, remain to be abandoned.

Following the August 2016 groundwater sampling results, three OU1 off-post monitoring wells (NW080, NW081R, and NW082R) are being recommended for removal of the OU1 monitoring program and to be abandoned. These three OU1 off-post wells have been below HALs for five years or longer. Monitoring well NW081R has been below HALs since 2012, and both NW080 and NW082R have been below HALs since 1997. Recommendations for removal from the program of the three OU1 off-post wells were presented during the CHAAP 2016 Annual Stakeholders Meeting (November 2, 2016).

Additionally in November 2016, one monitoring well (G0121) was installed at LL2 to provide an additional permanent annual sampling location to measure explosive concentrations and migration trends and to help monitor subsurface injection performance completed in the vicinity of this well. Monitoring well G0121 will be included in the OU1 Monitoring Program going forward. The OU1 2016 monitoring well installation and abandonment activities were also presented during the CHAAP 2016 Annual Stakeholders Meeting in November.

In August 2016, six OU3 Shop Area monitoring wells were sampled during the annual sampling event. Two wells (SHGW02 and SHGW03) are scheduled for annual sampling, while four wells (G0053, G0069, SAMW1, and SHGW04) are on a three-year sampling frequency (sampled in 2016). In 2016, SHGW02 had a detection of a VOC breakdown product (1,2-DCA) above its MCL, the only VOC detection above MCLs at OU3 Shop Area wells since 2014. Due to the VOC detection above MCL, the three-year sampling frequency is recommended to continue for the four Shop Area wells (next scheduled for sampling in 2019). Annual sampling is recommended for the remaining two OU3 Shop Area Wells (SHGW02 and SHGW03).

9.1.4 Groundwater Modeling

An estimated 29.5-percent reduction of RDX+TNT mass in the OU1 RAO Load Line Treatment Areas and 18.9-percent reduction of RDX+TNT mass between EW6 and EW7 was achieved between the August 2015 monitoring event and the August 2016 monitoring event (see **Table 7-1**). Mass reductions were calculated using computer-modeled results of the baseline (August 2015) and subsequent groundwater sampling events (February/August 2016).

Model-predicted results using current data indicate on-site remediation will be complete within 13 years; however, completing future subsurface injection treatment zones with additional plume refinement sampling activities would likely to further reduce this estimated site remediation timeframe. Model-predicted results also indicate GWTF operation may be discontinued after two years, with the remaining RDX and TNT concentrations reduced to below the HALs within the 13-year time frame cited previously through MNA. However, shutdown of the pump and treatment system will be based on actual concentrations and stakeholder approvals. This would be followed by several years of groundwater monitoring and MNA for localized areas where concentrations may still slightly exceed the HALs.

Based on the 2016 capture zone analysis, EW7 (pumping at 450 gpm) is maintaining hydraulic containment of the entire on-post explosives groundwater plume (RDX and/or TNT >2 µg/L). However, a pumping rate of 300 gpm will provide adequate capture of LL1 and the proximity of EW7 while allowing the upgradient plume at LL2 to naturally attenuate. Reducing the EW7 pumping rate to 300 gpm is being recommended within this report. The EW7 reduced pumping rate was presented during the CHAAP 2016 Annual Stakeholders Meeting (November 2, 2016). Upon Project Team approval, EW7 pumping rate will be reduced to 300 gpm.

9.2 2017 RECOMMENDATIONS

Recommendations for OU1 GWTF operations, OU1/OU3 annual groundwater monitoring, and reporting are based on data presented in this report. The following actions are recommended for 2017 at CHAAP:

9.2.1 Groundwater Treatment Facility

The following are recommended for the GWTF in 2017:

- Continue GWTF O&M and treatment system sampling in accordance with the O&M Manual, UFP-QAPP, and SSHP. Proposed GWTF treatment system sampling locations are provided in **Table 9-1**.
- Collect the necessary data and perform the necessary groundwater modeling to confirm hydraulic control of the explosives plume is maintained at the EW7 pumping rate of 450 gpm.
- Based on the results of the 2016 capture zone analysis (**Section 9.1.4**), reduce the EW7 pumping rate to 300 gpm. EW7 capture zone pathlines at a pumping rate of 300 gpm are shown on **Figures 9-1a**, **9-1b**, and **9-1c**. Once the pumping rate is reduced to 300 gpm, data from the first site-wide groundwater level measurement event completed after the change will be incorporated into the groundwater model to confirm hydraulic control is still achieved at the 300 gpm pumping rate.
- Continue to monitor EW7 performance. If it appears EW7 is approaching a point where it will no longer support the flow required to maintain hydraulic control of the dissolved on-post explosives plume, install a replacement or supplemental extraction well.
- Monitor the performance of the GAC treatment system, both in terms of removal efficiency and backwash frequency. Based on a carbon change-out event completed in May 2015 and the 20-month GWTF operational period between the previous GAC change-out event

(October 2013) and the May 2015 GAC change out event, a GAC change-out event may be required near the end of 2017. However, with declining RDX and TNT concentrations in the influent to the lead GAC vessel, along with reduced contaminant loading based on the proposed reduction in the EW7 pumping rate, a reduction in carbon consumption rates is anticipated. Consequently, based on contaminant loading alone, the next carbon change out event may extend beyond 2017. It is noted that the extended carbon bed life achieved with lower contaminant loading rates may lead to less effective backwash events over time and an increase in the backwash frequency as the useful GAC life extends into multiple years. In the event the backwash frequency reaches a point where the GWTF must be turned off to process backwash water, a lead GAC vessel carbon change out event will be scheduled at that time, even though from a treatment perspective the RDX and TNT concentrations in system effluent still conform with treatment objectives.

9.2.2 OU1/OU3 Groundwater Monitoring

9.2.2.1 OU1

Groundwater monitoring recommendations for OU1 are as follows:

- Continued annual site-wide groundwater level measurement event (OU1/OU3) from on- and off-post monitoring wells, piezometers, extraction wells, and observation wells (see **Table 9-2**).
- Continued annual monitoring of explosives concentrations and trends in 58 OU1 on-post monitoring wells and 16 piezometers to determine the effectiveness of the groundwater extraction and treatment system and the subsurface injection program (see **Table 9-3**). OU1 on-post monitoring wells and piezometers proposed for sampling in 2017 are shown on **Figures 9-1a**, **9-1b**, **9-1c**, and **9-2**.
- Continued annual monitoring of explosives concentrations and trends in 19 OU1 off-post monitoring wells (see **Table 9-3**). OU1 off-post monitoring wells proposed for sampling in 2017 are shown on **Figure 9-2**.
- Continued annual monitoring of natural attenuation trends in the on-post portion of the OU1 explosives plume to evaluate MNA parameters within subsurface injection treatment zones and monitor the effectiveness of the natural attenuation. As in 2015, laboratory MNA parameters will not be collected at OU1 off-post monitoring wells, due to the successful natural attenuation of explosives off-post (i.e., samples from all off-post monitoring wells demonstrating explosives concentrations have been below the HALs for three consecutive years) (see **Table 9-3**). Off-post monitoring wells will continue to be monitored for explosives concentrations only, to verify and document that rebound does not occur.

9.2.2.2 OU3

Groundwater monitoring recommendations for OU3 are as follows:

- Complete annual monitoring of VOC concentrations and trends at two OU3 Shop Area wells (see **Table 9-3**). OU3 Shop Area monitoring wells proposed for sampling in 2017 are shown on **Figure 9-3**.
- Complete annual monitoring of VOCs and MNA parameters, including analysis for methane, ethane, and ethene.
- Complete annual monitoring of TPH-DRO at one OU3 Shop Area well.

9.2.2.3 Proposed OU1/OU3 Groundwater Monitoring Schedule

The annual OU1/OU3 groundwater monitoring is scheduled to begin in March 2017. Private-property owners were contacted at least 1 week prior to OU1/OU3 groundwater monitoring activities beginning and advised of the 2017 field activity schedule. Once the field crew has mobilized to the site, an initial health and safety meeting will be completed. The Site Safety and Health Plan, Activity Hazard Analyses, and safety forms are provided within the 2017 UFP-QAPP Addendum (Trevet 2017).

9.2.3 Reporting

Reporting recommendations for 2017 are as follows:

- Describe GWTF O&M activities, including GWTF system sampling and results.
- Describe field activities completed in 2017 associated groundwater monitoring.
- Present the nature and extent of contamination and complete a natural attenuation evaluation.
- Recalibrate the groundwater flow and contaminant fate and transport model based on field measured water levels and explosives analytical results. Adjust RDX and TNT half-life input values and update constant concentrations within the LL1 and LL2 source areas based on the 2017 OU1/OU3 groundwater analytical data. These revisions to the model are expected to further affect the short-term model-predicted results and long-term site remediation time frames.
- Evaluate current EW7 pumping rate and verify the hydraulic control of explosives plume is being maintained, based on recalibration of the 2017 groundwater flow and contaminant fate and transport model.
- Evaluate and optimize OU1 GWTF and OU1/OU3 sampling programs and schedule.
- Complete an institutional controls review.
- Evaluate and provide recommendations for future activities (i.e., subsurface injections, monitoring program, well installations and abandonments, etc.).
- Use the recalibrated groundwater flow and contaminant fate and transport model to run multiple scenarios to predict the eventual shut down of EW7.

TABLE 9-1
2017 PROPOSED GWTF SAMPLING LOCATIONS
2016 ANNUAL REPORT

			Analytical Parameters									
			Explosives[1]				VOCs[2]		Metals[3]			
Sample ID	**Sample Description**	**Frequency[7]**	**HMX**	**RDX**	**Tetryl**	**TNT**	**Trichloroethylene**	**Trichlorotrifluoroethane**	**Selenium**	**pH[4]**	**TSS[5]**	**Field Duplicate Sample[6]**
SP-E1	GWTF Effluent	Quarterly	X	X	X	X	X	X	X	X		X
SP-S2	GAC System Influent	Quarterly	X	X	X	X	X	X		X	X	X
SP-S6	Between GAC Vessels	Quarterly	X	X	X	X						
SP-S8	GAC Effluent	Quarterly	X	X	X	X						
		GWTF Totals	**4**	**4**	**4**	**4**	**2**	**2**	**1**	**2**	**2**	**2**

Notes:

[1]Explosives laboratory analysis (SW846 Method SW8330A) completed on normal turnaround basis (21 days).

[2]VOC's laboratory analysis (SW846 Method SW8260B) completed on normal turnaround basis (21 days).

[3]Metals laboratory analysis (Method SW7740) completed on normal turnaround basis (21 days).

[4]pH laboratory analysis (Method SW150.1) completed on normal turnaround basis (21 days).

[5]TSS laboratory analysis (Method SW160.2) completed on normal turnaround basis (21 days).

[6] Field duplicate sample collected from SP-E1 analyzed for selenium only. Field duplicate sample collected from SP-S2 analyzed for all other parameters.

[7]Quarterly sampling frequency is twice the frequency required by the 2004 NPDES Permit (semi-annual).

GAC = granular activated carbon

GWTF = Groundwater Treatment Facility

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ID = identification number

MNX = mono-nitroso-RDX

NPDES = National Pollutant Discharge Elimination System

RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

TNT = 2,4,6-trinitrotoluene

TSS = total suspended solids

VOC = volatile organic compound

TABLE 9-2
2017 PROPOSED WATER LEVEL MEASUREMENT LOCATIONS, OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
OU1 Off-Post Monitoring Wells				
NW020	1898.51	15-25	1895.78	27.88
NW021	1898.76	37-42	1895.9	45.20
NW022	1898.68	59-64	1896.0	66.58
NW030	1890.41	10-20	1890.0	20.42
NW031	1890.65	32-37	1890.0	37.84
NW032	1890.40	57-62	1890.0	62.54
NW050	1887.20	10-20	NA	20.14
NW051	1887.38	30-35	NA	34.52
NW052	1886.77	55-60	NA	60.73
NW060	1889.18	10-20	NA	20.05
NW061	1888.80	40-45	NA	45.34
NW062	1888.97	58-63	NA	63.14
NW070	1884.77	10-20	NA	20.68
NW071	1884.59	55-60	NA	60.16
NW080	1885.28	8-18	1882.31	21.06
NW081R	1884.85	35-45	1882.08	47.75
NW082R	1884.86	46-56	1882.08	59.49
NW100	1883.37	10-20	NA	20.11
NW101	1883.55	35-40	NA	40.72
NW102	1883.46	55-60	NA	59.65
NW120	1877.31	10-20	NA	NA
NW121	1877.22	53-58	NA	57.44
NW122	1877.16	83-88	NA	87.38
NW130R	1871.09	8-18	NA	17.92
NW131R	1871.17	33-38	NA	38.22
NW132R	1871.33	52-57	NA	57.42
CA210	1888.15	5-15	NA	16.83
CA211	1888.22	30-40	NA	42.89
CA212	1888.17	54-64	NA	66.98
CA213	1888.07	77-87	NA	89.81
CA240	1885.83	5-15	NA	17.72
CA241	1885.23	27-37	NA	39.74
CA242	1885.65	51-61	NA	63.57
CA250	1877.21	5-15	NA	15.04
CA251	1877.25	30-40	NA	40.05
CA252	1877.14	48-58	NA	57.35
CA253	1881.77	74-84	NA	86.65
CA270	1871.06	5-15	NA	14.92
CA271	1870.30	28-38	NA	37.77
CA272	1870.29	46-56	NA	55.75
CA273	1871.24	73-83	NA	84.57
CA280	1878.22	7-17	NA	18.58
CA281	1878.23	31-41	NA	43.66
CA282	1877.91	54-64	NA	68.06
CA290R	1867.50	8-18	NA	18.29
CA291R	1867.49	27-37	NA	37.47
CA292R	1867.34	48-58	NA	56.98
CA310	1869.66	5-15	NA	17.49
CA311	1869.51	30-40	NA	42.23
CA312	1869.18	48-58	NA	60.2

TABLE 9-2
2017 PROPOSED WATER LEVEL MEASUREMENT LOCATIONS, OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
CA313	1868.94	73-83	NA	86.28
CA322	1867.07	47-57	NA	57.52
CA330	1866.15	8-18	NA	20.28
CA331	1866.12	29-34	NA	36.84
CA332	1866.31	44-54	NA	56.09
CA342	1864.43	45-55	NA	57.85
CA343	1864.30	70-80	NA	83.3
OU1 On-Post Monitoring Wells				
G0017	1910.60	16-31	1907.9	33.87
G0018	1906.26	18-33	1903.5	35.88
G0021	1900.64	19-34	1897.99	37.07
G0022	1899.16	18-33	1896.4	34.94
G0023	1901.71	19-34	1899.0	35.87
G0024	1896.00	16-31	1893.1	33.37
G0044	1918.95	11-26	NA	28.26
G0045	1910.10	45-55	1908.30	58.54
G0048	1900.80	6-16	1899.0	17.90
G0049	1901.28	46-56	1899.3	58.36
G0063	1910.75	3-18	1908.54	21.02
G0066R	1909.49	20-30	1907.5	32.36
G0067	1901.47	5-20	1899.6	22.49
G0070	1901.31	75-80	1898.8	82.73
G0075	1901.22	25-35	1899.2	37.73
G0076	1901.02	54-64	1898.9	65.29
G0077	1896.38	25-35	1893.9	37.69
G0078	1896.34	50-60	1894.1	62.85
G0079	1901.42	8-18	1899.0	19.61
G0080	1899.38	25-35	1896.8	37.80
G0081	1901.60	28-38	1899.1	41.30
G0082	1901.17	28-38	1898.7	41.05
G0083	1897.86	21-31	1895.4	33.47
G0084	1906.97	20-30	1904.6	32.88
G0085	1905.79	20-30	1903.5	32.98
G0086	1897.25	28-38	1895.8	40.25
G0087	1898.00	25-35	1895.7	37.51
G0088	1898.44	25-35	1896.0	37.42
G0089	1899.75	25-35	1897.3	37.96
G0090	1899.90	25-35	1897.3	37.84
G0091	1896.88	20-30	1894.8	31.88
G0092	1897.02	40-50	1894.7	52.80
G0093	1899.47	20-30	1897.14	32.11
G0094	1903.72	15-25	1901.47	27.48
G0095	1910.24	15-25	1908.6	27.07
G0096	1905.94	15-25	1903.3	27.94
G0097	1903.62	15-25	1901.1	27.79
G0098	1903.23	15-25	1900.6	27.83
G0099	1903.36	15-25	1900.7	27.44
G0100	1910.46	15-25	1907.8	27.84
G0101	1910.64	15-25	1907.9	27.92
G0102	1912.20	15-25	1908.91	28.16
G0103	1912.31	14-24	1908.92	28.23

TABLE 9-2
2017 PROPOSED WATER LEVEL MEASUREMENT LOCATIONS, OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
G0104	1911.55	15-25	1908.74	28.03
G0105	1911.41	15-25	1908.28	28.16
G0106	1912.15	15-25	1909.29	28.04
G0107	1911.38	15-25	1908.36	28.31
G0108	1902.84	15-25	1900.2	27.78
G0109	1901.24	15-25	1898.9	27.68
G0110	1901.91	15-25	1899.0	28.29
G0111	1911.94	15-25	1909.6	27.54
G0112	1901.06	15-25	1898.02	27.95
G0113	1903.06	15-25	1900.11	28.01
G0114	1901.92	15-25	1899.19	27.03
G0115	1908.41	20-30	1906.57	32.20
G0116	1904.19	20-30	1901.86	33.21
G0117	1905.50	20-30	1902.73	32.02
G0118	1901.28	15-25	1898.66	27.59
G0119	1909.16	20-30	1906.29	32.39
G0120	1904.91	20-30	1902.3	32.34
G0121	1909.10	20-30	1902.95	32.55
PZ001	1918.60	10-30	NA	32.89
PZ004	1916.69	10-30	NA	32.9
PZ005	1916.09	10-30	NA	32.91
PZ007	1909.49	10-30	1907.5	32.84
PZ009	1907.02	10-30	1904.9	32.88
PZ010	1907.31	10-30	1905.3	33.23
PZ011	1906.56	10-30	1904.9	32.80
PZ012	1906.92	10-30	1904.7	32.83
PZ013	1905.29	10-30	1902.3	32.87
PZ014	1905.21	10-30	1903.1	32.86
PZ015	1901.71	10-30	1899.6	32.84
PZ016	1901.62	10-30	1899.4	32.78
PZ017R	1895.17	10-30	1892.9	32.39
PZ018	1896.88	10-30	1894.7	31.92
PZ019	1901.30	10-30	1898.9	32.30
PZ020	1899.25	10-30	1897.0	32.35
EW7	1895.95	15-55	1894.0	NA
EW4-OW4A	1909.85	31-51	NA	52.93
EW4-OW4B	1910.11	31-51	NA	53.44
EW4-OW4C	1909.91	31-51	NA	53.20
EW5-OW5A	1907.88	29-59	NA	60.80
EW5-OW5B	1908.38	29-59	NA	60.99
EW5-OW5C	1908.11	29-59	NA	60.90
EW6-OW6A	1902.68	29-54	NA	55.96
EW6-OW6B	1902.70	29-54	NA	56.64
EW6-OW6C	1902.96	29-54	NA	56.71
EW7-OW7A	1896.19	25-50	NA	52.83
EW7-OW7B	1896.53	25-50	NA	52.25
EW7-OW7C	1894.48	25-50	NA	56.05

TABLE 9-2
2017 PROPOSED WATER LEVEL MEASUREMENT LOCATIONS, OU1/OU3
2016 ANNUAL REPORT

Groundwater Measurement Location	Top of Casing Elevation[1] (feet amsl)	Approximate Screened Interval (feet bgs)	Ground Elevation[1] (ft amsl)	Well Depth (ft btoc)
OU3 On-Post Monitoring Wells				
G0050	1902.29	NA	1900.6	25.24
G0051	1902.22	NA	1900.4	25.45
G0053	1902.88	NA	1901.1	25.08
G0069	1900.02	NA	1898.1	25.22
SAMW1	1899.91	NA	1899.91	22.17
SHGW02	1902.50	6-21	1902.5	24.18
SHGW03	1901.33	6-21	1901.33	23.72
SHGW04	1899.82	16-21	1899.82	23.02

Notes:

[1]Elevation datum based on National Geodetic Vertical Datum of 1929.

amsl = above mean sea level

bgs = below ground surface

btoc = below top of casing

ft = feet

ID = identification

NA = not available

OU = Operable Unit

PZ = piezometer

TABLE 9-3
2017 PROPOSED GROUNDWATER SAMPLING LOCATIONS, OU1/OU3 MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

Sample Location ID	Frequency	Screened Interval	Top of Casing Elevation (feet amsl)[1]	Approximate Sample Depth (feet btoc)	Approximate Sample Elevation (feet amsl)[1]	Analytical Parameters						
						Explosives[2]	VOCs[3]	TPH-DRO[4]	Laboratory MNA Parameters[5]	Field Water Quality Parameters[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]
OU1 Off-Post Monitoring Wells												
NW020	Annual	Top GI Fm.	1898.51	23	1875.5	X				X		
NW021	Annual	Mid GI Fm.	1898.76	43	1855.8	X				X	X	
NW022	Annual	Base GI Fm.	1898.68	63	1835.7	X				X		
CA270	Annual	Top GI Fm.	1871.06	10	1861.1	X				X		
CA271	Annual	Mid GI Fm.	1870.30	33	1837.3	X				X		
CA272	Annual	Base GI Fm.	1870.29	51	1819.3	X				X		
CA273	Annual	Top Holdrege Fm.	1871.24	78	1793.2	X				X		
CA290R	Annual	Top GI Fm.	1867.50	13	1854.5	X				X		
CA291R	Annual	Mid GI Fm.	1867.49	32	1835.5	X				X		
CA292R	Annual	Base GI Fm.	1867.34	53	1814.3	X				X		
CA310	Annual	Top GI Fm.	1869.66	13	1856.7	X				X		
CA311	Annual	Mid GI Fm.	1869.51	38	1831.5	X				X		
CA312	Annual	Base GI Fm.	1869.18	56	1813.2	X				X	X	
CA313	Annual	Top Holdrege Fm.	1868.94	81	1787.9	X				X		
CA330	Annual	Top GI Fm.	1866.15	16	1850.2	X				X		X
CA331	Annual	Mid GI Fm.	1866.12	35	1831.1	X				X		
CA332	Annual	Base GI Fm.	1866.31	52	1814.3	X				X		
CA342	Annual	Base GI Fm.	1864.43	53	1811.4	X				X		
CA343	Annual	Top Holdrege Fm.	1864.30	78	1786.3	X				X		
					OU1 Off-Post Totals	**19**	**0**	**0**	**0**	**19**	**2**	**1**
OU1 On-Post Monitoring Wells												
G0017	Annual	Top GI Fm.	1910.60	27	1883.6	X			X	X		
G0022	Annual	Top GI Fm.	1899.16	29	1870.2	X			X	X		
G0023	Annual	Top GI Fm.	1901.71	30	1871.7	X			X	X		
G0024	Annual	Top GI Fm.	1896.00	27	1869.0	X			X	X		
G0044	Annual	Top GI Fm.	1918.95	22	1897.0	X			X	X		
G0045	Annual	Base GI Fm.	1910.10	53	1857.1	X			X	X		
G0048	Annual	Top GI Fm.	1900.80	14	1886.8	X			X	X		
G0049	Annual	Base GI Fm.	1901.28	54	1847.3	X			X	X		
G0066R	Annual	Top GI Fm.	1909.49	28	1881.5	X			X	X		
G0067	Annual	Top GI Fm.	1901.47	16	1885.5	X			X	X		
G0070	Annual	Top Holdrege Fm.	1901.31	82	1819.3	X			X	X		X
G0075	Annual	Mid GI Fm.	1901.22	33	1868.2	X			X	X		
G0076	Annual	Base GI Fm.	1901.02	62	1839.0	X			X	X		

TABLE 9-3
2017 PROPOSED GROUNDWATER SAMPLING LOCATIONS, OU1/OU3 MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

Sample Location ID	Frequency	Screened Interval	Top of Casing Elevation (feet amsl)[1]	Approximate Sample Depth (feet btoc)	Approximate Sample Elevation (feet amsl)[1]	Analytical Parameters: Explosives[2]	VOCs[3]	TPH-DRO[4]	Laboratory MNA Parameters[5]	Field Water Quality Parameters[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]
G0077	Annual	Mid GI Fm.	1896.38	33	1863.4	X			X	X		
G0078	Annual	Base GI Fm.	1896.34	58	1838.3	X			X	X		
G0079	Annual	Top GI Fm.	1901.42	16	1885.4	X			X	X		
G0080	Annual	Mid GI Fm.	1899.38	33	1866.4	X			X	X		
G0081	Annual	Mid GI Fm.	1901.60	36	1865.6	X			X	X		
G0082	Annual	Mid GI Fm.	1901.17	36	1865.2	X			X	X		
G0083	Annual	Top GI Fm.	1897.86	29	1868.9	X			X	X		
G0084	Annual	Top GI Fm.	1906.97	28	1879.0	X			X	X		
G0085	Annual	Top GI Fm.	1905.79	28	1877.8	X			X	X	X	
G0086	Annual	Mid GI Fm.	1897.25	36	1861.3	X			X	X		
G0087	Annual	Mid GI Fm.	1898.00	33	1865.0	X			X	X		
G0088	Annual	Mid GI Fm.	1898.44	33	1865.4	X			X	X		
G0089	Annual	Mid GI Fm.	1899.75	33	1866.8	X			X	X		
G0090	Annual	Mid GI Fm.	1899.90	33	1866.9	X			X	X		
G0091	Annual	Top GI Fm.	1896.88	28	1868.9	X			X	X		
G0092	Annual	Mid GI Fm.	1897.02	48	1849.0	X			X	X		
G0093	Annual	Top GI Fm.	1899.47	28	1871.5	X			X	X		
G0094	Annual	Top GI Fm.	1903.72	23	1880.7	X			X	X		
G0095	Annual	Top GI Fm.	1910.24	23	1887.2	X			X	X		
G0096	Annual	Top GI Fm.	1905.94	23	1882.9	X			X	X		
G0097	Annual	Top GI Fm.	1903.62	23	1880.6	X			X	X		
G0098	Annual	Top GI Fm.	1903.23	23	1880.2	X			X	X		
G0099	Annual	Top GI Fm.	1903.36	23	1880.4	X			X	X		
G0100	Annual	Top GI Fm.	1910.46	23	1887.5	X			X	X		
G0101	Annual	Top GI Fm.	1910.64	23	1887.6	X			X	X		
G0102	Annual	Top GI Fm.	1912.20	23	1889.2	X			X	X		X
G0103	Annual	Top GI Fm.	1912.31	22	1890.3	X			X	X		
G0104	Annual	Top GI Fm.	1911.55	22	1889.6	X			X	X		
G0105	Annual	Top GI Fm.	1911.41	23	1888.4	X			X	X		
G0106	Annual	Top GI Fm.	1912.15	23	1889.2	X			X	X		
G0107	Annual	Top GI Fm.	1911.38	23	1888.4	X			X	X		
G0108	Annual	Top GI Fm.	1902.84	23	1879.8	X			X	X		
G0109	Annual	Top GI Fm.	1901.24	23	1878.2	X			X	X		
G0110	Annual	Top GI Fm.	1901.91	23	1878.9	X			X	X		
G0111	Annual	Top GI Fm.	1911.94	23	1888.9	X			X	X		

TABLE 9-3
2017 PROPOSED GROUNDWATER SAMPLING LOCATIONS, OU1/OU3 MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

Sample Location ID	Frequency	Screened Interval	Top of Casing Elevation (feet amsl)[1]	Approximate Sample Depth (feet btoc)	Approximate Sample Elevation (feet amsl)[1]	Analytical Parameters: Explosives[2]	VOCs[3]	TPH-DRO[4]	Laboratory MNA Parameters[5]	Field Water Quality Parameters[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]
G0112	Annual	Top GI Fm.	1901.60	23	1878.6	X			X	X		
G0113	Annual	Top GI Fm.	1903.06	23	1880.1	X			X	X		
G0114	Annual	Top GI Fm.	1901.92	23	1878.9	X			X	X		
G0115	Annual	Top GI Fm.	1908.41	28	1880.4	X			X	X		
G0116	Annual	Top GI Fm.	1904.19	28	1876.2	X			X	X		
G0117	Annual	Top GI Fm.	1905.50	28	1877.5	X			X	X		
G0118	Annual	Top GI Fm.	1901.28	22	1879.3	X			X	X		
G0119	Annual	Top GI Fm.	1909.16	27	1882.2	X			X	X		
G0120	Annual	Top GI Fm.	1904.91	27	1877.9	X			X	X		
G0121	Annual	Top GI Fm.	1909.10	27	1882.1	X			X	X		
PZ001	Annual	Top GI Fm.	1918.60	23	1895.6	X			X	X		X
PZ004	Annual	Top GI Fm.	1916.69	23	1893.7	X			X	X		
PZ005	Annual	Top GI Fm.	1916.09	23	1893.1	X			X	X		
PZ007	Annual	Top GI Fm.	1909.49	23	1886.5	X			X	X		X
PZ009	Annual	Top GI Fm.	1907.02	23	1884.0	X			X	X		
PZ010	Annual	Top GI Fm.	1907.31	23	1884.3	X			X	X		
PZ011	Annual	Top GI Fm.	1906.56	23	1883.6	X			X	X		
PZ012	Annual	Top GI Fm.	1906.92	23	1883.9	X			X	X		
PZ013	Annual	Top GI Fm.	1905.29	23	1882.3	X			X	X		
PZ014	Annual	Top GI Fm.	1905.21	23	1882.2	X			X	X		
PZ015	Annual	Top GI Fm.	1901.71	23	1878.7	X			X	X		
PZ016	Annual	Top GI Fm.	1901.62	23	1878.6	X			X	X		
PZ017R	Annual	Top GI Fm.	1895.17	23	1872.2	X			X	X	X	
PZ018	Annual	Top GI Fm.	1896.88	23	1873.9	X			X	X		
PZ019	Annual	Top GI Fm.	1901.30	23	1878.3	X			X	X		
PZ020	Annual	Top GI Fm.	1899.25	23	1876.3	X			X	X		
					OU1 On-Post Totals	**74**	**0**	**0**	**74**	**74**	**2**	**4**

TABLE 9-3
2017 PROPOSED GROUNDWATER SAMPLING LOCATIONS, OU1/OU3 MONITORING WELLS AND PIEZOMETERS
2016 ANNUAL REPORT

Sample Location ID	Frequency	Screened Interval	Top of Casing Elevation (feet amsl)[1]	Approximate Sample Depth (feet btoc)	Approximate Sample Elevation (feet amsl)[1]	Analytical Parameters						
						Explosives[2]	VOCs[3]	TPH-DRO[4]	Laboratory MNA Parameters[5]	Field Water Quality Parameters[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]
OU3 On-Post Monitoring Wells												
SHGW02	Annual	Top GI Fm.	1902.50	17	1885.5		X		X	X	X	
SHGW03	Annual	Top GI Fm.	1901.33	17	1884.3		X	X	X	X		
OU3 On-Post Totals						**0**	**2**	**1**	**2**	**2**	**1**	**0**
Overall Totals						**93**	**2**	**1**	**76**	**95**	**5**	**5**

Notes:

[1]Elevation datum based on National Geodetic Vertical Datum of 1929.

[2]Explosives (including MNX) laboratory analysis (SW846 Method 8330A) will be completed on normal turnaround basis (21 day).

[3]VOCs (including Freon 113) laboratory analysis (SW846 Method 8260B) will be completed on normal turnaround basis (21 day).

[4]TPH-DRO laboratory analysis (SW846 Method 8015) will be completed on normal turnaround basis (21 day).

[5]Laboratory MNA parameters for OU1 (on-post) include: methane (Method RSK 175), total Kjeldahl nitrogen (Method 351.2), nitrate/nitrite (Method 353.2), sulfate (Method 300.1), sulfide (Method 4500S-2F), ammonia (Method 350.1), dissolved organic carbon (Method 5310B), alkalinity (Method 2320B), and carbon dioxide (back calculated Method 2320B). Laboratory MNA parameters will not be collected at OU1 off-post locations. For OU3: methane, ethane, ethene (Method RSK 175), nitrate/nitrite (Method 353.2), sulfate (Method 300.1), and alkalinity (Method 2320B) only.

[6]Field water quality parameters include: dissolved oxygen, oxidation/reduction potential, ferrous iron, turbidity, specific conductance, pH, and temperature.

[7]Field duplicate samples will be collected at a rate of 5% (1 per 20 samples collected) for the full suite of laboratory parameters.

[8]MS/MSD samples will be collected at a rate of 5% (1 per 20 samples collected) for the full suite of laboratory parameters.

Laboratory analysis will be completed by TestAmerica, Inc., Denver, Colorado.

% = percent

amsl = above mean sea level

btoc = below top of casing

ID = identification number

MNX = mono-nitroso-RDX

MS/MSD = matrix spike/matrix spike duplicate

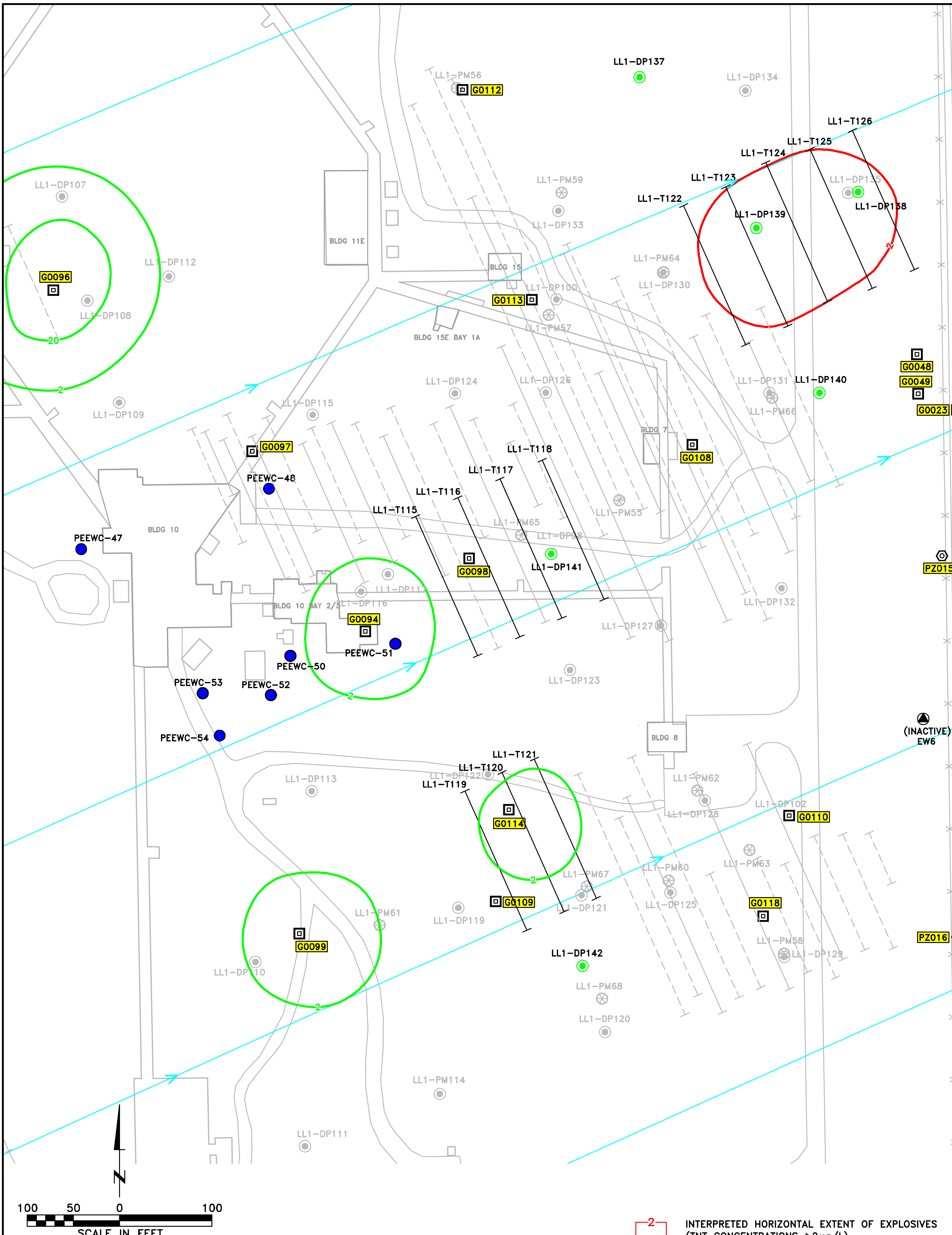
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine

RSK = Robert S. Kerr

TPH-DRO = total petroleum hydrocarbons-diesel range organics

VOC = volatile organic compound

13th STREET
COUNTY ROAD 24
ALDA ROAD
3rd AVENUE
NORTH 80th ROAD
SEE FIGURE 9-1c
SEE FIGURE 9-1b
EW4 (INACTIVE)
EW7 (ACTIVE)
G-130593
G-123999
INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20µg/L) FEBRUARY/AUGUST/NOVEMBER 2016
LEGEND
G0121 2017 OU1 GROUNDWATER SAMPLING LOCATIONS (MARCH)
2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
BLDG 14 FORMER SITE FEATURES
ADVECTIVE PARTICLE TRANSPORT FLOWPATH (EW7 AT 300 GPM)
FENCE
SURFACE DRAINAGE
EW3 (INACTIVE) EXTRACTION WELL
G0015 ON-POST GROUNDWATER MONITORING WELL
PZ007 ON-POST PIEZOMETER
LL1-DP137 2016 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (FEBRUARY)
EW7-DP35 2015 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH)
LL1-DP01 DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01 PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
ACTIVE IRRIGATION WELL
300 150 0 300
SCALE IN FEET
Bay West
Customer-Focused Environmental & Industrial Solutions
URS
PROPOSED 2017 WELL SAMPLING LOCATIONS MAP
LOAD LINE 1, LOAD LINE 2, AND BETWEEN EW6 AND EW7 (OU1)
CORNHUSKER ARMY AMMUNITION PLANT
DRN. BY: DPG
CHK'D. BY: CSA
DATE: 02/06/17
REVISION: 0
PROJECT NO. 16170837
FIG. NO. 9-1a
February 07, 2017 4:06:30 p.m.
Drawing: T:\CHAAP\16170837\27\9-1a.dwg



LEGEND

G0121	2017 OU1 GROUNDWATER SAMPLING LOCATIONS (MARCH)
	2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 300 GPM)
	FENCE
	SURFACE DRAINAGE
PEEWC-52	APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)
EW3 (INACTIVE)	EXTRACTION WELL
G0015	ON-POST GROUNDWATER MONITORING WELL
PZ007	ON-POST PIEZOMETER
LL1-DP137	2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION (FEBRUARY)
LL1-DP01	DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01	PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
2	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016
2	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016
20	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20μg/L) FEBRUARY/AUGUST/NOVEMBER 2016

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PROPOSED 2017 WELL SAMPLING LOCATIONS MAP
LOAD LINE 1 (OU1)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 02/06/17	PROJECT NO. 16170837	FIG. NO. 9-1b
CHK'D. BY: CSA	REVISION: 0		

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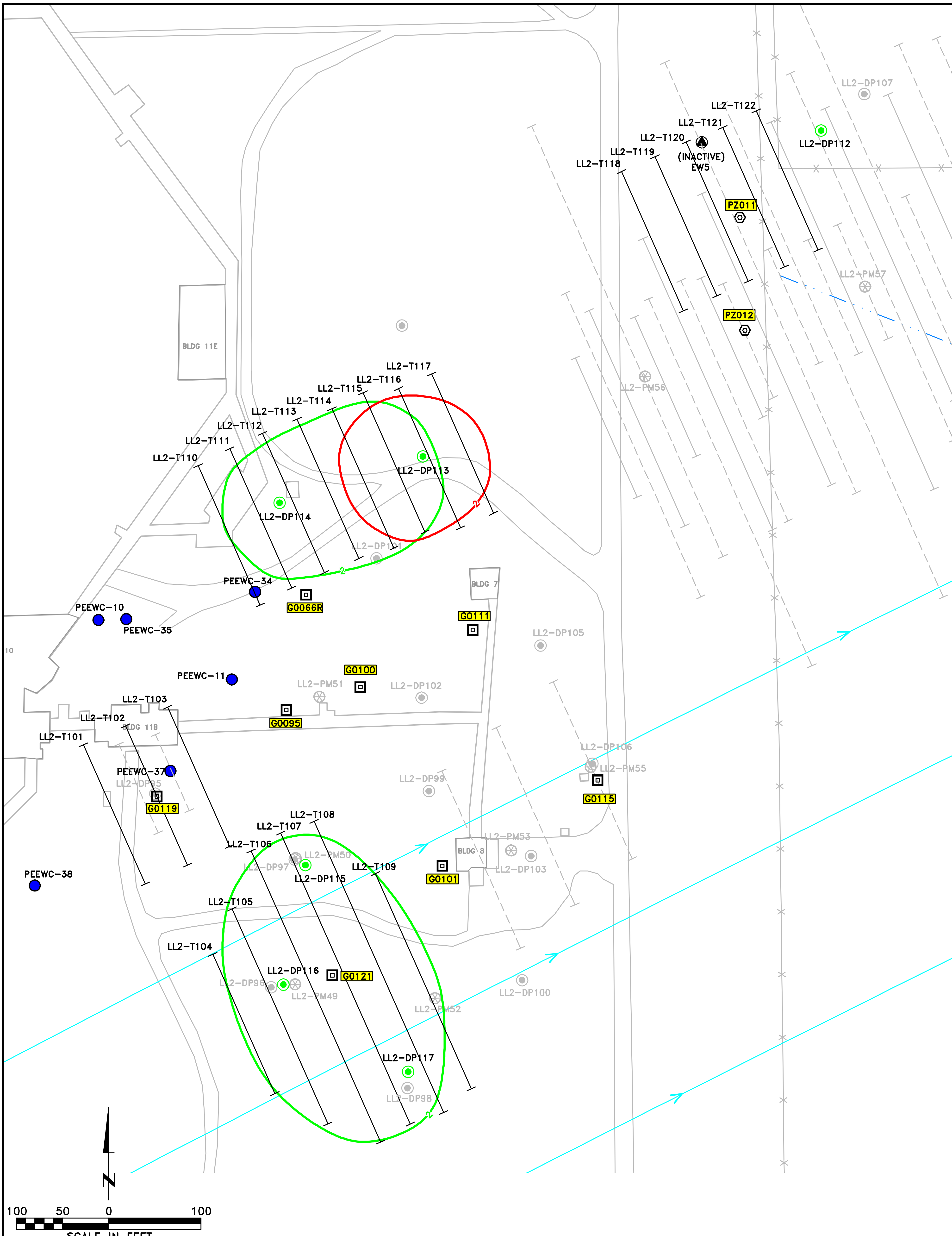

LEGEND

G0121	2017 OU1 GROUNDWATER SAMPLING LOCATIONS (MARCH)
	2016 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2015 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	2014 WESBLEND 66-10 TREATMENT WALL LOCATION (9.8% BY VOLUME)
	ADVECTIVE PARTICLE TRANSPORT FLOWPATH – (EW7 AT 300 GPM)
	FENCE
	SURFACE DRAINAGE
PEEWC-52	APPROXIMATE LOCATION OF PREVIOUSLY EXCAVATED EXPLOSIVES WASTEWATER CESSPOOLS (PEEWC) (ICF KA, 1996)
EW3 (INACTIVE)	EXTRACTION WELL
G0015	ON-POST GROUNDWATER MONITORING WELL
LL2-DP110	2016 DIRECT PUSH GROUNDWATER SAMPLE LOCATION (FEBRUARY)
PZ007	ON-POST PIEZOMETER
LL1-DP01	DIRECT PUSH GROUNDWATER SAMPLING LOCATION (MARCH 2013)
LL1-PM01	PERFORMANCE MONITORING LOCATION (MARCH, DECEMBER 2013)
2	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016
2	INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) FEBRUARY/AUGUST/NOVEMBER 2016

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PROPOSED 2017 WELL SAMPLING LOCATIONS MAP
LOAD LINE 2 (OU1)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 02/06/17	PROJECT NO.	FIG. NO.
CHK'D. BY: CSA	REVISION: 0	16170837	9-1c

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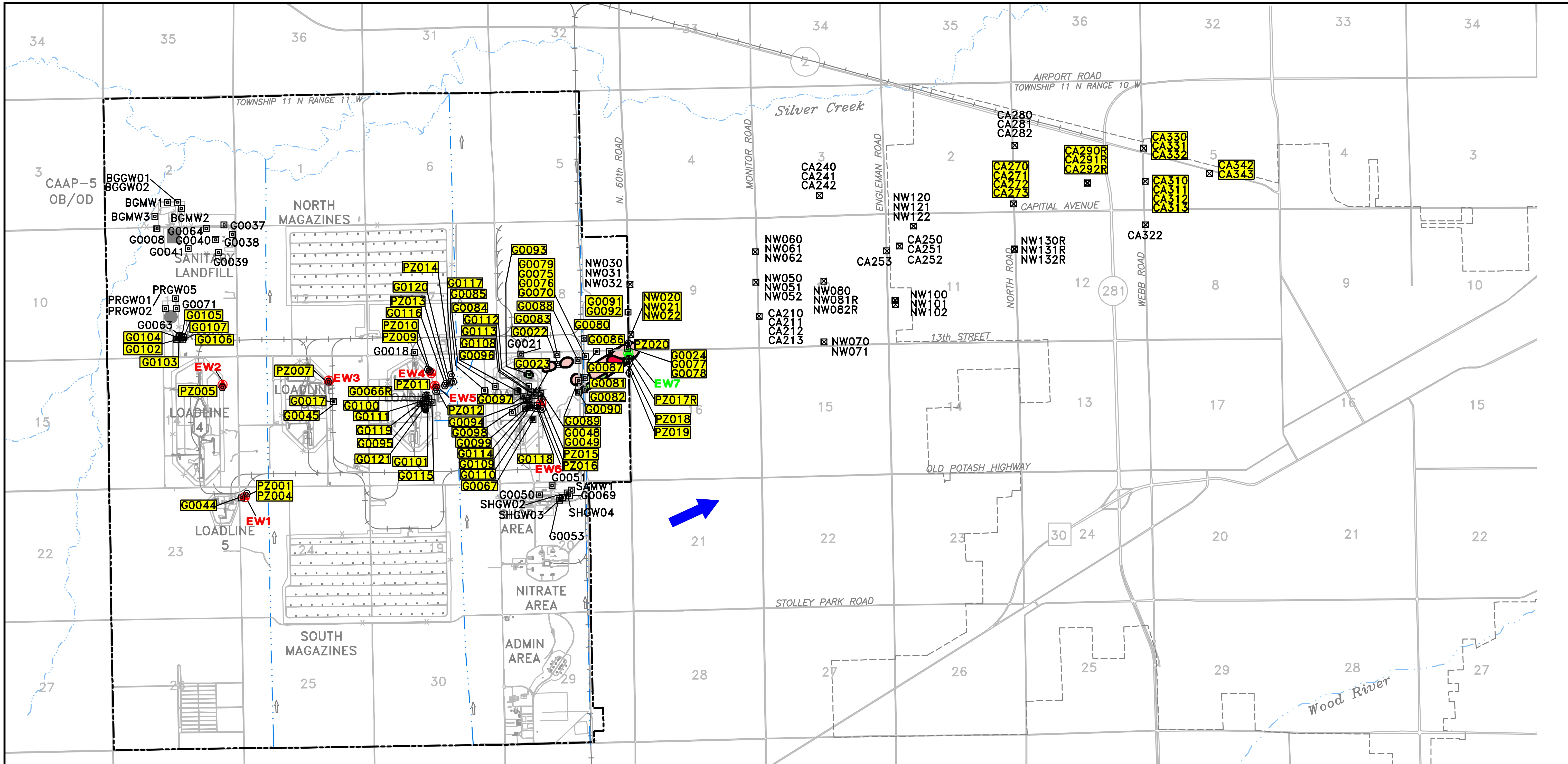

LEGEND:

- ON–POST GROUNDWATER MONITORING WELL
- OFF–POST GROUNDWATER MONITORING WELL
- ON–POST PIEZOMETER
- INACTIVE GROUNDWATER EXTRACTION WELL
- ACTIVE GROUNDWATER EXTRACTION WELL
- G0029 2017 OU1 GROUNDWATER SAMPLING LOCATIONS
- GENERAL GROUNDWATER FLOW DIRECTION

- ROADS
- FACILITY BOUNDARY
- GRAND ISLAND CITY LIMITS
- SURFACE DRAINAGE
- 281 STATE ROUTE
- 30 U.S. ROUTE

- 2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >2μg/L) AUGUST 2016
- 20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (TNT CONCENTRATIONS >20μg/L) AUGUST 2016
- 2 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >2μg/L) AUGUST 2016
- 20 INTERPRETED HORIZONTAL EXTENT OF EXPLOSIVES (RDX CONCENTRATIONS >20μg/L) AUGUST 2016

N

0 4000 8000
SCALE FEET

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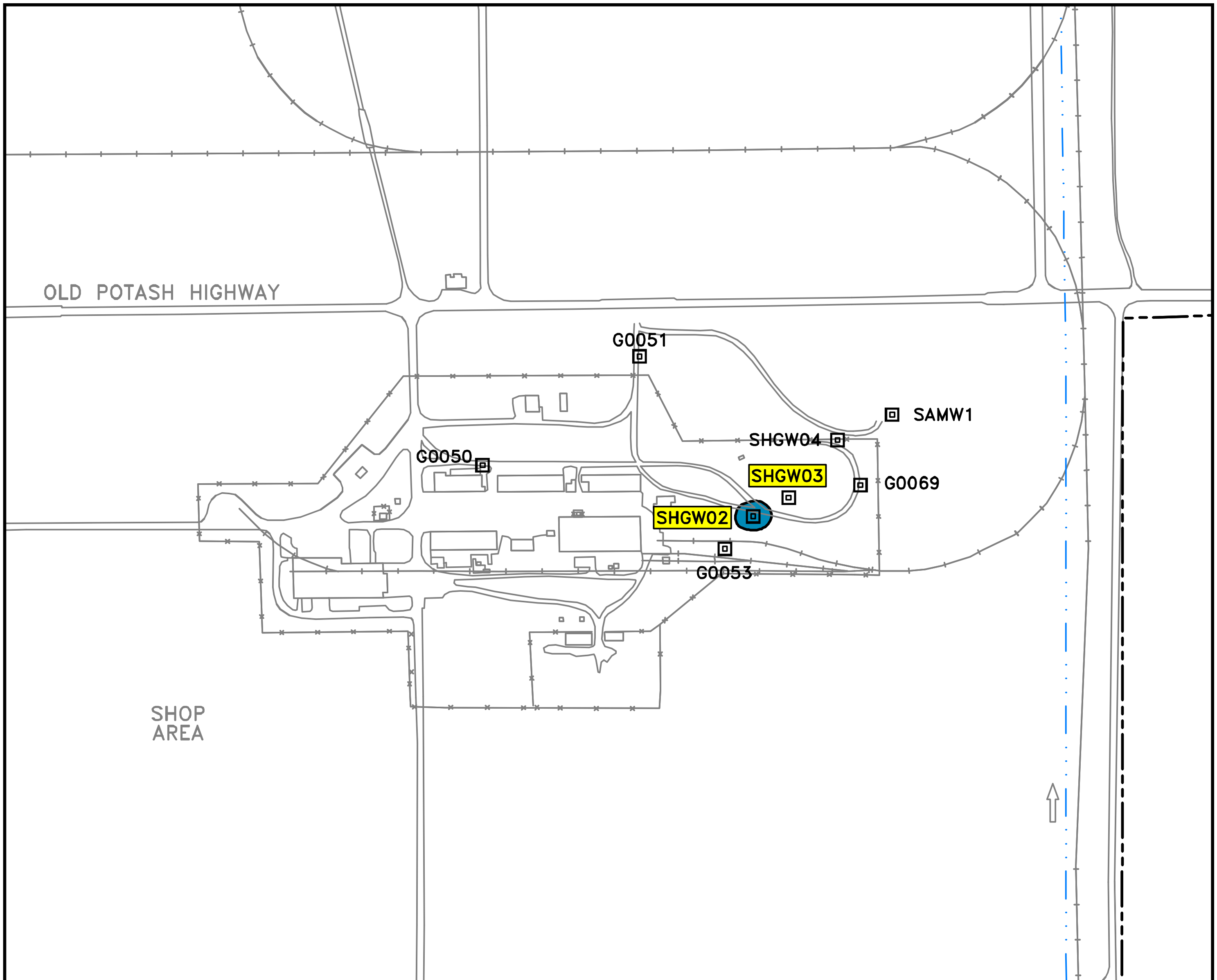
PROPOSED 2017 WELL SAMPLING LOCATIONS MAP
OFF–POST/ON–POST (OU1)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 2/2/17	PROJECT NO.	FIG. NO.
CHK'D. BY: DC	DATE: 2/2/17	16170837	9–2



LEGEND:

ON–POST GROUNDWATER MONITORING WELL

VOC CONCENTRATIONS > MCLs
(1,2–DCA MCL IS 5 µg/L) AUGUST 2016

SHGW02 2017 OU3 GROUNDWATER SAMPLING LOCATION

FACILITY BOUNDARY

DRAINAGE DITCH FLOW DIRECTION

1,2–DCA = 1,2–DICHLOROETHANE
MCL = MAXIMUM CONTAMINANT LEVEL
OU = OPERABLE UNIT
µg/L = MICROGRAMS PER LITER
VOC = VOLATILE ORGANIC COMPOUND

0 500 1000
SCALE FEET

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PROPOSED 2017 WELL SAMPLING LOCATIONS MAP
SHOP AREA (OU3)
CORNHUSKER ARMY AMMUNITION PLANT

DRN. BY: DPG	DATE: 2/2/17	PROJECT NO.	FIG. NO.
CHK'D. BY: RPC	DATE: 2/2/17	16170837	9–3

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