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Colonel Christopher J. King, USAF
Vice Commander
377th Air Base Wing
2000 Wyoming Blvd SE
Kirtland AFB NM 87117

GROUND WATER
MAY 07 2019
BUREAU

Michelle Hunter, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department (NMED)
1190 St. Francis Drive, Room N-2250
Santa Fe NM 87505

Dear Ms. Hunter

Attached please find Revision 1 of the *Standard Operating Procedure (SOP) for Cleaning and Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells* dated April 2019. This procedure has been revised to include mechanical cleaning, a second chemical for disinfection (also free chlorine releaser), and a request for cessation of the treatment-specific monitoring requirements based on five sampling events subsequent to the conditional approval from the New Mexico Environment Department Ground Water Quality Bureau August 6, 2018 and subsequent methods approval on November 16, 2018.

The conditional approval required collection of pre-treatment groundwater samples and post-treatment groundwater samples each disinfection event at each well to monitor background bromate, chlorite, and perchlorate levels in groundwater following a disinfection event. Sampling was performed on five well disinfection events in the fourth quarter of 2018 and the first quarter of 2019. Pre-treatment samples and post-treatment samples were analyzed for bromate and chlorite using Method E300.1 and perchlorate was analyzed using Method E331.0. Bromate and chlorite were not detected in any of the samples and perchlorate was detected at a maximum concentration of 1.2 micrograms per liter (µg/L), below the Project Screening Level of 14 µg/L. Groundwater from the Middle Rio Grande Basin has naturally occurring perchlorate concentrations of 0.12–1.8 µg/L. As there have been no impacts to groundwater documented from the disinfection events using sodium hypochlorite (free chlorine release) as the disinfection solution, this SOP does not recommend continuing pre- or post-disinfection samples.

If you have any questions or concerns, please contact Mr. Scott Clark at (505) 846-9017 or at scott.clark@us.af.mil or Mr. Sheen Kottkamp at (505) 846-7674 or at sheen.kottkamp.1@us.af.mil.

Sincerely

CHRISTOPHER J. KING, Colonel, USAF
Vice Commander

Attachment:
Standard Operating Procedure for Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells; Revision 1, April 2019; 2 Hard Copies/2 CDs

cc:
NMED (Pruett), letter

KAFB4219

NMED-OOTS (McQuillan), letter and CD
NMED HWB (Kieling), letter and CD
SAF-IEE (Lynnes), electronic only
AFCEC/CZ (Renaghan, Clark, Kottkamp), electronic only
USACE-ABQ District Office (Simpler, Phaneuf, Dreeland, Kunkel, Sanchez, Salazar), electronic only
Public Info Repository, Administrative Record/Information Repository (AR/IR) and File

Rec'd

Standard Operating Procedure for Cleaning and Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells

Revision 1
April 2019

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1 Groundwater Extraction and Treatment System Location
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TABLES

1 Mechanical Cleaning and Chemical Disinfection Methods
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4 Conveyance Line Specifications

ATTACHMENTS

A Sodium Hypochlorite Safety Data Sheet
B Wel-Chlor-*Plus* (Sodium Dichloroisocyanurate Dihydrate) Safety Data Sheet
C Extraction Well Construction Diagrams
D Monitoring Well Construction Information

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
0	3/13/2018	Created Standard Operating Procedure	K. McKeage	T. Curley, PE
1	2/20/2019	Updated for additional chemicals in rehabilitation	J. Livingston	D. Jercinovic, PG

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for performing well disinfection at the Kirtland Air Force Base (AFB) groundwater treatment system (GWTS) (Figure 1) and associated monitoring wells without dedicated pump systems (Figure 2). Currently, the GWTS has four extraction wells (KAFB-106228, KAFB-106233, KAFB-106234, and KAFB-106239), one injection well (KAFB-7; Figure 1) and 165 monitoring wells (Figure 2). Additional wells may be added to the project, and this SOP will apply to any newly added wells. Over time, the pumping efficiency of a well and/or the flow through the filter pack may decline due to bacterial growth and biofouling. Routine disinfection, or mechanical cleaning as needed, will assist in maintaining well efficiency.

A remediation well (extraction, injection, or monitoring) shall be mechanically cleaned (if needed) to remove any physical buildup such as iron or calcium deposits on the well screens, and biologic films present on well casing and screen surfaces. The mechanical cleaning process may consist of a combination of swabbing, bailing, surging, pumping, brushing, or jetting.

A remediation well shall be disinfected by providing the casing, screen, and surrounding filter pack around the well with a free chlorine residual of at least 50 milligrams per liter (mg/L), adequate mixing, and then removal from the well (American Water Works Association [AWWA], 2013). For injection wells, downhole equipment will require removal prior to disinfection in order to pump the well and remove the residual chlorine. The same standard describes the disinfection of existing gravel pack in wells not installed with equipment (monitoring wells) at a concentration not less than 100 mg/L free chlorine residual (AWWA, 2013). The following procedure has been prepared in accordance with the guidelines provided in the AWWA C654-13 Standards for Disinfection of Wells (AWWA, 2013) except where otherwise noted.

2. EQUIPMENT AND MATERIALS

The following equipment and materials may be required:

- Container able to hold the necessary amount of disinfection solution with the appropriate adapters and valves (a 250-gallon (gal) polyethylene tote equipped with a ball valve and adapter to fit 0.5-inch polyethylene tubing is recommended)

- City backflow preventer and permission to withdraw potable water from a nearby fire hydrant

- 3,000+-gal potable water truck equipped with adaptor to reach and fit the wellhead 1-inch polyvinyl chloride sounding drop pipe

- Tubing appropriate to the chosen container (600-foot (ft) length of 0.5-inch polyethylene tubing is appropriate for the recommended 250-gal polyethylene tote)

- 5-gal high-density polyethylene carboy with spigot adapted to fit a 0.5-inch polyethylene tube
- Field vehicle with the ability to elevate the container at least 3 ft above the top of the well
- Germicidal bleach (8.25 percent sodium hypochlorite solution) (Safety Data Sheet for appropriate material is provided in Attachment A)
- Wel-Chlor *Plus* (>90 percent sodium dichloroisocyanurate dihydrate) (Safety Data Sheet for appropriate material is provided in Attachment B; International Programme on Chemical Safety, February 2019).
- Potable water (from municipal/Base source)
- Field logbook
- Indelible ink pen
- Vault keys
- Camera
- Chlorine test paper strips (0-200 mg/L range; Advantec Chlorine Test Papers or equivalent)
- Chlorine colorimeter and reagents (0-2 mg/L; Hach Pocket Colorimeter II or equivalent)
- Well bailing or pumping equipment
- 21,000-gal tank (if needed for mechanical cleaning).

3. PROCEDURE

If a well requires disinfection or rehabilitation, different methods may be required to address well-specific issues. Table 1 provides a list of physical or chemical methods that are most effective for a given rehabilitation need, and the respective sections describing preparation and procedure.

Germicidal bleach and Wel-Chlor *Plus* should be alternated as the primary disinfectant solution as increasing bacterial resistance necessitates.

3.1 MECHANICAL CLEANING

Mechanical cleaning can be performed to remove any physical buildup such as iron or calcium deposits on the well screens. In addition, biologic films present on well casing and screen surfaces can be physically removed during the initial mechanical cleaning. The mechanical cleaning process may consist of a combination of swabbing, bailing, surging, pumping, brushing, or jetting. All water generated during this stage of well rehabilitation will be temporarily containerized in onsite storage tanks until it can be transferred to storage containers located on Kirtland AFB and subsequently sampled and analyzed for appropriate waste disposition.

3.2 DISINFECTION

If non-invasive biological cleaning is required, chemical disinfection is preferred. Note that the process presented below is general guidance and may be modified for this application based on actual conditions observed.

3.2.1 Calculating Static Well Volume

The locations of GWTS remediation wells are provided in Figure 1 and monitoring wells in Figure 2. Well construction information is provided in Attachment C. Prior to performing disinfection on any GWTS remediation well, the well shall be temporarily removed from service. Refer to the GWTS Operations and Maintenance Plan (U.S. Army Corps of Engineers [USACE], 2016, 2017, and 2018) or most current approved version for remediation well shutdown. Other remediation wells will continue to be in operation during the disinfection process.

1. Gauge the remediation well intended for disinfection.

2. Determine the static water volume by calculating the volume of static water in the well casing and filter pack (assuming that the filter pack occupies no volume) using the well construction information (Attachment C) and water level obtained in Step 1. One static water volume will be between approximately 800 and 1,400 gal. Exact static water volume can be calculated using the following equation:

   If the well screen is not submerged:

$$V_{well} = 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_b}{2}\right)^2(B-H)\right]$$
$$V_{well} = static\ water\ volume\ (gal)$$
$$d_b = borehole\ diameter\ (ft)$$
$$H = water\ level\ (ft\ bgs)$$
$$B = total\ depth\ (ft\ bgs)$$

If the well screen is submerged:

$$V_{well} = 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_b}{2}\right)^2(B-T)\right] + 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_c}{2}\right)^2(T-H)\right]$$

$V_{well} = static\ water\ volume\ (gal)$
$d_b = borehole\ diameter\ (ft)$
$d_c = casing\ diameter\ (ft)$
$H = water\ level\ (ft\ bgs)$
$B = total\ depth\ (ft\ bgs)$
$T = top\ of\ screen\ (ft\ bgs)$

3.2.2 Germicidal Bleach

Germicidal bleach (sodium hypochlorite) should be purchased at a concentration of 8.25 percent.

For the disinfection of one well, achieve the desired total free chlorine concentration down-well by mixing the appropriate amount of sodium hypochlorite, at a concentration of 8.25 percent, into one container filled with water, using the following equation. A down-well free chlorine concentration of 50 parts per million (ppm) is recommended. However, if a different concentration is required as the situation necessitates, the mixing concentration may be scaled linearly. A secondary container filled with water will be used to run the disinfection solution down the well to ensure well penetration. It is recommended, but not required, to use a 250-gal polyethylene tote as the container of choice.

$$V_T = V_{well} + (V_{cont})(2)$$

V_T = total volume that will dilute sodium hypochlorite (gal)
V_{well} = volume of well to be disinfected (gal, see Section 3.2.1).
V_{cont} = volume of container to hold solution (gal, 250 gal recommended).

$$V_{bleach} = \frac{(V_T)(C_{well})}{82{,}500\ \text{ppm}}$$

V_{bleach} = volume of bleach to add to the stock solution (gal)
V_T = total volume that will dilute sodium hypochlorite (gal)
C_{well} = desired down well concentration of free chlorine (ppm).

Pour an amount of 8.25 percent sodium hypochlorite solution, equal to V_{bleach}, into the first container, then fill full with water. Fill the second container full with water only. Test free chlorine concentration using chlorine test strips. Once the solution has been created, see Section 3.2.4 for procedures on general well disinfection.

With previous use of sodium hypochlorite as a well disinfectant, both pre- and post-disinfection sampling was performed in compliance with the New Mexico Environment Department

(NMED) Ground Water Quality Bureau approval letters (NMED, 2018a, 2018b) to monitor background bromate, chlorite, and perchlorate levels in groundwater following a disinfection event (Table 2). Bromate, chlorite, and perchlorate were not detected above the screening levels (Table 3) and therefore, it is recommended that sampling for these analytes be discontinued.

3.2.3 Wel-Chlor *Plus*

Wel-Chlor *Plus* is a well disinfectant and biofouling controller. Chemically, it is at least 90 percent sodium dichloroisocyanurate dihydrate, and is provided by Cotey Chemical Corporation®. According to Cotey Chemical Corporation®, "Wel-Chlor *Plus* is more effective at killing bacteria, more stable, has a superior shelf life, and is pH neutral" when compared to their original Wel-Chlor, which was primarily calcium hypochlorite (Cotey, February 2019).

Based on the pre- and post-treatment sample results (Table 3) documented for sodium hypochlorite, which releases free chlorine, sampling is not recommended for Wel-Chlor *Plus*, which is also a free chlorine releasing chemical.

A down-well concentration of 200 ppm of Wel-Chlor *Plus* is recommended by its producer, Cotey Chemical Company®. However, if a different concentration is required as the situation necessitates, the mixing concentration may be scaled linearly. To achieve the recommended concentration of 200 ppm of Wel-Chlor Plus down-well, mix the appropriate number of ounces of Wel-Chlor *Plus* with a container filled with water. Fill a secondary container with water to run the disinfection solution down-well. It is recommended, but not required, to use a 250-gal polyethylene tote as the container of choice.

$$V_T = V_{well} + (V_{cont})(2)$$

$V_T = total\ volume\ that\ will\ dilute\ sodium\ hypochlorite\ (gal)$
$V_{well} = volume\ of\ well\ to\ be\ disinfected\ (gal, see\ Section\ 3.2.1)$
$V_{cont} =$ volume of container to hold solution (gal, 250 gal recommended).

$$M_{WClP} = 0.05\ (\frac{\text{oz}}{\text{gal}})(V_T)$$

$M_{MClP} =$ mass of Wel-Chlor *Plus* to add to the stock solution (ounces [oz])
$V_T =$ total volume that will dilute Wel-Chlor *Plus* (gal)
NOTE: Cotey Chemical Company® recommends adding 5 oz of Wel-Chlor *Plus* per 100 gal of water in the well to achieve 200 ppm. Thus, 5 oz/100 gal, or 0.05 oz/gal. As the above equation can be seen as y=mx, the "slope" of 0.05 oz/gal can be increased or decreased, as the situation necessitates, to change the total concentration (ppm) of Wel-Chlor *Plus* down-well.

Add Wel-Chlor *Plus*, equal to M_{MClP}, into the first container, then fill full with water. Fill the second container full with water only. Test free chlorine concentration using chlorine test strips. Once the solution has been created, see Section 3.2.4 for procedures on general well disinfection.

3.2.4 Calculating Run-Time for Conveyance Line Disinfection

When disinfecting the conveyance lines from any of the four extraction wells concurrently while disinfecting the well itself, the well will need to be run, for a specific calculated time, after adding the disinfection solution down-well, to run the solution into the length of conveyance line and hold in place overnight (Section 3.2.5). Table 4 provides conveyance line specifications required to calculate operating run times require to fill the line with disinfection solution.

To calculate run-time for the conveyance line of each extraction well, follow the equation below:

$$t_{run} = V_{conveyance}/Q_{well}$$

t_{run} = total run-time to fill conveyance line (minuntes)
$V_{conveyance}$ = volume of conveyance line, calculated above (gal)
Q_{well} = volumetric flowrate of extraction well (gal per minute).

3.2.5 Disinfection Procedure for Extraction and Injection Wells

1. Prepare the tubing by measuring and marking the length to be deployed to have the bottom end of the tubing reach the bottom of the sounding drop pipe (Attachment C). Place the container into the bed of the field vehicle, and fill with disinfection solution, as discussed in Section 3.2.2 (sodium hypochlorite), or Section 3.2.3 (Wel-Chlor *Plus*). Potable water should be obtained from a nearby fire hydrant using an approved Albuquerque Bernalillo County Water Utility Authority backflow preventer and meter (ensure that the appropriate permits have been provided by Albuquerque Bernalillo County Water Utility Authority to utilize fire hydrant water) or brought from Kirtland AFB.

2. For extraction wells, remove the air relief valve overflow tubing connection from the sounding drop pipe, partially extract the well transducer so that it is suspended at least 50 ft above the water level, and lower the bottom end of the tubing down the well sounding drop pipe so that it deploys immediately below the drop tube. The tubing is not fully deployed to the bottom of the well screen as described in AWWA C654-13 due to concerns with tubing becoming caught on downhole equipment. If the well scheduled for disinfection is an injection well, ensure all downhole equipment has been removed, then lower the bottom end of the tubing down the well casing so that it deploys to the top of the well sump. Drain all of the disinfection solution from the first container into the well through the tube. Then move the tubing to the secondary container, and run all of the chasing water into the well.

3. After the addition of the disinfection solution down the tubing, ensure all wellhead openings have been adequately sealed before proceeding to the next step.

4. If the well scheduled for disinfection is an extraction well, and it is desired to disinfect its conveyance line, restart the well and let it run for the appropriate amount of time, depending on the well (see Section 3.2.4 for calculated run-times).

5. Leave the disinfectant down-well, without any further agitation, overnight (approximately 12 hours).

6. After approximately 12 hours of retention time have elapsed.

For extraction wells:

The extraction well will be restarted. Isolate the influent trains on the influent pipe tree and between the influent tanks. Refer to the GWTS Operations and Maintenance Plan (USACE, 2016) or most current approved version for extraction well startup. Monitor the influent of the isolated train treating water from the disinfected well. To determine the need to regulate the influx of the disinfected well's water if the concentration exceeds 2 mg/L, free chlorine concentration is measured through an in-line Hach CL17 Chlorine Analyzer located between the influent tank and the influent pump skid of Train 1 (if KAFB-106233 or KAFB-106234 is disinfected) or of Train 2 (if KAFB-106228 or KAFB-106239 is disinfected). To ensure that negligible concentrations of free chlorine exit the GWTS and run to the GCMP, free chlorine concentration is measured with a portable Hach Pocket Colorimeter II (or equivalent) at the sampling port of the effluent pump skid, of either Train 1 or Train 2.

Due to the catalytic nature of the sand filter media, minimal free chlorine is expected to pass through the sand filters and reach the granular activated carbon vessels; however, if concentrations exceeding 2 mg/L are detected at the sampling point immediately downstream of the sand filters, the extraction well will be shut down and water extracted from the well will be monitored and diverted to a holding tank upstream of the sand filters to preserve granular activated carbon life. Once the extraction well water free chlorine concentration has decreased below 2 mg/L entering the holding tank, the extraction well water discharge will be directed to the GWTS and the monitoring as mentioned above will be restarted. Bacteriological testing will not be performed as these wells are not intended for distribution as a drinking water supply. All well disinfection information will be recorded and reported in the appropriate quarterly monitoring report.

For injection wells:

The injection well will be bailed or pumped until free chlorine residual concentration in water removed from the well decreases to less than 0.4 mg/L, which is 10 percent of the National Primary Drinking Water Regulations 40 Code of Federal Regulations 141.54 Maximum residual disinfectant level goals for disinfectants (U.S. Environmental Protection Agency, 1998). All bailed or pumped water will be disposed of in accordance with federal and state wastewater requirements in accordance with waste profile information. Bacteriological testing will not be performed as these wells are not intended for distribution as a drinking water supply. All well disinfection information will be recorded and reported in the appropriate quarterly monitoring report.

3.2.6 Monitoring Well Disinfection

Monitoring well disinfection is performed following the steps outlined below:

1. Prepare the tubing by measuring and marking the length to be deployed to have the bottom end of the tubing reach the top of the sump and, when removed, the top of the screen using the well construction information (Attachment D) and the most current annual total depth measurements for the well. Place the container into the bed of the field vehicle.

2. Gauge the well that is intended for disinfection.

3. Determine the static water volume by calculating the volume of water in the submerged well casing and filter pack (assuming that the filter pack occupies no volume) using the well construction information (Attachment D) and water level obtained in Step 2. One static water volume will be between approximately 90 and 170 gal for reference elevation interval (REI) 4857, between 105 and 140 gal for REI 4838, and between 135 and 225 gal for REI 4814. Exact static water volume can be calculated using the following equation:

   If the well screen is not submerged:

$$V = 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_b}{2}\right)^2(B-H)\right]$$
$$V = static\ water\ volume\ (gal)$$
$$d_b = borehole\ diameter\ (ft)$$
$$H = water\ level\ (ft\ bgs)$$
$$B = total\ depth\ (ft\ bgs)$$

   If the well screen is submerged:

$$V = 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_b}{2}\right)^2(B-T)\right] + 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_c}{2}\right)^2(T-H)\right]$$
$$V = static\ water\ volume\ (gal)$$
$$d_b = borehole\ diameter\ (ft)$$
$$d_c = casing\ diameter\ (ft)$$
$$H = water\ level\ (ft\ bgs)$$
$$B = total\ depth\ (ft\ bgs)$$
$$T = top\ of\ screen\ (ft\ bgs)$$

4. Prepare the necessary concentration of disinfection solution based on the volume of the monitoring well to be disinfected (Sections 3.2.2 and 3.2.3).

5. Lower the bottom end of the tubing down the well casing so that it deploys to the top of the well sump. Affix the surface end of the tubing to the container containing the disinfection solution. Drain the disinfection solution from the tote into the well.

6. After the addition of the disinfection solution down the tubing, water in the well must be agitated to ensure even distribution of free chlorine throughout the entire water column and surrounding filter pack. Drain the second container containing only water into the well. Then disconnect all tubing from the well. Ensure all wellhead openings have been adequately sealed before proceeding to the next step.

7. The disinfectant is then left in the well without any agitation overnight (approximately 12 hours).

8. After approximately 12 hours of retention time have elapsed, the well will be bailed until free chlorine residual concentration in water bailed from the well decreases to less than 0.4 mg/L, which is 10 percent of the National Primary Drinking Water Regulations 40 Code of Federal Regulations 141.54 *Maximum residual disinfectant level goals for disinfectants* (U.S. Environmental Protection Agency, 1998). All bailed water will be collected and held pending approval to discharge to the GWTS or for offsite disposal. Bacteriological testing will not be performed as these wells are not intended for distribution as a drinking water supply. All well disinfection information will be recorded and reported in the appropriate quarterly monitoring report.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

Ensure the remediation well to be disinfected has been fully shut down prior to initiating the disinfection process. Concentrated disinfection solutions should be handled carefully utilizing the appropriate personal protective equipment. Review the appropriate sections of any relevant safety documentation (i.e., an Accident Prevention Plan) and any safety data sheets prior to initiating disinfection.

6. REFERENCES

American Water Works Association (AWWA). 2013. C654-13. *Standards for Disinfection of Wells.*

Cotey Chemical Corporation. 2019. Frequently Asked Questions. Available online at http://www.coteychemical.com/frequently-asked-questions/. Accessed February 25, 2019.

International Programme on Chemical Safety. Sodium Dichloroisocyanurate. Available online at http://www.inchem.org/documents/jecfa/jecmono/v52je21.htm.

New Mexico Environment Department (NMED). 2018a. Correspondence from Ms. Michelle Hunter, Chief, Ground Water Quality Bureau, New Mexico Environment Department to Colonel Dawn A. Nickell, Base Vice Commander, 377 AB/CC, Kirtland AFB, New Mexico *re: Conditional Approval of Standard Operating Procedure for Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells, DP-1839, Bulk Fuels Facility,* Solid Waste Management Unit ST-106/SS-11, Kirtland Air Force Base. August 6.

NMED. 2018b. Personal Communication (email) from Mr. Andrew Romero, Environmental Scientist, Ground Water Quality Bureau, New Mexico Environment Department to Ms. Kate Lynnes, HQE, Senior Advisor Bulk Fuels Facility Project, Kirtland AFB, New Mexico *re*: *Approval of Proposed Analytical Methods, DP-1839.* November 16.

Plummer, L.N., J.K. Bohlke, and M.W. Doughten. 2006. *Perchlorate in Pleistocene and Holocene Groundwater in North-Central New Mexico.* Environmental Science and Technology Vol. 40, pp. 1757-1763. February.

U.S. Army Corps of Engineers (USACE). 2016. Operations and Maintenance Plan, Groundwater Treatment System – Annual Update, Bulk Fuels Facility, SWMU ST-106/SS-111, Kirtland Air Force Base, New Mexico. Prepared by EA Engineering, Science, and Technology, Inc., PBC for the USACE–Albuquerque District under USACE Contract No. W912DR-12-D-0006. August.

USACE. 2017. *Operations and Maintenance Plan, Groundwater Treatment System, Bulk Fuels Facility, SWMU ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision 1.* Prepared by EA Engineering, Science, and Technology, Inc., PBC for the USACE–Albuquerque District under USACE Contract No. W912DR-12-D-0006. September.

USACE. 2018. *Operations and Maintenance Plan, Groundwater Treatment System, Bulk Fuels Facility, SWMU ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision 2.* Prepared by EA Engineering, Science, and Technology, Inc., PBC for the USACE–Albuquerque District under USACE Contract No. W912DR-12-D-0006. June.

U.S. Environmental Protection Agency. 1998. 40 CFR 141.54. *Maximum residual disinfectant level goals for disinfectants.*

FIGURES

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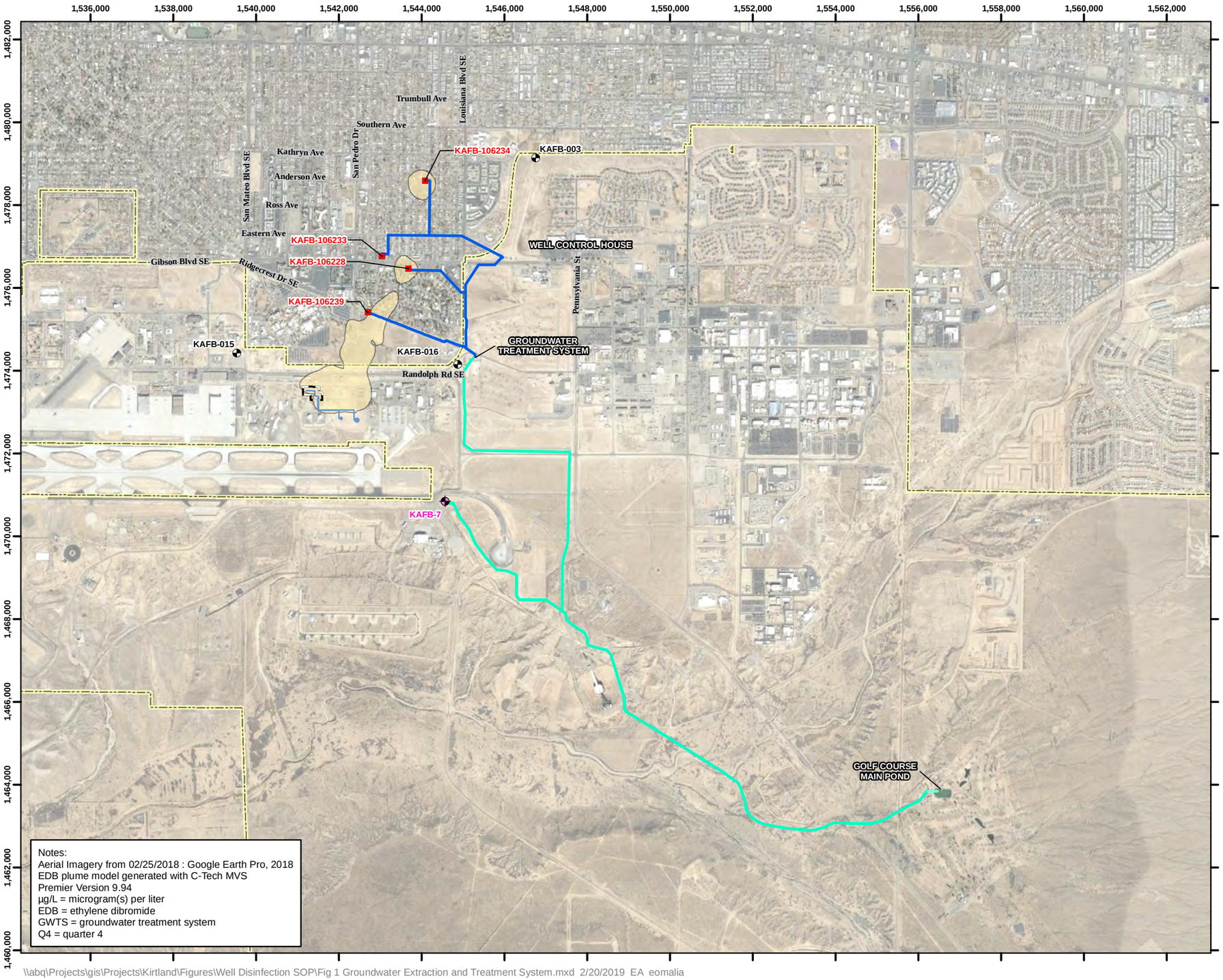
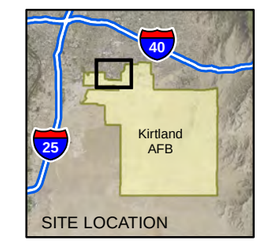


Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
EDB plume model generated with C-Tech MVS Premier Version 9.94
µg/L = microgram(s) per liter
EDB = ethylene dibromide
GWTS = groundwater treatment system
Q4 = quarter 4

Legend

- Extraction Well
- Injection Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Fuel Transfer Line
- GWTS Influent Piping
- GWTS Effluent Piping
- Installation Fence Boundary
- EDB Plume Q4 2018 (> 0.05 µg/L)
- Source Area



N

0 1,250 2,500 5,000

Feet

1 inch = 2,500 feet

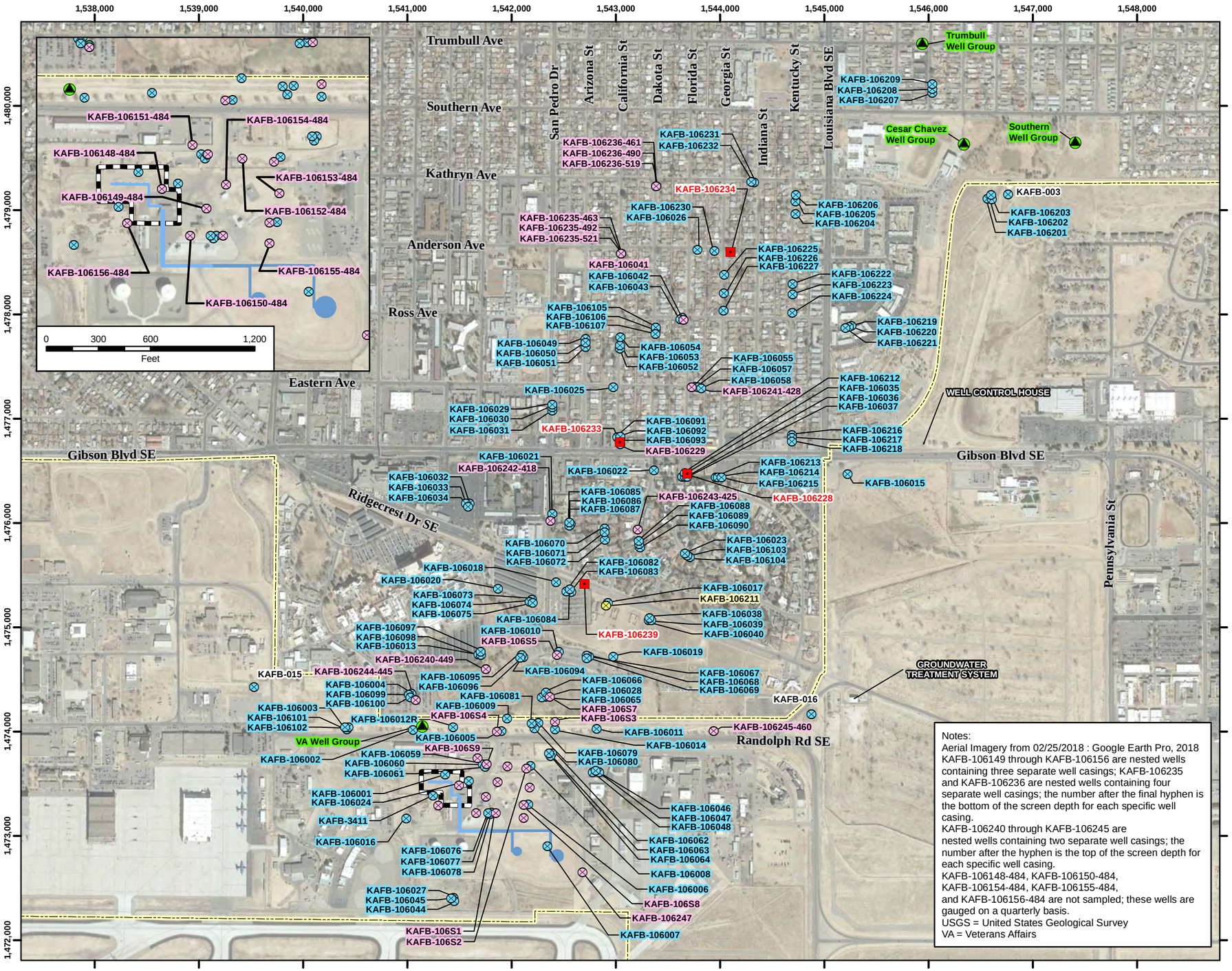
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

STANDARD OPERATING PROCEDURE FOR CLEANING AND DISINFECTION OF THE GWTS EXTRACTION WELLS AND GROUNDWATER MONITORING WELLS
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1

GROUNDWATER EXTRACTION AND TREATMENT SYSTEM LOCATION

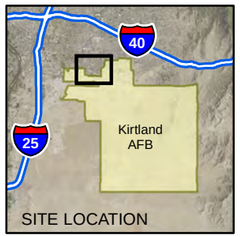
\\abq\Projects\gis\Projects\Kirtland\Figures\Well Disinfection SOP\Fig 1 Groundwater Extraction and Treatment System.mxd 2/20/2019 EA eomalia



Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
KAFB-106149 through KAFB-106156 are nested wells containing three separate well casings; KAFB-106235 and KAFB-106236 are nested wells containing four separate well casings; the number after the final hyphen is the bottom of the screen depth for each specific well casing.
KAFB-106240 through KAFB-106245 are nested wells containing two separate well casings; the number after the hyphen is the top of the screen depth for each specific well casing.
KAFB-106148-484, KAFB-106150-484, KAFB-106154-484, KAFB-106155-484, and KAFB-106156-484 are not sampled; these wells are gauged on a quarterly basis.
USGS = United States Geological Survey
VA = Veterans Affairs

Legend

- Newly Added Monitoring Well
- Monitoring Well (pending water table rise)
- Groundwater Monitoring Well
- Extraction Well
- USGS Monitored Sentinel Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Fence Boundary
- Bulk Fuels Facility (SWMU ST-106/SS-111)



N

0 500 1,000 2,000
Feet
1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

STANDARD OPERATING PROCEDURE FOR CLEANING AND DISINFECTION OF THE GWTS EXTRACTION WELLS AND GROUNDWATER MONITORING WELLS
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2

GROUNDWATER MONITORING NETWORK, DRINKING WATER SUPPLY WELL, AND EXTRACTION WELL LOCATIONS

\\abq\Projects\gis\Projects\Kirtland\Figures\Well Disinfection SOP\Fig 2 Groundwater Monitoring Network and Extraction Well Locations.mxd 2/20/2019 EA eomalia

TABLES

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Table 1
Mechanical Cleaning and Chemical Disinfection Methods

Rehabilitation Needs	**Remove iron/calcium deposits and/or biologic film buildup**	**Disinfect/sanitize, and control biofouling**	**Disinfect/sanitize, and control biofouling**
Method	Mechanical cleaning	Germicidal bleach	Wel-Chlor *Plus*
		(5-10% stock)	(>90% stock)
Section	3.1	3.2.2	3.2.3
Disinfection By-product	Suspended solids in water column (turbidity)	Free chlorine	Free chlorine

Table 2
Proposed Analytical Methods and and Screening Levels for Well Disinfection

Parameter	NMED Proposed Analytical Method/ Technique [a]	EA Proposed Analytical Method/ Technique	Screening Value (µg/L) [b]	Lab Reporting Limit (µg/L) [c]	NMWQCC Numeric Standard	Bottle Requirements
Perchlorate	E331/332 - LC/MS EI	E331 - LC/MS EI	13.8	0.5	NS	Plastic 125mL - sterile (no preservative)
Chlorite	E331/332 - LC/MS EI	E300.1B - IC	1000	20	NS	Amber Plastic 125mL - EDA
Bromate	E328.1-ICP/MS	E300.1B - IC	10.0	5.0	NS	Plastic 125mL - EDA

[a] Analysis as per the *Conditional Approval of Standard Operating Procedure for Disinfection of the Groundwater Treatment System* Remediation Wells and Groundwater Monitoring Wells, DP-1839, New Mexico Environment Dept (NMED, 2018a).

[b] Screening Value based on Safe Drinking Water Act Maximum Contaminant Level and NMED tapwater non-cancer screening value (2017).

[c] Analysis to be conducted by TestAmerica, Irvine, CA.

IC = Ion chromatography

ICP/MS = Inductively coupled plasma/mass spectrometry

LC/MS EI = Liquid chromatography/mass spectrometry electrospray ionization

NS = No New Mexico Water Quality Control Commission screening value

µg/L = Micrograms per liter

Table 3
Kirtland BFF Well Disinfection Analyses

		Well Location ID:	KAFB-106239			KAFB-106239			KAFB-106239			KAFB-106239			KAFB-106228		
		Field Sample ID:	GW239-184-Pre Dis[b]			GW239-184-Post Dis			GW239-191-PreDis[c]			GW239-191-POST DIS			GW228-184-Pre Dis		
		Sample Date:	Not Applicable			11/19/2018			1/16/2019			1/24/2019			11/19/2018		
		Sample Type:	REG			REG			REG			REG			REG		
Analytical Method	**Analyte**	**Screening Level[a]**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**
Method E300.1 (µg/L)	Bromate	10	NS	NS	NS	ND	U	5	ND	U	5	ND	U	10	ND	U	5
	Chlorite	1,000	NS	NS	NS	ND	U	20	ND	U	20	ND	U	20	ND	U	20
Method E331.0 (µg/L)	Perchlorate	14	NS	NS	NS	0.15	J	0.5	0.13	J	0.5	0.11	J	0.5	0.15	J	0.5

Table 3
Kirtland BFF Well Disinfection Analyses

		Well Location ID:	KAFB-106228			KAFB-106234			KAFB-106234			KAFB-106233			KAFB-106233		
		Field Sample ID:	GW228-184-Post Dis			GW234-184-Pre Dis			GW234-184-Post Dis			GW233-184-Pre Dis			GW233-184-Post Dis		
		Sample Date:	12/5/2018			12/5/2018			12/18/2019			12/12/2018			12/19/2018		
		Sample Type:	REG			REG			REG			REG			REG		
Analytical Method	**Analyte**	**Screening Level[a]**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**	**Result**	**Val Qual**	**RL**
Method E300.1 (µg/L)	Bromate	10	ND	U	5	ND	U	5	ND	UJ	25	ND	U	10	ND	UJ	5
	Chlorite	1,000	ND	U	20	ND	U	20	ND	U	20	ND	U	20	ND	U	20
Method E331.0 (µg/L)	Perchlorate	14	0.18	J	0.5	1.2	--	0.5	1.1	--	0.5	0.63	--	0.5	0.63	--	0.5

Table 3
Kirtland BFF Well Disinfection Analyses

[a] Project Screening Level based on EPA Safe Drinking Water Act Maximum Contaminant Level for chlorite and bromate (May 2009); and EPA RSL for Tapwater (November 2018) for hazard index = 1.0 for noncarcinogens.
[b] Well shocking was performed under emergency maintenance prior to SOP alternative methods being approved by NMED on 16 November 2018.
[c] Awaiting validated data.
µg/L = micrograms per liter
BFF = Bulk Fuels Facility
EPA = U.S. Environmental Protection Agency
ID = identification
KAFB = Kirtland Air Force Base
ND = not detected
NMED= New Mexico Environment Department
NS = not sampled
RL = Reporting limit
REG = normal field sample
RSL = regional screening level
Val Qual = validation qualifier
Shading = detected concentrations above the detection limit
Bold/Shading = reported concentrations exceed the project screening level
Val Quals based on independent data validation
J = Qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.
U = Qualifier denotes the analyte was analyzed but not detected above the detection limit. The value associated with the U-qualifier is the reporting limit.
-- = Compound not analyzed for and/or validation qualifier not assigned.

Table 4
Conveyance Line Specifications

Well ID	KAFB-106228	KAFB-106233	KAFB-106234	KAFB-106239	Combined KAFB-106233/234	Combined KAFB-106228/239
Length of conveyance line (ft)	3000	3535	3355	2540	3050	300
Diameter of conveyance line (in)	4	4	4	4	8	4
Volume of conveyance line ($V_{conveyance}$, gal)	1958	2308	2190	1658	7964	196

ft = feet
gal = gallons
in = inches

ATTACHMENTS

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ATTACHMENT A

SODIUM HYPOCHLORITE SAFETY DATA SHEET

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SAFETY DATA SHEET

Issuing Date January 5, 2015 **Revision Date** July 24, 2018 **Revision Number** 2

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name **Clorox® Germicidal Bleach**

Other means of identification

EPA Registration Number 67619-32

Recommended use of the chemical and restrictions on use

Recommended use Institutional hard surface disinfecting and sanitizing bleach

Uses advised against No information available

Details of the supplier of the safety data sheet

Supplier Address
The Clorox Company
1221 Broadway
Oakland, CA 94612

Phone: 1-510-271-7000

Emergency telephone number

Emergency Phone Numbers For Medical Emergencies, call: 1-800-446-1014
For Transportation Emergencies, call Chemtrec: 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Danger**

Hazard Statements
Causes severe skin burns and eye damage
Causes serious eye damage

Appearance Clear, pale yellow **Physical State** Thin liquid **Odor** Bleach

Precautionary Statements - Prevention
Wash face, hands and any exposed skin thoroughly after handling.
Wear protective gloves, protective clothing, face protection, and eye protection such as safety glasses.

Precautionary Statements - Response
Immediately call a poison center or doctor.
If swallowed: Rinse mouth. Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
Wash contaminated clothing before reuse.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
Specific treatment (see supplemental first aid instructions on this label).
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary Statements - Storage
Store locked up.

Precautionary Statements - Disposal
Dispose of contents in accordance with all applicable federal, state, and local regulations.

Hazards not otherwise classified (HNOC)
Although not expected, heart conditions or chronic respiratory problems such as asthma, chronic bronchitis, or obstructive lung disease may be aggravated by exposure to high concentrations of vapor or mist.

Product contains a strong oxidizer. Always flush drains before and after use.

Unknown Toxicity
Not applicable.

Other information
Very toxic to aquatic life with long lasting effects.

Interactions with Other Chemicals
Reacts with other household chemicals such as toilet bowl cleaners, rust removers, acids, or products containing ammonia to produce hazardous irritating gases, such as chlorine and other chlorinated compounds.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Weight %	Trade Secret
Sodium hypochlorite	7681-52-9	5 - 10	*

* The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

General Advice Call a poison control center or doctor immediately for treatment advice. Show this safety data sheet to the doctor in attendance.

Eye Contact Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Skin Contact Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Inhalation Move to fresh air. If breathing is affected, call a doctor.

Ingestion Have person sip a glassful of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person. Call a poison control center or doctor immediately for treatment advice.

Protection of First-aiders Avoid contact with skin, eyes, and clothing. Use personal protective equipment as required. Wear personal protective clothing (see section 8).

Most important symptoms and effects, both acute and delayed

Most Important Symptoms and Effects Burning of eyes and skin.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically. Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media
CAUTION: Use of water spray when fighting fire may be inefficient.

Specific Hazards Arising from the Chemical
This product causes burns to eyes, skin, and mucous membranes. Thermal decomposition can release sodium chlorate and irritating gases and vapors.

Explosion Data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Avoid contact with eyes, skin, and clothing. Ensure adequate ventilation. Use personal protective equipment as required. For spills of multiple products, responders should evaluate the MSDSs of the products for incompatibility with sodium hypochlorite. Breathing protection should be worn in enclosed and/or poorly-ventilated areas until hazard assessment is complete.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental Precautions This product is toxic to fish, aquatic invertebrates, oysters, and shrimp. Do not allow product to enter storm drains, lakes, or streams. See Section 12 for ecological Information.

Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Absorb and containerize. Wash residual down to sanitary sewer. Contact the sanitary treatment facility in advance to assure ability to process washed-down material.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Do not eat, drink, or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Store away from children. Reclose cap tightly after each use. Store this product upright in a cool, dry area, away from direct sunlight and heat to avoid deterioration. Do not contaminate food or feed by storage of this product.

Incompatible Products Toilet bowl cleaners, rust removers, acids, and products containing ammonia.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium hypochlorite 7681-52-9	None	None	None

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health.

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations
Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection If splashes are likely to occur: Wear safety glasses with side shields (or goggles) or face shield.

Skin and Body Protection Wear rubber or neoprene gloves and protective clothing such as long-sleeved shirt.

Respiratory Protection If irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice. Wash hands after direct contact. Do not wear product-contaminated clothing for prolonged periods. Remove and wash contaminated clothing before re-use. Do not eat, drink, or smoke when using this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical State	Thin liquid		
Appearance	Clear	**Odor**	Bleach
Color	Pale yellow	**Odor Threshold**	No information available

Property	**Values**	**Remarks/ Method**
pH	~12	None known
Melting/freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash Point	Not flammable	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
Upper flammability limit	No data available	None known
Lower flammability limit	No data available	None known
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Specific Gravity	~1.1	None known
Water Solubility	Soluble	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known
Explosive Properties	Not explosive	
Oxidizing Properties	No data available	

Other Information

Softening Point	No data available
VOC Content (%)	No data available
Particle Size	No data available
Particle Size Distribution	No data available

10. STABILITY AND REACTIVITY

Reactivity
Reacts with other household chemicals such as toilet bowl cleaners, rust removers, acids, or products containing ammonia to produce hazardous irritating gases, such as chlorine and other chlorinated compounds.

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
None known based on information supplied.

Incompatible materials
Toilet bowl cleaners, rust removers, acids, and products containing ammonia.

Hazardous Decomposition Products
None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information .

Inhalation Exposure to vapor or mist may irritate respiratory tract and cause coughing. Inhalation of high concentrations may cause pulmonary edema.

Eye Contact Corrosive. May cause severe damage to eyes.

Skin Contact May cause severe irritation to skin. Prolonged contact may cause burns to skin.

Ingestion Ingestion may cause burns to gastrointestinal tract and respiratory tract, nausea, vomiting, and diarrhea.

Component Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium hypochlorite 7681-52-9	8200 mg/kg (Rat)	>10000 mg/kg (Rabbit)	-

Information on toxicological effects

Symptoms May cause redness and tearing of the eyes. May cause burns to eyes. May cause redness or burns to skin. Inhalation may cause coughing.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization No information available.

Mutagenic Effects No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Sodium hypochlorite 7681-52-9	-	Group 3	-	-

IARC (International Agency for Research on Cancer)
Group 3 - Not Classifiable as to Carcinogenicity in Humans

Reproductive Toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.
Chronic Toxicity Carcinogenic potential is unknown.
Target Organ Effects Respiratory system, eyes, skin, gastrointestinal tract (GI).

Aspiration Hazard No information available.

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)
54 g/kg
ATEmix (inhalation-dust/mist)
58 mg/L

12. ECOLOGICAL INFORMATION

Ecotoxicity
Very toxic to aquatic life with long lasting effects.

This product is toxic to fish, aquatic invertebrates, oysters, and shrimp. Do not allow product to enter storm drains, lakes, or streams.

Persistence and Degradability
No information available.

Bioaccumulation
No information available.

Other adverse effects
No information available.

13. DISPOSAL CONSIDERATIONS

Disposal methods
Dispose of in accordance with all applicable federal, state, and local regulations. Do not contaminate food or feed by disposal of this product.

Contaminated Packaging
Do not reuse empty containers. Dispose of in accordance with all applicable federal, state, and local regulations.

14. TRANSPORT INFORMATION

DOT	Not restricted.
TDG	Not restricted for road or rail.
ICAO	Not restricted, as per Special Provision A197, Environmentally Hazardous Substance exception.
IATA	Not restricted, as per Special Provision A197, Environmentally Hazardous Substance exception.
IMDG/IMO	Not restricted, as per IMDG Code 2.10.2.7, Marine Pollutant exception.

15. REGULATORY INFORMATION

Chemical Inventories

TSCA	All components of this product are either on the TSCA 8(b) Inventory or otherwise exempt from listing.
DSL/NDSL	All components are on the DSL or NDSL.

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Sodium hypochlorite 7681-52-9	100 lb			X

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Sodium hypochlorite 7681-52-9	100 lb	–	RQ 100 lb final RQ RQ 45.4 kg final RQ

EPA Statement
This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

> **DANGER: CORROSIVE.** Causes irreversible eye damage and skin burns. Harmful if swallowed. Do not get in eyes, on skin, or on clothing. Wear protective eyewear and rubber gloves when handling this product. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the restroom. Avoid breathing vapors and use only in a well-ventilated area.

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Rhode Island	Illinois
Sodium hypochlorite 7681-52-9	X	X	X	X	
Sodium chlorate 7775-09-9	X	X	X		

International Regulations

Canada
WHMIS Hazard Class
E - Corrosive material

16. OTHER INFORMATION

NFPA	**Health Hazard**	3	**Flammability**	0	**Instability**	0	**Physical and Chemical Hazards** -
HMIS	**Health Hazard**	3	**Flammability**	0	**Physical Hazard**	0	**Personal Protection** B

Prepared By
Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Revision Date July 24, 2018

Revision Note Revised Section 1.

Reference 1064453/166081.094

General Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal, and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

ATTACHMENT B

WEL-CHLOR *PLUS* (SODIUM DICHLOROISOCYANURATE DIHYDRATE) SAFETY DATA SHEET

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Safety Data Sheet

Wel-Chlor *Plus*

Issue Date: 14-Dec-2016 **Revision Date:** **05**-July-2018 **Version** 1

1. IDENTIFICATION

Product Identifier

Product Name Wel-Chlor Plus

Other means of identification

SDS # CCH-007

UN/ID No UN

Recommended use of the chemical and restrictions on use

Recommended Use Disinfectant

Details of the supplier of the safety data sheet

Supplier Address
Cotey Chemical Corporation
4410 M.L.K. Blvd.
Lubbock, TX 79408

Emergency Telephone Number

Company Phone Number 806-747-2096

Emergency Telephone (24 hr) INFOTRAC 1-352-323-3500 (International)
1-800-535-5053 (North America)

2. HAZARDS IDENTIFICATION

Appearance White **Physical State** Solid Crystals **Odor** Slight chlorine odor

Classification

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 1 Sub-category B
Eye damage/eye irritation	Category 1

Signal Word
Danger

Hazard Statements
MAJOR HEALTH HAZARDS: CAUSES IRREVERSIBLE EYE DAMAGE. MAY BE FATAL IF INHALED. MAY CAUSE SKIN IRRITATION. MAY CAUSE RESPIRATORY TRACT IRRITATION. HARMFUL IF SWALLOWED. MAY CAUSE BURNS TO MOIST SKIN IF NOT PROMPTLY REMOVED.

PHYSICAL HAZARDS: STRONG OXIDIZER. MAY INTENSIFY FIRE. Contact with water slowly liberates irritating and hazardous chlorine containing gases. Contamination with moisture, organic material, or other incompatible chemicals may start a reaction with generation of heat, liberation of hazardous gases, and possible fire and explosion. Contact with acids liberates toxic gas. Decomposes at temperatures above 464 °F with liberation of harmful gases. When ignited will burn with the evolution of chlorine and equally toxic gases. Do not get water inside container. Wet material may generate nitrogen trichloride, an explosion hazard.

AQUATIC TOXICITY: Very toxic to aquatic organisms. Very toxic to aquatic life with long lasting effects.

Precautionary Statements - Prevention

Corrosive. Causes irreversible eye damage. May be fatal if inhaled. Do not breathe dust, vapor or spray mist . Harmful if swallowed or absorbed through skin. Do not get in eyes, on skin, or on clothing. Do not eat, drink, or smoke when using this product. Wear safety glasses with side shields, chemical splash goggles, face-shield, protective clothing, and chemical resistant gloves when handling this product . Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove contaminated clothing and wash before reuse. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Collect spillage. Store in a well-ventilated place. Keep material dry and store in a dry area. Keep container tightly closed. Keep separated from incompatible substances. Store in a secure manner.

Precautionary Statements - Response

Inhalation: This material in the form as sold is not expected to produce respiratory effects. Particles of respirable size are generally not encountered. The respirable fraction is typically less than 0.1% by weight for the granular and extra granular grades. If ground or otherwise in a powdered form, effects similar to a corrosive substance may occur. May cause severe irritation of the respiratory tract with coughing, choking, pain and possibly burns of the mucous membranes. If significant or prolonged exposure occurs, pulmonary edema may develop, either immediately or more often within a period of 5-72 hours. The symptoms may include tightness in the chest, dyspnea, frothy sputum, cyanosis, and dizziness. Physical findings may include moist rales, low blood pressure and high pulse pressure. Severe cases may be fatal.

Skin contact: This material is irritating to the skin. Direct contact with wet material or by moist skin may cause severe irritation, pain, and possibly burns. Dry material is less irritating than wet material. This material is not a skin sensitiser based on studies with guinea pigs.

Eye contact: This material is corrosive to the eye. Direct contact may cause severe irritation, pain and burns, possibly severe, and permanent damage including blindness. The degree of injury depends on the concentration and duration of contact.

Ingestion: Not a likely route of exposure. Harmful if swallowed. Ingestion may cause immediate pain and severe burns of the mucous membranes. There may be discoloration of the tissues. Swallowing and speech may be difficult at first and then almost impossible. The effects on the esophagus and gastrointestinal tract may range from irritation to severe corrosion. Edema of the epiglottis and shock may occur.

Chronic Effects: Based on animal studies, exposure to concentrations of monosodium cyanurate at the solubility limit may cause cardiovascular, kidney and urinary bladder effects.

Precautionary Statements - Storage

Store locked up
Store in a well-ventilated place. Keep container tightly closed

Precautionary Statements - Disposal

Dispose of contents/container to an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Weight-%
Sodium dichloroisocyanurate dihydrate	51580-86-0	>90

If Chemical Name/CAS No is "proprietary" and/or Weight-% is listed as a range, the specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. FIRST-AID MEASURES

First Aid Measures

General Advice Provide this SDS to medical personnel for treatment.

Eye Contact	Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. GET MEDICAL ATTENTION IMMEDIATELY.
Skin Contact	Immediately flush contaminated areas with water. Remove contaminated clothing, jewelry, and shoes immediately. Wash contaminated areas with soap and water. Thoroughly clean and dry contaminated clothing and shoes before reuse. IF IRRITATION OCCURS, GET MEDICAL ATTENTION.
Inhalation	Move to fresh air. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer Basic Life Support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.
Ingestion	Never give anything by mouth to an unconscious or convulsive person. If swallowed, do not induce vomiting. Give water. If vomiting occurs spontaneously, keep airway clear. Give water when vomiting stops. GET MEDICAL ATTENTION IMMEDIATELY.

Most important symptoms and effects

Symptoms	Harmful if swallowed. Causes severe skin burns and eye damage. May cause respiratory irritation. May cause drowsiness or dizziness.

Indication of any immediate medical attention and special treatment needed

Notes to Physician	Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE-FIGHTING MEASURES

Fire Hazard: Negligible fire hazard. If heated by outside source to temperatures above 240 C (464 F), this product will undergo decomposition with the evolution of noxious gases but no visible flame. Wet material may generate nitrogen trichloride, an explosion hazard.

Extinguishing Media: Flood with water. Do not use ABC fire extinguishers. Do not use dry chemicals, carbon dioxide, or halogenated extinguishing agents.

Fire Fighting: Consider evacuation of personnel located downwind. Keep unnecessary people away, isolate hazard area and deny entry. Move container from fire area if it can be done without risk. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode. Material which appears undamaged except for being damp on the outside, should be opened and inspected immediately. DO NOT attempt to reseal contaminated drums. Damp material should be neutralized to a non-oxidizing state.

Sensitivity to Mechanical Impact: Not sensitive.

Sensitivity to Static Discharge: Not sensitive.

Hazardous Combustion Products: Chlorine, Nitrogen, Nitrogen trichloride, Cyanogen chloride, Oxides of carbon, Phosgene

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions	Use personal protective equipment as required. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation, especially in confined areas.
Environmental Precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Clean-Up Keep unnecessary people away, isolate hazard area and deny entry. DO NOT add water to spilled material. DO NOT use floor sweeping compounds to clean up spills. Sweep and scoop spilled material into clean, dedicated equipment. Every attempt should be made to avoid mixing spilled material with other chemicals or debris when cleaning up. DO NOT attempt to reseal contaminated drums. DO NOT transport wet or damp material. Damp material should be neutralized to a non-oxidizing state. Keep out of water supplies and sewers. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on Safe Handling Handle in accordance with good industrial hygiene and safety practice. Do not eat, drink or smoke when using this product. Do not get in eyes, on skin, or on clothing. Avoid breathing vapors or dust when opening container. Avoid creation of dust. Wash thoroughly after handling. NEVER add water to this product. Always add product to large quantities of water. Use clean, dry utensils. Do not add the product to any dispensing device containing residuals of other products.

Conditions for safe storage, including any incompatibilities

Storage Conditions Store in original container and in a dry area where temperatures do not exceed 52 ^{o}C (125 ^{o}F) for 24 hours. Store and handle in accordance with all current regulations and standards. (NFPA Oxidizer Class 1). Do not allow water to get in container. If liner is present, tie after each use. Keep container tightly closed and properly labeled. Store containers on pallets. Keep away from food, drink and animal feed. Keep separated from incompatible substances (see Section 10 of the Safety Data Sheet). Product has an indefinite shelf life if stored in original container in a cool, dry place.

Incompatible Materials Acids, ammonia, bases, floor sweeping compounds, calcium hypochlorite, reducing agents, organic solvents and compounds

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines

Regulatory Exposure Limit(s): None Non-Regulatory Exposure Limit(s): None

Additional Advice: Chlorine and chlorine compounds may be found in slight amounts in the head space of containers.

Appropriate engineering controls

Engineering Controls Use only in well-ventilated areas. Provide local exhaust ventilation where dust or mist may be generated. Ensure compliance with applicable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Goggles or safety glasses with side shields. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection Neoprene or rubber gloves with cuffs. Coveralls, apron or other equipment should be worn to minimize skin contact. When potential for contact with dry material exists, wear disposable coveralls suitable for dust exposure, such as Tyvek®. Contaminated clothing should be removed and laundered before reuse.

Respiratory Protection A NIOSH approved respirator with N95 (dust, fume, mist) cartridges may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits, or when symptoms have been observed that are indicative of overexposure. The added protection of a full face piece respirator is required when visible dusty conditions are encountered and eye irritation may occur. Acid gas cartridges with N95 filters are required when fumes or vapor may be generated. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant use of a respirator.

General Hygiene Considerations	Handle in accordance with good industrial hygiene and safety practice. Do not eat, drink or smoke when using this product. Wash contaminated clothing before reuse.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Solid		
Appearance	White granules	**Odor**	Slight chlorine odor
Color	white	**Odor Threshold**	Not determined

Property	**Values**	**Remarks • Method**
pH	6-7	
Melting Point/Freezing Point	Not determined	
Boiling Point/Boiling Range	Not Determined	
Flash Point	Not determined	
Evaporation Rate	<1	(Water = 1)
Flammability (Solid, Gas)	NA	
Upper Flammability Limits	Not determined	
Lower Flammability Limit	Not determined	
Vapor Pressure	NA	
Vapor Density	NA	
Specific Gravity	1.95	(Water = 1)
Water Solubility	26.5g/100g	
Solubility in other solvents	Not determined	
Partition Coefficient	**K**ow = 0	
Auto-ignition Temperature	Not determined	
Decomposition Temperature	486 F	
Kinematic Viscosity	Not determined	
Dynamic Viscosity	Not determined	
Explosive Properties	Not determined	**Oxidizing Properties** Not determined

10. STABILITY AND REACTIVITY

Reactivity Not reactive under normal conditions.

Chemical Stability Stable.

Possibility of Hazardous Reactions None under normal processing.

Hazardous Polymerization Hazardous polymerization does not occur.

Conditions to Avoid
Keep out of reach of children. Do not get water inside container. Wet material may generate nitrogen trichloride, an explosion hazard. Avoid contact with easily oxidizable organic material.

Incompatible Materials
Acids, ammonia, bases, floor sweeping compounds, calcium hypochlorite, reducing agents, organic solvents and compounds

Hazardous Decomposition Products
chlorine, nitrogen, nitrogen trichloride, cyanogen chloride, oxides of carbon, phosgene

11. TOXICOLOGICAL INFORMATION

IRRITATION DATA:
PRIMARY SKIN IRRITATION: Severe Irritation, Corrosive (rabbit, 24 hr)
PRIMARY EYE IRRITATION: Severe Irritation, Corrosive (rabbit, 24 hr)

Component Information

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium dichloroisocyanurate dihydrate	1823 mg/kg (Rat)	> 5000 mg/kg (Rabbit)	0.27 - 1.17mg/L ppm (Rat) 1 h

TOXICITY: Monosodium cyanurate was administered via drinking water to rats for 104 weeks at concentrations of 0, 400, 1200, 2400, and 5375 ppm (solubility limit). No compound-related effects on body weights, clinical signs of toxicity or food or water consumption were noted during the study. An increased incidence of gross lesions in the urinary tract, calculi in the kidney and lesions in the heart were observed in males receiving the highest dose level of 5375 ppm (solubility limit). The health effects seen in this study were due to precipitation of the test substance in the urinary tract when the test substance was fed at the solubility limit. Adverse health effects were not seen at lower doses where precipitation did not occur.

CARCINOGENICITY: This product is not classified as a carcinogen by NTP, IARC or OSHA.

MUTAGENIC DATA: Not mutagenic in 5 salmonella strains and 1 E. coli strain with or without mammalian microsomal activation.

REPRODUCTIVE TOXICITY: There are no known or recorded effects on reproductive function or fetal development.

Symptoms Please see section 4 of this SDS for symptoms.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Carcinogenicity This product is not classified as a carcinogen by NTP, IARC or OSHA.

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)
A3 - Animal Carcinogen

IARC (International Agency for Research on Cancer)
Group 3 IARC components are "not classifiable as human carcinogens"

STOT - single exposure May cause respiratory irritation. May cause drowsiness or dizziness.

Numerical measures of toxicity
Not determined

12. ECOLOGICAL INFORMATION

Ecotoxicity

ECOTOXICITY DATA:
Fish Toxicity: LC50 Bluegill sunfish: 0.25-1.0 mg/L (96 hour) LC50 Rainbow trout: 0.13-0.36 mg/L (96 hour) LC50 Inland silversides: 1.21 mg/L (96 hour)
Invertebrate Toxicity:
LC50 Water flea: 0.196 mg/L (48 hour) LC50 Mysid shrimp: 1.65 mg/L (96 hour)
Other Toxicity: LD50 Mallard duck (oral): 1,916 mg/kg LD50 N. Bobwhite Quail (oral): 1,732 mg/kg LD50 Mallard duck (diet): >10,000 ppm LD50 N. Bobwhite Quail (diet): >10,000 ppm

FATE AND TRANSPORT:
BIODEGRADATION: This material is subject to hydrolysis. Cyanuric acid produced by hydrolysis is biodegradable.

PERSISTENCE: This material is believed not to persist in the environment. Free available chlorine is rapidly consumed by reaction with organic and inorganic materials to produce chloride ion. The stable degradation products are chloride ion and cyanuric acid.

BIOCONCENTRATION: This material hydrolyses in water liberating free available chlorine and cyanuric acid. These products are not bioaccumulative.

ADDITIONAL ECOLOGICAL INFORMATION: This product is toxic to fish and aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of appropriate regulatory requirements (e.g. permit and the permitting authority has been notified in writing prior to discharge). Do not discharge effluent containing this product into sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your local or regional regulatory water boards and/or other appropriate regulatory offices.

Other Adverse Effects Not determined

13. DISPOSAL CONSIDERATIONS

Disposal of Wastes Use or reuse if possible. This material is a registered pesticide. Dispose in accordance with all applicable regulations. Do not put product, spilled product, or filled or partially filled containers into the trash or waste compactor. DO NOT transport wet or damp material. Damp material should be neutralized to a non-oxidizing state. See product label for container disposal information. May be subject to disposal regulations.

Contaminated Packaging Disposal should be in accordance with applicable regional, national and local laws and regulations.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

Status: Non-Bulk Packaging: Not Regulated under DOT unless transported by Vessel Bulk Packaging or Shipment by Vessel: Regulated

UN NUMBER: UN3077

PROPER SHIPPING NAME: EnvironmentallyHazardousSubstance,Solid,n.o.s.(Sodiumdichloroisocyanurate dihydrate), Marine Pollutant

HAZARD CLASS/ DIVISION: 9 PACKING GROUP: III

LABELING REQUIREMENTS: 9, Marine Pollutant
MARINE POLLUTANT: Sodium dichloroisocyanurate dihydrate

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
Status: Non-Bulk packaging: Not Regulated unless transported by vessel Bulk Packaging or Shipment by vessel: Regulated

UN NUMBER: UN3077

SHIPPING NAME: Environmentally Hazardous Substance, Solid, n.o.s. (Sodium dichloroisocyanurate dihydrate), Marine Pollutant

HAZARD CLASS/ DIVISION: 9 PACKING GROUP: III

CAN. Marine Pollutant: Sodium dichloroisocyanurate dihydrate

15. REGULATORY INFORMATION

U.S. REGULATIONS

OSHA REGULATORY STATUS:
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200) CERCLA SECTIONS 102a/103

HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

EPCRA EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated
EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.10): Fire Hazard, Reactive Hazard, Acute Health Hazard
EPCRA SECTION 313 (40 CFR 372.65): Not regulated.
OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119): Not regulated
FIFRA REGULATIONS: Registered pesticide under 40 CFR 152.10, Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), EPA Reg. No. 935-38 (ACL 56 Chlorinating Composition)
NATIONAL INVENTORY STATUS
U.S. INVENTORY STATUS: Toxic Substance Control Act (TSCA): All components are listed or exempt. TSCA 12(b): This product is not subject to export notification
Canadian Chemical Inventory: All components of this product are listed on either the DSL or the NDSL.

STATE REGULATIONS
California Proposition 65: This product is not listed, but it may contain impurities/trace elements known to the State of California to cause cancer or reproductive toxicity as listed under Proposition 65 State Drinking Water and Toxic Enforcement Act.

US Federal Regulations

16. OTHER INFORMATION

NFPA

Health Hazards	2
Flammability	0
Instability	1
Special Hazards	Not determined

HMIS

Health Hazards	3
Flammability	0
Physical Hazards	1
Personal Protection	Not determined

Issue Date: 14 Dec. 2016 **Revision Date:** 14 Dec. 2016

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

ATTACHMENT C

EXTRACTION WELL CONSTRUCTION DIAGRAMS

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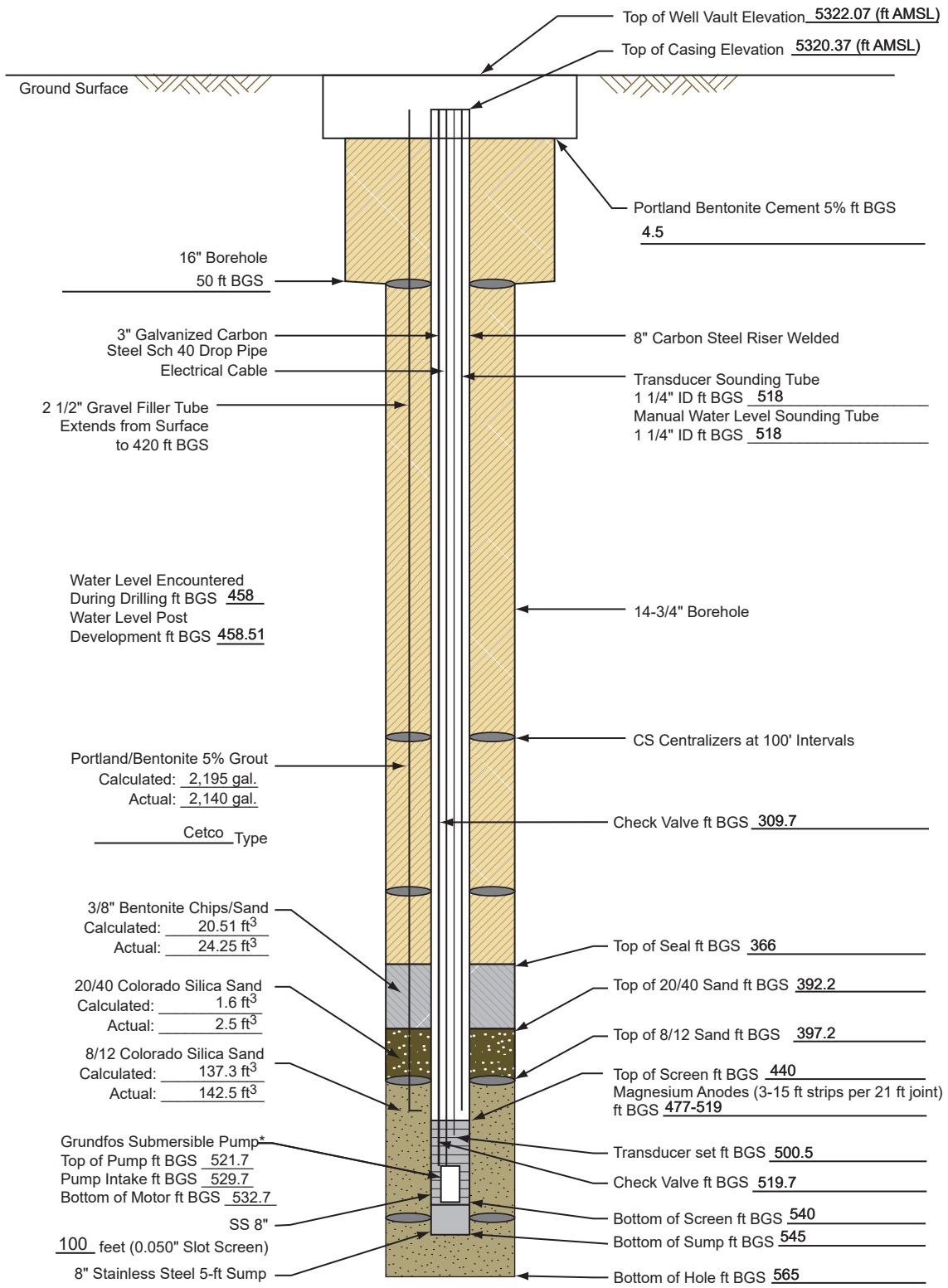
Extraction Well Construction Diagram KAFB-106228

Installation Start Date/Time: 5/18/2015
Installation End Date/Time: 6/2/2015
Magnesium Anodes and Sounding Tubes added: 7/6/2016



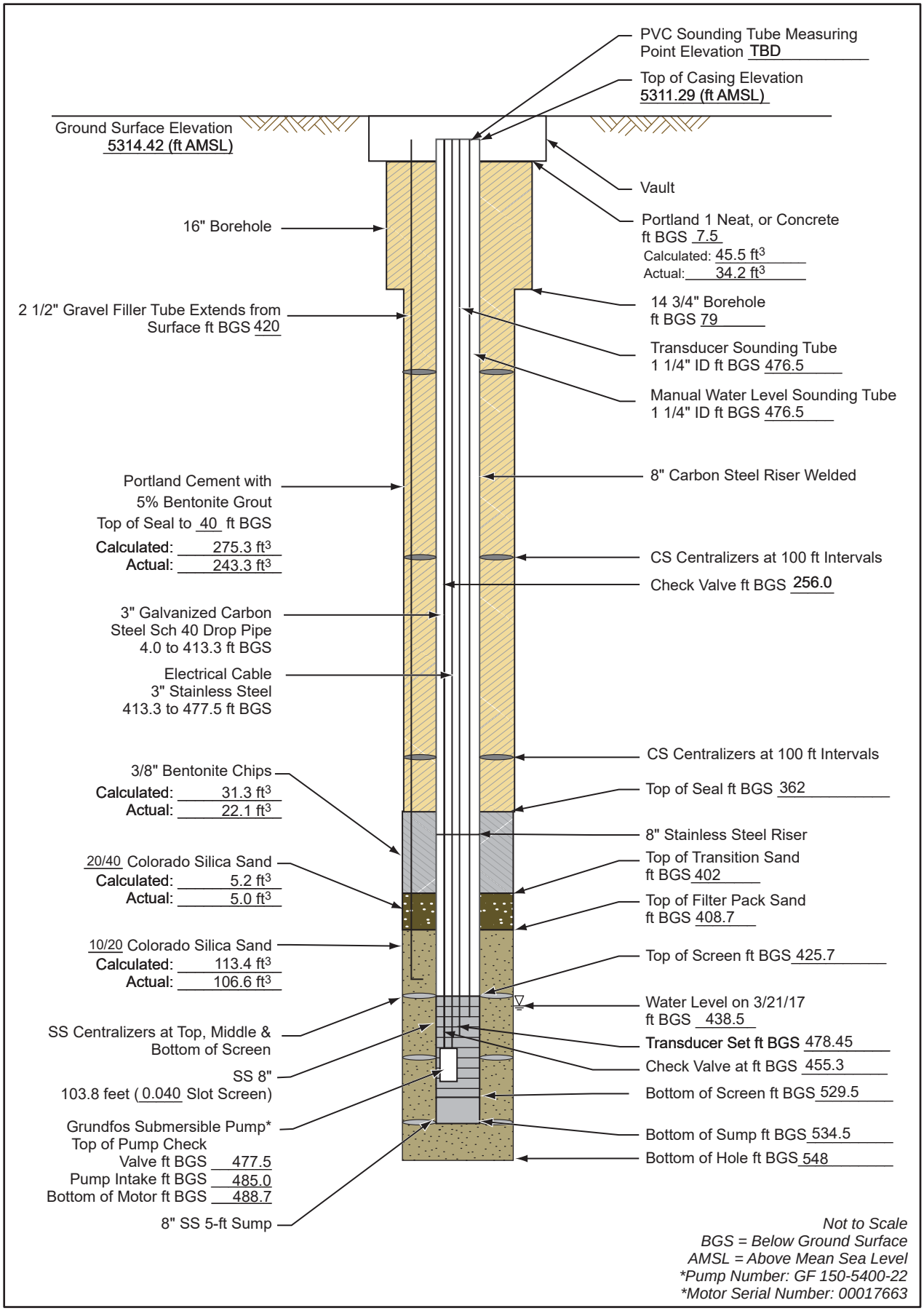
Elevations are NAVD 88 Datum values based on NGS Control Station "Hanger", Elevation = 5,343.43 ft. GPS/RTK methods and GEO1D99 model were used to determine elevations of all surveyed points.

Not to Scale
BGS = Below Ground Surface
AMSL = Above Mean Sea Level
**Pump Serial Number: 7656-13P21328*
**Motor Serial Number: 7656-13P21328*

140705.CB020403.A19

Revision Date: 20SEP2017

Extraction Well Construction Diagram KAFB-106233



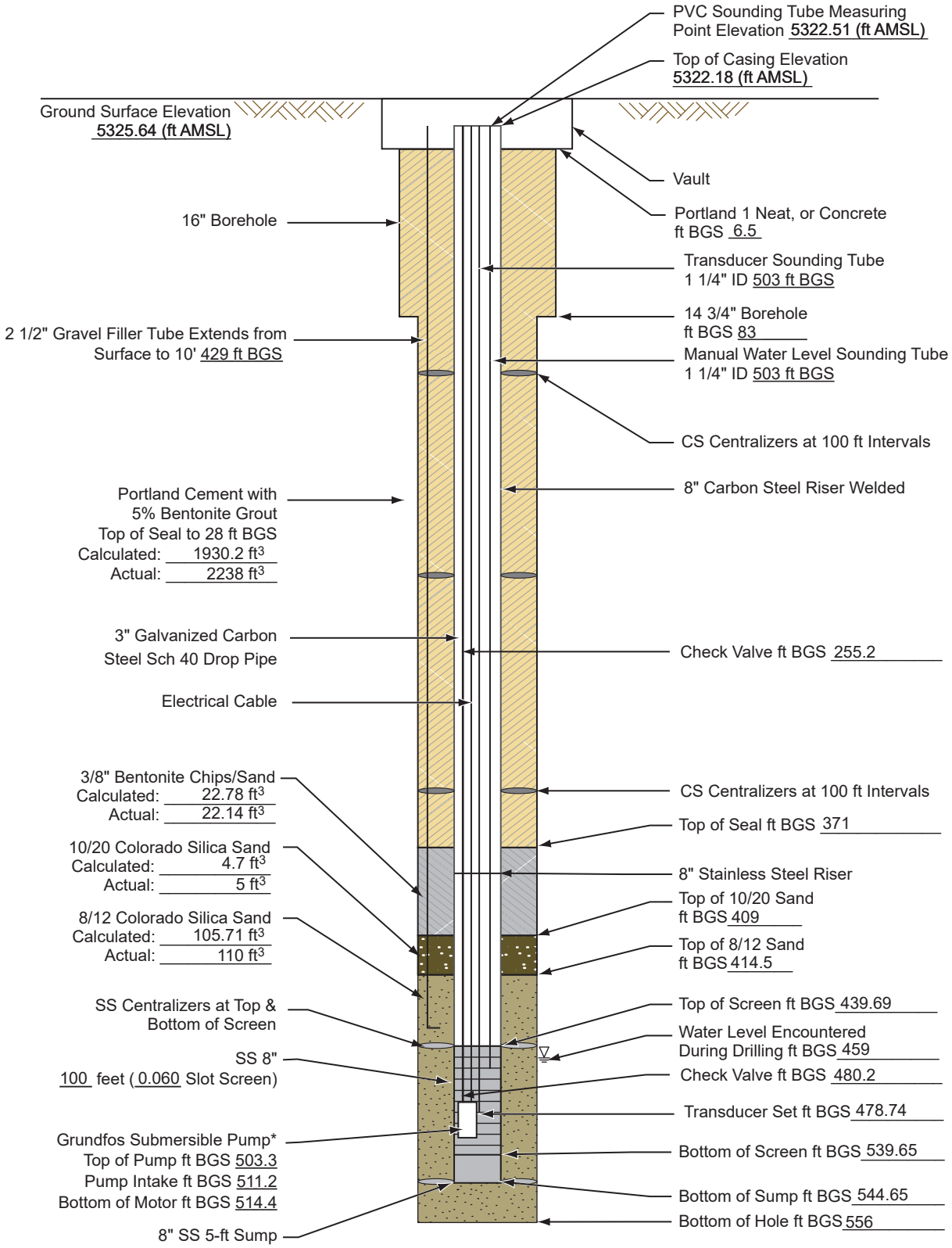
Not to Scale
BGS = Below Ground Surface
AMSL = Above Mean Sea Level
**Pump Number: GF 150-5400-22*
**Motor Serial Number: 00017663*

500433.04010300.A4

Revision Date: 20SEP2017

Extraction Well Construction Diagram KAFB-106234

Installation Start Date/Time: 10/2/2015
Installation End Date/Time: 10/9/2015

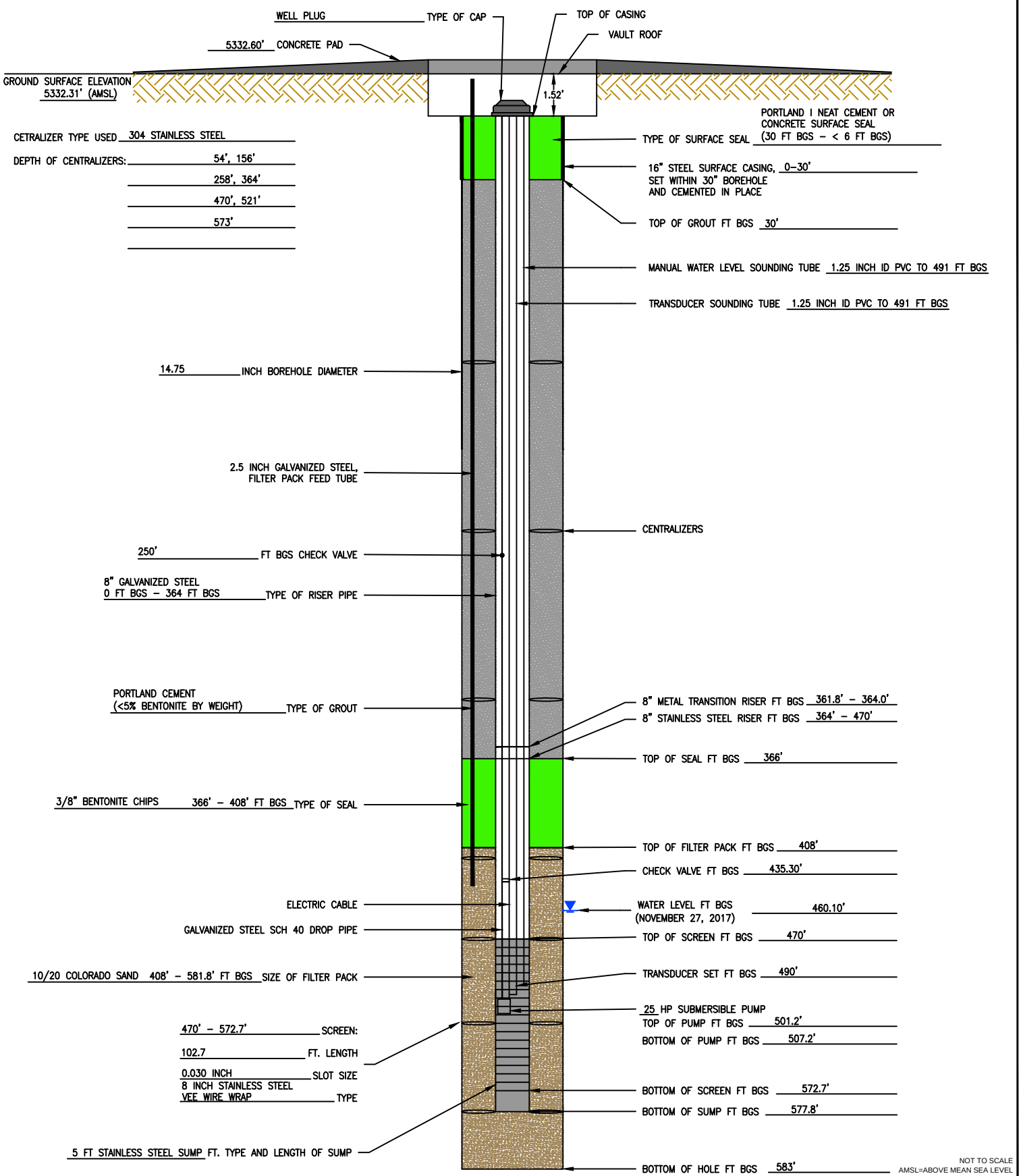


Not to Scale
BGS = Below Ground Surface
AMSL = Above Mean Sea Level
**Pump Serial Number: RWB13b60022P115420004*
**Motor Serial Number: 00024250*

500433.04010300.A5

Revision Date: 20SEP2017

EXTRACTION WELL CONSTRUCTION - KAFB-106239
FIGURE 2



NOT TO SCALE
AMSL=ABOVE MEAN SEA LEVEL
BGS=BELOW GROUND SURFACE
FT-FEET

NOTE: ALL DEPTHS REFERENCE IN FEET BELOW GROUND SURFACE

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC
320 Gold Avenue, SW Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013

KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME: NOV 3, 16	INSTALLATION END DATE/TIME: DEC 9, 16
PROJECT NO.: 62599DM01	WELL ID: KAFB-106239 (EXTRACTION)	GEOLOGIST: R. MARLEY	DRILLER: YELLOW JACKET

FILE PATH: Y:\ACTIVE PROJECTS\62599DM01 KIRTLAND BFF_USACE\9.1 GWTS EXTRACTION WELLS\KAFB-106239 AUTOCAD\EXTRACTION WELL COMPLETION DIAGRAM-KAFB-106239.DWG [EXTRACTION WELL COMBINED FIGURE] MCKEAGE, KEVIN 3/5/2018 3:33 PM

ATTACHMENT D

MONITORING WELL CONSTRUCTION INFORMATION

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Monitoring Well Construction Information

Well_ID	Dedicated System?	REI	Top of Screen (bgs)	Bottom of Screen (bgs)	Total Well Depth (bgs)	Borehole Diameter (in)	Borehole Diameter Screen Interval (in)	Casing Diameter (in)	Water Level (bgs)	Water Level (MRP)	WL Date	MPE-GE	G_Elevation_USGS	MPE_USGS	Well Volume (Gallons) Q1 2019 Gauging
KAFB-106001		4857 & 4838	483	508	508.5	12	10	4	467.16	470.44	2/7/2019	3.28	5341.62	5344.90	114
KAFB-106002	Y	4857	479	504	505	12	10	4	463.64	466.03	2/5/2019	2.39	5339.85	5342.24	116
KAFB-106003		4857	476	501	503	12	10	4	462.09	465.09	2/4/2019	3.00	5337.28	5340.28	119
KAFB-106004		4857	484	509	510	12	10	4	467.86	470.60	2/4/2019	2.74	5343.07	5345.81	117
KAFB-106005		4857	479	504	507	12	10	4	469.06	471.93	2/5/2019	2.87	5344.04	5346.91	121
KAFB-106006		4857	483.5	508.5	511	12	12	4	473.99	477.17	2/7/2019	3.18	5348.30	5351.48	168
KAFB-106007		4857	484	509	511	12	12	4	470.65	475.31	2/7/2019	4.66	5344.94	5349.60	167
KAFB-106008		4857	486	511	513.5	12	10	4	474.03	476.95	2/5/2019	2.92	5348.85	5351.77	120
KAFB-106009		4857	480	505	507.5	12	10	4	470.40	474.09	2/7/2019	3.69	5344.85	5348.55	118
KAFB-106010		4857	483	508	510.5	12	10	4	469.17	469.17	2/7/2019	0.00	5343.26	5343.26	121
KAFB-106011	Y	4857	486	511	516	12	10	4	475.43	478.48	2/5/2019	3.05	5350.10	5353.15	129
KAFB-106012R		4857	465.58	494.83	500	10	10	5	467.29	470.20	2/5/2019	2.91	5342.09	5345.00	133
KAFB-106013		4857	486.5	511.5	516.5	12	10	4	472.74	475.89	2/4/2019	3.15	5347.47	5350.62	131
KAFB-106014		4857	486	511	516	12	10	4	472.36	475.55	2/5/2019	3.19	5347.03	5350.22	131
KAFB-106015		4857 & 4838	485	510	515	12	10	4	466.36	468.88	2/5/2019	2.52	5339.92	5342.44	135
KAFB-106016	Y	4857	475	500	505	12	10	4	464.61	467.90	2/7/2019	3.29	5339.13	5342.43	129
KAFB-106017	Y	4857 & 4838	482	507	512	12	10	4	464.83	468.44	2/5/2019	3.61	5338.91	5342.52	134
KAFB-106018	Y	4857 & 4838	476	501	506	12	10	4	459.06	462.02	2/5/2019	2.96	5333.35	5336.31	133
KAFB-106019		4857 & 4838	493	518	523	12	10	4	476.50	479.41	2/5/2019	2.91	5351.71	5354.62	133
KAFB-106020		4857	482	507	512	12	10	4	466.35	466.35	2/5/2019	0.00	5341.05	5341.05	133
KAFB-106021		4857 & 4838	458	483	488	12	10	4	439.87	439.87	2/6/2019	0.00	5314.33	5314.33	134
KAFB-106022		4857 & 4838	462	487	492	12	10	4	444.09	444.08	2/5/2019	-0.01	5318.07	5318.06	134
KAFB-106023		4857	473	498	503	12	10	4	454.36	454.39	2/5/2019	0.03	5328.72	5328.76	135
KAFB-106024	Y	4857	481	506	511	12	10	4	469.12	469.12	2/7/2019	0.00	5343.55	5343.55	130
KAFB-106025		4857 & 4838	465	490	495	12	10	4	442.86	442.86	2/4/2019	0.00	5317.28	5317.28	137
KAFB-106027	Y	4857	481	501	506	12	10	4	470.69	473.85	2/4/2019	3.16	5345.45	5348.62	109
KAFB-106028	Y	4857	486	510	515	12	10	4	474.40	474.40	2/5/2019	0.00	5348.89	5348.89	126
KAFB-106029		4857	450.8	470.8	475.8	12	10	5	436.18	436.18	2/6/2019	0.00	5310.94	5310.94	117
KAFB-106030		4838	469.5	484.5	489.9	12	10	5	436.26	436.26	2/6/2019	0.00	5311.03	5311.03	117
KAFB-106031		4814	495.8	509.5	514.9	12	10	5	436.31	436.31	2/6/2019	0.00	5311.06	5311.06	139
KAFB-106032		4857	456	476	480.5	12	10	5	442.61	442.61	2/4/2019	0.00	5317.60	5317.60	114
KAFB-106033		4838	477	492	496.6	12	10	5	442.78	442.78	2/4/2019	0.00	5317.76	5317.76	115
KAFB-106034		4814	502	517	522	12	10	5	443.63	443.63	2/4/2019	0.00	5318.63	5318.63	141
KAFB-106035		4857	452	482	487	12	10	5	447.92	448.05	2/4/2019	0.13	5321.45	5321.58	147
KAFB-106036		4838	481.8	496.8	501.8	12	10	5	448.41	448.49	2/4/2019	0.08	5321.76	5321.85	116
KAFB-106037		4814	507	522	527	12	10	5	449.06	449.11	2/4/2019	0.05	5322.06	5322.10	141
KAFB-106038		4857	478	508	513	12	10	5	474.07	477.32	2/5/2019	3.26	5348.36	5351.61	147
KAFB-106039		4838	508.3	523.3	528.3	12	10	5	474.69	477.82	2/5/2019	3.13	5348.20	5351.32	116
KAFB-106040		4814	530.6	545.6	550.6	12	10	5	472.99	476.00	2/5/2019	3.01	5347.25	5350.26	140
KAFB-106041		4857	449	469	473.8	12	10	5	449.76	449.76	2/4/2019	0.00	5324.35	5324.35	98
KAFB-106042		4857	469	483.5	488.5	12	10	5	449.51	449.51	2/4/2019	0.00	5324.07	5324.07	99
KAFB-106043		4814	543	557.5	562.5	12	10	5	449.74	449.74	2/4/2019	0.00	5324.30	5324.30	175
KAFB-106044	Y	4838	504.2	519.2	523.9	12	10	5	470.52	473.66	2/4/2019	3.14	5345.65	5348.79	115
KAFB-106045		4814	528.3	543.3	548	6	10	5	470.25	473.67	2/4/2019	3.42	5345.09	5348.52	140
KAFB-106046	Y	4857	490	510	515	12	10	5	478.53	478.53	2/7/2019	0.00	5352.84	5352.84	114
KAFB-106047	Y	4838	512	527	532	12	10	5	478.19	478.19	2/5/2019	0.00	5352.81	5352.81	116
KAFB-106048		4814	535.5	550.5	555.5	12	10	5	477.92	477.92	2/5/2019	0.00	5352.58	5352.58	140
KAFB-106049		4857	456.8	476.8	480.7	12	10	5	441.33	441.33	2/4/2019	0.00	5316.10	5316.10	113
KAFB-106050		4838	474.4	489.4	494.8	12	10	5	440.68	440.68	2/4/2019	0.00	5315.51	5315.51	118
KAFB-106051		4814	500.8	515.8	521.2	12	10	5	440.97	440.97	2/4/2019	0.00	5315.78	5315.78	144
KAFB-106052		4857	449.6	479.6	484.8	12	10	5	444.38	444.38	2/7/2019	0.00	5318.86	5318.86	149
KAFB-106053		4838	478.4	493.4	498.4	12	10	5	444.29	444.29	2/4/2019	0.00	5318.67	5318.67	116
KAFB-106054		4814	504	519	524	12	10	5	443.87	443.87	2/4/2019	0.00	5318.38	5318.38	143
KAFB-106055		4857	465.8	485.8	490.3	12	10	5	450.81	450.81	2/4/2019	0.00	5325.09	5325.09	115
KAFB-106057		4838	484.9	499.9	505.3	12	10	5	451.16	451.16	2/4/2019	0.00	5325.46	5325.46	118
KAFB-106058		4814	511.8	526.8	530.3	12	10	5	451.70	451.70	2/4/2019	0.00	5326.05	5326.05	137
KAFB-106059		4857	483.4	503.4	508.4	12	10	5	470.64	473.70	2/7/2019	3.06	5344.81	5347.87	115
KAFB-106060	Y	4838	503	518	523	12	10	5	470.98	470.98	2/7/2019	0.00	5345.32	5345.32	114
KAFB-106061	Y	4814	573.2	588.2	593.2	12	10	5	470.96	470.96	2/7/2019	0.00	5345.43	5345.43	186
KAFB-106062	Y	4814	575.3	590.3	595	12	10	5	473.86	476.83	2/7/2019	2.97	5348.23	5351.20	184
KAFB-106065	Y	4838	508	523	528	12	10	5	474.30	474.30	2/5/2019	0.00	5348.76	5348.76	116
KAFB-106066	Y	4814	575.6	590.6	595.8	12	10	5	474.49	474.49	2/5/2019	0.00	5349.09	5349.09	186
KAFB-106067	Y	4857	485	505	510	12	10	5	473.31	473.31	2/5/2019	0.00	5347.50	5347.50	114
KAFB-106068	Y	4814	580	595	600	12	10	5	473.04	473.04	2/5/2019	0.00	5347.23	5347.23	191
KAFB-106069		4838	506	521	526	12	10	5	472.91	472.91	2/5/2019	0.00	5347.25	5347.25	115
KAFB-106070		4857	460	480	485	12	10	5	444.46	444.46	2/5/2019	0.00	5318.54	5318.54	118
KAFB-106071		4814	548	563	568	12	10	5	446.65	446.65	2/5/2019	0.00	5320.90	5320.90	185
KAFB-106072		4838	475	495	500	12	10	5	444.96	444.96	2/5/2019	0.00	5319.29	5319.29	133

Monitoring Well Construction Information

Well_ID	Dedicated System?	REI	Top of Screen (bgs)	Bottom of Screen (bgs)	Total Well Depth (bgs)	Borehole Diameter (in)	Borehole Diameter Screen Interval (in)	Casing Diameter (in)	Water Level (bgs)	Water Level (MRP)	WL Date	MPE-GE	G_Elevation_USGS	MPE_USGS	Well Volume (Gallons) Q1 2019 Gauging
KAFB-106073		4838	499.5	514.5	519.5	12	10	5	465.21	465.21	2/5/2019	0.00	5339.87	5339.87	117
KAFB-106074		4814	569.5	584.5	589.5	12	10	5	465.93	465.93	2/5/2019	0.00	5340.59	5340.59	187
KAFB-106075	Y	4857	480	500	505	12	10	5	465.91	465.91	2/5/2019	0.00	5340.50	5340.50	116
KAFB-106076		4857	480	500	505	12	10	5	470.78	470.78	2/7/2019	0.00	5344.92	5344.92	111
KAFB-106077		4838	504	519	524	12	10	5	471.84	471.84	2/7/2019	0.00	5344.72	5344.72	114
KAFB-106078	Y	4814	573.5	588.5	593.5	12	10	5	472.01	472.01	2/7/2019	0.00	5344.60	5344.60	185
KAFB-106079		4857	483.9	503.9	509.5	12	10	5	472.29	475.22	2/5/2019	2.93	5346.74	5349.67	116
KAFB-106080	Y	4838	503.1	518.1	523.3	12	10	5	470.85	473.66	2/5/2019	2.81	5345.68	5348.48	115
KAFB-106081	Y	4814	574.8	589.3	594.8	12	10	5	471.69	474.76	2/5/2019	3.07	5346.41	5349.48	187
KAFB-106082		4857	472	492	497.3	12	10	5	461.10	461.10	2/5/2019	0.00	5335.26	5335.26	114
KAFB-106083		4838	495.5	510.5	515.7	12	10	5	460.77	460.77	2/5/2019	0.00	5335.04	5335.04	118
KAFB-106084		4814	566	581	585.8	12	10	5	459.89	463.51	2/4/2019	3.62	5334.32	5337.94	189
KAFB-106085		4857	446.5	476.5	481.5	12	10	5	442.82	442.82	2/5/2019	0.00	5317.23	5317.23	147
KAFB-106086		4838	476	491	496	12	10	5	443.24	443.24	2/5/2019	0.00	5317.65	5317.65	115
KAFB-106087		4814	546	561	565.5	12	10	5	442.41	442.41	2/5/2019	0.00	5316.87	5316.87	185
KAFB-106088		4857	460	480	485	12	10	5	450.21	450.21	2/5/2019	0.00	5324.27	5324.27	112
KAFB-106089		4838	481.5	496.5	501.5	12	10	5	449.83	449.89	2/5/2019	0.06	5323.48	5323.54	114
KAFB-106090		4814	555	570	575	12	10	5	448.64	448.72	2/5/2019	0.08	5322.77	5322.85	190
KAFB-106091		4857	454	474	479	12	10	5	440.97	440.97	2/4/2019	0.00	5314.33	5314.33	115
KAFB-106092		4838	474	489	493.7	12	10	5	441.32	441.32	2/4/2019	0.00	5314.51	5314.51	114
KAFB-106093		4814	544	559	563.2	12	10	5	440.69	440.69	2/4/2019	0.00	5314.62	5314.62	184
KAFB-106094	Y	4857	484.2	504.2	509.2	12	10	5	470.46	470.46	2/4/2019	0.00	5345.07	5345.07	116
KAFB-106095		4838	503.75	518.75	523.75	12	10	5	469.96	470.06	2/4/2019	0.10	5344.56	5344.66	116
KAFB-106096	Y	4814	576.3	591.3	596.3	12	10	5	470.47	470.62	2/4/2019	0.15	5345.16	5345.31	190
KAFB-106097		4838	506	521	526	12	10	5	473.77	473.81	2/4/2019	0.04	5347.70	5347.74	114
KAFB-106098		4814	531	546	551.1	12	10	5	472.88	472.90	2/4/2019	0.02	5347.80	5347.83	141
KAFB-106099		4838	501	516	521	12	10	5	467.61	467.61	2/4/2019	0.00	5342.85	5342.85	116
KAFB-106100		4814	526	541	546	12	10	5	467.61	467.61	2/4/2019	0.00	5342.85	5342.85	141
KAFB-106101		4838	495.9	511.2	515.1	12	10	5	462.30	465.21	2/4/2019	2.91	5337.41	5340.32	113
KAFB-106102		4814	521.1	534.8	540.2	12	10	5	462.48	465.35	2/4/2019	2.88	5337.45	5340.32	138
KAFB-106103		4838	485	500	505.2	12	10	5	454.58	454.64	2/5/2019	0.06	5328.39	5328.44	113
KAFB-106104		4814	510	525	530	12	10	5	454.05	454.10	2/5/2019	0.05	5328.03	5328.08	139
KAFB-106105		4838	484	499	504	12	10	5	447.56	447.56	2/4/2019	0.00	5321.96	5321.96	119
KAFB-106106		4857	453.6	483.6	488.6	12	10	5	447.47	447.47	2/4/2019	0.00	5321.80	5321.80	149
KAFB-106107		4814	510.2	525.2	530.2	12	10	5	447.68	447.68	2/4/2019	0.00	5322.12	5322.12	145
KAFB-106148-484		4857	355	484	484	12	10	3	469.53	469.67	2/7/2019	0.14	5344.1	5344.24	59
KAFB-106149-484		4857	355	484	484	12	10	3	471.85	471.69	2/7/2019	-0.16	5346.1	5345.94	50
KAFB-106150-484		4857	355	484	484	12	10	3	470.11	470.01	2/7/2019	-0.10	5344.2	5344.1	57
KAFB-106151-484		4857	355	484	484	12	10	3	471.41	471.6	2/7/2019	0.19	5345.3	5345.49	51
KAFB-106152-484		4857	355	484	484	12	10	3	473.04	473.32	2/7/2019	0.28	5347.4	5347.68	45
KAFB-106153-484		4857	355	484	484	12	10	3	474.43	474.72	2/7/2019	0.29	5348.7	5348.99	39
KAFB-106154-484		4857	355	484	484	12	10	3	472.85	472.99	2/7/2019	0.14	5347.2	5347.34	45
KAFB-106155-484		4857	355	484	484	12	10	3	473.06	473.29	2/7/2019	0.23	5346.9	5347.13	45
KAFB-106156-484[b]		4857	355	484	484	12	10	3	467.82	468.11	2/7/2019	0.29	5340.9	5341.19	66
KAFB-106201		4857	487	517	522	12	10	5	478.69	481.34	2/4/2019	2.65	5354.35	5357.00	151
KAFB-106202		4838	517	532	537	12	10	5	479.15	482.04	2/4/2019	2.89	5354.90	5357.80	120
KAFB-106203		4814	620	635	640	12	10	5	478.99	482.07	2/4/2019	3.08	5354.44	5357.52	225
KAFB-106204		4857	462.5	492.5	497.5	12	10	5	457.67	457.67	2/4/2019	0.00	5332.86	5332.86	148
KAFB-106205		4838	492.5	507.5	512.5	12	10	5	458.05	458.05	2/4/2019	0.00	5333.29	5333.29	117
KAFB-106206		4814	593.5	608.2	613.2	12	10	5	458.16	458.16	2/4/2019	0.00	5333.46	5333.46	218
KAFB-106207		4857	473	503	508	12	10	5	468.29	468.23	2/4/2019	-0.06	5344.25	5344.20	148
KAFB-106208		4838	503	518	523	12	10	5	467.92	467.90	2/4/2019	-0.02	5343.87	5343.85	117
KAFB-106209		4814	603	617	622	12	10	5	467.26	467.22	2/4/2019	-0.04	5343.42	5343.38	216
KAFB-106212		4814	543.2	558.2	563.4	12	10	5	448.55	448.54	2/4/2019	-0.01	5321.81	5321.80	179
KAFB-106213		4857	448	478	483.4	12	10	5	451.50	451.41	2/4/2019	-0.09	5325.28	5325.19	130
KAFB-106214		4838	478.23	492.73	498.13	12	10	5	451.44	451.46	2/4/2019	0.02	5325.43	5325.45	109
KAFB-106215		4814	547	562	567	12	10	5	451.67	451.66	2/4/2019	-0.01	5325.78	5325.77	179
KAFB-106216		4857	455.5	485.5	490.5	12	10	5	459.60	459.60	2/4/2019	0.00	5333.91	5333.91	126
KAFB-106217		4838	485	500	505	12	10	5	459.49	459.49	2/4/2019	0.00	5333.85	5333.85	108
KAFB-106218		4814	552	567	572.45	12	10	5	459.62	459.62	2/4/2019	0.00	5333.64	5333.64	178
KAFB-106219		4857	462.7	492.7	497.9	12	10	5	465.50	465.50	2/4/2019	0.00	5340.41	5340.41	132
KAFB-106220		4838	493	508	513	12	10	5	465.44	465.44	2/4/2019	0.00	5340.34	5340.34	110
KAFB-106221		4814	561	576	581	12	10	5	465.23	465.23	2/4/2019	0.00	5340.10	5340.10	179
KAFB-106222		4857	457.8	487.8	493.2	12	10	5	458.57	458.57	2/4/2019	0.00	5333.24	5333.24	141
KAFB-106223		4838	487.8	502.8	508	12	10	5	459.25	459.25	2/4/2019	0.00	5333.96	5333.96	112
KAFB-106224		4814	555	570	575.5	12	10	5	460.41	460.41	2/4/2019	0.00	5335.08	5335.08	180
KAFB-106225		4857	450	480	485.2	12	10	5	452.06	452.06	2/4/2019	0.00	5326.36	5326.36	135
KAFB-106226		4838	480	495	500	12	10	5	452.70	452.70	2/4/2019	0.00	5327.31	5327.31	109

Monitoring Well Construction Information

Well_ID	Dedicated System?	REI	Top of Screen (bgs)	Bottom of Screen (bgs)	Total Well Depth (bgs)	Borehole Diameter (in)	Borehole Diameter Screen Interval (in)	Casing Diameter (in)	Water Level (bgs)	Water Level (MRP)	WL Date	MPE-GE	G_Elevation_USGS	MPE_USGS	Well Volume (Gallons) Q1 2019 Gauging
KAFB-106227		4814	548	563	568.5	12	10	5	453.47	453.47	2/4/2019	0.00	5328.09	5328.09	180
KAFB-106231		4857	440	475	480	12	10	5	452.25	452.25	2/6/2019	0.00	5327.56	5327.56	113
KAFB-106232		4838	503	518	523	12	10	5	451.73	451.73	2/6/2019	0.00	5327.20	5327.20	134
KAFB-106235-429[a]		NA	409	429	431	12	12	3	NA	NA	NA	-0.04	5315.55	5315.51	NA
KAFB-106235-463		4857	438	463	465	12	12	3	441.47	441.43	2/4/2019	-0.04	5315.55	5315.51	138
KAFB-106235-492		4838	472	492	494	12	12	3	441.42	441.38	2/4/2019	-0.04	5315.55	5315.51	140
KAFB-106235-521		4814	501	521	523	12	12	3	441.32	441.28	2/4/2019	-0.04	5315.55	5315.51	151
KAFB-106236-427[a]		NA	407	427	429	12	12	3	NA	NA	NA	-0.06	5315.76	5315.70	NA
KAFB-106236-461		4857	436	461	463	12	12	3	441.16	441.10	2/4/2019	-0.06	5315.76	5315.70	128
KAFB-106236-490		4838	470	490	492	12	12	3	440.98	440.92	2/4/2019	-0.06	5315.76	5315.70	140
KAFB-106236-519		4814	499	519	521	12	12	3	441.16	441.10	2/4/2019	-0.06	5315.76	5315.70	150
KAFB-106240-449		4857	449	489	491	12	12	3	472.78	472.92	2/4/2019	0.14	5347.43	5347.57	107
KAFB-106241-394[a]		NA	394	419	421	12	12	3	NA	NA	NA	0.10	5323.96	5324.06	NA
KAFB-106241-428		4857	428	468	470	12	12	3	450.37	450.47	2/4/2019	0.10	5323.96	5324.06	115
KAFB-106242-384[a]		NA	384	409	411	12	12	3	NA	NA	NA	0.14	5316.01	5316.15	NA
KAFB-106242-418		4857	418	458	460	12	12	3	441.71	441.85	2/6/2019	0.14	5316.01	5316.15	107
KAFB-106243-391[a]		NA	391	416	418	12	10	3	NA	NA	NA	0.04	5320.53	5320.57	NA
KAFB-106243-425		4857	425	465	467	12	10	3	446.53	446.57	2/4/2019	0.04	5320.53	5320.57	84
KAFB-106244-409[a]		NA	409	436	438	12	10	3	NA	NA	NA	0.09	5343.42	5343.51	NA
KAFB-106244-445		4857	445	485	487	12	10	3	468.45	468.54	2/4/2019	0.09	5343.42	5343.51	76
KAFB-106245-426[a]		NA	426	451	453	12	10	3	NA	NA	NA	3.17	5357.73	5360.90	NA
KAFB-106245-460		4857	460	500	502	12	10	3	483.65	486.82	2/5/2019	3.17	5357.73	5360.90	75
KAFB-106246-428[a]		NA	428	453	455	12	10	3	NA	NA	NA	-0.16	5347.28	5347.12	NA
KAFB-106247		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
KAFB-106S1-413		NA	413	438	440	12	10	3	NA	NA	NA	NA	NA	NA	NA
KAFB-106S1-447		4857	447	487	489	12	10	3	NA	NA	NA	NA	NA	NA	NA
KAFB-106S2-415[a]		NA	415	444	444	12	10	3	NA	NA	NA	3.05	5349.38	5352.43	NA
KAFB-106S2-451		4857	451	491	493	12	10	3	475.03	478.08	2/7/2019	3.05	5349.38	5352.43	73
KAFB-106S3-415[a]		NA	415	440	442	12	10	3	NA	NA	NA	3.21	5347.81	5351.02	NA
KAFB-106S3-449		4857	449	489	491.24	12	10	3	473.97	477.18	2/7/2019	3.21	5347.81	5351.02	70
KAFB-106S4-412[a]		NA	412	437	439	12	10	3	NA	NA	NA	2.94	5343.65	5346.59	NA
KAFB-106S4-446		4857	446	486	488	12	10	3	469.16	472.10	2/7/2019	2.94	5343.65	5346.59	77
KAFB-106S5-412[a]		NA	412	437	439	12	10	3	NA	NA	NA	0.00	5343.60	5343.60	NA
KAFB-106S5-446		4857	446	486	488	12	10	3	469.33	469.33	2/7/2019	0.00	5343.60	5343.60	76
KAFB-106S7		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
KAFB-106S8		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
KAFB-106S9-413[a]		NA	413	438	440	12	10	3	NA	NA	NA	0.00	5345.83	5345.83	NA
KAFB-106S9-447		4857	447	487	489	12	10	3	438.49	438.49	2/7/2019	0.00	5345.83	5345.83	174
KAFB-3411[b]		4857	477	502	503	9	9	4	467.08	470.14	2/7/2019	3.06	5340.42	5343.49	92

[a] currently dry contingency well installed to accommodate sampling if water levels continue to rise.

[b] depth to water from Q4 2018 due to gauging error in Q1 2019.

bgs = below ground surface
G = ground
GE = ground elevation
in = inch(es)
MPE = measurement point elevation
MRP = measurement reference point
NA = not applicable
Q1 = quarter 1
REI = reference elevation interval
USGS = US Geological Survey
WL = water level