Response to Ninth Amendment Directive 2

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Tetra Tech Project No. 114-010647

April 28, 2014

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1.0 INTRODUCTION AND BACKGROUND

The Louisiana Department of Natural Resources (LDNR) issued the Ninth Amendment to the Declaration of Emergency and Directive to Texas Brine Company, LLC (TBC) on November 22, 2013. As acknowledged by letter from LDNR to TBC dated March 25, 2014, TBC has complied with Directives 1, 3, and 4 of the Ninth Amendment. Directive 2 states that TBC shall install additional pressure monitoring wells (PMWs) per the Blue Ribbon Commission (BRC) Recommended Requirements Document, RRD-Gas-09 (RRD-09) MRAA Gas Pressure Monitoring.

TBC has previously installed three of the 14 PMWs required by Directive 2 (PMW-008, PMW-012 (also known as PMW-019) and PMW-016). TBC also installed PMW-018 west of Bayou Corne. Note that in addition to the four PMWs listed above, TBC has installed MRAA pressure monitoring wells TBC-1, TBC-2, TBC-3, and BC-2; however, wells TBC-1 and TBC-2 have been abandoned as they were located on Pad 3 of the TBC facility, which has been partially subsumed by the sinkhole.

As a result of the discussions with LDNR, TBC understands the rationale for some additional PMWs to be located in two areas (Sportsman's Paradise and the area south of Pad 9 on the TBC facility site) of the site that still have significant methane gas production from installed ORWs. Other PMW locations no longer have gas present. These additional PMWs coupled with the existing PMW network will be used for long term monitoring of pressures in the MRAA and will reduce the need for and frequency of repeat cone penetrometer testing (CPT) for gas pressure evaluation.

This document describes TBC's basis and rationale for installing additional PMWs to meet the requirements and intent of RRD-09. It also describes how the existing pressure monitoring network, which includes ORWs, PMWs, and shallow Geoprobe monitoring wells, will be used for pressure monitoring.

2.0 PROPOSED PRESSURE MONITORING WELLS (PMWS)

TBC proposes a modification to the BRC's recommended PMW monitoring network based on an evaluation of the proposed network and current data regarding the areal extent and present existence of methane gas in the MRAA. The BRC's RRD-09 guidance document was issued on June 18, 2013. Since that date TBC has flared a total of approximately 12 million cubic feet of methane gas and has installed the following:

- 16 ORWs (ORW-38 through ORW-58)
- 117 CPTs
- 4 PMWs
- 74 MiHPTs
- 15 Shallow bubble site Geoprobe wells (GP series)
- 8 MRAA wells equipped with pressure transducers

These newly installed ORWs, CPTs, MiHPTs and PMWs provide further data on the nature and extent of methane gas within and above the MRAA that was not available at the time the BRC developed its receommendations. Based on these data, an amended network of PMWs is proposed that will provide additional monitoring data to that already available through the above installed ORWs, CPTs, PMWs and MiHPTs. Through its various discussions with LDNR, TBC understands that LDNR agrees that the use of these new and existing PMWs for long term monitoring will significantly reduce the need for and frequency of repeat CPT borings to evaluate gas pressure.

Table 1, Evaluation of Original PMW Locations, describes each of the eleven PMWs proposed by the BRC that have not been installed to date and the rational for either installing or not installing a PMW at each location. Figure 1 shows the existing PMWs and the PMWs proposed for installation. The areal coverage of the existing and proposed PMWs will provide data representative of the areas of the site with remaining MRAA gas. Figure 2 shows the final gas pressure monitoring network with the proposed PMWs. This network includes the following:

- 18 Shallow Geoprobe monitoring wells (NSDMW001 through NSDMW018)
- 6 Shallow Geoprobe monitoring wells (GP-1 to GP-6)
- 15 Shallow bubble site monitoring wells (GP series wells)
- 6 Existing MRAA PMWs (BC-2, TBC-3, PMW-12M/19/S, PMW-8, PMW-16 & PMW-18)
- 3 New Proposed PMWs (PMW-004, PMW-007, and PMW-017)
- 47 ORWs (presently pressure transducers are installed in approximately 35 ORWs)
- 8 MRAA water wells equipped with pressure transducers

As shown on Figure 2, the proposed final gas monitoring network provides an extensive set of data points for evaluation of gas zones in the vicinity of the sinkhole and Bayou Corne community.

3.0 WORK PLAN FOR INSTALLATION OF NEW PMWS

TBC proposes to install each new PMW as a nested pair of single-riser wells constructed within the same temporarily-cased borehole. Each well is screened to monitor a specific zone, with filter packs and seals employed to isolate the zones. The PMWs are designed to provide a vertical distribution of in-situ pressures at the following two discrete zones in the vicinity of the top of the MRAA:

ZONE-S - Gas-filled sand or silt porosity located directly below the overlying clay aquitard

ZONE-M - Water-filled clean sand aquifer porosity located approximately 10 ft below the aquitard

Each nested well pair will be installed using conventional resonant sonic drilling technology and materials and installed by a Louisiana-licensed well driller in accordance with LDNR well construction requirements and LDNR guidance. A typical PMW nested well pair schematic is shown in Figure 3.

3.1 WELL BOREHOLE DRILLING

Prior to installing each PMW, a CPT will be installed immediately adjacent to the PMW location using standard site protocols and methods. The CPT will be installed under Tetra Tech direction. Results from the CPT will be used to identify the gas zone location and to finalize the screen elevation for the Zone-S screen.

Under Tetra Tech direction, Walker-Hill Environmental (WHE), a Louisiana-licensed well driller, will install the proposed PMW borings using its sonic well drilling rig with nominal 8" diameter drill casing and potable water drilling fluid. WHE will utilize personnel with extensive knowledge of general drilling safe work practices and specific gas well installation experience that was refined, in part, from installing over a hundred ORWs, PMWs, Geoprobe and MRAA aquifer wells across the Site. WHE will have previously verified that the proposed borehole location is clear of underground utilities and will probe the first 5-feet by hand with a utility locating tool. PMWs will be installed on constructed drill pads at elevations several feet above seasonable high marsh water levels and covered with temporary wooden mats. PMW locations will take advantage of existing streets or permanent access roads already installed.

Tetra Tech anticipates that the field activities will be conducted using Level D personal protective equipment and will follow the Site Specific Health and Safety Plans developed by Walker Hill Environmental, Inc. (WHE) and Tetra Tech for this project. Wells will be installed in general agreement with means and methods described in the following:

- Tetra Tech's Appendix I, Drilling Procedures and Well Diagrams, in the Alternative Technical Approach to Achieve Requirements of RRD-GAS-09 MRAA Gas Pressure Monitoring ;
- Comprehensive Workplan for Bayou Corne Community Gas Mitigation and Monitoring Plan, Tetra Tech, October 22, 2013;

- Construction of Geotechnical Boreholes and Groundwater Monitoring Systems Handbook, December 2000, by Louisiana DOTD and LDEQ; and,

- As further detailed, below.

Prior to well drilling, previous soil borings and CPT logs proximal to the boring location will be referenced to determine approximate depths for encountering the local MRAA contact and potential gas zones. The 8" drill casing will be advanced to a depth of approximately 3 to 4 feet above the bottom of the clay aquitard using standard sonic drilling techniques. Specific care will be taken to note depths of drilling resistance for comparison to nearby CPT boring stratigraphy for coordinating any differences between ground surface datums between different borings.

In an effort to limit potential negative impacts to multi-phase flow permeability within the MRAA sands immediately outside of the borehole caused by the sonic drilling method, WHE will advance boreholes through the bottom of the aquitard and through potential gas bearing zones to total depth using hydrostatically balanced drilling pressure across the drive shoe to minimize positive skin (zone of induced low permeability around the borehole due to the drilling method). This will be done in lieu of flushing all sediment from the borehole using overbalanced drilling techniques that flush material out of the bottom of the casing during advancement where it typically discharges up around the exterior casing annulus gap and discharges into the soft clay aquitard material above the MRAA. The proposed excavation process will be accomplished by first advancing a nominal 10-LF x 7-in diameter core barrel from the depth of the 8" drill casing shoe, then overriding the barrel with the 10-LF drill casing to the same interim depth. Next, the core barrel is retrieved and 10-LF core extruded at the ground surface. This iterative, stepwise process of advancing 7" core barrel into virgin ground followed by overriding with the 8" drill casing and withdrawing the cored material will be continued using balanced drilling techniques from several feet above the MRAA contact to total depth of between 14 and 24 feet below the bottom of the clay aquitard. The exact depth for initiating soil coring will be determined based on field conditions with the design intent to allow breaks in the 10-ft casing string to occur directly above and directly below known gas zones. The final borehole depth will coincide with the full penetration of the last piece of drill casing that first pushes the drive shoe past the 14 ft mark below the top of the MRAA.

In order to minimize gas kicks during drilling, WHE will strategically sequence 2, 5, 10 and 15-ft lengths of drill casing in a manner to avoid casing breaks where the casing shoe is located within identified gas zones. In the event gas kicks cannot be managed with potable drilling water, bentonite drilling mud will be used to provide additional downhole pressure to mitigate gas movement into the borehole. WHE will stop drilling briefly at the top of the MRAA (based on drilling cues) to allow the measurement of the depth of the MRAA contact as precisely as possible from the known length of casing and drive shoe in the ground. The core will be extruded into clear plastic core bags and provided to the Tetra Tech geologist for inspection and soil characterization logging.

3.2 WELL CONSTRUCTION

In order to measure vertical distribution of groundwater/gas head potential, screen intervals will be limited in length and separated by blank casing and annular seals. Once the drill casing is advanced to the target depth and confirmed free of soil, two well strings will be installed inside the casing and annulus well materials added during incremental casing withdrawal. The PMWs will be constructed using 1.5-in diameter, Schedule 40, type 304 stainless steel flush thread materials in the riser, end cap, and screen. The well screens for each installation will be

composed of 2.0 ft lengths of wire-wrapped 0.010-inch slots and separated vertically by approximately 10 to 20 feet of well materials. Riser material will be up to 20 LF long to minimize the number of flush threaded joints. Thread sealant with thread lock will be used for each flush thread well joint to minimize potential gas leakage. The risers will be bundled together and centralized in the borehole at approximate 40-LF intervals to provide a nominal bentonite grout annular seal at least two inches thick between the bundled risers and the sidewall of the borehole.

Annulus well materials will be added incrementally from the surface during drill casing withdrawal, using a weighted tag tape to ensure at least one-foot of materials are present within the bottom of the drill casing at all times to prevent potential formation collapse around the well. The well annulus inside the casing may be packed with multiple stratified materials to ease placement through gas zones. Filter pack, installed a nominal 2 LF above and below both screens, will consist of 20/40 silica sand, suitable for the variable geology typically encountered and proposed screen slot size. The filter packs will be separated from each other by very-fine seal sand (50-70 grade silica sand) that has permeability much less than the adjacent MRAA sands. Coated bentonite ¼" pellets will be used above the Zone S filter pack followed by a nominal 2-ft thick fine sand seal after an 8-hour bentonite hydration period. Thereafter, a cement-bentonite grout will be installed with tremmie pipe from the bottom up to land surface. A variance request to LDNR may be requested by Tetra Tech prior to well construction initiation to reduce the bentonite pellet hydration time to approximately 2.5 hours. In any case, a 2-foot fine sand seal (50-70 grade) will be added above the top bentonite seal immediately prior to grouting. The well will then be sealed to ground surface with 4% bentonite grout cement pumped from the bottom up via a side discharge tremmie pipe. Grout will be mixed in general concurrence with Exhibit 1 of the Construction of Geotechnical Boreholes and Groundwater Monitoring Systems Handbook, December 2000, by Louisiana DOTD and LDEQ and in accordance with following:

4% Bentonite-Grout Mix

A 6-sack mix of grout with bentonite will be blended in a 100-gallon tub with a mechanical mixer and recirculating pump according to the following:

- 6 x 94 lb bags of Type I/II Portland Cement
- 47 gallons of potable water
- Mix density to be verified equal to or greater than 14.1 lbs/gal using a mud balance. If needed, additional cement will be added to the mix.
- Slowly blend in 22.6 lbs (~1/2 bag) of regular bentonite powder to avoid clumping. Note that Tetra Tech will substitute high yield CETCO brand GEL-X bentonite for regular bentonite with its associated 50% reduction in material weight in the mix design referenced above.

An experienced Tetra Tech field geologist will log the soil samples, monitor the drilling operations, record the well installation procedures, and prepare boring logs and well construction diagrams. At the completion of the monitoring well installations, the horizontal and vertical coordinates of the monitoring wells will be surveyed by a Louisiana-licensed surveyor.

3.3 WELL DEVELOPMENT

Following well completion, the wells will be developed using the following guidelines:

- Development will not be initiated for a minimum of 24 hours after well construction to allow sufficient time for the well seal to cure.
- Development will consist of gentle surging of the screened interval and purging with an air-lift pump.
- Turbidity readings will be collected and recorded periodically during the well development process.
- Air lifting will continue until the turbidity has decreased to below 100 Nephelometric Turbidity Units (NTUs), or until a minimum of 20 well volumes have been removed.

3.4 WELL COMPLETION

Each well will be completed with a concrete pad, 1.5" oil, water, gas (OWG) valves, well heads, and instrumentation. The groundwater well will not initially need a 1.5" OWG valve, as no gas flow is expected. However, one will be installed as future subsidence or gas recharge, if any, could alter gas flow patterns, potentially requiring the need for well control. The well heads will be installed as shown in Figure 3. The top of the well risers will be assembled with low profile, full port, 1.5" WOG ball valves with a minimum rating of 100 psi. These valves will be staggered from 1 to 2 feet apart for access. The gas PMW will be completed with a Track-It well head gas pressure transducer/datalogger, pressure indicator gauge, and quick connect for pressure measurement using a portable pressure test gauge, all with WOG isolation ball valves. The aquifer PMW will be completed with 1.5" to 2.5" reducer with end cap and 2 x ¾" NPT ports machined into the end cap. One port will be left open as an atmospheric vent and for water level gauging access; the other port will be used to secure a vented LevelTroll 700 pressure transducer/datalogger cable using a conax fitting.

Security fences will be installed to enclose and secure PMW-004 and PMW-007, which are located in the Bayou Corne community.

3.5 SCHEDULE

Pending LDNR concurrence, TBC plans to begin this work the week of May 5th and proceed until complete. It is anticipated that the CPT borings will take approximately four days to complete and the PMW installations and development will take approximately 16 days to complete. All work will be completed prior to the May 31, 2014 deadline.

3.6 REPORTING

A Letter Report will be prepared documenting the results of CPT and PMW activities, including documentation of the CPT gas survey results, borehole installation, soil logging, well construction, well development and survey.

4.0 PMW TESTING TO CONFIRM CONNECTIVITY

4.1 PMW - GAS ZONE MONITORING WELL

Testing will be performed following installation and development of each new gas zone (Zone-S) well of each PMW nested pair to confirm gas connectivity with the aquifer. Testing will involve venting gas at a constant rate until a predetermined volume of gas has been drawn from the well and adjacent formation. Gas pressures will be monitored during the venting period and during recovery. The procedure suggested by LDNR (Horne, 1995) is typically used for testing high pressure gas reservoirs. At low pressures, analysis of the test is complicated by higher nonlinearities associated with the gas compressibility. The test would be difficult to implement, because it would likely lead to high gas flow rates in wells where substantial initial gas thickness is present. Alternatively, TBC proposes the following modifications to the bleed-down test (LDNR, 15 APR 2014) to demonstrate gas connectivity with the aquifer.

The one-time test specified by LDNR (15 APR 2014) requires the venting of three well volumes of gas calculated from the initial well head pressure. A typical gas zone PMW with 110 LF of riser above the screen has a riser geometric volume of 1.35 cubic feet and a compressed gas volume equivalent to approximately 6 standard cubic feet. Based on site experience, we would expect that the first well volume could be quickly evacuated in a few seconds by partially opening the control valve to induce an immediate drop of 15 to 20 psi from the static wellhead pressure. Historically, similar venting stresses have produced short term flow rates of 100's of MCFD in other wells initially opened for development. PMWs with good communication could produce the next two (2) compressed gas well volumes in less than half a minute with a significant amount of entrained groundwater.

To avoid this complication, TBC proposes to control the gas flow rate at 1.00 cubic feet per minute (1.44 MCFD) by dynamic use of a throttling valve downstream of an electronic thermal gas flow meter. This approach would extend the very short term test to approximately 18 minutes (three [3] compressed gas well volumes). This controlled constant discharge rate would limit water production and allow collection of more accurate and meaningful test data. After 18 minutes of venting, only 0.018 MCF of gas will be produced, a very small amount of gas that could be safely vented to the atmosphere locally. Instrumentation would include the well head pressure transducer/datalogger, downhole pressure transducer/datalogger, electronic gas flow meter/datalogger and well head pressure indicator gauge. Documentation of field data will be entered on a tabular field form.

Any groundwater produced during testing will be collected and discharged to the sinkhole through one of the permitted outfalls

4.2 PMW – WATER ZONE MONITORING WELL

Slug tests will be performed on all existing and proposed water-zone MRAA piezometers and repeated annually to confirm adequate aquifer communication. It is planned that slug tests will be performed using pneumatic techniques (Butler et al, 2003). All piezometers are screened within the confined MRAA. Slug test data will be analyzed using the AQTESOLV or similar aquifer test software. If oscillatory slug test results are obtained, they will be analyzed using methods similar to those described by Chen (2006).

A slug test is a particular type of aquifer test where water is “instantaneously” changed with the resultant hydraulic head monitored through time to determine the near-well aquifer

characteristics. It is a method used by hydrogeologists to determine the transmissivity/hydraulic conductivity and storativity of the material in the vicinity of the well screen. The water-level response is monitored using a high-speed recording pressure transducer and requires accurate water-level data.

Pneumatic slug tests use pressurized air or nitrogen as the slugging agent. The well is sealed, and the water column is pressurized. As the pressure increases, the water level drops and water is forced out of the column and into the aquifer. The level drops until the pressure of the water head is equal to the increased air pressure in the well. Once equilibrium is attained, the pressure is instantaneously released and the water level begins to return to the static water level.

Pneumatic slug tests will be performed in accordance with the procedure described below:

1. Equipment to be used will be inspected to ensure that it is in good working order.
2. Measuring and testing equipment will be calibrated and tested before use in accordance with manufacturer's specifications.
3. The existing vented LevelTroll 700 pressure transducer will be used for the test without altering its fixed deployment depth from the Conax high-pressure, pass-through, well head fitting.
4. Before testing, fluid levels and depth to the bottom of the well will be measured using an electric-sounding device and recorded on the slug test field form.
5. Before testing, downhole transducer measurements will be recorded on the slug test field form.
6. The pressure-tight well head equipment will be assembled above the 1 ½-inch WOG valve, including a pressure indicator gauge and quick release fitting for connecting an air hose from a compressor. The open port for the atmospheric vent will be closed.
7. Program the data log using the true logarithmic sampling mode to start prior to column pressurization in order to capture the original static water level and determine the elapsed time to column pressurization.
8. An air compressor will be attached to the air fitting on the well head, and the well will be pressurized to the pre-determined slug pressure. Usually the test pressure will be 1 to 3 pound per square inch (2 to 7 feet of water).
9. Allow the pressure in the well to stabilize as determined by the pressure gauge on the well-head assembly. Once equilibrium is reached, the test may commence.
10. Restart the data log in order to resume taking readings at the highest sampling rate.
11. Release the large air ball valve to induce the slug and monitor the rise in water level. Once the level has returned to approximate pre-test level, the test is complete.
12. The slug test data will be reviewed and the test repeated, if appropriate. If necessary, the oscillating slug test method will be used to analyze the slug test data.
13. After the tests are determined to be satisfactory, the downhole pressure transducer will be reprogrammed back to its original monthly monitoring status.
14. Slug test equipment will be removed from the well, and the wellhead vent port will be re-opened to the atmosphere.

5.0 PERIODIC VENTING OF PMWS PROCEDURE

The BRC has recommended in its Gas Safety Benchmark Framework and Guidance memorandum dated March 17, 2014 that the PMWs be bled (vent) periodically. BRC stated that this should be done to verify the presence or absence of gas accumulation at each well.

The following is the procedure that TBC will use to vent the PMWs periodically.

1. Install a flexible hose from each PMW gas well to a temporary surface tank. The hose will be used to discharge total fluids and gas to the tank while gas is allowed to vent to the atmosphere.

2. Gradually open the master wellhead valve allowing pressurized flow to the surface tank, allowing any liquids or solids to settle in the tank for collection.

3. The vented gas shall be discharged directly to the atmosphere and dispersed by a high capacity ventilation fan away from the work zone.

4. PMWs will be vented at a frequency of once per month, approximately at the mid-point between monthly bottomhole pressure transducer download cycles. The duration of each well venting is variable, as described below.

This procedure would meet the task objective of temporarily reducing the well head pressure but could also provide the benefit of developing certain gas wells. If persistent formation gas is present, gas flow may surge groundwater within the screened well bore and scrub fouled screens and surge the filter pack to remove fines. With sufficient gas and water flow, turbidity would be flushed to the surface tank, entrained in the gas stream. If enough gas is co-produced with groundwater, the well can be re-developed automatically during each purge cycle until groundwater is visibly clean. If little or no gas is present, the well may only need to be vented for a few seconds.

If little to no gas is produced from the gas well venting, the well screen should be redeveloped every 3 months with a surge block followed by pumping of turbid groundwater in an iterative fashion until produced groundwater water clarity is less than approximately 100 NTUs, or 10 well volumes has been purged, whichever occurs first.

The water piezometer of the pair will be developed every 6 months with a surge block and pumped to confirm water clarity less than approximately 100 NTUs.

6.0 MONITORING PROGRAM FOR PMWS AND SHALLOW GEOPROBE WELLS

6.1 MONTHLY DOWNLOADING OF PMW AND ORW DATA

All PMWs and a subset of ORWs are instrumented with pressure transducers/dataloggers for long term monitoring of total bottomhole pressure and well head gas pressures, as summarized in Table 2. As wells operational phases change, instrumentation will also change.

The bottomhole pressure transducer/data loggers are In-Situ Level TROLL 700 vented pressure transducers with pressure ranges from 15 to 100 psig. The vented transducers negate the need for a barometric pressure transducer; however, barometric pressure readings are recorded hourly on site via the Tetra Tech weather station attached to the Tetra Tech work trailer. The LevelTroll's are deployed at known cable length depths from a no-slip, Conax, high pressure, pass-through well head fitting. The instruments are programmed to record discrete pressure and temperature measurements every 5 minutes. The Level TROLLs have an accuracy of ±0.1% of the sensor's full scale (i.e., the Level TROLL 700s that are rated to 100 psig have an accuracy of +/- 0.1 PSI and the Level TROLL 700s that are rated to 15 psi have an accuracy of +/- 0.02 PSI).

The pressure transducers are installed in a well via rugged twist-lock data/vent cables. These transducer cables are coated in Tefzel (generic Teflon) for excellent methane chemical compatibility. Having data cables attached to the transducers will eliminate measurement error associated with the removal and reinstallation of transducers (i.e., the transducer being reinstalled at an incorrect depth or tangling and knotting of the cable causing a change in length of the cable). This also lessens the risk of complications at those ORWs and PMWs that are under pressure. The lengths of the data cable at an individual well should be based on screen and/or perforation intervals to ensure that the Level TROLLs are always submerged in groundwater. Transducer cables are installed through a reducing bushing in the well head. Each transducer cable features a stainless steel "Conax" high pressure pass-through fitting with neoprene grommet. The fitting will compress the grommet sealing the gap directly outside the transducer cable.

In-Situ desiccant modules are directly attached to the above-grade side of the transducer data cable with twist-lock fittings and housed in a water-proof locked enclosure. Desiccant crystals fill in the module to help prevent moisture from damaging electronic devices.

The wellhead gas pressure transducer/data loggers are Monarch Instrument Track-It absolute pressure transducers with a pressure range up to 150 psia. The Track-Its have an accuracy of ±1% of the sensor's full scale (i.e., +/- 1.5 psia).

Measurements will be performed in accordance with Tetra Tech's site specific pressure monitoring Standard Operating Procedure to promote consistency and quality in the performance of long-term water level and water/gas pressure monitoring of the ORWs and PMWs. ORWs and PMWs require high-frequency head measurements to better evaluate potential temporal variability in groundwater flow patterns, flow directions (horizontal and vertical), hydraulic gradients, and gas pressures. Pressure transducers and electronic logging equipment are used to measure and record the pressure data.

Data is retrieved from the transducers on a monthly basis. For wells or piezometers without tubing pressure, synoptic depth to water measurements are collected to the nearest 0.01 ft from surveyed measuring points for subsequent correlation of LevelTroll pressure data with water levels for that month.

Data reduction will be performed using the In-Situ software Win-Situ Sync, Win-Situ 5, and Excel software. The use of these programs allows for the data to be copied from the field PC to the Tetra Tech Boulder, Colorado server where staff converts the data to workable files, and further performs barometric pressure compensation calculations for the well head pressure data and presents data in various summary reports.

6.2 MONITORING OF SHALLOW GEOPROBE WELLS

Michael Pisani & Associates, Inc. (MP&A) began conducting shallow zone gas pressure monitoring in December 2012 and subsequently record water levels in small diameter (1-inch), PVC wells (Geoprobe wells) screened in a shallow water-bearing zone (~15 to 45-feet below the ground surface) within the MRAA confining unit and in two-inch diameter, PVC wells screened in the top portion (upper ~10-feet) of the MRAA. Chicago Bridge & Iron (CB&I) have also been conducting gas pressure monitoring in 18 Geoprobe wells since August 2013 and MP&A have been conducting oversight and recording the CB&I measurements gathered to date. Field measurements were historically recorded weekly then reduced to bi-weekly.

The following wells have been monitored by MP&A:

- GP 1 through GP-6
- BC-2
- TBC-3
- GP-ORW-5
- GP-ORW-6
- GP-ORW-8
- GP-ORW-9
- GP-ORW-16
- GP-ORW-17
- GP-ORW-19
- GP-ORW-27
- GP-BS-20
- BP-BS-26-1
- GP-22-1
- GP-22-2
- GP-22-3
- GP-37-1
- GP-37-2

The following wells have been monitored by CB&I:

- NSDMW001 through NSDMW018

On April 1, 2014, the LDNR issued a letter to TBC regarding “Proposal to Change Monitoring and Sampling Schedule, March 21, 2014” that specifies the following changes to the ongoing pressure monitoring program:

- "Proposal to reduce pressure monitoring in 38 Geoprobe wells and BC-1 and TBC-3 from two times a month to monthly – the LDNR/OC has no objection to this proposal. Texas Brine or their contractors will have sole responsibility to collect this data and maintain the 38 Geoprobe wells and BC-1 and TBC-3. LDNR/OC or designated representative may periodically provide oversight or observations during the pressure monitoring."

The monitoring procedures are divided into the following steps:

- Initial Inspection
- Pressure Gauging
- Well Head Air Monitoring
- Groundwater Level Measurements
- Securing the Site
- Field Documentation and Data Tabulation

The initial inspection is conducted by the field technician and consists of a visual inspection and ambient air monitoring. The field technician:

- Visually inspects the well site vicinity to assess whether any significant changes have occurred since the last site visit. The technician notes whether the pad or curb box protecting the well head has been damaged or if there are signs of tampering. The technician will also note if there is any sign of illegal dumping in the area or if there is any other indication that the well integrity may have been compromised. The area around the well head is also inspected for any biological hazards such as reptiles (e.g. snakes) and insects (e.g. fire ants).
- Immediately reports via cell phone to the Responsible Manager signs of damage, vandalism, or any other site conditions indicating that the well integrity may have been compromised.
- Conducts ambient air monitoring using a four gas detector in the breathing zone and at the curb box. If no hazards are present, then the top of the curb box is unbolted and removed. The field technician also makes sure that all gaskets are retained and protected.
- Screens the air inside the curb box using the four gas detector and records the monitoring results [lower explosion limit (LEL) and H2S].
- Inspects the well head assembly for damage.

Pressure gauging is conducted using two pressure gauge/air sampling assemblies in sequence. The first gauge has a pressure range of 0 to 30 pounds per square inch (psi), followed by the second gauge with a range of 0 to 5 psi, if appropriate. The field technician:

- Securely attaches the 0-30 psi gauge to the well head assembly tubing.
- Records observed pressure reading on the field form. If no pressure is indicated, or the pressure is below 5 psi, then the 0-5 psi gauge is used.
- Detaches the 0-30 psi gauge and then attaches the 0-5 psi gauge using the techniques and precautions previously described.

Well head air monitoring for methane and Hydrogen Sulfide is conducted using the LANDTEC GEM™2000 Gas Analyzer & Extraction Monitor (Gem2K) pressure gauging/air sampling assembly. The field technician:

- Prepares the Gem2K for operation in accordance with the manufacturer's operating instructions.
- Attaches the intake tube on the Gem2K to the sample tubing from the pressure gauging/air sampling assembly.
- Opens the ball valve on the pressure gauge assembly.
- Observes the methane, Hydrogen Sulfide, LEL and atmospheric pressure readings on the Gem2K and records the maximum percentage displayed for each parameter.
- Detaches the Gem2K from the sample tubing and closes the in-line needle valve on the sample tubing.
- Turns off the Gem2K and allows it to purge according to the manufacturer's instructions.
- Detaches the pressure gauging/air sampling assembly from the well head assembly.
- Slowly opens the bull plug on the well head to bleed off any residual pressure remaining in the well head in preparation for taking the groundwater level measurement.

The depth to groundwater is measured from the top of casing (TOC) using an electronic water level indicator. Depths are recorded to the nearest hundredth of a foot (0.01'). The field technician:

- Removes the bull plug from the TOC by unscrewing it from the threaded coupling at the top of the well riser.
- If possible, the top of water is observed for bubbling. If bubbling is occurring this information is recorded.
- Activates and test the water level indicator.
- Lowers the water level probe into the well until the audible signal is activated indicating that the top of water has been reached.

- Adjusts the probe in order to determine the depth to the top of water and record the depth to the nearest hundredth of a foot (0.01').
- Recovers the probe and decontaminates the equipment using distilled water and clean paper towels.

Upon completion of the monitoring the field technician secures each site by:

- Replacing the bull plug by screwing it by hand into the threaded coupler at the TOC until tight. If required, replaces the Teflon tape seal on the well head assembly threads before replacing the bull plug.
- Ensuring that the O-ring gasket seat is clean and free of any debris before reinstalling the gasket in the curb box.
- Replacing the cover on the curb box cover and aligns the bolt holes.
- Ensuring that plastic washers are replaced on the bolts, thread the bolts into the anchors on the inside of the curb box by hand to ensure that they are not cross-threaded, and then secure the bolts using a socket and ratchet.
- Wiping down and securing all gauging assemblies and monitoring instruments in the cases provided in order to protect them during transport.
- Collecting all tools and materials used during monitoring.
- Collecting and bagging any trash or debris.
- Conducting a final inspection of the site before departing.

After the monitoring event is completed all pressure gauging/air sampling assemblies, monitoring instruments, tools, water trap, and water level indicator are wiped clean before storing. Monitoring instruments are placed on chargers as appropriate so that they will be ready for the next monitoring event.

The field technician records the data gathered in the field during each monitoring event in a bound field logbook using a black or blue pen. Upon completion of each monitoring event MP&A updates the Microsoft Excel spreadsheets that are used to electronically compile the field data from the wells. The updated spreadsheets are then emailed to TBC representatives for distribution.

7.0 REPORTING

As indicated in Section 3.6, a letter report will be prepared and submitted to LDNR which summarizes the CPT and PMW installation activities. ORW, PMW and shallow geoprobe data will be compiled monthly and uploaded to the Box.com file sharing site. The data submittal will include monthly graphing of the PMW results showing the differential pressure between the Zone-S (shallow) interval and the Zone-M (medium) interval for well pair.

An example differential pressure graph is shown in Figure 4.

8.0 REFERENCES

Butler, J.J., E.J. Garnett, and J.M. Healy. 2003. “Analysis of Slug Test in formations of High Hydraulic Conductivity, “ Ground Water, Vol. 41, No. 5, p.630-640.

Chen, C.S. 2006. “An Analytic Data Analysis Method for Oscillatory Slug Tests, “ Ground Water, Vol. 44, No. 4, p. 604-608.

TABLES

TABLE 1. EVALUATION OF ORIGINAL PMW LOCATIONS

PMW #	Install or Eliminate	Comments
004	Install	TBC recommends locating this PMW to a location midway between ORW-36, ORW-37 and ORW-50. The location will be near the projected high elevation of the top of the MRAA in this area.
005	Eliminate	This location will provide no additional useful data. CPT-10, CPT-39W, CPT-40 and CPT 42, as well as CPTs further to the south, all indicate minimal or no gas present in the MRAA. ORW-38 and ORW-21 testing confirms that no recoverable gas is located in this northern area of Bayou Corne community. The current pressure monitoring well BC-2 indicates that there is little to no gas present in the area of the Bayou Corne community
006	Eliminate	This location will provide no additional useful data. CPT-34, CPT-35W, CPT-36W and CPT 32 all indicate minimal or no gas present in the MRAA. ORW-21 testing confirms that no recoverable gas is located in this northern area of Bayou Corne community.
007	Install	TBC would locate PMW-007 south of ORW-49 and at the far south edge of the Sportsman's Paradise cul de sac. This PMW will provide monitoring data for both ORW-50 and ORW-55. The location is at the high elevation of the top of the MRAA in this area.
008	Installed	Installed slightly south of originally proposed location to eliminate the need for PMW-010. Providing good data.
009	Eliminate	This location is in the area where methane gas has been depleted from the MRAA.
010	Eliminate	Revised location of PMW-008 eliminated the need for PMW-010.
011	Eliminate	The PMW locations were selected in RRD-09 back in June 2013 prior to having the CPT data and ORW production data from wells near and south of this location which indicate little to no gas is present within the MRAA in this area. Therefore this remote location provides no additional protection to the community of Bayou Corne.
012S & 019M	Installed	Installed and providing good data.
013	Eliminate	This location is in the area where methane gas has been depleted from the MRAA.
014	Eliminate	This location is in the area where methane gas has been depleted from the MRAA.

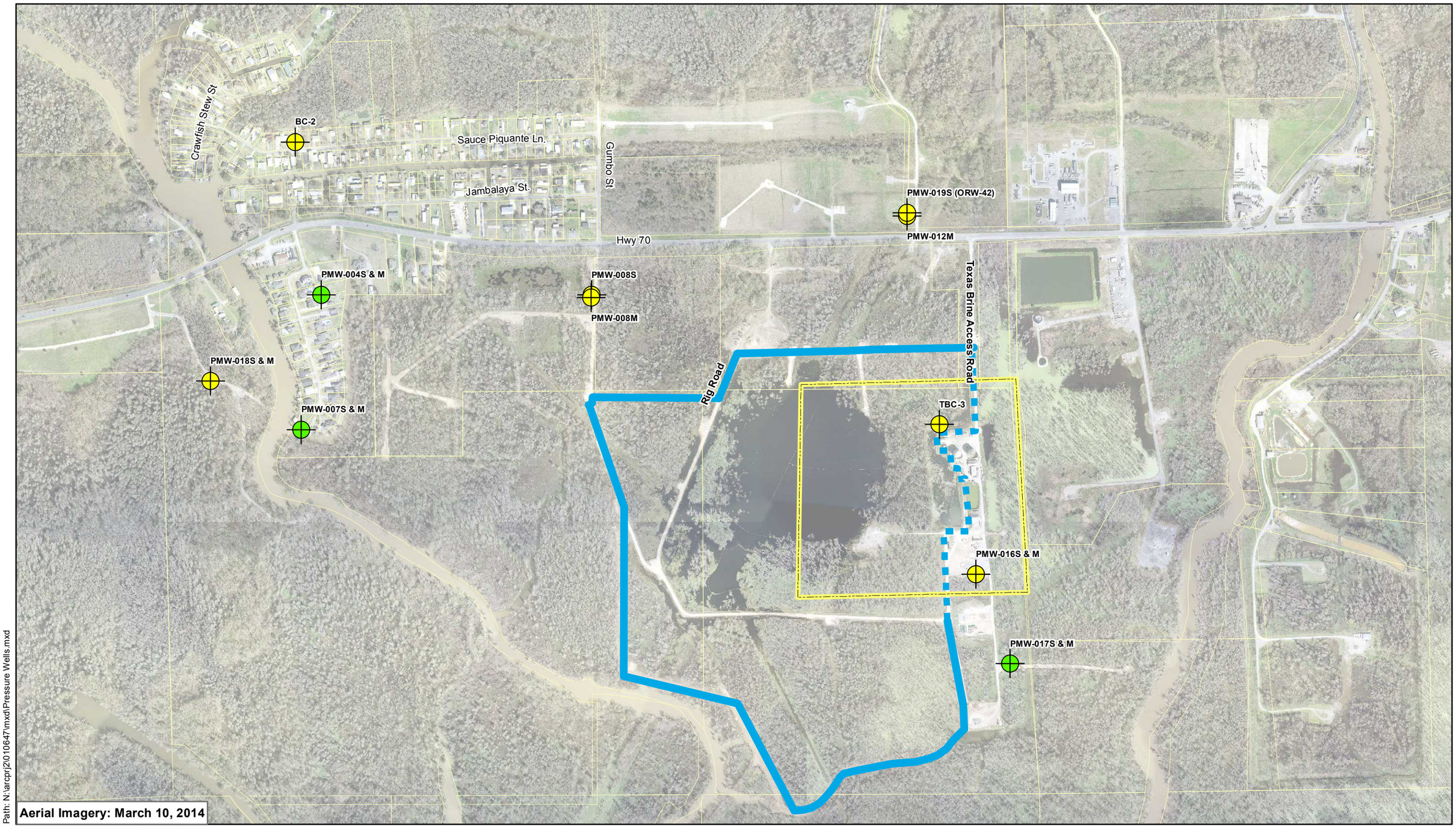
PMW #	Install or Eliminate	Comments
015	Eliminate	A PMW should not be installed at this location on the south berm due to stability considerations. PMW-008's location between the sinkhole and Bayou Corne community makes this PMW unnecessary.
016	Installed	TBC's location replaces DNR's PMW-016 and PMW-017 and is in the middle of these 2 BRC proposed locations that was previously agreed to by DNR.
017	Install	Proposed location is to the south of Pad 9 on the TBC facility on the road leading to ORW-57. This location will provide additional data on gas depletion in this area.
018	Installed	Installed and providing good data. TBC voluntarily put in this PMW nested well.

TABLE 2. MONITORING PROGRAM FOR ORW/PMW

Wells with Downhole Pressure Transducers	Wells with Wellhead Gas Pressure Gauges
OGRW-1	Y
ORW-6	N
ORW-9	N
ORW-11	N
ORW-13	N
ORW-15	N
ORW-17	N
ORW-19	N
ORW-22	N
ORW-27	N
ORW-29	N
ORW-38	Y
ORW-39	N
ORW-40	N
ORW-41	N
ORW-43	N
ORW-46	N
ORW-48	N
ORW-49	Y
ORW-50	Y
ORW-52	Y
ORW-53	Y
ORW-54 (PMW-12S)	Y

Wells with Downhole Pressure Transducers	Wells with Wellhead Gas Pressure Gauges
ORW-56	N
ORW-57	na
ORW-58	N
PMW-08S	Y
PMW-08M	N
PMW-12M	N
PMW-16S	Y
PMW-16M	N
PMW-18S	Y
PMW-18M	N
PMW-19S (Former ORW-42)	Y-(Transducers on Tubing and Annulus)

FIGURES



Path: N:\arcprj\2010647\mxd\Pressure Wells.mxd

Legend

- Installed Pressure Monitoring Well
- Proposed Pressure Monitoring Well
- Boundary of Containment (40 feet)
- Existing Barrier
- Approximate TBC Leased Property Line

N

SCALE IN FEET

0 400

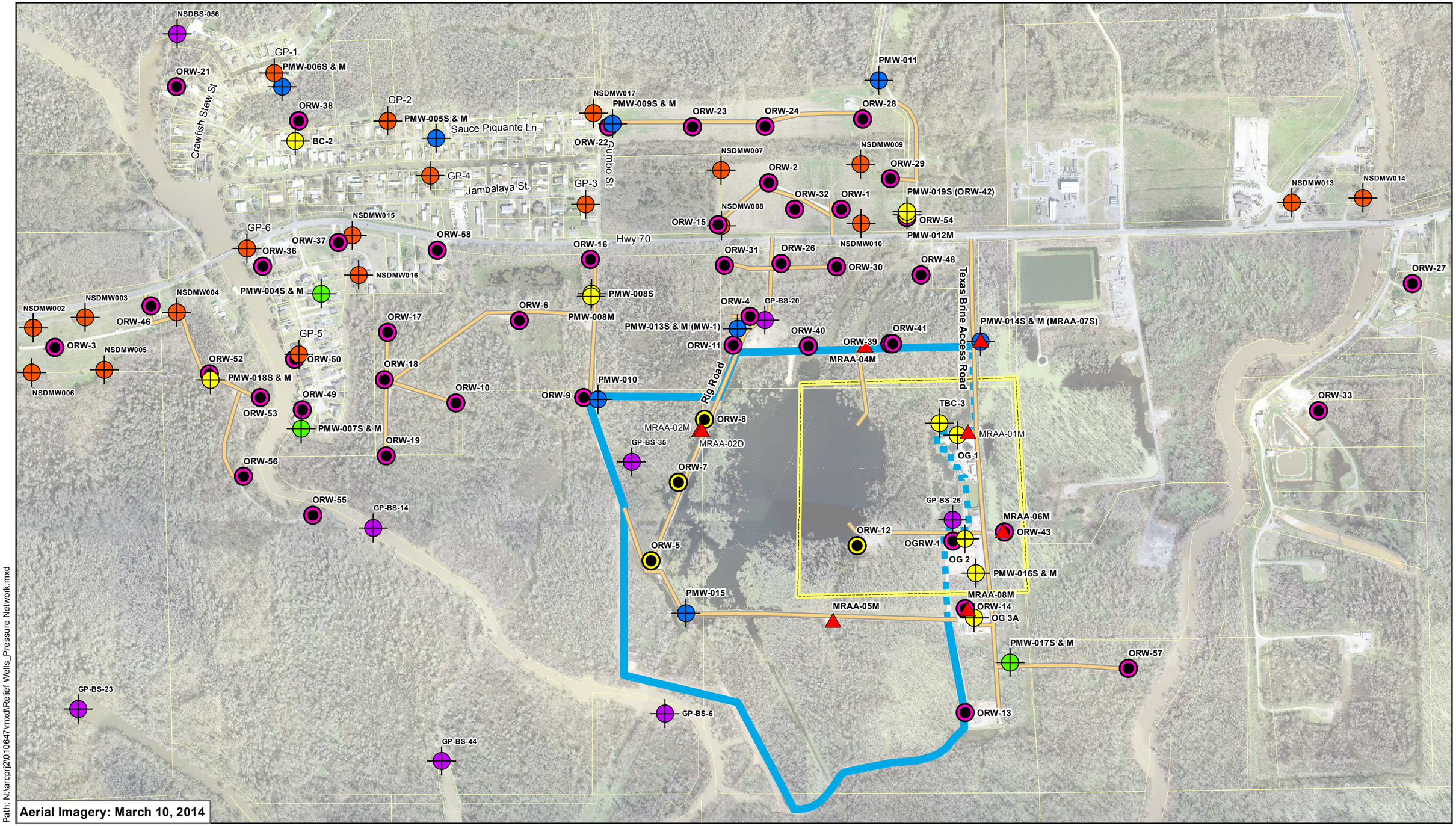
Apr 28, 2014

Figure 1

Napoleonville Salt Dome Project

Pressure Monitoring Well Locations

Texas Brine Company, LLC



Path: N:\arcpri\2010647\mxd\Relief Wells_Pressure Network.mxd

Aerial Imagery: March 10, 2014

Legend

- Proposed Pressure Monitoring Well - Not to be Installed
- Proposed Pressure Monitoring Well
- Installed Pressure Monitoring Well
- Plugged ORW Well
- ORW Installed
- Geoprobe/Monitoring Well
- Bubble Site Geoprobe
- MRAA Wells
- Approximate TBC Leased Property Line
- Well Access Road (26 feet)
- Boundary of Containment (40 feet)
- Existing Barrier

N

SCALE IN FEET

0 400

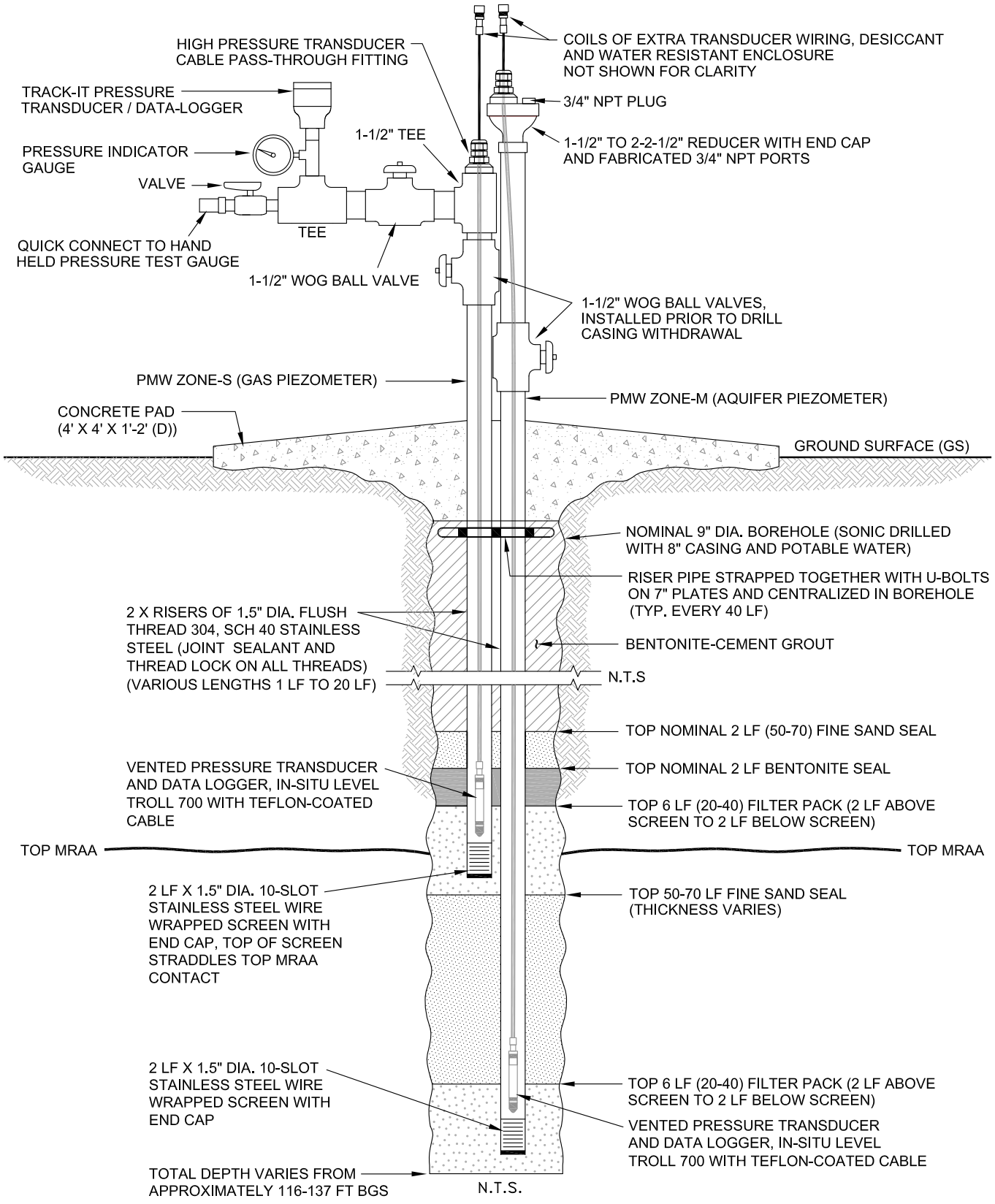
Apr 28 2014

Figure 2

Napoleonville Salt Dome Project

Pressure Monitoring Well Network

Texas Brine Company, LLC



TOP OF SCREEN:

ZONE-S APPROXIMATE TOP MRAA CONTACT

ZONE-M APPROXIMATELY 10 TO 20 FT BELOW TOP OF MRAA CONTACT

TITLE:

PROPOSED NESTED PRESSURE MONITOR WELL DESIGN FOR MRAA GAS AND GROUNDWATER ZONES

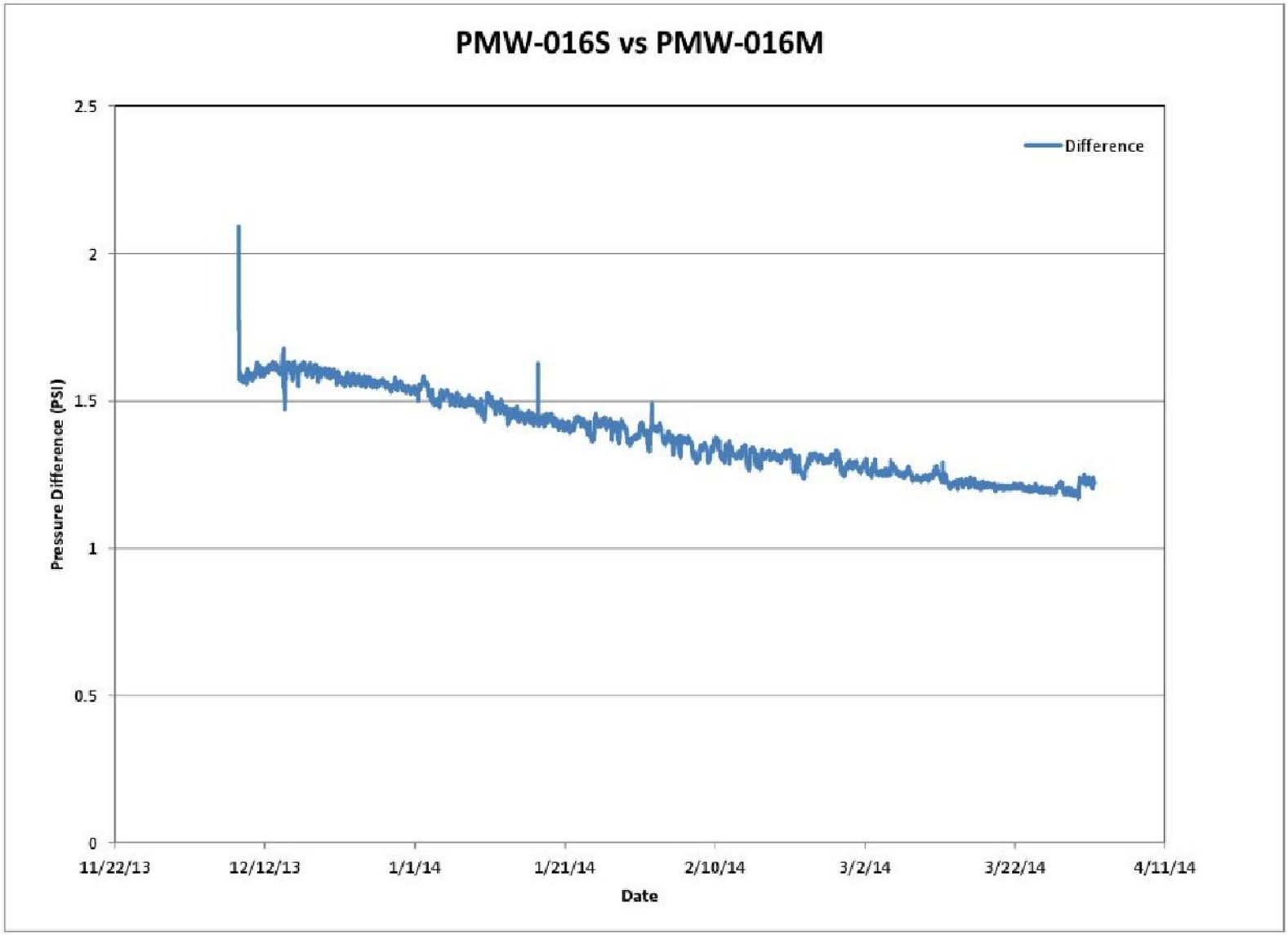
LOCATION: **Napoleonville Salt Dome Project**
Bayou Corne, Louisiana

TETRA TECH

APPROVED	JT
DRAFTED	CP
PROJECT#	117-0504124
DATE	4-15-14

FIGURE **3**

P:\ACAD\0504-124-BAYOU\0504124108A.DWG



Scale: As Shown Designed by: JN Drawn by: JJA Checked by: JN Approved by: JN	Issued for: Texas Brine Company, LLC	Issued by: TETRA TECH 4900 Pearl East Circle, Ste 300W Boulder, CO 80301 (303) 447-1823 (303) 447-1836 fax	FIGURE 4 EXAMPLE PRESSURE MONITORING WELL DIFFERENTIAL GRAPH Project: TEXAS BRINE Project no.: 114–010647 Location: LOUISIANA Date: 04/23/14	0 REVISION 1 SHEET OF 1