NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

TEST PLAN

TITLE:	Revision: **0**
Recompletion and Pumping Test of Groundwater Evaluation Well NC-GWE-GF-4PB, Southern Nye County	Date: **03/27/2014** Page: **1 of 20**

TEST PLAN NUMBER:	SUPERSEDES:
TPN-5.7	

APPROVAL	CONCURRENCE
3-28-14 Project Manager Date	3-28-2014 Geoscience Manager Date
	3/28/14 Principal Investigator Date
	3/27/14 Quality Assurance Officer Date

1.0 INTRODUCTION

This test plan (TPN) provides instructions for recompletion and conducting pumping tests at Nye County Nuclear Waste Repository Project Office (NWRPO) Groundwater Evaluation (GWE) wells. These instructions include the following tasks:

- Instrumentation of monitoring wells;
- Background data collection;
- Pump and packer installation;
- Well recompletion;
- Step rate test;
- Constant rate test; and
- Groundwater sampling.

2.0 PURPOSE AND JUSTIFICATION

The Nye County NWRPO is conducting groundwater evaluation (GWE) studies in southern Nye County under a Department of Energy (DOE) grant. As part of this work, the county has installed a network of groundwater piezometer wells to supplement the existing groundwater monitoring network. Included in this monitoring network are test/monitoring well, NC-GWE-GF-4PB (GF-4PB), and test/monitoring well, NC-GWE-GF-3T, (GF-3T) at two existing testing complexes to characterize the hydrologic properties of the Gravity Fault.

The Gravity Fault in Amargosa Valley is a prominent hydrologic feature that controls head relationships between the Lower Carbonate Aquifer (LCA) to the east, and Valley Fill Aquifer (VFA) to the west. The fault and overlying saturated zone sediments probably also control discharge from the LCA to the VFA. Although this feature was identified in the 1970's, and the feature has been incorporated into several hydrologic flow models, no direct hydrologic testing has been conducted to evaluate the hydrologic significance of the fault. The GF-3 and GF-4 well complexes provide the opportunity to conduct a series of aquifer pumping tests to better determine the hydrologic characteristics of the Gravity Fault.

Testing of well GF-3T indicates that the VFA in proximity to the LCA at the GF-3/4 sites has very low permeability. As well, the well yield in GF-3T is also very low making a test between the VFA and LCA impractical.

Preliminary well testing at GF-4PB indicated that additional open-area of the slotted well casing would be needed to adequately develop and test the very high permeability zone within the LCA intersected by this well.

Well GF-3T is screened over two intervals. Installation of a packer to isolate the screened intervals in this well will allow two distinct VFA zones to be monitored during the GF-4PB pumping test.

3.0 SCOPE OF WORK FOR WELL RECOMPLETION, INSTRUMENTATION, AND PUMPING TEST

3.1 Responsibilities and Pre- and Post-Operation Requirements

3.1.1 Responsibilities, Chain of Command, and Communication

The Nye County NWRPO Geoscience Manager (GSM) will be responsible for supervising all technical data collection described in this plan. The NWRPO-designated field representative (NDFR), in most cases the Contract Managing Geologist, will supervise other contract geologists and technicians, collectively referred to as NWRPO field personnel herein. NWRPO field personnel are responsible for conducting the activities described in this TPN.

The drilling or pump contractor is responsible for well recompletion and installation of downhole equipment as specified in the Scope of Work: Attachment A. A drilling contractor-designated field representative (CDFR) will direct all completion contractor activities, with the exception of the NWRPO-directed activities specified in the drilling contract, which the NDFR, or designee, is responsible for directing. The NDFR and CDFR will communicate on a daily basis and review, approve, and sign daily drilling records that document contract billable items.

3.1.2 Site Locations and Pad Preparation

Sites for GWE Gravity Fault wells are located in Amargosa Valley in southern Nye County, Nevada (Figure 1). All sites have gravel access roads. Well locations were prepared and surveyed in accordance with proper NWRPO Quality Assurance (QA) protocols, and all processed data has been transmitted to the QA Records Center (QARC) along with associated metadata.

3.1.3 Permitting, License, and Reporting Requirements

The NWRPO, as the well owner, has completed all required federal and state permits. No additional permits are required from the U.S. Department of the Interior, U.S. Bureau of Land Management (BLM), Nevada Division of Water Resources (NDWR), or Nevada Division of Water Pollution Control.

The drilling contractor is required to meet the reporting requirements of Nevada Revised Statute (NRS) 534.170 and Nevada Administrative Code (NAC) 534.340 by submitting a revised Well Driller's Report and Record of Work to the NDWR within 30 days of the recompletion well GF-4PB. Copies of the documents will also be transmitted to the NWRPO.

3.1.4 Mobilization and Demobilization

Mobilization will be considered complete when the following steps have been taken:

1. The pump setting rig and associated equipment has been inspected and approved by the NDFR as being in clean condition and good working order.
2. Material safety data sheets (MSDSs) for all applicable materials on site have been submitted to the NDFR.
3. All proofs of insurance, personnel training, and other certifications specified in the contract have been submitted to the NWRPO.
4. All State of Nevada requirements for the drilling or pump contractor (e.g., Notice of Intent to Drill) have been met and applicable documents submitted to the NDWR, with copies to the NWRPO.
5. All personnel, equipment, tools, and material required under the contract are on the site, except those not needed immediately. The drilling contractor may use the NWRPO lay-down yard in Lathrop Wells for equipment storage; however, rig time incurred while waiting for such equipment to be retrieved will be at the drilling contractor's expense.

Demobilization will be considered complete when the following steps have been taken.

1. Tasks specified in the contract are complete or exempt from completion by approval from the NWRPO.
2. Any pits and berms on all the drill sites have been graded to approximately the original elevation.
3. All personnel, equipment, tools, unused materials, and drilling-related debris have been removed from the site, as well as from the NWRPO lay-down yard.

3.1.5 Dust Control

Best Management Practices will be utilized to control dust on gravel access roads, including limiting vehicle speed to 25 mph and watering roads as necessary. Water will also be used to control dust where necessary.

3.1.6 Other Drilling Contractor Responsibilities

It is the responsibility of the drilling or pump contractor to be aware of, and comply with, the conditions of the *NWRPO Site Specific Health and Safety Plan for the Drilling, Well Construction and Testing of Groundwater Evaluation Piezometer Wells, Southern Nye County* (NWRPO, 2013b). A copy of this plan will be given to the drilling contractor at the preconstruction meeting. As part of every shift, a tailgate safety meeting will be conducted and documented on the Tailgate Safety Briefing Worksheet.

The well sites are located on private lands, and will not require special training, badging, and/or security clearances for the drilling contractor or the contractor's employees.

All solid waste, trash, and construction debris will be removed from the site and managed in accordance with applicable regulations. No wastes will be disposed onsite. Hazardous wastes are not expected to be generated during the drilling and monitoring processes. Drilling returns are not hazardous wastes.

In compliance with BLM permit requirements, the drilling contractor will take steps to control noxious weeds. The drilling contractor will steam-clean the undercarriage of all drilling and heavy equipment before entering public lands.

3.2 Background Data Collection

At each observation well within the Gravity Fault test area (GF-3PA, GF-4, GF-4PA, GF-4PB, prior to recompletion, and GF-3T, prior to zonal isolation), sound static water level (depth to water) using an electric well sounder, install Level Troll pressure transducer on 100 ft compensated Rugged Troll cable, record initial submergence, and start logging transducer information at a maximum 15 minute interval. Record all information for each observation well on a separate page in the scientific notebook. Ideally, the observation wells would be instrumented with transducers at least two weeks prior to test pumping. Periodic static water level measurements with an electric well sounder may be required at other GWE monitoring wells at the discretion of the PI or GSM.

It is preferable that a minimum of two weeks of background data also be collected at well GF-3T after packer inflation to measure the water level recovery in the upper and lower screened intervals. At the discretion of the PI or GSM, water may be added or removed from the well to expedite the water level recovery to pre-completion levels.

3.3 Well GF-3T Zonal Isolation and Instrumentation

Following is the general procedure to install zonal pressure isolation and pressure transducers in monitoring well GF-3T.

1. Remove background monitoring pressure transducer installed earlier.
2. Mobilize pump contractor with small pump rig. Measure water level in well.
3. Assemble 3-inch Grundfos 30SQ-130 240V pump with 3-inch pass-through subs and 8-inch TAM packer on 2-inch production drop pipe.
4. Direct pump contractor to connect submersible pump cable (10-2 with ground) to the pump, passing conductors inside packer (through both pass-through subs).
5. Connect ¼-inch stainless steel tubing with open end below packer (through both pass-through subs) to the area below pump intake, as a lower zone capillary tube.
6. Connect another ¼-inch stainless steel tube (from spooled roll, approx. 500 ft) to packer inflation connection.
7. Test all connections for a hydraulic seal, and test run pump before lowering assembly into well.
8. Begin running in assembly on sixteen 21-foot joints of 2-inch Schedule 40 drop pipe. Bundle a 1-1/4-inch PVC coupled tubing string to first joint of drop pipe. Connect the 1-1/4-inch lower zone PVC sounding tube to the lower zone capillary tube.
9. Begin adding the second (upper zone) 2-inch flush threaded PVC sounding tube with 20-feet of slotted casing on bottom with end open. Add after 5th 21 foot drop pipe is run in. (Bottom of joint 6, depth ~230 ft BGS).
10. Continue running in pump and packer assembly adding the two PVC sounding pipes, taping cables, pump cable and tubing securely to the drop pipe.
11. Land packer and tubing assembly on wellhead. Cut PVC sounding pipes to slightly above well head. Record tubing string (2-inch steel) on a Tubing and Casing Record (Attachment B)
12. Add an elbow and discharge head including gate-valves and 1-1/2 inch totalizing flowmeter to 2-inch discharge/drop pipe.

13. Direct pump contractor to connect 10-2 submersible pump cable to County-provided 11KV generator. Ground casing to generator. Pump will be used for sampling at a later date. Remove discharge assembly and generator from site until well sampling.
14. Measure water level in both sounding tubes and record in scientific notebook.
15. Install one In-Situ Level Troll pressure transducer in lower zone (1-1/4-inch) sounding tube to measure pressure below packer and one In-Situ Level Troll in upper zone (2-inch) sounding tube to measure pressure above packer. Program transducers to record readings at two minute intervals.
16. Record minimum of one half hour data with packer deflated.
17. Inflate packer and allow pressure above and below packer to equilibrate for a minimum of 24 hours.
18. Download data from the transducer and transmit data, copies of the scientific notebook and forms to NWRPO.

3.4 Well GF-4PB Recompletion and Development

Well GF-4PB is an existing 287-foot deep 5.5-inch OD steel well that will be re-worked including perforation of approximately 7.5 feet of existing blank and slotted casing. The newly perforated well will be air-lift developed with 2-inch airline discharging to diverter and air-cyclone system until sand production has diminished. An optional 10-foot long section of 4.5-inch OD "double slotted" screen casing with 0.080-inch slots will be sleeved within existing newly perforated interval, should sand production not decline during air-lift development. Following air-lifting, the well will be outfitted with a 4-inch 460V 3-Phase submersible test pump, discharge head including elbow, gate valve, pressure gauge, sampling ports, totalizing flowmeter, gate-valve and pump controller panel. A 48 hr constant discharge aquifer test will be conducted after a 4 to 8 hour step test.

The detailed contractor scope of work for the recompletion, air-lift development and testing of well GF-4PB is also included as Attachment A.

3.4.1 Well Casing Perforation – GF-4PB

1. Mobilize pump contractor with large pump rig and support equipment and tools.
2. Run in perforation tools and perforate with approximate 3/8-inch diameter holes through two depth intervals of 5.5-inch diameter J55 flush-threaded blank (274.0 to 276.5 feet BGS) and slotted casing (277.5 to 282.5 BGS). Additional perforations, if needed, can extend upward to as shallow as 270 ft BGS.
3. Remove tools from well.

3.4.2 Air-Lift Development – GF-4PB

1. Run a 2-inch steel air-lift line to near the bottom of the well.
2. Connect discharge diverter to top of 8 5/8-inch casing. Connect diverter discharge line to air-cyclone discharge. Connect 250 CFM compressor to air-lift line.
3. Air-lift well for up to 8 hours, or until sand production diminishes. If sand production continues, install 4.5-inch OD screen joint at bottom of well and continue air-lifting.
4. Remove air-lift line, diverter/discharge head and surface lines.

3.4.3 Pump Installation – GF-4PB

Install 4-inch 460V 3-phase submersible pump with check valve on 2-inch drop pipe with submersible pump cable to a depth of approximately 250 feet (DTW= 45 feet from TOC). Install In-Situ transducer and cable and a ¾-inch flush-threaded PVC sounding tube with 20 feet slotted section on bottom to 200 feet. Install surface discharge assembly including landing plate, elbow, gate valve, ball valve, flow meter, sample port and discharge hose. Connect discharge to previously supplied air cyclone. Connect pump controller panel to pump and 105 Kw generator. Test run/start generator and submersible pump to confirm proper operation and pump rotation.

3.5 Well GF-4PB Pumping Test

After air-lift well development, the test well will be test pumped using a submersible pump and generator. The pump will be set by a pump contractor. The pumping test will include drawdown measurements from pressure transducers deployed with the well pump and at observation wells GF-4, GF-4PA, GF-3PA and the upper and lower zones of GF-3T. Additionally, drawdown measurements will be conducted using electric well sounders through the ¾-inch sounding tube installed with pump. Discharge measurements will be made using a combination of a 3-inch totalizing flow meter and timed barrel tests to confirm flow meter readings. Data collected during test pumping will be documented on a GWE Well Pump Testing Form (Attachment C) and the scientific notebook. Data files from the transducers will be transmitted to the QARC with the form. The general sequence for pump testing the test well is:

1) Mobilize pump contractor with pump, pump string and discharge head and generator to the well site, conduct safety briefing.
2) Sound depth to water in test well using an electric well sounder and record on the GWE Well Test Pumping Form.
3) Attach Level Troll pressure transducer probe to pump bundle, approximately 1 foot above the top of the pump. Measure distance between transducer port and intake screen on pump.
4) Run in pump/motor assembly, sounding tubes, and transducer to approximately 250 feet below static water level . Record pump string on Tubing and Casing Record (Attachment B). Set discharge line including: elbow, pressure gauge, ball valve, flow meter, including minimum 4-foot “straight” run before and after flow meter, gate valve and sample port. Set discharge line on a saw horse and place a 50-gallon plastic barrel beneath discharge. Discharge area will include a pallet or similar system to minimize erosion at the discharge site. Record depth of transducer (submergence in feet) from data logger. Start logging transducer data at 2 second interval.
5) At each observation well within the Gravity Fault test area (GF-4, GF-4PA, GF-3PA and two zones in GF-3T), sound static water level (depth to water) using an electric well sounder, confirm that previously installed Level Troll transducers are operating correctly, reset logging interval to 5 minute interval. Record all information for each observation well on a separate page in the scientific notebook. Ideally, the observation wells would be instrumented with transducers several days prior to test pumping.

3.5.1 Step Test Procedure

1) Start pump at approximately 20 gpm and wait for drawdown to stabilize (at least 20 minutes); then observe water quality. Record pumping rate, wellhead pressure, submergence and time [Step Test 1].
2) If drawdown from Step 1 is less than 10% of available drawdown (i.e., less than 20 ft), increase pump rate to 40 gpm [Step Test 2];
   If drawdown is between 10 and 25% of available drawdown (i.e., between 20 and 50 ft), increase rate to 30 gpm [Step Test 2];
   If drawdown is between 25 and 100% of available drawdown (i.e., between 50 and 200 ft), decrease rate to 20 gpm; see procedure in 6) below
3) Wait for drawdown to stabilize (at least 20 minutes, observe water quality). Record pumping rate, wellhead pressure, submergence and time.
   If drawdown is still less than 20% of available drawdown (i.e., less than 20 ft), increase pump rate to 60 gpm [Step Test 3];
   If drawdown is between 20 and 50% of available drawdown increase rate to 40 gpm [Step Test 3];
4) Wait for drawdown to stabilize (at least 20 minutes, observe water quality). Record pumping rate, wellhead pressure, submergence and time.
   If drawdown is still less than 50% of available drawdown (i.e., less than 30 ft), increase pump rate to 100 gpm or the maximum pump rate [Step Test 4];

If drawdown is between 50 and 75% of available drawdown increase rate to 80 gpm [Step Test 4];

5) Wait for drawdown to stabilize (at least 20 minutes, observe water quality). Record pumping rate, wellhead pressure, submergence and time. Determine an ideal test yield based on the performance of the well during step testing. The ideal test yield should drawdown the well approximately 120 to 160 feet.
6) For low yield wells identified in step 2) above, conduct test at step rates of 10, 20, 30, 40 gpm or at similar lower increments based on the well performance (i.e., 5, 10, 15, 20 gpm), such that the highest step (step 4) does not draw down the well to below the pump intake.
7) Determine an ideal test yield based on the performance of the well during step testing. The ideal test yield should draw the well down approximately 120 to 160 feet.
8) Shut in test by closing ball valve and then stopping pump. Allow well to recover (ideally overnight).

3.5.2 Constant Discharge Test Procedure

1) Check that all transducers in all wells are operating correctly. Sound depth to water with electric well sounder. Start pump and adjust pump rate to pre-determined rate based on step test above. Record rate and initial drawdown. If drawdown is greater than 160 feet, decrease rate slightly using gate valve on discharge assembly. Record the adjusted rate.
2) Pump well continuously for a minimum of 48 hours. Record pumping rate and drawdown every two minutes (or after 3, 6, and 10 minutes) for the first 10 minutes and then every 10 minutes between 10 minutes and 100 minutes and every 60 minutes until the end of the test. If timed barrel tests are within 10% of the flow meter readings, flow meter readings are considered accurate and no further timed barrel tests are needed, except a final barrel test prior to pump shut-in. Drawdown can exceed 160 feet provided the total drawdown does not reach the pump and transducer. Should the drawdown begin to approach 200 feet, adjust the discharge rate down in 10% increments. Record the times that these pump rate changes are made.
3) Record pumping rate and transducer submergence prior to shutting in pump. Shut in pump.
4) Allow well to recover within 95% of the drawdown recorded in step 4 above.
5) Remove pump and transducer from well; secure wellhead.
6) Download data from the transducer and transmit data, copies of the scientific notebook and forms to NWRPO as soon as possible.

4.0 SAMPLE MANAGEMENT

Groundwater samples will be collected prior to shut in of the GF-4PB pumping test. Groundwater samples will also be collected from both the upper and lower zones of well GF-3T. These samples will be collected per TPN-11.6.

5.0 DRILL SITE MANAGEMENT

5.1 Field Changes to TPN Procedures

It is the responsibility of the NWRPO person in charge in the field to execute fieldwork in accordance with the controls of the approved work package.

However, unanticipated conditions may require deviation from the approved procedures outlined in this TPN. It is the intent of this test plan to ensure prior approval for field changes that may have *significant impact* on the planned purpose of a well. This will include significant impact to drilling, sampling, testing, completion, or cost. Insignificant field deviations to the controls of the approved drilling package need not be approved in advance.

The following process shall be followed if significant changes to the procedures are required:

1. The NWRPO Person in Charge in the field will contact the GSM and the Principal Investigator (PI) by telephone (a three-way conference call is preferable) or in person to discuss the proposed departure from the approved procedures prior to carrying out a change. Verbal agreement from the GSM and PI will signal approval for the NWRPO Person in Charge in the field to execute the change. The NWRPO Person in Charge in the field will document the approval in the scientific (field) notebook for the subject well.

2. If verbal approval is given by the GSM and the PI, then the person proposing the change will transmit a summary of the changes on the Field Change Approval Form (Attachment D) to the GSM within 24 hours. The GSM will sign and date the form and pass it on to the PI. The PI will then sign and date the form, route a copy to the QARC, and give the completed Field Change Approval Form to the NWRPO person in charge in the field.

3. The NWRPO Person in Charge in the field will document known effects of the field change in the scientific (field) notebook for the subject well.

5.2 Field Operations Documentation

The NWRPO person in charge in the field will ensure that completions and well testing site operations are documented as specified in the following:

1. Re-completion operations will be documented by NWRPO field personnel in drilling operation records. GWE drilling operation records are listed in Section 8.0 and included as attachments in Section 10.0. Depth control while running casing during well completion is documented in the Tubing and Casing Record (Attachment B). Those personnel entering the data in drilling operations records shall sign forms as preparers.

2. All information entered into these forms will be checked for accuracy in the field by NWRPO field personnel different from those originally entering information into the forms. These forms will be transmitted to the QARC generally once per week.

3. Important completion operations-related information that is not documented in drilling operations records should be recorded in the scientific notebook for the project.

4. Aquifer testing activities should be documented in the scientific notebook and on the GWE Well Pump Testing Form and all hard copy and electronic data generated shall be transmitted to the QARC as soon as possible after testing has been completed.

6.0 MANAGEMENT

All NWRPO field personnel performing the tasks described in this TPN will be trained in the procedures specifically applicable to the equipment and methods used before conducting work. Personnel will document that they have read and understand this TPN.

The QA Officer is responsible for ensuring that this plan meets QA requirements and that NWRPO field personnel are trained to and comply with the requirements of this TPN. The PI is responsible for the preparation, technical review, and revision of this TPN, as well as oversight of its performance. NWRPO field personnel are responsible for conducting field logging, depth control, drill site management and well testing.

7.0 REFERENCES

NAC (Nevada Administrative Code) 534.320. “Notice of Intent to Drill: Contents, Submission.”

NAC (Nevada Administrative Code) 534.330. “Responsibilities of Licensed Well Drillers at Drilling Site.”

NAC (Nevada Administrative Code) 534.340. “Log and Record of Work: Form; Contents.”

NRS (Nevada Revised Statutes) 534.170. “Underground Water and Wells, Well Driller to Keep Log and Records; Contents; Information to be Furnished to State Engineer; Report of Test.”

NWRPO (Nuclear Waste Repository Project Office), 2013b. Groundwater Evaluation, Site Specific Health and Safety Plan, Nye County NWRPO, Pahrump, Nevada.

NWRPO (Nuclear Waste Repository Project Office), 2012. Groundwater Sampling and Analysis of Groundwater Evaluation Program Wells., Nye County NWRPO, Pahrump, Nevada.

8.0 RECORDS

GWE Well Pump Testing Form

Field Change Approval Form

9.0 FIGURES

Figure 1 Location Map

10.0 ATTACHMENTS

A Scope of Work from Well Drilling and Completion of Groundwater Evaluation Wells in Southern Nye County - Bid Specifications and Request for Bids, Nye County, NV, NWRPO

B Tubing and Casing Record

C GWE Well Pump Testing Form and GWE Well Pump Testing Form Continuation

D Field Change Approval Form

FIGURES

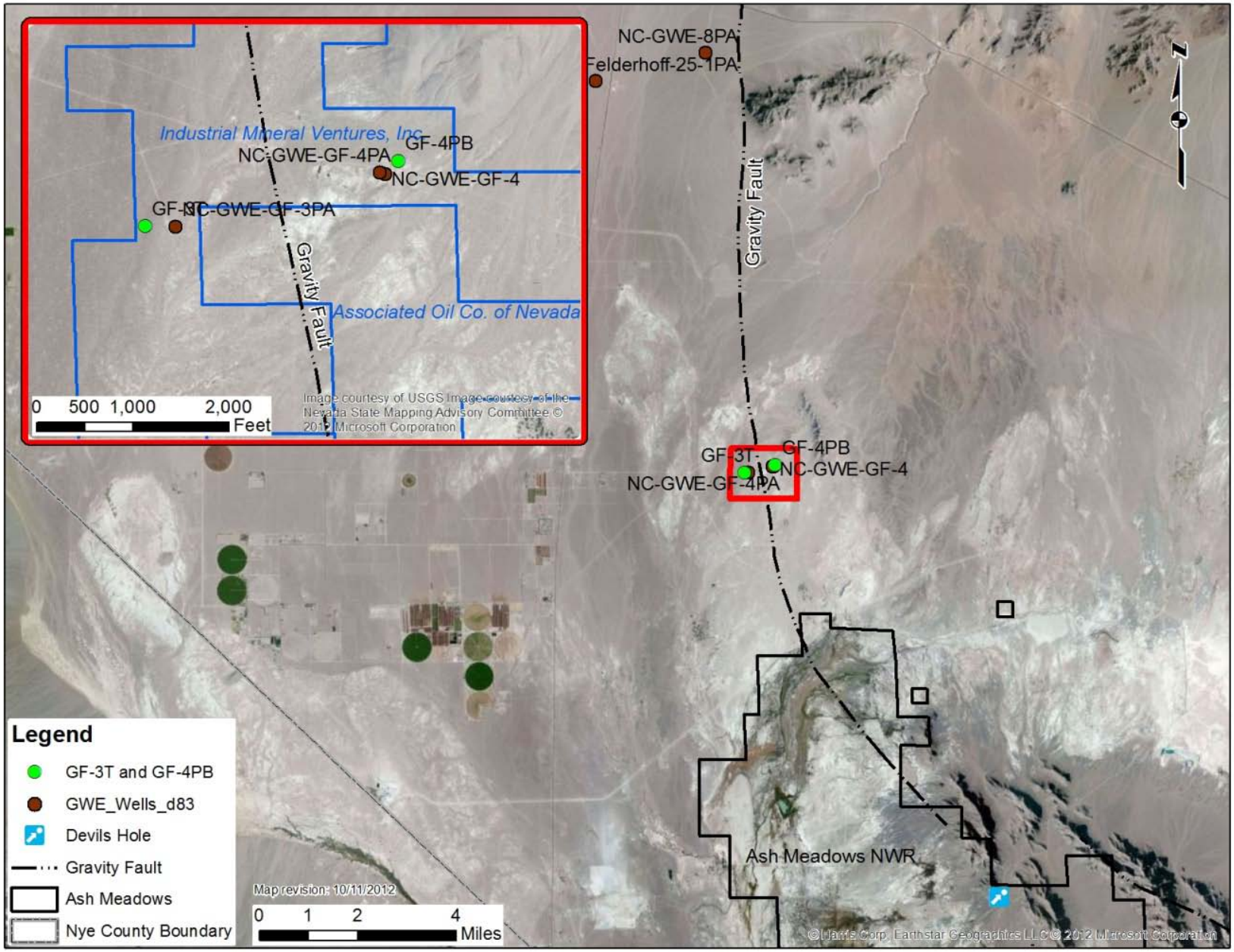


Figure 1
Location Map

Attachment A
Scope of Work for Groundwater Evaluation Well Re-Completion and Testing in Southern Nye County

One existing 287-foot deep 5.5-inch OD steel well will be re-worked including perforation of approximately 7.5 feet of existing blank and slotted casing. The newly perforated well will be air-lift developed with 2-inch airline discharging to diverter and air-cyclone (or similar) system until sand production has diminished. An optional 10-foot long section of 4.5-inch "double slotted" screen casing with 0.080-inch slots will be sleeved within existing newly perforated interval, should sand production not decline during air-lift development. Lastly, the well will be outfitted with a 4-inch 10HP 460V 3-Phase Submersible Test Pump with check valve run on 2-inch drop-pipe, discharge head including elbow, pressure gauge, sampling ports, totalizing flowmeter, gate-valve, gate valve, and pump controller panel. A 48 hour constant discharge test will be conducted after a 4 to 8 hour step test using a county-supplied generator.

Access roads will be maintained by the NWRPO.

1.0 Re-Completion and Testing of Monitoring/Test Well

The location of the existing well is shown in Figure 1. The well NC-GWE-GF-4PB is a 287-foot deep well constructed with 5.5-inch J55 flush-threaded steel well casing with machine-slotted well screen. A schematic well completion diagram for NC-GWE-GF-4PB showing borehole and well completion details is shown in Figure 2. A schematic surface completion diagram for the well is shown in Figure 3.

1.1 Background Information

Nye County is conducting groundwater evaluation (GWE) studies in southern Nye County under a Department of Energy (DOE) grant. As part of the grant work, the county has installed a network of groundwater piezometer and test monitoring wells to supplement the existing groundwater monitoring network. Additionally, at sites GF-3 and GF-4, a testing complex has been developed to characterize the hydrologic properties of the Gravity Fault. This testing complex will require the re-completion of an existing monitor/test well NC-GWE-GF-4PB at well site GF-4 and the subsequent installation of pumping test equipment for aquifer testing.

Since 1998, the Nye County Nuclear Waste Repository Project Office has been involved in installing a network of deep wells in northern Amargosa Valley as part of the county's oversight of the Yucca Mountain project. The well boreholes have used a variety of drilling methods including: dual wall air rotary, conventional mud rotary, reverse mud rotary, several casing advance methods and sonic coring. At site GF-4, a 5.5-inch diameter steel well with slotted screen was installed to a depth of 287-feet in 2013. The borehole was drilled with open-hole air rotary methods and encountered substantial water production (+ 500 GPM) below 269 feet within fractured/rubblized quartzite of the Lower Carbonate Aquifer (LCA). Subsequent to the installation and testing of the well, it was realized that additional open-area of the slotted well casing would be needed to adequately develop and test this very high permeability zone within the Lower Carbonate Aquifer (LCA) intersected by the well. An approximate 7.5-foot interval of blank and slotted casing will be perforated, air-lift developed, possibly sleeved with 4-inch screen, and tested using a submersible pump.

1.2 Re-Completion of Well NC-GWE-GF-4PB

1.2.1 Run in perforation tools and perforate with approximate 3/8-inch diameter holes through two depth intervals of 5.5-inch diameter J55 flush-threaded blank (274.0 to 276.5 feet BGS) and slotted casing (277.5 to 282.5 BGS). Perforations will be evenly spaced and include approximately 12 total perforation per linear foot of casing. Remove tools from well.

1.3 Air-Lift Development

1.3.1 Run a 2-inch steel air-lift line to near the bottom of the well.

1.3.3 Add a 5.5-inch diverter elbow to the top of well casing to divert discharge through a 4-inch discharge hose to an air cyclone separator or similar system. Establish a method to sample and quantify sand discharge for determining sand production. It is expected that the well will yield several 100's of gallons per minute under airlift.

1.3.4 Connect a 250 CFM -200 PSI air compressor or larger to the secured air-lift line. Air lift well continuously for several hours to a maximum of 8-hours, while sampling discharge at the cyclone on 10-minute intervals and measuring relative sand production. Foamer (Baroid Quik-Foam or equivalent) can be added to the airstream to remove solids from the well. Should the well continue to produce significant proportions of sand after 8 hours of air lifting, a second screen will be required (See 1.3.4). After several hours and at least one hour of relatively sand free discharge, shut in air lifting and remove diverter head and air-lift line.

1.3.5 Air-lift solids from the very bottom of the well by lowering 2-inch air lift line to 285 feet while air-lifting to clean out remaining solids from the bottom of the casing. Remove airline. Should the well continue to produce significant proportions of sand after 8 hours of air lifting, run in on retractable string a single joint of 4-inch OD "double" slotted or wire-wrapped screen with 0.080-inch openings to the bottom of the well. Land screen joint on bottom of well and retract string. Airlift well similar to step 1.3.3 for 2 hours and check for a substantial decrease in sand production.

1.4 Well Testing

1.4.1 Install supplied 4-inch 460V 3-phase submersible pump with check valve on 2-inch drop pipe with supplied #6 gauge submersible pump cable to a depth of approximately 250 feet BGS (DTW= 45 feet from TOC). Pump string will also include a supplied In-Situ pressure transducer and cable and a ¾-inch flush-threaded PVC sounding tube with 20' slotted section on bottom to 200'. Install surface discharge assembly including landing plate, elbow, pressure gauge, gate valve, flow meter, sample port and discharge line. Set discharge line on saw horses or similar such that a 50-gallon barrel can be used to measure discharge. Connect pump controller panel to pump and supplied 105 KW generator. Test run/start generator and submersible pump to confirm operation and correct pump rotation.

1.4.2 Allow Nye County staff contractors 3-days (and up to 10-days) to test pump the well. Nye County may request the contractor to supply diesel fuel delivered to the operating generator during well testing.

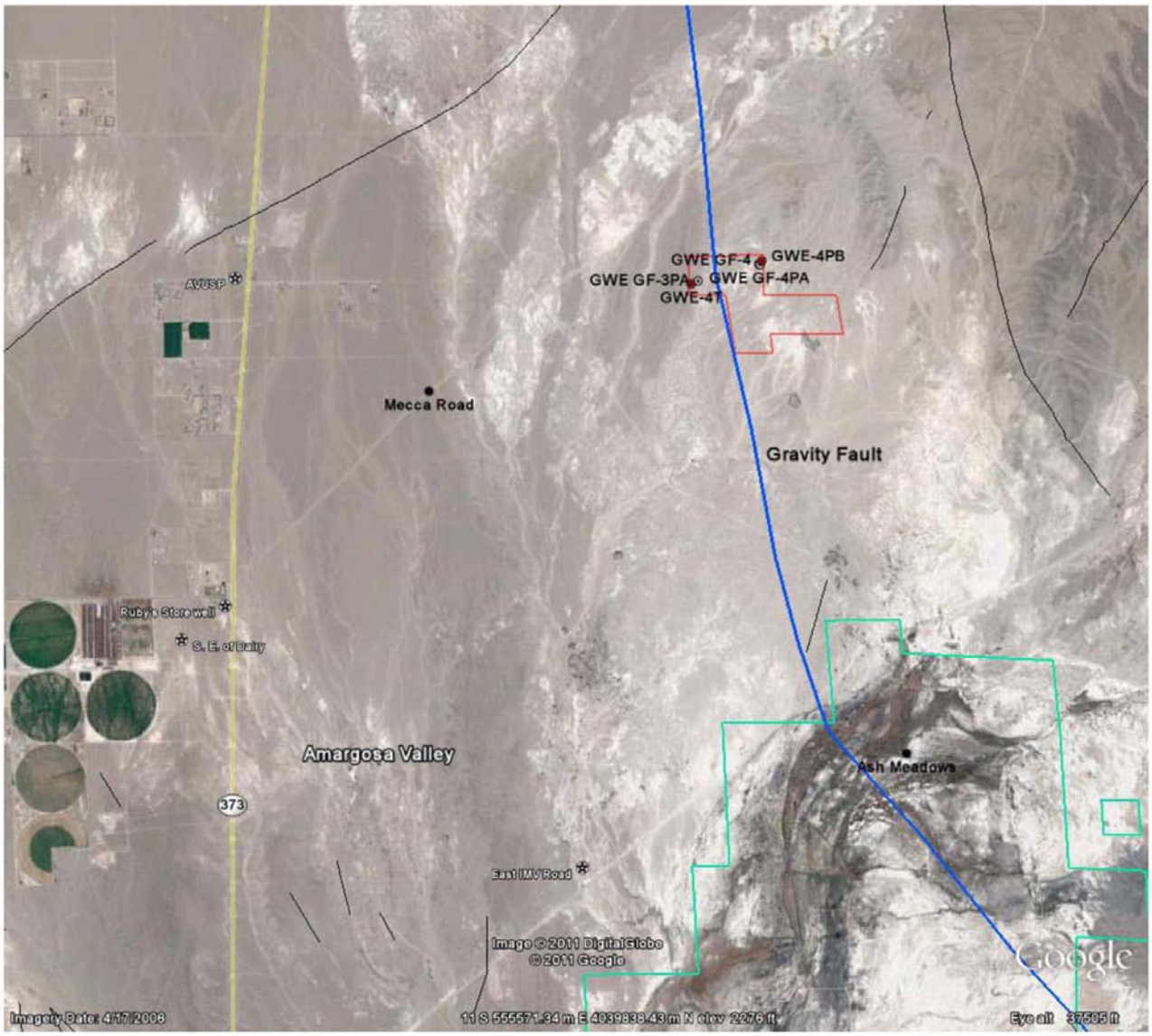
1.4.3 After Nye County has conducted pump testing of the well, return to the location to remove well discharge head, well pump and cyclone from location. Remove all equipment and trash from site.

Attachment Table 1
Groundwater Evaluation Well Drilling

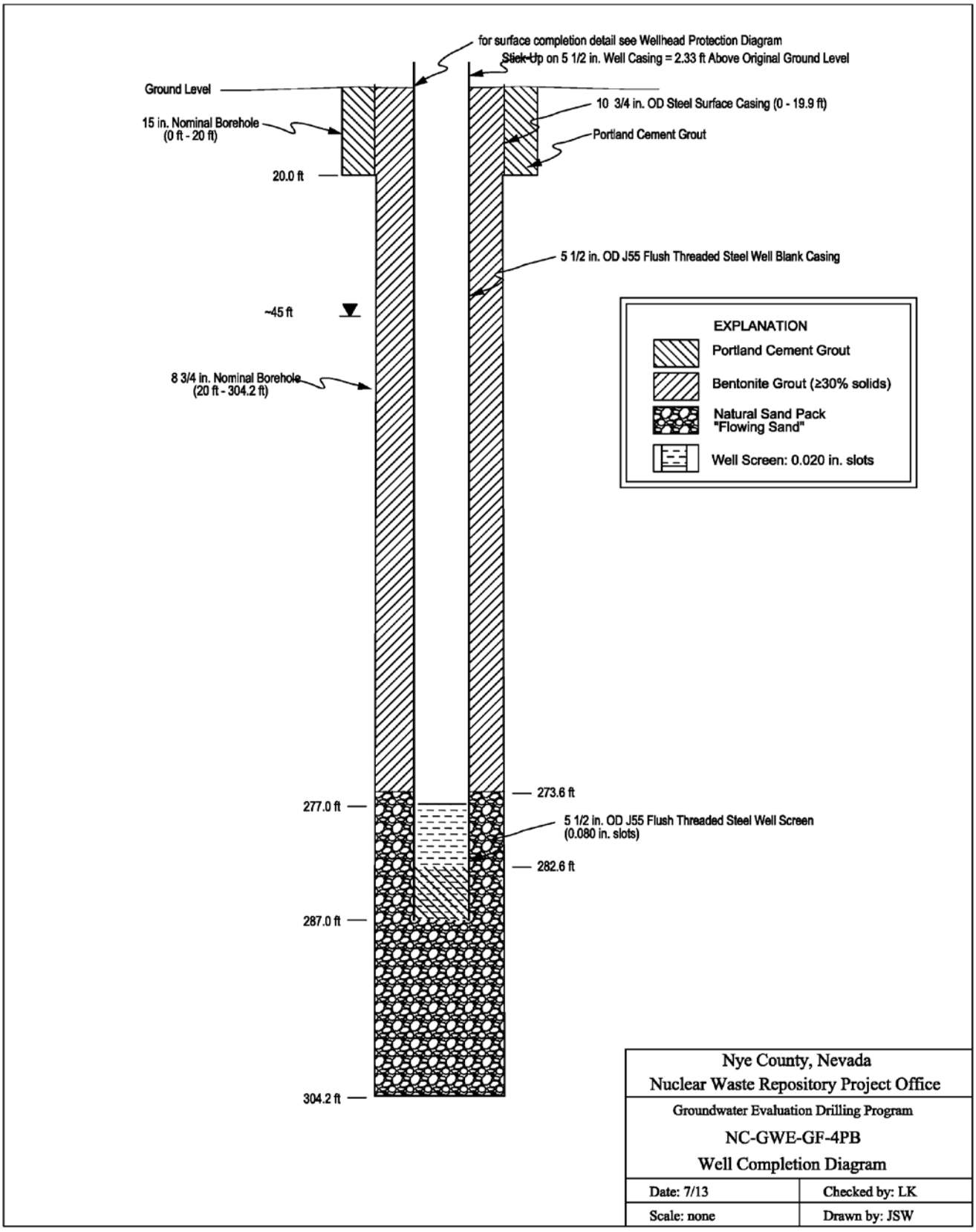
Well No. (NC-GWE-)[a]	Drilling Method[b]	Well Depth (ft)	Completion Type	Screen Depths (ft, bgs)	Perforation intervals (ft, bgs)	Approximate Depth to Water (ft, bgs)	Approximate Unconsolidated Thickness (ft)
GF-4PB	CAR[b]	287	5.5-inch OD flush threaded J55 steel well casing	277.0-282.6[c]	274.0-276.5 and 277.5-282.5	45	269

[a] Suffix for all GWE wells
[b] Conventional Air Rotary (Air-Foam)
[c] Cement plug in casing 282.6 to 287 feet.

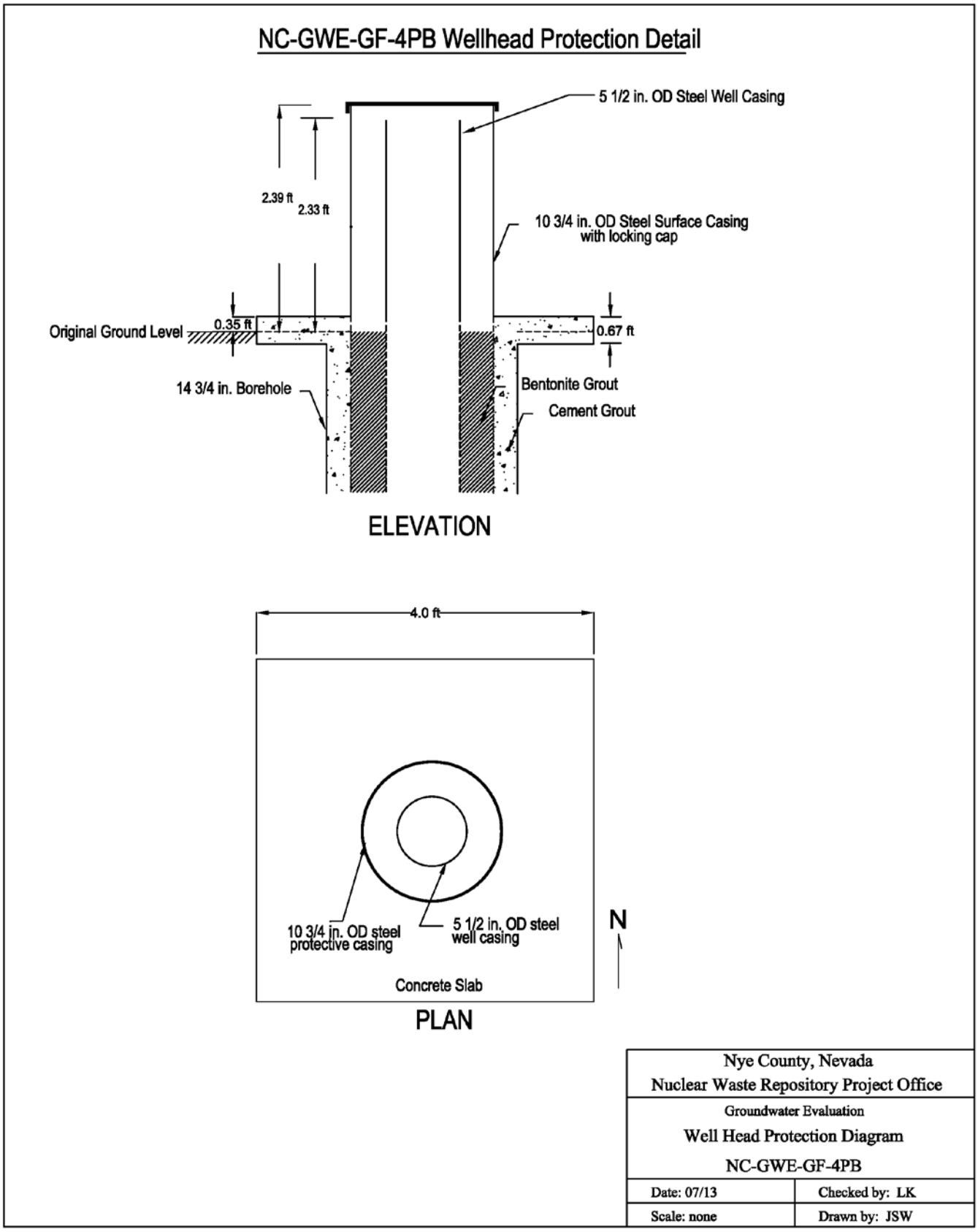
Attachment Figure 1
Location Map



Attachment Figure 2
Schematic Well Completion Diagram for GWE GF-4PB



Attachment Figure 3
Schematic Wellhead Protection detail for Well GWE-GF-4PB



Attachment B
Tubing and Casing Record

Nye County
Nuclear Waste Repository Project Office
TUBING AND CASING RECORD

TPN-5.6, Rev. 0
05-10-2010

Page 1 of ____

ONLY APPLICABLE BLOCKS ARE TO BE COMPLETED

Borehole Name/ID:	Date/Time Started:	Date/Time Completed:
Borehole Depth:	Borehole Size:	Drill Rig Used:

Description Tubing or Casing:

Tubing or Casing Tally (Measurements to nearest 1/100 of a foot):

Item No.	Item Length	Cum. Length	Item No.	Item Length	Cum. Length	Item No.	Item Length	Cum. Length	Item No.	Item Length	Cum. Length	Item No.	Item Length	Cum. Length
1			21			41			61			81		
2			22			42			62			82		
3			23			43			63			83		
4			24			44			64			84		
5			25			45			65			85		
6			26			46			66			86		
7			27			47			67			87		
8			28			48			68			88		
9			29			49			69			89		
10			30			50			70			90		
11			31			51			71			91		
12			32			52			72			92		
13			33			53			73			93		
14			34			54			74			94		
15			35			55			75			95		
16			36			56			76			96		
17			37			57			77			97		
18			38			58			78			98		
19			39			59			79			99		
20			40			60			80			100		
Total			Total			Total			Total			Total		

Bottom Hole Assembly (BHA) Description/Information:

Tubing or Casing Depth Info:		Remarks/Notes:
BHA Length	Ft.	
Total Ft. This Page	Ft.	
Total From Page 2	Ft.	
Total Feet	Ft.	
Stick Up on Last Joint	Ft.	
String Set at G. L.	Ft.	

Prepared by: _____ Date: _____

Checked by: _____ Date: _____

Attachment C
GWE Piezometer Well Pump Testing Form

Nye County NWRPO

GWE Well Pump Testing Form

TPN-5.7, Rev. 0
05-10-2010

Preliminary Information

Well Name: _____ Personnel On-Site: _____

Static Water Level: _____ Sounder #: _____ Initials: _____

Part 1: Step Testing

Date: _____

Pump and Transducer Detail

Pump Type and Model: _____ Transducer Serial Number: _____

Distance Between Pump Intake and Transducer Port (0.00 ft): _____ ft

Time Tranducer Start Recording: _____

Depth of Pump Setting (approx.): _____

Initial Transducer Depth (submergance in ft)

Time	Rate (GPM)	Submergance (ft)	Rate Change (GPM) From	Rate Change (GPM) To	Step # and Comments

Final Ideal Rate for Constant Discharge Test (GPM): _____

Approximate Submergance for Constant Discharge Test (ft): _____

Part 2: Constant Discharge Test

Date: _____ Personnel On-Site: _____

Initial Transducer Depth (submergance in ft): _____ Recovery from Step Test %: _____

Time Pump On: _____ Ideal Test Rate (GPM): _____

Time	Rate (GPM)	Submergance (ft)	Rate Change (GPM) From	Rate Change (GPM) To	Comments

(Use Continuation Sheet for more Readings)

Pump Removal

Submergance _____ Percentage Recovery from Step Test: _____

Time for Transducer Off: _____

Prepared by: _____ Date: _____

Checked by: _____ Date: _____

Attachment C (continued)
GWE Well Pump Testing Form Continuation

Nye County NWRPO
GWE Well Pump Testing Form (continuation)

TPN-5.6, Rev. 1
03-27-2014

Preliminary Information

Well Name: _____

Part 2: Constant Discharge Test

Date: _____ Personnel On-Site: _____

Initial Transducer Depth (submergance in ft) _____

Time Pump On: _____ Ideal Test Rate (GPM): _____

Time	Rate (GPM)	Submergance	Rate Change (GPM) From	Rate Change (GPM) To	Comments

Prepared by: _____ Date: _____

Checked by: _____ Date: _____

Attachment D
Field Change Approval Form

Nye County Nuclear Waste Repository Project Office — TPN-5.6, Rev. 0 05-10-2010

Field Change Approval Form

Title(s) of Plan(s) proposed to be changed: _____

NWRPO Field Personnel In Charge: _____

Name Date

DESCRIPTION OF PROPOSED CHANGE - INCLUDE KNOWN EFFECTS OF CHANGE:
(Reference borehole IDs, Locations, Specific Tests, all necessary information to identify change)

APPROVAL: _____ Geoscience Manager — Time/Date

APPROVAL: _____ Principal Investigator — Time/Date

Copy to: Nye County Nuclear Waste Repository Project Office, Quality Assurance Records Center (QARC)