GEOHYDROLOGIC DATA SECTION
Standard Operating Procedures

January 2014

Data Collection Bureau
Southwest Florida Water Management District
2379 Broad Street
Brooksville, Florida 34604-6899

Table of Contents

Real Estate Acquisition

PURPOSE

Establishment of a uniform procedure for acquiring a parcel of land for the construction of a monitor well station.

PROCEDURE

1. Review Site Acquisition Guidelines (Attachment -1)
2. Draft a Site Acquisition memorandum to Real Estate Services (Attachment -2) The memorandum should list:
    a. Site location: specify a preferred area for the site (include a map)
    b. Site size requirements:
        1. Perpetual well site: (example: 20 feet x 80 feet)
        2. Temporary construction area: (example: 250 feet x 300 feet)
        3. Perpetual Ingress/Egress: (example: 10 feet wide)
    c. Time requirements:
        1. Perpetual well site: (example: perpetual)
        2. Temporary construction area: (example: 60 months)
        3. Ingress/egress easement: (example: perpetual)
    d. Aquifer Performance Test (APT) requirement:
        1. If required – the location must have a suitable surface feature to accept the water discharged during APT
3. Real Estate Services will provide a list of possible locations
    a. Plan a visit to each site:
        1. Complete the Proposed Well Site Evaluation Site Form (Attachment -3)
        2. Give GEO Section Well Construction Overview pamphlet to land owner or site representatives (Attachment -4)

ATTACHMENTS

1. Site Acquisition Guidelines
2. Site Acquisition Memorandum
3. Proposed Well Site Evaluation Form
4. Well Construction Overview Pamphlet

ATTACHMENT –1 Site Acquisition Guidelines

Site Acquisition Guidelines

Easement Size:

1) **The size of the perpetual easement should be dependent upon the number of permanent monitor wells expected to be installed.** The size of the perpetual easement would therefore be dependent on the expected hydrogeology of the site. Before site acquisition is complete, the general hydrogeology of the area should be researched and the following guidelines should be used:

Number of Permanent Wells	Perpetual Easement Size
1 - 2	20' x 10'
2 - 3	20' x 20'
3 - 4	20' x 40'
4 +	20' x 80'

2) **Sites that will have APTs should, at an absolute minimum, have temporary construction easements of 250 feet x 250 feet.** This is necessary to accommodate the drilling crew during well construction activities and at the same time have 200 feet between the perpetual easement and a pumped well during the APT. See the attached figure if an alternative size is required.

3) **Sites that will NOT have APTs, should preferably have temporary construction easements of around 150 feet x 150 feet.**

4) **The ingress/egress easement should be at least 15 feet wide to accommodate large vehicles and equipment.**

APT Discharge:

1) **Potential sites should have an APT discharge area no more than 0.5 miles away from the pumped well.** Piping water any further becomes strategically difficult. In addition, the discharge area should be far enough away so as not to interfere with testing. This will of course depend on local hydrogeology and the scale/depth of the testing.

2) **The APT discharge area should be able to handle the volume of the ground water pumped during testing.** Potential sites should ideally be near a discharge area that can handle a discharge rate of up to 3,000 gallons per minute (gpm) with a pumping duration of up to 7 days. However, sites that are near a discharge area that can only handle discharge rates as low as 1,500 gpm with a pumping duration as short as 2 days may be deemed acceptable. *Discharge to anywhere other than an open field or a closed retention pond will require a Florida Department of Environmental Protection discharge permit [62-61-300 (2)]. See Standard Operating Procedure # 04.02.00 Conducting an Aquifer Performance Test.*

Access:

1) **Access to the site should accommodate large vehicles and equipment.** A potential site should either already be able to handle large vehicle traffic, or be easily converted to do so. There should be enough overhead clearance (20 feet) and access roadways should be able to handle heavy vehicle traffic. A large contract drill rig weighs 113,000 pounds (lbs). Smaller drilling rigs and equipment are usually less than 30,000 lbs.

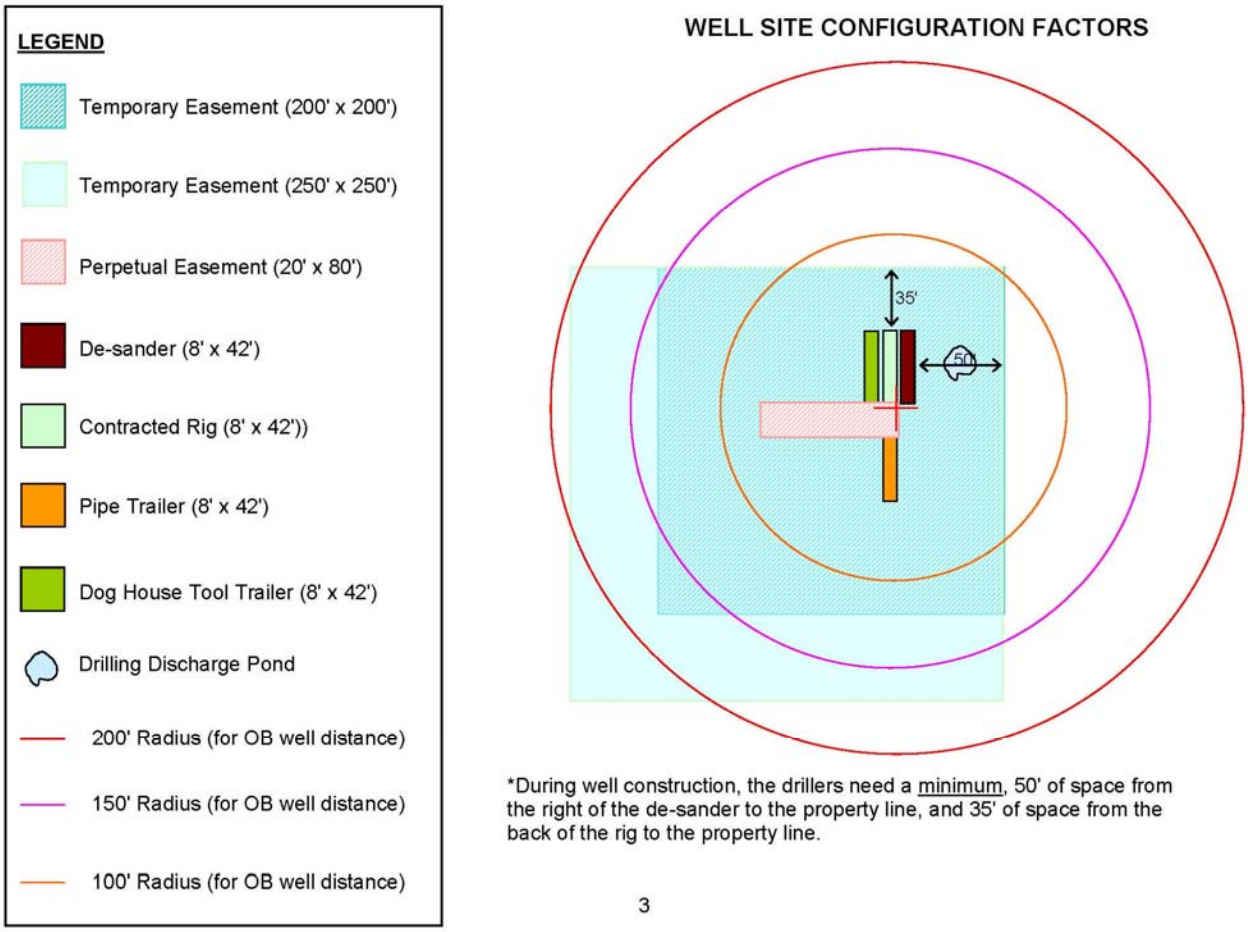
Overhead Electrical Lines:

The Drill rigs and other equipment must be positioned a minimum of 20 feet from all overhead electrical lines . A distance of 70+ feet is preferable to prevent any contact with an electrical line in the event of equipment failure (example: cable breakage). OSHA standard 29 CFR 1926.550(a)(15) requires a minimum clearance of 10 feet from power lines up to 50 kilovolts plus 0.4 inches for each kilovolt above 50 kilovolts.

References:

Occupational Safety & Health Administration, 1980. 29 CFR 1926.550(a)(15(i) Clearance Between Electrical Power Lines and Cranes. Retrieved December 5, 2013 from: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1810.

Attachment – 1 Site Acquisition Guidelines (continued)



ATTACHMENT – 2 Site Acquisition Memorandum

November 17, 2011

MEMORANDUM

TO: Steve Blaschka, Land Acquisition Manager (LND)

THROUGH: Jerry Mallams, Geohydrologic Data Manager (RDR-BRO)
Ron Basso, Senior Professional Geologist (PRJ)

FROM: Anna Janosik, Hydrologist (RDR-TPA)

SUBJECT: ROMP 37 Site Acquisition Request

Acquisition of a new well site in Manatee County, called ROMP 37, is requested. This site was identified in the Regional Observation and Monitor-well Program's Work Plan 2011-2015 as a coring and testing site that will commence in 2013. Below are the site's location and size requirements. There has been no prior acquisition work.

Site Location:
The ROMP 37 site would ideally be located in western Manatee County within one of the Sections shown on the attached map.

Size Requirements:
The ROMP 37 site will be a full ROMP site, meaning space is required for an exploratory coring and testing phase, a well construction phase, an aquifer performance testing (APT) phase, and eventually perpetual monitoring. The perpetually monitored site will require room for up to five wells; one surficial aquifer well, two Hawthorn aquifer system wells, and two Upper Floridan aquifer wells. Since so much will be invested, a license agreement is not an option for the perpetual site. The approximate sizes of the easement required are below and can be changed to fit the geometry and land owner requirements of the location picked.

Perpetual Well Site:	10-ft x 40-ft (minimum)
Temporary Construction Area:	250-ft x 300-ft
Perpetual Ingress/Egress:	10-ft wide

Time Requirements:
The time period between the start of exploratory coring and testing, and the end of the APT, for a site this large in scope, could be 4-years. Water quality and/or water level data collection at this well site will be perpetual. If a license agreement is obtained for the temporary construction area, the four year period should *begin at the start of construction,* which may be well after the time of acquisition (other accommodations for this flexible time period can be discussed).

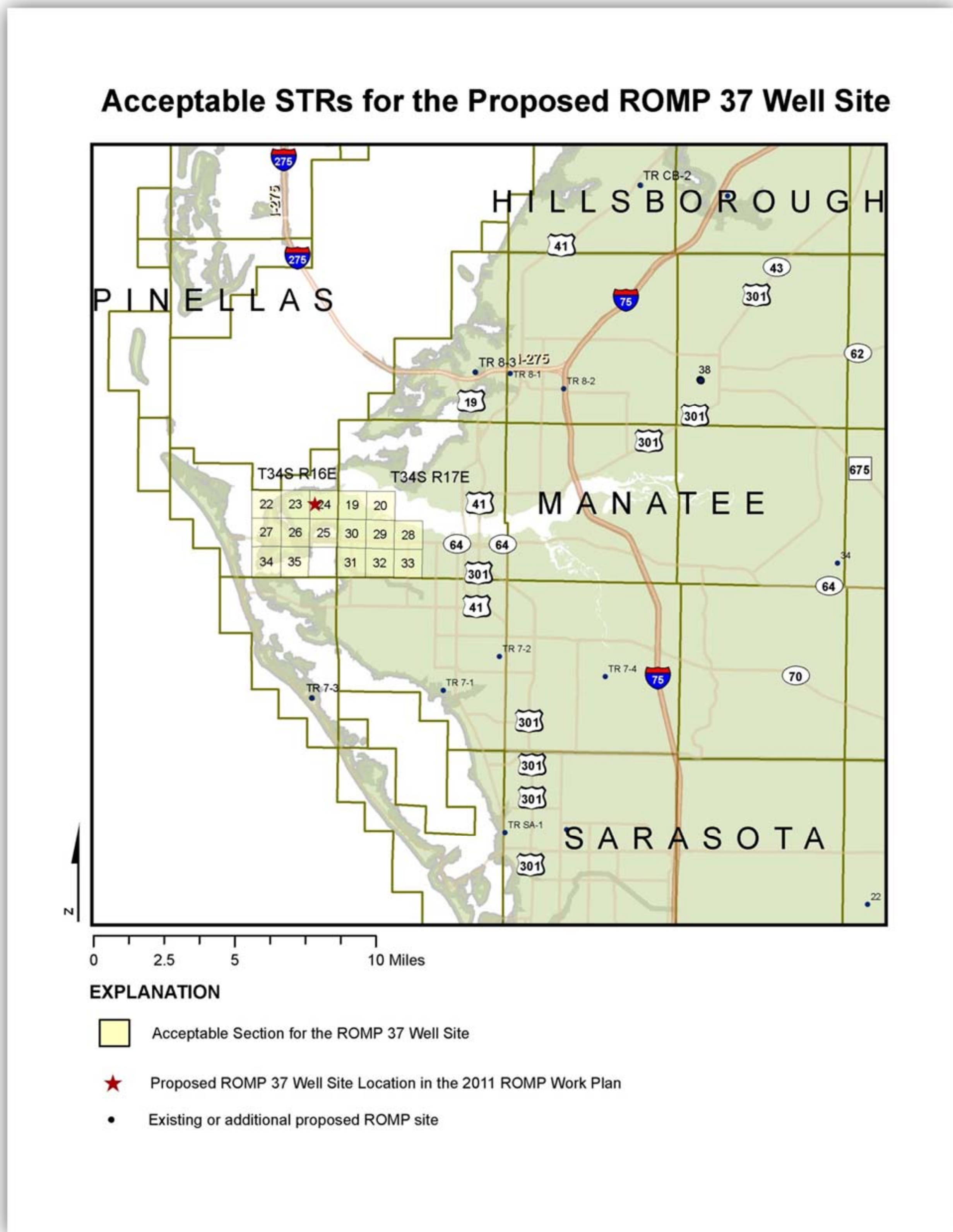
Aquifer Performance Testing Requirements
Although it will be up to a ROMP staff member to determine if a potential site is suitable for aquifer performance testing, it should be noted that any potential site will need to be less than a mile away from a feature or water body that can accept the discharge water.

Please feel free to contact me if you require any additional information.

ALJ

Attachments (1)

Attachment – 2 Site Acquisition Memorandum (continued)



ATTACHMENT – 3 Proposed Well Site Evaluation Form

REGIONAL OBSERVATION AND MONITOR-WELL PROGRAM
PROPOSED WELL SITE FIELD EVALUATION
Southwest Florida Water Management District

I. GENERAL INFORMATION

Investigator(s):________________________________ Date:____________

ROMP No./Name:____

County:__________________________ STR:______________________

Latitude:_____________________ Longitude:______________________

Property Owner:_________________________ Phone:________________

County/District Parcel No.:____

II. SITE CONSIDERATIONS/CONCERNS:

a. Overhead Concerns (Wires, etc.) ☐ None ☐ Yes (explain)

b. Underground Concerns ☐ None ☐ Yes (explain)

c. Wildlife Concerns ☐ None ☐ Yes (explain)

d. Wetland Concerns ☐ None ☐ Yes (explain)

e. Is the Property State Lands ☐ No ☐ Yes
(If Yes, contact the Division of State Lands, Bureau of Historical Resources)

____

____

____

III. APT CONSIDERATIONS: ☐ N/A (skip to IV.)

Boundary Concerns (wells, lakes, rivers, etc.): ☐ None ☐ Yes (explain)

Discharge Route Concerns: ☐ None ☐ Yes (explain)

____

____

Disposal Area Name, if applicable:________________________________

Bearing from well site:_____________ Distance:_______________

Approx. size:__________________ Depth:_________________

Owner of Discharge Location:_____________________________

IV. SITE ACCESS:

Length from Nearest Public Road:__________________________________

Improvements Necessary: ☐ No ☐ Yes (explain)

____

____

JLM 1/11/2007

Attachment – 3 Proposed Well Site Evaluation Form (continued)

REGIONAL OBSERVATION AND MONITOR-WELL PROGRAM
PROPOSED WELL SITE FIELD EVALUATION
Southwest Florida Water Management District

V. EASEMENT SIZE:

Temporary Construction Easement Size:______________________________

Perpetual Construction Easement Size:______________________________

Ingress/Egress Easement Size:______________________________

____

____

VI. SITE SKETCH AND PHOTOGRAPHS:
Include a general site sketch of the easements and access to the site. The sketch should identify any concerns recognized in items II-IV. Photographs of the site, access and any concerns recognized in items II-IV should be attached.

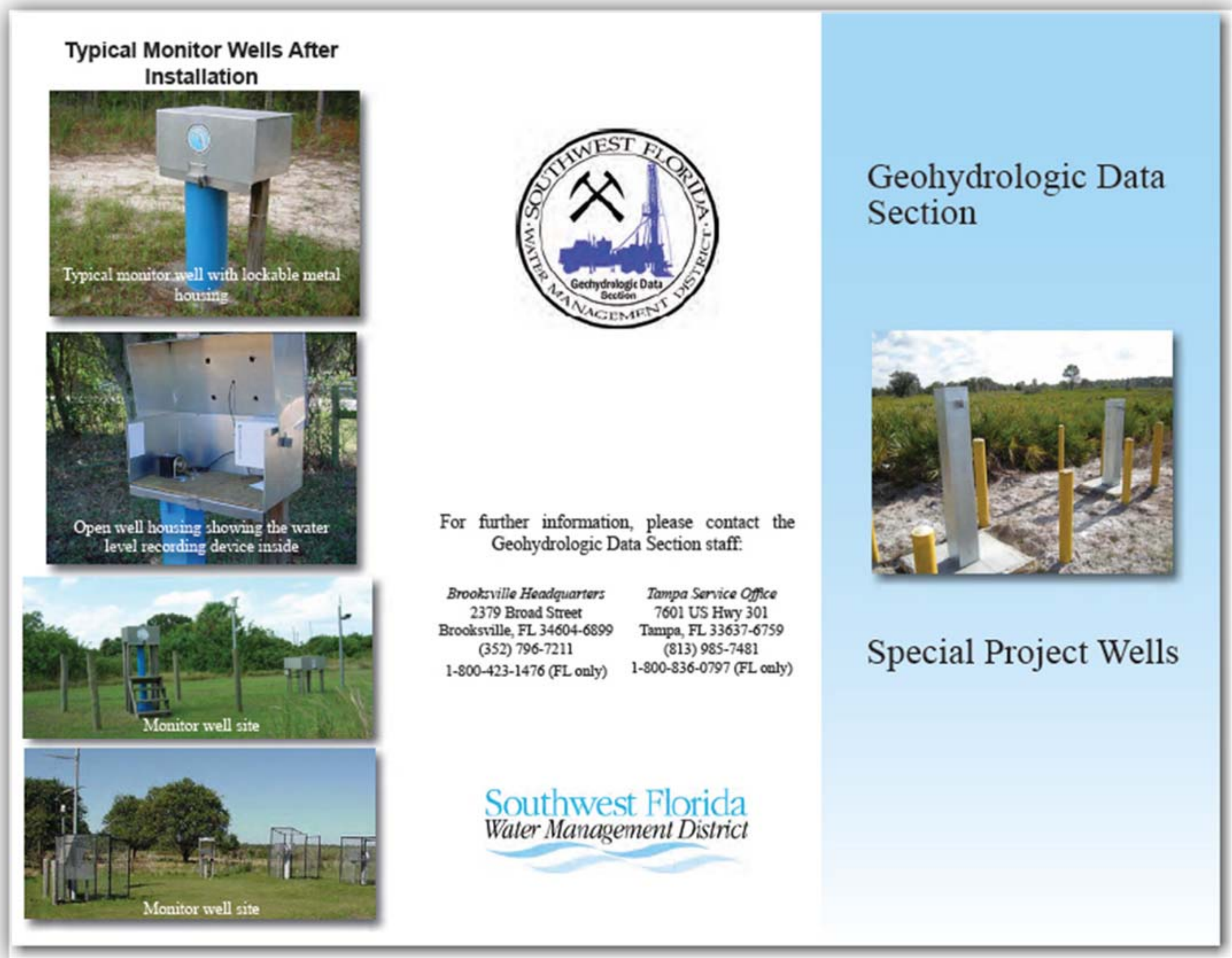
Pictures attached: ☐ No ☐ Yes

Not to Scale

Additional Comments:

JLM 1/11/2007

ATTACHMENT – 4 Well Construction Overview Pamphlets



Typical Monitor Wells After Installation

Typical monitor well with lockable metal housing

Open well housing showing the water level recording device inside

Monitor well site

Monitor well site

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
Geohydrologic Data Section

For further information, please contact the Geohydrologic Data Section staff:

Brooksville Headquarters
2379 Broad Street
Brooksville, FL 34604-6899
(352) 796-7211
1-800-423-1476 (FL only)

Tampa Service Office
7601 US Hwy 301
Tampa, FL 33637-6759
(813) 985-7481
1-800-836-0797 (FL only)

Southwest Florida
Water Management District

Geohydrologic Data Section

Special Project Wells

Attachment – 4 Well Construction Overview Pamphlets (continued)

Overview

The Geohydrologic Data Section conducts coring, testing, and installs monitor wells to support the hydrogeologic data needs for the Southwest Florida Water Management District (District). The monitor wells installed by the Geohydrologic Data Section form the backbone of the District's long-term aquifer monitoring networks. The data collected from these wells improve the District's understanding of the hydrogeologic systems in the region, and are used to develop Minimum Flows and Levels (MFLs) for impacted water bodies, estimate long-term resource availability, monitor and evaluate well field recovery, establish precise groundwater models, provide data in areas with limited information, and ultimately support the development of new regulatory guidelines.

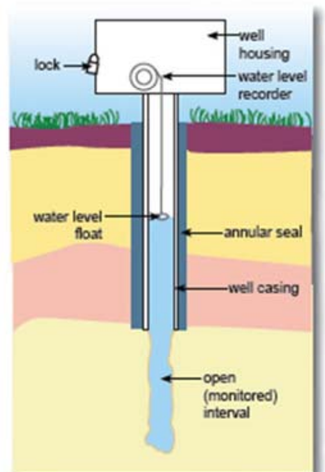
Time and Space Requirements

District well sites are comprised of a temporary construction area, permanent well site, and an ingress/egress agreement. The District pursues easements, when possible, for the permanent well site to ensure an uninterrupted data record. The temporary construction area is larger than the permanent site to accommodate the equipment required to construct the well(s).

Well sites are typically completed two to three weeks from the start of construction, however construction may not begin until months after the well site location is acquired. Once construction is complete, the temporary construction area is returned to pre-construction conditions.

Well Installation

Typical Well Diagram



Well Site Activities

Most special project well sites are deemed so because they are required to provide data for a specific project of the District. The data collection objectives at each site vary depending on the data needs of the region. The field work typically performed at a special project well site include:

1. **Site Acquisition** - District staff work with property owners to acquire a location for the monitor well(s) that will supply the necessary data and long-term access.
2. **Exploration of the shallow sediments** - Geohydrologic Data staff oversee geologic sampling conducted by a licensed drilling contractor. These samples enable the characterization of the local hydrogeology and ensures proper monitor well installation.
3. **Installation of the monitor well(s)** - Geohydrologic Data staff oversee the construction of the monitor well(s) by a licensed drilling contractor. Once installed, the well(s) are typically fenced for protection. A variety of fencing options are available.
4. **Long-term water level and/or water quality monitoring** - After construction, the well(s) enter one of the District's water level and/or water quality monitoring networks. The well(s) may be equipped with a water level recorder which logs water level readings at predetermined intervals. District staff return to the site periodically to collect the data.

Well Site Preparation

PURPOSE

Establishment of a uniform procedure for well site preparation.

PROCEDURE

1. Visit site to determine site specific requirements
2. Determine:
    a. Site access – are there ditches present that will require the installation of culverts to access site? - utilize District engineering staff if possible for culvert designs
    b. Mowing or tree removal – utilize Operations section or hire contractor
    c. Shell requirements – if needed coordinate with Operations section to deliver and install
    d. Water supply source – is a fire hydrant or other potable source available or will a water supply well need to be drilled?
    e. Silt fence – determine if necessary
    f. Fencing – does construction area need to be fenced?

3. Prepare Health and Safety Plan
    a. Note site conditions for staff safety considerations
    b. Note location of nearest hospital
    c. Distribute plan to all staff working on site

Wire-Line Coring

PURPOSE

Establishment of a uniform procedure for wire-line core drilling.

EQUIPMENT

1. Core drilling rig (equipped with positive displacement, variable speed pump)
2. Air compressor
3. Wire-line coring system (outer barrel, inner barrel, core bit, core retrieval system)
4. Core drilling rods (NQ, NRQ)
5. Weir discharge tank
6. Core barrel bench

PROCEDURE

1. Core Drilling:
    a. Ensure inner barrels are adjusted properly. 3/8”-1/4” minimum from end of shoe to taper on bit
    b. Clamp core rods, unscrew core rods
    c. Insert inner barrel into core rods
    d. Add one core rod, screw rods together, torque to specifications
    e. Suspend core rods off bottom and pump on high level until inner barrel has been locked into outer barrel (Usually indicated by feeling it hit when the barrel becomes locked in and an increase on the pump pressure gauge, use stopwatch to know when it should be there)
    f. Core the length of one core run if possible. At the end of the run keep water pump on to allow the drill cuttings to move up the hole. Pump pressures of 50-100psi are normal
    g. Stop rotation. Pull rods up with rotary head to break the core off formation. Pump 30 to 40 gallons of H20 minimum
    h. Pull up core rods, unscrew core rods and retrieve inner core barrel
2. Removal of Inner Barrel:
    a. Lower overshot retrieval tool inside the core rods until it connects to the inner barrel, run water down the core rods as the overshot tool is being lowered (water keeps drill cuttings from settling in the borehole)
    b. Begin retrieving inner barrel
    c. Place inner barrel release tool around the wire-line while retrieving
    d. Lower the inner barrel and remove from retrieval tool
3. Removal of Core from Inner Barrel:
    a. Clamp inner barrel in vice
    b. Unscrew the top and bottom parts of inner barrel using circle wrenches
    c. Slide rock core out of barrel (tapping on barrel with rubber mallet can help free core if stuck)
    d. Flush barrel with water
    e. Add small amount of grease to threads on both ends of barrel and reassemble

   f. Grease the inner tube head assembly bearing
4. Airlifting:
   a. The borehole is usually cleared of drill cuttings after coring 20 feet by using the airlifting method of pumping
   b. Remove the inner barrel
   c. Install appropriate length of 0.5-inch airline equipped with check-valve into drill string and connect to air swivel
   d. Connect core rods
   e. Discharge cuttings and water into mud pit
   f. After discharge water is free of cuttings, measure discharge rate using the weir tank
5. Hole Sweeping:
   a. “Sweeping” the borehole is accomplished by lifting the core rods off bottom (tens to hundreds of feet) and then airlifting at various depths while lowering the rods back to bottom
   b. The borehole is “swept” to clean cuttings that have lodged in the annulus between the rods and the borehole (increased rotational torque, reduced flow rates, and an increase in the amount of time required to airlift the borehole clean are all indications that cuttings may be lodging in the borehole annulus)

SUGGESTED REFERENCES

1. Shuter, E, Teasdale, W. E., 1989, Application of drilling, coring, and sampling techniques to test holes and wells: U.S. Geological Survey, Techniques of Water-Resource Investigation; 02-F1, 97 p.

Lithologic Sample Collection

PURPOSE

Establishment of a uniform procedure for the collection and processing of lithologic samples during drilling.

EQUIPMENT

1. Munsell rock and/or soil color chart
2. Carpenters folding ruler
3. Hand lens
4. Dunham (1962) Limestone classification
5. Hydrochloric acid for carbonate testing
6. Hydrogeology Field Log

PROCEDURE

1. Collect sample from driller (core, split spoon, or rock cuttings)
2. Measure the sample and determine the percentage recovered (core/split-spoon)
3. Place sample in the appropriate container
4. Record depth interval on container
5. Describe sample and record data on Hydrogeology Field Log

SUGGESTED REFERENCES

1. Duhnam, R. J., 1962. Classification of carbonate rocks according to depositional texture in Ham, W. E., ed., Classification of carbonate rocks: American Association of Petroleum Geologists Memoir 1, p. 108-121.
2. Midwest Geosciences, 2001. Field Guide for Soil and Stratigraphic Analysis: Midwest Geosciences Group Press, Chart 2 p.
3. Midwest Geosciences, 2001. Field Guide for Rock Core Logging and Fracture Analysis: Midwest Geosciences Group Press, Chart 2 p.

ATTACHMENTS

1. Hydrogeology Field Log

ATTACHMENT – 1 Hydrogeology Field Log

HYDROGEOLOGY FIELD LOG

Site Name:
Hydrogeologist:
Page: of

Date	Box No.	Geology	Hydrogeology	Hydrostrat.	Depth (ft bls)	Recovery (%)	Lithology	Porosity (%)	Description	Test Interval	Packer Test WL, WQ, Purge Record	Notes

Slug Testing

PURPOSE

To establish a uniform procedure for performing slug tests while wire-line core drilling to determine hydraulic conductivity of the tested interval.

EQUIPMENT

1. Electronic water level tape
2. Carpenter's ruler
3. Laptop computer (with PC400 software installed)
4. Campbell CR800 data logger
5. Pressure transducer and/or PVC spacer (with integrated transducer) for test casing
6. Pressure transducer for annulus
7. Pressure transducer for pneumatic valve pressure

PROCEDURE

1. Preliminary Set Up:
    a. Develop borehole
    b. Review core to determine optimal location to install packer
    c. Have drillers install packer at selected depth (if packer is required)
    d. Collect static water level with packer installed
2. Reading in Air:
    a. Connect pressure transducers to the data logger (be careful not to twist base of caps on cables)
    b. Remove vent tube caps and turn reel so vent tube points down
    c. Connect laptop to CR800 data logger
    d. Launch PC400 program
        1. Select the "Setup/Connect" tab at top of screen.
            a. Click on the "connect" button (when the data logger is connected to the computer there will be a green bar at the bottom right of the screen that will show the connection time)
            b. Click on the "select and send program…" button and choose the program "SLUG_TEST_FINAL_9" from the appropriate folder
            c. Program will display "*Data from this data logger will be lost. Are you sure you wish to proceed?"* Press *"yes".*
            d. Synchronize the data logger time with the computer time by selecting the "set clock" button
        2. Select the "Monitor Values" tab at the top of the screen.
            a. Record the readings in air in the *Set-up Information* section of the SLUG TEST – DATA ACQUISITION SHEET
                1. "Submerge Test Int" = Transducer #1 (test casing)
                2. "Submerge P Head" = Transducer #2 (gauge)
                3. "Submerge Annulus" = Transducer #3 (annulus)

For our KPSI pressure transducers, readings in air should be no more than ±0.05% of the full scale range (FSR) with a thermal error of ±0.05% of the FSR per °C from 25 °C.

-Therefore, if using our 15 psi (34.65 ft) transducers at an air temperature of 30 °C, readings in air should be no more than:

$$\pm\left((FSR)(0.0005)+(FSR)(0.0005)\left(\left|25-Temperature\ in\ {}^{\circ}C\right|\right)\right)ft$$

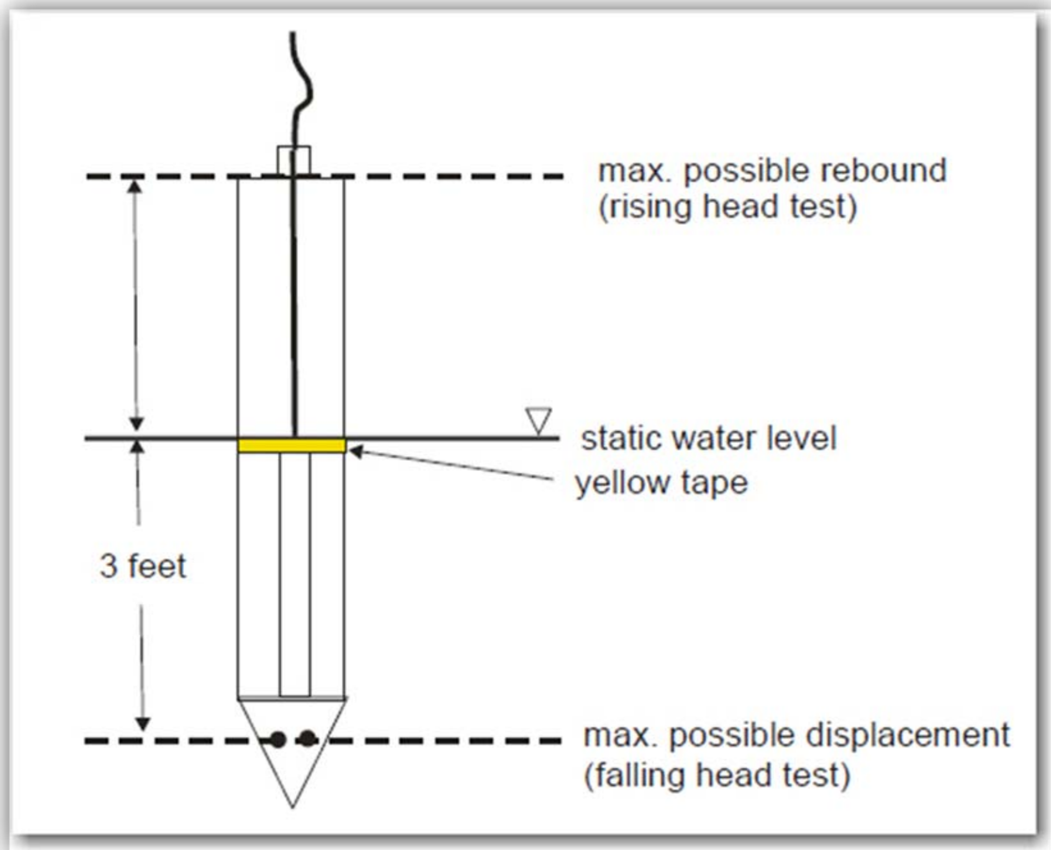
$$\pm\left((34.65)(0.0005)+(34.65)(0.0005)\left(\left|25-30\right|\right)\right)ft$$

$$\pm 0.10\ ft$$

        3. Unhook and re-cap the cables so that they can be measured and brought over to the rig

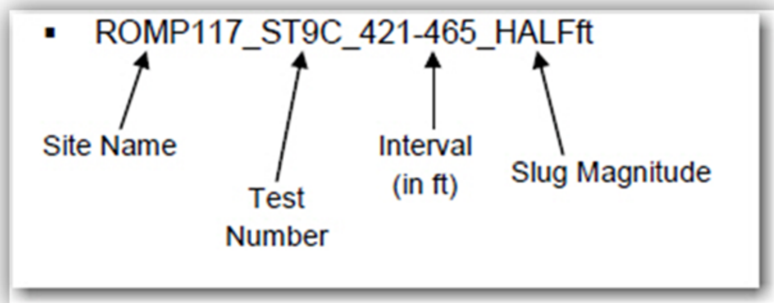
3. Water Levels:
    a. Use the water level tape and carpenter's ruler to measure the casing stickup and water level in both the NQ and HQ (*Remember to unscrew the cap that holds the pressure fittings onto the NQ so that the WL measurements are from the top of the NQ, not the cap (which can change.*
    b. Record this information in the *General Information* section of the *SLUG TEST – DATA ACQUISITION SHEET*
        1. NQ stickup measurement = *Test Casing Height (ft als)*
        2. NQ water level measurement = *Initial Static WL (ft btoc)*
        3. Record the HW stickup and water level somewhere on the sheet for your own knowledge

4. Determine Depth to put Spacer and Annulus Transducer:
    a. Use water level measurements from Step 3 to determine the appropriate depth of spacer:
        1. The static water level should be near the top of the yellow tape on the spacer (which is exactly three feet above the ports on the pressure transducer). This will allow three feet of water above the pressure transducer at the end of the spacer
        2. Using measuring tape, mark the depth of the spacer with yellow tape on the transducer cable
        3. Choose a depth for the annulus transducer
            a. The depth should be at least as large as the largest slug
            b. Mark this depth on the cable with yellow tape
            c. Be sure to measure up from the holes at the nose of transducer



5. Connect Transducers:
    a. Drillers lower the spacer and annulus into the borehole
    b. Connect surface pressure transducer to gauge on top of NQ rods
    c. Re-connect all transducers to the data logger
    d. Plug electric valve cord into electric outlet in the CR800 box
    e. Select “Monitor Values” tab at the top of the PC400 screen and confirm transducer readings are correct
    f. Once drillers have set transducers, select “Monitor” from the menu at top of screen, select “Ports and Flags”
        1. Click on circle next to the flag labeled “Bernie” to open the valve so water levels can equilibrate before first test
            a. When valve is open, both the circle next to the “Bernie” flag and the circle next to the “PortStatus(2)” port should be green
    g. Once the water levels have equilibrated, close the valve by selecting the circle next to the “Bernie” flag again (Note: if water levels do not equilibrate, packer may be leaking)
        1. All ports and flags should be black

6. Running a Test:
    a. Ask driller to add pressure to the system, and wait until the water levels equilibrate again
        1. Test A will be 2 feet of pressure
        2. Test B will be 1 foot of pressure
        3. Test C will be 0.5 feet of pressure
        4. Test D will be 2 feet of pressure
        5. Test E (if needed) will be the smallest slug necessary to produce a good test
    b. Create output file names for each test by selecting the "Collect Data" tab at the top of the screen
        1. Highlight the test you wish to create an output file name for and then click the "Change Table's Output File" button
        2. Use the following as an example for formatting file names



        3. On the "Save as type" drop down list, choose "CSV File (*.csv)
        4. Click "Save"
    c. Go back to the "Monitor Values" tab and record the pre-test readings of the spacer transducer and annulus transducer in the *Test Data* section of the *SLUG TEST – DATA AQCUISTION SHEET*
        1. *"Submerge_Test_Int" = Pre-test Sub #1*
        2. *"Submerge_Annulus" = Pre-test Sub #3*
    d. When you are ready to begin first test, open the "Ports and Flags" menu again and click the circle next to the "Control_A" flag
        1. After 5 seconds, the valve will automatically open and the "*PortStatus(2)*" circle will turn green
    e. When the readings have equilibrated you can stop the test
        1. Click the circle next to the "Control_A" flag until the valve closes ("*PortStatus(2)*" should return to black).
            a. This will be three clicks if the test time is under five minutes, two clicks if test time is under ten minutes, and one click if test time is over ten minutes
    f. Record the post-test readings of the spacer transducer in the *Test Data* section of the *SLUG TEST – DATA AQCUISTION SHEET*
        1. "Submerge_test_Int" = *Post-test Sub #1*

g. Calculate the Residual Deviation from H_o (should be less than 10 percent) and record it in on the *SLUG TEST – DATA AQCUISTION SHEET*

$$Residual\ Dev\ from\ H_o = \frac{|(Pre-test\ Sub.\#1)-(Post-test\ Sub.\#1)|}{(Pre-test\ Sub.\#1)} \times 100$$

h. Go back to the “Collect Data” tab
   1. Check the box of the test you wish to collect data from
   2. Select the “Collect” button near the top left of the screen

i. Select the “Tools” menu at the top of the page, then select “View”
   1. Another window will open. Go to the “File” menu, and select “Open”
   2. Navigate to the file of the test you just ran and open it
      a. Once the file is open, scroll down to the point of test initiation and record the *Expected Displacement* and *Observed Displacement* in the *Test Data* section of the *SLUG TEST – DATA ACQUISTION SHEET. Expected Displacement* = the value in column “P_Head” at the time of test initiation
      b. *Observed Displacement* = the value in the column “Test-Int” at the time of test initiation

$$Slug\ Discrepancy = \frac{|(Expected\ Displacement)-(Observed\ Displacement)|}{(Expected\ Displacement)} \times 100$$

   3. Calculate the Slug Discrepancy and record it on the *SLUG TEST – DATA ACQUISTION SHEET*

7. Repeat:
   a. Repeat Step 6 for different slug magnitudes.
   b. Make sure that Test A and D are of the same slug magnitude so that any developing skin effect can be seen
   c. If after Test D there are no tests with slug discrepancies <10%, run another test or two to try to get one good test
      1. If you do this, you must resend the program to the data logger, since it can only hold four tests. Make sure that all data has been collected from the data logger before you resend the program
8. Remove Equipment:
   a. Replace desiccant caps on transducers
   b. Collect water level in borehole after equipment has been removed and record in the “Final Static WL (ft btoc)” on the *SLUG TEST – DATA ACQUISITION SHEET*
   c. Normalize all curves to check for “Low-Permeability Skin Effect”

SUGGESTED REFERENCES

1. Butler, J.J., Jr., Duffield, G.M., and Kelleher, D.L., 2009. Field Guide for Slug Testing and Data Analysis: Midwest GeoSciences Group Press, Chart, 2 p.
2. LaRoche, J., and Mallams, J., 2004. Slug Testing Issues and Guidelines for the Design, Performance and Analyses as they apply to ROMP CME corehole slug testing, Southwest Florida Water Management District, Geohydrologic Data Section, ROMP Instructional Memo Series RIMS 01-04, 5 p.

ATTACHMENTS

1. Slug Test – Data Acquisition Sheet

ATTACHMENT - 1 Slug Test – Data Acquisition Sheet

WATER QUALITY SAMPLE ACQUISITION

WQ No.

General Information

Wellsite ____________________ Date ____________________

Well ____________________ Time ____________________

SID# ____________________ Performed by ____________________

Well Depth (ft bls) ________ Packed Interval (ft-ft bls) ________

Casing (HW) Depth (ft bls) ________ Packed Interval (m-m bls) ________

Casing (HW) Diameter (in.) ________ Initial Test Interval WL (ft bls) ________

Hole Diameter (in.) ________ Initial Annulus WL (ft bls) ________

Note: 1ft = 0.3048 m

Purge Volume (gallons)

1 [ ] g/ft X [ ] ft (interval) = [ ] gallons

2 [ ] g/ft X [ ] ft (interval) = [ ] gallons

TOTAL PURGE VOLUME (one) = [ ] gallons

Pump Method ____________________

Airline Length ________ feet

Discharge Rate (gpm) ________ gpm

Pump Time / Volume ________ minutes **X THREE =** [ ] minutes

Collection Method: Surface Discharge or Wireline Bailer or Nested Bailer

Comments: ____________________

Note: NQ=0.2301 gal/ft; HW=0.6528 gal/ft; open hole(NQ)=0.3623 gal/ft

Test Information

Water Quality During Purge			
Time	Sp. Cond.	Temp.	pH

Start Purge ________

End Purge ________

Sample Time ________

Multimeter	
Sp. Cond. (µS/cm)	
Temperature (°C)	
pH (SU)	

Photometer	
Chloride (mg/l)	
Sulfate (mg/l)	
pH (SU)	

Samples Sent to District's Laboratory for Standard Complete Analysis? Y or N

Well Site Data Forms_013012.xls

Water Quality Sampling

PURPOSE

Establish a uniform procedure for collecting water quality samples.

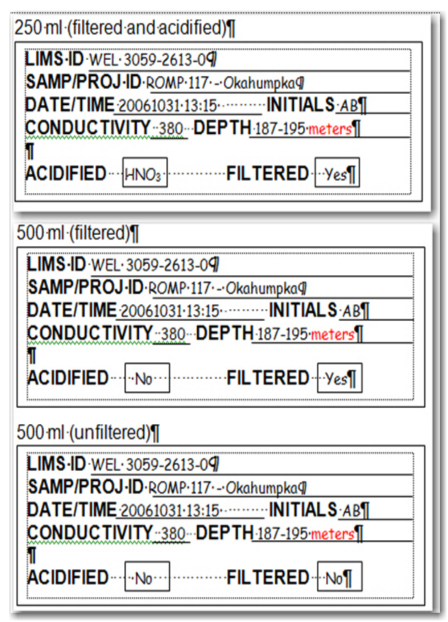
EQUIPMENT

1. Electronic water level tape
2. Peristaltic pump
3. Tripod filter and filter media
4. pH, conductance and temperature meter
5. Photometer
6. De-ionized (DI) water
7. Rubber gloves
8. 250 milligrams/liter (ml) and 500ml bottles
9. Nitric acid

PROCEDURE

1. Choose Appropriate Method to Collect Sample:
   a. Wire line bailer, nested bailer, or surface discharge
2. Purge:
   a. Calculate the volume of the well or sample interval
   b. Pump the well and calculate discharge in gallons per minute (gpm)
   c. Calculate the time needed to purge three well or sample volumes [Note purge start and stop times on *Water Quality Acquisition* form (Attachment D-1)]
   d. Measure field parameters after each 0.5 volumes have been purged from the well (Divide total time to purge three well volumes by 6).
   e. Record field parameters (elapsed time, specific conductance, temperature, and pH) on the *Water Quality Acquisition* form.

3. Label Bottles/Prepare Tripod Filter:
   a. Complete labels for sample bottles (fill in conductivity and time when sample is collected)
   b. Rinse tripod filter parts with DI water
   c. Place new filter media in tripod filter holder
4. Collect the Sample:
   a. Put on rubber gloves
   b. Rinse the sample collection container with sample water
   c. Collect the sample
5. Meter Measurements:
   a. Rinse probe with portion of the sample before submerging
   b. Record Specific Conductance, Temperature, and pH on the *Water Quality Acquisition* form
   c. Record the time and Specific Conductance on sample labels



6. Fill Sample Bottles:
    a. Attach plastic tubing to peristaltic pump
    b. Purge tubing with sample water
    c. Fill the unfiltered 500ml bottle with sample water
    d. Attach tubing to top of tripod filter
    e. Purge filter by opening and closing air release valve
    f. Fill the filtered 250ml and 500ml bottles
    g. Acidify the 250ml bottle with nitric acid (HNO_3) using one glass "snap-off" ampoule
    h. Check acidification by pouring small amount of the sample directly over a strip of pH litmus paper. The pH strip should NEVER be dipped into the sample bottle, this may contaminate the sample. Compare the results of the litmus paper to the pH range shown on the litmus paper container. The pH must be less than 2.0. Adding more HNO_3 should not be necessary
    i. Put sample bottles in iced cooler
7. Clean-up:
    a. Rinse the photometer tubes and mixing sticks with DI water and set on paper towel to dry
    b. Pump DI water through the peristaltic pump until tubing is purged
    c. Disassemble tripod, dispose of old filter and rinse all parts with DI water; allow parts to air dry
    d. Rinse all sampling containers with DI water and allow to air dry
    e. Rinse meter probe with DI water, pour small amount of pH 4 buffer solution into calibration cup and then screw cup tightly onto probe

SUGGESTED REFERENCES

1. Water Quality Monitoring Program, 2013. Standard Operating Procedures for the Collection of Water Quality & Biological Samples, Revision 9.0: Southwest Florida Water Management District, 135 p.

ATTACHMENTS

1. Water Quality Acquisition Form

ATTACHMENT – 1 Water Quality Acquisition Form

WATER QUALITY SAMPLE ACQUISITION

WQ No.

General Information

Wellsite ____________ Date ____________
Well ____________ Time ____________
SID# ____________ Performed by ____________

Well Depth (ft bls) ______ Packed Interval (ft-ft bls) ______
Casing (HW) Depth (ft bls) ______ Packed Interval (m-m bls) ______
Casing (HW) Diameter (in.) ______ Initial Test Interval WL (ft bls) ______
Hole Diameter (in.) ______ Initial Annulus WL (ft bls) ______

Note: 1ft = 0.3048 m

Purge Volume (gallons)

1		g/ft	X		ft (interval)	=		gallons
2		g/ft	X		ft (interval)	=		gallons
					TOTAL PURGE VOLUME (one) =			gallons

Pump Method ____________
Airline Length ______ feet
Discharge Rate (gpm) ______ gpm
Pump Time / Volume ______ minutes **X THREE =** ______ minutes
Collection Method: Surface Discharge or Wireline Bailer or Nested Bailer
Comments: ____________

Note: NQ=0.2301 gal/ft; HW=0.6528 gal/ft; open hole(NQ)=0.3623 gal/ft

Test Information

Water Quality During Purge			
Time	Sp. Cond.	Temp.	pH

Start Purge ______
End Purge ______
Sample Time ______

Multimeter	
Sp. Cond. (µS/cm)	
Temperature (°C)	
pH (SU)	

Photometer	
Chloride (mg/l)	
Sulfate (mg/l)	
pH (SU)	

Samples Sent to District's Laboratory for Standard Complete Analysis? Y or N

Well Site Data Forms_013012.xls

Well and Aquifer Test Design

PURPOSE

Establishment of a uniform procedure for designing wells and planning aquifer performance tests (APTs).

PROCEDURE

1. Review Data:
   a. Review available hydrogeologic data (core drilling and testing data if available)
   b. Delineate aquifers present and determine monitoring intervals for all wells to be constructed
2. Estimate Aquifer Hydraulic Parameters:
   a. Using the slug test data collected during wire-line coring, estimate values for transmissivity (T), hydraulic conductivity (k), and aquifer thickness (b) for each aquifer test interval (T = k·b). Estimate a value for storativity (S) from the Aquifer Hydraulic Properties Table (Attachment -1)
3. Determine the estimated pump rate for the APT using the *Confined_Predict.xlsx* spreadsheet (Attachment -2):
   a. Input values for: hydraulic conductivity (k), aquifer thickness (b), and storativity (S), pumping rate in gallons per minute (GPM) and distance from well in feet
   b. Determine the pump to be used for the test based on the specifications listed on the Geohydrologic Data Section Pump list (Attachment -3)
   c. Determine the pumped well casing diameter and type:
      - Example: 3,000 GPM diesel pump column pipe couplings are 12-inches in diameter. A 16-inch casing size will allow room for pressure transducers and water level tape
      - Steel casing should be used because of the higher hydraulic collapse pressure than plastic casing
   d. Determine pumped well casing depth:
      - Use pump curve for selected pump to determine the net positive suction head (NPSH) for the selected rate
      - Determine friction loss (feet per 100 feet of pipe) for the column pipe used with pump in the selected casing
      - Calculate the total dynamic head (this is the minimum depth needed to be set below water level):

(water level) + (expected drawdown) + (NPSH) + (friction loss) = total dynamic head (minimum casing length)

Ex. (64 feet bls) + (15 feet) + (26 feet) + ((7.4/100)*105 = 113 feet

      - To keep pump inside casing, the casing length will be equal to or greater than total dynamic head

e. Determine observation well distances:
   - Use the *forward project* feature in AQTESOLV to determine the expected drawdown and distances in the proposed observation wells

f. Design permanent wells:
   - Permanent wells are usually designed with 6-inch diameter poly vinyl-chloride (PVC) casing

SUGGESTED REFERENCES

1. Osborne, P. S., 1993. Suggested Operating Procedures for Aquifer Pumping Tests. U.S. EPA, Office of Research and Development, EPA 540/S-93/503.

ATTACHMENTS

1. District Aquifer Hydraulic Properties
2. Confined Predict Spreadsheet
3. Geohydrologic Data Section Pumps

ATTACHMENT – 1 District Aquifer Hydraulic Properties

Aquifer Hydaulic Properites

	Storage Coefficient (dimensionless)		Specific Yield (dimensionless)		Transmissivity (feet^2/day)		Hydraulic Conductivity (feet/day)		Leakance (feet/day/foot)	
General Aquifers[1]	Low	High	Low	High	Low	High	Low	High	Low	High
Unconfined Aquifers	0.01	0.3								
Confined Aquifers[2]	1.E-05	1.E-03								
Clay			0.01	0.2			3.E-07	3.E-04		
Sand			0.01	0.4			0.03	3280		
Crystalline limestone			0	NA			3.E-05	0.3		
Karst limestone			NA	0.4			0.3	3281		
District aquifers[3]										
surficial			5.E-05	0.3	8	7,754	0.1	1,493		
IAS or HAS	3.E-06	2.E-03	NA	NA	31	17,901			1.E-10	0.1
UFA	1.E-05	0.4	NA	NA	0.4	9,358,288			1.E-07	30

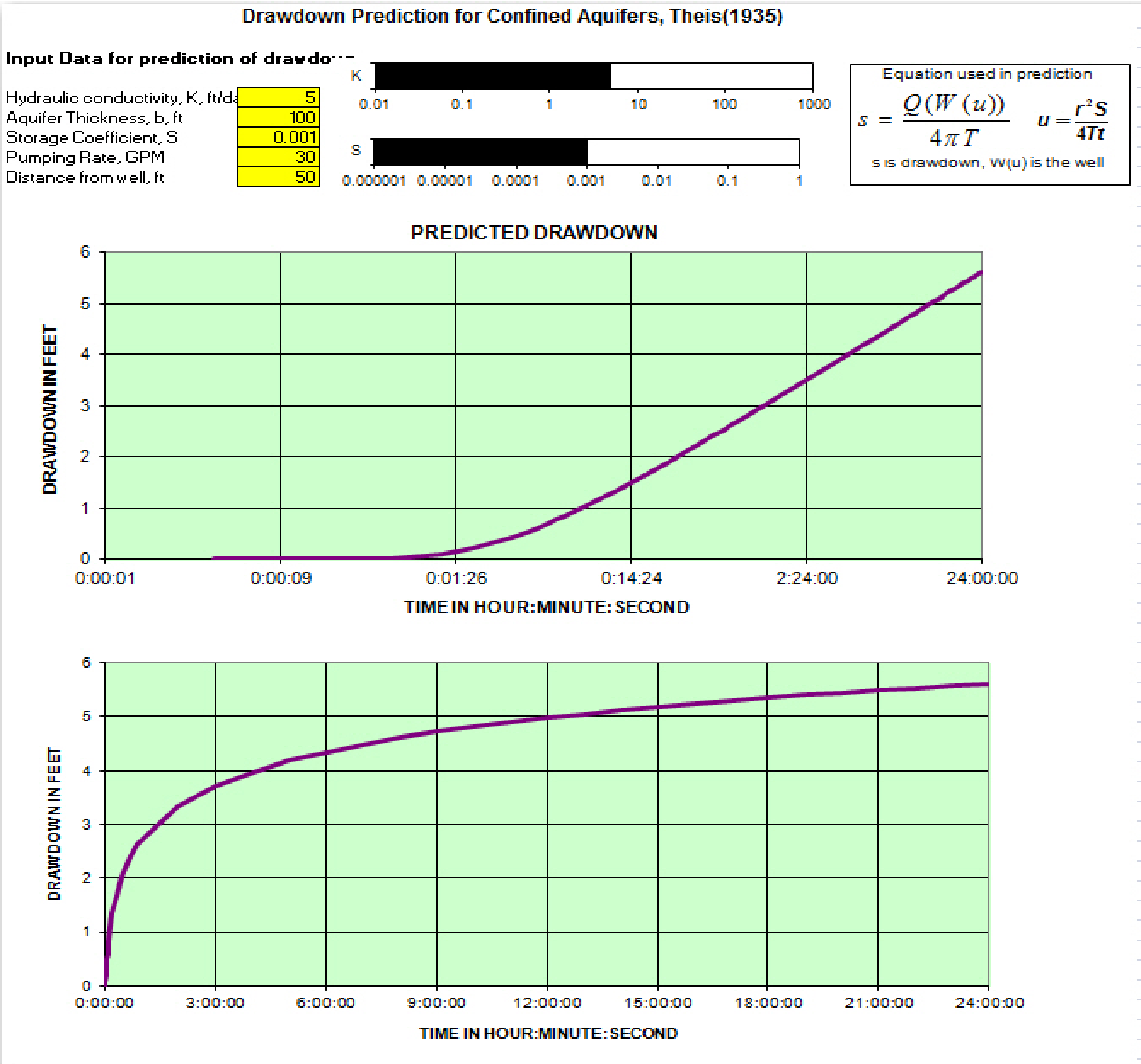
[1]Groundwater and Wells, Driscoll, 1986 and Aquifer Hydraulics, Batu,1998.

[2] Fine-grained materials ~ 0.00001, Clean coarse grained materials ~0.001

[3] Aquifer Characteristics within the SWFWMD

NA- Not applicable

ATTACHMENT – 2 Confined Predict Spreadsheet

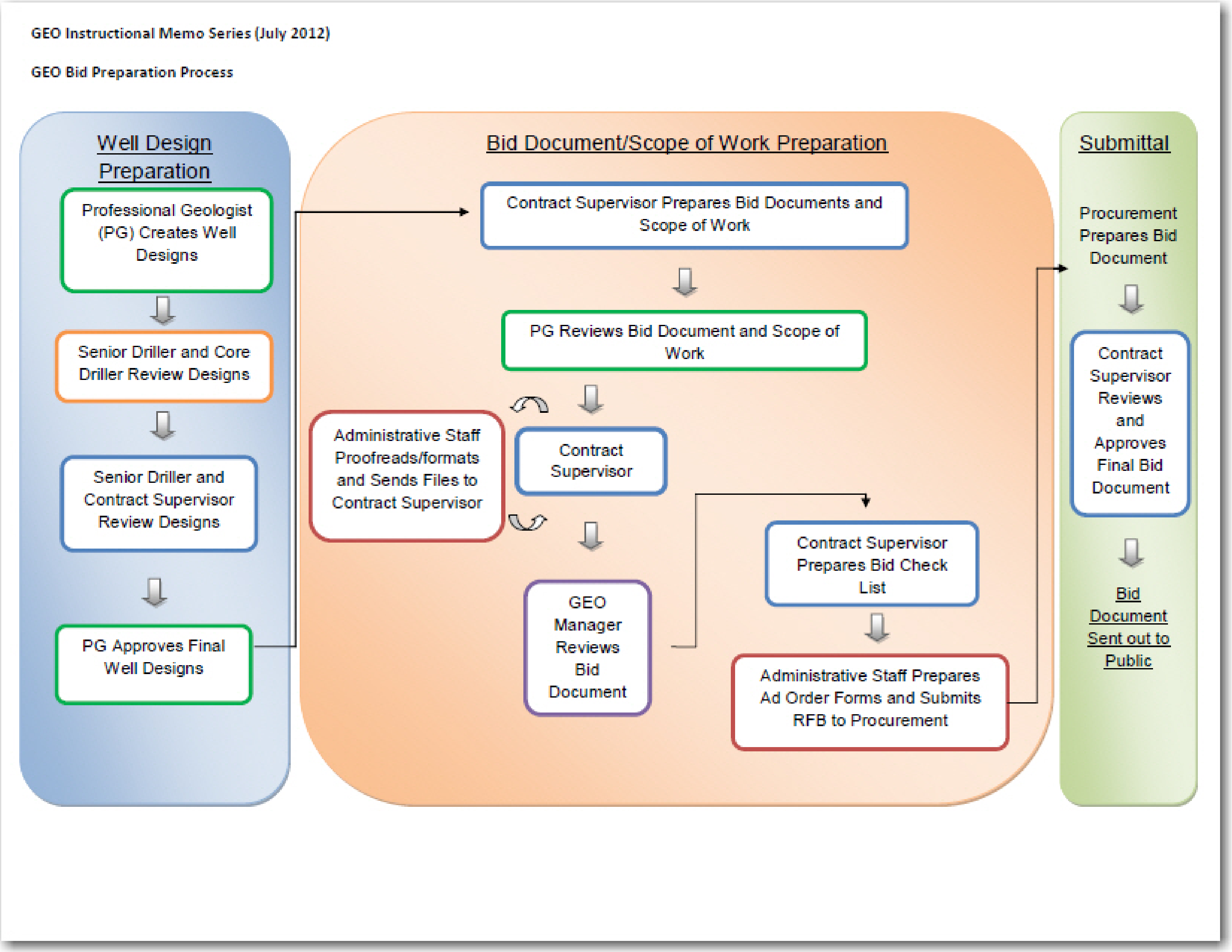


ATTACHMENT – 3 Geohydrologic Data Section Pump List

GEO Section Pumps

Pump type	GPM Range	Control Box	Generator Needed to operate pumps	Bowles (stages)	Drop Pipe (inches)	diameter (inches) (does not include space for transducer)	Recommended Casing Size	Comments	Serial #	Model #	Purchased
3-inch submersible	22	no	5000 Watt 240 V 30 Amp		2"	3"	3"	Can use 1" pvc hose to allow room for P.T.		22SQ190	
4-inch submersible Goulds 1.5 HP	33	yes	5000 Watt 240 V 30 Amp		2"	4"	4"			33GS15	
4-inch submersible Shaeffer	35	yes	5000 Watt 240 V 30 Amp		2"	4"	4"			35LD2S4	
4-inch submersible Goulds 2 HP	40	yes	5000 Watt 240 V 30 Amp		2"	4"	4"	Control box is with pump			
4-inch submersible Goulds 5 HP	80	yes	15KW 240 V 30 Amp		2"	4"	4"	Control box is unattached. Wires are cut.			
4-inch submersible Grundfos 10 HP	100-250gpm	yes	15 KW 440 V 3 phase	16 stage	2"	4"	6"	Control box is unattached.			
6-inch submersible 10 HP	250-375gpm	yes	45 KW 440 V 3 phase	3 stage	3" or 4" Depending on casing size	6"	8"	8 inch if using SDR-17 Inside Diameter of 6" SDR- 17 is 5.728"	#1001982	NS320/3	motor replaced 8/2008
6-inch submersible 30 HP	375-525gpm	yes	460volt 3phase	5 stage	3" or 4" Depending on casing size	6"	8"	8 inch if using SDR-17 Inside Diameter of 6" SDR- 17 is 5.728"			purchased10/2008
6-inch Lineshaft Diesel	750-1500gpm	NA	NA	2 stage	6"	8"	10"				replaced 2005
8-inch lineshaft Diesel	1500-2200gpm	NA	NA	7 stage	8"	12"	12"				purchased 9/2010
10-inch Lineshaft Diesel	2000-3000gpm	NA	NA	4 stage	10"	14"	16"				purchased 2/2006

Drilling Contractor Selection Flowchart



General Well Construction

PURPOSE

Establishment of a uniform procedure for monitor well construction.

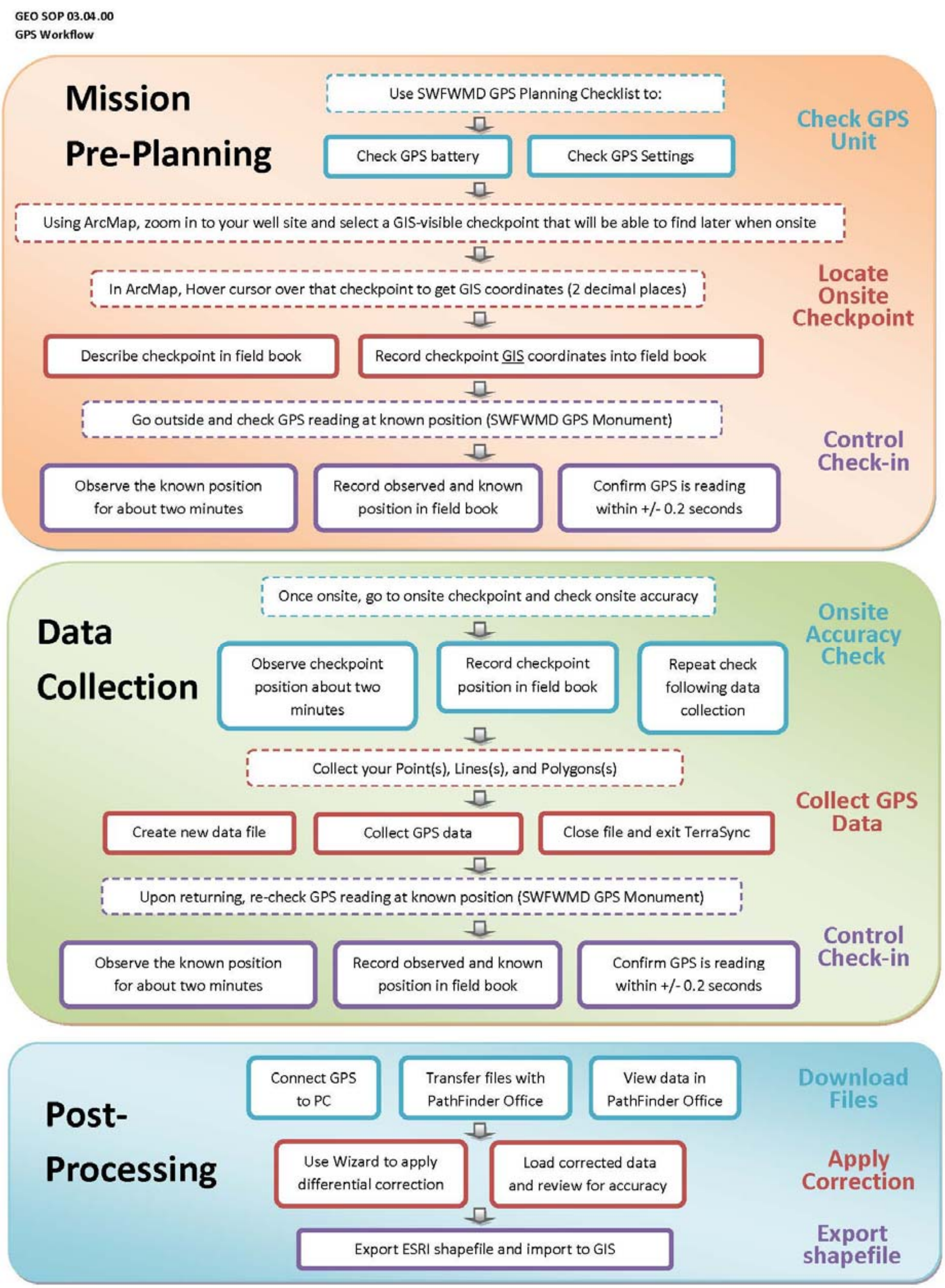
PROCEDURE

1. Monitor well construction designs are prepared by the project geologist. Example well diagrams can be found at: L:\GEO Section\ROMP\ROMP information\Misc\figures\Power Point Figures.
2. The monitor well designs are reviewed by a professional geologist and a senior driller. If monitor well designs are based on data collected during the core drilling phase, the monitor well designs should also be reviewed by the project core driller.
3. Any changes to well designs during construction should be approved by a professional geologist and a senior driller.
4. Well casing installations should be designed to terminate above known permeable zones when possible to prevent lost circulation when using the mud-rotary drilling method.
5. The deepest monitor well proposed at the site should be constructed first. This will help prevent drilling mud and grout from migrating through permeable zones into the monitored zones of shallower wells adjacent to the deeper well.
6. The final casing of permanent monitor wells is usually constructed of 6-inch diameter plastic casing. Different casing sizes and materials may be used in special cases.

SUGGESTED REFERENCES

1. Chapter 40D-3, F.A.C.
2. Florida Department of Environmental Protection, 2008, Monitoring Well Design and Construction Guidance Manual, Florida Department of Environmental Protection, 73 p.
3. Lapham, W.W., Wilde, F.D., Koterba, M.T., 1997, Guidelines and Standard Procedures for Studies of Ground-Water Quality: Selection and Installation of Wells, and Supporting Documentation, U.S. Geological Survey, Water Resources Investigations Report 96-4233, 110 p.
4. United States Environmental Protection Agency, 2008, Design and Installation of Monitoring Wells: US. Environmental Protection Agency, 33 p.

Geopositioning Flowchart



Staff Oversight During Well Construction

PURPOSE

Establishment of a standard procedure that stipulates District staff responsibilities when supervising drilling companies contracted by the District to construct wells for District projects.

PROCEDURE

1. Site foreman duties prior to Contractor mobilizing to site:
    a. Review all well designs and Scope of Work for project
    b. Coordinate the ordering and delivery of materials to the site
    c. Establish contact and exchange contact information with the driller for the contracted drilling company
    d. Ensure all well construction permits have been obtained prior to drilling start date
    e. Establish drilling start date for the project
2. Site foreman needs to be on-site to verify the following activities:
    a. Contractor mobilization to the site. Instruct contractor on where the well is to be constructed on site.
    b. Ensure that all proposed well locations are within the temporary and permanent well easements
    c. Verify that contractor rig and equipment are satisfactory to perform work.
    d. Collect and review contractor's daily logs. Foreman will place the well construction permit (WCP) number on District's daily log for each well being constructed
    e. Casing installations – verify the casing depth matches the proposed well design submitted by the site hydrologist; witness all casing installations including casing connections.
    f. Grouting – check contractors grout volume calculations (but do not perform this task for them), verify grout composition, and witness all grouting operations
    g. Well development – witness well development methods and ensure water from well is clear and free of sand.
    h. Well logging – review caliper logs on site to verify the open-hole interval is as specified and verify final casing depth and integrity.
    i. Well head completions – verify all well heads are completed as specified.
    j. Review contractor invoices for comparison to daily logs
    k. Contractor demobilization – verify contractor removes all equipment and materials and ensure well site is clean and secure within one week of completion.
3. Site foreman to complete End of Site checklist and provide to Supervisor.

SUGGESTED REFERENCES

1. Florida Department of Environmental Protection, 2008, Monitoring Well Design and Construction Guidance Manual, Florida Department of Environmental Protection, 73 p.

ATTACHMENTS

1. Contractor Final Payment Checklist

ATTACHMENT – 1 Contractor Payment Checklist

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

GEOHYDROLOGIC DATA SECTION

REGIONAL OBSERVATION AND MONITOR WELL PROGRAM (ROMP)

CONTRACTOR FINAL PAYMENT CHECK LIST

Well Site Name: ______________________________

Well Site Number: ____________________________

Drilling Contractor: ___________________________

Commencement Date: _________________________

Completion Date: _____________________________

(Below to be completed by the Site Foreman)

Site Foreman Name: ___________________________

Check all that applies to Scope of Work for this project:

☐ Wells satisfactorily developed?

Wellhead protectors completed? (Check appropriate box)

☐ Lockable with concrete slab

☐ Welded plate only

Site cleaned of trash from contractor (Check appropriate box)

☐ Not Responsible (District provided dumpster) ☐ Responsible (turnkey quote)

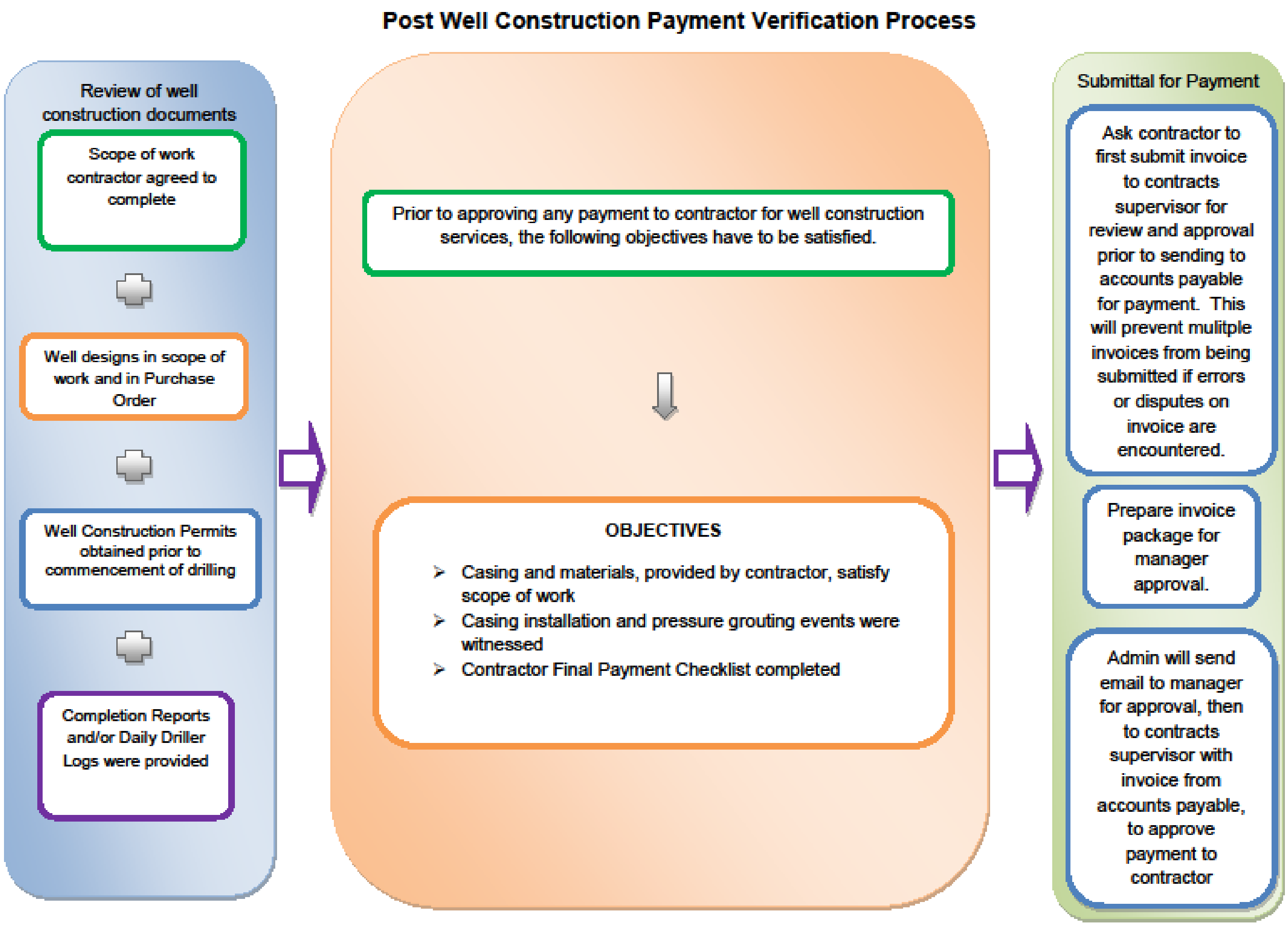
☐ Completed wells Geophysically logged and meet scope of work

☐ Completion Reports submitted by Drilling Contractor

☐ Daily logs, if applicable, received from Drilling Contractor

kjs\S:\Word\Final Contractor Payment Checklist

Post Well Construction Payment Verification Flowchart



Aquifer Performance Test (APT) Equipment Set Up

PURPOSE

Establishment of a uniform procedure for selection and installation of equipment to perform an aquifer performance test (APT) at a District well site.

EQUIPMENT

1. Crane truck and hoist truck
2. 6- and 10-inch diesel powered turbine pump
3. 3-, 4-, and 6-inch electrical submersible pumps from 1 horsepower single phase to 30 horsepower three phase
4. 2- and 4-inch steel drop pipe for submersible pumps.
5. 5 kilo-watt (kW) and 60 kW generators
6. Approximately 3,200 feet of 10-inch aluminum discharge pipe with air relief valves and an assortment of 90 degree connectors and 45 degree connectors
7. 2-, 4-, 6-, and 10-inch flow meters
8. 4 foot x 8 foot water tank with flange connection to discharge pipe
9. Flow through circular orifice weir with monometer tube
10. Assorted circular orifice plates
11. Erosion control for discharge
12. Road ramp
13. Backhoe
14. Pipe elevators
15. Slip plate

PROCEDURE FOR PUMP SELECTION

1. A specific capacity test should be conducted in the pumped well to determine the proper pump and flow meter to be used during the APT.
2. Make pump selection based on well diameter and water level.
3. Select power source: diesel engine or generator (5 kW or 60 kW).
4. Select mechanical equipment needed for pump installation: crane truck, and/or hoist truck, and/or backhoe.
5. Establish the Net Positive Suction Head (NPSH) to determine proper pump set depth.
6. Select proper circular orifice weir plate based of flow rate.

PROCEDURE FOR 6- AND 10-INCH TURBINE PUMP INSTALLATION

1. For installing 6- or 10-inch line-shaft turbine pump, the crane must be set as close as possible to well head for maximum lift capacity.
2. Using the proper size elevators for pump selected, begin by lifting pump over well casing and lower into well as centered as possible, utilizing a slip plate to hold pump column securely to well head.
3. At this point the line shaft (LEFT HAND THREAD) must be installed to the pump before adding the next column pipe. At every connection a spider fitting must be installed into column pipe and over line-shaft to keep line-shaft straight throughout entire length of pump column. Continue this method until desired depth is reached.

4. Once pump is set to required depth, the right angle drive and stuffing box must be installed and secured to pump column. Adjust the position of the impellers inside the bowl assembly for maximum performance. The impellers must be raised slightly to prevent dragging on the bowls. The impellers must be down against the bowl seat when starting impeller adjustments. When pumps are subjected to suction pressure the pressure acting against the shaft tends to raise it. Make sure the shaft is down when starting to adjust the impellers. The impellers for 10-inch line shaft should be raised 0.25 inches for best operation.
5. A one-way check valve is installed to discharge head or stuffing box to keep water from back flowing during shut down. The proper size hose is attached to check valve, then to flow meter.
6. Connect the 10-inch aluminum discharge pipe to discharge side of flow meter. An air-relief valve should be placed immediately after flow meter. Air-relief valves should be placed evenly throughout total length of discharge pipe. Connectors (90 degree and 45 degree) can be used to adjust the pipeline route around obstacles. Every connector must have o-ring and Travis circle locks to complete connection.
7. Once all discharge pipes have been installed, connect the circular orifice weir pipe with monometer tube to the aluminum discharge pipe. There are four leveling jacks mounted to orifice weir pipe that must be level before the test can begin.
8. Start pump for a pre-APT check. Pump should be run at the proposed discharge rate for the APT. Check pump and piping for leaks and make any necessary adjustments to equipment. Check the discharge point for any erosion control issues that may need addressing before the actual APT begins.
9. At the conclusion of the pre-APT test, the pump should be disengaged from the diesel engine and the diesel engine throttle should be reduced to idle speed for a minimum of 15 minutes to allow the engine to cool down before turning engine off. This will prevent damage to the engine turbocharger.

PROCEEDURE FOR ELECTRICAL SUBMERSIBLE PUMP INSTALLATION

1. The hoist truck can be utilized for installing most submersible pumps.
2. Begin by lowering the selected submersible pump and drop pipe into the well casing. Casing elevators or a pull plug should be used to lift and lower the drop pipe.
3. Use electrical tape to secure the pump wiring to the drop pipe as the pump is lowered to the selected depth.
4. Once the pump is lowered to the selected depth, a slip plate is installed at the top of the well casing to secure the pump and column pipe in place.
5. Connect the pump wiring leads to the pump control box and wire accordingly. These wires are color coded to avoid confusion. Wires leaving control box must be connected to a power supply, either the 60 kW or 5 kW generator. These wires are not color coded and special attention must be made when connecting these wires to a generator.
6. Connect the appropriate discharge pipe to the top of the column pipe. Connect the appropriate flow meter to the discharge pipe.
7. Connect the discharge pipe to the circular orifice weir pipe and manometer tube. The circular orifice pipe should be installed to flow into the 4 foot x 8 foot water tank.

8. Connect the 10-inch aluminum discharge pipe to the 4 foot x 8 foot water tank mounted on a flatbed trailer. The water discharged into the tank will then gravity flow through the discharge pipe to the discharge point.

Conducting An Aquifer Performance Test

PURPOSE

Establishment of a uniform procedure for conducting aquifer performance tests (APTs).

EQUIPMENT

1. APT trailer
2. Electronic water level tape
3. Carpenter's ruler to measure casing height
4. Survey equipment (transit and rod)
5. Laptop computer with software installed (Win-Situ, Virtual Hermit, Excel)
6. In-Situ Rugged Reader (handheld computer)
7. In-Situ Level Troll 700's (30 pound per square inch (psi) and 100 psi), Baro-Troll, Troll Net Hub (8 ports), In-Situ extension cables, other ancillary equipment (all stored in large black pelican box)
8. Campbell CR1000 data logger for recording flow meter.
9. Marine batteries to supply power for flow meter.
10. Extension cables (4-20) to connect flow meter to Campbell CR 1000 data logger.
11. Rain gauge

PROCEDURE

1. Prepare for test:
    a. Submit work order for the Survey Section to determine the top of casing (TOC) elevation to the North American Vertical Datum of 1988 (NAVD 88) for all on-site monitor wells.
    b. Obtain discharge permit [62-621-300 (2)] from the Florida Department of Environmental Protection if required (discharge of non-contaminated water to an open field or retention pond does not require permit [Attachment D-1]).
    c. Request drilling staff to conduct specific capacity test on each pumped well.
    d. Determine the appropriate pumping rate, duration and estimated drawdown in the pumped well and in the observation wells.
2. Collect background data:
    a. Record all measurements on the APT_dataform_revised.xls form (Attachment D-2).
    b. Install rain gauge on-site.
    c. Measure static water levels in all wells.
    d. Determine the appropriate depth to install Level Trolls in the pumped and observation wells (account for possible water level increase during background phase and drawdown during pumping phase).
    e. Install Level Trolls in all wells and connect to laptop computer.
    f. Determine background data collection (usually 15 minute intervals for minimum of 1 week before pumping phase).
    g. Start Virtual Hermit data logger for background data collection.
    h. Disconnect cables from Level Trolls and install caps on wells.
    i. Secure equipment in APT trailer for background phase.

3. Drawdown Phase:
    a. Review background data to establish regional trend prior to starting drawdown phase.
    b. Measure static water level in all wells.
    c. Install Level Trolls in Manometer tube.
    d. Connect Level Trolls to the laptop computer.
    e. Connect flow meter (record totalizer value) to the CR1000 data logger.
    f. Select a logarithmic data collection schedule and prepare Virtual Hermit for drawdown phase.
    g. Begin recording with Virtual Hermit and Campbell data logger.
    h. Start pump.
    i. During drawdown phase, review plot curves and analyze data to ensure enough data has been collected to determine hydraulic parameters for transmissivity, storativity, and leakance.
4. Recovery Phase:
    a. Stop recording drawdown, start recording recovery on Virtual Hermit.
    b. Stop pump.
    c. Record recovery data for minimum of one week.
    d. Review recovery data for regional trend prior to stopping data logger.
5. End Test:
    a. Remove Level Trolls, cables, and CR1000 data logger from site.
    b. Install caps on wells and lock covers.
    c. Coordinate with drilling staff to remove pumps, discharge pipe, flow meters and other equipment from site.

REFERENCES

1. Florida Department of Environmental Protection, 2000. Generic permit for the discharge of produced ground water from any non-contaminated site activity: Florida Department of Environmental Protection, Document number 62-621.300 (2).

ATTACHMENTS

1. Groundwater Discharge Memorandum
2. APT Dataform

ATTACHMENT – 1 Groundwater Discharge Documents

From: Greenwell, Jeff
To: Ted Gates
Subject: RE: Discharge of groundwater during aquifer performance test
Date: Thursday, May 09, 2013 10:45:36 AM

Yes, this is what we discussed, but applicability is based on whether the discharging is to surface water not duration. If you have an open field or a retention pond (no outfall) for discharge, no testing is required regardless of duration. Otherwise, you are subject to the generic permit requirements which have some screening constituents.

Best Regards,
jeff

Please take a few minutes to share your comments on the service you received from the department by clicking on this link DEP Customer Survey.
From: Ted Gates [mailto:Ted.Gates@swfwmd.state.fl.us]
Sent: Thursday, May 09, 2013 8:26 AM
To: Greenwell, Jeff
Subject: Discharge of groundwater during aquifer performance test

Hey Jeff,

We talked yesterday about not needing a permit for discharging clean water pumped from a Southwest Florida Water Management District (District) monitor well during an aquifer performance test. I have been asked to follow up on this. I found this DEP document (attached) while researching the issue. Do you think this would apply for short term 24 – 36 hour aquifer tests routinely performed by the District?

Thanks,

M. Ted Gates, P.G., CPG
Professional Geologist
Data Collection Bureau
Southwest Florida Water Management District
7601 Hwy 301 North
Tampa, FL 33637-6759

(800) 836-0797 Ext. 2221 (FL only)
(813) 985-7481 Ext. 2221
(813) 781-1425 (cell)
(813) 987-6585 (fax)
email: ted.gates@swfwmd.state.fl.us

District Website: www.swfwmd.state.fl.us

ATTACHMENT – 2 APT Data Form

AQUIFER PERFORMANCE TEST - DATA ACQUISITION SHEET

General Information:

Site Name:		Date:	
Reporting Code:		Performed by:	
County:		S/T/R:	
Pumped Well:		Pumped Zone OB(s):	
Pump Type:			
Test Rate/Duration:		Non-Pumped Zone OB(s):	
Pump Set Depth:			

Setup Information:

Datalogger:		Time Synchronized:	
Datalogger SN:		Time Datum:	
Program Name:			
Program Start Date:			
Program End Date:			

Test Information:

Pump On Time:		Flow Meter Totalizer Start:	
Pump Off Time:		Flow Meter Totalizer End:	

		CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	CH 7	CH 8	
Well										
Riser ht.	als ft									
TOC elev	elev ft									<- Elev Ref. ______
static WL	btoc ft									<- Date ______
static WL	elev ft									TOC elev - static WL(btoc)
XD Rating	psi									
Serial No.										
Reading in Air	ft									
XD depth	btoc ft									
XD elev	elev ft									TOC elev - XD depth(btoc)
XD subm	WL tape ft									WL tape value of submergence
XD subm	XD read ft									XD value of submergence
XD Diff.	ft									$Subm_{WL tape}$ - $Subm_{XD}$

Date	Time	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	CH 7	CH 8	Totalizer (g x 1000)	Notes
Units	----------->										

Slug Test Analysis

PURPOSE

Establishment of a uniform procedure for analyzing data from slug tests.

PROCEDURE

1. Compile raw data from all slug tests conducted for the selected test interval (see SOP# GEO 02.03.00 for procedure on conducting slug tests), normalize, graph and format for AQTESOLV input:
    a. Data for AQTESOLV should be adjusted time in minutes since t_0 (first value will be 0 minutes) versus displacement since t_0.
2. Input calculated annulus radius of test casing (r_c) and open test interval (r_w):
    a. Fill in all fields in AQTESOLV – Radius Tab using the values as specified in the attached table (Attachment -1) for the calculated annulus radius.
    b. Specified values apply to typical GEO Section slug tests performed with the following criteria:
        1. NQ drill rods function as the test casing
        2. Packer and spacer are used
    c. If packer and spacer are not used, the radii will be equivalent to the NQ rods or HW casing inside diameter (see Attachment -1)
3. Apply frictional well loss correction (see RIMS 09-07).
4. Filter data if necessary:
    a. This keeps automatic parameter estimation and re-drawing of type curves during analyses to a reasonable duration
    b. Suggested filter for observations is to retain every five observations (on "Observation" tab, click "Filters" button, check "Retain every 5 observations")
    c. If data is filtered, be sure to keep the H_0 selected on the "General" tab as the original maximum displacement prior to filtering our observations.
5. Adjust x and y axes. Display as appropriate for length of test and amplitude of displacement.
6. Use Midwest Geosciences *Field Guide for Slug Testing and Data Analysis* (Attachment -2) to help determine the appropriate analysis method.

SUGGESTED REFERENCES

1. Janosik, A., and Clayton, J.M., 2007. Recommended use of the correction for frictional well losses when using the Butler solution to analyze slug test data in AQTESOLV. Southwest Florida Water Management District, Geohydrologic Data Section, ROMP Instructional Memo Series RIMS 09-07, 3 p.
2. LaRoche, J.L., 2010. Tips for ROMP slug test analyses in AQTESOLV. Southwest Florida Water Management District, Geohydrologic Data Section, ROMP Instructional Memo Series RIMS 05-10, 3 p.
3. LaRoche, J.L. R102.5_102.5_ST14_1689-1907_TEMPLATE.xlsx. File last modified 5 April 2011. Microsoft Excel file.
4. SOP #GEO GEO 02.03.00 "Slug Testing", current version.

ATTACHMENTS

1. Table - ROMP Coresite Packer Test Radius Calculator
2. Midwest Geosciences' *Field Guide for Slug Testing and Data Analysis*

ATTACHMENT -1 ROMP Coresite Packer Test Radius Calculator

ROMP Coresite Packer Test Radius Calculator

Inside Radius of Test Casing (r_c)

	Diameter (inch)	Radius (inch)	Radius (feet)	Area (inch)
NQ, NRQ (ID)	2.375	1.1875	0.098958	4.430137
HW (ID)	4	2	0.166667	12.56637
Old Spacer OD (7ft spacer)	1.25	0.625	0.052083	1.227185
Old Spacer OD (10ft spacer)	1.625	0.8125	0.067708	2.073942
New Spacer/XD OD (5ft spacer)	1.662	0.831	0.06925	2.169461
Combo Line OD	0.43	0.215	0.017917	0.14522
PXD OD (In-Situ)	0.25	0.125	0.010417	0.049087
PXD OD (KPSI)	0.3	0.15	0.0125	0.070686
Annulus Old (7ft spacer)	1.950186	0.975093	0.081258	2.987046
Annulus Old (10ft spacer)	1.650788	0.825394	0.068783	2.140289
Annulus New (5ft spacer)	1.641183	0.820591	0.068383	2.115455
Annulus w/out Spacer	2.316403	1.158202	0.096517	4.214231

Radius of Open Hole (r_w)

	OD Diameter (inch)	OD Radius (inch)	OD Radius (feet)
NQ plus new shoe (OD)	3.032	1.516	0.126333

AqteSolv Inputs (radius tab):

If using calculated annulus radius for r_c (standard):

	(ft)
r_c	0.0989583
r_{eq}	0
r_p	0
r_w	0.1263333
r_{sk}	0.1263333

SOP#	GEO_05.01.00
Date	10/22/2013
Revision #	Original

ATTACHMENT – 2 Midwest Geosciences' Field Guide for Slug Testing and

FIELD GUIDE FOR SLUG TESTING AND DATA ANALYSIS™

midwest GEOSCIENCES group
www.midwestgeo.com

STEP FIVE: DATA ANALYSIS

SELECTION OF TEST FOR ANALYSIS

1. If normalized plots from a series of slug tests coincide, choose only one test for analysis. The selected test should have the lowest data noise level of that series.
2. If normalized plots do not coincide, seek explanation for lack of coincidence. Possible explanations include insufficiently developed well and non-laminar flow losses. See Butler (1998) and Butler et al. (2003) for further explanations of lack of coincidence of normalized plots.

SELECTION OF TEST CATEGORY

Select appropriate category for well-formation configuration.

CATEGORY I - Wells in Confined Formations and Wells Screened Below the Water Table in Unconfined Formations.

CATEGORY II - Wells Screened Across the Water Table.

CATEGORY III - Wells in Category I and in Highly Permeable Formations.

FRACTURED FORMATIONS

If formation is densely fractured and behaves as an equivalent porous media, standard methods are valid. If formation behaves as a double-porosity media, then validity decreases as well screen increases in length. If formation is sparsely fractured and flow is restricted to fractures, the validity of standard methods varies. If flow induced by test is radial, standard methods are valid. If flow is restricted to only a small portion of fracture plane, standard methods are not appropriate. See Butler (1998) and Shapiro and Hsieh (1998) for details.

TEST CATEGORIES

CATEGORY I ANALYSIS

A) Analyze data with Cooper et al. model for tests in fully penetrating wells.
B) Question: Can a good fit be obtained using a physically plausible storage estimate?
  - If so, the hydraulic conductivity estimate can be calculated from the transmissivity (T) estimate using $K = T / L_e$
  - If not, go to C.
C) Question: Is the well fully or partially penetrating?
  - If fully pentrating well, test may be affected by insufficient development or double-porosity flow. See Butler (1998).
  - If partially penetrating well, test may be affected by vertical flow above or below the screened interval. Go to D.
D) Analyze data with KGS model for tests in partially penetrating wells.
E) Question: Can a good fit be obtained using a physically plausible storage estimate?
  - If so, the hydraulic conductivity estimate should be reasonable.
  - If not, the test may be affected by insufficient development. See Butler (1998) for details.

CATEGORY II ANALYSIS

A) Question: Do data display a double straight line on a log normalized head vs. linear time plot (see Category II Figure)?
  - If so, go to B.
  - If not, go to A of Category I Analysis.
B) Fit a straight line to the formation response portion of the plot (2nd straight line segment).
C) Estimate K with Bouwer and Rice model.
  - Use effective casing radius, not nominal casing radius, in analysis. See Butler (1998).

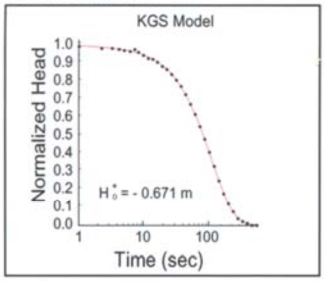
BOUWER & RICE AND HVORSLEV MODELS

These approximate methods involve fitting a straight line to data plotted in a log normalized head vs. linear time format. Although K estimates are obtained rapidly, these methods, unlike the Cooper et al. and KGS models, cannot provide clues that the test has been significantly impacted by insufficient development. If flow is primarily horizontal, data will display a concave-upward curvature in this plotting format. Straight line should be fit to the 0.15 - 0.25 (Hvorslev) and 0.2 - 0.3 (Bouwer & Rice) normalized head range. These ranges should be with respect to H_0^+ when data plot as a double straight line (see Category II Analysis Plot).

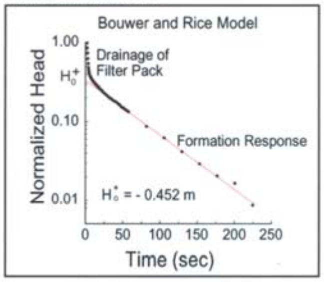
CATEGORY III ANALYSIS

A) Question: Are data oscillatory in nature or display a concave-downward curvature on a log normalized head vs. linear time plot?
  - If so, go to B.
  - If not, go to A of Category I Analysis.
B) Question: Do normalized data plots coincide?
  - If so, go to C.
  - If not, go to D.
C) Question: Is well fully penetrating or nearly so?
  - If so, analyze data with Butler & Zhan model.
  - If not, analyze data with either Butler & Zhan model or high-K extensions of Hvorslev and Bouwer-Rice models.
D) Question: Do normalized data plots from tests initiated with similar H_0^* coincide?
  - If so, go to E.
  - If not, further development may be needed.
E) Question: Can tests be repeated?
  - If so, repeat tests with smaller initial displacements and go to B.
  - If not, analyze data with non-linear slug test model of McElwee and Zenner. Note error in K estimate may increase as well screen approaches full penetration.

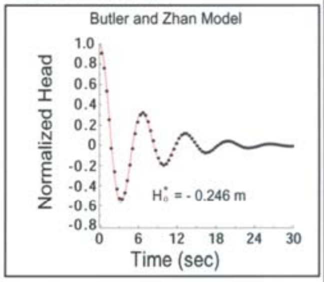
CATEGORY I ANALYSIS



CATEGORY II ANALYSIS



CATEGORY III ANALYSIS



REFERENCES *Technical Content: J.J. Butler, Jr., G.M. Duffield, and D.L. Kelleher* *Graphic Design: D.L. Kelleher*

Butler, 1998, *The Design, Performance, and Analysis of Slug Tests*, Lewis Publishers, 252 pp.

Butler, Garnett and Healey, 2003, Analysis of slug tests in formations of high hydraulic conductivity, *Ground Water*, v. 41, no. 5, 620 - 630.

Shapiro and Hsieh, 1998, How good are estimates of transmissivity from slug tests in fractured rock? *Ground Water*, v. 36, no. 1, 37-48.

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Data Analysis

Aquifer Performance Test Analysis

PURPOSE

Establishment of a uniform procedure for analyzing data from an aquifer performance test (APT).

PROCEDURE

1. Create Hydrograph from Data Logger File:
    a. Open APT_ANALYSIS_INSTRUCTIONS_mtg.xlsx file for examples to the following steps
    b. Copy raw data from data logger to new EXCEL file to make hydrograph
    c. Create column of elapsed time (in days)
    d. Create columns of water level submergence data that adds background + drawdown + recovery
    e. Convert water level data to elevation (from top of casing surveyed elevation data (in feet)
    f. Create graph of time (in days) versus water level elevation (in feet)
2. Analyze Hydrograph to Determine Regional Trend:
    a. On new tab in EXCEL file, paste time (in days) and water level elevation (in feet)
    b. Copy the water level column to new column and remove the drawdown and recovery data
    c. Create graph of time (in days) versus water level elevation (in feet)
    d. Add trend line to the data and plot the equation and R^2 data on the chart
    e. Determine the slope of the line (the value next to the x in the equation) in feet/day
    f. Convert the regional trend to feet/minute by dividing by 1440 minutes/day
3. Create Data Set for Input Into AQTESOLV:
    a. Create column of elapsed time (in minutes) for drawdown and recovery phases of test
    b. Create column of drawdown + recovery data for the observation well using the formula"$displacement \pm regional\ trend \times time$"
    c. Create graph that plots time versus uncorrected data and regionally corrected data – confirm it is correct
4. AQTESOLV Analysis:
    a. Paste the regionally corrected drawdown + recovery data into the “Observations” tab for the observation well (in AQTESOLV)
    b. Input the rate of discharge (must include an initial rate of 0 and the time pump stopped)
    c. Match the drawdown data using appropriate solution
    d. Match recovery data using the Theis recovery method or other solutions
5. Determine Leakance:
    a. Calculate the value for leakance using the leakance spreadsheet, input r/B and T values determined from the drawdown data in AQTESOLV

REFERENCE:

APT_analsis_instructions_mtg.xlsx

Report Formatting

PURPOSE

Establishment of a uniform format for GEO Section reports.

PROCEDURE

1. See Attached Guidelines:

Report Title

Hydrogeology, Water Quality, and Well Construction at the ROMP 132 - Blitch Plantation Well Site in Marion County, Florida

Table of Contents/Report Structure

Abstract (if desired)
Introduction
    Site Location
    Methods
Well Construction
Geology (listed oldest to youngest)
    Unit 1
    Unit 2
    Unit 3
Hydrology (listed top to bottom)
    Unit 1
    Unit 2
    Unit 3
Water Quality
Summary
References
Appendix A – Methods of the Regional Observation and Monitor-well Program
Appendix B - Well Diagrams
Appendix C – Lithologic Logs (FGS or field if no FGS yet)
Appendix D - Geophysical Logs
Appendix E - Slug Test Field Sheets
Appendix F- Slug Test Curve Matches
Appendix G - Water Quality Results (Lab/Field)
Appendix H – APT Field Sheets
Appendix I – APT Curve Matches

Notes:

1) Methods section should be brief, and only discuss methods unique to the site (how deep did each rig core, how many slug tests were collected, etc). General data collection methods should be discussed in Appendix A (samples were collected with wire-line, the function of geophysical logs, etc).

2) Hydrology section includes slug test, APT, and geophysical data relevant to each unit (there should not be a separate section for say, APTs).

3) Water Quality section includes samples taken during APTs.

4) Appendix order can be rearranged as needed.

RIMS 05-2011
page 1 of 3

Typical Figures

Figure	Template	x-axis label	y-axis label
Site location map	-	-	-
Easement map	-	-	-
Stratigraphic column	-	-	DEPTH, IN FEET BE-LOW LAND SURFACE
Hydraulic conductivity and groundwater level with depth	Grapher	HYDRAULIC CON-DUCTIVITY, IN FEET PER DAY WATER LEVEL, IN FEET BELOW LAND SURFACE	DEPTH, IN FEET BE-LOW LAND SURFACE
Hydrographs	-	date	GROUNDWATER ELEVATION, IN FEET NAVD 88
Major ion concentration with depth	Grapher	CONCENTRATION, IN MILLIGRAMS PER LITER	DEPTH, IN FEET BE-LOW LAND SURFACE
Piper diagrams	Grapher	-	-
Molar Ratios	Grapher	-	DEPTH, IN FEET BE-LOW LAND SURFACE

Note: Figures can be omitted as needed

Other Matters

1) Stratigraphic terms should be written out in the text (don't use UFA, LFA, MCU...)

2) Sections should not be numbered (1.0, 2.0, 2.1...)

3) Paragraphs should be indented and have no spaces between them (paragraph style "body text" in the InDesign template should take care of this)

4) Significant figures for hydraulic parameters should be as follows:
   - If less than 10, use one significant figure
   - If greater than 10, use two significant figures

5) Keep well names consistent throughout report (between text, figures, and tables)

6) Appendices should be labeled alphabetically. Figures/tables in appendices should be labeled Figure/Table A-1, Figure/Table A-2... (not Appendix A-1, Appendix A-2...).

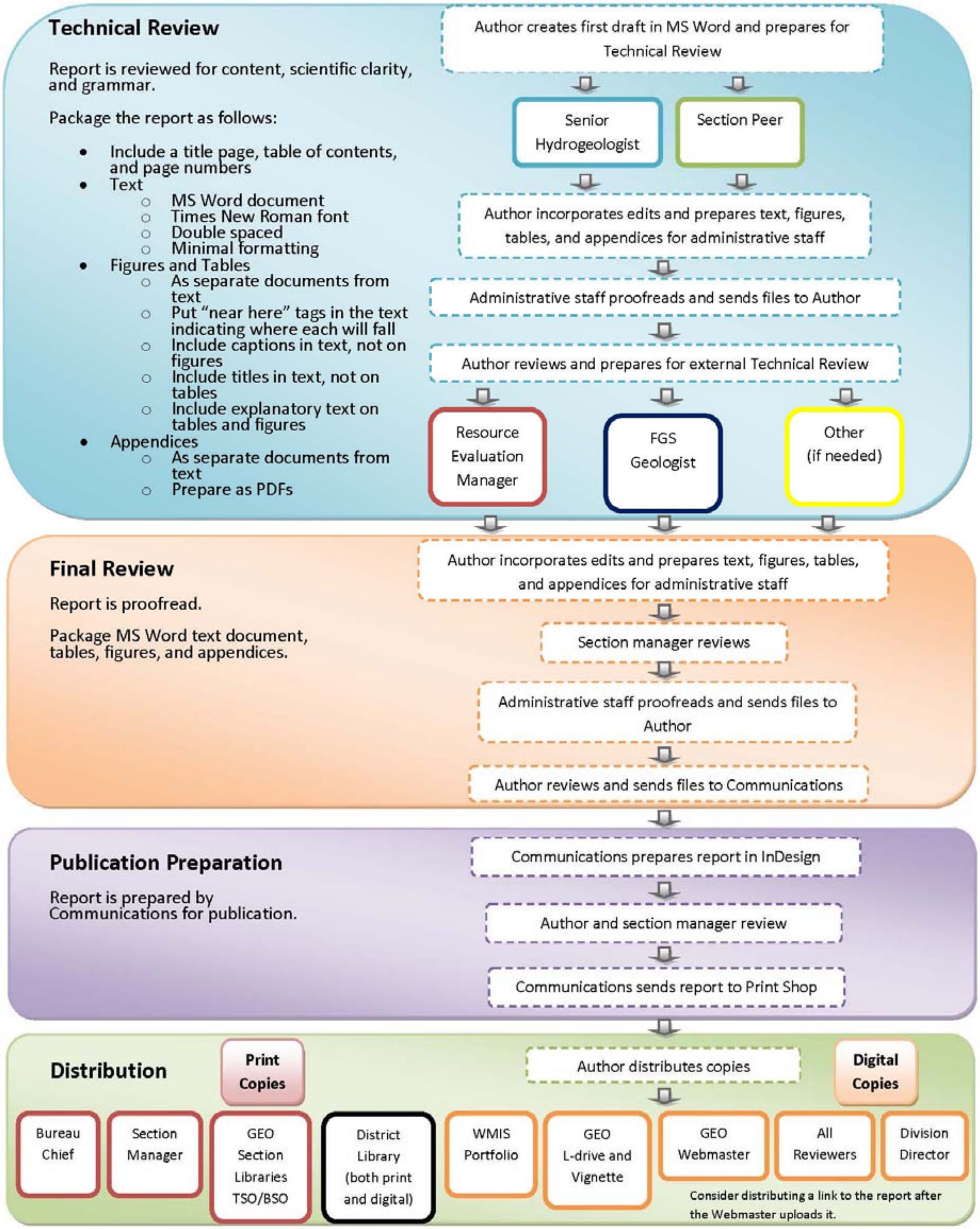
7) Be sure to run the Section 508 script before exporting the digital version of the report

8) Make sure final pdf exports of the report have working bookmarks and links (this is something that will need to be done manually in some files)

9) (*added July 2011 per staff meeting discussion*) Printed versions of the report should have all appendices on a CD. Fully printed versions should only be created on explicit request.

10) (*added October 2011 per staff meeting discussion*) Printed versions of the report should be saddle stitched (staple bound).

Report Review and Publication Flowchart



<u>Note (per October 2011 staff meeting):</u> Any report revisions should be reviewed by the section manager (mandatory) and a peer (if revisions are large in scope) before redistribution.

Well Site Restoration

PURPOSE

Establishment of a uniform procedure for restoring a monitor well site following completion of all construction activities.

EQUIPMENT

1. Backhoe
2. Cutting Torches.
3. Crane

PROCEDURE

1. After all exploratory coring, well construction, aquifer performance testing, back-plugging, and liners have been completed:
    a. Remove all trash, airlines, and waterlines from site
    b. Properly abandon all observation wells, cut well casing three feet below land surface and fill with soil
    c. Have all rental equipment, dumpsters, and portable toilets removed from site
    d. Complete an Operations work order and specify the following:
        1. Remove all mud from mud pit and fill with clean soil
        2. Remove all shell from site and grade soil
        3. Remove all silt fencing
        4. Remove all temporary fencing from well site
        5. Install permanent fencing around permanent well site
    e. Submit a request for a new Data Collection Site through the Water Management Information System

Data Management

PURPOSE

Establish a comprehensive list of required data management tasks and procedures for projects completed by section (tasks may not apply to all project types).

PROCEDURE – For Project Geologist

1. Water Management Information System(WMIS) Site Identification (SID) Data Collection Requests – Contact data technician to submit requests for wells for the following:
    a. Coreholes and Exploratory Boreholes – Must complete SID request prior to Phase 1 in order to submit laboratory samples
    b. Baseline Water Quality (WQ) sampling – Submit right after Phase 2 well construction so Water Quality Monitoring Program (WQMP) can sample without removing equipment
    c. Water Level (WL) monitoring – Submit following Phase 3 Aquifer Performance Tests (APTs) (use existing SIDs if applicable)
    d. Note: Data technician will need the following to complete SID requests:
        1. Trimble-derived and post-processed Latitude/Longitude coordinates
        2. Well construction details (s-built diagram is sufficient)
        3. All Well Construction Permit (WCP) numbers associated with each well
2. Geohydrologic Data Section (GEO) parameter data – create your own project folders at L:\GEO Section\ROMP\ROMP data, copy your files and/or paste your data into WMIS loading. Include:
    a. Geophysical logs
        1. Copies of .LOG and .LAS files
        2. Paste data from .LAS into .xlsx geophysical template (for WMIS loading)
    b. Lithologic log(s)
        1. Copies of .DAT and .TXT files from FGS
    c. Slug test data
        1. Paste your data into .xlsx slug test template (for WMIS loading)
        2. APT data - paste your data into .xlsx APT template (for WMIS loading)
3. GEO site data summary – Fill out (use .xlsx template) and submit to data technician.
4. Field data deliverables – Submit form for all laboratory WQ samples to SWFWMD laboratory **OR** send returned copies of laboratory Chain of custody (COC) forms for all samples to data technician for submission.
5. Hard Copy Files of Record:
    a. Organize/label all files using project folder hierarchy (Identify any files already scanned and/or uploaded to Collaboration)
    b. Submit files to section administrative assistant for scanning, archiving, and storage
6. GEO Well Site Completion Checklist – Complete all applicable tasks on form; template located at L:\GEO Section\ROMP\ROMP information\Technical Information\Tools_Hydros\Forms\E-Data QC Templates and submit to data technician for QC check.

PROCEDURE – For GEO E-Data Technician

1. WMIS SID Data Collection Requests:
    a. SIDs created for all wells (temporary and permanent)
    b. Also create separate SID(s) created for any well construction modifications that subsequently change the monitored interval of the well
    c. SID latitude/longitude coordinates are Trimble® Geographic Positioning System (GPS) derived and post-processed (DCGPS-Pathfinder®)
    d. SID Request Details:
        1. Step 1 of 5 (three scenarios).
            a. If requesting SID for corehole or exploratory borehole:
                1. Select 'Geologic/Lithologic' for 'Parameter Type'
                2. Select 'One-Time Sampling' for 'Frequency'
                3. Select 'Temporary' for 'Duration'
                4. Select 'Geohydrologic Data Section' for 'Who is Collecting?'
            b. WQMP notified of permanent well(s) for baseline WQ sampling (consider completing this step right after phase 2 well construction to allow WQMP.
                1. Select 'Water Quality' for 'Parameter Type'
                2. Select 'Baseline' for 'Frequency'
                3. Select 'Temporary' for 'Duration'
                4. Select 'Water Quality Section' for 'Who is Collecting?'
            c. DAT notified to equip permanent well(s) for WL monitoring.
                1. Select 'Water Level' for 'Parameter Type'
                2. Select 'Hourly/Recorder' for 'Frequency'
                3. Select 'Ongoing' for 'Duration'
                4. Select 'Hydrologic Data Section' for 'Who is Collecting?'
        2. Step 2 of 5
            a. Requesting Organization = 6930 Geohydrologic Data
            b. Project = multiple selections (function pending)
                1. Data – Aquifer Exploration & Monitor Well Drilling Program (ROMP) District-wide Initiative C005
                2. Data - Geohydrologic Data Support Z693
                3. ROMP ## _______ CA##
        3. Step 3 of 5→Site Location Review Page (Informational Only).
        4. Step 4 of 5
            a. Finalized well construction details
            b. Previous/Subsequent SID(s) and comments as necessary
        5. Step 5 of 5
            a. 'Purpose of Site' – Modify standard language examples provided in 'WMIS Site Purpose Examples' on (L:) drive
            b. Comments Regarding Site Setup – List all WCPs associated (temporary work-around)

2. Create project portfolio with all SIDs and corresponding project numbers (C005, Z693, CA##)
    a. Add well site SIDs to appropriate portfolios (portfolio maintenance):
        1. GEO - All Constructed Wells
        2. GEO – ROMP Inland Grid Wells
        3. GEO – ROMP Coastal Transect Wells
        4. GEO – Project Support Wells
3. All GEO parameter data uploaded using GEO loaders:
    1. Geophysical
    2. Lithologic Log
    3. Slug Test
    4. APT
    5. Stratigraphy (based on geologist-provided site summary)
4. Review GEO End-of-Site Checklist from Geologist:
    a. Verify for completion/accuracy all steps pertaining to electronic data
    b. If complete, forward copy to manager with statement that it has been QC checked for all applicable steps and archive copy in QC folder
    c. If incomplete, return to geologist with list of needs

Well Site Completion Checklist

PURPOSE

Establishment of a procedure to document the completion of a well construction project.

PROCEDURE:

GEO Well Site Completion Checklist

Site Number/Name: ______________________

Project Manager: ______________________

Well Site Considerations

NA	Done
☐	☐ Geophysical logs collected on all wells
☐	☐ Temporary wells and core hole have been plugged
☐	☐ Permanent wells have been lined or backplugged
☐	☐ Temporary construction area has been restored
☐	☐ Permanent well site fenced
☐	☐ Land owner notified of project completion, possible future data collection, and sent final report
☐	☐ Dumpster and/or portalet removed
☐	☐ Temporary fence removed

Report Considerations

NA	Done
☐	☐ Digital report has ADA Statement
☐	☐ Bookmarks and links work in the report pdf (digital)
☐	☐ Report uploaded to L-drive and Vignette (digital)
☐	☐ Report given to webmaster for upload to external website (digital)
☐	☐ Report given to District library (print and digital)
☐	☐ Report given to reviewers and manager(print)
☐	☐ Report uploaded to WMIS portfolio (digital)

Data Management Considerations

NA	Done
☐	☐ All wells (temp and perm) have SIDs created w/ WCPs and finalized well construction details
☐	☐ All SID lat/longs are Trimble derived AND have been post-processed
☐	☐ WQMP has been notified of finished permanent well(s) for baseline sampling (WMIS SID Request)
☐	☐ DAT has been notified to equip permanent well(s) for water level monitoring (WMIS SID Request)
☐	☐ Portfolio created for well site with all SIDs added and Project #'s listed (C005, CAXX, etc.)
☐	☐ Geophysical logs uploaded
☐	☐ Slug test data uploaded
☐	☐ Lithologic data uploaded
☐	☐ Aquifer performance test data uploaded
☐	☐ All GEO parameter data uploaded to WMIS double checked for accuracy (also water quality)

Other Considerations

NA	Done
☐	☐ Hard files imaged and in Alchemy and Collaboration
☐	☐ Hard files sent to vault for final storage
☐	☐ Project folder created in Collaboration and electronic files uploaded (includes project e-mail)
☐	☐ PIMS project status updated and all milestones complete
☐	☐ Field data deliverables for all lab WQ samples are complete and forwarded to the lab
☐	☐ Site metrics report and graphs are complete

Geophysical and Video Well Logging

PURPOSE

Establishment of a uniform procedure for collecting geophysical and video logs for various projects.

Geohydrologic Data Section Wells

PROCEDURE

1. Receive request from site hydrologist to perform geophysical logging at site. Collect the following information:
    a. Date that the logging needs to be completed
    b. Time the wells need to be logged
    c. Site Identification Number (SID) and name for the well to be logged
    d. Depths or intervals required for logging
    e. Which logging tools to be run?
    f. Will assistance be available from site hydrologist or drilling staff while logging?
2. After arriving on-site:
    a. Inspect the site for possible hazards (i.e., mud pits, electric lines, vehicles or moving equipment)
    b. Collect well and site information from site hydrologist or driller to complete log header information. If information is not available at the time of logging, complete the logging and enter header data prior to uploading files to database or converting to Log ASCII Standard (LAS) file
    c. Install cable pulley in a suitable location above the well to be logged
    d. Consult user guide for logging directions for specific tool
3. Geophysical log calibration:
    a. Caliper tool should be calibrated between a range of 3-inch to 8-inch in diameter when logging a core hole
    b. Caliper tool should be calibrated with the long arms if the expected borehole size or casing is greater than 12-inches in diameter
    c. The multi-tool should always be calibrated before logging a well
4. Order for running logging tools:
    a. Core hole (core rods in hole) – run the #9165 slim-line caliper/gamma or the #9060 slim-line caliper/gamma through the core rods. After the rods have been removed from the core hole, run the (#9511 or 9512) induction tools and/or (#8043, 8044, or 8143) multi-tools prior to running any of the caliper tools
5. Log Quality:
    a. Confirm that log is collecting accurate data during logging. If a log appears to be collecting erroneous data:
        1. Attempt to re-run the log
        2. Restart the computer
        3. Use another available tool
        4. If unable to correct the situation, note the problem in the information area in the log header
    b. Edit all header information prior to converting the log to a LAS file or placing the log in the geophysical log database

Quality of Water Improvement Program (QWIP) Wells

PROCEDURE

1. Locate well on landowner property:
    a. Inspect site for objects that could be damaged by driving logging equipment onto property (sprinkler heads, septic tanks, flowerbeds, etc).
    b. Inspect site for possible hazards (power lines, homeowner animals, etc).
2. Set-up the logging unit:
    a. Remove well cap, well seal, or cover from well casing
3. Gather pertinent well information:
    a. Measure casing diameter and determine the casing material; i.e., Poly Vinyl Chloride (PVC), black or galvanized steel
    b. Measure water level depth or measure the height and orifice diameter of the artesian flow above top of casing
    c. Take water sample from well bore with hand thief sampler if not flowing. If well is flowing, collect sample from flow. (Follow procedure for collecting water quality samples)
    d. Collect conductivity, pH and temperature of water sample
    e. Collect the latitude & longitude of the well location
    f. Record all information collected above onto Well Site Data Sheet, (WSDS).
4. Install pulley device or tripod.
5. Run dummy tool in well prior to running geophysical tools.
6. Calibrating the caliper tool (Review User's Guide):
    a. Connect caliper probe to the logging cable-head. Tighten locking nut on cable-head and wrap black tape around locking nut to prevent unscrewing
    b. Turn on computer and log in with the user name and password (both inputs are "user")
    c. Unspool enough cable to place tool into well. Adjust tool elevation until the taped locking nut is at land surface
    d. If a manual counter is available on the draw works set it to zero
    e. Record total depth and casing depth on WSDS. The total logged depth of the well will be listed at the top of the page in the file name
    f. Monitor the data collected while in Real Time Logging to confirm that the data looks accurate and the tool is functioning properly
7. Editing the log header:
    a. With the log pulled up in Display, select "Edit" then "Header" then uncheck API header Template on the bottom of the header information
    b. Scroll down and enter the casing depth where indicated
    c. Scroll down to Other Services #1 and enter the average borehole diameter obtained from the Excel processed log
    d. Select "Done" and save log. At the prompt "Overwrite current log?" Select "Yes
8. Determining the average borehole diameter:
    a. Note - The process to determine the average borehole diameter can be performed in the field or in the office
    b. Open the Office Excel program:

1. From the main menu, select "File, open" and select the LAS file to be averaged. Select "Fixed Width" then select "Next." Scroll down to data columns and place vertical lines between columns to separate. Select "Next," select "General" for the format then select "Finish".
2. Scroll down to bottom of Caliper/Diameter column place cursor on first empty space; select the "AutoSum Formula" button (from top of Excel menu). Select "Average" and the average diameter of the borehole will be displayed. Go to the top of the column and delete all "zeros" from the averaging column so they aren't added to the borehole average.

c. Transfer the average borehole diameter number onto the WSDS

d. When prompted to save changes select "No"

9. Converting caliper log to LAS file:
   a. Select "Display" in the Main Menu, select "Processing", select "File Conversion", and Input the file you want to convert. Select "Las Unwrapped" then the "Convert" button. Select the curves to be modified then select "Continue" then select "OK"
10. Printing log and header:
    a. In Display with the log pulled up that you want to print, Select "Print Log" from menu, check "Print Wide Header" on the bottom of the Log Printer Parameters Box
    b. For single sheet printing of just the log, multiply the total depth of the log by a factor of 1.3. Enter this new number in the "Ratio" block. Enter 100 in the "Depth Label Increment" block, enter 20 in the "Major Divisions" block, enter 1 in the "Medium Divisions" block, enter 2 in the "Minor Divisions" block. Select "Both" on the Print Scales, Select "Print Log"
    c. Save Log and LAS log to a flash drive
11. Exit out of the program and turn off computer

Water Use Permitted Wells (WUP)

PROCEDURE

1. When logging for WUP wells, follow the same procedures above for collecting pertinent information, editing the header, saving the file and converting the file to a LAS file. WUP wells require a caliper, multi-parameter and in some occasions a water quality sample. Consult user guide for logging directions for specific tools.

Facilitating Agricultural Resource Management Systems (FARMS) Wells

PROCEDURE

B. When logging for FARMS wells, follow the same procedures above for collecting pertinent information, editing the header, saving the file and converting the file to a LAS file. FARMS wells require a caliper, multi-parameter, induction and a water quality sample. Consult user guide for logging directions for specific tools.

Legal Compliance Logging

PROCEDURE

1. Typically logging for legal compliance requires only a caliper log. These requests are usually for casing and total depths only. Consult user guide for logging directions and proper calibration procedures for this tool.

VIDEO LOGGING

PROCEDURE

1. Set up file and/or location map to well site. Get contact names and obtain permission to run video log in well.
2. Turn on control panel power supply to video camera and monitor.
3. Determine which light head to use the smallest diameter that is expected to be in the well. Longer light heads should be used for larger diameter wells and short light heads and light ring for the smaller diameter wells.
4. Turn on control panel power supply to video camera.
5. Verify both views on camera are functioning using joystick.
6. Set up tripod over well or use block suspended from cable line from the rig.
7. Secure tripod down with rope and stakes.
8. Adjust cable so the top of the video camera connection is at land surface or at the top of the wellbore.
9. Reset manual counter on draw works to zero.
10. Reset the preset depth button on the control panel to three feet (the approximate length of the video camera when the camera connection is at land surface.
11. Insert blank DVD into DVD unit, use controls on DVD remote to specify well name, date, time, WUP, and DID numbers and enter this information on the inspection sheet.
12. Adjust light level controls on joystick.
13. Adjust centralizers on camera for smallest diameter borehole expected to encounter. Push the “record” button on remote or on the DVD unit.
14. Using draw works controller, proceed slowly into wellbore.
15. Check casing integrity as video camera goes deeper into the well. Stop and inspect casing or joints with side-looking lens if anything needs inspecting.
16. When the camera reaches the bottom of the casing, stop and inspect using the side looking lens.
17. Record casing depth on video logging inspection sheet.
18. Use the side looking lens to view large vertical cracks.
19. After reaching the bottom of the wellbore, reverse draw works direction and return to land surface.
20. At the top of the well press “Stop” on the remote to end recording.
21. Using the remote, finalize DVD recording. Make copies of the recording using the DVD copier in the trailer. The original goes in the top tray; the other two other trays are for the blank discs. Provide copies to the requestor and send original to supervisor.

SUGGESTED REFERENCES

1. ASTM Standard D5753, 2005 (2010) Standard guide for planning and conducting borehole geophysical logging, ASTM International, West Conshohocken, PA, 2010, DOI: 10.1520/D5753-05R10, www.astm.org.

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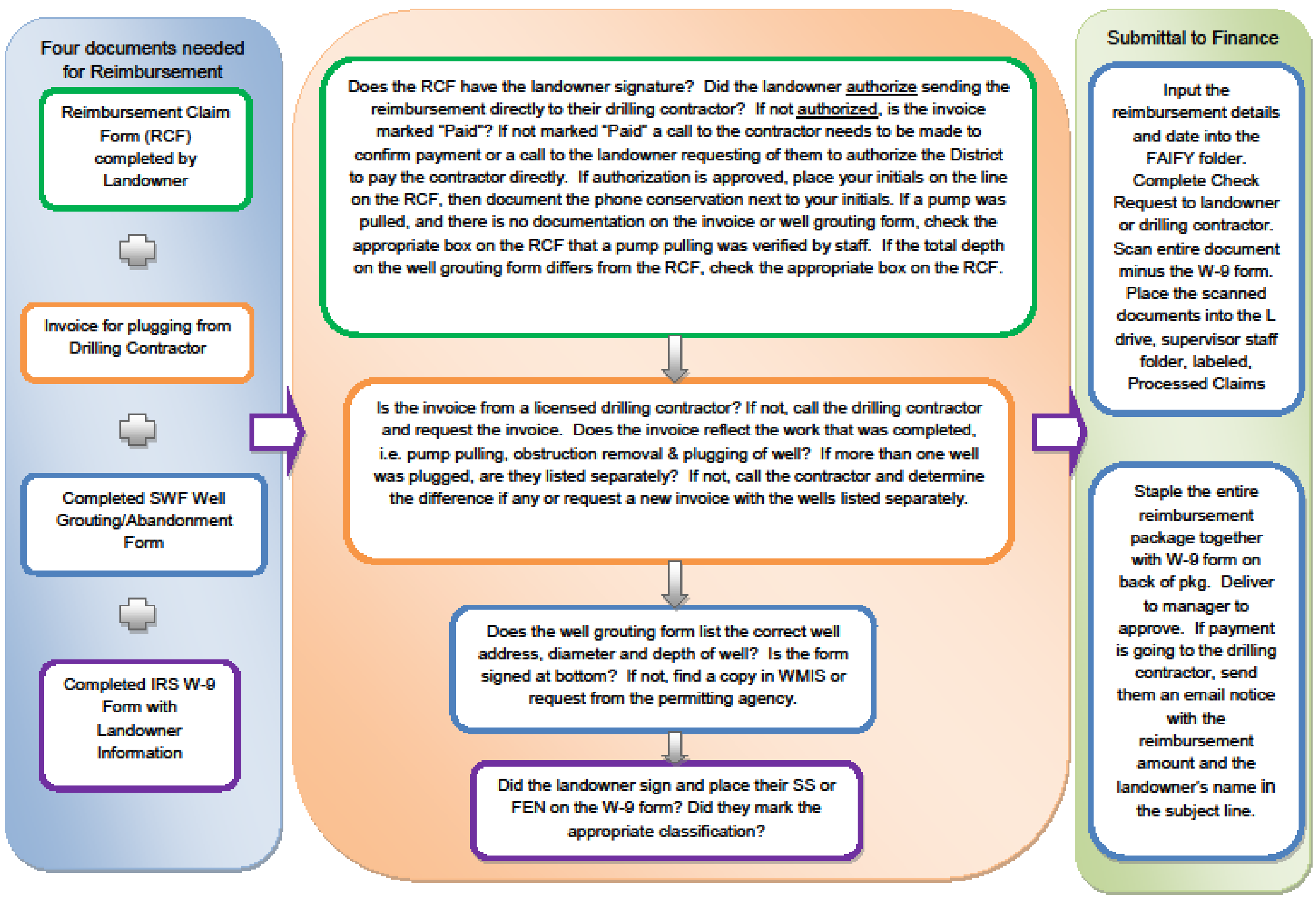
Revision #	Original

Quality of Water Improvement Reimbursement Process Flowchart

QWIP REIMBURSEMENT PROCESS



Establishing New Quality of Water Improvement Program (QWIP) Well File

PURPOSE

The following guidelines are to be used when establishing a new QWIP well file.

PROCEDURE

1. Receive request for well plugging funding assistance.
2. Determine if the well meets funding assistance requirements:
    a. Four-inch diameter or larger
       OR
    b. Well was drilled for a water supply
       OR
    c. Well was completed into an "Artesian Aquifer"
       OR
    d. Well is at least one year old
3. Establish and complete a "Well Site Data Sheet" containing:
    a. Landowner's name, mailing address, and phone number
    b. Contact name and phone number (if different than landowner)
    c. Physical address of well location (if no address available, request specific directions or request map of well location)
    d. Determine County, Section, Township and Range of well location
       Determine what the well was used for, i.e., irrigation, domestic, public supply, or abandoned
4. Record reason well is to be plugged, i.e., poor water quality, development, abandoned.
5. Record if there is a pump in the well. If yes, enter when is it scheduled to get pulled. State the type of pump (submersible, jet, centrifugal or turbine).
6. Establish Section, Township and Range, and Quad Map name by reviewing "Political Basin & Regional Observation and Monitor-well Program (ROMP) map".
7. Assign next available QWIP well number for that Political Basin.
8. Verify the landowner information through the County Property Appraiser's web site.
9. Verify if the well has a Water Use Permit (WUP) from WMIS data base.
10. Enter well number and landowner information into QWIP Database.
11. Print road map of well location (Google, AAA, or MapQuest).
12. Schedule time and meeting place to perform inspection and well logging.

AFTER WELL LOGGING IS COMPLETE

1. Input well information into the database.
2. Determine the average borehole diameter of the well from the processed LAS file to determine the reimbursement amount.
3. Input landowner and well information into the Reimbursement Claim Form (RCF); print out two copies of RCF.

4. Place copy of the RCF in the selected file for Claim Form PDFs.

5. If requested, fax a copy of logs to well contractor, and local permitting authority (i.e., Tampa/Bartow REG, Sarasota Health Department, or the Manatee Environmental Services Management).
6. Transfer the geophysical and LAS files from flash drive and place into the appropriate electronic storage file.
7. Place a paper copy of the logs and RCF in overnight mail to the appropriate administrative assistant along with a note as to which letter to send to the landowner or their contact.
   a. Letter number 1 - Open well
   b. Letter number 2 - Plugged well
   c. Letter number 3 - Obstructed well
8. Place all paperwork into the proper ACTIVE Fiscal Year three-ring binder. A Check Request Packet will be emailed after the claim is processed for reimbursement.

UPON RECEIVEING REIMBURSEMENT PACKET VIA EMAIL

1. Enter plugged date and action taken into the electronic database. DO NOT PRINT PACKET.
2. Transfer the Well Site Data Sheet packet from the ACTIVE binder to the PLUGGED binder.
3. The binders will remain with the Sarasota Service Office for future technician referencing.

ATTACHMENTS

1. Reimbursement Claim Form

ATTACHMENT – 1 Reimbursement Claim Form

DATA COLLECTION BUREAU
QUALITY OF WATER IMPROVEMENT PROGRAM (QWIP)

REIMBURSEMENT CLAIM FORM

Well Number: **Date Issued:** ______________ **WUP Number** ________
DID Number ________

Technician:

Technician Phone Number

Property Owner:

Contact:

Address:

Phone Number

Well location:

Reason well is being plugged:

Surface Casing Dia.: inches
Avg. Borehole Dia.: inches
Obstruction Depth: feet (bls)
Pull Pump? (y/n):
Additional Footage Cleared: feet
Total Depth of Well: feet

Mob/Demob of Equipment: ______________
Drill Time: ______________
Trip Time to Obstruction: ______________
Pull Pump: ______________
Approved contractor charges Total: ______________

Add'l Trip Time: ______________
Plugging Amount: ______________
Total: ________

Eligible Reimbursement Amount (ERA) Total: ________

This ERA may not cover the total cost to plug large diameter wells and should not be considered as the maximum amount your Drilling Contractor may charge for their services.

Comments: ☐ **Pump pulling verified by QWIP Staff**
☐ **Total depth is determined by QWIP Staff.**

Property Owner Section

Above property owner requests reimbursement of the stated Eligible Reimbursement Amount or the ATTACHED CONTRACTOR'S INVOICE (whichever is less), for costs associated with the plugging of an abandoned artesian well. The Property Owner may elect, by also initialing in the space provided below, to authorize the District to reimburse the eligible reimbursement amount directly to your Drilling Contractor ____________ **initials**

Property Owner: ______________________________ ______________
Date

Owner/Agent Signature: ______________________________

************************** The Following information will be filled out by District Staff ****************************

Return To: Southwest Florida Water Management District
Kevin J. Stover, Supervisor, QWIP
2379 Broad Street
Brooksville, Florida 34604

(Phone) 1-800-423-1476 (Toll Free)
352-796-7211
Extension 4517
(FAX) 1-352-540-6056

__________ **Contractor Invoice**
__________ **Well Completion Report**
__________ **Check Request**

FINAL REIMBURSEMENT AMOUNT: $______________

WELL MUST BE PLUGGED AND PROCESSED FOR REIMBURSEMENT WITHIN 90 DAYS OF CLAIM FORM DATE OR THE FUNDING WILL BE CANCELED.