

Brazos Valley GCD E-line Measuring Protocol

1. ~~The well should be as close to a stable water-level condition as possible when taking a static water-level measurement.¹ The well where the static² water level is to be measured should not be pumped for 24 hours, if possible, -prior to taking the static water-level measurements, if possible. If the well has been pumped less than 24 hours prior to taking the water-level measurement, record in the official record³ of how long the pump has been off prior to taking the measurement, if known. Confirm and indicate in the official record that no non-exempt well completed in the same aquifer within a ½ mile radius to the well being measured is being actively pumped at the time of taking the water-level measurement.⁴ Unless this can be confirmed, no water-level measurement should be taken. Obtain permission to collect measurement at a later time. Also record if any wells within ½-mile that screen the same aquifer are pumping and could influence the water level in the well when taking the measurement. This is mainly a concern in well field areas.~~
- 1.2. ~~If well is equipped with a submersible pump, confirm and record in the official record that the pump is not in operation. Unless it is determined that the pump is not operational, no water-level measurement should be taken or recorded. Obtain permission to collect measurement at a later time.⁵~~
- 2.3. ~~Identify a port or opening in the pump discharge head or in the pump foundation (surface casing vent pipe) that provides access for the e-line to the annulus between the surface casing and the pump column assembly, water-level measuring pipe or open casing if the well is not equipped with a pump⁶.~~
- 3.4. ~~Measure and record the height of the opening above ground level and this will become the measuring point. Describe the measuring point in the official record for the well, and use the same measuring point each time when measuring the water level. If possible, this measuring point should be used each time the water level is measured for consistency of measurements. If not possible, record the height of the measuring point above land surface each time the water level is measured.⁷ Record the measuring point height above ground level.~~
- 4.5. ~~Prior to taking the water-level measurement, review previous water-level measurements to estimate the current water level depth. to get an idea of regarding how deep the water level may be encountered.~~
- 5.6. ~~Turn on the power to the e-line on and adjust sensitivity of sound meter to about halfway. If light used to detect water level, no need to adjust sound level.~~

¹ Redundant with the sentence that follows removed by BVGCD staff

² Static was removed in all references as per Bryan comment 4

³ Clarification of where data would be recorded as per Bryan redline addition

⁴ Clarification of what wells are being referenced added by BVGCD staff

⁵ Detailed wording added as per Bryan comment 7

⁶ Detailed wording added by BVGCD staff

⁷ Wording added by BVGCD staff to be consistent with all other protocol

~~6.7.~~ Lower the e-line into the well annulus between the pump column and casing⁸ until the e-line signals it has encountered the water level in the well. Retract the e-line about one foot above where the e-line signaled water encountered and slowly lower again until the water level is encountered again.

~~7.8.~~ Mark the wire on the e-line at the opening and measure the water level depth on the e-line wire to the nearest 0.01-foot. Hold the electric line with a fingertip at the measuring point when the water is encountered. Using the 0.01 feet markings on the electric line, determine depth to water to the nearest 0.01 of a foot and record in the official record.⁹

~~8.9.~~ Retract the e-line about 5 feet, wait five minutes and repeat the process to ensure an accurate reading has been made of a stable water level. If both measurements are not within 0.05-foot of each other, note in the field log and schedule for water-level measurement at a future date, record both.¹⁰ ~~Compare the reading with previous water level measurements and verify a reasonable measurement has been obtained.~~¹¹

~~9.—10.~~ Subtract the measuring point height from the measured depth to water obtained in Step 8 to determine depth of water from land surface, and record in the official record.¹²

~~10;11.~~ Record date and time of measurement, pumping conditions (Item 1.) and measurement point height above ground level (Item 3).

~~11;12.~~ Retract the e-line from the well and clean the lower 20 feet with Clorox bleach wipes, bleach wipes with an equivalent percentage sodium hypochlorite or a minimum 0.5% sodium hypochlorite in solution (NaOCl and water)¹³ prior to measuring the water level in the next well.

~~13.~~ Replace cap on any port in discharge head or casing, any other openings used to gain access to the well. Leave the well and pump in same condition as observed on arrival.¹⁴

~~11.~~ _____

⁸ Wording more concisely stated by BVGCD staff

⁹ Detailed clarifying wording in response to Bryan comment 8

¹⁰ Reworded in response to Bryan comment 9 and BVGCD staff recommendations

¹¹ Deleted as necessary step by BVGCD staff

¹² Wording added for further clarification by BVGCD staff

¹³ Wording added in response to Bryan steel tape comment 13

¹⁴ Clarification wording added in response to Bryan steel tape comment 14

Brazos Valley GCD Airline Measuring Protocol

- ~~The well should be at as close to stable water level condition as possible when taking a static water level measurement.~~¹-The well where ~~that the static~~² water level is to be measured should not be pumped for ~~a minimum of~~ 24 hours, ~~if possible,~~ prior to taking the static water-level measurements, ~~if possible.~~ If the well has been pumped less than 24 hours prior to taking the water-level measurement, ~~make note and~~³ record in the official record⁴ how long the pump had been off prior to taking the measurement, ~~if known.~~ Confirm and indicate in the official record that no non-exempt well completed in the same aquifer within a ½ mile radius to the well being measured is being actively pumped at the time of taking the water-level measurement.⁵ Unless this can be confirmed, no water-level measurement should be taken. Obtain permission to collect measurement at a later time. Also make note of any wells within ½ mile that were pumping that may have influence on the water level when taking the measurement. This is mainly a concern in well field areas.
- Prior to taking the water-level measurement, review previous ~~water level~~ measurements ~~to get an idea of regarding~~⁶ how deep the water level may be encountered and records showing the depth setting of the airline.
- Measure and record the height of the ~~pressure gauge~~base of the pump discharge head above ground level, and this will become the measuring point.⁷ as this is typically where the airline setting depth is measured from. Describe the measuring point in the records for the well, and use the same measuring point each time when measuring the depth to water.⁸
- 3.4. Determine the manufacturer of the gauge to be used, the serial number, and the date last calibrated. Record this in the official record.⁹
- 4.5. Check and record depth of airline setting below ground level or below pump base based on air line setting data from well owner and/or pump setting contractor.¹⁰
- 5.6. If well is equipped with a submersible pump, confirm and record in the official record that the pump is not in operation. ~~e~~check whether the pump is in operation (if there is any

¹ Redundant with the sentence that follows removed by BVGCD staff

² Static was removed in all references as per Bryan comment 4

³ Redundant wording removed by BVGCD staff

⁴ Clarification of where data would be recorded as per Bryan redline addition

⁵ Clarification of what wells are being referenced added by BVGCD staff

⁶ More concise wording added by BVGCD staff

⁷ Exact description of how to determine the measuring point so all data will be relative to land surface added by BVGCD staff

⁸ Additional description of protocol added by BVGCD staff

⁹ Wording added to the protocol as per Bryan comment 6 and BVGCD staff

¹⁰ Details added in response to Bryan comment 6

~~vibration of the pump discharge pipe, the pump is in operation). Unless it is determined that the pump is not operational, no water-level measurement should be taken or recorded. Obtain permission to collect measurement for a later time.~~¹¹

~~6.7.~~ Use an air or nitrogen source with adequate pressure to blow air out the bottom of the airline.

~~7.8.~~ Open the valve on the air supply.

~~8.9.~~ Attached the air hose nozzle to the valve on the airline.

~~9.10.~~ The needle on the pressure gauge should rise to the approximate pressure ~~of air supply or pressure~~¹² at bottom of airline as the water has been purged from the bottom of the airline.

~~10.11.~~ Remove the air hose nozzle, and then the needle on the pressure gauge will slowly descend and stabilize at the static current water-level pressure. If this does not occur, have a spare, quality pressure gauge available that can be installed and used on a temporary basis. Repeat Steps 7-10.

~~11.12.~~ Record the measurement from the pressure gauge in units provided on the gauge.¹³ ~~The pressure gauge may provide readings of pressure in pounds per square inch (psi), feet of water or both. The recorded measurement should be in feet of water.~~ If the pressure gauge only has psi readings, multiply the psi reading by 2.31 to convert the reading to feet of water.

~~12.13.~~ The recorded measurement in Item ~~10.12~~ is how many feet of water are above the bottom of the airline. Subtract the measurement from the depth setting of the airline to convert the measurement to depth to water below from land surface. (Example: If airline is installed to a depth of 400 feet below land surface and the pressure gauge reading is 150 feet above the bottom of the air line, the depth to water from land surface is = $400' - 150' = 250'$ below land surface). If the air line setting is depth below the pump base, subtract the measuring point from the depth to water reading to calculate depth to water below land surface.¹⁴

~~13.14.~~ Repeat steps in Items 6- 11, as necessary, to ensure an accurate measurement has been obtained. Only record data if the air gauge pressure holds constant for five minutes.¹⁵

~~14.15.~~ Record date and time of measurement, ~~pumping conditions (Item 1) and measuring point height above ground level (Item 3).~~¹⁶

¹¹ Detailed wording added as per Bryan comment 7

¹² Unnecessary wording removed by BVGCD staff

¹³ More concise wording added by BVGCD staff

¹⁴ Detailed wording to concisely note how water-level calculation is to be made added by BVGCD staff

¹⁵ Added in response to Bryan comment 13

¹⁶ Redundant wording deleted by BVGCD staff

Brazos Valley GCD Steel Tape Measuring Protocol

~~1. The well should be as close to a stable water level condition as possible when taking a static water level measurement.¹–The well where the static² water level is to be measured should not be pumped for 24 hours, if possible, prior to taking the static water-level measurements, if possible. If the well has been pumped less than 24 hours prior to taking the water-level measurement, record in the official record³ how long the pump has been off prior to taking the measurement, if known. Confirm and indicate in the official record that no non-exempt well completed in the same aquifer within a ½ mile radius to the well being measured is being actively pumped at the time of taking the water-level measurement.⁴ Unless this can be confirmed, no water-level measurement should be taken. Obtain permission to collect measurement at a later time. Also record if any wells within ½ mile that screen the same aquifer are pumping and could influence the water level in the well when taking the measurement. This is mainly a concern in well field areas.~~

~~1.2. If well is equipped with a submersible pump, confirm and record in the official record that the pump is not in operation. Unless it is determined that the pump is not operational, no water-level measurement should be taken or recorded. Obtain permission to collect measurement at a later time.⁵~~

~~2.3. Identify a port or opening in the pump discharge head or casing or in the pump foundation (surface casing vent pipe) that provides access for the steel tape to the annulus between the surface casing and the pump column assembly, water-level measuring pipe or open casing if the well is not equipped with a pump⁶.~~

~~3.4. Measure and record the height of the opening above ground level and this will become the measuring point. Describe the measuring point in the official record for the well, and use the same measuring point each time when measuring the water level. If possible, this measuring point should be used each time the water level is measured for consistency of measurements. If not possible, record the height of the measuring point above land surface each time the static water level is measured.~~

~~4.5. Prior to taking the water-level measurement, review previous water-level measurements to get an idea of at what depth estimate the current water level depth the water level may be encountered.~~

~~5.6. Use carpenter's chalk to coat the lowest 15-30⁷ feet of the steel tape.~~

¹ Redundant with the sentence that follows removed by BVGCD staff

² Static was removed in all references as per Bryan comment 4

³ Clarification of where data would be recorded as per Bryan redline addition

⁴ Clarification of what wells are being referenced added by BVGCD staff

⁵ Detailed wording added as per Bryan comment 7

⁶ Detailed wording added by BVGCD staff

⁷ Variable footage added by BVGCD staff

~~6.7.~~ Lower the steel tape in the annulus between the pump column and casing, down the open casing if not equipped with a pump⁸ or down a water-level measuring pipe until the depth of the tape is 10 feet lower than the last recorded ~~static~~ water level. Record the length of tape installed in the well with the footage marker exactly at the measuring point. Refer to this length as the “hold”. Retract the steel tape and record the length of the tape to the nearest hundredth of a foot that is wet. This measurement is called the “cut”. Record both measurements. Remove the wet chalk on the tape ~~and rechalk the tape~~.

~~8.~~ Wait 5 minutes after initial measurement, re-chalk tape and lower the tape ~~one~~¹⁻² ~~foot~~^{feet}⁹ deeper than the hold depth for ~~on~~ the previous measurement. Retract the tape and record the cut length. Subtract the cut length from the hold length to calculate the depth to water. The difference between the two measurements should be no greater than 0.02 feet. If the difference in depth to water is greater than 0.02 feet, note in the field log and schedule for water-level measurement at a future date, repeat the procedure until two measurements are obtained that are within 0.02 of a foot of each other.¹⁰

~~7.~~ 9. Subtract the measuring point height from the measured depth to water to obtain depth of water below land surface and record in the official record.¹¹

~~8.9.~~ Compare the static water level measured during this visit to the well with the static water level measured during the last visit to the well to verify a reasonable measurement has been obtained.

~~9.10.~~ Record date and time of measurement, ~~pumping conditions and measuring point height above ground level~~.¹²

~~10.11.~~ Remove the chalk from the steel tape and clean the lowest 30 feet with Clorox bleach wipes, bleach wipes with an equivalent percentage sodium hypochlorite or a minimum 0.5% sodium hypochlorite solution (NaOCl and water)¹³ before measuring the water level in another well.

~~11.12.~~ Replace cap on any port in discharge head or ~~casing, any other openings used to gain access to the well, if possible~~. If the well has a pump resting on top of the casing with space between the pump discharge head and casing, ~~leave~~ Leave the well and pump in same condition as ~~found~~ observed on arrival.¹⁴

⁸ Wording added to cover all possible well conditions by BVGCD staff

⁹ Wording added by BVGCD staff

¹⁰ Wording added and removed in response to Bryan comment 9

¹¹ Wording added for further clarification by BVGCD staff

¹² Redundant wording removed by BVGCD staff

¹³ Wording added in response to Bryan comment 13

¹⁴ Clarification wording added in response to Bryan comment 14

Brazos Valley GCD Pressure Transducer Utilization Protocol

~~Pressure transducers are utilized to measure and record accurate water levels in wells. The transducer measures pressure of the water column above the unit and is placed at a known depth in the well and a conversion of pressure from water above transducer to feet of water column is made. If a pump is already installed in the well, then the transducer is often installed just above the installed depth of the pump. If the well is open, then the transducer should be installed a minimum of about 50 feet below the deepest water level expected. Once feet of water above transducer are known, the pressure data is converted to feet of water above transducer. Many models of transducers allow you to program that level into the data set so that it records either depth to water or water level elevation. Transducers are generally rated by the maximum pressure in pounds per square inch (psi) that the units will accurately measure. The model and pressure rating of transducers can be matched to the depth of well and expected depth of water above transducer. Many units operate best at about 10 to 90 percent of their full pressure rating. So for example, if a unit is rated at 100 psi, then it operates best at 10 to 90 psi (23 to 208 feet submergence). Additionally, many of the models will record and operate at pressures above their maximum pressure rating. Check the specifications on your selected model of transducer. The following are some general guidelines for transducers:~~

- ~~1) Select and purchase all equipment best suited for long term monitoring needs (~~static water level and well depth~~). ~~Generally, t~~The equipment needed for the transducer includes pressure transducer, cable, adapters for computer and software. ~~Other optional equipment also is available from the vendor.~~~~
- ~~2) Install manufacturer supplied software to computer(s) that will be used to interface with the transducers. ~~Manufacturer provides you with software to run equipment along with installation instructions.~~~~
- ~~3) Install transducer onto cable making sure to and follow ~~manufactures~~manufacturer's instructions. ~~The transducers are waterproof if properly installed.~~~~
- ~~4) Use an open-ended pipe perforated at its bottom and extending to at least the transducer setting or open casing void of a pump to provide protective housing for the transducer.~~
- ~~3)5) Measure the water level in the water-level measuring pipe or open casing with a steel tape following the steel tape measuring protocol.~~
- ~~4)6) Connect transducer cable to computer allowing software to establish signal to transducer.~~
- ~~5)7) Input correct settings for data recording task at hand. ~~Determine how often water level will be recorded. Many models allow for recording to range from seconds to days. Start with a data collection frequency of one measurement per hour. After signal established and transducer programmed, disconnect transducer from computer. Measure the static water level from ground surface with calibrated electric line or steel tape to get baseline information.~~~~
- ~~6)8) Install transducer ~~into~~ well at a depth deemed suitable to capture all anticipated water levels. Secure transducer and cable following manufacturer's recommendations to keep unit stable. Reconnect transducer to computer and program the pressure transducer so that water level measured is the same as the water level measured with the steel tape. Use ground level~~

as the depth datum. Secure transducer and cable that is installed in the well to keep unit stable. Each manufacturer has different protocol for securing all equipment in well hole for monitoring long periods of time. Follow manufactures instruction for this step.

7)9) After transducer has been recording water levels for some period, days to potentially a month, download data. Depending on data storage capacity of transducer and frequency of measurements, time between advisable data downloads will vary. Follow Step 4 above and manufactures guidelines for downloading the data. Record water level data for two months and download data. Measure water level in the well with a steel tape and record depth to water. Compare depth to water measured with the steel tape with the depth to water measured with the pressure transducer. Record both readings in the official record. Both readings should be within 1.0 foot of each other.

10) If pressure transducer and steel tape depth to water measurements are within 1.0 foot of each other after the first two months of data collection, record measurements in the official record and resume data collection. Repeat Step 9. If the water level measurements are not within 1.0 foot of each other, recalibrate or replace transducer and reinstall the recalibrated or new transducer. Record the transducer equipment change and any transducer depth setting change in the official record.

8)11) Program transducer to collect water-level data at least once per day and resume data collection. Repeat Steps 9 and 10.¹

¹ All changes were in response to Bryan comments 4 & 5 and BVGCD staff clarification