ASSESSMENT TO DEVELOP A PUBLIC WATER SUPPLY WELL NEAR THE LAUREL VALLEY LANDFILL

CULPEPER COUNTY, VIRGINIA

YIELD AND QUALITY TESTING OF PROPOSED PRODUCTION WELL CCO-17A

August 2014

Presented to:

Mr. Paul Howard, Jr.
Director of Environmental Services
Culpeper County, Virginia

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August 15, 2014

Mr. Paul Howard, Jr.
Director of Environmental Services
118 W. Davis Street, Suite 101
Culpeper, VA 22701

Dear Paul,

Please find enclosed Emery & Garrett Groundwater Investigations, LLC's (EGGI's) summary report regarding the yield and quality testing of proposed Production Well CCO-17A located near the Laurel Valley Landfill in Culpeper County, Virginia.

We hope you find the information contained herein responsive to your needs. If you have any questions concerning this material, please do not hesitate to contact us.

Best regards,

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Senior Structural Geologist

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I. INTRODUCTION AND BACKGROUND

Emery & Garrett Groundwater Investigations, LLC (EGGI) has prepared the following hydrogeologic report regarding the yield and quality testing of proposed Production Well CCO-17A for Culpeper County, Virginia. This study is an expansion of previous investigations in the region by EGGI (1998 and 2008). The goal of the current investigation is to confirm that Production Well CCO-17A, located south of Cherry Hill Road (Route 638) north of Culpeper, Virginia, can be developed as public drinking water supply well in the vicinity of Culpeper County's Laurel Valley Landfill (Figures 1 and 2).

This document discusses the well drilling and resultant yield and quality testing conducted on proposed Production Well CCO-17A. The results of this testing program have determined that this Well is capable of producing 130,000 gallons per day (gpd) or 90 gallons per minute (gpm), which significantly exceeds the current water supply demand. It also provides sufficient excess capacity to meet the future expansion of the water system.

II. EXPLORATORY TEST WELL DRILLING PROGRAM

Groundwater Systems, Inc. of Herndon, Virginia, performed the exploratory test well drilling program using air-rotary drilling methods. The Water Well Completion Report (GW-2 form) submitted by the driller is included in Appendix A. EGGI supervised the drilling operation, evaluated rock formation changes while drilling advanced, measured field chemistry parameters, and created a hydrogeologic log for Well CCO-17A (Appendix A). The results of this drilling program are summarized on Table I.

During the drilling of Well CCO-17A as a six-inch-diameter test well, 19 feet of unconsolidated material was intercepted above the bedrock surface (Table I and Appendix A). The bedrock penetrated consists of a granofels (metamorphosed greywacke sandstone and siltstone). Seven water-bearing zones were intercepted within the Well, two of which were later cased off when the Well was reamed. The most significant water-bearing zone was intercepted at 297 feet and yielded 56 gpm (Table I and Appendix A). Drilling of the Well was terminated at

500 feet. A final airlift yield of 115 gpm was measured at the conclusion of drilling test Well CCO-17A (Table I and Appendix A).

Following the six-inch-diameter test well drilling, the Well was reamed to an eight-inch-diameter Production Well to its full depth of 500 feet. Production Well CCO-17A was constructed in accordance with Virginia Water Work's and Culpeper County regulations for public water supply wells by installing 103 feet of heavy-wall steel casing (Class I construction). The well casing was pressure grouted with cement from the bottom of the casing to ground surface (Appendix A).

III. YIELD AND QUALITY TESTING PROGRAM – REVIEW OF BACKGROUND CONDITIONS AND DESIGN OF PUMPING TEST

A. Introduction

The specific objectives of the yield and quality testing program conducted on Well CCO-17A included the following:

- To determine the overall pumping yield capacity of Production Well CCO-17A.
- To assess the availability and nature of recharge to the bedrock aquifer (by observing the rate of recovery of the groundwater levels in Well CCO-17A after pumping was terminated).
- To assess the quality of groundwater produced by Production Well CCO-17A under extended pumping conditions.
- To assess potential off-site impacts to local domestic well owners in the area.
- To provide basic hydrogeologic data needed to develop a Groundwater Operations Plan that will serve to promote a scheduled, managed use of groundwater resources withdrawn from Well CCO-17A.

B. Pumping Test Set-Up

Well CCO-17A was tested using a submersible pump powered by a portable diesel generator. The discharge rate was controlled using a gate valve and measured using an orifice weir (Figure 3). Volumetric measurements collected using a stopwatch and graduated container were used to verify the pumping discharge rate.

A spigot was provided on the discharge line to allow for the convenient collection of water samples and to minimize the risk of introducing contamination into the samples. Chlorine was added to Well CCO-17A to disinfect it prior to the start of the pumping test.

Water levels measured during the test were recorded to within 0.01 feet, using both manual and automated monitoring equipment. Discharge water was piped approximately 100

feet into an upper tributary of Balds Run, located down gradient of the Well (Figure 2). The stream continued flowing throughout the pumping test program.

C. Climatological Conditions

According to the USGS meteorological station at Washington Dulles Airport, in Sterling, Virginia, a total of 0.41 inches of rainfall occurred in two separate precipitation events during the pumping interval (Figure 4 and Plate 1). However, a very rainy period occurred between April 28 and May 1, with a total of 5.48 inches of rain just before the monitoring period began. Despite this large rain event, ambient groundwater levels in the area were very stable in many of the wells monitored, with only a few receding throughout the pumping test interval (Plate 1). A few minor rain events occurred within a few days after pumping was terminated, but the first significant rainfall (1.91 inches) following the pumping interval was recorded seven days into the recovery period (Figure 4).

D. Selection of Monitoring Well Locations

EGGI only installed one other exploratory test well in the vicinity of proposed Production Well CCO-17B and it was the only idle groundwater monitoring location that could be identified in the area of study (Figures 1 and 2). However, numerous domestic wells exist nearby; therefore, in the interest of determining the potential impact of pumping the new Production Well on domestic wells, Culpeper County asked EGGI to inventory domestic wells in the area. EGGI sent letters requesting permission to monitor domestic wells within approximately 2,000 feet of Production Well CCO-17A and a number of domestic well owners granted that permission (Figure 5 and Appendix B). Other neighboring landowners were concerned about potential impacts, so Culpeper County invited local landowners to an informational meeting to discuss potential impacts. Following that meeting, several additional landowners agreed to have their wells monitored also.

After inspecting the available domestic wells, EGGI determined that 16 domestic wells would become part of the groundwater level monitoring program. EGGI then outfitted their wells with automated water level monitoring equipment. The distribution of available domestic wells provided good coverage of the local area where potential impacts caused by pumping might occur. Unfortunately, a few of these domestic wells were constructed such that monitoring them would have damaged the well (or the pumping equipment), so those wells had to be left out of the monitoring program. In one case where automated equipment could not be used (the Bobbit Domestic Well), the homeowner still requested that his well be monitored; EGGI was able to collect manual water level measurements four times during the testing period from this well (Plate 1).

The final total number of locations monitored during this groundwater investigation included the following (Figures 1 and2, Table II, and Plate 1):

- Production Well CCO-17A;
- Exploratory Test Well CCO-17B;
- 17 Domestic Wells;
- One Spring; a small spring located on the Kern property was outfitted with a temporary structure that allowed volumetric measurements of flow rate to be collected during the testing program.

IV. YIELD TEST RESULTS - PROPOSED PRODUCTION WELL CCO-17A

A. Well CCO-17A: Response to Pumping

The first phase of the pumping test program involved a step drawdown test on Well CCO-17A. The step drawdown test was designed such that the Well was pumped at sequentially higher rates for equal periods of time; in this case, one hour durations (Figure 6). The step drawdown test is used to test the effectiveness of the temporary pumping system and equipment and provides a measure of the pumping-induced drawdown at differing pumping rates. The amount of drawdown relative to the location of water-bearing fracture zones is critical to determining a realistic pumping rate for the longer-term constant rate pumping test. In this case, projections of drawdown during the 150 gpm and 168 gpm steps did not leave enough available drawdown above significant water-bearing fractures; therefore, EGGI selected a pumping rate of 110 gpm for the constant rate pumping test.

Well CCO-17A was pumped continuously for 72 hours at an average rate of 110 gpm (158,400 gpd). A total of 475,200 gallons of groundwater was withdrawn from the bedrock aquifer during the test (Table III). Water level response plots are presented as water level versus arithmetic time (Figure 7) and water level versus logarithmic time (Figure 8). During the first 12 hours of the pumping period, water levels appeared to be gradually leveling off; however, t a barrier boundary condition was intercepted that forced drawdown to occur at a much more rapid rate (observed on Figure 8). Such barriers in fractured bedrock aquifers limit the pumping cone of depression from expanding in all directions. However, late in the pumping interval, the rate of drawdown slowed significantly and the pumping response curve began to gradually flatten again.

The total drawdown in Well CCO-17A at the end of pumping was 176.17 feet and the specific capacity measured at the conclusion of the pumping test was 0.62 gallons per minute per foot of induced drawdown (gpm/ft) (Table III). The most significant water-bearing zone in Well CCO-17A was intercepted at 297 feet below ground surface (Table I). ***Thus, at the conclusion of the 72-hour pumping test, only 61% of the available drawdown above this water-bearing zone had been utilized. That means that another 113 feet of potential drawdown existed above the water-bearing zone at 297 feet, providing a substantial buffer for additional pumping.***

B. Recovery Test on Well CCO-17A

In general, groundwater recharge to a bedrock aquifer is considered favorable when a well recovers fully during a post-pumping time interval equal to the length of the pumping period. Full replenishment of water levels at the pumping well was reached after four days of recovery, one full day later than a period equal to the pumping interval (Figures 7 and 8). The subdued recovery response suggests that some of the groundwater withdrawn was removed from storage and local recharge could not sustain the pumping rate of 110 gpm. The recovery response alone does not warrant a reduction in the sustainable capacity of Well CCO-17A. However, due to the combined evidence of the recovery response and drawdown projections (discussed later), the long-term sustainable pumping rate for Well CCO-17A for the long-term use of this Well is recommended to be 90 gpm (130,000 gpd).

C. Response of the Domestic Wells, Monitoring Well, and Spring to the Pumping of Well CCO-17A

Pumping-induced drawdown was observed in three of the 19 monitoring locations where water levels were recorded during the pumping test (Table IV). The greatest amount of pumping-induced drawdown was observed in the Hill 2 Domestic Well, with 24.13 feet. The Guinn Domestic Well was impacted by 11.43 feet, and Exploratory Test Well CCO-17B experienced 3.12 feet of drawdown. The other 16 monitoring locations (including the Kern Spring) were not impacted by the pumping of Production Well CCO-17A during the 72 continuous hours of pumping at 110 gpm. Observations at the Kern Spring could only be accomplished manually and those relatively few measurements do indicate a general decline in spring flow. However, it is EGGI's professional opinion that the subtle decline is the direct result of the general recession of groundwater levels following the extensive rain that fell prior to the test.

To the best of our knowledge, the two domestic wells that were impacted, Guinn and Hill 2, experienced no water supply or quality issues during the pumping test (i.e., turbid water, discolored water, etc.). The Quinn and Hill 2 Wells are deep bedrock wells, with depths of 320 and 225 feet, respectively, so there is a large amount of available drawdown remaining in both wells during the pumping test (Table II). Both wells remained fully capable of meeting the water supply needs of their respective residences throughout the testing period.

The responses to pumping were observed to occur in a north northwest direction and an east west direction as a result of pumping Well CCO-17A (Plate 1). The lack of response measured in the other monitoring locations confirms that the responses were only observed along these two discrete areas and that wells in the remaining area of this investigation will not be impacted in any way by the pumping of Well CCO-17A.

D. Projection of Pumping-Induced Impacts

A conservative projection of the pumping test data was applied to each of the wells that responded to pumping as a means of estimating potential impacts under the long-term operation of Production Well CCO-17A. The projection was based on a linear extrapolation of the water level vs. logarithmic time plotted out to 90 continuous days of pumping (an unrealistic, but very conservative estimate). In each case, the linear extrapolation was based on water level data collected near the end of the pumping interval, after the pumping impact was well established.

The projection of the pumping data from Production Well CCO-17A indicates that up to 280 feet of drawdown could be induced in the Well after 90 days of pumping at 110 gpm. Such an amount of drawdown would come very close to the major water-bearing zone located at 297 feet below ground surface. Based on that projection, and the water level response observed during recovery, EGGI recommends reducing the long-term groundwater withdrawal rate to 90 gpm (129,600 gpd) to alleviate the induced stress on the bedrock fracture system.

The reduction in groundwater withdrawals will also serve to mitigate the projected response on the two domestic wells that responded to pumping. The Hill 2 Well is projected to be impacted by up to 56 feet of interference drawdown (at a pumping rate of 110 gpm) which, when added to the static water level of 35 feet below ground, would leave water levels 91 feet below ground. With the total depth of the Well at 225 feet, a significant amount of the available drawdown will still remain even after the pumping-induced impacts are incurred. It is unknown where the pump is set in the Hill 2 Well, but it is likely near the bottom of the Well. We anticipate that the Hill 2 Well will be able to safely continue operating with no adverse impacts, even under extended pumping conditions at Well CCO-17A. However, by reducing groundwater withdrawals from CCO-17A from 110 gpm to 90 gpm, the potential for any adverse impacts to occur will be significantly lessened.

The Guinn Domestic Well is projected to experience up to 40 feet of interference drawdown after a 90-day projection pumping at 110 gpm; however, that is also not expected to interfere with normal operating conditions, because the Well is 320 feet deep and is rated at 15 gpm. The recovery response in the Guinn Domestic Well suggests that pumping-induced drawdown resulted in a net lowering of the local water table by approximately four feet (Figure 9). Presumably, recharge to the end of the discrete fracture network is limited and long-term pumping of Well CCO-17A may result in a slight lowering of the local water table in that immediate area. Reducing the long-term pumping rates from 110 gpm to 90 gpm will serve to lessen the potential for this water level decline to occur.

V. WATER QUALITY MONITORING PROGRAM

A full suite of groundwater samples was collected from Well CCO-17A shortly before the termination of the pumping test. The samples were submitted to the Division of Consolidated Laboratory Services (DCLS) in Richmond, Virginia, and National Testing Laboratories of

Cleveland, Ohio (Table V and Appendix C). Twenty bacteria samples were collected from Well CCO-17A (taken at a minimum of one-hour intervals throughout the final two days of the pumping test) and submitted to Joiner Micro Laboratories, Inc. of Warrenton, Virginia, for bacteriological analyses. In addition, a composite sample of the groundwater was collected and microscopic particulate analysis (MPA) was performed to evaluate the likelihood of surface water influence on the groundwater supply. The MPA analysis was conducted by Clancy Environmental, Inc. of St. Albans, Vermont. Temperature, pH, oxidation/reduction potential, specific conductance, hardness, sulfate, and iron were also measured in the field throughout the pumping test to evaluate transient changes in groundwater chemistry (Table VI).

All of the analytical results available to date indicate that the water produced from Well CCO-17A is of very good quality (Table V). One water quality analysis result exceeds the EPA Primary Drinking Water Maximum Contaminant Levels (PMCL) for combined radium. The combined concentration of Radium-226 and -228 was 7.3 picoCuries per liter (pC/l), and the PMCL is 5.0 pC/l (Table V). ***Therefore, this Well will require treatment to mitigate the radium concentration.*** Manganese was the only parameter that exceeded the EPA's Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/l. The concentration of manganese that was detected in the groundwater from Well CCO-17A was 0.086 mg/l (Table V and Appendix C). Secondary limits are not enforceable and are only recommended based on aesthetic and taste concerns; therefore, the County will have to determine whether they wish to treat for manganese or not.

Bacteriological results for Well CCO-17A showed the presence of total coliform bacteria in 13 of 20 samples with a geometric mean of 1.15 colonies per 100 milliliters (Table V and Appendix C). ***No E. coliform bacteria were identified in Well CCO-17A.*** Based on these data, the groundwater from Well CCO-17A will not require disinfection, but the County may elect to maintain a residual level of chlorine in the distribution system as a safety precaution.

The MPA results indicate that the groundwater is classified according to the EPA Consensus Method as "Low" risk for groundwater to be under the influence of surface water (Table V and Appendix C).

The field chemistry results did not highlight any clear trends in groundwater quality during the 72-hour testing period. Although it does appear that iron concentrations declined throughout the pumping period, significant scatter exists in the data. Laboratory data from both labs shows iron to be low or not present. The County should retain a water quality treatment specialist for advice on recommended treatment strategy for radium and manganese.

VI. CONCLUSIONS/RECOMMENDATIONS FOR THE LONG-TERM MANAGEMENT OF PROPOSED PRODUCTION WELL CCO-17A

A. Summary

The performance and analysis of the pumping test on proposed Production Well CCO-17A has served to document the following:

- Well CCO-17A was pumped continuously for a period of 72 hours at a constant withdrawal rate of 110 gpm (158,400 gpd). The total volume of groundwater withdrawn from the underlying bedrock aquifer during this groundwater testing program was 475,200 gallons.

- Water levels in Well CCO-17A were monitored throughout the testing program. Pumping water levels never fully stabilized during the pumping interval, but never declined below 185 feet below ground and utilized only 61% of the available drawdown in the pumping well.

- Water levels were monitored throughout the pumping test program at 19 different locations, in addition to monitoring the flow of the Kern Spring. Pumping-induced impacts were observed in three of the wells: Exploratory Test Well CCO-17B, the Hill2 Domestic Well, and the Guinn Domestic Well. During the extended testing program, the pumping-induced drawdown in the two domestic wells did not, in any way, interfere with their ability to use the wells to meet their daily water needs.

- Projection of the pumping test water level data to 90 days of continuous pumping at 110 gpm shows that most of the available drawdown would be utilized in the Production Well.[1] In addition, the Hill 2 and Guinn Domestic Wells could experience interference drawdown of up to 56 and 40 feet, respectively. Based upon the recovery response observed after pumping ceased, combined with the projected drawdown in the pumping well, EGGI has determined that the long-term sustainable pumping rate should be reduced from the 110 gpm (used during the pumping test) to a maximum of 90 gpm (130,000 gpd).

- The flow rate of the Kern Spring declined gradually during the pumping test program; however, EGGI believes this is the result of local ambient groundwater recession from the excessive rain that fell during the week before the test.

[1] Note, this is not anticipated to ever happen, as the Well will never be pumped 24 hours per day for 90 consecutive days.

- The water produced from Well CCO-17A is of very good quality. Bacteriological results for Well CCO-17A showed the presence of total coliform bacteria in 13 of 20 samples with a geometric mean of 1.15 colonies per 100 milliliters. ***No E. coliform bacteria were identified in Well CCO-17A.*** Based upon this information, disinfection of this water source will not be required, but the County may want to seek counsel from a professional water treatment expert regarding this matter.

- The combined concentration of Radium-226 and -228 exceeded the EPA Primary Drinking Water Maximum Contaminant Level (PMCL) of 5.0 pC/l, and will necessitate treatment to bring levels below the PMCL. Manganese was the only parameter that exceeded the EPA's Secondary Maximum Contaminant Level (SMCL), which was established based on aesthetic and taste concerns.

B. Recommendations -- Proposed Groundwater Operation Plan

Based upon the results of this yield and quality testing program, proposed Production Well CCO-17A has met nearly all of the State Health Department regulations to serve as a public water supply well; the only exception being elevated levels of radium.

The following table provides EGGI's recommendations for pump depth setting and pumping rate.

Proposed Production Well Identification	Major Water-Bearing Zone (feet)	Recommended Pump Setting (feet)	Maximum Pumping Rate (gpm)
CCO-17A	297 (56 gpm)	280	90

EGGI also offers the following recommendations:

- Well CCO-17A can be pumped at a constant rate of 90 gpm to satisfy the potable water needs for Culpeper County in the area of the Laurel Valley Landfill. It is recommended that this Well be pumped 12 to 16 hours per day (64,800 to 86,400 gpd) with the remaining portion of each day reserved for aquifer recovery. This is a reduction from the average rate of 110 gpm maintained during the pumping test. The reduction in sustainable capacity is based on the desire to reduce pumping-induced impacts in the Production Well and to lessen potential interference drawdown in the two Domestic Wells (Hill2 and Guinn).

- The water levels in Well CCO-17A should be maintained above the major primary water-bearing zone (i.e., above 297 feet) at all times. Ideally, pumping water levels can be maintained above 180 feet (an upper water-bearing zone) as often as possible to minimize the degree of cascading water

entering the borehole. Minimizing such cascading is critical for the long-term maintenance of the Production Well because it prevents the introduction of oxygen into the groundwater, which can lead to problems associated with iron bacteria growth and oxidation of minerals.

- An automated water level recording device should be installed in Well CCO-17A. Collection of long-term monitoring data is the best means to establish/maintain an effective Groundwater Management Plan. In addition, if the County intends to utilize the Production Well to its full potential, EGGI recommends the installation of automated water level monitoring equipment in the Hill 2 and/or Guinn Domestic Wells to observe actual pumping-induced declines in the water table area at those locations.

- A water quality treatment specialist/consultant should review all of the water quality data collected from Well CCO-17A to determine the best means to reduce radium concentrations. This consultant can also provide counsel as to whether manganese should be treated or not.

- The final wellhead and well lot for Well CCO-17A will need to be maintained in accordance with Virginia Office of Drinking Water well permits and the Commonwealth of Virginia Waterworks Regulations, 12 VAC 5-590-280 and 12 VAC 5-590-840. An all weather access road to the Well must also be provided. In addition, it is EGGI's recommendation that Well CCO-17A remain outside of the designed pump house. In this way, a drill rig may easily access the Well for the purpose of redevelopment, if needed.

VII. LIMITATIONS

EGGI has collected the technical data in accordance with the Virginia Department of Health requirements. It should be recognized that the groundwater testing program was limited to that which is presented in this report, and that the program was carried out during a period that may not be representative of the full range of climatological conditions that could be encountered at this site. The recommendations provided herein regarding the long-term yield and quality of this well represent EGGI's professional opinion and do not constitute a warranty written or implied.

VIII. REFERENCES

EGGI, 1998, Groundwater Exploration and Development – Results of Phase I Investigation, Proposed Culpeper County Water Service Area.

EGGI, 2008, Culpeper Study Areas A and B Groundwater Investigation - Selection Of Proposed Exploratory Test Well Sites (Results Of Phase II – Geophysical Surveys), Culpeper County, Virginia.

FIGURES

Figure 3 -- Schematic of the Wellhead Design for the Proposed Production Well CCO-17A Pumping Test

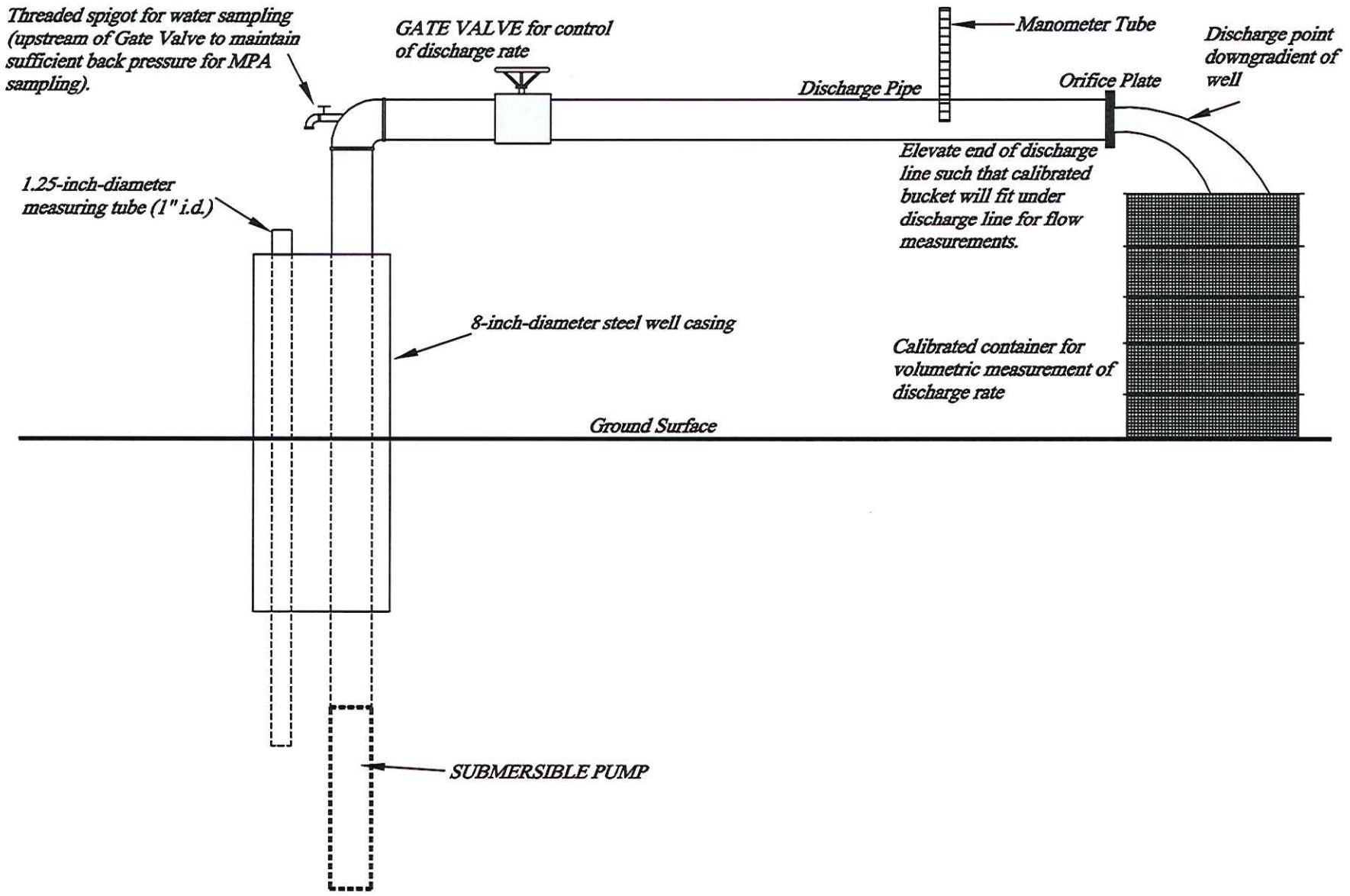

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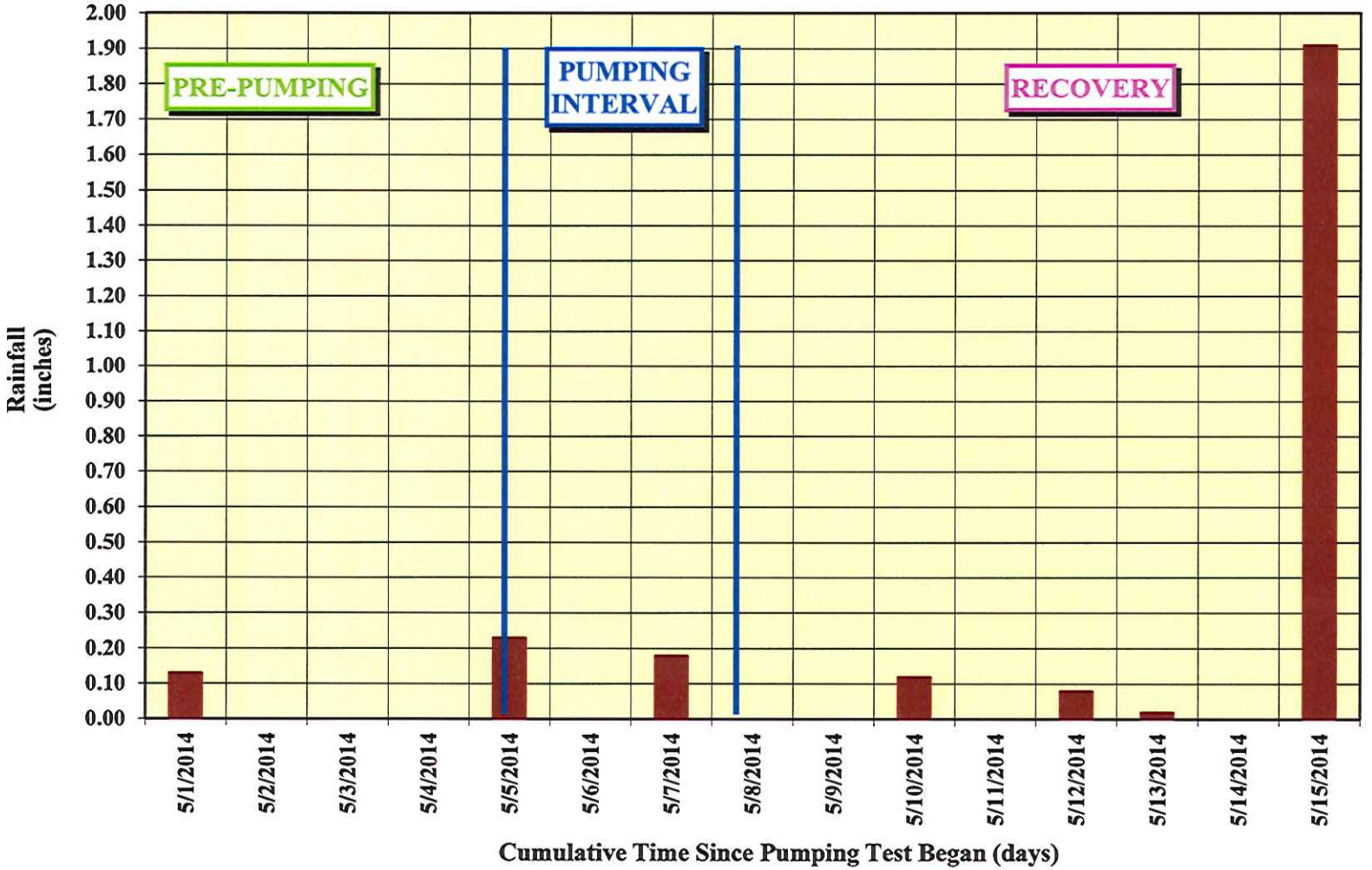
FIGURE 3

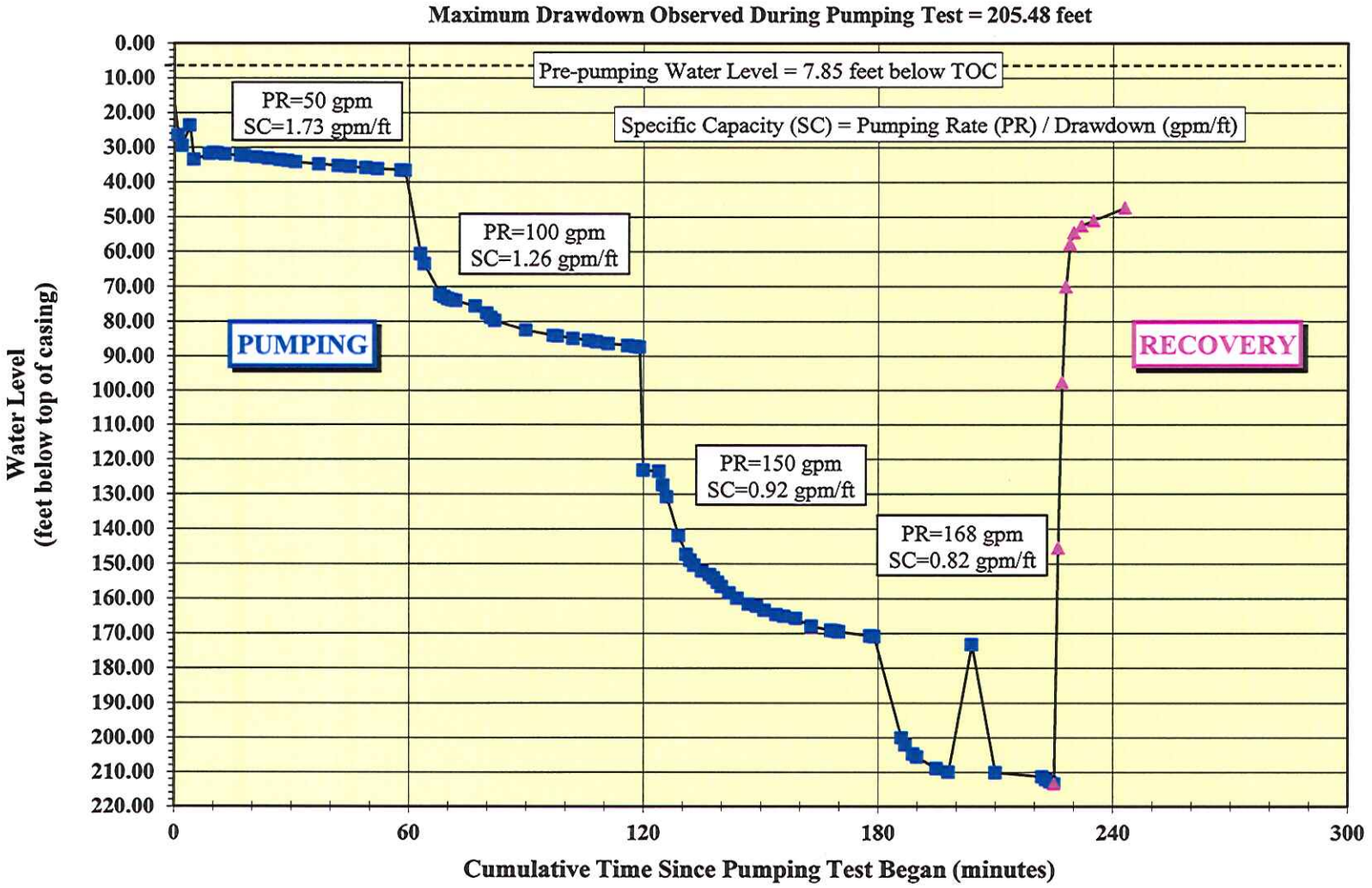
Figure 4 - Rainfall as Reported at Washington Dulles Airport, Virginia



Plot of Rainfall versus Time for May 1 to May 15, 2014

Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

Figure 6 -- Proposed Production Well CCO-17A Step Drawdown Test

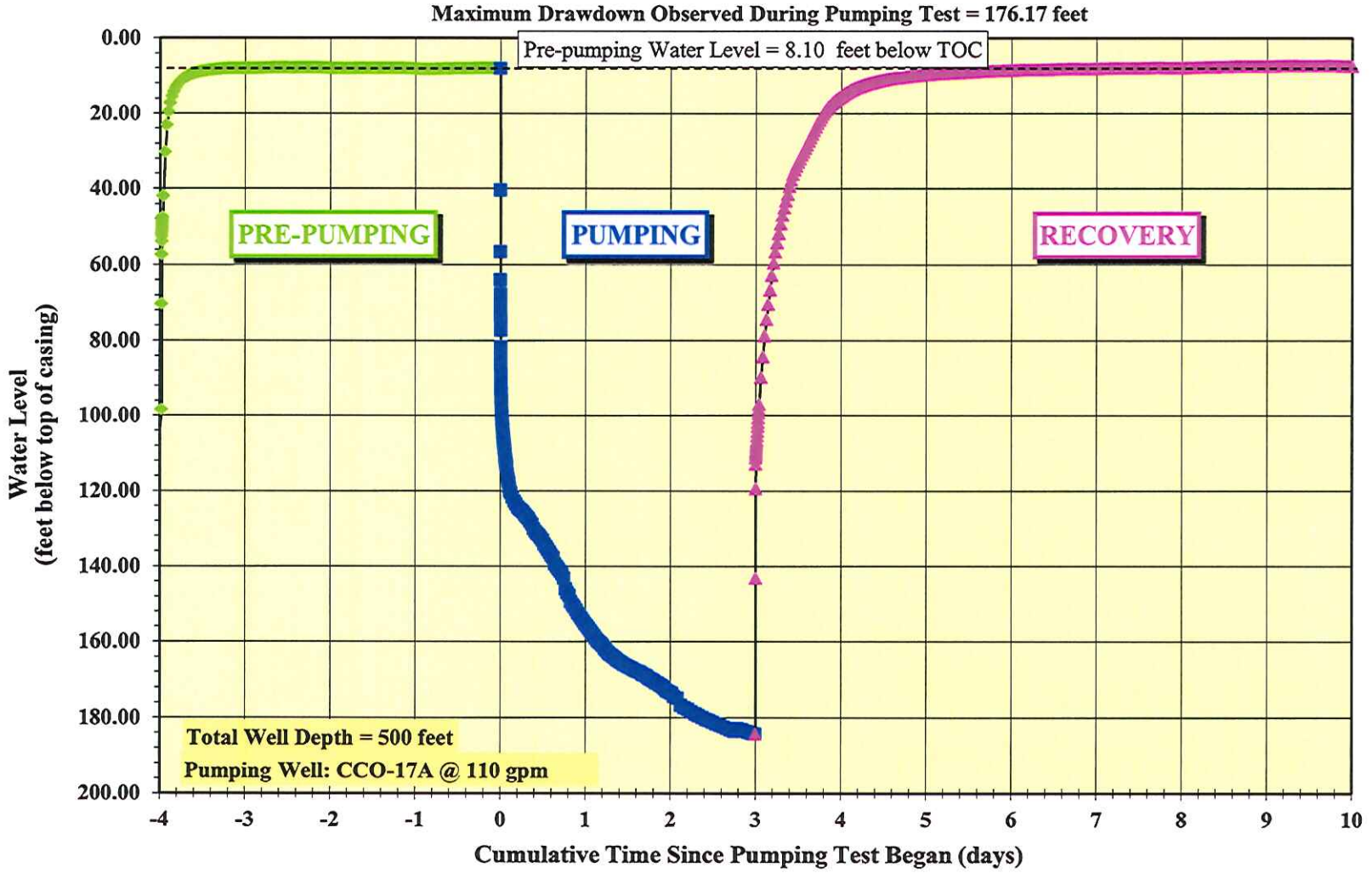


Plot of Water Level versus Time for May 1, 2014

Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill

Culpeper County, Virginia

Figure 7 -- Plot of Water Level Versus Arithmetic Time Scale for Proposed Production Well CCO-17A

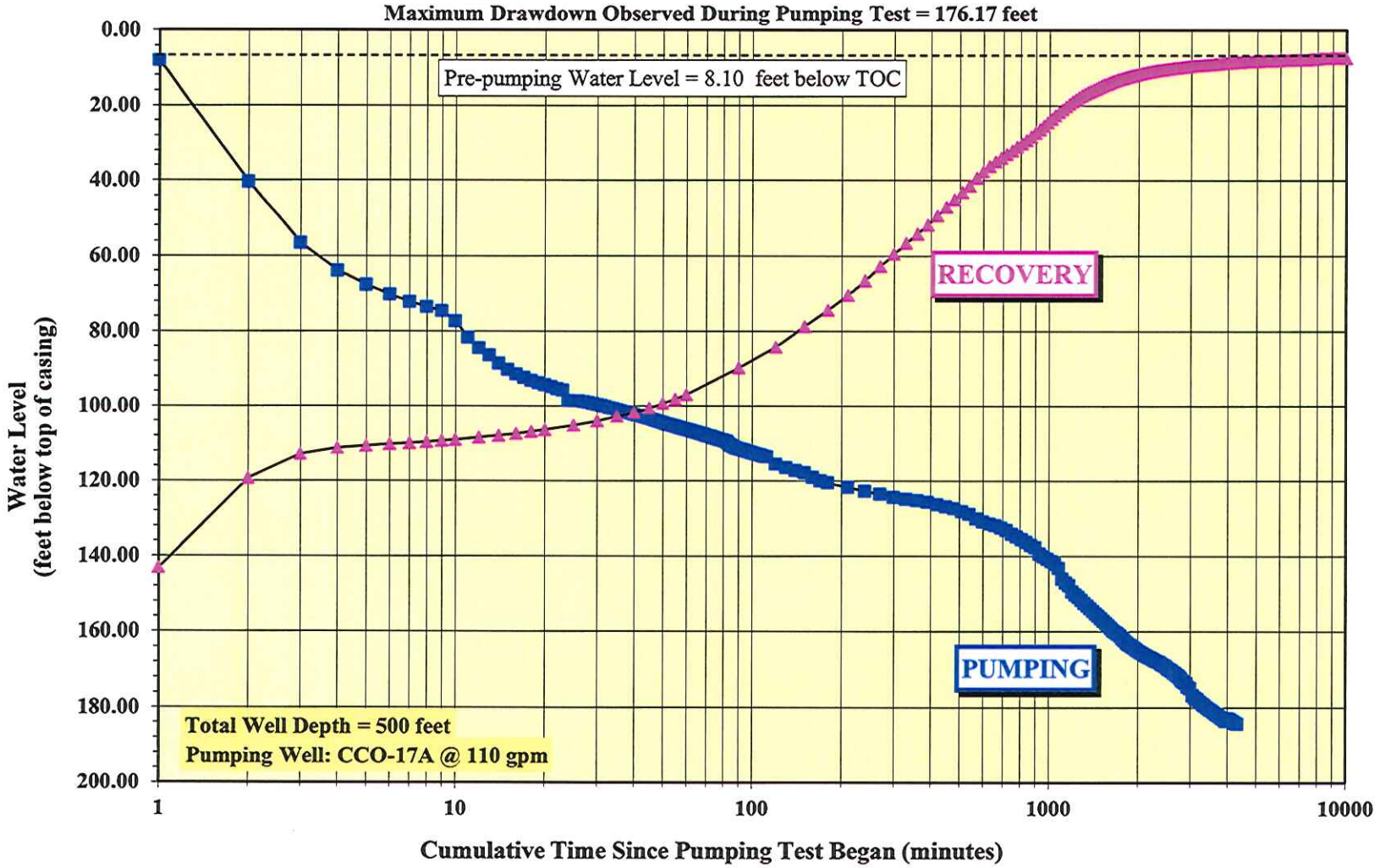


Plot of Water Level versus Time for May 1 to May 15, 2014

Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill

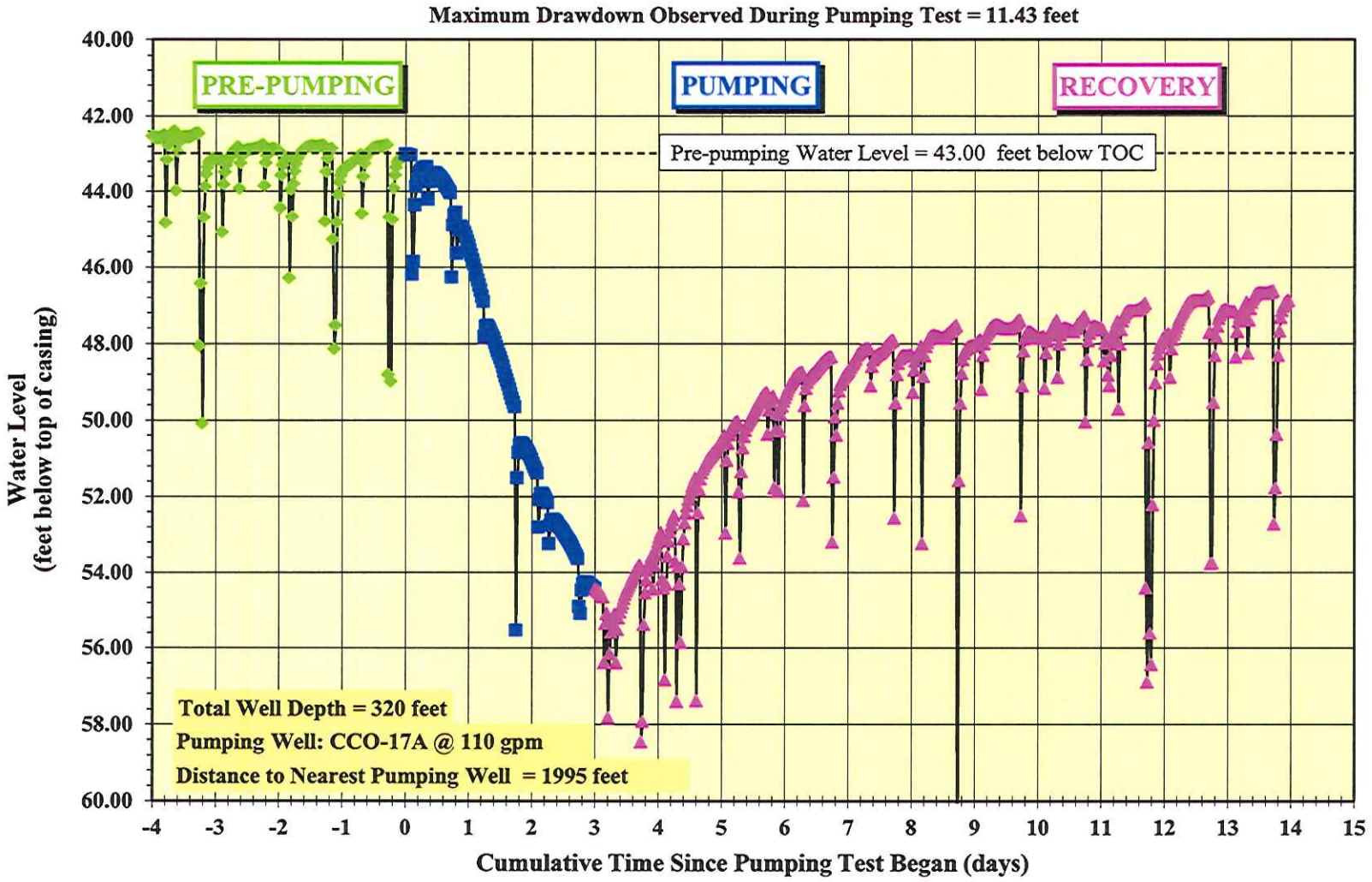
Culpeper County, Virginia

Figure 8 -- Plot of Water Level Versus Semi-Logarithmic Time Scale for Proposed Production Well CCO-17A



Plot of Water Level versus Logarithmic Time for Pumping and Recovery
Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

Figure 9 -- Guinn Domestic Well



Plot of Water Level versus Time for May 1 to May 15, 2014

Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill

Culpeper County, Virginia

TABLES

TABLE I
Results of Drilling Proposed Production Well CCO-17A
Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

Well ID	Date Drilled	State Plane Virginia North (feet)	Total Depth (feet)	Casing Depth (Diameter) (feet) (inches)	Depth to Bedrock (feet)	Water-Bearing Zones Depth (feet)	Water-Bearing Zones Airlift Yield (gpm)*	Final Airlift Yield* (gpm)
CCO-17A	10/16 - 10/17/2013	6,868,548 N 11,617,508 E	500	103 (8)	19	60	12	**160 (Final 8-Inch Production Well)**
						90	8	
						150-156	7	
						180	14	
						297	56	115 (6-Inch Exploratory Test Well)
						415	6	
						435	12	

*Airlift tests involve using the drill rig to "airlift" the water out of the well during the drilling process such that a preliminary measurement of the rate of water produced from each well can be made. An accurate determination of the pumping capacity of the well is determined by conducting long-term pumping tests.

TABLE II
Basic Information for Monitoring Well Locations
Used During the Pumping Test of Proposed Production Well CCO-17A
Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

Monitoring Locations Production Well	Well Depth (feet)	Estimated Yield (gpm)	Distance to Pumping Well CCO-17A
CCO-17A	500	160	0
Domestic Wells			
Bobbitt	unknown	unknown	1,955
Bowler	305	3	1,910
Brown	280	12	1,415
Cave	unknown	unknown	1,955
Farnam	unknown	unknown	2,025
Guinn	320	15	1,995
Hill 1	245	7	1,135
Hill 2	225	12	1,035
Howard	unknown	unknown	1,585
JMAR	unknown	unknown	1,865
Jones	unknown	unknown	1,940
Kern	85	12	1,205
Mills	330	80	2,560
Ohleger	unknown	unknown	1,960
Strickland	160	7	2,625
Tapscott	unknown	unknown	2,900
Woodson	295	unknown	1,840
Exploratory Test Well			
CCO-17B	560	1	1,145
Spring Information			
Kern Spring	N/A	6-7[1]	1,290

[1] = Spring flow measured by EGGI staff.

TABLE III
Summary of Pumping Test Results for Proposed Production Well CCO-17A
Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

Well Name	Pre-Pumping Water Level (feet)	Start and Stop Time of Pumping Test (date, 24-hr. time)	Test Duration (hours)	Average Pumping Rate (gpm)	Final Drawdown (feet)	Total Volume Pumped (gallons)	Percent of Available Drawdown Used*	Final Specific Capacity** (gpm/ft)
CCO-17A	8.10	5/5/14; 13:00 5/8/14; 13:00	72	110	176.17	475,200	61%	0.62

*The available drawdown for the pumping well was calculated by subtracting the pre-pumping water level from the depth of the major water-bearing fracture (intercepted at 297 feet).

**The final specific capacity is calculated by dividing the final pumping rate (gpm) by the maximum pumping water level drawdown (feet).

TABLE IV
Water Level Information and Water Level Responses Observed During the Pumping Test of Proposed Production Well CCO-17A
Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

Monitoring Locations Proposed Production Well	Well Casing Elevation[1] (feet above msl)	Pre-Pumping Water Level (feet)[2]	Pre-Pumping Water Level Elevation (feet above msl)	Maximum Drawdown Observed During Pumping Test (feet)	Projected Drawdown after 90 Days of Pumping (feet)
CCO-17A	459	8.10	450.90	176.17	280
Domestic Wells					
Bobbitt	517	7.60[3]	509.40	not impacted	not impacted
Bowler	518	29.19	488.81	not impacted	not impacted
Brown	525	53.47	471.53	not impacted	not impacted
Cave	537	8.91	528.09	not impacted	not impacted
Farnam	473	19.73	453.27	not impacted	not impacted
Guinn	523	43.00	480.00	11.43	40
Hill 1	515	27.98	487.02	not impacted	not impacted
Hill 2	501	34.79	466.21	24.13	56
Howard	535	3.37	531.63	not impacted	not impacted
JMAR	515	20.74	494.26	not impacted	not impacted
Jones	543	24.47	518.53	not impacted	not impacted
Kern	519	23.22	495.78	not impacted	not impacted
Mills	509	39.61	469.39	not impacted	not impacted
Ohleger	530	17.37	512.63	not impacted	not impacted
Strickland	566	14.05	551.95	not impacted	not impacted
Tapscott	541	37.89	503.11	not impacted	not impacted
Woodson	506	34.17	471.83	not impacted	not impacted
Exploratory Test Well					
CCO-17B	455	18.31	436.69	3.12	7.4
Spring					
Kern Spring	494	n/a	494.00	not impacted	not impacted

1) Well casing elevations were estimated from Culpeper County 2-foot elevation contour map (Culpeper County GIS).
2) measured in feet below top of well casing
3) Bobbitt pre-pumping water level estimated based-upon four water levels measured in well during the pumping test.
n/a = not applicable

TABLE V
Results of Laboratory Analyses from Water Quality Samples Collected During the 72-Hour Pumping Test of Proposed Production Well CCO-17A Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill Culpeper County, Virginia

Well	Lab	Iron (mg/l)	Manganese (mg/l)	pH	Arsenic (mg/l)	Alkalinity (mg/l)	Chloride (mg/l)	Turbidity (ntu)	Hardness (mg/l)	Total Dissolved Solids (mg/l)	Sulfate (mg/l)	Nitrate (mg/l)	SOCs (mg/l)	VOCs (mg/l)
	MCL	***0.30***	***0.05***	***6.5-8.5***	***0.01***		***250***	***1***		***500***	***250***	***10***		
CCO-17A	VA ST	ND	**0.083**	7.07	ND	105	ND	0.12	94	134	ND	0.17	ND	ND
	NTL	0.026	**0.086**	7.5	ND	100	ND	ND	95	130	ND	ND	ND	ND

Well	Lab	Gross Alpha (lab VA ST)	Gross Beta (lab VA ST)	Radium 226+228 (lab VA ST)
	MCL	***15 pC/l***	***50 pC/l***	***5 pC/l***
CCO-17A	VA ST	9.0	10.2	**7.3**

ND = parameter not detected
na - Results not available at the time of this writing.
LAB CODES:
VA ST = Division of Consolidated Laboratory Services (Virginia State Laboratory)
NTL = National Testing Laboratories, Ltd

JOINER MICRO LABS
BACTERIOLOGICAL RESULTS FOR WELL CCO-17A:

CCO-17A - Bacteriological Analysis-- All twenty samples collected were absent for E. coli bacteria. Seven samples were absent for Total Coliform bacteria. Total Coliform bacteria were detected in thirteen samples at 1.0 colonies per 100 ml. The geometric mean for Total Coliform for all 20 samples is 1.15 colonies per 100 ml.

Microscopic Particulate Analysis (MPA) - Water is classified according to the EPA Consensus Method as *LOW* risk (0 risk rating) for groundwater to be under direct influence of surface water (GUDI).

TABLE VI
Results of Field Chemistry Analyses
During the 72-Hour Pumping Test of Proposed Production Well CCO-17A
Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

WELL ID	Date and Time of Sampling	Temperature (degrees C)	pH	Redox (millivolts)	Specific Conductance (microsiemens)	Sulfate (mg/l)	Hardness (mg/l)	Iron (mg/l)
	5/5/14; 16:00	16	7.94	-55.4	234	<50	100	0.12
CCO-17A	5/6/14; 07:35	14.6	7.94	-54.9	236	<50	120	0.09
	5/6/14; 15:00	15.3	7.76	-42.3	236	<50	100	0.06
	5/7/14; 07:00	14.7	7.98	-55.6	237	<50	120	0.07
	5/7/14; 15:15	15.1	7.93	-53.4	239	<50	100	0.09
	5/8/14; 10:35	15.3	7.85	-49.1	243	<50	120	0.04

APPENDIX A

HYDROGEOLOGIC WELL LOG AND WATER WELL COMPLETION REPORT (GW-2)

HYDROGEOLOGIC LOG FOR CCO-17A
CULPEPER LANDFILL
CULPEPER COUNTY, VIRGINIA

Project: *Culpeper County Landfill*
Geologist: *Michael O'Brien*
Driller: *Groundwater Systems, Inc.*
Date Drilled: *10/16/13 - 10/17/13*
Drill Rig Type: *Air Rotary*
Well Diameter: *6"*
Latitude: *N38°30' 28"* **Longitude:** *W78° 1' 44"*
Surface Elevation: *459.7'*

Steel Casing Depth: *103'* **Casing Stickup:** *2'*
Casing Thickness: *0.322"*
Depth Drilled: *500' (8" diameter)*
Depth to bedrock: *19'*
Static Water Level: *9.11'*
Airlift Yield: *115 gpm (6"); 160 gpm (8")*
Grout Type (Depth): *Cement (103')*

Depth (feet)	Airlift Yield* (gpm)	Graphic Log	Descriptive Log**
0			
10	Steel Casing		0' - 19': Saprolite - residual products of in-situ weathering of bedrock.
20			
30			19' - 400': Medium to dark gray to greenish gray, medium-grained granofels (metamorphosed greywacke sandstone and siltstones) with variable amounts of biotite and pyrite. Occasional phyllitic and schistose layers with higher mica content.
40			
50			
60	12		60': WATER BEARING ZONE: 12 gpm
70			70': Quartz veinlets.
80			
90	20		90': WATER BEARING ZONE: 8 gpm
100			
110			
120			
130			
140			
150	27		150' - 153': Soft. Increased drilling rate. 150' - 156': WATER BEARING ZONE: 7 gpm
160			
170			
180	41		180': WATER BEARING ZONE: 14 gpm
190			
200			200': Quartz veinlets.
210			
220			
230			
240			
250			
260			
270			
280			
290	97		297': WATER BEARING ZONE: 56 gpm
300			297' - 300': Quartz vein.
310			303' - 305': Quartz vein.
320			
330			
340			
350			
360			

HYDROGEOLOGIC LOG FOR CCO-17A
CULPEPER LANDFILL
CULPEPER COUNTY, VIRGINIA

Project: *Culpeper County Landfill*
Geologist: *Michael O'Brien*
Driller: *Groundwater Systems, Inc.*
Date Drilled: *10/16/13 - 10/17/13*
Drill Rig Type: *Air Rotary*
Well Diameter: *6"*
Latitude: *N38°30' 28"* **Longitude:** *W78° 1' 44"*
Surface Elevation: *459.7'*

Steel Casing Depth: *103'* **Casing Stickup:** *2'*
Casing Thickness: *0.322"*
Depth Drilled: *500' (8" diameter)*
Depth to bedrock: *19'*
Static Water Level: *9.11'*
Airlift Yield: *115 gpm (6"); 160 gpm (8")*
Grout Type (Depth): *Cement (103')*

Depth (feet)	Airlift Yield* (gpm)	Graphic Log	Descriptive Log**
370			
380			
390			
400			
410	103		415': WATER BEARING ZONE: 6 gpm
420			
430	115		435': WATER BEARING ZONE: 12 gpm
440			440': End of 6" test well.
450			
460			
470			HACH field test collected at 500': Sulfate: <50 mg/l
480			Iron: 0.05 mg/l
490			Conductivity: 228 uS Hardness: 100 mg/l
500			pH: 7.61 500': End of 8" reaming.

Cuttings of bedrock collected at 10-foot intervals and at changes in lithology. * Yield determined during drilling of 6" test well.
** Minerals describing rock types are listed in order of increasing abundance.

Form GW-2 BWCM No. _____

COMMONWEALTH OF VIRGINIA
WATER WELL COMPLETION REPORT
(Certification of Completion/County Permit)

County/City: *CULPEPER COUNTY*
County/City Stamp

SWCB Permit _____
County Permit _____

Owner: *CULPEPER COUNTY ENVIRONMENTAL SERVICES*
Well Designation or Number: *CCO-17A*
Address: *118 W. DAVIS STREET, SUITE 101*
CULPEPER VIRGINIA 22701
Phone: *Paul Howard*

Certification of Inspecting Official:
This well does ____ does not ____
meet code/low requirements.
S _____
Date _____
For Office Use

Drilling Contractor: Groundwater Systems, Inc
Address: 3159 Mary Etta Lane
Herndon, Virginia 20171
Phone: (703) 620-2040

Tax Map ID No. _____
Subdivision _____
Section _____
Block _____ Lot _____
Class Well: I __ IIA X IIB __ IIIA __
IIIB __ IIIC __ IIID __ IIIE __ IV __

Well Location: *PWSID# 6047500*
WELL CCO-17A

Date Started : *10/16/13* Date Completed: *01/10/14* Type of Rig: *Rotary*

1. WELL DATA: New *X* Worked ____ Deepened ____

Total Depth: *600'*

Depth of Bedrock: *19'*

HOLE SIZE (Also include reamed zones)
12" inches from *0* to *103'* ft.
8" inches from *103'* to *500'* ft.
____ inches from ____ to ____ ft.

CASING SIZE (I.D.) and material:
6 inches from *+2* to *103'* ft.
Material: *STEEL*
Wt. Per foot: *28 lb* or wall thickness *.322* in.
____ inches from ____ to ____ ft.
Material: _____
Wt. Per foot: ____ or wall thickness ____ in.
____ inches from ____ to ____ ft.
Material: _____
Wt. Per foot: ____ or wall thickness ____ in.

SCREEN SIZE and mesh for each zone
(where applicable)
____ inches from ____ to ____ ft.
Mesh Size ____ Type _____
____ inches from ____ to ____ ft.
Mesh Size ____ Type _____
____ inches from ____ to ____ ft.
Mesh Size ____ Type _____

GRAVEL PACK
From _____ To _____ ft.
From _____ To _____ ft.

GROUT
From *100+* To *0* ft. Type Pressure *Tremmie*
From ____ To ____ ft. Type Pressure *Neat Cement*

2. WATER DATA: Water Tempature _____ degrees.
Static water level (unpumped level measured) *9.11'* ft.
Stabilized meas. pumping water level _____ ft.
Stabilized yield *160* gpm after *2+* hours.
Natural Flow: Yes ____ No *X* Flow rate ____ gpm.
Comment on Quality: *CLEAR*

3. WATER ZONES: From *156* ft. *7* gpm.
From *180* ft. *14* gpm. From *297* ft. *56* gpm.
From *415* ft. *6* gpm. From *435* ft. *12* gpm.

4. USE DATA:
Type of Use: Drinking *X* Livestock Watering ____
Irrigation ____ Food Processing ____ Household ____
Manufacturing ____ Fire Safety ____ Cleaning ____
Recreation ____ Aesthetic ____ Cooling or Heating ____
Injection ____ Other _____
Type of Facility: Domestic ____ Public Water Supply X
Public Institution ____ Farm ____ Industry ____
Commercial ____ Other _____

5. PUMP DATA: Type _____ Rated HP _____
Intake depth ____ Capacity ____ at ____ head

6. WELLHEAD: Type well seat _____
Pressure Tank ____ gal Loc _____
Sample Tap ____ Measurement Port _____
Well Vent ____ Pressure Relief Valve _____
Gate Valve ____ Check Valve (when required) ____
Electrical Disconnect Switch on Power Supply ____

7. DISINFECTION: Well Disinfected: Yes ____ No ____
Date _____ Disinfectant Used _____

8. ABANDONMENT (where applicable): Yes ____ No ____
Casing Pulled Yes ____ No ____ Not Applicable ____
Plugging Grout From ____ To ____ Material _____
From ____ To ____ Material _____

OWNER *CULPEPER COUNTY ENV. SERVICES*

WELL CCO-17A *PWSID# 6047500*

9. State law requires submitting to the Virginia State Water control Board information about groundwater and wells for every well made in the State intended for water, or any other non-exempt well. This information must be submitted whether the well is completed, on standby, or abandoned. Information required includes: an accurately and completely prepared completion report, full data from any aquifer pumping tests, drill cuttings taken at ten foot intervals (unless exemption is secured), the results of any chemical analysis, and copies of any geophysical logs. Quarterly-pumpage and use reports are required from owners of public supply and industrial wells. The Virginia State Health Department requires a water well completion report for public supply wells.

10. **DRILLERS LOG** (use additional sheets if necessary)

DIAGRAM OF CONSTRUCTION (with dimensions)

DEPTH (feet)		**TYPE OF ROCK OR SOIL**	**REMARKS**
From	To	(color, mineral, fossils, hardness, etc.	(water, caving, cavities, broken, core, shot, etc.)
		PLEASE SEE ATTACHED EGGI, INC. HYDROGEOLOGIC LOG FOR CCO-17A	

11. Well lot dedicated?_____; Size _____ ft. x _____ ft. Well house?_____; Distance to nearest pollutant source _____ ft.
Type _____. Distance to nearest property line _____ ft., Building _____ ft.

12. **WATER SERVICE PIPE:** Checked under _____ psi for _____ minutes. Pipe size _____ in. Material_____
Installer _____
Date _____

13. I certify that the information contained herein is true and correct and that this well and/or system has been installed and constructed in accordance with the requirements for well construction as specified in compliance with appropriate county or independent city ordinances and the laws and rules of the Commonwealth of Virginia.

SIGNATURE *GROUNDWATER SYSTEMS, INC.* (Seal) Date July 31, 2014
(Well Driller or Authorized Person)

License No. 2705019869 WWP

County License No.: W0004
Virginia License No.:

APPENDIX B

CONSENT FORMS

YES

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES,) I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Jackie Bobbitt Date: March 5. 2014
Jeff Bobbitt

Well Owner Name: Jackie C. Bobbitt
Address: 11403 Cherry Hill Rd.
Culpeper, VA. 22701

Phone (home): (540) 825-2558 Cell (~~work~~): (540) 621-8818
PIN # 30 36A Best Number Jeffrey Bobbitt Son

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: 1972

Total depth of the well: ? feet

Diameter of well: 6" inches

Length of steel casing: ? feet

Estimated yield (from driller): ? gallons per minute

Water level (below ground): ? feet

Type of rock or material encountered: ? (i.e., siltstone/diabase)

Depth of Pump Setting: ? (feet from ground surface)

Type of Pump: Jet (submersible, jet, etc.)

Describe the location of the well on your property: Pump house in Front Yard

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) 6" Pipe with 2 pipes going down the top width is bolted down.

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES) I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Carolyn G. Bowler Date: 3/5/14

Well Owner Name: Carolyn J Bowler
Address: 1439B Woodland Ch. Rd.
Culpeper, VA 22701

Phone (home): 540. 825-0662 (work): 540-522-3511
PIN # 30 47E

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: Hall's Well & Pump - 2012

Total depth of the well: 305 feet

Diameter of well: _____ inches

Length of steel casing: 75 feet

Estimated yield (from driller): 3 gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: in front yard of home

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES), I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Ethel Mae Brown Date: 2-20 2014

Well Owner Name: Mr + Mrs Levi D. Brown
Address: 14325 Woodland Church Rd.
Culpeper, Va. 22701

Phone (home): 540 825-7335 (work): Retired
PIN # 30 56

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: 1983

Total depth of the well: 280 feet

Diameter of well: 6 inches

Length of steel casing: _____ feet

Estimated yield (from driller): 12 gallons per minute

Water level (below ground): 30 feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: 250 (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.) at the end of the drive way on the left to the Right

Describe the location of the well on your property: Please Call we will Meet you

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) Tele 540 825 7335

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

✓ (YES, I would like my well monitored during the study.)

NO, I would not like my well monitored during the study.

Signature: Robin Cave Date: 2/28/13

Well Owner Name: Robin Cave
Address: 14233 woodland church rd.
Culpeper, VA. 22701

Phone (home): (540) 317-5824 (work): _____
PIN #30 50A

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: _____

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: _____

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES, I would like my well monitored during the study.)

NO, I would not like my well monitored during the study.

Signature: _____ Date: 2-20-14

Well Owner Name: WILLIAM E FARRAR
Address: 12032 BAEDERWOOD LANE
CULPEPER VA 22701

Phone (home): 540 825 4515 (work): _____
PIN # 30 58

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: 1994

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: RIGHT SIDE OF PARKING AREA @ HOUSE

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) CASING W/ REMOVABLE CAP

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES, I would like my well monitored during the study.)

NO, I would not like my well monitored during the study.

Signature: Ronald P. Guinn Date: 2-20-14

Well Owner Name: Ronald P Guinn
Address: 11491 Cherry Hill Rd
Culpeper, VA. 22701

Phone (home): 540-825-9171 (work): N/A
PIN # 30 36

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: Northern VA Drilling, Inc July 2007

Total depth of the well: 320 feet

Diameter of well: 6 inches

Length of steel casing: 84 feet

Estimated yield (from driller): 15 gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: _____

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) 6 inch casing in front yard close to driveway.

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

YES, I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: James M. Hill Date: 2/20/14

Well Owner Name: James M. Hill
Address: 11528 CHERRY HILL RD

Phone (home): 540-825-3281 (work): _____
PIN # 30 52

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: CURTIS BROS 2006

Total depth of the well: 246 feet

Diameter of well: 6 inches

Length of steel casing: _____ feet

Estimated yield (from driller): 7 gallons per minute

Water level (below ground): 15 feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: V (submersible, jet, etc.)

Describe the location of the well on your property: 150 REAR OF HOUSE

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) YES

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

YES, I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: James M Hill Date: 2/20/2014

Well Owner Name: James M. Hill
Address: _____

_____

Phone (home): 540 825-3281 (work): _____
PIN # 30 53

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: CURTIS BRO. 2007

Total depth of the well: 225 feet

Diameter of well: 6 inches

Length of steel casing: _____ feet

Estimated yield (from driller): 12 gallons per minute

Water level (below ground): 10 feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: 200 (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: S-W- OF House 150 ft

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

_____

_____

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

YES, I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: James M Hill Date: 2/ 20/ 0C/

Well Owner Name: James M. Hill
Address: 1115 28 Cherry Hill Rd

Phone (home): 540-825-3281 (work): _____
PIN # 30 54

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: HEMERY SOWERS ~ 1976

Total depth of the well: 78 feet

Diameter of well: 6 inches

Length of steel casing: _____ feet

Estimated yield (from driller): 10 gallons per minute

Water level (below ground): 8 feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: 65 (feet from ground surface)

Type of Pump: Jet (submersible, jet, etc.)

Describe the location of the well on your property: 500 ft. NORTH OF HOUSE

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES, I would like my well monitored during the study.)

NO, I would not like my well monitored during the study.

Signature: Michael Paul Howard Date: 3/5/14

Well Owner Name: Michael Paul Howard
Address: 11344 Cherry Hill Rd.
Culpeper, VA 22701

Phone (home): 540-710-4567 (work): _____
PIN # 30F 1 6

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: 1985 No info on record

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: 100 feet southeast from house

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) There is no information on record with the county about this well. It wasn't required when the house was built.

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

YES, I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: [signature] Date: 2-17-14

House burned years ago

Well Owner Name: J MAR Farm Partnership
Address: c/o D J RE LLC
602 S Main St - Culpeper Va 22701

Phone (home): _____ (work): 825-1234
PIN # 30 38

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: _____

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: _____

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES, I would like my well monitored during the study.)

NO, I would not like my well monitored during the study.

Signature: Mike H Jenkins Agent Date: 2-17-14

Well Owner Name: TMAL Rappahannock LLC
Address: c/o TMAL Real Estate LLC
602 S Main St Culpeper VA 22701

Phone (home): _____ (work): 825-1234
PIN # 30 47H

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: _____

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: _____

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES), I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Clarence Jones Sheila A. Jones Date: 3-5-14

Well Owner Name: CLARENCE P. JONES
Address: 14302 WOODLAND CHURCH ROAD
CULPEPER, VA. 22701

Phone (home): 540-829-6068 (work): _____
PIN # 30 48

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: 1985

Total depth of the well: N/A feet

Diameter of well: N/A inches

Length of steel casing: N/A feet

Estimated yield (from driller): N/A gallons per minute

Water level (below ground): N/A feet

Type of rock or material encountered: N/A (i.e., siltstone/diabase)

Depth of Pump Setting: N/A (feet from ground surface)

Type of Pump: N/A (submersible, jet, etc.)

Describe the location of the well on your property: FRONT YARD CIRCLE FLOWER BED

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) N/A

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES) I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: James E. Kern Date: 3/6/14

Well Owner Name: JAMES KERN
Address: 1427 Woodland Church Rd
Culpeper, VA 22701

Phone (home): 540-222-8590 (work): _____
PIN # 30 35

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: Lewzer 1986

Total depth of the well: 85 feet
Diameter of well: 6 inches
Length of steel casing: 30' feet
Estimated yield (from driller): 12 ga/min gallons per minute
Water level (below ground): ? feet
Type of rock or material encountered: blue rock or shale (i.e., siltstone/diabase)
Depth of Pump Setting: not sure 20? (feet from ground surface)
Type of Pump: jet (submersible, jet, etc.)

Describe the location of the well on your property:

about 75' rear of house

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?)

6" case w/ removable lab

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

[YES,] I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Howard M. Mills Date: 2/ /14

Well Owner Name: Howard M. Mills
Address: 12045 Turner Lane
PO Box 247 Culpeper VA 22701

Phone (home): 540 825 0991 (work): —
PIN # 30 58B

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: Dennis Gentry 1991

Total depth of the well: 330 feet

Diameter of well: 6" inches

Length of steel casing: 85 feet ? ? ?

Estimated yield (from driller): 80 gallons per minute ? ?

Water level (below ground): unknown feet

Type of rock or material encountered: Black Rock (i.e., siltstone/diabase)

Depth of Pump Setting: unknown (feet from ground surface)

Type of Pump: Sub mersible (submersible, jet, etc.)

Describe the location of the well on your property: Approx 100 Ft. NW of House

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) unknown

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES), I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Jo Ann O. Ohleger Date: 9/19/14

Well Owner Name: Jo Ann O. Ohleger
Address: 11368 Cherry Hill Rd.
Culpeper, VA 22701

Phone (home): (540) 825-2323 (work): Retired
PIN # 30F 1 2

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: UNKNOWN 1970

Total depth of the well: ? feet

Diameter of well: 6" inches

Length of steel casing: ? feet

Estimated yield (from driller): ? gallons per minute very good output

Water level (below ground): 10' feet

Type of rock or material encountered: ? (i.e., siltstone/diabase)

Depth of Pump Setting: Less than 100 Feet (feet from ground surface)

Type of Pump: → (submersible, jet, etc.)

Describe the location of the well on your property: FRONT YARD NEAR CENTER CLOSER TO ROAD THAN HOUSE

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) 6" CASING WITH REMOVABLE CAP.

Don't know IF IT HAS A RUBBER SEAL

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

(YES), I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Wade Strickland Date: 4-10-14

Well Owner Name: Wade Strickland
Address: 14011 Woodland Church Rd
Culpeper, Va. 22701

Phone (home): 540-825-4281 (work): N/A
PIN # 30 35

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: Don't No / 1988

Total depth of the well: 160 feet

Diameter of well: 6 inches

Length of steel casing: ? feet

Estimated yield (from driller): 7 gallons per minute

Water level (below ground): 10 feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: 130 (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: Left Corner Facing house

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

4/18/14 Rec'd Env Serv.

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

✓ YES, I would like my well monitored during the study. KTM

NO, I would not like my well monitored during the study.

Signature: Kathryn M. Tapscott Date: 4-14-14

Well Owner Name: Kathryn M. Tapscott
Address: 13510 Woodlawn Pl.
Culpeper VA 22701

Phone (home): 571-437-9617 (work): 703-392-~~3913~~ 1613
PIN # 30 35

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: ?

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: Front of prop.

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) Pipe standing up from ground.

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

✓ YES, I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Gladys B. Woodson Date: 4-14-14

Well Owner Name: Gladys B. Woodson
Address: 11471 Beechwood Ln
Culpeper, Va. 22701

Phone (home): 540-825-7308 (work): —
PIN # 30 35

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: 1993 –

Total depth of the well: 295 feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: Back of house 200' ?

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

NO

FEB 2 4 2014

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

YES, I would like my well monitored during the study.

* NO, I would not like my well monitored during the study.

Signature: Frances L. Leavell Date: 2/15/14

Well Owner Name: Frances L. Leavell
Address: 14163 Woodland Church Rd
Culpeper, VA 22701

Phone (home): (540) 825-5087 (work): _____
PIN # 30 51A

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: _____

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): _____ feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: _____

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

FEB 2 7 2014

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

YES, I would like my well monitored during the study.

NO, I would not like my well monitored during the study.

Signature: Ronald Weakley Date: 2/24/14

Well Owner Name:
Address: 11425 Cherry Hill Rd
Culpeper, VA 22701

Phone (home): 540-829-6065 (work):
PIN # 30 36B

CONSENT FORM FOR WELL MONITORING

After reading the information supplied on the previous page, please indicate to us your decision to allow Emery & Garrett Groundwater Investigations, LLC to monitor your well during the groundwater level monitoring study.

YES, I would like my well monitored during the study.

(NO) I would not like my well monitored during the study.

Signature: Margaret Wells Date: 2-20-14

Well Owner Name: Margaret Wells
Address: Contact: 1251 Delaware ave. S.W.
Washington, D.C. 20024

Phone (home): 202-554-4140 (work): _____
PIN # 30 51B

Don't know

WELL INFORMATION SURVEY

It would be most helpful if you could provide any information on the installation and design of your well. If you have knowledge of any of the following information, please fill out the form below. Thank you.

Well Driller and Year of Installation: _____

Total depth of the well: _____ feet

Diameter of well: _____ inches

Length of steel casing: _____ feet

Estimated yield (from driller): _____ gallons per minute

Water level (below ground): Very deep feet

Type of rock or material encountered: _____ (i.e., siltstone/diabase)

Depth of Pump Setting: _____ (feet from ground surface)

Type of Pump: _____ (submersible, jet, etc.)

Describe the location of the well on your property: _____

What does the well look like? (i.e., is it 6-inch casing with a removable cap, is it covered with a cement tile, does it have a rubber seal within the casing?) _____

_____

_____

APPENDIX C

WATER QUALITY

Informational Water Quality Report

Watercheck w/PO

National Testing Laboratories, Ltd.
Quality Water Analysis
6571 Wilson Mills Rd
Cleveland, Ohio 44143
1-800-458-3330

Client:
Culpeper County

Ordered By:
Emery & Garrett Groundwater Investigations, LLC 56 Main Street PO Box 1578 Meredith, NH 03253

Sample Number: 845027

Location:	CCO-17A
Type of Water:	Well Water
Collection Date and Time:	5/8/2014 07:30
Received Date and Time:	5/9/2014 11:35
Date Completed:	5/21/2014

Metals not filtered
72-hr pumping test

Definition and Legend

This informational water quality report compares the actual test result to national standards as defined in the EPA's Primary and Secondary Drinking Water Regulations.

Primary Standards:	Are expressed as the maximum contaminant level (MCL) which is the highest level of contaminant that is allowed in drinking water. MCLs are enforceable standards.
Secondary standards:	Are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor,or color) in drinking water. Individual states may choose to adopt them as enforceable standards.
Action levels:	Are defined in treatment techniques which are required processes intended to reduce the level of a contaminant in drinking water.
mg/L (ppm):	Unless otherwise indicated, results and standards are expressed as an amount in milligrams per liter or parts per million.
Minimum Detection Level (MDL):	The lowest level that the laboratory can detect a contaminant.
ND:	The contaminant was not detected above the minimum detection level.
NA:	The contaminant was not analyzed.

✓ The contaminant was not detected in the sample above the minimum detection level.

● The contaminant was detected at or above the minimum detection level, but not above the referenced standard.

▲ The contaminant was detected above the standard, which is not an EPA enforceable MCL.

✚ The contaminant was detected above the EPA enforceable MCL.

✖ These results may be invalid.

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
			Inorganic Analytes - Other			
✓	Chloride	ND	mg/L	250	EPA Secondary	5.0
✓	Fluoride	ND	mg/L	4.0	EPA Primary	0.5
✓	Nitrate as N	ND	mg/L	10	EPA Primary	0.5
✓	Nitrite as N	ND	mg/L	1	EPA Primary	0.5
✓	Ortho Phosphate	ND	mg/L	--		2.0
✓	Sulfate	ND	mg/L	250	EPA Secondary	5.0
			Organic Analytes - Trihalomethanes			
✓	Bromodichloromethane	ND	mg/L	--		0.002
✓	Bromoform	ND	mg/L	--		0.004
✓	Chloroform	ND	mg/L	--		0.002
✓	Dibromochloromethane	ND	mg/L	--		0.004
✓	Total THMs	ND	mg/L	0.080	EPA Primary	0.002
			Organic Analytes - Volatiles			
✓	1,1,1,2-Tetrachloroethane	ND	mg/L	--		0.002
✓	1,1,1-Trichloroethane	ND	mg/L	0.2	EPA Primary	0.001
✓	1,1,2,2-Tetrachloroethane	ND	mg/L	--		0.002
✓	1,1,2-Trichloroethane	ND	mg/L	0.005	EPA Primary	0.002
✓	1,1-Dichloroethane	ND	mg/L	--		0.002
✓	1,1-Dichloroethene	ND	mg/L	0.007	EPA Primary	0.001
✓	1,1-Dichloropropene	ND	mg/L	--		0.002
✓	1,2,3-Trichlorobenzene	ND	mg/L	--		0.002
✓	1,2,3-Trichloropropane	ND	mg/L	--		0.002
✓	1,2,4-Trichlorobenzene	ND	mg/L	0.07	EPA Primary	0.002
✓	1,2-Dichlorobenzene	ND	mg/L	0.6	EPA Primary	0.001
✓	1,2-Dichloroethane	ND	mg/L	0.005	EPA Primary	0.001
✓	1,2-Dichloropropane	ND	mg/L	0.005	EPA Primary	0.002
✓	1,3-Dichlorobenzene	ND	mg/L	--		0.001

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
✓	1,3-Dichloropropane	ND	mg/L	--		0.002
✓	1,4-Dichlorobenzene	ND	mg/L	0.075	EPA Primary	0.001
✓	2,2-Dichloropropane	ND	mg/L	--		0.002
✓	2-Chlorotoluene	ND	mg/L	--		0.001
✓	4-Chlorotoluene	ND	mg/L	--		0.001
✓	Acetone	ND	mg/L	--		0.01
✓	Benzene	ND	mg/L	0.005	EPA Primary	0.001
✓	Bromobenzene	ND	mg/L	--		0.002
✓	Bromomethane	ND	mg/L	--		0.002
✓	Carbon Tetrachloride	ND	mg/L	0.005	EPA Primary	0.001
✓	Chlorobenzene	ND	mg/L	0.1	EPA Primary	0.001
✓	Chloroethane	ND	mg/L	--		0.002
✓	Chloromethane	ND	mg/L	--		0.002
✓	cis-1,2-Dichloroethene	ND	mg/L	0.07	EPA Primary	0.002
✓	cis-1,3-Dichloropropene	ND	mg/L	--		0.002
✓	DBCP	ND	mg/L	--		0.001
✓	Dibromomethane	ND	mg/L	--		0.002
✓	Dichlorodifluoromethane	ND	mg/L	--		0.002
✓	Dichloromethane	ND	mg/L	0.005	EPA Primary	0.002
✓	EDB	ND	mg/L	--		0.001
✓	Ethylbenzene	ND	mg/L	0.7	EPA Primary	0.001
✓	Methyl Tert Butyl Ether	ND	mg/L	--		0.004
✓	Methyl-Ethyl Ketone	ND	mg/L	--		0.01
✓	Styrene	ND	mg/L	0.1	EPA Primary	0.001
✓	Tetrachloroethene	ND	mg/L	0.005	EPA Primary	0.002
✓	Tetrahydrofuran	ND	mg/L	--		0.01
✓	Toluene	ND	mg/L	1	EPA Primary	0.001
✓	trans-1,2-Dichloroethene	ND	mg/L	0.1	EPA Primary	0.002

Status	Contaminant	Results	Units	National Standards		Min. Detection Level
✓	trans-1,3-Dichloropropene	ND	mg/L	--		0.002
✓	Trichloroethene	ND	mg/L	0.005	EPA Primary	0.001
✓	Trichlorofluoromethane	ND	mg/L	--		0.002
✓	Vinyl Chloride	ND	mg/L	0.002	EPA Primary	0.001
✓	Xylenes (Total)	ND	mg/L	10	EPA Primary	0.001
	Organic Analytes - Others					
✓	2,4-D	ND	mg/L	0.07	EPA Primary	0.010
✓	Alachlor	ND	mg/L	0.002	EPA Primary	0.001
✓	Aldrin	ND	mg/L	--		0.002
✓	Atrazine	ND	mg/L	0.003	EPA Primary	0.002
✓	Chlordane	ND	mg/L	0.002	EPA Primary	0.001
✓	Dichloran	ND	mg/L	--		0.002
✓	Dieldrin	ND	mg/L	--		0.001
✓	Endrin	ND	mg/L	0.002	EPA Primary	0.0001
✓	Heptachlor	ND	mg/L	0.0004	EPA Primary	0.0004
✓	Heptachlor Epoxide	ND	mg/L	0.0002	EPA Primary	0.0001
✓	Hexachlorobenzene	ND	mg/L	0.001	EPA Primary	0.0005
✓	Hexachlorocyclopentadiene	ND	mg/L	0.05	EPA Primary	0.001
✓	Lindane	ND	mg/L	0.0002	EPA Primary	0.0002
✓	Methoxychlor	ND	mg/L	0.04	EPA Primary	0.002
✓	Pentachloronitrobenzene	ND	mg/L	--		0.002
✓	Silvex 2,4,5-TP	ND	mg/L	0.05	EPA Primary	0.005
✓	Simazine	ND	mg/L	0.004	EPA Primary	0.002
✓	Total PCBs	ND	mg/L	0.0005	EPA Primary	0.0005
✓	Toxaphene	ND	mg/L	0.003	EPA Primary	0.001
✓	Trifluralin	ND	mg/L	--		0.002

Status	Contaminant	Results	Units	National Standards	Min. Detection Level

We certify that the analyses performed for this report are accurate, and that the laboratory tests were conducted by methods approved by the U.S. Environmental Protection Agency or variations of these EPA methods.

These test results are intended to be used for informational purposes only and may not be used for regulatory compliance.

National Testing Laboratories, Ltd.

NATIONAL TESTING LABORATORIES, LTD

TETRA TECH

REPORT: *Giardia* and *Cryptosporidium*

Laboratory EPA ID No. : VT00972

Client Information

Name: Emery & Garrett Groundwater

Address: P. O. Box 1578
Meredith, NH 03253

Report Date: 22 May 2014

Attention: Daniel Tinkham

Sample Information

Lab ID:	214129-1
Sample Site:	CCO - 17A
Filter Type:	Envirochek™ HV
Sample Volume:	5450.4 L
Sample Volume Analyzed:	545 L
Date Sampled:	07-08 May 2014
Date Received:	09 May 2014
*Turbidity Start/End (ntu):	Not Recorded
*pH Start/End:	Not Recorded
Packed Pellet Volume:	0.2 mL

* As reported by the client.

***Giardia* and *Cryptosporidium* Analysis**

Giardia Cysts:	<1/ 545 L
Cryptosporidium Oocysts:	<1/ 545 L

Analyst: SWR

Summary 214129-1 CCO - 17A

The sample was collected with an Envirochek™ HV filter and processed using USEPA Method 1623.

No objects resembling *Giardia* cysts or *Cryptosporidium* oocysts were observed in the sample.

MPA

According to the USEPA Consensus Method the relative risk of surface water contamination for this sample is low. See sample analysis report.

Reviewed by:

Clancy Environmental -a Tetra Tech, Inc. company
20 Mapleville Depot St. Albans, VT 05478
Tel 802.527.2460 Ext: 32 Fax 802.524.3909 www.ttwater.com

ANALYSIS FOR WATERBORNE PARTICULATES

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Invoice 20140181

Customer 20142018
Tetra Tech
20 Mapleville Depot
St. Albans, VT 05478

Laboratory Information
Federal Express; 5/13/2014; 1340 Hrs; 18.6°C; Packed pellet
Results submitted by:
Kenneth Duncan
Laboratory Director 5/21/2014

Sample Identification: 214129-1

Sample Information:

Sample Date & Time: Unrecorded **Sampler:** unrec.

Amount: 2452.7 L **Filter Color:** N/A **Filter Type:** N/A

Date/Time Eluted: **Centrifugate:** N/A

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 290 L

Amorphous Debris	clay (1-2 µm), silt (2-50 µm), sand (50-2000 µm), inorganic precipitate, aggregates
Algae	ND
Diatoms	ND
Plant debris	ND
Rotifers	ND
Nematodes	ND
Pollen (pine)	ND
Ameba	ND
Ciliates	ND
Colorless Flagellates	ND
Crustaceans	ND
Other Arthropods	ND
Other	ND

Giardia and Coccidia are none detected (ND) by MPA unless reported under "Other".

This sample was analyzed for particulates following the Environmental Protection Agency Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA). 1992. USEPA, Port Orchard, WA, EPA 910/9-92-029. All limitations stated in the methods apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, particulate extraction was modified.

COMMENTS: Score: 0-Low Risk per EPA Consensus Method referenced above.

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Warrenton, VA 20186
540-347-7212

JOINER MICRO
LABORATORIES, INC

joinermicrolab.com
info@joinermicrolab.com

JML LAB ID # 127825

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater
ADDRESS: 56 Main Street
P.O. Box 1578
Meredith, NH 03253-1578

PROPERTY: CCO-17A
Culpeper County

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-6-14/1200
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-6-14/1648
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Non-Detectable (tested at lab)
DATE AND TIME OF SAMPLE ANALYSIS: 5-6-14/1702

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM 9223 B-2004 Colilert MPN

RESULTS: MPN < 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*
This result indicates the absence of coliform bacteria.

This water sample **HAS PASSED** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

NELAP ACCREDITED TNI LABORATORY

#460034

77 W Lee St. #202
Warrenton, VA 20186
540-347-7212

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CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P.O. Box 1578
Meredith, NH 03253-1578

PROPERTY: CCO-17A
Culpeper County

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-6-14/1300
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-6-14/1648
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-6-14/1702

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN <1/100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

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540-347-7212

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JML LAB ID # 127827

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater **PROPERTY:** CCO-17A
ADDRESS: 56 Main Street Culpeper County
P.O. Box 1578
Meredith, NH 03253-1578

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-6-14/1400
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-6-14/1648
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-6-14/1703

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM 9223 B-2004 Colilert MPN

RESULTS: MPN < 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*
This result indicates the absence of coliform bacteria.

This water sample **HAS PASSED** the minimum potable water test requirements established by the Virginia Department of Health.

•MPN-Most Probable Number• < - Less than• > - Greater than•

Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

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info@joinermicrolab.com

JML LAB ID # 127828

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater **PROPERTY:** CCO-17A
ADDRESS: 56 Main Street Culpeper County
P.O. Box 1578
Meredith, NH 03253-1578

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-6-14/1500
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-6-14/1648
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-6-14/1703

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM 9223 B-2004 Colilert MPN

RESULTS: MPN < 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*
This result indicates the absence of coliform bacteria.

This water sample **HAS PASSED** the minimum potable water test requirements established by the Virginia Department of Health.

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Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

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CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P.O. Box 1578
Meredith, NH 03253-1578

PROPERTY: CCO-17A
Culpeper County

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-6-14/1600
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-6-14/1648
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-6-14/1704

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN <1/100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

NELAP ACCREDITED TNI LABORATORY

#460034

Form # 53-1 March 12, 2014

CHAIN OF CUSTODY RECORD

Joiner Micro Laboratories, Inc.

77 West Lee Street, #202
Warrenton, Virginia 20186
540-347-7212 Fax 540-347-1606

KEEP SAMPLES ON ICE

BILL TO: EGGI, Inc.
56 Main Street/PO Box 1578
Meredith, NH 03253-1578
Contact: Peter Foster
Phone: 703-297-7548

PROPERTY REFERENCE: Culpeper County

Sample Type Code	Container Code	Preservation Code
DW-Drinking Water	P=Plastic	A= None
WW-Wastewater	G=Glass	B= H_2SO_4
S=Solid	A=Amber	C= NaOH
A= Aqueous	V=VOA Vial	D=HNO_3
		E=HCL
		F=Thio

Results are to be: Mailed ☐ or Picked up at lab ☐ or faxed ☐ _____ or Emailed ☒ peterfoster@eggi.com (Data deliverables via Email will not be mailed unless requested)

SAMPLED BY
Print Name: Peter Foster
Signature: [signature]

ANALYSIS REQUESTED

Shaded areas for lab use only
Date 5-6-14 Analyst DD

Sample ID (Location)	Date/Time of Collection	Sample Type	Grab/ Comp	Number of Containers	LL MPN		Lab ID #	Lab Tracking #	Container Volume (mL)	Container Type	Preservation on arrival	Lot # of Preservative	pH on Arrival (SU)	pH adjusted (SU)/ Preservation code	Lot # of Preservative	Comments (see below)
CCO-17A	5/6/14; 1200	DW		1	X		127825	127825	150	Pster	A	NA				
	1300			1	X		127826	127826	150							
	1400			1	X		127827	127827	150							
	1500			1	X		127828	127828	150							
	1600			1	X		127829	127829	150	Pster	A					

Relinquished By: (Signature) [signature] 5/6/14; 16:45
Received By: (Signature)
Relinquished By: (Signature)
Received By: (Signature)
Lab Receipt By: (Signature) [signature] 05-06-14 16:48 RCVD
Comments
Temp upon receipt <1.0 °C

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Warrenton, VA 20186
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CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/0700
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Non Detectable (tested at Lab)
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1725

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 12, 2014

NELAP ACCREDITED JML LABORATORY

#460034

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Warrenton, VA 20186
540-347-7212

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CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/0800
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1726

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 12, 2014

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ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/0900
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1726

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

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Robyn Joiner
Lab Director
May 12, 2014

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JML LAB ID # 127856

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P.O. Box 1578
Meredith, NH 03253-1578

PROPERTY: CCO-17A
Culpeper County

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-7-14/1000
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-7-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-7-14/1726

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM 9223 B-2004 Colilert MPN

RESULTS: MPN < 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*
This result indicates the absence of coliform bacteria.

This water sample **HAS PASSED** the minimum potable water test requirements established by the Virginia Department of Health.

•MPN-Most Probable Number• < - Less than• > - Greater than•

Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

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540-347-7212

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joinermicrolab.com
info@joinermicrolab.com

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/1100
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1727

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 12, 2014

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#460034

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CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/1200
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1727

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN < 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 12, 2014

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Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/1300
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1727

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: Robyn Joiner
Lab Director
May 12, 2014

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CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/1400
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1728

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 12, 2014

NELAP ACCREDITED TNI LABORATORY

#460034

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JOINER MICRO
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CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/1500
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1728

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 12, 2014

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#460034

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Warrenton, VA 20186
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JOINER MICRO
LABORATORIES INC

joinermicrolab.com
info@joinermicrolab.com

JML LAB ID #127862

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc.
ADDRESS: 56 Main Street
P. O. Box 1578
Meredith, NH 03253-1578

PROPERTY: Culpeper County
CCO-17A

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 05-07-14/1600
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 05-07-14/1644
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 05-07-14/1728

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 2 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

•MPN-Most Probable Number• < - Less than• > - Greater than•

Certified by: _____
Robyn Joiner
Lab Director
May 12, 2014

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#460034

CHAIN OF CUSTODY RECORD

Joiner Micro Laboratories, Inc.
77 West Lee Street, #202
Warrenton, Virginia 20186
540-347-7212 Fax 540-347-1606

KEEP SAMPLES ON ICE

BILL TO: EGGI, Inc.
56 Main Street/PO Box 1578
Meredith, NH 03253-1578
Contact: Peter Foster
Phone: 703-297-7548

PROPERTY REFERENCE: Culpeper County

Sample Type Code	Container Code	Preservation Code
DW-Drinking Water	P=Plastic	A= None
WW-Wastewater	G=Glass	B= H_2SO_4
S=Solid	A=Amber	C= NaOH
A= Aqueous	V=VOA Vial	D=HNO_3
		E=HCL
		F=Thio

Results are to be: Mailed ☐ or Picked up at lab ☐ or faxed ☐ _____ or Emailed ☒ peterfoster@eggi.com
(Data deliverables via Email will not be mailed unless requested)

SAMPLED BY
Print Name: Peter Foster
Signature: Peter Foster

ANALYSIS REQUESTED

Shaded areas for lab use only
Date 5-7-14 Analyst DC

Sample ID (Location)	Date/Time of Collection	Sample Type	Grab/Comp	Number of Containers	LL MPN		Lab ID #	Lab Tracking #	Container Volume (mL)	Container Type	Preservation on arrival	Lot # of Preservative	pH on Arrival (SU)	pH adjusted (SU)/ Preservation code	Lot # of Preservative	Comments (see below)
CCO-17A	5/7/14; 0700	DW	X	1	X		127853	127853	150	Pstc	A	NA				
	0800		X	1	X		127854	127854	150	Pstc	A	NA				
	0900		X	1	X		127855	127855	150	Pstc	A	NA				
	1000		X	1	X		127856	127856	150	Pstc	A	NA				
	1100		X	1	X		127857	127857	150	Pstc	A	NA				
	1200		X	1	X		127858	127858	150	Pstc	A	NA				
	1300		X	1	X		127859	127859	150	Pstc	A	NA				
	1400		X	1	X		127860	127860	150	Pstc	A	NA				
	1500		X	1	X		127861	127861	150	Pstc	A	NA				
	1600		X	1	X		127862	127862	150	Pstc	A	NA				

Relinquished By: (Signature) 5/7/14 1643
Received By: (Signature)
Relinquished By: (Signature)
Received By: (Signature)
Lab Receipt By: (Signature) D. Chapman 05-07-14 16:44 RCVD
Comments
Temp upon receipt < 1.0 °C

77 W Lee St. #202
Warrenton, VA 20186
540-347-7212

JOINER MICRO
LABORATORIES INC

joinermicrolab.com
info@joinermicrolab.com

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc. **PROPERTY:** CCO-17A
ADDRESS: 56 Main Street Culpeper County
P.O. Box 1578
Meredith, NH 03253-1578

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-8-14/0700
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-8-14/1512
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Non Detectable (tested at Lab)
DATE AND TIME OF SAMPLE ANALYSIS: 5-8-14/1639

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 2 /100 mL for Total Coliform Bacteria
MPN <1/100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by:
Robyn Joiner
Lab Director
May 13, 2014

Reported results relate only to the items tested, as received by the laboratory.
The test results in this report meet all NELAC requirements for accredited parameters, unless otherwise noted in this report.
Pursuant to NELAC, this report may not be reproduced except in full, without written consent from Joiner Micro Laboratories.
For questions please contact the Lab Director at the email address listed on this page.

NELAP ACCREDITED TNI LABORATORY

#460034

77 W Lee St. #202
Warrenton, VA 20186
540-347-7212

JOINER MICRO
LABORATORIES INC

joinermicrolab.com
info@joinermicrolab.com

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater, Inc. **PROPERTY:** CCO-17A
ADDRESS: 56 Main Street Culpeper County
P.O. Box 1578
Meredith, NH 03253-1578

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-8-14/0800
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-8-14/1512
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-8-14/1639

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM21 9223 B-2004 Colilert MPN

RESULTS: MPN 4 /100 mL for Total Coliform Bacteria
MPN <1/100 mL for *E. coli*

This water sample **DOES NOT PASS** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

NELAP ACCREDITED TNI LABORATORY

#460034

77 W Lee St. #202
Warrenton, VA 20186
540-347-7212

JOINER MICRO
LABORATORIES INC

joinermicrolab.com
info@joinermicrolab.com

JML LAB ID # 127899

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater **PROPERTY:** CCO-17A
ADDRESS: 56 Main Street Culpeper County
P.O. Box 1578
Meredith, NH 03253-1578

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-8-14/1000
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-8-14/1512
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-8-14/1639

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM 9223 B-2004 Colilert MPN

RESULTS: MPN < 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*
This result indicates the absence of coliform bacteria.

This water sample **HAS PASSED** the minimum potable water test requirements established by the Virginia Department of Health.

♦MPN-Most Probable Number♦ < - Less than♦ > - Greater than♦

Certified by: _____
Robyn Joiner
Lab Director
May 13, 2014

NELAP ACCREDITED TNI LABORATORY

#460034

77 W Lee St. #202
Warrenton, VA 20186
540-347-7212

JOINER MICRO
LABORATORIES INC

joinermicrolab.com
info@joinermicrolab.com

CERTIFICATE OF ANALYSIS

NAME: Emery & Garrett Groundwater **PROPERTY:** CCO-17A
ADDRESS: 56 Main Street Culpeper County
P.O. Box 1578
Meredith, NH 03253-1578

SAMPLE SOURCE: Well
SAMPLE LOCATION: CCO-17A
DATE AND TIME SAMPLE COLLECTED: 5-8-14/1200
SAMPLE COLLECTED BY: Peter Foster
SAMPLE RECEIVED FROM: Peter Foster
DATE AND TIME SAMPLE RECEIVED IN LAB: 5-8-14/1512
SAMPLE CONTAINER: Sterile Plastic Container supplied by JML
CHLORINE SCREEN: Not Applicable
DATE AND TIME OF SAMPLE ANALYSIS: 5-8-14/1640

TESTS REQUESTED: TOTAL COLIFORM BACTERIA

METHOD OF ANALYSIS: SM 9223 B-2004 Colilert MPN

RESULTS: MPN < 1 /100 mL for Total Coliform Bacteria
MPN < 1 /100 mL for *E. coli*
This result indicates the absence of coliform bacteria.

This water sample **HAS PASSED** the minimum potable water test requirements established by the Virginia Department of Health.

•MPN-Most Probable Number• < - Less than• > - Greater than•

Certified by: Robyn Joiner
Robyn Joiner
Lab Director
May 13, 2014

NELAP ACCREDITED TNI LABORATORY

#460034

CHAIN OF CUSTODY RECORD

Joiner Micro Laboratories, Inc.
77 West Lee Street, #202
Warrenton, Virginia 20186
540-347-7212 Fax 540-347-1606

KEEP SAMPLES ON ICE

BILL TO: EGGI, Inc.
56 Main Street/PO Box 1578
Meredith, NH 03253-1578
Contact: Peter Foster
Phone: 703-297-7548

PROPERTY REFERENCE
Culpeper County

Sample Type Code	Container Code	Preservation Code
DW-Drinking Water	P=Plastic	A= None
WW-Wastewater	G=Glass	B= H_2SO_4
S=Solid	A=Amber	C= NaOH
A= Aqueous	V=VOA Vial	D=HNO_3
		E=HCL
		F=Thio

Results are to be: Mailed ☐ or Picked up at lab ☐ or faxed ☐ _____ or Emailed ☒ peterfoster@eggi.com
(Data deliverables via Email will not be mailed unless requested)

SAMPLED BY
Print Name: Peter Foster
Signature: [signature]

ANALYSIS REQUESTED

Shaded areas for lab use only
Date 5-8-14 Analyst [initials]

Sample ID (Location)	Date/Time of Collection	Sample Type	Grab/Comp	Number of Containers	LL MPN		Lab ID #	Lab Tracking #	Container Volume (mL)	Container Type	Preservation on arrival	Lot # of Preservative	pH on Arrival (SU)	pH adjusted (SU)/ Preservation code	Lot # of Preservative	Comments (see below)
CCO-17A	5/8/14; 0700	DW	X	1	X		127897	127897	150	Pstr	A	NA				
	0800		X	1	X		127898	127898	150	Pstr	A	NA				
	1000		X	1	X		127898	127899	150	Pstr	A	NA				
	1100		X	1	X		127906	127900	150	Pstr	A	NA				
	1200		X	1	X		127901	127901	150	Pstr	A	NA				

Relinquished By: (Signature) [signature] 5/8/14; 1510
Received By: (Signature)
Relinquished By: (Signature)
Received By: (Signature)
Lab Receipt By: (Signature) [signature] 05-08-14 15:12 RCVD
Comments
Temp upon receipt ≤1.0 °C

Commonwealth of Virginia
Division of Consolidated Laboratory Services
600 North 5th St.
Richmond, Virginia 23219
804-648-4480

DCLS

REPORT OF ANALYSIS

Report Date: 05/22/2014
DCLS LIMS #: E140301187

Mail To

CULPEPER CO ENVIRO SERV-WELL CCO-17A
118 W DAVIS ST STE 101
CULPEPER, VA 22701

ATTN: PAUL HOWARD JR

PWSID 7600373
REGION 7

Sample Information

DATE RECEIVED	05/08/2014 15:38	**LOCATION**	WELL CCO-17A CULPEPER CO
SAMPLING DATE	05/08/2014 07:30	**FACILITY**	WL130
COLLECTED BY	PETER FOSTER	**COMPLIANCE**	Y
SAMPLE MATRIX	DRINKING WATER	**TYPE**	SP
ORDERED TEST	206-004 NO2/NO3	**CATEGORY**	GE
PROJECT NAME	DW2014-Q1	**ORDER NUMBER**	90023303

Test Results

APPROVED BY: JARMSTRONG, Scientist Senior **DATE APPROVED:** 05/22/2014

METHOD	PARAMETER	RESULT	PMCL	SMCL	ANALYSIS DATE
EPA 353.2	Nitrate + Nitrite	0.17 mg/L	10		05/21/2014 14:00

Explanation of Terms and Disclaimers

PMCL is defined as the "Primary Maximum Contaminant Level." SMCL is defined as the "Secondary Maximum Contaminant Level". If blank, level not defined by EPA. Results denoted with an asterisk (*) indicate that the PMCL is exceeded. Test Results meet all requirements of NELAC. Non-NELAC accredited analyses noted by ^^. The results included on this report relate only to this specific sample and not to other samples tested from this sampling location.

Commonwealth of Virginia
Division of Consolidated Laboratory Services
600 North 5th St.
Richmond, Virginia 23219
804-648-4480

DCLS

REPORT OF ANALYSIS

Report Date: 05/21/2014
DCLS LIMS #: E140301188

Mail To

CULPEPER CO ENVIRO SERV-WELL CCO-17A
118 W DAVIS ST STE 101
CULPEPER, VA 22701

ATTN: PAUL HOWARD JR

PWSID 7600373
REGION 7

Sample Information

DATE RECEIVED	05/08/2014 15:38	**LOCATION**	WELL CCO-17A CULPEPER CO
SAMPLING DATE	05/08/2014 07:30	**FACILITY**	WL130
COLLECTED BY	PETER FOSTER	**COMPLIANCE**	Y
SAMPLE MATRIX	DRINKING WATER	**TYPE**	SP
ORDERED TEST	206-005 NITRITE	**CATEGORY**	GE
PROJECT NAME	DW2014-Q1	**ORDER NUMBER**	90023303

Test Results

APPROVED BY: CMORTON, Scientist Senior DATE APPROVED: 05/21/2014

METHOD	PARAMETER	RESULT	PMCL	SMCL	ANALYSIS DATE
EPA 300.0	Nitrite as N	< 0.05 mg/L			05/09/2014 09:29

Explanation of Terms and Disclaimers

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Commonwealth of Virginia
Division of Consolidated Laboratory Services
600 North 5th St.
Richmond, Virginia 23219
804-648-4480

DCLS

REPORT OF ANALYSIS

Report Date: 05/27/2014
DCLS LIMS #: E140301186

Mail To

CULPEPER CO ENVIRO SERV-WELL CCO-17A
118 W DAVIS ST STE 101
CULPEPER, VA 22701

ATTN: PAUL HOWARD JR

PWSID 7600373
REGION 7

Sample Information

DATE RECEIVED	05/08/2014 15:38	LOCATION	WELL CCO-17A CULPEPER CO
SAMPLING DATE	05/08/2014 07:30	FACILITY	WL130
COLLECTED BY	PETER FOSTER	COMPLIANCE	Y
SAMPLE MATRIX	DRINKING WATER	TYPE	SP
ORDERED TEST	206-094 DW-METALS	CATEGORY	GE
PROJECT NAME	DW2014-Q1	ORDER NUMBER	90023303

Test Results

APPROVED BY: MMOUER, Scientist Senior DATE APPROVED: 05/27/2014

METHOD	PARAMETER	RESULT	PMCL	SMCL	ANALYSIS DATE
EPA 200.7					
	Iron	< 0.05 ppm		0.3	05/23/2014
	Sodium	9.06 ppm			05/23/2014
	Silver	< 0.01 ppm		0.10	05/23/2014
EPA 200.8					
	Beryllium	< 0.002 ppm	0.004		05/21/2014
	Aluminum	< 0.05 ppm		0.05 - 0.2	05/21/2014
	Chromium	< 0.01 ppm	0.1		05/21/2014
	Manganese	0.083 ppm		0.05	05/21/2014
	Nickel	< 0.01 ppm			05/21/2014
	Copper	< 0.010 ppm	1.3		05/21/2014
	Zinc	0.010 ppm		5	05/21/2014
	Arsenic	< 0.002 ppm	0.010		05/21/2014
	Selenium	< 0.01 ppm	0.05		05/21/2014
	Cadmium	< 0.002 ppm	0.005		05/21/2014
	Antimony	< 0.002 ppm	0.006		05/21/2014
	Barium	0.028 ppm	2		05/21/2014
	Mercury	< 0.0002 ppm	0.002		05/21/2014
	Thallium	< 0.002 ppm	0.002		05/21/2014
	Lead	< 0.002 ppm	0.015		05/21/2014

Explanation of Terms and Disclaimers

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Commonwealth of Virginia
Division of Consolidated Laboratory Services
600 North 5th St.
Richmond, Virginia 23219
804-648-4480

DCLS

REPORT OF ANALYSIS

Report Date: 05/29/2014
DCLS LIMS #: E140301185

Mail To

CULPEPER CO ENVIRO SERV-WELL CCO-17A
118 W DAVIS ST STE 101
CULPEPER, VA 22701

ATTN: PAUL HOWARD JR

PWSID 7600373
REGION 7

Sample Information

DATE RECEIVED	05/08/2014 15:38	LOCATION	WELL CCO-17A CULPEPER CO
SAMPLING DATE	05/08/2014 07:30	FACILITY	WL130
COLLECTED BY	PETER FOSTER	COMPLIANCE	Y
SAMPLE MATRIX	DRINKING WATER	TYPE	SP
ORDERED TEST	206-095 INORGANICS	CATEGORY	GE
PROJECT NAME	DW2014-Q1	ORDER NUMBER	90023303

Test Results

APPROVED BY: CMORTON Scientist Senior DATE APPROVED: 05/29/2014

METHOD	PARAMETER	RESULT	PMCL	SMCL	ANALYSIS DATE
EPA 300.0					
	Chloride	< 5.0 mg/L		250	05/09/2014 10:29
	Sulfate	< 5.0 mg/L		250	05/09/2014 10:29
	Ortho Phosphate as P	< 0.05 mg/L			05/09/2014 10:29
SM 2320B/4500H+B					
	Alkalinity, Total	105 mg/L			05/15/2014 08:49
	pH @21.00 °C	7.07 S.U.		6.5 - 8.5	05/15/2014 08:49
	PARAMETER QUALIFIER: Sample processed out of holding time. Result bias unknown.				
SM 2510B					
	Specific Conductance	228 µmhos/cm			05/20/2014 13:48
SM 2540C					
	Total Dissolved Solids	134 mg/L		500	05/20/2014 14:00
380-75 WE					
	FLUORIDE	0.28 ppm	4	2	05/13/2014 22:00
SM 2120 B					
	Color-PCU @ pH 7.6	< 5 PCU		15	05/10/2014 16:00
SM 2130 B					
	Turbidity	0.12 NTU			05/09/2014 11:11
SM 2330B					
	Aggressive Index	11.0 AI			05/28/2014 16:46
ASTM D6919/SM 2340 B					
	Calcium Hardness	78 mg/L			05/14/2014 11:13
	Hardness-Total	94 mg/L			05/14/2014 11:13

Explanation of Terms and Disclaimers

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Commonwealth of Virginia
Division of Consolidated Laboratory Services
600 North 5th St.
Richmond, Virginia 23219
804-648-4480

DCLS

REPORT OF ANALYSIS

Report Date: 05/14/2014
DCLS LIMS #: E140301195

Mail To

CULPEPER CO ENVIRO SERV-WELL CCO-17A
118 W DAVIS ST STE 101
CULPEPER, VA 22701

ATTN: PAUL HOWARD JR

PWSID 7600373
REGION 7

Sample Information

DATE RECEIVED	05/08/2014 15:38	**LOCATION**	WELL CCO-17A CULPEPER CO
SAMPLING DATE	05/08/2014 07:30	**FACILITY**	WL130
COLLECTED BY	PETER FOSTER	**COMPLIANCE**	Y
SAMPLE MATRIX	DRINKING WATER	**TYPE**	SP
ORDERED TEST	206-101 M524	**CATEGORY**	GE
PROJECT NAME	DW2014-Q1	**ORDER NUMBER**	90023303

Test Results

APPROVED BY: TPAYNE, Scientist Senior **DATE APPROVED:** 05/14/2014

METHOD	PARAMETER	RESULT	PMCL	SMCL	ANALYSIS DATE
EPA 524.2					
	Vinyl Chloride	< 0.50 ppb	2		05/09/2014
	1,1-Dichloroethene	< 0.50 ppb	7		05/09/2014
	Methylene Chloride	< 0.50 ppb	5		05/09/2014
	trans-1,2-Dichloroethene	< 0.50 ppb	100		05/09/2014
	Methyl tert-Butyl Ether	< 5.0 ppb			05/09/2014
	cis-1,2-Dichloroethene	< 0.50 ppb	70		05/09/2014
	Chloroform	< 0.50 ppb			05/09/2014
	1,2-Dichloroethane	< 0.50 ppb	5		05/09/2014
	1,1,1-Trichloroethane	< 0.50 ppb	200		05/09/2014
	Carbon Tetrachloride	< 0.50 ppb	5		05/09/2014
	Benzene	< 0.50 ppb	5		05/09/2014
	1,2-Dichloropropane	< 0.50 ppb	5		05/09/2014
	Trichloroethene	< 0.50 ppb	5		05/09/2014
	Bromodichloromethane	< 0.50 ppb			05/09/2014
	1,1,2-Trichloroethane	< 0.50 ppb	5		05/09/2014
	Toluene	< 0.50 ppb	1000		05/09/2014
	Dibromochloromethane	< 0.50 ppb			05/09/2014
	Tetrachloroethylene	< 0.50 ppb	5		05/09/2014
	Chlorobenzene	< 0.50 ppb	100		05/09/2014
	Ethylbenzene	< 0.50 ppb	700		05/09/2014
	Bromoform	< 0.50 ppb			05/09/2014
	Styrene	< 0.50 ppb	100		05/09/2014
	p-Dichlorobenzene	< 0.50 ppb	75		05/09/2014
	o-Dichlorobenzene	< 0.50 ppb	600		05/09/2014
	1,2,4-Trichlorobenzene	< 0.50 ppb	70		05/09/2014
	Total Xylenes	< 0.50 ppb	10000		05/09/2014

Explanation of Terms and Disclaimers

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Commonwealth of Virginia
Division of Consolidated Laboratory Services
600 North 5th St.
Richmond, Virginia 23219
804-648-4480

DCLS

REPORT OF ANALYSIS

Report Date: 05/29/2014
DCLS LIMS #: E140301191

Mail To

CULPEPER CO ENVIRO SERV-WELL CCO-17A
118 W DAVIS ST STE 101
CULPEPER, VA 22701

ATTN: PAUL HOWARD JR

PWSID 7600373
REGION 7

Sample Information

DATE RECEIVED	05/08/2014 15:38	**LOCATION**	WELL CCO-17A CULPEPER CO
SAMPLING DATE	05/08/2014 07:30	**FACILITY**	WL130
COLLECTED BY	PETER FOSTER	**COMPLIANCE**	Y
SAMPLE MATRIX	DRINKING WATER	**TYPE**	SP
ORDERED TEST	206-103 HERBICIDE	**CATEGORY**	GE
PROJECT NAME	DW2014-Q1	**ORDER NUMBER**	90023303

Test Results

APPROVED BY: P LOGAN Scientist Senior DATE APPROVED: 05/29/2014

METHOD	PARAMETER	RESULT	PMCL	SMCL	ANALYSIS DATE
EPA 515.3					
	Dalapon	< 3.0 ppb	200		05/21/2014
	2,4-D	< 1.0 ppb	70		05/21/2014
	Pentachlorophenol	< 0.1 ppb	1		05/21/2014
	Silvex	< 1.0 ppb	50		05/21/2014
	Dinoseb	< 1.0 ppb	7		05/21/2014
	Picloram	< 1.0 ppb	500		05/21/2014

Explanation of Terms and Disclaimers

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Commonwealth of Virginia
Division of Consolidated Laboratory Services
600 North 5th St.
Richmond, Virginia 23219
804-648-4480

DCLS

REPORT OF ANALYSIS

Report Date: 06/26/2014
DCLS LIMS #: E140301189

Mail To

CULPEPER CO ENVIRO SERV-WELL CCO-17A
118 W DAVIS ST STE 101
CULPEPER, VA 22701

ATTN: PAUL HOWARD JR

PWSID 7600373
REGION 7

Sample Information

DATE RECEIVED	05/08/2014 15:38	**LOCATION**	WELL CCO-17A CULPEPER CO
SAMPLING DATE	05/08/2014 07:30	**FACILITY**	WL130
COLLECTED BY	PETER FOSTER	**COMPLIANCE**	Y
SAMPLE MATRIX	DRINKING WATER	**TYPE**	SP
ORDERED TEST	206-074 RADILOGIC	**CATEGORY**	GE
PROJECT NAME	DW2014-Q1	**ORDER NUMBER**	90023303

Test Results

APPROVED BY: PMA Scientist Senior DATE APPROVED: 06/26/2014

METHOD	PARAMETER	RESULT	PMCL	SMCL	ANALYSIS DATE
EPA 900.0					
	Alpha, Gross	9.0 ± 1.1 pCi/L	15		06/06/2014
	Beta, Gross	10.2 ± 1.1 pCi/L			06/06/2014
EPA 904.0					
	Radium-228	2.8 ± 0.6 pCi/L	5		06/18/2014
EPA 903.0					
	Radium-226	4.5 ± 0.72 pCi/L	5		06/25/2014

5 pCi/L PMCL is the sum of Ra-228 and Ra-226.

Explanation of Terms and Disclaimers

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PLATE

FIGURE 1

Proposed Production Well CCO-17A
and Groundwater Monitoring Locations
Culpeper County, Virginia

Guinn
Cherry Valley Road
Tapscott
Bobbitt
Hill 1
Ohleger
Hill 2
Strickland
Howard
Proposed Production Well CCO-17A
CCO-17B
Cave
Kern
Kern Spring
Jones
Brown
Farnam
Bowler
JMAR
Woodson
Mills

Legend

- Proposed Production Well
- Exploratory Test Well
- Domestic Well Monitored
- Spring
- Culpeper County Parcels

N

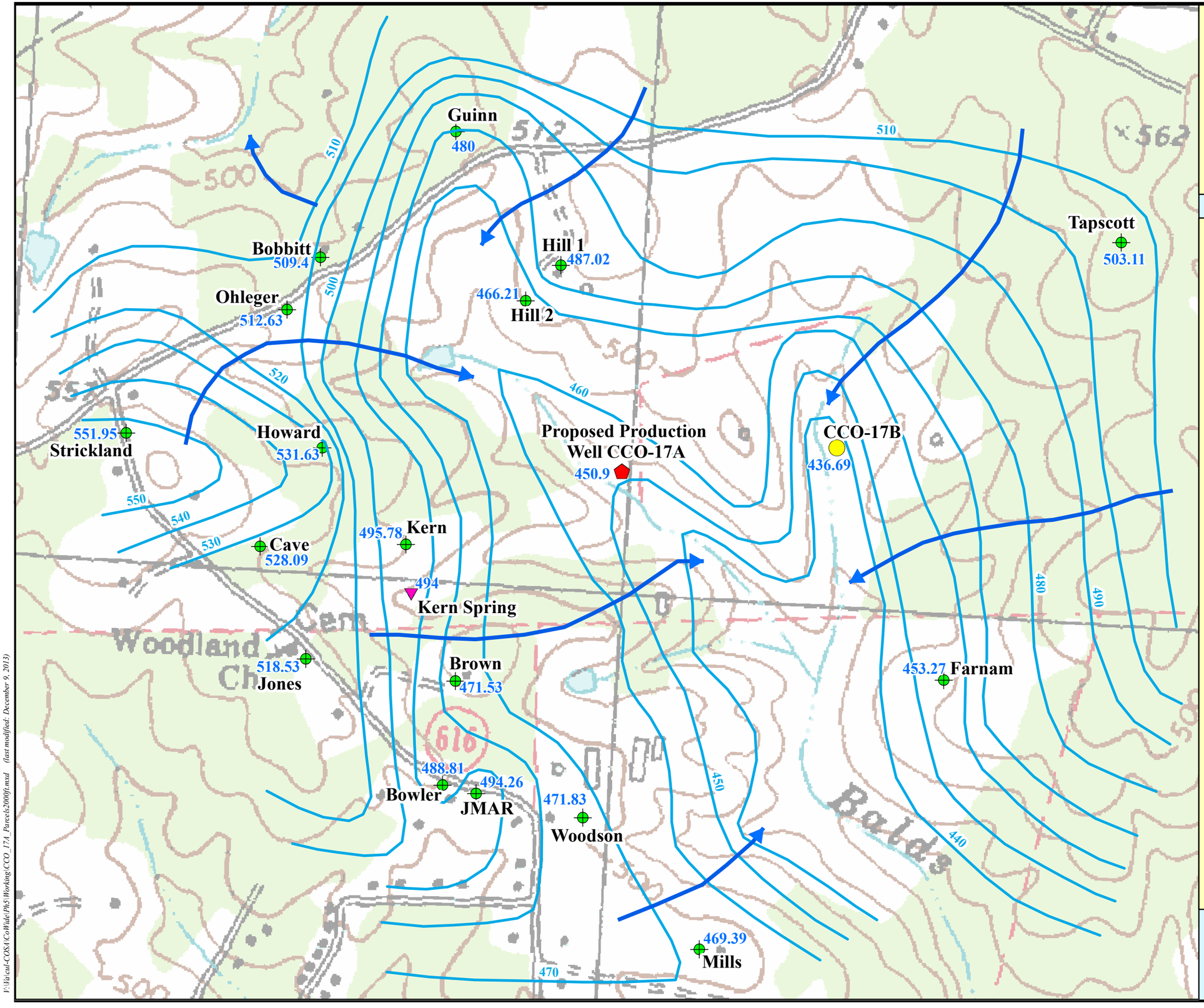
Scale is 1:6,000
1 inch = 500 feet

FIGURE 1
Emery & Garrett Groundwater Investigations, LLC

V:\Vacul-COSA\CoWide\Ph5\Working\CCO_17A_Parcels2000ft.mxd (last modified: December 9, 2013)

FIGURE 2

Proposed Production Well CCO-17A,
Groundwater Monitoring Locations, and
Pre-Pumping Groundwater
Elevation Contours
Culpeper County, Virginia



Legend

- Groundwater Flowpaths
- Groundwater Contours *Based on Pre-Pumping Groundwater Levels*
- Proposed Production Well
- Exploratory Test Well
- Domestic Well Monitored
- Spring

N

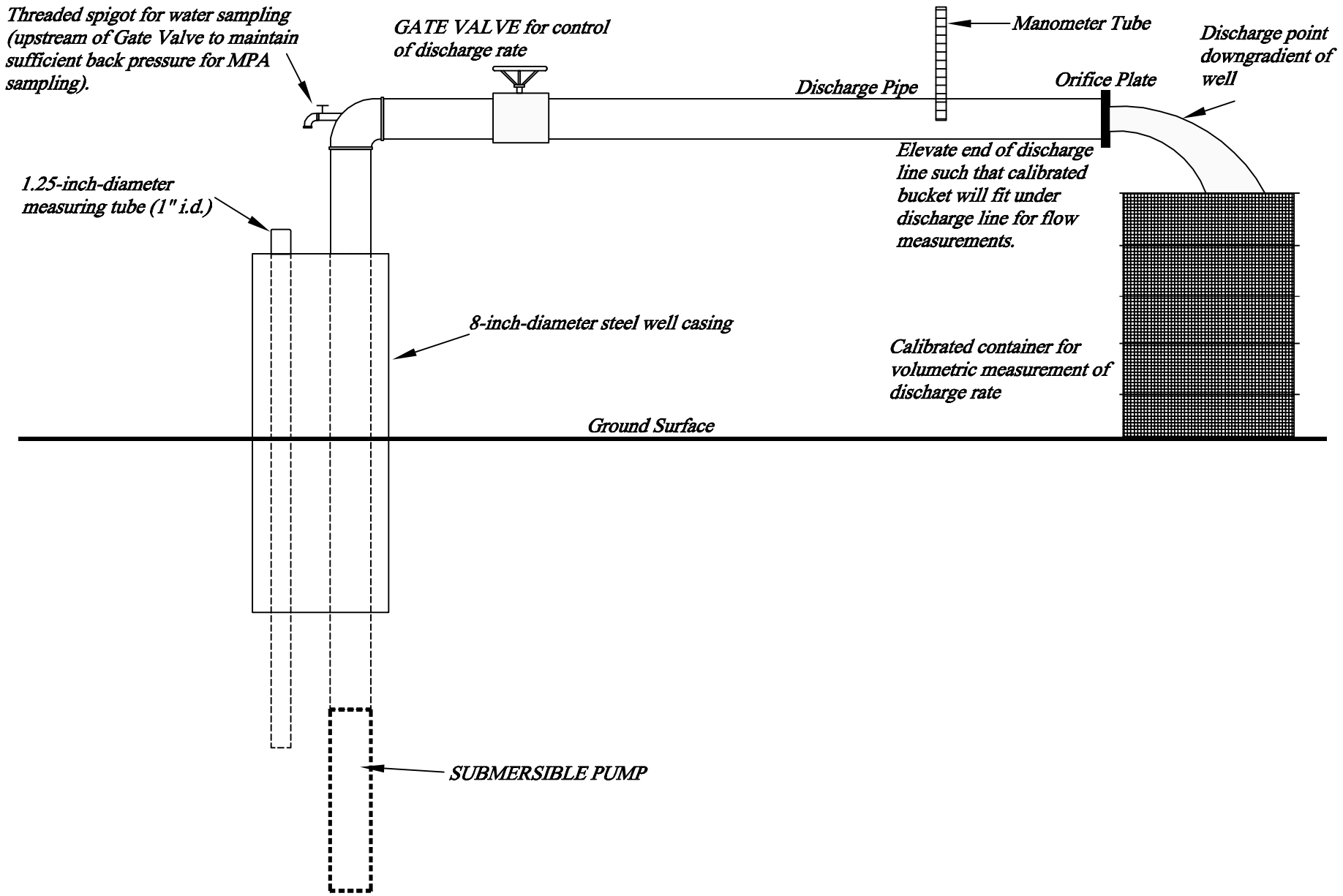
Scale is 1:6,000
1 inch = 500 feet

FIGURE 2

Emery & Garrett Groundwater Investigations, LLC

V:\Vaculi-COSA\CoWide\Ph5 Working\CCO_17A_Parcels2000ft.mxd (last modified: December 9, 2013)

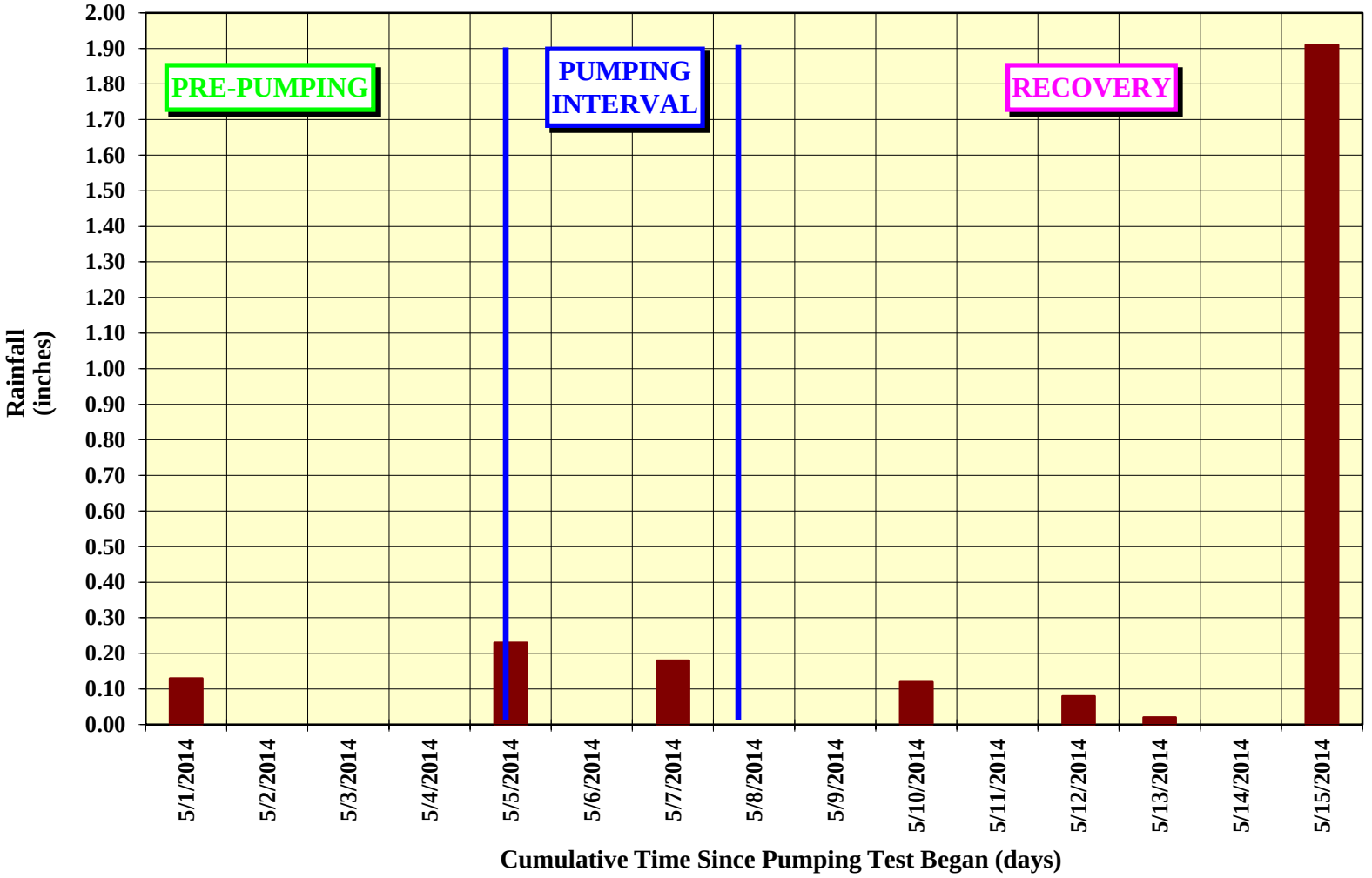
Figure 3 -- Schematic of the Wellhead Design for the Proposed Production Well CCO-17A Pumping Test



Emery & Garrett Groundwater Investigations, LLC

FIGURE 3

Figure 4 - Rainfall as Reported at Washington Dulles Airport, Virginia



Plot of Rainfall versus Time for May 1 to May 15, 2014

Assessment to Develop a Public Water Supply Well Near the Laurel Valley Landfill
Culpeper County, Virginia

FIGURE 5

Response From Landowners Contacted For Groundwater Monitoring Program
Culpeper County, Virginia

Parcel Legend

- 2,000-Foot Buffer Around Well CCO-17A
- Landowners That Granted Permission To Monitor Well
- Landowners That Granted Permission To Monitor Well - Well Not Accessible
- Landowners That Did Not Respond To Groundwater Monitoring Letter.
- Landowner Outside of Contact Area Who Requested Well be Monitored
- Tax Lot Boundaries as listed by Culpeper County

Well Legend

- Proposed Production Well
- Exploratory Test Well
- Domestic Well
- Spring

Guinn
Bobbitt
Hill 1
Hill 2
Ohleger
Tapscott
Strickland
39A
Howard
Proposed Production Well CCO-17A
CCO-17B
Kern
Cave
Kern Spring
Jones
Brown
Farnam
Bowler
JMAR
Woodson
Mills

N

Scale is 1:6,000
1 inch = 500 feet

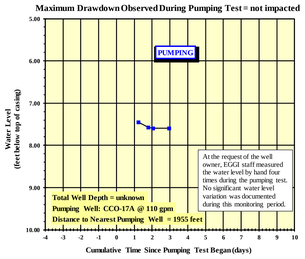
V:\Vaicul-COS\ACoWide\Ph5 Working\CCO_17A_Parcels2000ft.mxd (last modified: December 9, 2013)

FIGURE 5
Emery & Garrett Groundwater Investigations, LLC

PLATE 1 — RESULTS OF THE LONG-TERM PUMPING TEST CONDUCTED ON PROPOSED PRODUCTION WELL CCO-17A, CULPEPER COUNTY, VIRGINIA

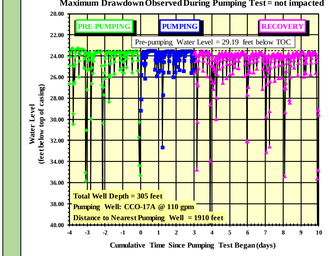
Domestic Wells - Not Impacted

Bobbitt Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



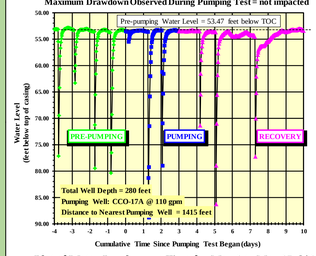
Plot of Water Level versus Time for May 1 to May 15, 2014

Bowler Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



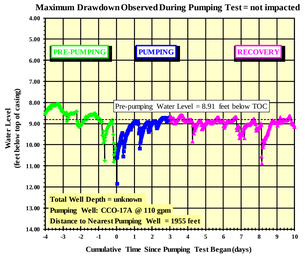
Plot of Water Level versus Time for May 1 to May 15, 2014

Brown Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



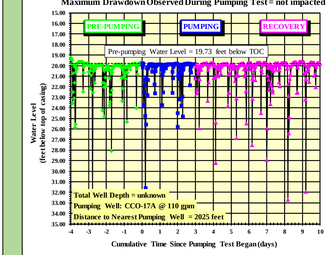
Plot of Water Level versus Time for May 1 to May 15, 2014

Cave Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



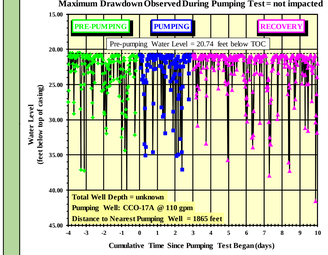
Plot of Water Level versus Time for May 1 to May 15, 2014

Farnam Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



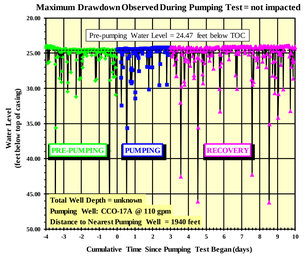
Plot of Water Level versus Time for May 1 to May 15, 2014

JMAR Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



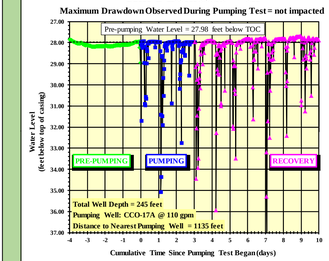
Plot of Water Level versus Time for May 1 to May 15, 2014

Jones Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



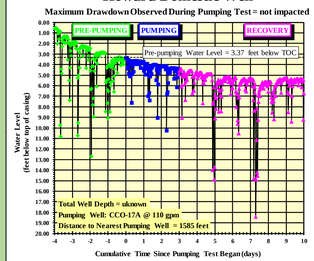
Plot of Water Level versus Time for May 1 to May 15, 2014

Hill 1 Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



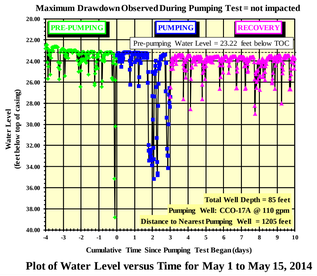
Plot of Water Level versus Time for May 1 to May 15, 2014

Howard Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



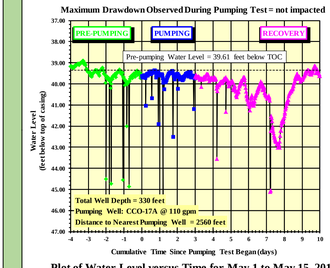
Plot of Water Level versus Time for May 1 to May 15, 2014

Kern Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



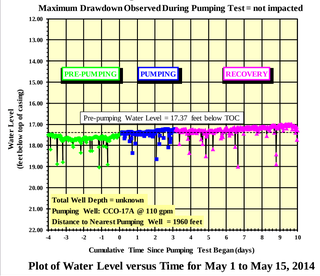
Plot of Water Level versus Time for May 1 to May 15, 2014

Mills Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



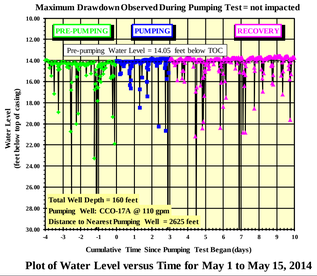
Plot of Water Level versus Time for May 1 to May 15, 2014

Ohleger Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



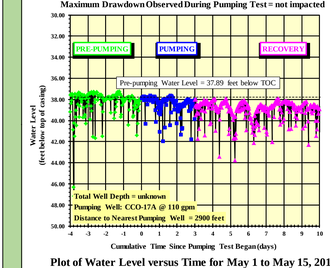
Plot of Water Level versus Time for May 1 to May 15, 2014

Strickland Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



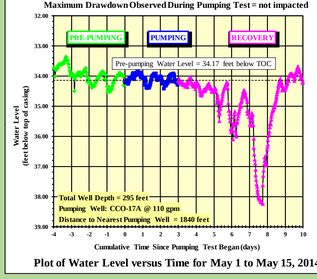
Plot of Water Level versus Time for May 1 to May 15, 2014

Tapscott Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



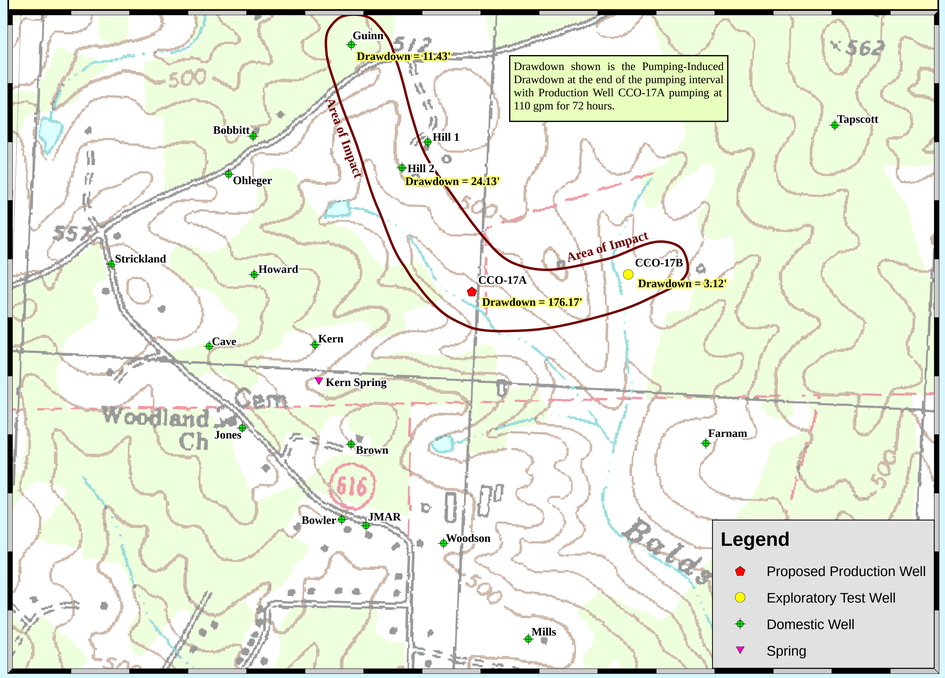
Plot of Water Level versus Time for May 1 to May 15, 2014

Woodson Domestic Well
Maximum Drawdown Observed During Pumping Test = not impacted



Plot of Water Level versus Time for May 1 to May 15, 2014

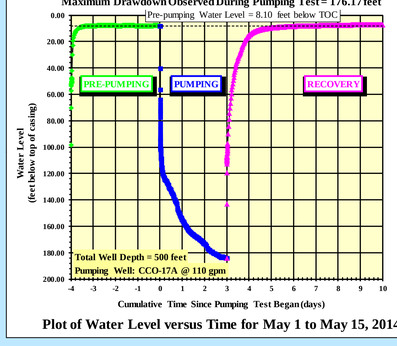
A) LOCATION OF MONITORING WELLS AND PUMPING-INDUCED IMPACTS



USGS Topographic quadrangle map base.
UTM Zone 18N, NAD 27, meters.
Topographic contours interval: 10 feet.

Proposed Production Wells

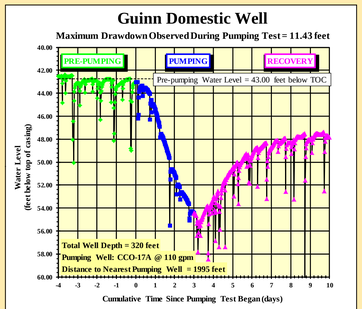
Proposed Production Well CCO-17A
Maximum Drawdown Observed During Pumping Test = 176.17 feet



Plot of Water Level versus Time for May 1 to May 15, 2014

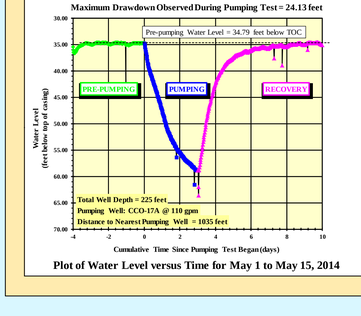
Impacted Domestic Wells

Guinn Domestic Well
Maximum Drawdown Observed During Pumping Test = 11.43 feet



Plot of Water Level versus Time for May 1 to May 15, 2014

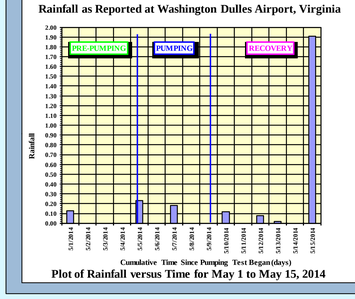
Hill 2 Domestic Well
Maximum Drawdown Observed During Pumping Test = 24.13 feet



Plot of Water Level versus Time for May 1 to May 15, 2014

Climate Data

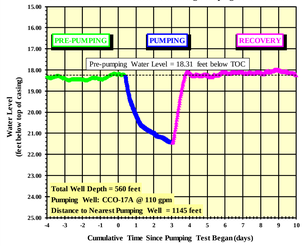
Rainfall as Reported at Washington Dulles Airport, Virginia



Plot of Rainfall versus Time for May 1 to May 15, 2014

Exploratory Test Well

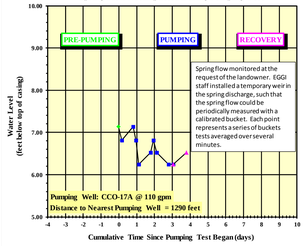
Monitoring Well CCO-17B
Maximum Drawdown Observed During Pumping Test = 3.12 feet



Plot of Water Level versus Time for May 1 to May 15, 2014

Spring

Kern Spring Flow
Spring Flow Not Impacted During Pumping Test



Plot of Water Level versus Time for May 1 to May 15, 2014

PLATE 1
HYDROGEOLOGIC INVESTIGATION RESULTS
CULPEPER COUNTY, VIRGINIA

RESULTS OF THE LONG-TERM PUMPING TEST CONDUCTED ON PROPOSED PRODUCTION WELL CCO-17A

Emery & Garrett Groundwater Investigations
Groundwater Exploration, Development, and Protection
South Atlantic — Mid Atlantic — Northeast

August 2014 — V:\Excel-CO\SA\Culpeper\PhS\Working\GIS\CCO_17A_PT_Plate1.mxd (last modified 8/20/2014) — VA0105993