

Joanna Phalen

Water Well Design

Susquehanna County, PA.
July 2021



CALL BEFORE YOU DIG!
PENNSYLVANIA LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE - STOP CALL
POCS SERIAL NUMBER
PA 1
SYSTEM, INC.
1-800-242-1776
20212023420

Prepared by Edward T. Vint Date 07/2021

Approved by Andrew Wodehouse 8/2021 Date _____

WATER WELL

OPERATION AND MAINTENANCE

Joanna Phalen

July 2021

Note: This plan and the well design package should be kept on file by the owner with the well construction records. Any problems with the well shall be documented and filed with this plan. As a minimum, list the identified problem, corrective action taken, date, and specific capacity (yield per unit drawdown) of well before and after corrective action was taken.

Many things can reduce the output of a producing well. The owner can do some things to maintain an effective well, but some things are beyond his control. A producing well may fail completely or its output may decrease so that it is uneconomical to continue its use. Well failure is generally a result of continued sand pumping until the well caves in, the collapse of the well casing from corrosion, or pumping the aquifer dry. A decrease in the well discharge is usually due to a lowering of the water table; encrustation on the well screen or perforations; settlement of fine aquifer materials in the gravel pack; or wearing of the pump, motor, or both, so that the pumping efficiency is decreased. There is no treatment for a falling water table except to use a pumping rate or cycle that allows the water table to be recharged as rapidly as water is withdrawn.

Follow manufactures instructions and recommendations for pump operation and maintenance. Keep all pump information such as specification sheets, performance curves, parts lists, etc. with this plan.

Encrustation of screen stoppage is caused primarily by deposit of chemicals such as carbonates of calcium or magnesium, deposit of soil materials such as clays or silts, and the presence of iron, bacteria, or slime forming organisms in the water. There is no foolproof prevention for most chemical encrustation. Pumping at less than maximum drawdown, however, reduces it. The chemistry of well corrosion and encrustation is complex. Detailed information on treating wells is available through commercial well-screen companies and chemical supply houses.

Where encrustation is a problem, periodic cleaning by a reliable and experienced well servicer may be necessary. The well should be cleaned before the yield is reduced seriously. Various acids are used to treat wells, depending on the type of encrustation, but any well so treated must have an acid-resistant screen.

Keep livestock fence away from the well head.

Maintain surface water controls to divert water away from well.

Keep setback distances in mind for future expansion from potential contaminant sources to well.

Water Quality Testing

It is recommended to test the quality of well water soon after installation and occasionally thereafter. Sampling and testing shall comply with all applicable federal, state, and local requirements.

Disinfection

Wells shall be disinfected immediately following their construction or repair to neutralize any contamination from equipment, material, or surface drainage introduced during construction or repair. The disinfection process shall comply with local or state requirements.

Contact the Bloomsburg Field Office if there are any problems or concerns.

Natural Resources Conservation Service
702 Sawmill Road
Bloomsburg, PA 17815
Phone: 570-784-1062

WELL

(Animal Watering System)

Joanna Phalen
Susquehanna County
July 2021

Narrative.

This system is being installed under an EQIP and Growing Greener contract. Ms. Phalen is interested in installing a watering system on her property. She would like the well to be drilled on the east side, at the top of the hill, of her pasture. A more exact location will be provided before installation. A high yield well is desired.

A livestock watering system is planned to provide water for 21 beef cattle. The well yield will determine if the watering system design is adequate as is. This design was completed by NRCS staff in the Mayfield Field Office.

A PA One Call for final design was completed on 07/21/2021. Installation of the well shall not start until a PA One Call is made for construction and response has been provided.

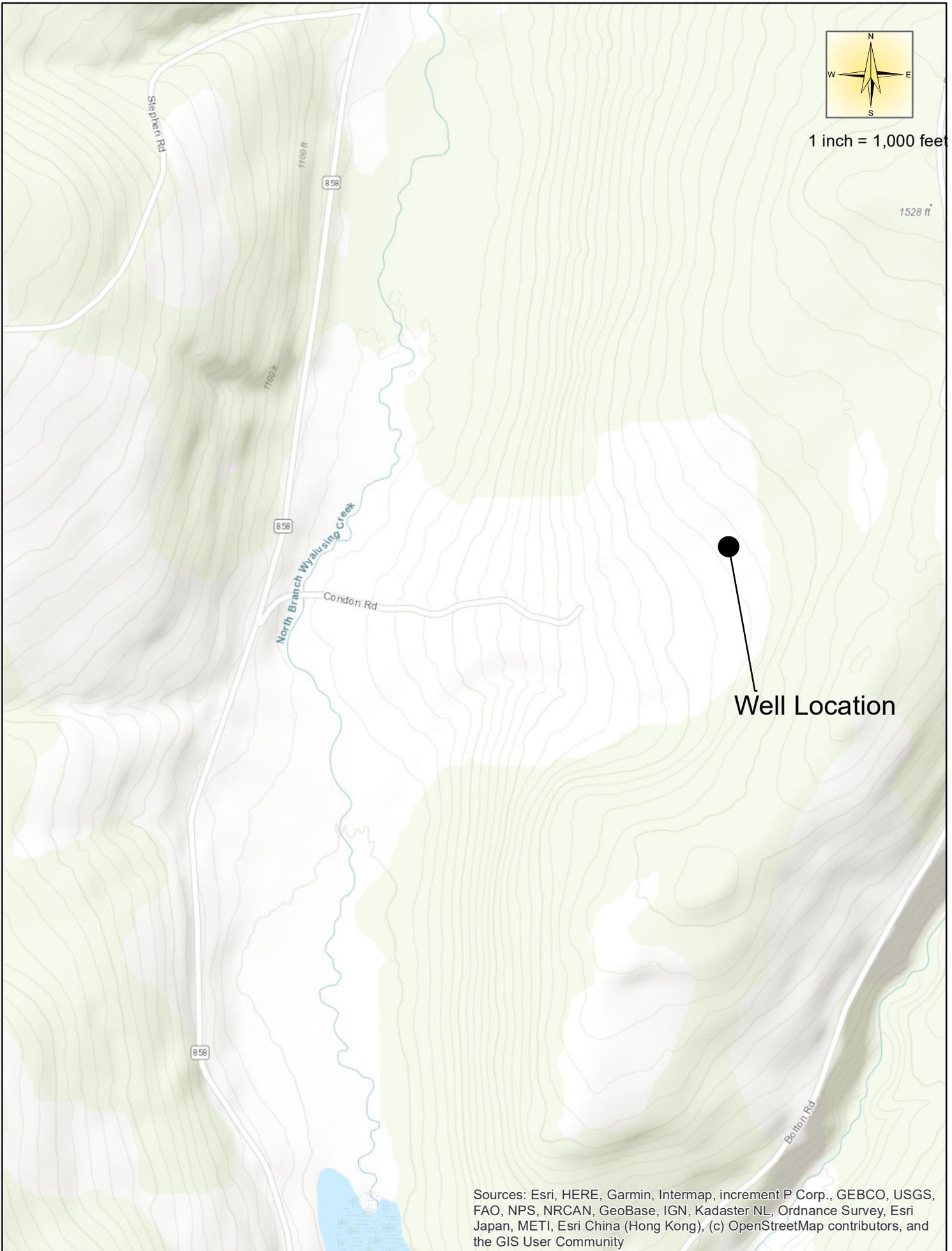
All work shall be done in accordance with the attached specifications and drawings.

Quality assurance for the installation will be provided by the NRCS Mayfield Field Office.

Installation Sequence

Joanna Phalen - Well

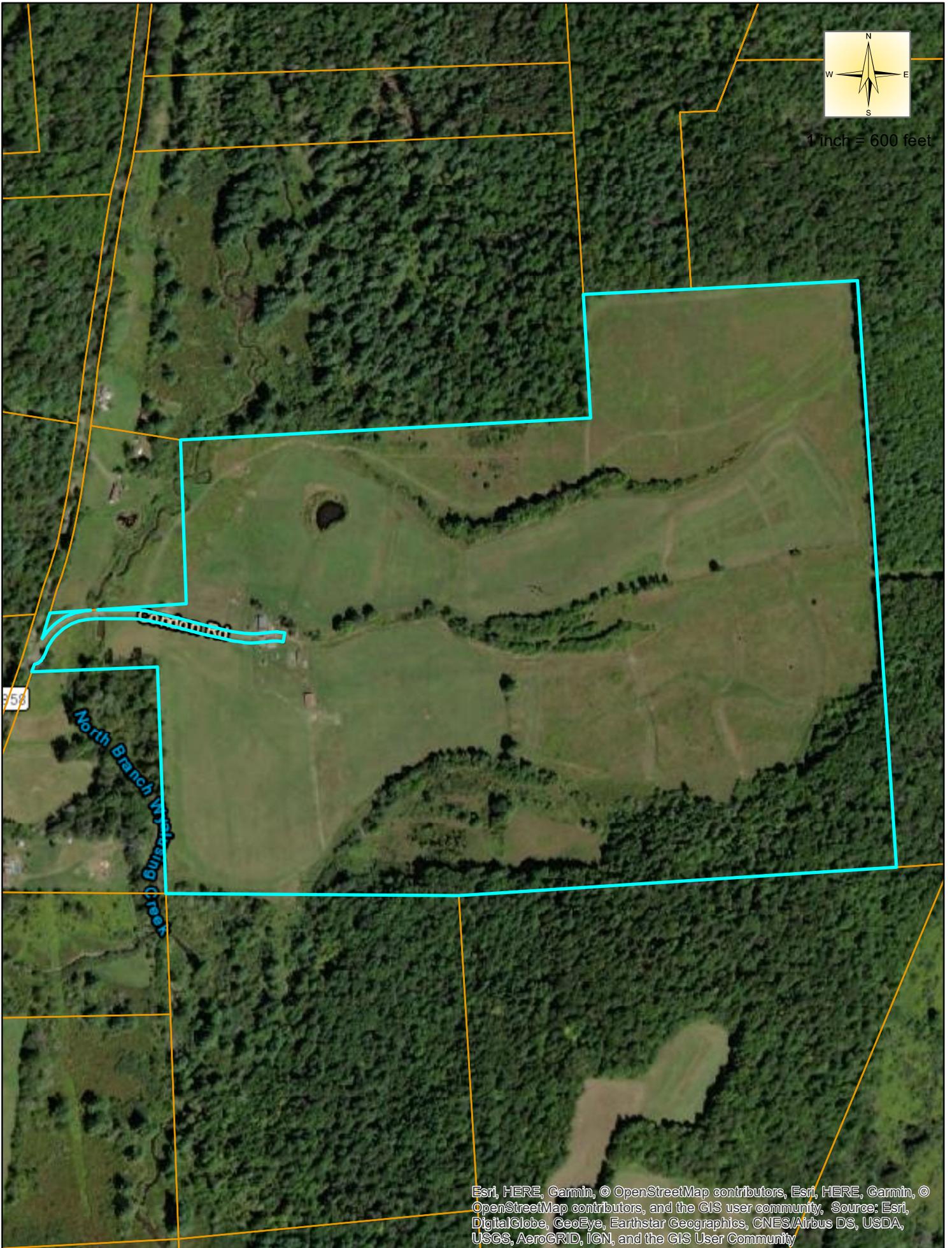
1. Call PA. One Call for utility check.
2. Obtain any necessary permits.
3. A pre construction meeting shall be held with the contractor, farmer and NRCS representative prior to starting the work. The design and installation shall be reviewed and discussed in detail. The proposed location of the well shall be determined at this time. A start date shall be scheduled and the contractor must notify the NRCS representative at least 24 hrs prior to starting construction.
4. Install required erosion and sediment control practices. (silt fence/straw bales)
5. Have all required construction equipment and materials to finish the well at the site before drilling starts.
6. Install the well, adhering to the PA-642 Construction Specification. Grout the opening around the outside of the casing, starting at the bottom of the casing and working upwards.
7. Avoid leaving a hole open for any length of time; swelling, caving in, and sloughing of formation materials might permanently damage the well and lessen its yield.
8. Condition the well to produce the maximum amount of sediment free water with minimum drawdown by mechanical removal of fine sand, silt, and clay from about the well. This can be done by using methods such as surging, backwashing, jetting, pumping, etc.
9. Install well cap equipped with access port.
10. Complete final grading and divert any surface water away from well.
11. Remove silt fence or straw bales and seed all disturbed areas.
12. Measure flow, water depth etc.
13. Complete the disinfection process.
14. Complete the water well completion report.



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

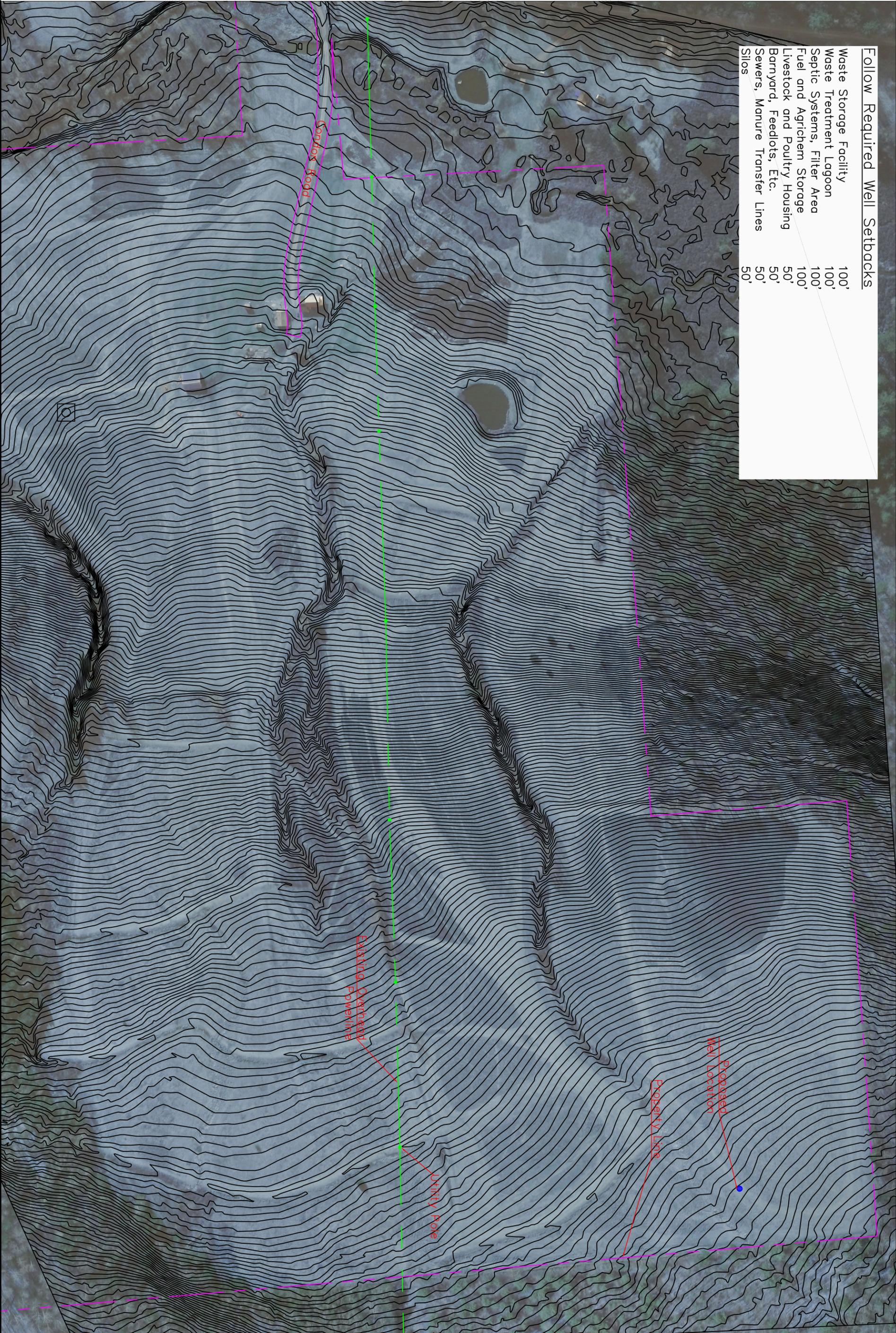


1 inch = 600 feet



Esri, HERE, Garmin, © OpenStreetMap contributors, Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Follow Required Well Setbacks	
Waste Storage Facility	100'
Waste Treatment Lagoon	100'
Septic Systems, Filter Area	100'
Fuel and Agrichem Storage	100'
Livestock and Poultry Housing	50'
Barnyard, Feedlots, Etc.	50'
Sewers, Manure Transfer Lines	50'
Silos	50'



FILE NO. WELMAP-DWG
 DRAWING NO. EG02
 7/27/21 1:49 PM
 SHEET 1 OF #



JOANNA PHALEN
 WATER WELL SITE MAP
 TOPOGRAPHIC PLAN
 179 CONDON ROAD, LITTLE MEADOWS SUSQUEHANNA COUNTY, PA

	DESIGNED	DATE
ETV	ETV	07/02/21
ETV	ETV	07/02/21
#	#	#
#	#	#

Quality Assurance Plan

Joanna Phalen - Well

Landowner/Operator: Joanna Phalen

Location: Susquehanna County

Job Description: Water Well

Job Class: IV

Inspector Assigned: _____

Estimated Performance Time: 1-4 days depending on method used

It is recommended that the inspector be on site before the drilling or driving is completed and during the grouting process of the well.

Pre-Construction Meeting

A pre construction meeting shall be held with the contractor, farmer and NRCS representative prior to starting the work. The design, installation and desired well yields shall be reviewed, discussed in detail and documented. The proposed location of the well shall be determined at this time. A start date shall be scheduled and the contractor must notify the NRCS representative at least 24 hrs prior to starting construction.

Specific Items of Work to be Checked and Documentation Needed:

1. Setback requirements from potential contaminant sources. Locate the septic system for the residence.
2. Erosion and sediment control practices are in place.
3. Underground and overhead utility locations.
4. Construction method used. (Driven or Drilled)
5. Check diameter of drill. A larger bit is needed for the area where casing and grouting is to be done. I.E. 11" dia. drill for 6" casing.
6. First section of casing should have a beveled shoe, which is driven into the bedrock.
7. Casing materials used.
8. Observe grouting and document the method, type and amount used.
9. Make effort to verify the well depth by counting the drill sections or by measuring the depth with a weighted tape, which should be done prior to sanitizing the well.
10. Surface water diverted away from the well head.
11. Well head protection.
12. Final grading, clean up, seeding and mulching completed.
13. Obtain a copy of the water well completion report.
14. Complete as-built information prior to final approval.

CONSTRUCTION SPECIFICATION

642. WATER WELL

1. SCOPE

The work shall consist of furnishing materials and installing all components of the water well as outlined in this specification and the drawings.

2. MATERIALS

Casings: Casings shall be of steel, iron, stainless steel, copper alloys, plastic, fiberglass, or concrete of sufficient strength and durability consistent with the intended use of the water and the maximum anticipated differential head between the inside and outside of the casing. Unless otherwise set forth in Section 5 of this specification:

- Plastic casings made of acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene-rubber (SR) shall conform to material, dimensional and quality requirements specified in ASTM F 480.
- Filament-wound fiberglass casings (glass-fiber-reinforced-thermosetting-resin pipe, RTRP) may be used if material meets requirements specified in ASTM D 2996. Tests for long-term cyclic pressure strength, long-term static pressure strength, and short-term rupture strength as required in ASTM D 2996 are not needed because the pipe is to be used for well casing. Joints shall meet requirements specified in section 3.8, ASTM F 480.
- Fiberglass pressure pipe (also called reinforced polymer mortar pipe, RPMP, or fiberglass pipe with aggregate) shall meet or exceed requirements specified in ASTM D 3517.

Other casing materials shall be certified by the manufacturer or a registered Professional Engineer as being of adequate strength.

Joints: Well casing joints shall have adequate strength to carry the load due to the casing length and still be watertight, or shall be mechanically supported during installation to maintain joint integrity. Such mechanically supported casings shall terminate on firm material that can adequately support the casing weight.

Screen: Well screens shall be constructed of commercially manufactured screen sections, well points, or field-perforated sections. Perforation by any method is allowable provided the following provisions can be met:

- For uniform size aquifer material, screen openings are smaller than the average diameter of aquifer material;
- For non-uniform aquifer material, screen openings are smaller than 60 percent of the aquifer material;
- Screen openings, for filter/gravel pack must exclude at least 85 percent of the filter pack material;
- Size the length and open area of the screen to keep entrance velocity or shear stress below the threshold for erosion of filter pack particles and transport into the well;
- Casing must not be functionally weakened or deformed.

Gravel Pack: If gravel pack is used, it shall have the gradation and thickness specified in Section 5, or as shown on the drawings.

If acceptable *filter materials are unavailable*, use a commercially manufactured, pre-packed well screen. A pre-packed well screen consists of inner and outer screens that contain the engineered filter material. The material must meet the following quality criteria:

- Less than five percent fines (the proportion that passes the number 200 sieve);

- Predominantly rounded, dense, siliceous materials;
- No angular particles, such as crushed rock, or flat particles, such as mica;
- No earthy or soft materials, such as clay, shale, silt, gypsum, or anhydrite;
- No organic matter, no other impurities or metallic substances;
- No material soluble in hydrochloric acid, such as limestone.

3. EQUIPMENT

The installer shall provide and operate all equipment necessary to install the well in a safe manner. The operator shall have a Water Well Driller's License and a Drilling Rig Permit, issued by the PA Geological Survey, for the equipment used on the site.

4. INSTALLATION

Drilled, jetted, bored, and driven wells shall be sufficiently round, straight, and of adequate diameter, to permit satisfactory installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used. Hard rock formations or physically stable geologic materials may not require casing except for the uppermost 10 feet. However, casing shall be installed to seal out undesirable surface or shallow groundwater, and to support the side of the hole through unstable earth materials

If drilling encounters erodible, friable, or otherwise unstable material, install watertight, grouted casing throughout, with the exception of the intake portions.

Provide a watertight seal in the annulus of all well casing. Acceptable sealants include mortar containing expansive hydraulic cement (ASTM C 845), bentonite-based grout, bentonite chips and pellets, sand-cement grout, neat cement, or concrete. The length of the grout seal shall be no less than 10 feet, and not less than the minimum specified in state or locally applicable construction codes.

If one or more zones are encountered that produce water of unacceptable quality, use grout or packers to prevent comingling of waters or cross-contamination of aquifers.

Provide a packer, or similar retaining device, or a sealant between the casing and the less pervious material overlying the aquifer of artesian wells. Provide a similar positive seal to separate water bearing zones where comingling of waters is undesirable.

For artesian conditions, seal the confining geologic units directly above and below the aquifer in such a manner as to retain its confining pressure.

Casing shall extend from above the ground surface down through unstable earth materials to an elevation of at least 2 feet into stable material or to the top of the screen.

If casing extends to the bottom of the drill hole, install a watertight end cap or grout seal to prevent entry of geologic material into the well from the bottom.

When the design requires telescoped screen assemblies, install one or more sand-tight seals between the top of the telescoped screen assembly and the casing.

Upon completion, provide a suitably threaded, flanged, or welded cap or compression seal to prevent entry of contaminants into the well.

Well Development: After completion of well construction, ensure that the well is developed. Well development is required regardless of whether the well is finished in unconsolidated materials or hard rock aquifers. Use one or more development techniques to effectively loosen and remove silt, fine sand, drill cuttings, drilling muds, or additives deposited by the drilling operation on the uncased borehole face and in adjacent portions of the aquifer. For screened zones, the development technique must collapse sand bridges and remove fines outside the screen. Following the development process, remove accumulated sediment at the bottom of the well bore by bailing or pumping.

Pump the well at approximately 120 percent of the anticipated normal production rate until suspended sediment and associated turbidity clears. Do not use the permanent pump to conduct any well development work.

Unless otherwise set forth in Section 5, wells to be completed without a filter pack in unconsolidated granular aquifers shall be developed following guidance provided in ASTM D 5521, *Standard Guide for*

Development of Ground-Water Monitoring Wells in Granular Aquifers.

The method shall be selected based on geologic character of the aquifer, type of drilling rig, and type of screen.

Aquifer Development: For massive, unfractured rock formations unresponsive to well development procedures, the use of aquifer stimulation techniques may be used to improve well efficiency and capacity, if permitted in Section 5 of this specification. Techniques may include dry ice, acidizing, explosives, or hydrofracturing, depending on the composition and structure of the formation, and as specified in Section 5.

Access Port: An access port with a minimum diameter of 0.5 inch shall be installed to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well. Access ports and pressure gages or other openings in the cover shall be sealed or capped to prevent entrance of surface water or foreign material into the well. Removable caps are acceptable as access ports.

Wellhead Protection: Surface runoff and drainage that might reach the wellhead from areas used by livestock or other contaminant sources shall be diverted away from the well.

The ground surface around the well shall be graded away from the well for a distance of at least five feet in all directions. Low points where water can puddle on the surface shall be eliminated.

If the well water is intended for human consumption, the casing shall be surrounded at the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions.

If the top of the well casing is subject to flooding from surface water, either of two methods shall be used to prevent floodwater

from entering the well: (1) the well cap shall be water tight and equipped with a vent that extends two feet above the 100 year flood level, or (2) the well casing shall be extended to two feet above the 100 year flood level.

Disinfection: Wells shall be disinfected immediately following their construction or repair to neutralize any contamination from equipment, material, or surface drainage introduced during construction. The disinfection process shall comply with all local or state requirements.

Prior to final chemical disinfection, remove foreign substances, such as grease, soil, sediment, joint dope, and scum from the well and near the wellhead. Clean all pump parts before placing them into the well. Disinfect the well using a chlorine compound at a concentration of no less than 100 mg/L (100 ppm) available chlorine in solution to treat the entire well.

Water Quality Testing: Sampling and testing shall comply with all applicable federal, state, and local requirements. These requirements vary according to the water quality parameters associated with the intended use(s) of the water. Test well water according to the *Construction Specification for Groundwater Testing (PA355)*.

Well Performance Testing. After completion of well construction and the water level is stable, conduct a pump test to determine specific capacity and dynamic water level. Record the length of test and pumping rate.

Documentation: The well driller shall provide to the landowner and the PA-DCNR Topographic and Geological Survey copies of the water well completion report.

5. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

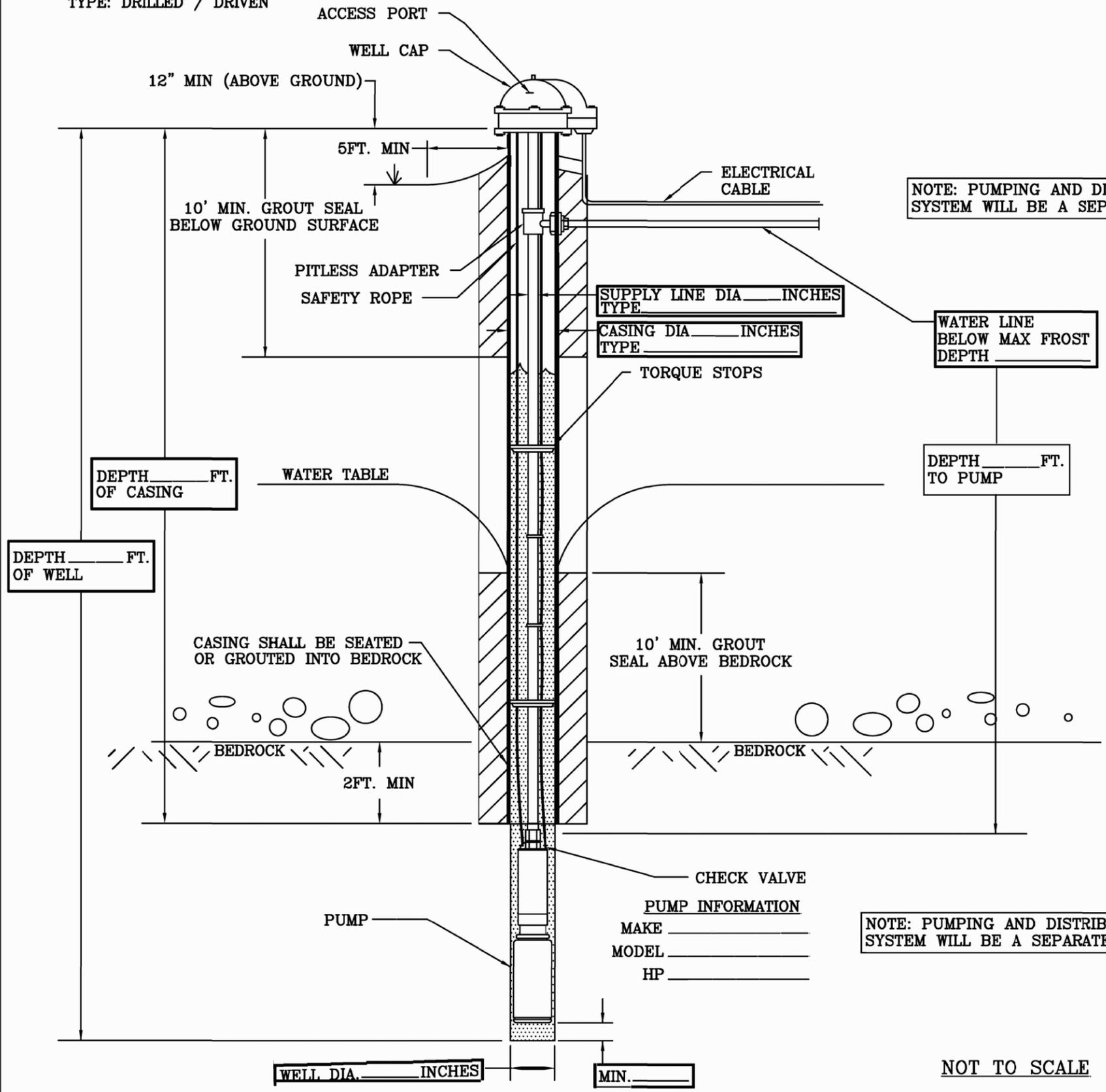
ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

- A. The scope of this project includes the installation of a well for providing water to a cattle watering system. It includes all components necessary for the installation, erosion and sediment control provisions, grouting and sealing, final grading and any needed repair and clean up of the site. It does not include installation of the pump system or pipeline.
- B. The contractor is responsible for the location and depth of the well, the method of installation, and any enhancements (e.g. gravel packs, well development, sealing of aquifers, etc.) based on what is encountered in installing the well.
- C. The contractor shall explain in detail at the pre construction meeting or provide a detailed plan of the proposed installation prior to start of construction. The casing must be grouted to a minimum as shown on the drawings or the entire length, including 2' into bedrock.
- D. The contractor shall review the enclosed plan view drawing, which shows information and limitations for the proposed wells.
- E. Wells constructed through unconsolidated (soil) surface material shall be set back at least the following minimum distances from potential contaminant sources:

Waste Storage Facility	100 ft.	Livestock and Poultry Housing	50 ft.
Waste Treatment Lagoon	100 ft.	Barnyards, Feedlots, etc.	50 ft.
Septic Systems, Filter Areas	100 ft.	Sewers, Manure Transfer Lines	50 ft.
Fuel and Agrichemical Storage	100 ft.	Silos	50 ft.

- F. The purpose of the well is to support a beef cattle watering system with a minimum of 420 gallon per day, at a minimum flow rate of 1.17 gpm, with a desired 8 gpm min. well yield. The watering system design may require modification depending on well yields. Discuss the flow rates with NRCS and the landowner during the well installation.
- G. No aquifer development such as hydrofracturing will be permitted without concurrence from the NRCS representative.
- H. Casing shall be steel with an outside diameter of 6.625" and have a wall thickness of 0.188" (3/16"). Other casing can be used if approved by the NRCS representative. All casing shall meet the strength requirements in the National Engineering Handbook, Part 631, Chapter 33 (NEH-631-33).
- I. The contractor shall provide copies of the "water well completion report" to the landowner, the NRCS representative and the PA Geological Survey.
- J. Install a sanitary well cap and final grade so that surface water will be diverted away from the well.
- K. Any disturbed areas shall be seeded and mulched. This will be the responsibility of the landowner.

DRILLER INFORMATION
 DATE COMPLETED _____
 TYPE: DRILLED / DRIVEN



NOTE: PUMPING AND DISTRIBUTION SYSTEM WILL BE A SEPARATE DESIGN

WATER LINE BELOW MAX FROST DEPTH _____

DEPTH _____ FT. TO PUMP

DEPTH _____ FT. OF CASING

DEPTH _____ FT. OF WELL

10' MIN. GROUT SEAL ABOVE BEDROCK

CASING SHALL BE SEATED OR GROUTED INTO BEDROCK

PUMP INFORMATION
 MAKE _____
 MODEL _____
 HP _____

NOTE: PUMPING AND DISTRIBUTION SYSTEM WILL BE A SEPARATE DESIGN

SYSTEM DATA

- TOTAL OPERATING HEAD _____ FT.
- OPERATING VOLUME _____ GALLONS PER MINUTE
- OPERATING PRESSURE (AT PUMP) _____ PSI
- SUPPLY LINE

SIZE	LENGTH
_____	_____
_____	_____
_____	_____

CONSTRUCTION NOTES

- SYSTEM SHOWN IS A REPRESENTATION. MODIFICATIONS OR ADDITIONS SHOULD BE MADE AS APPROVED BY NRCS REPRESENTATIVE.
- ANTI-SIPHON VALVE IS REQUIRED FOR ALL SYSTEMS. ANTI-SIPHON VALVE SHALL BE A WATTS 9-D OR EQUIVALENT.
- GROUT SEAL REQUIRED FOR ALL SYSTEMS.
- A CONCRETE COLLAR IS REQUIRED FOR POTABLE SYSTEMS.
- GROUT SEAL LENGTH SHALL AT A MINIMUM EXTEND 10 FT. ABOVE THE BEDROCK IN ADDITION TO 10 FT. BELOW THE GROUND SURFACE. THE AREA IN BETWEEN MAY BE FILLED WITH FINES OBTAINED FROM THE DRILLING PROCESS BUT IT IS RECOMMENDED TO GROUT ALONG THE ENTIRE LENGTH OF CASING.

NOT TO SCALE

NOTE:
 PA STANDARD DRAWING PA-071
 MODIFIED BY PAS 6-13-17

DATE	07/02/21
DESIGNED	ETV
DRAWN	ETV
CHECKED	#
APPROVED	#

JOANNA PHALEN
 WATER WELL DESIGN
 TYPICAL DETAIL
 179 CONDON ROAD, LITTLE MEADOWS
 SUSQUEHANNA COUNTY, PA



FILE NO.	WELLMAP.DWG
DRAWING NO.	EG02
DATE	7/27/21 2:28 PM
SHEET	2 OF #