

WORK PLAN FOR HYDROGEOLOGIC INVESTIGATION CULBERTSON FEN ENON SAND & GRAVEL

Introduction

This document is a work plan for evaluation of the potential for a hydrogeologic interconnection between the subsurface materials at the Enon Sand & Gravel Phase I quarry area and the Culbertson Fen. The Culbertson Fen is located west of the Phase I operational area along Garrison Road in Mad River Township, Clark County, Ohio. Enon Sand & Gravel intends to quarry limestone to a floor elevation of approximately 846 to 852 feet above mean sea level (feet, msl) in the Phase I quarry area east of Garrison Road, as shown on the attached Figure 1.

Figure 2 is a map of the site showing residential well locations, the locations of existing site test borings, a cross-section trace (A-A') through the residential wells, and the proposed location of a test borings to define subsurface stratigraphy east of Garrison Road and on the Culbertson property west of Garrison Road. The logs of the residential wells and the site borings are included in Appendix A of this work plan.

Figure 3 is a cross section (A-A') through the residential wells and shows the bedrock surface and the overlying glacial stratigraphy. Water levels from the well logs also are shown on the cross section. The cross section shows that the thickness of unconsolidated material above bedrock varies from approximately 36 to 70 feet and is composed mainly of materials described on the well logs as clay and clay and gravel. Deposits of sand, gravel, or sand and gravel are relatively thin and discontinuous. No residential wells are completed in the unconsolidated deposits so water levels above bedrock are not defined by the available data. Bedrock water levels are below the top of rock, except at Well Nos. 762321 and 913338. Bedrock water levels below the top of bedrock indicate unconfined aquifer conditions and a lack of hydraulic interconnection between the bedrock and the isolated sand and gravel deposits. Based on the stratigraphic and water-level data, the Culbertson Fen appears to be perched above the local aquifer and does not have a hydraulic interconnection with the bedrock aquifer.

Investigative Procedures

In order to define the depth to bedrock and to characterize the unconsolidated materials above bedrock east of Garrison Road, we propose completion of four soil borings at the locations shown on Figure 2. If permission can be obtained, a test boring will also be drilled on the Culbertson property west of Garrison Road, between Garrison Road and the Culbertson Fen. These borings will be drilled using sonic drilling and sampling techniques. Specifically, a 6-inch diameter drill pipe will be used to drill the holes and a 4-inch diameter sample barrel that fits within the 6-inch drill pipe will be used to collect continuous soil samples as the test boring is drilled. An experienced hydrogeologist from Eagon & Associates will supervise drilling and log samples from the test borings.

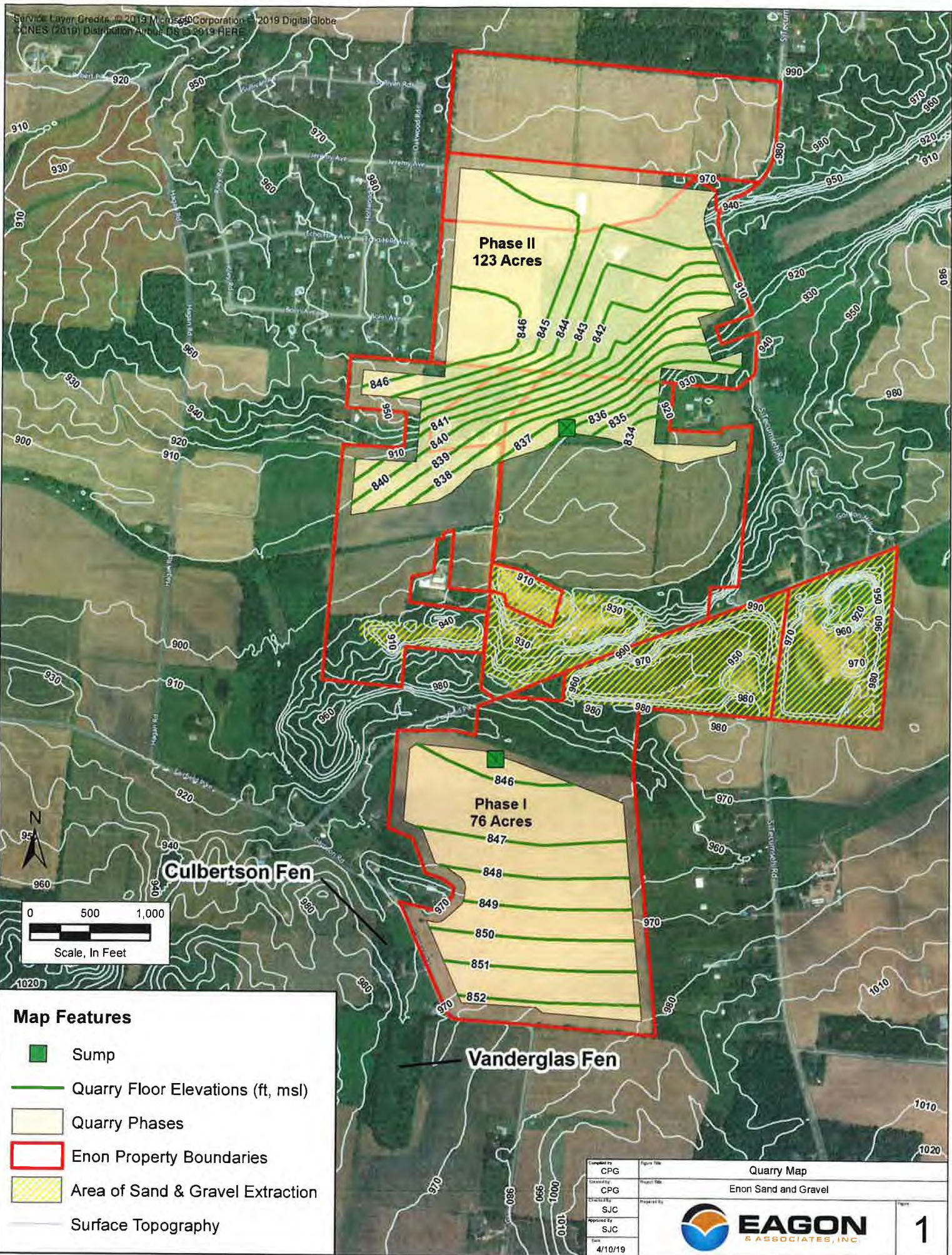
If saturated intervals of sand, or sand and gravel, are encountered at the test-boring locations, two-inch diameter monitoring wells will be installed. The wells will be constructed using Schedule 40 PVC casings with thread and couple joints and PVC well screens with 0.010-inch slot openings. Screen lengths will be nominal five or ten feet; to be determined in the field based on the thickness of sand/sand and gravel zones. The monitoring wells will be developed to insure that the well screens are open to facilitate measurement of accurate water levels and responsiveness during hydraulic testing. Well development will be accomplished by surging, bailing, and/or pumping depending on the productivity of the well. Hydraulic testing will be performed at each monitoring well to determine the hydraulic conductivity of the screened material. Hydraulic testing may be performed using slug or pumping test methods, depending on the amount of drawdown observed during well development. Slug and/or pumping-test data will be analyzed using standard methods to determine hydraulic conductivities. The monitoring well elevations (ground and top-of-well casing) and locations will be surveyed so that water levels and stratigraphy can be accurately correlated. Ground-water levels from the monitoring wells will be used to evaluate groundwater flow and hydraulic gradients, if possible. The monitoring wells, if any are installed, can be used for groundwater monitoring during quarry operation.

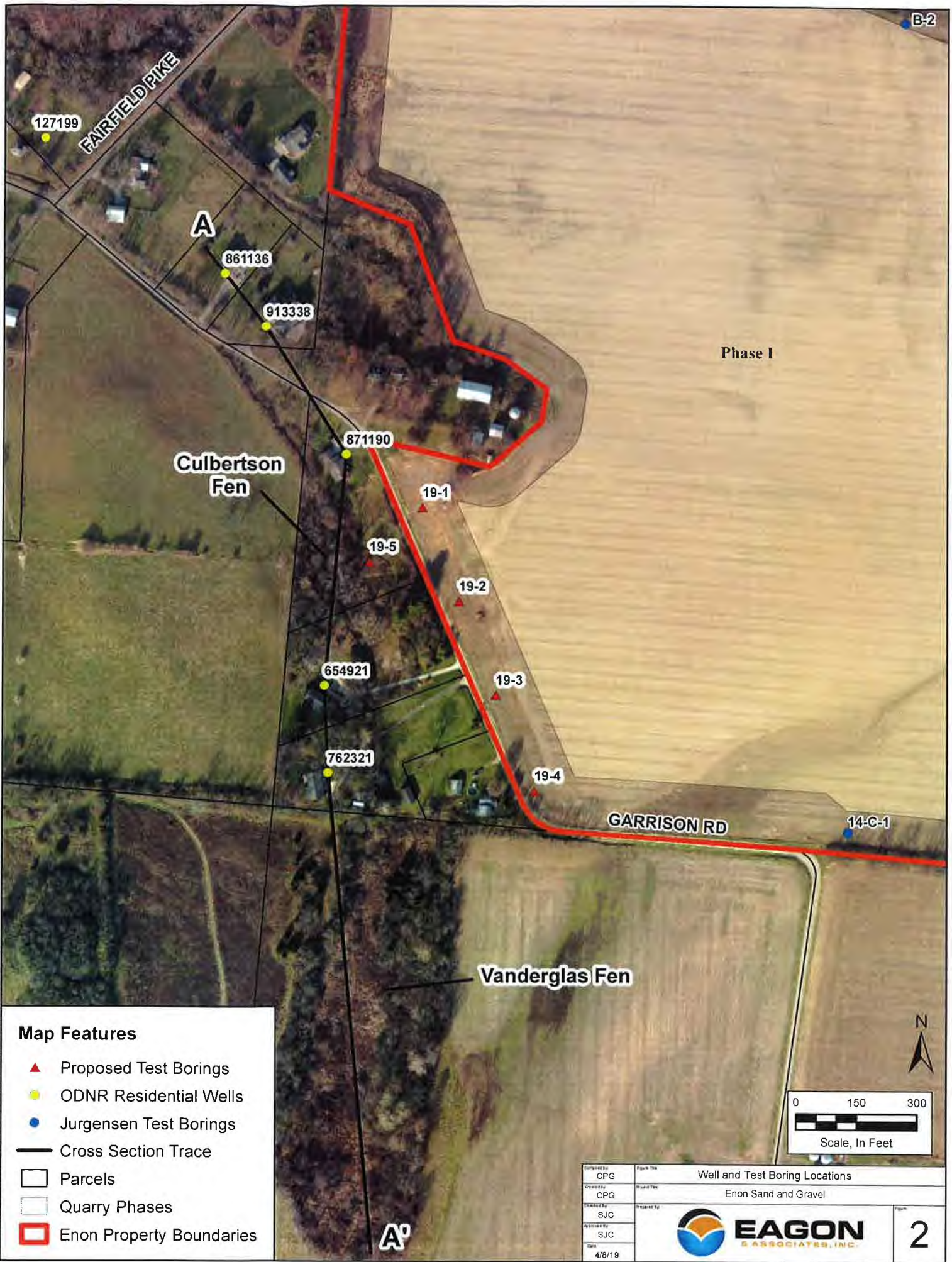
If no saturated intervals of sand, or sand and gravel, are encountered at the borings, the boreholes will be grouted and no monitoring wells will be installed. Independent of the results of the investigation of unconsolidated materials, one bedrock monitoring well will be installed near the proposed location of boring 19-1, using standard rotary methods. The bedrock monitoring well will be constructed similar to the residential wells with casing seated into competent bedrock and an open borehole from the bottom of the casing to the base of the carbonate aquifer. The bedrock well will be used for long-term water-level monitoring during quarry operations. As part of the investigation, the water level at the Culbertson well will also be measured. The ground and top-of-casing elevations at the Culbertson well will be surveyed. Points around the Culbertson Fen will also be surveyed to provide an accurate map of the fen including ground elevations. If the Culbertson well can be measured, it will be used as part of the water-level monitoring network during quarry operation. Any work performed on the Culbertson property will be dependent on being granted access to the property and permission to perform the work as specified.

Data Analysis

Data collected during this investigation will be provided to Ohio EPA in a written report. The report will include well logs, well construction diagrams, and the results of any hydraulic testing. Depending on the number and locations of monitoring wells installed, the report may

also include groundwater flow maps and additional cross sections to better visualize the relationships between saturated hydrostratigraphic units. The report will also include observations regarding any potential hydraulic interconnection between unconsolidated deposits and/or bedrock and the Culbertson Fen and recommendations for future monitoring.





Map Features

- ▲ Proposed Test Borings
- ODNR Residential Wells
- Jurgensen Test Borings
- Cross Section Trace
- ▭ Parcels
- ▭ Quarry Phases
- Enon Property Boundaries

Compiled by CPG	Figure Title Well and Test Boring Locations
Created by CPG	Phase Title Enon Sand and Gravel
Checked by SJC	Prepared by EAGON ASSOCIATES, INC.
Approved by SJC	Figure 2
Date 4/8/19	

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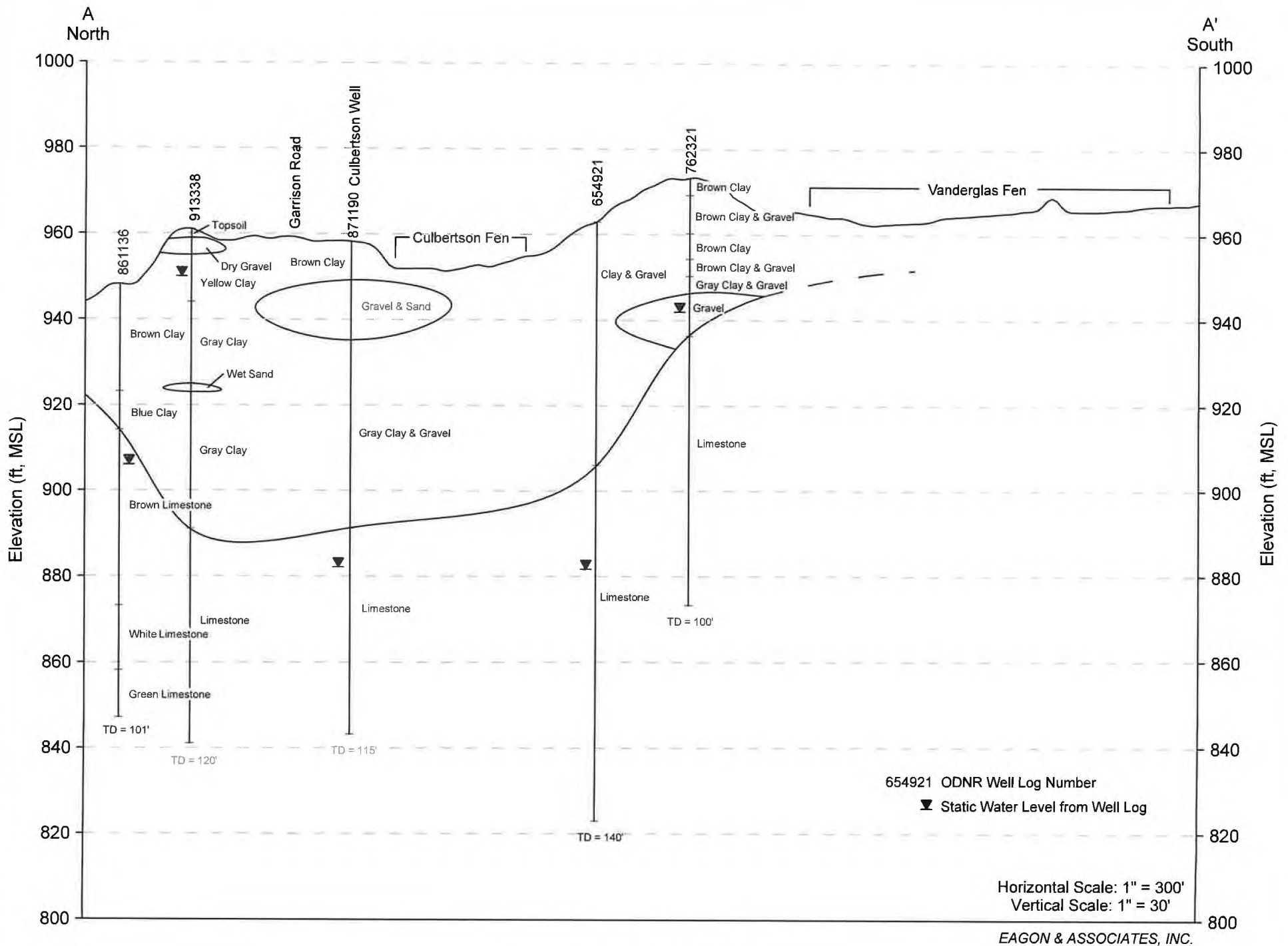


Figure 3. Cross Section A-A'
Enon Sand and Gravel - Clark County, Ohio