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TW21-1C Water Supply Assessment
Proposed Residential Development
Creekside 2 - Village of Richmond
2770 Eagleson Road
Ottawa, Ontario

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Submitted to:

1470424 Ontario Inc.
301 Moodie Drive, Suite 100
Ottawa, Ontario
K2H 9C4

TW21-1C Water Supply Assessment
Proposed Residential Development
Creekside 2 - Village of Richmond
2770 Eagleson Road
Ottawa, Ontario

December 14, 2021
Project: 61899.03

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Ottawa, ON, Canada
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December 14, 2021 File: 61899.03

1470424 Ontario Inc.
301 Moodie Drive, Suite 100
Ottawa, Ontario
K2H 9C4

Attention: Tyler Ferguson, Land Development Manager

Re: TW21-1C Water Supply Assessment, Proposed Residential Development
Creekside 2 – Village of Richmond, 2770 Eagleson, Ottawa, Ontario

Please find enclosed our hydrogeological investigation report for the above noted project based on the scope of work provided in our proposal dated February 21, 2020. This report was prepared by GEMTEC Consulting Engineers and Scientists Limited (GEMTEC).

Do not hesitate to contact the undersigned if you have any questions or require additional information.

Andrius Paznekas, M.Sc., P.Geo

Shaun Pelkey, M.Sc.E., P.Eng.

Steve Livingstone, M.Sc., P.Geo.

Enclosures
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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by 1470424 Ontario Inc. to carry out a hydrogeological investigation for a proposed residential subdivision (Creekside 2) which consists of a 25.67 hectare site (approximate) located in the northwest corner of Eagleson Drive and Perth Street within the Northeast Development Lands of the Village of Richmond in Ottawa, Ontario (refer to Figure 1, attached).

Based on the Village of Richmond Community Design Plan Amendment #181, dated March 9, 2017, development in the Western Development Lands, Northeast Development Lands and Industrial Lands shall be on the basis of communal well services. The preliminary development plan of Creekside 2 includes a total of 455 units: 74 semi-detached, 250 single family houses and 130 townhouses.

The development will require a water supply in the form of a communal well(s) to provide the source of water. The lots will be connected to a residential wastewater service and as such, an impacted assessment for septic services has not been conducted.

1.1 Technical Guidance

This study was carried out in general accordance with the technical requirements outlined in the Ministry of Environment and Conservation and Parks (MECP) document entitled Procedure D-5-5 Technical Guidance for Private Wells: Water Supply Assessment, or the principles of the MECP Hydrogeological Technical Information Requirements for Land Development Applications (April 1995) and the City of Ottawa document *Hydrogeological and Terrain Analysis Guidelines, March 2021.* The City of Ottawa had indicated that they will be the owner / operator of the communal well system and all wells must be constructed to their specifications and relevant sections of the City of Ottawa Official Plan. As such meetings were held with City representatives and the Rideau Valley Conservation Authority (RVCA) to discuss the proposed hydrogeological evaluation methodology and present submittals for review prior to the start of the field work.

A meeting with the City, 1470424 Ontario Inc. and the GEMTEC team was held on October 26, 2020 to review the proposed work scope and field program. On November 10, 2020, GEMTEC prepared and submitted to the City a Technical memo - Conceptual Site Model and Work Plan- entitled *Proposed Field Program to Support Creekside 2 Groundwater Supply Development Village of Richmond, Ottawa, Ontario.* This technical memorandum outlined the preliminary field testing program that will be carried out to support the groundwater supply assessment for the residential development of Creekside 2. The field program was developed using a preliminary Conceptual Site Model (CSM) that was established by the project team, technical specifications provided by the City of Ottawa, and common hydrogeological practices for communal well supplies.

Following comments from the City on the technical memo, an updated memo was prepared and submitted on November 23, 2020. On November 30, 2020, an email was received by the GEMTEC team from the City that all comments had been addressed with no further comments.

As presented in the technical memo, the preferred location for the communal well within the development layout was provided on Figure A2.1 and the other test well location was located approximately 100 m to 300 m away (to be determined in the field). At the time of this investigation, the preferred location was based on the site infrastructure design and development fabric. An updated site infrastructure design (November 2021) is provided on Figure A2.2 which shows the location of the communal well located along Eagleson Drive in the southeast corner of the property. This proposed communal well is located approximately 120 metres from the test well location, as described in this report. As this revised location is proximal to the test well locations and the Nepean Aquifer is regionally extensive with similar hydrogeological properties, it is expected that comparable results in terms of groundwater quantity and quality will be obtained during communal well drilling in this area.

1.2 Study Objectives and Scope of Work

The purpose of this Hydrogeological and Water Supply Assessment is to evaluate the potential for the use of a communal well(s) system to support the water requirements of the proposed Creekside 2 development including groundwater quantity and quality. As such, the scope of work for the assessment included:

- Development of geological and hydrogeological framework and conceptual site model
- Evaluation of Water Demand and Potential Aquifer Yield
- Completion of a baseline water quality sampling program of private wells
- Completion of a Hydrogeological Investigation
    - Drill shallow and deep test wells
    - Instrument on and off-site wells with water level data recorders
    - Complete a 72-hr pump test to determine potential well yields, water quality and communal well location siting
- Data Evaluation and Reporting

This report is arranged into seven sections, including this introduction. Section 2 provides background information on the physical setting of the Site from a regional perspective. Section 3 discusses the methods used to complete the site-specific hydrogeological investigation with Section 4 presenting the results of this assessment and the specific hydrogeological characteristics. Section 5 presents an evaluation of the impacts in terms of quantity and quality. Section 6 provides the conclusions and recommendations of the report. Section 7 provides closure, limitations and references. Figures and tables referred to in the text are provided in Appendices at the back of this report.

2.0 SITE BACKGROUND

2.1 Data Sources

The Ministry of the Environment, Conservation and Parks (MECP) Water Well Information System was downloaded from the online platform in September 2020 to provide insight into the geology and hydrogeology of the Richmond area. The distribution of water wells contained within the database are illustrated as yellow circles on Figures A1 and A2 (figures refenced A# are provided in Appendix A). As illustrated, there is a wealth of domestic water well data in the area west and south of the Site where individual wells were drilled for many of the residential subdivisions. In the agricultural areas north and east of Richmond, the density of water well data is significantly lower.

The Ministry's Permit to Take Water dataset was also downloaded from the MECP website and the only long-term active permits within the Richmond area are the municipal wells: Kings Park Wells 1 and 2, and Richmond West Well 1 and 2 (Figure A3). Permits exist in the database for short term takings such as pumping tests or construction dewatering, but these permits are not expected to impact the groundwater levels on the Site. The High Park Well located west of the Site (Figure A1) does not have a permit to take water but is a communal well of interest in this project.

A set of digital elevation model (DEM) tiles were downloaded from the Province's *Land Information Ontario* website to characterize the ground surface topography in the area (Figure A3). Specifically, the Digital Raster Acquisition Project Eastern Ontario (DRAPE) from 2019 was used to represent the ground surface in the area.

2.2 Site Description and Topography

The proposed development (the Site) is in situated at the northwest corner of Eagleson Drive and Perth Street within the Northeast Development Lands of the Village of Richmond. The Site is bounded to the north by agricultural land, and to the south by a rural commercial zone. To the west is a municipal drainage swale, then residential development along Shea Road. On the west side of Shea Road is an existing village residential zone. The site is currently used as agricultural lands.

Topography within the study area is relatively flat and slopes towards the Jock River, with elevations ranging from approximately 95 m asl in the northwest to 90 m asl adjacent to the Jock River and flood plains.

Surface drainage is interpreted to follow the local topographic features. A number of small creeks and streams occur in the study area including the municipal drainage swale that drain into the Jock River, a tributary to the Rideau River that flows through the Village of Richmond (see Figure A3).

2.3 Regional Geology

The Site is located within the Ottawa Valley Clay Plains physiographic region (Chapman and Putnam, 1984) which is characterized by clay plains with minor sand and gravel zones (see Figure A4).

Beneath the Study Area, the surficial geologic units consist of fine-grained clays, silty sand, and till that overlie limestone and sandstone bedrock. Minor amounts of sand and gravel were also noted. The Paleozoic-aged bedrock units of the Ottawa area were characterized by Williams (1991) in an Ontario Geological Survey report.

2.3.1 Overburden Geology

Overburden beneath the Site consists predominately of clay, till and lesser sands. The lowermost overburden sequence in the area is a glacial till, deposited during the late Wisconsin ice advance and retreat approximately 12,000 years ago. Overlying the till in many areas is glaciolacustrine silts and clays that were deposited when the area was isostatically depressed due to the weight of the glaciers, and marine seawater inundated the area forming the Champlain Sea. Thick layers of clay were deposited before the land surface rebounded, and the sea retreated to the east, down the St. Lawrence River valley. The ice sheet retreated northward, and large volumes of meltwater drained into the Ottawa area, in some places leaving behind sands and gravels on top of the marine silts and clays.

Figure A4 illustrates the surficial geology mapped in the area, which is mapped as glaciomarine silt and clay across much of Richmond, with a small area of sand and gravel mapped at surface west of the Richmond West municipal wells.

2.3.2 Paleozoic Bedrock Formations

Beneath the Site, the uppermost bedrock formation is a limestone unit that is interpreted to be part of the Oxford and March Formations, which are collectively referred to as the Beekmantown Group (Figure A5). The depth to the top of bedrock is shown on Figure A6.

The uppermost formation beneath the Site is the **Oxford Formation,** which is described as a dolostone with shaly and sandy interbeds that are up to 30 cm thick (Williams, 1991). The formation is characterized by light to medium brownish to greenish grey dolostone and is estimated to be approximately 30 m thick in the Richmond area.

The Oxford Formation is underlain by the **March Formation,** an interbedded grey quartz sandstone, dolomitic quartz sandstone, and blue-grey sandy dolostone and dolostone. The unit represents a transition zone between the Oxford Formation dolostones above, and the Nepean Formation sandstone below. Dolostones of the March Formation are lithologically similar to the overlying Oxford Formation, making them difficult to distinguish using drill cuttings. Within the

Richmond area, the March Formation is estimated to be approximately 8 to 9 m thick (Paterson Group, 2011).

The underlying **Nepean Formation** is a quartz sandstone that is thinly bedded to massive and well sorted (see Figure A7 for interpreted depth to Nepean Formation). The sandstone is variable in colour and can be white to light grey, brown, reddish brown and green. It underlies the March Formation beneath the Site, and the upper Nepean Formation contact is marked by the lowermost unit of (sandy) dolostone. Locally, the Nepean Formation is described as cream coloured, coarse-grained sandstone with a weathered grey and irregular brown stained colour (Paterson Group, 2011).

2.4 Regional Hydrostratigraphy

There are no mapped overburden aquifers in the Richmond area and surrounding area; the only aquifers beneath the Site are the upper Oxford and March formation dolostones, and the underlying Nepean Formation sandstone. The water levels in the upper and lower bedrocks aquifers are similar, with groundwater levels lying only a few metres below ground surface.

The water level elevations reported in all water wells that are completed in bedrock are illustrated on Figures A8 to A12. The water levels recorded in the March and Oxford formations are denoted with circles, and the water levels for wells completed in the Nepean Formation are denoted by black squares and circles. The labels denote the static water level noted on the drillers log at the time the well was drilled. Water levels were collected from a wide variety of time periods from the 1960s to 2019 and represent water levels collected in spring when levels are at their highest and summer when levels are at their lowest. They water levels are useful for identifying broad trends across an area, but cannot be relied upon to provide the exact water level at any given point on the map. In general, water levels in the Richmond area lie 2 to 4 metres below ground surface and within 1 m in the low-lying areas along the Jock River (Figure A12). A three-dimensional view of surficial and bedrock geology across the site are illustrated on Figures A13 and A14.

2.5 Regional Groundwater Quality

In general, the groundwater quality from private wells in the Oxford and Nepean formations within the Village of Richmond is considered potable and good quality. Elevated concentrations of iron, hardness, sodium and total dissolved solids (TDS) and hydrogen sulphide occur locally (Golder, 2003, 2017; JWEL, 1991 and Geofirma, 2020). The identified elevated concentrations which can be locally present are typically within the range that can be treated by conventional water treatment systems.

3.0 STUDY METHODOLOGY

3.1 Groundwater Supply Investigation

3.1.1 Test Well Siting and Monitoring Well Network

A total of four bedrock test wells were advanced on-site from January 7 to January 15, 2021 by Air Rock Drilling Ltd. under well contractor license number 1119. Well grouting inspections were carried out by GEMTEC staff during the sealing of the well casings in all test wells. The test wells were completed in pairs, at two potential production well locations. Each well cluster includes a shallow bedrock well completed in the Oxford and March Formation (Beekmantown Group) and deep bedrock well completed in the Nepean Formation.

In addition to the four on-site bedrock test wells, groundwater level monitoring was completed in three private homeowner wells (A274440, A260995, A274380), one commercial well (TW2 – A138253) and a series of overburden monitoring wells installed as part of the geotechnical investigation (GEMTEC, 2021); refer to Detailed Site Plan Figure 1 for well locations.

3.1.2 Permit To Take Water (PTTW) Application

GEMTEC prepared and submitted a Category 2 PTTW application to the Ministry of the Environment, Conservation and Parks (MECP) required for groundwater pumping greater than 50,000 litres per day. The PTTW application was approved and issued by the MECP on March 3, 2021 (PTTW Number 7422-BYQNKJ). Groundwater pumping in excess of 50,000 litres per day was carried out in accordance with the permit requirements.

3.1.3 Hydraulic Testing

Pumping tests were completed at test well TW21-1C to assess the groundwater quality and quantity. Following well drilling, a preliminary pumping test was completed on February 2, 2021. The test well TW21-1C was pumped at a rate of approximately 340 litres per minute for a period of 2.5 hours, for a total groundwater discharge of approximately 49,000 litres. Groundwater quality samples were collected at the end of the pumping tests and submitted to Paracel Laboratories for ‘subdivision package’ and ‘heavy metal’ parameters.

A step test was completed at TW21-1C on March 12, 2021 in order to assess the performance of the well, prior to conducting a long-duration pumping test. The test well TW21-21C was pumped for three one-hour intervals at rates of approximately 680 litres per minute, 910 litres per minute and 1,060 litres per minute.

A 72-hour constant rate pumping test was completed at TW21-1C on March 15 to March 18, 2021. The pumping test was conducted by Aardvark Drilling Inc. using a 30Hp downhole pump, installed at a depth of 64.5 metres. The test well was pumped at a rate of approximately 910 litres per minute and groundwater discharge monitored using a calibrated flow meter and totalizer

(Seametrics model #IP117S-126). The groundwater was discharged to ground surface approximately 400 metres from the test well in accordance with permit requirements.

3.1.4 Groundwater Sampling

Groundwater samples from TW21-1C were collected during the February 2, 2021 short duration pumping test and from March 15-18, 2021 during the 72-hour pumping test. The groundwater samples were collected in laboratory supplied bottles and prepared/preserved in the field in accordance with the industry standard sampling, handling and preservation procedures required by the laboratory. All water samples, including samples for metal analysis, were unfiltered. The groundwater samples were subsequently submitted to Paracel laboratories in Ottawa, Ontario for the following parameters:

- February 2, 2021 (short duration pumping test) and March 16/17/18, 2021 (24-hour, 48-hour and 72-hour samples)
    - "Subdivision Package": total coliform, E. coli, fecal coliform, heterotrophic plate count, electrical conductivity, pH, hardness, total dissolved solids, alkalinity, fluoride, chloride, nitrate, nitrite, sulphate, ammonia, total kjeldahl nitrogen, dissolved organic carbon, phenols, hydrogen sulphide, true colour, turbidity, calcium, manganese, magnesium, potassium and sodium.
    - 'Heavy Metals": aluminum, antimony, arsenic, barium, boron, cadmium, chromium, chromium VI, copper, lead, mercury, selenium, uranium, and zinc.
- March 18, 2021 (72-hour sample)
    - Volatile Organic Compounds (VOCs), Petroleum Hydrocarbons (PHCs) and pesticides/herbicides.

Field parameters were measured at periodic intervals during the pumping tests. The measured field parameters and equipment used during the pumping test are provided in Table 3.1.

Table 3.1 – Field Equipment Overview

Field Parameters	Manufacturer	Model No.
Total and Free Chlorine	Hach	DR 900
pH, temperature, conductivity, total dissolved solids, dissolved oxygen and oxygen reduction potential	Horiba[1]	Horiba U-52[1]
Turbidity	Hanna	HI 98703

Field Parameters	Manufacturer	Model No.
Colour (filtered[2] and unfiltered)	Hach	DR 900

Notes: 1. Rental equipment from Maxim Environmental and Safety Inc. Calibrated by Maxim Environmental and checked/re-calibrated daily with standard solutions provided by Maxim.
2. Groundwater samples field filtered using 0.45 micron filters.

3.1.5 Borehole Geophysics

Downhole geophysical surveys were completed in four test wells (Figure 1) at the Site. The surveys were completed to characterize rock units within each test well. Surveys were focused on logging structures within the shallower Nepean formation (upper ~50 m) and the deeper Oxford / March formation (beyond ~50 m). Surveys logged rock units within each formation to characterize stratigraphy, fractures, joints, bedding, foliations, faults, etc. Downhole probes included both optical and acoustic imaging televiewers, and an additional probe (40GRP-1000) to log gamma, 16" normal resistivity, 64" normal resistivity, single point resistance, and spontaneous potential measurements.

Test wells were drilled in two different locations on the site and consisted of a shallow and deep well at each location. Shallow wells were contained within the upper 50 metres (Nepean formation) at each location, and deeper wells were cased to approximately 55 metres (below ground surface) and extended to depths of approximately 110 – 120 metres.

In completing the downhole program, geophysical surveys were conducted over a 3-day period from February 3 - 6, 2021. Equipment for the surveys required a 500 metre winch and data logger system, coupled with Mount Sopris ALT probes that included the following:

- QL40-ABI (acoustic televiewer);
- QL40-OBI (optical televiewer); and
- 40GRP-1000 probe.

Optical and acoustic televiewer data was collected and combined with gamma and resistivity logs generated by the 40GRP-1000 probe. Each of the probes are discussed in the following subsections.

3.1.6 Televiewers

Televiewer logging instruments are used to obtain high-resolution and oriented images of borehole walls for a variety of investigation types. These instruments function to provide in-situ and relatively undisturbed measurements of rock units where core recovery is difficult/unreliable, costly, or otherwise unavailable. Televiewer surveys are often used as standalone data sets, to provide supplemental information for drill programs, and/or as a quality control measure during characterization studies. For this investigation, data sets from both optical and acoustic

televiewers were used to image test wells to collect structural information in near surface formations to better understand the similarities and differences between these rock units.

A generalized schematic of the optical and acoustic televiewer probes deployed downhole is displayed in Figure D1, Appendix D.

3.1.7 Acoustic Televiewers

Downhole surveys at each test well were completed using the optical and acoustic televiewer, the 40GRP-1000 probe, a data logger, a winching system, and tripod positioned over each of the test wells. To initiate each of the surveys, probes were positioned over test wells, zeroed at ground surface, and lowered to full depth. Data collection was completed during ascent (under tension), which provided a more controlled data collection stream without the hang-ups that can occur as probes descend under the force of gravity. This is a necessity for the televiewers as they require centralizers to keep the probes positioned correctly in the boreholes, and during descent, these probes often get hung-up on borehole wall irregularities. During data collection, acoustic, optical, and 40GRP-1000 data records were acquired at a rate of approximately 1.5 m/min to ensure adequate sampling rates

3.2 Offsite Domestic Well Water Quality

The offsite water quality was assessed through sampling domestic private wells in the Creekside Phase 1 residential development, sampling Creekside Phase 1 test wells and a review of available hydrogeological reports for the adjacent commercial development, all of which are located west of the Site (Figure 1). The domestic water supply wells in the Creekside 1 development are completed in the limestone bedrock of the Oxford Formation, with well depths in the range of 25 to 66 metres.

Information letters were delivered in November 2020 to all residents within the Creekside Phase 1 residential development and homeowner sampling was completed between December 2020 and May 2021. A total of 19 homeowners voluntarily participated in the sampling program. Field testing for turbidity, pH, total dissolved solids, electrical conductivity, temperature and total chlorine was carried out at the time of sampling. Groundwater samples were collected from untreated taps (e.g. outdoor tap or pressure tank bypass) after running the cold water for a minimum of ten minutes. The samples were preserved in laboratory supplied bottles using established sampling protocols. The water samples were submitted to Paracel Laboratories Ltd. for ‘subdivision package’ parameters.

Water quality information from the commercial development was reviewed to assess the background water quality in the Nepean aquifer. The following background reports reviewed include:

- Hydrogeological Study, Proposed Development Part of Lot 26, Concession 4 Geographic Township of Goulbourn, City of Ottawa (Richmond Village), Ontario, report by Golder Associates report number: 1418381-1000, Rev.2, September 2017.
- Hydrogeological Report and Terrain Analysis, Proposed Commercial Development Phase 2, Richmond Village Square, Ottawa, Ontario, report by Paterson Group Inc., Report:PH4188-LET.01, March 24, 2021.

Elevated chloride concentrations were noted during the Creekside 1 water quality sampling and further investigated by GEMTEC under a separate cover, titled “Investigation of Potential Chloride Sources – Creekside Subdivision Phase 1, Village of Richmond, Ottawa, Ontario” and dated May 31, 2021. The investigation is currently ongoing and under review by the MECP. Follow-up water quality sampling has been completed at numerous times since May, 2021 and reported under separate cover.

4.0 RESULTS AND DISCUSSION

4.1 Geologic Characterization

Beneath the Site, the geologic units consist of a fine-grained clays, silty sand and till that overlie limestone and sandstone bedrock. The Paleozoic-aged bedrock units of the Ottawa area were characterized by Williams (1991). A description of the geological site conditions is presented in this section based on local and recent on-site drilling data.

4.1.1 Overburden

The overburden geology was characterized on-site during the TW21-1C Water Supply Assessment completed by GEMTEC (Draft report dated Dec 11, 2020).

The fieldwork for this investigation was carried out between July 3 and 20, 2020. During that time, a total of 26 boreholes were advanced using a track mounted hollow stem auger drill rig supplied and operated by CCC Geotechnical and Environmental Drilling of Ottawa, Ontario.

Details for the boreholes advanced are provided below:

- 21 boreholes, numbered 20-01A, 20-02 to 20-04, 20-05A, 20-06, 20-07A, 20-08, 20-09, 20-10A, 20-11 to 20-15, 20-16A, 20-17, 20-18A, 20-19, 20-20, 20-21, and 20-25 were advanced to depths ranging from about 6.1 to 10.4 metres below ground surface.
- 6 boreholes, numbered 20-01B, 20-05B, 20-07B, 20-10B, 20-16B, and 20-18B were advanced adjacent to boreholes 20-01A, 20-05A, 20-07A, 20-10A, 20-16A, and 20-18A, respectively, for the installation of shallow monitoring wells and/or obtaining relatively undisturbed Shelby tube samples.

Well screens were sealed in the overburden at all borehole locations, except borehole 20-05B, to measure the groundwater levels and for hydraulic conductivity testing. The record of borehole sheets and monitoring well logs are provided in Appendix B.

From the investigation the overburden beneath the Site consists predominately of clay, till and lesser sands. The lowermost overburden sequence in the area is a glacial till, deposited during the late Wisconsin ice advance and retreat approximately 12,000 years ago. Overlying the till in many areas is glaciolacustrine silts and clays that were deposited when the area was isostatically depressed due to the weight of the glaciers, and marine seawater inundated the area forming the Champlain Sea. Thick layers of clay were deposited before the land surface rebounded, and the sea retreated to the east, down the St. Lawrence River valley. The ice sheet retreated northward, and large volumes of meltwater drained into the Ottawa area, in some places leaving behind sands and gravels on top of the marine silts and clays.

Figure A4 illustrates the surficial geology mapped in the area, which is mapped as glaciomarine silt and clay across much of Richmond, with a small area of sand and gravel mapped at surface west of the Richmond West municipal wells.

Based on detailed geotechnical studies (25 boreholes by GEMTEC, 7 boreholes by others), the overburden generally comprises deposits of silty clay and glacial till over bedrock. A layer of sand was also noted at two of the borehole locations. Native deposits of silty clay were encountered in all of the boreholes. Where fully penetrated, the silty clay extends to depths ranging from about 2.6 to 8.4 metres below ground surface.

Grain size distribution tests were undertaken on four selected samples of the weathered silty clay crust from boreholes 20-06, 20-13, 20-14, and 20-20. The results are summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Test (Weathered Crust)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
20-06	2	08 – 1.4	0	2	45	53
20-13	3	1.5 – 2.1	0	1	38	61
20-14	3	1.5 – 2.1	0	2	41	57
20-20	3	1.5 – 2.1	0	2	37	61

A deposit of glacial till was encountered below the silty clay and clayey silt in boreholes 20-01, 20-02, 20-04, 20-07 to 20-12, 20-15, and 20-17 to 20-21. The glacial till was not fully penetrated

in the boreholes but was proven to depths ranging from about 5.3 to 10.4 metres below ground surface (elevation ranging from about 83.3 to 88.8 metres).

Two grain size distribution test was undertaken on select samples of the glacial till from boreholes 20-15 and 20-19. The results are summarized in Table 4.2.

Table 4.2 – Summary of Grain Size Distribution Test (Glacial Till)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
20-15	5	3.1 – 3.7	20	43	25	11
20-19	5	3.1 – 3.7	9	46	27	19

The glacial till is a heterogeneous mixture of all grain sizes, which at this Site, can be described as grey silty sand with trace to some gravel and clay to gravelly silty sand with some clay. Although not encountered in the borehole locations directly, the glacial till deposits in this area are known to contain cobbles and boulders.

A deposit of sand with trace to some gravel was encountered below the glacial till in boreholes 20-12 and 20-15. Boreholes 20-12 and 20-15 extended 1.4 and 0.8 metres into the sand, respectively. The sand deposit was not fully penetrated by the boreholes but was proven to depths of about 6.7 and 6.1 in boreholes 20-12 and 10-15, respectively (elevations of about 87.2 and 88.0 metres, respectively).

One grain size distribution test was undertaken on a sample of the sand from borehole 20-15. The results are summarized in Table 4.3.

Table 4.3 – Summary of Grain Size Distribution Test (Sand)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
20-15	8	5.5 – 5.9	1	92	2	5

Depth to Top of Bedrock/ Overburden Thickness

A surface was generated to illustrate the depth to the top of bedrock (overburden thickness) beneath the Site and surrounding areas (Figure A6). The surface was created using the depth at the uppermost bedrock contact noted in each drillers log in the MECP water well database. As illustrated on Figure A6, depth to bedrock in the Richmond area ranges from less than 1 m to over 15 m, but on average bedrock lies approximately 10 m below ground surface.

Inferred bedrock was recorded in site-specific geotechnical studies that were carried out at the Site. Table 4.4 summarizes the depth and the corresponding elevations of refusal and bedrock surface at the borehole locations.

Table 4.4 – Bedrock Surface Summary (Various geotechnical studies)

Borehole	Ground Surface Elevation (metres)	Depth to Bedrock (metres)	Bedrock Surface Elevation (metres)
20-07	93.8	6.5	87.3[1]
13-2	94.0	11.8	82.2[2]
13-4	93.6	12.3	81.3
13-8	-	13.6	-
13-9	-	11.8[2]	-
13-5	93.5	11.9	81.6
13-6	93.7	7.4	86.3
15-1	93.7	12.3	81.4
15-2	93.6	10.9	82.7

Notes: 1 – Bedrock surface inferred from auger refusal
2 – Bedrock surface inferred from dynamic cone penetration testing

During the previous investigations, the limestone bedrock was encountered in boreholes 13-4 and 13-8 at depths of about 12.3 and 13.6 metres below ground surface. Refusal to dynamic cone penetration testing was encountered in boreholes 13-2 and 13-5 at depths of about 11.8 and 11.9 metres below ground surface. Based on the geotechnical study of the Site, the overburden thickness ranges in thickness from 6.5 to 13.6 metres, averaging 11 metres.

4.1.2 Bedrock

A total of four bedrock test wells were advanced on-site between January 7 and January 15, 2021. The construction details of the test wells are summarized in Table 4.5 below.

Table 4.5 – Summary of Test Well Construction Details

Test Well ID	Well Tag #	Geological Formation	Casing Diameter (m)	Casing Depth (m BGS)	Screen/Open Interval (m BGS)	Total Depth (m BGS)
TW21-1B	A313189	Oxford	0.152	15.8	15.8 – 48.8	48.8
TW21-1C *(PUMPING WELL)*	A313115	Nepean	0.203	57.3	57.3 – 122.2	122.2
TW21-2B	A313190	Oxford	0.152	15.2	15.2 – 45.7	45.7
TW21-2C	A313188	Nepean	0.152	57.3	57.3 – 109.1	109.1

As presented earlier, beneath the Site, the uppermost bedrock formation is a limestone unit that is interpreted to be part of the Oxford and March Formations, which are collectively referred to as the Beekmantown Group (Figure A5).

TW21-1B and TW21-2B Oxford Formation

The **Oxford Formation,** which is described as a dolostone with shaly and sandy interbeds that are up to 30 cm thick (Williams, 1991). The formation is characterized by light to medium brownish to greenish grey dolostone and is estimated to be approximately 30 m thick in the Richmond area.

The Oxford Formation is underlain by the **March Formation,** an interbedded grey quartz sandstone, dolomitic quartz sandstone, and blue-grey sandy dolostone and dolostone. The unit represents a transition zone between the Oxford Formation dolostones above, and the Nepean Formation sandstone below. Dolostones of the March Formation are lithologically similar to the overlying Oxford Formation, making them difficult to distinguish using drill cuttings. Within the Richmond area, the March Formation is estimated to be approximately 8 to 9 m thick (Paterson Group, 2011).

TW21-1B was drilled into the Oxford formation to a total depth of 48.8 m bgs. The borehole log is presented in Appendix C and the major features are described below:

- Overburden Clay with gravel at depth of 14.02 m bgs
- Grey Limestone to a depth of 48.8 m bgs

TW21-2B was drilled to a depth a total depth of 45.7 m bg. The borehole log is presented in Appendix C and the major features are described below:

- Overburden Clay with some boulders and gravel to depth of 13.4 m bgs.
- White quartzite to a depth of 19.5 m bgs
- Grey limestone to a final depth of 45.7 m bgs.

TW21-1C and TW21-2C- Nepean Formation

The underlying **Nepean Formation** is a quartz sandstone that is thinly bedded to massive and well sorted. The sandstone is variable in colour and can be white to light grey, brown, reddish brown and green. It underlies the March Formation beneath the Site, and the upper Nepean Formation contact is marked by the lowermost unit of (sandy) dolostone. Locally, the Nepean Formation is described as cream coloured, coarse-grained sandstone with a weathered grey and irregular brown stained colour (Paterson Group, 2011).

TW21-1C (main pumping well) was drilled into the Nepean formation to a total depth of 122.2m bgs. The borehole log is presented in Appendix C and the major features are described below:

- Overburden consisting of Clay and Hardpan to a depth of 14.63 m bgs
- Grey Limestone with trace grey sandstone to depth of 67 m bgs
- Grey Sandstone to a depth of 122 m bgs

TW21-2C was drilled into the Nepean formation to a total depth of 109.1 m bgs. The borehole log is presented in Appendix C and the major features are described below:

- Overburden consisting of Clay with trace gravel to a depth of 14 m bgs
- Grey Limestone with trace grey sandstone to depth of 68 m bgs
- Grey Sandstone to a depth of 109.1 m bgs

Depth to Top of Nepean Sandstone

The topography at the top of the Nepean Formation was contoured by interpolating the uppermost “sandstone” descriptor in the water well record. As illustrated on Figure A7, depth to the Nepean Sandstone lies approximately 67m bgs based on the on-site drilling results. The figure also illustrates the locations of wells that intercept the top of the Nepean Formation; several wells intersect the Nepean Formation south and west of the Site, however, there are few deep bedrock wells east and north of the Site. The topography on the top of the Nepean Formation is fairly constant across the Richmond area, increasing slightly in areas where overburden thickens east of Richmond (Figure A7).

Cross-Sections

Figures A8 to A11 are cross-sections that were generated using the information contained within the MECP water well database. The cross-section locations are illustrated on Figure A1. The bedrock surface and the top of the Nepean Formation surface described in the overlying sections are illustrated on the sections to illustrated estimated depths to the top of these surfaces. The ground surface topography represented in the 2 m DEM was also applied as the uppermost line on the cross-section.

Figure A8 is a cross-section (A-A') that runs southwest to northeast across Richmond just north of and parallel to Perth Street with the Site lying on the right side of the cross-section. The main features are as follows:

- Overburden south of the Site along cross-section A-A' is approximately 10-12 m thick and is underlain by approximately 40 to 45 m of dolostone (limestone) of the March and Oxford Formations.
- Due to the coarse nature of lithologic descriptions noted in the water well drillers logs (e.g., limestone), these two formations were not able to be reliably subdivided on the cross-sections.
- As illustrated on Figure A8, the upper surface of the Nepean Formation sandstone lies approximately 50 m bgs. On-site drilling confirmed the depth to be on the order of 68 m bgs.

Figure A9 is a cross-section (B-B') that runs from the Site in the north through the Kings Park Well 2 in the central portion of the section to the southeastern reaches of the town of Richmond. The main features are as follows:

- Overburden beneath the Site is estimated to be approximately 4 m at the north end of the Site to 10 m at the south end (Figure A6), and is expected to consist of silt and clay at surface with a discontinuous fine-grained till overlying bedrock.
- The underlying Oxford and March Formation dolostone (limestone) underlie the overburden and the Nepean Formation was encountered at approximately 67 m below ground surface (Figure A7).
- As illustrated on the cross-section the domestic wells in the area are completed in both the upper limestone, as well as the lower Nepean Formation. The cross-section intersects the Jock River and a tributary of the Jock River and the difference in elevation between the riverbanks and the water level elevation are minor (< 2 to 3 m; Figure A9).

Figure A10 is a cross-section (C-C') that runs from north to south along the western reaches of the Site in the north, to the Kings Park Well 1 in the south. The main features are as follows:

- The cross-section illustrates the commercial well TW2, where a transducer is currently installed collecting background water levels, and the relationship between this well and the nearby Kings Park Well 1, approximately 1.3 km to the south.
- As illustrated on the cross-section (Figure A10), the depth to the upper surface of the Nepean Formation along the length of the cross-section is estimated to be approximately 50 to 55 m below ground surface.

Figure A11 is a cross-section (D-D') that runs from northwest to southeast through the neighbouring Creekside 1 residential development and commercial property. The main features are as follows:

- Overburden south of the Site along cross-section D-D' is approximately 8-12 m thick and is underlain by approximately 40 to 45 m of dolostone (limestone) of the March and Oxford Formations.
- Due to the coarse nature of lithologic descriptions noted in the water well drillers logs (e.g., limestone), these two formations were not able to be reliably subdivided on the cross-sections.
- The cross-section illustrates two test wells in the Creekside 1 development, TW15-01 and TW15-03 and a commercial well TW2, where pressure transducers are currently installed collecting background water levels.
- As illustrated on the cross-section (Figure A11), the depth to the upper surface of the Nepean Formation along the length of the cross-section is estimated to be approximately 50 to 55 m below ground surface.

In general, water levels in the Richmond area lie 2 to 4 metres below ground surface and within 1 m in the low-lying areas along the Jock River (Figure A12).

A summary of the local scale Site conditions is presented as 3-D conceptual models on Figures A13 and A14.

4.1.3 Bedrock Structural Characteristics

Figure A5 illustrates the uppermost bedrock group mapped in the area, as well as the location of bedrock faults; both mapping products were generated by the Geological Survey of Canada at a regional-scale, so uncertainty exists with the exact location of the geologic contacts and faults.

4.2 Borehole Geophysics

Both optical and acoustic images, structural data (joints/fractures and bedding foliations), resistivity, SPR, SP, and natural gamma are included in the logs in Appendix D. Optical and acoustic images are oriented to magnetic north and horizontal (ground surface) for dip.

Two primary fractures were noted in both the upper Oxford-March and lower Nepean formations and are shown in the summary images below.

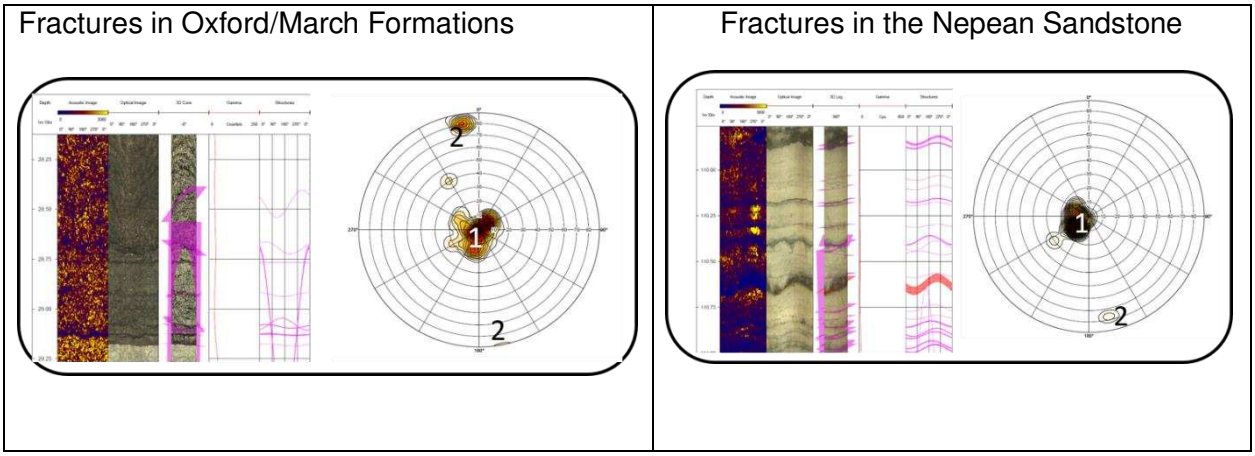

Figure D2 (Appendix D) - Illustration displaying primary fractures noted in Oxford/March and Nepean Formations.

Individual pole plots for each test hole are included in Appendix D.

Fracture set 1 represents bedding plane fractures. These fractures are relatively flat lying in both formations but the bedding in the Nepean Sandstone dips more uniformly at 5 to 10 degrees in an east – northeast direction. Fracture set 2 is sub-vertical and strikes at approximately 170 degrees but dips more prominently to the north in the deeper sandstone unit. The presence of a similarly orientated sub-vertical fracture set in both upper and lower bedrock formations may indicate a similar genesis. Fracture set 2 may transmit groundwater from the shallow limestone bedrock to the deeper sandstone unit.

Fracture apertures / fracture zones (low amplitude acoustic responses) in the Nepean Sandstone are typically wider than in the upper predominately limestone Formations which may explain why the sandstone has a much higher storage coefficient and transmissivity.

4.3 Water Supply Investigation

4.3.1 Test Well and Observation Well Network

The construction details of the test wells are summarized in Table 4.6 below. In addition to the on-site bedrock test wells, a series of off-site bedrock domestic and commercial water supply wells were used for groundwater level monitoring (refer to Detailed Site Plan, Figure 1 for well locations and Table 3.1 for well construction details). The test well and observation well records are provided in Appendix C.

Table 4.6 – Summary of Test Well Construction Details

	Test Well ID[1]	Well Tag #	Geological Formation	Casing Diameter (m)	Casing Depth (m BGS)	Screen/Open Interval (m BGS)	Total Depth (m BGS)	Distance to Pumped Well (m)
On-Site Well Cluster 1	MW20-07S	- (1)	Overburden	0.051	2.5	2.5 – 4.0	4.0	70
	MW20-07D	- (1)	Overburden	0.051	5.0	5.0 – 6.5	6.5	70
	TW21-1B	A313189	Oxford	0.152	15.8	15.8 – 48.8	48.8	12
	TW20-1C *(PUMPING WELL)*	A313115	Nepean	0.203	57.3	57.3 – 122.2	122.2	0
On-Site Well Cluster 2	MW20-15	- (1)	Overburden	0.051	2.5	2.5 – 4.0	4.0	230
	TW20-2B	A313190	Oxford	0.152	15.2	15.2 – 45.7	45.7	225
	TW21-2C	A313188	Nepean	0.152	57.3	57.3 – 109.1	109.1	225
O-Site Overburden	MW20-01S	- (1)	Overburden	0.051	2.32	2.32 – 3.84	3.84	290
	MW20-01D	- (1)	Overburden	0.051	7.68	7.68 – 9.20	9.20	290
	MW20-16S	- (1)	Overburden	0.051	2.48	2.48 – 4.00	4.00	225
	MW20-16D	- (1)	Overburden	0.051	7.68	7.68 – 9.20	9.20	225
	MW20-18S	- (1)	Overburden	0.051	2.48	2.48 – 4.00	4.00	400
	MW20-19S	- (1)	Overburden	0.051	2.48	2.48 – 4.00	4.00	340
Off-Site Bedrock Wells	TW15-01	A165020	Oxford	0.152	13.1	13.1 – 29.9	29.9	680
	TW15-03	A165022	Oxford	0.152	9.4	9.4 – 28.5	28.5	615
	Colonnade TW2	A138253	Oxford / Nepean	0.152	16.4	16.4 - 49.1	49.1	550
	A274440	-(2)	Oxford	0.152	14.0	14.0 – 30.5	30.5	550

	Test Well ID[1]	Well Tag #	Geological Formation	Casing Diameter (m)	Casing Depth (m BGS)	Screen/Open Interval (m BGS)	Total Depth (m BGS)	Distance to Pumped Well (m)
	A260995	-[(2)]	Oxford	0.152	12.2	12.2 – 42.7	42.7	580
	A274380	-[(2)]	Oxford	0.152	9.75	9.75 – 25.0	25.0	560

1. Monitoring well installed as part of geotechnical investigation (GEMTEC, 2021)
2. Water well ID not provided in order to protect the confidentiality of private well owners. Well information maintained by GEMTEC.

4.3.2 TW21-1C Hydraulic Testing Results

The transmissivity and storativity of the water supply aquifer were estimated from the 72-hour pumping test drawdown data using Aqtesolv version 4.5, a commercially available software program from HydroSOLVE Inc. An analysis of the pumping test data was carried out using the Cooper-Jacob and Theis recovery methods.

Test Well TW21-1C sustained a constant pumping rate of approximately 910 litres per minute for a period of 72 hours. The maximum observed drawdown in the pumping well, TW21-1C was 44.07 metres (65% of the available drawdown). Observation wells located 10 to 725 metres from the pumping well reported water level drawdown ranging from <0.1 to 5.67 metres. Following cessation of pumping, the water level in TW21-1C recovered 95% within 2 hours.

A summary of the maximum observed drawdown, estimated transmissivity and storativity from the pumping well and observation wells are provided in Table 4.7. The drawdown and recovery plots are provided in Appendix E.

Table 4.7: Aquifer Test Results

	Test Well ID[1]	Geological Formation	Total Depth (m BGS)	Distance to Pumped Well (m)	Maximum Drawdown @ 72 hours (m)	T[1] Drawdown (m^2/day)	T[1] Recovery (m^2/day)	S[2] (-)
Well Cluster 1	MW20-07S	Overburden	4.0	70	0.31	-	-	-
	MW20-07D	Overburden	6.5	70	1.19	-	-	-
	TW21-1B	Oxford	48.8	12	5.67	58	47	3×10^{-3}
	TW21-1C *(PUMPING WELL)*	Nepean	122.2	0	44.07	39	50	-
Well	MW20-15S	Overburden	4.0	230	<0.1	-	-	-

	Test Well ID[1]	Geological Formation	Total Depth (m BGS)	Distance to Pumped Well (m)	Maximum Drawdown @ 72 hours (m)	T[1] Drawdown (m^2/day)	T[1] Recovery (m^2/day)	S[2] (-)
	TW21-2B	Oxford	45.7	225	0.88	670	864	3×10^{-4}
	TW21-2C	Nepean	109.1	225	0.85	670	813	3×10^{-4}
Overburden Monitoring	MW20-01S	Overburden	3.84	290	<0.1	-	-	-
	MW20-01D	Overburden	9.20	290	0.66	-	-	-
	MW20-16S	Overburden	4.00	225	<0.1	-	-	-
	MW20-16D	Overburden	9.20	225	1.27	-	-	-
	MW20-18S	Overburden	4.00	400	<0.1	-	-	-
	MW20-19S	Overburden	4.00	340	<0.1	-	-	-
Off-Site	TW15-01	Oxford	29.9	680	<0.1	-	-	-
	TW15-03	Oxford	28.5	615	0.44	-	-	-
	Colonnade TW2	Oxford / Nepean	49.1	550	0.46[3]	-	-	-
	A274440	Oxford	30.5	550	0.41[3]	-	-	-
	A260995	Oxford	42.7	580	0.40[3]	-	-	-
	A274380	Oxford	25.0	560	0.46[3]	-	-	-

Notes: 1. T = transmissivity; 2. S = Storativity; 3. Residential or commercial well in-use.

The calculated transmissivity of the pumping well (TW21-1C) is 39 and 50 m^2/day from drawdown and recovery, respectively. The calculated transmissivity of the observation well cluster TW21-2B (Oxford) and TW21-2C (Nepean) ranged from 670 to 864 m^2/day, with a storativity of 3×10^{-4}. The calculated transmissivity and storativity from the bedrock observation wells are consistent with transmissivity (362 to 755 m^2/day) and storativity (1.0×10^{-2} to 1.4×10^{-4}) estimates from local studies of the Nepean Aquifer (Golder, 2011; Geofirma, 2021). The transmissivity estimates from the pumping well TW21-1C are an order of magnitude lower than TW21-2B and TW21-2C; however, this can be attributed to head losses in the pumped well and well efficiency and thus not representative of the aquifer properties.

4.3.3 Aquifer Hydraulic Connectivity

Pumping in the Nepean Sandstone caused drawdown in the upper bedrock formations and in the overburden (deep) monitoring wells that were installed in both the till and clay (with sand seams). Sub-vertical fractures that cut across both the deep and shallow bedrock Formations likely transmit groundwater to the deeper aquifer during pumping. The hydraulic connection between

the two Formations was also noted in the pump test data from the Western Development Lands, although not described in detail, the drawdown data for shallow and deep bedrock wells show a similar hydraulic response to this this study.

The drawdown in the deep monitoring wells suggest that the groundwater in the overburden is connected to the bedrock aquifer system and that the overburden will respond to pumping stresses in the deep bedrock aquifers. The drawdown in a deep overburden well MW20-16D, installed in the clay was 1.27 metres and located 225 metres from the pumping well. The clay at this location was noted to contain sand seams which likely connects to the sandy till or silty sand soils.

4.4 TW21-1C Water Quality Results

The results of the chemical, physical and bacteriological analyses on the water samples from test well TW21-1C is summarized in Appendix G and the laboratory results from Paracel are provided in Appendix H.

4.4.1 Bacteriological Parameters

Total and free chlorine measurements confirmed that total and free chlorine concentrations in the well water was non-detectable (<0.02 mg/L) at the time of bacteriological sampling during the pumping test (refer to Appendix G).

Based on water samples collected from test well TW21-1C, all samples were non-detect for total coliform, e. Coli and fecal coliform bacteria. The water quality meets the Ontario Drinking Water Quality Standards (ODWQS) maximum acceptable concentrations.

4.4.2 Other Health Related Parameters

No other maximum acceptable concentration limits of the ODWQS were exceeded in the 24-hour, 48-hour or 72-hour water samples collected from TW21-1C. This includes fluoride, nitrate, nitrite, heavy metals (mercury, aluminum, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, selenium and uranium), PHCs, VOCs or pesticides/herbicides.

4.4.3 Operational Guideline Exceedances

Operational related exceedances of the ODWQS were noted for hardness and these are discussed in the following section:

Hardness

The concentration of hardness in water samples obtained from TW21-1C ranged from 326 to 340 mg/L as $CaCO_3$ and is higher than the operational guideline of 80 to 100 mg/L of $CaCO_3$ as specified in the ODWQS.

Water having a hardness level above 80 to 100 mg/L as CaCO3 is often softened for domestic use. The MECP Procedure D-5-5 document states that water having a hardness value more than 300 mg/L is considered "very hard". The Ontario Ministry of the Environment publication entitled "Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines", states that water with hardness in excess of 500 mg/L is considered to be unacceptable for most domestic purposes. There is no upper treatable limit for hardness specified in MECP Procedure D-5-5.

The concentrations of hardness in all the test wells are below the reported threshold of 500 mg/L as CaCO3 as specified in the Technical Support Document for the ODWQS. The concentration of hardness observed in the test wells is considered to be reasonably treatable using a conventional water softener. Based on our experience, most water supply wells within rural eastern Ontario are equipped with water softeners.

Water softening by conventional sodium ion exchange may introduce relatively high concentrations of sodium into the drinking water that may be of concern to persons on a sodium restricted diet. The use of potassium chloride in the water softener (which adds potassium to the water instead of sodium); could be considered as a means of keeping sodium concentrations in the water at background levels.

4.4.4 Aesthetic Objective Exceedances

Aesthetic objective exceedances of the ODWQS included total dissolved solids and colour. These exceedances are discussed in the following sections:

Total Dissolved Solids (TDS)

The TDS levels in samples from TW21-1C during the 72-hour pumping test increased from 484 to 514 mg/L. The sample collected at 72-hours exceeds the ODWQS aesthetic objective of 500 mg/L, with a TDS of 514 mg/L. Elevated levels of TDS can lead to problems associated with encrustation and corrosion

To determine the corrosive nature of the groundwater, the Langelier Saturation Index (LSI) was calculated for the samples obtained from the test wells. These values are based on the laboratory measured TDS, pH, alkalinity, and hardness following 72-hours of pumping. The LSI was calculated to be 0.68, using a field-measured groundwater temperature of 8°C (refer to Appendix F). The calculated LSI value is between 0.5 and 2, which indicates the groundwater scale forming, but non-corrosive.

As per the “Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines”, TDS levels in excess of 500 mg/L may result in excessive hardness, taste, mineral deposition or corrosion. According to the “Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Total Dissolved Solids (TDS)”, published by Health Canada

(1991), TDS levels between 600 and 900 mg/L are considered to be 'fair'. At levels above 1,200 mg/L, the palatability of drinking water is 'unacceptable'. The palatability of the drinking water is considered to be acceptable.

Colour

The analytical laboratory results for colour are reported as 'colour' (TCU; filtered) and 'apparent colour' (ACU; unfiltered). The colour decreased from 15 TCU to 7 TCU from the 24-hour and 72-hour samples respectively. Similarly, the apparent colour decreased from 28 to 19 ACU from the 24-hour and 72-hour samples respectively.

Water having a faint yellow/brown colour can be caused by organic materials and contributed to by iron and manganese. Colour is not generally considered a health issue and the aesthetic objective is set by appearance. The elevated laboratory colour may be the result of iron and manganese, which can precipitate out of solution and increase the colour levels.

Although the laboratory-measured colour exceeded the MECP D-5-5 aesthetic objective of 5 TCU, the field-measured colour was non-detectable (less than 5 TCU). The colour decreased throughout the pumping test, along with turbidity, and is anticipated to further decrease following additional well development. The elevated laboratory colour levels are likely related to iron and manganese and based on the measured true colour at the time of sampling, the colour levels are considered to be acceptable.

4.4.5 Notable Parameters

A Golder (2011) study of the Nepean Aquifer in Richmond reported chloride concentrations in the 43-44 mg/L range. The 2018 Annual Monitoring Report for the Kings Park communal wells, in the Village of Richmond reported chloride concentrations in treated water of 168.8 mg/L (City of Ottawa, 2018).

During the 72-hour pump test for this study chloride was noted to increase from 94 mg/L after 24 hours of pumping to 122 mg/L after 48 hours and finally 138 mg/L at the end of the 72 hour test. The increase in chloride is still with in the range of values noted in the Kings Park Communal wells and elsewhere for the Nepean Aquifer. A study of the Nepean Aquifer in Greely (Geofirma, 2021) reported increasing chloride concentrations from 85 to 104 mg/L and 116 to 129 mg/L in two Nepean test wells.

4.5 Offsite Well Water Quality Results – Creekside 1

The offsite water quality was assessed by sampling 24 domestic private wells and two test wells in the Creekside 1 development, all of which are completed in limestone bedrock of the Oxford Formation (refer to Water Well Records in Appendix H)

The domestic well sampling identified five private wells and one test well localized in the southern portion of the Creekside 1 development with multiple ODWQS aesthetic objective and operational guideline exceedances. The ODWQS exceedances include chloride (366 - 837 mg/L), hardness (522 – 1110 mg/L), sodium (133 – 270 mg/L), turbidity (<0.1 - 34.4 NTU) and total dissolved solids (842 - 2080 mg/L). These exceedances were further investigated by GEMTEC under a separate cover, titled “Investigation of Potential Chloride Sources – Creekside Subdivision Phase 1, Village of Richmond, Ottawa, Ontario” and dated May 31, 2021.

The hydrogeological investigation (GEMTEC, 2021) identified a stormwater management pond in an adjacent property as a potential source of chlorides. The investigation into this impact is ongoing. Follow-up sampling of the six affected private wells completed in July 2021 found significant decreases in chloride concentrations, from 223 – 837 mg/L to 103 - 224 mg/L (Appendix I). The decreases in chloride concentrations supports the hydrogeological conceptual model presented in GEMTEC (2021), which suggests seasonal de-icing salt inputs into the local groundwater system from the adjacent stormwater management pond. Follow-up water quality sampling has been completed since July 2021 and reported under separate cover. Further testing will be required to confirm the source and appropriate mitigation measures.

With the exception of the six impacted private wells in the Creekside 1 development, the water quality in the other 18 private wells sampled, meets all the ODWQS health related, maximum acceptable concentrations and treatability limits. A summary of the water quality results is provided in Appendix I. The following operational guideline and aesthetic objective exceedances are noted:

- Operational guideline: hardness (17 / 18 wells) and organic nitrogen (1 / 18 wells)
- Aesthetic Objective: total dissolved solids (3/ 17 wells), colour (6 / 18 wells), turbidity (1 / 17 wells) and iron (2 / 18 wells).

The groundwater quality of the 17 private wells are generally consistent with the findings of the initial Creekside 1 hydrogeological investigation (Golder, 2017), with aesthetic objective exceedances of colour and total dissolved solids, and operational guideline exceedances of hardness. Some variability in the range of water quality parameters were observed as expected given the number of wells tested and the variability in private wells depths.

The investigation is currently ongoing and under review by the MECP. Follow-up water quality sampling has been completed at numerous times since May, 2021 and reported under separate cover.

5.0 IMPACT ASSESSMENT

Based on the results of this study the following impact assessment is presented.

5.1 Water Quantity

The aquifer is capable of meeting the water quantity demands of the proposed 455-unit subdivision. As part of this study a test well was pumped at approximately 2.5 times the average demand (peak rate) for the development for 72 hours. The resulting maximum drawdown in the aquifer was 44.1 metres (65% of the available drawdown) and the test well recovered quickly, less than 2 hours for 95% recovery.

It is anticipated that the final production well(s) will encounter similar aquifer hydraulics to the test wells in the proposed communal well location (See Figure A2.2 in Appendix A); however, the production wells will be 50% larger in diameter than the main test well, 305 mm versus 203 mm, and the actual operational pumping will be less than the 72 hours test duration. Based on these factors the pumping stresses on the aquifer system by the final production well(s) and resulting drawdowns will be less that those imposed during the pump test.

5.2 Wellhead Protection and Water Quality Impacts

The results of this study suggest that the bedrock and surficial overburden groundwater systems are more interconnected, at least local to the study area, than other past studies have shown. From a wellhead protection perspective, this would mean that more recharge and potential chemical inputs could occur in areas where the surficial soils are thin or the near surface clay is absent. Overall, this may also reduce the size of the modelled wellhead capture zones.

The aquifer may be more vulnerable to surficial contamination from reduced thickness of low permeability soils or higher permeable windows above the upper bedrock aquifer. Groundwater quality impacts from chlorides have been identified in the Creekside 1 residential subdivision (GEMTEC, 2021). The hydrogeological investigation (GEMTEC, 2021) suggests seasonal de-icing salt inputs into the upper limestone bedrock from the adjacent stormwater management pond, which is excavated approximately 4 metres below ground surface. The investigation is ongoing and the source of chlorides has not been confirmed.

The impacted water supply wells in the Creekside 1 development are localized to the shallow water supply wells in the southern portion of the development. Follow-up sampling suggests that the source is seasonally active and the inputs are rapidly flushed through the aquifer system. Appropriate mitigation measures and well head protection best management practices are expected to reduce potential impacts to the shallow bedrock aquifer and the proposed deep water supply aquifer for the Creekside 2 development.

5.3 Hydrogeological Sensitivity

Water levels recorded as part of this investigation demonstrate that the deeper Nepean aquifer and shallow Oxford / March Formations are interconnected and that high rates of groundwater pumping from the deeper aquifer causes drawdown in the upper bedrock system. In addition, pumping from the deeper aquifer also causes drawdown in the deep overburden sediments.

However, the absence of drawdown in near surface wells installed in the clay deposits suggests that the aquifer system is still somewhat isolated from surface contamination.

Hydrogeological sensitive areas may exist where the clay is absent or it is removed from the surface by excavation. In general, the groundwater chemistry results, an absence of nitrate compounds and bacteriological parameters, also supports the water level data and suggest that the Site is not hydrogeological sensitive. However, consideration should be given to any excavations, such as storm water ponds, that could remove protective clays from the near surface at the Site. In these instances where excavations must be made, protective clay liners or geosynthetic liners should be considered.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on the results of the hydrogeological investigation, the following conclusions and professional opinions are provided:

- The surficial geology across the Site generally consists of deposits of clay (with sand seams), till and lesser sands. The lowermost overburden sequence in the area is glacial till, overlain by glaciolacustrine silts and clays. Sand layers were also noted at two of 25 borehole locations. The Site overburden thickness ranges from approximately 6.5 to 13.6 metres, averaging 11 metres.
- The Site is not considered to be hydrogeologically sensitive based on the absence of thin soils, highly permeable soils or karst features.
- The water supply aquifers encountered at the Site includes limestone of the Oxford and March Formations (Beekmantown Group) underlain by sandstones of the Nepean Formation.
    - The Nepean sandstone lies approximately 67m bgs based on the on-site drilling results and is aquifer tested in this investigation.
    - Neighbouring water well users primarily rely on the Oxford and March Formation water supply aquifer.
    - Similar geological and hydrogeological conditions were found at both drilling and testing locations (e.g. TW21-1C; TW21-2C) located spatial 230 metres apart across the development site.
- Hydrogeological conceptual model (CSM)
    - The CSM was updated based on the on-site drilling results and hydraulic responses during the pump tests
    - The drawdown in the deep monitoring wells suggest that the groundwater in the overburden is connected to the bedrock aquifer system and that the overburden will respond to pumping stresses in the deep bedrock aquifers.

- Specifically, pumping in the Nepean Sandstone caused drawdown in the upper bedrock formations and in the overburden (deep) monitoring wells that were installed in both the till and clay (with sand seams).
- It is likely that the sub-vertical fractures that cut across both the deep and shallow bedrock Formations can transmit groundwater to the deeper aquifer during pumping. The presence of a similarly orientated sub-vertical fracture set in both upper and lower bedrock formations may indicate a similar genesis.
- Fracture aperatures / fracture zones in the Nepean Sandstone are typically wider than in the upper predominately limestone Formations which may explain why the sandstone has a much higher storage coefficient and transmissivity.
- The measured water level drawdowns within the overburden unit during the pump tests, should be evaluated as part of the building geotechnical designs.
- The aquifer may be more vulnerable to surficial contamination from reduced thickness of low permeability soils or higher permeable windows above the upper bedrock aquifer

- The water quality available from test well TW21-1C, completed in the Nepean sandstone aquifer is safe for consumption based on the absence of health-related exceedances; however, groundwater treatment for aesthetic parameters will be required.
  - Treatment for hardness, colour and iron may be desirable and can be treated using conventional water softeners and/or manganese greensand filters.
  - Sodium concentrations exceed the warning level for persons on sodium restricted diets of 20 mg/L and the Local Medical Officer of Health should be notified.
  - Total Dissolved Solids slightly exceeded the ODWQS aesthetic objective of 500 mg/L at 514 mg/L. LSI values indicate the water is considered scale forming, but non-corrosive; some encrustation can be expected.

- The water quality of the upper bedrock water supply aquifer (Oxford/March Formations), with the exception of the localized wells in the southern portion of the Creekside 1 development, meets the ODWQS maximum acceptable concentrations and treatability limits, with aesthetic objective and operational guideline exceedances of colour, total dissolved solids, hardness and the sodium warning level.
  - Private well owners interviewed in Creekside 1 – Phase 1 noted multiple groundwater quality issues, namely ‘sulfur’ odours, iron staining, high hardness and total dissolved solids. The groundwater quality issues are consistent with the aesthetic objective and operational guideline exceedances stated in the hydrogeological investigation (Golder, 2017). Although the sampling did not identify ODWQS for hydrogen sulphide, ‘sulphur’ odours were noted by 10 homeowners.
  - Multiple wells in the southern portion of the Creekside 1 development have reported intermittent elevated chlorides, total dissolved solids, sodium, hardness

and turbidity. An offsite impact is suspected as the source of the contamination. This potential source is currently being investigated.

- Impacted wells are localized to the southern portion of Phase 1 of the Creekside 1 development.
- Follow-up sampling in July 2021 found decreasing chloride concentrations in all affected wells which are within the ODWQS aesthetic objective, suggesting that the source is seasonally active and the inputs are rapidly flushed through the aquifer system.
- The investigation is currently ongoing and under review by the MECP. Follow-up water quality sampling has been completed at numerous times since May, 2021 and reported under separate cover.

- The water quality determined in the course of this investigation is representative of long-term water quality and is consistent with water quality investigations of the Nepean Aquifer in the Ottawa area (Golder, 2011; Geofirma, 2021; City of Ottawa 2018; City of Ottawa, 2020).

- The quantity of groundwater available from the proposed water supply aquifer is sufficient for the proposed development and will sustain repeated pumping at the test rate and duration at 24-hour intervals over the long term.
  - TW21-1C was pumped at a constant rate of approximately 910 litres per minute for 72 hours. The maximum drawdown observed at the end of pumping was 44.07 metres and following cessation of pumping, the water level recovered 95% within 2 hours.
  - The large drawdown observed in TW21-1C and relatively low transmissivity of the pumping well can be attributed to well inefficiencies (i.e. well losses, pump configuration, pump depth, etc.). Larger diameter production wells will reduce well inefficiencies and associated water level drawdown.

- Interference between neighbouring private drinking water wells is expected to be minimal.
  - Drawdown at neighbouring residential wells in the Creekside 1 development (Oxford/March Formations) and Colonnade commercial development (Oxford/ March/ Nepean Formation) during the pumping test was less than 0.5 metres.

6.2 Recommendations

The following provides recommendations regarding well construction specifications and water quality:

6.2.1 Well Construction Recommendations

- Future production wells should be constructed in accordance with the City of Ottawa's Drinking Water Facility Design Guidelines and MECP regulations, including, but not limited to, Ontario Reg. 903. The well bore opening should be a minimum of 0.254 metres (10 inches) to reduce well inefficiencies.

- Well casings should be extended at least 57.3 metres (188 feet) below ground surface. The entire annular space between the steel casing and the overburden/ bedrock should be filled with a suitable cement or bentonite grout;

- A well grouting certification inspection should be conducted during the installation and grouting of the well casing for all future wells installed on the Site. The well grouting certification inspection should be conducted under the supervision of a professional engineer or professional geoscientist.

- The future production wells should be located proximal to TW21-1C within the proposed Communal Well location in accordance with any specific wellhead protection requirements. As the Nepean Aquifer is regionally extensive with similar hydrogeological properties, it is expected that comparable results in terms of groundwater quantity and quality will be obtained during communal well drilling at the proposed preferred location within the development area.

6.2.2 Water Quality Recommendations

- It is recommended that a water quality treatment specialist appropriately configure and size the treatment systems.

- It is recommended that homeowners and the Local Medical Officer of Health be informed that sodium concentrations exceed 20 mg/L and exceed the warning level for persons on sodium restricted diets.

7.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Andrius Paznekas, M.Sc., P.Geo.
Hydrogeologist

Shaun Pelkey, M.Sc.E., P.Eng.
Principal, Environmental Engineer

Stephen Livingstone, M.Sc., P.Geo.
Senior Hydrogeologist

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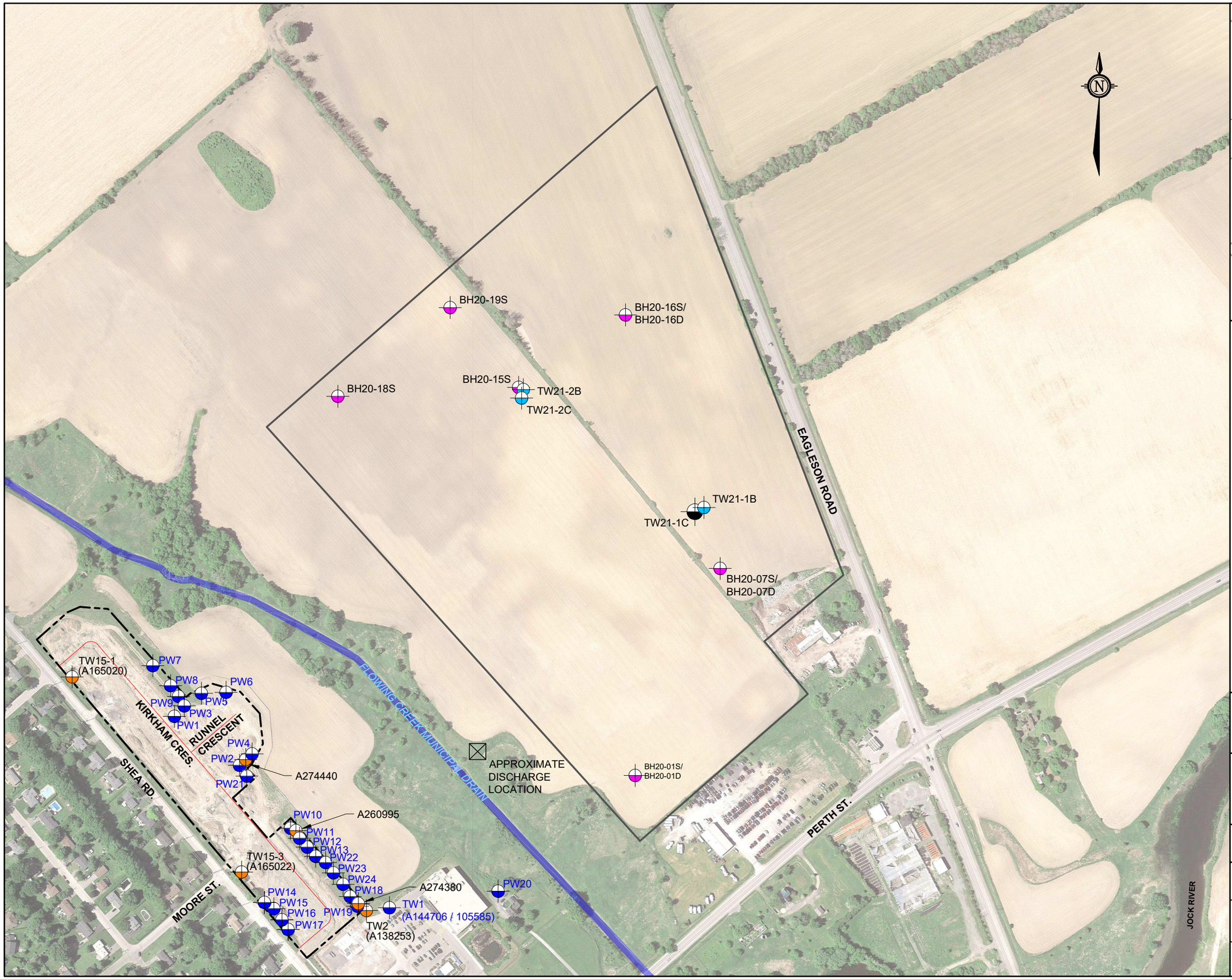
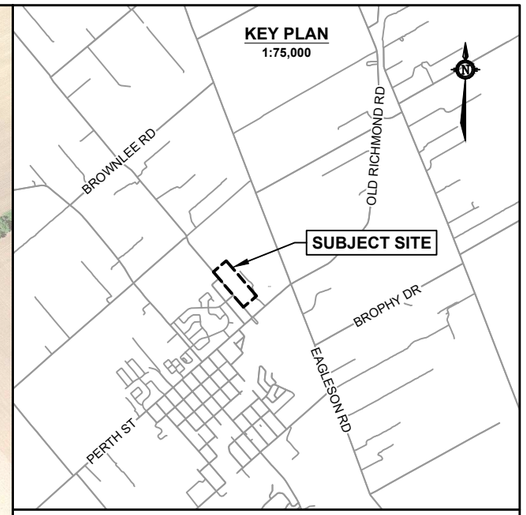
7.2 Limitations

This report was prepared for 1470424 Ontario Inc. and is intended for the exclusive use of 1470424 Ontario Inc. This report may not be relied upon by any other person or entity without the express written consent of GEMTEC and 1470424 Ontario Inc. Nothing in this report is intended to provide a legal opinion.

The investigation undertaken by GEMTEC with respect to this report and any conclusions or recommendations made in this report reflect the best judgments of GEMTEC based on the Site conditions observed during the investigations undertaken at the date(s) identified in the report and on the information available at the time the report was prepared. This report has been prepared for the application noted and it is based, in part, on visual observations made at the Site, subsurface investigations at discrete locations and depths and laboratory analyses of specific chemical parameters and material during a specific time interval, all as described in the report. Unless otherwise stated, the findings contained in this report cannot be extrapolated or extended to previous or future site conditions, portions of the Site that were unavailable for direct investigation, subsurface locations on the Site that were not investigated directly, or chemical parameters, materials or analysis which were not addressed.

Should new information become available during future work, including excavations, borings or other studies, GEMTEC should be requested to review the information and, if necessary, re-assess the conclusions presented herein.





LEGEND

- PUMPING WELL
- ON-SITE BEDROCK OBSERVATION WELL
- ON-SITE OVERBURDEN OBSERVATION WELL
- OFF-SITE OBSERVATION WELL
- PRIVATE WELL
- APPROXIMATE DISCHARGE LOCATION
- APPROXIMATE BOUNDARY OF CREEKSIDE 2 RESIDENTIAL DEVELOPMENT
- APPROXIMATE BOUNDARY OF CREEKSIDE 1 RESIDENTIAL DEVELOPMENT
- WATER COURSES
- EXISTING ROAD

Scale 1:4000

0 80 160 240m

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www.gemtec.ca
ottawa@gemtec.ca

Client	Project
CARDEL HOMES	61999.03

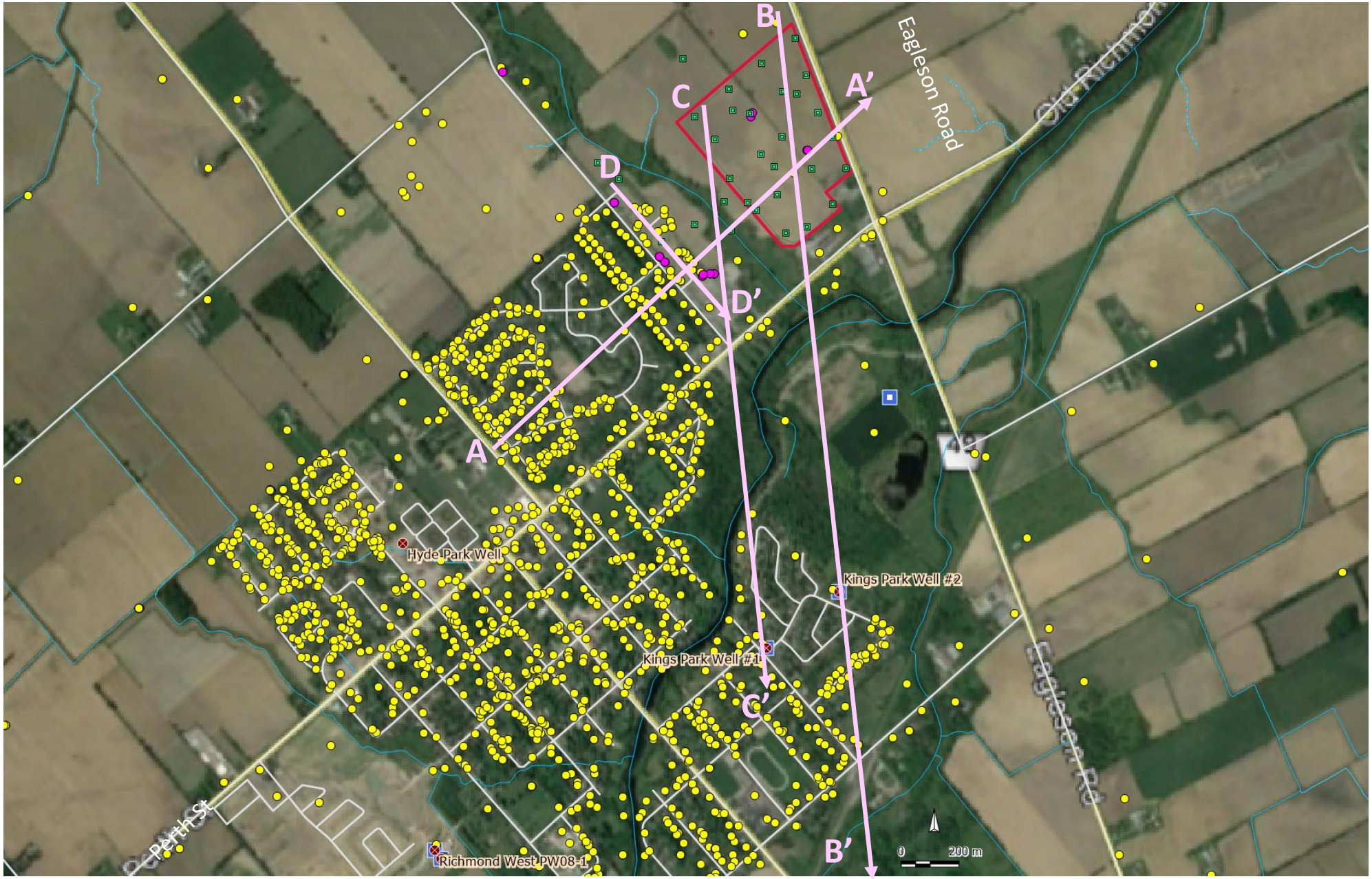
Location: CREEKSIDE DEVELOPMENT - PHASE 1
EAGLESON ROAD, OTTAWA, ONTARIO

Drwn by	Chkd by	
S.L.	A.P.	DETAILED SITE PLAN

Date	Rev.	
JULY, 2021	0	**FIGURE 1**

APPENDIX A

Conceptual Site Model Figures



Municipal/ Communal Well
Permitted Water Takers
Potential Monitoring/ Test Wells
Water Wells
Site Boundary
Cross-Section Location

Roads
Intermittent Streams
Permanent Rivers
Geotechnical Well/
Potential Monitoring Well

Creekside Development
Conceptual Site Model

Site Map and Cross-Section Locations

GEMTEC
Consulting Engineers and Scientists

Site Boundary
Road
Stream/River
Open Hole Well Extending into Nepean Fm
Geotechnical Well/ Potential Monitoring Well
Potential Monitoring/ Test Well
Water Wells

Creekside Development
Conceptual Site Model

Site Map

GEMTEC
Consulting Engineers and Scientists

2.1

Site Boundary
Road
Stream/River
Open Hole Well Extending into Nepean Fm
Geotechnical Well/ Potential Monitoring Well
Potential Monitoring/ Test Well
Water Wells

Creekside Development
Conceptual Site Model

Revised Site Plan

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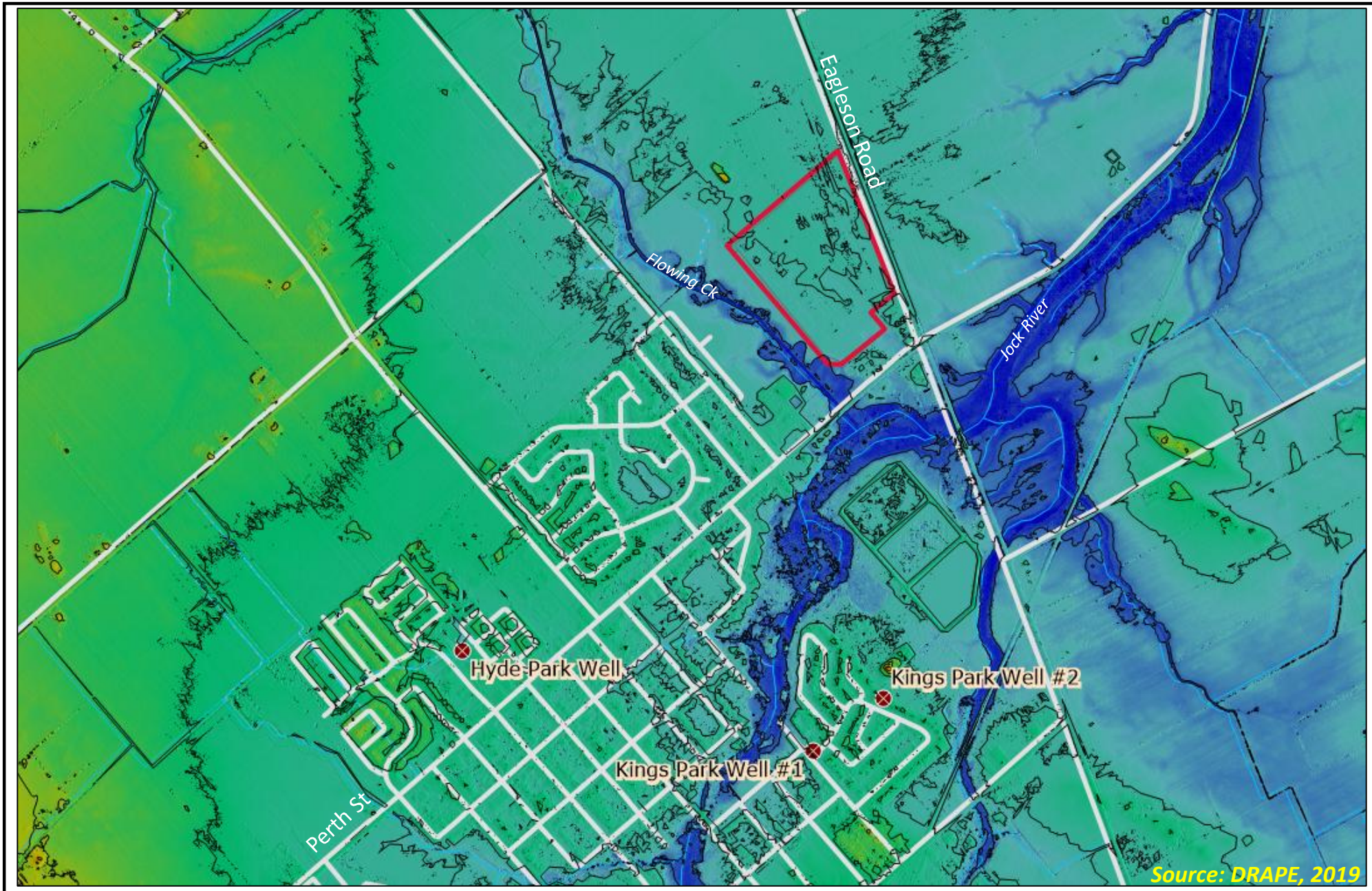
2.2



Site Area
Municipal/ Communal Wells
Roads
Intermittent Streams
Permanent Rivers
Ground Surface Contours (2 m)

Ground Surface Elev (m asl)
104
101
98
95
93
90

Creekside Development
Conceptual Site Model

Ground Surface Elevation

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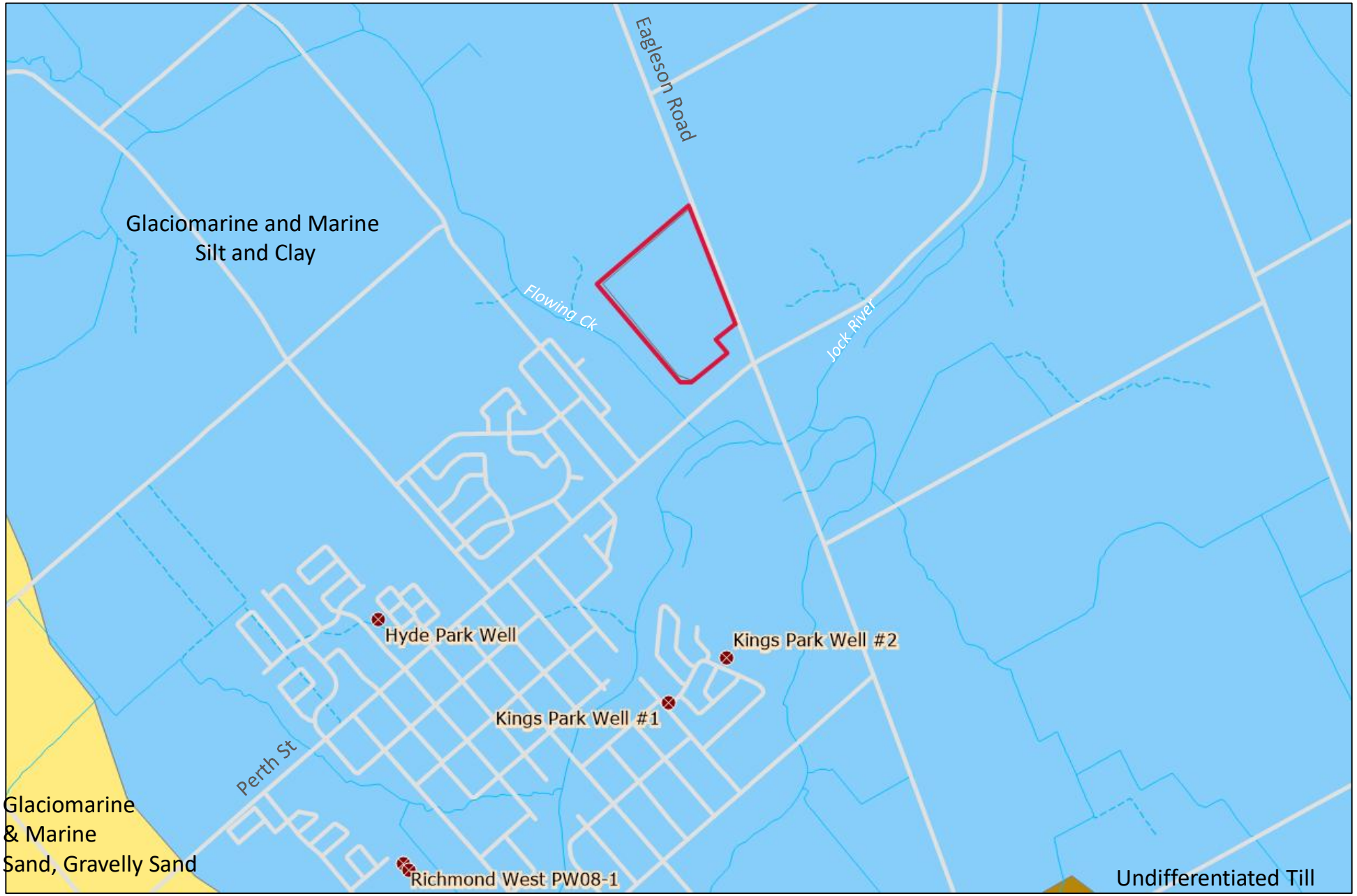

Site Area
Municipal/ Communal Wells
Roads
Intermittent Streams
Permanent Rivers

sand, gravelly sand and gravel, nearshore and beach deposits
silt and clay, basin and quiet water deposits
undifferentiated till, predominantly sandy silt to silt matrix

Creekside Development
Conceptual Site Model

Surficial Geology

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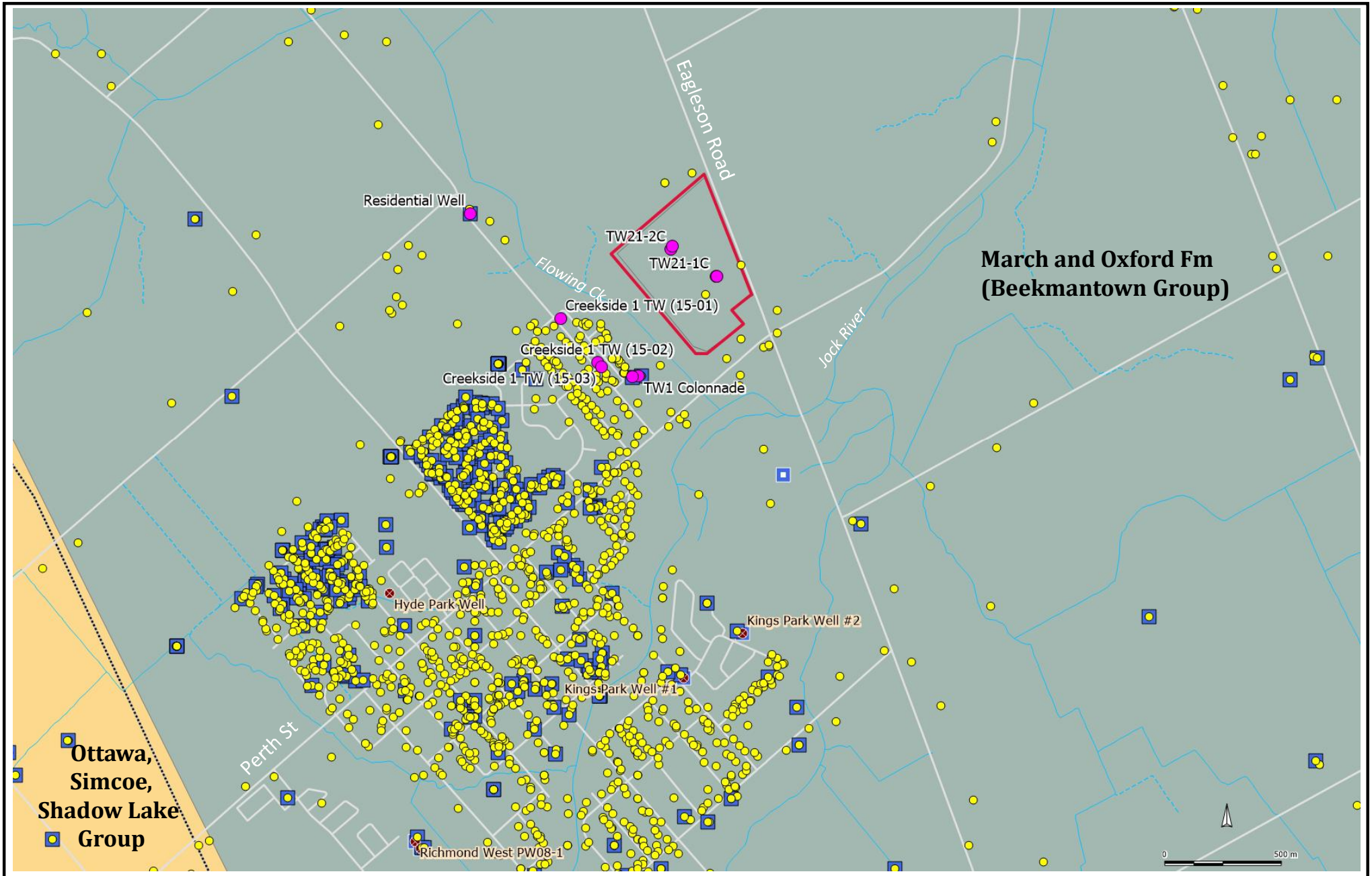

Site Area
Municipal/ Communal Wells
Roads
Intermittent Streams
Permanent Rivers
Potential Monitoring Wells/ Test Wells
Water Wells
Faults
Beekmantown Group
Ottawa Gp.; Simcoe Gp.; Shadow Lake Fm
Open Hole Well Extending into Nepean Fm

Creekside Development
Conceptual Site Model

Bedrock Geology

GEMTEC
Consulting Engineers and Scientists

Site Area
Municipal/ Communal Wells
Roads
Intermittent Streams
Permanent Rivers

Depth to Top of Bedrock (m)

31	14
27	11
24	7
21	4
17	0-1

Data Source: Ministry of Environment Conservation and Parks Water Well Information System

Creekside Development
Conceptual Site Model

Depth to Top of Bedrock
(Overburden Thickness)

GEMTEC
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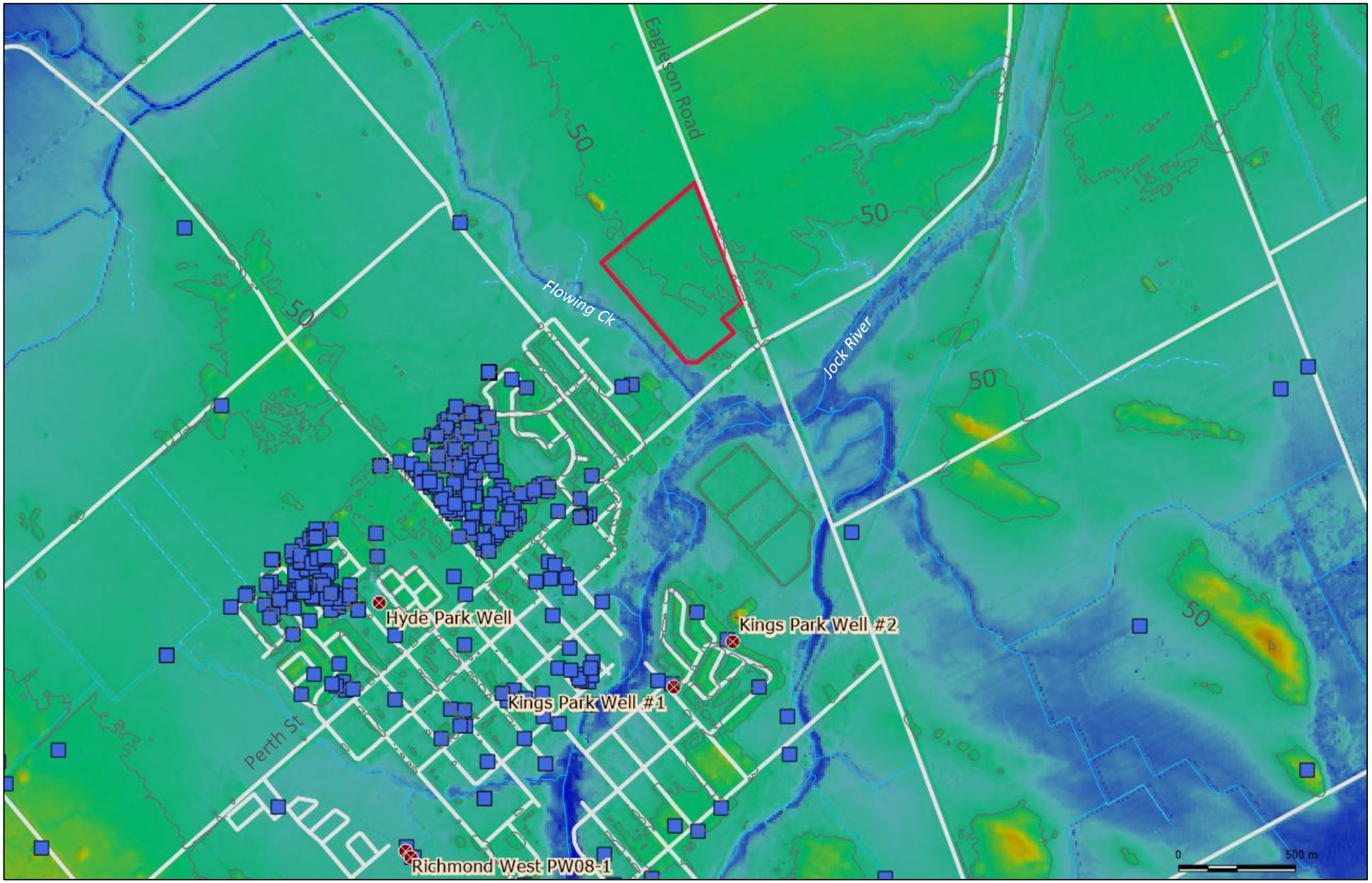

Site Area
Municipal/ Communal Wells
Roads
Intermittent Streams
Permanent Rivers
Open Hole Well Extending into Nepean Fm

Depth to Top of Nepean (m)
56
53
50
48
45
5 m Elevation Contours

Creekside Development
Conceptual Site Model

Interpreted Depth to Nepean Formation
(Sandstone)

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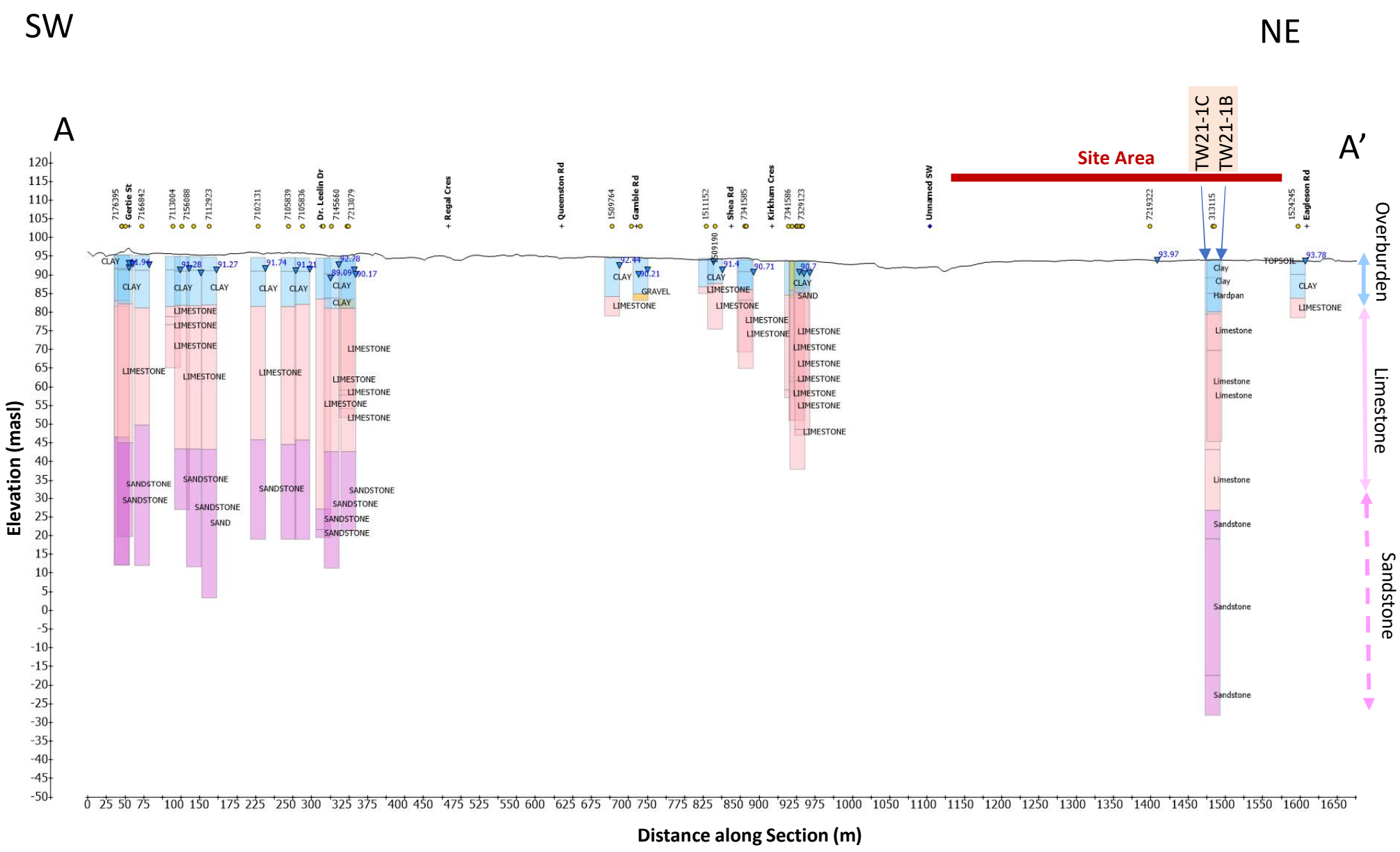

Creekside Development
Conceptual Site Model

Cross-section A-A'

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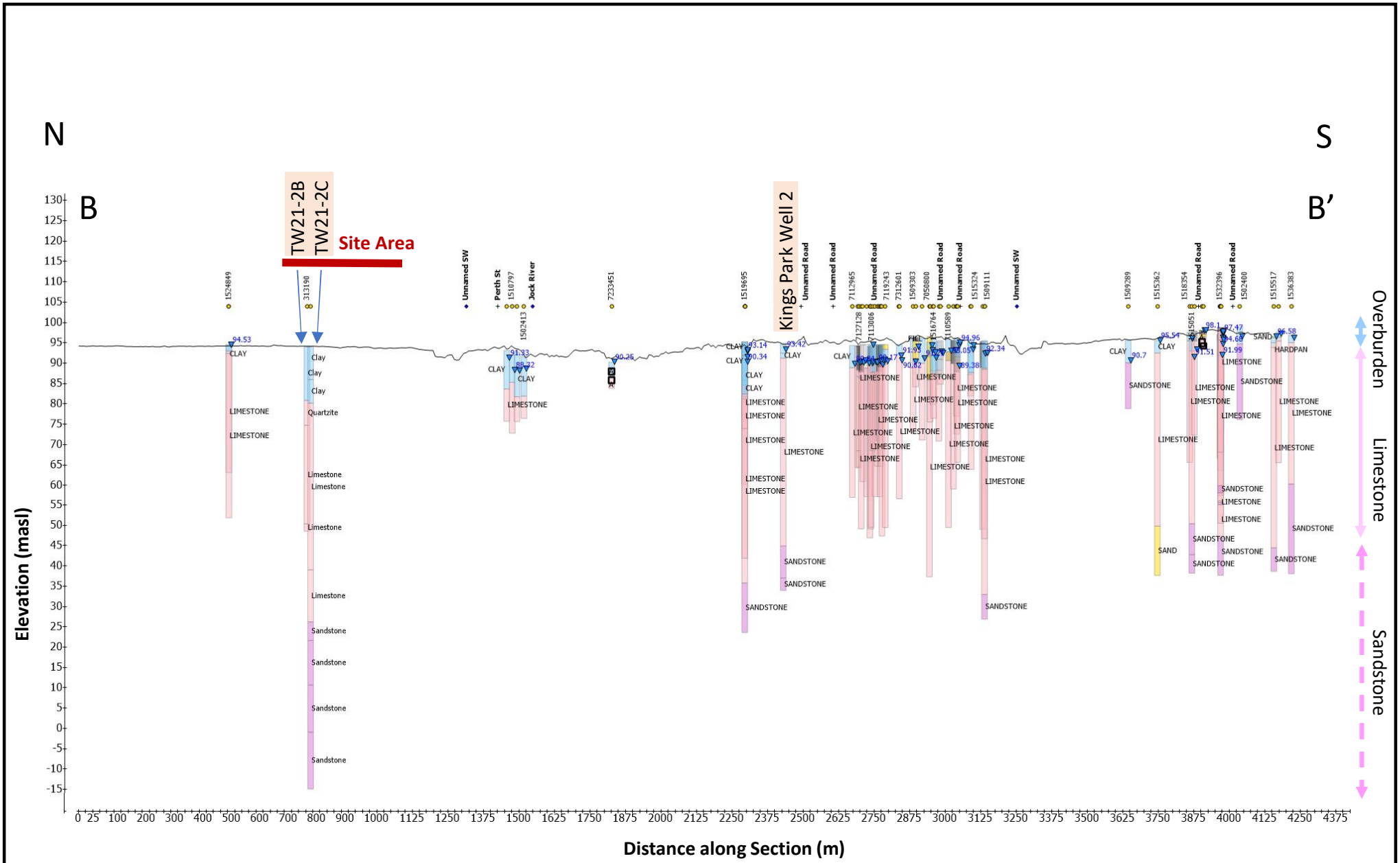
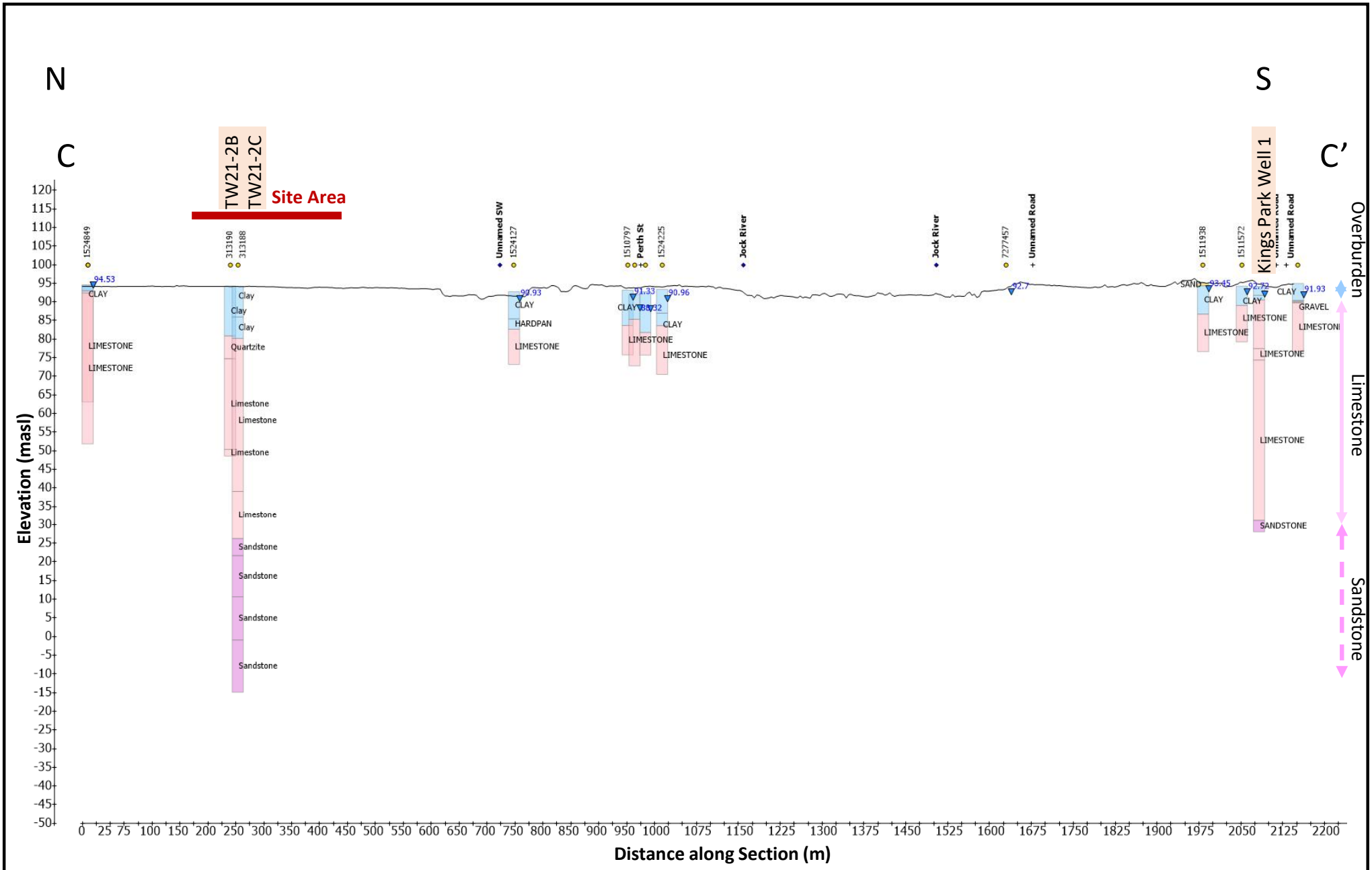


Creekside Development
Conceptual Site Model

Cross-section B-B'

GEMTEC
Consulting Engineers and Scientists



Water Level

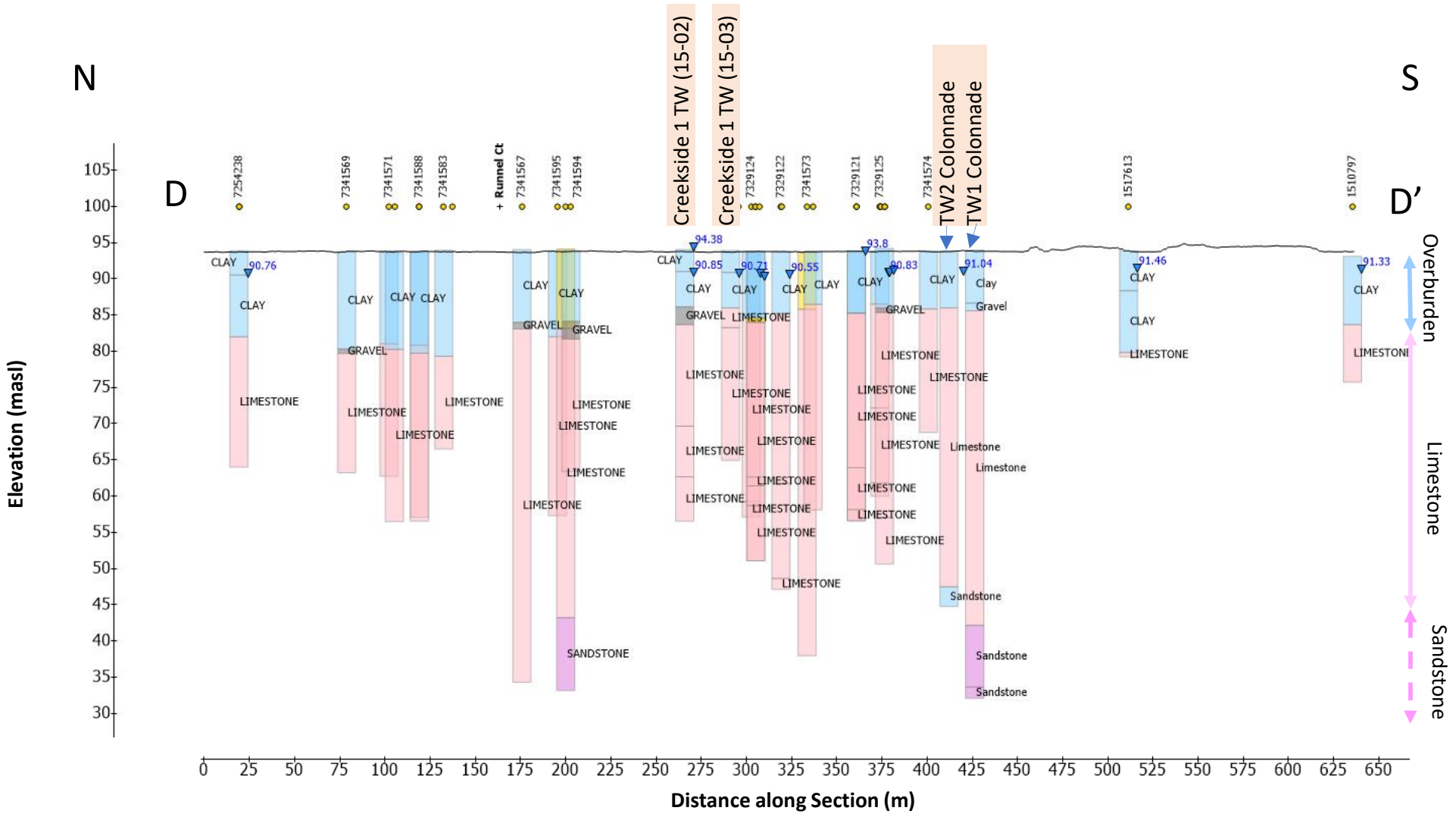
Borehole Lithology

- Hardpan
- Clay
- Till
- Silt
- Boulders, Gravel
- Sand
- Limestone/ Dolostone
- Sandstone

Creekside Development
Conceptual Site Model

Cross-section C-C'

GEMTEC
Consulting Engineers and Scientists



Water Level

Borehole Lithology

- Hardpan
- Clay
- Till
- Silt
- Boulders, Gravel
- Sand
- Limestone/ Dolostone
- Sandstone

Creekside Development
Conceptual Site Model

Cross-section D-D'

GEMTEC
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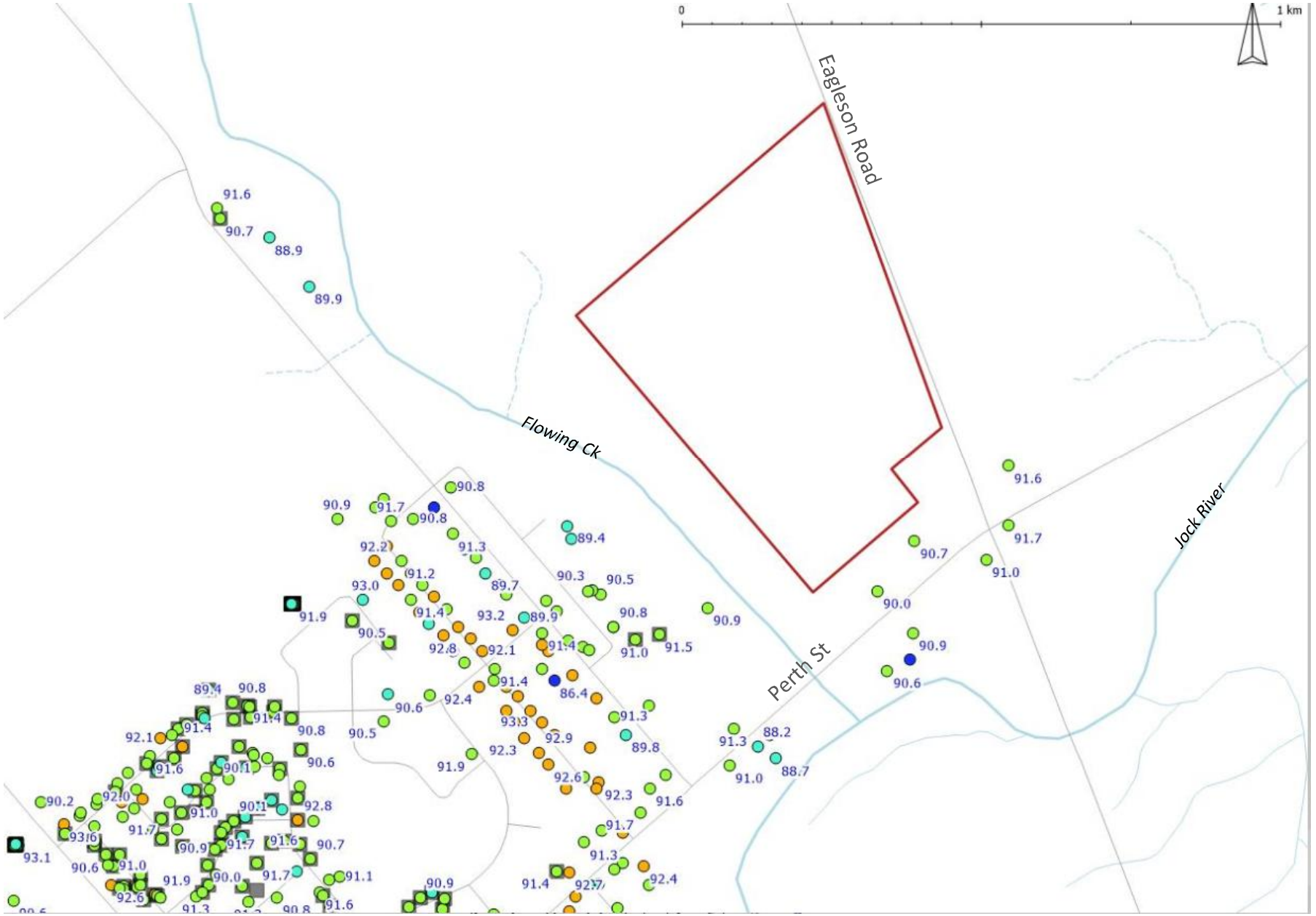

Roads
Intermittent Streams
Permanent Rivers

Water Wells (colour and label denote water level elevation in m asl)
Open Hole Well Extended into Nepean Fm (Sandstone)
Site Boundary

Creekside Development
Conceptual Site Model

Bedrock Water Level Elevations

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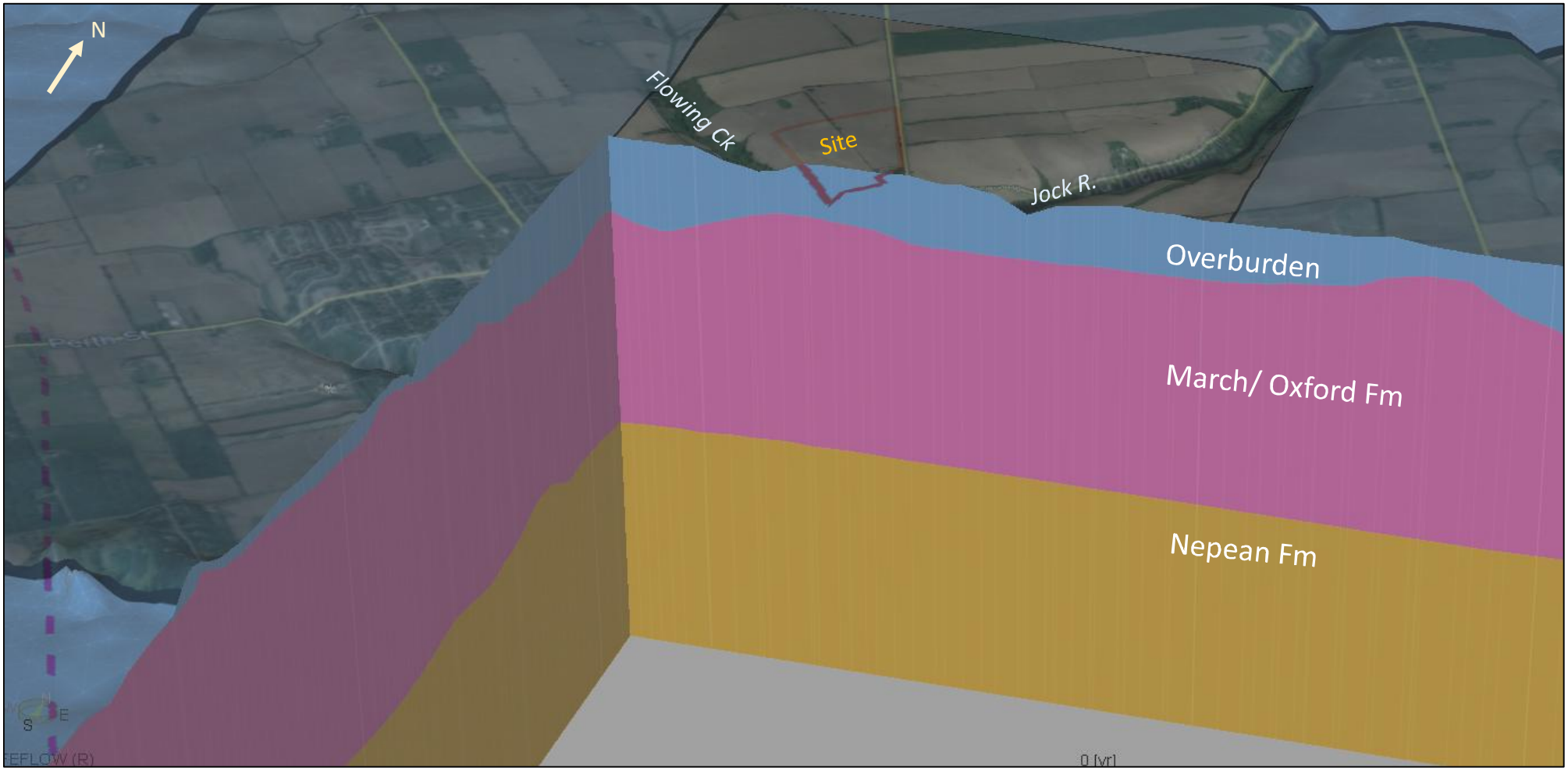

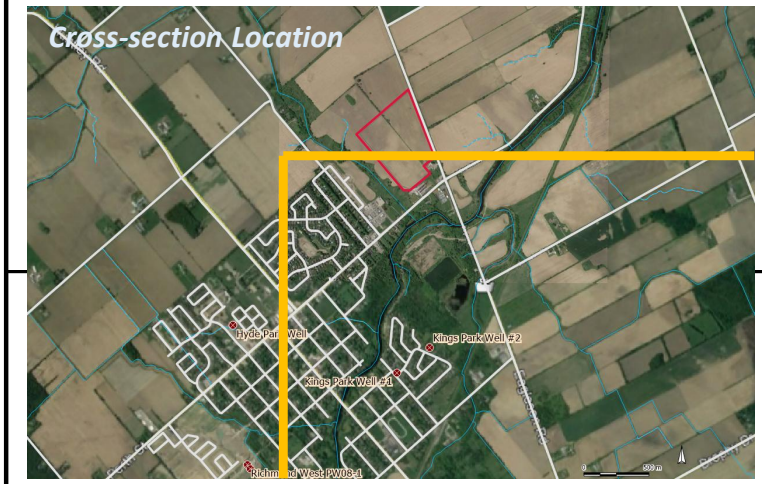

Creekside Development
Conceptual Site Model

Three-Dimensional View of Subsurface Units

GEMTEC
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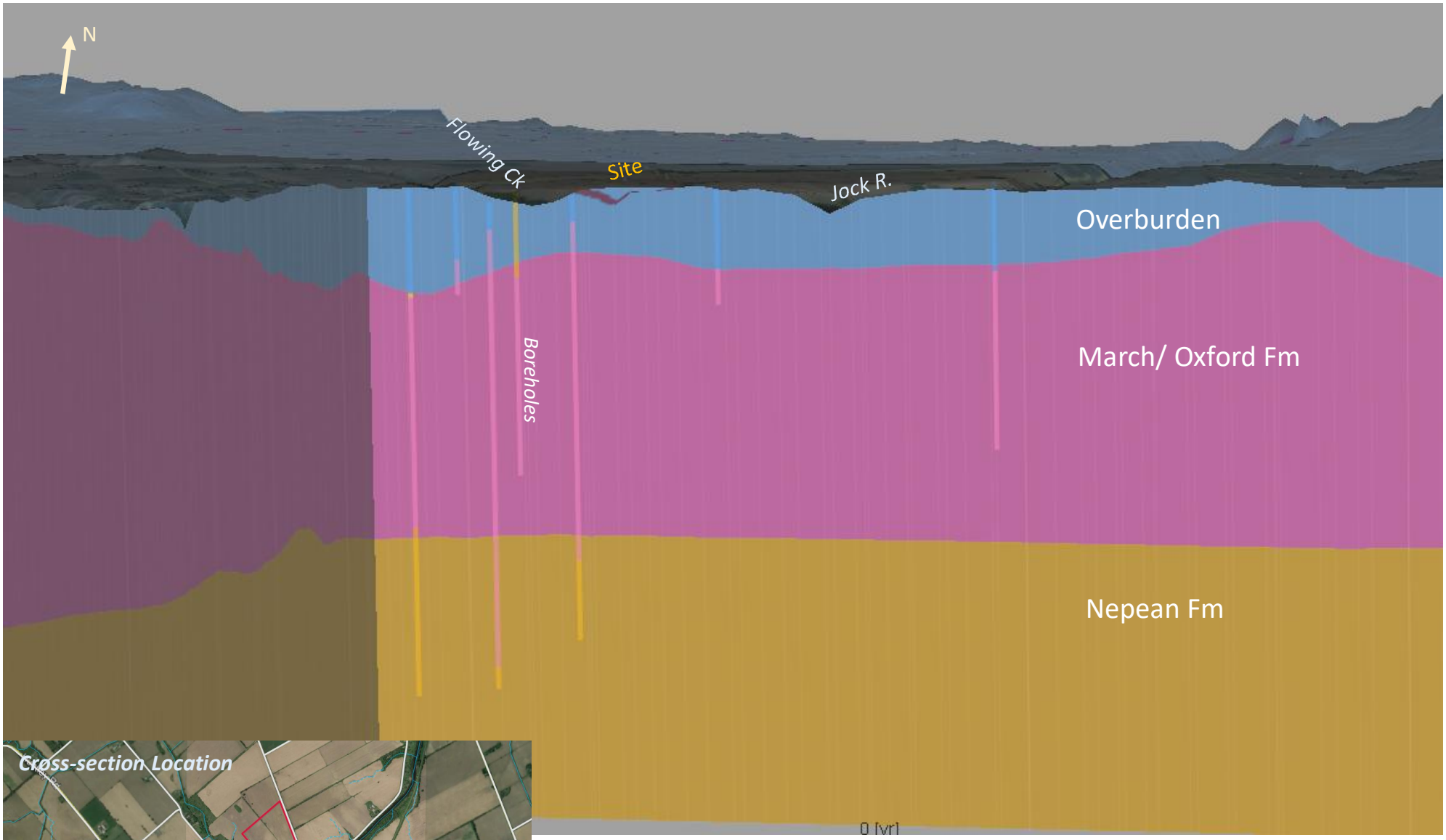

Creekside Development
Conceptual Site Model

Three-Dimensional View of Subsurface Units

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Consulting Engineers and Scientists

APPENDIX B

Record of Borehole Sheets (GEMTEC, 2021)

RECORD OF BOREHOLE 20-01A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 16 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.88					10 20 30 40 50 60 70 80 90		
		TOPSOIL		93.68							
		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)		0.20	1	SS	205	12			Above Ground Protector & Bentonite
1					2	SS	100	7			
					3	SS	455	5			
2											Soil Cuttings
					4	SS	610	9			
3					5	SS	610	4			
				90.07							
4		Stiff, grey SILTY CLAY		3.81	6	SS	610	2			
					7	SS	610	WH			Bentonite
5											
				88.09							
6		Very loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		5.79	8	SS	610	7			
7					9	SS	50	1			Filter Sand
					10	SS	610	3			50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
8					11	SS	455	3			Cave
9					12	SS	310	15			Cave
				84.13							
10		End of borehole		9.75							
11											
12											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.4 ▽	91.5

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

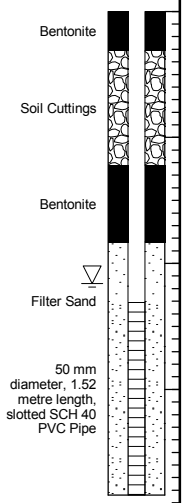
RECORD OF BOREHOLE 20-01B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 16 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.88							
		TOPSOIL		93.68 / 0.20							
1		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)									
2											
3											
				90.04 / 3.84							
4		End of borehole Soil stratigraphy inferred from BH 20-1A									
5											
6											
7											
8											
9											
10											
11											
12											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.2 ▽	91.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-02

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 16 2020

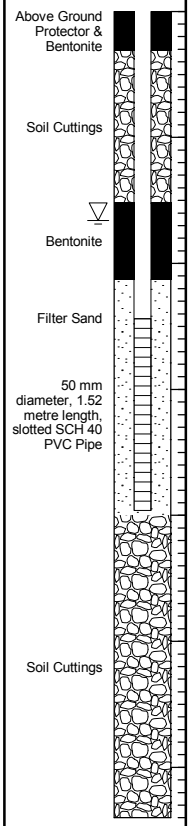
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		93.59				
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		93.39 / 0.20	1	SS	205	9
		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	455	7
1					3	SS	610	7
2					4	SS	610	6
3					5	SS	610	4
				89.78 / 3.81				
4		Stiff, grey SILTY CLAY			6	SS	610	4
5				88.41 / 5.18				
		Loose to compact grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			7	SS	310	9
6					8	SS	310	25
				87.19 / 6.40				
		End of borehole						
7								
8								
9								
10								
11								
12								

SOIL PROFILE | SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.7 ▽	91.9

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-03

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 17 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger	Ground Surface		93.44					MH	Above Ground Protector & Bentonite
		TOPSOIL		93.29 / 0.15	1	SS	150	6		
		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	405	6		Soil Cuttings
1										
					3	SS	510	3		Bentonite
2										
					4	SS	610	5		Filter Sand
3	Hollow Stem Auger (210mm OD)									50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
					5	SS	610	6		
				89.63 / 3.81						
4		Stiff, grey SILTY CLAY			6	SS	610	WH		
					7	SS	610	WH		Soil Cuttings
5										
					8	SS	610	WH		
6										
		End of borehole		86.89 / 6.55						
7										
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % — W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	0.3 ▽	93.1

GEMTEC
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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-04

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

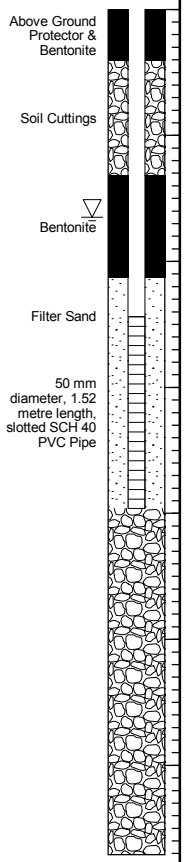
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 3 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		93.73				
		TOPSOIL		0.08	1	SS	405	8
		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	460	10
1								
					3	SS	405	6
2								
					4	SS	610	5
3								
					5	SS	610	4
				90.07				
		Stiff to very stiff, grey SILTY CLAY		3.66				
4					6	SS	310	1
5								
				88.40				
		Very loose to loose, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		5.33	7	SS	405	2
6								
					8	SS	355	5
				87.02				
		End of borehole		6.71				
7								
8								
9								
10								
11								
12								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.7 ▽	92.1

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-05A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 15 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		93.58						
0	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		93.45 / 0.13						Above Ground Protector & Bentonite
		Stiff to very stiff, grey brown SILTY CLAY, trace sand (WEATHERED CRUST)			1	SS	205	18		
1					2	SS	100	9		Soil Cuttings
2					3	SS	455	5		Bentonite
					4	SS	610	4		Filter Sand
3					5	SS	610	2		50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
				89.92 / 3.66						
4		Firm to stiff, grey SILTY CLAY								
					6	SS	610	WH		
5										Soil Cuttings
6				87.48						
		End of borehole		6.10						
7										
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.1	91.5

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-05B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 16 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.58							
		TOPSOIL		93.45 / 0.13							
1		Stiff to very stiff, grey brown SILTY CLAY, trace sand (WEATHERED CRUST)									
2											
3				89.92 / 3.66							Soil Cuttings
4		Firm to stiff, grey SILTY CLAY			1	TP	610	PM			
5				88.22 / 5.36							
6		End of borehole Soil stratigraphy inferred from BH 20-5A									
7											
8											
9											
10											
11											
12											

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-06

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 14 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (260mm OD)	Ground Surface		93.72					MH	Above Ground Protector & Bentonite
		TOPSOIL		93.52 / 0.20	1	SS	180	14		
1		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			2	SS	355	5		Soil Cuttings
2					3	SS	610	5		Bentonite
					4	SS	610	5		Filter Sand
3					5	SS	610	5		50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
4		Stiff, grey SILTY CLAY		89.91 / 3.81	6	SS	610	WH		
5					7	SS	610	WH		Soil Cuttings
6					8	SS	610	WH		
		End of borehole		87.17 / 6.55						
7										
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.0 ▽	91.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-07A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 20 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.80							
		TOPSOIL		93.65 / 0.15							
		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)			1	SS	205	10			Above Ground Protector & Bentonite
1					2	SS	405	6			
2					3	SS	610	5			Soil Cuttings
					4	SS	610	4			
3				90.45 / 3.35	5	SS	610	6			
		Very loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)									
4					6	SS	205	9			Bentonite
5					7	SS	205	3			Filter Sand
					8	SS	25	9			50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
6					9	SS	100	26			
				87.27							
		Auger refusal / End of borehole		6.53							
7											
8											
9											
10											
11											
12											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.6 ▽	91.3

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-07B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 17 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.80							
		TOPSOIL		93.65 / 0.15							
1		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)									
2											
3				90.45							
4		Very loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		3.35 / 89.53							
		End of borehole Soil stratigraphy inferred from BH 20-7A		4.27							
5											
6											
7											
8											
9											
10											
11											
12											

10 20 30 40 50 60 70 80 90

Above Ground Protector & Bentonite
Soil Cuttings
Bentonite
Filter Sand
50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
Soil Cuttings

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.1 ▽	91.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-08

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

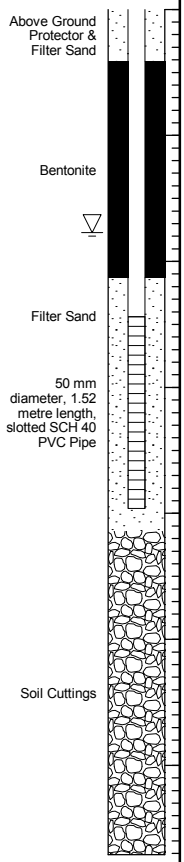
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 6 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		93.70				
		TOPSOIL		0.10	1	SS	355	9
		Stiff to very stiff, grey brown SILTY CLAY, trace sand (WEATHERED CRUST)			2	SS	405	5
					3	SS	610	5
					4	SS	610	5
				90.04				
		Firm, grey SILTY CLAY		3.66	5	SS	610	WH
					6	TP	610	PM
				88.06				
		Very loose grey SILTY SAND, some gravel, with cobbles (GLACIAL TILL)		5.64	7	SS	150	2
				86.99				
		End of borehole		6.71				

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.8 ▽	91.9

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-09

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 17 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.81							
		TOPSOIL		0.05							
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			1	SS	205	8			Above Ground Protector & Bentonite
1					2	SS	610	9			Soil Cuttings
2					3	SS	610	7			Bentonite
					4	SS	535	4			Filter Sand
3					5	SS	610	3			50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
4		Stiff, grey SILTY CLAY		89.85 3.96							
					6	SS	610	1			
5											
				88.09							
6		Compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		5.72	7	SS	355	15			
				87.10							
7		End of borehole		6.71							
8											
9											
10											
11											
12											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.2 ▽	91.6

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-10A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 13 2020

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface	93.68						Above Ground Protector & Bentonite
		TOPSOIL	93.48 / 0.20	1	SS	100	11		
1		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		2	SS	75	9		
2				3	SS	405	5		
				4	SS	610	4		
3				5	SS	610	4		Soil Cuttings
			89.87 / 3.81						
4		Firm to stiff, grey SILTY CLAY		6	SS	610	1		
5				7	SS	610	WH		
6									
7				8	SS	610	1		Bentonite
			86.36 / 7.32						
		Loose, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		9	SS	405	3		Filter Sand
8				10	SS	610	4		50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
9			84.54 / 9.14						
		Compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		11	SS	455	28		
10				12	SS	610	27		Soil Cuttings
			83.32 / 10.36						Notes: Monitoring well blocked at 2.1m depth
11		End of borehole							
12									

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

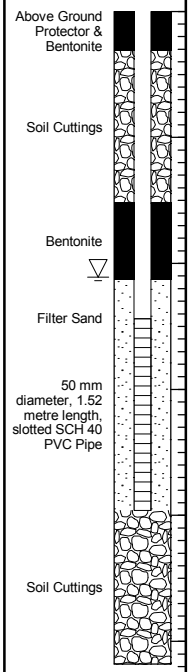
RECORD OF BOREHOLE 20-10B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 14 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.68							
		TOPSOIL		93.48 / 0.20							
1		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)									
2											
3				89.87 / 3.81							
4		Firm to stiff, grey SILTY CLAY									
5				88.50 / 5.18							
		End of borehole Soil stratigraphy inferred from BH 20-10A									
6											
7											
8											
9											
10											
11											
12											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.1 ▽	91.6

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-11

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

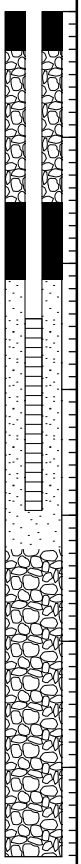
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 10 2020

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
		Ground Surface		93.77					
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		93.57 / 0.20					
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			1	SS	125	9	
1					2	SS	230	6	
2					3	SS	610	5	
					4	SS	610	4	
3				90.11 / 3.66	5	SS	610	3	
4		Firm, grey SILTY CLAY			6	SS	610	WH	
				89.30 / 4.47					
5		Very loose to loose grey CLAYEY SILT, some sand, trace gravel			7	SS	405	4	MH
				88.28 / 5.49	8	SS	205	23	
6		Loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			9	SS	455	10	
				87.06 / 6.71					
7		End of borehole							
8									
9									
10									
11									
12									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.3 ▽	91.5

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-12

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

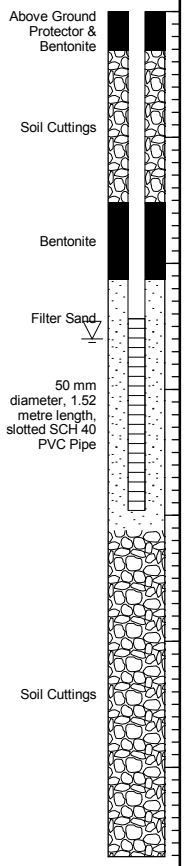
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 17 2020

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface	93.94				
		TOPSOIL	0.10	1	SS	100	12
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		2	SS	355	9
2				3	SS	610	5
				4	SS	610	4
			90.49	5	SS	610	4
		Very loose to loose, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	3.45	6	SS	255	4
5				7	SS	255	5
			88.61				
		Compact, grey SAND, some gravel	5.33	8	SS	355	28
6				9	SS	455	24
			87.23				
7		End of borehole	6.71				
8							
9							
10							
11							
12							

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.6 ▽	91.3

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-13

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 6 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.97						
		TOPSOIL		0.08	1	SS	355	11		
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			2	SS	510	9		
2					3	SS	610	8	MH	
					4	SS	610	3		
3					5	SS	610	2		
				90.46 3.51						
4		Firm to stiff, grey SILTY CLAY								
5					6	SS	610	WH		
					7	SS	610	1		
6										
				87.26 6.71						
7		End of borehole								
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, % (W_P, W, W_L)
10 20 30 40 50 60 70 80 90

Above Ground Protector & Filter Sand
Bentonite
Soil Cuttings
Bentonite
Filter Sand
50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
Soil Cuttings

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.8 ▽	92.2

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Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-14

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 9 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		93.91						
0	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		93.71 / 0.20	1	SS	50	11		Above Ground Protector & Bentonite
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			2	SS	50	4		Soil Cuttings
1										
2					3	SS	455	3	MH	Bentonite
					4	SS	610	3		Filter Sand
3										50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
					5	SS	610	2		
				90.25 / 3.66						
4		Firm to stiff, grey SILTY CLAY								
					6	SS	610	WH		
5										Soil Cuttings
6				87.81 / 6.10						
		End of borehole								
7										
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.2 ▽	91.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-15

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

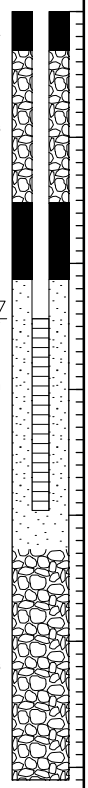
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 10 2020

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	Power Auger, Hollow Stem Auger (260mm OD)	Ground Surface		94.09					
		TOPSOIL		93.89					
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		0.20	1	SS	355	8	
1					2	SS	0	9	
2					3	SS	405	7	
					4	SS	610	6	
3				91.04					
		Very loose to compact, grey gravelly SILTY SAND, some clay, with cobbles and boulders (GLACIAL TILL)		3.05	5	SS	355	6	MH
4					6	SS	200	1	
5					7	SS	200	26	
				88.76					
		Loose, grey SAND		5.33	8	SS	355	6	MH
6				87.99					
		End of borehole		6.10					
7									
8									
9									
10									
11									
12									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.4 ▽	91.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-16A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

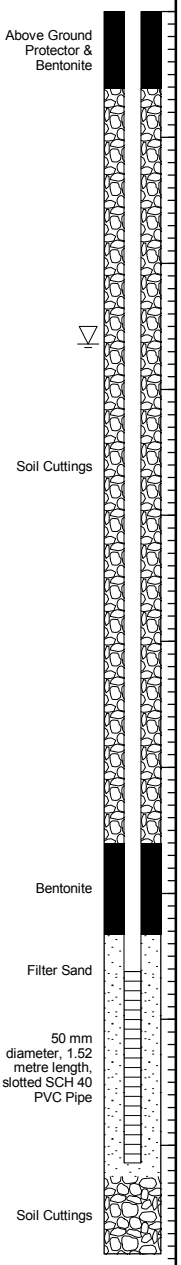
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 7 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		93.77				
		TOPSOIL		0.10	1	SS	310	9
		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	610	8
1					3	SS	610	5
2					4	SS	610	4
3				90.72				
		Firm to stiff, grey SILTY CLAY, trace sand seams		3.05	5	SS	610	1
4								
					6	TP	610	PM
5								
6					7	SS	610	WH
7								
					8	SS	610	WH
8								
9					9	SS	310	2
		End of borehole		83.91 / 9.86				
10								
11								
12								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, % (W_P, W, W_L)
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.6 ▽	91.1

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

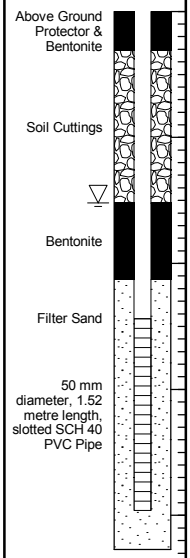
GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-16B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 7 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.77					10 20 30 40 50 60 70 80 90		
		TOPSOIL		0.10							
1		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)									
2											
3				90.72							
		Firm to stiff, grey SILTY CLAY, trace sand seams		3.05							
4											
		End of borehole		89.50							
		Soil stratigraphy inferred from BH 20-16A		4.27							
5											
6											
7											
8											
9											
10											
11											
12											



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.5 ▽	92.3

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-17

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 6 2020

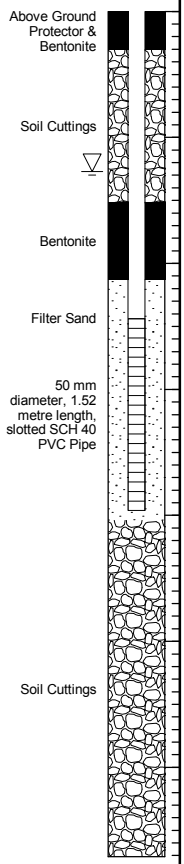
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		93.79				
0	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		93.66 / 0.13				
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			1	SS	280	9
1					2	SS	460	6
2					3	SS	610	7
					4	SS	610	4
3								
4				89.22 / 4.57				
		Stiff, grey SILTY CLAY			5	SS	610	WH
5				88.07 / 5.72				
		Very dense, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			6	SS	310	109
6				87.08 / 6.71				
		End of borehole						
7								
8								
9								
10								
11								
12								

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.3 ▽	92.5

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-18A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 9 2020

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface	93.94						
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL	93.79 / 0.15	1	SS	50	9		Above Ground Protector & Bentonite
		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)		2	SS	50	6		
1									
				3	SS	355	6		
2									
				4	SS	610	5		Soil Cuttings
3			90.89 / 3.05						
		Firm to stiff, grey SILTY CLAY		5	SS	610	3		
4									
				6	SS	610	WH		
5									Bentonite
				7	SS	610	WH		
6									
				8	SS	610	3		
7									Filter Sand
			85.56 / 8.38						
8		Compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		9	SS	405	20		50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
9				10	SS	460	16		Soil Cuttings
									Note: Monitoring well blocked at 4.0m depth
10		End of borehole							
11									
12									

SOIL PROFILE | STRATA PLOT | SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % : W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

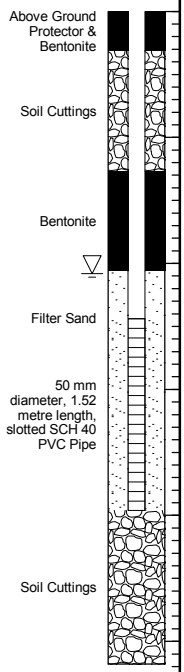
RECORD OF BOREHOLE 20-18B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 9 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.94							
		TOPSOIL		93.79 / 0.15							
1		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)									
2											
3				90.89 / 3.05							
		Firm to stiff, grey SILTY CLAY									
4					1	TP	610	PM			
5				88.76 / 5.18							
		End of borehole Soil stratigraphy inferred from BH 20-18A									
6											
7											
8											
9											
10											
11											
12											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.1 ▽	91.9

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-19

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 8 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		94.20						Above Ground Protector & Bentonite
		TOPSOIL		0.08	1	SS	75	11		
1		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	510	5		Soil Cuttings
2					3	SS	610	4		Bentonite
				91.61	4	SS	610	8		Filter Sand
3		Loose to compact, grey brown SILTY SAND, trace gravel, with cobbles and boulders (GLACIAL TILL)		2.59	5	SS	455	20	MH	50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
				90.54						
4		Loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		3.66	6	SS	125	11		
5					7	SS	100	10		Soil Cuttings
6				88.10	8	SS	255	16		
		End of borehole		6.10						
7										
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.5 ▽	91.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-20

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 8 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		93.87						
		TOPSOIL		0.08	1	SS	100	9		Above Ground Protector & Filter Sand
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)								Bentonite
1					2	SS	205	7		Soil Cuttings
2					3	SS	610	4	MH	Bentonite
					4	SS	610	2		FIlter Sand
				90.97						
3		Firm, grey SILTY CLAY		2.90	5	SS	610	1		50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
4										
5					6	SS	610	WH		
6					7	SS	610	WH		Soil Cuttings
				87.16						
7		End of borehole		6.71						
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.2 ▽	92.6

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-21

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 7 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.88							
		TOPSOIL		0.10	1	SS	310	9			Above Ground Protector & Bentonite
		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	610	5			Soil Cuttings
1											
					3	SS	610	4			Bentonite
2											
					4	SS	610	3			FIlter Sand
3				90.83							
		Firm to stiff, grey SILTY CLAY		3.05	5	SS	610	1			50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
4											
					6	SS	610	WH			
5											Soil Cuttings
					7	SS	610	WH			
6				87.17							
		End of borehole		6.71							
7											
8											
9											
10											
11											
12											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	0.9 ▽	93.0

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-25

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 14 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		92.97							
		TOPSOIL		92.77							
				0.20	1	SS	205	18			Above Ground Protector & Bentonite
1		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			2	SS	150	8			Soil Cuttings
2	Power Auger				3	SS	510	5			Bentonite
	Hollow Stem Auger (210mm OD)				4	SS	610	4			Filter Sand
3				89.92							
		Soft to firm, grey SILTY CLAY		3.05	5	SS	610	1			50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
4											
					6	TP	610	PM			
5											Soil Cuttings
6				86.87							
		Very loose to loose, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		6.10	7	SS	455	4			
				86.26							
		End of borehole		6.71							
7											
8											
9											
10											
11											
12											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.6 ▽	91.4

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

APPENDIX C

On-Site & Observation Well Records

Ontario — Ministry of the Environment, Conservation and Parks

Tag#:A313115 (Print Below)

A313115

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	1470424 Ontario Inc.C/O GEMTEC		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
32 Stacie Drive	Ottawa	ON	K2K 2A9	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Eagleson/Perth Street(NO CIVIC)	Goulbourn	26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	435150	5006263		TW 1 of 4 TEST WELL 21-1C

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay			0'	16'
	Hard Pan		[redacted]	16'	48'
Grey	Limestone			48'	167'
Grey	Limestone	w/Grey Sandstone (trace)		167'	221'
Grey	Sandstone			221'	246'
Grey	Sandstone			246'	366'
Grey	Sandstone			366'	401'
	TEST WELL #21-1C		(8" WELL)		

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
188'	178'	Neat cement	10.9
178'	0'	Bentonite slurry	46.2

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
8¼"	Steel	.188"	+2'	188'
8"	Open Hole		188'	401'

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water: Fresh	Untested	Other, specify
246	☐	☐	☒	
270	☐	☐	☒	
366	☐	☐	☒	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	50'	14"
50'	187'	12"
187'	401'	8"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 300

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 13'3"

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 100'

Recommended pump rate (l/min/GPM): 20

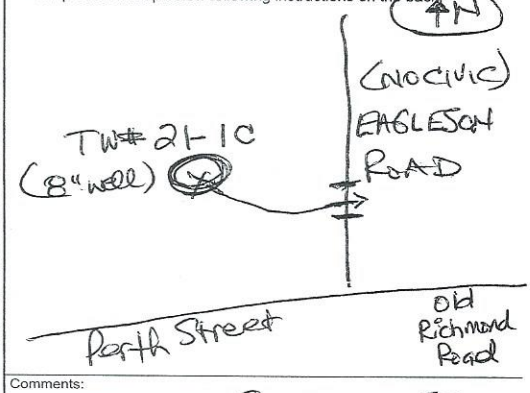
Well production (l/min/GPM): 200

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	9'2"		13'3"
1	10.5	1	12
2	10.8	2	10.9
3	11	3	9.9
4	11.1	4	9.2
5	11.2	5	9.2
10	11.5	10	9.2
15	11.8	15	9.2
20	12.1	20	9.2
25	12.3	25	9.2
30	12.5	30	9.2
40	12.9	40	9.2
50	13.1	50	9.2
60	13'3"	60	9'2"

Map of Well Location

Please provide a map below following instructions on the back.



Comments:
1 HP-20 GPM Set @ 100 FT

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7681

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6858 Franktown Road	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted (Y Y Y Y M M D D)
6138382170	Hanna, Jeremy	T3632		2021 01 31

Well owner's information package delivered	Date Package Delivered (Y Y Y Y M M D D)	Date Work Completed (Y Y Y Y M M D D)
☒ Yes ☐ No	2021 01 12	2021 01 07

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Audit No. Z355255

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Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☒ Imperial

W Tag#:A313189 (Print Below)

A313189

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	1470424 Ontario Inc.C/O GEMTEC		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
32 Stacie Drive	Ottawa	ON	K2K 2A9	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Eagleson/Perth Street (NO CIVIC)	Goulbourn	26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	435148	5006259		TW 2 OF 4 TEST WELL# 21-1B

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay			0	30
	Clay & Stone & Gravel			30	46
Grey	Limestone			46	80
Grey	Limestone			80	160

Test Well # 21-1B (6" well)

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
52	42	Neat cement	10.9
42	0	Bentonite slurry	16.8

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2	52
6"	Open Hole		52	160

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Water Details

Water found at Depth (m/ft)	Kind of Water	Gas	Other, specify
80	☐ Fresh ☒ Untested	☐	
	☐ Fresh ☐ Untested	☐	
	☐ Fresh ☐ Untested	☐	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	52	9 3/4"
52	160	6"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 150

Pumping rate (l/min/GPM): 1.8

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 49'8"

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 1/2 HP-5 GPM Set @ 140 FT

Recommended pump rate (l/min/GPM): 1.8

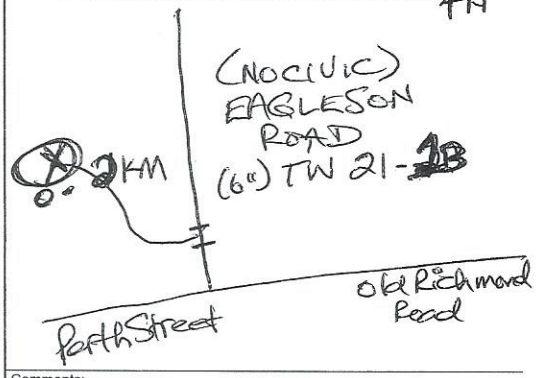
Well production (l/min/GPM): 1.8

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	61"		49.8"
1	12	1	44
2	13.9	2	42.5
3	15.3	3	41.2
4	16.6	4	40
5	17.8	5	38.8
10	23.1	10	35.4
15	27.4	15	28.7
20	31.1	20	24.6
25	34.3	25	21.2
30	37.2	30	18.3
40	42.1	40	13.9
50	46.3	50	9.9
60	49.8"	60	6.1"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1/2 HP-5 GPM Set @ 140 FT

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7681

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6659 Franktown Road	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hanna, Jeremy

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted (Y Y Y Y M M D D)
13632		2021 01 31

Well owner's information package delivered	Date Package Delivered (Y Y Y Y M M D D)	Date Work Completed (Y Y Y Y M M D D)
☒ Yes ☐ No	2021 01 18	2021 01 13

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Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☒ Imperial

Tag#:A313190

A313190

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	1470424 Ontario Inc.C/O GEMTEC		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
32 Stacie Drive	Ottawa	ON	K2K 2A9	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Eagleson/Perth Street (NO CIVIC)	Goulbourn	26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434971	5006391		TW 3294 TEST WELL # 21-2B

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay	& Boulders & Gravel		0	44
White	Quartzite			44	64
Grey	Limestone			64	144
Grey	Limestone			144	150

TEST WELL # 21-2B

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
50	40	Neat cement	10.9
40	0	Bentonite slurry	25.2

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2	50
6"	Open Hole		50	150

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Water Details

Water found at Depth	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
144 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify			
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	0	50	9 3/4"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	50	150	6"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 140

Pumping rate (l/min / GPM): 2.3

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 26.7"

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 140'

Recommended pump rate (l/min/GPM): 2.3

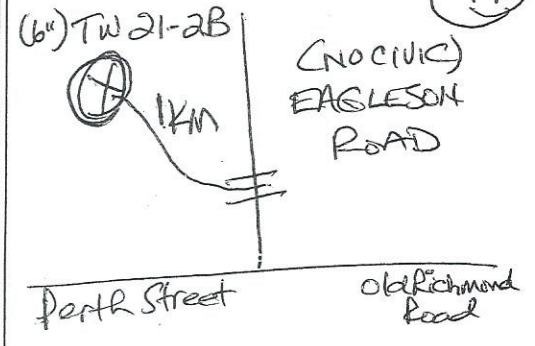
Well production (l/min/GPM): 2.3

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	6'6"			26.7"
1	15.3	1		21.2
2	16	2		17.3
3	16.7	3		16.3
4	17.3	4		15.3
5	17.8	5		14.4
10	19.9	10		11.2
15	21.4	15		8.2
20	22.5	20		6.6
25	23.4	25		6.6
30	24	30		6.6
40	24.9	40		6.6
50	25.8	50		6.6
60	26.7"	60		6.6"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1/2 HP-56PM @ 140 FT

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7681

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6059 Franktown Road	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
6138382170	Hanna, Jeremy	13632		2021 01 31

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2021 01 18	2021 01 14

Ministry Use Only

Audit No. Z355250

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Ministry's Copy

Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☒ Imperial

W Tag#:A313188 (Print Below)

A313188

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	1470424 Ontario Inc.C/O GEMTEC		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
32 Stacie Drive	Ottawa	ON	K2K 2A9	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Eagleson/Perth Street (NO CIVIC)	Goulbourn	26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	434982	5006384		TW#4814 TEST WELL# 21-2C

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay			0'	27'
	Clay & Stone & Gravel			27'	46'
Grey	Limestone			46'	181'
Grey	Limestone	w/ Grey Sandstone Mix		181'	223'
Grey	Sandstone			223'	238'
Grey	Sandstone			238'	274'
Grey	Sandstone			274'	312'
Grey	Sandstone			312'	358'

TEST WELL # 21-2C

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/cu ft)
188'	178'	Neat cement	10.9
178'	0'	Bentonite slurry	16.8

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	188'
6"	Open Hole		188'	358'

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Water Details

Water found at Depth	Kind of Water	Hole Diameter Depth (m/ft) From	To	Diameter (cm/in)
238 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify			
274 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	0	50	
312 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	50	358	

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7681

Business Address (Street Number/Name)	Municipality
6659 Franktown Road	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hanna, Jeremy

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T3632		2021 01 31

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify — Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 200

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 9.6'

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 100'

Recommended pump rate (l/min/GPM): 20+

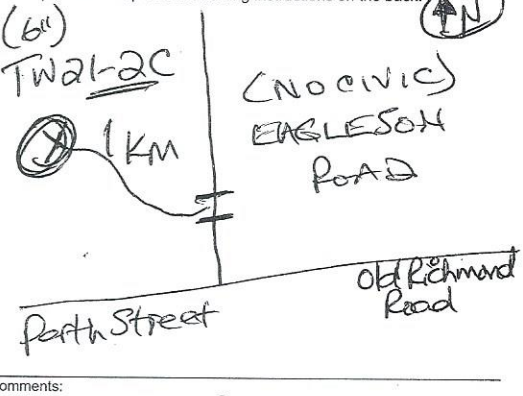
Well production (l/min/GPM): 200

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	78"		9.6"
1	8.9	1	8.6
2	9	2	7.8
3	9.1	3	7.8
4	9.1	4	7.8
5	9.1	5	7.8
10	9.2	10	7.8
15	9.3	15	7.8
20	9.3	20	7.8
25	9.4	25	7.8
30	9.4	30	7.8
40	9.5	40	7.8
50	9.6	50	7.8
60	9.6"	60	7.8"

Map of Well Location

Please provide a map below following instructions on the back.



Comments:
1HP 20GPM SET @ 100 FT

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2021 01 18	2021 01 15

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Received

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Ministry's Copy

RECORD OF BOREHOLE 20-01A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 16 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.88					10 20 30 40 50 60 70 80 90		
		TOPSOIL		93.68							
		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)		0.20	1	SS	205	12			Above Ground Protector & Bentonite
1					2	SS	100	7			
					3	SS	455	5			
2											Soil Cuttings
					4	SS	610	9			
3					5	SS	610	4			
				90.07							
4		Stiff, grey SILTY CLAY		3.81	6	SS	610	2			
					7	SS	610	WH			Bentonite
5											
				88.09							
6		Very loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		5.79	8	SS	610	7			
7					9	SS	50	1			Filter Sand
					10	SS	610	3			50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
8					11	SS	455	3			Cave
9					12	SS	310	15			Cave
				84.13							
10		End of borehole		9.75							
11											
12											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.4 ▽	91.5

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Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

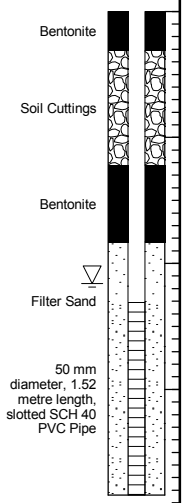
RECORD OF BOREHOLE 20-01B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 16 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.88							
		TOPSOIL		93.68 / 0.20							
1		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)									
2											
3											
				90.04 / 3.84							
4		End of borehole Soil stratigraphy inferred from BH 20-1A									
5											
6											
7											
8											
9											
10											
11											
12											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.2 ▽	91.7

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CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-07A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 20 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.80							
		TOPSOIL		93.65 / 0.15							
		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)			1	SS	205	10			Above Ground Protector & Bentonite
1					2	SS	405	6			
2					3	SS	610	5			Soil Cuttings
					4	SS	610	4			
3				90.45 / 3.35	5	SS	610	6			
		Very loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)									
4					6	SS	205	9			Bentonite
5					7	SS	205	3			Filter Sand
					8	SS	25	9			50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
6					9	SS	100	26			
				87.27							
		Auger refusal / End of borehole		6.53							
7											
8											
9											
10											
11											
12											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.6 ▽	91.3

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GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-07B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 17 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.80							
		TOPSOIL		93.65 / 0.15							
1		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)									
2											
3				90.45							
4		Very loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		3.35 / 89.53							
		End of borehole Soil stratigraphy inferred from BH 20-7A		4.27							
5											
6											
7											
8											
9											
10											
11											
12											

10 20 30 40 50 60 70 80 90

Above Ground Protector & Bentonite
Soil Cuttings
Bentonite
Filter Sand
50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
Soil Cuttings

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.1 ▽	91.7

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GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-15

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

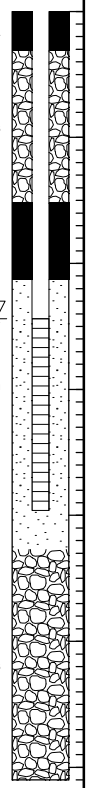
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 10 2020

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	Power Auger, Hollow Stem Auger (260mm OD)	Ground Surface		94.09					
		TOPSOIL		93.89					
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		0.20	1	SS	355	8	
1					2	SS	0	9	
2					3	SS	405	7	
					4	SS	610	6	
3				91.04					
		Very loose to compact, grey gravelly SILTY SAND, some clay, with cobbles and boulders (GLACIAL TILL)		3.05	5	SS	355	6	MH
4					6	SS	200	1	
5					7	SS	200	26	
				88.76					
		Loose, grey SAND		5.33	8	SS	355	6	MH
6				87.99					
		End of borehole		6.10					
7									
8									
9									
10									
11									
12									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.4 ▽	91.7

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LOGGED: ML
CHECKED: WAM

RECORD OF BOREHOLE 20-16A

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

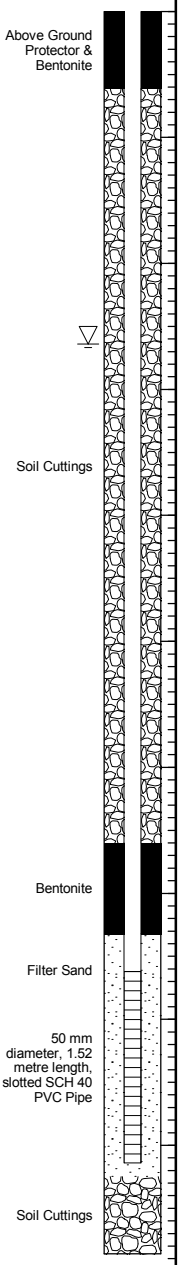
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 7 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		93.77				
		TOPSOIL		0.10	1	SS	310	9
		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	610	8
1					3	SS	610	5
2					4	SS	610	4
3				90.72				
		Firm to stiff, grey SILTY CLAY, trace sand seams		3.05	5	SS	610	1
4								
					6	TP	610	PM
5								
6					7	SS	610	WH
7								
					8	SS	610	WH
8								
9					9	SS	310	2
		End of borehole		83.91 / 9.86				
10								
11								
12								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, % (W_P, W, W_L)
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.6 ▽	91.1

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CHECKED: WAM

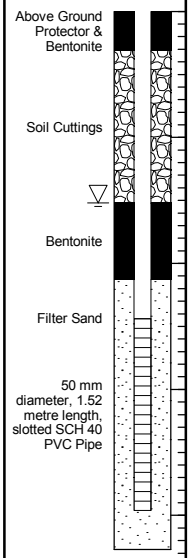
GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-16B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 7 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		93.77					10 20 30 40 50 60 70 80 90		
		TOPSOIL		0.10							
1		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)									
2											
3				90.72							
		Firm to stiff, grey SILTY CLAY, trace sand seams		3.05							
4											
		End of borehole		89.50							
		Soil stratigraphy inferred from BH 20-16A		4.27							
5											
6											
7											
8											
9											
10											
11											
12											



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	1.5 ▽	92.3

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

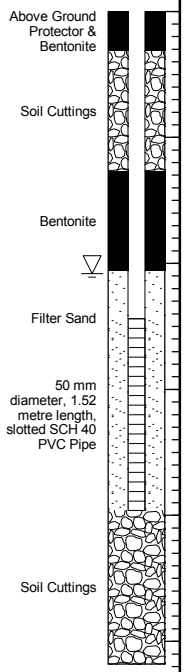
RECORD OF BOREHOLE 20-18B

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 9 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		93.94							
		TOPSOIL		93.79 / 0.15							
1		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)									
2											
3				90.89 / 3.05							
		Firm to stiff, grey SILTY CLAY									
4					1	TP	610	PM			
5				88.76 / 5.18							
		End of borehole Soil stratigraphy inferred from BH 20-18A									
6											
7											
8											
9											
10											
11											
12											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.1 ▽	91.9

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

RECORD OF BOREHOLE 20-19

CLIENT: Cardel Homes
PROJECT: Geotechnical & Hydrogeological Investigation
JOB#: 61899.04
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 8 2020

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		94.20						Above Ground Protector & Bentonite
		TOPSOIL		0.08	1	SS	75	11		
1		Stiff to very stiff, grey brown SILTY CLAY, trace sand seams (WEATHERED CRUST)			2	SS	510	5		Soil Cuttings
2					3	SS	610	4		Bentonite
				91.61	4	SS	610	8		Filter Sand
3		Loose to compact, grey brown SILTY SAND, trace gravel, with cobbles and boulders (GLACIAL TILL)		2.59	5	SS	455	20	MH	50 mm diameter, 1.52 metre length, slotted SCH 40 PVC Pipe
				90.54						
4		Loose to compact, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		3.66	6	SS	125	11		
5					7	SS	100	10		Soil Cuttings
6				88.10	8	SS	255	16		
		End of borehole		6.10						
7										
8										
9										
10										
11										
12										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
20-09-30	2.5 ▽	91.7

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CHECKED: WAM

GEO - BOREHOLE LOG 61899.04_BOREHOLE LOGS_R0_2020-07-17.GPJ GEMTEC 2018.GDT 11-30-20

APPENDIX D

Geophysics

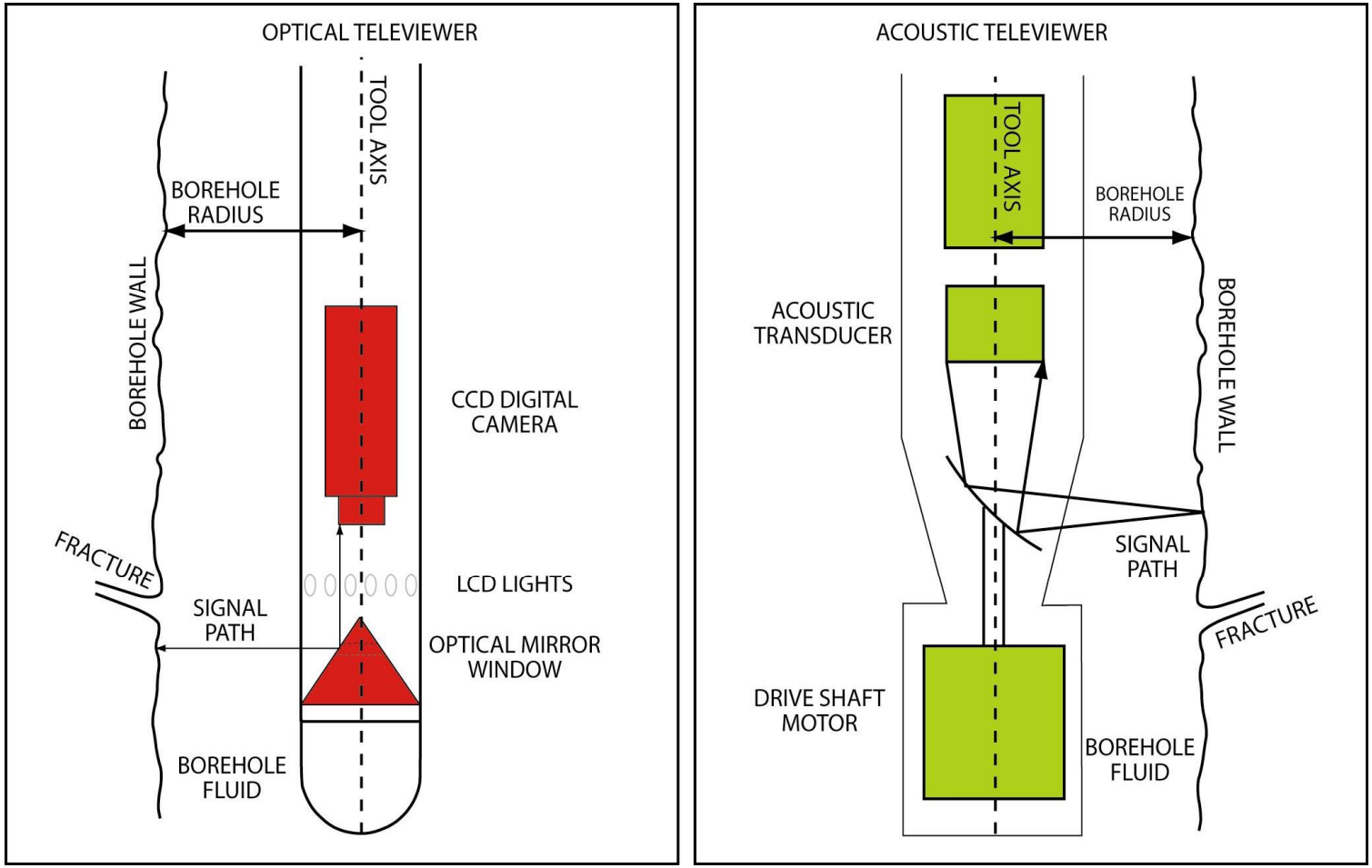

Illustration displaying a generalized schematic of the optical and acoustic televiewers deployed downhole.

Geophysics Investigation

Optical and Acoustic Televiewer Illustrations

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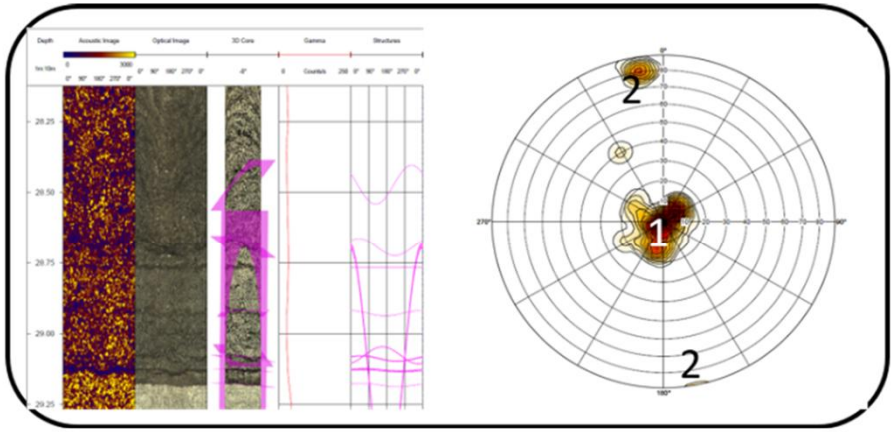
D1

Fractures in Oxford/March Formations



Fractures in the Nepean Sandstone

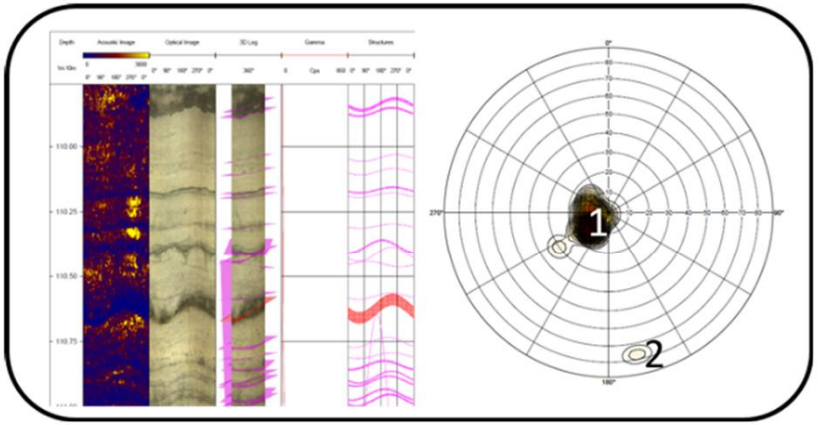


Illustration displaying primary fractures noted in Oxford/March and Nepean Formations.

Geophysics Investigation

Pole Plots

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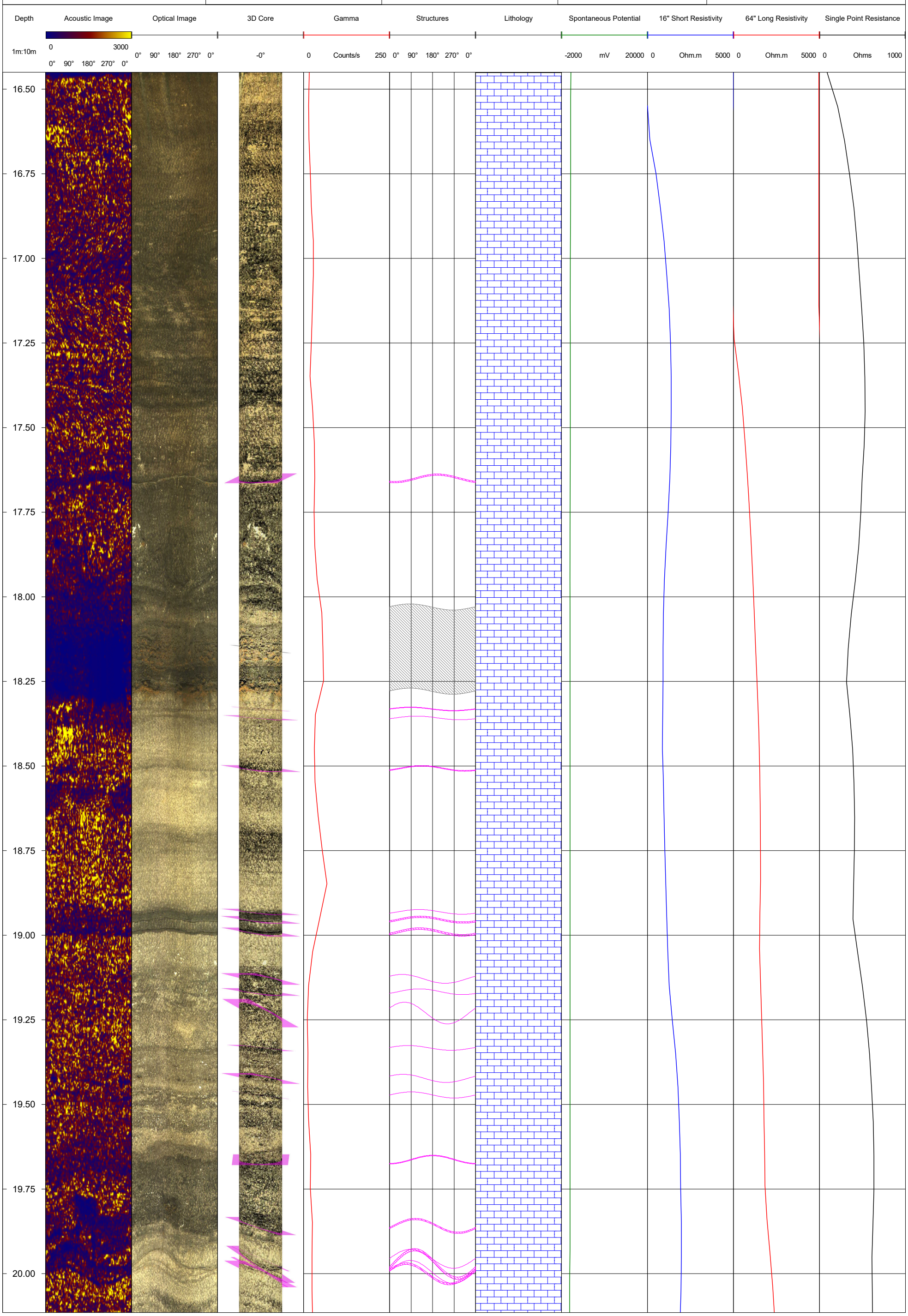
D2

GEMTEC
Consulting Engineers and Scientists

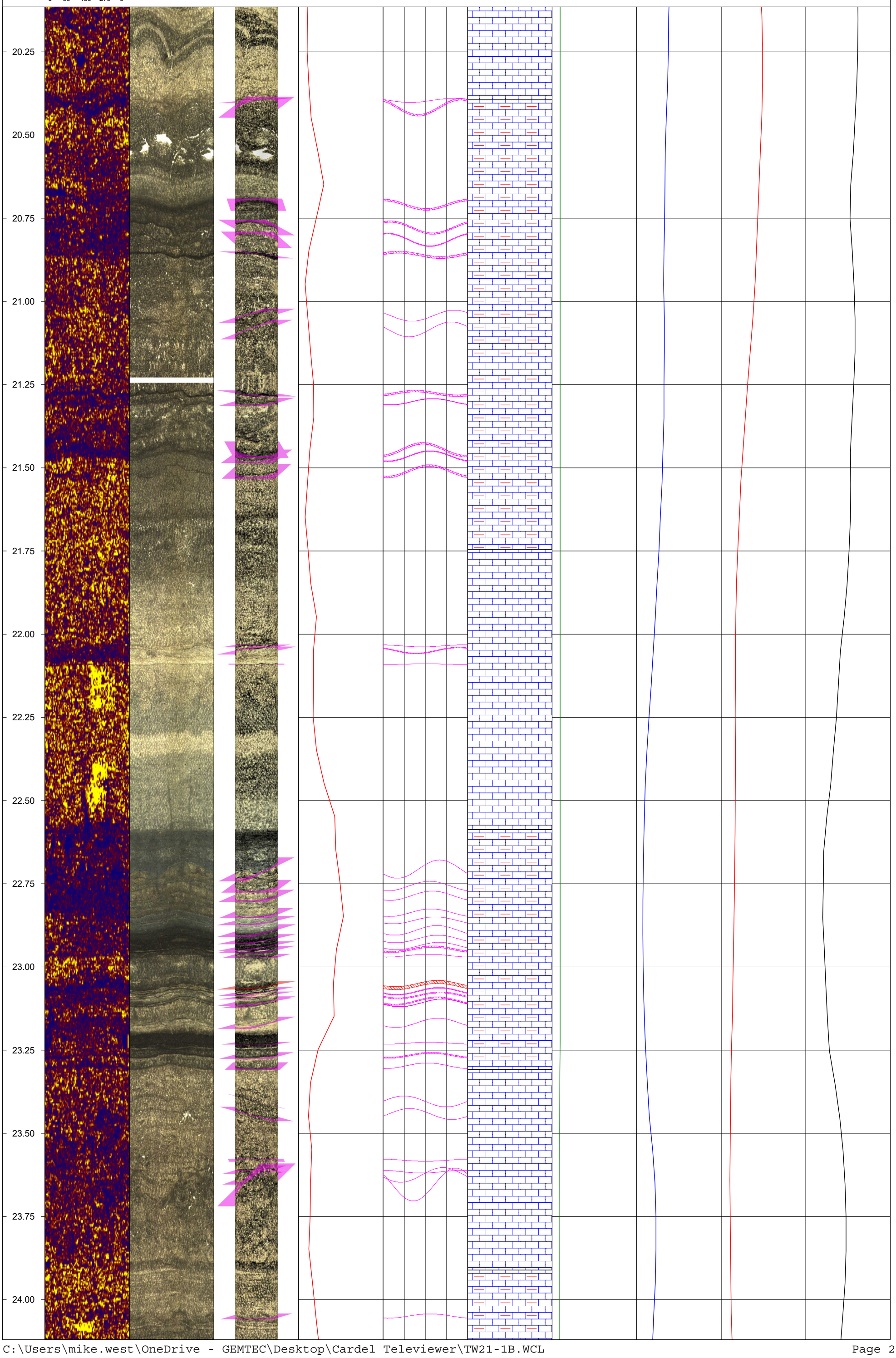
Client	Cardel Homes		
Project #	61899.04		
Logged By	Brett Webster	Drilled Depth	48.75 metres
Reviewed by	Mike West	Elevation	
Date Logged	February 2021	Angle	Vertical
Hole Number	TW21-1B	Location	Creekside Development

Broken Zone / Undifferentiated
Major Open Joint / Fracture
Minor Open Joint / Fracture

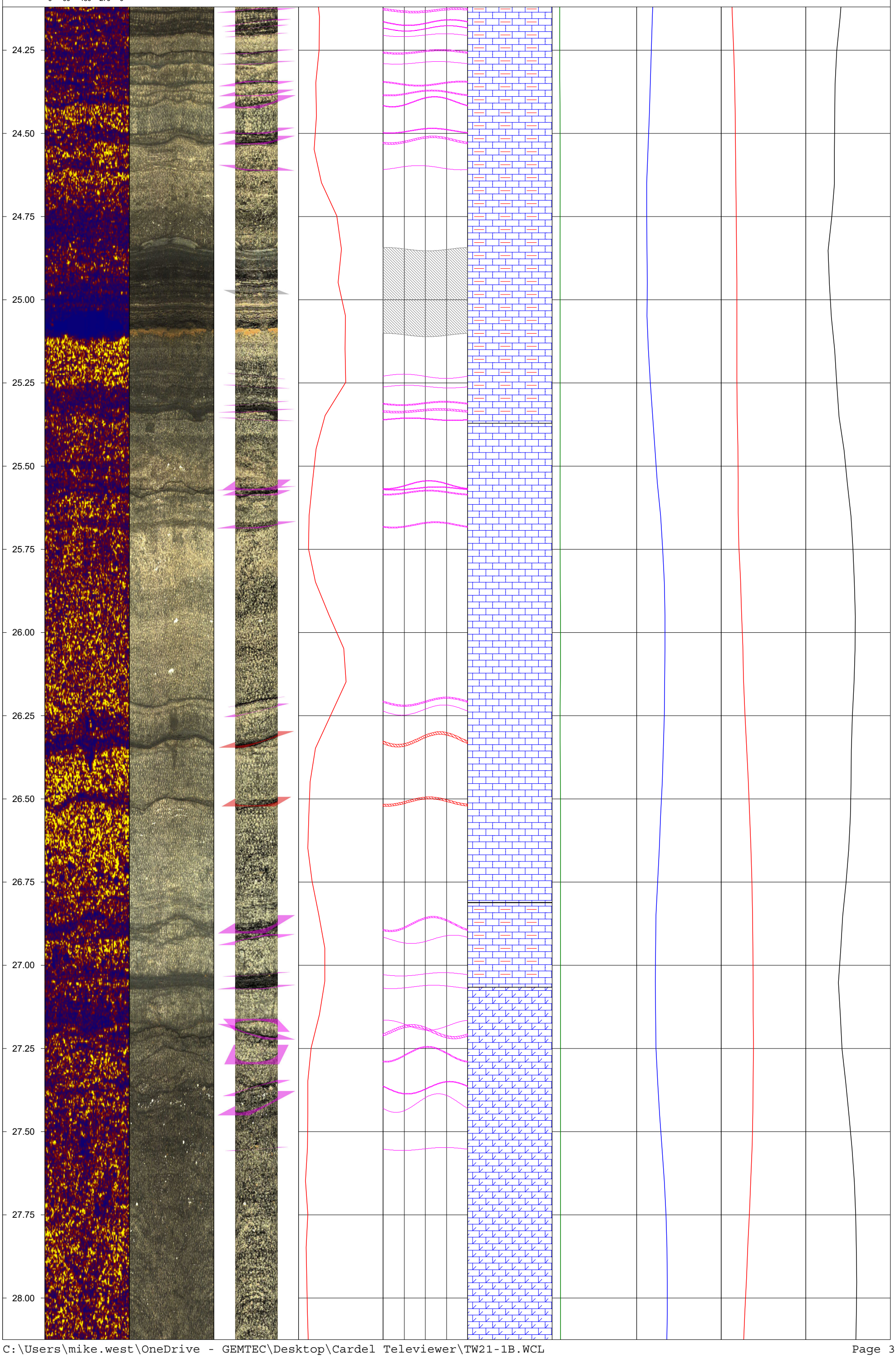
Limestone
Limestone/shale
Limestone - dolomitic (10-50% Dolomite)



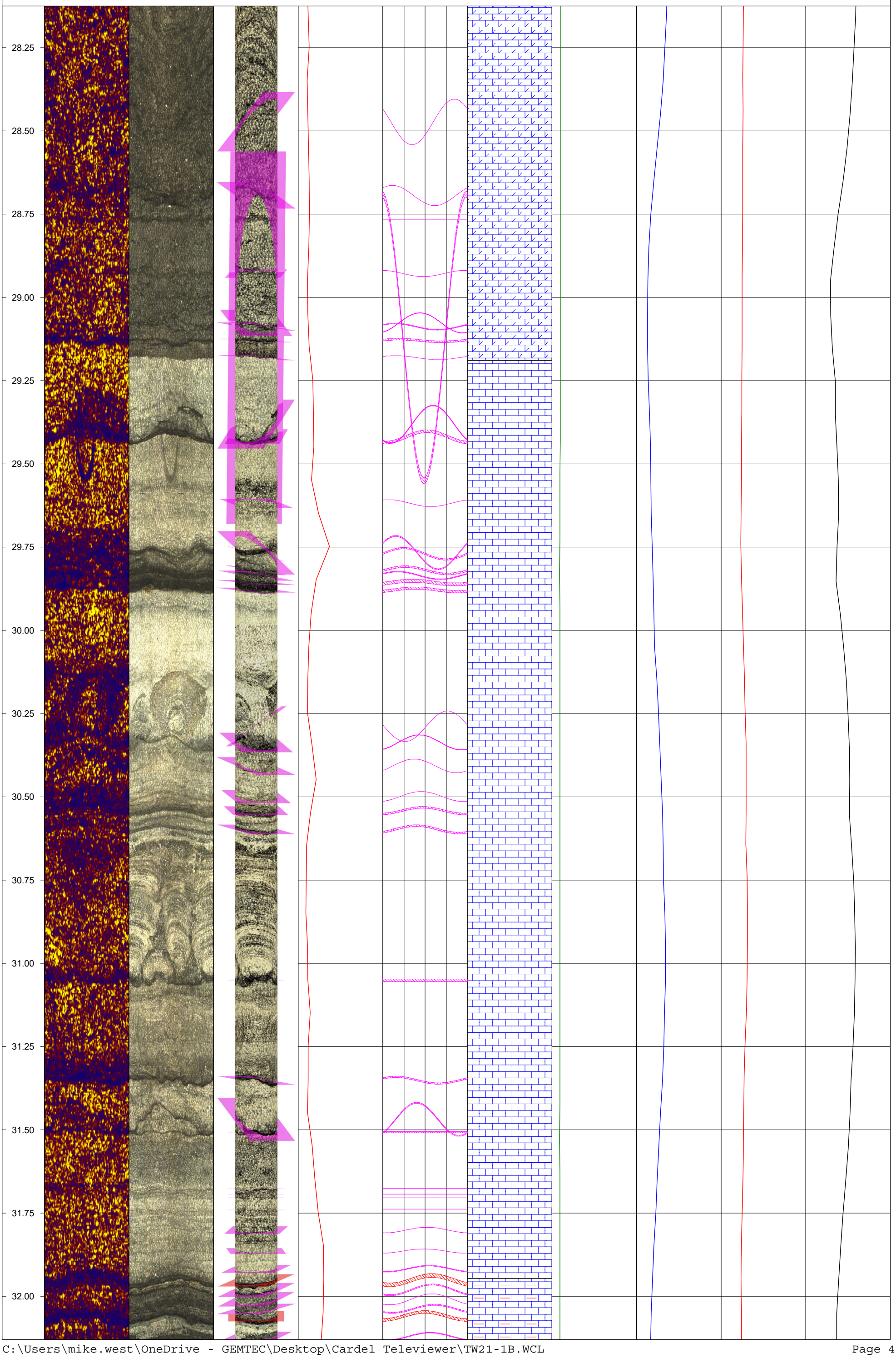
Depth	Acoustic Image	Optical Image	3D Core	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistivity	64" Long Resistivity	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	-0°	0 Counts/s 250	0° 90° 180° 270° 0°		-2000 mV 20000	0 Ohm.m 5000	0 Ohm.m 5000	0 Ohms 1000
	0° 90° 180° 270° 0°									



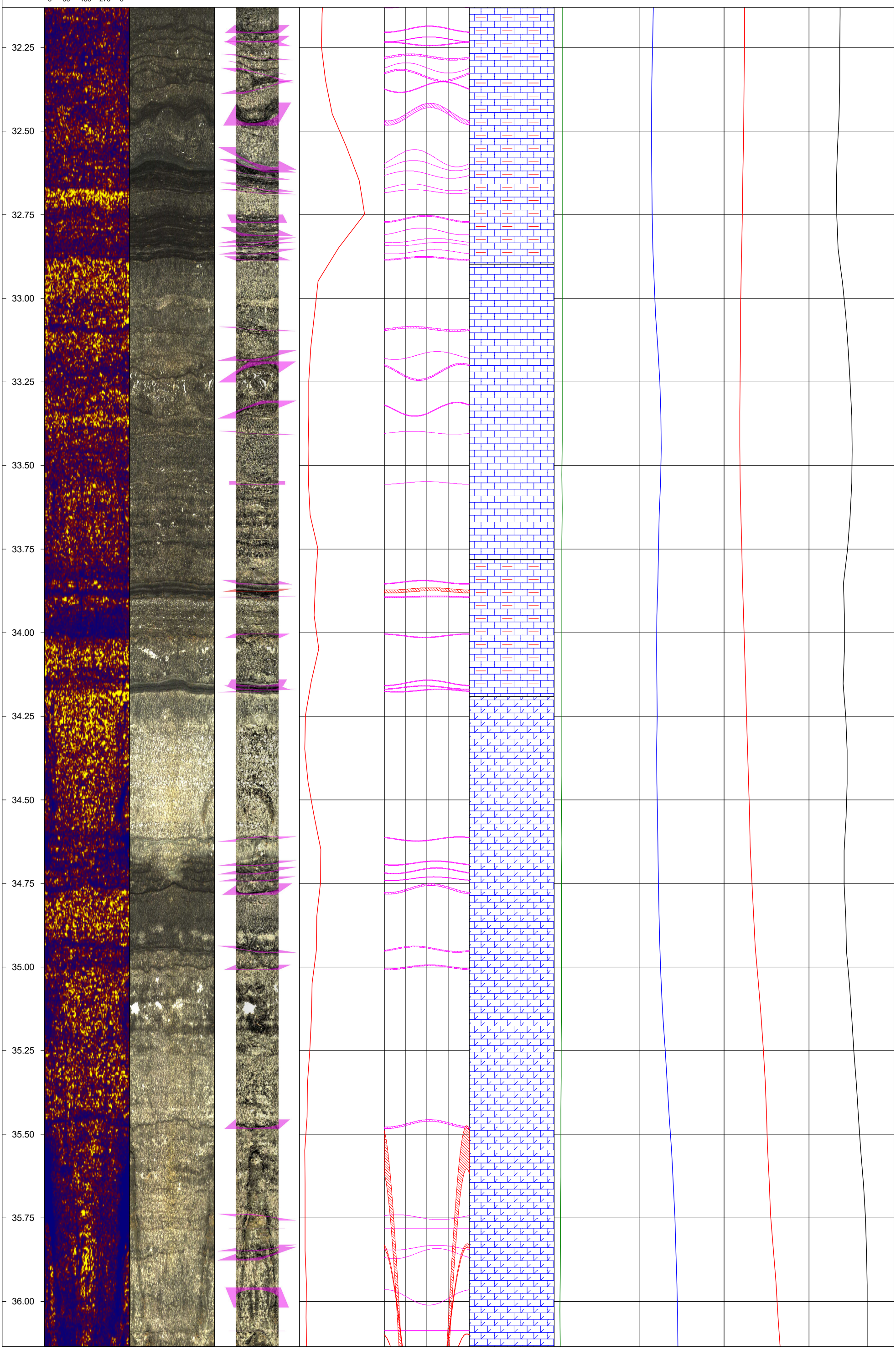
Depth	Acoustic Image	Optical Image	3D Core	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistivity	64" Long Resistivity	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	-0°	0 Counts/s 250	0° 90° 180° 270° 0°		-2000 mV 20000	0 Ohm.m 5000	0 Ohm.m 5000	0 Ohms 1000
	0° 90° 180° 270° 0°									



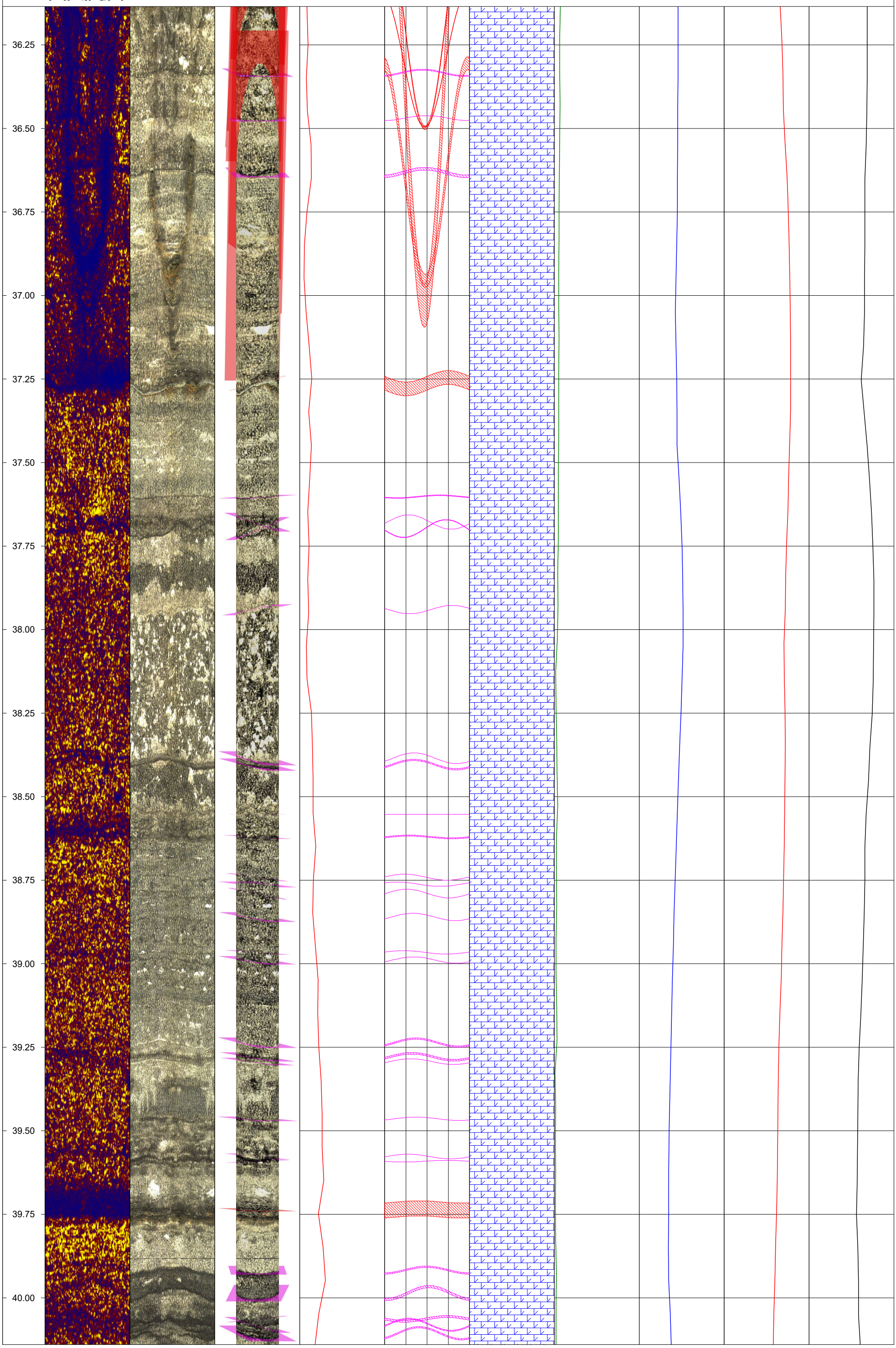
Depth	Acoustic Image	Optical Image	3D Core	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistivity	64" Long Resistivity	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	-0°	0 Counts/s 250	0° 90° 180° 270° 0°		-2000 mV 20000	0 Ohm.m 5000	0 Ohm.m 5000	0 Ohms 1000



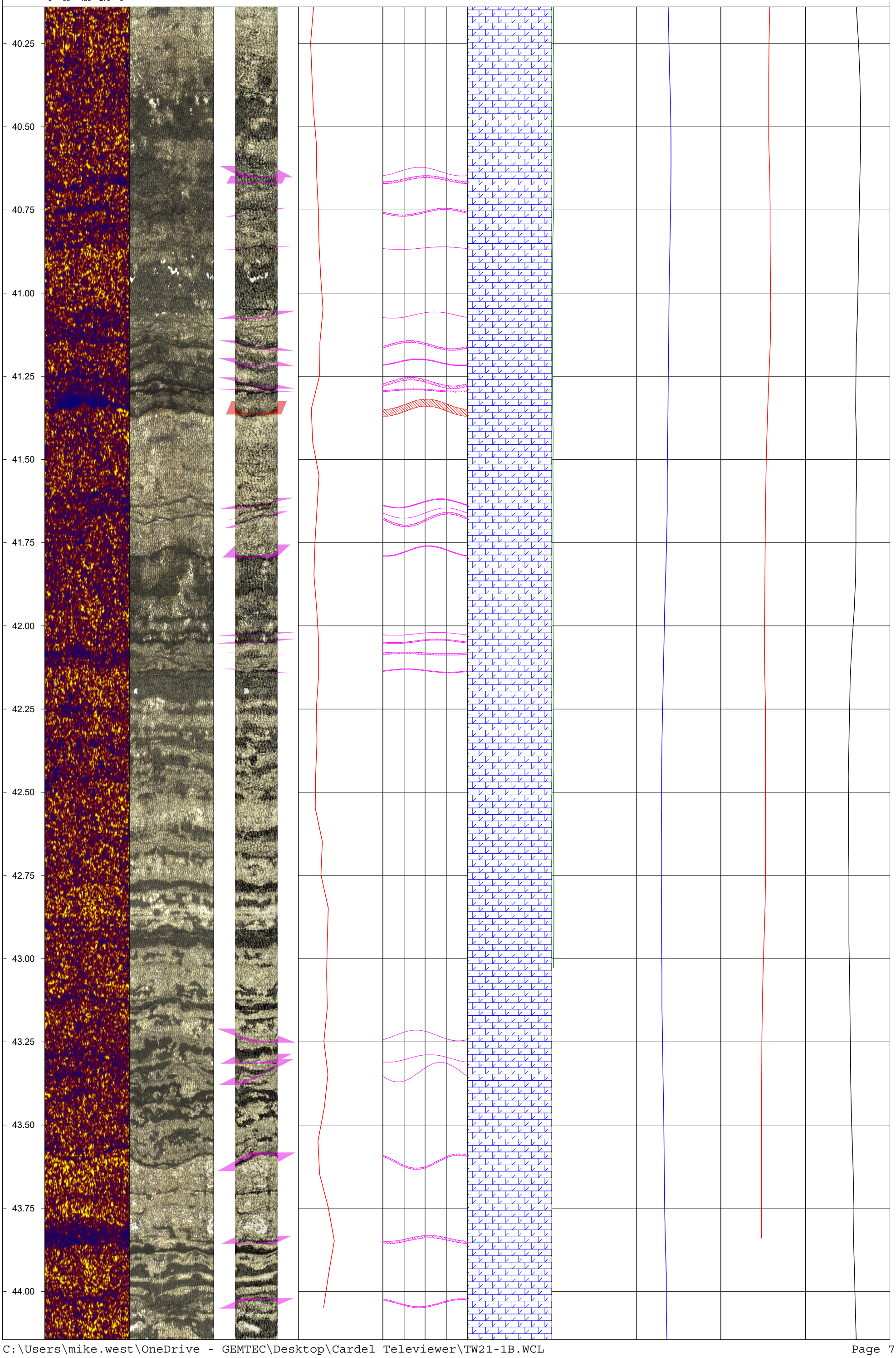
Depth	Acoustic Image	Optical Image	3D Core	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistivity	64" Long Resistivity	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	-0°	0 Counts/s 250	0° 90° 180° 270° 0°		-2000 mV 20000	0 Ohm.m 5000	0 Ohm.m 5000	0 Ohms 1000

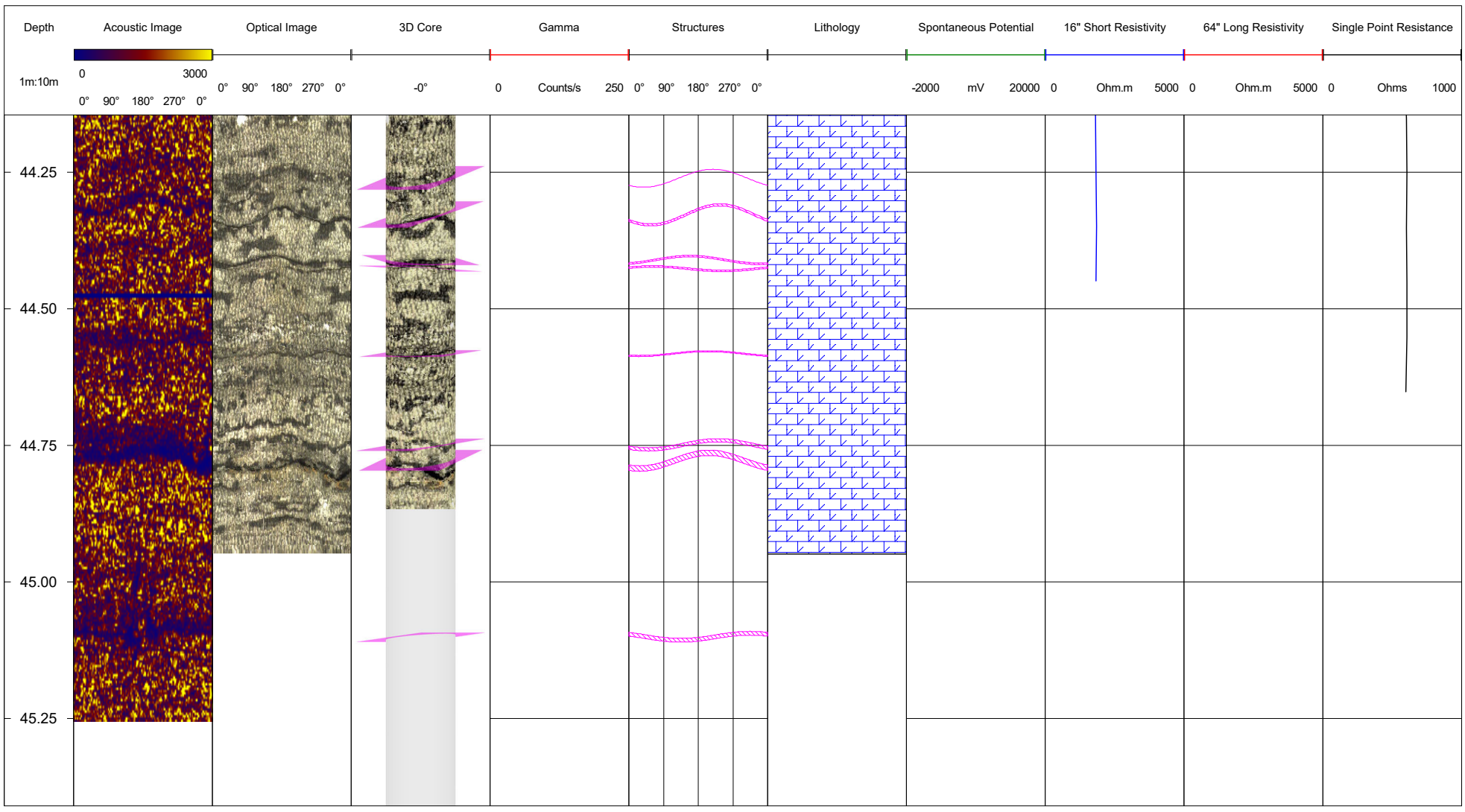


Depth	Acoustic Image	Optical Image	3D Core	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistivity	64" Long Resistivity	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	-0°	0 Counts/s 250	0° 90° 180° 270° 0°		-2000 mV 20000	0 Ohm.m 5000	0 Ohm.m 5000	0 Ohms 1000
	0° 90° 180° 270° 0°									



Depth	Acoustic Image	Optical Image	3D Core	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistivity	64" Long Resistivity	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	-0°	0 Counts/s 250	0° 90° 180° 270° 0°		-2000 mV 20000	0 Ohm.m 5000	0 Ohm.m 5000	0 Ohms 1000
	0° 90° 180° 270° 0°									




Depth
Acoustic Image
Optical Image
3D Core
Gamma
Structures
Lithology
Spontaneous Potential
16" Short Resistivity
64" Long Resistivity
Single Point Resistance
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Counts/s
250
0° 90° 180° 270° 0°
-2000
mV
20000
0
Ohm.m
5000
0
Ohm.m
5000
0
Ohms
1000
44.25
44.50
44.75
45.00
45.25

GEMTEC
Consulting Engineers and Scientists

Client	Cardel Homes	Logged By	Brett Webster	Drilled Depth	122.25 metres
Project #	61899.04	Reviewed by	Mike West	Elevation	
		Date Logged	February 2021	Angle	Vertical
		Hole Number	TW21-1C	Location	Creekside Development

Major Open Joint / Fracture

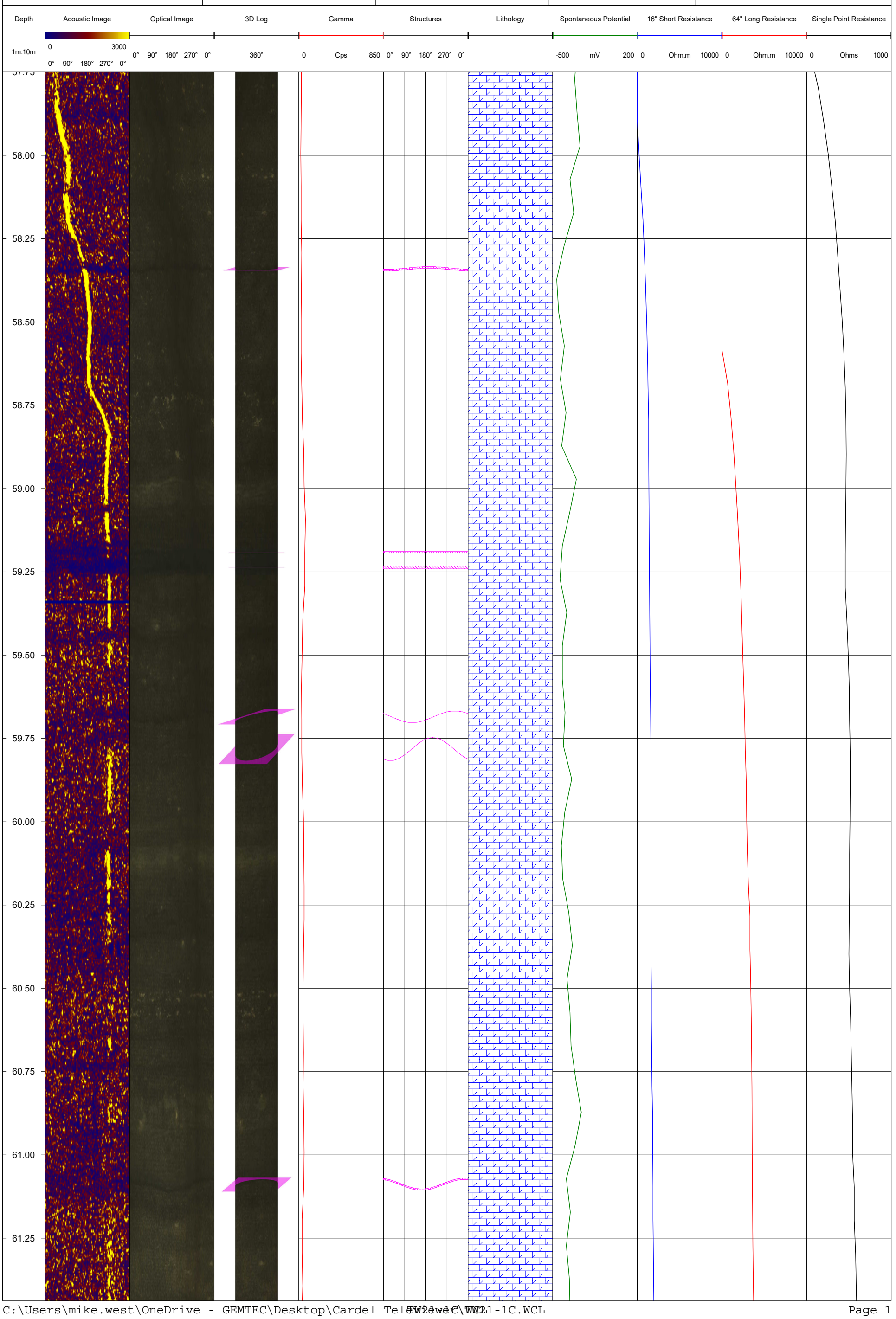
Minor Open Joint / Fracture

Argillaceous sandstone

Limestone

Limestone/shale

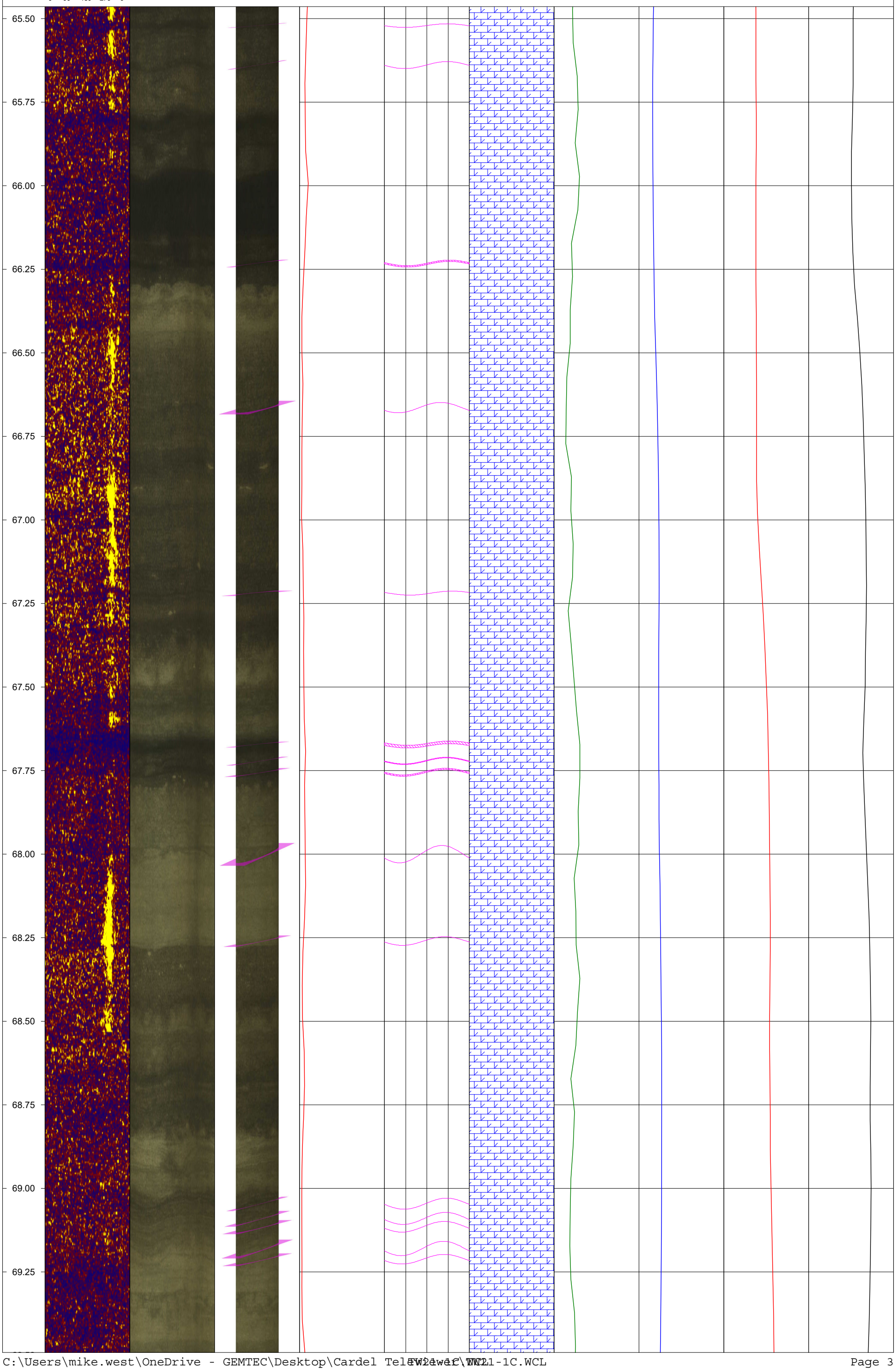
Limestone - dolomitic (10-50% Dolomite)

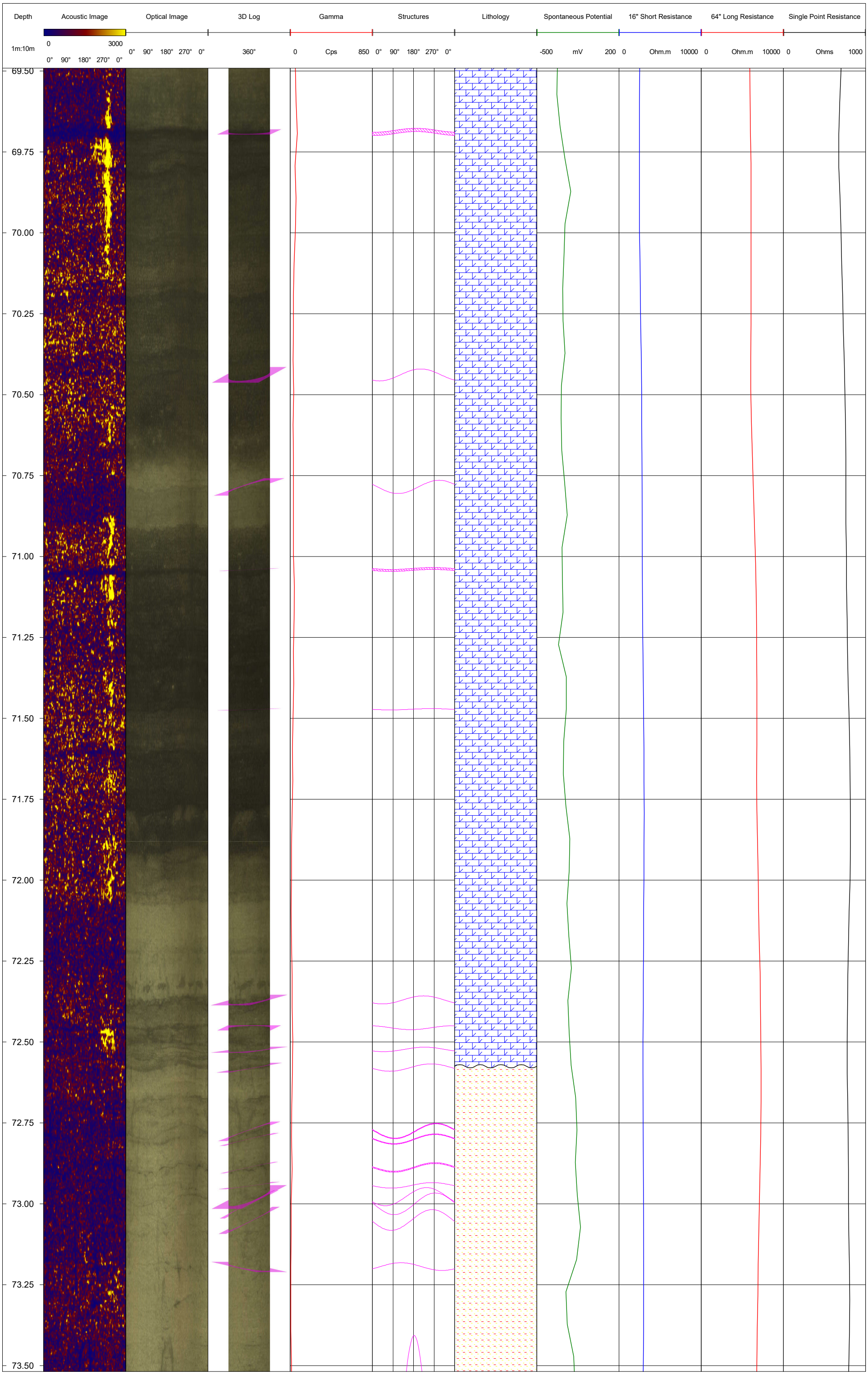


Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									

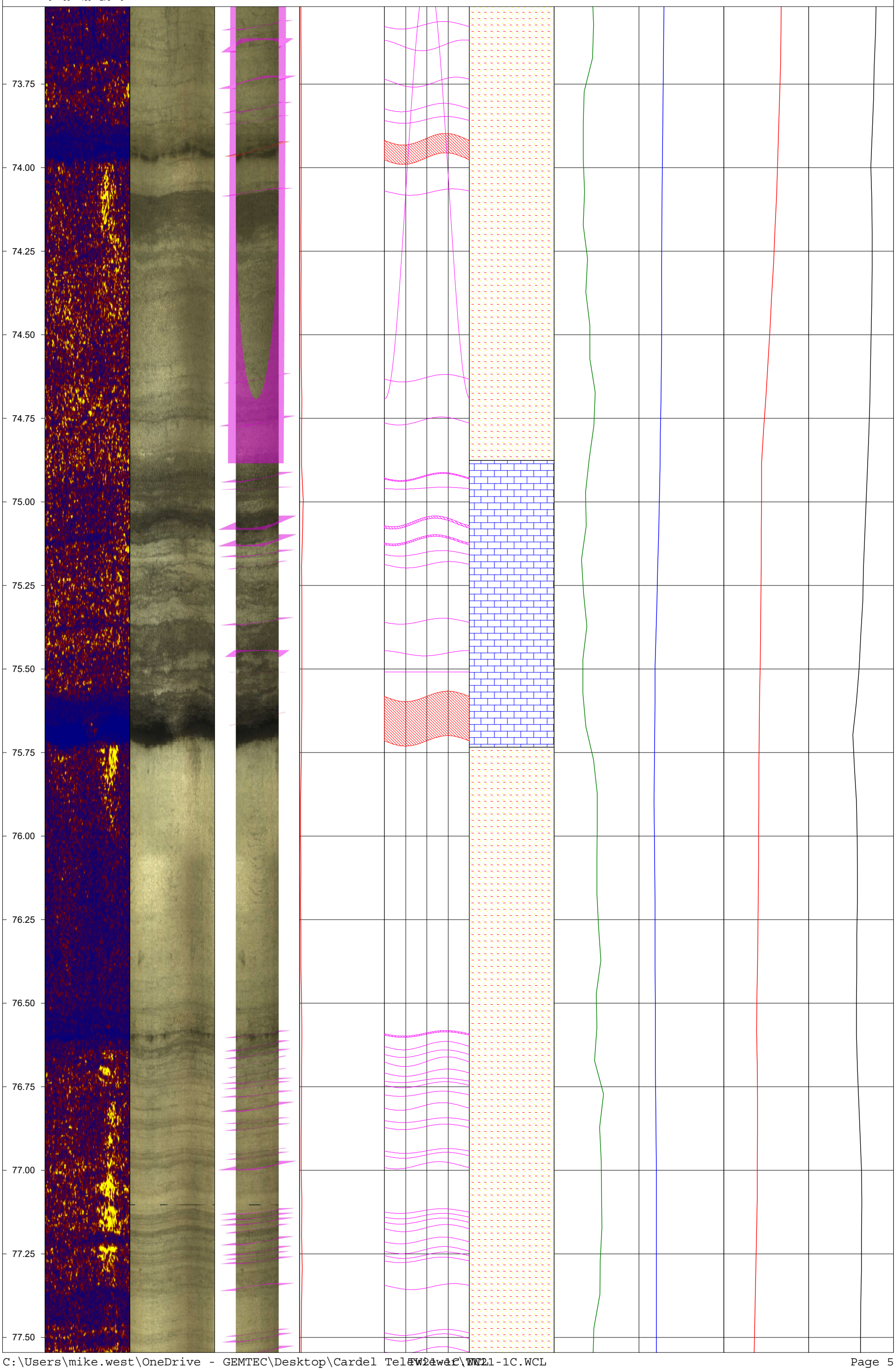
61.50
61.75
62.00
62.25
62.50
62.75
63.00
63.25
63.50
63.75
64.00
64.25
64.50
64.75
65.00
65.25

Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									




Depth
Acoustic Image
Optical Image
3D Log
Gamma
Structures
Lithology
Spontaneous Potential
16" Short Resistance
64" Long Resistance
Single Point Resistance
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
360°
0
Cps
850
0° 90° 180° 270° 0°
-500
mV
200
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohms
1000
69.50
69.75
70.00
70.25
70.50
70.75
71.00
71.25
71.50
71.75
72.00
72.25
72.50
72.75
73.00
73.25
73.50

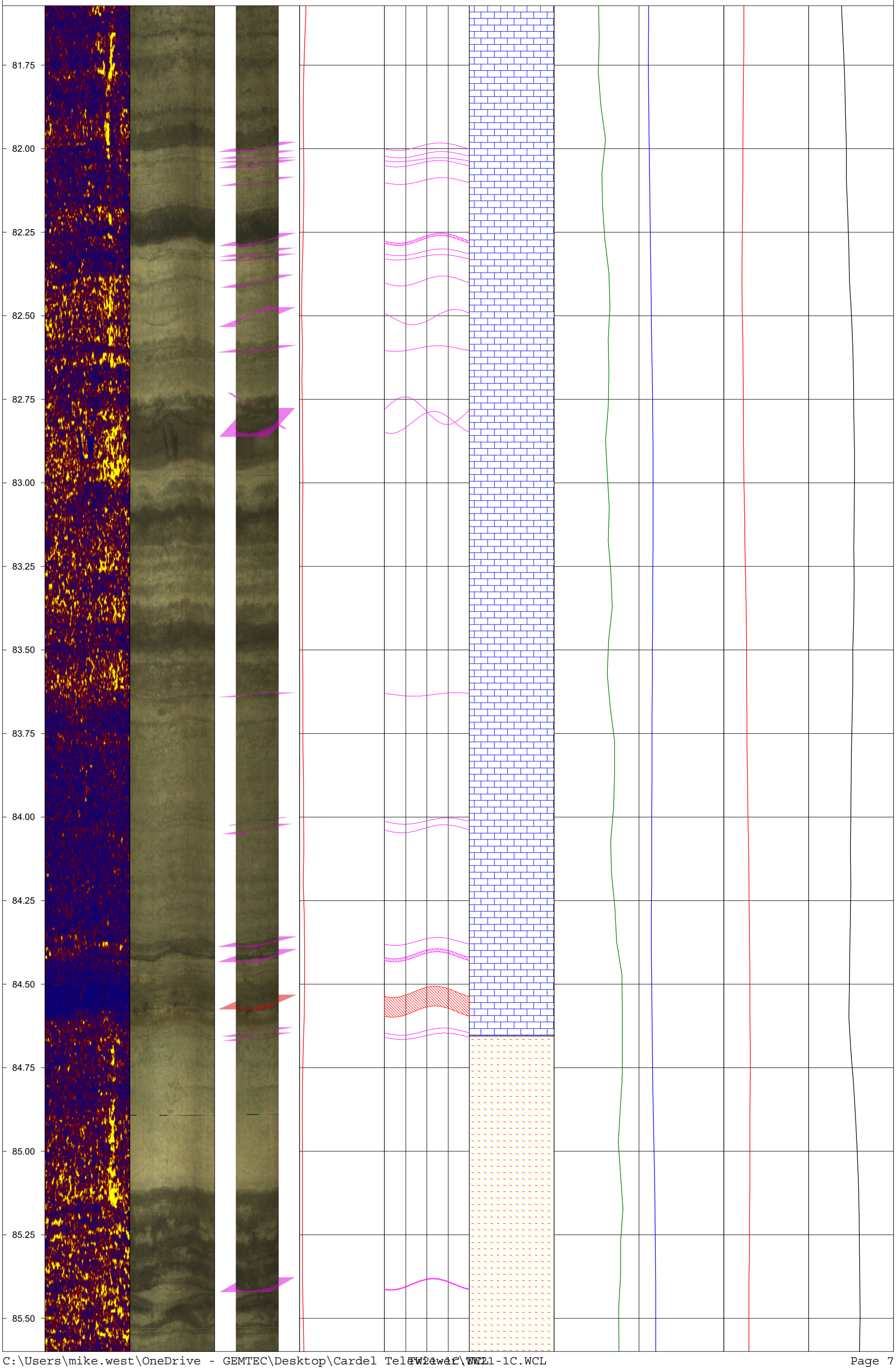
Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									

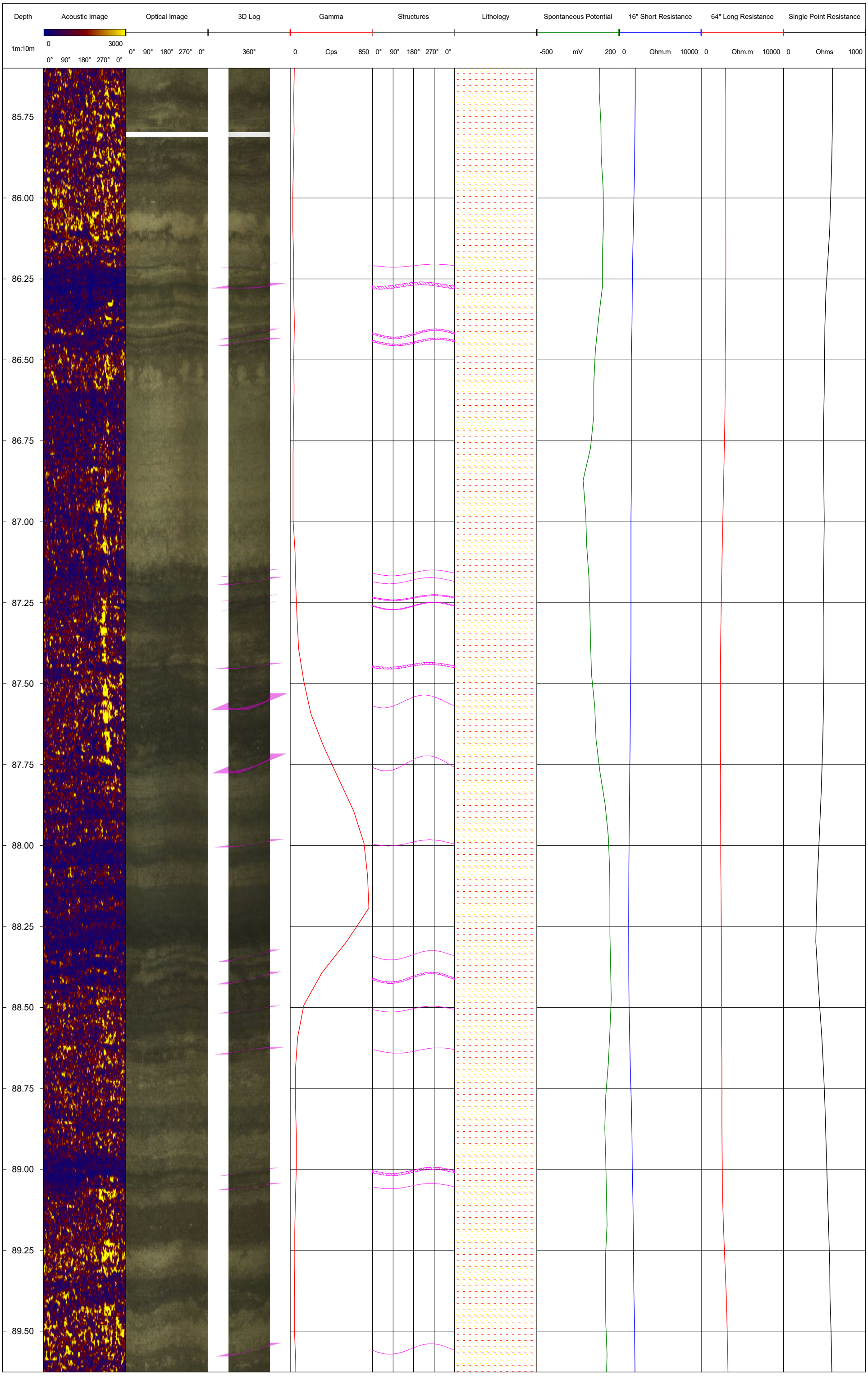


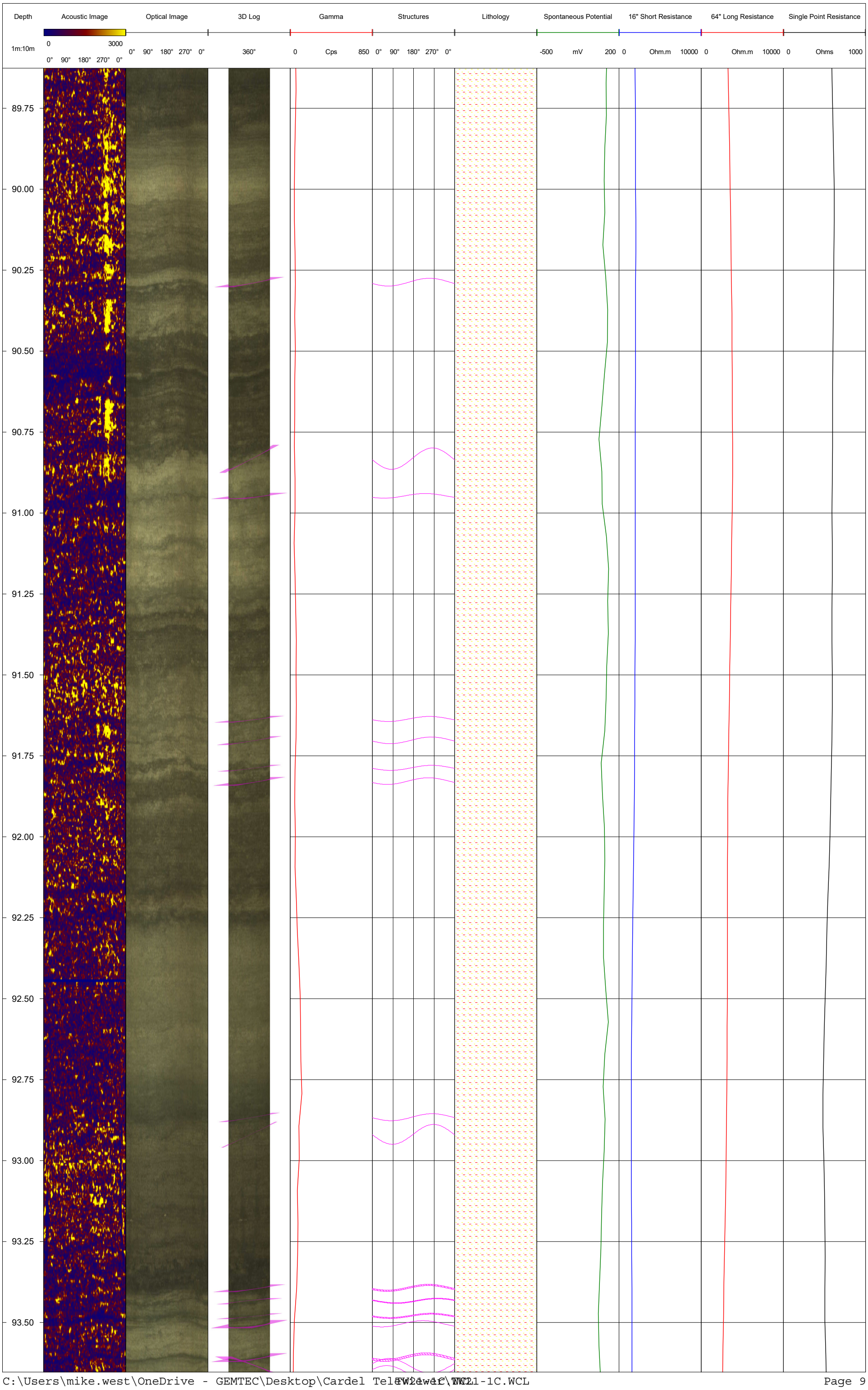
Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000 0° 90° 180° 270° 0°	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000

77.75
78.00
78.25
78.50
78.75
79.00
79.25
79.50
79.75
80.00
80.25
80.50
80.75
81.00
81.25
81.50

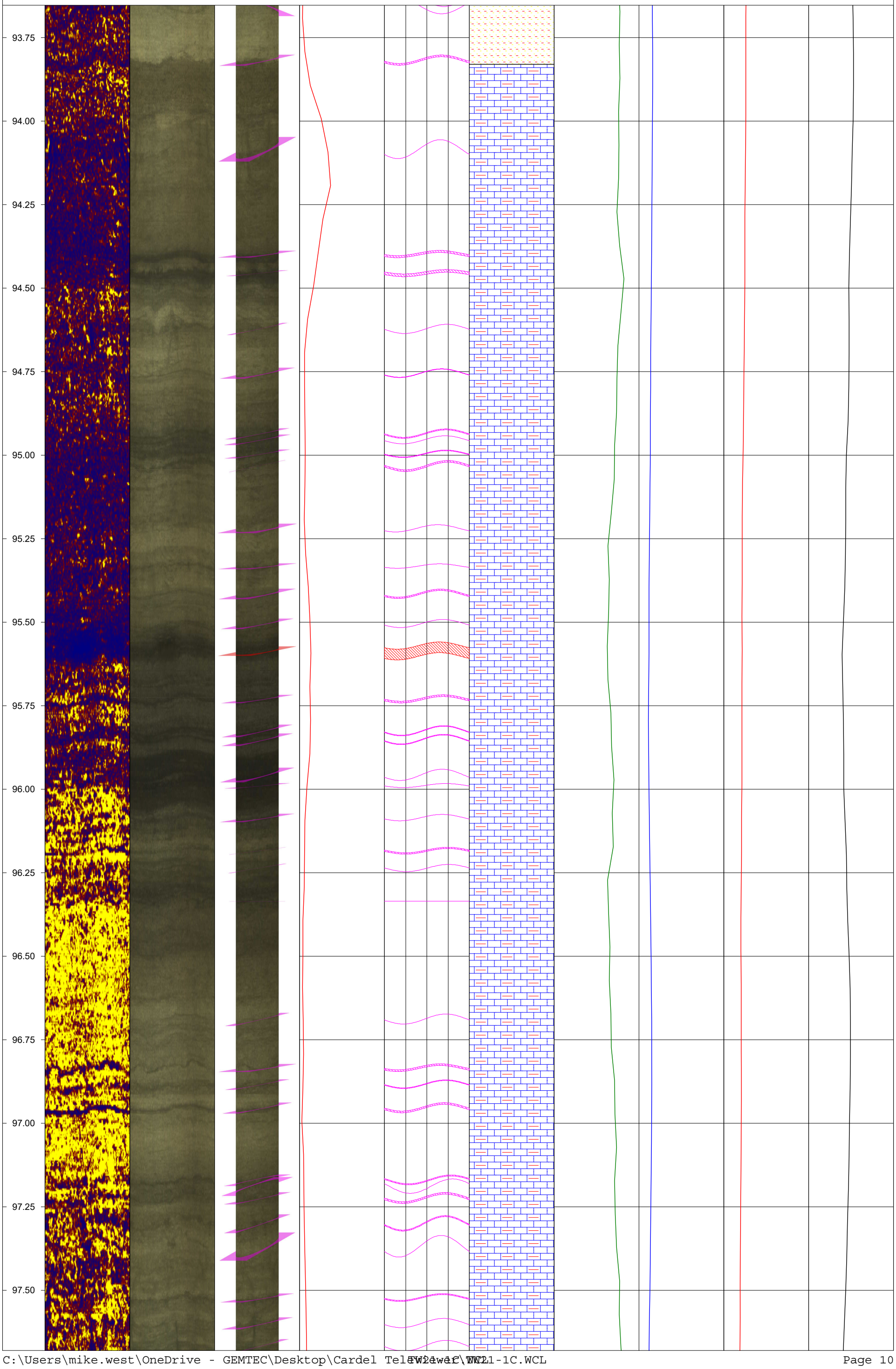
Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									



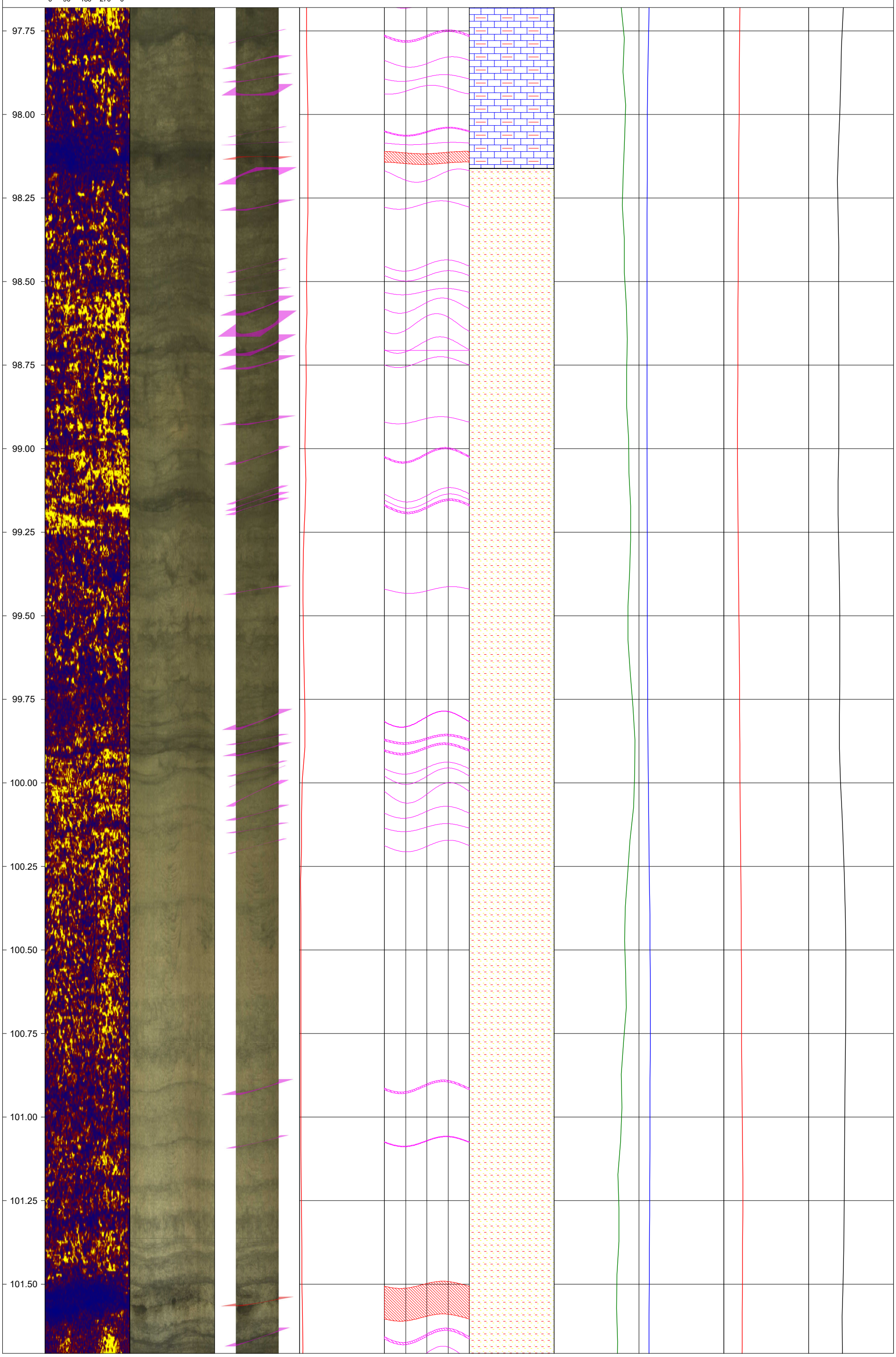

Depth
Acoustic Image
Optical Image
3D Log
Gamma
Structures
Lithology
Spontaneous Potential
16" Short Resistance
64" Long Resistance
Single Point Resistance
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
360°
0
Cps
850
0° 90° 180° 270° 0°
-500
mV
200
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohms
1000
85.75
86.00
86.25
86.50
86.75
87.00
87.25
87.50
87.75
88.00
88.25
88.50
88.75
89.00
89.25
89.50


Depth
Acoustic Image
Optical Image
3D Log
Gamma
Structures
Lithology
Spontaneous Potential
16" Short Resistance
64" Long Resistance
Single Point Resistance
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
360°
0
Cps
850
0° 90° 180° 270° 0°
-500
mV
200
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohms
1000
89.75
90.00
90.25
90.50
90.75
91.00
91.25
91.50
91.75
92.00
92.25
92.50
92.75
93.00
93.25
93.50

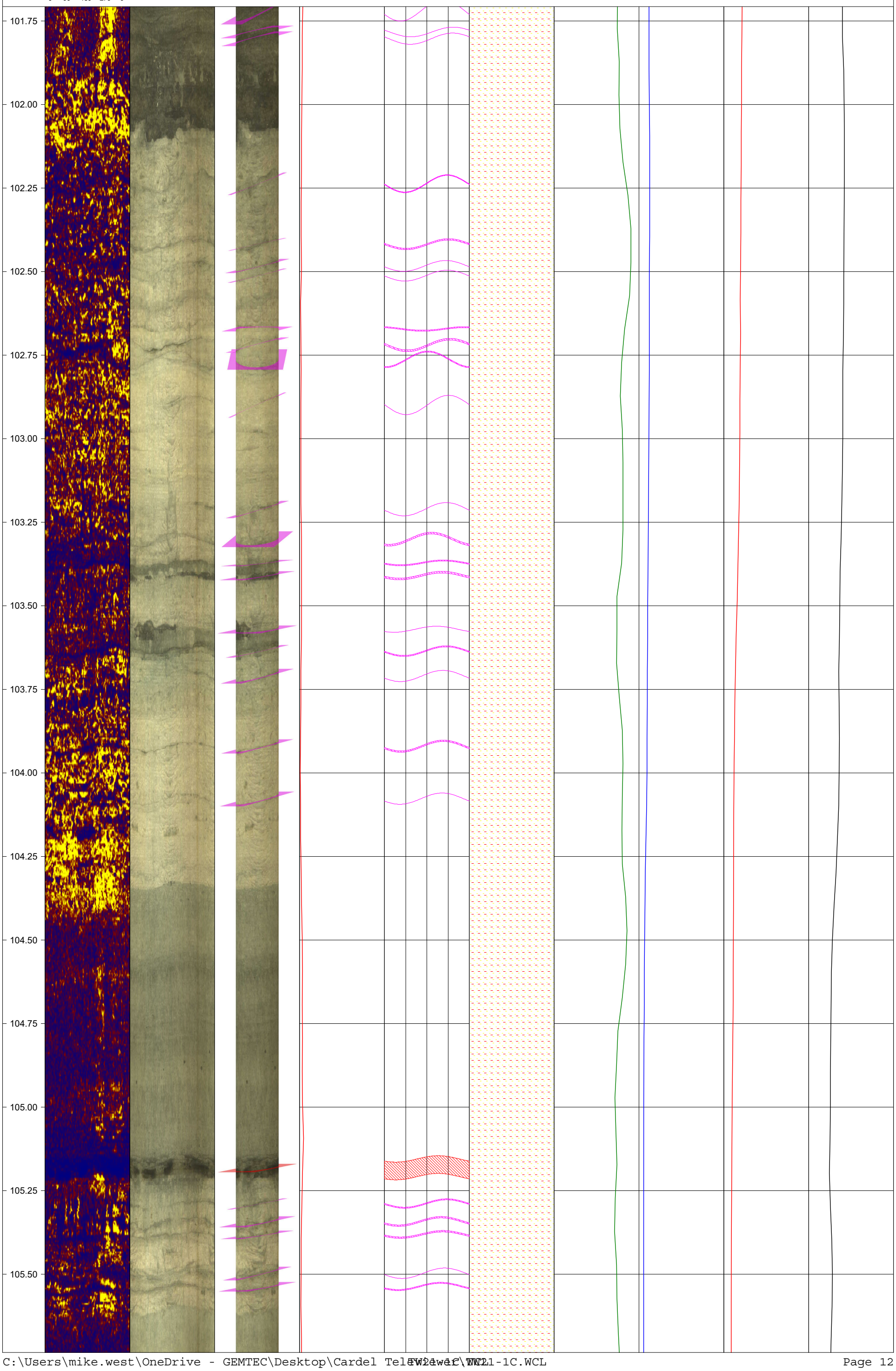
Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									



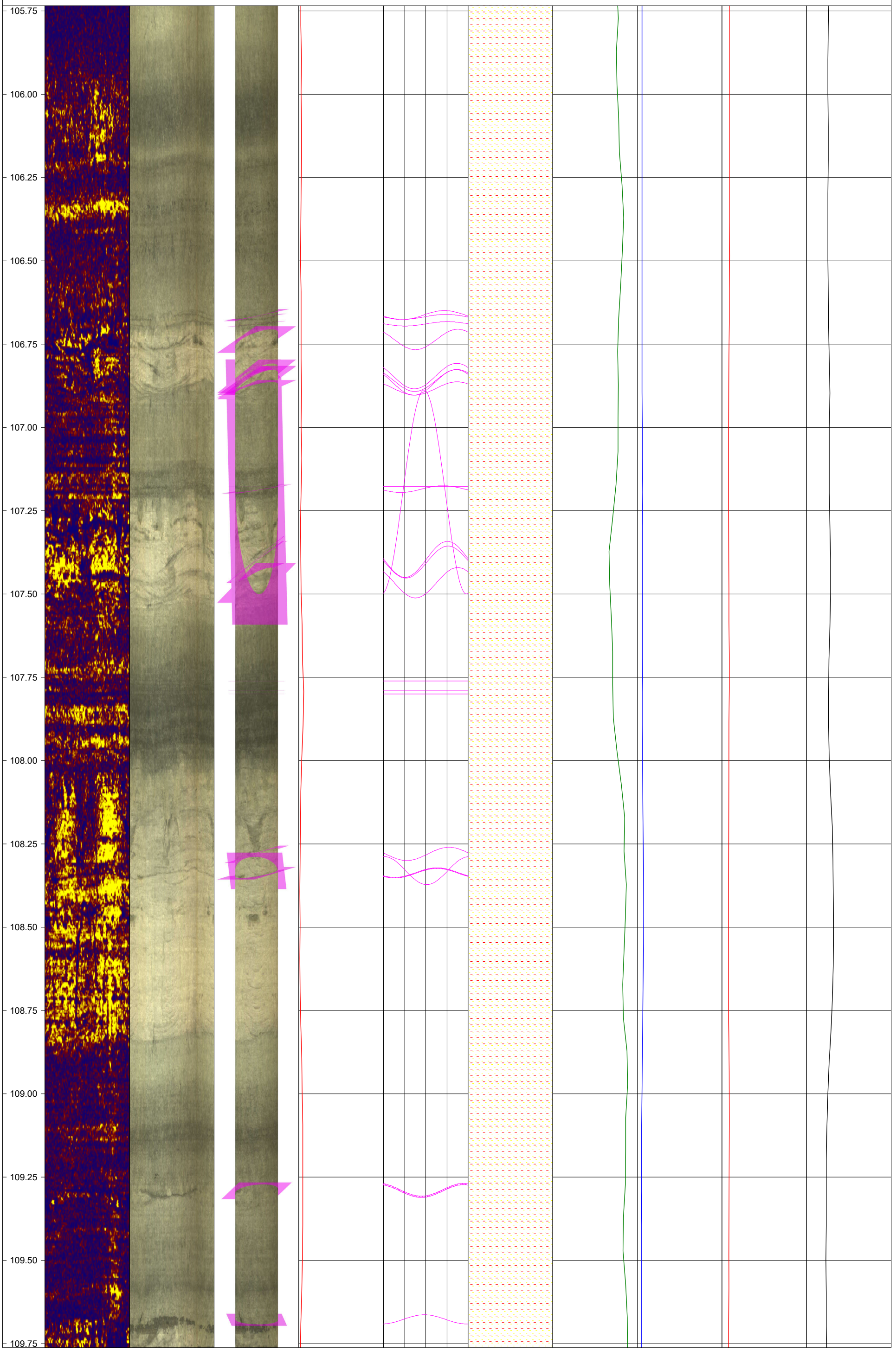
Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000



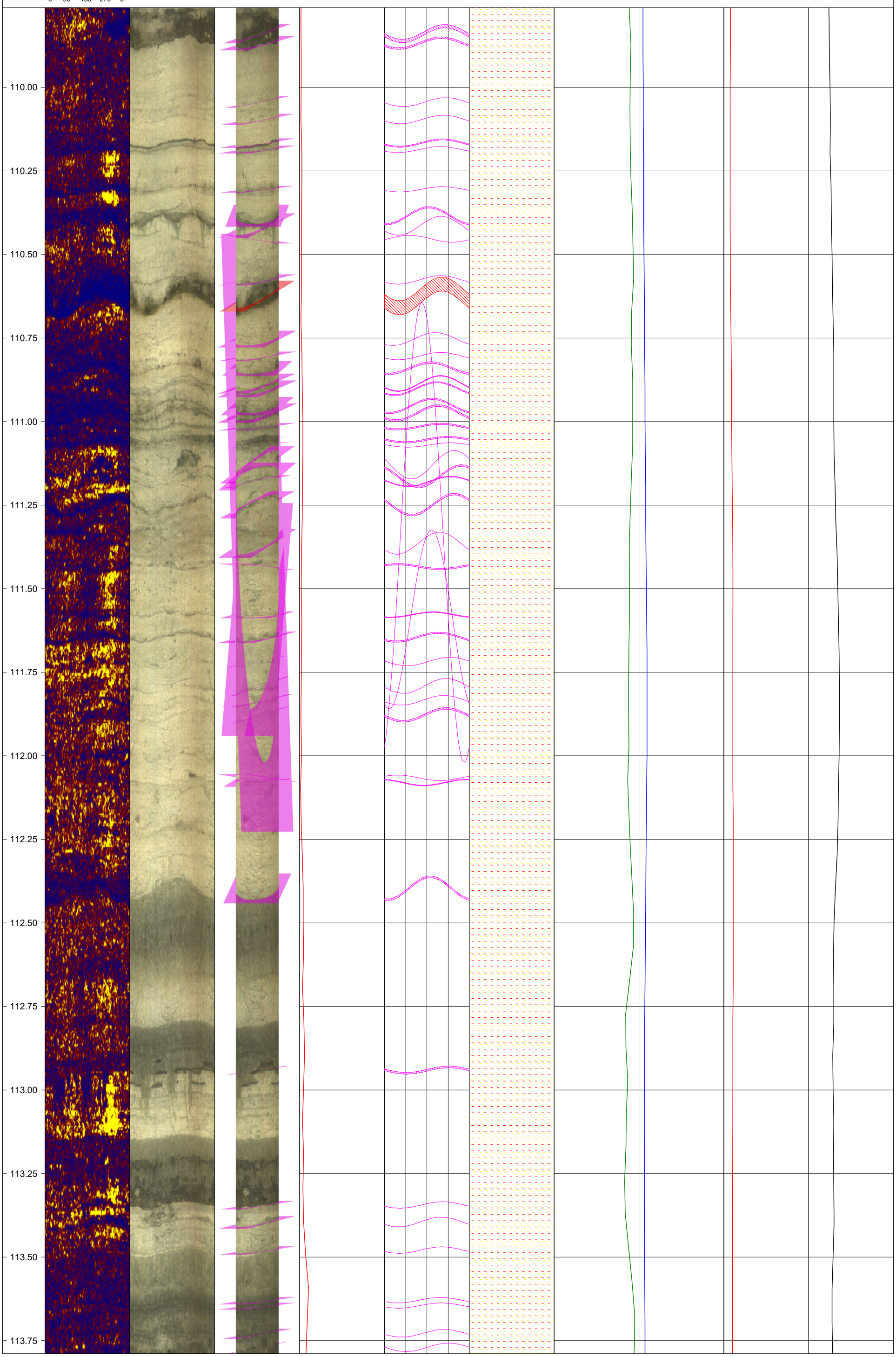
Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									



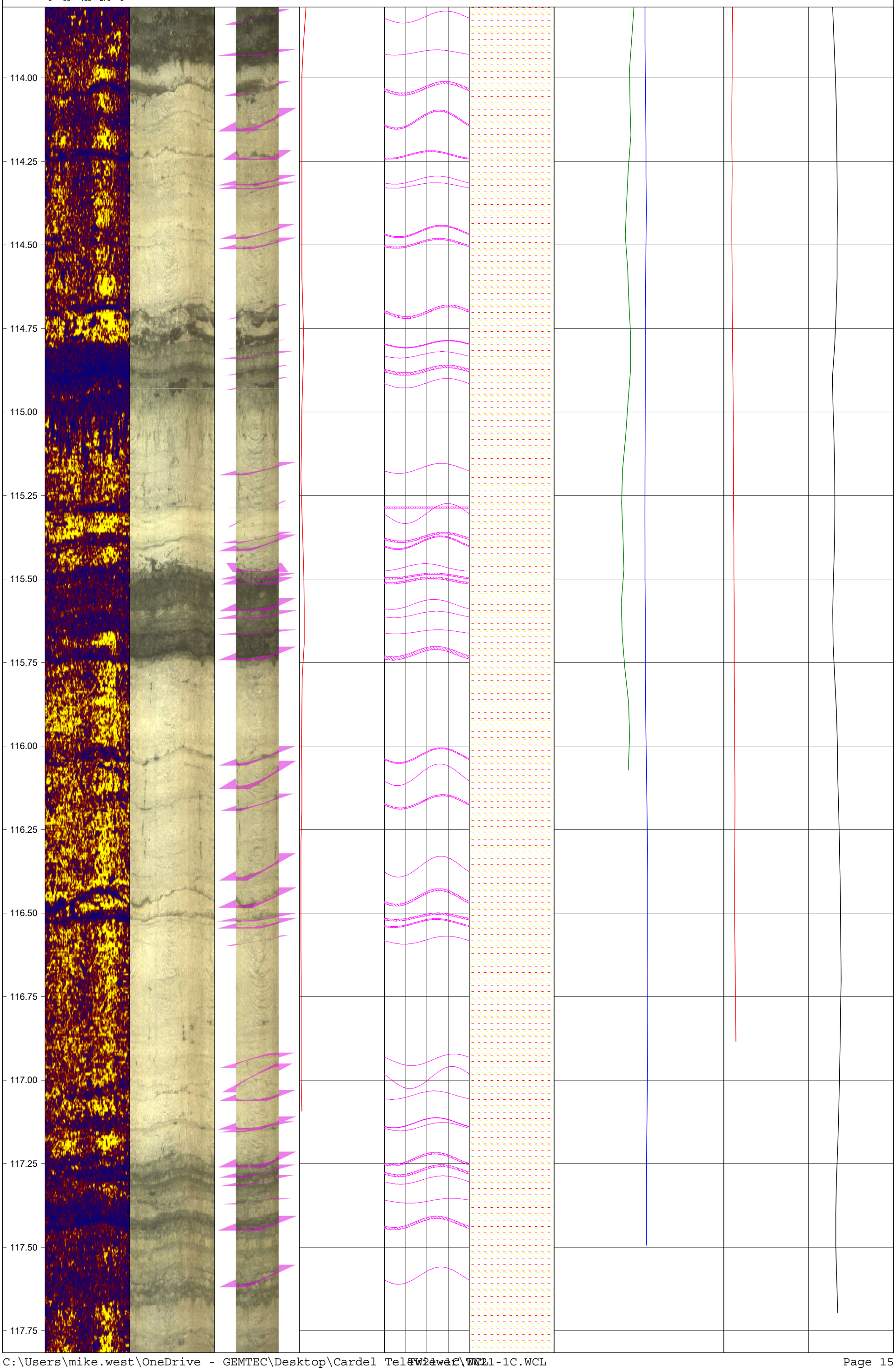
Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									

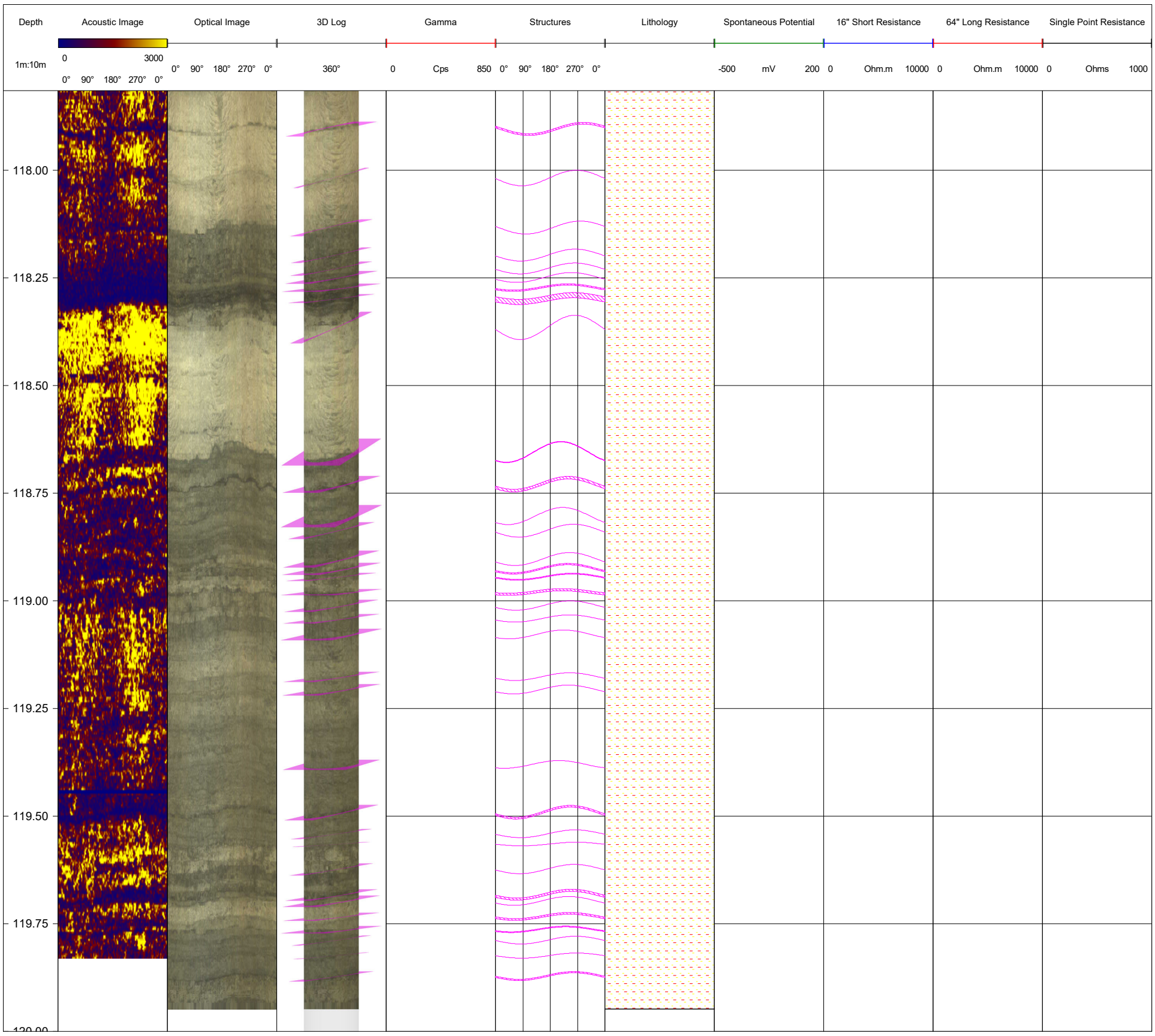


Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									



Depth	Acoustic Image	Optical Image	3D Log	Gamma	Structures	Lithology	Spontaneous Potential	16" Short Resistance	64" Long Resistance	Single Point Resistance
1m:10m	0 3000	0° 90° 180° 270° 0°	360°	0 Cps 850	0° 90° 180° 270° 0°		-500 mV 200	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohms 1000
	0° 90° 180° 270° 0°									




Depth
Acoustic Image
Optical Image
3D Log
Gamma
Structures
Lithology
Spontaneous Potential
16" Short Resistance
64" Long Resistance
Single Point Resistance
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
360°
0
Cps
850
0° 90° 180° 270° 0°
-500
mV
200
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohms
1000
118.00
118.25
118.50
118.75
119.00
119.25
119.50
119.75

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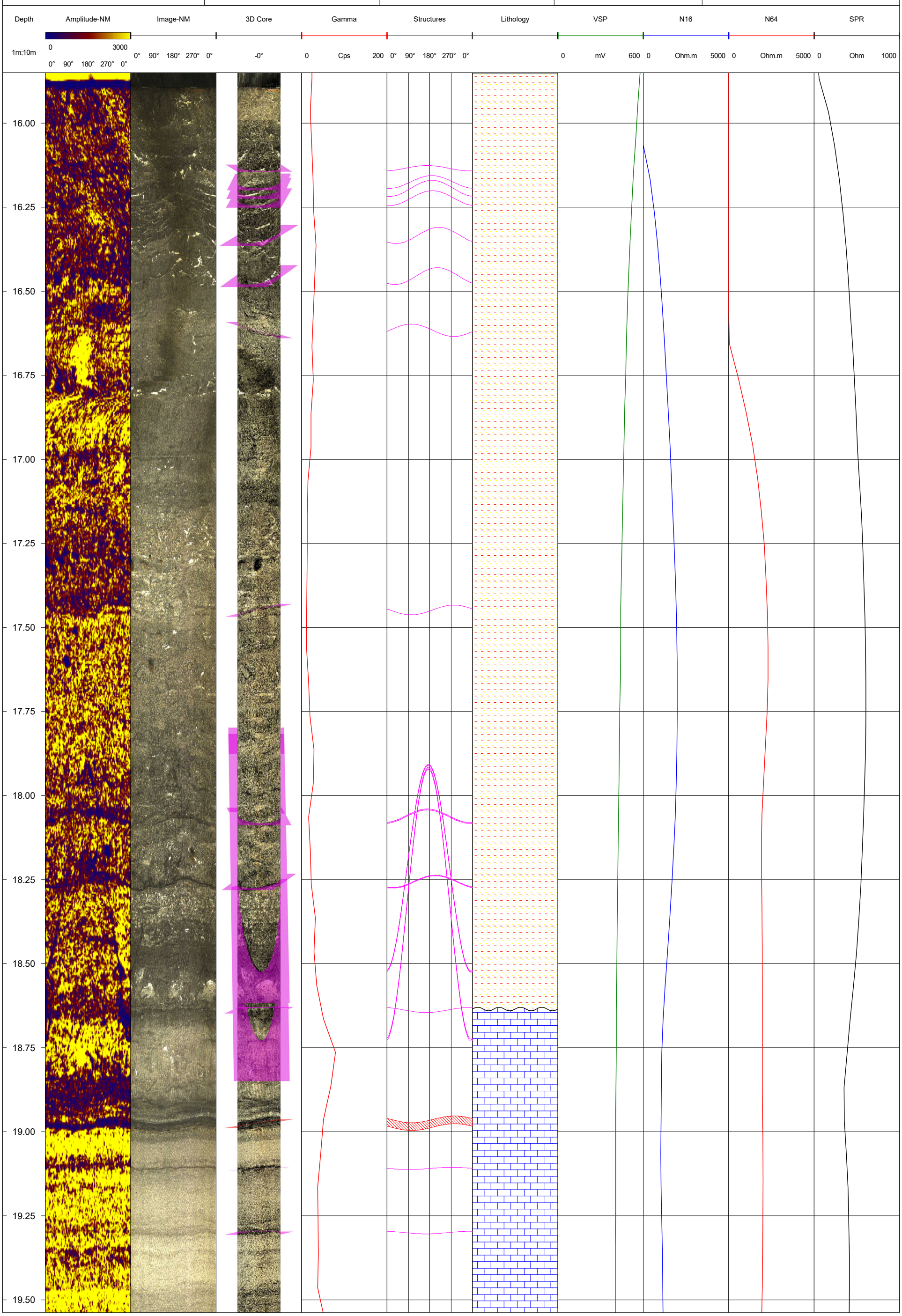
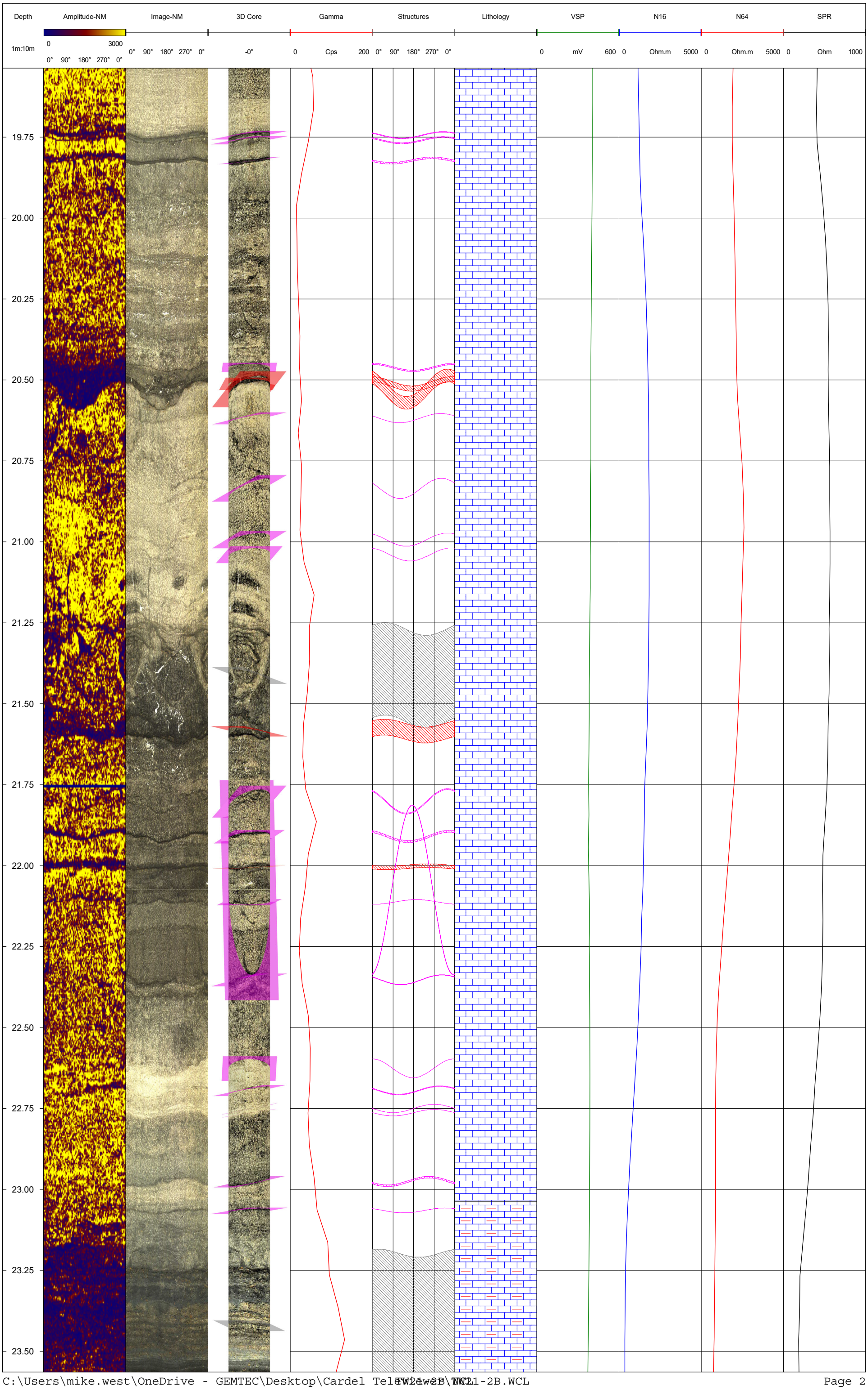
Client	Cardel Homes	Logged By	Brett Webster	Drilled Depth	45.75 metres
Project #	61899.04	Reviewed by	Mike West	Elevation	
		Date Logged	February 2021	Angle	Vertical
		Hole Number	TW21-2B	Location	Creekside Development

Broken Zone / Undifferentiated
Major Open Joint / Fracture
Minor Open Joint / Fracture

Argillaceous sandstone
Limestone
Limestone/shale
Limestone - dolomitic (10-50% Dolomite)




Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
200
0° 90° 180° 270° 0°
0
mV
600
0
Ohm.m
5000
0
Ohm.m
5000
0
Ohm
1000
19.75
20.00
20.25
20.50
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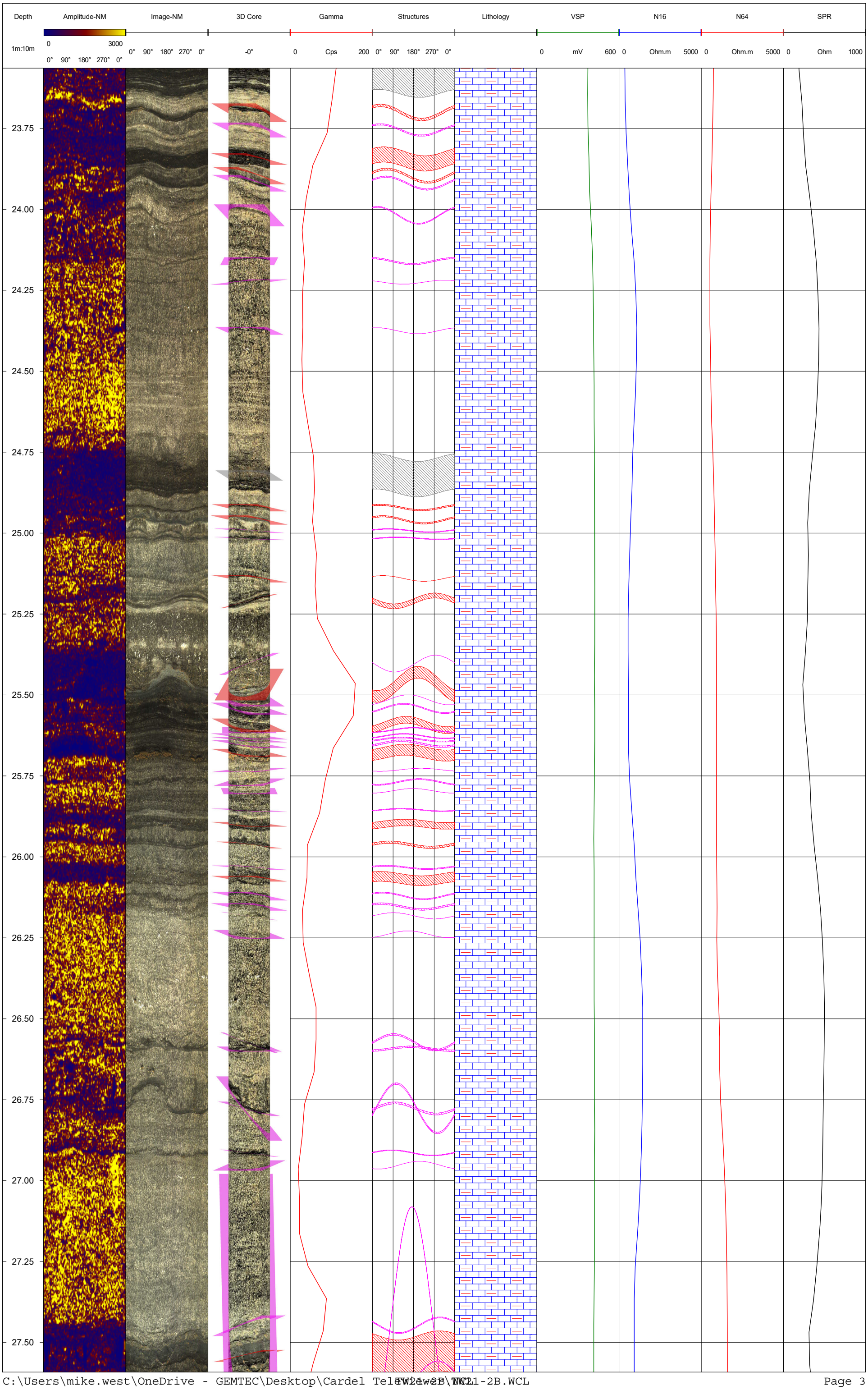
23.00
23.25
23.50


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
200
0° 90° 180° 270° 0°
0
mV
600
0
Ohm.m
5000
0
Ohm.m
5000
0
Ohm
1000
23.75
24.00
24.25
24.50
24.75
25.00
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25.50
25.75
26.00
26.25
26.50
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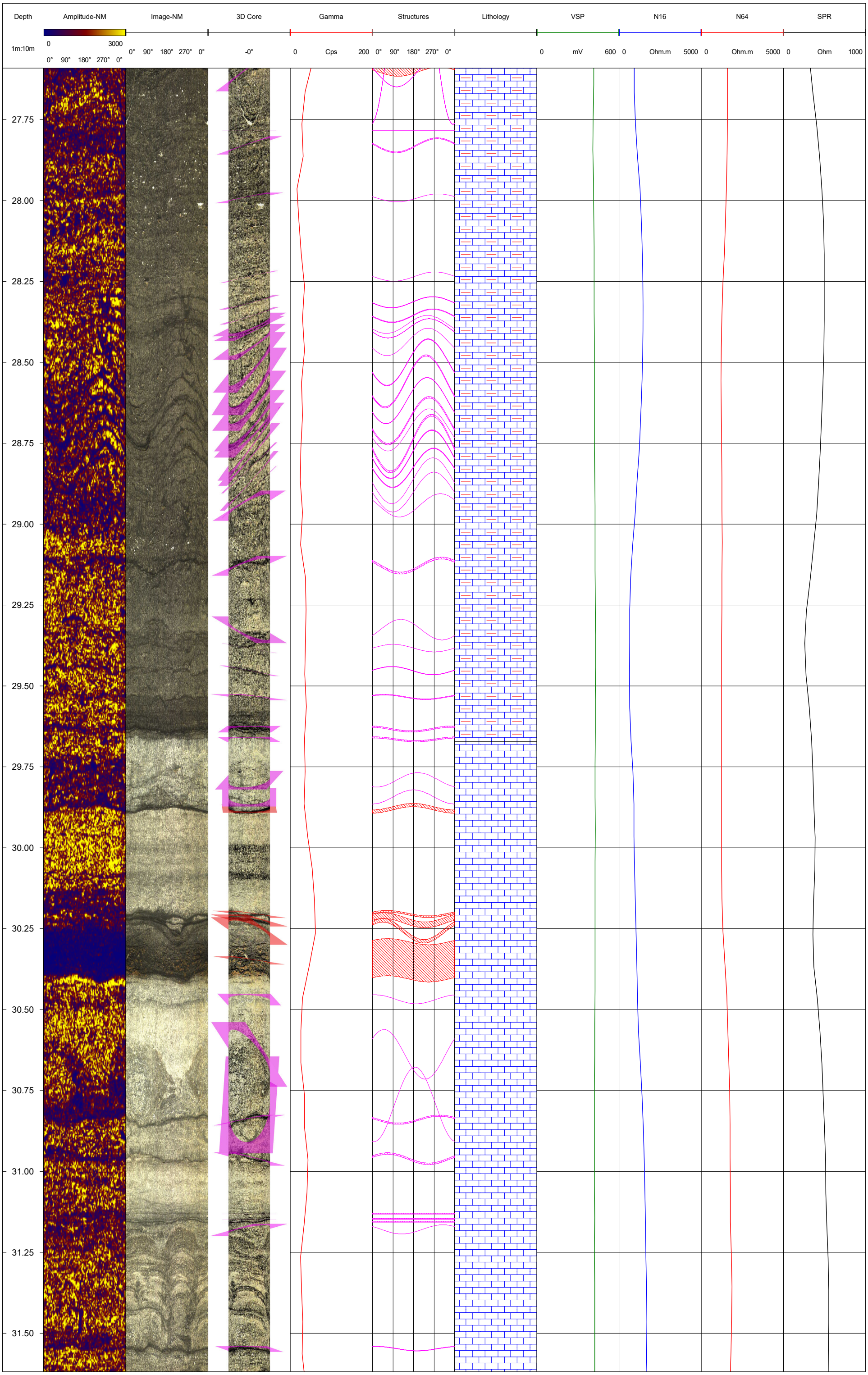
27.00
27.25
27.50


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
200
0° 90° 180° 270° 0°
0
mV
600
0
Ohm.m
5000
0
Ohm.m
5000
0
Ohm
1000
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28.00
28.25
28.50
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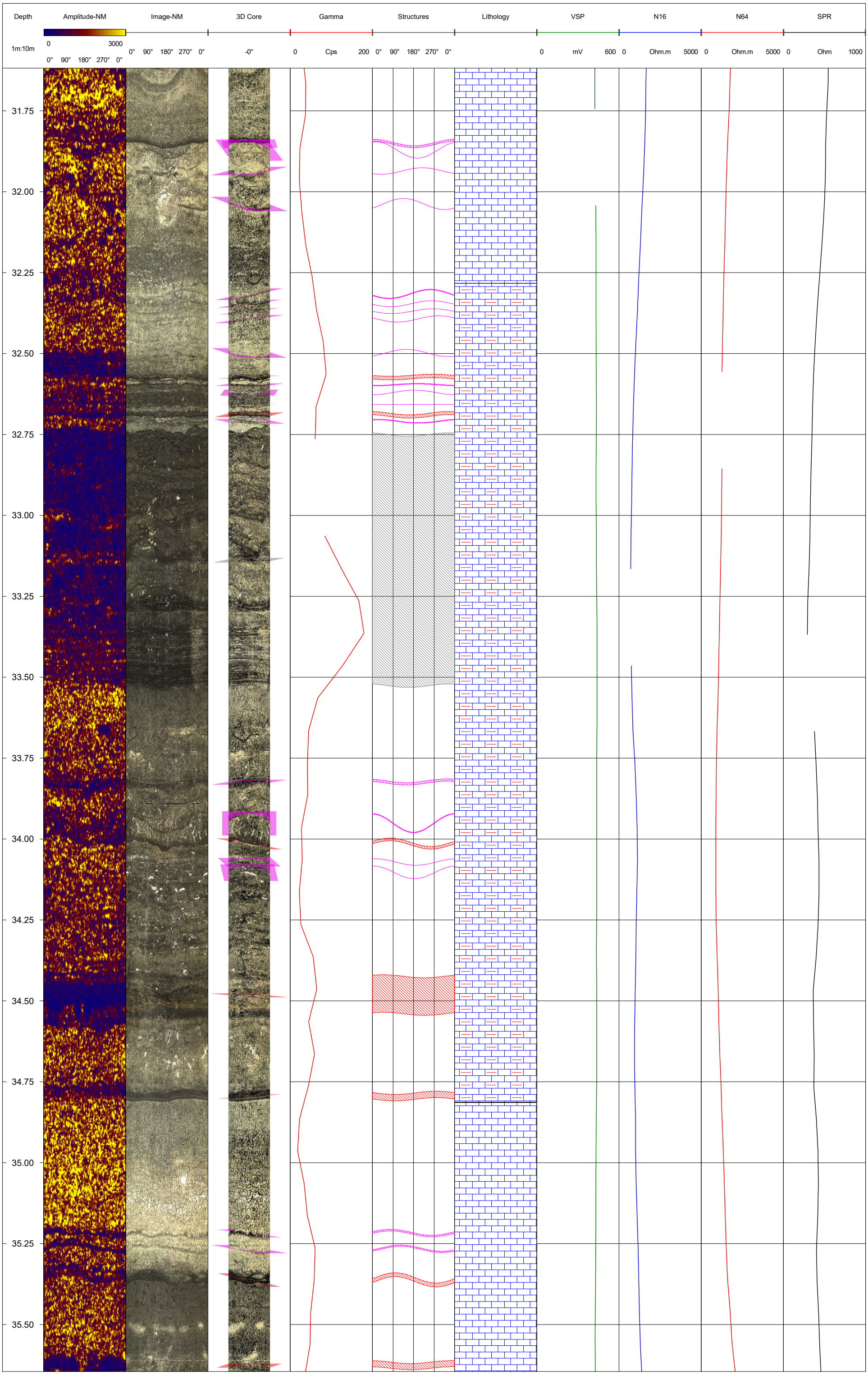
31.00
31.25
31.50


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
200
0° 90° 180° 270° 0°
0
mV
600
0
Ohm.m
5000
0
Ohm.m
5000
0
Ohm
1000
31.75
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32.25
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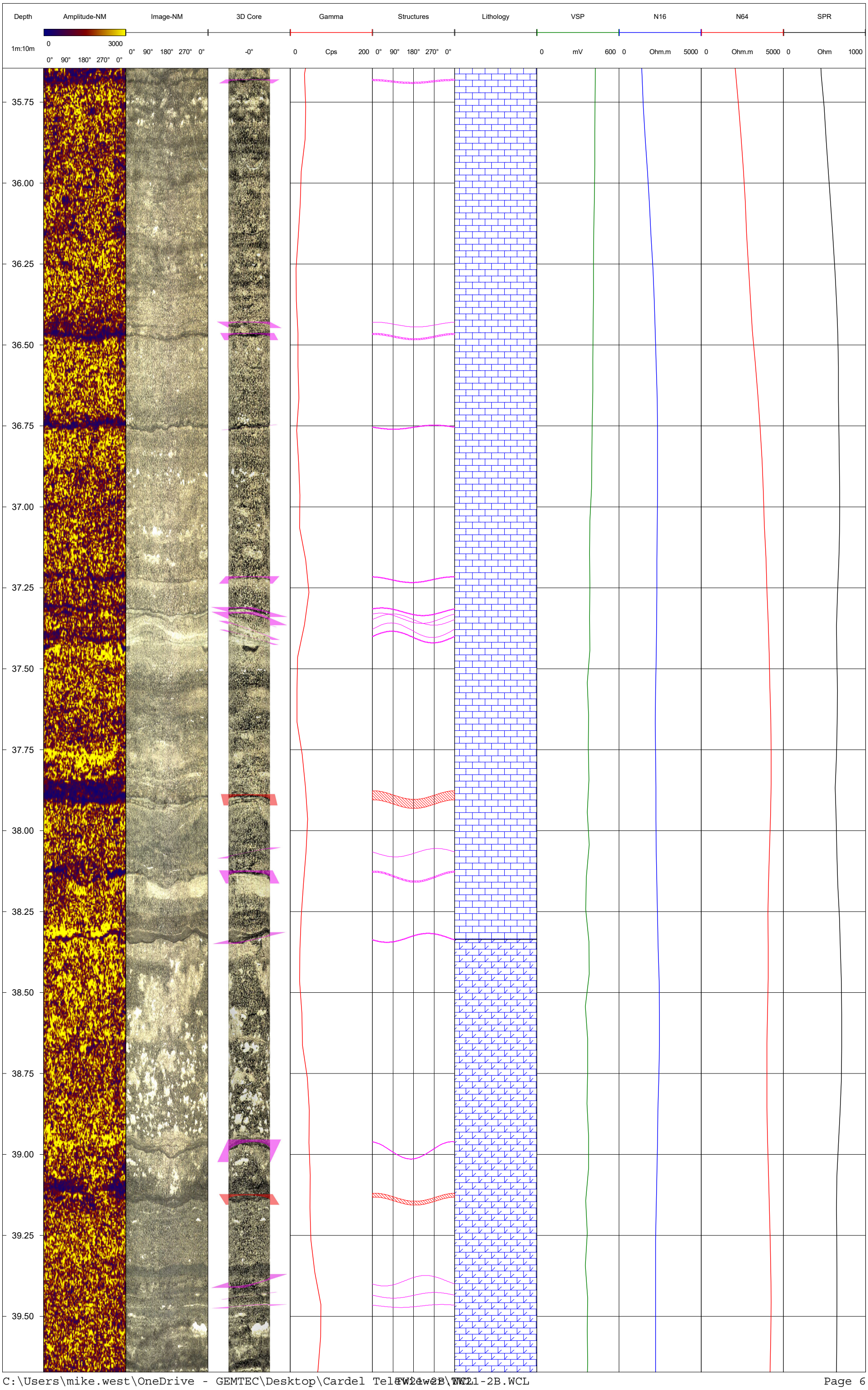
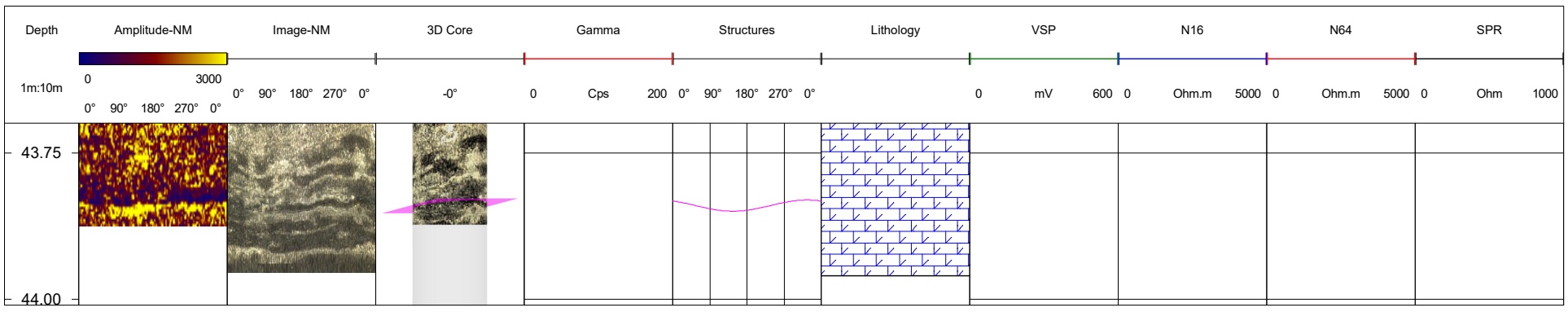
35.00
35.25
35.50


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
200
0° 90° 180° 270° 0°
0
mV
600
0
Ohm.m
5000
0
Ohm.m
5000
0
Ohm
1000
35.75
36.00
36.25
36.50
36.75
37.00
37.25
37.50
37.75
38.00
38.25
38.50
38.75
39.00
39.25
39.50

Depth	Amplitude-NM	Image-NM	3D Core	Gamma	Structures	Lithology	VSP	N16	N64	SPR
1m:10m	0 3000	0° 90° 180° 270° 0°	-0°	0 Cps 200	0° 90° 180° 270° 0°	0	mV 600	0 Ohm.m 5000	0 Ohm.m 5000	0 Ohm 1000
	0° 90° 180° 270° 0°									

39.75
40.00
40.25
40.50
40.75
41.00
41.25
41.50
41.75
42.00
42.25
42.50
42.75
43.00
43.25
43.50


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1m:10m
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
200
0° 90° 180° 270° 0°
0
mV
600
0
Ohm.m
5000
0
Ohm.m
5000
0
Ohm
1000
43.75
44.00

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Client	Cardel Homes	Logged By	Brett Webster	Drilled Depth	45.75 metres
Project #	61899.04	Reviewed by	Mike West	Elevation	
		Date Logged	February 2021	Angle	Vertical
		Hole Number	TW21-2C	Location	Creekside Development

Major Open Joint / Fracture

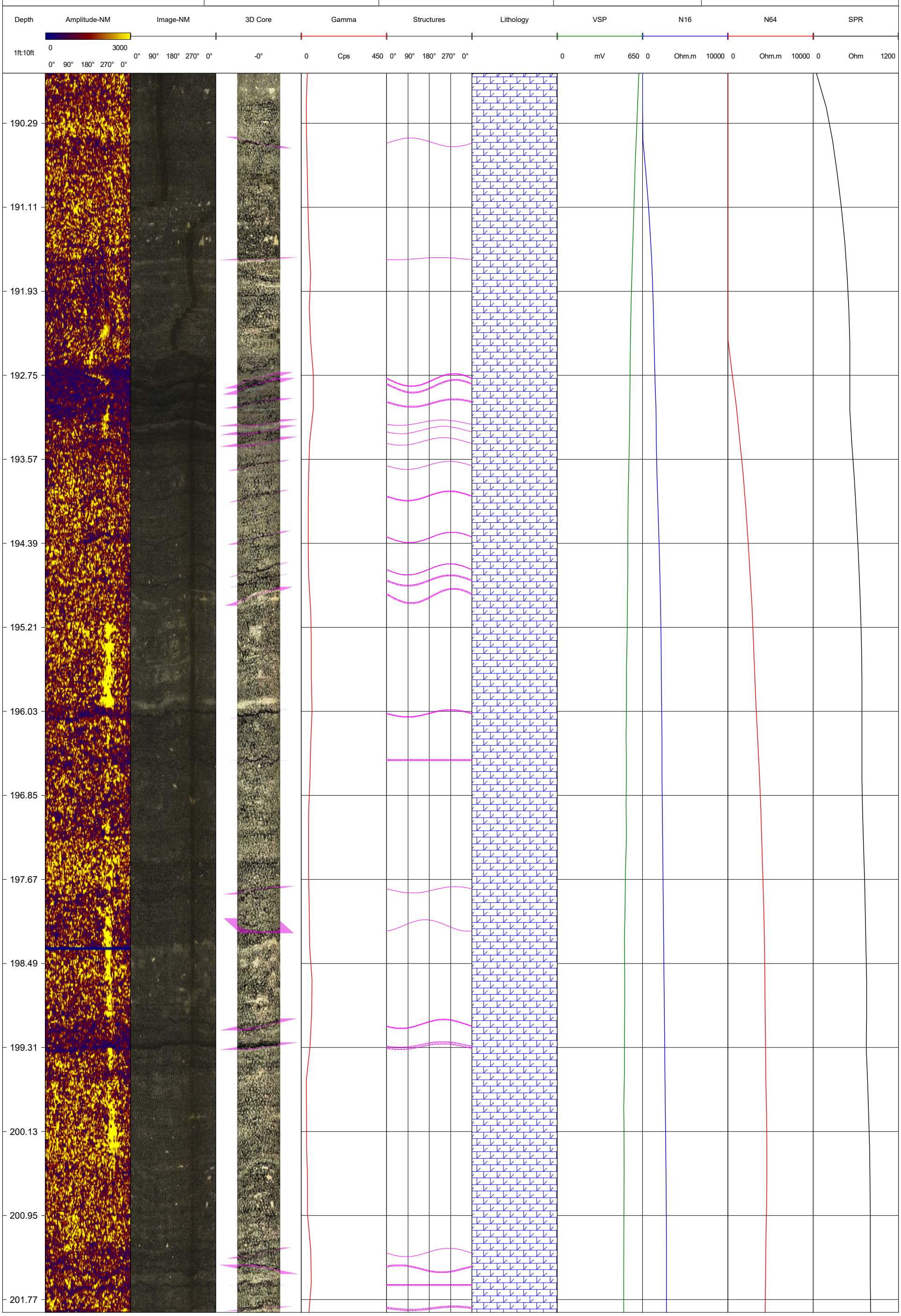
Minor Open Joint / Fracture

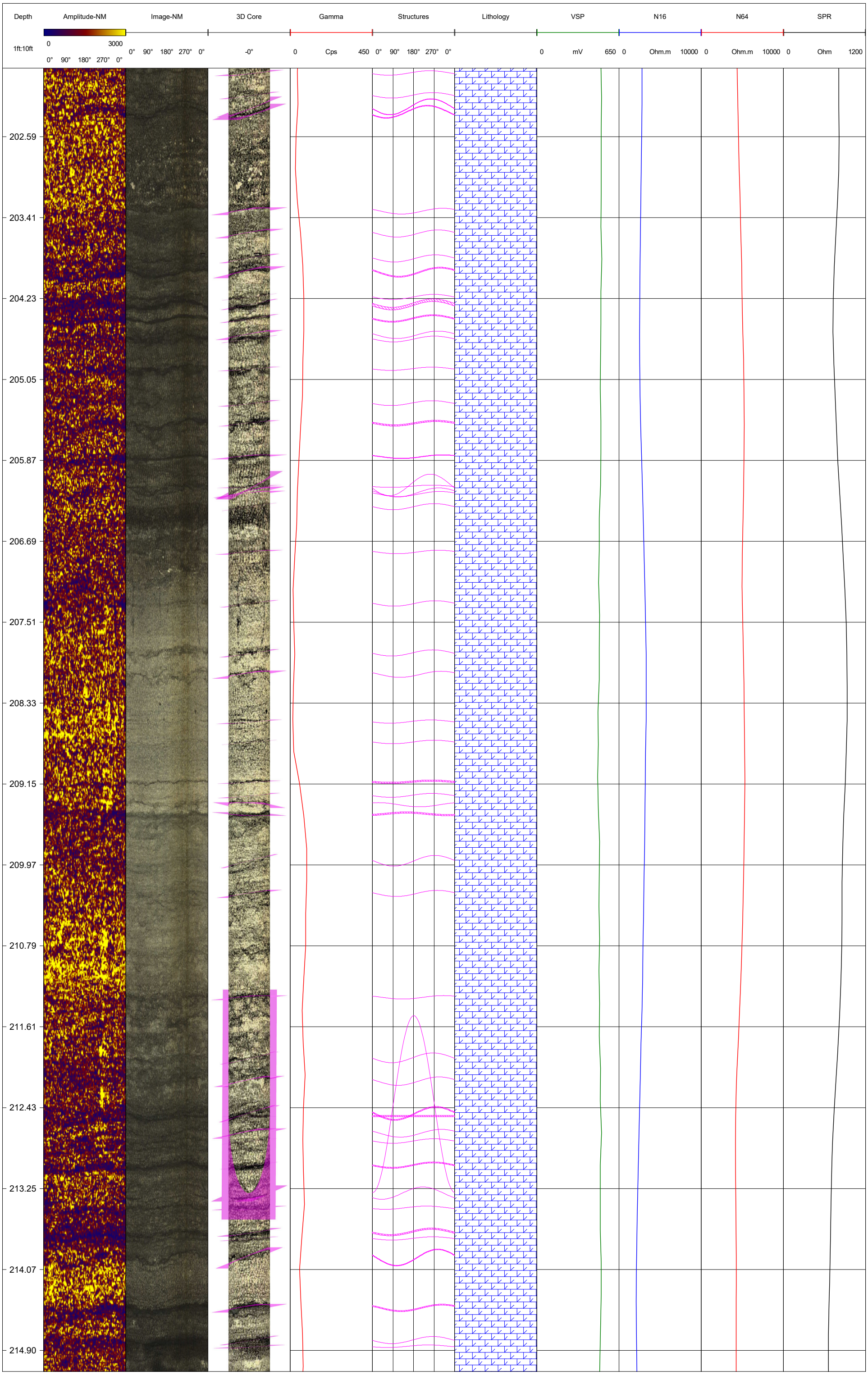
Argillaceous sandstone

Limestone

Limestone/shale

Limestone - dolomitic (10-50% Dolomite)




Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
202.59
203.41
204.23
205.05
205.87
206.69
207.51
208.33
209.15
209.97
210.79
211.61
212.43
213.25
214.07
214.90

Depth | Amplitude-NM | Image-NM | 3D Core | Gamma | Structures | Lithology | VSP | N16 | N64 | SPR

1ft:10ft

Amplitude-NM: 0 3000 | 0° 90° 180° 270° 0° | 0° 90° 180° 270° 0°

Image-NM: 0° 90° 180° 270° 0°

3D Core: -0°

Gamma: 0 Cps 450

Structures: 0° 90° 180° 270° 0°

Lithology: 0

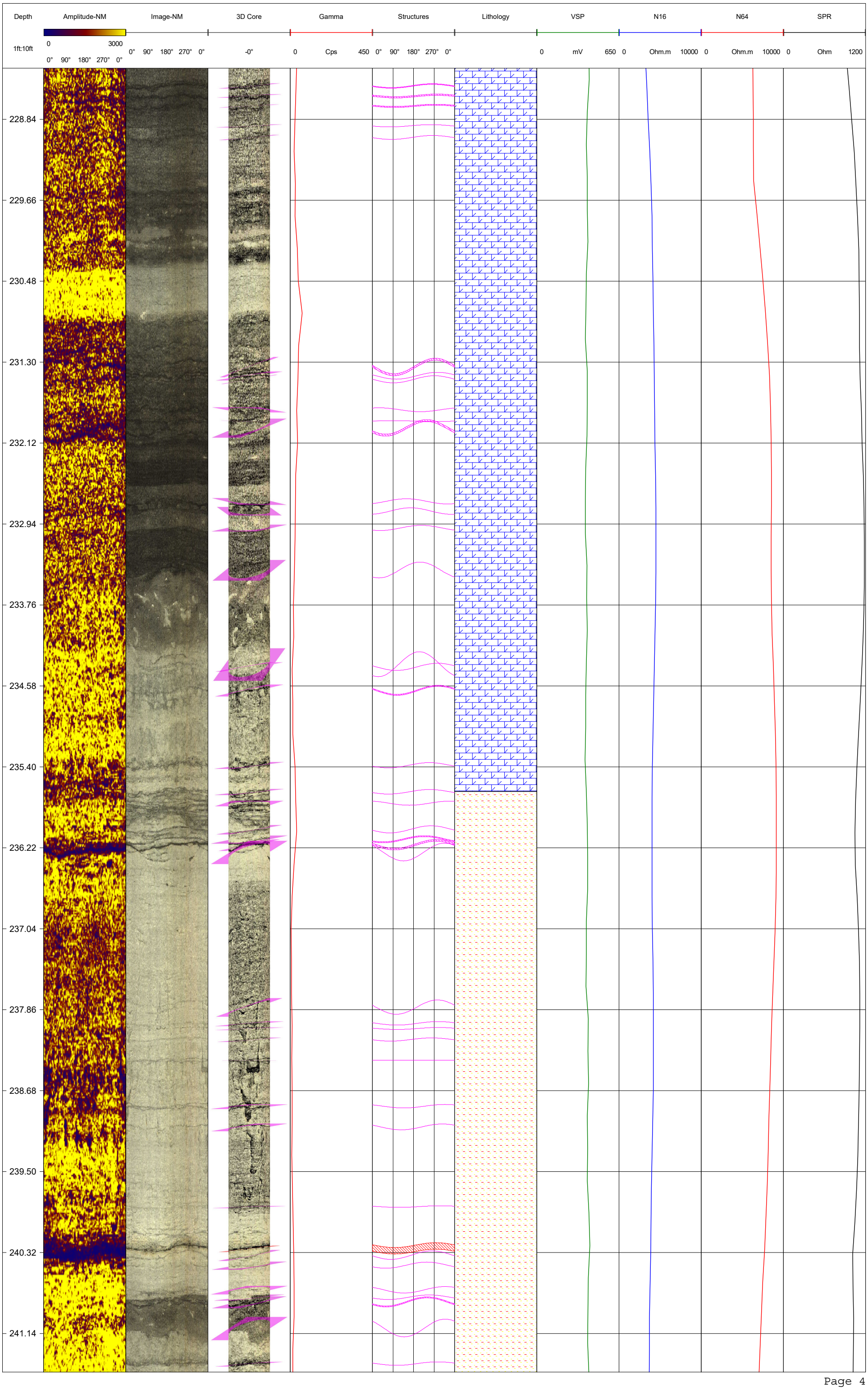
VSP: mV 650

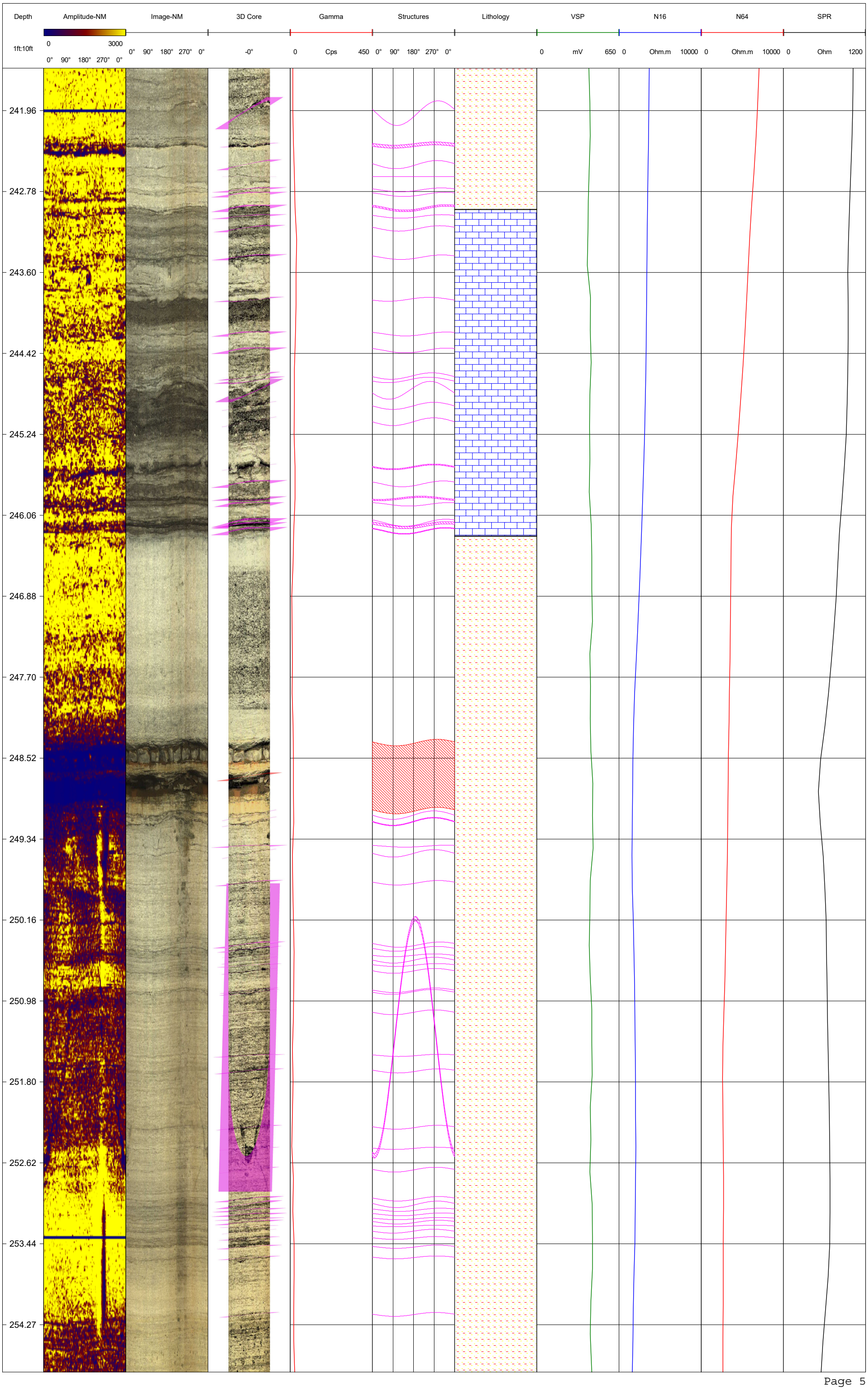
N16: 0 Ohm.m 10000

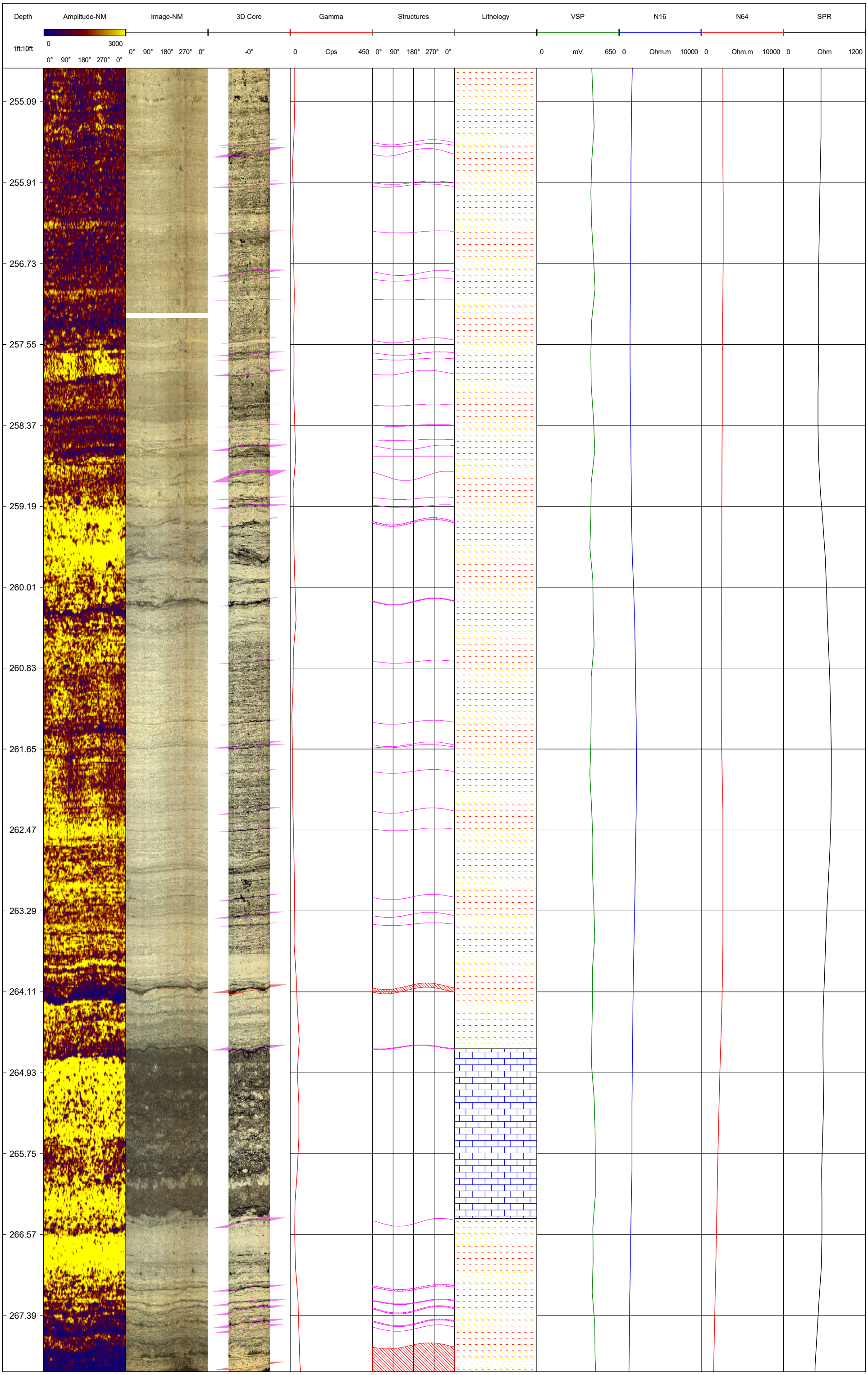
N64: 0 Ohm.m 10000

SPR: 0 Ohm 1200

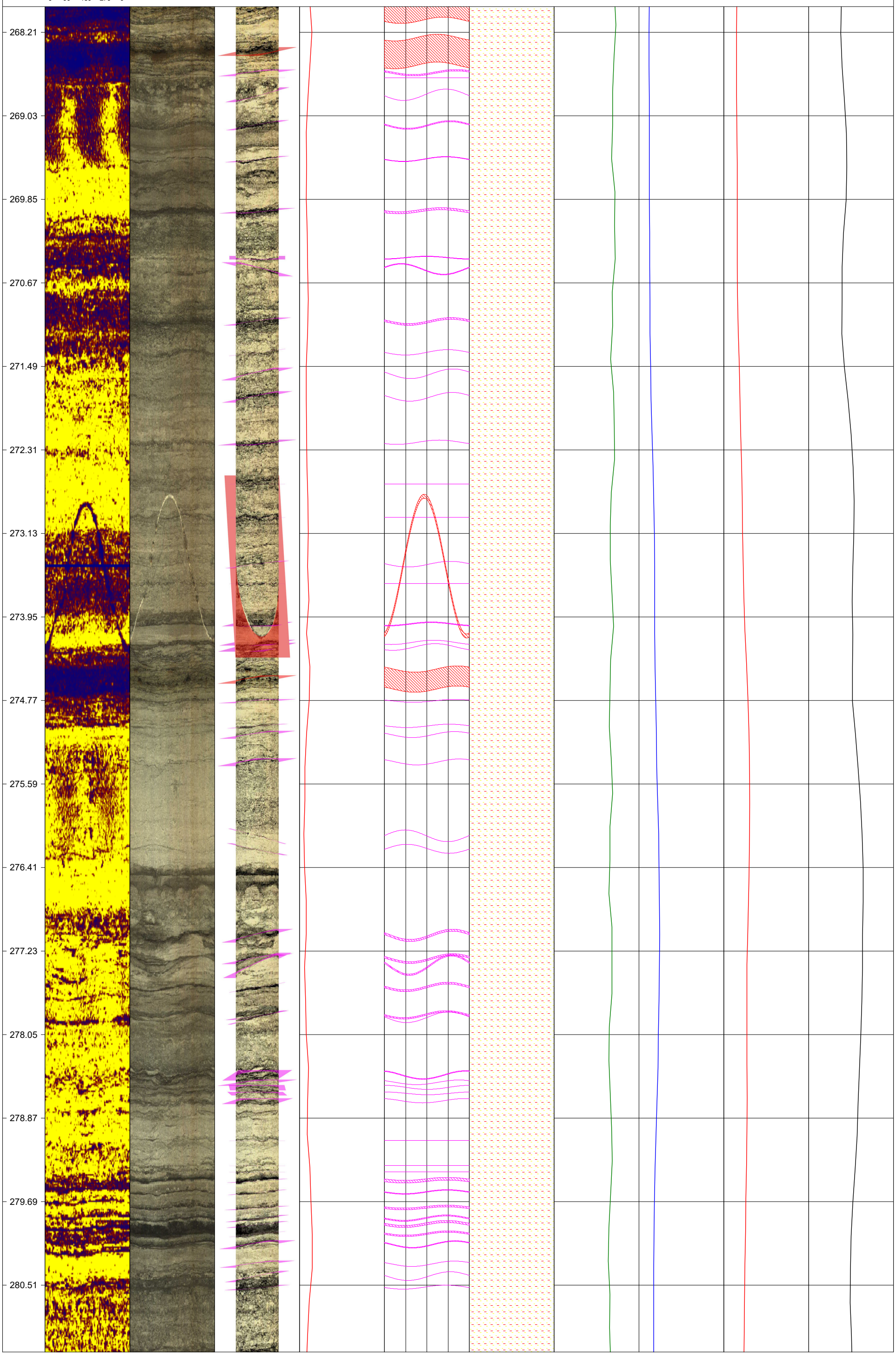
215.72
216.54
217.36
218.18
219.00
219.82
220.64
221.46
222.28
223.10
223.92
224.74
225.56
226.38
227.20
228.02

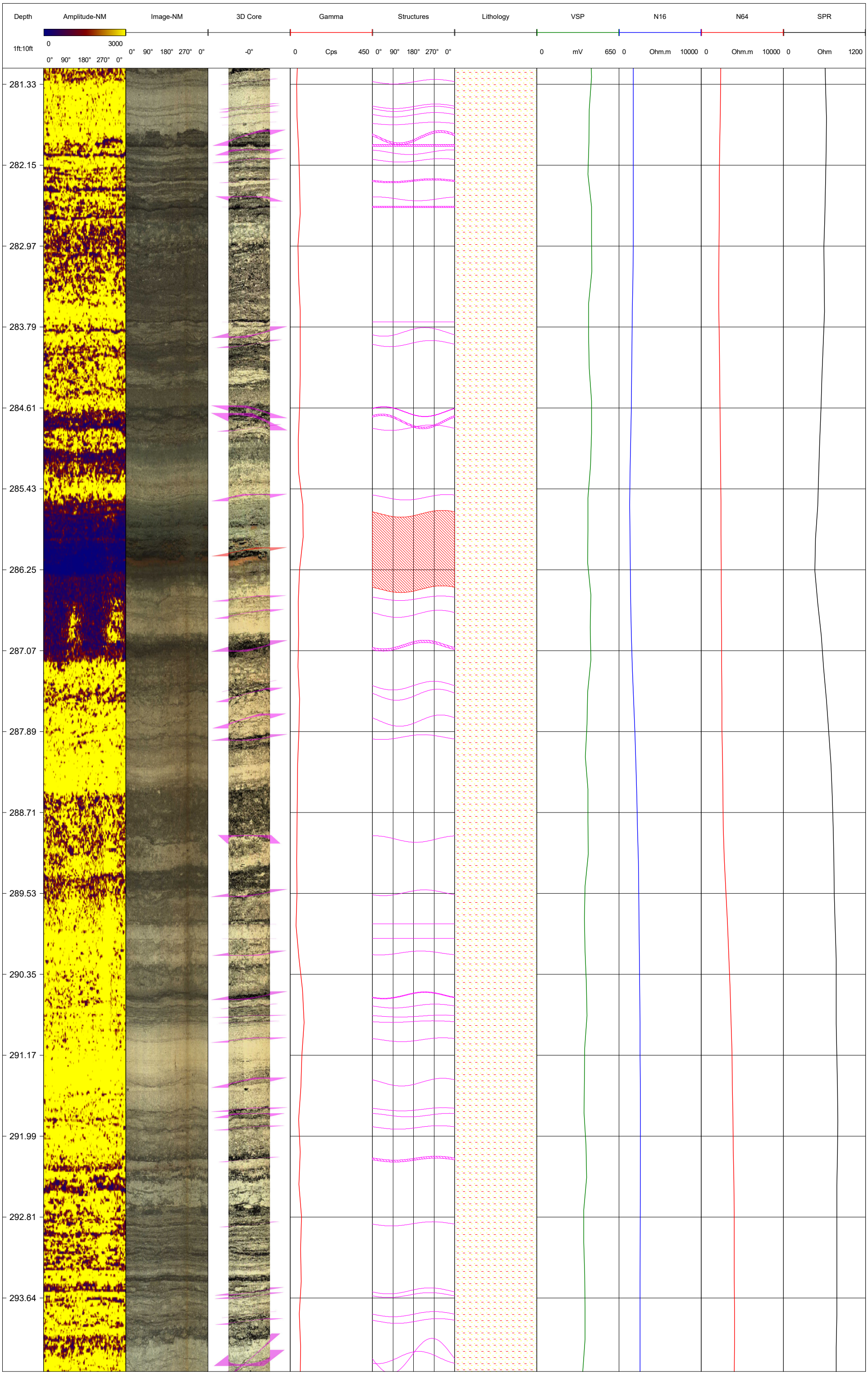

Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
228.84
229.66
230.48
231.30
232.12
232.94
233.76
234.58
235.40
236.22
237.04
237.86
238.68
239.50
240.32
241.14

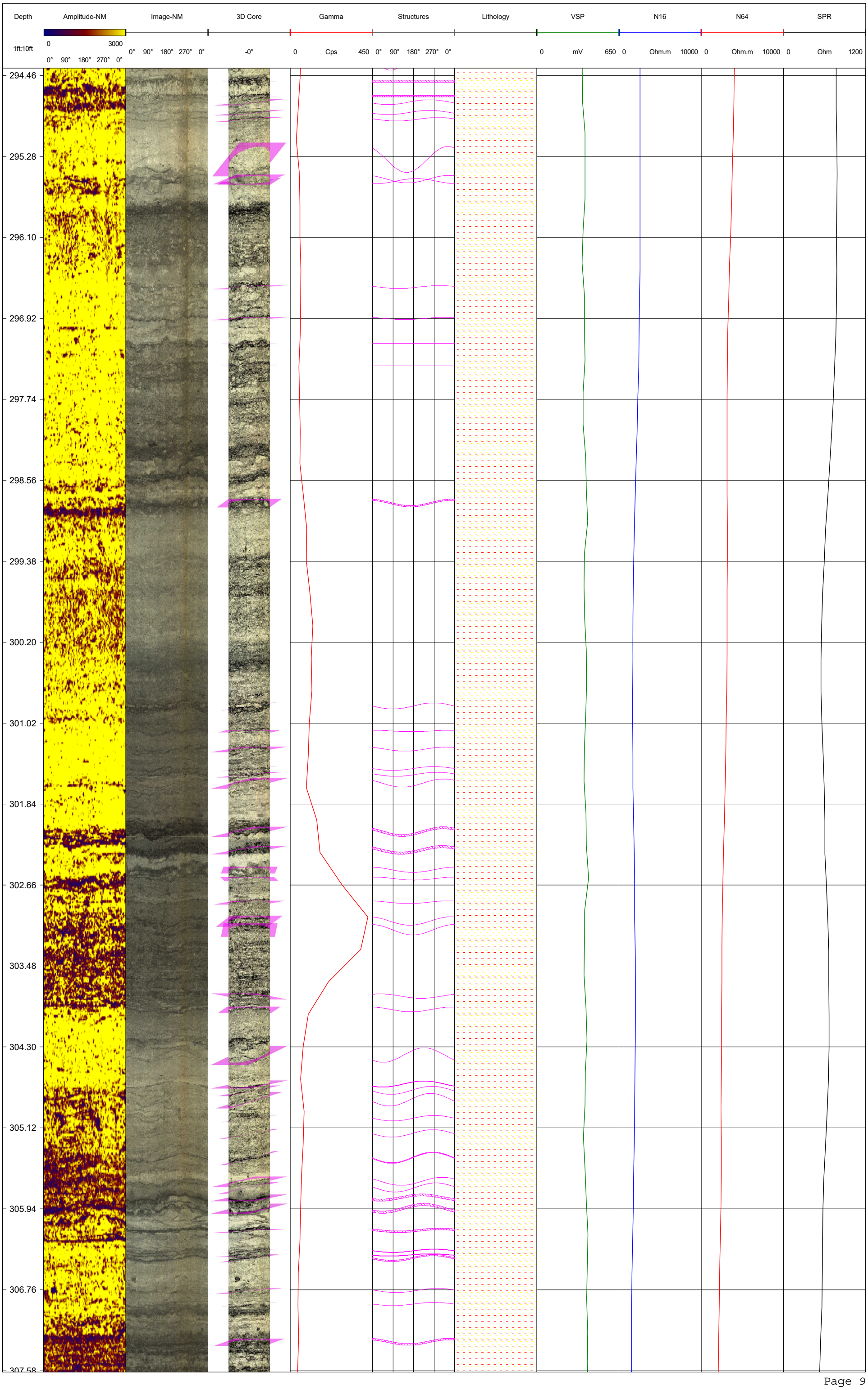

Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
241.96
242.78
243.60
244.42
245.24
246.06
246.88
247.70
248.52
249.34
250.16
250.98
251.80
252.62
253.44
254.27

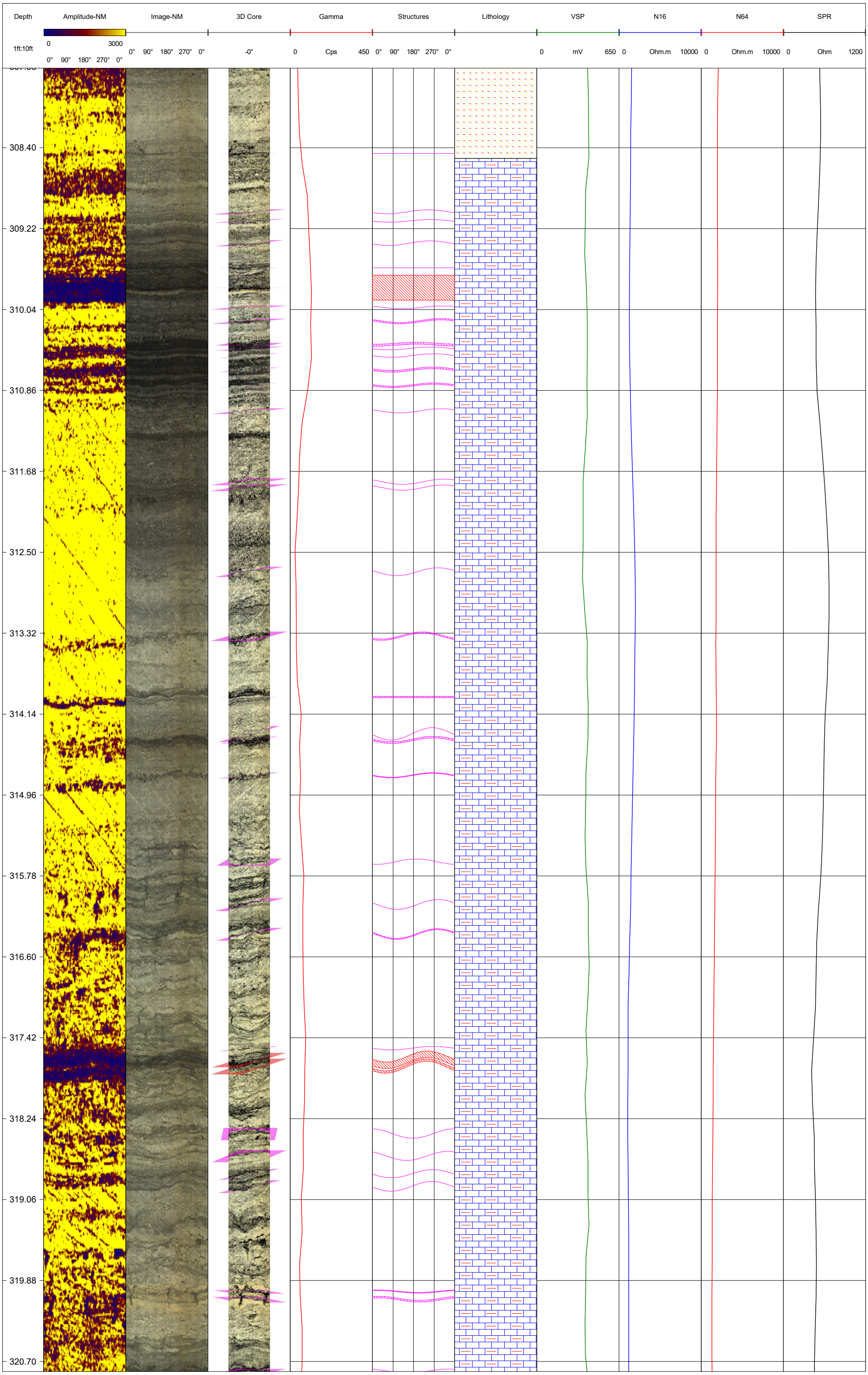

Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
255.09
255.91
256.73
257.55
258.37
259.19
260.01
260.83
261.65
262.47
263.29
264.11
264.93
265.75
266.57
267.39

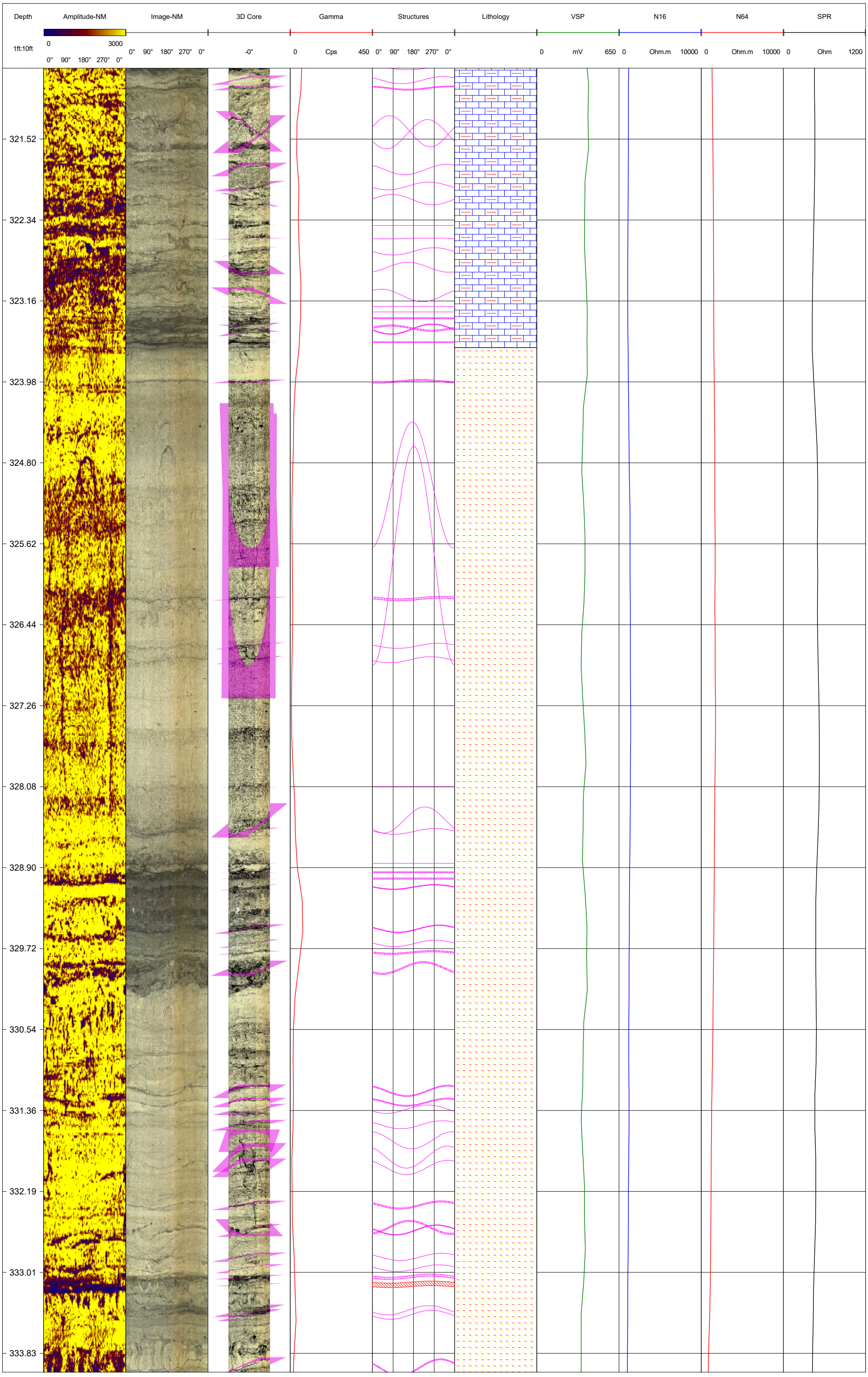
Depth	Amplitude-NM	Image-NM	3D Core	Gamma	Structures	Lithology	VSP	N16	N64	SPR
1ft:10ft	0 3000	0° 90° 180° 270° 0°	-0°	0 Cps 450	0° 90° 180° 270° 0°		0 mV 650	0 Ohm.m 10000	0 Ohm.m 10000	0 Ohm 1200




Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
281.33
282.15
282.97
283.79
284.61
285.43
286.25
287.07
287.89
288.71
289.53
290.35
291.17
291.99
292.81
293.64


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
294.46
295.28
296.10
296.92
297.74
298.56
299.38
300.20
301.02
301.84
302.66
303.48
304.30
305.12
305.94
306.76
307.58


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
308.40
309.22
310.04
310.86
311.68
312.50
313.32
314.14
314.96
315.78
316.60
317.42
318.24
319.06
319.88
320.70


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
321.52
322.34
323.16
323.98
324.80
325.62
326.44
327.26
328.08
328.90
329.72
330.54
331.36
332.19
333.01
333.83

Depth | Amplitude-NM | Image-NM | 3D Core | Gamma | Structures | Lithology | VSP | N16 | N64 | SPR

1ft:10ft

Amplitude-NM: 0 3000 0° 90° 180° 270° 0°

Image-NM: 0° 90° 180° 270° 0°

3D Core: -0°

Gamma: 0 Cps 450

Structures: 0° 90° 180° 270° 0°

Lithology

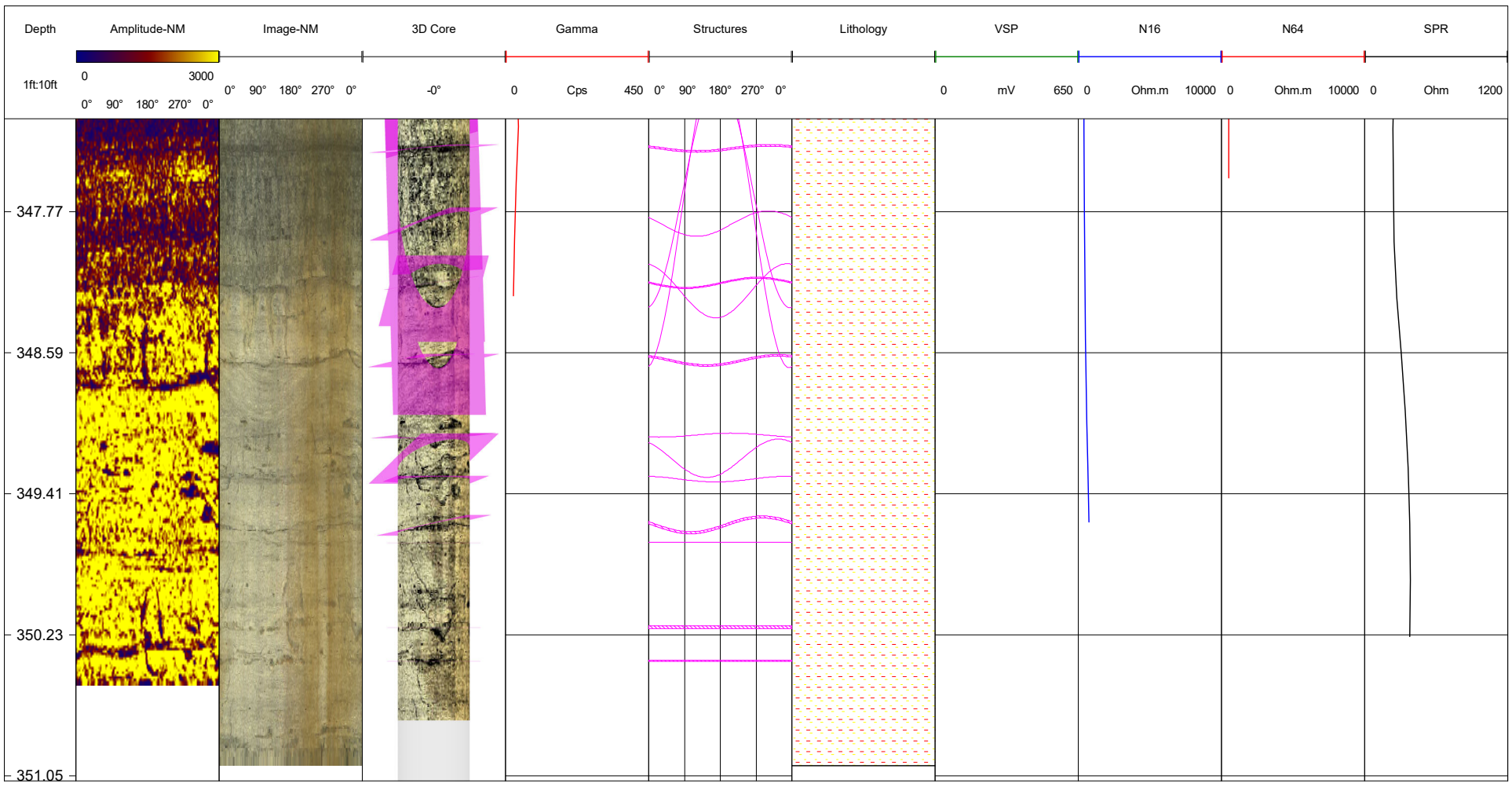
VSP: 0 mV 650

N16: 0 Ohm.m 10000

N64: 0 Ohm.m 10000

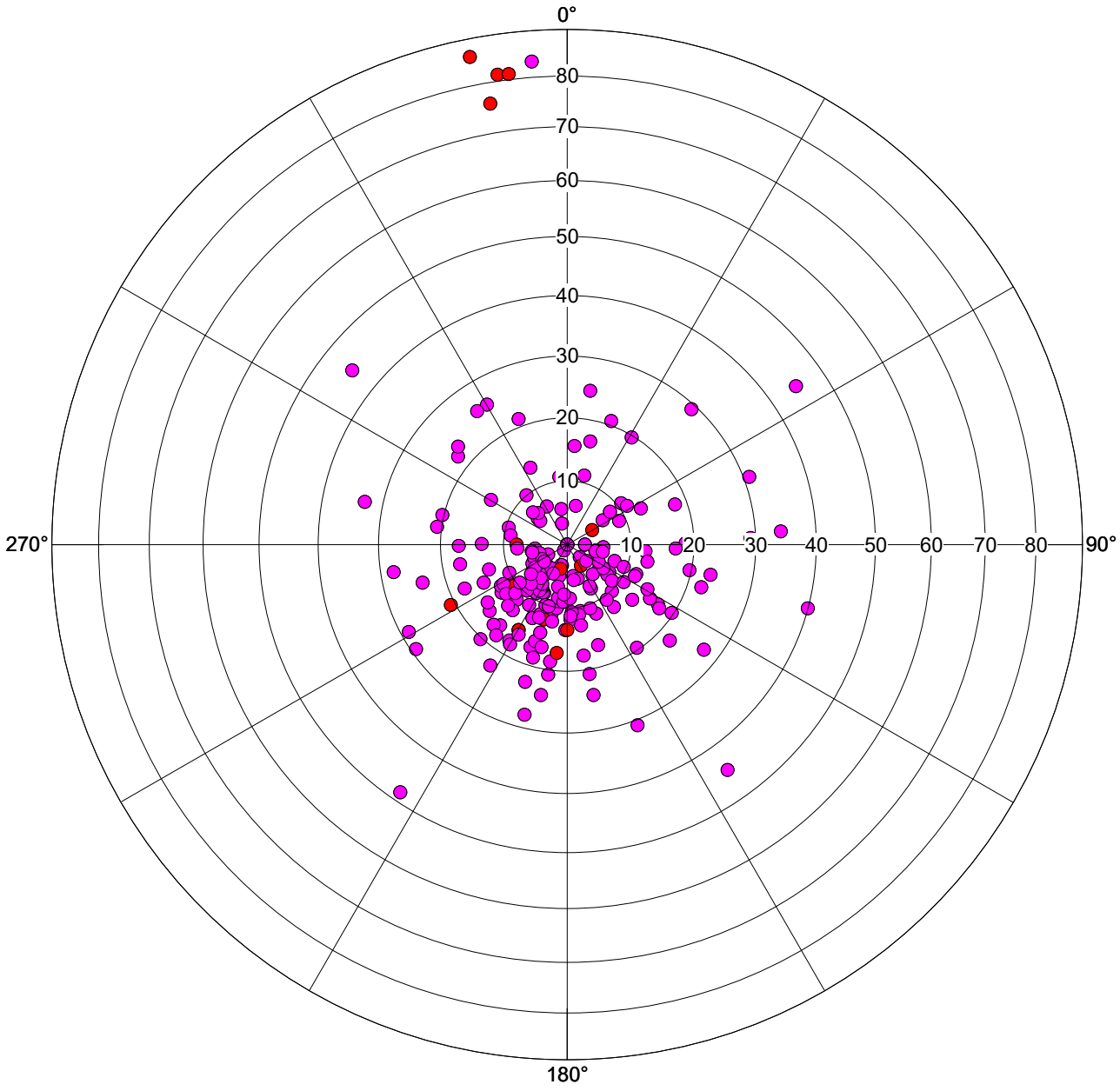
SPR: 0 Ohm 1200

334.65
335.47
336.29
337.11
337.93
338.75
339.57
340.39
341.21
342.03
342.85
343.67
344.49
345.31
346.13
346.95


Depth
Amplitude-NM
Image-NM
3D Core
Gamma
Structures
Lithology
VSP
N16
N64
SPR
1ft:10ft
0
3000
0° 90° 180° 270° 0°
0° 90° 180° 270° 0°
-0°
0
Cps
450
0° 90° 180° 270° 0°
0
mV
650
0
Ohm.m
10000
0
Ohm.m
10000
0
Ohm
1200
347.77
348.59
349.41
350.23
351.05

Attribute : Type
Symbol Code - Description
1 - Major Open Joint / Fracture
2 - Minor Open Joint / Fracture

TW21-1B



Schmidt Plot (Dip) - LH - Type
Plot: Structures
Depth: from -16.72 to -44.16 [m]

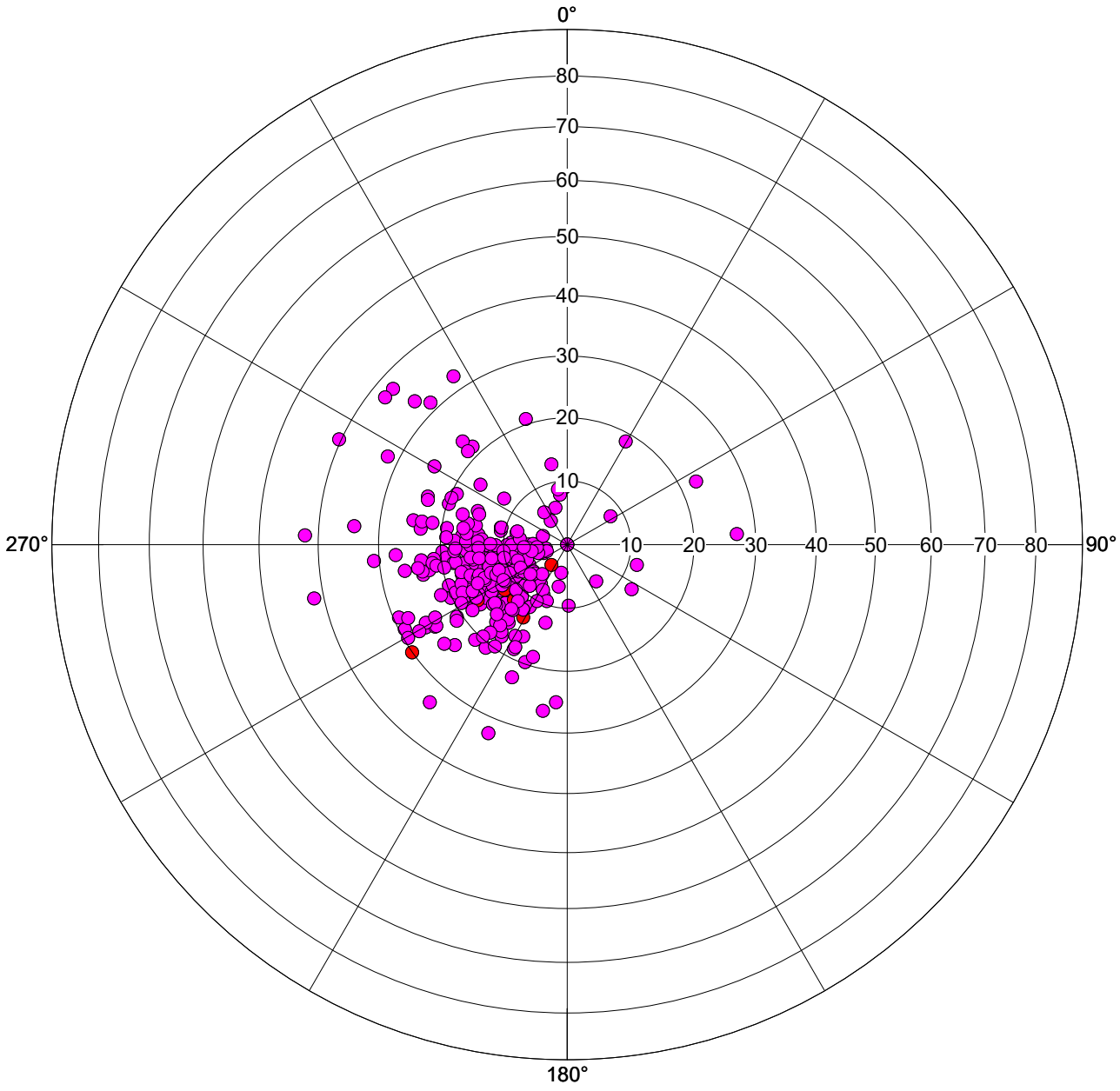
Plot: Structures

Symbol	Name	Nb Points	Azi Mean	Dip Mean	Azi Min	Dip Min	Azi Max	Dip Max
	All	217.00	12.47	4.85	0.00	0.00	358.58	86.17

Attribute : Type

Symbol	Code - Description
●	1 - Major Open Joint / Fracture
●	2 - Minor Open Joint / Fracture

TW21-1C



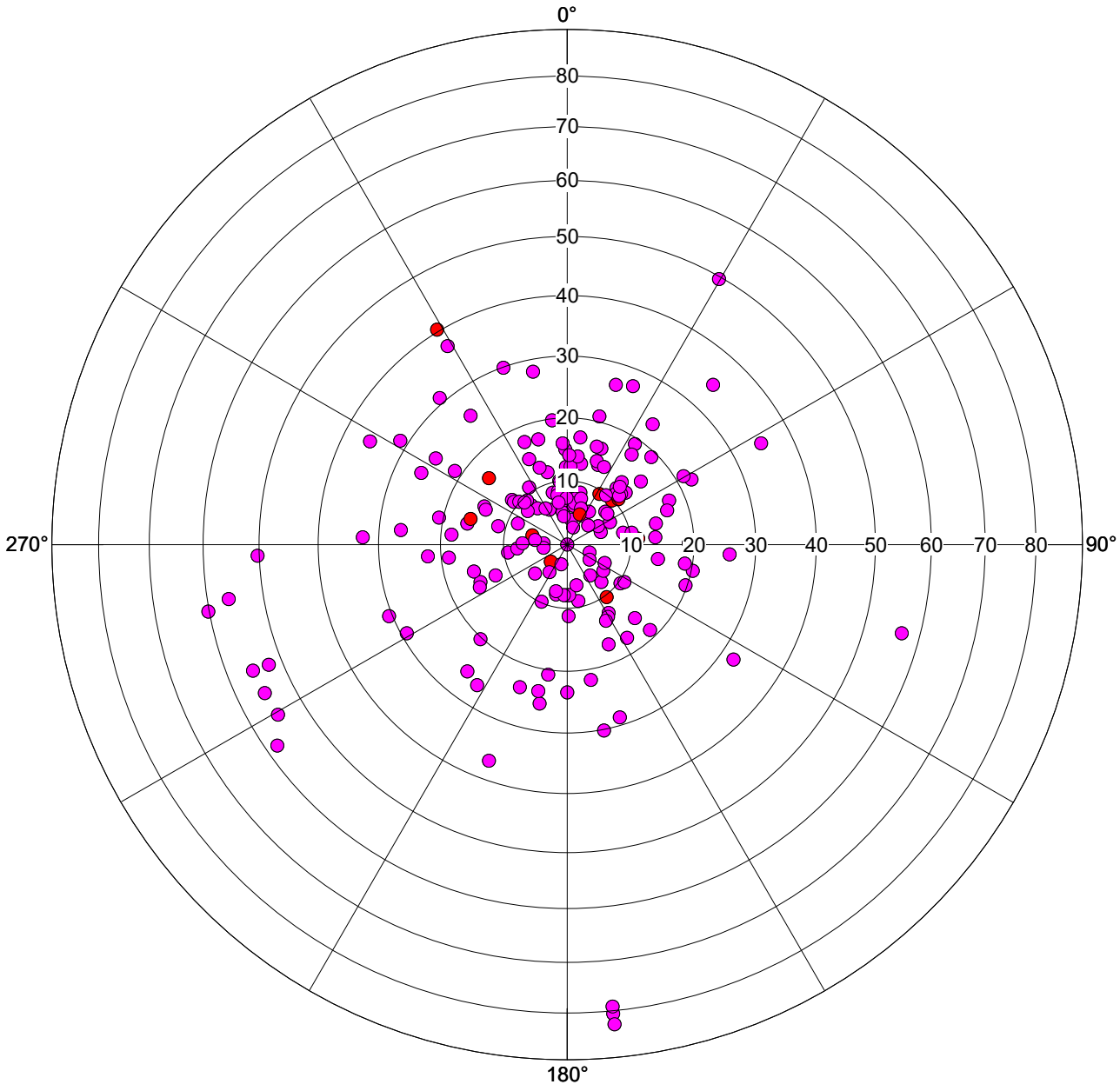
Schmidt Plot (Dip) - LH - Type
Plot: Structures
Depth: from -57.68 to -119.22 [m]

Plot: Structures

Symbol	Name	Nb Points	Azi Mean	Dip Mean	Azi Min	Dip Min	Azi Max	Dip Max
	All	326.00	73.13	12.58	0.00	0.00	358.58	42.30

Attribute : Type
Symbol Code - Description
1 - Major Open Joint / Fracture
2 - Minor Open Joint / Fracture

TW21-2B



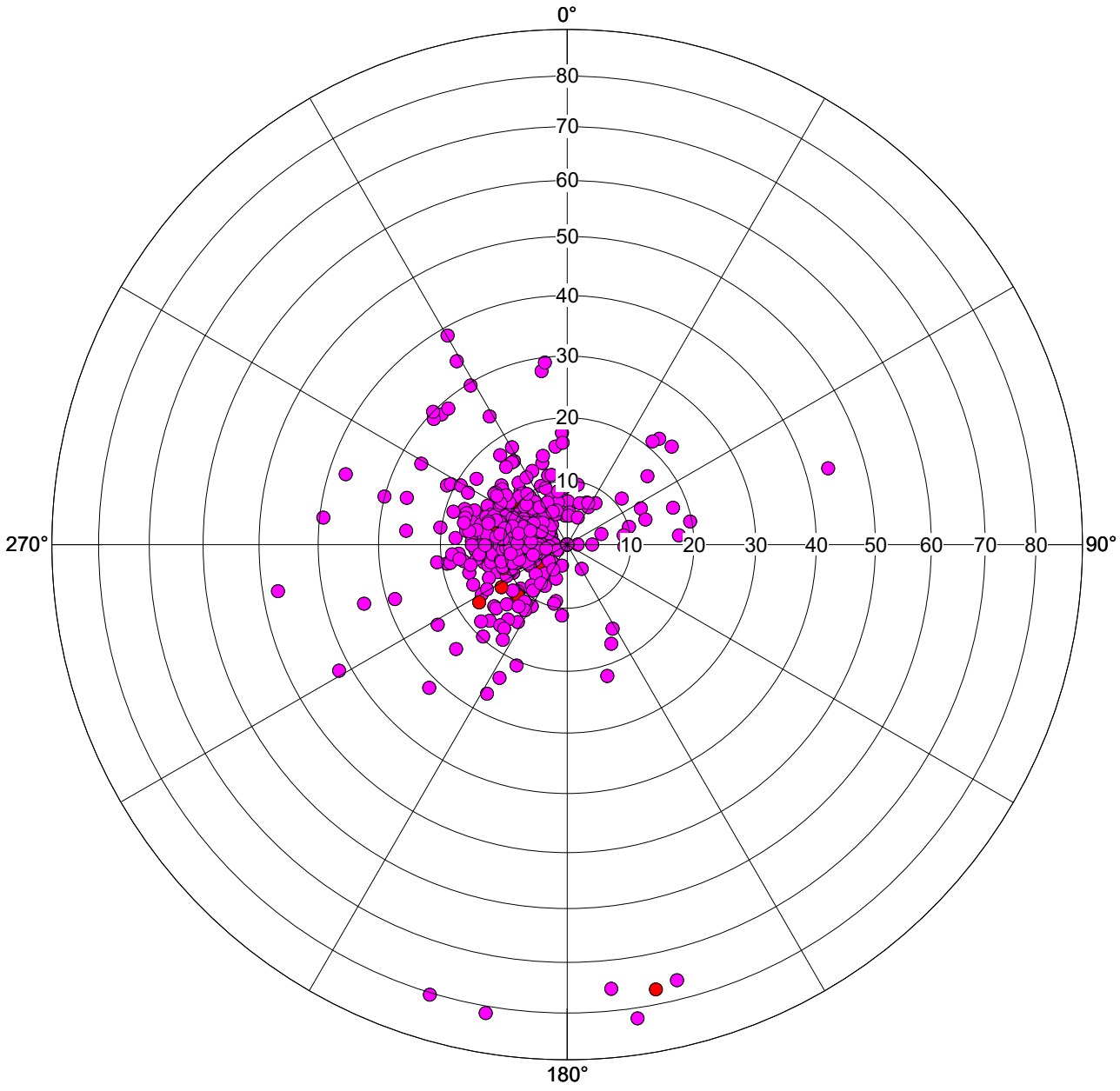
Schmidt Plot (Dip) - LH - Type
Plot: Structures
Depth: from -15.47 to -43.18 [m]

Plot: Structures

Symbol	Name	Nb Points	Azi Mean	Dip Mean	Azi Min	Dip Min	Azi Max	Dip Max
	All	196.00	159.71	3.21	0.00	0.00	358.58	82.95

Attribute : Type
Symbol Code - Description
1 - Major Open Joint / Fracture
2 - Minor Open Joint / Fracture

TW21-2C



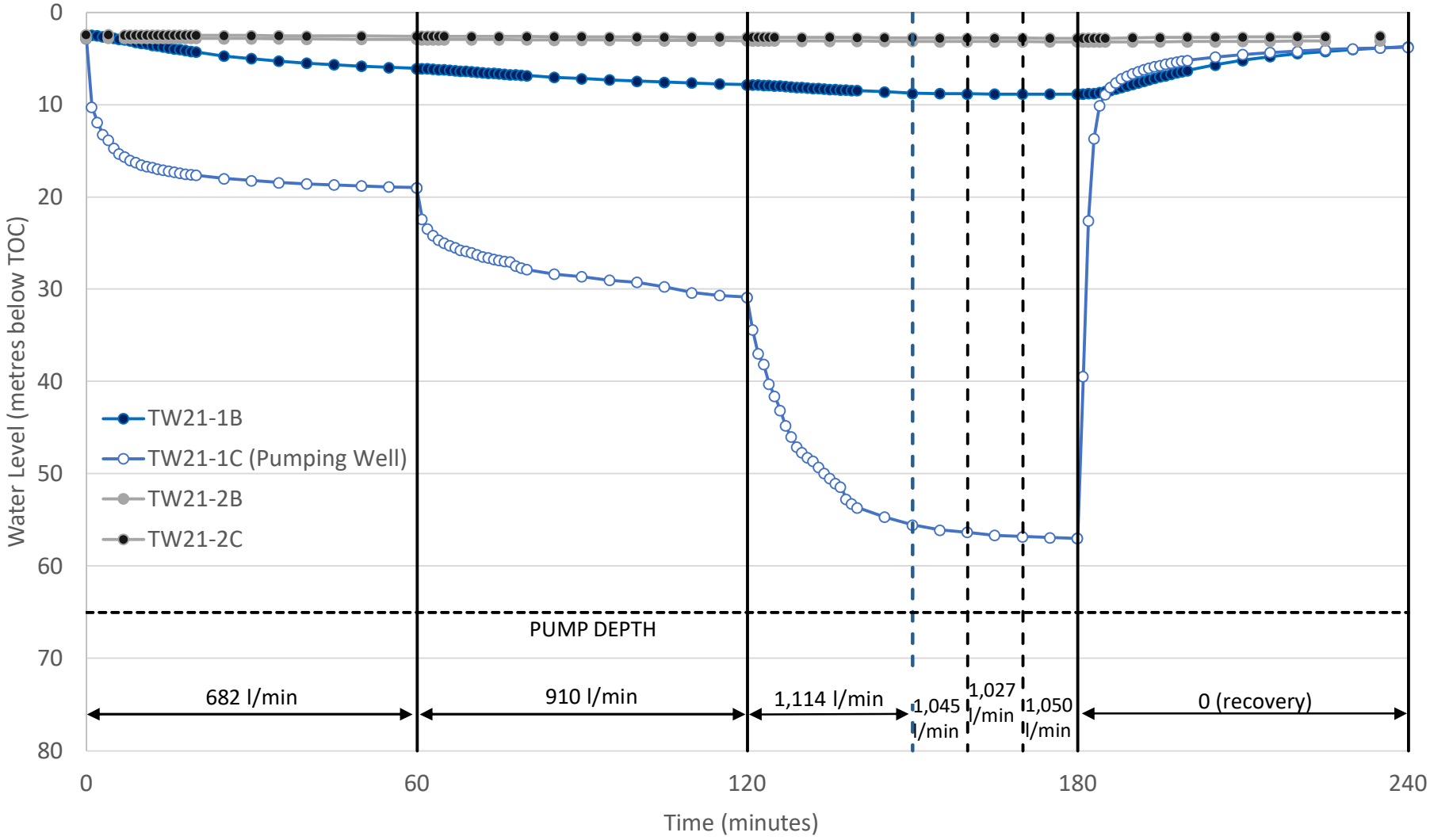
Schmidt Plot (Dip) - LH - Type
Plot: Structures
Depth: from -58.00 to -256.00 [m]

Plot: Structures

Symbol	Name	Nb Points	Azi Mean	Dip Mean	Azi Min	Dip Min	Azi Max	Dip Max
	All	456.00	99.70	7.56	0.00	0.00	354.33	82.31

APPENDIX E

TW21-1C Pumping Test Data

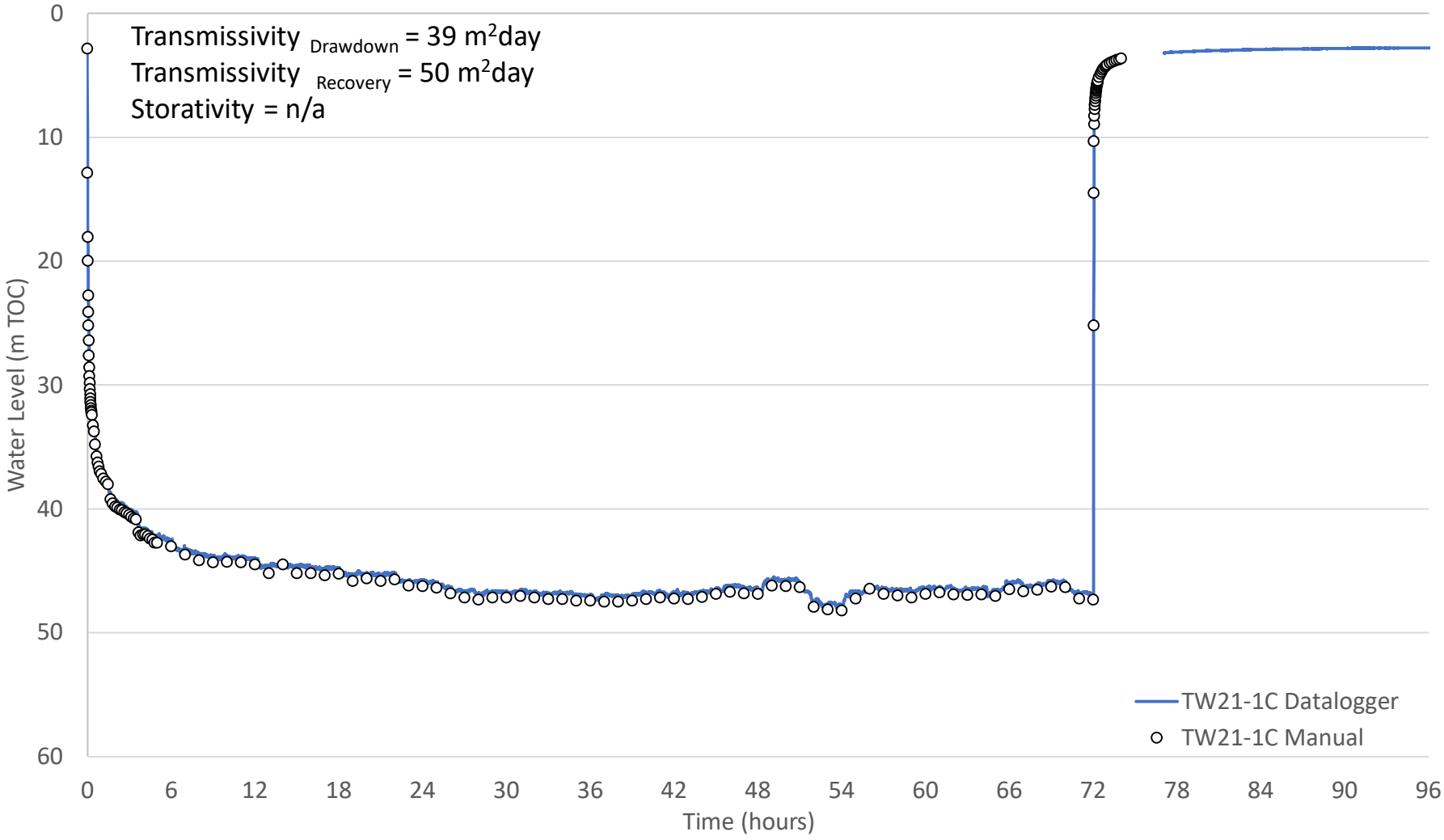


Date: March 12, 2021

TW21-1C (Pumping Well) Step Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03



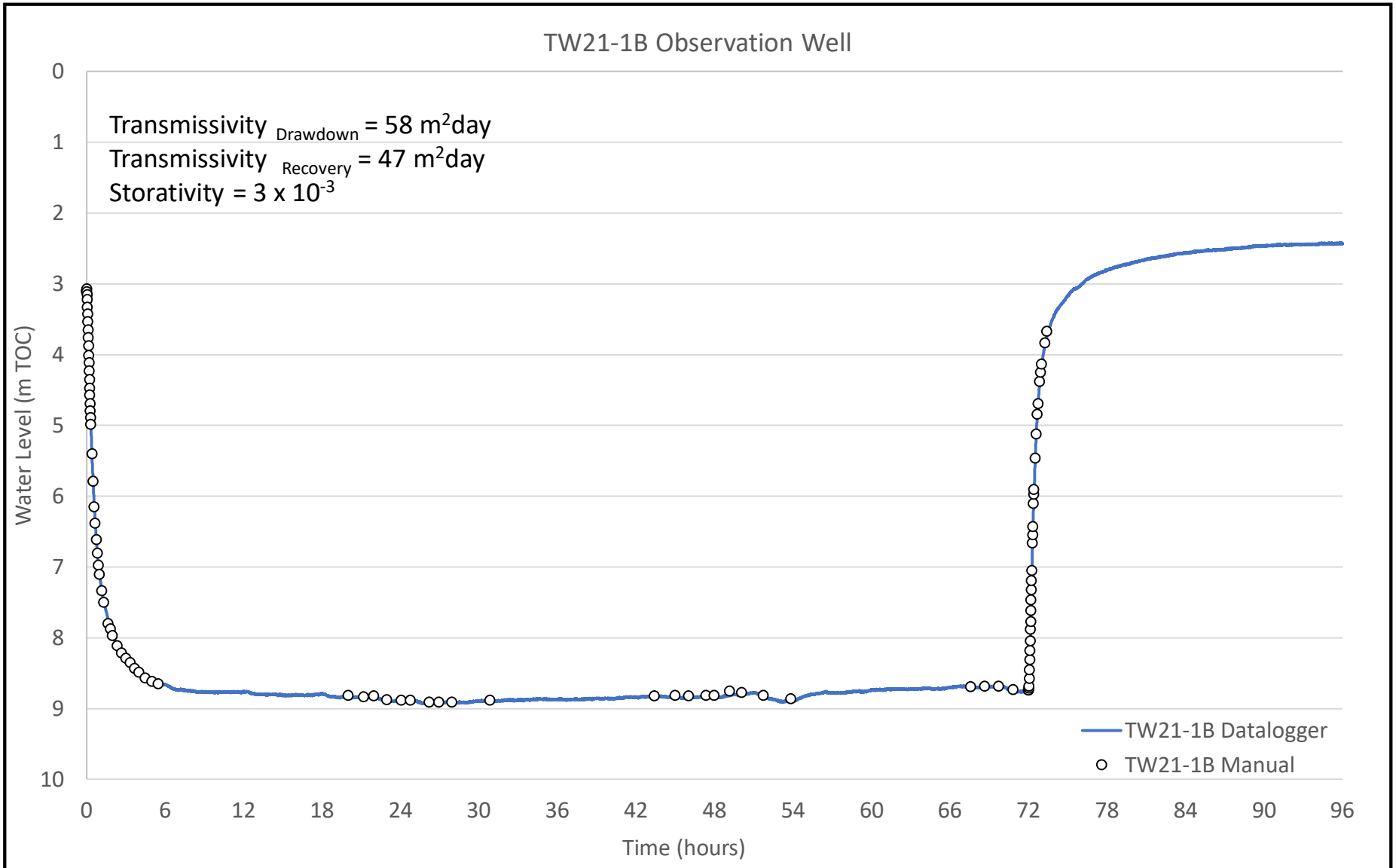
Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Water Level (static): 2.84 m TOC
Water Level (end of test): 46.91 m TOC
Water Level (2-hour recovery): 3.35 m TOC
Water Level (24-hour recovery): 2.80 m TOC

TW21-1C (Pumping Well) 72-Hour Pumping Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03



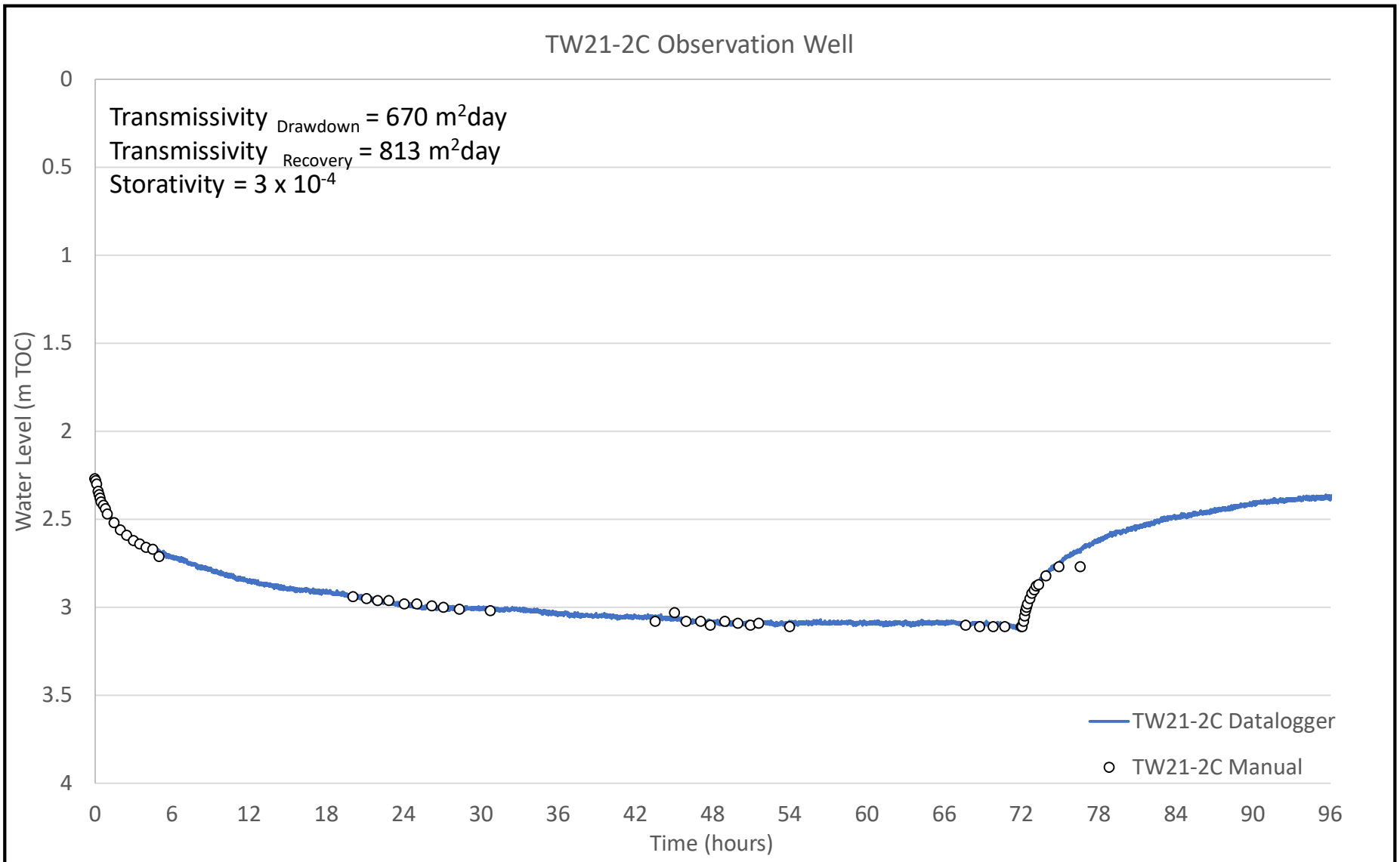
Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Water Level (static): 3.10 m TOC
Water Level (end of test): 8.77 m TOC
Water Level (2-hour recovery): 3.43 m TOC
Water Level (24-hour recovery): 2.43 m TOC

TW21-1B (Observation Well)
72-Hour Pumping Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03



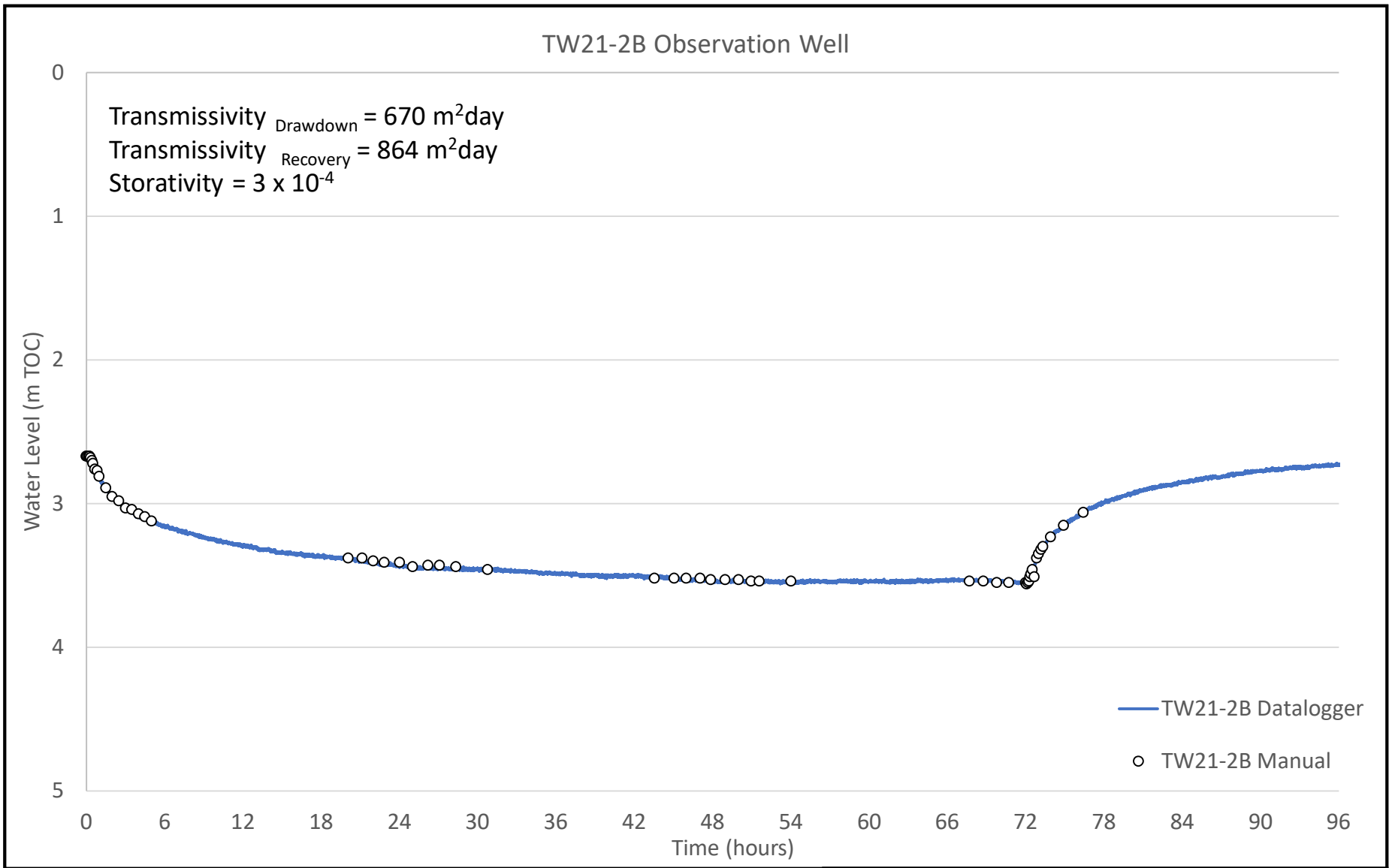
Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Water Level (static): 2.27 m TOC
Water Level (end of test): 3.12 m TOC
Water Level (2-hour recovery): 2.80 m TOC
Water Level (24-hour recovery): 2.38 m TOC

TW21-2C (Observation Well)
72-Hour Pumping Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03



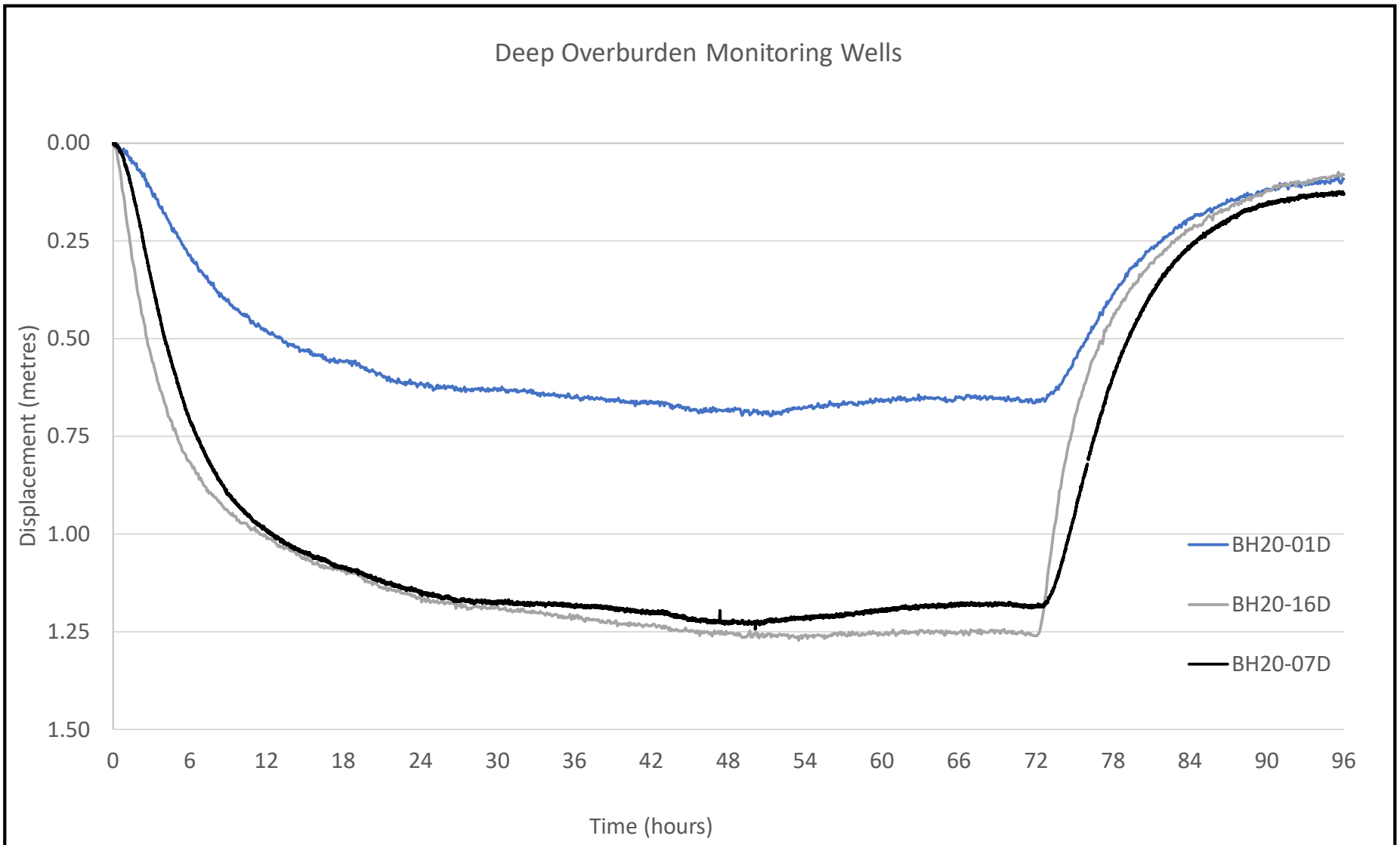
Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Water Level (static): 2.67 m TOC
Water Level (end of test): 3.55 m TOC
Water Level (2-hour recovery): 3.24 m TOC
Water Level (24-hour recovery): 2.73 m TOC

TW21-2B (Observation Well)
72-Hour Pumping Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03

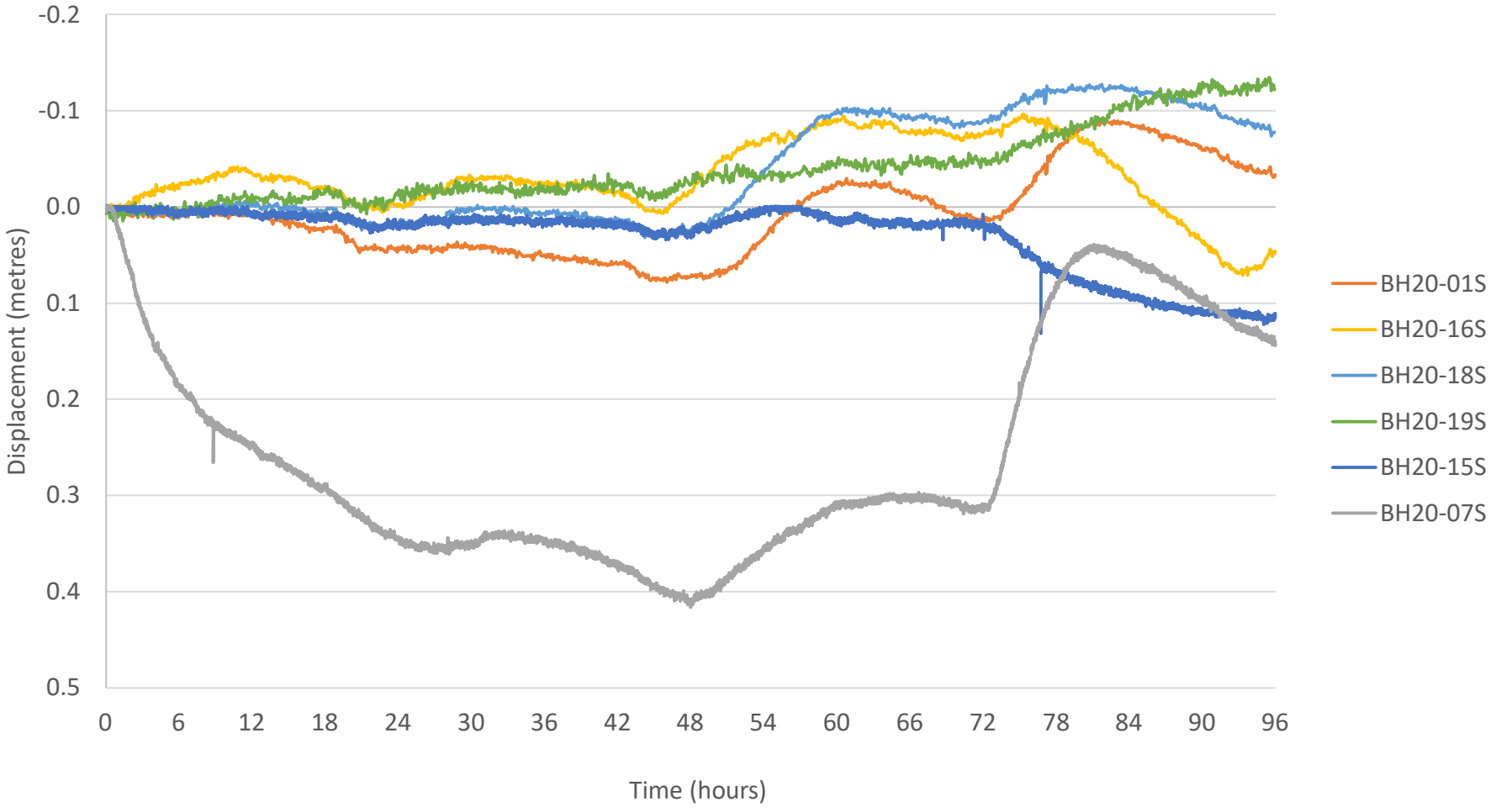


Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Deep Overburden Monitoring Wells
72-Hour Pumping Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03

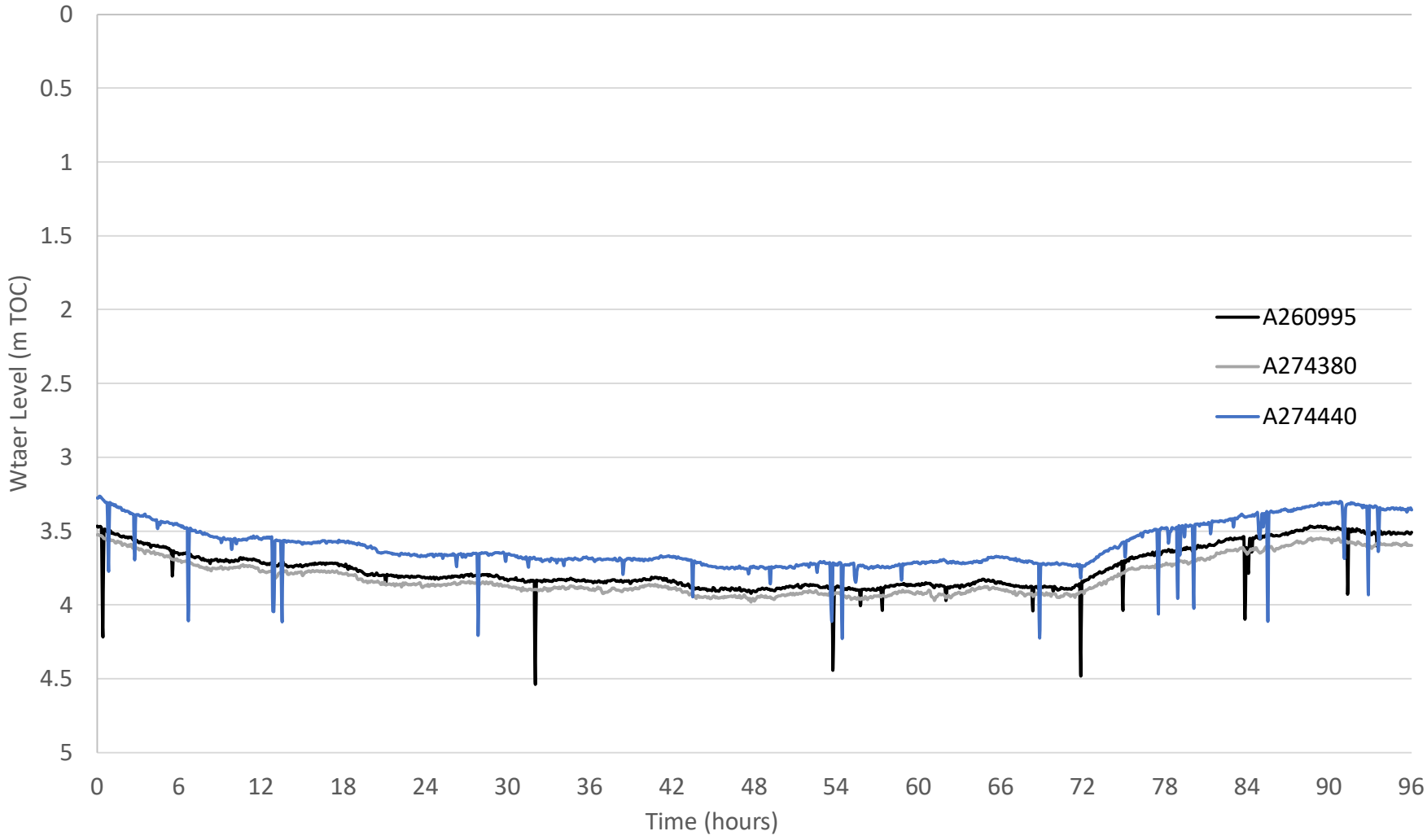


Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Shallow Overburden Monitoring Wells
72-Hour Pumping Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03

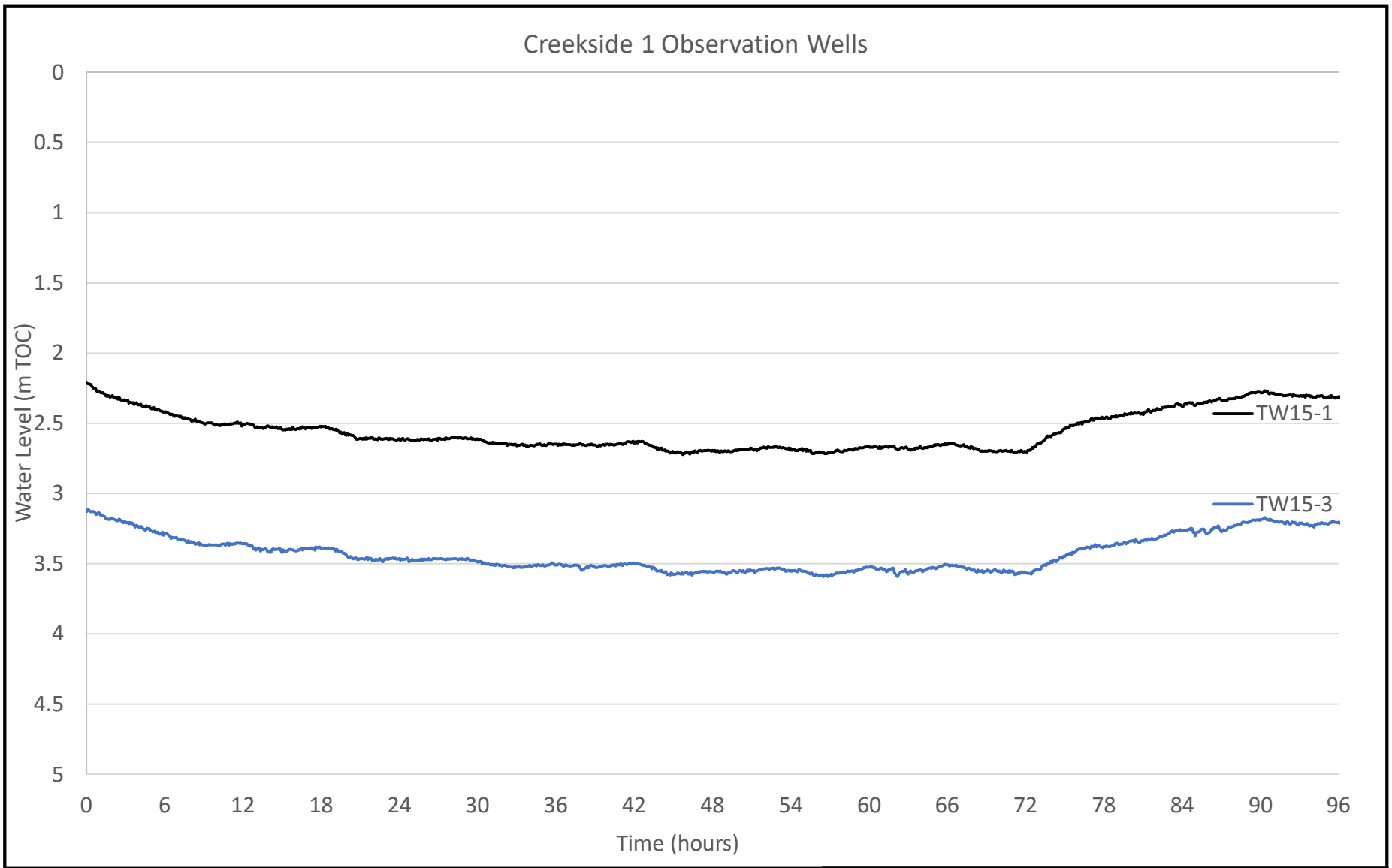


Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Off-Site Bedrock Observation Wells (Domestic)
72-Hour Pumping Test

GEMTEC
Consulting Engineers and Scientists

Project: 61899.03



Date: March 15, 2021 12:15 PM to March 18, 2021 12:15PM

Off-Site Bedrock Observation Wells
(Creekside 1 Test Wells)
72-Hour Pumping Test

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Project: 61899.03

APPENDIX F

Water Quality Summary (Creekside 2)

61899.03

Field Measured Water Quality Parameters

TW21-1C Tag #A313115

Date/Time	March 15, 2021	March 16, 2021 Noon 24-hr	March 17, 2021 Noon 48-hr	March 18, 2021 Noon 72-hr
pH	6.58	7.64	7.95	7.88
Temp (°C)	7.48	8.63	9.20	8.05
EC (us/cm)	733	854	929	987
TDS (ppm)	468	546	595	633
Turbidity (NTU)	6.46	3.7	1.5	2.03
Colour (ACU - unfiltered)	-	-	5, 6, 4	22, 25, 26
Colour (TCU – filtered)	-	-	<5	<5
Free chlorine (mg/L)	-	<0.02	<0.02	<0.02
Total Chlorine (mg/L)	-	<0.02	<0.02	<0.02
DO mg/L	-	4.53	6.96	8.35
DP %	-	38.9	60.0	68.4
ORP mV	-	34	20	20
Sample Collected (Y / N)	Y	Y	Y	Y

TW21-1C Water Quality Summary
(1/3)

GEMTEC Consulting Engineers and Scientists Limited PROJECT: 61899.03								
Parameter	**Units**	**MDL**	**Regulation**	**Regulation**	**Step-Test**	**72-Hour P-Test**		
					TW21-1c 2106227-01	**TW21-1C 24hr 2112287-01**	**TW21-1C 48h 2112452-01**	**TW21-1C 72hr 2112541-01**
Sample Date (m/d/y)			**ODWQS - Maximum Allowable Concentration**	**ODWQS Asthetic Objectives / Operational Guidelines**	**02/02/2021**	**03/16/2021**	**03/17/2021**	**03/18/2021**
Microbiological Parameters								
E. Coli	CFU/100 mL	1	0 CFU/100 mL	-	ND (1)	ND (1)	ND (1)	ND (1)
Fecal Coliforms	CFU/100 mL	1	-	-	ND (1)	ND (1)	ND (1)	ND (1)
Total Coliforms	CFU/100 mL	1	0 CFU/100 mL	-	ND (1)	ND (1)	ND (1)	ND (1)
Heterotrophic Plate Count	CFU/mL	10	-	-	30	ND (10)	ND (10)	ND (10)
General Inorganics								
Alkalinity, total	mg/L	5	-	500 mg/L	299	287	279	279
Ammonia as N	mg/L	0.01	-	-	0.08	0.16	0.14	0.14
Dissolved Organic Carbon	mg/L	0.5	-	5 mg/L	1.2	2.8	2.4	1.7
Colour	TCU	2	-	5 TCU (5 ACU)	ND (2)	**15**	**8**	**7**
Colour, apparent	ACU	2	-	5 TCU (5 ACU)	47	28	24	19
Conductivity	uS/cm	5	-	-	685	876	961	1040
Hardness	mg/L		-	80 - 100 mg/L	**340**	**326**	**335**	**334**
pH	pH Units	0.1	-	-	7.8	8.0	8.0	8.2
Phenolics	mg/L	0.001	-	-	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)
Total Dissolved Solids	mg/L	10	-	500 mg/L	400	484	500	**514**
Sulphide	mg/L	0.02	-	0.5 mg/L	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)
Tannin & Lignin	mg/L	0.1	-	-	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Total Kjeldahl Nitrogen	mg/L	0.1	-	-	0.1	0.1	0.2	0.1
Turbidity	NTU	0.1	-	5 NTU	5.8	3.4	2.9	2.0
Anions								
Bromide	mg/L	0.1	-	-	ND(0.1)	0.3	0.4	0.4
Chloride	mg/L	1	-	250 mg/L	47	94	122	138
Fluoride	mg/L	0.1	1.5 mg/L	-	0.5	0.2	0.2	0.5
Nitrate as N	mg/L	0.1	10 mg/L	-	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Nitrite as N	mg/L	0.05	1 mg/L	-	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)
Sulphate	mg/L	1	-	500 mg/L	36	38	42	44
Metals								
Mercury	mg/L	0.0001	0.001 mg/L	-	ND (0.0001)	ND (0.0001)	ND (0.0001)	ND (0.0001)
Aluminum	mg/L	0.001	-	0.1 mg/L	0.067	0.079	0.060	0.026
Antimony	mg/L	0.0005	0.006 mg/L	-	ND (0.0005)	ND (0.0005)	ND (0.0005)	ND (0.0005)
Arsenic	mg/L	0.001	0.01 mg/L	-	0.002	0.001	0.001	0.001
Barium	mg/L	0.001	1 mg/L	-	0.224	0.222	0.231	0.226
Boron	mg/L	0.01	5 mg/L	-	0.12	0.18	0.18	0.20
Cadmium	mg/L	0.0001	0.005 mg/L	-	ND (0.0001)	ND (0.0001)	ND (0.0001)	ND (0.0001)
Calcium	mg/L	0.1	-	-	85.0	82.5	85.9	85.2
Chromium (VI)	mg/L	0.010	-	-	ND (1)	ND (0.010)	ND (0.010)	ND (0.001)
Chromium	mg/L	0.001	0.05 mg/L	-	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.010)
Copper	mg/L	0.0005	-	1 mg/L	ND (0.0005)	0.0007	ND (0.0005)	ND (0.0005)
Iron	mg/L	0.1	-	0.3 mg/L	0.5	0.3	0.3	0.3
Lead	mg/L	0.0001	0.01 mg/L	-	ND (0.0001)	ND (0.0001)	0.0001	0.0001
Magnesium	mg/L	0.2	-	-	31.0	29.1	29.4	29.4
Manganese	mg/L	0.005	-	0.05 mg/L	0.030	0.029	0.029	0.029
Potassium	mg/L	0.1	-	-	4.5	5.4	5.7	5.9
Selenium	mg/L	0.001	0.05 mg/L	-	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)
Sodium	mg/L	0.2	20 mg/L	200 mg/L	**37.0**	**66.7**	**82.2**	**87.3**
Uranium	mg/L	0.0001	0.02 mg/L	-	0.0006	0.0008	0.0007	0.0008
Zinc	mg/L	0.005	-	5 mg/L	ND (0.005)	0.008	ND (0.005)	0.007

TW21-1C Water Quality Summary
(2/3)

GEMTEC Consulting Engineers and Scientists Limited PROJECT: 61899.03								
Parameter	**Units**	**MDL**	**Regulation**	**Regulation**	**Step-Test**	**72-Hour P-Test**		
					TW21-1c 2106227-01	**TW21-1C 24hr 2112287-01**	**TW21-1C 48h 2112452-01**	**TW21-1C 72hr 2112541-01**
Sample Date (m/d/y)			**Ontario Drinking Water Standards - Maximum Allowable Concentration**	**Ontario Drinking Water Standards - Asthetic Objectives**	**02/02/2021**	**03/16/2021**	**03/17/2021**	**03/18/2021**
Volatiles								
Acetone	mg/L	0.0050	-	-	-	-	-	ND (0.0050)
Benzene	mg/L	0.0005	0.005 mg/L	-	-	-	-	ND (0.0005)
Bromodichloromethane	mg/L	0.0005	0.016 mg/L	-	-	-	-	ND (0.0005)
Bromoform	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
Bromomethane	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
Carbon Tetrachloride	mg/L	0.0002	0.002 mg/L	-	-	-	-	ND (0.0002)
Chlorobenzene	mg/L	0.0005	0.08 mg/L	0.03 mg/L	-	-	-	ND (0.0005)
Chloroform	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
Dibromochloromethane	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
Dichlorodifluoromethane	mg/L	0.0010	-	-	-	-	-	ND (0.0010)
1,2-Dichlorobenzene	mg/L	0.0005	0.2 mg/L	0.003 mg/L	-	-	-	ND (0.0005)
1,3-Dichlorobenzene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
1,4-Dichlorobenzene	mg/L	0.0005	0.005 mg/L	0.001 mg/L	-	-	-	ND (0.0005)
1,1-Dichloroethane	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
1,2-Dichloroethane	mg/L	0.0005	0.005 mg/L	-	-	-	-	ND (0.0005)
1,1-Dichloroethylene	mg/L	0.0005	0.014 mg/L	-	-	-	-	ND (0.0005)
cis-1,2-Dichloroethylene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
trans-1,2-Dichloroethylene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
1,2-Dichloropropane	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
cis-1,3-Dichloropropylene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
trans-1,3-Dichloropropylene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
1,3-Dichloropropene, total	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
Ethylbenzene	mg/L	0.0005	0.14 mg/L	0.0016 mg/L	-	-	-	ND (0.0005)
Ethylene dibromide (dibromoethan	mg/L	0.200	-	-	-	-	-	ND (0.200)
Hexane	mg/L	0.0010	-	-	-	-	-	ND (0.0010)
Methyl Ethyl Ketone (2-Butanone)	mg/L	0.0050	-	-	-	-	-	ND (0.0050)
Methyl Isobutyl Ketone	mg/L	0.0050	-	-	-	-	-	ND (0.0050)
Methyl tert-butyl ether	mg/L	0.0020	-	0.015 mg/L	-	-	-	ND (0.0020)
Methylene Chloride	mg/L	0.0050	0.05 mg/L	-	-	-	-	ND (0.0050)
Styrene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
1,1,1,2-Tetrachloroethane	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
1,1,2,2-Tetrachloroethane	mg/L	0.0005		-	-	-	-	ND (0.0005)
Tetrachloroethylene	mg/L	0.0005	0.01 mg/L		-	-	-	ND (0.0005)
Toluene	mg/L	0.0005	0.06 mg/L	0.024 mg/L	-	-	-	ND (0.0005)
1,1,1-Trichloroethane	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
1,1,2-Trichloroethane	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
Trichloroethylene	mg/L	0.0005	0.005 mg/L	-	-	-	-	ND (0.0005)
Trichlorofluoromethane	mg/L	0.0010	-	-	-	-	-	ND (0.0010)
Vinyl Chloride	mg/L	0.0002	0.002 mg/L	-	-	-	-	ND (0.0002)
m/p-Xylene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
o-Xylene	mg/L	0.0005	-	-	-	-	-	ND (0.0005)
Xylenes, total	mg/L	0.0005	0.09 mg/L	0.02 mg/L	-	-	-	ND (0.0005)
Hydrocarbons								
F1 PHCs (C6-C10)	mg/L	0.0250	-	-	-	-	-	ND (0.0250)
F2 PHCs (C10-C16)	mg/L	0.1	-	-	-	-	-	ND (0.1)
F3 PHCs (C16-C34)	mg/L	0.1	-	-	-	-	-	ND (0.1)
F4 PHCs (C34-C50)	mg/L	0.1	-	-	-	-	-	ND (0.1)

TW21-1C Water Quality Summary
(3/3)

GEMTEC Consulting Engineers and Scientists Limited PROJECT: 61899.03								
Parameter	**Units**	**MDL**	**Regulation**	**Regulation**	**Step-Test**	**72-Hour P-Test**		
					TW21-1c 2106227-01	**TW21-1C 24hr 2112287-01**	**TW21-1C 48h 2112452-01**	**TW21-1C 72hr 2112541-01**
Sample Date (m/d/y)			**Ontario Drinking Water Standards - Maximum Allowable Concentration**	**Ontario Drinking Water Standards - Asthetic Objectives**	**02/02/2021**	**03/16/2021**	**03/17/2021**	**03/18/2021**
Herbicdes / Pesticides								
2,3,4,6-Tetrachlorophenol	ug/L	-	-	-	-	-	-	<0.3
2,4,6-Trichlorophenol	ug/L	-	-	-	-	-	-	<0.2
2,4-Dichlorophenol	ug/L	-	-	-	-	-	-	<0.2
Pentachlorophenol	ug/L	-	-	-	-	-	-	<0.3
Carbaryl	ug/L	-	-	-	-	-	-	<1
Carbofuran	ug/L	-	-	-	-	-	-	<2
Diuron	ug/L	-	-	-	-	-	-	<6
Diquat	ug/L	-	-	-	-	-	-	<0.4
Paraquat	ug/L	-	-	-	-	-	-	<0.2
Alachlor	ug/L	-	-	-	-	-	-	<0.231
Atrazine	ug/L	-	-	-	-	-	-	<0.231
Azinphos-methyl (Guthion)	ug/L	-	-	-	-	-	-	<0.173
Chlorpyriphos (Dursban)	ug/L	-	-	-	-	-	-	<0.173
Desethyl atrazine	ug/L	-	-	-	-	-	-	<0.289
Diazinon	ug/L	-	-	-	-	-	-	<0.173
Dimethoate	ug/L	-	-	-	-	-	-	<0.173
Malathion	ug/L	-	-	-	-	-	-	<0.173
Metolachlor	ug/L	-	-	-	-	-	-	<0.116
Metribuzin (Sencor)	ug/L	-	-	-	-	-	-	<0.116
Phorate	ug/L	-	-	-	-	-	-	<0.116
Prometryne	ug/L	-	-	-	-	-	-	<0.0578
Simazine	ug/L	-	-	-	-	-	-	<0.173
Terbufos	ug/L	-	-	-	-	-	-	<0.116
Triallate	ug/L	-	-	-	-	-	-	<0.116
Trifluralin	ug/L	-	-	-	-	-	-	<0.116
Benzo(a)pyrene	ug/L	-	-	-	-	-	-	<0.01
Decachlorobiphenyl (Surr.)	% Rec	-	-	-	-	-	-	136
Total PCBs	ug/L	-	-	-	-	-	-	<0.06
2,4-D	ug/L	-	-	-	-	-	-	<0.365
Bromoxynil	ug/L	-	-	-	-	-	-	<0.0972
Dicamba	ug/L	-	-	-	-	-	-	<0.0851
Dichlorophenyl acetic acid (Surr.	% Rec	-	-	-	-	-	-	88.3
Diclofop-methyl	ug/L	-	-	-	-	-	-	<0.122
MCPA	ug/L	-	-	-	-	-	-	<6.08
Picloram	ug/L	-	-	-	-	-	-	<0.0851
Atrazine + N-dealkylated metabo	ug/L	-	-	-	-	-	-	<0.5

Langelier Saturation Index Calculation

Project 61899.03
Test Well: TW21-1C 72-hr
Date: March 18, 2021

Inputs

pH =	8.2	
Total Dissolved Solids =	514	
Calcium (as $CaCO_3$) =	213	Note: Ca (as CaCO3) = 2.5 x Ca
Alkalinity (as $CaCO_3$) =	279	
Temperature (^oC) =	8	(estimated)

Where Langelier Saturation Index (LSI) is defined as: $LSI = pH - pH_s$

Where: $pH_s = (9.3 + A + B) - (C + D)$

And:

$$A = \frac{(\log_{10}[TDS] - 1)}{10}$$

$$B = -13.12 \cdot \log_{10}[Temp + 273] + 34.55$$

$$C = \log_{10}[Calcium] - 0.4$$

$$D = \log_{10}[Alkalinity]$$

Output:

A =	0.17
B =	2.42
C =	1.93
D =	2.45
pH_s =	7.52
LSI =	**0.68**

LSI Value	Indication
-2.0 to -0.5	Serious corrosion
-0.5 to 0.0	Slight corrosion but non-scale forming
LSI = 0	Balanced but corrosion possible
0.0 to 0.5	Slightly scale forming and corrosive
0.5 to 2	Scale forming but non corrosive

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APPENDIX G

Laboratory Certificates of Analysis

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61899.03
Custody: 12097

Report Date: 23-Mar-2021
Order Date: 16-Mar-2021

Order #: 2112287

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2112287-01	TW21-1C 24hr

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 23-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 16-Mar-2021

Client PO:

Project Description: 61899.03

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	22-Mar-21	22-Mar-21
Ammonia, as N	EPA 351.2 - Auto Colour	18-Mar-21	18-Mar-21
Anions	EPA 300.1 - IC	18-Mar-21	18-Mar-21
Chromium, hexavalent - water	MOE E3056 - colourimetric	17-Mar-21	18-Mar-21
Colour	SM2120 - Spectrophotometric	17-Mar-21	17-Mar-21
Colour, apparent	SM2120 - Spectrophotometric	17-Mar-21	17-Mar-21
Conductivity	EPA 9050A- probe @25 °C	22-Mar-21	22-Mar-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	18-Mar-21	18-Mar-21
E. coli	MOE E3407	17-Mar-21	17-Mar-21
Fecal Coliform	SM 9222D	17-Mar-21	17-Mar-21
Heterotrophic Plate Count	SM 9215C	17-Mar-21	17-Mar-21
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	18-Mar-21	18-Mar-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	17-Mar-21	17-Mar-21
pH	EPA 150.1 - pH probe @25 °C	22-Mar-21	22-Mar-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	17-Mar-21	17-Mar-21
Hardness	Hardness as CaCO3	17-Mar-21	17-Mar-21
Sulphide	SM 4500SE - Colourimetric	18-Mar-21	18-Mar-21
Tannin/Lignin	SM 5550B - Colourimetric	22-Mar-21	22-Mar-21
Total Coliform	MOE E3407	17-Mar-21	17-Mar-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	22-Mar-21	22-Mar-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	19-Mar-21	22-Mar-21
Turbidity	SM 2130B - Turbidity meter	17-Mar-21	17-Mar-21

Certificate of Analysis

Report Date: 23-Mar-2021

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 16-Mar-2021

Client PO:

Project Description: 61899.03

	Client ID:	TW21-1C 24hr	-	-	-
	Sample Date:	16-Mar-21 12:00	-	-	-
	Sample ID:	2112287-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	-	-	-
Fecal Coliforms	1 CFU/100 mL	ND	-	-	-
Total Coliforms	1 CFU/100 mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	287	-	-	-
Ammonia as N	0.01 mg/L	0.16	-	-	-
Dissolved Organic Carbon	0.5 mg/L	2.8	-	-	-
Colour	2 TCU	15	-	-	-
Colour, apparent	2 ACU	28	-	-	-
Conductivity	5 uS/cm	876	-	-	-
Hardness	mg/L	326	-	-	-
pH	0.1 pH Units	8.0	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	484	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	<0.1	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.1	-	-	-
Turbidity	0.1 NTU	3.4	-	-	-
Anions					
Chloride	1 mg/L	94	-	-	-
Fluoride	0.1 mg/L	0.2	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	38	-	-	-
Metals					
Mercury	0.0001 mg/L	<0.0001	-	-	-
Aluminum	0.001 mg/L	0.079	-	-	-
Antimony	0.0005 mg/L	<0.0005	-	-	-
Arsenic	0.001 mg/L	0.001	-	-	-
Barium	0.001 mg/L	0.222	-	-	-
Boron	0.01 mg/L	0.18	-	-	-
Cadmium	0.0001 mg/L	<0.0001	-	-	-
Calcium	0.1 mg/L	82.5	-	-	-
Chromium	0.001 mg/L	<0.001	-	-	-

Certificate of Analysis

Report Date: 23-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 16-Mar-2021

Client PO:

Project Description: 61899.03

	Client ID:	TW21-1C 24hr	-	-	-
	Sample Date:	16-Mar-21 12:00	-	-	-
	Sample ID:	2112287-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Chromium (VI)	0.010 mg/L	<0.010	-	-	-
Copper	0.0005 mg/L	0.0007	-	-	-
Iron	0.1 mg/L	0.3	-	-	-
Lead	0.0001 mg/L	<0.0001	-	-	-
Magnesium	0.2 mg/L	29.1	-	-	-
Manganese	0.005 mg/L	0.029	-	-	-
Potassium	0.1 mg/L	5.4	-	-	-
Selenium	0.001 mg/L	<0.001	-	-	-
Sodium	0.2 mg/L	66.7	-	-	-
Uranium	0.0001 mg/L	0.0008	-	-	-
Zinc	0.005 mg/L	0.008	-	-	-

Certificate of Analysis

Report Date: 23-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 16-Mar-2021

Client PO:

Project Description: 61899.03

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Mercury	ND	0.0001	mg/L						
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium (VI)	ND	0.010	mg/L						
Chromium	ND	0.001	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Sodium	ND	0.2	mg/L						
Uranium	ND	0.0001	mg/L						
Zinc	ND	0.005	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	94.8	1	mg/L	94.2			0.6	10	
Fluoride	0.22	0.1	mg/L	0.22			0.8	10	
Nitrate as N	ND	0.1	mg/L	ND			NC	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	38.6	1	mg/L	38.3			0.8	10	
General Inorganics									
Alkalinity, total	282	5	mg/L	287			1.9	14	
Ammonia as N	0.258	0.01	mg/L	0.251			2.5	17.7	
Dissolved Organic Carbon	14.7	0.5	mg/L	13.3			9.8	37	
Colour	15	2	TCU	15			0.0	12	
Colour, apparent	9	2	ACU	9			0.0	12	
Conductivity	850	5	uS/cm	876			3.0	5	
pH	8.0	0.1	pH Units	8.0			0.5	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	544	10	mg/L	528			3.0	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.28	0.1	mg/L	0.30			6.8	16	
Turbidity	1.7	0.1	NTU	1.6			7.2	10	
Metals									
Mercury	ND	0.0001	mg/L	ND			NC	20	
Aluminum	0.003	0.001	mg/L	0.003			0.6	20	
Antimony	0.0008	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.023	0.001	mg/L	0.022			3.3	20	
Boron	0.02	0.01	mg/L	0.02			3.2	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	38.4	0.1	mg/L	38.5			0.1	20	
Chromium (VI)	ND	0.010	mg/L	ND			NC	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Copper	0.0077	0.0005	mg/L	0.0079			2.5	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Lead	0.0008	0.0001	mg/L	0.0008			4.1	20	
Magnesium	8.8	0.2	mg/L	9.4			6.8	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	2.0	0.1	mg/L	2.0			1.7	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Sodium	18.8	0.2	mg/L	19.5			3.4	20	
Uranium	0.0003	0.0001	mg/L	0.0003			3.7	20	
Zinc	0.039	0.005	mg/L	0.039			0.5	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	9.74	1	mg/L	ND	97.4	85-115			
Fluoride	1.17	0.1	mg/L	0.22	94.7	79-121			
Nitrate as N	1.06	0.1	mg/L	ND	106	79-120			
Nitrite as N	1.03	0.05	mg/L	ND	103	84-117			
Sulphate	47.0	1	mg/L	38.3	86.7	74-126			
General Inorganics									
Ammonia as N	0.503	0.01	mg/L	0.251	101	81-124			
Dissolved Organic Carbon	20.6	0.5	mg/L	13.3	73.3	60-133			
Phenolics	0.028	0.001	mg/L	ND	111	69-132			
Total Dissolved Solids	96.0	10	mg/L	ND	96.0	75-125			
Sulphide	0.51	0.02	mg/L	ND	102	79-115			
Tannin & Lignin	1.1	0.1	mg/L	ND	106	71-113			
Total Kjeldahl Nitrogen	2.00	0.1	mg/L	0.37	81.8	81-126			
Metals									
Mercury	0.0033	0.0001	mg/L	ND	108	70-130			
Aluminum	46.1	0.001	mg/L	3.42	85.4	80-120			
Antimony	49.2	0.0005	mg/L	0.175	98.1	80-120			
Arsenic	49.2	0.001	mg/L	0.788	96.8	80-120			
Barium	69.7	0.001	mg/L	22.4	94.6	80-120			
Boron	64.9	0.01	mg/L	23.8	82.2	80-120			
Cadmium	46.7	0.0001	mg/L	0.0378	93.3	80-120			
Calcium	47400	0.1	mg/L	38500	89.8	80-120			
Chromium (VI)	0.209	0.010	mg/L	ND	104	70-130			
Chromium	51.5	0.001	mg/L	0.296	102	80-120			
Copper	54.0	0.0005	mg/L	7.90	92.3	80-120			
Iron	2370	0.1	mg/L	28.0	93.7	80-120			
Lead	40.0	0.0001	mg/L	0.833	78.4	80-120			QS-02
Magnesium	19500	0.2	mg/L	9380	101	80-120			
Manganese	50.7	0.005	mg/L	0.652	100	80-120			
Potassium	13700	0.1	mg/L	2000	117	80-120			
Selenium	46.0	0.001	mg/L	0.151	91.8	80-120			
Sodium	29600	0.2	mg/L	19500	101	80-120			
Uranium	41.8	0.0001	mg/L	0.330	83.0	80-120			
Zinc	82.1	0.005	mg/L	39.0	86.1	80-120			

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

QS-02 : Spike level outside of control limits. Analysis batch accepted based on other QC included in the batch.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61899.03
Custody: 14579

Report Date: 23-Mar-2021
Order Date: 17-Mar-2021

Order #: 2112452

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2112452-01	TW21-16 48h

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 23-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 17-Mar-2021

Client PO:

Project Description: 61899.03

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	22-Mar-21	22-Mar-21
Ammonia, as N	EPA 351.2 - Auto Colour	22-Mar-21	23-Mar-21
Anions	EPA 300.1 - IC	18-Mar-21	18-Mar-21
Chromium, hexavalent - water	MOE E3056 - colourimetric	19-Mar-21	19-Mar-21
Colour	SM2120 - Spectrophotometric	18-Mar-21	18-Mar-21
Colour, apparent	SM2120 - Spectrophotometric	18-Mar-21	18-Mar-21
Conductivity	EPA 9050A- probe @25 °C	22-Mar-21	22-Mar-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	18-Mar-21	18-Mar-21
E. coli	MOE E3407	18-Mar-21	18-Mar-21
Fecal Coliform	SM 9222D	18-Mar-21	18-Mar-21
Heterotrophic Plate Count	SM 9215C	18-Mar-21	20-Mar-21
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	19-Mar-21	23-Mar-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	18-Mar-21	18-Mar-21
pH	EPA 150.1 - pH probe @25 °C	22-Mar-21	22-Mar-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	19-Mar-21	19-Mar-21
Hardness	Hardness as CaCO3	18-Mar-21	18-Mar-21
Sulphide	SM 4500SE - Colourimetric	18-Mar-21	18-Mar-21
Tannin/Lignin	SM 5550B - Colourimetric	22-Mar-21	22-Mar-21
Total Coliform	MOE E3407	18-Mar-21	18-Mar-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	22-Mar-21	22-Mar-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	19-Mar-21	22-Mar-21
Turbidity	SM 2130B - Turbidity meter	18-Mar-21	18-Mar-21

Certificate of Analysis

Report Date: 23-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 17-Mar-2021

Client PO:

Project Description: 61899.03

	Client ID:	TW21-16 48h	-	-	-
	Sample Date:	17-Mar-21 09:00	-	-	-
	Sample ID:	2112452-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	-	-	-
Fecal Coliforms	1 CFU/100 mL	ND	-	-	-
Total Coliforms	1 CFU/100 mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	279	-	-	-
Ammonia as N	0.01 mg/L	0.14	-	-	-
Dissolved Organic Carbon	0.5 mg/L	2.4	-	-	-
Colour	2 TCU	8	-	-	-
Colour, apparent	2 ACU	24	-	-	-
Conductivity	5 uS/cm	961	-	-	-
Hardness	mg/L	335	-	-	-
pH	0.1 pH Units	8.0	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	500	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	<0.1	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.2	-	-	-
Turbidity	0.1 NTU	2.9	-	-	-
Anions					
Chloride	1 mg/L	122	-	-	-
Fluoride	0.1 mg/L	0.2	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	42	-	-	-
Metals					
Mercury	0.0001 mg/L	<0.0001	-	-	-
Aluminum	0.001 mg/L	0.060	-	-	-
Antimony	0.0005 mg/L	<0.0005	-	-	-
Arsenic	0.001 mg/L	0.001	-	-	-
Barium	0.001 mg/L	0.231	-	-	-
Boron	0.01 mg/L	0.18	-	-	-
Cadmium	0.0001 mg/L	<0.0001	-	-	-
Calcium	0.1 mg/L	85.9	-	-	-
Chromium	0.001 mg/L	<0.001	-	-	-

Certificate of Analysis

Report Date: 23-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 17-Mar-2021

Client PO:

Project Description: 61899.03

	Client ID:	TW21-16 48h	-	-	-
	Sample Date:	17-Mar-21 09:00	-	-	-
	Sample ID:	2112452-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Chromium (VI)	0.010 mg/L	<0.010	-	-	-
Copper	0.0005 mg/L	<0.0005	-	-	-
Iron	0.1 mg/L	0.3	-	-	-
Lead	0.0001 mg/L	0.0001	-	-	-
Magnesium	0.2 mg/L	29.4	-	-	-
Manganese	0.005 mg/L	0.029	-	-	-
Potassium	0.1 mg/L	5.7	-	-	-
Selenium	0.001 mg/L	<0.001	-	-	-
Sodium	0.2 mg/L	82.2	-	-	-
Uranium	0.0001 mg/L	0.0007	-	-	-
Zinc	0.005 mg/L	<0.005	-	-	-

Certificate of Analysis

Report Date: 23-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 17-Mar-2021

Client PO:

Project Description: 61899.03

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Mercury	ND	0.0001	mg/L						
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium (VI)	ND	0.010	mg/L						
Chromium	ND	0.001	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Sodium	ND	0.2	mg/L						
Uranium	ND	0.0001	mg/L						
Zinc	ND	0.005	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	94.8	1	mg/L	94.2			0.6	10	
Fluoride	0.22	0.1	mg/L	0.22			0.8	10	
Nitrate as N	ND	0.1	mg/L	ND			NC	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	38.6	1	mg/L	38.3			0.8	10	
General Inorganics									
Alkalinity, total	282	5	mg/L	287			1.9	14	
Ammonia as N	0.166	0.01	mg/L	0.168			1.2	17.7	
Dissolved Organic Carbon	14.7	0.5	mg/L	13.3			9.8	37	
Colour	8	2	TCU	8			0.0	12	
Colour, apparent	25	2	ACU	24			4.1	12	
Conductivity	850	5	uS/cm	876			3.0	5	
pH	8.0	0.1	pH Units	8.0			0.5	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	544	10	mg/L	528			3.0	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.28	0.1	mg/L	0.30			6.8	16	
Turbidity	3.0	0.1	NTU	2.9			2.0	10	
Metals									
Mercury	ND	0.0001	mg/L	ND			NC	20	
Aluminum	0.056	0.001	mg/L	0.057			2.0	20	
Antimony	ND	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.012	0.001	mg/L	0.012			0.7	20	
Boron	ND	0.01	mg/L	ND			NC	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	9.4	0.1	mg/L	9.4			0.0	20	
Chromium (VI)	ND	0.010	mg/L	ND			NC	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Copper	0.0041	0.0005	mg/L	0.0040			0.3	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Lead	0.0010	0.0001	mg/L	0.0010			5.0	20	
Magnesium	2.3	0.2	mg/L	2.3			2.7	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	0.8	0.1	mg/L	0.8			0.2	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Sodium	17.1	0.2	mg/L	17.2			0.6	20	
Uranium	ND	0.0001	mg/L	ND			NC	20	
Zinc	0.008	0.005	mg/L	0.008			1.0	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	9.74	1	mg/L	ND	97.4	85-115			
Fluoride	1.17	0.1	mg/L	0.22	94.7	79-121			
Nitrate as N	1.06	0.1	mg/L	ND	106	79-120			
Nitrite as N	1.03	0.05	mg/L	ND	103	84-117			
Sulphate	47.0	1	mg/L	38.3	86.7	74-126			
General Inorganics									
Ammonia as N	0.421	0.01	mg/L	0.168	101	81-124			
Dissolved Organic Carbon	20.6	0.5	mg/L	13.3	73.3	60-133			
Phenolics	0.025	0.001	mg/L	ND	99.7	69-132			
Total Dissolved Solids	96.0	10	mg/L	ND	96.0	75-125			
Sulphide	0.51	0.02	mg/L	ND	102	79-115			
Tannin & Lignin	1.1	0.1	mg/L	ND	106	71-113			
Total Kjeldahl Nitrogen	2.00	0.1	mg/L	0.37	81.8	81-126			
Metals									
Mercury	0.0032	0.0001	mg/L	ND	108	70-130			
Aluminum	65.5	0.001	mg/L	24.2	82.6	80-120			
Antimony	54.5	0.0005	mg/L	0.436	108	80-120			
Arsenic	50.1	0.001	mg/L	0.202	99.8	80-120			
Barium	67.1	0.001	mg/L	12.4	109	80-120			
Boron	53.3	0.01	mg/L	5.80	94.9	80-120			
Cadmium	53.2	0.0001	mg/L	0.0432	106	80-120			
Chromium (VI)	0.209	0.010	mg/L	ND	104	70-130			
Chromium	54.4	0.001	mg/L	0.136	109	80-120			
Copper	54.0	0.0005	mg/L	4.05	99.8	80-120			
Iron	2460	0.1	mg/L	72.7	95.6	80-120			
Lead	46.3	0.0001	mg/L	0.954	90.6	80-120			
Magnesium	14000	0.2	mg/L	2330	116	80-120			
Manganese	56.8	0.005	mg/L	3.51	107	80-120			
Potassium	12200	0.1	mg/L	731	115	80-120			
Selenium	49.2	0.001	mg/L	0.113	98.2	80-120			
Sodium	27500	0.2	mg/L	17200	103	80-120			
Uranium	45.1	0.0001	mg/L	0.0398	90.0	80-120			
Zinc	65.4	0.005	mg/L	8.08	115	80-120			

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61899.03
Custody: 13283

Report Date: 24-Mar-2021
Order Date: 18-Mar-2021

Order #: 2112541

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2112541-01	TW21-1C 72hr

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	22-Mar-21	23-Mar-21
Ammonia, as N	EPA 351.2 - Auto Colour	22-Mar-21	23-Mar-21
Anions	EPA 300.1 - IC	22-Mar-21	22-Mar-21
Chromium, hexavalent - water	MOE E3056 - colourimetric	19-Mar-21	19-Mar-21
Colour	SM2120 - Spectrophotometric	19-Mar-21	19-Mar-21
Colour, apparent	SM2120 - Spectrophotometric	19-Mar-21	19-Mar-21
Conductivity	EPA 9050A- probe @25 °C	22-Mar-21	23-Mar-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	23-Mar-21	23-Mar-21
E. coli	MOE E3407	19-Mar-21	19-Mar-21
Fecal Coliform	SM 9222D	19-Mar-21	19-Mar-21
Heterotrophic Plate Count	SM 9215C	20-Mar-21	22-Mar-21
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	19-Mar-21	23-Mar-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	19-Mar-21	19-Mar-21
pH	EPA 150.1 - pH probe @25 °C	22-Mar-21	23-Mar-21
PHC F1	CWS Tier 1 - P&T GC-FID	22-Mar-21	23-Mar-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	23-Mar-21	24-Mar-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	19-Mar-21	19-Mar-21
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	22-Mar-21	23-Mar-21
Hardness	Hardness as CaCO3	19-Mar-21	19-Mar-21
Sulphide	SM 4500SE - Colourimetric	23-Mar-21	23-Mar-21
Tannin/Lignin	SM 5550B - Colourimetric	22-Mar-21	22-Mar-21
Total Coliform	MOE E3407	19-Mar-21	19-Mar-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	22-Mar-21	22-Mar-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	19-Mar-21	22-Mar-21
Turbidity	SM 2130B - Turbidity meter	19-Mar-21	19-Mar-21

Certificate of Analysis

Report Date: 24-Mar-2021

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 18-Mar-2021

Client PO:

Project Description: 61899.03

	Client ID:	TW21-1C 72hr	-	-	-
	Sample Date:	18-Mar-21 12:00	-	-	-
	Sample ID:	2112541-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	-	-	-
Fecal Coliforms	1 CFU/100 mL	ND	-	-	-
Total Coliforms	1 CFU/100 mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	279	-	-	-
Ammonia as N	0.01 mg/L	0.14	-	-	-
Dissolved Organic Carbon	0.5 mg/L	1.7	-	-	-
Colour	2 TCU	7	-	-	-
Colour, apparent	2 ACU	19	-	-	-
Conductivity	5 uS/cm	1040	-	-	-
Hardness	mg/L	334	-	-	-
pH	0.1 pH Units	8.2	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	514	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	<0.1	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.1	-	-	-
Turbidity	0.1 NTU	2.0	-	-	-
Anions					
Chloride	1 mg/L	138	-	-	-
Fluoride	0.1 mg/L	0.5	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	44	-	-	-
Metals					
Mercury	0.0001 mg/L	<0.0001	-	-	-
Aluminum	0.001 mg/L	0.026	-	-	-
Antimony	0.0005 mg/L	<0.0005	-	-	-
Arsenic	0.001 mg/L	0.001	-	-	-
Barium	0.001 mg/L	0.226	-	-	-
Boron	0.01 mg/L	0.20	-	-	-
Cadmium	0.0001 mg/L	<0.0001	-	-	-
Calcium	0.1 mg/L	85.2	-	-	-
Chromium	0.001 mg/L	<0.001	-	-	-

Certificate of Analysis

Report Date: 24-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 18-Mar-2021

Client PO:

Project Description: 61899.03

	Client ID:	TW21-1C 72hr	-	-	-
	Sample Date:	18-Mar-21 12:00	-	-	-
	Sample ID:	2112541-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Chromium (VI)	0.010 mg/L	<0.010	-	-	-
Copper	0.0005 mg/L	<0.0005	-	-	-
Iron	0.1 mg/L	0.3	-	-	-
Lead	0.0001 mg/L	0.0001	-	-	-
Magnesium	0.2 mg/L	29.4	-	-	-
Manganese	0.005 mg/L	0.029	-	-	-
Potassium	0.1 mg/L	5.9	-	-	-
Selenium	0.001 mg/L	<0.001	-	-	-
Sodium	0.2 mg/L	87.3	-	-	-
Uranium	0.0001 mg/L	0.0008	-	-	-
Zinc	0.005 mg/L	0.007	-	-	-
Volatiles					
Acetone	0.0050 mg/L	<0.0050	-	-	-
Benzene	0.0005 mg/L	<0.0005	-	-	-
Bromodichloromethane	0.0005 mg/L	<0.0005	-	-	-
Bromoform	0.0005 mg/L	<0.0005	-	-	-
Bromomethane	0.0005 mg/L	<0.0005	-	-	-
Carbon Tetrachloride	0.0002 mg/L	<0.0002	-	-	-
Chlorobenzene	0.0005 mg/L	<0.0005	-	-	-
Chloroform	0.0005 mg/L	<0.0005	-	-	-
Dibromochloromethane	0.0005 mg/L	<0.0005	-	-	-
Dichlorodifluoromethane	0.0010 mg/L	<0.0010	-	-	-
1,2-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	-
1,3-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	-
1,4-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	-
1,1-Dichloroethane	0.0005 mg/L	<0.0005	-	-	-
1,2-Dichloroethane	0.0005 mg/L	<0.0005	-	-	-
1,1-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	-
cis-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	-
trans-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	-
1,2-Dichloropropane	0.0005 mg/L	<0.0005	-	-	-
cis-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	-	-	-
trans-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	-	-	-
1,3-Dichloropropene, total	0.0005 mg/L	<0.0005	-	-	-
Ethylbenzene	0.0005 mg/L	<0.0005	-	-	-
Ethylene dibromide (dibromoethane, 1,2-)	0.200 mg/L	<0.200	-	-	-

Certificate of Analysis

Report Date: 24-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 18-Mar-2021

Client PO:

Project Description: 61899.03

	Client ID:	TW21-1C 72hr	-	-	-
	Sample Date:	18-Mar-21 12:00	-	-	-
	Sample ID:	2112541-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Hexane	0.0010 mg/L	<0.0010	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.0050 mg/L	<0.0050	-	-	-
Methyl Isobutyl Ketone	0.0050 mg/L	<0.0050	-	-	-
Methyl tert-butyl ether	0.0020 mg/L	<0.0020	-	-	-
Methylene Chloride	0.0050 mg/L	<0.0050	-	-	-
Styrene	0.0005 mg/L	<0.0005	-	-	-
1,1,1,2-Tetrachloroethane	0.0005 mg/L	<0.0005	-	-	-
1,1,2,2-Tetrachloroethane	0.0005 mg/L	<0.0005	-	-	-
Tetrachloroethylene	0.0005 mg/L	<0.0005	-	-	-
Toluene	0.0005 mg/L	<0.0005	-	-	-
1,1,1-Trichloroethane	0.0005 mg/L	<0.0005	-	-	-
1,1,2-Trichloroethane	0.0005 mg/L	<0.0005	-	-	-
Trichloroethylene	0.0005 mg/L	<0.0005	-	-	-
Trichlorofluoromethane	0.0010 mg/L	<0.0010	-	-	-
Vinyl chloride	0.0002 mg/L	<0.0002	-	-	-
m,p-Xylenes	0.0005 mg/L	<0.0005	-	-	-
o-Xylene	0.0005 mg/L	<0.0005	-	-	-
Xylenes, total	0.0005 mg/L	<0.0005	-	-	-
4-Bromofluorobenzene	Surrogate	91.9%	-	-	-
Dibromofluoromethane	Surrogate	85.9%	-	-	-
Toluene-d8	Surrogate	107%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	0.0250 mg/L	<0.0250	-	-	-
F2 PHCs (C10-C16)	0.1 mg/L	<0.1	-	-	-
F3 PHCs (C16-C34)	0.1 mg/L	<0.1	-	-	-
F4 PHCs (C34-C50)	0.1 mg/L	<0.1	-	-	-

Certificate of Analysis

Report Date: 24-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 18-Mar-2021

Client PO:

Project Description: 61899.03

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Hydrocarbons									
F2 PHCs (C10-C16) - PAHs	0.0		mg/L						
F3 PHCs (C16-C34) - PAHs	0.0		mg/L						
F1 PHCs (C6-C10)	ND	0.0250	mg/L						
F2 PHCs (C10-C16)	ND	0.1	mg/L						
F3 PHCs (C16-C34)	ND	0.1	mg/L						
F4 PHCs (C34-C50)	ND	0.1	mg/L						
Metals									
Mercury	ND	0.0001	mg/L						
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium (VI)	ND	0.010	mg/L						
Chromium	ND	0.001	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Sodium	ND	0.2	mg/L						
Uranium	ND	0.0001	mg/L						
Zinc	ND	0.005	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						
Volatiles									
Acetone	ND	0.0050	mg/L						
Benzene	ND	0.0005	mg/L						
Bromodichloromethane	ND	0.0005	mg/L						
Bromoform	ND	0.0005	mg/L						
Bromomethane	ND	0.0005	mg/L						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Carbon Tetrachloride	ND	0.0002	mg/L						
Chlorobenzene	ND	0.0005	mg/L						
Chloroform	ND	0.0005	mg/L						
Dibromochloromethane	ND	0.0005	mg/L						
Dichlorodifluoromethane	ND	0.0010	mg/L						
1,2-Dichlorobenzene	ND	0.0005	mg/L						
1,3-Dichlorobenzene	ND	0.0005	mg/L						
1,4-Dichlorobenzene	ND	0.0005	mg/L						
1,1-Dichloroethane	ND	0.0005	mg/L						
1,2-Dichloroethane	ND	0.0005	mg/L						
1,1-Dichloroethylene	ND	0.0005	mg/L						
cis-1,2-Dichloroethylene	ND	0.0005	mg/L						
trans-1,2-Dichloroethylene	ND	0.0005	mg/L						
1,2-Dichloropropane	ND	0.0005	mg/L						
cis-1,3-Dichloropropylene	ND	0.0005	mg/L						
trans-1,3-Dichloropropylene	ND	0.0005	mg/L						
1,3-Dichloropropene, total	ND	0.0005	mg/L						
Ethylbenzene	ND	0.0005	mg/L						
Ethylene dibromide (dibromoethane, 1,2	ND	0.200	mg/L						
Hexane	ND	0.0010	mg/L						
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L						
Methyl Isobutyl Ketone	ND	0.0050	mg/L						
Methyl tert-butyl ether	ND	0.0020	mg/L						
Methylene Chloride	ND	0.0050	mg/L						
Styrene	ND	0.0005	mg/L						
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L						
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L						
Tetrachloroethylene	ND	0.0005	mg/L						
Toluene	ND	0.0005	mg/L						
1,1,1-Trichloroethane	ND	0.0005	mg/L						
1,1,2-Trichloroethane	ND	0.0005	mg/L						
Trichloroethylene	ND	0.0005	mg/L						
Trichlorofluoromethane	ND	0.0010	mg/L						
Vinyl chloride	ND	0.0002	mg/L						
m,p-Xylenes	ND	0.0005	mg/L						
o-Xylene	ND	0.0005	mg/L						
Xylenes, total	ND	0.0005	mg/L						
Surrogate: 4-Bromofluorobenzene	*0.0731*		*mg/L*		*91.3*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0686*		*mg/L*		*85.8*	*50-140*			
Surrogate: Toluene-d8	*0.0859*		*mg/L*		*107*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	7.02	1	mg/L	7.12			1.4	10	
Fluoride	0.71	0.1	mg/L	0.73			2.9	10	
Nitrate as N	0.59	0.1	mg/L	0.60			1.6	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	24.6	1	mg/L	24.8			0.9	10	
General Inorganics									
Alkalinity, total	282	5	mg/L	287			1.9	14	
Ammonia as N	0.166	0.01	mg/L	0.168			1.2	17.7	
Dissolved Organic Carbon	4.0	0.5	mg/L	3.3			19.6	37	
Colour	8	2	TCU	8			0.0	12	
Colour, apparent	19	2	ACU	19			0.0	12	
Conductivity	850	5	uS/cm	876			3.0	5	
pH	8.0	0.1	pH Units	8.0			0.5	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	544	10	mg/L	528			3.0	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.28	0.1	mg/L	0.30			6.8	16	
Turbidity	18.7	0.1	NTU	18.6			0.5	10	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.0250	mg/L	ND			NC	30	
Metals									
Mercury	ND	0.0001	mg/L	ND			NC	20	
Aluminum	ND	0.001	mg/L	ND			NC	20	
Antimony	ND	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.023	0.001	mg/L	0.022			3.2	20	
Boron	0.06	0.01	mg/L	0.06			0.8	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	94.1	0.1	mg/L	93.3			0.9	20	
Chromium (VI)	ND	0.010	mg/L	ND			NC	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Copper	0.0052	0.0005	mg/L	0.0054			3.7	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Lead	0.0004	0.0001	mg/L	0.0005			16.6	20	
Magnesium	26.3	0.2	mg/L	25.9			1.4	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	3.2	0.1	mg/L	3.1			2.0	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Sodium	10.7	0.2	mg/L	11.0			3.5	20	
Uranium	ND	0.0001	mg/L	0.0001			NC	20	
Zinc	0.005	0.005	mg/L	0.005			1.1	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	1			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	
Volatiles									
Acetone	ND	0.0050	mg/L	ND			NC	30	
Benzene	ND	0.0005	mg/L	ND			NC	30	
Bromodichloromethane	ND	0.0005	mg/L	ND			NC	30	
Bromoform	ND	0.0005	mg/L	ND			NC	30	
Bromomethane	ND	0.0005	mg/L	ND			NC	30	
Carbon Tetrachloride	ND	0.0002	mg/L	ND			NC	30	
Chlorobenzene	ND	0.0005	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.0005	mg/L	ND			NC	30	
Dibromochloromethane	ND	0.0005	mg/L	ND			NC	30	
Dichlorodifluoromethane	ND	0.0010	mg/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloropropane	ND	0.0005	mg/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
Ethylbenzene	ND	0.0005	mg/L	ND			NC	30	
Ethylene dibromide (dibromoethane, 1,2-	ND	0.200	mg/L	ND			NC	30	
Hexane	ND	0.0010	mg/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	0.0050	mg/L	ND			NC	30	
Methyl tert-butyl ether	ND	0.0020	mg/L	ND			NC	30	
Methylene Chloride	ND	0.0050	mg/L	ND			NC	30	
Styrene	ND	0.0005	mg/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
Tetrachloroethylene	ND	0.0005	mg/L	ND			NC	30	
Toluene	ND	0.0005	mg/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
Trichloroethylene	ND	0.0005	mg/L	ND			NC	30	
Trichlorofluoromethane	ND	0.0010	mg/L	ND			NC	30	
Vinyl chloride	ND	0.0002	mg/L	ND			NC	30	
m,p-Xylenes	ND	0.0005	mg/L	ND			NC	30	
o-Xylene	ND	0.0005	mg/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*0.0717*		*mg/L*		*89.6*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0754*		*mg/L*		*94.2*	*50-140*			
Surrogate: Toluene-d8	*0.0864*		*mg/L*		*108*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	16.7	1	mg/L	7.12	95.6	77-123			
Fluoride	1.54	0.1	mg/L	0.73	80.7	79-121			
Nitrate as N	1.60	0.1	mg/L	0.60	100	79-120			
Nitrite as N	0.914	0.05	mg/L	ND	91.4	84-117			
Sulphate	33.2	1	mg/L	24.8	84.1	74-126			
General Inorganics									
Ammonia as N	0.421	0.01	mg/L	0.168	101	81-124			
Dissolved Organic Carbon	13.9	0.5	mg/L	3.3	107	60-133			
Phenolics	0.025	0.001	mg/L	ND	99.7	69-132			
Total Dissolved Solids	96.0	10	mg/L	ND	96.0	75-125			
Sulphide	0.52	0.02	mg/L	ND	104	79-115			
Tannin & Lignin	1.1	0.1	mg/L	ND	106	71-113			
Total Kjeldahl Nitrogen	2.00	0.1	mg/L	0.37	81.8	81-126			
Hydrocarbons									
F1 PHCs (C6-C10)	2.21	0.0250	mg/L	ND	110	68-117			
F2 PHCs (C10-C16)	1.4	0.1	mg/L	ND	86.2	60-140			
F3 PHCs (C16-C34)	3.7	0.1	mg/L	ND	95.3	60-140			
F4 PHCs (C34-C50)	2.2	0.1	mg/L	ND	89.5	60-140			
Metals									
Mercury	0.0032	0.0001	mg/L	ND	108	70-130			
Aluminum	42.2	0.001	mg/L	ND	84.4	80-120			
Antimony	42.6	0.0005	mg/L	ND	85.1	80-120			
Arsenic	49.9	0.001	mg/L	0.135	99.5	80-120			
Barium	68.3	0.001	mg/L	22.5	91.7	80-120			
Boron	55.4	0.01	mg/L	9.16	92.6	80-120			
Cadmium	45.3	0.0001	mg/L	0.0603	90.5	80-120			
Calcium	20800	0.1	mg/L	9130	117	80-120			
Chromium (VI)	0.209	0.010	mg/L	ND	104	70-130			
Chromium	52.8	0.001	mg/L	0.084	105	80-120			
Copper	51.6	0.0005	mg/L	5.42	92.3	80-120			
Iron	2410	0.1	mg/L	8.3	96.1	80-120			
Lead	42.5	0.0001	mg/L	0.473	84.0	80-120			
Magnesium	36200	0.2	mg/L	25900	103	80-120			
Manganese	55.3	0.005	mg/L	3.83	103	80-120			
Potassium	12500	0.1	mg/L	732	117	80-120			
Selenium	47.7	0.001	mg/L	0.124	95.1	80-120			
Sodium	21700	0.2	mg/L	11000	107	80-120			
Uranium	46.9	0.0001	mg/L	0.128	93.6	80-120			
Zinc	50.3	0.005	mg/L	5.19	90.3	80-120			
Volatiles									
Acetone	0.112	0.0050	mg/L	ND	112	50-140			
Benzene	0.0367	0.0005	mg/L	ND	91.8	60-130			
Bromodichloromethane	0.0338	0.0005	mg/L	ND	84.5	60-130			
Bromoform	0.0430	0.0005	mg/L	ND	108	60-130			
Bromomethane	0.0335	0.0005	mg/L	ND	83.6	50-140			
Carbon Tetrachloride	0.0338	0.0002	mg/L	ND	84.5	60-130			
Chlorobenzene	0.0426	0.0005	mg/L	ND	106	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	0.0391	0.0005	mg/L	ND	97.6	60-130			
Dibromochloromethane	0.0372	0.0005	mg/L	ND	93.0	60-130			
Dichlorodifluoromethane	0.0357	0.0010	mg/L	ND	89.3	50-140			
1,2-Dichlorobenzene	0.0400	0.0005	mg/L	ND	100	60-130			
1,3-Dichlorobenzene	0.0399	0.0005	mg/L	ND	99.8	60-130			
1,4-Dichlorobenzene	0.0398	0.0005	mg/L	ND	99.4	60-130			
1,1-Dichloroethane	0.0346	0.0005	mg/L	ND	86.4	60-130			
1,2-Dichloroethane	0.0446	0.0005	mg/L	ND	111	60-130			
1,1-Dichloroethylene	0.0302	0.0005	mg/L	ND	75.6	60-130			
cis-1,2-Dichloroethylene	0.0310	0.0005	mg/L	ND	77.6	60-130			
trans-1,2-Dichloroethylene	0.0310	0.0005	mg/L	ND	77.6	60-130			
1,2-Dichloropropane	0.0368	0.0005	mg/L	ND	91.9	60-130			
cis-1,3-Dichloropropylene	0.0396	0.0005	mg/L	ND	99.1	60-130			
trans-1,3-Dichloropropylene	0.0329	0.0005	mg/L	ND	82.3	60-130			
Ethylbenzene	0.0410	0.0005	mg/L	ND	103	60-130			
Hexane	0.0298	0.0010	mg/L	ND	74.6	60-130			
Methyl Ethyl Ketone (2-Butanone)	0.0865	0.0050	mg/L	ND	86.5	50-140			
Methyl Isobutyl Ketone	0.0835	0.0050	mg/L	ND	83.5	50-140			
Methyl tert-butyl ether	0.0847	0.0020	mg/L	ND	84.7	50-140			
Methylene Chloride	0.0323	0.0050	mg/L	ND	80.8	60-130			
Styrene	0.0432	0.0005	mg/L	ND	108	60-130			
1,1,1,2-Tetrachloroethane	0.0400	0.0005	mg/L	ND	100	60-130			
1,1,2,2-Tetrachloroethane	0.0436	0.0005	mg/L	ND	109	60-130			
Tetrachloroethylene	0.0434	0.0005	mg/L	ND	109	60-130			
Toluene	0.0440	0.0005	mg/L	ND	110	60-130			
1,1,1-Trichloroethane	0.0326	0.0005	mg/L	ND	81.4	60-130			
1,1,2-Trichloroethane	0.0354	0.0005	mg/L	ND	88.4	60-130			
Trichloroethylene	0.0365	0.0005	mg/L	ND	91.2	60-130			
Trichlorofluoromethane	0.0320	0.0010	mg/L	ND	80.0	60-130			
Vinyl chloride	0.0351	0.0002	mg/L	ND	87.8	50-140			
m,p-Xylenes	0.0941	0.0005	mg/L	ND	118	60-130			
o-Xylene	0.0393	0.0005	mg/L	ND	98.3	60-130			
Surrogate: 4-Bromofluorobenzene	*0.0834*		*mg/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0763*		*mg/L*		*95.4*	*50-140*			
Surrogate: Toluene-d8	*0.0826*		*mg/L*		*103*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

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300 - 2319 St. Laurent Blvd
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Subcontracted Analysis

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Tel: (613) 836-1422
Fax: (613) 836-9731

Paracel Report No **2113090**
Client Project(s): **61899.03**
Client PO:
Reference:
CoC Number: **13282**

Order Date: 18-Mar-21
Report Date: 7-Apr-21

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	Client ID	Analysis
2113090-01	TW21-1C-72hr	ODWS - REG 170 Sch 24 less VOCs

TESTMARK Laboratories Ltd.
Committed to Quality and Service

CERTIFICATE OF ANALYSIS

Client:	Dale Robertson	Work Order Number:	425827
Company:	Paracel Laboratories Ltd.- Ottawa	PO #:	
Address:	300-2319 St. Laurent Blvd. Ottawa, ON, K1G 4J8	Regulation: Project #:	None 2113090
Phone/Fax:	(613) 731-9577 / (613) 731-9064	DWS #:	
Email:	drobertson@paracellabs.com	Sampled By:	
Date Order Received:	3/23/2021	Analysis Started:	3/29/2021
Arrival Temperature:	7 °C	Analysis Completed:	4/7/2021

WORK ORDER SUMMARY

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
TW21-1C-72hr	1627333	Water	None		3/18/2021	12:00 PM

METHODS AND INSTRUMENTATION

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
Acid Ext. Water (A41)	Garson	Determination of Acid Extractables in Water by GC-MS	Modified from SW846-8270D
Carbamates/W (A57)	Garson	Determination of Carbamate Pesticides and Diuron in Water by HPLC	Modified from SW846-8318A
Diquat/Paraquat/ Water (A70)	Garson	Determination of Diquat and Paraquat in water by HPLC	Modified from EPA 549.2
OPPest Water (A18)	Garson	Determination of Triazine Herbicides and Organophosphorus Pesticides in Water	Modified from SW846-8270 D
PAH Water SIM (A41)	Garson	Determination of PAH in Water by GC/MS	Modified from SW846-8270D
PCBs Water (A19)	Garson	Determination of Polychlorinated Biphenyls in Water by GC/ECD	Modified from SW846-8082-A
PhenoxyHerb-W (A56)	Garson	Determination of Phenoxy Acid Herbicides in Water by GC/ECD/ECD	Modified from SW846-8151A
Sched. 24 Aggregrate Grp 1 (R99)	Garson	Calculation of Schedule 24 Aggregrate Parameters	In House

REPORT COMMENTS

Not Reportable

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CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd.- Ottawa

Work Order Number: 425827

This report has been approved by:

Brad Halvorson, B.Sc.
Laboratory Director

7 Margaret Street, Garson, ON, P3L 1E1
Phone: (705) 693-1121 Fax: (705) 693-1124 Web: www.testmark.ca

CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd.- Ottawa

Work Order Number: 425827

WORK ORDER RESULTS

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

Acid Extractable Organics	Result	MDL	Units	Criteria: ODWS
2,3,4,6-Tetrachlorophenol	<0.3	0.3	ug/L	100
2,4,6-Trichlorophenol	<0.2	0.2	ug/L	5
2,4-Dichlorophenol	<0.2	0.2	ug/L	900
Pentachlorophenol	<0.3	0.3	ug/L	60

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

Carbamate Pesticides	Result	MDL	Units	Criteria: ODWS
Carbaryl	<1	1	ug/L	90
Carbofuran	<2	2	ug/L	90
Diuron	<6	6	ug/L	150

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

OP Pesticides	Result	MDL	Units	Criteria: ODWS
Alachlor	<0.231	0.231	ug/L	5
Atrazine	<0.231	0.231	ug/L	~
Azinphos-methyl (Guthion)	<0.173	0.173	ug/L	20

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CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd.- Ottawa

Work Order Number: 425827

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

OP Pesticides	Result	MDL	Units	Criteria: ODWS
Chlorpyriphos (Dursban)	<0.173	0.173	ug/L	90
Desethyl atrazine	<0.289	0.289	ug/L	~
Diazinon	<0.173	0.173	ug/L	20
Dimethoate	<0.173	0.173	ug/L	20
Malathion	<0.173	0.173	ug/L	190
Metolachlor	<0.116	0.116	ug/L	50
Metribuzin (Sencor)	<0.116	0.116	ug/L	80
Phorate	<0.116	0.116	ug/L	2
Prometryne	<0.0578	0.0578	ug/L	1
Simazine	<0.173	0.173	ug/L	10
Terbufos	<0.116	0.116	ug/L	1
Triallate	<0.116	0.116	ug/L	230
Trifluralin	<0.116	0.116	ug/L	45

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

PAH	Result	MDL	Units	Criteria: ODWS
Benzo(a)pyrene	<0.01	0.01	ug/L	0.01

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CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd.- Ottawa

Work Order Number: 425827

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

PCBs	Result	MDL	Units	Criteria: ODWS
Decachlorobiphenyl (Surr.)	136	N/A	% Rec	~
Total PCBs	<0.06	0.06	ug/L	3

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

Pesticides	Result	MDL	Units	Criteria: ODWS
Diquat	<0.4	0.4	ug/L	70
Paraquat	<0.2	0.2	ug/L	10

Sample Description	TW21 - 1C - 72hr
Sample Date	3/18/2021 12:00 PM
Lab ID	1627333

Phenoxyacid Herbicides	Result	MDL	Units	Criteria: ODWS
2,4-D	<0.365	0.365	ug/L	100
Bromoxynil	<0.0972	0.0972	ug/L	5
Dicamba	<0.0851	0.0851	ug/L	120
Dichlorophenyl acetic acid (Surr.)	88.3	N/A	% Rec	~
Diclofop-methyl	<0.122	0.122	ug/L	9
MCPA	<6.08	6.08	ug/L	100
Picloram	<0.0851	0.0851	ug/L	190

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CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd.- Ottawa

Work Order Number: 425827

Sample Description	TW21 - 1C - 72hr			
Sample Date	3/18/2021 12:00 PM			
Lab ID	1627333			
Schedule 24 Organics	Result	MDL	Units	Criteria: ODWS
Atrazine + N-dealkylated metabolites (Calc.)	<0.5	0.5	ug/L	5

LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.

[rr]: After a parameter name indicates a re-run of that parameter. If multiple re-runs exist they are suffixed by a number. Sample may not have been handled according to the recommended temperature, hold time and head space requirements of the method after the initial analysis.

MDL: Method detection limit or minimum reporting limit.

% Rec: Surrogate compounds are added to the sample in some cases and the recovery is reported as a % recovered.

~: In a criteria column indicates the criteria is not applicable for the parameter row.

Quality Control: All associated Quality Control data is available on request.

Field Data: Reports containing Field Parameters represent data that has been collected and provided by the client. Testmark is not responsible for the validity of this data which may be used in subsequent calculations.

Sample Condition Deviations: A noted sample condition deviation may affect the validity of the result. Results apply to the sample(s) as received.

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APPENDIX H

Off-Site MECP Water Well Records

Ontario — Ministry of the Environment

Measurements recorded in: [X] Metric [ ] Imperial

Well Tag No. *(Place Sticker and/or Print Below)*: A165020

Tag #: A165020

Well Record

Regulation 903 Ontario Water Resources Act

Page _____ of _____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	[ ] Well Constructed by Well Owner
	1470424 Ontario Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
301 Moodie Dr. Suite 100	Nepean	Ontario	K2H 9C4	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
TW15-01 Shea Road	Goulbourn		

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434498	5006085		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Brown	Clay		Packed	0	3.35
Grey	Clay		Sticky	3.35	11.88
Grey	Limestone		Medium	11.88	29.86

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used *(Material and Type)*	Volume Placed (m^3/ft^3)
13.10	0	Grouted Cement & Bentonite	.42m^3

Method of Construction

[ ] Cable Tool [ ] Diamond
[X] Rotary (Conventional) [ ] Jetting
[ ] Rotary (Reverse) [ ] Driving
[ ] Boring [ ] Digging
[X] Air percussion
[ ] Other, *specify* _____

Well Use

[ ] Public [ ] Commercial [ ] Not used
[X] Domestic [ ] Municipal [ ] Dewatering
[ ] Livestock [X] Test Hole [ ] Monitoring
[ ] Irrigation [ ] Cooling & Air Conditioning
[ ] Industrial
[ ] Other, *specify* _____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
27.13	Open		0	13.10
15.86	Steel	.48	+.45	13.10

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

[X] Water Supply
[ ] Replacement Well
[ ] Test Hole
[ ] Recharge Well
[ ] Dewatering Well
[ ] Observation and/or Monitoring Hole
[ ] Alteration (Construction)
[ ] Abandoned, Insufficient Supply
[ ] Abandoned, Poor Water Quality
[ ] Abandoned, other, *specify*
[ ] Other, *specify*

Water Details

Water found at Depth	Kind of Water	
14.02 (m/ft) [ ] Gas	[ ] Fresh [X] Untested	[ ] Other, *specify*
29.25 (m/ft) [ ] Gas	[ ] Fresh [X] Untested	[ ] Other, *specify*
(m/ft) [ ] Gas	[ ] Fresh [ ] Untested	[ ] Other, *specify*

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	13.10	15.86
13.10	29.86	15.55

Results of Well Yield Testing

After test of well yield, water was:
[X] Clear and sand free
[ ] Other, *specify* _____

If pumping discontinued, give reason:

Pump intake set at (m/ft): 15.23

Pumping rate (l/min / GPM): 45.5

Duration of pumping: 6 hrs + 10 min

Final water level end of pumping (m/ft): 3.08

If flowing give rate (l/min / GPM):

Recommended pump depth (m/ft): 12.19

Recommended pump rate (l/min / GPM): 45.5

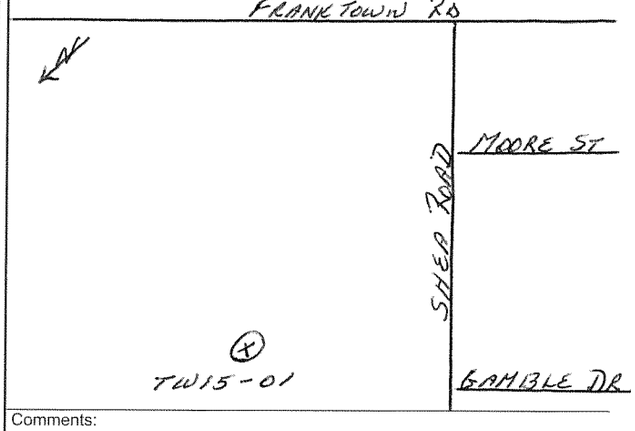
Well production (l/min / GPM):

Disinfected? [X] Yes [ ] No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	3.11		
1	3.16	1	3.08
2	3.14	2	3.08
3	3.14	3	3.08
4	3.13	4	3.08
5	3.14	5	3.08
10	3.13	10	3.08
15	3.13	15	3.08
20	3.13	20	3.08
25	3.13	25	3.05
30	3.13	30	
40	3.13	40	
50	3.12	50	
60	3.12	60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Capital Water Supply Ltd.	1558

Business Address (Street Number/Name)	Municipality
Box 490	Stittsville

Province	Postal Code	Business E-mail Address
Ontario	K2S1A6	office@capitalwater.ca

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
6138361766	Miller, Stephen

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
0097		2015091 5

Well owner's information package delivered	Date Package Delivered	Date Work Completed
[X] Yes [ ] No	2015091 1	2015081 8

Ministry Use Only

Audit No: Z 188470

Received DEC 16 2015

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Ministry's Copy

Ontario — Ministry of the Environment

Measurements recorded in: [X] Metric [ ] Imperial

Well Tag No. *(Place Sticker and/or Print Below)*: A165021

Tag #: A165021

Well Record

Regulation 903 Ontario Water Resources Act

Page _____ of _____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	[ ] Well Constructed by Well Owner
	1470424 Ontario Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
301 Moodie Dr. Suite 100	Nepean	Ontario	K2H9C4	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
TW15-02 Shea Rd.	Goulbourn		

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434657	5005896		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Brown	Clay		Packed	0	3.04
Grey	Clay		Sticky	3.04	7.92
Grey	Gravel	Broken Rock	Wet	7.92	10.36
Grey	Limestone		Soft	10.36	24.38
Grey	Limestone		Badly Broken	24.38	31.39
Grey	Limestone		Medium	31.39	37.48

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
11.27	0	Grouted Cement & Bentonite	1.392m^3

Method of Construction

[ ] Cable Tool [ ] Diamond
[X] Rotary (Conventional) [ ] Jetting
[ ] Rotary (Reverse) [ ] Driving
[ ] Boring [ ] Digging
[X] Air percussion
[ ] Other, *specify*

Well Use

[ ] Public [ ] Commercial [ ] Not used
[X] Domestic [ ] Municipal [ ] Dewatering
[ ] Livestock [X] Test Hole [ ] Monitoring
[ ] Irrigation [ ] Cooling & Air Conditioning
[ ] Industrial
[ ] Other, *specify*

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
27.13	Open		0	11.27
15.86	Steel	.48	+.45	11.27

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

[X] Water Supply
[ ] Replacement Well
[ ] Test Hole
[ ] Recharge Well
[ ] Dewatering Well
[ ] Observation and/or Monitoring Hole
[ ] Alteration (Construction)
[ ] Abandoned, Insufficient Supply
[ ] Abandoned, Poor Water Quality
[ ] Abandoned, other, *specify*
[ ] Other, *specify*

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Other, specify
24.38	[ ]	[ ] Fresh [X] Untested	
33.52	[ ]	[ ] Fresh [X] Untested	
	[ ]	[ ] Fresh [ ] Untested	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	11.27	15.86
11.27	37.48	15.55

Results of Well Yield Testing

After test of well yield, water was:
[X] Clear and sand free
[ ] Other, *specify*

If pumping discontinued, give reason:

Pump intake set at (m/ft): 21.33

Pumping rate (l/min / GPM): 36.40

Duration of pumping: 6 hrs + 10 min

Final water level end of pumping (m/ft): 8.15

If flowing give rate (l/min / GPM):

Recommended pump depth (m/ft): 15.23

Recommended pump rate (l/min / GPM): 36.40

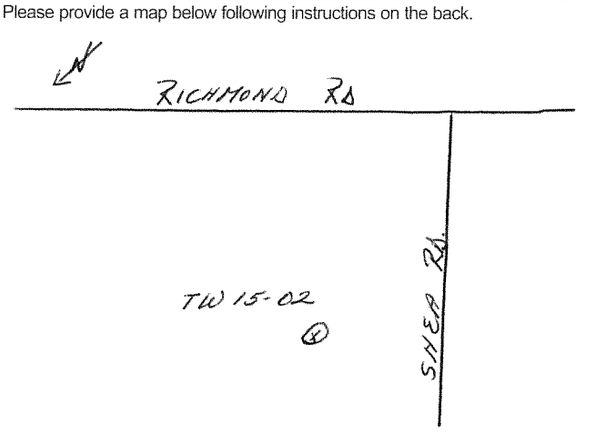
Well production (l/min / GPM):

Disinfected? [X] Yes [ ] No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	3.18		
1	5.26	1	6.55
2	5.68	2	5.43
3	6.23	3	4.50
4	6.53	4	4.00
5	6.80	5	3.57
10	7.23	10	3.16
15	7.71	15	3.15
20	7.97	20	3.15
25		25	3.15
30	8.00	30	3.15
40	8.02	40	3.15
50		50	3.15
60	8.15	60	3.15

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Capital Water Supply Ltd.	1558

Business Address (Street Number/Name)	Municipality
Box 490	Stittsville

Province	Postal Code	Business E-mail Address
Ontario	K2S1A6	office@capitalwater.ca

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
6138361766	Miller, Stephen

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
0097		20150915

Well owner's information package delivered	Date Package Delivered	Date Work Completed
[X] Yes [ ] No	20150910	20150819

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Audit No: Z188465

Received DEC 16 2015

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Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* N/A

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	1470424 Ontario Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
Suite 100-301 Moodie Drive	Ottawa	Ontario	K2H 9C4	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
3315 SHEA ROAD	Goulbourn	Pt Lot 26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa - Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434657	5005896	RP-4R27894	Parts 4, 5 & 7

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	6" Drilled well Abandonment			0'	123'
	* TW 15-02 *				

*WWR Attached - W/TAR A165021

*Capdel Water Supply - Aug 19/15

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
123'	3'	3/8 tblet plug	36 BAGS
3'	0'	Backfill	—

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☐ Other, specify ____

Well Use

☐ Public ☐ Commercial ☐ Not used ☐ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☐ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify ____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
			New Subdivision	
			Not Required/Placement	

Status of Well

☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☒ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ____ ☐ Other, specify ____

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
AIR ROCK DRILLING CO LTD	1119

Business Address (Street Number/Name)	Municipality
RR#1	Richmond

Province	Postal Code	Business E-mail Address
ONT	K0A 2Z0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
613 838 2170	DeSaulniers, Ken

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
1174		2018/04/30

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, specify ____

If pumping discontinued, give reason: ____

Pump intake set at (m/ft) ____

Pumping rate (l/min / GPM) ____

Duration of pumping ____ hrs + ____ min

Final water level end of pumping (m/ft) ____

If flowing give rate (l/min / GPM) ____

Recommended pump depth (m/ft) ____

Recommended pump rate (l/min / GPM) ____

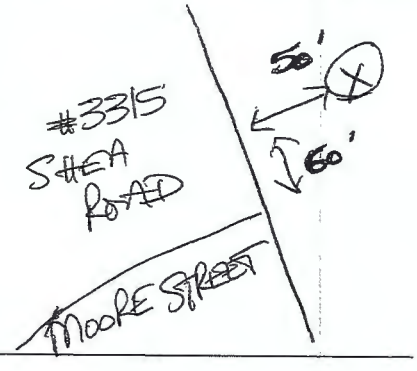
Well production (l/min / GPM) ____

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments: ____

Well owner's information package delivered: ☐ Yes ☒ No

Date Package Delivered: 2018/04/30

Date Work Completed: 2018/04/09

Ministry Use Only

Audit No. 2262405

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0506E (2014/11)

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Ontario — Ministry of the Environment

Measurements recorded in: [X] Metric [ ] Imperial

Well Tag No. (Place Sticker and/or Print Below): A165021

Tag #: A165021

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	[ ] Well Constructed by Well Owner
	1470424 Ontario Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
301 Moodie Dr. Suite 100	Nepean	Ontario	K2H9C4	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
TW15-02 Shea Rd.	Goulbourn		

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434657	5005896		

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Brown	Clay		Packed	0	3.04
Grey	Clay		Sticky	3.04	7.92
Grey	Gravel	Broken Rock	Wet	7.92	10.36
Grey	Limestone		Soft	10.36	24.38
Grey	Limestone		Badly Broken	24.38	31.39
Grey	Limestone		Medium	31.39	37.48

123'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
11.27	0	Grouted Cement & Bentonite	1.392m^3

Method of Construction

[ ] Cable Tool [ ] Diamond
[X] Rotary (Conventional) [ ] Jetting
[ ] Rotary (Reverse) [ ] Driving
[ ] Boring [ ] Digging
[X] Air percussion
[ ] Other, specify ____

Well Use

[ ] Public [ ] Commercial [ ] Not used
[X] Domestic [ ] Municipal [ ] Dewatering
[ ] Livestock [X] Test Hole [ ] Monitoring
[ ] Irrigation [ ] Cooling & Air Conditioning
[ ] Industrial
[ ] Other, specify ____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
27.13	Open		0	11.27
15.86	Steel	.48	+.45	11.27

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

[X] Water Supply
[ ] Replacement Well
[ ] Test Hole
[ ] Recharge Well
[ ] Dewatering Well
[ ] Observation and/or Monitoring Hole
[ ] Alteration (Construction)
[ ] Abandoned, Insufficient Supply
[ ] Abandoned, Poor Water Quality
[ ] Abandoned, other, specify
[ ] Other, specify

Water Details

Water found at Depth (m/ft)	Kind of Water	Gas	Other, specify
24.38	[ ] Fresh [X] Untested	[ ]	
33.52	[ ] Fresh [X] Untested	[ ]	
	[ ] Fresh [ ] Untested	[ ]	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	11.27	15.86
11.27	37.48	15.55

Results of Well Yield Testing

After test of well yield, water was:
[X] Clear and sand free
[ ] Other, specify ____

If pumping discontinued, give reason:

Pump intake set at (m/ft): 21.33

Pumping rate (l/min / GPM): 36.40

Duration of pumping: 6 hrs + 10 min

Final water level end of pumping (m/ft): 8.15

If flowing give rate (l/min / GPM):

Recommended pump depth (m/ft): 15.23

Recommended pump rate (l/min / GPM): 36.40

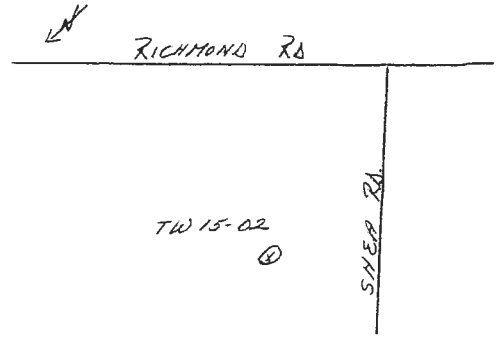
Well production (l/min / GPM):

Disinfected? [X] Yes [ ] No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	3.18			
1	5.26	1	6.55	
2	5.68	2	5.43	
3	6.23	3	4.50	
4	6.53	4	4.00	
5	6.80	5	3.57	
10	7.23	10	3.16	
15	7.71	15	3.15	
20	7.97	20	3.15	
25		25	3.15	
30	8.00	30	3.15	
40	8.02	40	3.15	
50		50	3.15	
60	8.15	60	3.15	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Capital Water Supply Ltd.	1558

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
Box 490	Stittsville	Ontario	K2S1A6	office@capitalwater.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
5138361766	Miller, Stephen	0097		2015091 5

Well owner's information package delivered	Date Package Delivered	Date Work Completed
[X] Yes [ ] No	2015091 0	2015081 9

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Audit No Z 188465

DEC 16 2015

Ontario — Ministry of the Environment

Measurements recorded in: [X] Metric [ ] Imperial

Well Tag No. *(Place Sticker and/or Print Below)*: A165022

Tag #: A165022

Well Record

Regulation 903 Ontario Water Resources Act

Page _____ of _____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	[ ] Well Constructed by Well Owner
	1470424 Ontario Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
301 Moodie Dr. Suite 100	Nepean	Ontario	K2H 9C4	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
TW15-03 Shea Road	Goulbourn		

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434675	5005878		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Brown	Clay		Packed	0	3.04
Grey	Clay		Sticky	3.04	7.92
Grey	Limestone		Medium Hard	7.92	10.66
Grey	Limestone		Badly Layered & Broken	10.66	28.95

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
9.44	0	Grouted Cement & Bentonite	.252m^3

Method of Construction

[ ] Cable Tool [ ] Diamond
[X] Rotary (Conventional) [ ] Jetting
[ ] Rotary (Reverse) [ ] Driving
[ ] Boring [ ] Digging
[X] Air percussion
[ ] Other, *specify*

Well Use

[ ] Public [ ] Commercial [ ] Not used
[X] Domestic [ ] Municipal [ ] Dewatering
[ ] Livestock [X] Test Hole [ ] Monitoring
[ ] Irrigation [ ] Cooling & Air Conditioning
[ ] Industrial
[ ] Other, *specify*

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
27.13	Open		0	9.44
15.86	Steel	.48	+.45	9.44

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

[X] Water Supply
[ ] Replacement Well
[ ] Test Hole
[ ] Recharge Well
[ ] Dewatering Well
[ ] Observation and/or Monitoring Hole
[ ] Alteration (Construction)
[ ] Abandoned, Insufficient Supply
[ ] Abandoned, Poor Water Quality
[ ] Abandoned, other, *specify*
[ ] Other, *specify*

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Other, specify
10.66	[ ]	[ ] Fresh [X] Untested	
28.95	[ ]	[ ] Fresh [X] Untested	
	[ ]	[ ] Fresh [ ] Untested	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	9.44	15.86
9.44	28.95	15.55

Results of Well Yield Testing

After test of well yield, water was:
[X] Clear and sand free
[ ] Other, *specify*

If pumping discontinued, give reason:

Pump intake set at (m/ft): 9.14

Pumping rate (l/min / GPM): 36.40

Duration of pumping: 6 hrs + _____ min

Final water level end of pumping (m/ft): 3.74

If flowing give rate (l/min / GPM):

Recommended pump depth (m/ft): 9.14

Recommended pump rate (l/min / GPM): 36.40

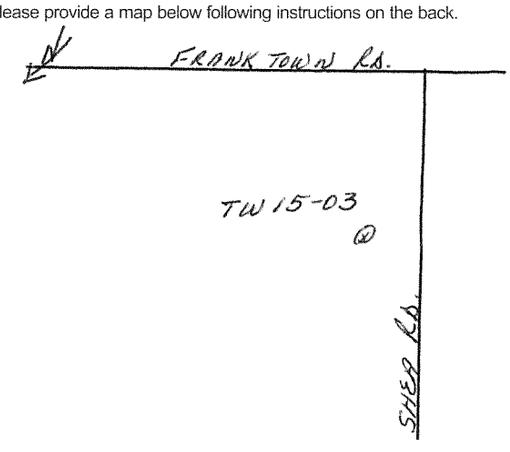
Well production (l/min / GPM):

Disinfected? [X] Yes [ ] No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		3.22		
1	1	4.54	1	3.24
2	2	3.91	2	3.22
3	3		3	3.22
4	4	3.71	4	3.22
5	5	3.71	5	3.22
10	10	3.71	10	3.22
15	15	3.72	15	3.22
20	20	3.72	20	3.22
25	25	3.73	25	3.22
30	30	3.74	30	3.22
40	40	3.74	40	3.22
50	50	3.74	50	3.22
60	60	3.75	60	3.22

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Capital Water Supply Ltd.	1558

Business Address (Street Number/Name)	Municipality
Box 490	Stittsville

Province	Postal Code	Business E-mail Address
Ontario	K2S1A6	office@capitalwater.ca

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
6138361766	Miller, Stephen

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
0097		2015091 5

Well owner's information package delivered	Date Package Delivered	Date Work Completed
[X] Yes [ ] No	20150910	20150820

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TW1

Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☒ Imperial

Well A105585 (Below)

Well Record

Regulation 903 Ontario Water Resources Act

Page ___ of ___

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Colonnade Management Inc		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
#200-16 Concourse Gate	Nepean	ON	K2E 7S8	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
(no civic) Shea Road	Goulbourn	P/L 26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Subject Number	Other
NAD 8 3	18	434846	5005870		

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Clay			0	24
	Gravel			24	27.6
Grey	Limestone			27.6	170
Grey & White	Sandstone	and	Limestone Mix	170	198
Grey & White	Sandstone	and	Limestone Mix	198	203

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³)
196	0	Bentonite slurry	197

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6"	Steel	188"	+2'	196'
5 1/16"	Open Hole		196'	203'

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Water Details

Water found at Depth (m/ft)	Kind of Water	Gas	Other, specify
198	☐ Fresh ☒ Untested	☐	
	☐ Fresh ☐ Untested	☐	
	☐ Fresh ☐ Untested	☐	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	196	6"
196	203	5 1/16"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 190

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 62

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft): 80'

Recommended pump rate (l/min / GPM): 20 GPM

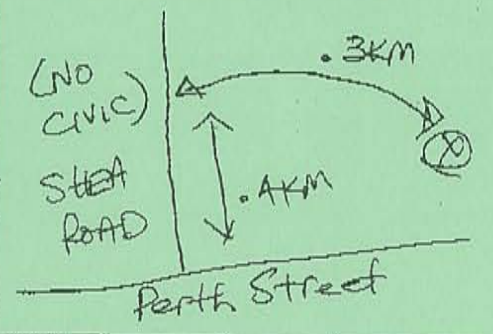
Well production (l/min / GPM): 20 GPM

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	51'		62'
1	61"	1	62"
2	62	2	5.1
3	62	3	5.1
4	62	4	5.1
5	62	5	5.1
10	62	10	5.1
15	62	15	5.1
20	62	20	5.1
25	62	25	5.1
30	62	30	5.1
40	62	40	5.1
50	62	50	5.1
60	62"	60	5.1

Map of Well Location

Please provide a map below following instructions on the back.



Comments: TEST WELL

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd	1149

Business Address (Street Number/Name)	Municipality
6659 Franktown Road, RR#1	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Graham, Ryan

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T3484		2011 01 31

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☒ Yes ☐ No	2011/01/31	Audit No. Z 119907
	Date Work Completed: 2010/12/23	Received

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Tag#: A144706 (Print Below) — A144706

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Colonnade Management Inc		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
#200-16 Concourse Gate	Nepean, Ont		K2E 7S8	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
#5873 STEA ROAD	GOULBOURN	P/L 26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa-Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	434846	5005839		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Amended Audit 2119907 - Dec 22/10.				
	CASING EXTENSION				
	AMEND CIVIC ADDRESS				
	TAG A105585 - LOST / AMEND. ADD TAG A144706				

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
-7	+2	Casing Extension	X

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☐ Other, *specify* ____

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify* ____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6"	Steel	.188	-7	+2

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☐ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☒ Other, *specify* EXTEND CASING

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water: ☐ Fresh ☐ Untested	Other, *specify*

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify* ____

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping ____ hrs + ____ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

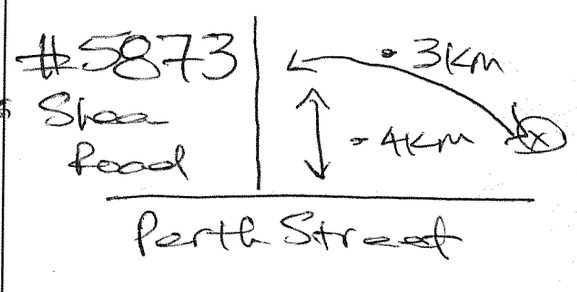
Well production (l/min / GPM)

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
TR Rock Drilling Co Ltd	1119

Business Address (Street Number/Name)	Municipality
RR#1	Richmond

Province	Postal Code	Business E-mail Address
ONT	K0A 2Z0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
613 838 2170	Kenny, Desaulniers

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
1714		2013/12/9

Well owner's information package delivered: ☐ Yes ☒ No

Date Package Delivered: ____

Date Work Completed: 2013/10/21

Ministry Use Only

Audit No. Z155272

DEC 13 2013

Ministry's Copy

Ontario — Ministry of the Environment

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*
Tag#: A138253

Well Record
Regulation 903 Ontario Water Resources Act

Page 1 of 3

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	COLONADE RETAIL OPPORTUNITY		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
16 CONCOURSE GATE SUITE 200	OTTAWA	ONT	K2E7S8	6132258118

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
5905 PERTH ST	GOULBOURN		4

County/District/Municipality	City/Town/Village	Province	Postal Code
OTTAWA	RICHMOND	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434806	5005583		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
BROWN	CLAY	STONES	DENSE	0	25.75
BROWN	LIMESTONE	OCCASIONAL LAYERS	OF GREY LIMESTONE	25.75	152
GREY	SANDSTONE			152	161

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³ / ~~cu ft~~) yd³
0	30	CEMENT GROUT	.543
0	34.5	BENTONITE	1.37
34.5	47	CEMENT GROUT	.145
47	53	BENTONITE SLURRY	.064

Method of Construction

☐ Cable Tool ☐ Diamond
☒ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, *specify* _____

Well Use

☐ Public ☒ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify* _____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
10 1/4	STEEL	.250	0 +.25	30
6 3/4	STEEL	.188	0 +3.75	53.75
10	OPEN HOLE		53.75	161

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☐ Other, *specify*

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water: ☒ Fresh ☐ Untested	Other, *specify*
151	☐		
	☐	☐ Fresh ☐ Untested	
	☐	☐ Fresh ☐ Untested	

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	30	14 3/4
30	161	10

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify* CLEARING

If pumping discontinued, give reason: _____

Pump intake set at (m/ft): 100

Pumping rate (l/min / GPM): 30

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 8.45

If flowing give rate (l/min / GPM): _____

Recommended pump depth (m/ft): 100

Recommended pump rate (l/min / GPM): 90

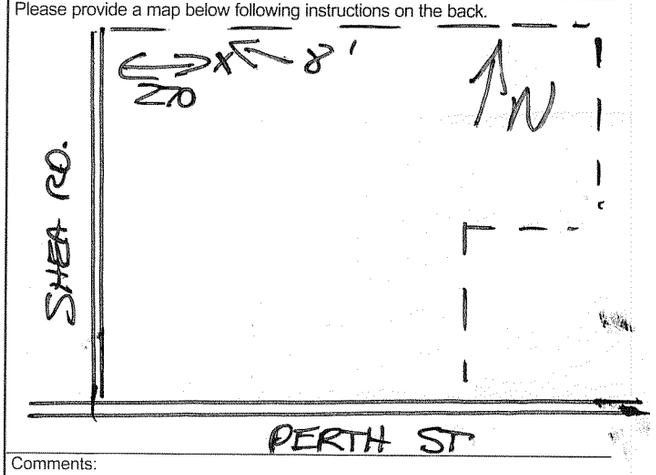
Well production (l/min / GPM): 100

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		8.24		
1	1	8.34	1	8.24
2	2	8.34	2	
3	3	8.36	3	
4	4	8.36	4	
5	5	8.36	5	
10	10	8.37	10	
15	15	8.38	15	
20	20	8.40	20	
25	25	8.41	25	
30	30	8.43	30	
40	40	8.44	40	
50	50	8.45	50	
60	60	8.45	60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
SAUNDERS WELL DRILLING LTD	4879

Business Address (Street Number/Name)	Municipality
RR#1	BRAESIDE

Province	Postal Code	Business E-mail Address
ONT.	K0A1G0	

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
6132298716	SAUNDERS TROY

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T5117		20130915

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	20130730	20130815

Ministry Use Only
Audit No. Z175248
Received OCT 10 2013

Ministry's Copy

Ontario — Ministry of the Environment, Conservation and Parks

Tag#:A274440

Measurements recorded in: ☐ Metric ☒ Imperial

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Cardel Homes Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
Suite 100-301 Moodie Drive	Ottawa	ON	K2H 9C4	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
3 Runnel Court	Goulbourn	P/L 26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	434671	5005994	4R-27894	S/L 40

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay			0	32
	Gravel			32	40
Grey	Limestone			40	91
Grey	Limestone			91	100

* PO 2801 904 000 96
* JOB 2801 904 00

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
46	36	Neat cement	9.38
36	0	Bentonite slurry	18.8

Method of Construction

☐ Cable Tool ☐ Diamond ☒ Air percussion ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used ☒ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☐ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2	46
5 7/8"	Open Hole		46	100

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

Water Details

Water found at Depth (m/ft)	☐ Gas	Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify
91		

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	46	9 3/4"
46	100	5 7/8"

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, specify Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 90

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 23.9

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 80'

Recommended pump rate (l/min / GPM): 20

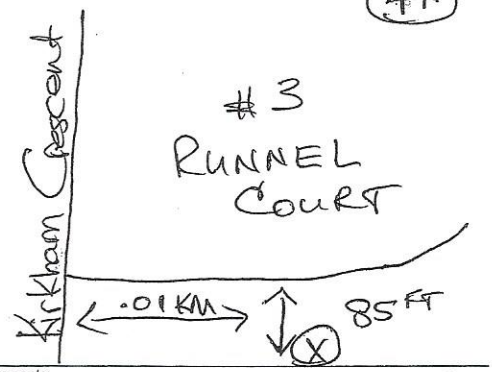
Well production (l/min / GPM): 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	14.6"		23.9"
1	20.2	1	14.6
2	21.7	2	14.6
3	22.4	3	14.6
4	22.6	4	14.6
5	22.8	5	14.6
10	23.3	10	14.6
15	23.4	15	14.6
20	23.5	20	14.6
25	23.6	25	14.6
30	23.7	30	14.6
40	23.8	40	14.6
50	23.8	50	14.6
60	23.9"	60	14.6"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1/2HP-10GPM Set@80 FT

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7881

Business Address (Street Number/Name)	Municipality
1659 Russell Road	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138882170	Purcell, Shannon

Well [redacted] Licence No.	Signature of Technician and/or Contractor	Date Submitted (Y Y Y Y M M D D)
T4033		2020 08 31

Well owner's information package delivered	Date Package Delivered (Y Y Y Y M M D D)	Ministry Use Only
☒ Yes ☐ No	2020 08 05	Audit No. Z337536
	Date Work Completed: 2020 08 04	Received

0506E (2018/12) Ministry's Copy

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Tag# A260995 (Print Below) — A260995

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name: | Last Name / Organization: Cardel Homes Inc | E-mail Address: | ☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name): Suite 100-301 Moodie Drive | Municipality: Ottawa | Province: ON | Postal Code: K2H9C4 | Telephone No. (inc. area code):

Well Location

Address of Well Location (Street Number/Name): 751 Kirkham Crescent | Township: Goulbourn | Lot: PR 26 | Concession: 4

County/District/Municipality: Ottawa Carleton | City/Town/Village: Richmond | Province: Ontario | Postal Code:

Unit Concession Zone | Easting | Northing | Multi-lot Plan and Subdivision Number: 4R-27964 | Other: SR 11

NAD 8 3 | 18 | 434734 | 4995843

Overburden and Bedrock Materials/Abandonment Sealing Record

General Colour	Most Common Material	Other Materials	General Description	Depth (ft) From	Depth (ft) To
	Clay			0	30
	Sand & Gravel			30	32
Grey	Limestone			32	102
Grey	Limestone			102	108
Grey	Limestone			108	115
Grey	Limestone			115	140

Po# 2801904400 31
Job# 2801904 40

Annular Space

Depth Set at (ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (ft³)
40'	30'	Neat cement	9.38
30'	0'	Bentonite slurry	21

Method of Construction

☐ Cable Tool ☐ Rotary (Conventional) ☐ Rotary (Reverse) ☐ Boring ☒ Air percussion ☐ Other, specify: SURGED ☐ Diamond ☐ Jetting ☐ Driving ☐ Digging

Well Use

☒ Domestic ☐ Public ☐ Commercial ☐ Not used ☐ Livestock ☐ Municipal ☐ Dewatering ☐ Irrigation ☐ Test Hole ☐ Monitoring ☐ Industrial ☐ Cooling & Air Conditioning ☐ Other, specify

Construction Record - Casing

Inside Diameter (inch)	Open hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (inch)	Depth (ft) From	Depth (ft) To
6 1/4"	Steel	188	+2'	40'
5 7/8"	Open Hole		40'	140'

Construction Record - Screen

Outside Diameter (inch)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (ft) From	Depth (ft) To

Status of Well

☒ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

Water Details

Water found at Depth (ft)	Kind of Water	Hole Diameter Depth (ft) From	Depth (ft) To	Diameter (inch)
100 (ft)	☐ Fresh ☒ Untested ☐ Gas ☐ Other, specify	0'	40'	9 3/4"
108 (ft)	☐ Fresh ☒ Untested ☐ Gas ☐ Other, specify	40'	140'	5 7/8"
112 (ft)	☐ Fresh ☒ Untested ☐ Gas ☐ Other, specify			

Well Contractor and Well Technician Information

Business Name of Well Contractor: Air Rock Drilling Co. Ltd | Well Contractor's License No: 8116

Business Address (Street Number/Name): 6692 Frankcom Road, RR#1 | Municipality: Richmond

Province: ON | Postal Code: K0A 2Z0 | Business E-mail Address: airrock@sympatico.ca

Bus. Telephone No. (inc. area code): (613)838-3702 | Name of Well Technician (Last Name, First Name): Purcell, Shannon

Well Technician's Licence No.: [redacted] | Signature of Technician and/or Contractor: | Date Submitted: 2018 12 21

Pump Rate

After test of well yield, water was: ☐ Clear and stayed free ☐ Other, specify: Mud Swirled

If pumping discontinued, give reason: ☒

Pump intake set at (ft): 120

Pumping rate (l/min / GPM): 12

Duration of pumping: 2 hrs + 0 min

Final water level end of pumping (ft): 26.2

If flowing give rate (l/min / GPM):

Recommended pump depth (ft): 100

Recommended pump rate (l/min / GPM): 12

Well production (l/min / GPM): 12

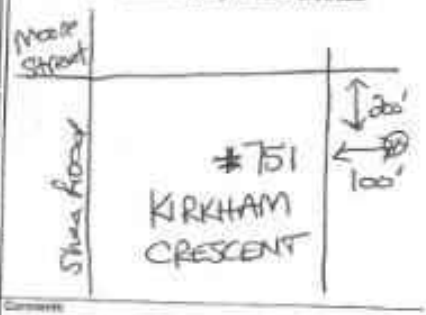
Disinfected? ☒ Yes ☐ No

Draw Down and Recovery

Time (min)	Draw Down Water Level (ft)	Time (min)	Recovery Water Level (ft)
Static Level	11'		26.2'
1	17.9	1	14.9
2	19.7	2	11
3	21.3	3	11
4	22.4	4	11
5	23.2	5	11
10	25.1	10	11
15	25.5	15	11
20	25.6	20	11
25	25.7	25	11
30	25.9	30	11
40	26.1	40	11
50	26.2	50	11
60	26.3	60	11

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1/2 HP 10 GPM SET AT 100 FEET

Well owner's information package delivered: ☒ Yes ☐ No

Date Package Delivered: 2018 12 20

Date Work Completed: 2018 12 19

Ministry Use Only — Audit No. Z302506

Ministry's Copy

Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: Metric / ~~Imperial~~

Tag#: A274380

A274380

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	Well Constructed by Well Owner
	Cardel Homes Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
Suite 100-301 Moodie Drive	Ottawa	ON	K2H 9C4	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
765 Kirkham Crescent	Goulbourn	P/L 26	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa-Carleton	Richmond	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Subdivision Number	Other
NAD 8 3	18	434799	5005843	4R-27894	S/L 51

Overburden and Bedrock Materials/Abandonment Sealing Record

General Colour	Most Common Material	Other Materials	General Description	Depth (ft) From	Depth (ft) To
	Clay	+ Gravel		0	28
Grey	Limestone			28	44
Grey	Limestone			44	67
Grey	Limestone			67	76
Grey	Limestone			76	82

Pork 7801 905 100 94

Job# 7801 905 10

Annular Space

Depth Set at (ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (ft³)
32'	22'	Neat cement	7.8
22'	0'	Bentonite slurry	16.5

Method of Construction

Cable Tool / Rotary (Conventional) / Rotary (Reverse) / Boring / Air percussion / Other, specify

Diamond / Jetting / Driving / Digging

Well Use

Domestic / Livestock / Irrigation / Industrial / Other, specify

Commercial / Municipal / Test Hole / Cooling & Air Conditioning

Not used / Dewatering / Monitoring

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fiberglass, Concrete, Plastic, Steel)	Wall Thickness (mm/in)	Depth (ft) From	Depth (ft) To
6¼"	Steel	.188"	+2'	32'
6⅛"	Open Hole		32'	82'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (ft) From	Depth (ft) To

Status of Well

Water Supply / Replacement Well / Test Hole / Recharge Well / Dewatering Well / Observation and/or Monitoring Hole / Alteration (Construction) / Abandoned, Insufficient Supply / Abandoned, Poor Water Quality / Abandoned, other, specify / Other, specify

Water Details

Water Found at Depth (ft)	Kind of Water	Depth (ft) From	Depth (ft) To	Diameter (inches)
44	Fresh / Salty / Gas / Other, specify	0'	32'	9¾"
67	Fresh / Salty / Gas / Other, specify	32'	82'	6⅛"
76	Fresh / Salty / Gas / Other, specify			

Hole Diameter

(See Depth (ft) From / To and Diameter (inches) above)

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's License No.
Air Rock Drilling Co. Ltd.	7661

Business Address (Street Number/Name)	City/Town	Province	Postal Code	Business E-mail Address
2008 Fransiscan Road	Richmond	ON	K0A 2Z0	arrock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6139982170	Purcell, Shannan

Well Technician's License No. T4038 — Signature of Technician and/or Contractor — Date 2020/10/31

Ministry's Copy

Results of Well Yield Testing

After test of well yield, water was: Clear and sand free / Other, specify: Not tested

If pumping discontinued, give reason: X

Pump intake set at (ft): 60

Pumping rate (l/min / GPM): 20

Duration of pumping: ___ hr + ___ min

Final water level end of pumping (ft): 12.3'

If flowing give rate (l/min / GPM):

Recommended pump depth (ft): 60'

Recommended pump rate (l/min / GPM): 20

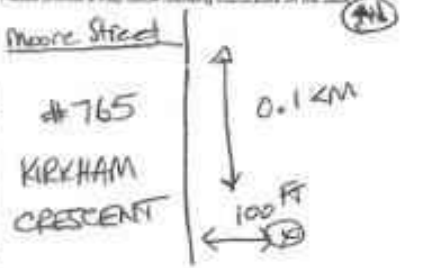
Well production (l/min / GPM): 20

Disinfected: Yes / No

Time (min)	Draw Down Water Level (mft)	Time (min)	Recovery Water Level (mft)
Static Level	12'3"		12.3'
1	12.3	1	12.2
2	12.3	2	12.2
3	12.3	3	12.2
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Map of Well Location

Please provide a map below following instructions on the back. (#1)



1/2 HP - 10 GPM SET @ 60 FT

Well owner's information package delivered: Yes / No

Date Package Delivered: 2020/03/05

Date Work Completed: 2020/03/03

Ministry Use Only

Audit No: Z316802

APPENDIX I

Water Quality Summary (Creekside 1)

Creekside 1 Domestic Well Water Quality

GEMTEC Consulting Engineers and Scientists Limited
PROJECT: 100443.001

Parameter	Units	MDL	TW15-1, TW15-2, TW15-3 Range	PW Range	PW1	PW2	PW3	PW4	PW5	PW6	PW7	PW8	PW9
Sample Date (m/d/y)			2015 Hydrog (Golder, 2017)	2021 Sampling	12/07/2020	12/08/2020	12/07/2020	12/07/2020	12/08/2020	12/08/2020	12/15/2020	12/15/2020	12/07/2020
Microbiological Parameters													
E. Coli	CFU/100 mL	1	ND(1)	ND (1) - 1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Fecal Coliforms	CFU/100 mL	1	-	ND (1) - 6	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Total Coliforms	CFU/100 mL	1	ND(1) - 2	ND (1) - 23	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Heterotrophic Plate Count	CFU/mL	10	-	ND(10) - >2000	ND (10)	40	10	30	50	30	20	ND (10)	ND (10)
General Inorganics													
Alkalinity, total	mg/L	5	226 - 268	237 - 279	250	238	243	262	249	243	258	256	246
Ammonia as N	mg/L	0.01	0.203 - 0.23	0.15 - 0.29	0.2	0.19	0.21	0.17	0.19	0.29	0.19	0.21	0.2
Dissolved Organic Carbon	mg/L	0.5	0.91 - 1.1	1.2 - 2.8	1.8	1.2	1.8	1.7	2	1.8	2	1.9	1.4
Colour	TCU	2	ND (2) - 6	2 - 14	9	4	13	5	ND (2)	2	2	4	6
Colour, apparent	ACU	2	-	3 - 57	21	11	20	9	3	5	4	7	18
Conductivity	uS/cm	5	839 - 967	675 - 1320	774	777	739	747	701	675	710	724	739
Hardness	mg/L		144 - 195	114 - 384	181	166	167	158	138	120	114	137	162
pH	pH Units	0.1	7.73 - 8.18	7.4 - 8.2	8	7.7	8.1	8	7.8	7.9	8.2	8.1	8.1
Phenolics	mg/L	0.001	ND (0.001) - ND(0.002)	ND(0.001) - 0.001	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)
Total Dissolved Solids	mg/L	10	545 - 629	260 - 670	394	380	406	370	372	364	298	344	372
Sulphide	mg/L	0.02	-	ND(0.02) - 0.03	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)
Tannin & Lignin	mg/L	0.1	ND(0.1) - 0.2	ND(0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Total Kjeldahl Nitrogen	mg/L	0.1	0.2 - 0.29	0.2 - 0.4	0.3	0.3	0.3	0.3	0.2	0.4	0.3	0.3	0.3
Turbidity	NTU	0.1	0.8 - 1.7	0.1 - 8.3	1.3	1	1.5	0.7	0.2	0.1	0.4	0.6	1
Organic Nitrogen (calculated)	mg/L	-	0 - 0.08	<0.10 - 0.2	0.1	0.1	0.1	0.1	<0.10	0.1	0.1	0.1	0.1
Anions													
Chloride	mg/L	1	104 - 118	49 - 122	79	80	73	54	62	58	49	55	65
Fluoride	mg/L	0.1	0.59 - 1.1	0.7 - 1.3	1.1	1.1	1.1	1.1	1.3	1.3	1.2	1.1	1.2
Nitrate as N	mg/L	0.1	ND(0.01)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Nitrite as N	mg/L	0.05	ND(0.08) - ND(0.1)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)
Sulphate	mg/L	1	40 - 61	23 - 64	37	45	34	31	29	25	31	34	36
Metals													
Calcium	mg/L	0.1	28 - 71	28.2 - 95.6	48.7	44	44.5	43	37.4	30.9	28.2	33.9	43.7
Iron	mg/L	0.1	0.13 - 0.22	0.1 - 0.6	0.2	0.2	0.3	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	0.1
Magnesium	mg/L	0.2	18 - 34	10.4 - 35.2	14.5	13.6	13.5	12.3	10.8	10.4	10.5	12.7	12.9
Manganese	mg/L	0.005	ND (0.01)	ND (0.005) - 0.021	0.009	0.008	0.008	0.008	0.008	ND (0.005)	0.005	0.006	0.011
Potassium	mg/L	0.1	6 - 7	4.8 - 6.5	5.9	5.3	6	5.5	4.8	5	5.4	6.1	5.4
Sodium	mg/L	0.2	88 - 123	62.4 - 115	95.8	100	93.5	93.1	98.3	99	107	102	93
Bromide	mg/L	0.1	-	0.1 - 0.4	0.4	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.3
Iodide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-

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Parameter	Units	MDL	TW15-1, TW15-2, TW15-3 Range	PW Range	PW10	PW11	PW13	PW17		PW21	PW22	PW23	PW24
Sample Date (m/d/y)			2015 Hydrog (Golder, 2017)	2021 Sampling	12/08/2020	12/07/2020	05/20/2021	12/07/2020	05/14/2021	07/14/2021	07/20/2021	07/20/2021	07/20/2021
Microbiological Parameters													
E. Coli	CFU/100 mL	1	ND(1)	ND (1) - 1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	1
Fecal Coliforms	CFU/100 mL	1	-	ND (1) - 6	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	6
Total Coliforms	CFU/100 mL	1	ND(1) - 2	ND (1) - 23	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	23
Heterotrophic Plate Count	CFU/mL	10	-	ND(10) - >2000	ND (10)	20	10	ND (10)	-	40	210	300	>2000
General Inorganics													
Alkalinity, total	mg/L	5	226 - 268	237 - 279	259	256	259	245	237	255	263	262	268
Ammonia as N	mg/L	0.01	0.203 - 0.23	0.15 - 0.29	0.18	0.29	0.23	0.15	0.2	0.23	0.18	0.02	0.19
Dissolved Organic Carbon	mg/L	0.5	0.91 - 1.1	1.2 - 2.8	1.6	2.4	2.2	2	ND (0.5)	1.6	2.9	2.2	2.6
Colour	TCU	2	ND (2) - 6	2 - 14	14	5	ND (2)	8	3	3	11	ND (2)	4
Colour, apparent	ACU	2	-	3 - 57	22	20	5	24	9	57	13	ND (2)	5
Conductivity	uS/cm	5	839 - 967	675 - 1320	751	683	947	900	947	802	830	837	1060
Hardness	mg/L		144 - 195	114 - 384	182	209	249	217	238	157	203	0.819 [1]	267
pH	pH Units	0.1	7.73 - 8.18	7.4 - 8.2	7.7	7.9	8	7.9	8	8.1	8.0	8.0	7.8
Phenolics	mg/L	0.001	ND (0.001) - ND(0.002)	ND(0.001) - 0.001	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.001	ND (0.001)	ND (0.001)	ND (0.001)
Total Dissolved Solids	mg/L	10	545 - 629	260 - 670	386	326	**504**	260	**504**	420	432	430	**518**
Sulphide	mg/L	0.02	-	ND(0.02) - 0.03	ND (0.02)	ND (0.02)	ND (0.02)	0.03	ND (0.02)	ND (0.02)	0.02	ND (0.02)	ND (0.02)
Tannin & Lignin	mg/L	0.1	ND(0.1) - 0.2	ND(0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Total Kjeldahl Nitrogen	mg/L	0.1	0.2 - 0.29	0.2 - 0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	ND (0.1)	0.2
Turbidity	NTU	0.1	0.8 - 1.7	0.1 - 8.3	2	1.6	0.5	2.4	0.8	8.3	0.3	0.2	0.9
Organic Nitrogen (calculated)	mg/L	-	0 - 0.08	<0.10 - 0.2	0.1	<0.10	0.1	0.2	<0.10	<0.10	<0.10	<0.10	<0.10
Anions													
Chloride	mg/L	1	104 - 118	49 - 122	70	58	105	114	122	72	74	74	129
Fluoride	mg/L	0.1	0.59 - 1.1	0.7 - 1.3	1.1	0.9	0.9	0.9	0.9	1.1	0.8	0.8	0.7
Nitrate as N	mg/L	0.1	ND(0.01)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Nitrite as N	mg/L	0.05	ND(0.08) - ND(0.1)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)
Sulphate	mg/L	1	40 - 61	23 - 64	34	23	42	49	47	34	34	34	49
Metals													
Calcium	mg/L	0.1	28 - 71	28.2 - 95.6	48.9	52.4	60.9	59.8	62	40.7	53.0	0.3	67.7
Iron	mg/L	0.1	0.13 - 0.22	0.1 - 0.6	0.3	0.3	ND (0.1)	0.3	0.1	0.6	0.2	ND (0.1)	0.1
Magnesium	mg/L	0.2	18 - 34	10.4 - 35.2	14.5	19	23.6	16.5	20.3	13.4	17.1	ND (0.2)	23.8
Manganese	mg/L	0.005	ND (0.01)	ND (0.005) - 0.021	0.008	0.007	0.01	0.009	0.009	0.009	0.010	ND (0.005)	0.013
Potassium	mg/L	0.1	6 - 7	4.8 - 6.5	5.1	5.6	6.5	5.7	5.9	5.6	6.2	0.3	5.9
Sodium	mg/L	0.2	88 - 123	62.4 - 115	91.5	62.4	113	102	115	97.8	109	175	119
Bromide	mg/L	0.1	-	0.1 - 0.4	0.2	0.1	0.2	0.3	0.4	0.3	0.2	0.2	0.3
Iodide	mg/L	-	-	-	-	-	ND (0.2)	-	ND (1.0)	-	-	-	-

Notes: 1. PW23 was collected post-water softener and possibly other treatment systems.

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Creekside 1 Domestic Wells - Impacted Water Quality

GEMTEC Consulting Engineers and Scientists Limited
PROJECT: 100443.001

Parameter	Units	MDL	PW12		PW14			PW15		PW16			PW18		PW19		
Sample Date (m/d/y)			01/04/2021	07/13/2021	12/07/2020	04/08/2021	07/20/2021	05/14/2021	07/14/2021	12/15/2020	04/08/2021	07/13/2021	05/20/2021	07/14/2021	12/07/2020	04/08/2021	07/13/2021
Microbiological Parameters																	
E. Coli	CFU/100 mL	1	ND (1)	-	ND (1)	-	-	ND (1)	-	ND (1)	-	-	ND (1)	-	ND (1)	-	-
Fecal Coliforms	CFU/100 mL	1	ND (1)	-	ND (1)	-	-	ND (1)	-	ND (1)	-	-	ND (1)	-	ND (1)	-	-
Total Coliforms	CFU/100 mL	1	ND (1)	-	ND (1)	-	-	ND (1)	-	ND (1)	-	-	ND (1)	-	ND (1)	-	-
Heterotrophic Plate Count	CFU/mL	10	10	-	10	-	-	-	-	90	-	-	950	-	ND (10)	-	-
General Inorganics																	
Alkalinity, total	mg/L	5	279	-	331	-	-	363	-	311	-	-	336	-	381	-	-
Ammonia as N	mg/L	0.01	0.23	-	0.20	-	-	0.16	-	0.05	-	-	0.25	-	0.26	-	-
Dissolved Organic Carbon	mg/L	0.5	2.8	-	1.5	-	-	ND (0.5)	-	1.8	-	-	2.4	-	2.2	-	-
Colour	TCU	2	2	-	6	162	-	7	-	3	30	-	2	-	35	-	-
Colour, apparent	ACU	2	3	-	32	21	-	8	-	4	<2	-	45	-	117	-	-
Conductivity	uS/cm	5	1320	-	2000	-	-	2150	-	1730	-	-	2620	-	3240	-	-
Hardness	mg/L		384	-	642	534	-	644	-	522	686	-	843	-	1100	1110	-
pH	pH Units	0.1	7.4	-	7.5	-	-	7.7	-	7.6	-	-	7.4	-	7.3	-	-
Phenolics	mg/L	0.001	ND (0.001)	-	ND (0.001)	-	-	ND (0.001)	-	ND (0.001)	-	-	ND (0.001)	-	ND (0.001)	-	-
Total Dissolved Solids	mg/L	10	670	-	1140	1340	-	1260	-	842	1220	-	1610	-	2030	2080	-
Sulphide	mg/L	0.02	ND (0.02)	-	ND (0.02)	-	-	ND (0.02)	-	ND (0.02)	-	-	ND (0.02)	-	ND (0.02)	-	-
Tannin & Lignin	mg/L	0.1	ND (0.1)	-	ND (0.1)	-	-	0.2	-	ND (0.1)	-	-	ND (0.1)	-	ND (0.1)	-	-
Total Kjeldahl Nitrogen	mg/L	0.1	0.4	-	0.4	-	-	0.2	-	0.2	-	-	0.4	-	0.4	-	-
Turbidity	NTU	0.1	0.4	-	2.5	34.4	-	1.2	-	ND (0.1)	-	-	11.7	-	15.2	9.7	-
Organic Nitrogen (calculated)	mg/L	-	0.17	-	0.2	-	-	0.04	-	0.15	-	-	0.15	-	0.14	-	-
Anions																	
Chloride	mg/L	1	223	112	**420**	**447**	224	**430**	194	**366**	**414**	182	**574**	103	**837**	**739**	173
Fluoride	mg/L	0.1	0.7	-	0.4	-	-	0.3	-	0.4	-	-	0.4	-	0.4	-	-
Nitrate as N	mg/L	0.1	ND (0.1)	-	ND (0.5)	-	-	ND (0.1)	-	0.1	-	-	ND (0.1)	-	ND (0.5)	-	-
Nitrite as N	mg/L	0.05	ND (0.05)	-	ND (0.05)	-	-	ND (0.05)	-	ND (0.05)	-	-	ND (0.05)	-	ND (0.05)	-	-
Sulphate	mg/L	1	64	-	119	-	-	119	-	107	-	-	140	-	198	-	-
Metals																	
Calcium	mg/L	0.1	95.6	-	151	125	-	151	-	54.1	158	-	189	-	243	261	-
Iron	mg/L	0.1	ND (0.1)	-	0.3	2	-	0.3	-	ND (0.1)	-	-	0.8	-	1.3	0.9	-
Magnesium	mg/L	0.2	35.2	-	64.4	53.9	-	64.6	-	94.0	70.7	-	89.9	-	119	112	-
Manganese	mg/L	0.005	0.021	-	0.037	-	-	0.046	-	0.035	-	-	0.060	-	0.076	-	-
Potassium	mg/L	0.1	6.2	-	6.8	-	-	4.7	-	8.8	-	-	8.1	-	8.0	-	-
Sodium	mg/L	0.2	103	111	148	139	124	178	109	133	172	125	193	99.1	**215**	**270**	125
Bromide	mg/L	0.1	0.2	-	0.1	-	-	ND (0.1)	-	0.1	-	-	0.2	-	0.3	-	-
Iodide	mg/L	-	-	-	-	-	-	ND (1.0)	-	-	-	-	ND (0.2)	-	-	-	-

Creekside 1 Test Wells - Water Quality

GEMTEC Consulting			Creekside Phase 1 (Golder, 2017)								
PROJECT: 100443.001			TW15-1 (A165020)			TW15-2 (A165021)			TW15-3 (A165022)		
Parameter	Units	MDL	TW15-1			TW15-2			TW15-3		
			A165020	A165020	A165020	A165021	A165021	A165021	A165022	A165022	A165022
Sample Date (m/d/y)			Sep 2015 Ptest 3 Hr	Sep 2015 Ptest 6 Hr	May-21	Sep 2015 Ptest 3 Hr	Sep 2015 Ptest 6 Hr	ABANDONED	Sep 2015 Ptest 3 Hr	Sep 2015 Ptest 6 Hr	May-21
Microbiological Parameters											
E. Coli	CFU/100 mL	1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	-	ND (1)	ND (1)	ND (1)
Fecal Coliforms	CFU/100 mL	1	-	-	ND (1)	-	-	-	-	-	ND (1)
Total Coliforms	CFU/100 mL	1	2	2	ND (1)	ND (1)	ND (1)	-	ND (1)	ND (1)	ND (1)
Heterotrophic Plate Count	CFU/mL	10	-	-	-	-	-	-	-	-	
General Inorganics											
Alkalinity, total	mg/L	5	229	226	260	244	251	-	265	268	359
Ammonia as N	mg/L	0.01	0.23	0.23	0.28	0.251	0.203	-	0.235	0.207	0.28
Dissolved Organic Carbon	mg/L	0.5	1.8	1.1	2.0	0.91	0.91	-	1.1	1	0.9
Colour	TCU	2	4	ND(2)	4	ND(2)	ND(2)	-	4	6	16
Colour, apparent	ACU	2	-	-	-	-	-	-	-	-	
Conductivity	uS/cm	5	839	839	782	887	879	-	975	967	1870
Hardness	mg/L		144	144	138	195	195	-	316	317	585
pH	pH Units	0.1	7.75	7.73	8.1	8.24	8.18	-	8.18	8.13	7.5
Phenolics	mg/L	0.001	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.002)	ND (0.002)	-	ND (0.002)	ND (0.002)	ND (0.001)
Total Dissolved Solids	mg/L	10	545	545	402	577	571	-	634	629	1110
Sulphide	mg/L	0.02	-	-	ND (0.02)	-	-	-	-	-	ND (0.02)
Tannin & Lignin	mg/L	0.1	ND (0.1)	ND (0.1)	ND (0.1)	6.4	0.1	-	0.2	0.2	ND (0.1)
Total Kjeldahl Nitrogen	mg/L	0.1	0.2	0.2	0.4	0.29	0.25	-	0.36	0.29	0.4
Turbidity	NTU	0.1	2.2	0.8	0.9			-	0.9	1.7	7.0
Organic Nitrogen (calculated)	mg/L	-	0	0	0.1	0.04	0.05	-	0.12	0.08	0.12
Anions											
Chloride	mg/L	1	102	104	76	108	105	-	122	118	382
Fluoride	mg/L	0.1	1.1	1.1	1.0	0.91	0.91	-	0.59	0.59	0.3
Nitrate as N	mg/L	0.1	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	-	ND (0.1)	ND (0.1)	ND (0.1)
Nitrite as N	mg/L	0.05	ND (0.08)	ND (0.08)	ND (0.05)	ND (0.08)	ND (0.08)	-	ND (0.1)	ND (0.1)	ND (0.05)
Sulphate	mg/L	1	40	40	30	45	45	-	63	61	102
Metals											
Calcium	mg/L	0.1	28	28	34.7	40	40	-	72	71	136
Iron	mg/L	0.1	0.27	0.13	0.1	0.19	0.16	-	0.22	0.22	0.6
Magnesium	mg/L	0.2	18	18	12.5	23	23	-	33	34	59.4
Manganese	mg/L	0.005	ND (0.01)	ND (0.01)	ND (0.005)	0.01	ND (0.01)	-	ND (0.01)	ND (0.01)	0.027
Potassium	mg/L	0.1	7	7	5.5	6	6	-	6	6	6.7
Sodium	mg/L	0.2	121	123	107	115	113	-	90	88	146

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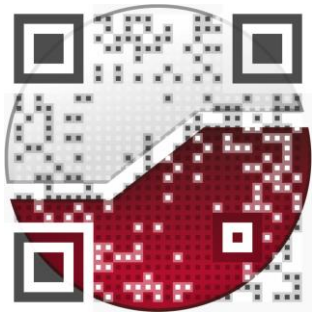

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité