

Resource Conservation Recovery Act Facility Investigation Work Plan Addendum No. 1

Former Willow Run Company Vehicle Operations Area
Ypsilanti, Michigan

Revitalizing Auto Communities Environmental Response Trust (RACER)

Based on my knowledge of the conditions of the property described in the remedial action plan and my inquiry of the person or persons who manage the system referenced in the operator's certification, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Grant Trigger
Michigan Cleanup Manager
Revitalizing Auto Communities
Environmental Response Trust

3-8-16

Date

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List of Acronyms

bgs	Below Ground Surface
cis-1,2-DCE	cis-1,2-dichlorethene
COCs	Constituents of Concern
CVO	Willow Run Company Vehicle Operations
CVOCs	Chlorinated Volatile Organic Compounds
DNAPL	Dense Non-Aqueous Phase Liquid
RCRA	Resource Conservation and Recovery Act
FID	Flame Ionization Detector
FAV	Final Acute Value
FMGs	Field Method Guidelines
GSI	Groundwater Surface Water Interface
HSA	Hollow Stem Augers
IMs	Interim Measures
IMWP	Interim Measures Work Plan
IRAs	Interim Response Actions
LNAPL	Light Non-Aqueous Phase Liquid
mg/L	milligrams per liter
MIP	Membrane Interface Probe
MS/MSD	Matrix Spike/Matrix Spike Duplicates
NRDW	Non-Residential Drinking Water
PAOC	Potential Areas of Concern
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
QAPP	Site Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RACER	Revitalizing Auto Communities Environmental Response Trust
RDW	Residential Drinking Water

RFI	Resource Conservation and Recovery Act Field Investigation
Site	Willow Run Company Vehicle Operations property, Ypsilanti, Michigan
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCE	Trichloroethylene
TCL	Target Compound List
VC	Vinyl Chloride
VOCs	Volatile Organic Compounds
XSD	Halogen-Specific Detector

1. Introduction

On behalf of Revitalizing Auto Communities Environmental Response Trust (RACER) , GHD has prepared this Resource Conservation Recovery Act (RCRA) facility investigation (RFI) Work Plan Addendum No. 1 (Work Plan) for the Willow Run Company Vehicle Operations (CVO) property located in Ypsilanti, Michigan (Site). Figure 1.1 presents the Site location.

This Work Plan is prepared to further investigate the chlorinated volatile organic compounds (CVOCs) at the Site to aid in providing identification, evaluation, and selection of effective remedial alternatives by defining or eliminating the potential for additional source areas. Specifically, this investigation will delineate groundwater impacts at the northern and southern property boundary and address the potential source areas identified during the membrane interface probe (MIP) investigation completed in late 2014.

2. Background

Historical filling practices at the Site have impacted soil and groundwater. Within the Site, there are several locations designated as Potential Areas of Concern (PAOCs). Many investigations have been completed at the Site over the years for source evaluation and to delineate impacts within groundwater and soils at various PAOCs. The shallow groundwater at the Site has been impacted with CVOCs. The main constituents of concern (COCs) at the Site are trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC).

Several Interim Response Actions (IRAs) and Interim Measures (IMs) have been completed at the Site between 2001 and 2014. Additional Site background information and the results of the investigations are provided in the Site Summary Report (CRA, January 2012) and the RFI Report (CRA, October 2013). Two areas, Area 1 (northeast of the Haulaway Building) and Area 2 (PAOC 18 located along the southern bank of Tyler Pond), of higher contaminations were identified where chemical oxidation was used in a Groundwater IRA to reduce concentrations. Despite these IRAs, significant impacts remain within groundwater indicating further investigation is needed to fully understand the fate and transport mechanisms so additional remedial efforts can be considered.

Remediation activities were completed in 2013 and 2014 within PAOC 18 to reduce the concentrations of CVOCs in groundwater venting to Tyler Pond. Paint sludge was removed beneath the northern portion of the Haulaway in 2013 and 2014 to reduce soil gas and potential groundwater impacts but not to fully remediate the VOC impacts in the area.

Regular groundwater sampling events have been completed to monitor constituent concentrations at the Site over the past several years. A hydraulic divide exists across the central portion of the property, generally running parallel to Tyler Pond. Groundwater to the south/southwest of the divide flows to the south/southeast, while groundwater to the north/northeast of the divide flows towards Tyler pond. The groundwater contour map for the August 2015 event is presented on Figure 2.1.

2.1 Basis for Investigation

Groundwater data and previous investigations including the recently completed MIP investigation suggest that there are several data gaps that, if investigated, will aid in providing identification,

evaluation, and selection of effective remedial alternatives by defining or eliminating the potential for additional source areas.

Groundwater iso-contours were generated using data from the 2015 annual sampling event. Since only the property boundary locations and select monitoring wells were sampled as part of the 2015 annual sampling event, groundwater data from additional locations (collected over past years) were also used to interpolate and define the extent of contaminants at the Site. Groundwater iso-contours generated for VC, cis-1,2-DCE, and TCE are provided on Figures 2.2 through 2.4. An iso-contour for the sum of these constituents is presented on Figure 2.5. For contouring purposes estimated concentrations (reported as J) were assumed to be equivalent to their reported value whereas non-detect concentrations were assumed to be present at 50 percent of the reporting limit.

The iso-contour maps indicate that high levels of TCE are observed near the Haulaway Building whereas VC and cis-1,2-DCE impacts are present throughout the Site. The iso-contours further show that the chlorinated impacts are mainly observed in the western portion (west of the utility corridor) of the Site.

The MIP investigation (completed within the western portion of the Site) confirms the presence of chlorinated impacts through the west portion of the Site and identifies areas requiring further investigation. A memorandum summarizing the MIP results is presented in Appendix A.

Groundwater iso-contour maps along with the MIP investigation results highlight the following areas that require further investigation. Figure 2.6 presents locations of these areas.

- Northern property boundary
- Area between MW3 and southern property boundary
- Area northeast of MW-5
- Southeastern property boundary
- PAOC 18

2.1.1.1 Sitewide Data Gap Analysis

Northern Property Boundary: The groundwater data suggest that concentrations at the wells located at the top of the bank are significantly higher than the monitoring wells located at the bottom of the bank. In 2015, VC levels ranged between 1.7 to 15 mg/L at the top of the bank and from 0.00097 to 0.41 mg/L at the bottom of the bank.

The 2015 groundwater data shows that VC and cis-1,2-DCE exceed the residential drinking water (RDW), non-residential drinking water (NRDW), and the groundwater surface water interface (GSI) criteria at various locations along in the parking lot and at the top of the bank. Although levels of VC and cis-1,2-DCE exceed the RDW and NRDW criteria at two locations (GS-4 and GS-16) adjacent to the pond, an exceedance of GSI criteria was only observed at GS-16 during the 2015 groundwater monitoring event. No exceedances are observed at GS-3. In addition, concentrations at the bottom of the bank do not exceed the final acute value (FAV).

This is the typical trend of substantially decreasing groundwater concentrations that is observed between the top and the bottom of the bank over the past years. An investigation is required to evaluate the movement of contaminants from the top to the bottom of the bank.

In addition, elevated flame ionization detector (FID), photoionization detector (PID), and/or halogen specific detector (XSD) readings were observed along the northern edge of the MIP investigation area by the MIP equipment. Groundwater data and MIP results indicate that the delineation of potential impacts to Tyler Pond is incomplete and therefore further investigation is required to fully understand soil stratigraphy, hydrogeologic, and biological conditions to select the appropriate remedial measures within the area.

Area between MW3 and Southern Property Boundary: The elevated FID, XSD, and PID results in the northeast investigation area suggest a potential additional source area east of MW3. Based on the groundwater data and the MIP investigation, an unidentified hot spot is identified near MW19-07. High levels of VC have also been observed in groundwater at MW19-07 over the past years. High levels of CVOCs were also observed in a borehole water sample collected at SB19-30 (located near MW19-07) during the preferential pathway investigation completed in spring 2006. A copy of the preferential pathway investigation memorandum completed in 2006 and 2007 is provided in Appendix B. Further evaluation is required to address these impacts.

Area northeast of MW-5 and the Southern Property Boundary: The groundwater data further indicates that concentrations along the southern property boundary are highest between monitoring wells MW19-02 and MW19-24, while concentrations east and west of these locations decrease substantially. Low to no detectable levels of CVOCs are observed at wells located east of MW19-02. The preferential pathway investigations completed in 2006 and 2007 identified impacts between MW19-24 and north towards MW5.

Further delineation is required to assess whether impacted groundwater extends northeast and across groundwater divide. An investigation is also required to confirm that groundwater impacts do not extend in the southeastern portion of the Site.

2.1.2 PAOC 18 Post Remediation Activities

Excavation and disposal of impacted soils within PAOC 18 was completed between the fall of 2013 and summer of 2014 as part of the interim measure activities. Two monitoring wells upgradient of PAOC 18 are proposed to replace monitoring points that were removed during the excavation. These will aid in evaluating groundwater north of the groundwater divide.

2.1.3 Stormwater/Outfall Sampling

Storm water runoff from paved areas and building roofs are collected by a storm water sewer system that flows into Tyler Pond through a series of outfalls. Outfall 11 drains the CVO parking lot west of the catwalks and part of the adjacent Willow Run Business Center (WRBC) property. Outfall 12 was abandoned during the construction of the PAOC 18 sheet pile wall in 2004. The sewer that previously connected the east and west sides of the Site was removed in 2013 during the PAOC 18 IM activities. Storm water from the eastern portion of the property discharges to Tyler Pond through Outfalls 13 and 14.

Storm water samples from the utfalls are required to assess infiltration of impacted groundwater through the storm sewer network and to determine the current conditions of the discharge water flowing into Tyler Pond.

The scope of work for each of the investigative areas is provided in Section 3.0.

3. Investigation Program

Detailed stratigraphy logs will be completed for each borehole and monitoring well installed. Permanent monitoring wells will be installed using 4-1/4 inch inside diameter hollow stem augers (HSA). Soil borings will be completed using a GeoProbe direct push rig.

Soil borings will be completed at least six inches into the confining clay layer unless otherwise stated which is encountered at approximately 16 feet below ground surface (bgs) at the Site (not including on the bank of Tyler Pond). Monitoring wells will be installed such that the bottom of the screen is sunken into the clay and the top of the screen is above the water table. Ten foot screens have traditionally been used at this Site to monitor both the confining clay surface for dense non-aqueous phase liquid (DNAPL) and the water table surface for light non-aqueous phase liquid (LNAPL) that are related to historical filling activities.

Soil samples will be collected if significant odor, staining, or elevated PID readings are observed. Soil samples will be analyzed for target compound list (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), Site target analyte list (TAL) metals, and polychlorinated biphenyls (PCBs). Groundwater samples will be collected from monitoring wells for TCL VOCs. Borehole water samples from soil borings will be collected through a GeoProbe screen point using a peristaltic pump for TCL VOCs analysis. The screen will be set at the mid-point of the saturated zone to collect pore water samples and field parameters will be collected as specified in the Site-specific Field Method Guidelines (FMG). Applicable Site-specific FMGs are provided in Appendix A of the RFI Work Plan (CRA, November 2011).

Field related activities (borings, well development, groundwater sampling, etc.) will be conducted following the FMG.

The investigative program described in this Work Plan consists of the following three phases:

- Sitewide Data Gap Analysis – to Investigate the groundwater concentrations trend observed at the northern portion of the Site, evaluate source area identified during the MIP investigation, and to delineate groundwater impacts observed at the southern property boundary
- PAOC 18 Post Remediation Activities
- Storm Sewer Discharge Evaluation

All proposed soil borings and monitoring well locations are presented on Figure 3.1. Tables 3.1, 3.2, and 3.3 summarize the sampling programs for this scope of work. The following subsections present an overview of the three phases.

3.1 Sitewide Data Gap Analysis

3.1.1 Northern Property Boundary

A two-staged investigation is proposed to define the extent of chlorinated impacts within the northern property boundary. Stage I investigation will be completed within the northern portion of the parking lot to determine the existing conditions and evaluate the movement of contaminants from the parking lot to the bottom of the bank. Following review of the hydrogeological information gathered from this investigation and previous work completed on Site, a Stage II investigation will be conducted. The Stage II investigation will be completed on the bank (between the top and

bottom of the bank) to evaluate the concentration gradient between existing monitoring points and to further evaluate the GSI pathway.

A total of six monitoring wells (MW19-45 through MW19-50 and MW19-52) will be completed to define the extent of chlorinated impacts and to assess physical and biological conditions of the area for evaluating potential remedial options.

As stated above, soil samples will be collected based on field observations. In addition, soil samples will also be collected at select locations at intervals (presented in Table 3.1) where highest MIP impacts were observed within the area. Geotechnical samples will be collected to determine physical properties of the soils within the area. Groundwater samples will be collected from new locations and existing locations within the vicinity. Biological conditions will be assessed by monitoring the natural attenuation parameters within groundwater. This information will be used to evaluate current conditions of the area that will aid in the evaluation and selection of remedial options.

3.1.2 Source Evaluation Based on MIP Impacts

An investigation is proposed between MW3 and the southern property boundary area to provide additional information for the unidentified sources for hotspots identified during the MIP investigation. A total of two soil borings (SB19-114 and SB19-115) and three monitoring wells (MW19-51 through MW19-53) as shown on Figure 3.1 are proposed to investigate the chlorinated impacts.

In addition, a 2-inch monitoring well (MW19-54) is proposed to confirm the elevated CVOCs observed at SB19-30 during the preferential pathway investigation completed in spring 2006.

3.1.3 Southern Property Boundary

Two transects will be completed to evaluate groundwater impacts east of the utility corridor. Transect 1, shown on Figure 3.1, will be completed northeast of MW5 to evaluate migration of contaminated groundwater. Borehole water and groundwater samples will be collected from two soil borings (SB19-116 and SB19-117) and a monitoring well (MW19-55), respectively to assess whether impacted groundwater extends northeast along the groundwater divide. It should be noted that MW19-56 is installed to monitor groundwater conditions upgradient of PAOC 18. Groundwater results from this location will also be used to evaluate the groundwater impacts to the northeast of groundwater divide.

Borehole water samples will be collected from soil borings through GeoProbe screen point using a peristaltic pump and will be analyzed for TCL VOCs. Groundwater samples will be collected from the two new wells and an existing well (MW-5).

Transect 2, shown on Figure 3.1, will be completed between MW19-03 through MW19-04 located southeastern property boundary to define the extent of chlorinated impacts in groundwater. Borehole water samples from four soil borings (SB19-118 through SB19-121) will be collected to confirm that no impacts extend to this portion of the Site. Additionally, groundwater samples will be collected from existing monitoring wells.

The results from this investigation will also be used to confirm that no impacted groundwater exist within the eastern portion (east of the utility corridor) of the Site. In addition, the investigation results

will be utilized to define the area requiring groundwater treatment or barrier methods for addressing groundwater impacts.

3.2 PAOC 18 Locations

Two new monitoring wells are proposed as a part of the post implementation/remedial evaluation for PAOC 18. These monitoring wells are upgradient of PAOC 18 and will be monitored for VOCs to determine the quality of groundwater before it enters PAOC 18.

The IMWP also called for evaluating groundwater conditions post excavation at locations near former GS-6 and GS-8 wells. Two GSI wells (GS-17 and GS-18) will be installed within PAOC 18 during the Stage II investigation activities described in Section 3.1.1.

3.3 Storm Sewer Discharge Sampling

It is suspected that the storm water from the outfalls is infiltrating groundwater conditions. The discharge from the three storm sewer outfalls (Outfall 11, 13, and 14) will be sampled during dry conditions to assess infiltration of impacted groundwater through the storm sewer network. Storm water samples will be submitted for TCL VOCs analysis.

4. Sampling Methodology

Field related activities including soil boring completion, monitoring well installation, sample collection, etc. will be conducted in accordance with Site-specific FMGs. Applicable Site-specific FMGs are provided in Appendix A of the RFI Work Plan (CRA, November 2011). Samples will be shipped to the laboratory under chain of custody procedures.

4.1 Sample Nomenclature

Each sample will be labeled with a unique sample number consistent with the Site-specific sample designation system.

Series-Project Number –Date-Initials-xxx

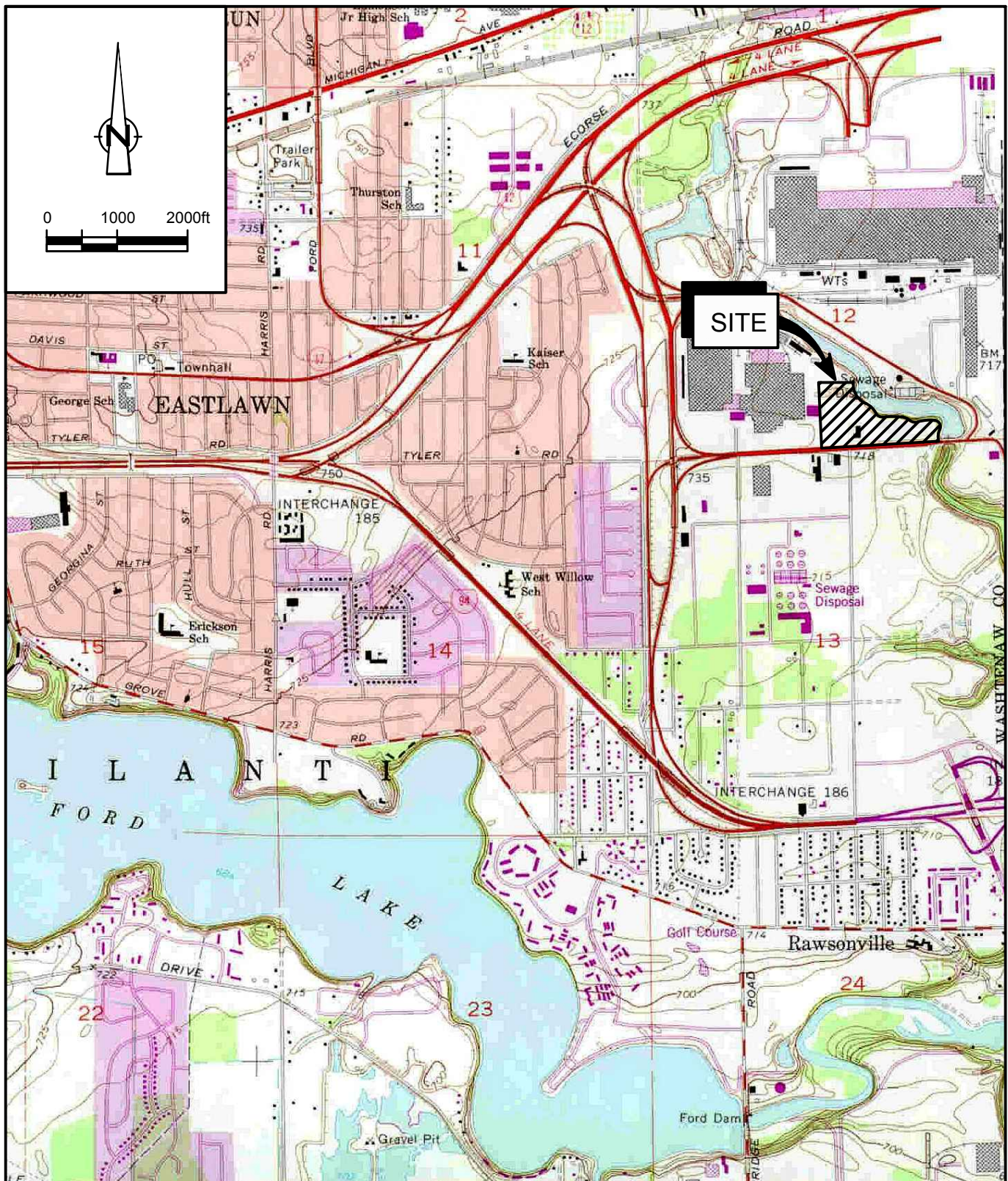
The series is a letter or letters that designates a group of samples (GW, groundwater; S, soil; N, non-aqueous phase liquid; RB, rinse equipment blank; WSS, water storm sewer). Initials refer to the sampler's initials. The xxx sample identification number will carry forward from previously collected samples at the Site.

4.2 Quality Assurance/Quality Control

Quality Assurance/Quality Control (QA/QC) field samples (duplicates and matrix spike/matrix spike duplicates [MS/MSD]) will be collected in accordance with in the Site Quality Assurance Project Plan (QAPP). The Site QAPP is provided in Appendix B of the RFI Work Plan (CRA, November 2011). Validation of analytical data will be performed by the GHD chemistry department as stated in the QAPP.

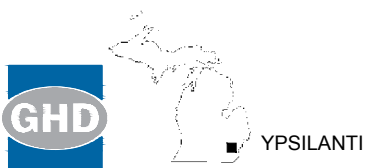
5. References

- CRA. November 2011 – Resource Conservation Recovery Act (RCRA) Field Investigation (RFI) Work Plan, Willow Run Company Vehicle Operations Area, Ypsilanti, Michigan.
- CRA. January 2012. Site Summary Report, Former General Motors Company Vehicle Operations Property, Ypsilanti, Michigan.
- CRA. October 2013. Resource Conservation Recovery Act (RCRA) Field Investigation (RFI) Report, Company Vehicle Operations (CVO) Ypsilanti, Michigan.
- CRA. February 2013. PAOC 18 Interim Measures Work Plan, Company Vehicle Operations (CVO), Ypsilanti, Michigan.



SOURCE USGS UADRANGLE MAP
YPSILANTI EAST, MICHIGAN

figure 1.1



SITE LOCATION
RFI WORK PLAN ADDENDUM
COMPANY VEHICLE OPERATIONS PROPERTY
Ypsilanti, Michigan

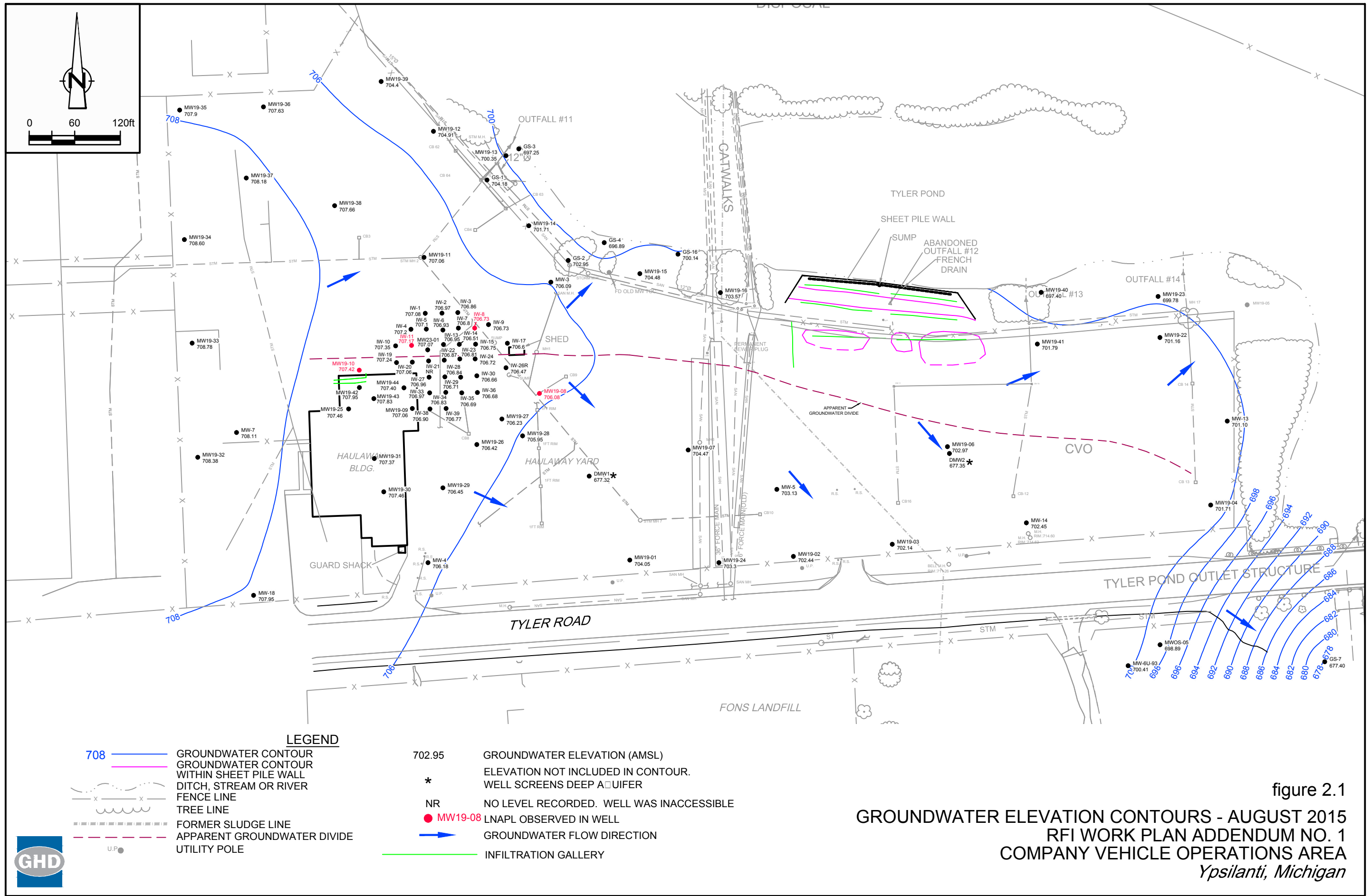
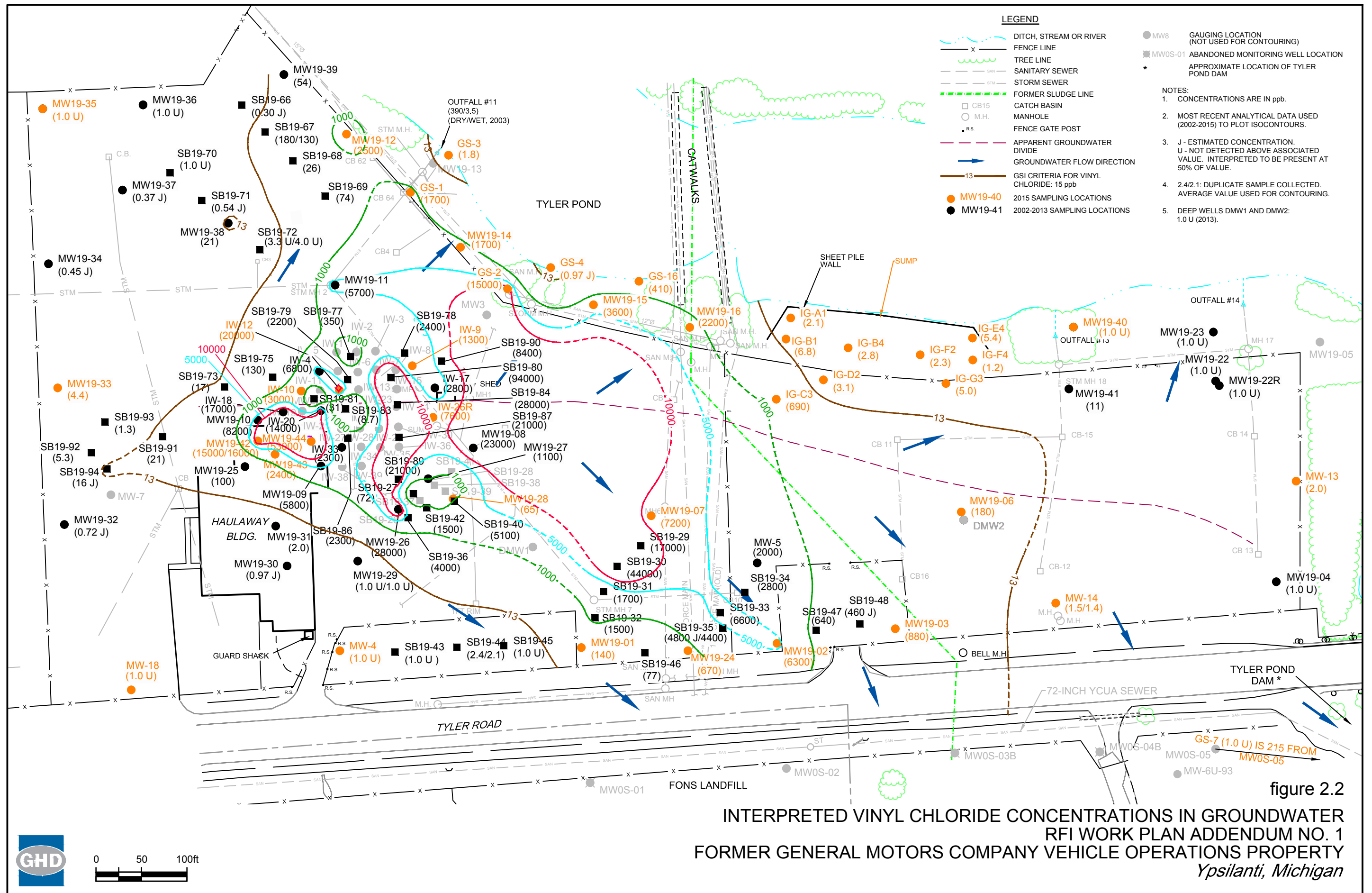
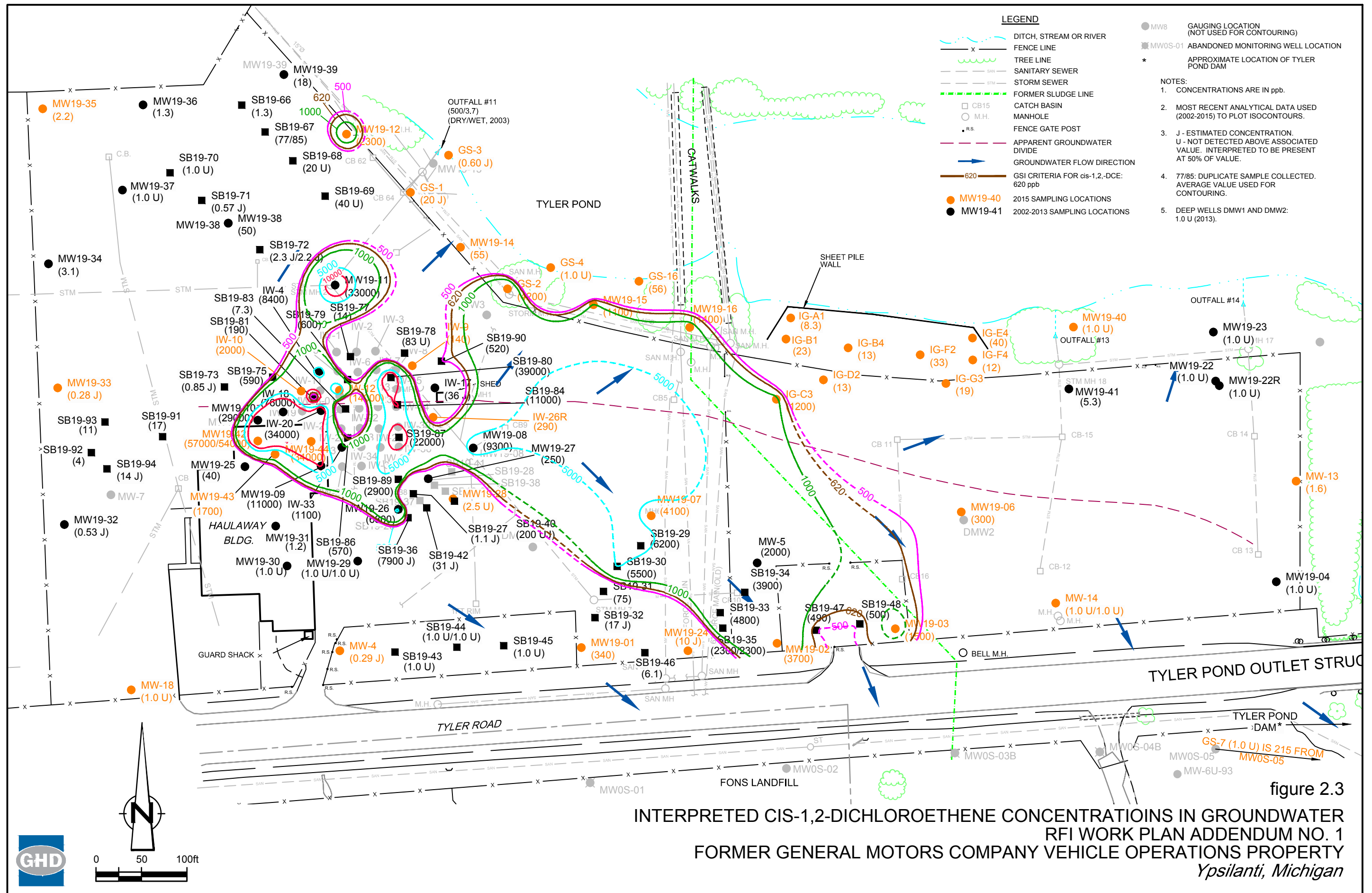
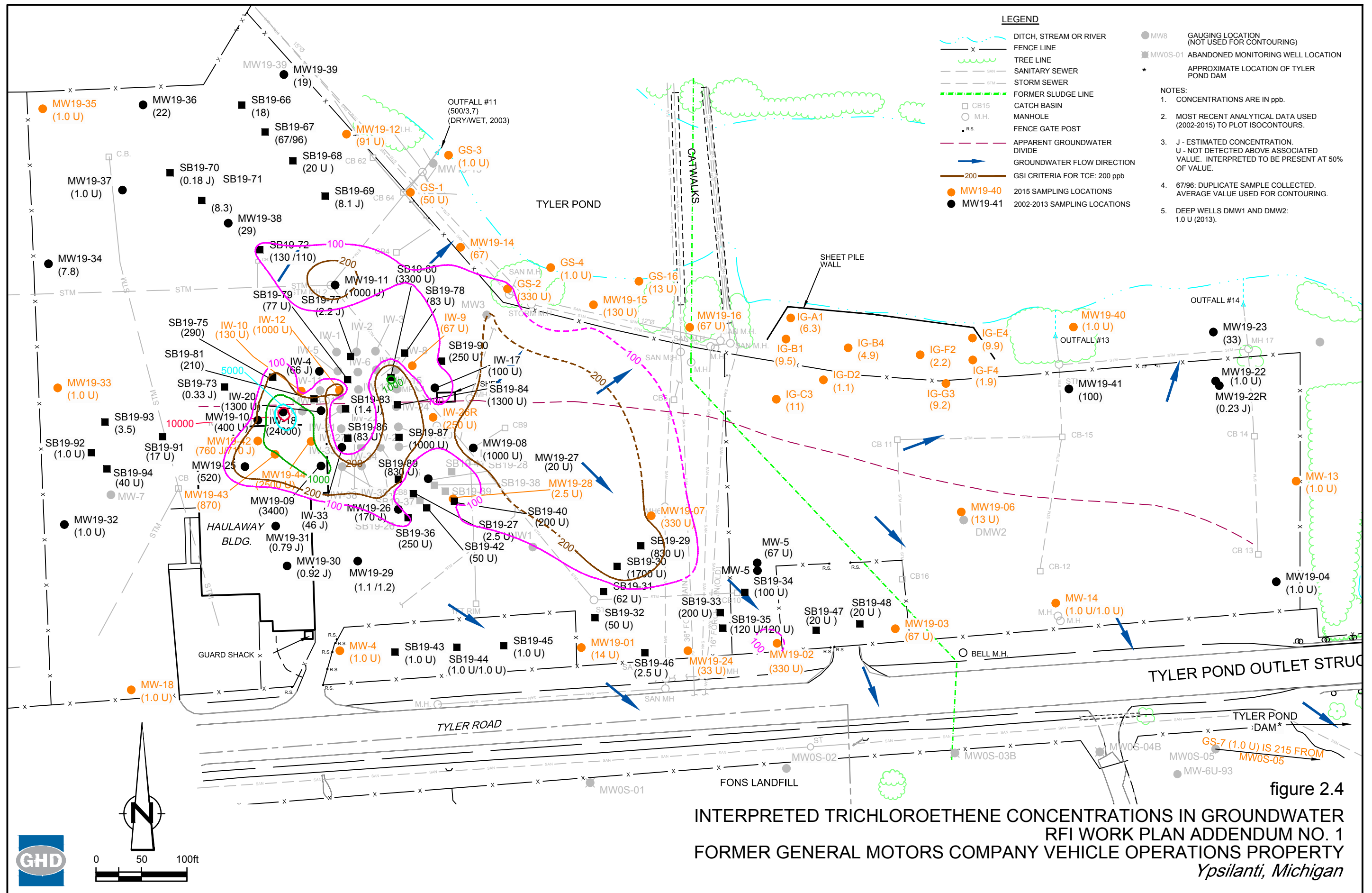
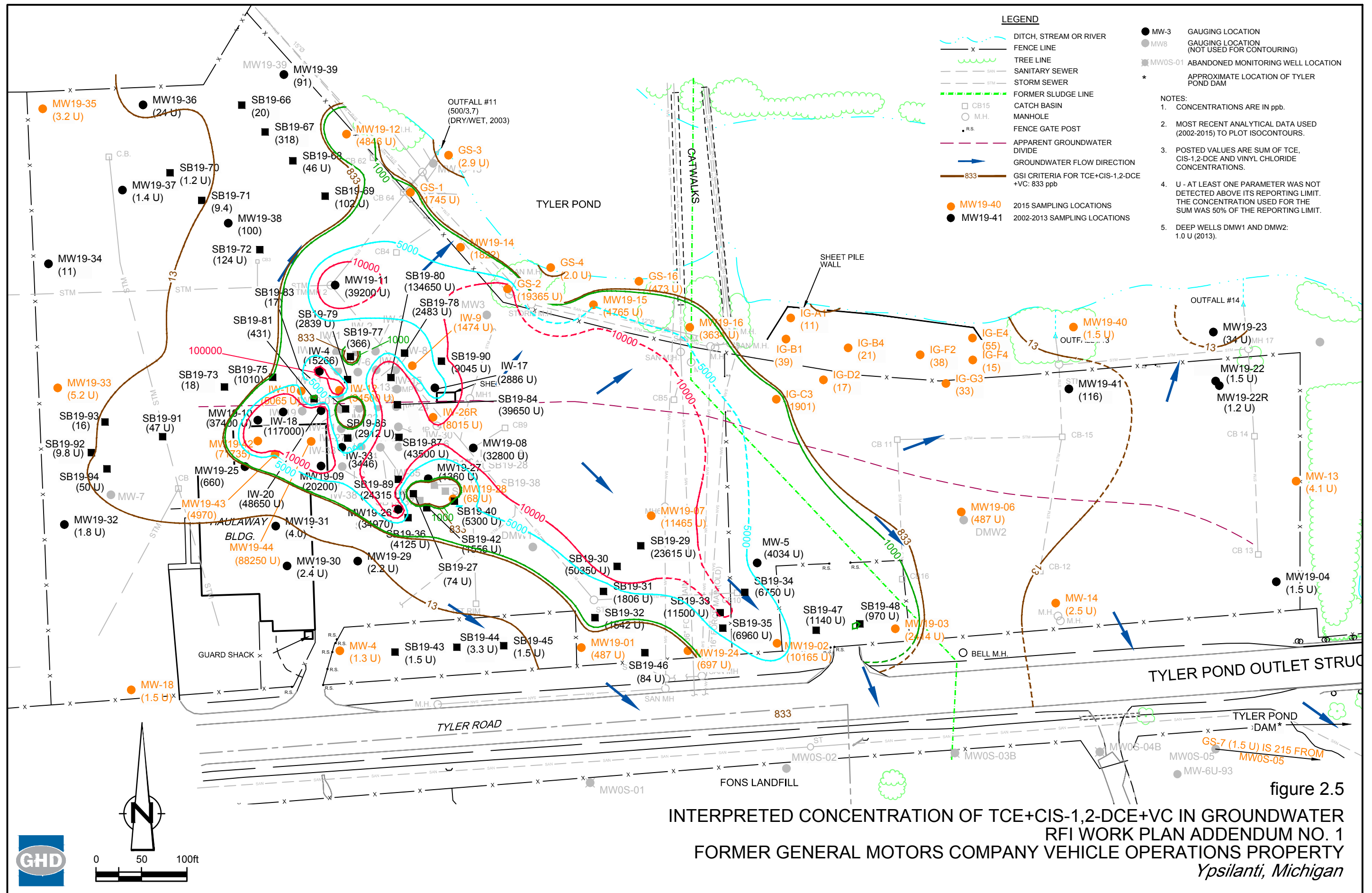


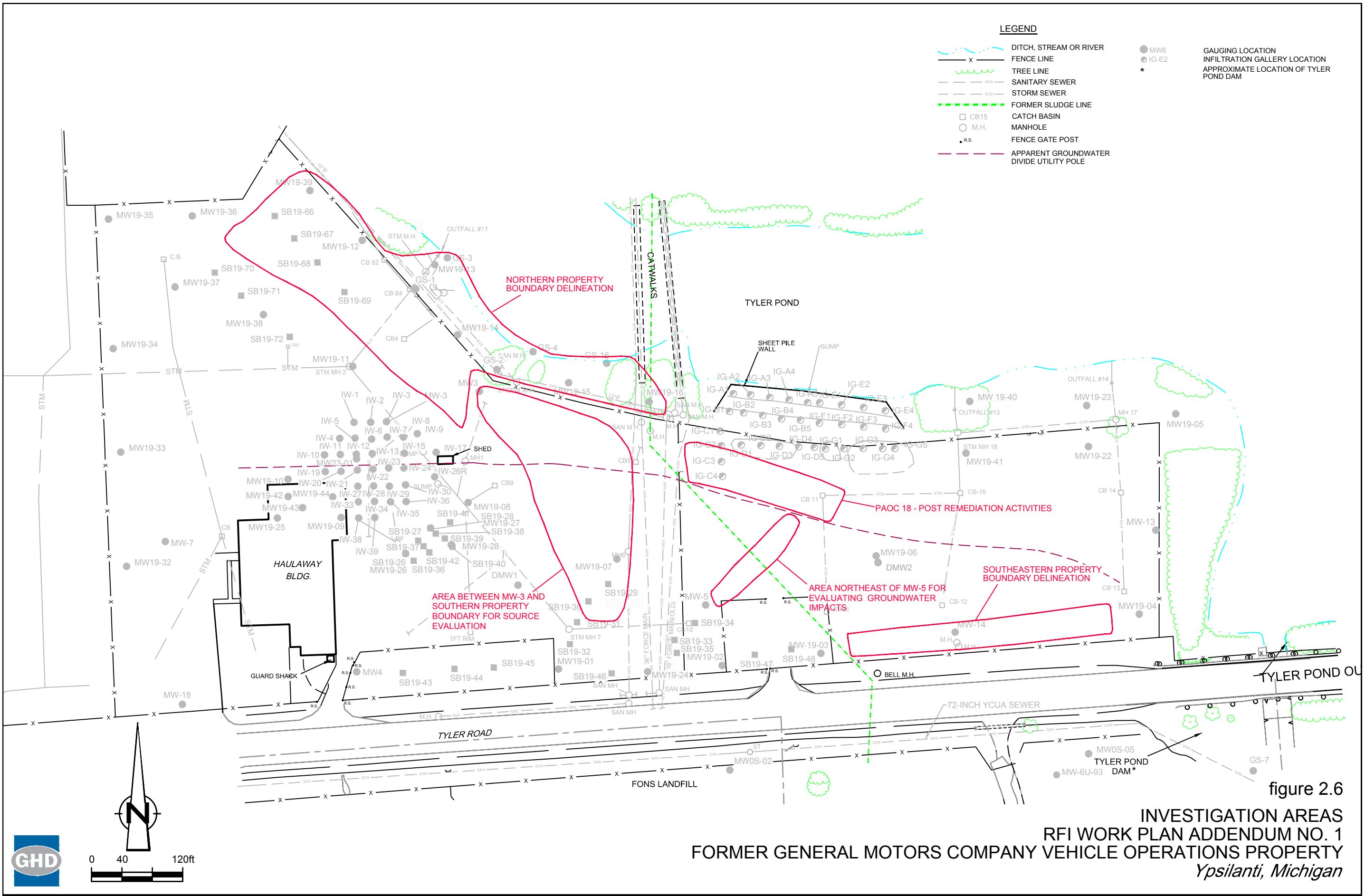
figure 2.1
GROUNDWATER ELEVATION CONTOURS - AUGUST 2015
 RFI WORK PLAN ADDENDUM NO. 1
 COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan











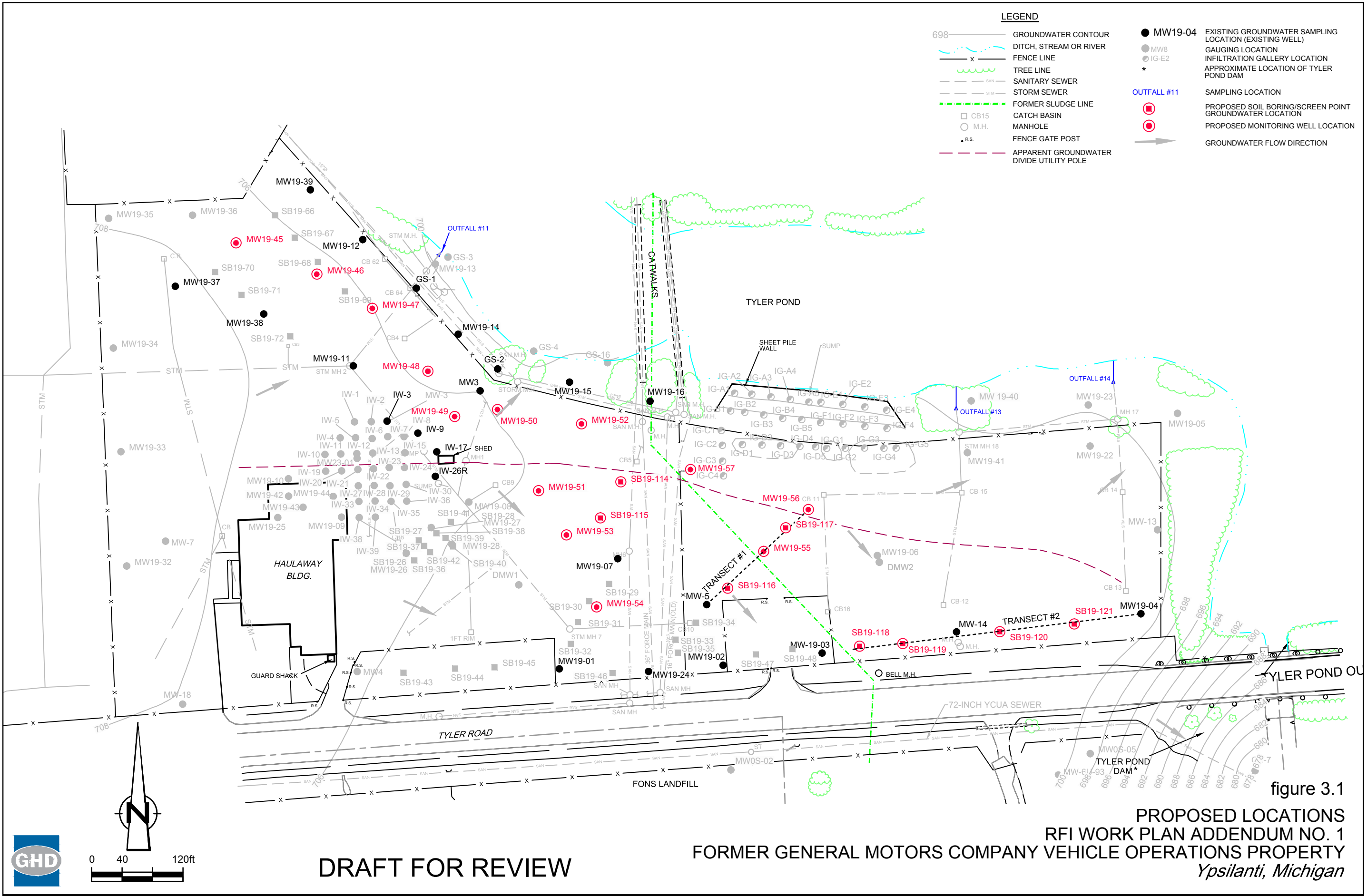


Table 3.1

Soil Sampling Program
RFI Work Plan Addendum No. 1
Willow Run Company Vehicule Operations Area
Ypsilanti, Michigan

Soil Boring/or Well ID ¹	Target Borehole Depth	Sample Type and Intervals (feet bgs)	Screen Interval	Sampling Reason
North/Northwestern Investigation				
MW19-45 through MW19-49	10' into clay	Environmental analysis / Field observations ² Geotechnical analysis ³	10-foot screen, advanced six inches into clay	Northern Boundary Investigation to delineate groundwater impacts and to obtain hydrogeologic information to evaluate the potential remedial options.
MW19-50	10' into clay	Environmental analysis / Field observations ² and 3-5 and 10-12 ft bgs (based on MIP impacts) Geotechnical analysis ³	10-foot screen, advanced six inches into clay	Northern Boundary Investigation to delineate groundwater impacts and to obtain hydrogeologic information to evaluate the potential remedial option.
Datagap Analysis near MW19-07				
MW19-51	6" into clay	Environmental analysis/Field observations ²	10-foot screen, advanced six inches into clay	Defining the extent of impact based on MIP results.
MW19-52	10' into clay	Environmental analysis / Field observations ² and 4-6 ft bgs (based on MIP impacts) Geotechnical analysis ³	10-foot screen, advanced six inches into clay	Defining the extent of impact based on MIP results. Location MW19-52 is also part of the Northern Boundary Investigation scope of work.
MW19-53	6" into clay	Environmental analysis/Field observations ²	10-foot screen, advanced six inches into clay	Area near MW19-07 - Defining the extent of impact based on MIP results.
MW19-54	6" into clay	Environmental analysis/Field observations ²	10-foot screen, advanced six inches into clay	Area near MW19-07 and Southern Property Boundary (West of utility corridor) -Confirmation of chlorinated impacts observed during 2006 investigation.
SB19-114 and SB19-115	6" into clay	Environmental analysis/Field observations ²	Halfway of saturated zone ⁴	Area near MW19-07 (West of utility corridor) - Evaluation of MIP results and groundwater impacts east of utility corridor.
Southern Property Boundary				
MW19-55	6" into clay	Environmental analysis/Field observations ²	10-foot screen, advanced six inches into clay	Southern Property Boundary (East of utility corridor) - Evaluating migration of contaminated groundwater in the southern property boundary i.e. assessing whether impacted groundwater extends northeast.
SB19-116 and SB19-117	6" into clay	Environmental analysis/Field observations ²	Halfway of saturated zone ⁴	Southern Property Boundary (East of utility corridor) - Evaluating migration of contaminated groundwater in the southern property boundary i.e. assessing whether impacted groundwater extends northeast.
SB19-118 through SB19-121	6" into clay	Environmental analysis/Field observations ²	Halfway of saturated zone ⁴	Southeastern Property Boundary - Defining the extent of chlorinated impacts in groundwater and confirming that impacts are not present in southeastern portion of the Site.
PAOC 18 - Post Remediation Activities				
MW19-56	6" into clay	Environmental analysis/Field observations ²	10-foot screen, advanced six inches into clay	PAOC 18 Post Remediation Evaluation - To determine the quality of groundwater before it enters PAOC 18. This location will also be used to assess groundwater impacts to northeast and across groundwater divide.
MW19-57	6" into clay	Environmental analysis/Field observations ²	10-foot screen, advanced six inches into clay	PAOC 18 Post Remediation Evaluation - To determine the quality of groundwater before it enters PAOC 18. This location will be used to assess groundwater impacts across groundwater divide.

Notes:

Groundwater samples will be collected to delineate soil impacts observed within the saturated zone.

¹ Monitoring wells will be 2-inch diameter PVC with maximum of 10-foot long screens

² Environmental samples will be collected if field observations indicate impacts (i.e. odors, staining, PID readings). Environmental analysis will include TCL VOCs, TCL SVOCs, Site TAL Metals, and total PCBs.

³ Physical properties will be analyzed for hydraulic conductivity, grain size analysis, bulk density, Fraction Organic carbon (or Total Organic Carbon) within the saturated zone.

⁴ Screen is required for the collection of porewater samples.

Table 3.2

**Groundwater Sampling Program
RFI Work Plan Addendum No. 1
Willow Run Company Vehicle Operations Area
Ypsilanti, Michigan**

Monitoring Well ID	Analysis ¹	Sampling Reason
New Locations		
<i>Groundwater Investigation within north/northwest area</i>		
MW19-45	TCL VOCs and MNA	Northern Property Boundary Investigation
MW19-46	TCL VOCs	Northern Property Boundary Investigation
MW19-47	TCL VOCs and MNA	Northern Property Boundary Investigation and to evaluate the natural attenuation conditions
MW19-48	TCL VOCs and MNA	Northern Property Boundary Investigation and to evaluate the natural attenuation conditions
MW19-49	TCL VOCs	Northern Property Boundary Investigation
MW19-50	TCL VOCs	Northern Property Boundary Investigation
<i>Datagap Analysis</i>		
MW19-51	TCL VOCs	Evaluation of MIP impacts near MW19-07
MW19-52	TCL VOCs and MNA	Defining the extent of impact based on MIP results and to evaluate the natural attenuation conditions.
MW19-53	TCL VOCs	Area near MW19-07 - Defining the extent of impact based on MIP results.
MW19-54	TCL VOCs	Area near MW19-07 and Southern Property Boundary (west of utility corridor) - Further evaluation of chlorinated impacts observed during 2006 investigation
SB19-114 and SB19-115	TCL VOCs	Area near MW19-07 - Evaluation of MIP results
<i>Southern Property Boundary</i>		
MW19-55	TCL VOCs	Southern Property Boundary (East of utility corridor) - Evaluating migration of contaminated groundwater in the southern property boundary i.e. assessing whether impacted groundwater extends northeast
SB19-116 and SB19-117	TCL VOCs	Southern Property Boundary (East of utility corridor) - Evaluating migration of contaminated groundwater in the southern property boundary i.e. assessing whether impacted groundwater extends northeast
SB19-118 through SB19-121	TCL VOCs	Southeastern Property Boundary - Defining the extent of chlorinated impacts in groundwater and confirming that impacts are not present in southeastern portion of the Site
<i>PAOC 18 - Post Remediation Activities</i>		
MW19-56	TCL VOCs	Southern Property Boundary Investigation and PAOC 18 Post Remediation Monitoring
MW19-57	TCL VOCs	PAOC 18 Post Remediation Monitoring
Existing Locations		
MW3	TCL VOCs	Northern Property Boundary Investigation
MW-5	TCL VOCs	Southern Property Boundary (East of utility corridor) - Evaluating migration of contaminated groundwater in the southern property boundary i.e. assessing whether impacted groundwater extends northeast
MW19-01 through MW19-04	TCL VOCs	Southeastern Property Boundary - Defining the extent of chlorinated impacts in groundwater.
MW19-07	TCL VOCs and MNA	To evaluate groundwater conditions based on MIP impacts and to evaluate the nature attenuation conditions
MW-14	TCL VOCs	Southeastern Property Boundary - Defining the extent of chlorinated impacts in groundwater.
MW19-24	TCL VOCs and MNA	Southeastern Property Boundary - Defining the extent of chlorinated impacts in groundwater.
MW19-37	TCL VOCs	Northern Property Boundary Investigation and to evaluate the natural attenuation conditions
MW19-38	TCL VOCs and MNA	Northern Property Boundary Investigation and to evaluate the natural attenuation conditions
MW19-39	TCL VOCs	Northern Property Boundary Investigation

**Groundwater Sampling Program
RFI Work Plan Addendum No. 1
Willow Run Company Vehicle Operations Area
Ypsilanti, Michigan**

Monitoring Well ID	Analysis ¹	Sampling Reason
MW19-11 and MW19-12	TCL VOCs	Northern Property Boundary Investigation
MW19-14 and MW19-15	TCL VOCs	Northern Property Boundary Investigation
MW19-16	TCL VOCs and MNA	Northern Property Boundary Investigation and to evaluate the natural attenuation conditions
GS-1	TCL VOCs	Northern Property Boundary Investigation
GS-2	TCL VOCs and MNA	Northern Property Boundary Investigation and to evaluate the natural attenuation conditions
IW-3	TCL VOCs	Northern Property Boundary Investigation
IW-9	TCL VOCs	Northern Property Boundary Investigation
IW-17	TCL VOCs	Northern Property Boundary Investigation
IW-26R	TCL VOCs	Northern Property Boundary Investigation

Notes

TCL VOCs - Target Compound List Volatile Organic Compounds

MNA - Monitored Natural Attenuation

¹ "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"
SW846, 3rd Edition, updated November 1986

VOCs U.S. EPA Method SW846-8260

MNA parameters include nitrate, sulfate, chloride, total and dissolved iron and manganese, methane, ethane, ethene, alkalinity, Total organic carbon, dissolved oxygen, pH, and oxidation reduction potential.

Table 3.3

**Storm Water Sampling Program
RFI Work Plan Addendum No. 1
Willow Run Company Vehicle Operations Area
Ypsilanti, Michigan**

Outfall	Analysis ¹	Sampling Reason	Sampling Frequency
Outfall 11	TCL VOCs	Storm discharge evaluation/characterization	Dry weather
Outfall 13	TCL VOCs	Storm discharge evaluation/characterization	Dry weather
Outfall 14	TCL VOCs	Storm discharge evaluation/characterization	Dry weather

Notes

TCL VOCs - Target Compound List Volatile Organic Compounds

¹ "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

SW846, 3rd Edition, updated November 1986

VOCs - U.S. EPA Method SW846-8260

Appendices

Appendix A

MIP Summary Memo



Memorandum

To: Grant Trigger, RACER

Ref. No.: 017303

From: Beth Landale//172/Det.

Date: March 10, 2016

cc: Kevin Lund, MDEQ

**Re: 2014 Membrane Interface Probe Investigation Summary
RACER - Willow Run Company Vehicle Operations
2901 Tyler Road
Ypsilanti, Michigan**

1. Introduction

On behalf of Revitalizing Auto Communities Environmental Response Trust (RACER), GHD has prepared this memorandum to summarize the results of the Membrane Interface Probe (MIP) investigation completed in December 2014 at the Company Vehicle Operations in Ypsilanti, Michigan (Site). The MIP investigation was designed to evaluate chlorinated volatile organic compounds (CVOC) as part of the ongoing evaluation of remedial options for the Site. Despite many rounds of investigation at the Site, there were several data gaps that, if investigated, may more fully inform the identification, evaluation and selection of effective remedial alternatives by defining or eliminating the potential of additional source areas. The MIP investigation included installation of 82 MIP soil boring locations to clay and working with Matrix Environmental (Matrix) (MIP contractor) to generate isocontour maps and a 3D model of the investigated area.

The proposed locations are presented on Figure 1a and are categorized by four investigation objectives:

- Pink Locations – to provide additional information into unidentified sources for hotspots such as MW19-07 and MW19-12. Some of these locations also fill in large data gaps where high contaminate levels were detected (MW19-42), but there was limited upgradient data to define the extent of upgradient impacts, despite current understanding of source areas.
- Orange Locations – to provide information on transport of impacts to the east into a potential off-site migration pathway.
- Blue Locations – to provide additional delineation of impacts laterally and vertically related to the groundwater–surface water interface pathway and transport of impacts along the bank of the Site and Tyler Pond.

- Green Locations – to provide additional information to determine if there are impacts pooling at the clay surface. A close review of the field logs from this area indicated that there appears to be shallow bowl in the clay in the area.

The following sections summarize the investigation and the results.

2. MIP Advancement and Results

Prior to the beginning of the scope of work, locations were field marked, cleared by a private utility locate contractor, and surveyed. Between December 2 and December 18, 2014, 82 MIP soil boring locations were installed throughout the northwestern portion of the Site (west of the north-south running sanitary sewer corridor that bisects the Site) and generally north and east of the Haulaway Building (Figure 1b). Soil borings were advanced to the massive, continuous clay approximately 25 feet below ground surface (bgs), as detected by rate of push and electric resistivity.

The MIP probe is attached to a geoprobe rig and advanced through the soil to log the relative concentrations of volatile organic compounds (VOCs) in the soils. For this scope of work, the MIP probe was outfitted with:

- Photoionization detector (PID) that detects VOCs in the hydrocarbon range (e.g., benzene, toluene, ethylbenzene, xylene [BTEX]).
- Flame ionization detector (FID) that detects total VOCs and methane.
- Halogen specific detector (XSD) that detects VOCs in the chlorinated range (i.e., trichloroethylene [TCE] and tetrachloroethylene [PCE]).

With the direct push nature of the MIP probe, no soil cuttings were generated.

The Matrix Report provided in Attachment 1 provides:

- General background on the equipment used including the MIP probe, the detectors, response tests, etc.
- Site specific information for this with respect to locations where refusals and repairs took place.
- MIP Field Log Summary which includes date completed depth and comments which include refusals, additional wait times, significant fuel responses, repairs, questionable readings.
- MIP Analytical Interpretation table which provides maximum detections and depths for each detector per location and estimated concentration ranges at intervals.
- MIP logs with PID/FID/XSD and electrical conductivity results plotted side by side.
- QA/QC pre and post log checks.

3. Evaluation of Results

Utilizing the MIP results, Matrix generated several isocontour figures based on the XSD, FID, PID, and PID minus XSD which is the PID results corrected by lowering the results in direct relation to elevated XSD results (Figures 2 – 6). The PID minus XSD results, like all of the MIP results, should be viewed as strictly relative. XSD results indicated that highest chlorinated impacts are located north-northeast of the Haulaway building along the groundwater divide on-Site and extend eastward to the north-south running sewer corridor

to the east. A pocket of additional elevated chlorinated impacts is located in the northwest portion of the Site. The corrected PID isocontour figure indicates that the hydrocarbon impacts are in basically the same areas as the chlorinated impacts, though the extent is somewhat larger. One area of note is the hot spot near MIP-059 northwest of the Haulaway Building on the XSD and PID isocontours. These impacts are further upgradient than impacts were previously known to extend. The FID isocontour, as it detects the entire VOC range, shows a much larger area of impacts; however, the large range of detection also means that it is hard to discern what type of impacts elevated results indicate. Two notable areas of elevated VOCs that showed up on the FID isocontour but not on the XSD or PID isocontours are located near the northeast area of investigation adjacent to the bank of Tyler Pond and the sewer corridor and the other area is located near the southeast portion of the investigation area. These locations do not show up as particularly "hot" on the XSD or PID results, but the elevated FID results are consistent with historical constituent sampling in the area.

In addition to the isocontours, Matrix created a 3D model of the investigation which is on file at GHD. Several screen shots of the model are presented in Figures 7 through 12. The figures present slices of the models of the PID and XSD results; cross section locations are presented in Figure 1b. The vertical and horizontal extent of both PID and XSD (gasoline and chlorinated range VOCs, respectively) along line A-A' is illustrated on Figures 7 and 8. The highly elevated PID and somewhat elevated XSD readings in the northwestern portion of the line (near MIP-27) are likely due to debris and tar/tar-sludge encountered in this area during previous test pitting. The downgradient elevation of both PID and XSD readings near MIP-20 along A-A' may be from migration. Along line B-B' (Figures 9 and 10), the impacts near MIP-072 are obvious in both the PID and XSD responses. Drums containing DNAPL were removed from this area in 2005 and impacts from those drums likely account for the elevated responses throughout the boring. Elevated PID responses extending to/into the clay layer may be the result of system delay to flush out the elevated constituents. The separate pocket of elevated XSD readings between MIP-073 and MIP-036 to the northeast is fairly cross-gradient. PID and XSD impacts are undelineated at MIP-011, adjacent to the bluff leading down to Tyler Pond. On the C-C' section, the XSD and PID impacts follow the same basic pattern with the exception of greater vertical PID impacts at MIP-059. XSD impacts are undefined to the northeast at MIP-005, adjacent to the bluff leading down to Tyler Pond.

4. Conclusions

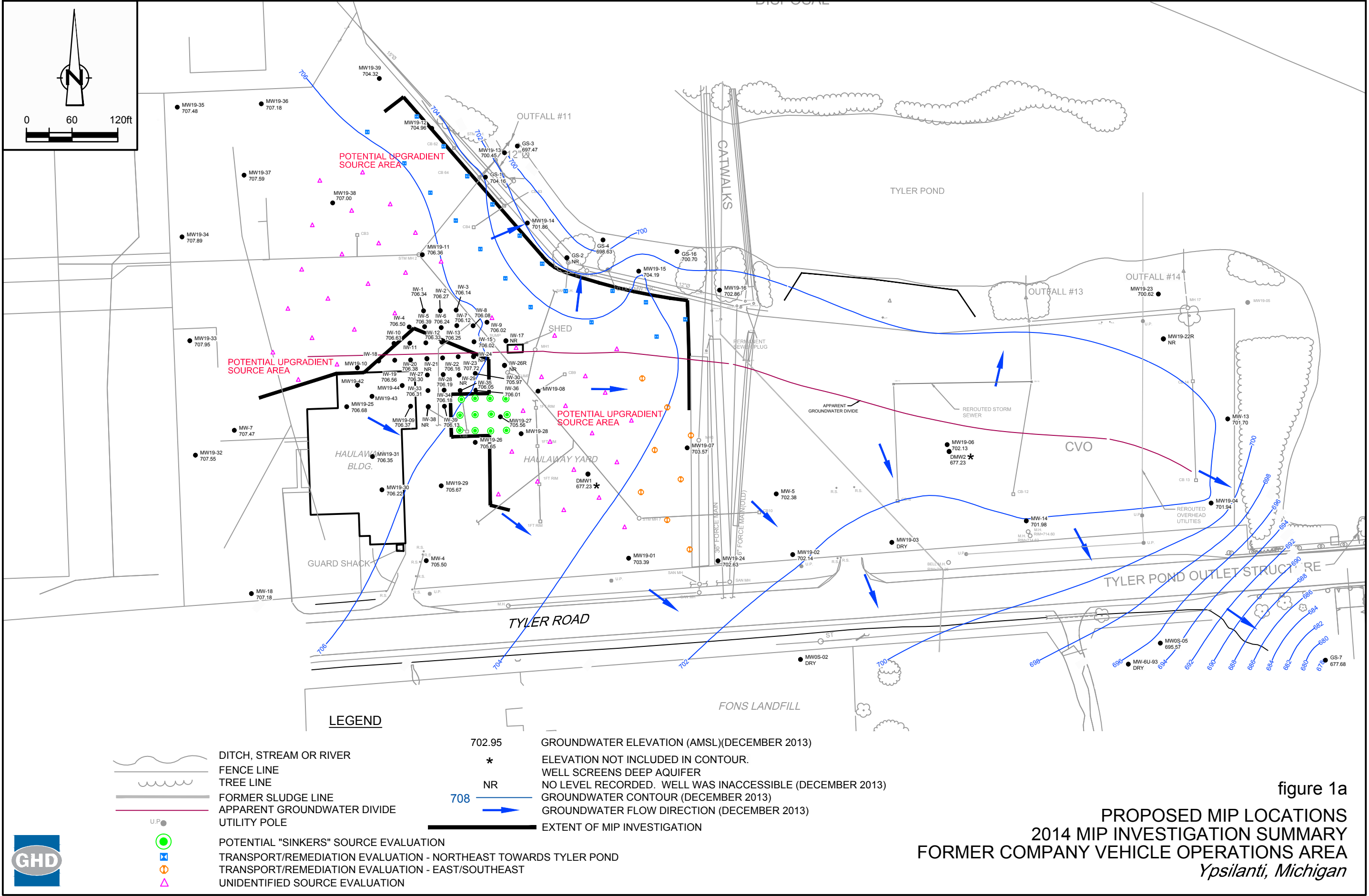
Several Site issues have been highlighted by the MIP investigation. From a source investigation viewpoint, the elevated FID, PID and XSD results northwest of the Haulaway building near MIP-028 indicate a previously unidentified potential upgradient source. During previous test pitting investigations in this area, automotive debris, some drum remnants, and solidified tar were found in this area. During drilling, non-aqueous phase liquid (NAPL) was observed on the rods while advancing MIP-027. The elevated FID results in the northeast investigation area near MIP-10 suggest a potential additional source area, though the nature of impacts is unknown.

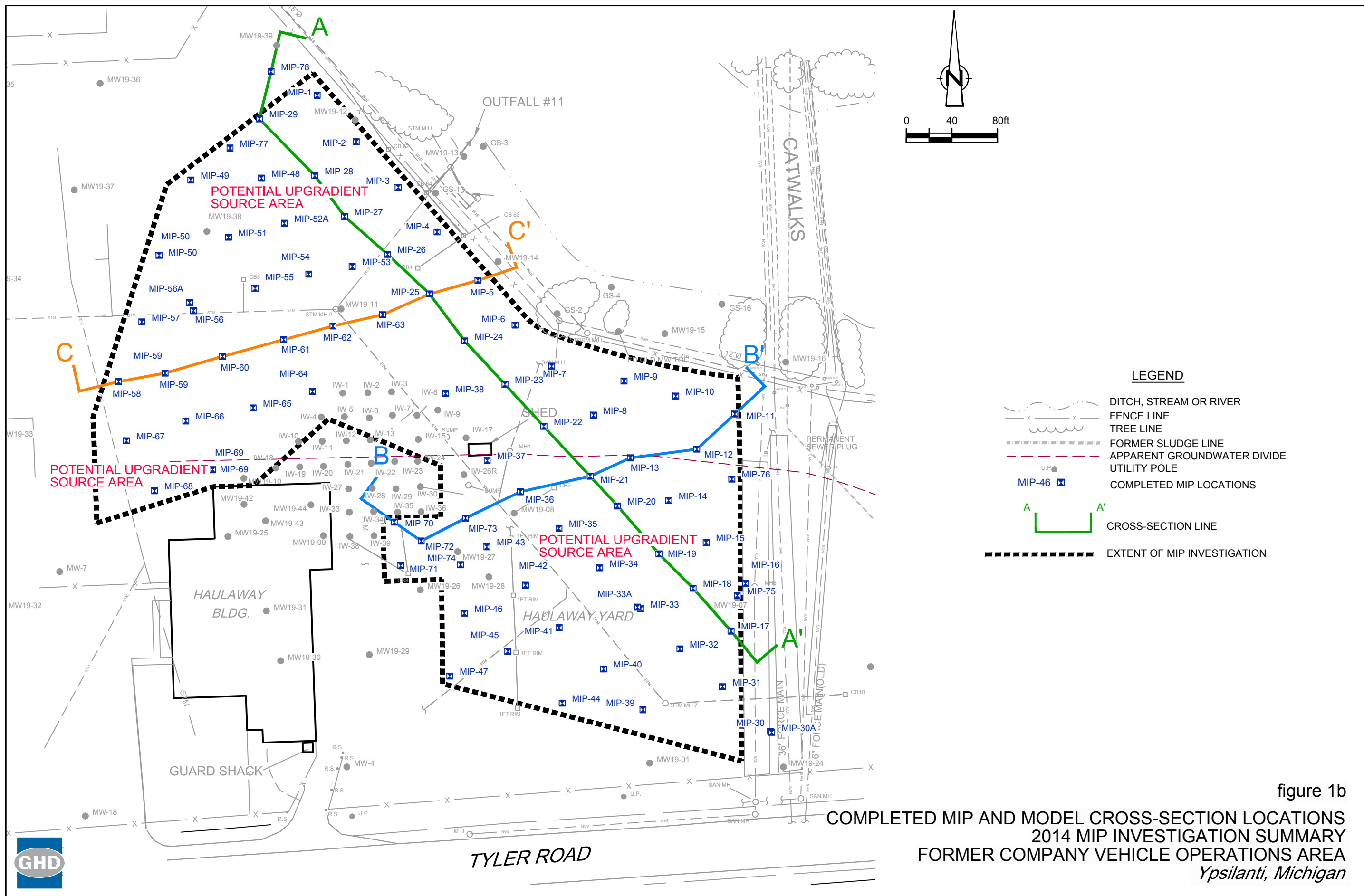
The impacts at MIP-072 stand out in the model as the impacts extend from the ground surface to the underlying clay. As mentioned, several drums were removed from this area, some of which contained DNAPL. After removal, soil from the excavation that was field screened as "clean" with a PID was returned to the excavation. It is likely that these backfilled soils are the cause of the vertical extent of impacts up to the ground surface. The extent down to the clay may be a drag-down effect where very highly elevated levels can take an extended amount of time to flush out of the MIP system and affect the results below.

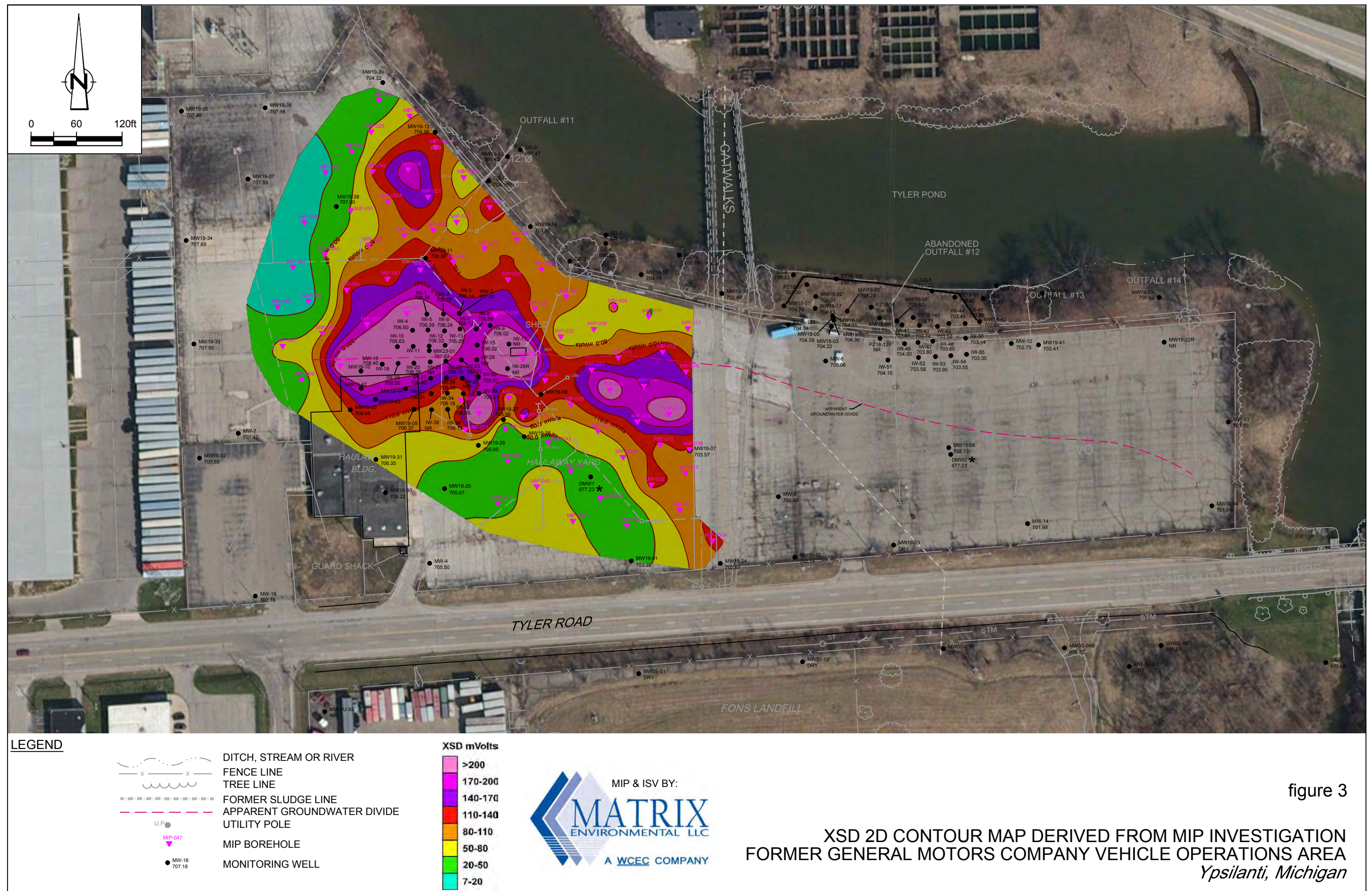
Several of the MIP borings along the northern edge of the investigation area indicated elevated FID, PID, and/or XSD readings, leaving the delineation of potential impacts to Tyler Pond incomplete.

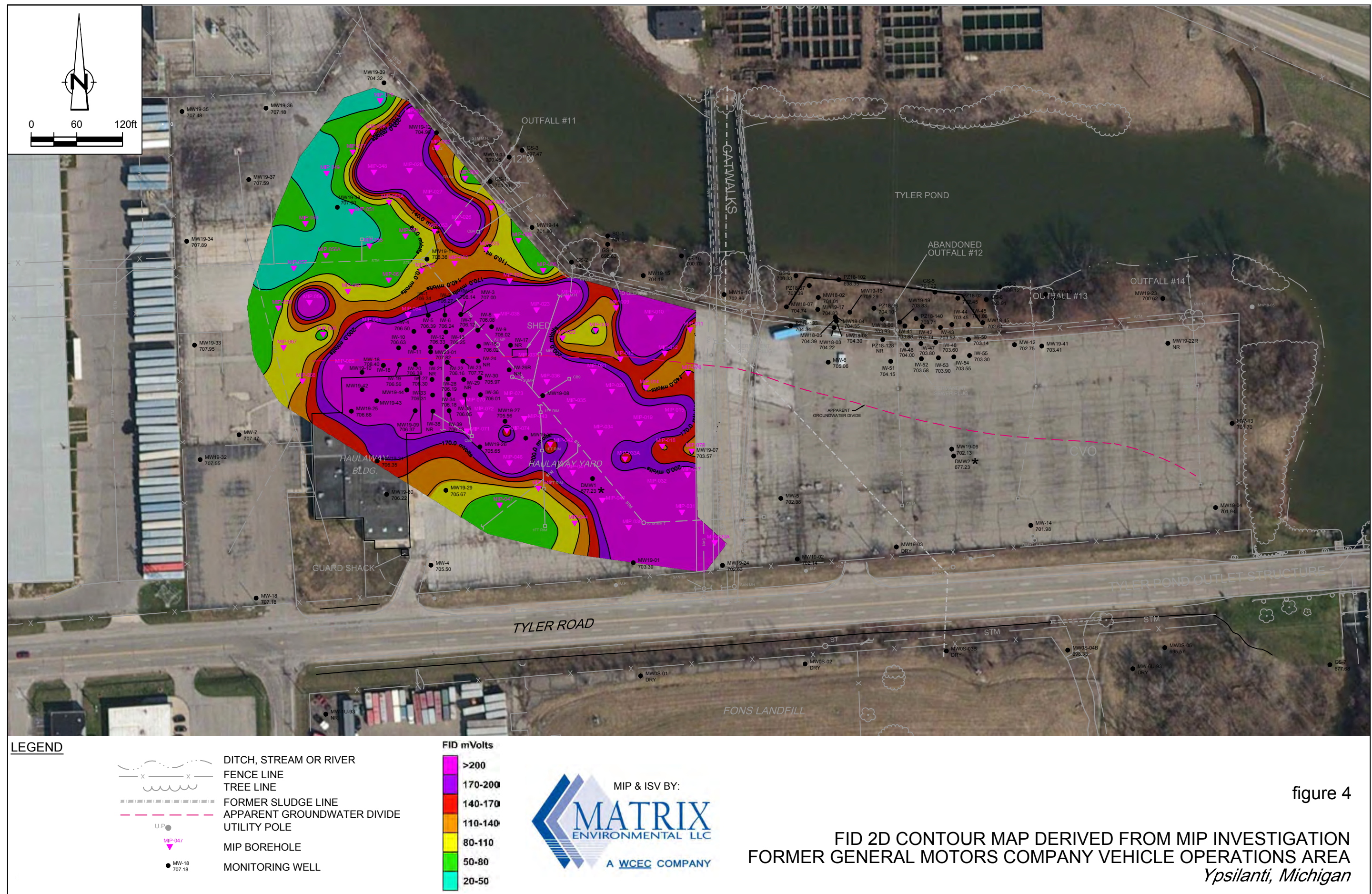
The results discussed in this memorandum will be incorporated into an updated conceptual site model along with groundwater and other media results.

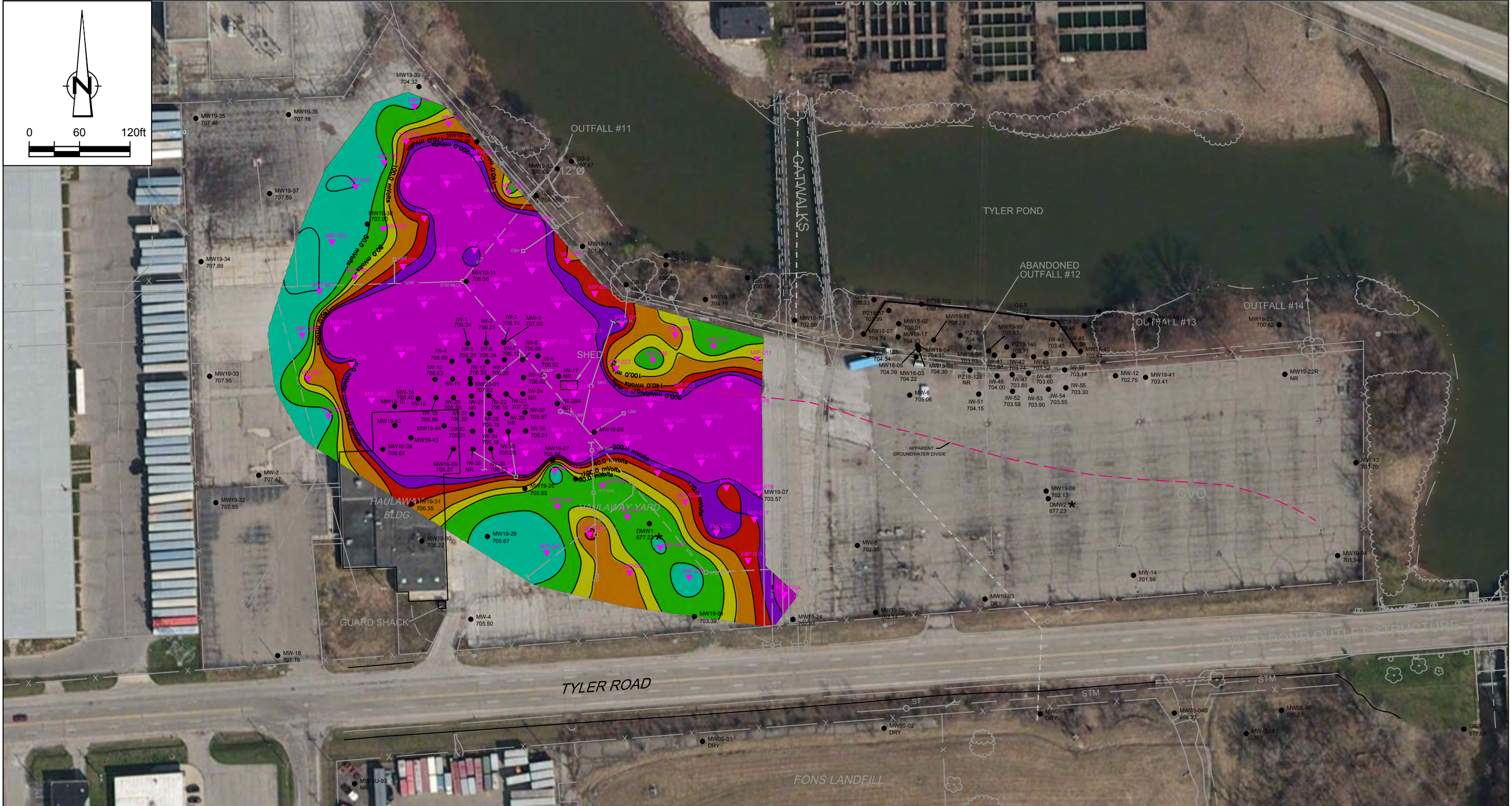
DRAFT





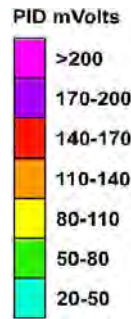






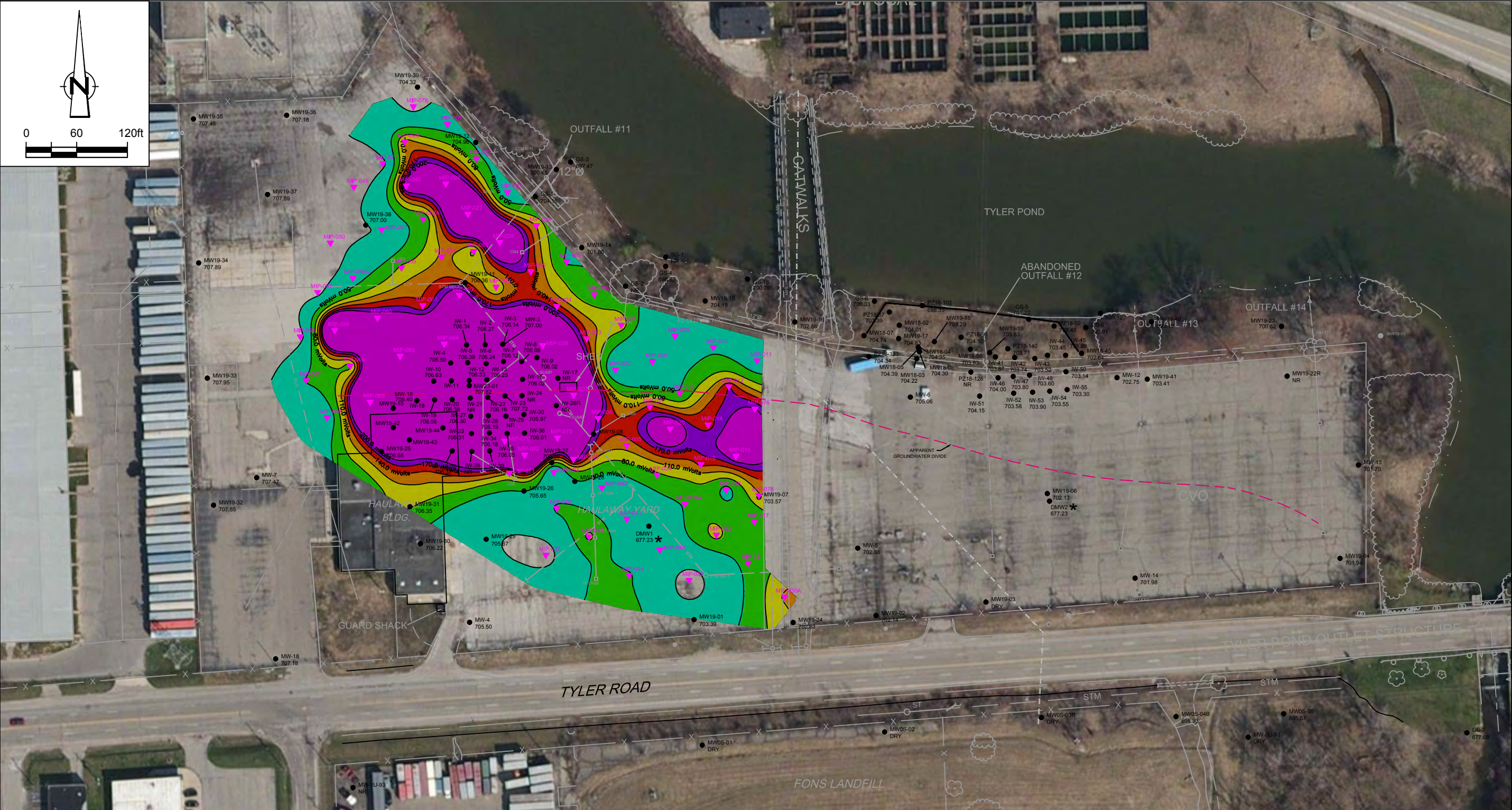
LEGEND

- DITCH, STREAM OR RIVER
- FENCE LINE
- TREE LINE
- FORMER SLUDGE LINE
- APPARENT GROUNDWATER DIVIDE
- UTILITY POLE
- MIP BOREHOLE
- MONITORING WELL



**PID 2D CONTOUR MAP DERIVED FROM MIP INVESTIGATION
FORMER GENERAL MOTORS COMPANY VEHICLE OPERATIONS AREA
*Ypsilanti, Michigan***

figure 5



LEGEND

- DITCH, STREAM OR RIVER
- FENCE LINE
- TREE LINE
- FORMER SLUDGE LINE
- APPARENT GROUNDWATER DIVIDE
- UTILITY POLE
- MIP-047
- MIP BOREHOLE
- MONITORING WELL

PID-XSD mVolts

- >200
- 170-200
- 140-170
- 110-140
- 80-110
- 50-80
- 20-50

MIP & ISV BY:

MATRIX
ENVIRONMENTAL LLC

A WCEC COMPANY

figure 6

PID (MINUS XSD) 2D CONTOUR MAP DERIVED FROM MIP INVESTIGATION
FORMER GENERAL MOTORS COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

3D Visualization of PID Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Easting = 13,344,208.5 ft
Slice Azimuth = 140 degrees

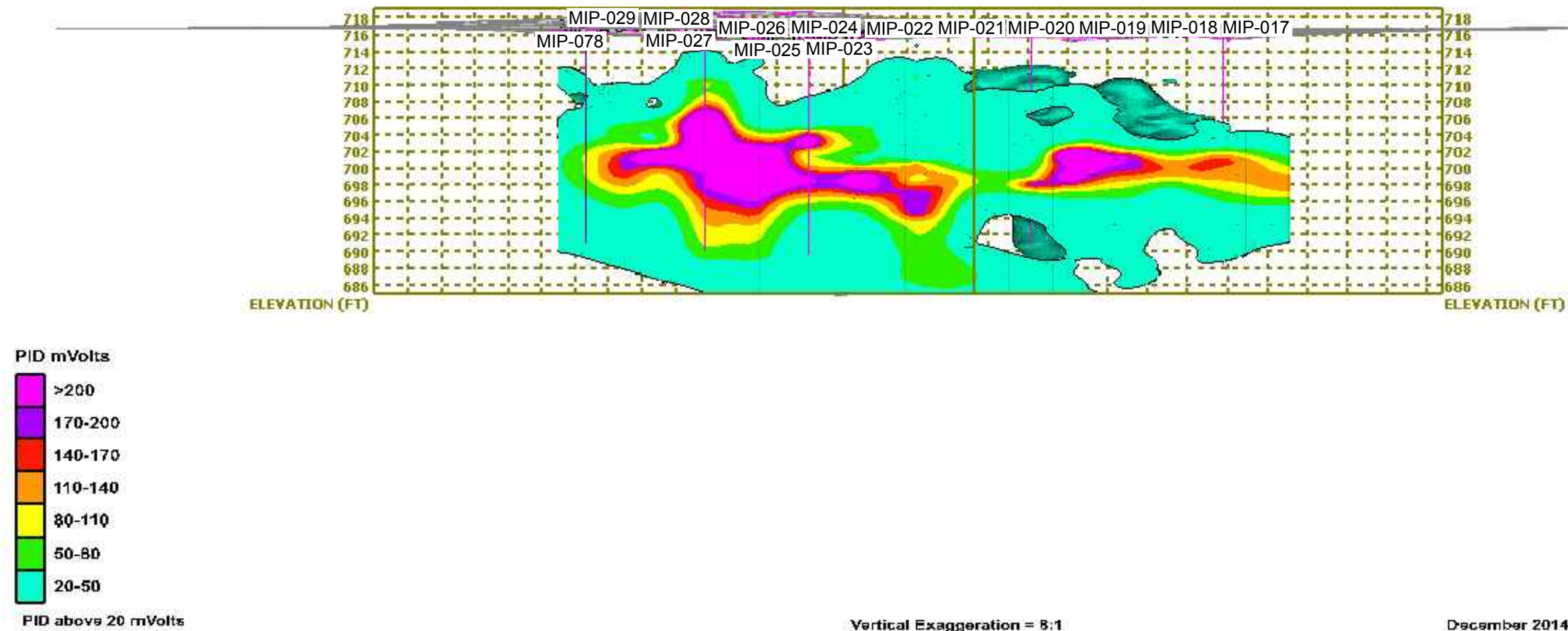


figure 7
EASTING SLICES A-A' - PID RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



3D Visualization of XSD Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Easting = 13,344,208.5 ft
Slice Azimuth = 140 degrees

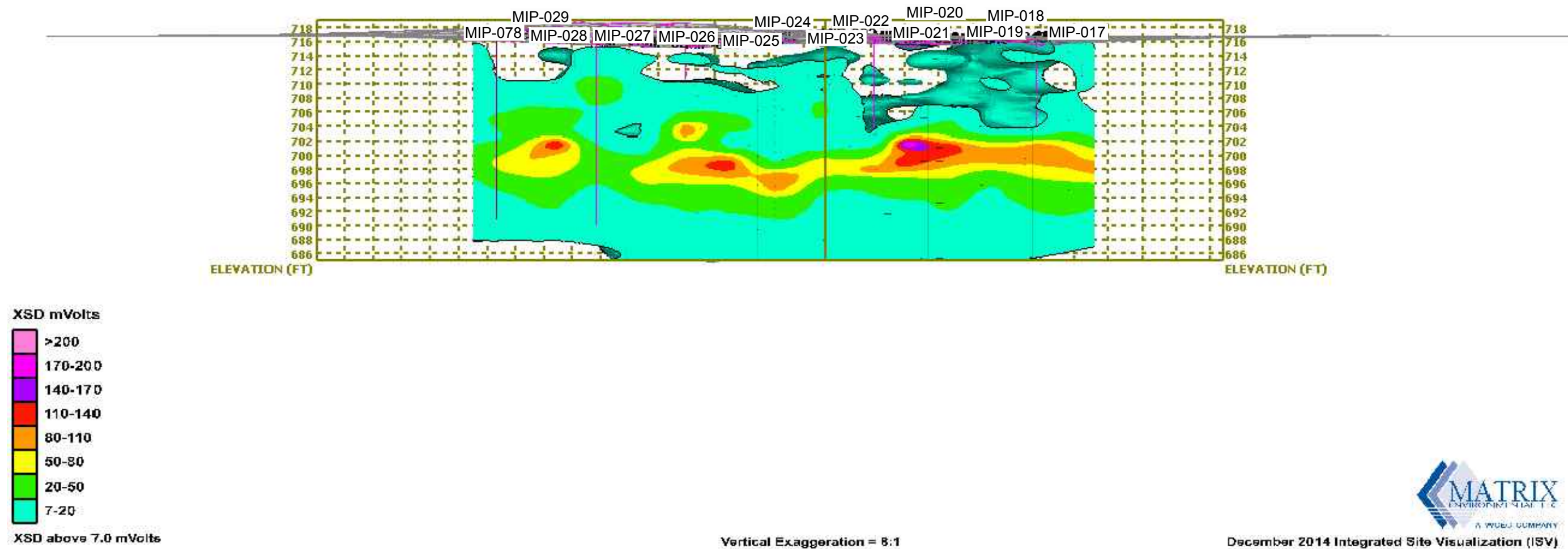


figure 8
EASTING SLICES A-A' - XSD RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



3D Visualization of PID Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Northing = 268,304.2 ft
Slice Azimuth = 72 degrees

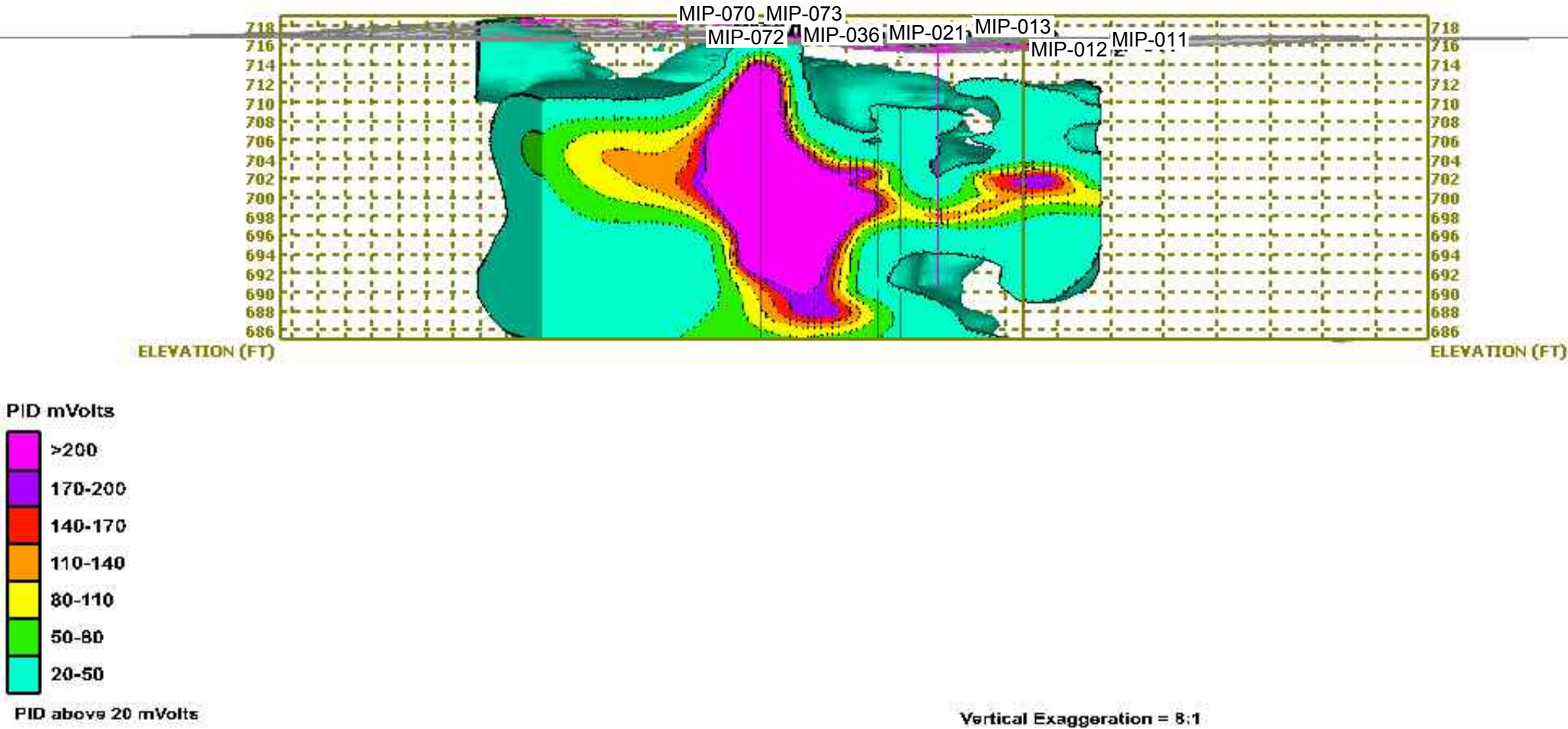
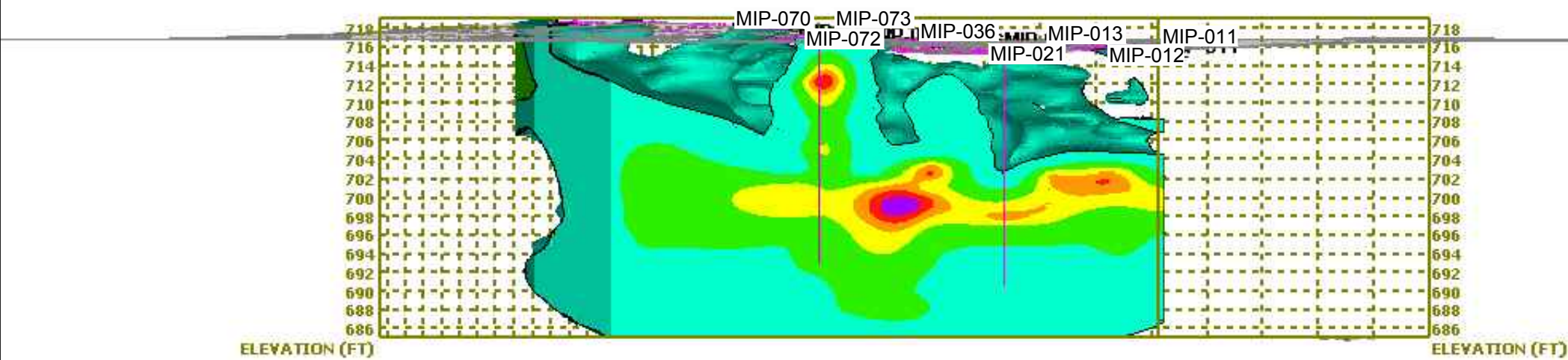


figure 9
NORTHING SLICES B-B' - PID RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

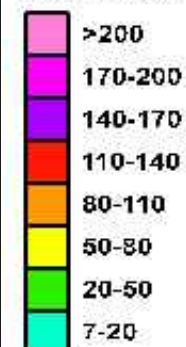


3D Visualization of XSD Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Northing = 268,304.2 ft
Slice Azimuth = 72 degrees



XSD mVolts



XSD above 7.0 mVolts

Vertical Exaggeration = 8:1



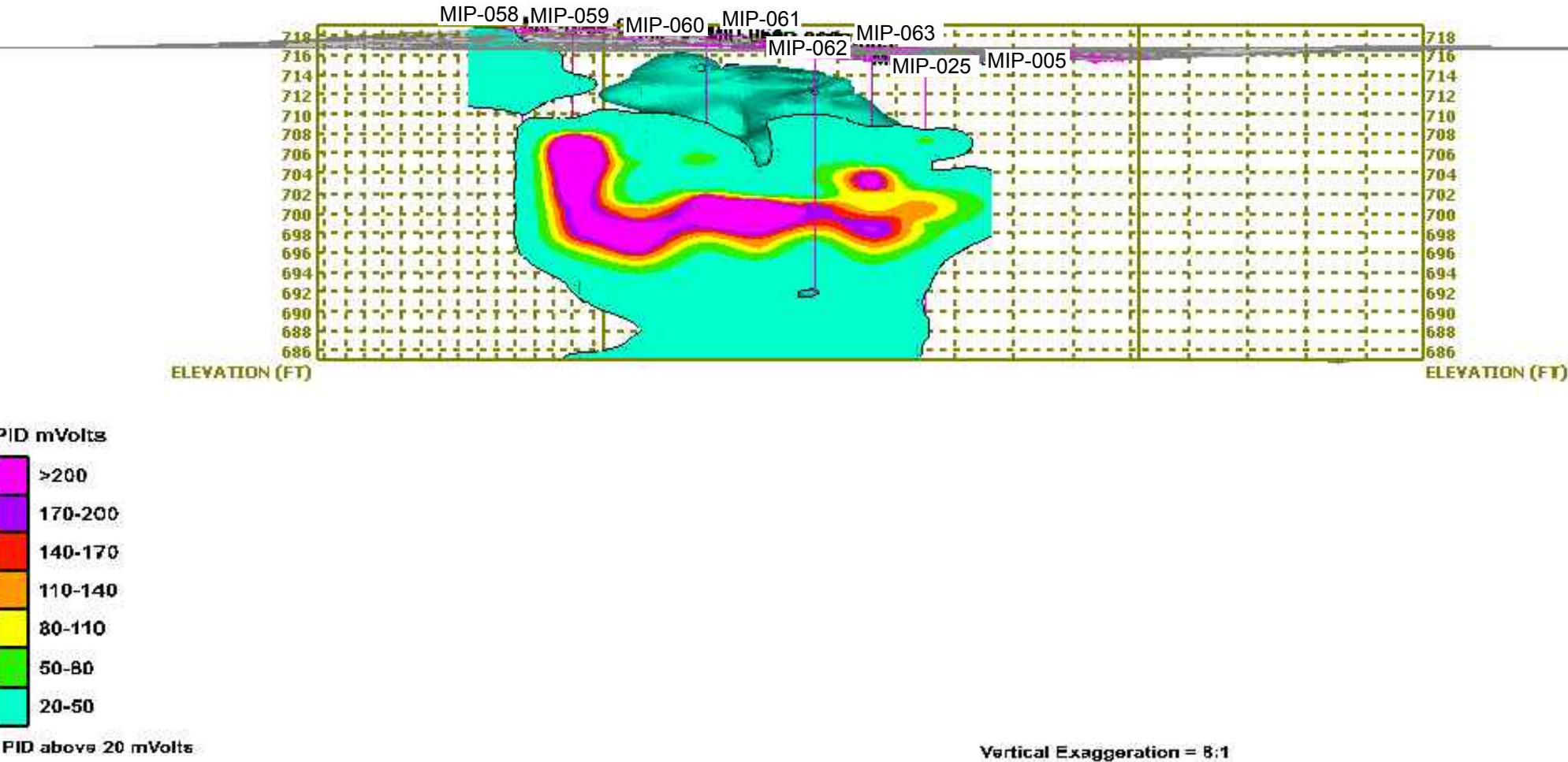
December 2014 Integrated Site Visualization (ISV)

figure 10
NORTHING SLICES B-B' - XSD RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



3D Visualization of PID Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Northing = 268,497.5 ft
Slice Azimuth = 72 degrees



December 2014 Integrated Site Visualization (ISV)

figure 11
NORTHING SLICES C-C' - PID RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



3D Visualization of XSD Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Northing = 268,497.5 ft
Slice Azimuth = 72 degrees

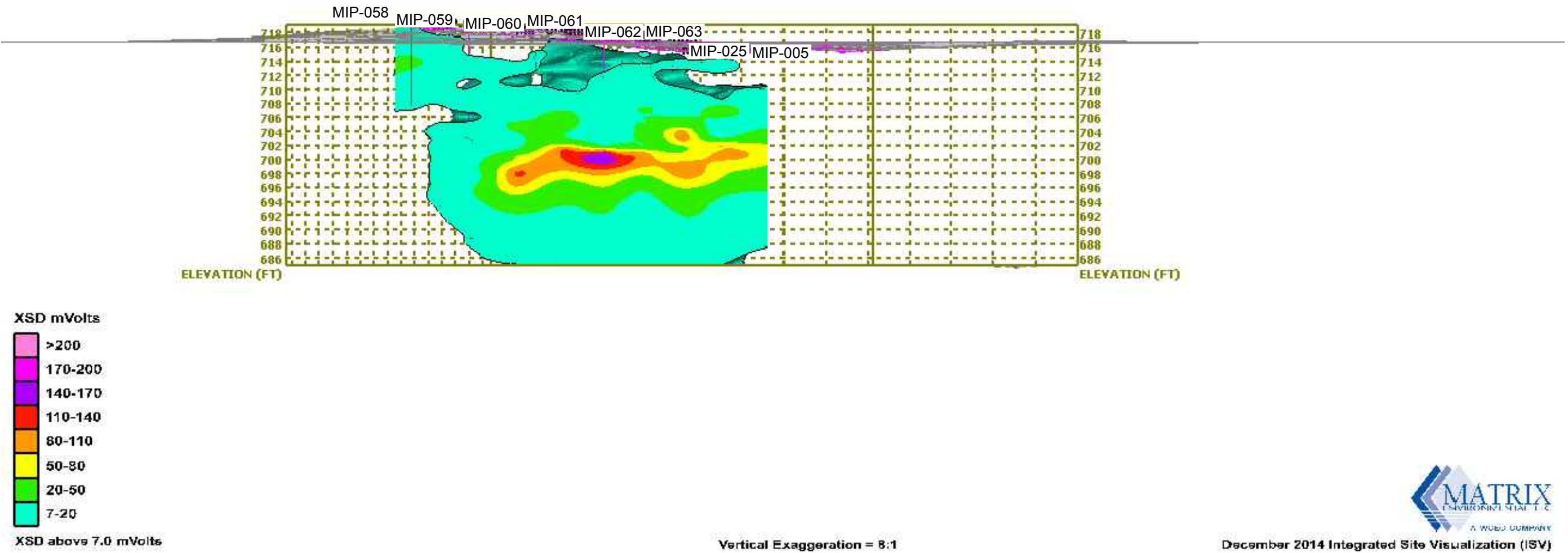


figure 12
NORTHING SLICES C-C' - XSD RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



Attachment 1

MIP Report Matrix



Monday, January 26, 2015

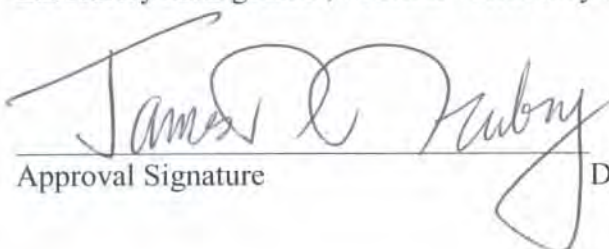
11253 91st Ave N.
Maple Grove, MN 55369
763-424-4803
FAX: 763-424-9452

-Direct Sensing Report, MIP-

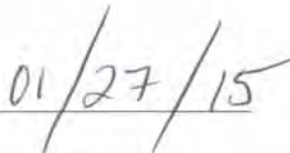
Client: **CRA**
Project Name: **Former Willow Run**
Location: **Ypsilanti, MI**
Project Number: **319.14**

The analysis and opinions expressed in this report are based upon data obtained from the samples collected at the indicated locations and from other information discussed in this report. Exceptions, if any, are discussed in the accompanying comments section of this report. This report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted laboratory practices. Reported results shall not be reproduced, except in full, without written approval of Matrix Environmental, LLC. The sample results relate only to the analytes of interest tested. No warranties, expressed or implied are intended or made.

I certify that the data contained in this final report has been generated and reviewed in accordance with approved methods and our Standard Operating Procedure. Release of this final report is authorized by Laboratory management, which is verified by the following signature.


Approval Signature

Date



MIP SYSTEM DESCRIPTION AND ON-SITE CHEMICAL ANALYSIS

VOCs are semi-quantitatively analyzed in-situ using a membrane interface probe (MIP). The probe is pushed into the ground at a rate of 1 foot per minute (including 45 second residence time). The membrane block heats to a temperature of approximately 90-120°C. Any volatile organic compounds present diffuse across the membrane into the trunkline carrier gas tubing and are brought to the surface and into the GC analytical system. The carrier gas containing samples from the subsurface then passes through a naphion dryer (if used) and a heated GC oven to remove any moisture prior to detector analysis. Compounds appropriate for the detectors and in high enough concentrations (about 1 ppm or higher for Standard MIP and about 100 ppb or higher for Low Level MIP) will produce an electrical signal which is analyzed.

The GC system is comprised of the following three-detector system: Lab grade PID/FID tandem and an XSD. The MIP's trunkline return gas is Y-split in the GC to accomplish this detector configuration. The PID utilizes a 10.0 eV lamp and will ionize aromatic, olefinic, and unsaturated halogenated hydrocarbons with an ionization potential of 10.0 eV or less. The FID will respond to all types of hydrocarbons including methane, halogenated hydrocarbons and other saturated hydrocarbons (generally the FID response gives a good indication of total hydrocarbons present.) The XSD responds selectively to only halogenated compounds (hydrocarbons containing Cl or Br atoms).

Electrical Conductivity (EC) is a measure of the soils ability to conduct an electrical current between two dipoles on the MIP/EC probe. Conductivity is the reciprocal of electrical resistivity and has the units (in our application) of millisiemens per meter (mS/m). Since soil is in the pathway of the charge flow, the grain size can be determined by comparing the EC log to a soil boring. Conductivity readings in the 100s indicate smaller grain (size such as clay). Larger grain size (sand and gravels) are typically in the 10s of mS/m range. Prior to every log the EC point of the MIP probe is checked for proper operation by performing a voltage test with a voltage meter and a conductivity test with a test block.

Since the MIP system is a screening tool, some laboratory analysis of soil or groundwater samples or some historical analytical data is needed in order to obtain optimum MIP log correlation. The following quality assurance/control measures are routinely conducted to ensure the validity of the analytical results:

Chemical Response Test: MIP data needs to be validated with passing QC at the beginning and end of every log. The probe is immersed into a 500 mL cylinder of water containing the compound(s) of interest. This test will be performed at multiple concentration levels at the beginning of each day to verify detector response and generate detection limits of the system (For example: 3 levels of TCE @ 1, 5, & 25 ppm). QC tests of at least one level are checked between each boring to determine system integrity and monitor membrane and detector fluctuations. The results of this are listed in the QA/QC report.

Butane response: May be run between each boring by dispensing butane over the membrane. Measuring the lag time of the carrier gas from the probe to the detectors is used to determine trip time and to verify FID detector response.

Continuity check: Performed before and after each boring to verify system continuity throughout the project for the electrical conductivity data.

DISCUSSION AND COMMENTS

Matrix performed chemical response tests at 0, 1, 5, and 10 ppm TCE at various times throughout the project. At a minimum, a one level response test was performed before or after each log on the MIP system (PID/FID/XSD) to assure data quality. The response tests appeared normal and were indicative of a functional MIP system

For each log, the probe was advanced one foot and then the probe was allowed residence time of 45 seconds or longer - time for the probe to reach temperature and for volatile organic compounds to diffuse through the membrane and into the trunkline. The trip time was about 60 seconds for the trunkline.

Electrical conductivity (EC) data was collected simultaneously at each MIP location. The EC was tested before and after each log for continuity and performance. All tests passed Geoprobe QC specs.

Geoprobe's recommended refusal push rate is 1 foot per minute. This project required pushing the probe at 0.5-1 foot/minute in the 10-14 foot interval for several locations in order to achieve desired depth. See ROP logs (rate of push, by date). Because of these harder drilling conditions, we did encounter refusals at 2 locations:

MIP-016 - refusal @ 12.7 feet.

MIP-056 – refusal @ 9.55 feet. Moved over 2 feet the next day – MIP-056A.

Also, the nitrogen-sending gas line on the probe broke @ MIP-030.

The stringpot (depth control) malfunctioned during MIP-052. The Pre-Log QC passed and this data was retained for this location so we moved over 2 feet and started again naming it MIP-052A.

The detector starting baselines (see *Field Summary Logs*) were elevated for some logs due to high fuel or tar contamination at the previous location. The elevated baselines were allowed due to the time constraints of waiting for the trunkline to clear out. Observing the Post-Log QC after a very contaminated log does help to gauge the amount of baseline shift for each detector independently and it should be noted that the XSD baseline was generally much less affected. The detector baselines were elevated at the start of MIP-072 because that location was very hot. As soon as the probe was lowered into the open pre-probed borehole, the membrane began collecting volatiles that were present. Note that the baselines in the Pre-Log QC are at a normal level (probe not in ground yet).

MIP-048, MIP-069 and MIP-072 contain EC readings above the clay which seem to be associated with high contamination levels (possibly tar, creosote or paint sludge). After retracting rods from location MIP-048 it was observed that the rods smelled like creosote or fuel. The probe and rod treads were covered with a "fuel" sheen (NAPL) and the probe was also covered heavily with tar. According to the site map it was noted that MIP-048 was in between 2 "tar laden" test pits.

During MIP-030 the gas line cracked on the probe/trunkline connection. The line was repaired, but the trunkline may have become compromised with fine soil particles and moisture. After observing some erratic pressure and detector readings, the trunkline and probe were changed after MIP-033. The detector data between 7-14 feet and after 20 feet was disregarded for MIP-031.



11253 91st Ave. N.
Maple Grove, Minnesota 55369
(763) 424-4803
fax (763) 424-9452

Client: CRA
Contact: Beth Landale
Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-001	12/02/14	pass	pass	pass	25.90	3	Start project with trunkline P150 1491, Probe MP6520 4449R
MIP-002	12/02/14	pass	pass	pass	26.00	3	NC (no comment)
MIP-003	12/02/14	pass	pass	pass	28.05	3	Turn down trunkline flow @ 12 feet
MIP-004	12/02/14	pass	pass	pass	28.05	3	NC
MIP-005	12/02/14	pass	pass	pass	28.05	3	NC
MIP-006	12/03/14	pass	pass	pass	25.80	3	NC
MIP-007	12/03/14	pass	pass	pass	25.80	3	Turn up trunkline flow 1 psi @ 17 feet
MIP-008	12/03/14	pass	pass	pass	26.25	3	Drill rig down. Electrical issues
MIP-009	12/03/14	pass	pass	pass	26.00	3	NC
MIP-010	12/03/14	pass	pass	pass	25.95	3	Very hard drilling @ 4-10 feet.
MIP-011	12/03/14	pass	pass	pass	26.00	3	NC
MIP-012	12/03/14	pass	pass	pass	25.85	3	NC
MIP-013	12/04/14	pass	pass	pass	29.00	3	Wait 5 minutes (instead of typical 1 min) between 28 and 29 feet.
MIP-014	12/04/14	pass	pass	pass	26.00	3	NC
MIP-015	12/04/14	pass	pass	pass	27.05	3	NC
MIP-016	12/04/14	pass	pass	pass	12.70	3	Refusal @ 12.7 feet.
MIP-017	12/04/14	pass	pass	pass	28.05	3	NC
MIP-018	12/04/14	pass	pass	pass	26.00	3	Wait 5 minutes (instead of typical 1 min) between 25 and 26 feet.
MIP-019	12/04/14	pass	pass	pass	28.05	3	NC
MIP-020	12/05/14	pass	pass	pass	25.85	3	NC
Total Footage					520.40	(this sheet)	



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Client: CRA
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Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)			Final Depth (ft)	prep robed Depth (ft)	Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunk line Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test			
MIP-021	12/05/14	pass	pass	pass	25.85	3	Turned up trunkline flow @ 10 feet.
MIP-022	12/05/14	pass	pass	pass	25.90	3	NC
MIP-023	12/05/14	pass	pass	pass	25.85	3	NC
MIP-024	12/05/14	pass	pass	pass	25.95	3	NC
MIP-025	12/08/14	pass	pass	pass	25.85	3	Very hard drilling @ 5-14 feet.
MIP-026	12/08/14	pass	pass	pass	25.95	3	Significant fuel response (PID/FID) starting @ 11 feet. Elevated Post-Log QC as a result
MIP-027	12/08/14	pass	pass	pass	25.90	3	Very significant fuel response (PID/FID) starting @ 8 feet. NAPL visually observed on probe/rods
MIP-028	12/08/14	pass	pass	pass	25.95	3	NC
MIP-029	12/08/14	pass	pass	pass	25.95	3	NC
MIP-030	12/09/14	pass	pass	pass	17.80	3	Charge hammer on rig. Stopped log @ 15', system pressure loss, repaired cracked teflon gas line.
MIP-030A	12/09/14	pass	pass	pass	25.95	3	NC
MIP-031	12/09/14	pass	pass	pass	34.95	3	Use data from 14-20 feet only. Erratic pressure and detector readings. Changed MIP membrane.
MIP-032	12/09/14	pass	pass	pass	25.90	3	Pressure/flow fluctuations at bottom of boring (water/soil particles entered trunkline @ MIP-030?)
MIP-033	12/09/14	pass	pass	pass	9.00	3	Pressure/flow fluctuations. After MIP-033 - restring MIP system with new trunkline & probe
MIP-033A	12/09/14	pass	pass	pass	25.90	3	Probe 4655, Trunkline 1492
MIP-034	12/10/14	pass	pass	pass	25.90	3	NC
MIP-035	12/10/14	pass	pass	pass	25.95	3	NC
MIP-036	12/10/14	pass	pass	pass	25.95	3	NC
MIP-037	12/10/14	pass	pass	pass	29.90	3	Very hot location, especially on PID/FID (fuel) Waited 5 min between 29 and 30 feet.
MIP-038	12/10/14	pass	pass	pass	29.10	3	Waited 90 minutes for detector baselines prior to this log (trunkline carry-over)
Total Footage					509.45	(this sheet)	



11253 91st Ave. N.
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Client: CRA
Contact: Beth Landale
Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-039	12/10/14	pass	pass	pass	25.95	3	NC (no comments)
MIP-040	12/10/14	pass	pass	pass	25.95	3	NC
MIP-041	12/10/14	pass	pass	pass	28.05	3	NC
MIP-042	12/11/14	pass	pass	pass	25.95	3	NC
MIP-043	12/11/14	pass	pass	pass	25.85	3	NC
MIP-044	12/11/14	pass	pass	pass	26.00	3	NC
MIP-045	12/11/14	pass	pass	pass	29.00	3	NC
MIP-046	12/11/14	pass	pass	pass	25.85	3	New MIP membrane
MIP-047	12/11/14	pass	pass	pass	21.90	3	Questionable response on XSD (somewhat atypical XSD plot shape, PID doesn't confirm response)
MIP-048	12/12/14	pass	pass	pass	25.95	3	New MIP membrane. Significant "tar" response, Wait 5 minutes between 25 and 26'.
MIP-049	12/12/14	pass	pass	pass	25.05	3	Detector baseline dropping throughout log due to "tar" from MIP-048. See Post-Log QC -048-049.
MIP-050	12/12/14	pass	pass	pass	25.95	3	NC
MIP-051	12/12/14	pass	pass	pass	27.10	3	NC
MIP-052	12/15/14	pass	pass	pass	2.75	3	Abort run, stringpot malfunction. Save Pre-Log QC for MIP-052A.
MIP-052A	12/15/14	pass	pass	pass	25.90	3	NC
MIP-053	12/15/14	pass	pass	pass	29.95	3	NC
MIP-054	12/15/14	pass	pass	pass	25.95	3	NC
MIP-055	12/15/14	pass	pass	pass	25.85	3	NC
MIP-056	12/15/14	pass	pass	pass	9.55	3	Refusal @ 9.55 feet, very hard obstruction.
MIP-056A	12/16/14	pass	pass	pass	25.95	3	NC
Total Footage					484.45	(this sheet)	



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Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-057	12/15/14	pass	pass	pass	25.95	3	Possibly a very low XSD response @ 14 feet.
MIP-058	12/16/14	pass	pass	pass	22.90	3	NC
MIP-059	12/16/14	pass	pass	pass	21.85	3	High "fuel" response @ 11 feet. Turn up flow @ 17 feet to facilitate clean-up.
MIP-060	12/16/14	pass	pass	pass	29.00	3	Clay (& XSD response) are a few feet deeper at this location.
MIP-061	12/16/14	pass	pass	pass	25.85	3	NC
MIP-062	12/16/14	pass	pass	pass	39.50	3	NC
MIP-063	12/16/14	pass	pass	pass	25.05	3	NC
MIP-064	12/16/14	pass	pass	pass	25.70	3	NC
MIP-065	12/17/14	pass	pass	pass	25.95	3	Significant "Fuel" response reflected in Post-Log QC baselines.
MIP-066	12/17/14	pass	pass	pass	25.80	3	NC
MIP-067	12/17/14	pass	pass	pass	25.85	3	Chlorinated solvent response near surface. No response @ the clay.
MIP-068	12/17/14	pass	pass	pass	21.45	3	Questionable response on XSD @ 5-10 feet. (PID does not confirm response)
MIP-069	12/17/14	pass	pass	pass	27.05	3	NC
MIP-070	12/17/14	pass	pass	pass	25.95	3	High "fuel" response starting @ 5 feet.
MIP-071	12/17/14	pass	pass	pass	25.95	3	NC
MIP-072	12/18/14	pass	pass	pass	24.00	3	High "fuel" response starting @ 3 feet. Baseline increased as soon as probe was put into hole.
MIP-073	12/18/14	pass	pass	pass	25.85	3	High "fuel" response starting @ 11 feet.
MIP-074	12/18/14	pass	pass	pass	21.00	3	Detector baselines dropping throughout log due to "fuel at precious locations.
MIP-075	12/18/14	pass	pass	pass	25.90	3	NC
MIP-076	12/18/14	pass	pass	pass	24.05	3	NC
MIP-077	12/18/14	pass	pass	pass	25.95	3	NC
MIP-078	12/18/14	pass	pass	pass	25.90	3	NC
Total Footage					566.45	(this sheet)	



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Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-001	12/02/14	98	16.0	314	16.0	71	16.0	Estimated 1-5 ppm chlorinated solvent responses @ 7-16 feet. 20 ppm starting @ 20 feet.
MIP-002	12/02/14	167	16.0	122	12.0	123	16.0	Estimated 2 ppm chlorinated solvent responses @ 9-10 feet. 10 ppm @ 14-16 feet. 30 ppm starting @ 16 feet.
MIP-003	12/02/14	55	10.5	48	13.6	52	10.5	Estimated 6-13 ppm chlorinated solvent responses @ 7-11 feet. 4-12 ppm 13.6-19 feet.
MIP-004	12/02/14	238	16.0	112	16.0	139	16.0	Estimated 1-3 ppm chlorinated solvent responses @ 7-11 feet. 12-35 ppm 13-19 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-005	12/02/14	123	15.0	58	17.0	87	15.0	Estimated 14 ppm chlorinated solvent response @ 8 feet. 22 ppm 12.5-16 feet. Hydrocarbon responses on FID @ 17-20'
MIP-006	12/03/14	148	13.9	40	13.9	91	13.9	Estimated 2 ppm chlorinated solvent responses @ 8.5 & 9.8 feet. 14-23 ppm 11.9-16 feet.
MIP-007	12/03/14	194	17.0	435	3.8	101	16.0	Estimated 2 ppm chlorinated solvent response @ 14.4', 12 ppm 15-16'. 25 ppm starting @ 16 feet. Petroleum responses on FID @ 3-7 & 10-14.5'
MIP-008	12/03/14	47	17.3	58	14.6	50	17.3	Estimated 1 ppm chlor solv responses @ 12.7-14.5'. 2 ppm @ 14.5-15.2'. 7-13 ppm starting at 15'. Additional petroleum observed on PID/FID
MIP-009	12/03/14	100	16.1	110	13.7	80	16.1	Estimated 2 ppm chlorinated solvent responses @ 7.1 & 12'. 8-20 ppm starting @ 14 feet. Hydrocarbon responses on FID @ 12-14 feet.
MIP-010	12/03/14	41	15.1	290	5.2	43	13.1	Estimated 7-11 ppm chlorinated solvent responses starting @ 121 feet. Petroleum observed starting at 4'on PID/FID in addition to chlorinated.
MIP-011	12/03/14	80	15.2	98	4.5	67	15.2	Estimated 1 ppm chlor solv responses @ 7.9-8.2'. 2-7 ppm @ 12-15. 17 ppm starting @ 15.2 feet. Petroleum responses on PID/FID @ 4-7.6 feet.
MIP-012	12/03/14	310	13.4	143	13.4	148	13.5	Estimated 1 ppm chlorinated solvent responses @ 5 & 7 feet. 35 ppm 12.5-13.9 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-013	12/04/14	150	14.2	120	3.7	110	13.9	Estimated 16-28 ppm chlorinated solvent responses starting @ 13.8 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-014	12/04/14	304	13.4	114	13.4	158	13.4	Estimated 6-13 ppm chlorinated solvent responses @ 11.7-13 feet. 40 ppm starting @ 13.2 feet.
MIP-015	12/04/14	487	13.3	264	13.3	244	13.3	Estimated 1-2 ppm chlorinated solvent responses @ 9.9-10.9 feet, 6-18 ppm @ 12.3-13'. 61 ppm starting @ 13.3 feet.
MIP-016	12/04/14	11	10.5	22	10.5	4*	12.7	Refusal @ 12.7 feet. Starting to detect chlorinated solvent at the bottom of boring. Some petroleum observed on PID/FID @ 10.5 feet.
MIP-017	12/04/14	153	15.1	253	14.7	103	15.1	Estimated 25 ppm chlorinated solvent responses starting @ 14 feet. Petroleum responses on PID/FID @ 5.6 feet.
MIP-018	12/04/14	125	16.1	118	14.0	97	16.1	Estimated 6-11 ppm chlorinated solvent responses starting @ 13.5-15'. 25 ppm starting @ 15'. Petroleum responses on PID/FID @ 5.3-5.8 feet.
MIP-019	12/04/14	192	14.7	256	14.6	160	14.7	Estimated 6-16 ppm chlorinated solvent responses @ 10-13.9 feet. 40 ppm starting @ 14.7 feet.
MIP-020	12/05/14	585	14.8	331	14.8	253	14.8	Estimated 6-32 ppm chlorinated solvent responses @ 13.1-14 feet, 63 ppm starting @ 14.3 feet. Petroleum responses on PID/FID @ 6.8-7.8 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-021	12/05/14	303	18.2	250	18.1	163	18.2	Estimated 1-14 ppm chlorinated solvent responses @ 13.9-17.9'. 41 ppm starting @ 18.2'. Petroleum responses on PID/FID @ 8 & 9'.
MIP-022	12/05/14	68	18.0	77	103.0	59	18.0	Estimated 1 ppm chlorinated solvent responses @ 4.8-8.9'. 5 ppm @ 9.1-11.5'. 15 ppm starting at 17.2'. Additional hydrocarbons observed on FID
MIP-023	12/05/14	207	21.9	1,006	21.8	91	20.0	Estimated 2-4 ppm chlorinated solvent responses @ 5, 12.4-15.8, 16.9-19'. 23 ppm starting @ 19'. Petroleum responses on PID/FID @ 15.2-17'.
MIP-024	12/05/14	271	17.1	156	13.2	130	17.1	Estimated 2-12 ppm chlorinated solvent responses @ 9.9-12.5. , 19-33 ppm @ 16-19'. Additional hydrocarbons observed on FID @ 12-14 feet.
MIP-025	12/08/14	252	12.2	91	12.2	102	12.2	Estimated 5-7 ppm chlorinated solvent responses @ 7.2 & 9-11'. 25 ppm @ 11-13' and @ 16-18 feet.
MIP-026	12/08/14	595	13.9	634	12.6	63	17.9	Estimated 1 ppm chlor solv responses @ 5.1-9.8, 14'. 8-16 ppm starting at 16.2'. Significant additional petroleum observed on PID/FID starting @ 11'.
MIP-027	12/08/14	845	11.9	370	12.2	163	5.4	Estimated 40 ppm chlor solv response @ 5.4'. 8-11 ppm @ 7-8'. 4 ppm @ 14-18'. Significant additional petroleum observed on PID/FID starting @ 10'.
MIP-028	12/08/14	499	14.7	218	14.6	200	14.7	Estimated 9-14 ppm chlorinated solvent responses @ 9.8-12'. 40-50 ppm @ 14-15.2 feet.
MIP-029	12/08/14	130	13.9	126	13.9	50	18.0	Estimated 5-10 ppm chlorinated solvent responses @ 11.1-13.9, 15.6, & 17.1'. 13 ppm @ 18'. Petroleum responses on PID/FID @ 13.9-15.5'.
MIP-030	12/09/14	NA	NA	NA	NA	NA	NA	No useful data acquired. See summary comments
MIP-030A	12/09/14	220	18.9	205	18.9	112	18.9	Estimated 9-28 ppm chlorinated solvent responses @ 15-20 feet.
MIP-031	12/09/14	145	15.1	197	19.2	98	15.1	Estimated 13-24 ppm chlorinated solvent responses @ 14.5-19.3 feet.
MIP-032	12/09/14	200	15.0	233	14.8	115	15.0	Estimated 1 ppm chlorinated solvent responses @ 5.5-6 & 7.7-11.5'. 1-10 ppm @ 12.5-13.9. 13-29 ppm starting @ 15'.
MIP-033	12/09/14	NA	NA	NA	NA	NA	NA	Questionable data acquired. See summary comments
MIP-033A	12/09/14	113	16.0	140	16.0	67	16.1	Estimated 3-9 ppm chlorinated solvent responses @ 12.6-16 feet. 17 ppm starting @ 16'.
MIP-034	12/10/14	139	16.0	272	14.8	73	16.0	Estimated 8-15 ppm chlorinated solvent responses @ 12-14 feet. 11-18 ppm @ 16-19 feet.
MIP-035	12/10/14	209	16.1	380	15.0	96	15.0	Estimated 15-24 ppm chlorinated solvent responses @ 12.6-18 feet.
MIP-036	12/10/14	276	17.0	362	15.4	120	13.7	Estimated 18-30 ppm chlorinated solvent responses @ 12.5-18 feet.
MIP-037	12/10/14	3,140	20.1	6,700	19.1	390	18.0	Estimated 12-50 ppm chlorinated solvent responses @ 13-17 feet. 78-98 ppm starting @ 17 feet.
MIP-038	12/10/14	966	18.0	270	18.0	173	18.0	Estimated 1-2 ppm chlorinated solvent responses @ 12.7-15.7 feet. 13 ppm @ 16 feet. 28-44 ppm @ 17-20 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-039	12/10/14	126	16.1	344	23.1	20	16.1	Estimated 1 ppm chlorinated solvent responses @ 11.2-13.1' & 14'-14.5'. 4-5 ppm @ 15-16.8'. Hydrocarbon responses on FID @ 22.6-24'.
MIP-040	12/10/14	30	13.1	231	13.1	18	16.1	Estimated 1-3 ppm chlorinated solvent responses @ 12-13.2'. 2-5 ppm @ 15.1-17.9'. Hydrocarbon responses on FID @ 13.1-16.2'.
MIP-041	12/10/14	46	14.0	274	15.1	40	21.2	Estimated 1 ppm chlorinated solvent responses @ 13. 8 ppm @ 14'. 3-10 ppm @ 18-22'. Hydrocarbon responses on FID @ 14-18'.
MIP-042	12/11/14	34	17.1	133	14.0	32	17.1	Estimated 3-8 ppm chlorinated solvent responses @ 15-19.1'. Hydrocarbon responses on FID @ 10-16'.
MIP-043	12/11/14	372	18.2	605	18.2	164	18.0	Est. 1 ppm chl sol responses @ 4.9, 6.9, 7.9, 9, & 10-11.4'. 2-14 ppm @ 11.4-17.1'. 10-41 ppm @ 17.5-19.2'. Hydrocarbon responses on FID @ 4-15'.
MIP-044	12/11/14	98	17.2	82	16.1	56	17.2	Estimated 1 ppm chlorinated solvent responses @ 8-12.5 feet. 13 ppm @ 12.5-18 feet.
MIP-045	12/11/14	156	13.0	88	19.0	75	13.0	Estimated 2-6 ppm chlorinated solvent responses @ 10.8-12.9 feet. 8-19 ppm @ 13-15 feet. Additional hydrocarbon responses on FID @ 11-19'.
MIP-046	12/11/14	62	13.0	332	13.0	27	17.1	Estimated 2-7 ppm chlorinated solvent responses @ 12.6-20 feet. Additional hydrocarbon responses on FID @ 12.5-19 feet.
MIP-047	12/11/14	6*	11.7	40	14.7	5*	17.1	Estimated 1 ppm chlorinated solvent responses @ 17.1 & 18 feet. Additional hydrocarbon responses on FID @ 10.4-15.1 feet.
MIP-048	12/12/14	387	10.0	1,450	5.1	112	9.1	Estimated 13-28 ppm chlorinated solvent responses @ 7.1-11'. 7-13 ppm @ 15.1-19.1'. Additional hydrocarbon responses on FID @ 5.1-6.1 feet.
MIP-049	12/12/14	10	16.7	26	11.3	12	17.1	Estimated 1-3 ppm chlorinated solvent responses @ 15.1-19.1' & 23.2 feet. Additional hydrocarbon responses on FID @ 9.7-13.9 feet.
MIP-050	12/12/14	9	121.0	44	18.4	9	17.1	Estimated 1 ppm chlorinated solvent responses @ 7.2, 8, 9, 17 & 20-25? feet. Additional hydrocarbon responses on FID @ 8-14 & 18.4 feet.
MIP-051	12/12/14	55	18.0	17	19.0	47	19.1	Estimated 3 ppm chlorinated solvent responses @ 11-12 feet and 5-12 ppm @ 13-19 feet.
MIP-052	12/15/14	NA	NA	NA	NA	NA	NA	Stringpot malfunction
MIP-052A	12/15/14	119	13.8	67	13.8	87	13.8	Estimated 1 ppm chlorinated solvent responses @ 9.4-9.8, 11 & 12 feet. 8-22 ppm @ 12.9-19.1 feet.
MIP-053	12/15/14	155	15.3	100	15.2	90	15.3	Estimated 1 ppm chlorinated solvent responses @ 5.6 & 7 feet. 2-8 ppm @ 8-13 feet. 12-23 ppm @ 14.4-19 feet.
MIP-054	12/15/14	202	16.1	41	11.7	99	16.1	Estimated 1-4 ppm chlorinated solvent responses @ 8-15'. 11-25 ppm starting @ 15'. Additional hydrocarbon responses on FID @ 8.9-13.7 feet.
MIP-055	12/15/14	152	17.0	39	11.3	74	17.0	Estimated 2 ppm chlorinated solvent responses @ 11-12 & 14.5'. 13-19 ppm @ 15-19'. Additional hydrocarbon responses on FID @ 9 & 11.3 feet.
MIP-056	12/15/14	NA	NA	NA	NA	NA	NA	Refusal @ 9.5 feet.
MIP-056A	12/16/14	67	18.0	42	15.2	45	18.0	Estimated 3 ppm chlorinated solvent responses @ 12-17'. 8-11 ppm starting @ 17'. Additional hydrocarbon responses on FID @ 13.8-15.2 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-057	12/15/14	7	1.9	9	18.0	3*	13.0	Estimated 1 ppm chlorinated solvent responses @ 3-5 & 11-14 feet.
MIP-058	12/16/14	11	4.9	47	15.0	11	4.9	Estimated 2 ppm chlorinated solvent responses @ 4.9-5.7 feet. 1 ppm @ 15 feet. Hydrocarbon responses on FID @ 14-16 feet.
MIP-059	12/16/14	1,197	12.7	557	12.0	8	5.2	Estimated 2 ppm chlor solv response @ 5-5.9' & 1 ppm @ 7-8'. 1 ppm @ 8.9-20'. Significant petroleum observed on PID/FID starting @ 11 feet.
MIP-060	12/16/14	358	20.0	69	17.6	124	20.1	Estimated 1 ppm chlor solv responses @ 5'. 5 ppm @ 8.9, 10, 13-14 & 16.6'. 15-31 ppm @ 17.7-22'. Hydrocarbon responses on FID @ 14-16 feet.
MIP-061	12/16/14	250	16.0	50	16.0	117	16.0	Estimated 2 ppm chlorinated solvent responses @ 10.1 feet. 8 ppm @ 10.9-12.5 feet. 29 ppm starting @ 16 feet.
MIP-062	12/16/14	420	17.1	107	17.1	160	17.1	Estimated 33 ppm chlorinated solvent responses starting @ 316.1 feet.
MIP-063	12/16/14	180	16.1	100	16.1	104	16.1	Estimated 2-6 ppm chlor solv responses @ 7.9-13.7'. 9 ppm @ 15.4 feet. 26 ppm starting @ 16.1'. Hydrocarbon responses on FID @ 10.8-13.9 feet.
MIP-064	12/16/14	1,125	18.0	171	18.0	249	18.0	Estimated 1-2 ppm chlor solv responses @ 11.9-15'. 28 ppm @ 17.1, 62 ppm starting @ 18'. Hydrocarbon responses on FID @ 11.5-14.6 feet.
MIP-065	12/17/14	760	15.1	219	12.3	181	15.1	Estimated 45 ppm chlor solv response starting @ 14 feet'. Significant petroleum observed on PID/FID starting @ 8 feet.
MIP-066	12/17/14	130	20.1	39	14.3	72	20.1	Estimated 3-4 ppm chlor solv responses @ 16.9-19'. 14 ppm @ 19.1, 18 ppm starting @ 20.1'. Hydrocarbon responses on FID @ 12-17.9 feet.
MIP-067	12/17/14	102	4.9	75	14.1	59	4.9	Estimated 9-15 ppm chlorinated solvent responses @ 2-4.9'. 1-2 ppm @ 20, 23.1, 24.1 & 25'. Hydrocarbon responses on FID @ 10.6-16'.
MIP-068	12/17/14	23	12.0	91	12.7	28	6.0	Estimated 7 ppm chlorinated solvent responses starting @ 5 feet. Hydrocarbon responses on PID/.FID @ 12-16 feet.
MIP-069	12/17/14	1,165	12.1	433	12.1	273	12.1	Estimated 15-39 ppm chl solv response @ 9.9-11.1', 69 ppm starting @ 12.1', 19-27 ppm @ 17.1-20'. Additional petroleum on PID/FID starting @ 9 feet.
MIP-070	12/17/14	785	12.0	273	13.4	72	17.1	Estimated 2-5 ppm chlor solv response @ 4.9-7.1'. 4 ppm @ 11.9 & 14.9'. 15-18 ppm starting @ 16'. Significant petroleum on PID/FID starting @ 5'.
MIP-071	12/17/14	203	15.0	205	15.0	110	15.0	Estimated 3-11 ppm chlorinated solvent responses @ 5.2-13.9 feet. 27 ppm starting @ 15 feet.
MIP-072	12/18/14	436	54.0	1,169	5.0	735	4.1	Estimated 25 ppm chl solv response @ 2-3'. 75-183 ppm @ 3-5.9'. 32-58 ppm @ 7-8' & 9.9-12.9'. Significant additional petroleum on PID/FID.
MIP-073	12/18/14	393	17.0	228	4.1	81	17.9	Estimated 9 ppm chlorinated solvent response @ 15-15.7'. 17-21 ppm 16-19'. Additional petroleum on PID/FID & FID only @ 1.8-10.2'.
MIP-074	12/18/14	16	17.1	123	12.7	20	14.1	Estimated 1 ppm chlorinated solvent responses @ 5 & 14.1 feet. 3-5 ppm @ 16-19.1 feet. Hydrocarbon responses on FID @ 5.4-15.1'.
MIP-075	12/18/14	197	17.1	109	14.1	103	14.5	Estimated 1 ppm chlorinated solvent responses @ 1.9 & 2.9-3.5 feet. 26 ppm starting @ 14.5 feet.
MIP-076	12/18/14	326	14.5	131	14.5	123	14.5	Estimated 1 ppm chlorinated solvent responses @ 7, 8, 9-9.9 & 11-12'. 5 ppm @ 13.3'. 32 ppm @ 13.9-14.9'. 18 ppm @ 16-17'. 2 ppm @ 21-22'.
MIP-077	12/18/14	35	18.0	50	13.8	25	17.1	Estimated 2 ppm chlor solvent responses @ 4.2, 7.1 & 8-11'. 3-6 ppm @ 13.9-20.1'. 1 ppm @ 23-25.4'. Hydrocarbon responses on FID @ 11-14.5'.
MIP-078	12/18/14	34	16.1	24	19.1	28	17.1	Estimated 4 ppm chlorinated solvent responses @ 15-16 feet. 4-7 ppm @ 16.1-19.1'. 2 ppm @ 19.6-25.1 feet.

* Indicates @ or near detection limit.

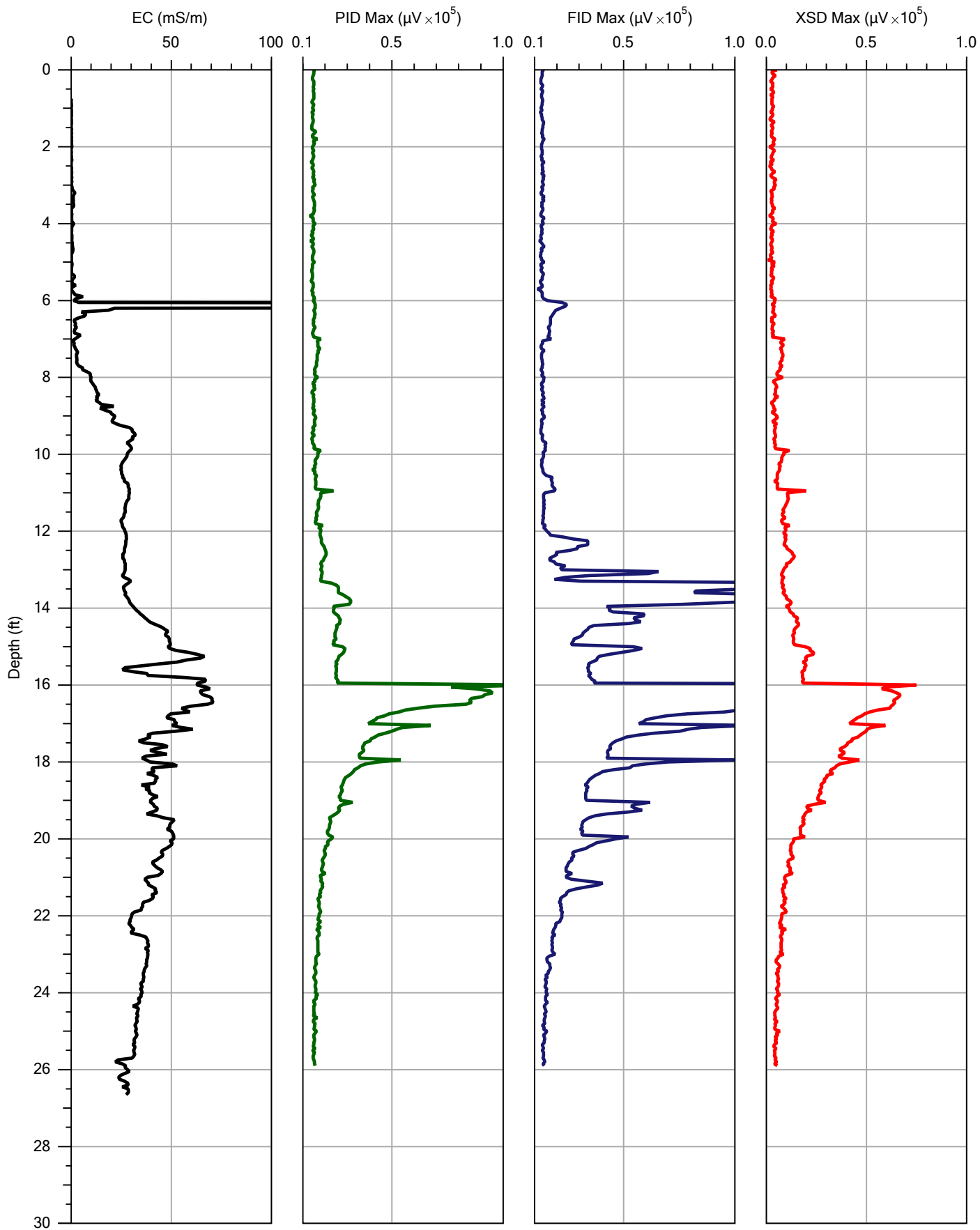
‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.

MIP LOGS

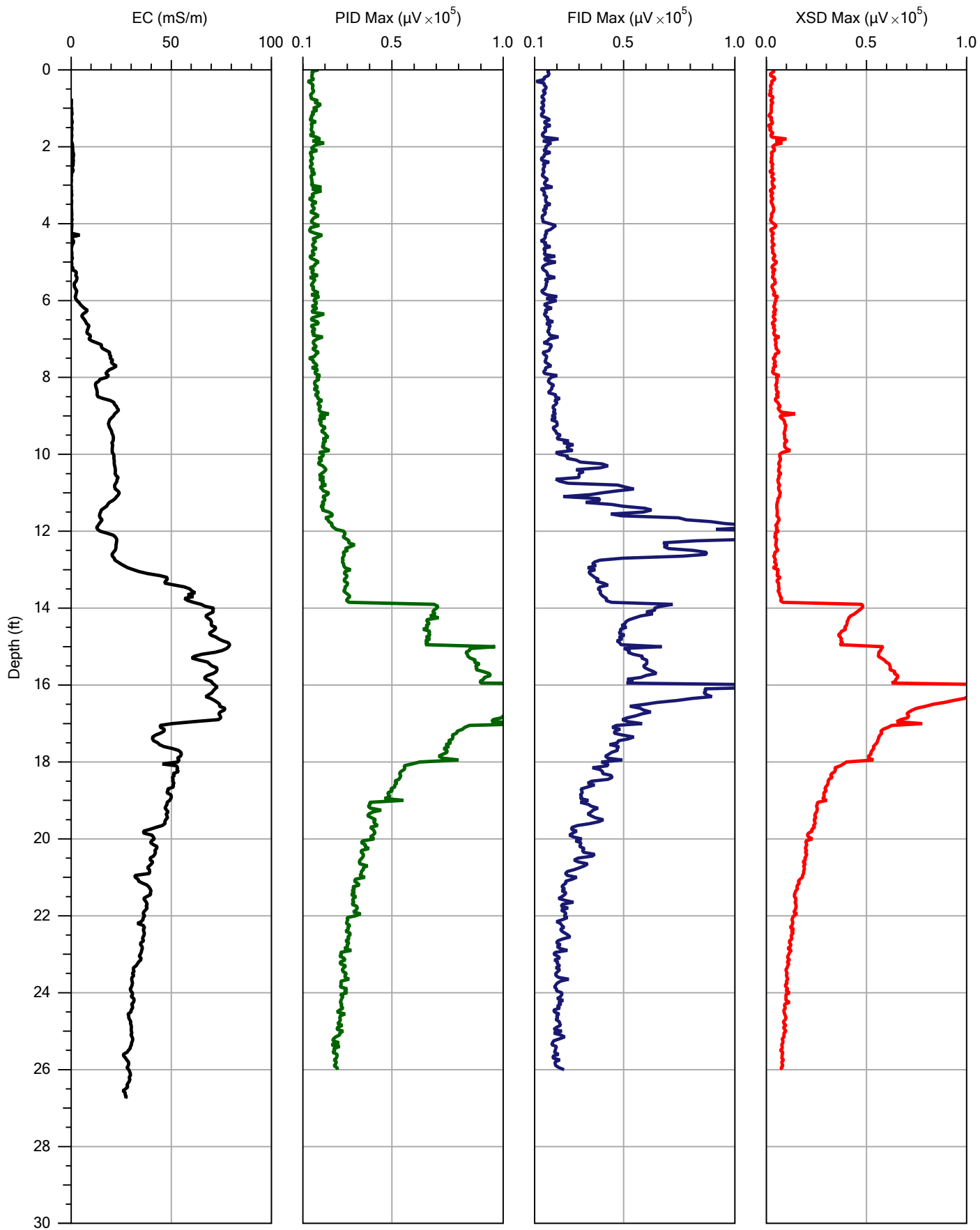
With detectors @ 100 mVolts



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

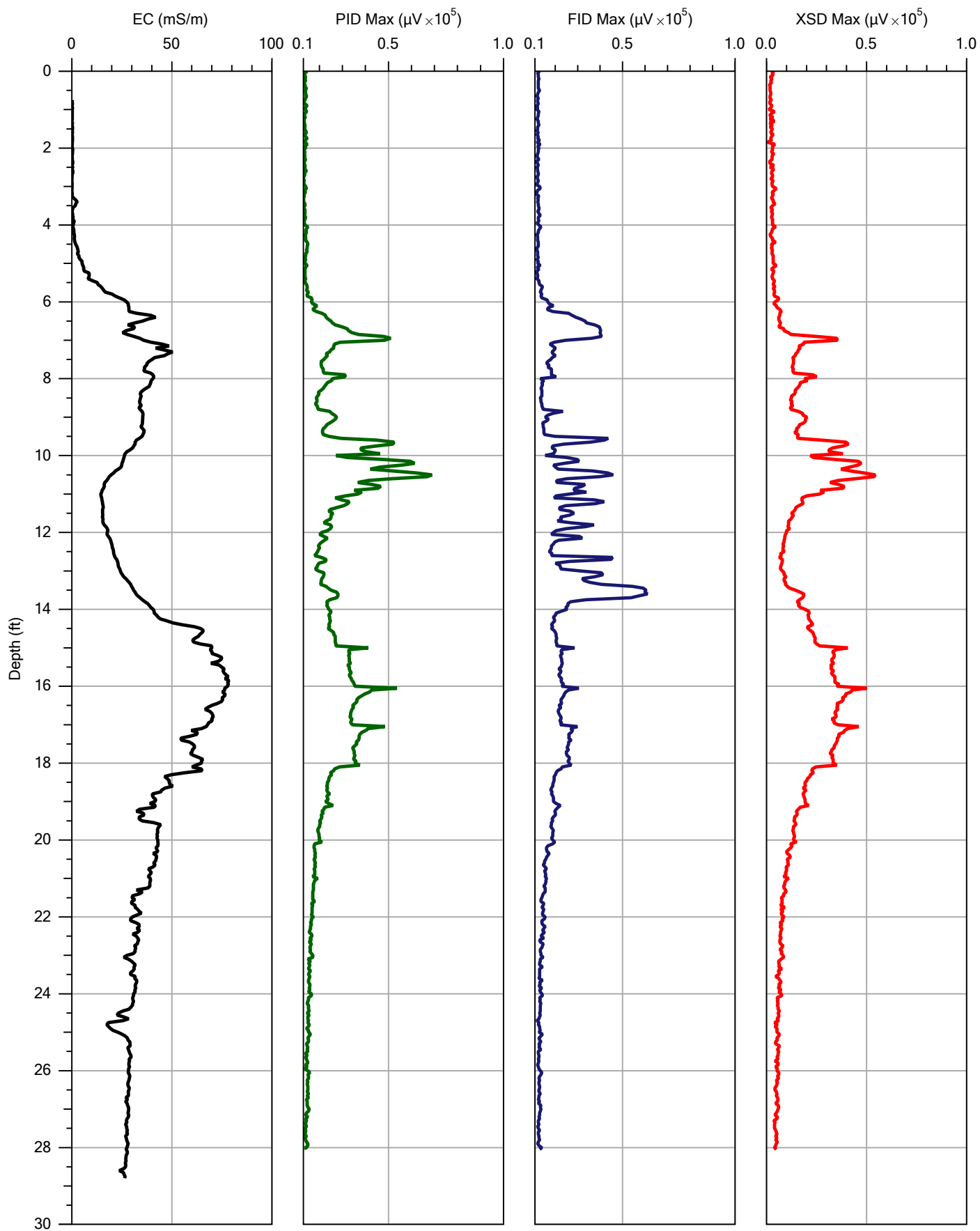
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Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

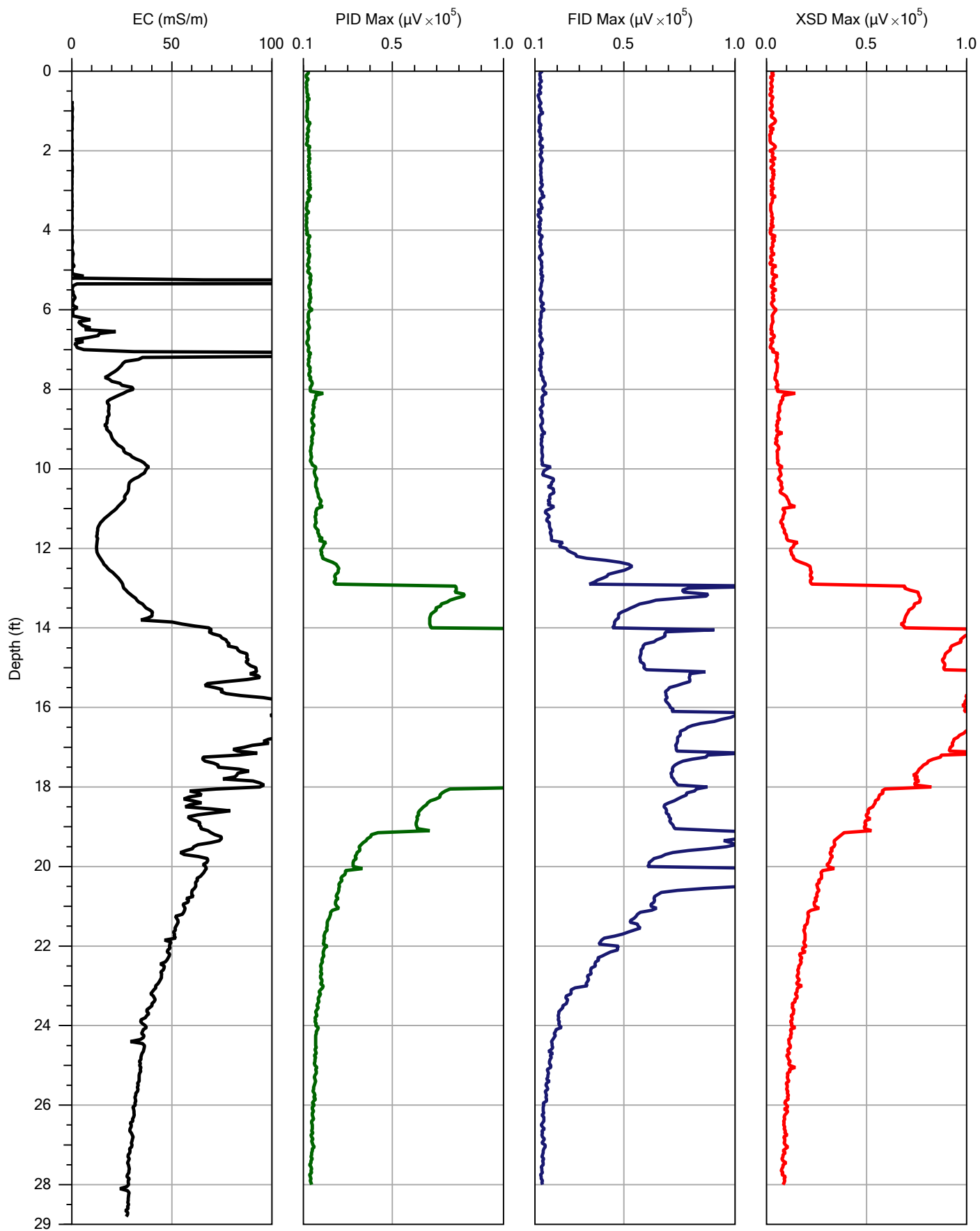
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

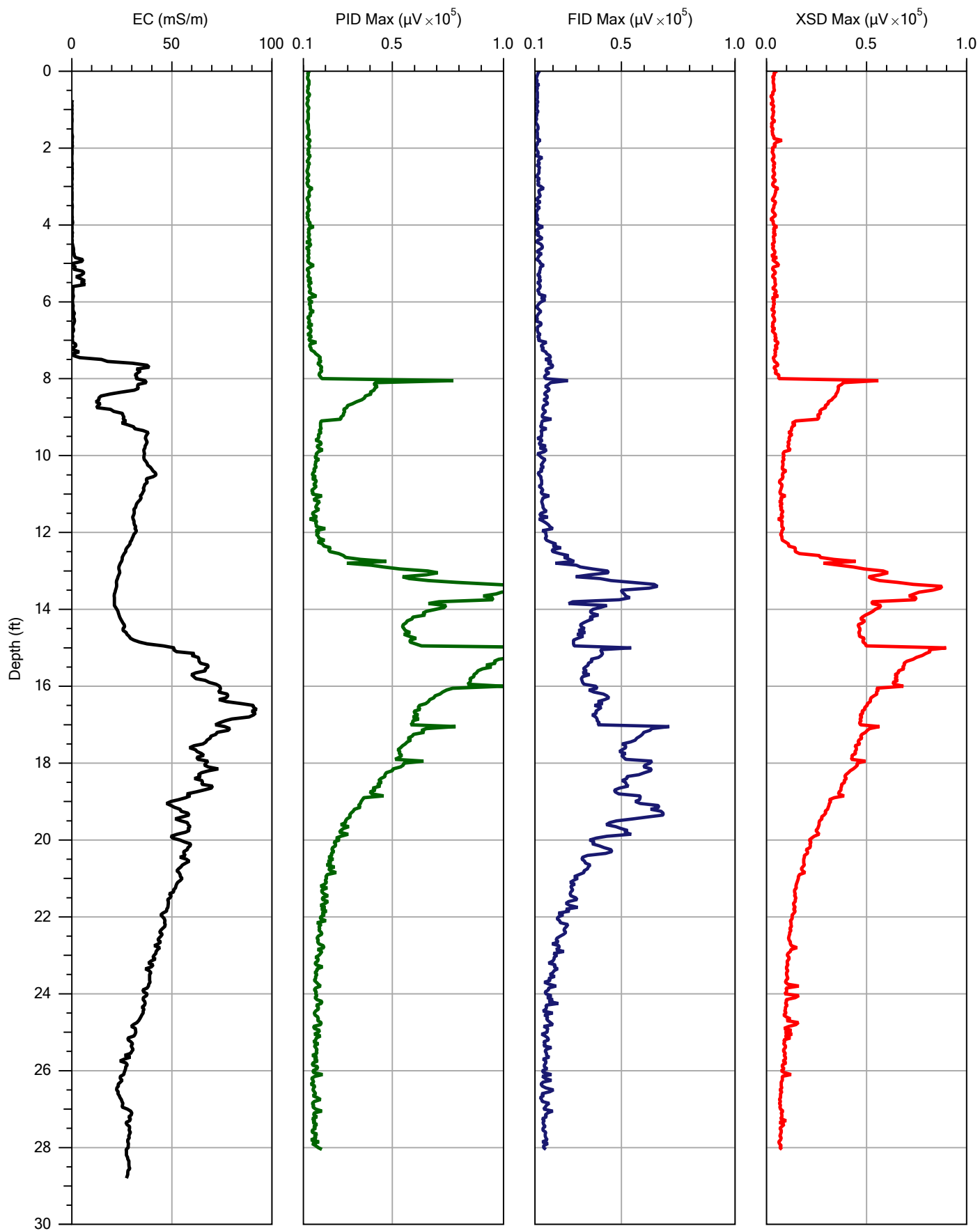
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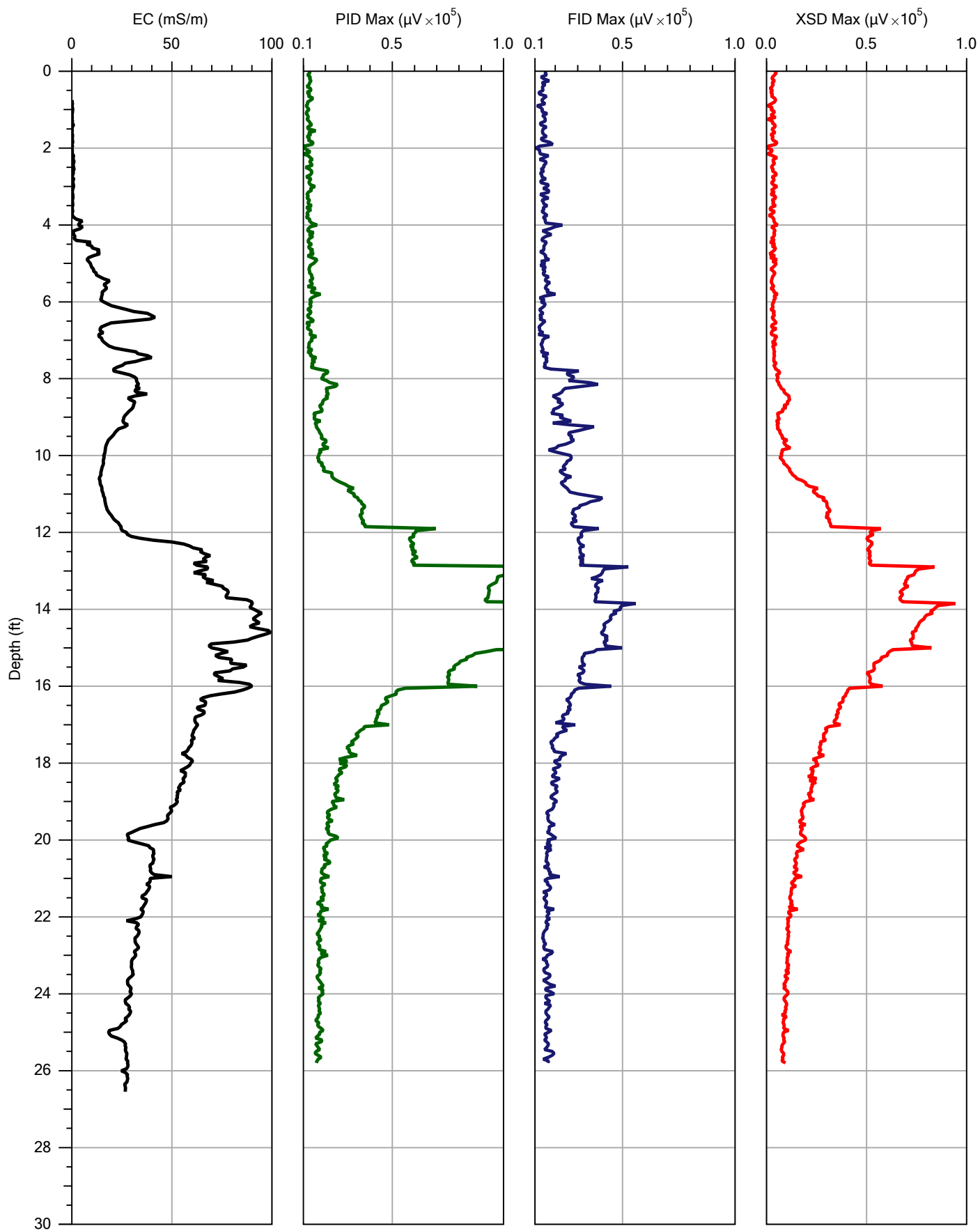
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

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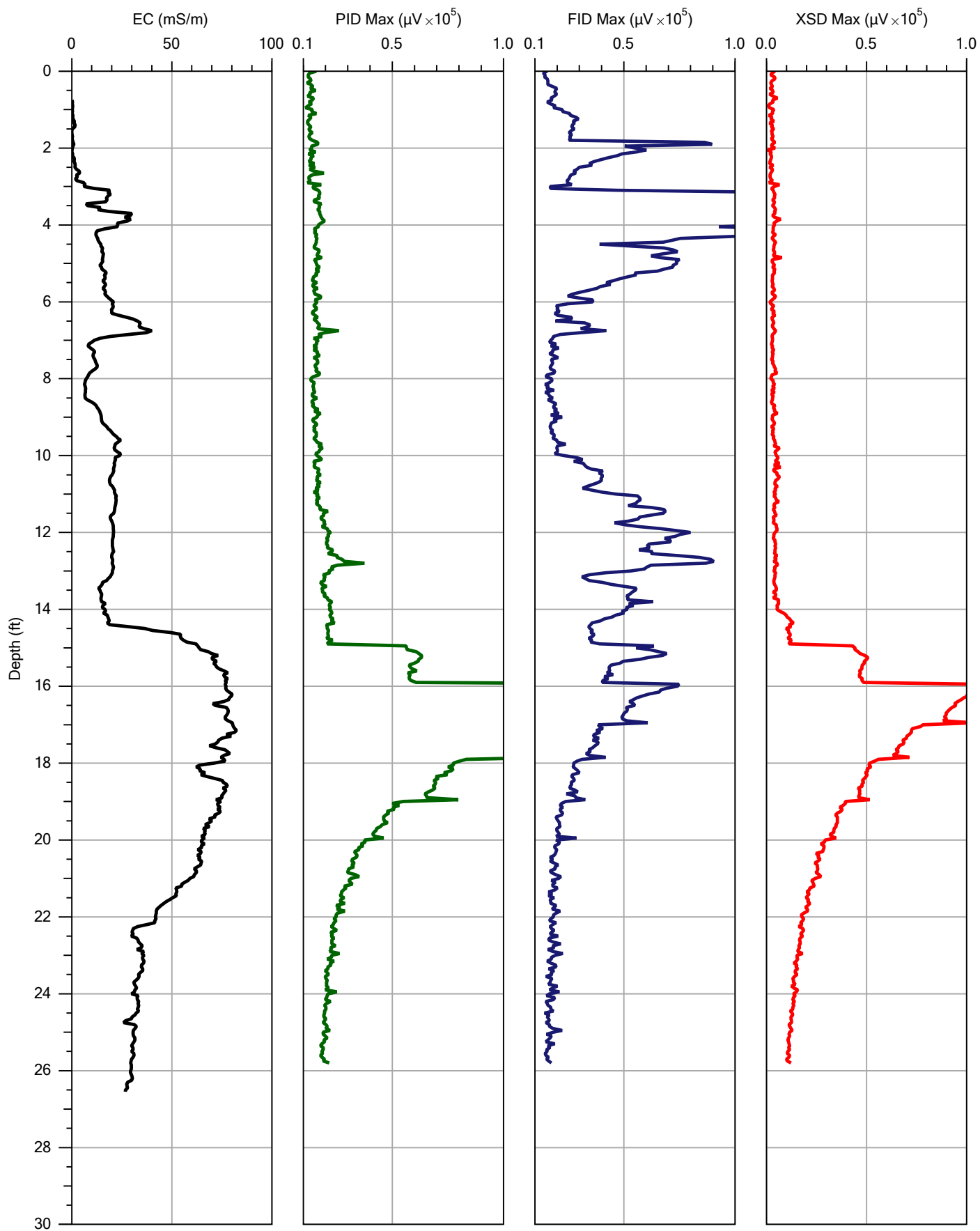
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Project ID: 319.14	Client: CRA	Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

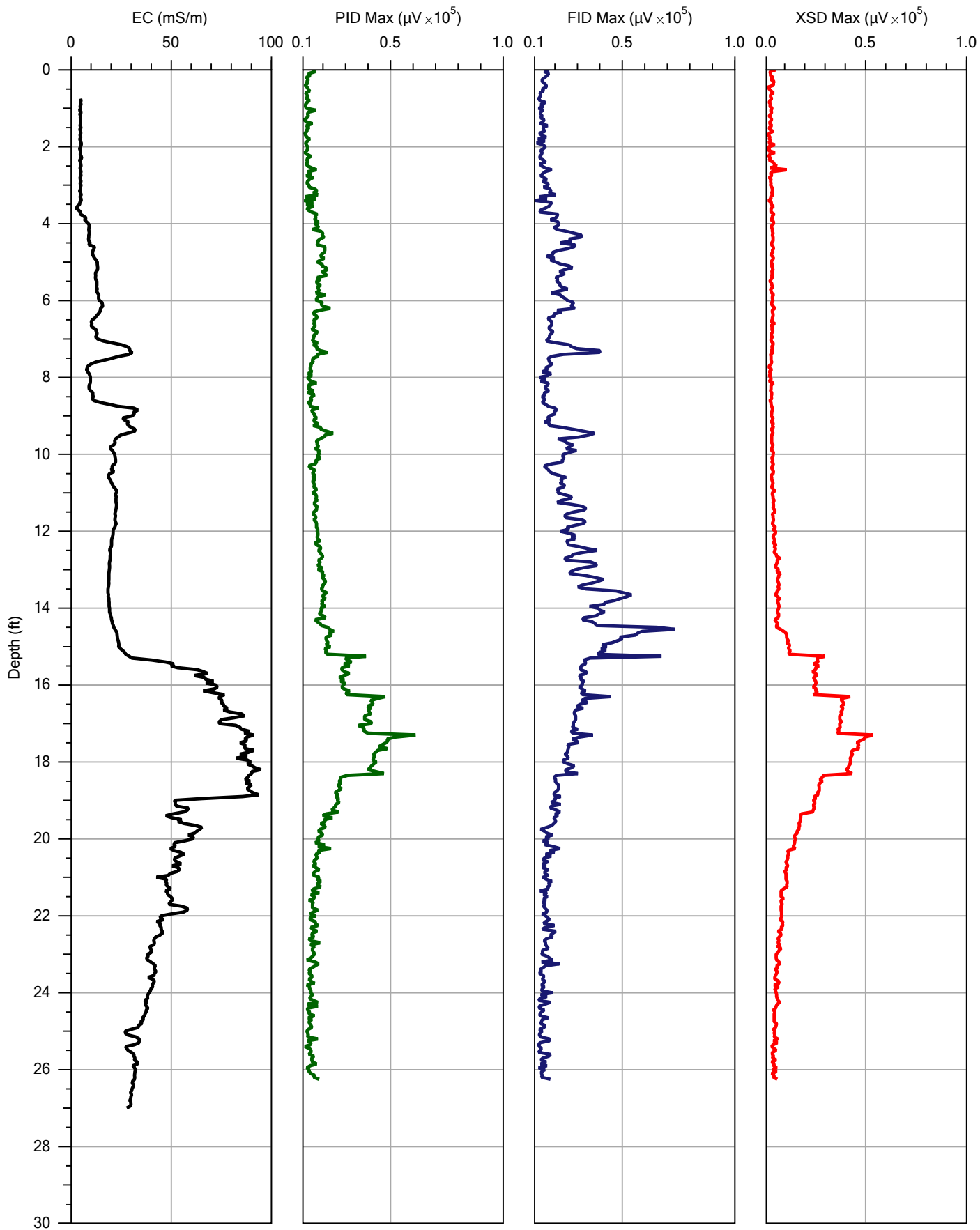
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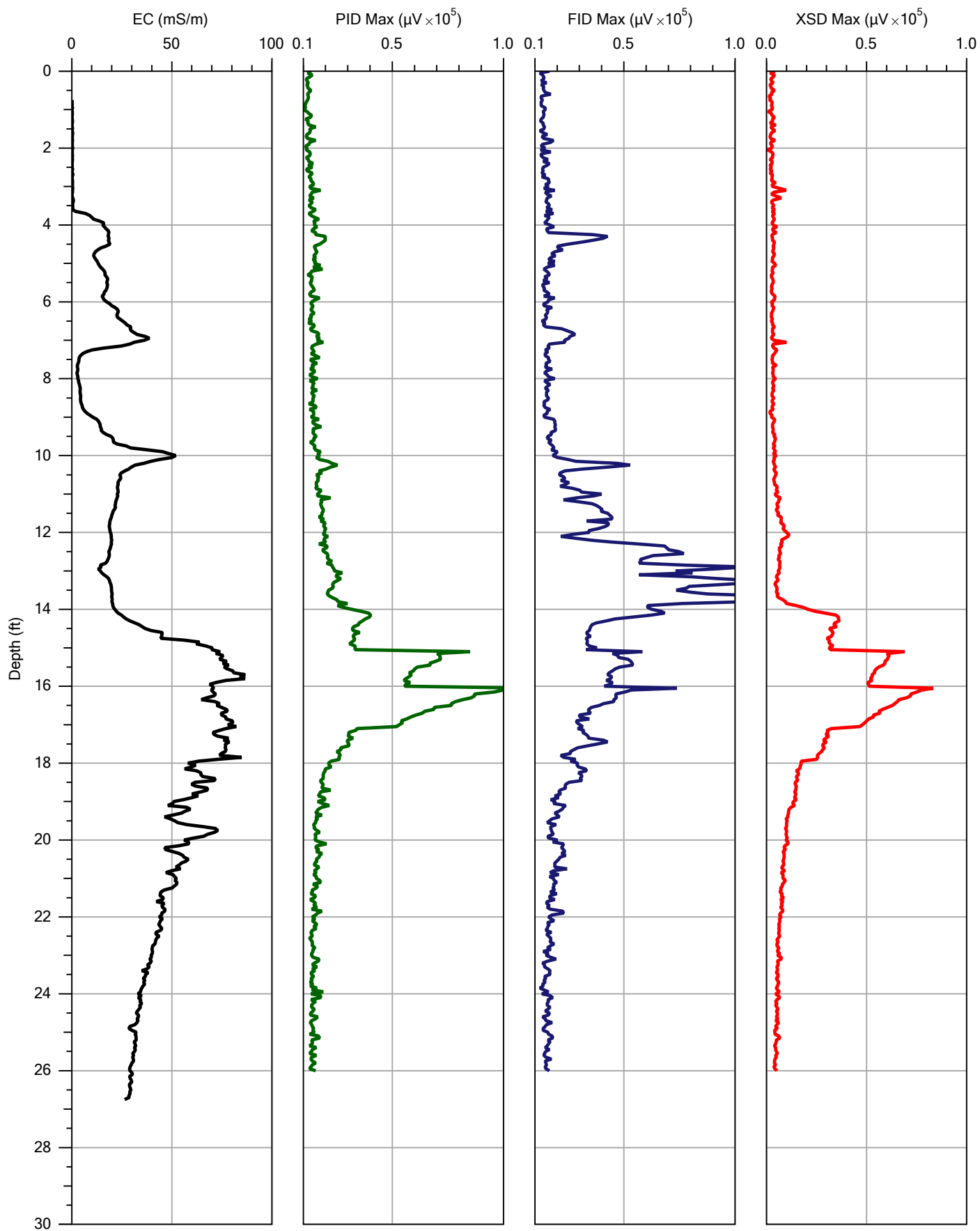
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

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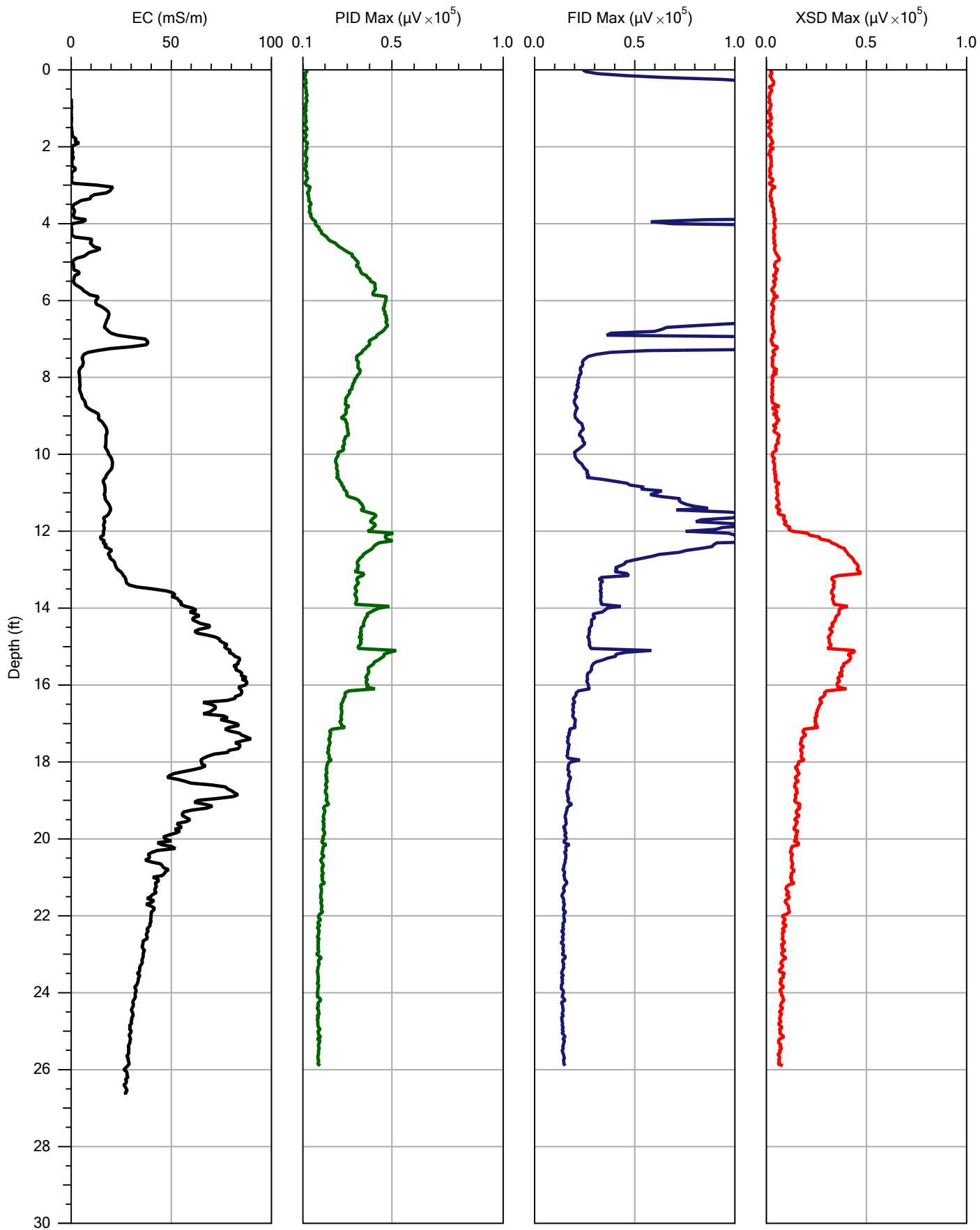
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

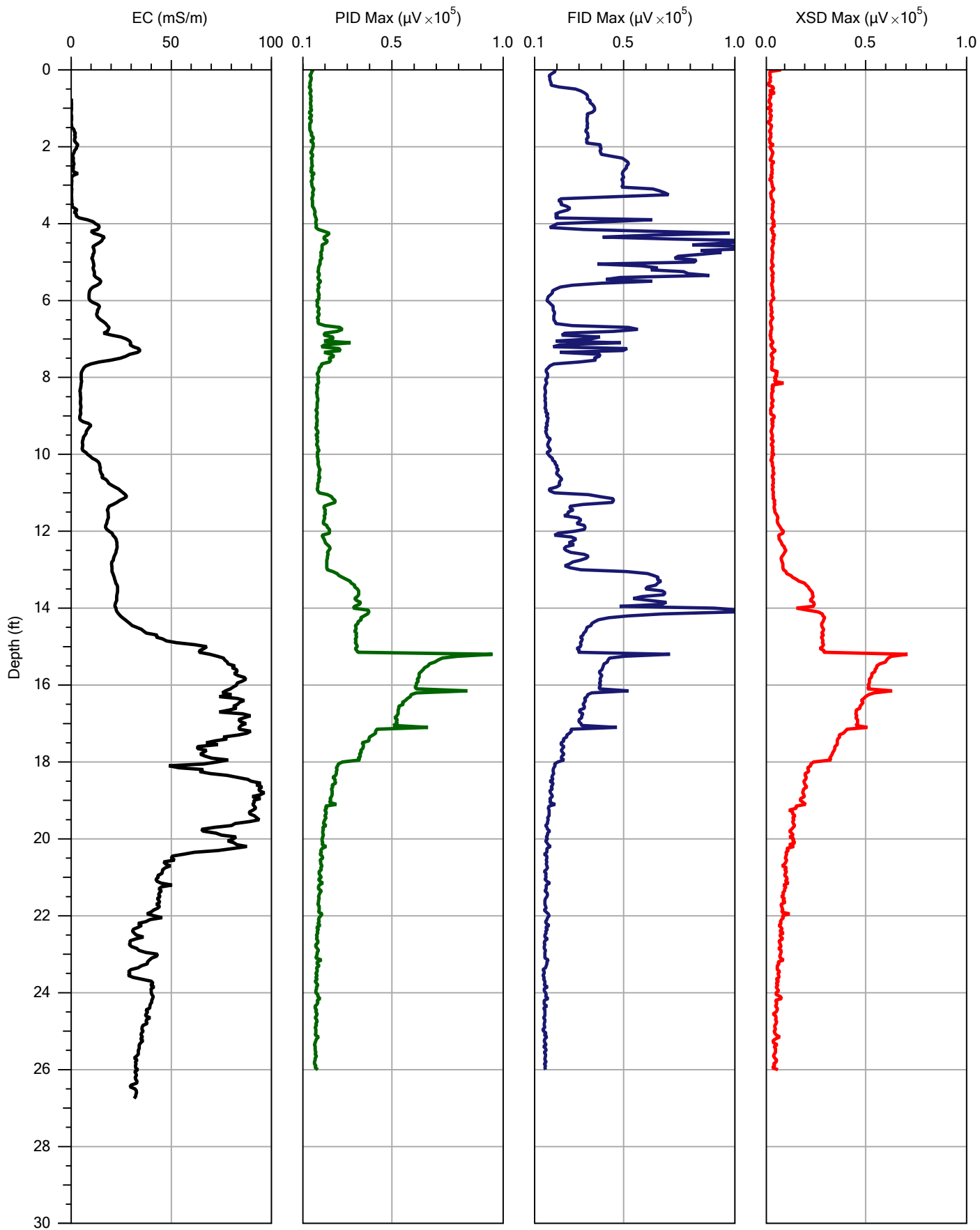
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

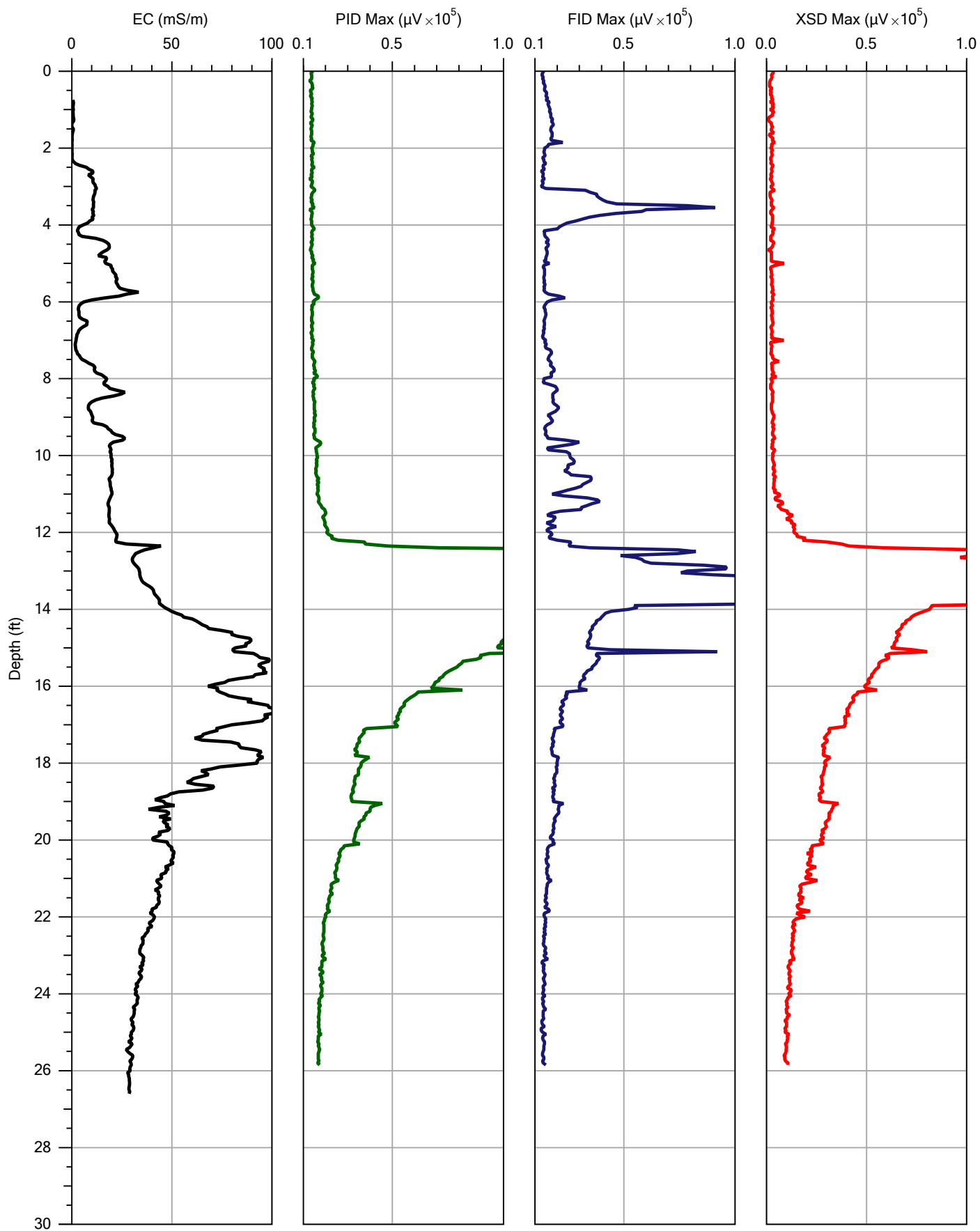
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

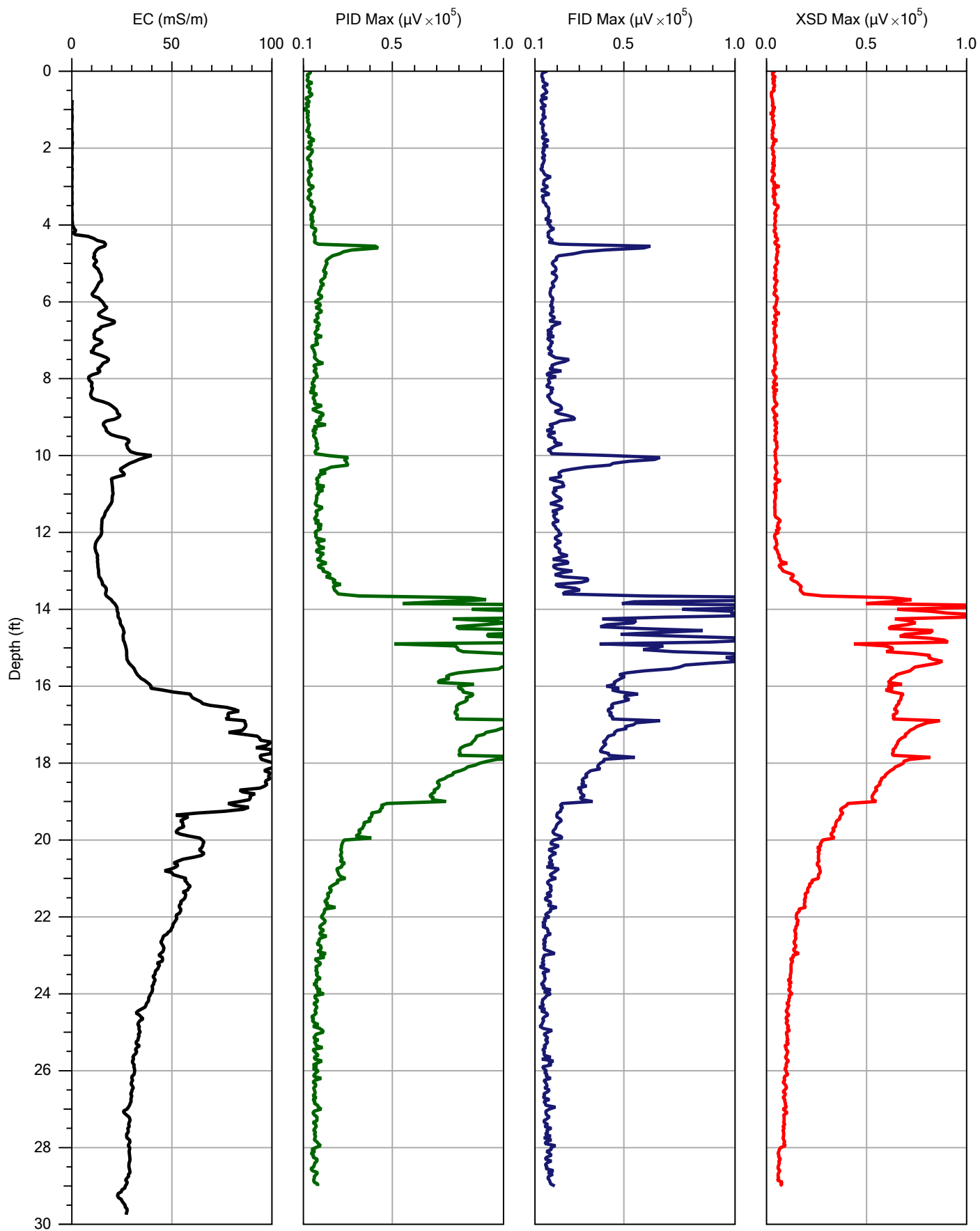
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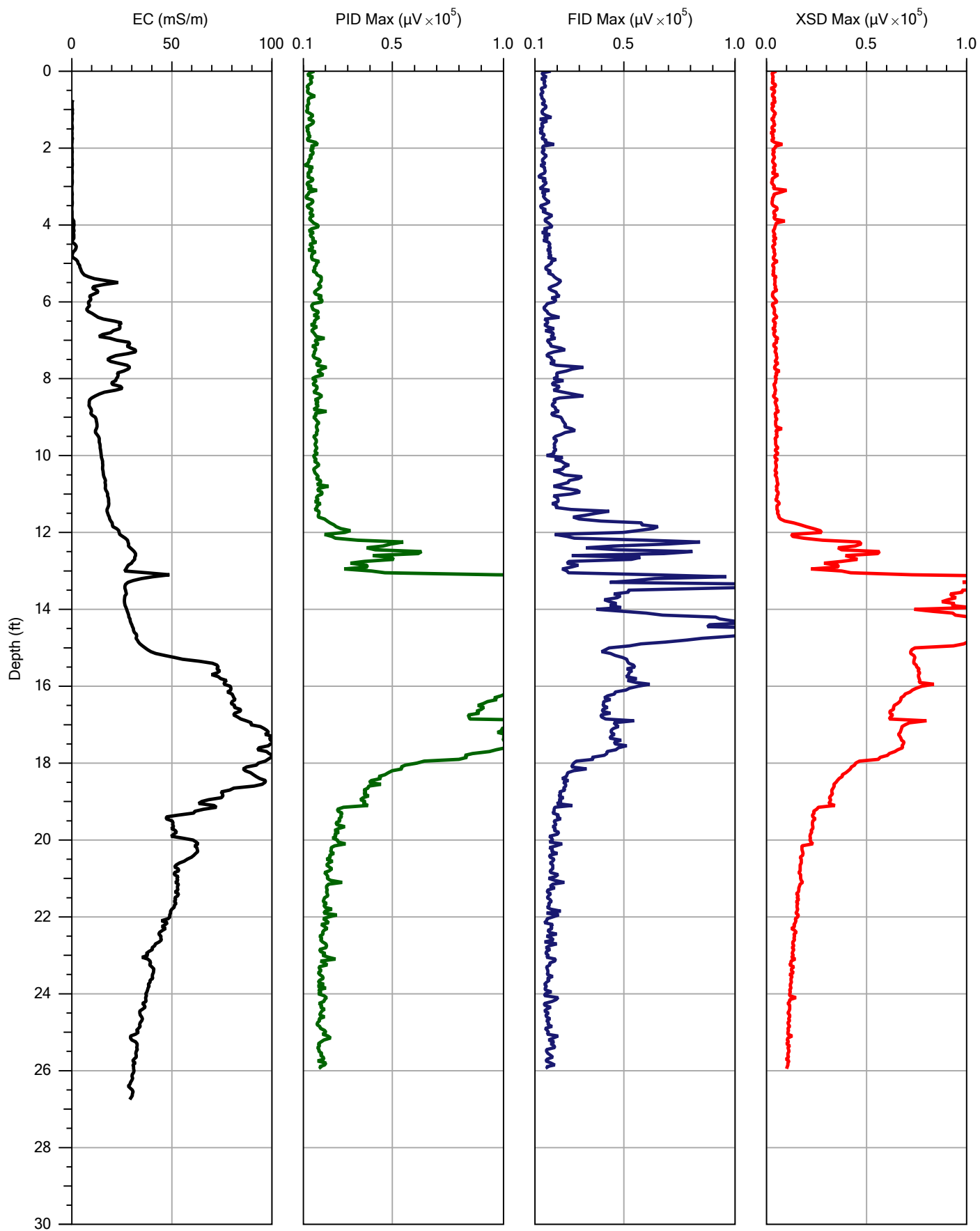
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Project ID: 319.14

Operator: M Jensen
Client: CRA

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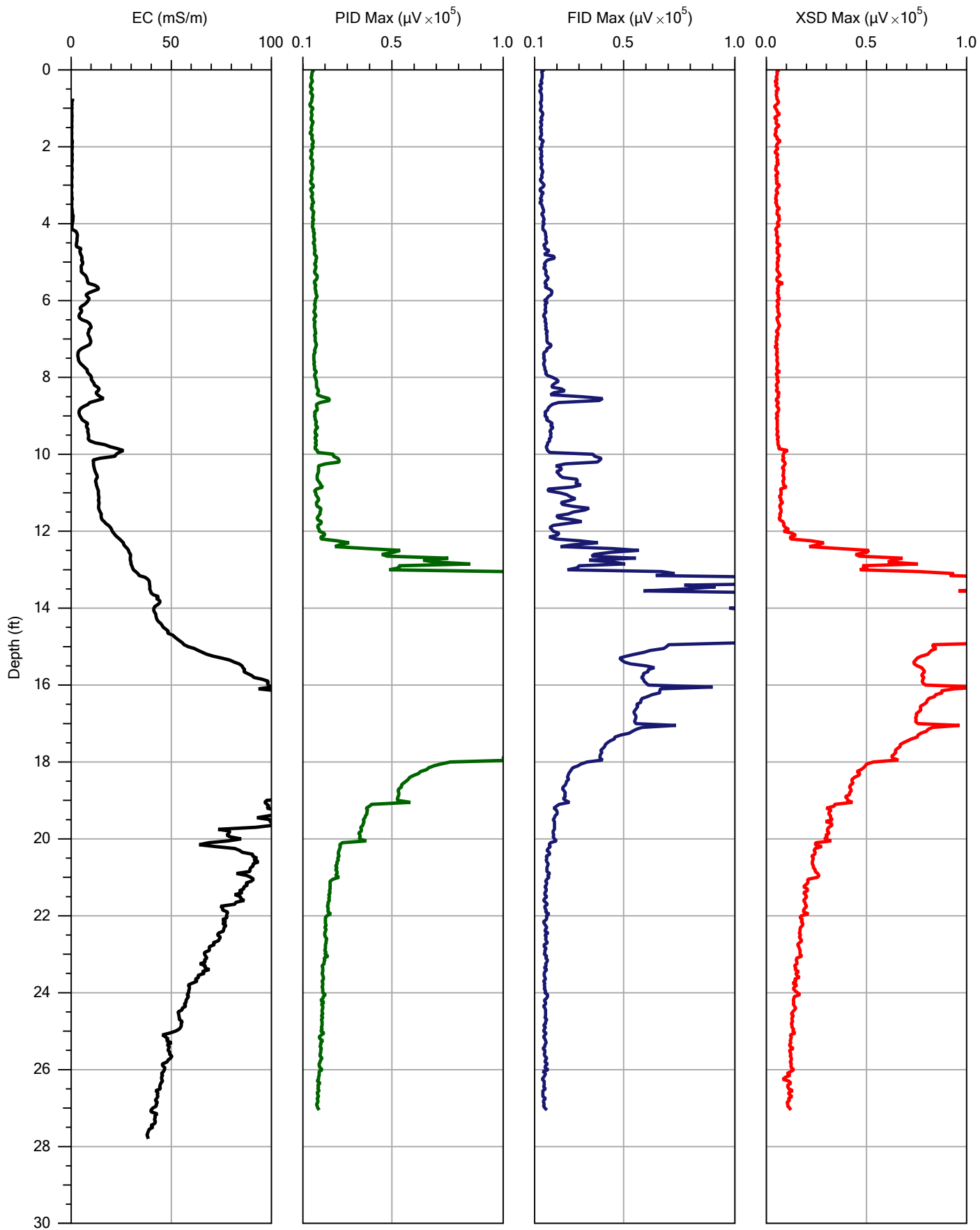
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

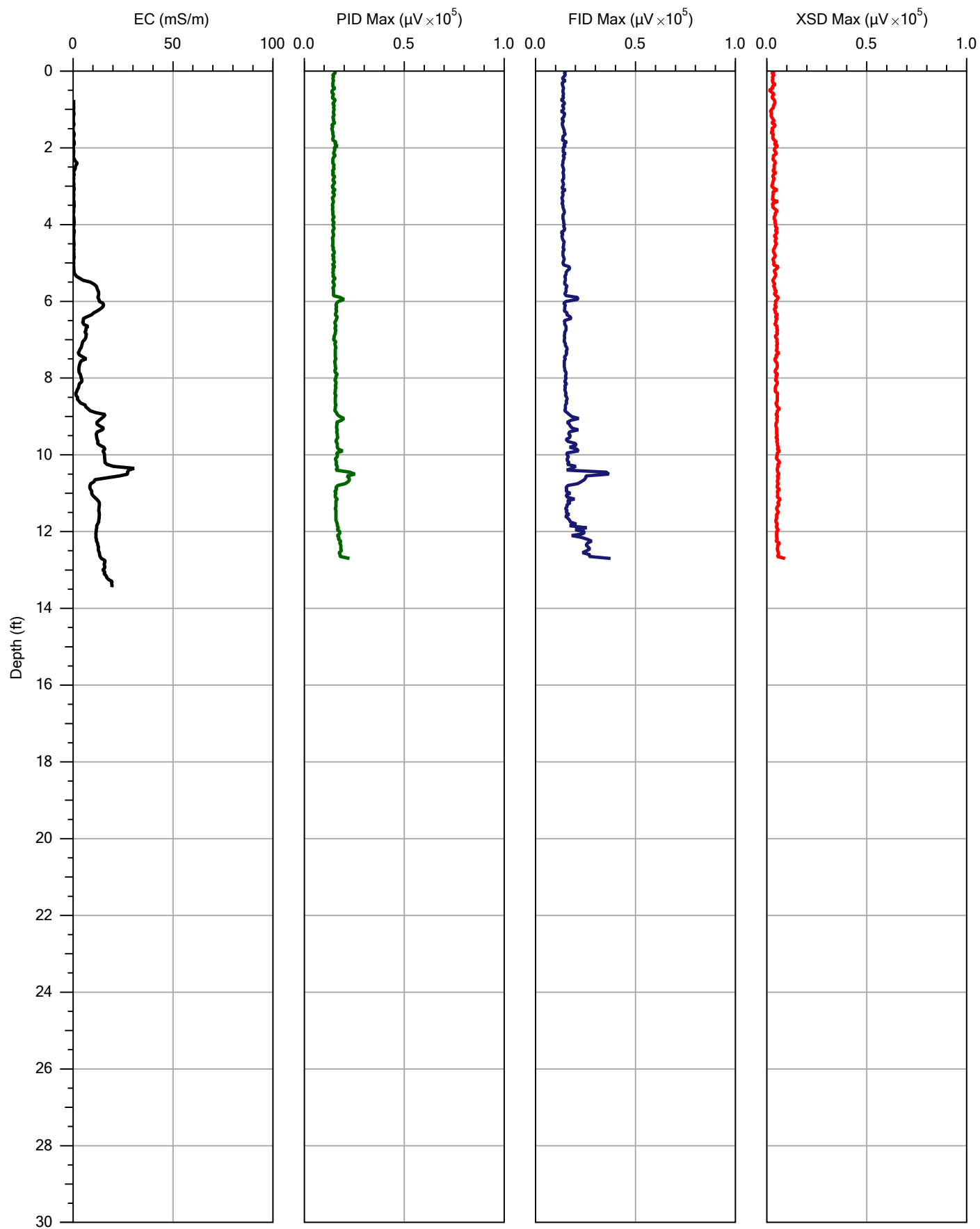
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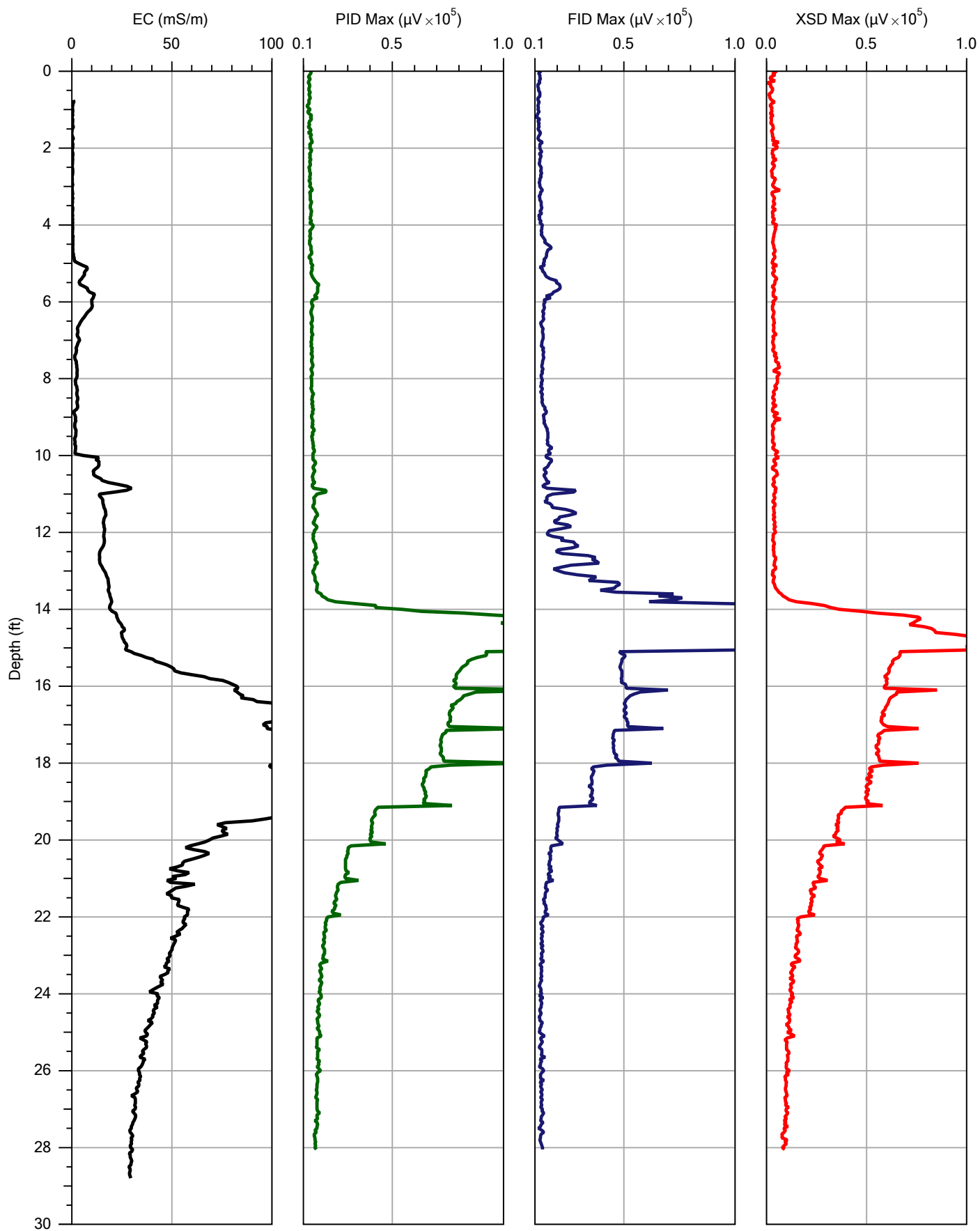
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Project ID: 319.14

Operator: M Jensen
Client: CRA

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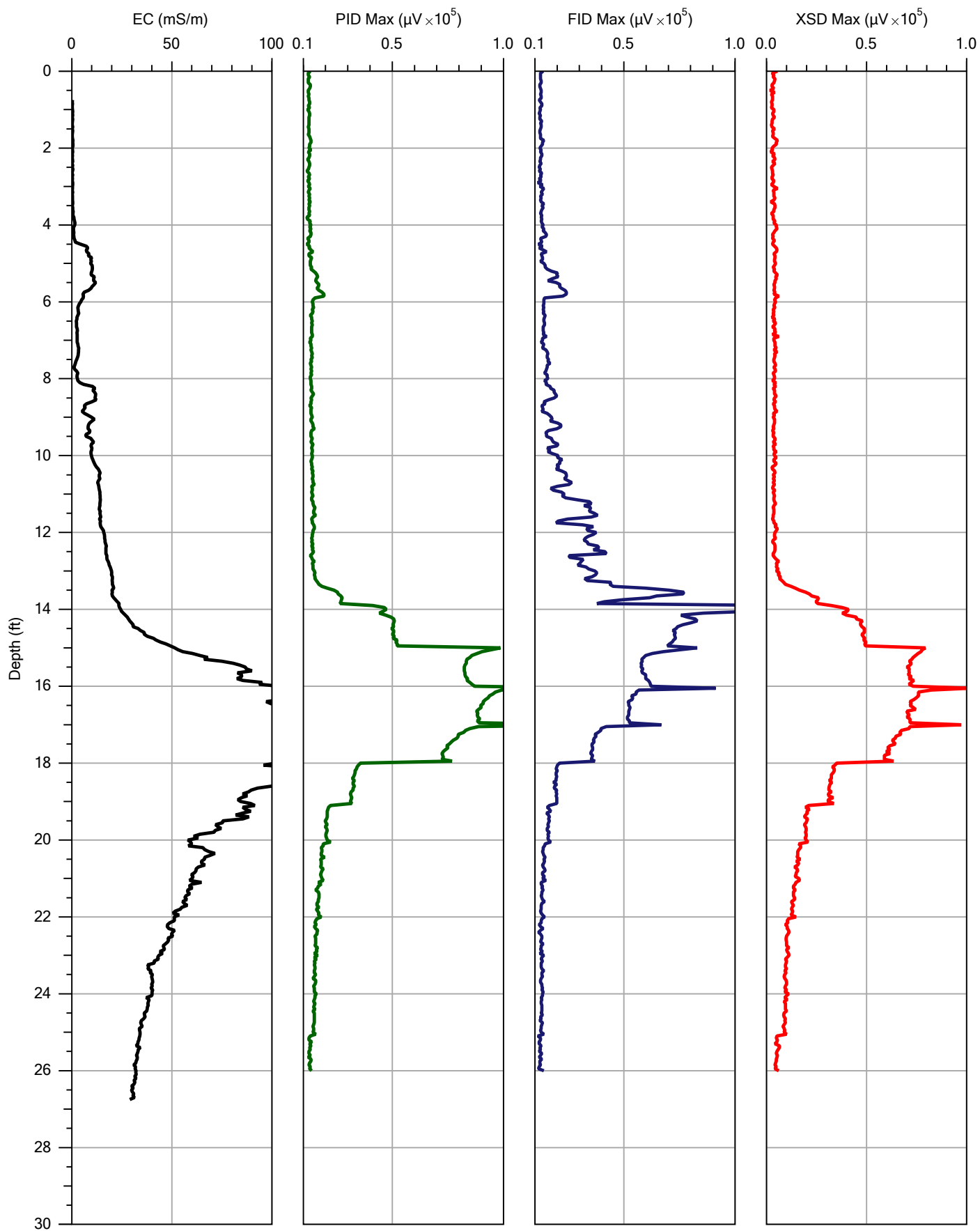
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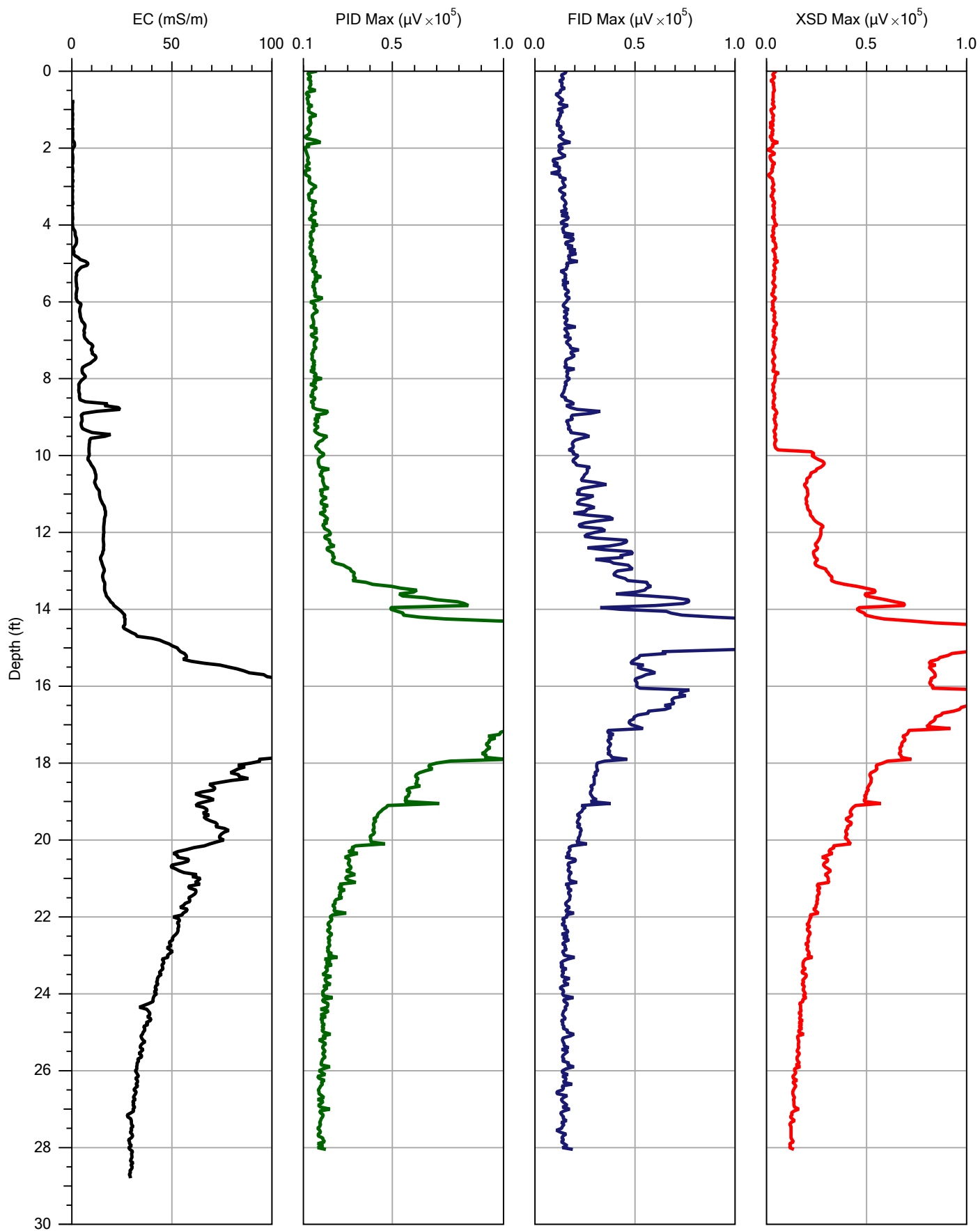
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Project ID: 319.14

Operator: M Jensen
Client: CRA

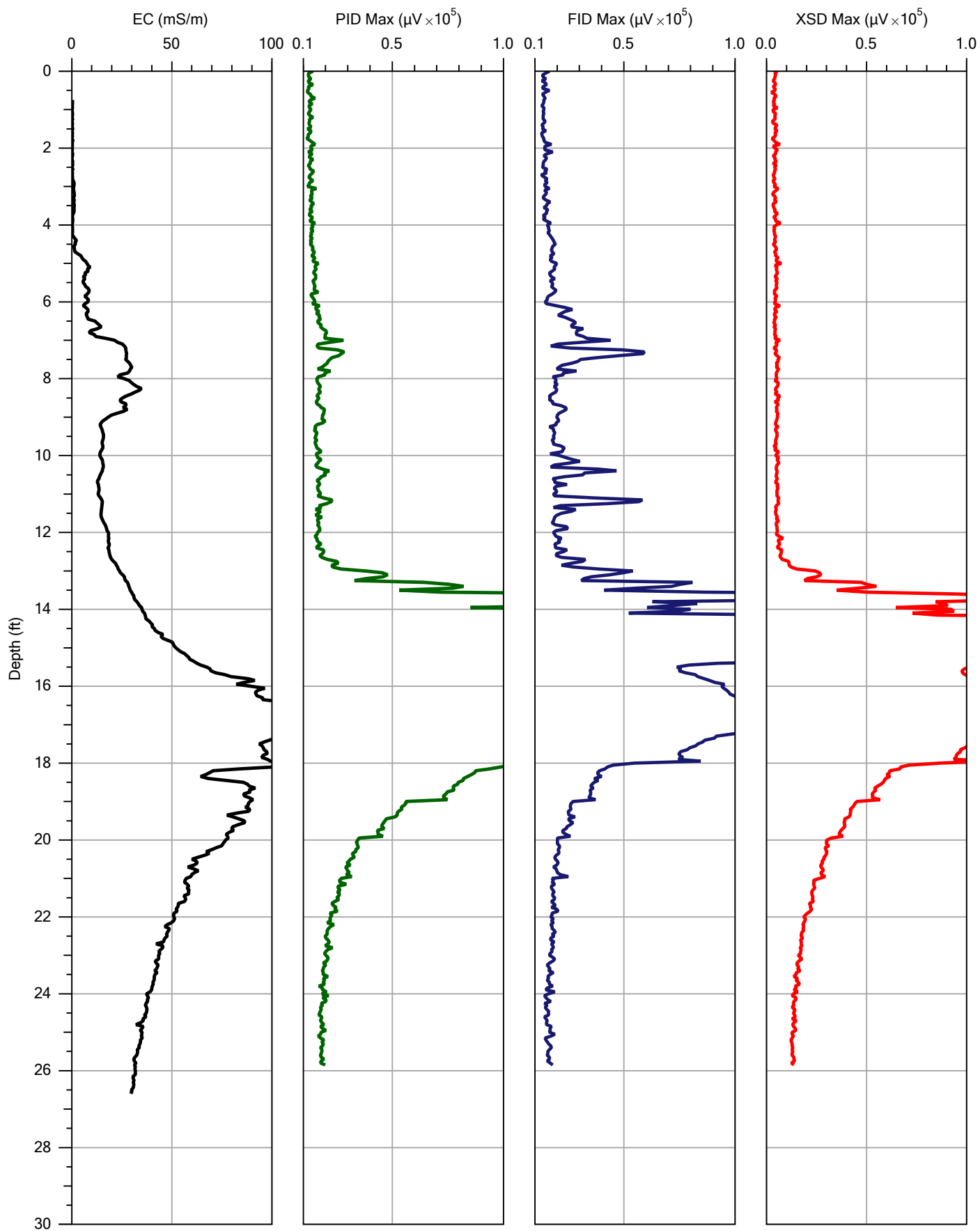
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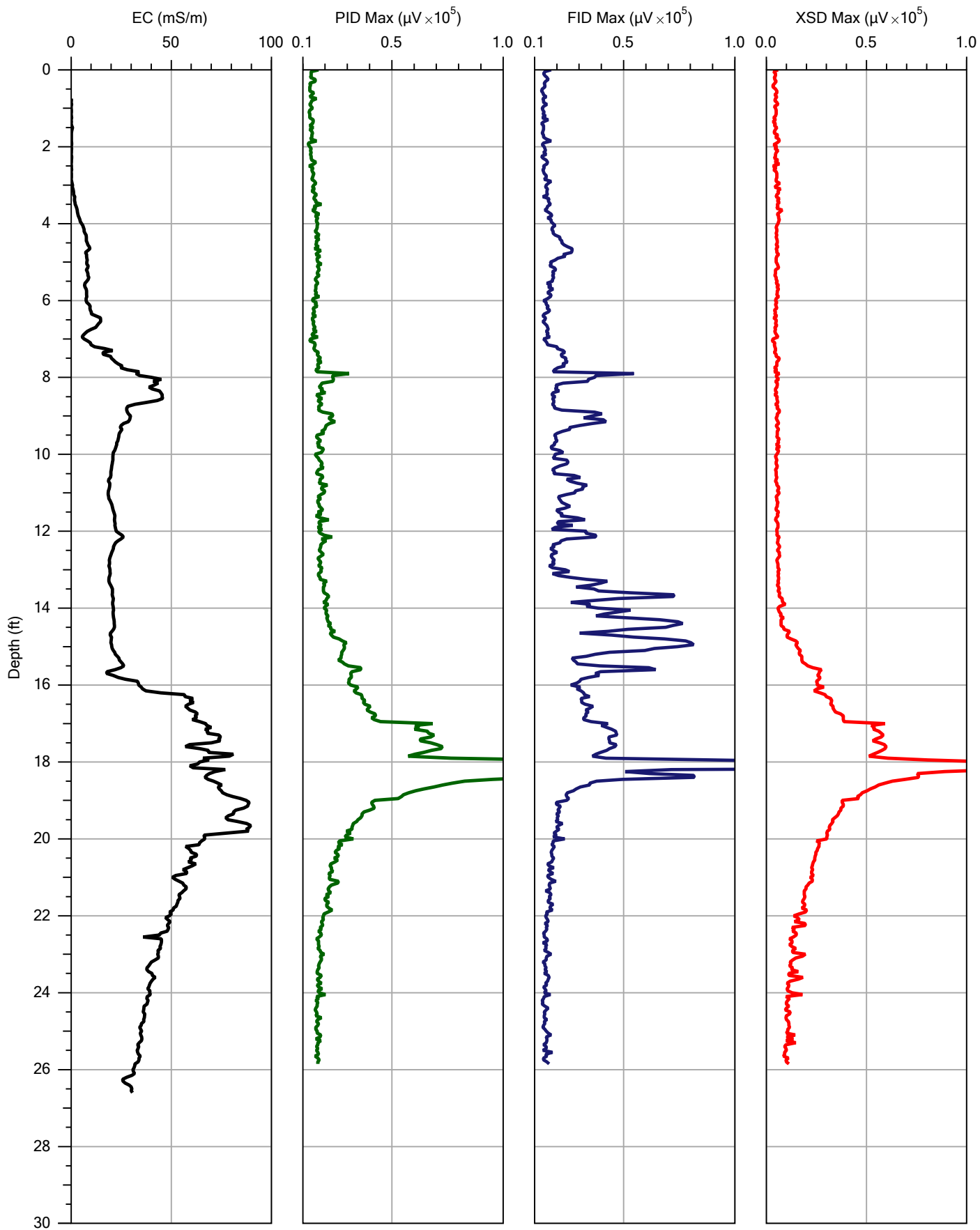
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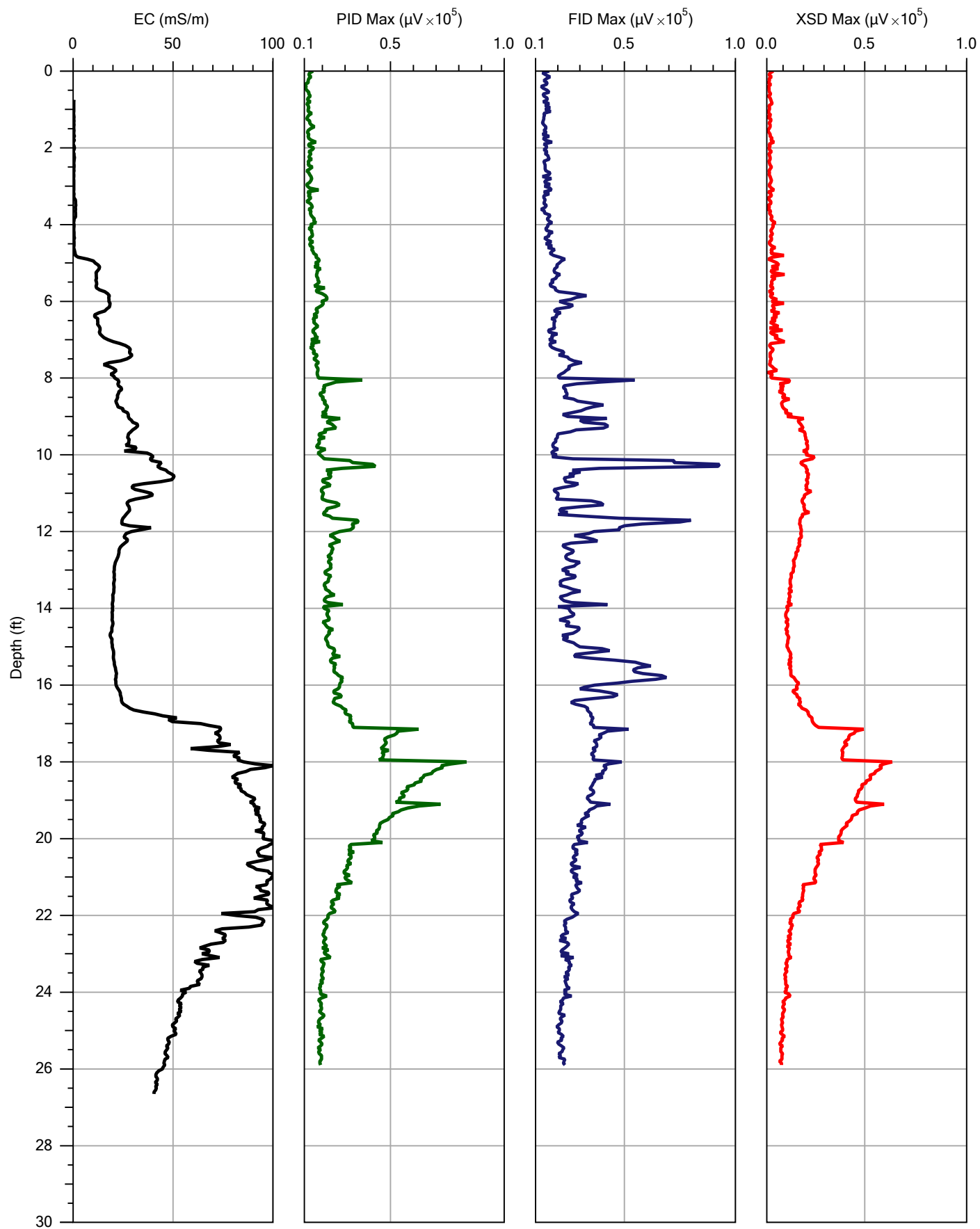
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319.14		CRA	12/5/2014
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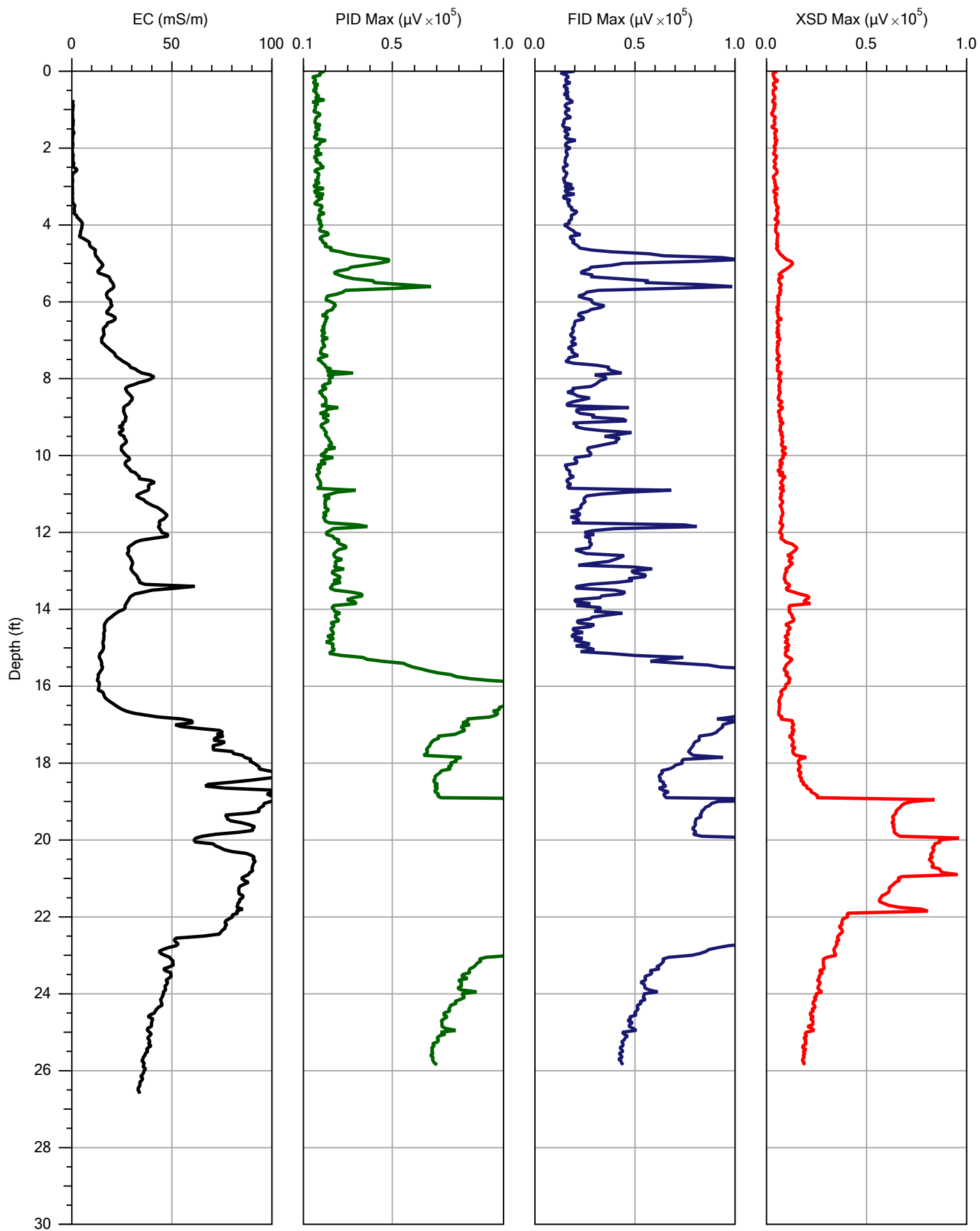
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Project ID: 319.14

Operator: M Jensen
Client: CRA

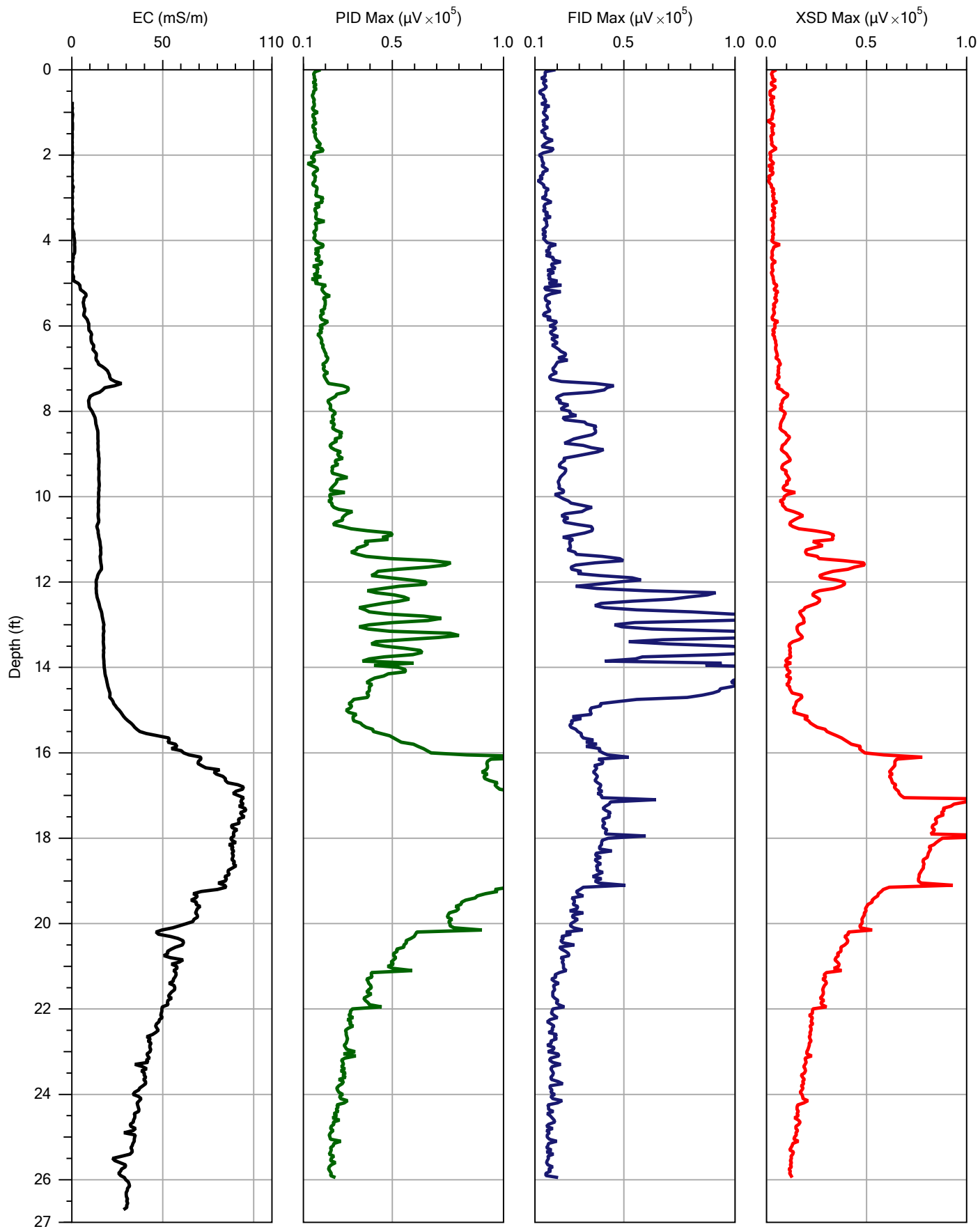
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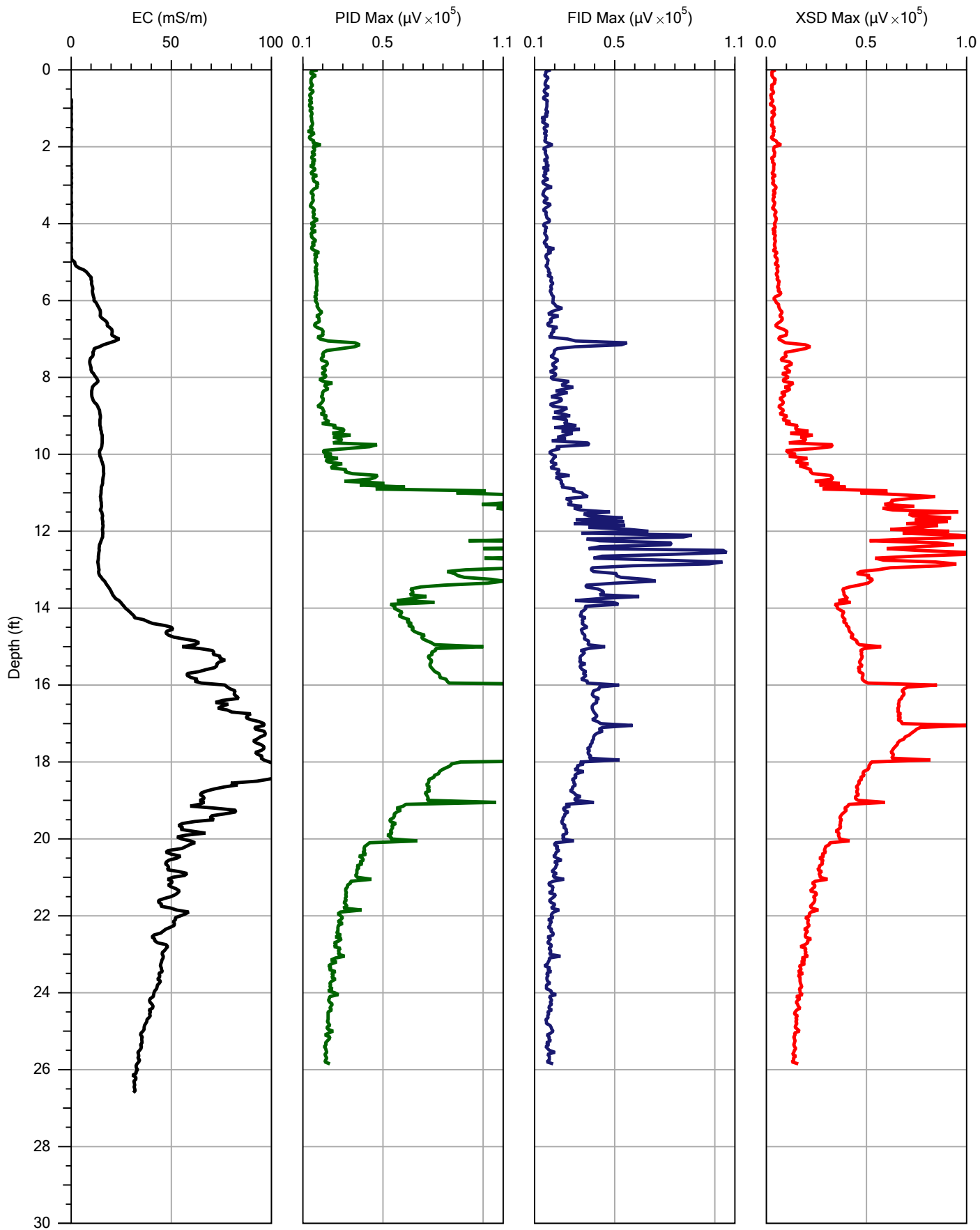
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

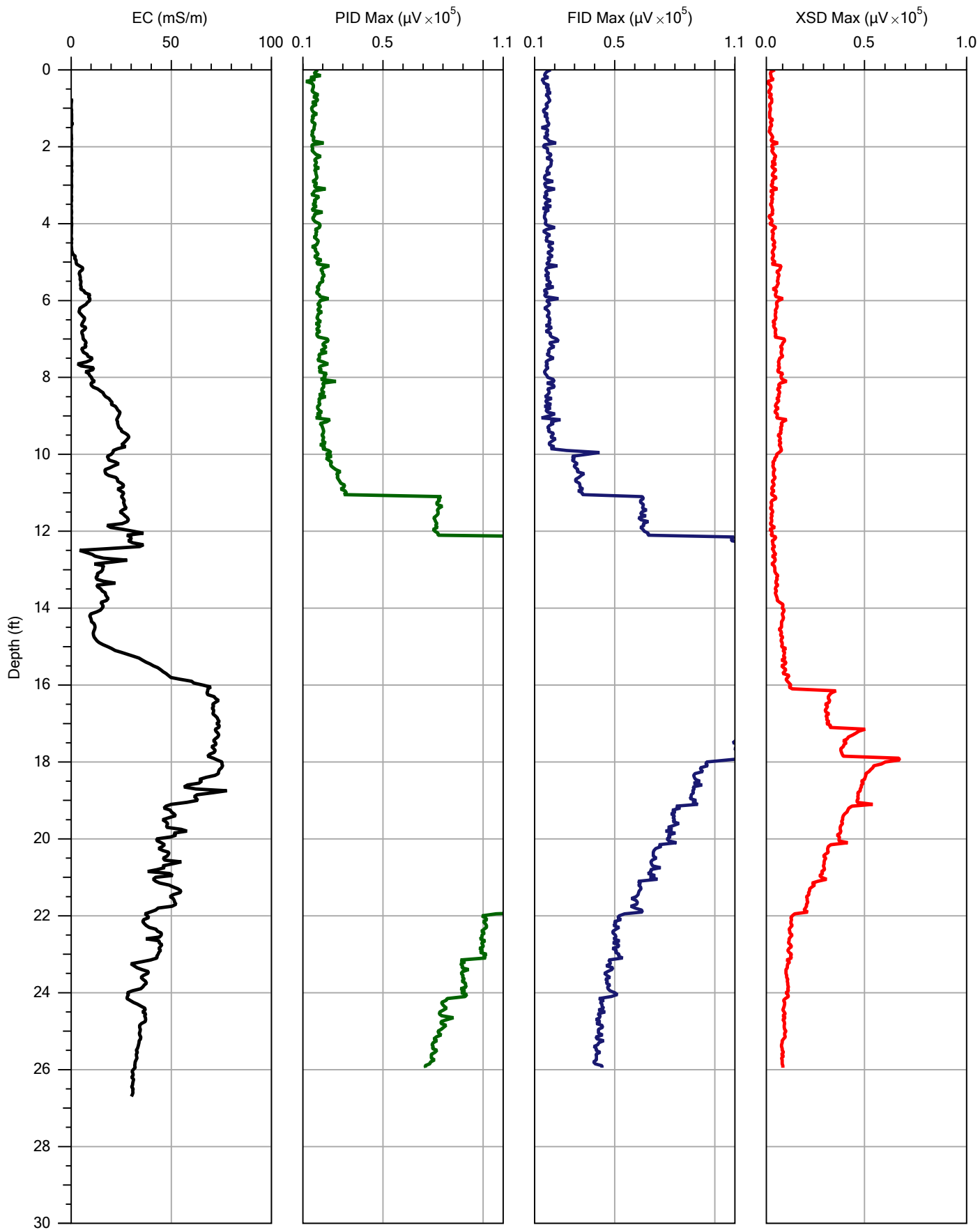
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

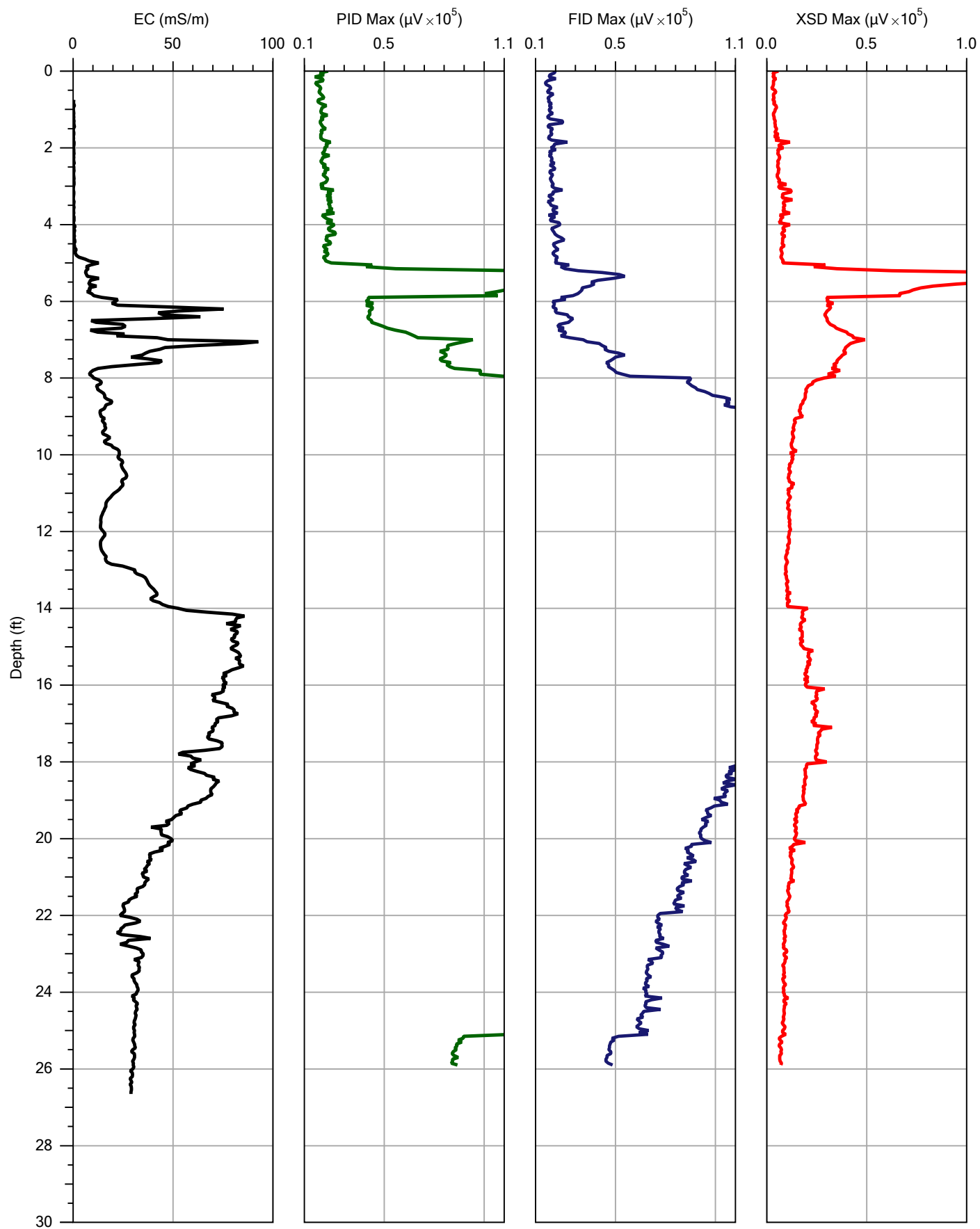
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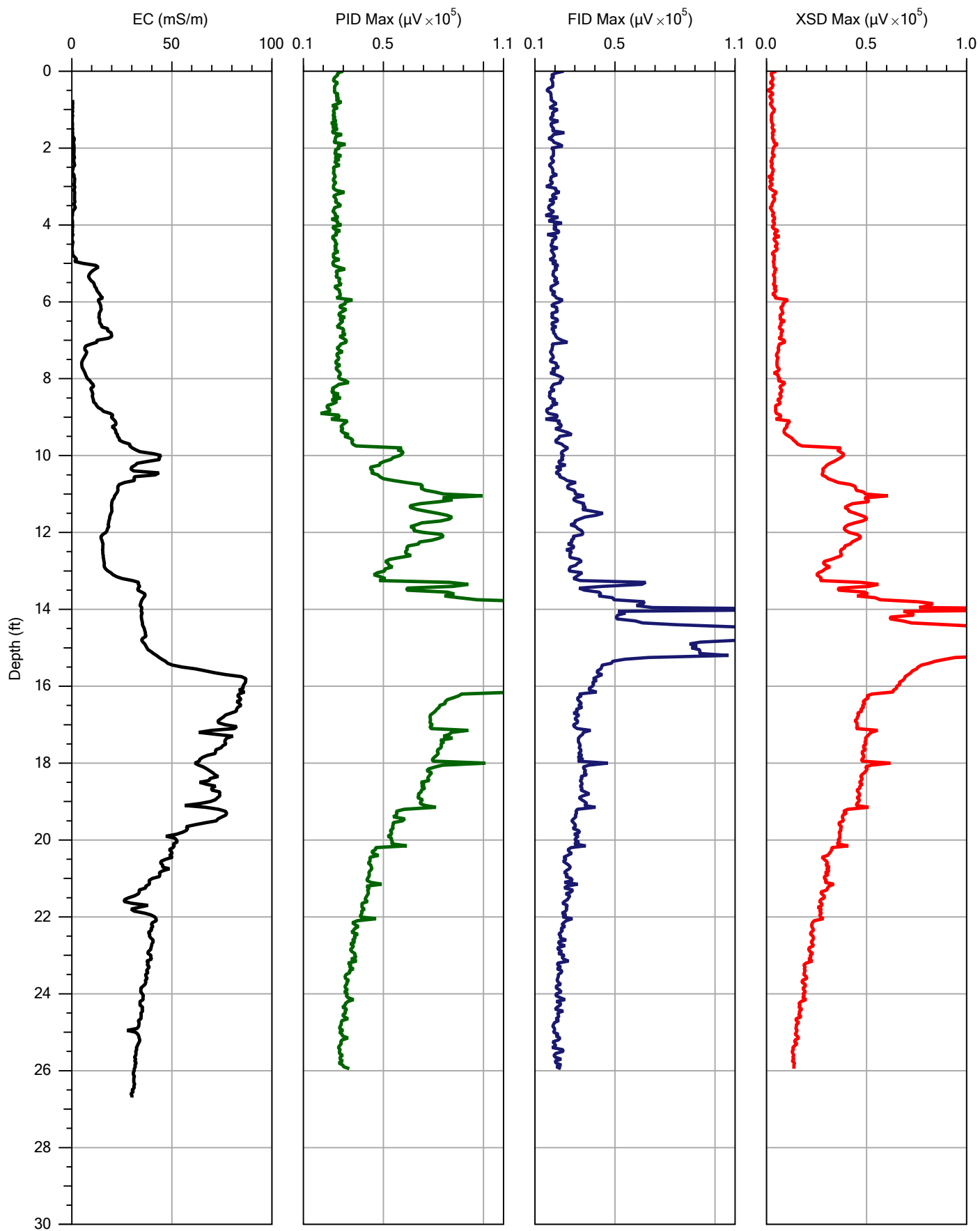
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Project ID: 319.14

Operator: M Jenson
Client: CRA

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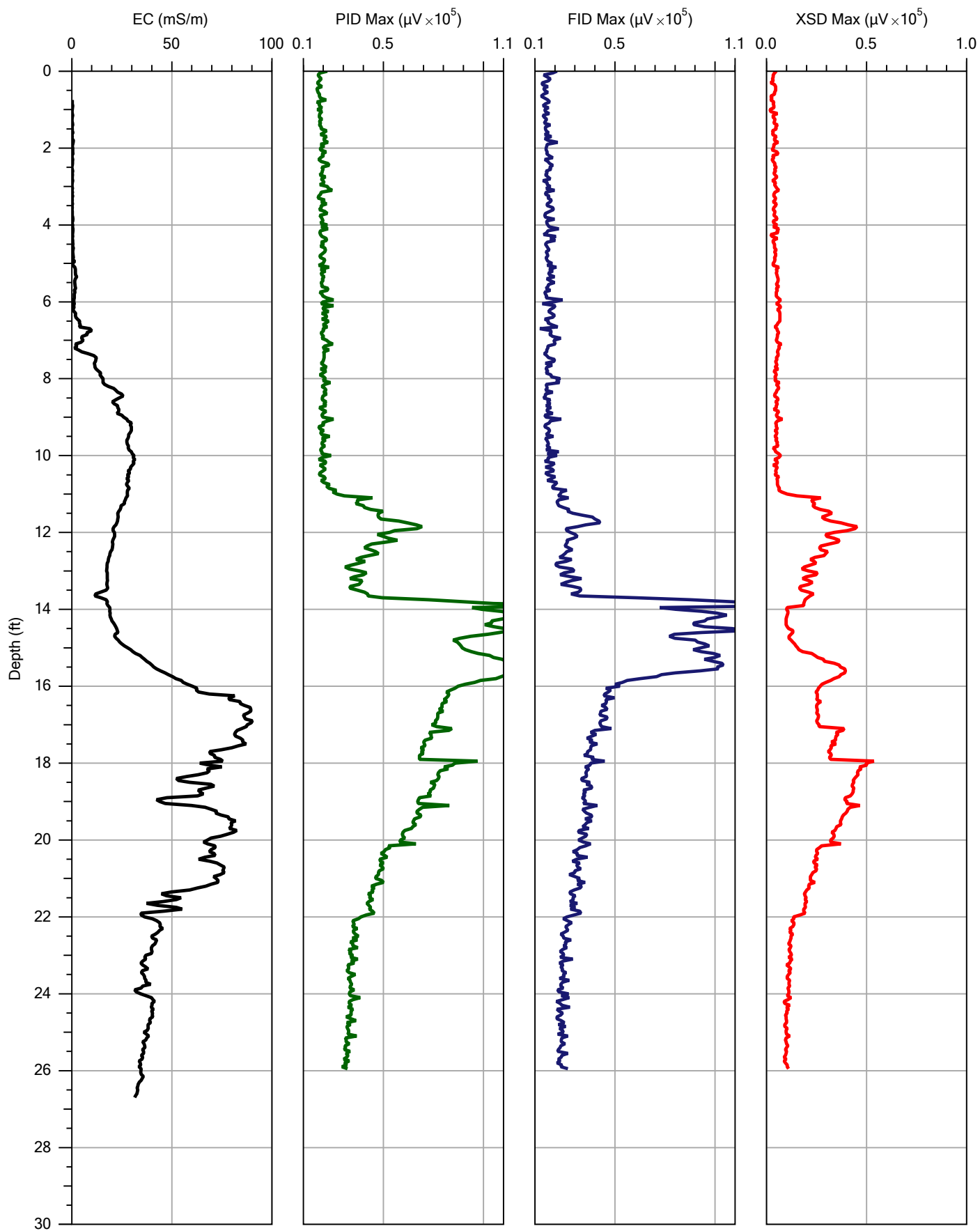
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

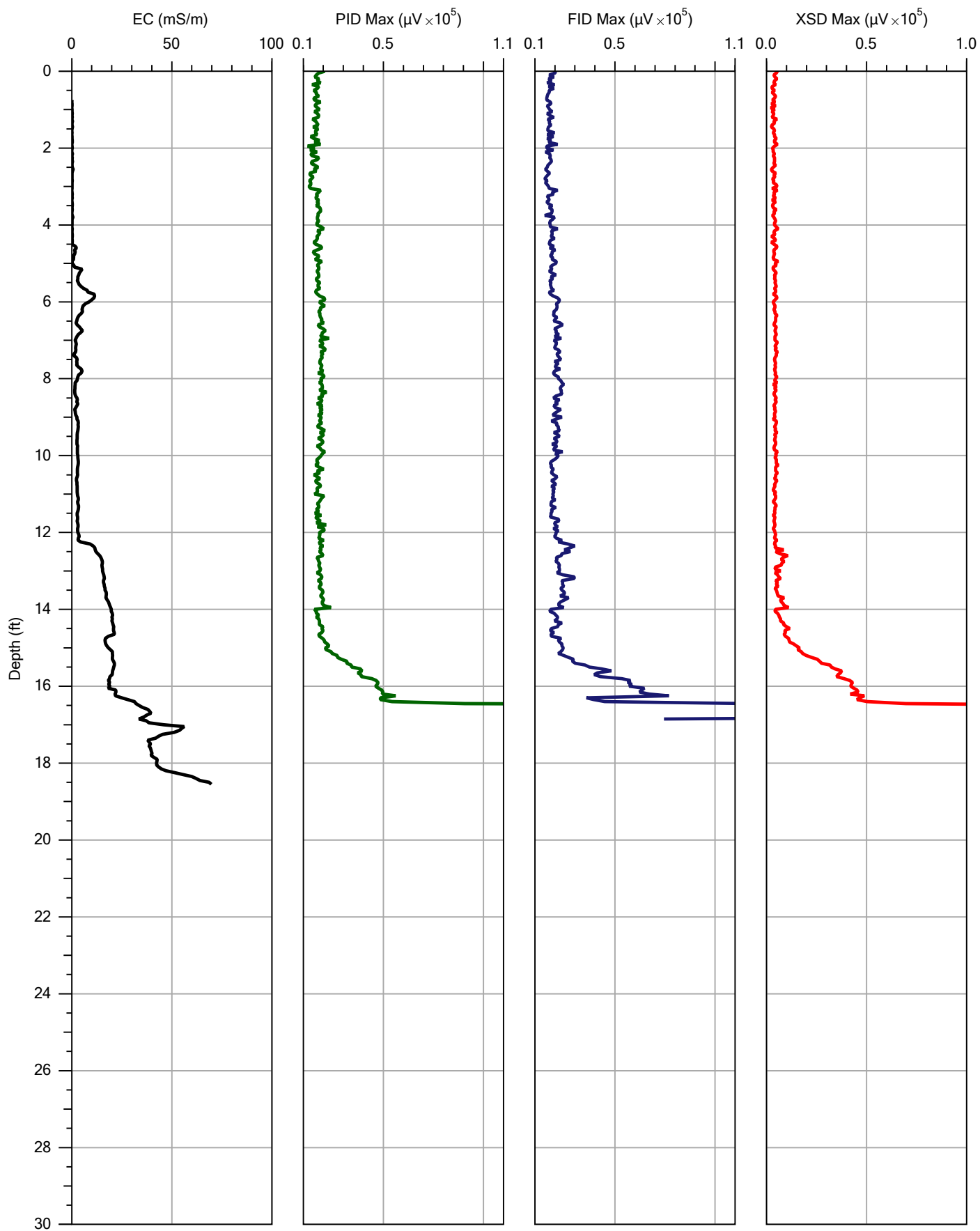
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

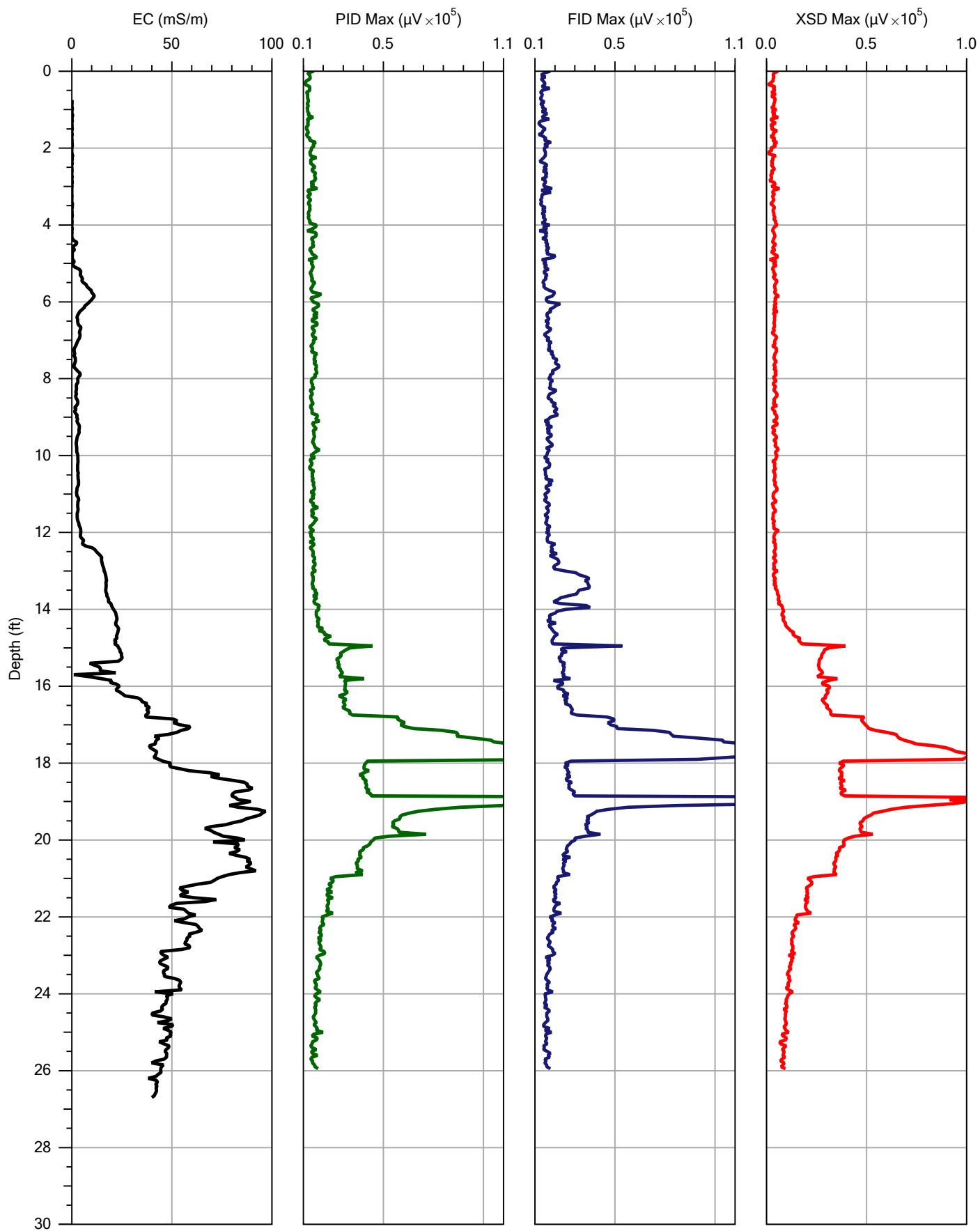
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Company: Matrix Environmental
 Project ID: 319.14

Operator: M Jenson
 Client: CRA

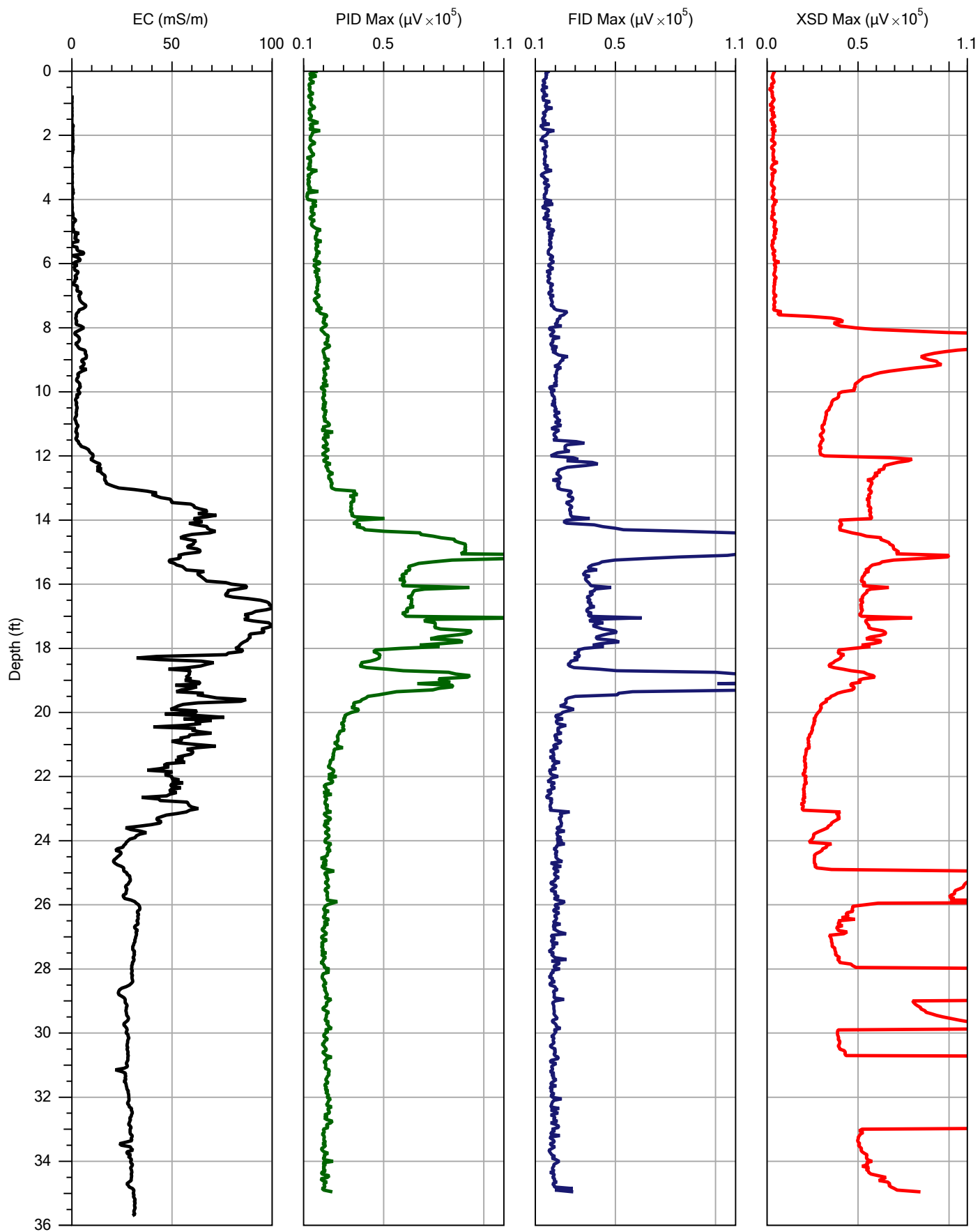
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

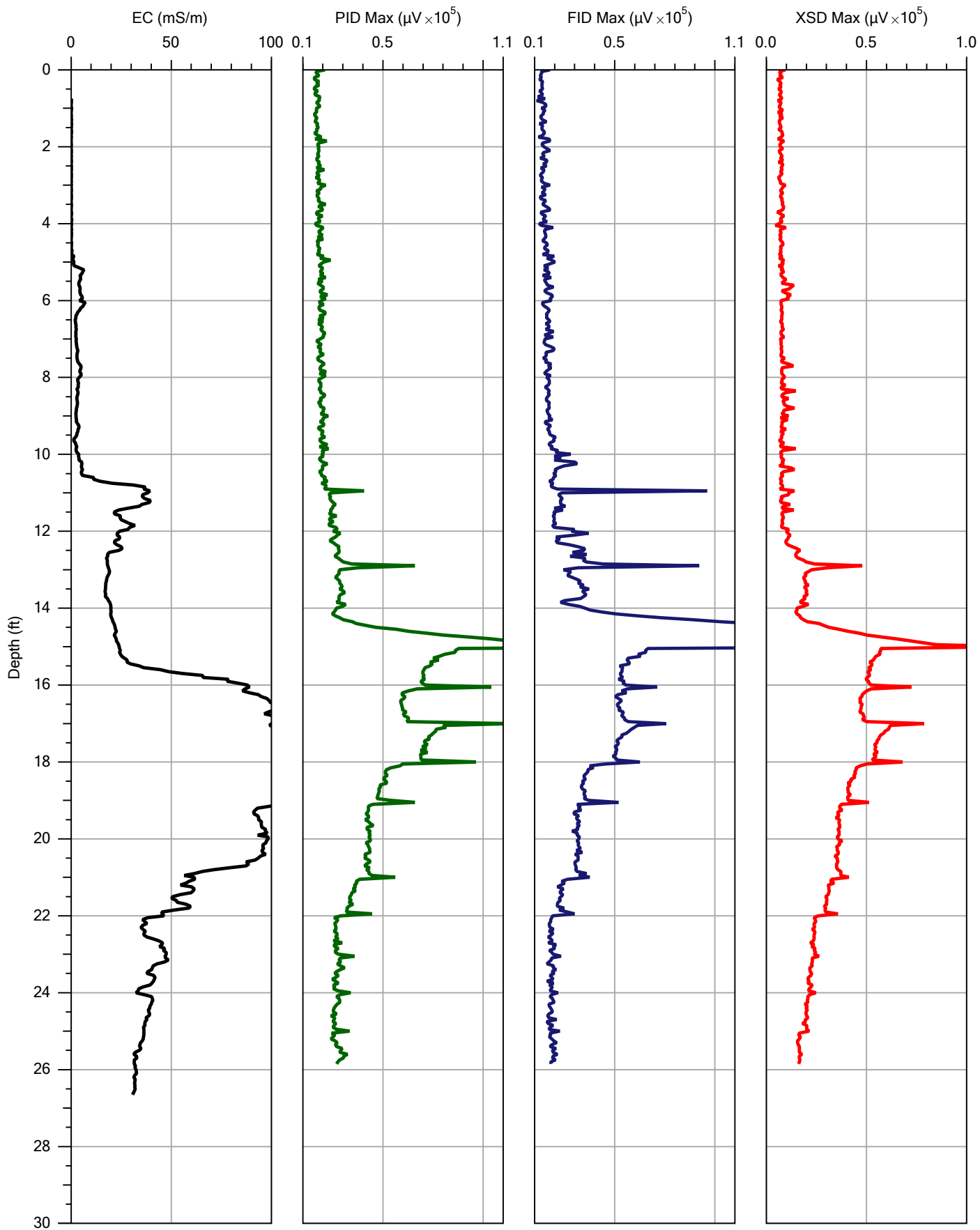
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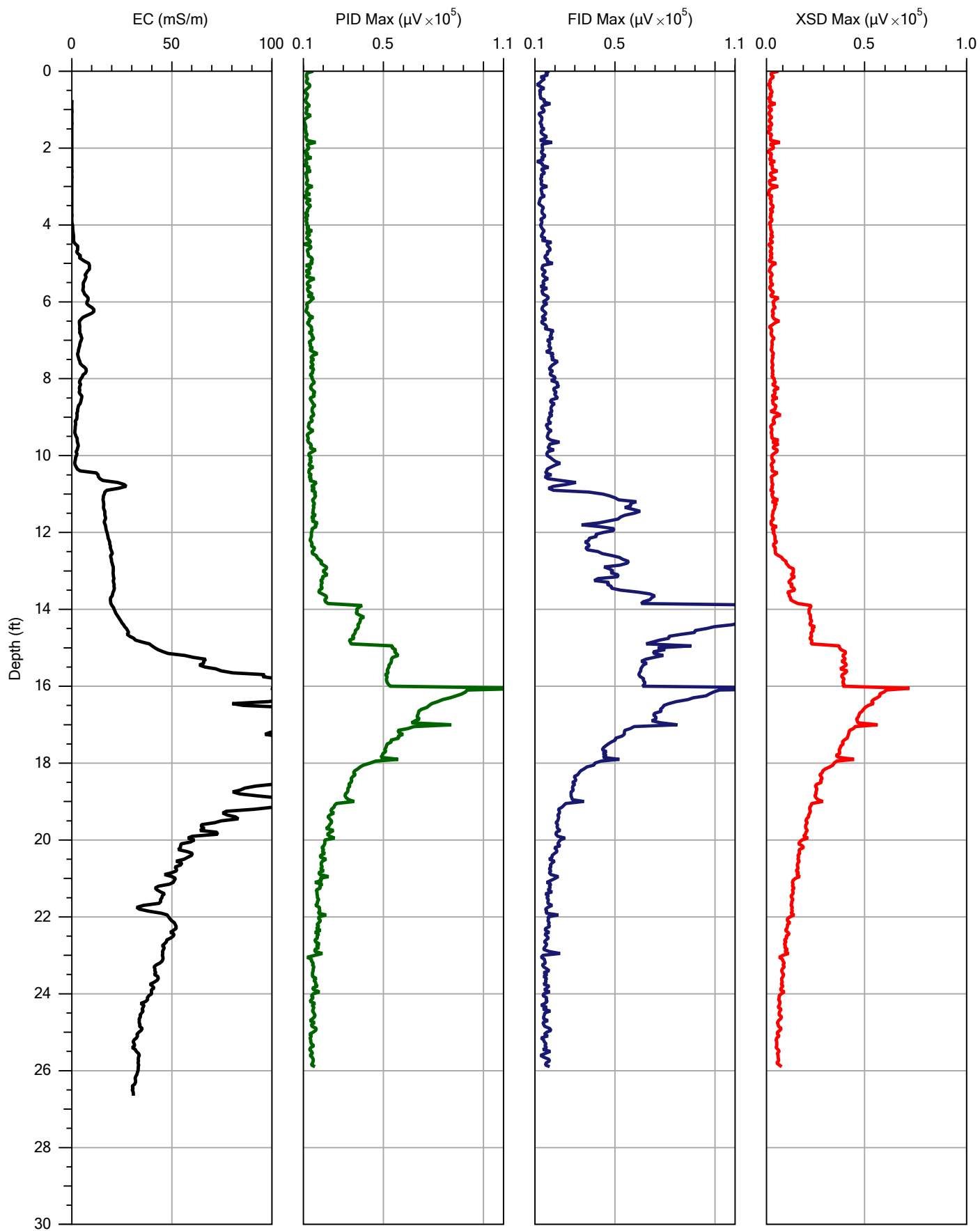
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Project ID: 319.14

Operator: M Jenson
Client: CRA

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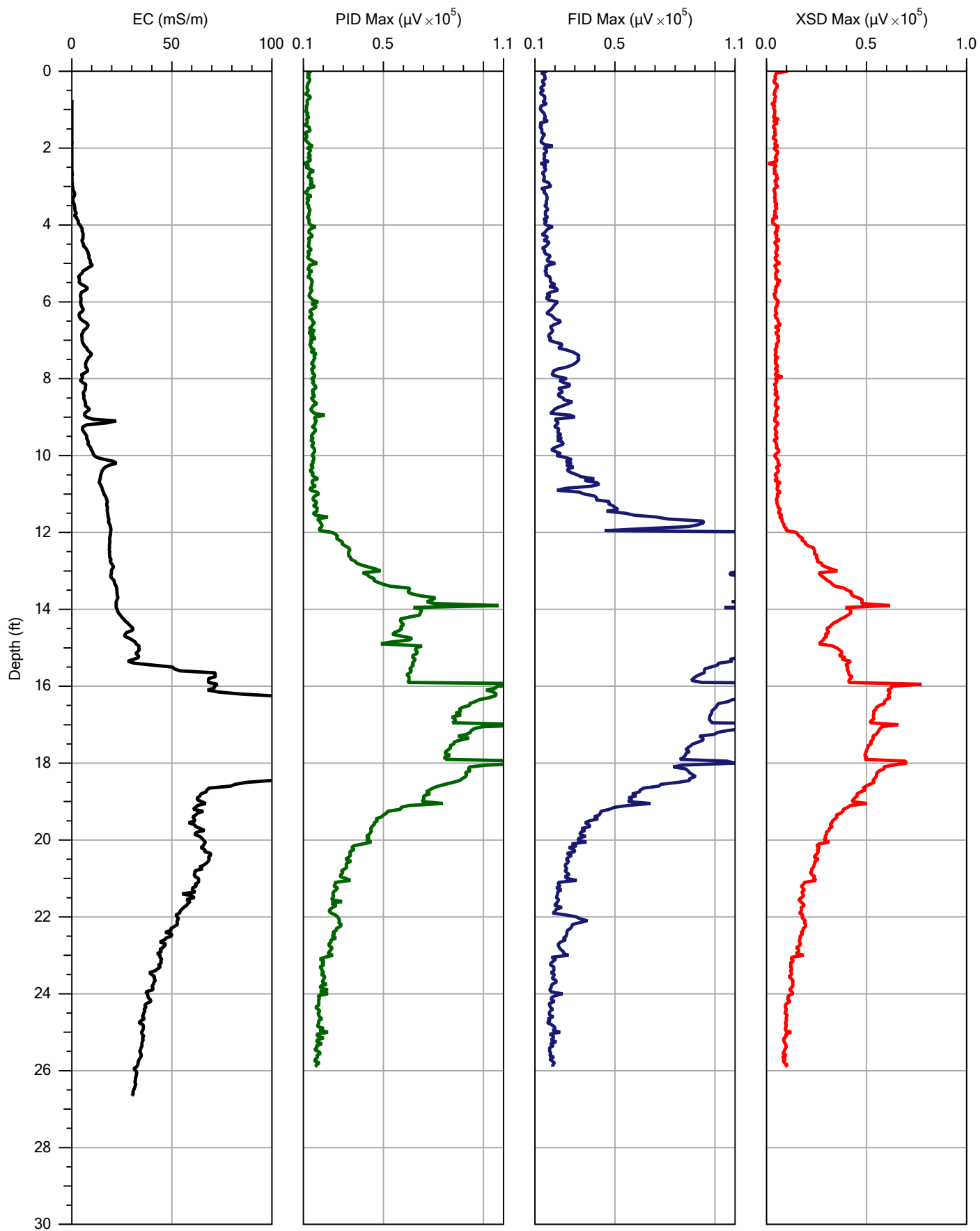
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

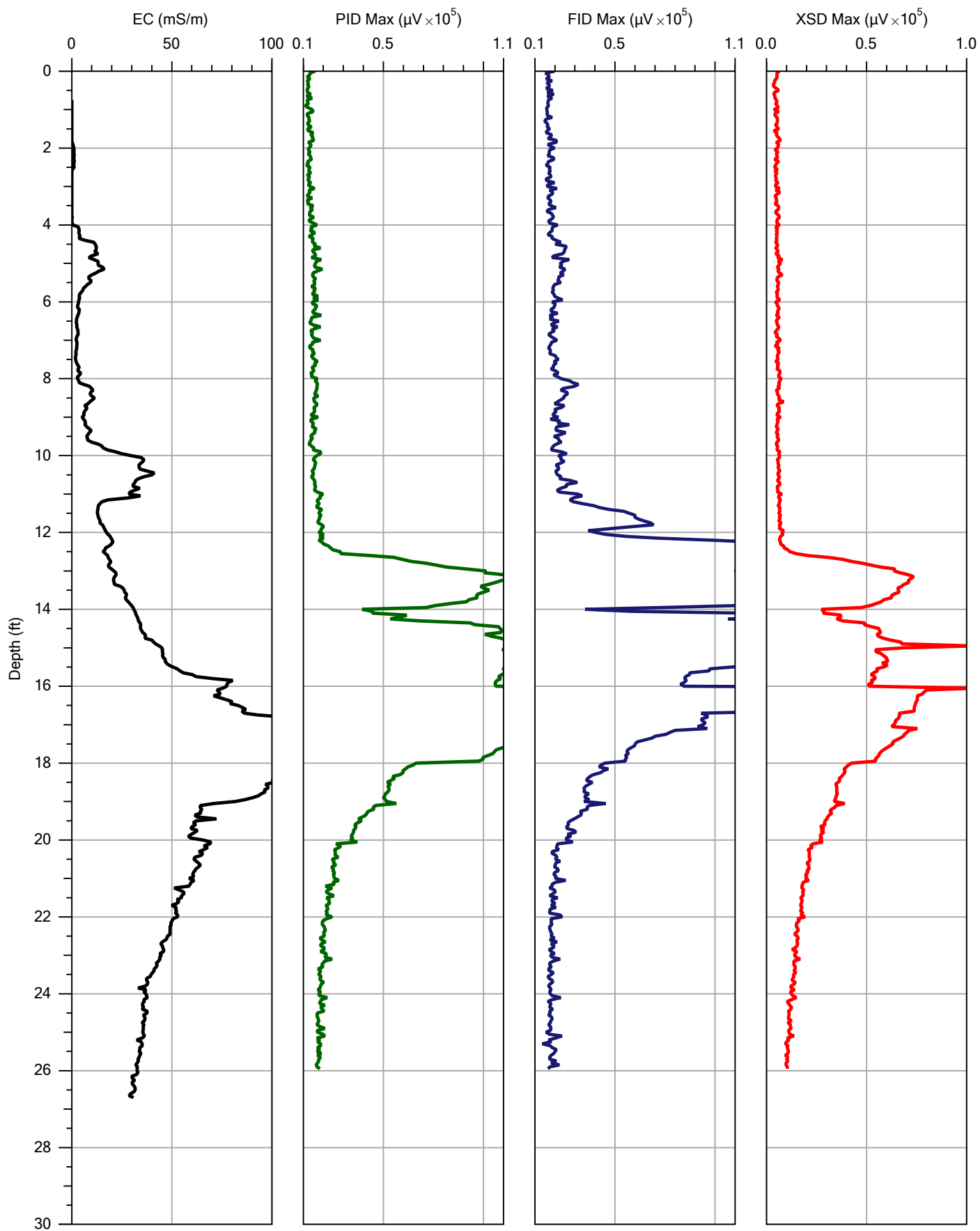
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

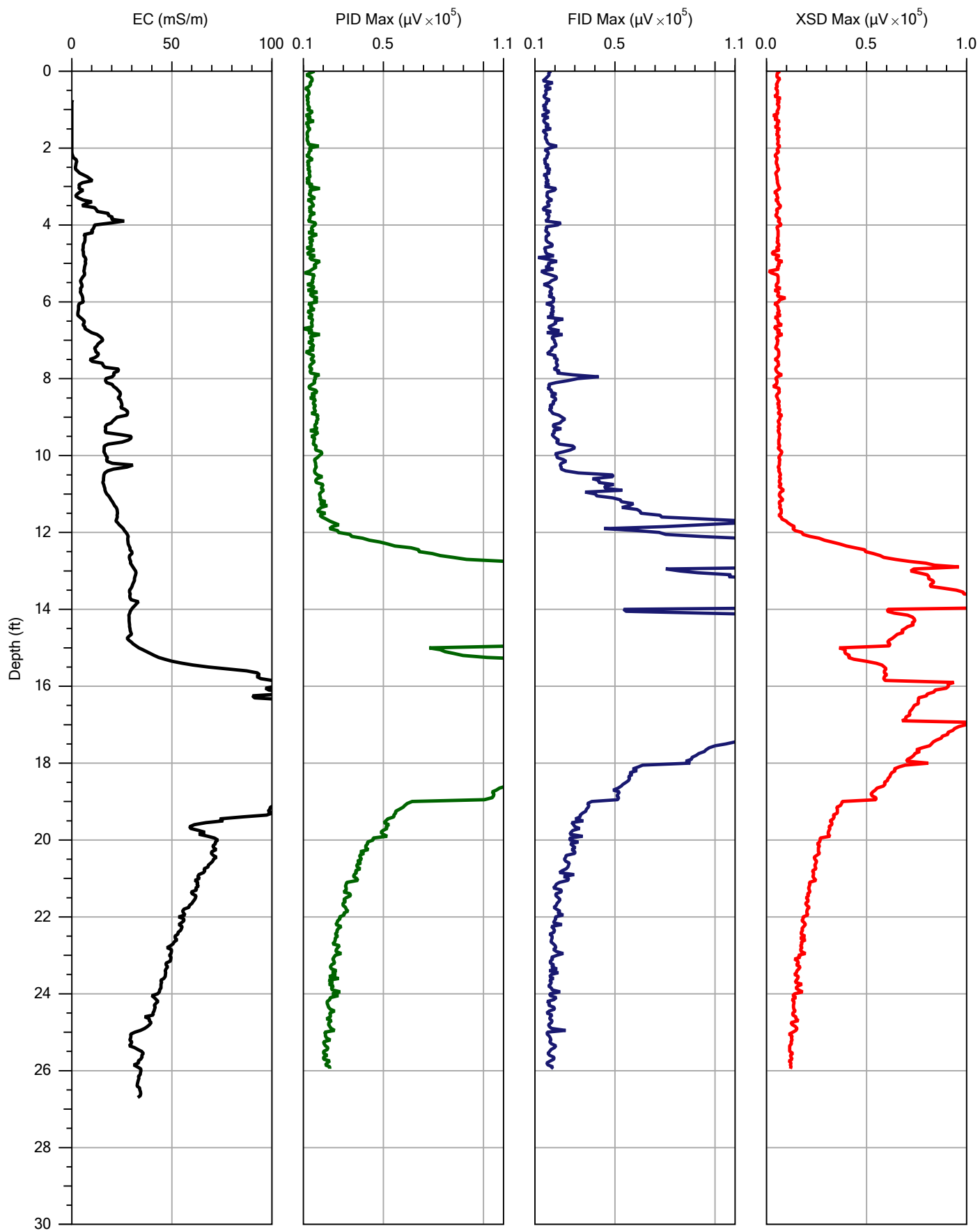
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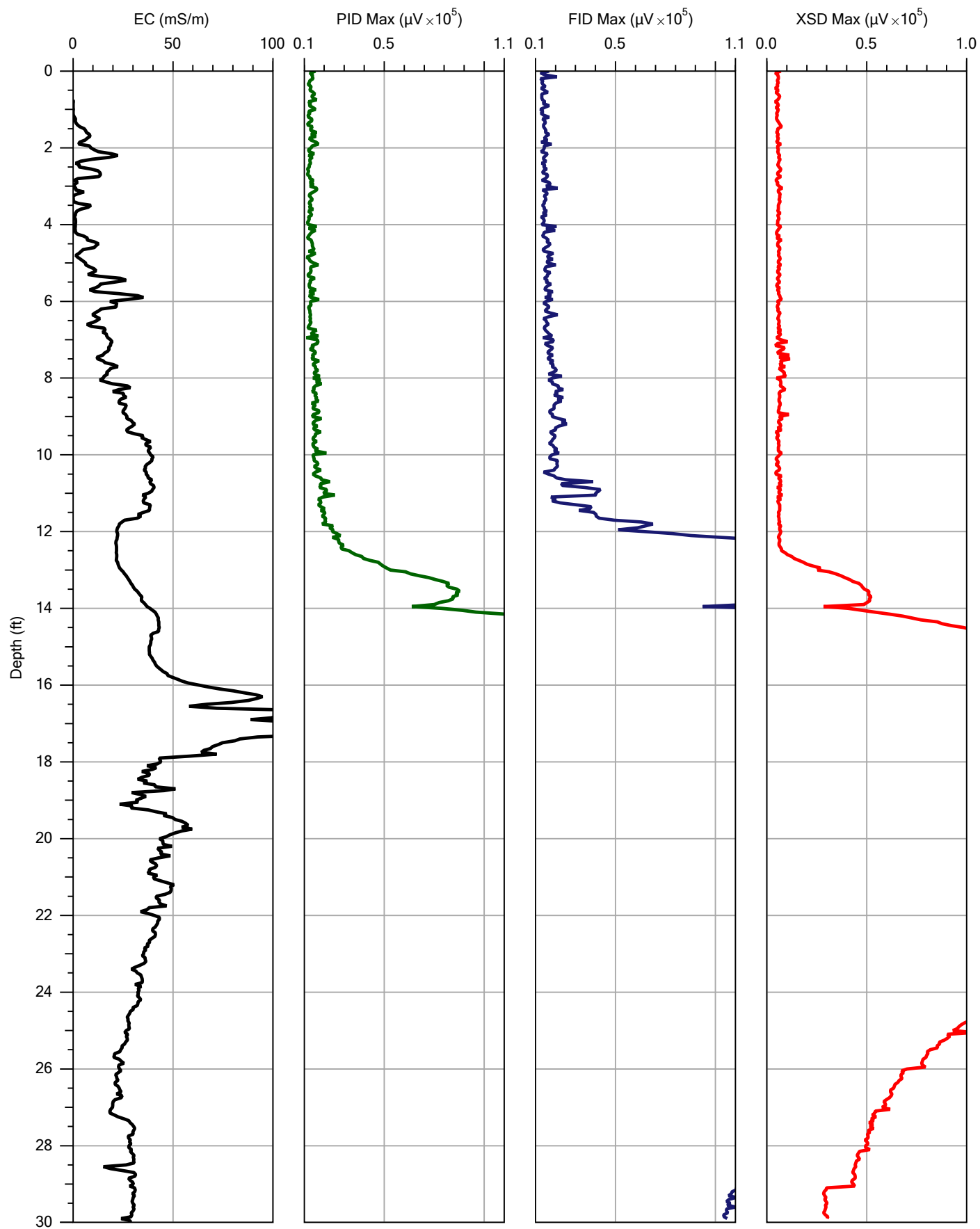
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Project ID: 319.14

Operator: M Jensen
Client: CRA

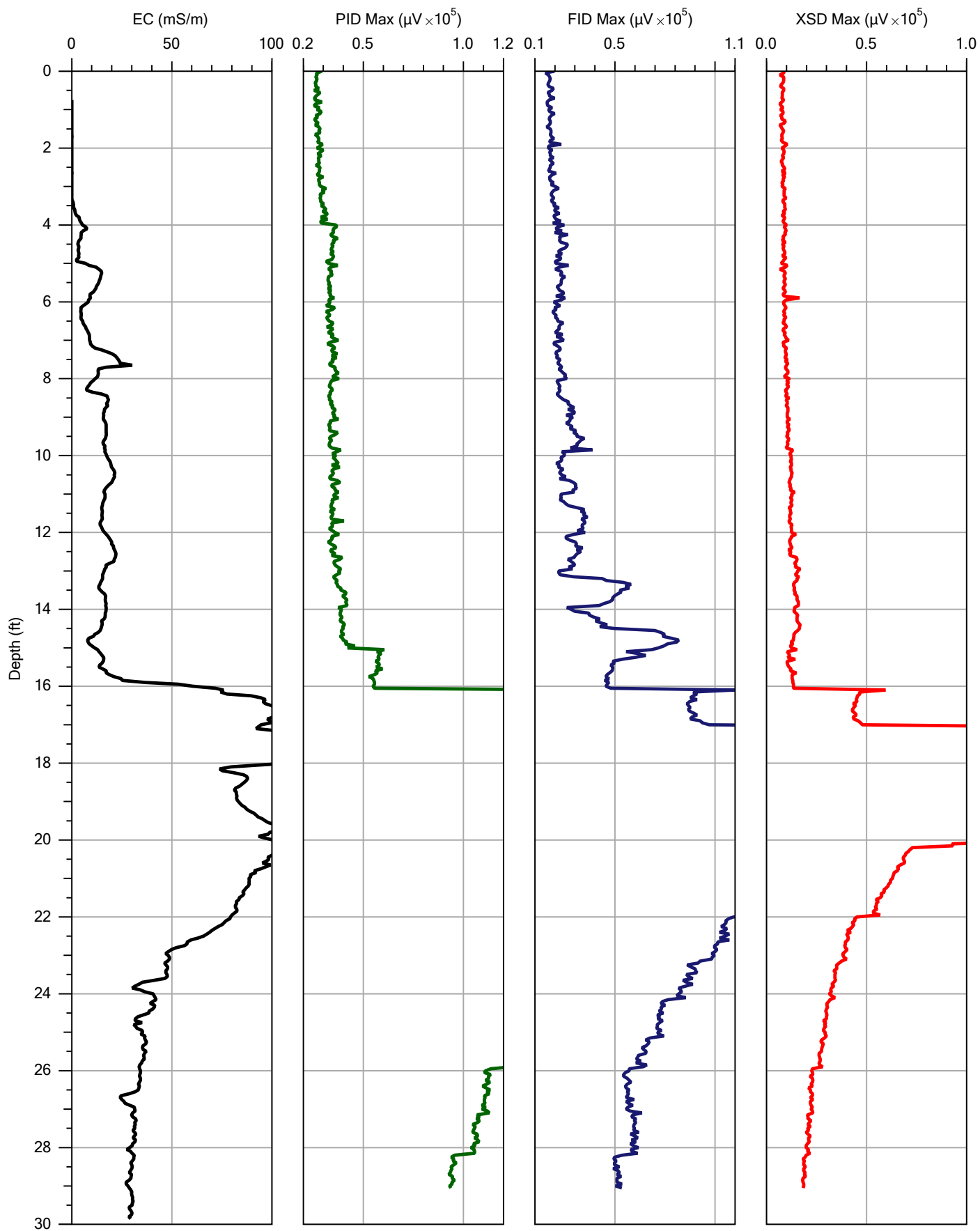
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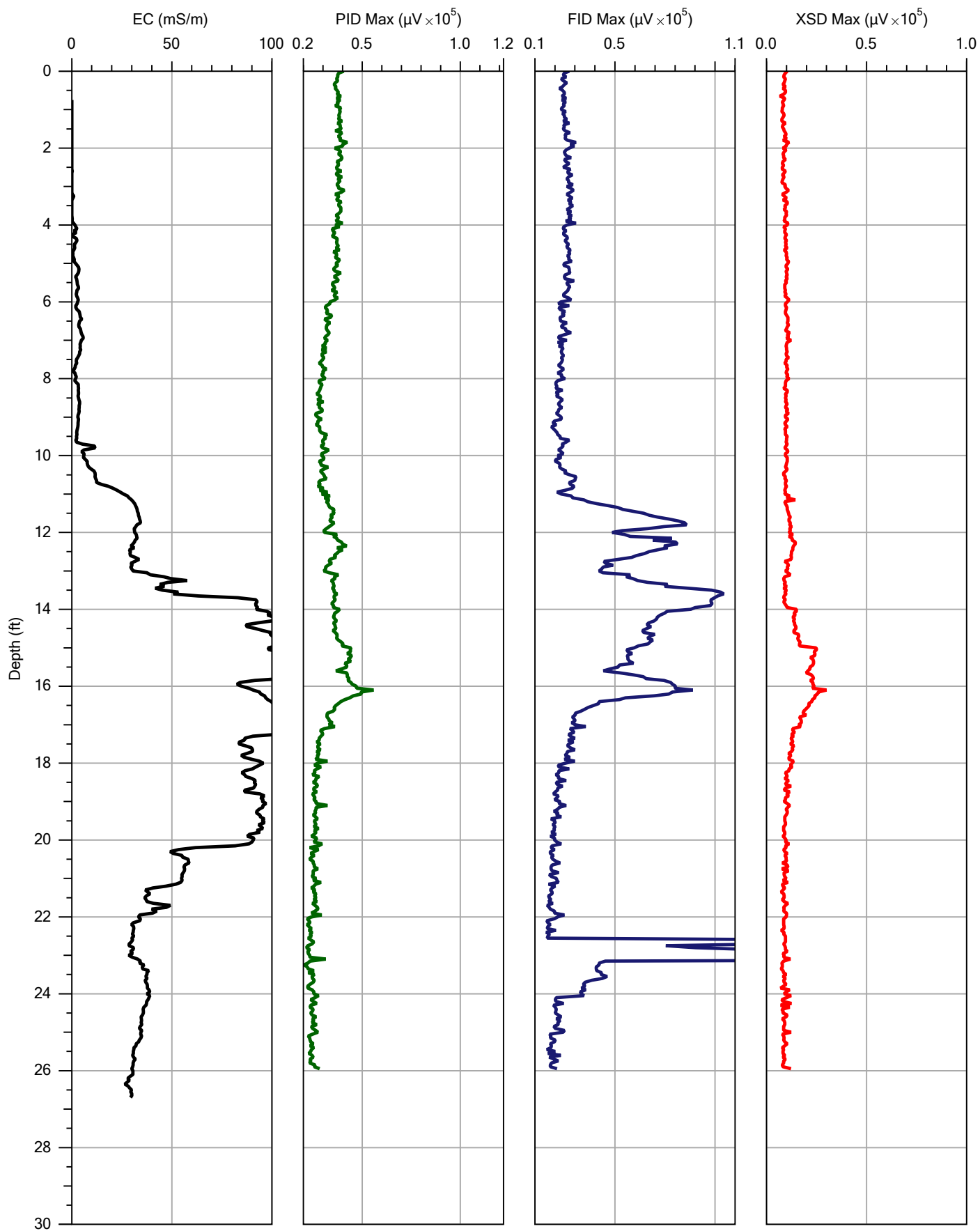
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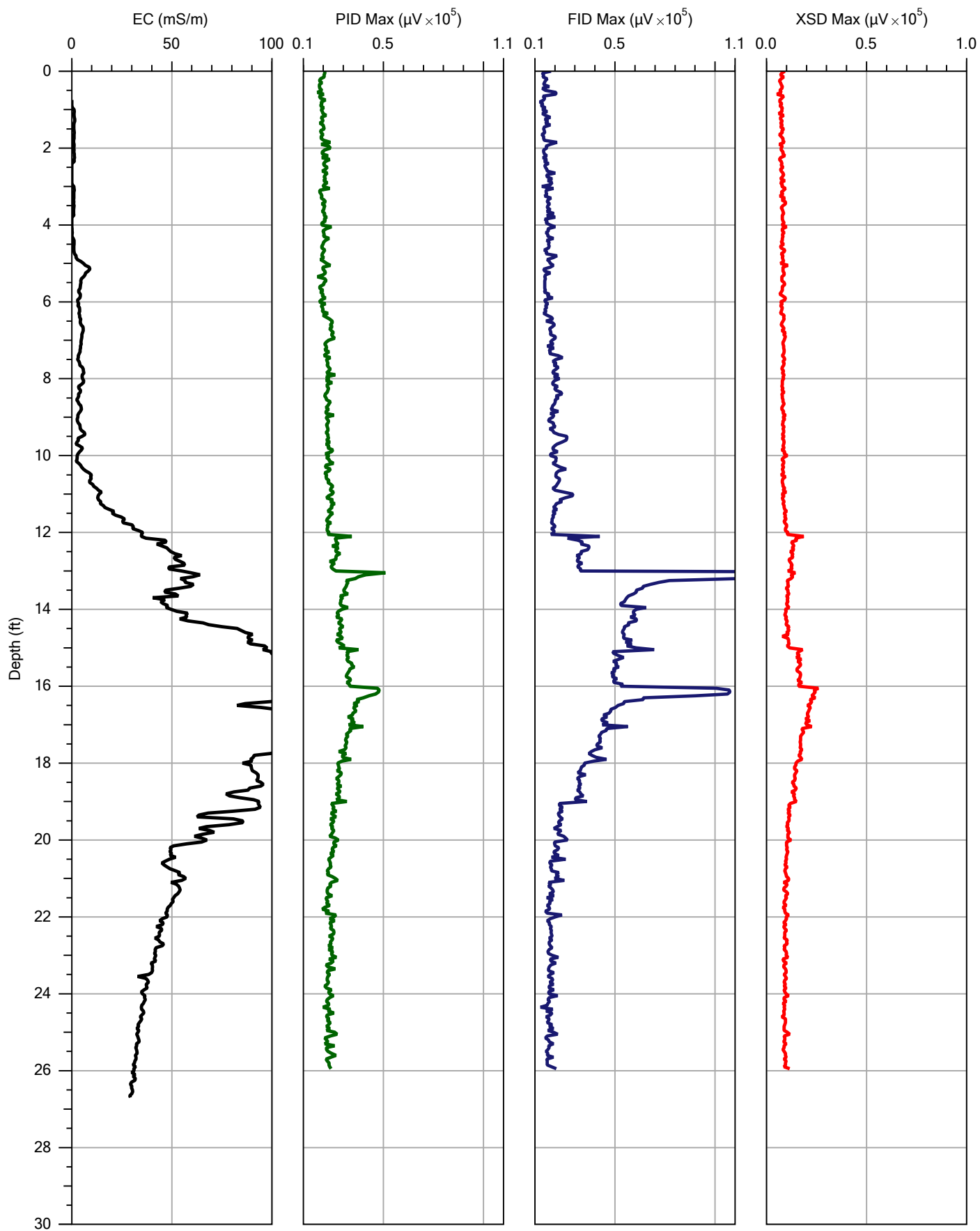
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

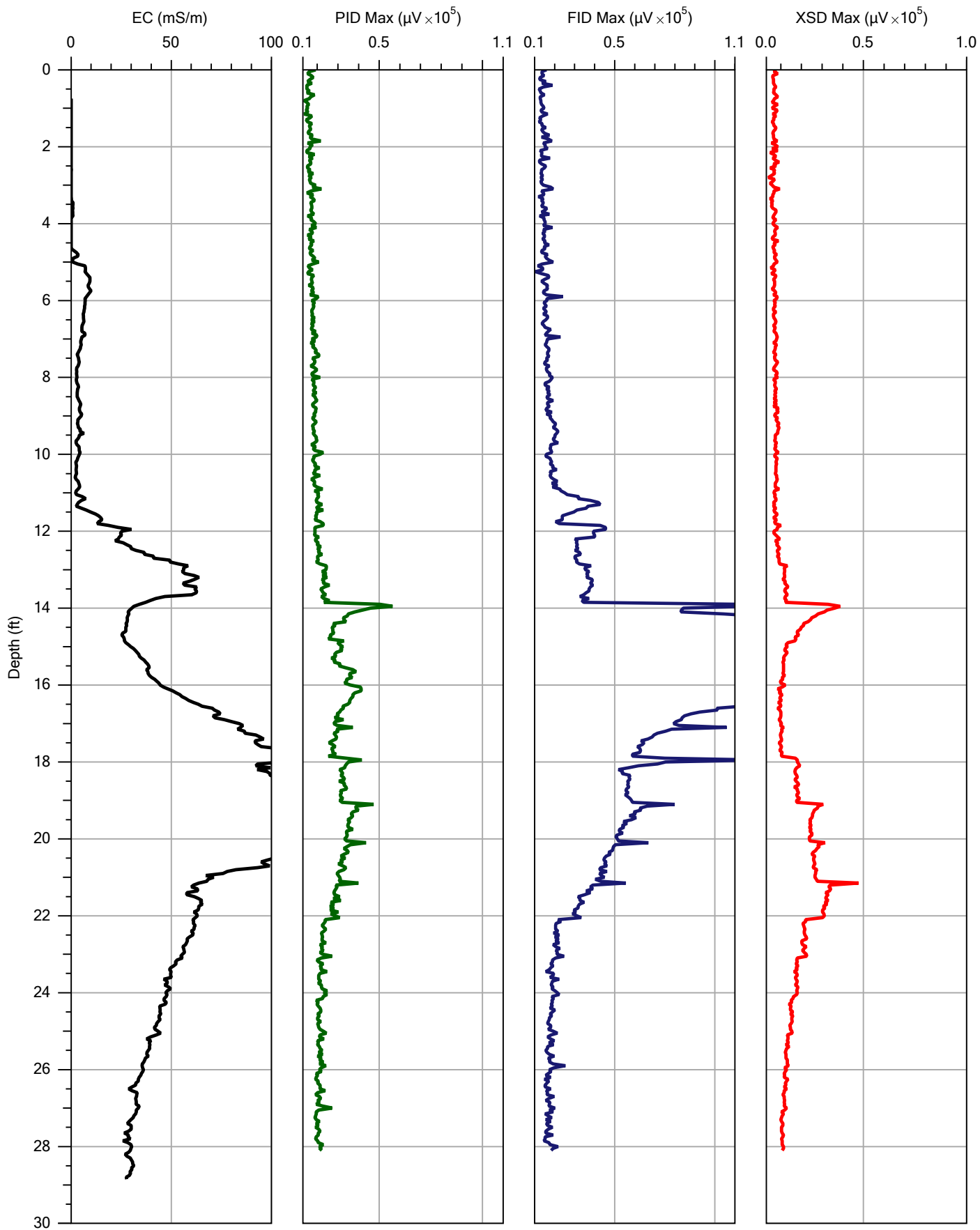
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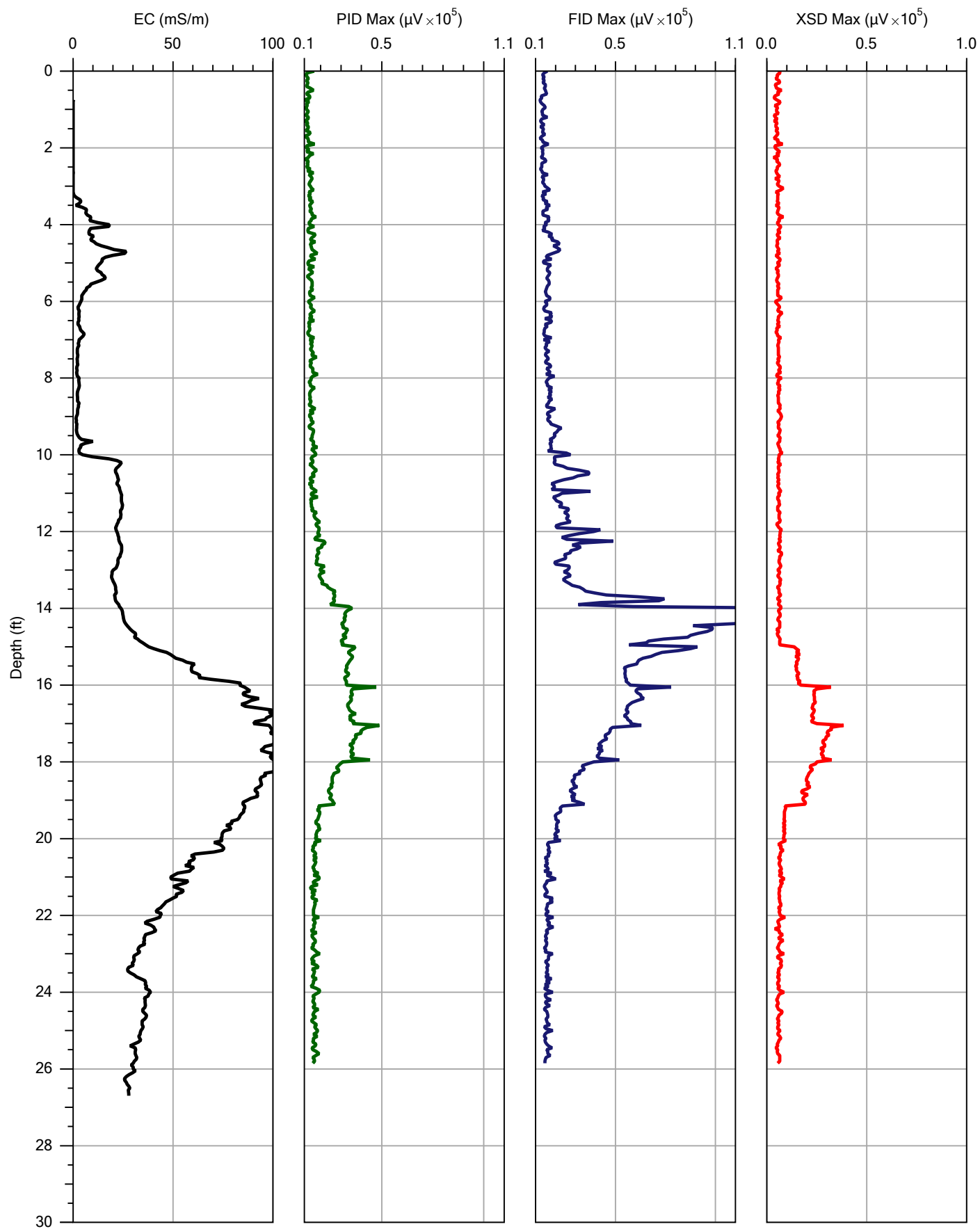
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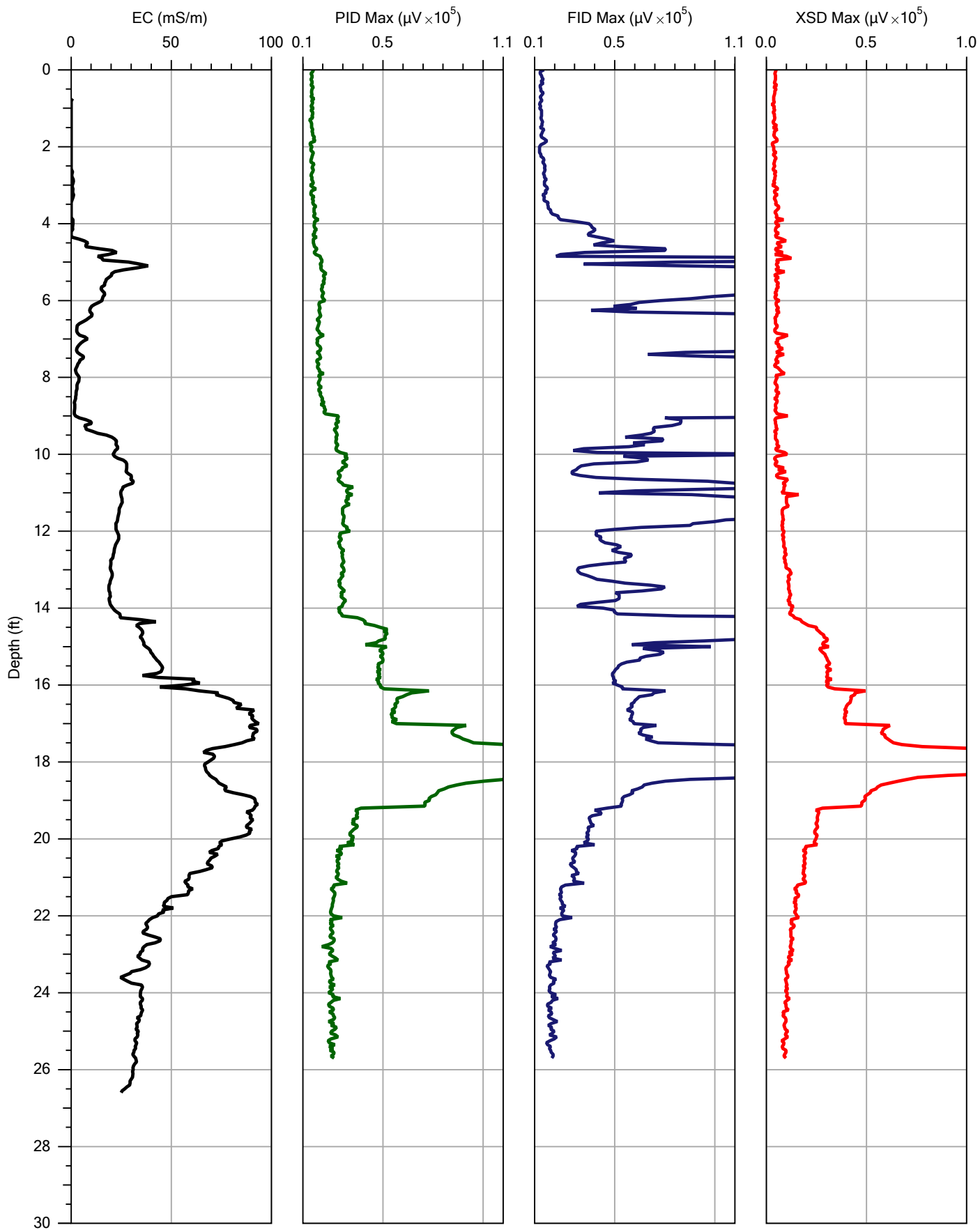
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Company: Matrix Environmental		File: MIP-041.MIP
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Project ID: 319.14	Client: CRA	Location:



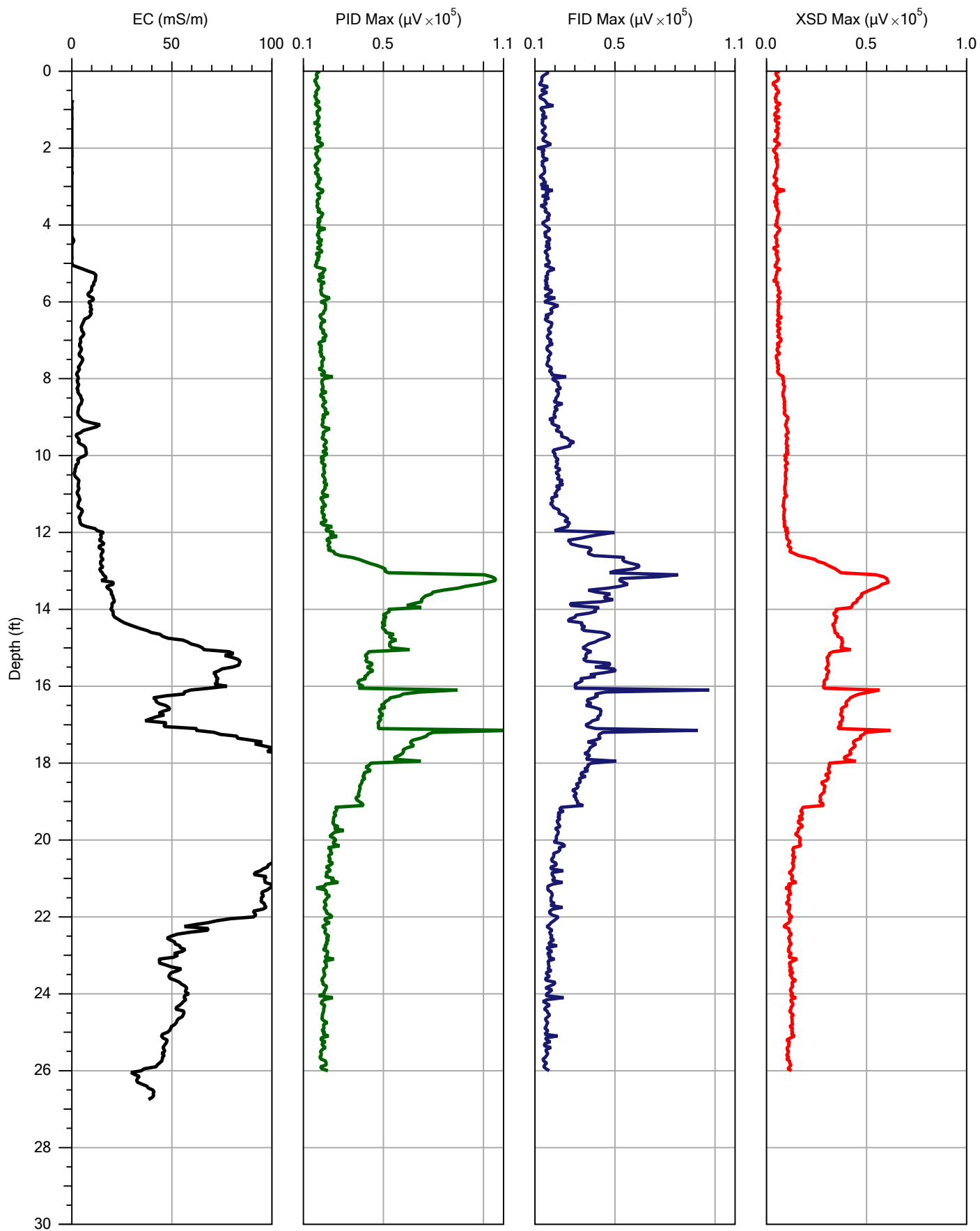
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

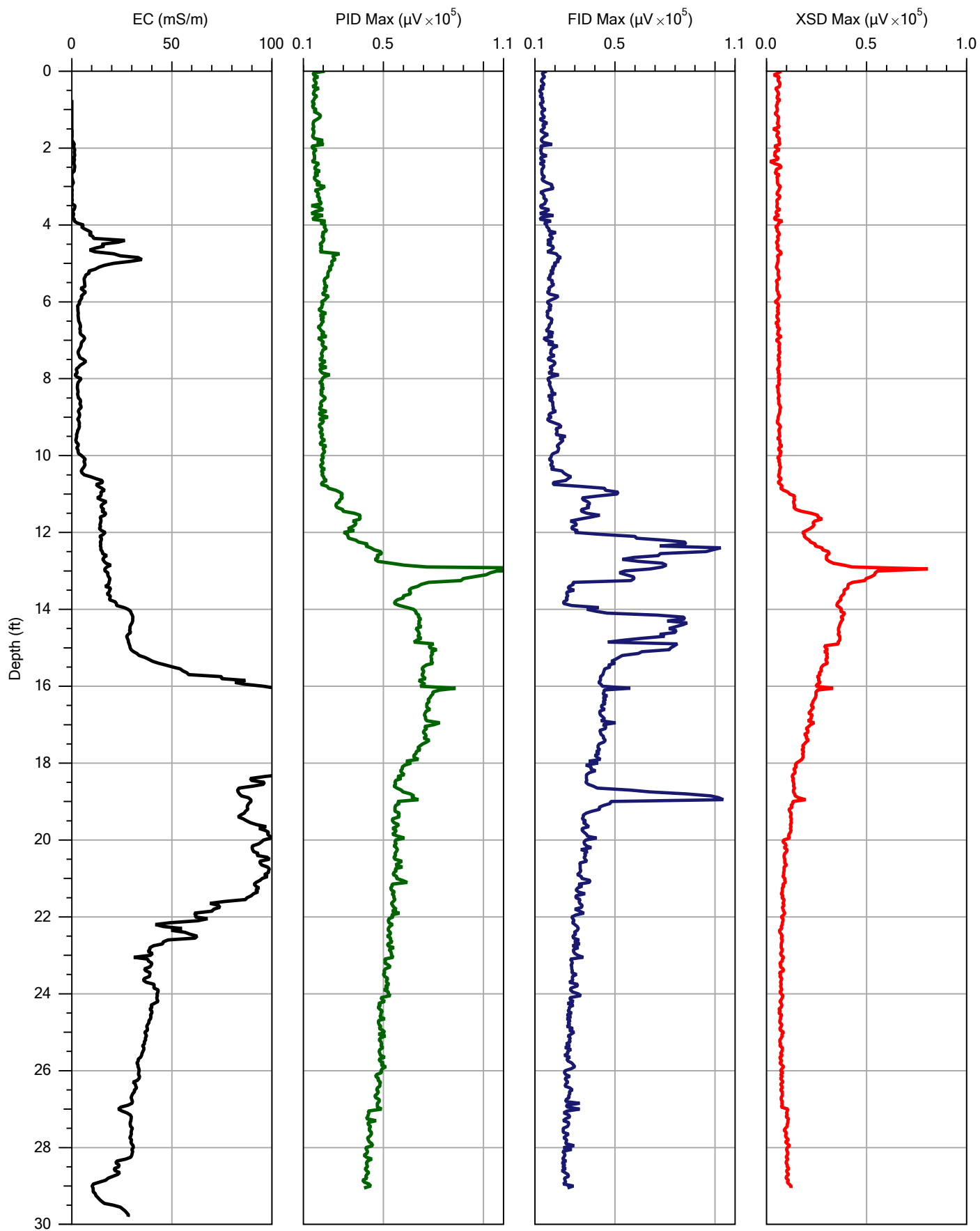
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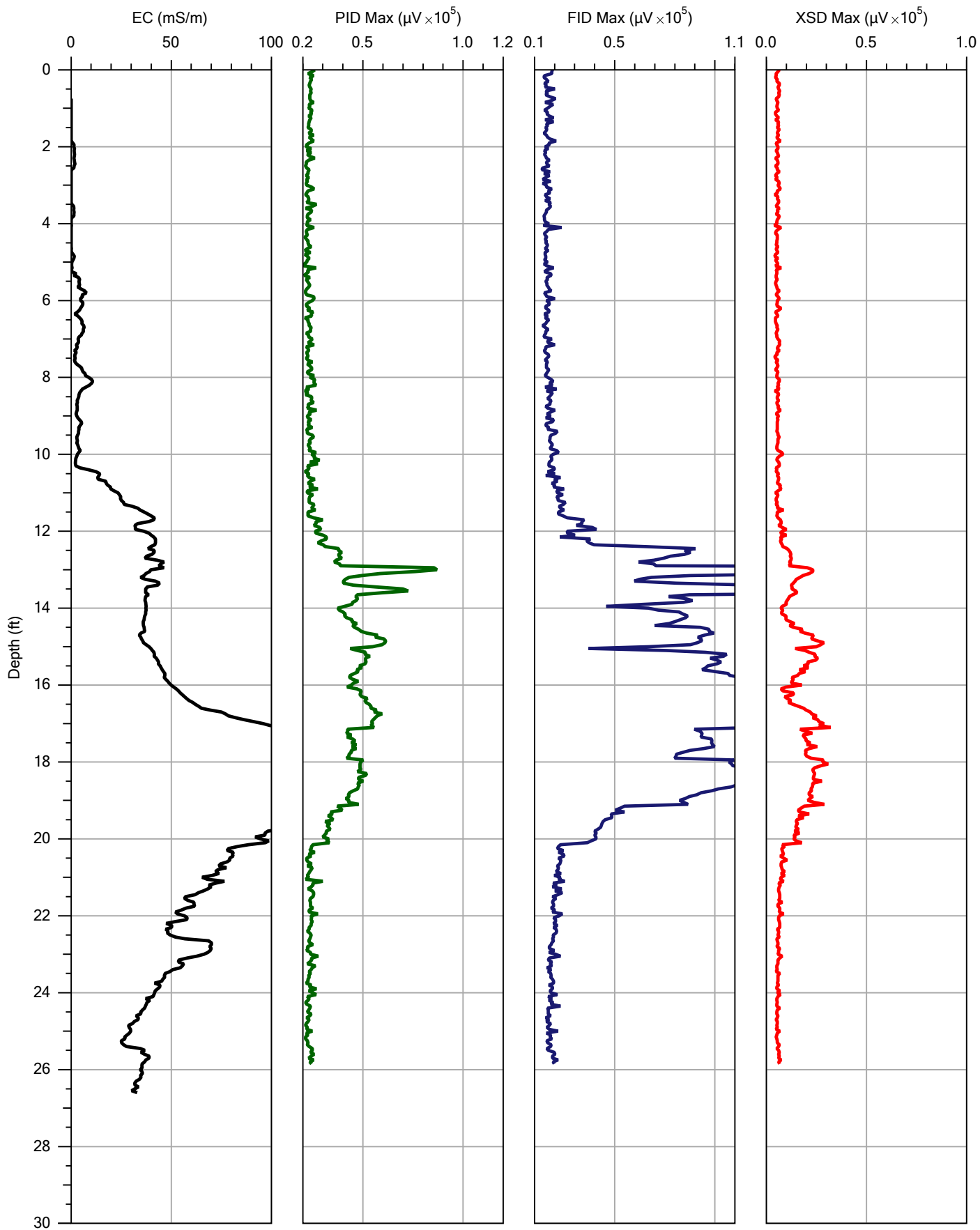
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Project ID: 319.14

Operator: M Jensen
Client: CRA

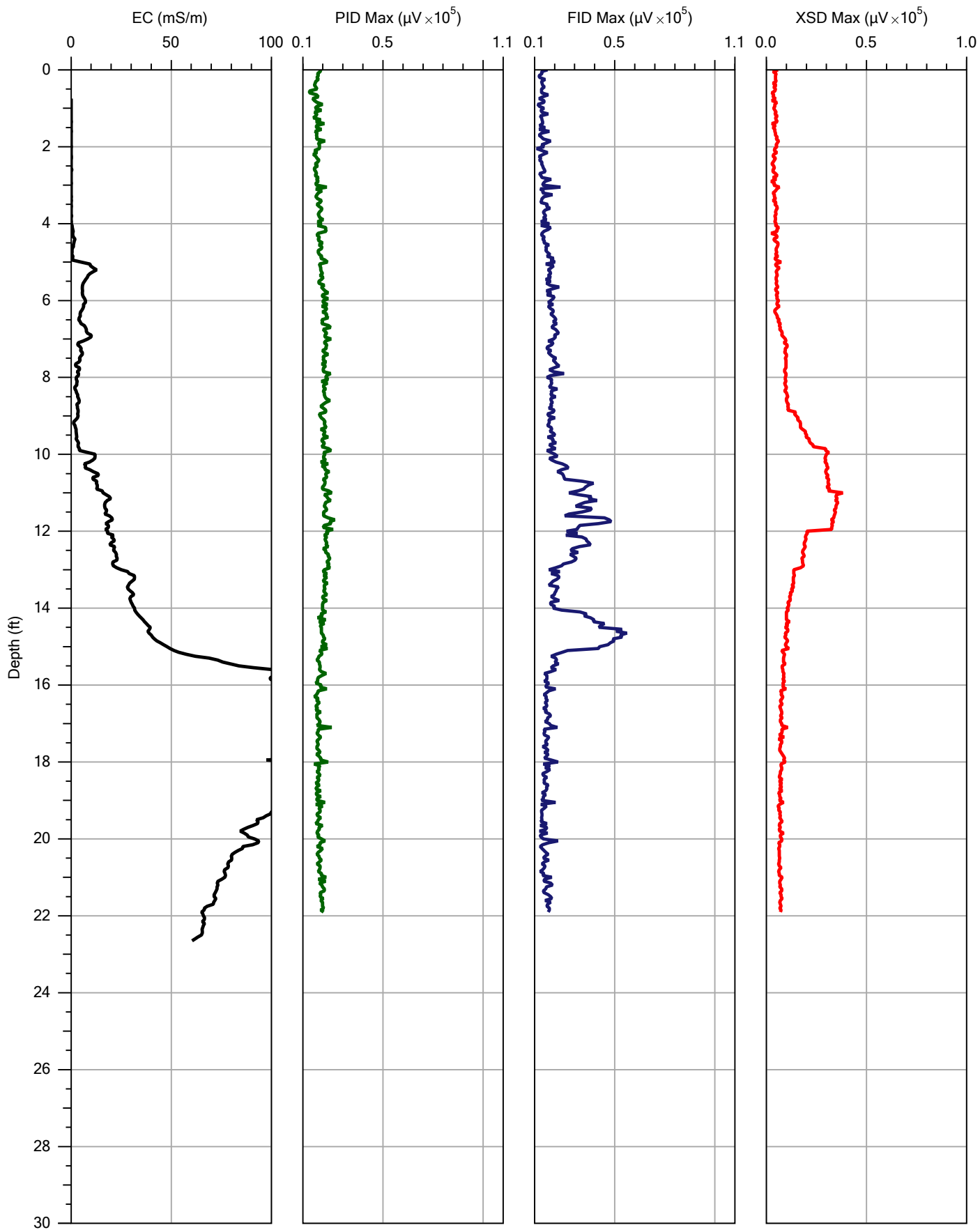
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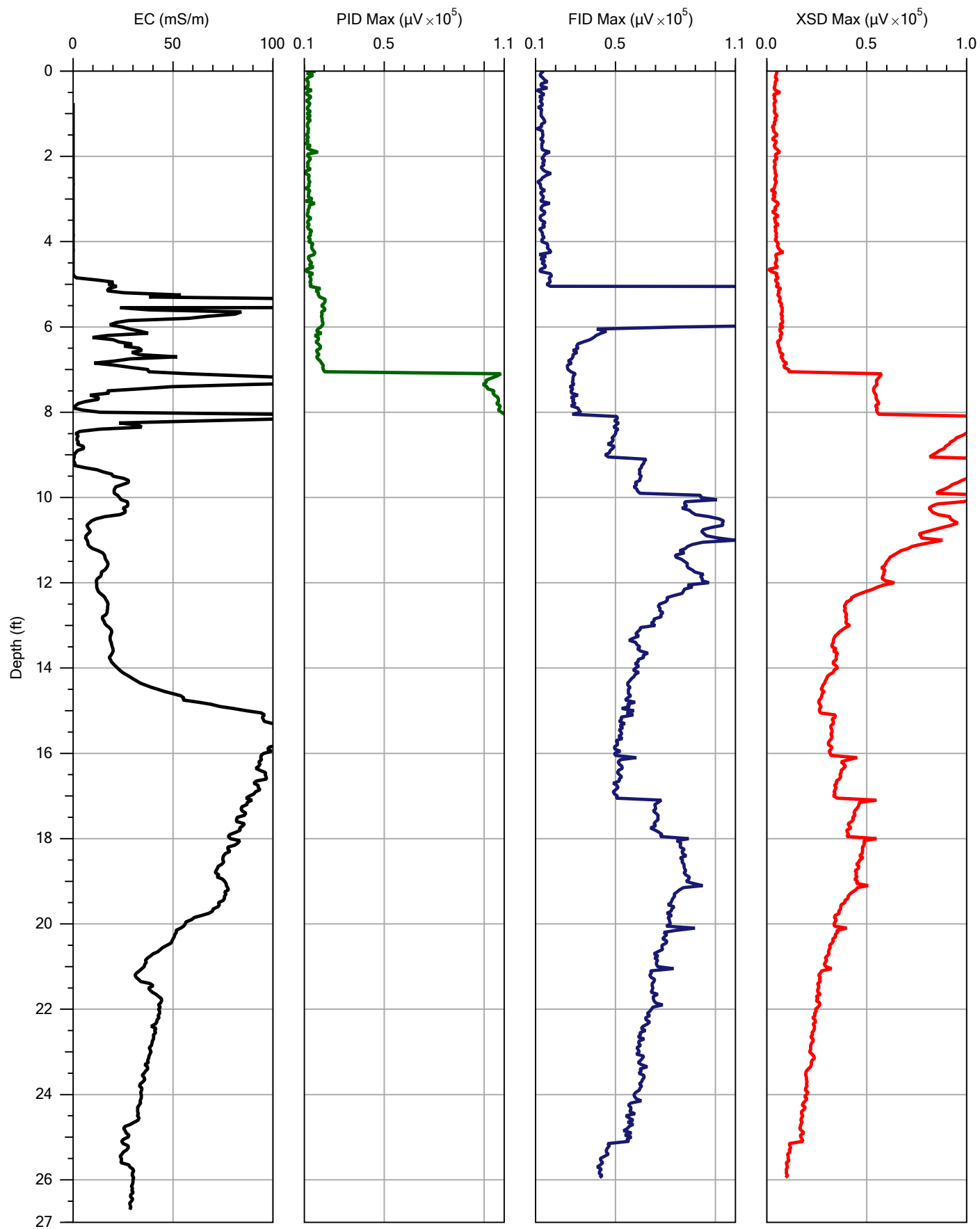
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

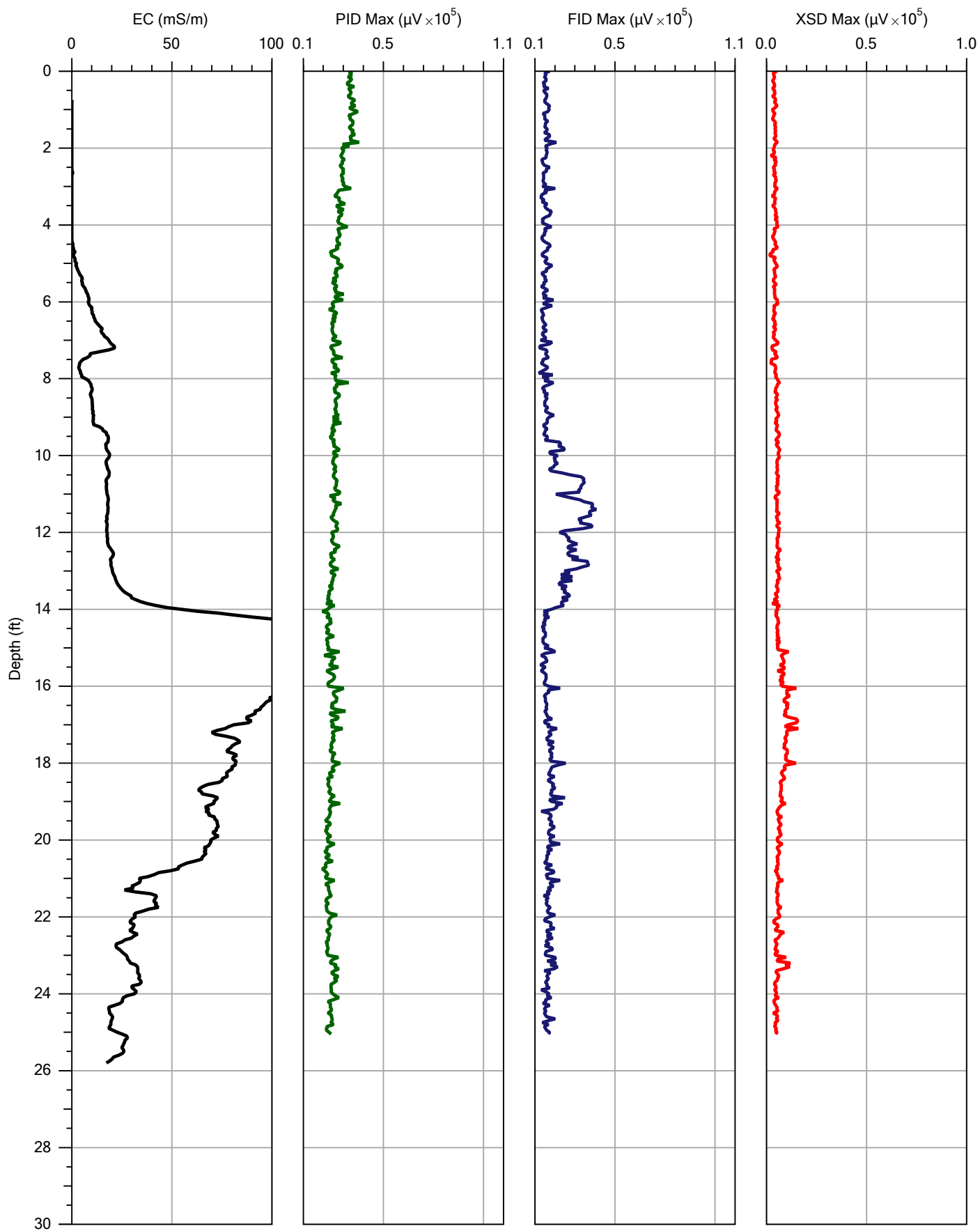
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

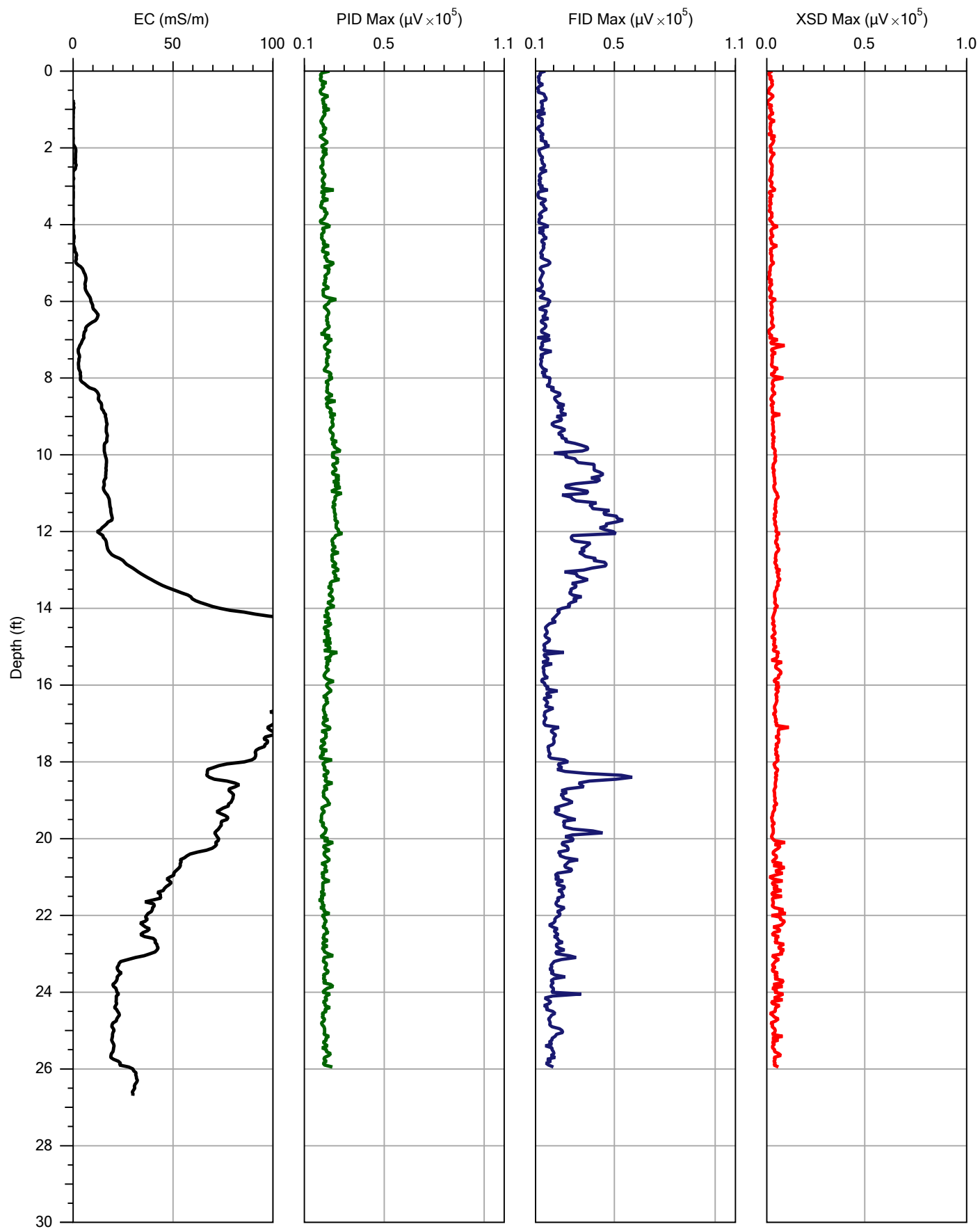
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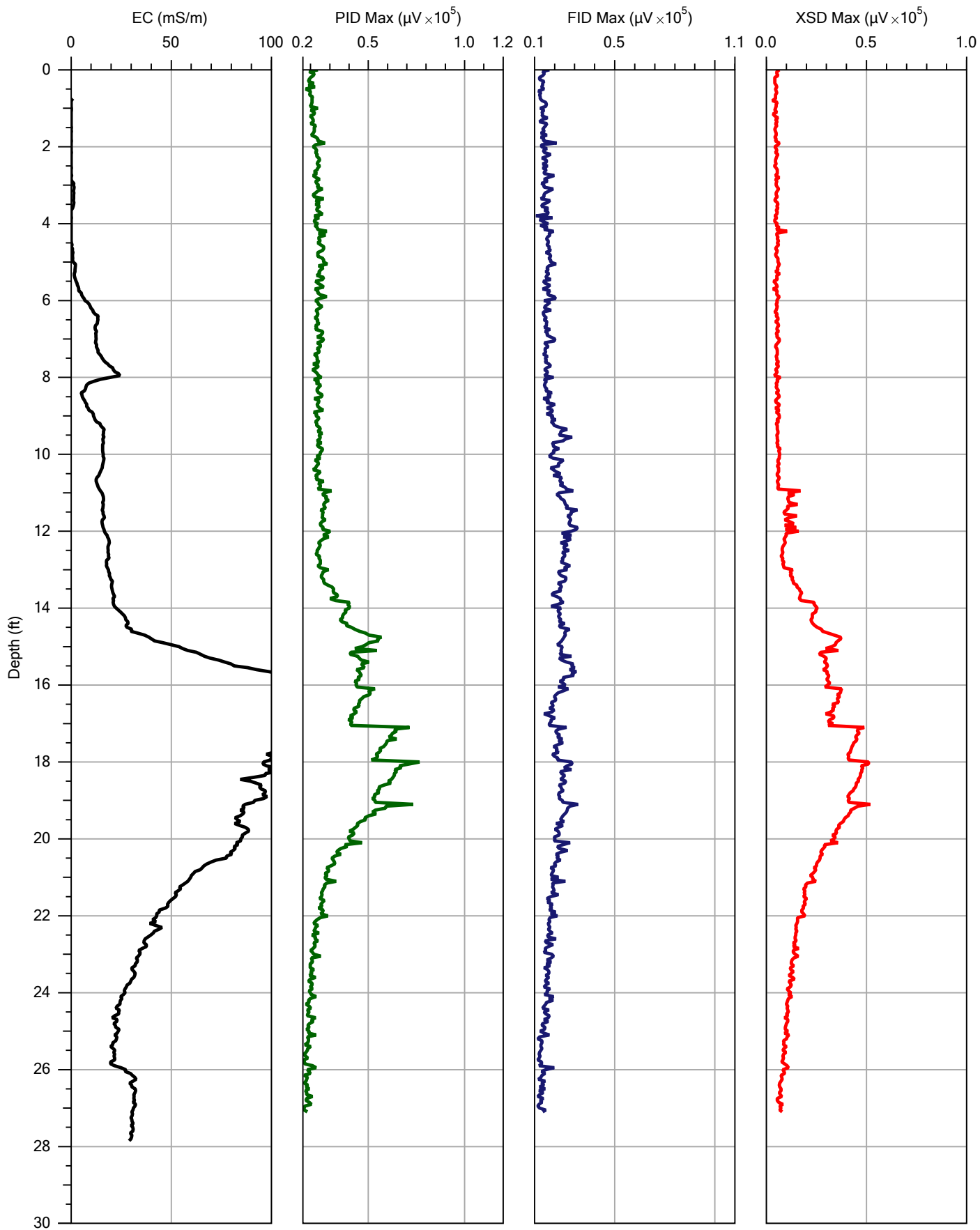
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Project ID: 319.14

Operator: M Jenson
Client: CRA

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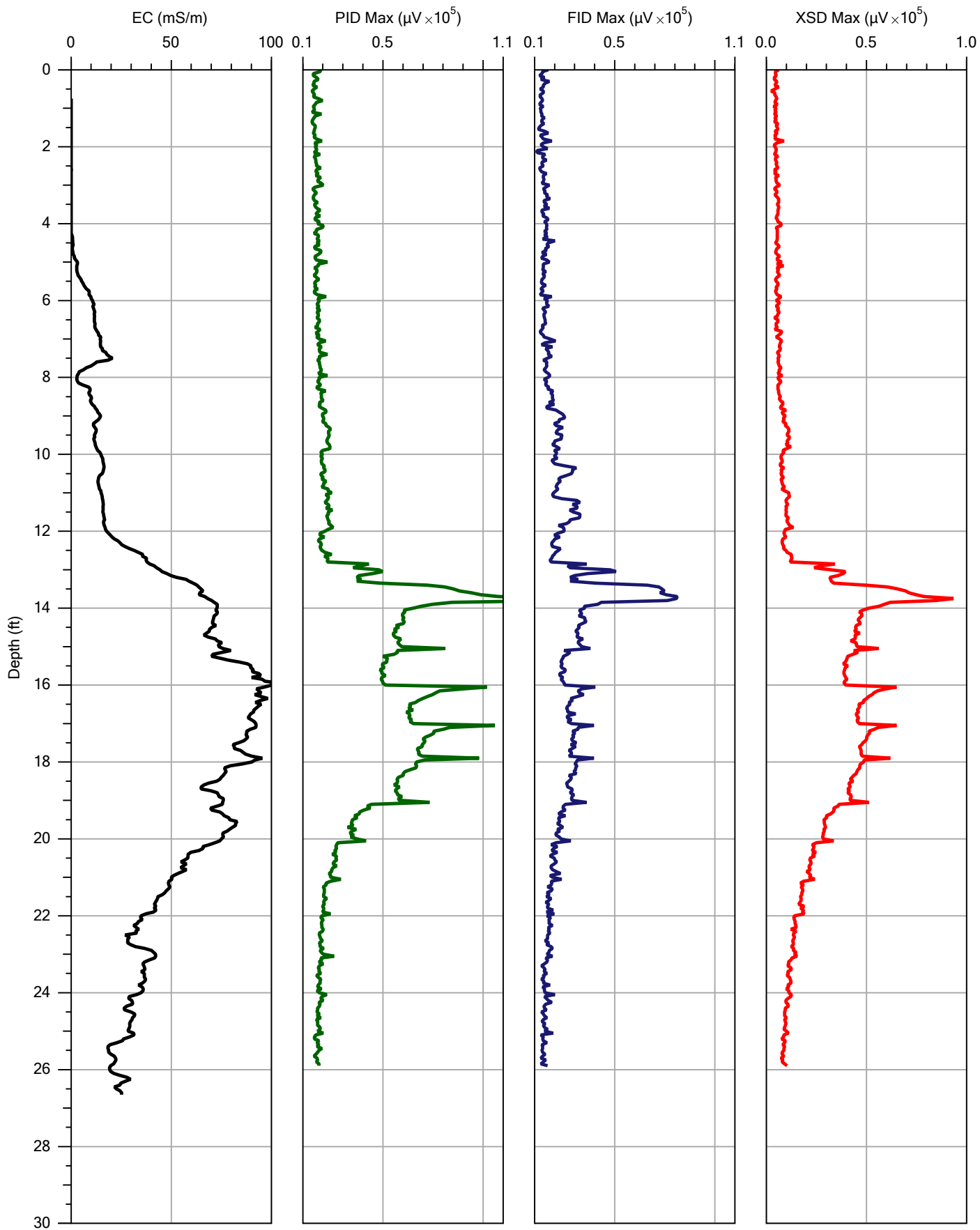
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

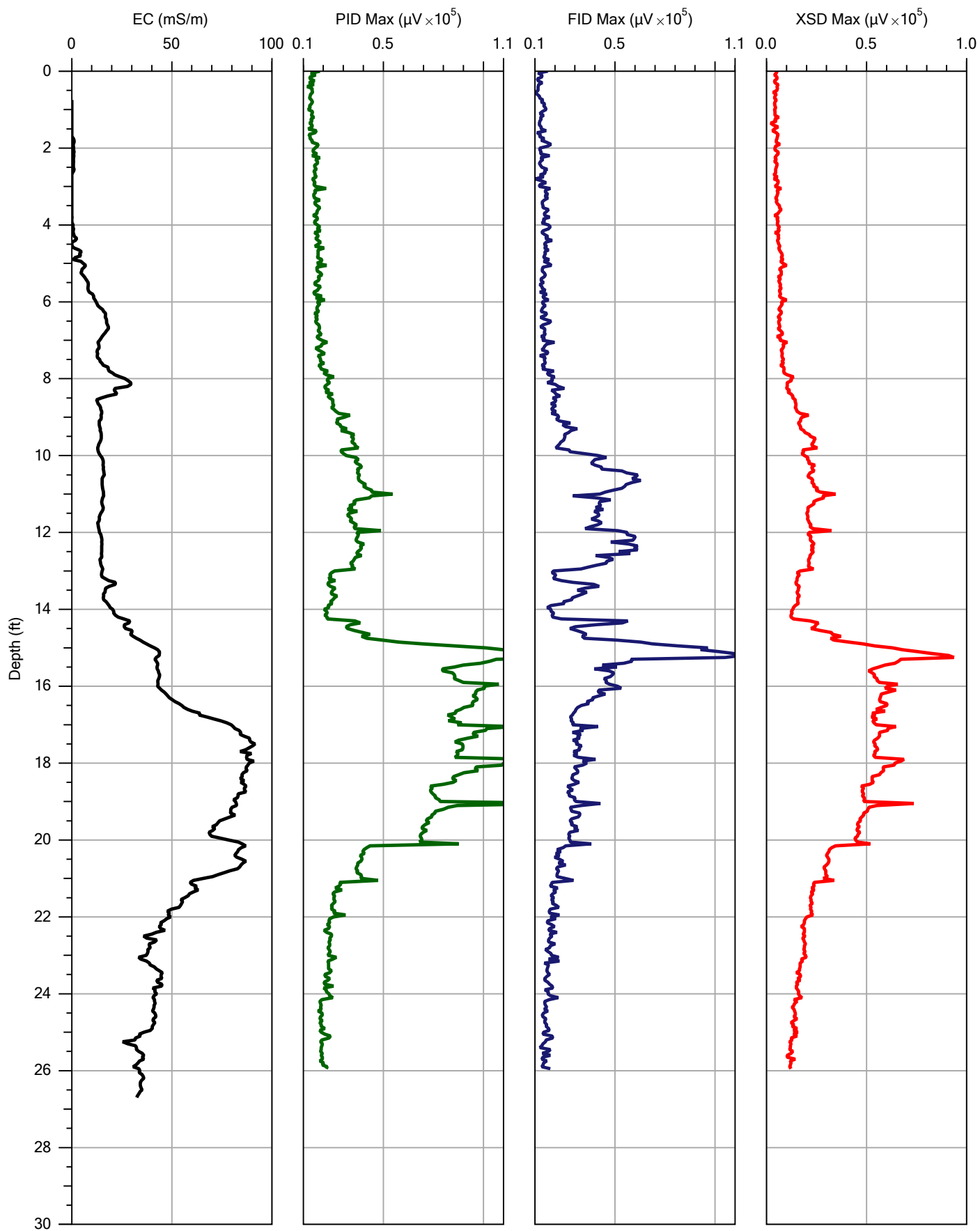
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Date:	12/12/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

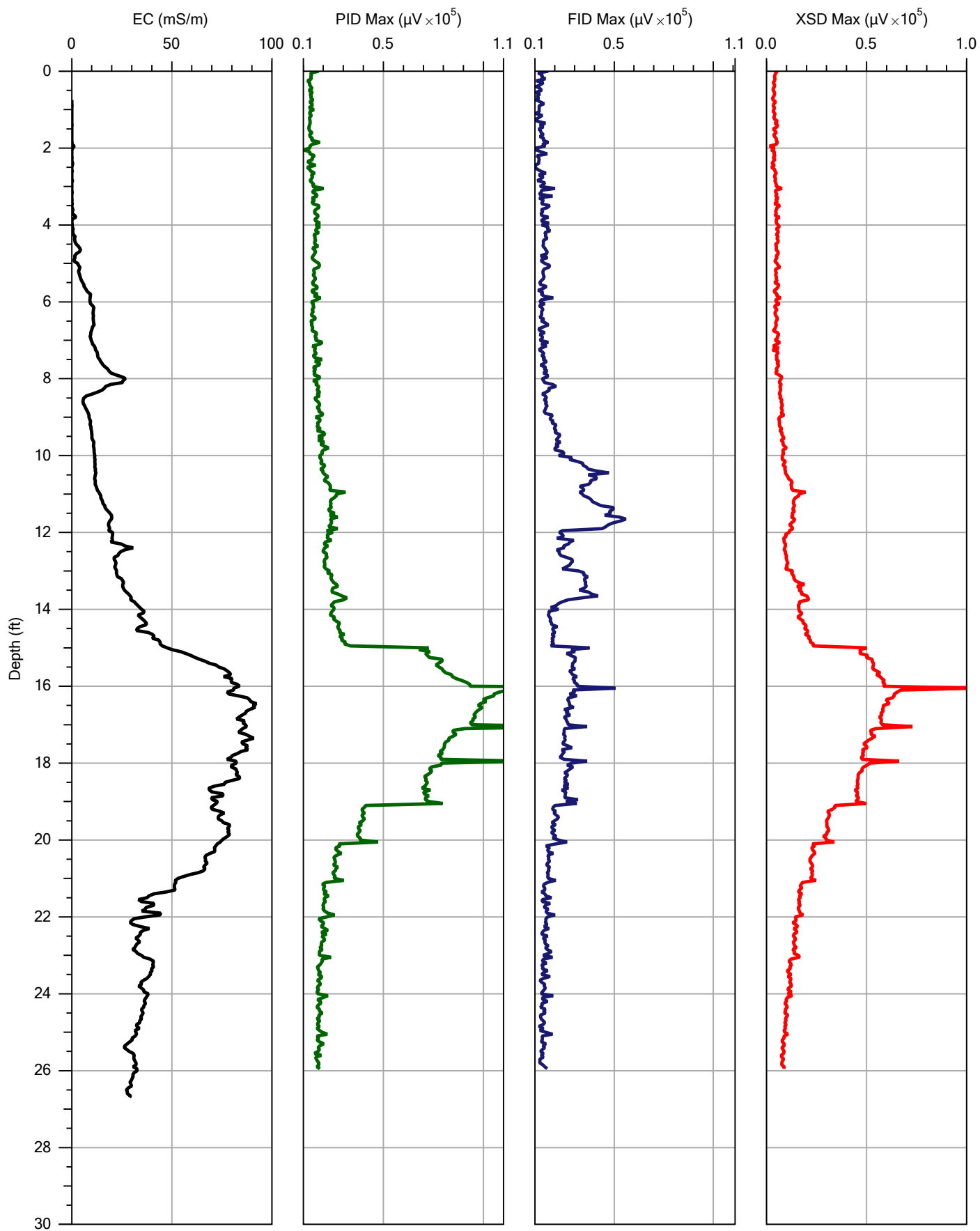
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Date:	12/15/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

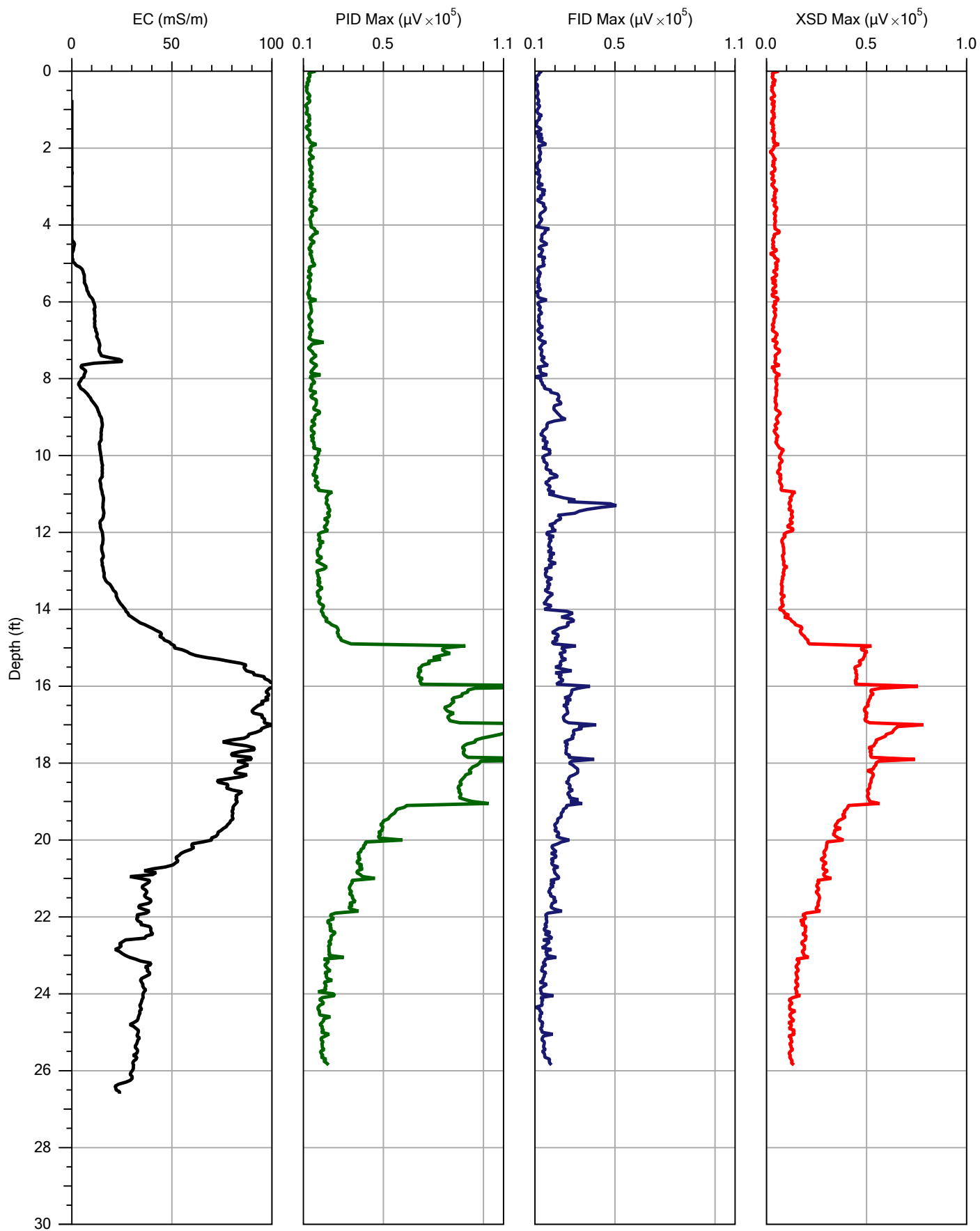
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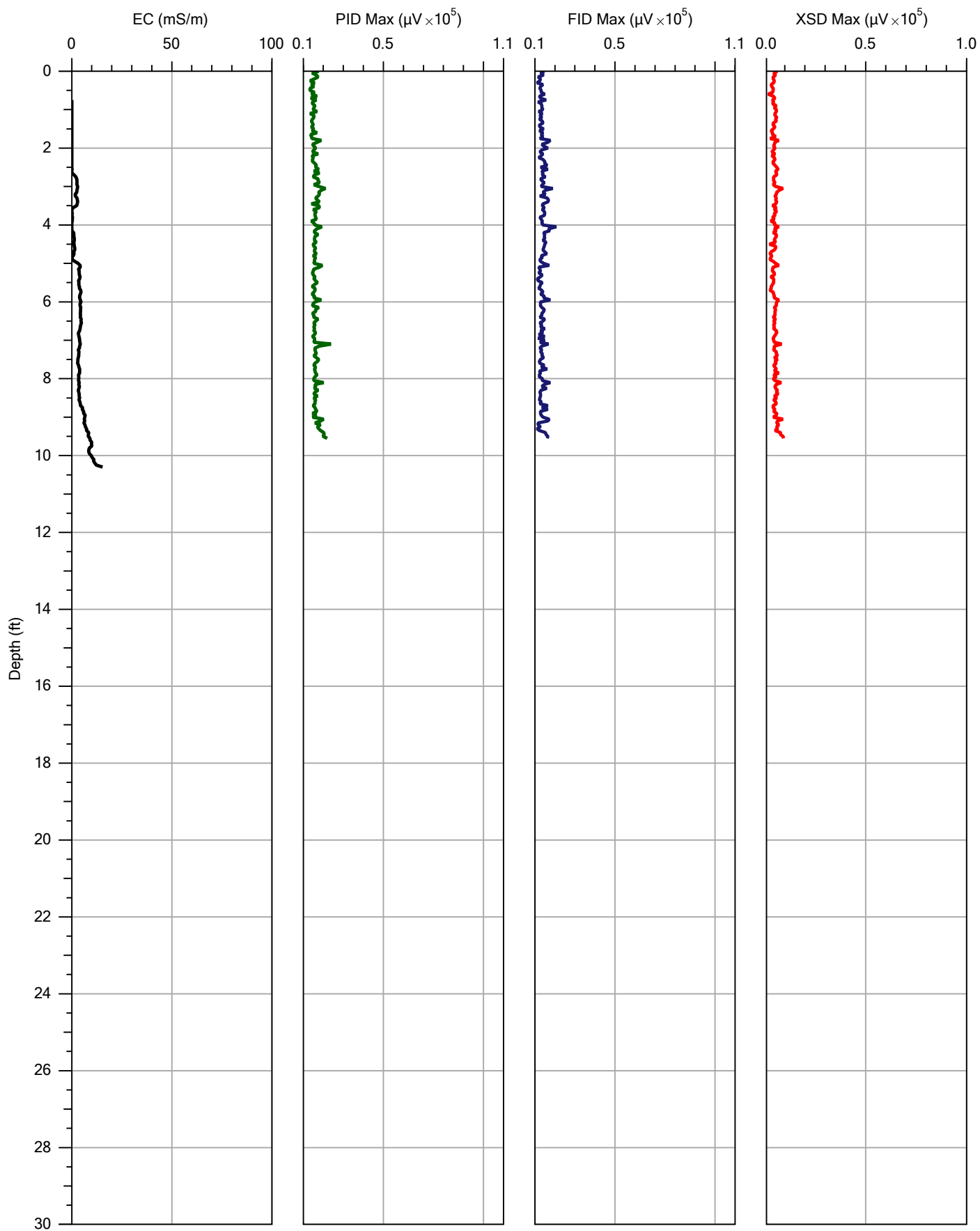
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Project ID: 319.14

Operator: M Jensen
Client: CRA

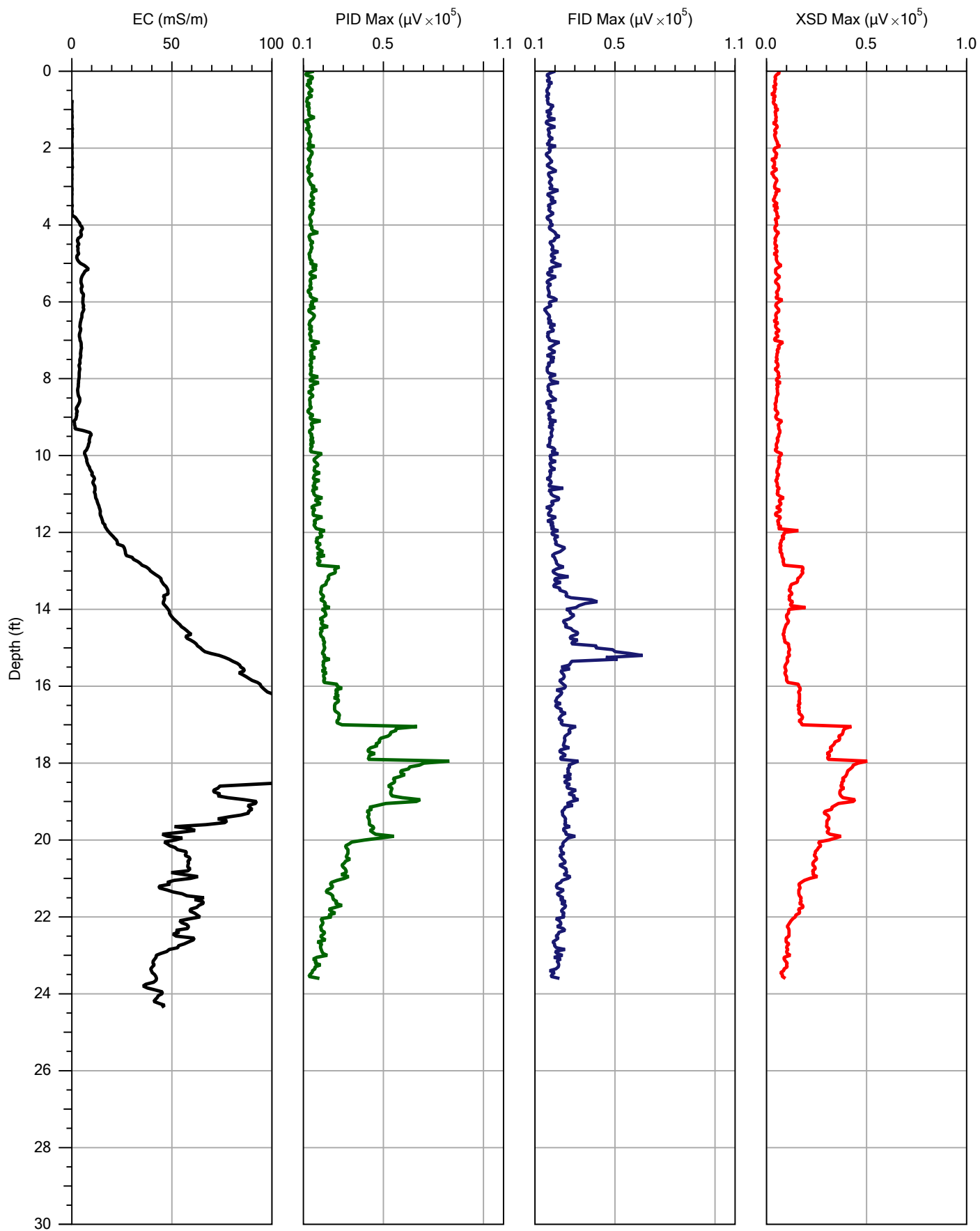
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Location:	



Company:		Operator:	File:
Matrix Environmental		M Jensen	MIP-055.MIP
Project ID:		Client:	Date:
319.14		CRA	12/15/2014
			Location:



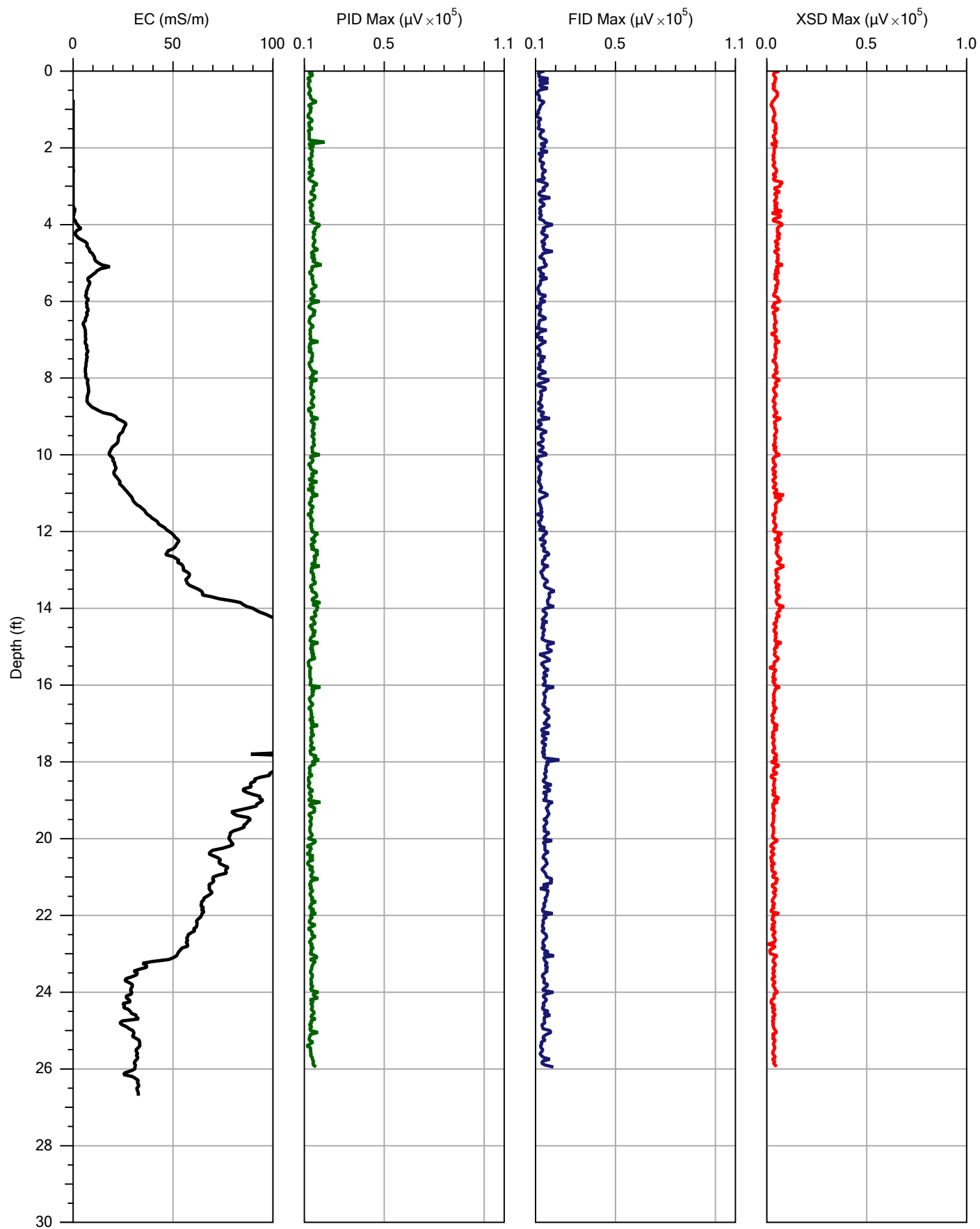
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Project ID: 319.14		Client: CRA	Date: 12/15/2014
			Location:



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

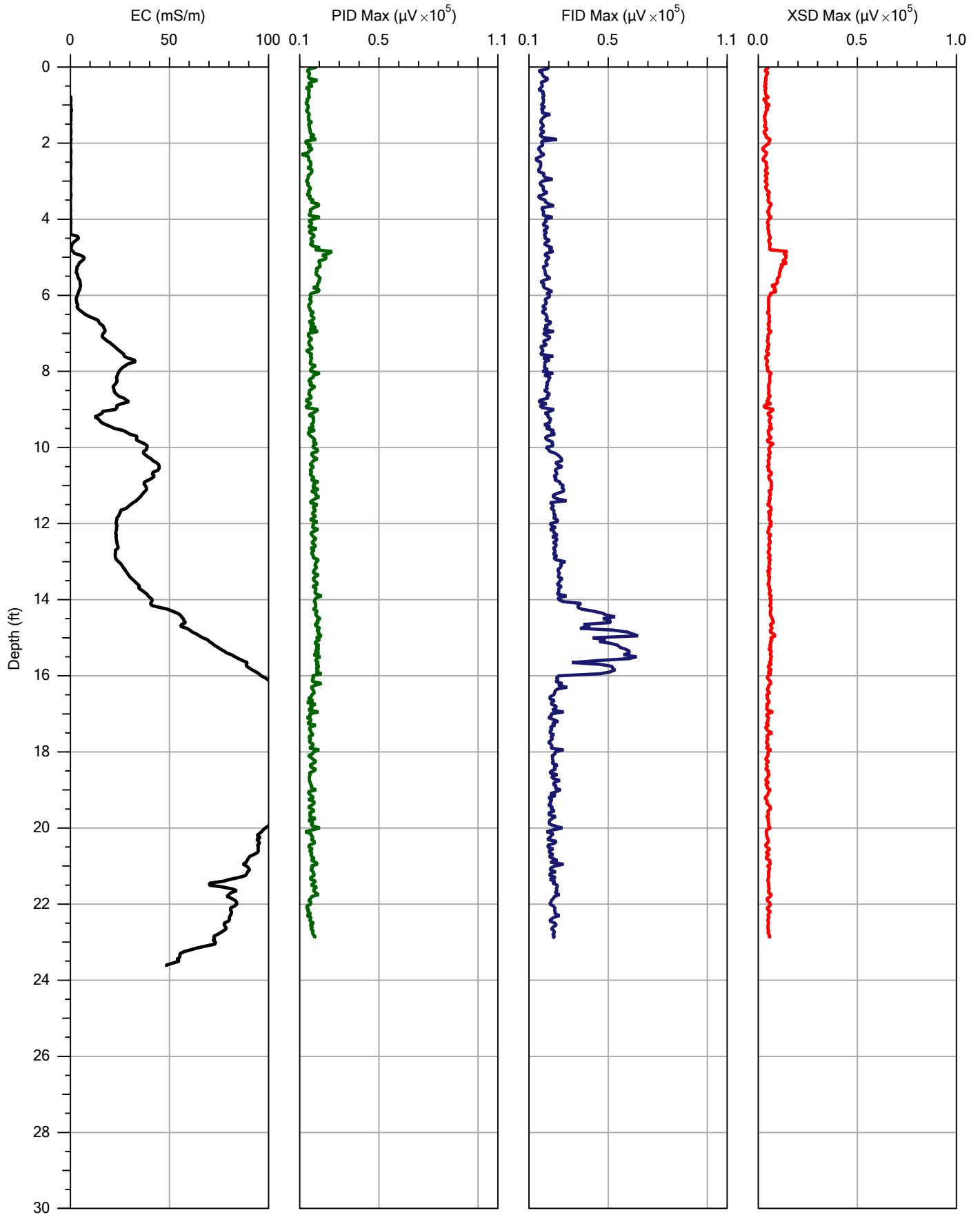
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Date: 12/16/2014
Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

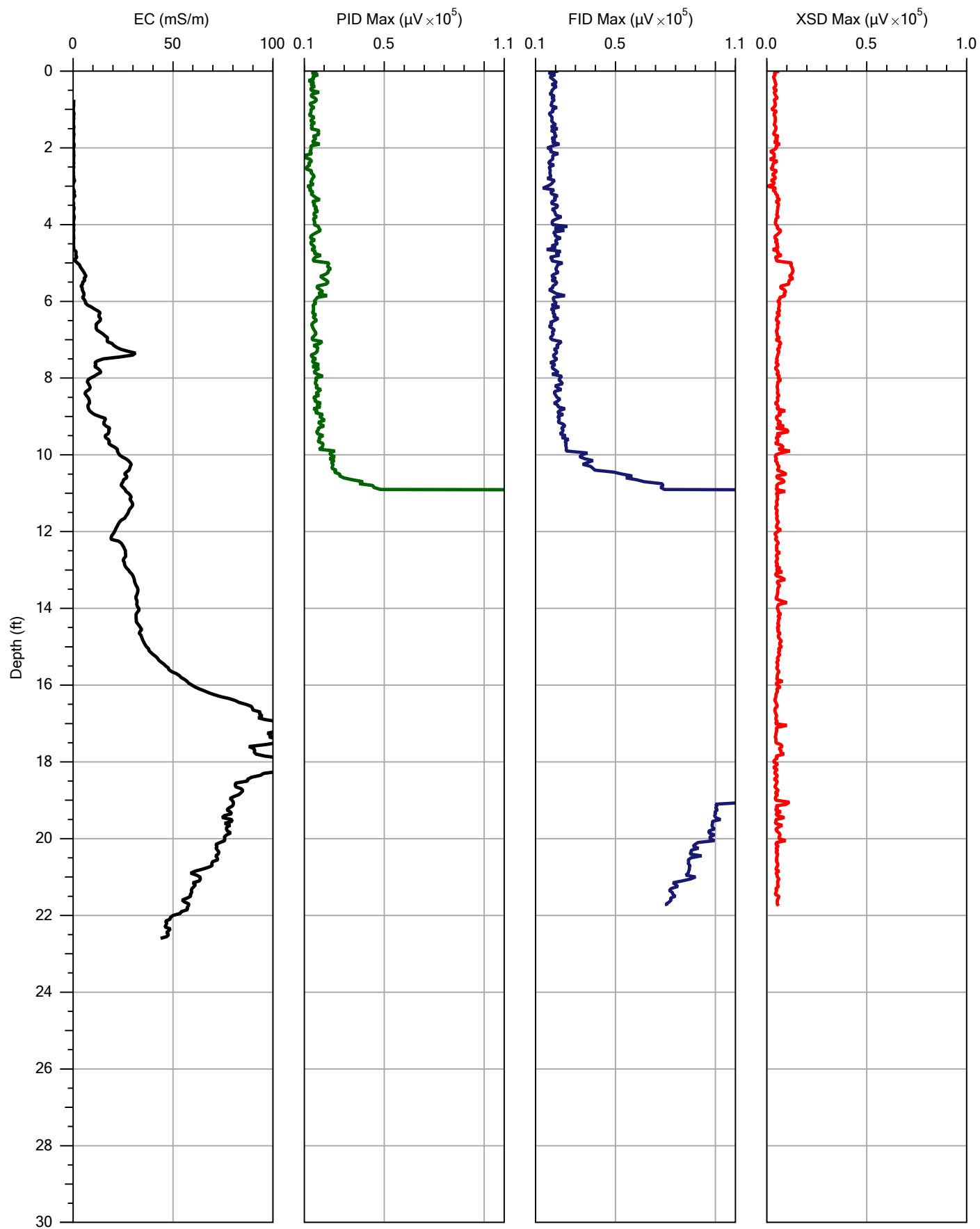
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Location:	



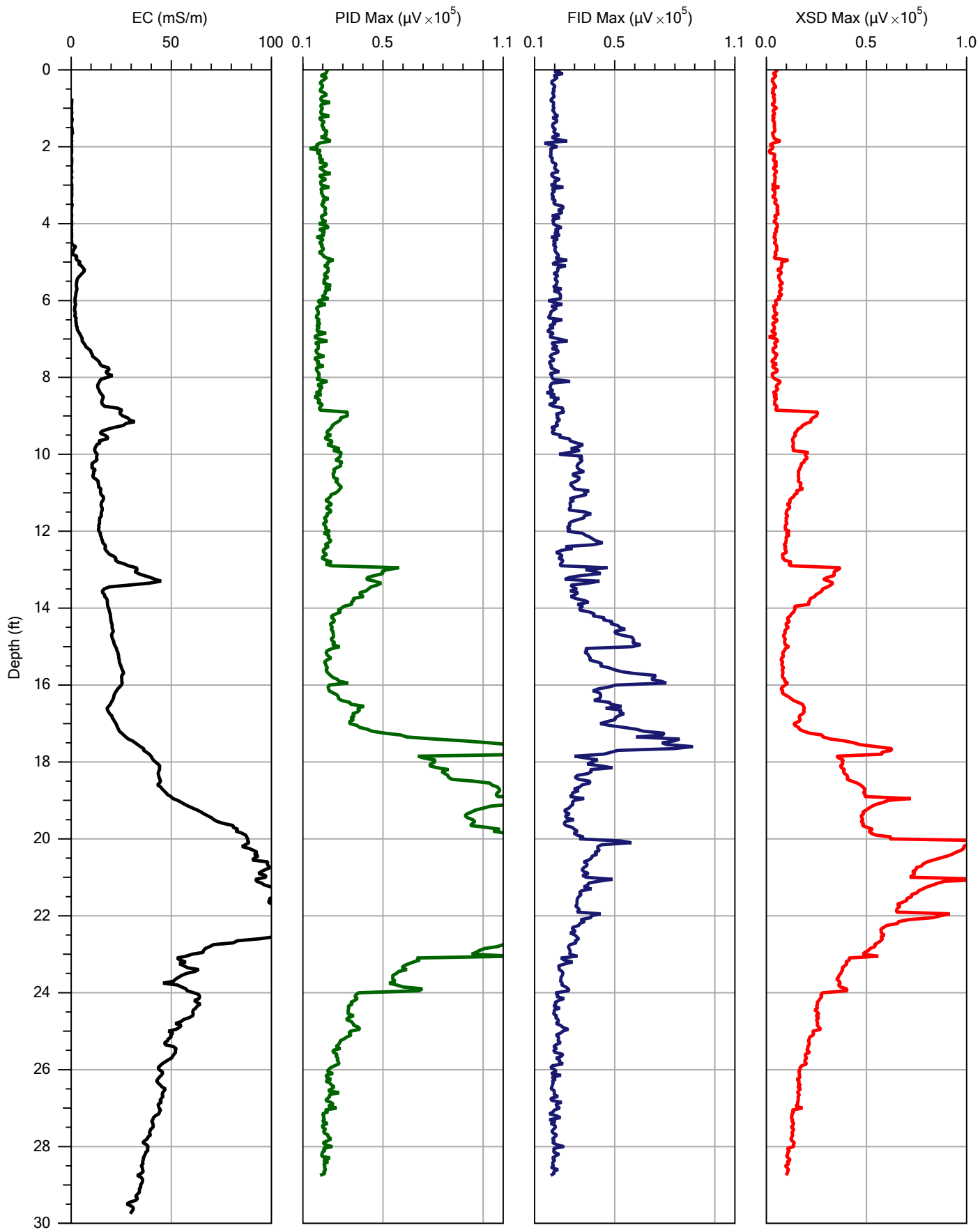
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

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Location:	



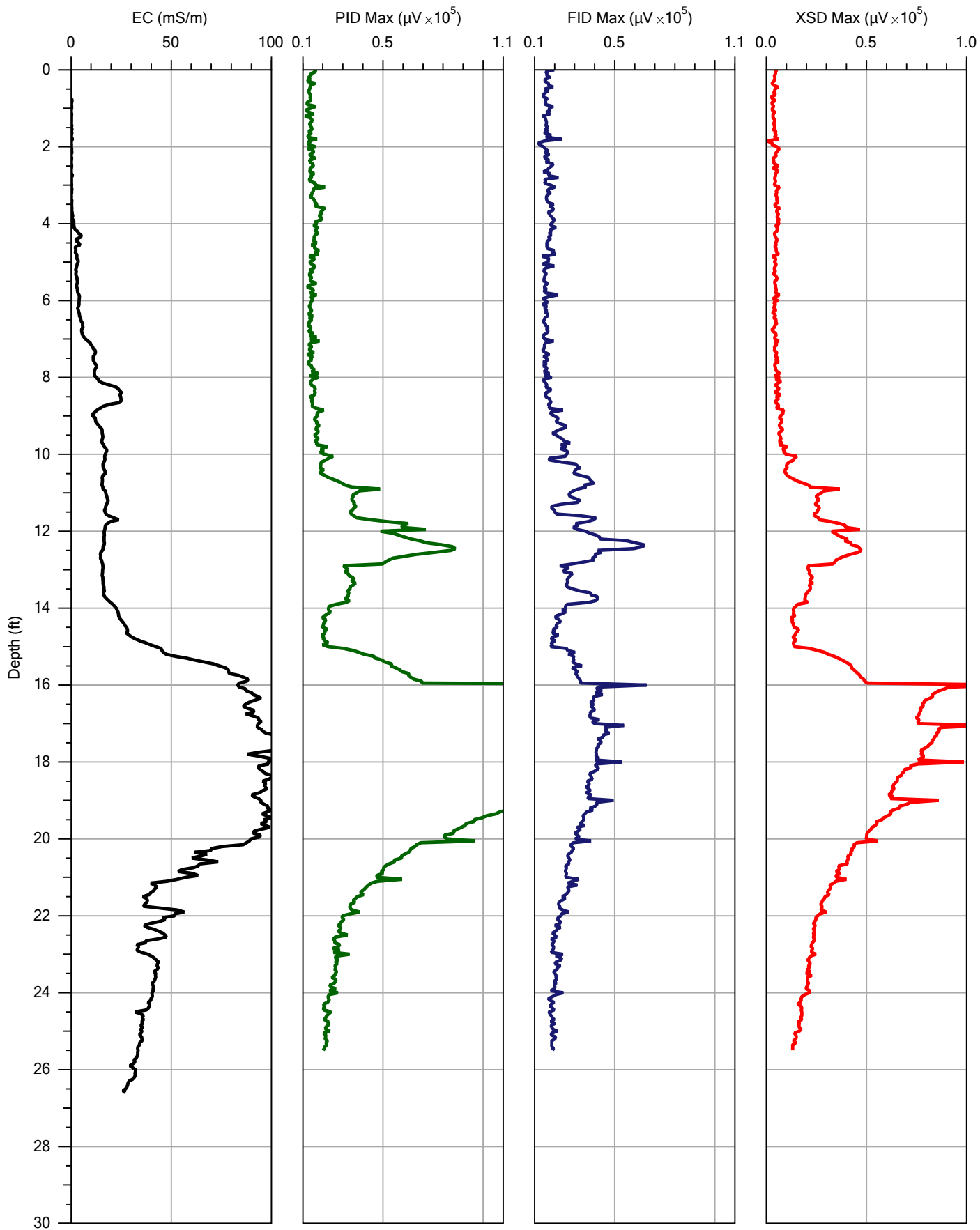
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				Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

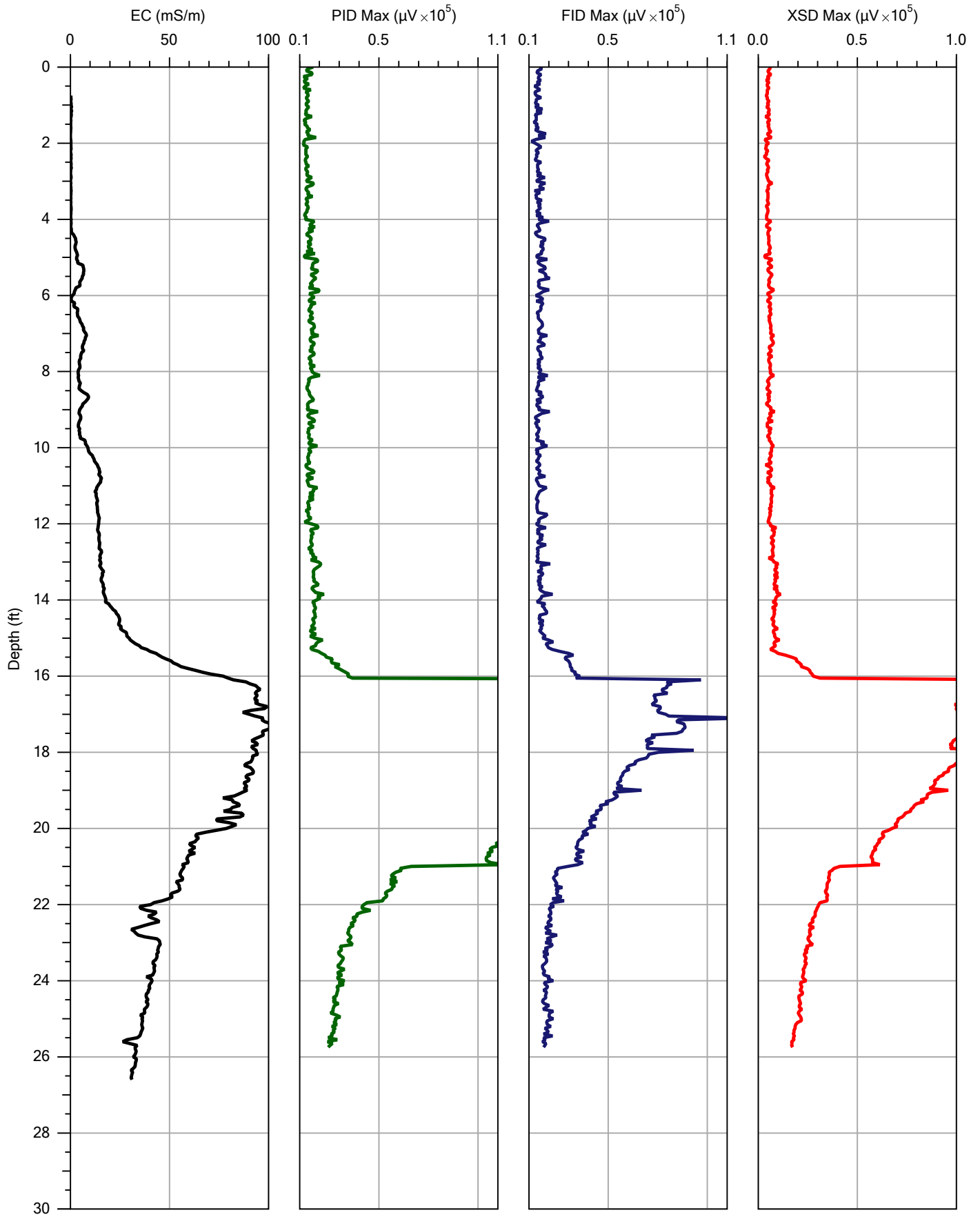
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Date: 12/16/2014
Location:



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

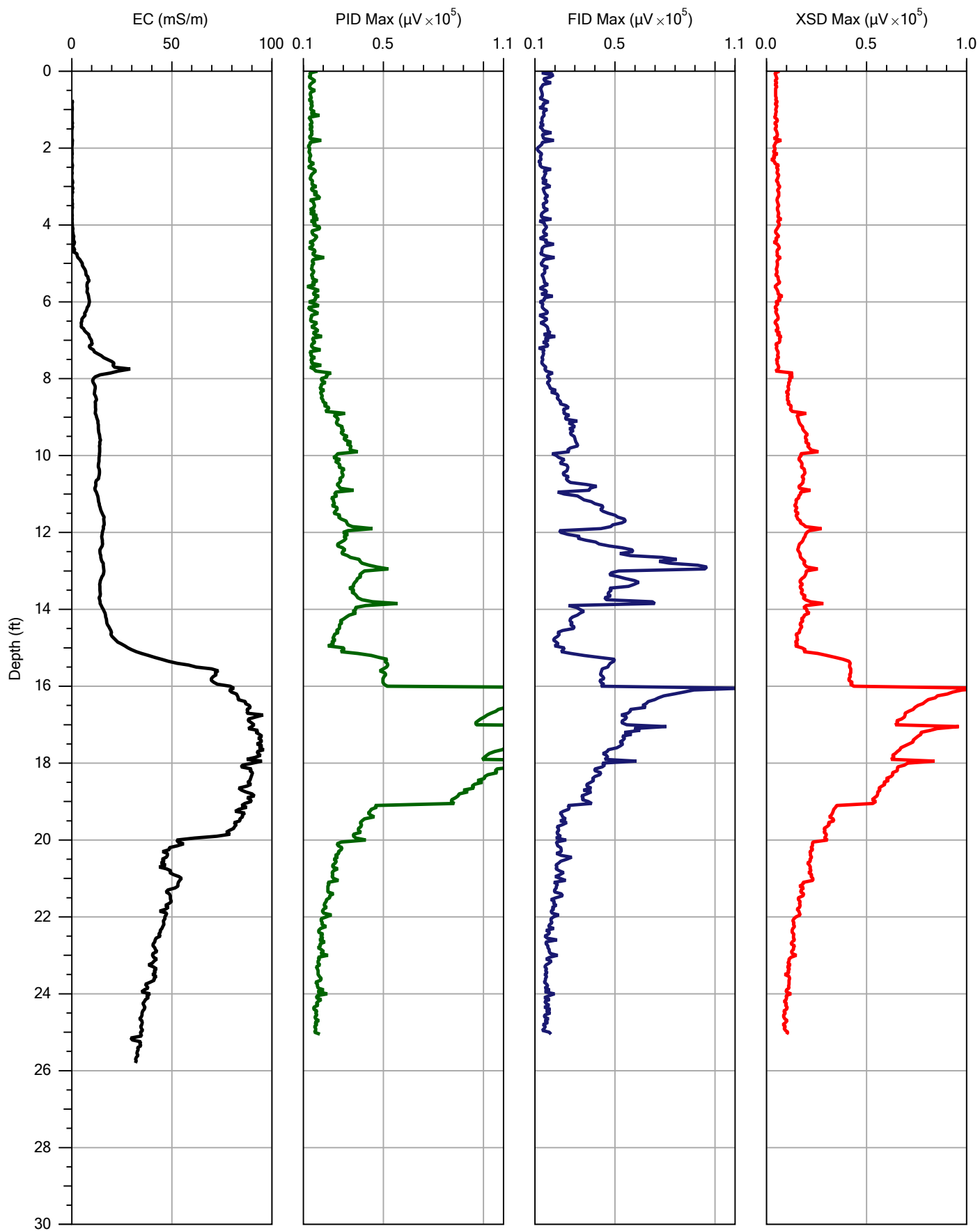
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Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

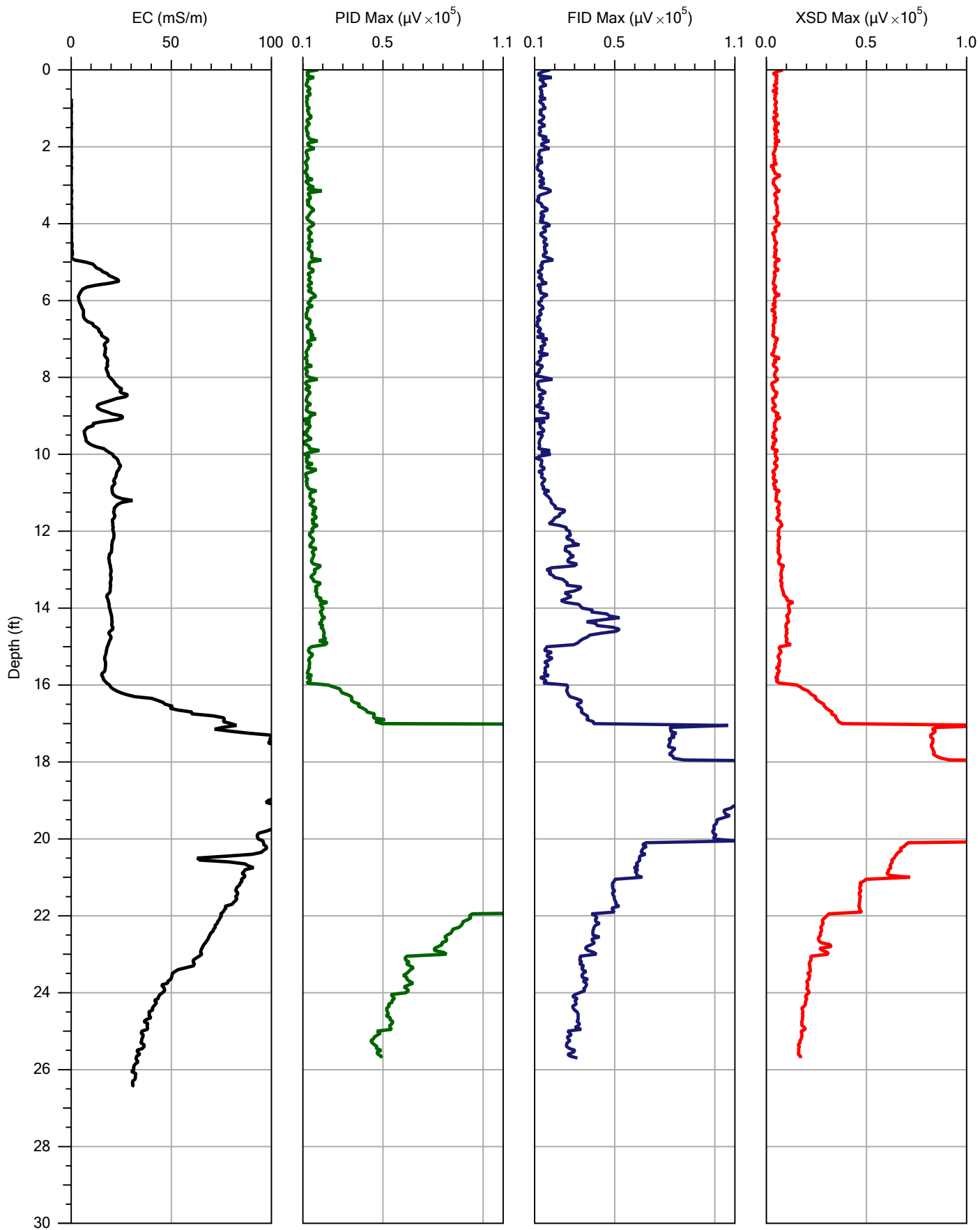
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Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

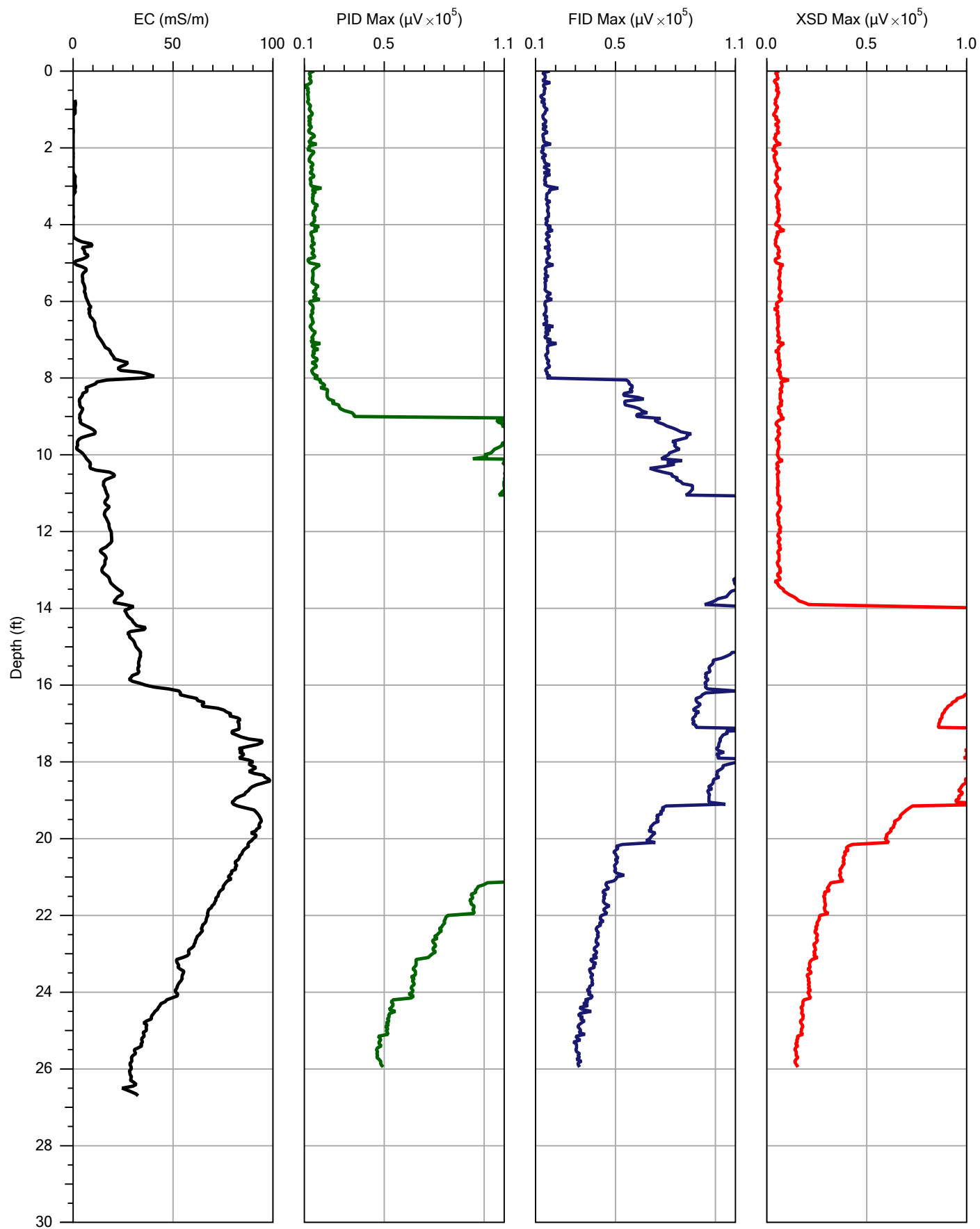
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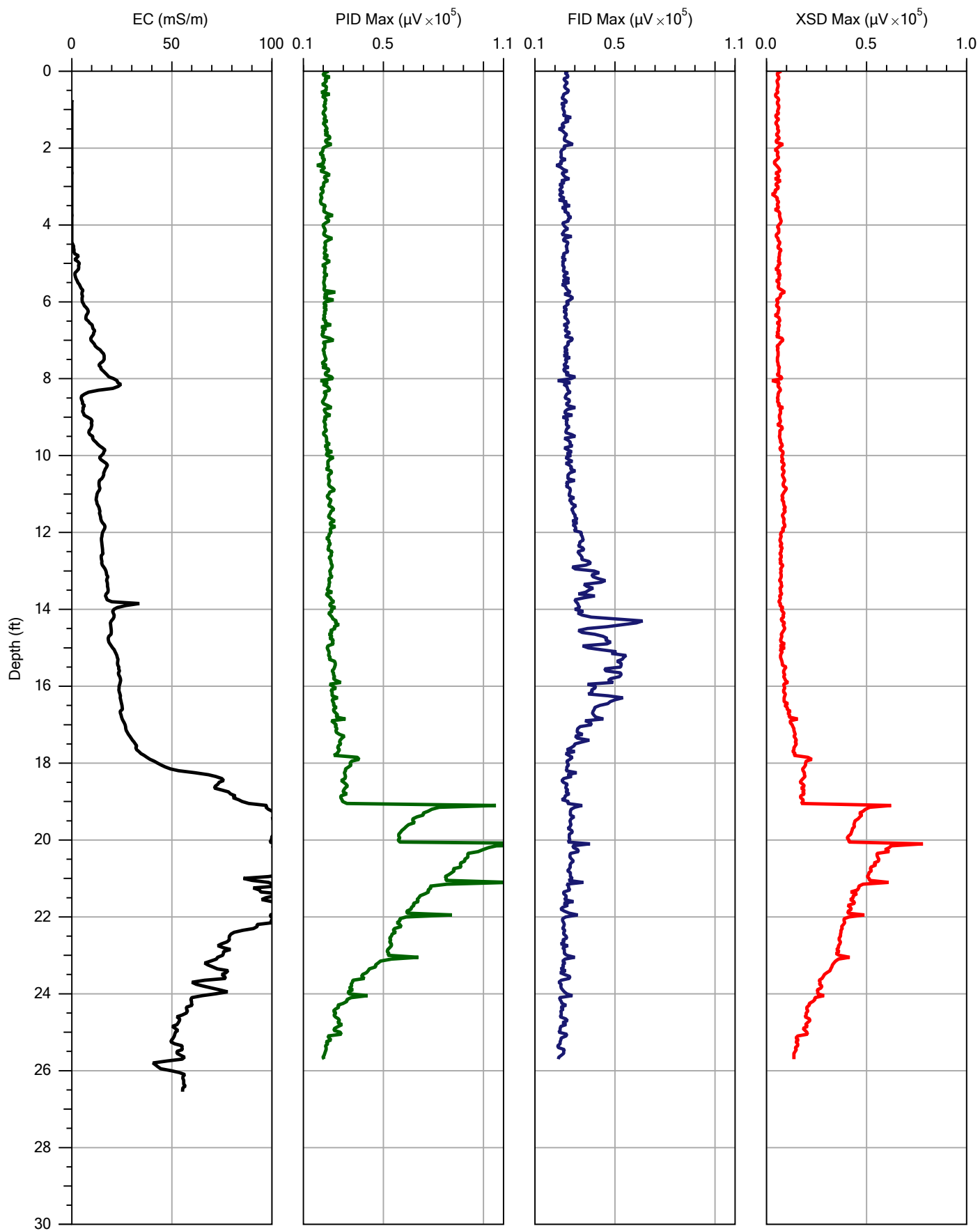
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Project ID: 139.14

Operator: M Jenson
Client: CRA

File:	MIP-064.MIP
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Location:	



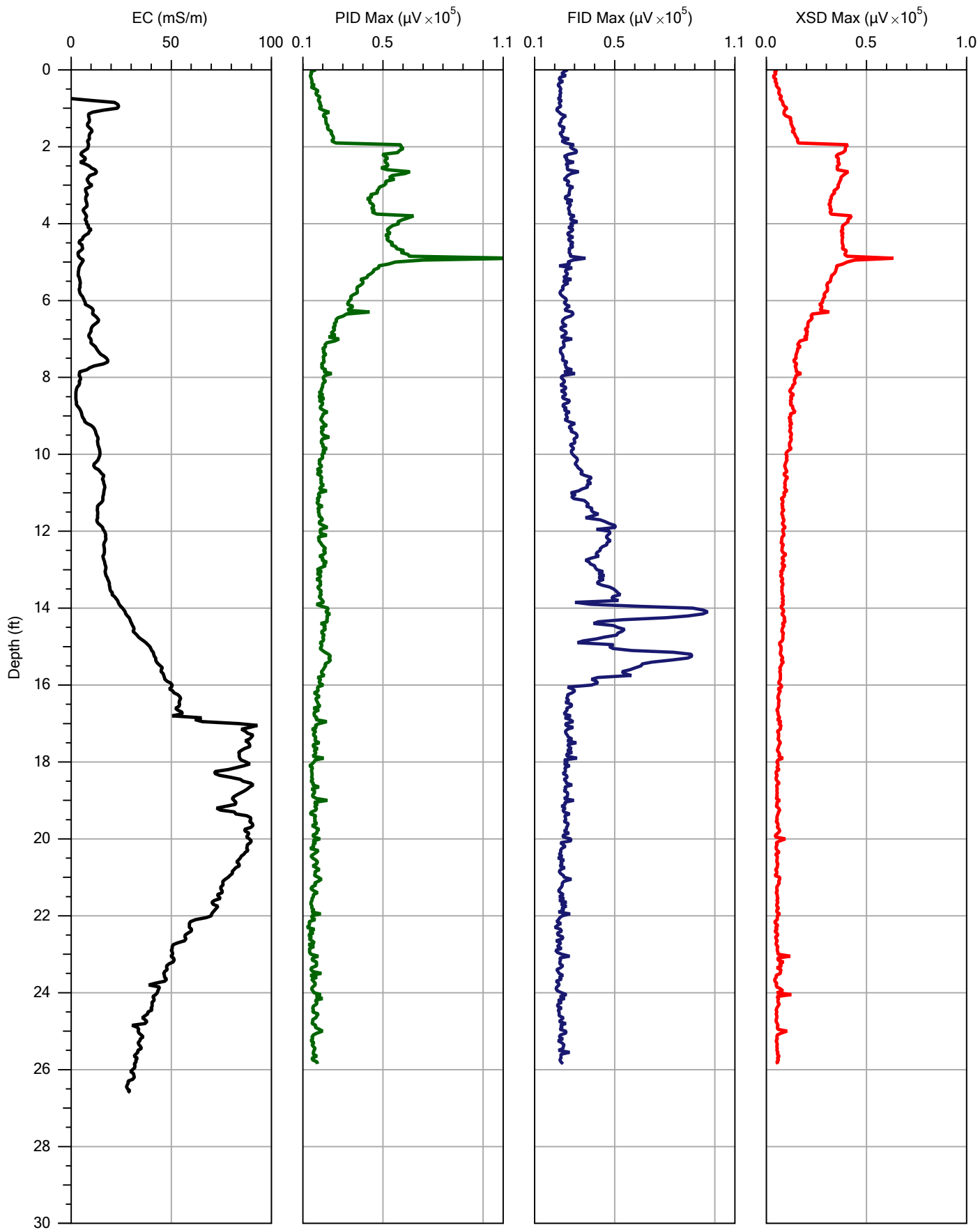
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Project ID:	139.14	Client:	CRA	Date:	12/17/2014
				Location:	



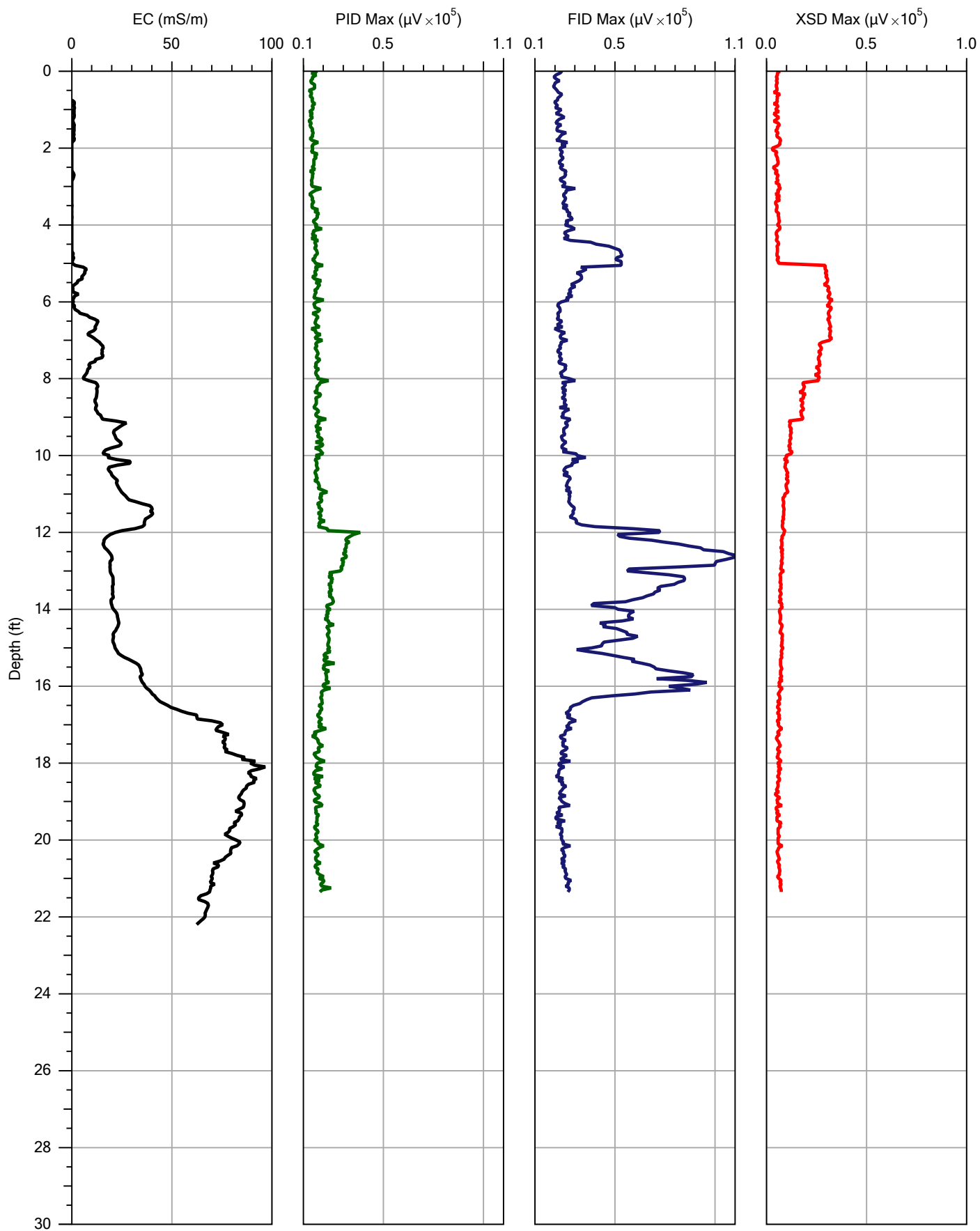
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

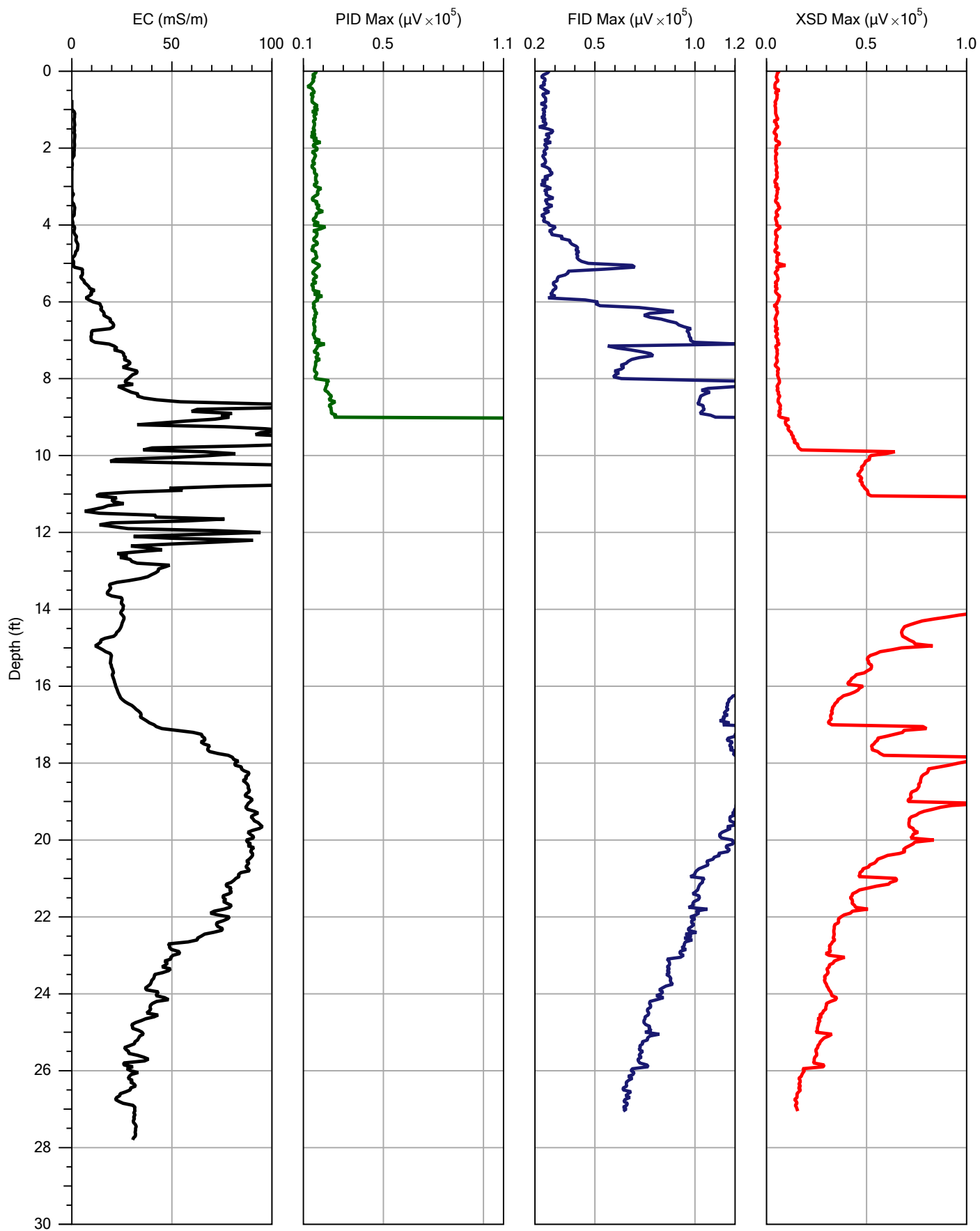
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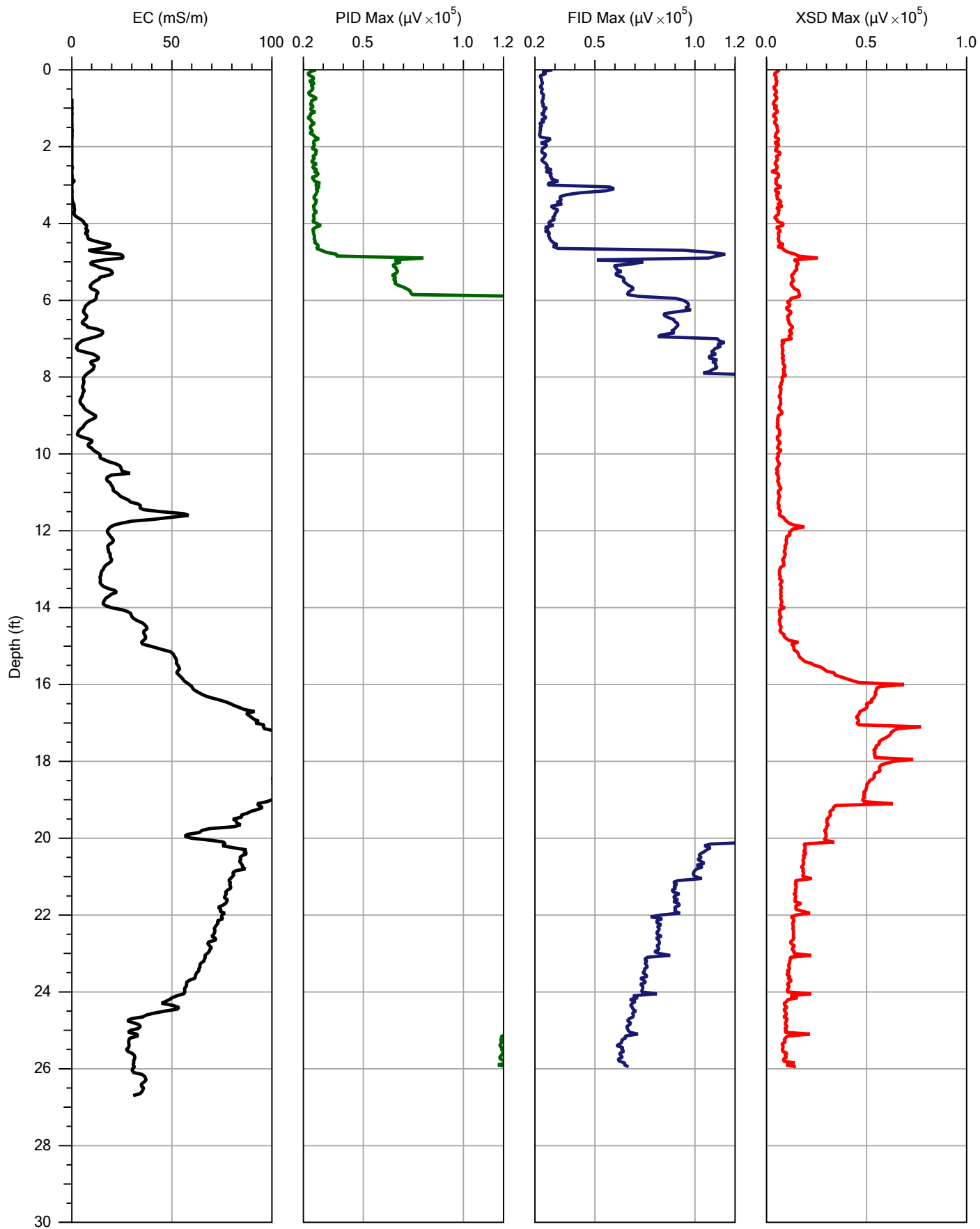
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Project ID:	139.14	Client:	CRA	Date:	12/17/2014
				Location:	



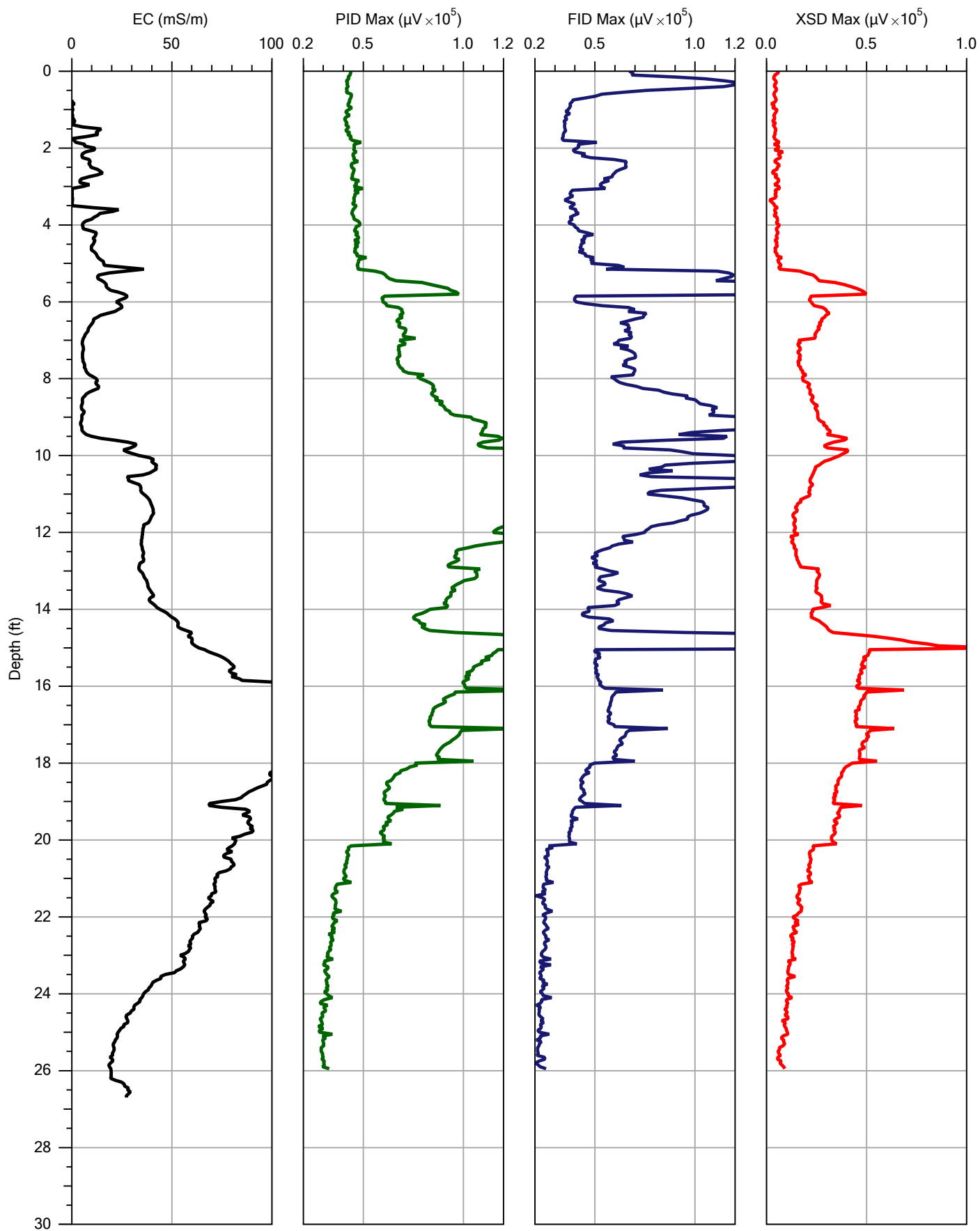
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Project ID:	139.14	Client:	CRA	Date:	12/17/2014
				Location:	



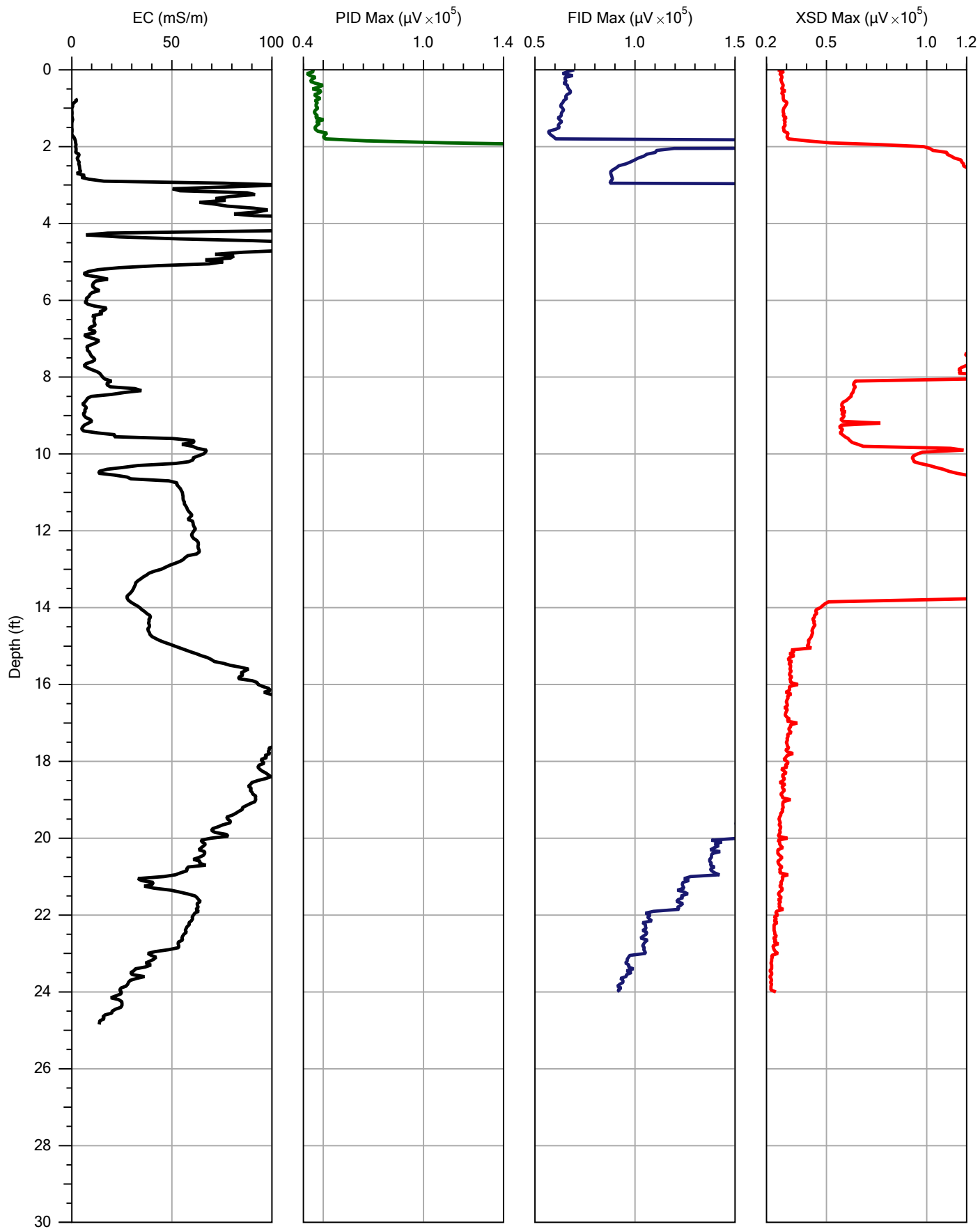
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Project ID:	139.14	Client:	CRA	Date:	12/17/2014
				Location:	



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Project ID:	139.14	Client:	CRA	Date:	12/17/2014
				Location:	



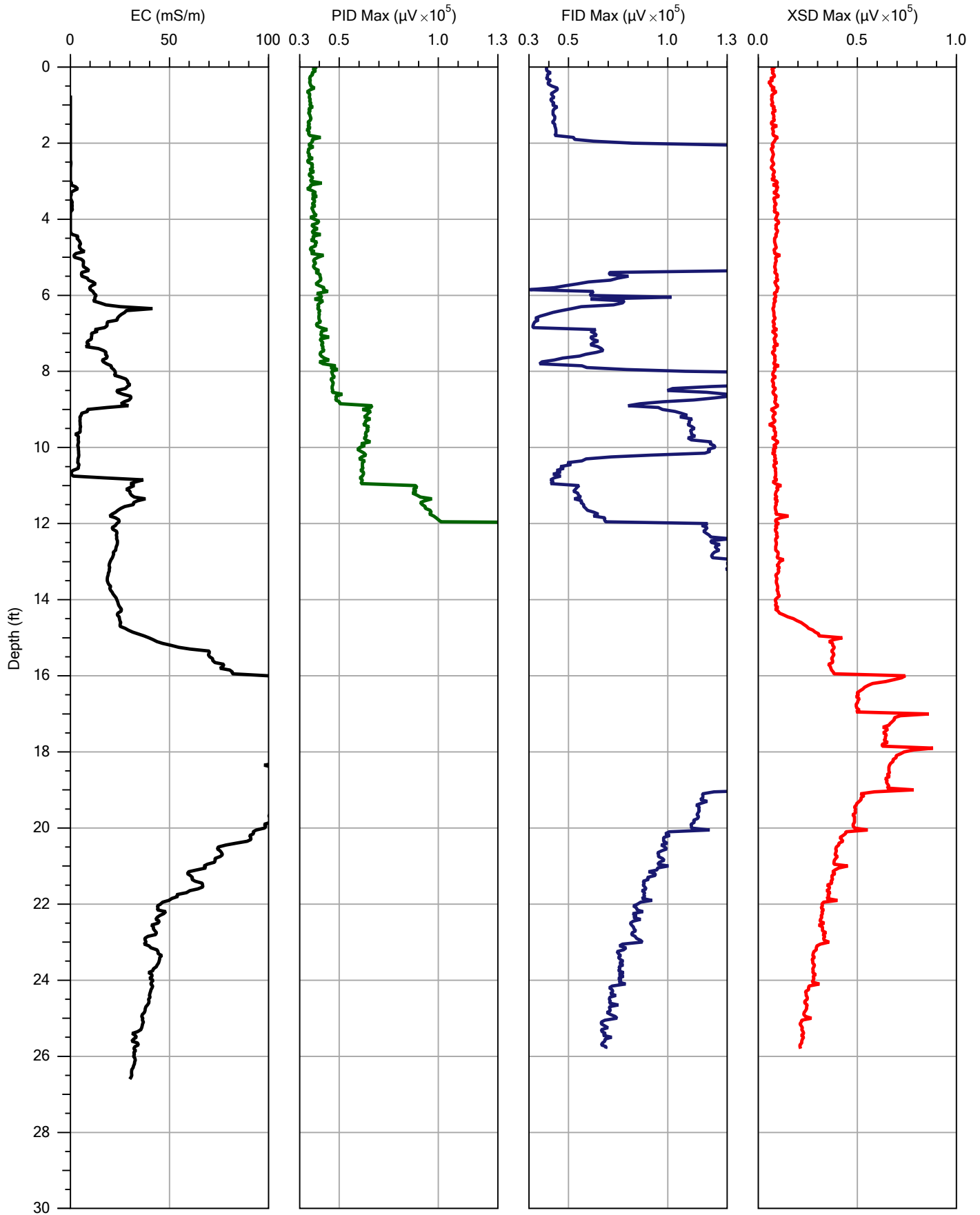
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Matrix Environmental		M Jenson	MIP-071.MIP
Project ID:		Client:	Date:
139.14		CRA	12/17/2014
			Location:



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

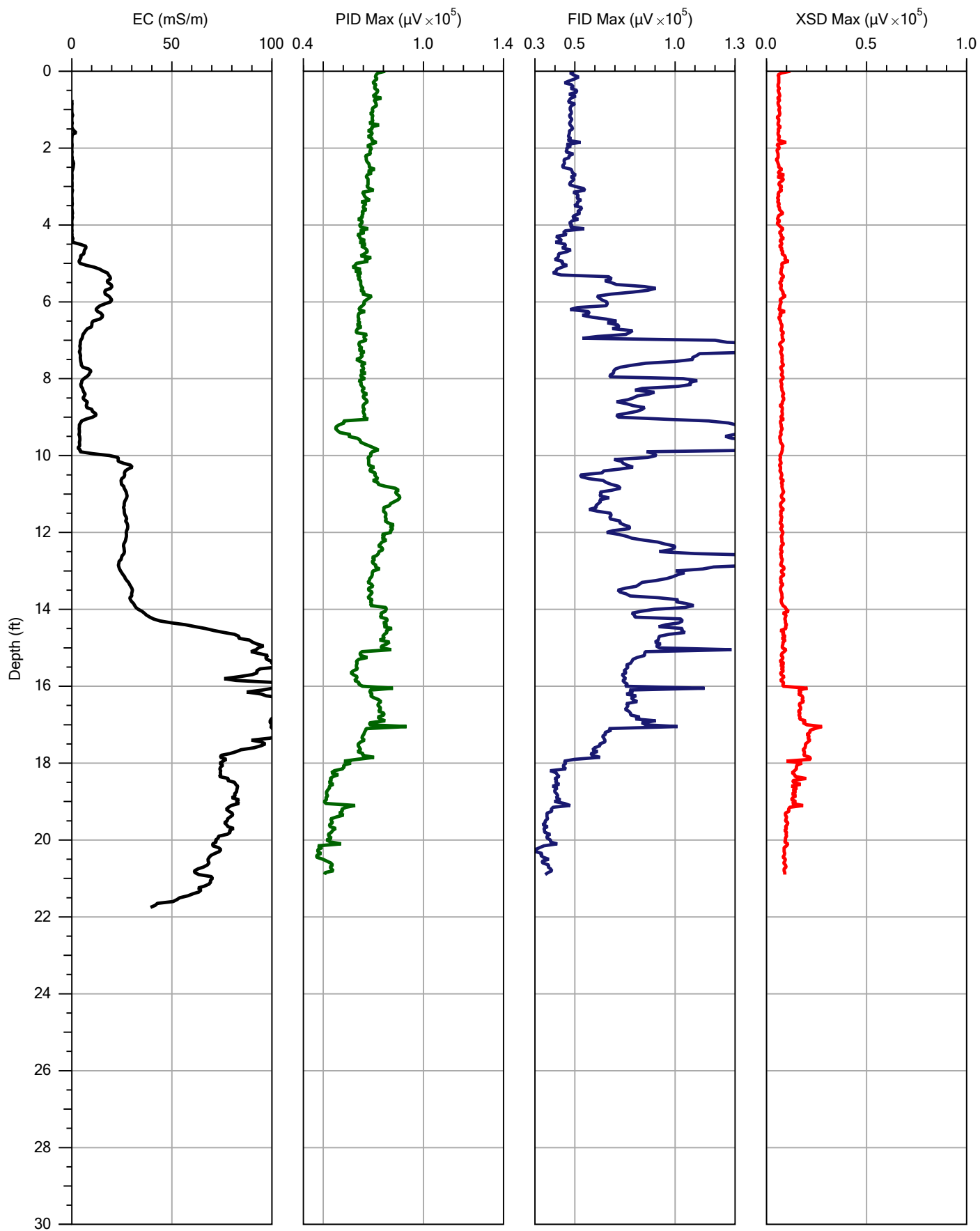
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Date: 12/18/2014
Location:



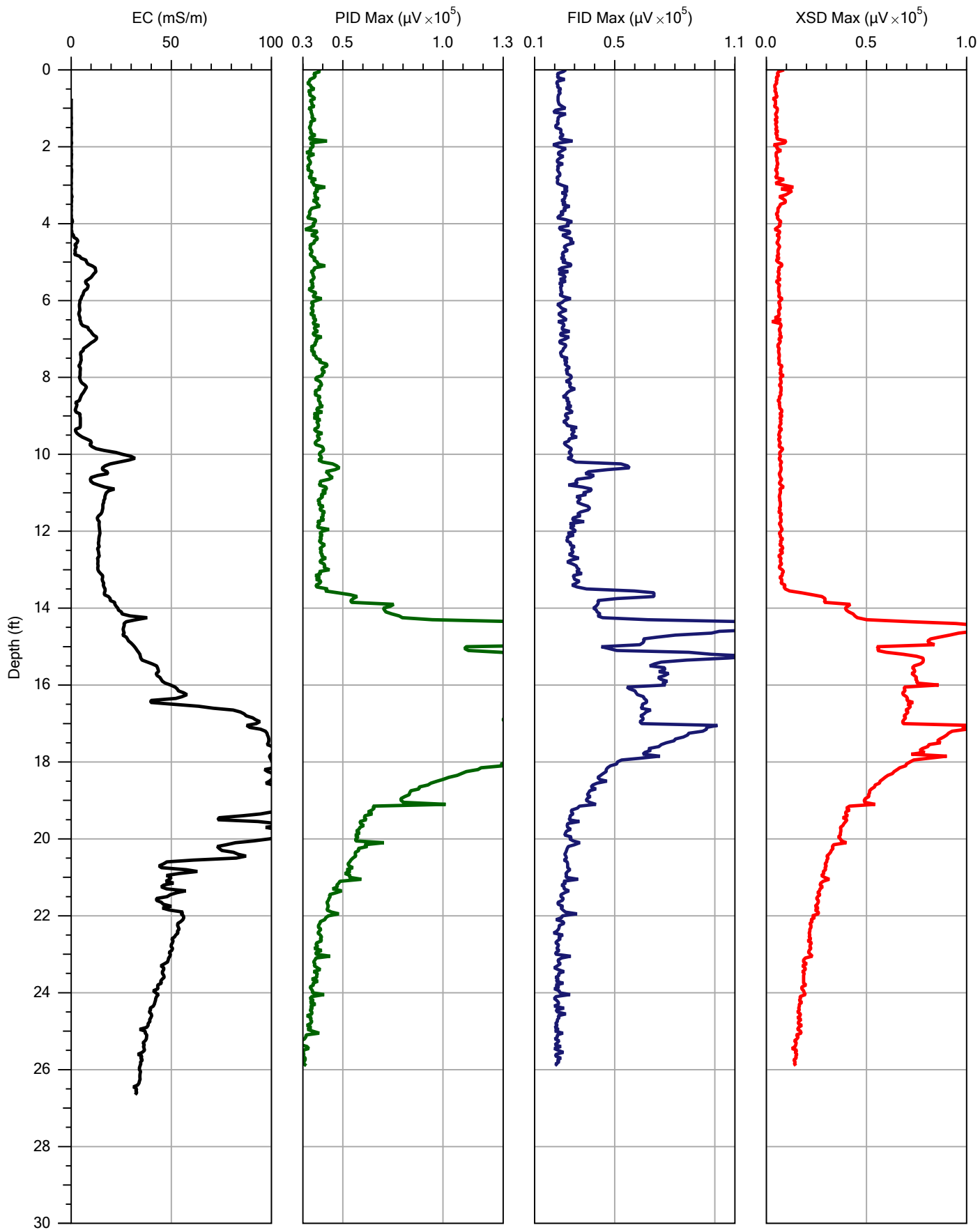
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

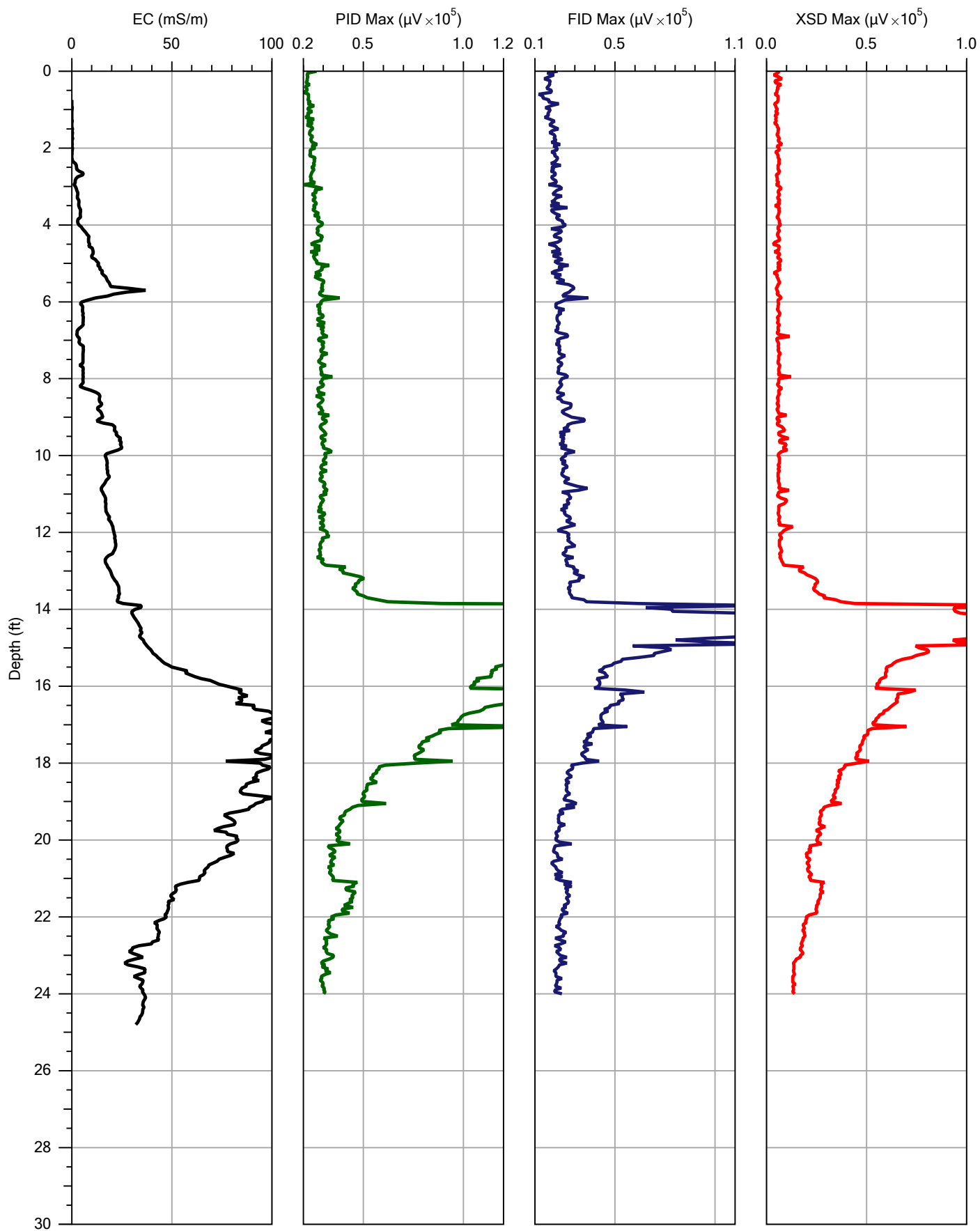
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Date:	12/18/2014
Location:	



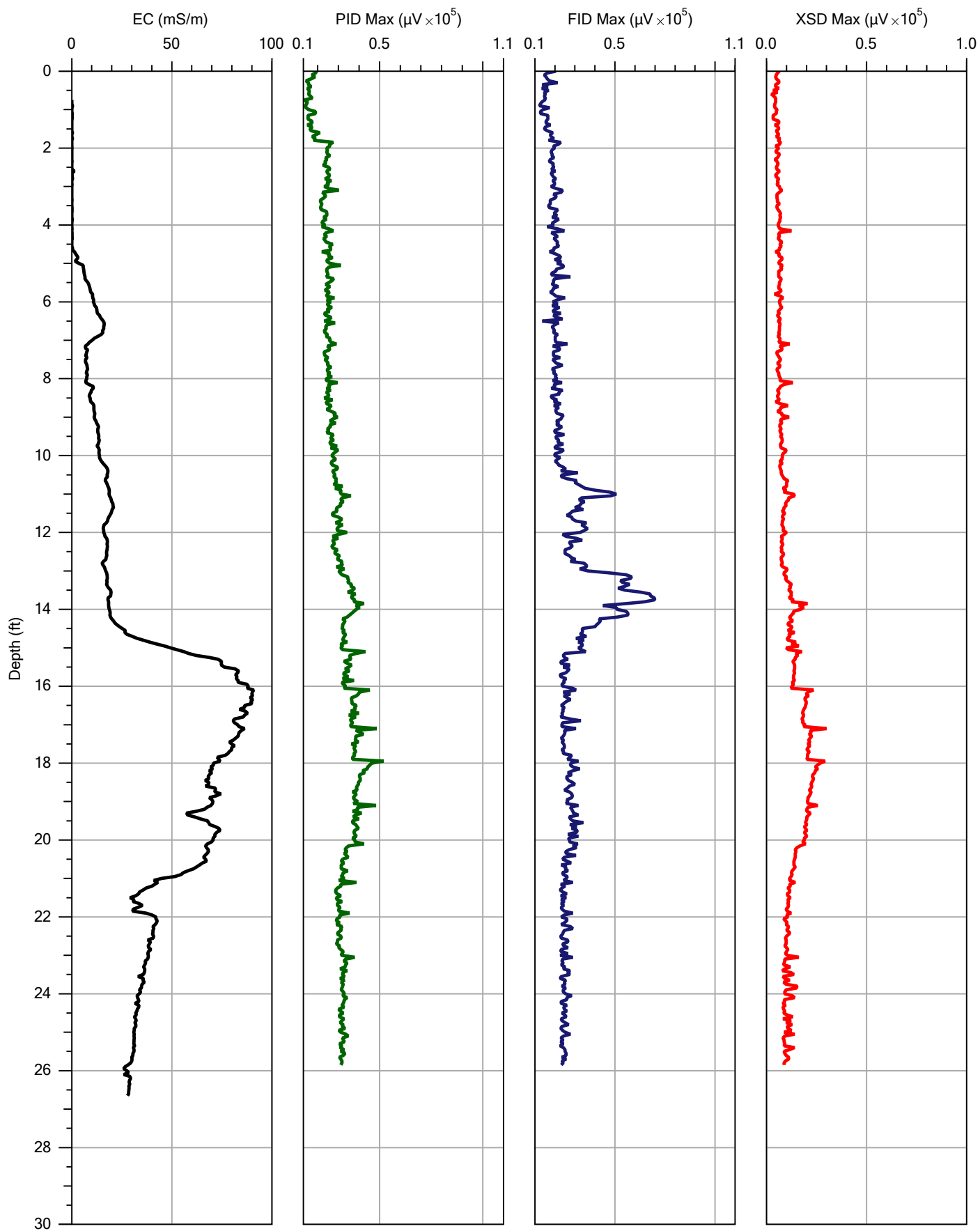
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Project ID:	139.14	Client:	CRA	Date:	12/18/2014
				Location:	



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Project ID:	139.14	Client:	CRA	Date:	12/18/2014
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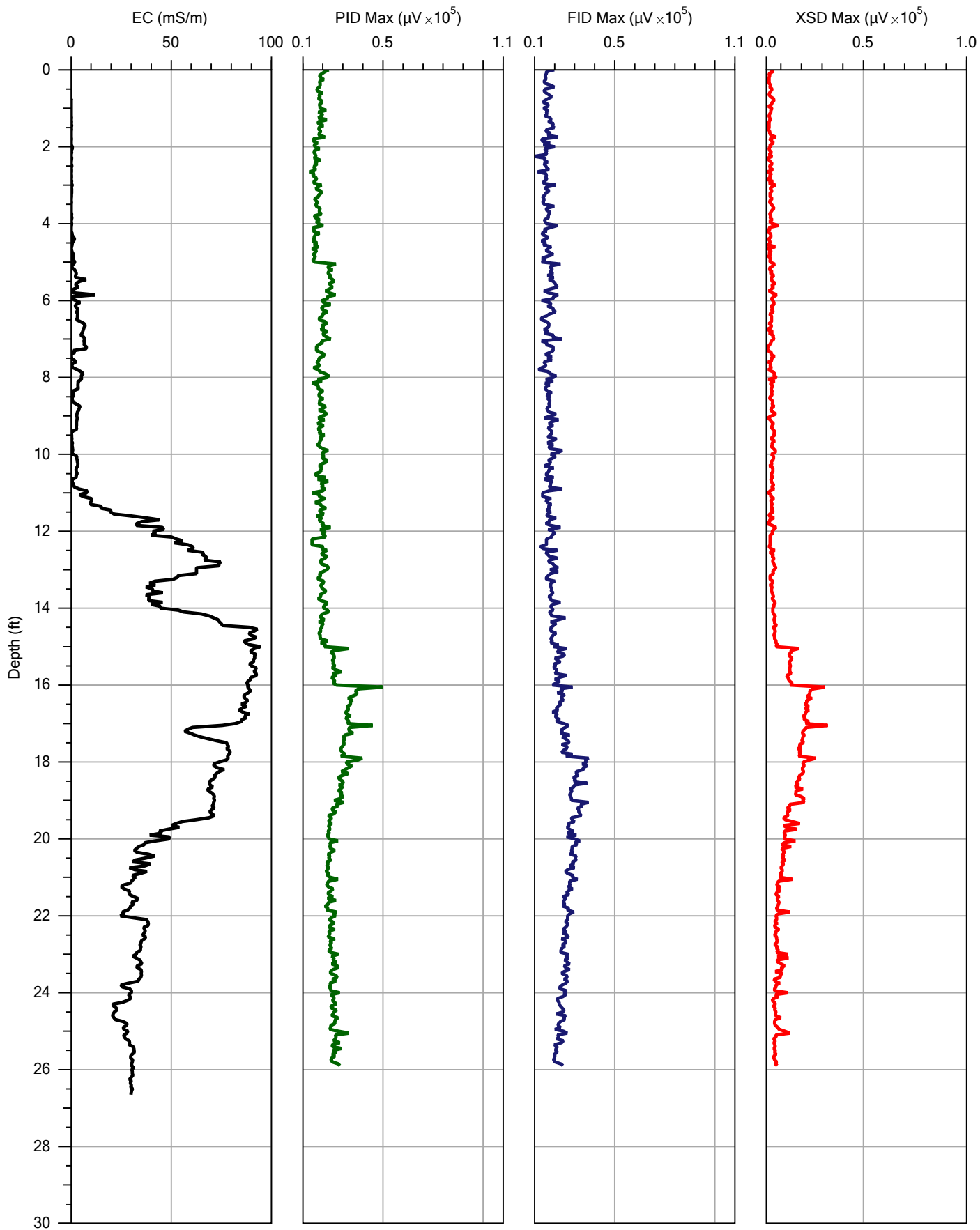
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Operator: M Jensen		Date: 12/18/2014
Project ID: 139.14	Client: CRA	Location:



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

File:	MIP-077.MIP
Date:	12/18/2014
Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

File: MIP-078.MIP
Date: 12/18/2014
Location:

Attachment 1

MIP Report Matrix



Monday, January 26, 2015

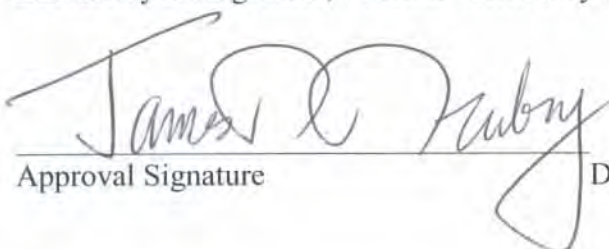
11253 91st Ave N.
Maple Grove, MN 55369
763-424-4803
FAX: 763-424-9452

-Direct Sensing Report, MIP-

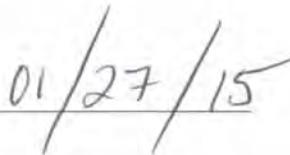
Client: **CRA**
Project Name: **Former Willow Run**
Location: **Ypsilanti, MI**
Project Number: **319.14**

The analysis and opinions expressed in this report are based upon data obtained from the samples collected at the indicated locations and from other information discussed in this report. Exceptions, if any, are discussed in the accompanying comments section of this report. This report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted laboratory practices. Reported results shall not be reproduced, except in full, without written approval of Matrix Environmental, LLC. The sample results relate only to the analytes of interest tested. No warranties, expressed or implied are intended or made.

I certify that the data contained in this final report has been generated and reviewed in accordance with approved methods and our Standard Operating Procedure. Release of this final report is authorized by Laboratory management, which is verified by the following signature.


Approval Signature

Date



MIP SYSTEM DESCRIPTION AND ON-SITE CHEMICAL ANALYSIS

VOCs are semi-quantitatively analyzed in-situ using a membrane interface probe (MIP). The probe is pushed into the ground at a rate of 1 foot per minute (including 45 second residence time). The membrane block heats to a temperature of approximately 90-120°C. Any volatile organic compounds present diffuse across the membrane into the trunkline carrier gas tubing and are brought to the surface and into the GC analytical system. The carrier gas containing samples from the subsurface then passes through a naphion dryer (if used) and a heated GC oven to remove any moisture prior to detector analysis. Compounds appropriate for the detectors and in high enough concentrations (about 1 ppm or higher for Standard MIP and about 100 ppb or higher for Low Level MIP) will produce an electrical signal which is analyzed.

The GC system is comprised of the following three-detector system: Lab grade PID/FID tandem and an XSD. The MIP's trunkline return gas is Y-split in the GC to accomplish this detector configuration. The PID utilizes a 10.0 eV lamp and will ionize aromatic, olefinic, and unsaturated halogenated hydrocarbons with an ionization potential of 10.0 eV or less. The FID will respond to all types of hydrocarbons including methane, halogenated hydrocarbons and other saturated hydrocarbons (generally the FID response gives a good indication of total hydrocarbons present.) The XSD responds selectively to only halogenated compounds (hydrocarbons containing Cl or Br atoms).

Electrical Conductivity (EC) is a measure of the soils ability to conduct an electrical current between two dipoles on the MIP/EC probe. Conductivity is the reciprocal of electrical resistivity and has the units (in our application) of millisiemens per meter (mS/m). Since soil is in the pathway of the charge flow, the grain size can be determined by comparing the EC log to a soil boring. Conductivity readings in the 100s indicate smaller grain (size such as clay). Larger grain size (sand and gravels) are typically in the 10s of mS/m range. Prior to every log the EC point of the MIP probe is checked for proper operation by performing a voltage test with a voltage meter and a conductivity test with a test block.

Since the MIP system is a screening tool, some laboratory analysis of soil or groundwater samples or some historical analytical data is needed in order to obtain optimum MIP log correlation. The following quality assurance/control measures are routinely conducted to ensure the validity of the analytical results:

Chemical Response Test: MIP data needs to be validated with passing QC at the beginning and end of every log. The probe is immersed into a 500 mL cylinder of water containing the compound(s) of interest. This test will be performed at multiple concentration levels at the beginning of each day to verify detector response and generate detection limits of the system (For example: 3 levels of TCE @ 1, 5, & 25 ppm). QC tests of at least one level are checked between each boring to determine system integrity and monitor membrane and detector fluctuations. The results of this are listed in the QA/QC report.

Butane response: May be run between each boring by dispensing butane over the membrane. Measuring the lag time of the carrier gas from the probe to the detectors is used to determine trip time and to verify FID detector response.

Continuity check: Performed before and after each boring to verify system continuity throughout the project for the electrical conductivity data.

DISCUSSION AND COMMENTS

Matrix performed chemical response tests at 0, 1, 5, and 10 ppm TCE at various times throughout the project. At a minimum, a one level response test was performed before or after each log on the MIP system (PID/FID/XSD) to assure data quality. The response tests appeared normal and were indicative of a functional MIP system

For each log, the probe was advanced one foot and then the probe was allowed residence time of 45 seconds or longer - time for the probe to reach temperature and for volatile organic compounds to diffuse through the membrane and into the trunkline. The trip time was about 60 seconds for the trunkline.

Electrical conductivity (EC) data was collected simultaneously at each MIP location. The EC was tested before and after each log for continuity and performance. All tests passed Geoprobe QC specs.

Geoprobe's recommended refusal push rate is 1 foot per minute. This project required pushing the probe at 0.5-1 foot/minute in the 10-14 foot interval for several locations in order to achieve desired depth. See ROP logs (rate of push, by date). Because of these harder drilling conditions, we did encounter refusals at 2 locations:

MIP-016 - refusal @ 12.7 feet.

MIP-056 – refusal @ 9.55 feet. Moved over 2 feet the next day – MIP-056A.

Also, the nitrogen-sending gas line on the probe broke @ MIP-030.

The stringpot (depth control) malfunctioned during MIP-052. The Pre-Log QC passed and this data was retained for this location so we moved over 2 feet and started again naming it MIP-052A.

The detector starting baselines (see *Field Summary Logs*) were elevated for some logs due to high fuel or tar contamination at the previous location. The elevated baselines were allowed due to the time constraints of waiting for the trunkline to clear out. Observing the Post-Log QC after a very contaminated log does help to gauge the amount of baseline shift for each detector independently and it should be noted that the XSD baseline was generally much less affected. The detector baselines were elevated at the start of MIP-072 because that location was very hot. As soon as the probe was lowered into the open pre-probed borehole, the membrane began collecting volatiles that were present. Note that the baselines in the Pre-Log QC are at a normal level (probe not in ground yet).

MIP-048, MIP-069 and MIP-072 contain EC readings above the clay which seem to be associated with high contamination levels (possibly tar, creosote or paint sludge). After retracting rods from location MIP-048 it was observed that the rods smelled like creosote or fuel. The probe and rod treads were covered with a "fuel" sheen (NAPL) and the probe was also covered heavily with tar. According to the site map it was noted that MIP-048 was in between 2 "tar laden" test pits.

During MIP-030 the gas line cracked on the probe/trunkline connection. The line was repaired, but the trunkline may have become compromised with fine soil particles and moisture. After observing some erratic pressure and detector readings, the trunkline and probe were changed after MIP-033. The detector data between 7-14 feet and after 20 feet was disregarded for MIP-031.



11253 91st Ave. N.
Maple Grove, Minnesota 55369
(763) 424-4803
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Client: CRA
Contact: Beth Landale
Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-001	12/02/14	pass	pass	pass	25.90	3	Start project with trunkline P150 1491, Probe MP6520 4449R
MIP-002	12/02/14	pass	pass	pass	26.00	3	NC (no comment)
MIP-003	12/02/14	pass	pass	pass	28.05	3	Turn down trunkline flow @ 12 feet
MIP-004	12/02/14	pass	pass	pass	28.05	3	NC
MIP-005	12/02/14	pass	pass	pass	28.05	3	NC
MIP-006	12/03/14	pass	pass	pass	25.80	3	NC
MIP-007	12/03/14	pass	pass	pass	25.80	3	Turn up trunkline flow 1 psi @ 17 feet
MIP-008	12/03/14	pass	pass	pass	26.25	3	Drill rig down. Electrical issues
MIP-009	12/03/14	pass	pass	pass	26.00	3	NC
MIP-010	12/03/14	pass	pass	pass	25.95	3	Very hard drilling @ 4-10 feet.
MIP-011	12/03/14	pass	pass	pass	26.00	3	NC
MIP-012	12/03/14	pass	pass	pass	25.85	3	NC
MIP-013	12/04/14	pass	pass	pass	29.00	3	Wait 5 minutes (instead of typical 1 min) between 28 and 29 feet.
MIP-014	12/04/14	pass	pass	pass	26.00	3	NC
MIP-015	12/04/14	pass	pass	pass	27.05	3	NC
MIP-016	12/04/14	pass	pass	pass	12.70	3	Refusal @ 12.7 feet.
MIP-017	12/04/14	pass	pass	pass	28.05	3	NC
MIP-018	12/04/14	pass	pass	pass	26.00	3	Wait 5 minutes (instead of typical 1 min) between 25 and 26 feet.
MIP-019	12/04/14	pass	pass	pass	28.05	3	NC
MIP-020	12/05/14	pass	pass	pass	25.85	3	NC
Total Footage					520.40	(this sheet)	



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Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)			Final Depth (ft)	prep robed Depth (ft)	Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunk line Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test			
MIP-021	12/05/14	pass	pass	pass	25.85	3	Turned up trunkline flow @ 10 feet.
MIP-022	12/05/14	pass	pass	pass	25.90	3	NC
MIP-023	12/05/14	pass	pass	pass	25.85	3	NC
MIP-024	12/05/14	pass	pass	pass	25.95	3	NC
MIP-025	12/08/14	pass	pass	pass	25.85	3	Very hard drilling @ 5-14 feet.
MIP-026	12/08/14	pass	pass	pass	25.95	3	Significant fuel response (PID/FID) starting @ 11 feet. Elevated Post-Log QC as a result
MIP-027	12/08/14	pass	pass	pass	25.90	3	Very significant fuel response (PID/FID) starting @ 8 feet. NAPL visually observed on probe/rods
MIP-028	12/08/14	pass	pass	pass	25.95	3	NC
MIP-029	12/08/14	pass	pass	pass	25.95	3	NC
MIP-030	12/09/14	pass	pass	pass	17.80	3	Charge hammer on rig. Stopped log @ 15', system pressure loss, repaired cracked teflon gas line.
MIP-030A	12/09/14	pass	pass	pass	25.95	3	NC
MIP-031	12/09/14	pass	pass	pass	34.95	3	Use data from 14-20 feet only. Erratic pressure and detector readings. Changed MIP membrane.
MIP-032	12/09/14	pass	pass	pass	25.90	3	Pressure/flow fluctuations at bottom of boring (water/soil particles entered trunkline @ MIP-030?)
MIP-033	12/09/14	pass	pass	pass	9.00	3	Pressure/flow fluctuations. After MIP-033 - restring MIP system with new trunkline & probe
MIP-033A	12/09/14	pass	pass	pass	25.90	3	Probe 4655, Trunkline 1492
MIP-034	12/10/14	pass	pass	pass	25.90	3	NC
MIP-035	12/10/14	pass	pass	pass	25.95	3	NC
MIP-036	12/10/14	pass	pass	pass	25.95	3	NC
MIP-037	12/10/14	pass	pass	pass	29.90	3	Very hot location, especially on PID/FID (fuel) Waited 5 min between 29 and 30 feet.
MIP-038	12/10/14	pass	pass	pass	29.10	3	Waited 90 minutes for detector baselines prior to this log (trunkline carry-over)
Total Footage					509.45	(this sheet)	



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Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-039	12/10/14	pass	pass	pass	25.95	3	NC (no comments)
MIP-040	12/10/14	pass	pass	pass	25.95	3	NC
MIP-041	12/10/14	pass	pass	pass	28.05	3	NC
MIP-042	12/11/14	pass	pass	pass	25.95	3	NC
MIP-043	12/11/14	pass	pass	pass	25.85	3	NC
MIP-044	12/11/14	pass	pass	pass	26.00	3	NC
MIP-045	12/11/14	pass	pass	pass	29.00	3	NC
MIP-046	12/11/14	pass	pass	pass	25.85	3	New MIP membrane
MIP-047	12/11/14	pass	pass	pass	21.90	3	Questionable response on XSD (somewhat atypical XSD plot shape, PID doesn't confirm response)
MIP-048	12/12/14	pass	pass	pass	25.95	3	New MIP membrane. Significant "tar" response, Wait 5 minutes between 25 and 26'.
MIP-049	12/12/14	pass	pass	pass	25.05	3	Detector baseline dropping throughout log due to "tar" from MIP-048. See Post-Log QC -048-049.
MIP-050	12/12/14	pass	pass	pass	25.95	3	NC
MIP-051	12/12/14	pass	pass	pass	27.10	3	NC
MIP-052	12/15/14	pass	pass	pass	2.75	3	Abort run, stringpot malfunction. Save Pre-Log QC for MIP-052A.
MIP-052A	12/15/14	pass	pass	pass	25.90	3	NC
MIP-053	12/15/14	pass	pass	pass	29.95	3	NC
MIP-054	12/15/14	pass	pass	pass	25.95	3	NC
MIP-055	12/15/14	pass	pass	pass	25.85	3	NC
MIP-056	12/15/14	pass	pass	pass	9.55	3	Refusal @ 9.55 feet, very hard obstruction.
MIP-056A	12/16/14	pass	pass	pass	25.95	3	NC
Total Footage					484.45	(this sheet)	



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Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-057	12/15/14	pass	pass	pass	25.95	3	Possibly a very low XSD response @ 14 feet.
MIP-058	12/16/14	pass	pass	pass	22.90	3	NC
MIP-059	12/16/14	pass	pass	pass	21.85	3	High "fuel" response @ 11 feet. Turn up flow @ 17 feet to facilitate clean-up.
MIP-060	12/16/14	pass	pass	pass	29.00	3	Clay (& XSD response) are a few feet deeper at this location.
MIP-061	12/16/14	pass	pass	pass	25.85	3	NC
MIP-062	12/16/14	pass	pass	pass	39.50	3	NC
MIP-063	12/16/14	pass	pass	pass	25.05	3	NC
MIP-064	12/16/14	pass	pass	pass	25.70	3	NC
MIP-065	12/17/14	pass	pass	pass	25.95	3	Significant "Fuel" response reflected in Post-Log QC baselines.
MIP-066	12/17/14	pass	pass	pass	25.80	3	NC
MIP-067	12/17/14	pass	pass	pass	25.85	3	Chlorinated solvent response near surface. No response @ the clay.
MIP-068	12/17/14	pass	pass	pass	21.45	3	Questionable response on XSD @ 5-10 feet. (PID does not confirm response)
MIP-069	12/17/14	pass	pass	pass	27.05	3	NC
MIP-070	12/17/14	pass	pass	pass	25.95	3	High "fuel" response starting @ 5 feet.
MIP-071	12/17/14	pass	pass	pass	25.95	3	NC
MIP-072	12/18/14	pass	pass	pass	24.00	3	High "fuel" response starting @ 3 feet. Baseline increased as soon as probe was put into hole.
MIP-073	12/18/14	pass	pass	pass	25.85	3	High "fuel" response starting @ 11 feet.
MIP-074	12/18/14	pass	pass	pass	21.00	3	Detector baselines dropping throughout log due to "fuel at precious locations.
MIP-075	12/18/14	pass	pass	pass	25.90	3	NC
MIP-076	12/18/14	pass	pass	pass	24.05	3	NC
MIP-077	12/18/14	pass	pass	pass	25.95	3	NC
MIP-078	12/18/14	pass	pass	pass	25.90	3	NC
Total Footage					566.45	(this sheet)	



11253 91st Ave. N.
Maple Grove, Minnesota 55369
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Client: CRA
Contact: Beth Landale
Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-001	12/02/14	98	16.0	314	16.0	71	16.0	Estimated 1-5 ppm chlorinated solvent responses @ 7-16 feet. 20 ppm starting @ 20 feet.
MIP-002	12/02/14	167	16.0	122	12.0	123	16.0	Estimated 2 ppm chlorinated solvent responses @ 9-10 feet. 10 ppm @ 14-16 feet. 30 ppm starting @ 16 feet.
MIP-003	12/02/14	55	10.5	48	13.6	52	10.5	Estimated 6-13 ppm chlorinated solvent responses @ 7-11 feet. 4-12 ppm 13.6-19 feet.
MIP-004	12/02/14	238	16.0	112	16.0	139	16.0	Estimated 1-3 ppm chlorinated solvent responses @ 7-11 feet. 12-35 ppm 13-19 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-005	12/02/14	123	15.0	58	17.0	87	15.0	Estimated 14 ppm chlorinated solvent response @ 8 feet. 22 ppm 12.5-16 feet. Hydrocarbon responses on FID @ 17-20'
MIP-006	12/03/14	148	13.9	40	13.9	91	13.9	Estimated 2 ppm chlorinated solvent responses @ 8.5 & 9.8 feet. 14-23 ppm 11.9-16 feet.
MIP-007	12/03/14	194	17.0	435	3.8	101	16.0	Estimated 2 ppm chlorinated solvent response @ 14.4', 12 ppm 15-16'. 25 ppm starting @ 16 feet. Petroleum responses on FID @ 3-7 & 10-14.5'
MIP-008	12/03/14	47	17.3	58	14.6	50	17.3	Estimated 1 ppm chlor solv responses @ 12.7-14.5'. 2 ppm @ 14.5-15.2'. 7-13 ppm starting at 15'. Additional petroleum observed on PID/FID
MIP-009	12/03/14	100	16.1	110	13.7	80	16.1	Estimated 2 ppm chlorinated solvent responses @ 7.1 & 12'. 8-20 ppm starting @ 14 feet. Hydrocarbon responses on FID @ 12-14 feet.
MIP-010	12/03/14	41	15.1	290	5.2	43	13.1	Estimated 7-11 ppm chlorinated solvent responses starting @ 121 feet. Petroleum observed starting at 4'on PID/FID in addition to chlorinated.
MIP-011	12/03/14	80	15.2	98	4.5	67	15.2	Estimated 1 ppm chlor solv responses @ 7.9-8.2'. 2-7 ppm @ 12-15. 17 ppm starting @ 15.2 feet. Petroleum responses on PID/FID @ 4-7.6 feet.
MIP-012	12/03/14	310	13.4	143	13.4	148	13.5	Estimated 1 ppm chlorinated solvent responses @ 5 & 7 feet. 35 ppm 12.5-13.9 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-013	12/04/14	150	14.2	120	3.7	110	13.9	Estimated 16-28 ppm chlorinated solvent responses starting @ 13.8 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-014	12/04/14	304	13.4	114	13.4	158	13.4	Estimated 6-13 ppm chlorinated solvent responses @ 11.7-13 feet. 40 ppm starting @ 13.2 feet.
MIP-015	12/04/14	487	13.3	264	13.3	244	13.3	Estimated 1-2 ppm chlorinated solvent responses @ 9.9-10.9 feet, 6-18 ppm @ 12.3-13'. 61 ppm starting @ 13.3 feet.
MIP-016	12/04/14	11	10.5	22	10.5	4*	12.7	Refusal @ 12.7 feet. Starting to detect chlorinated solvent at the bottom of boring. Some petroleum observed on PID/FID @ 10.5 feet.
MIP-017	12/04/14	153	15.1	253	14.7	103	15.1	Estimated 25 ppm chlorinated solvent responses starting @ 14 feet. Petroleum responses on PID/FID @ 5.6 feet.
MIP-018	12/04/14	125	16.1	118	14.0	97	16.1	Estimated 6-11 ppm chlorinated solvent responses starting @ 13.5-15'. 25 ppm starting @ 15'. Petroleum responses on PID/FID @ 5.3-5.8 feet.
MIP-019	12/04/14	192	14.7	256	14.6	160	14.7	Estimated 6-16 ppm chlorinated solvent responses @ 10-13.9 feet. 40 ppm starting @ 14.7 feet.
MIP-020	12/05/14	585	14.8	331	14.8	253	14.8	Estimated 6-32 ppm chlorinated solvent responses @ 13.1-14 feet, 63 ppm starting @ 14.3 feet. Petroleum responses on PID/FID @ 6.8-7.8 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-021	12/05/14	303	18.2	250	18.1	163	18.2	Estimated 1-14 ppm chlorinated solvent responses @ 13.9-17.9'. 41 ppm starting @ 18.2'. Petroleum responses on PID/FID @ 8 & 9'.
MIP-022	12/05/14	68	18.0	77	103.0	59	18.0	Estimated 1 ppm chlorinated solvent responses @ 4.8-8.9'. 5 ppm @ 9.1-11.5'. 15 ppm starting at 17.2'. Additional hydrocarbons observed on FID
MIP-023	12/05/14	207	21.9	1,006	21.8	91	20.0	Estimated 2-4 ppm chlorinated solvent responses @ 5, 12.4-15.8, 16.9-19'. 23 ppm starting @ 19'. Petroleum responses on PID/FID @ 15.2-17'.
MIP-024	12/05/14	271	17.1	156	13.2	130	17.1	Estimated 2-12 ppm chlorinated solvent responses @ 9.9-12.5. , 19-33 ppm @ 16-19'. Additional hydrocarbons observed on FID @ 12-14 feet.
MIP-025	12/08/14	252	12.2	91	12.2	102	12.2	Estimated 5-7 ppm chlorinated solvent responses @ 7.2 & 9-11'. 25 ppm @ 11-13' and @ 16-18 feet.
MIP-026	12/08/14	595	13.9	634	12.6	63	17.9	Estimated 1 ppm chlor solv responses @ 5.1-9.8, 14'. 8-16 ppm starting at 16.2'. Significant additional petroleum observed on PID/FID starting @ 11'.
MIP-027	12/08/14	845	11.9	370	12.2	163	5.4	Estimated 40 ppm chlor solv response @ 5.4'. 8-11 ppm @ 7-8'. 4 ppm @ 14-18'. Significant additional petroleum observed on PID/FID starting @ 10'.
MIP-028	12/08/14	499	14.7	218	14.6	200	14.7	Estimated 9-14 ppm chlorinated solvent responses @ 9.8-12'. 40-50 ppm @ 14-15.2 feet.
MIP-029	12/08/14	130	13.9	126	13.9	50	18.0	Estimated 5-10 ppm chlorinated solvent responses @ 11.1-13.9, 15.6, & 17.1'. 13 ppm @ 18'. Petroleum responses on PID/FID @ 13.9-15.5'.
MIP-030	12/09/14	NA	NA	NA	NA	NA	NA	No useful data acquired. See summary comments
MIP-030A	12/09/14	220	18.9	205	18.9	112	18.9	Estimated 9-28 ppm chlorinated solvent responses @ 15-20 feet.
MIP-031	12/09/14	145	15.1	197	19.2	98	15.1	Estimated 13-24 ppm chlorinated solvent responses @ 14.5-19.3 feet.
MIP-032	12/09/14	200	15.0	233	14.8	115	15.0	Estimated 1 ppm chlorinated solvent responses @ 5.5-6 & 7.7-11.5'. 1-10 ppm @ 12.5-13.9. 13-29 ppm starting @ 15'.
MIP-033	12/09/14	NA	NA	NA	NA	NA	NA	Questionable data acquired. See summary comments
MIP-033A	12/09/14	113	16.0	140	16.0	67	16.1	Estimated 3-9 ppm chlorinated solvent responses @ 12.6-16 feet. 17 ppm starting @ 16'.
MIP-034	12/10/14	139	16.0	272	14.8	73	16.0	Estimated 8-15 ppm chlorinated solvent responses @ 12-14 feet. 11-18 ppm @ 16-19 feet.
MIP-035	12/10/14	209	16.1	380	15.0	96	15.0	Estimated 15-24 ppm chlorinated solvent responses @ 12.6-18 feet.
MIP-036	12/10/14	276	17.0	362	15.4	120	13.7	Estimated 18-30 ppm chlorinated solvent responses @ 12.5-18 feet.
MIP-037	12/10/14	3,140	20.1	6,700	19.1	390	18.0	Estimated 12-50 ppm chlorinated solvent responses @ 13-17 feet. 78-98 ppm starting @ 17 feet.
MIP-038	12/10/14	966	18.0	270	18.0	173	18.0	Estimated 1-2 ppm chlorinated solvent responses @ 12.7-15.7 feet. 13 ppm @ 16 feet. 28-44 ppm @ 17-20 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-039	12/10/14	126	16.1	344	23.1	20	16.1	Estimated 1 ppm chlorinated solvent responses @ 11.2-13.1' & 14'-14.5'. 4-5 ppm @ 15-16.8'. Hydrocarbon responses on FID @ 22.6-24'.
MIP-040	12/10/14	30	13.1	231	13.1	18	16.1	Estimated 1-3 ppm chlorinated solvent responses @ 12-13.2'. 2-5 ppm @ 15.1-17.9'. Hydrocarbon responses on FID @ 13.1-16.2'.
MIP-041	12/10/14	46	14.0	274	15.1	40	21.2	Estimated 1 ppm chlorinated solvent responses @ 13. 8 ppm @ 14'. 3-10 ppm @ 18-22'. Hydrocarbon responses on FID @ 14-18'.
MIP-042	12/11/14	34	17.1	133	14.0	32	17.1	Estimated 3-8 ppm chlorinated solvent responses @ 15-19.1'. Hydrocarbon responses on FID @ 10-16'.
MIP-043	12/11/14	372	18.2	605	18.2	164	18.0	Est. 1 ppm chl sol responses @ 4.9, 6.9, 7.9, 9, & 10-11.4'. 2-14 ppm @ 11.4-17.1'. 10-41 ppm @ 17.5-19.2'. Hydrocarbon responses on FID @ 4-15'.
MIP-044	12/11/14	98	17.2	82	16.1	56	17.2	Estimated 1 ppm chlorinated solvent responses @ 8-12.5 feet. 13 ppm @ 12.5-18 feet.
MIP-045	12/11/14	156	13.0	88	19.0	75	13.0	Estimated 2-6 ppm chlorinated solvent responses @ 10.8-12.9 feet. 8-19 ppm @ 13-15 feet. Additional hydrocarbon responses on FID @ 11-19'.
MIP-046	12/11/14	62	13.0	332	13.0	27	17.1	Estimated 2-7 ppm chlorinated solvent responses @ 12.6-20 feet. Additional hydrocarbon responses on FID @ 12.5-19 feet.
MIP-047	12/11/14	6*	11.7	40	14.7	5*	17.1	Estimated 1 ppm chlorinated solvent responses @ 17.1 & 18 feet. Additional hydrocarbon responses on FID @ 10.4-15.1 feet.
MIP-048	12/12/14	387	10.0	1,450	5.1	112	9.1	Estimated 13-28 ppm chlorinated solvent responses @ 7.1-11'. 7-13 ppm @ 15.1-19.1'. Additional hydrocarbon responses on FID @ 5.1-6.1 feet.
MIP-049	12/12/14	10	16.7	26	11.3	12	17.1	Estimated 1-3 ppm chlorinated solvent responses @ 15.1-19.1' & 23.2 feet. Additional hydrocarbon responses on FID @ 9.7-13.9 feet.
MIP-050	12/12/14	9	121.0	44	18.4	9	17.1	Estimated 1 ppm chlorinated solvent responses @ 7.2, 8, 9, 17 & 20-25? feet. Additional hydrocarbon responses on FID @ 8-14 & 18.4 feet.
MIP-051	12/12/14	55	18.0	17	19.0	47	19.1	Estimated 3 ppm chlorinated solvent responses @ 11-12 feet and 5-12 ppm @ 13-19 feet.
MIP-052	12/15/14	NA	NA	NA	NA	NA	NA	Stringpot malfunction
MIP-052A	12/15/14	119	13.8	67	13.8	87	13.8	Estimated 1 ppm chlorinated solvent responses @ 9.4-9.8, 11 & 12 feet. 8-22 ppm @ 12.9-19.1 feet.
MIP-053	12/15/14	155	15.3	100	15.2	90	15.3	Estimated 1 ppm chlorinated solvent responses @ 5.6 & 7 feet. 2-8 ppm @ 8-13 feet. 12-23 ppm @ 14.4-19 feet.
MIP-054	12/15/14	202	16.1	41	11.7	99	16.1	Estimated 1-4 ppm chlorinated solvent responses @ 8-15'. 11-25 ppm starting @ 15'. Additional hydrocarbon responses on FID @ 8.9-13.7 feet.
MIP-055	12/15/14	152	17.0	39	11.3	74	17.0	Estimated 2 ppm chlorinated solvent responses @ 11-12 & 14.5'. 13-19 ppm @ 15-19'. Additional hydrocarbon responses on FID @ 9 & 11.3 feet.
MIP-056	12/15/14	NA	NA	NA	NA	NA	NA	Refusal @ 9.5 feet.
MIP-056A	12/16/14	67	18.0	42	15.2	45	18.0	Estimated 3 ppm chlorinated solvent responses @ 12-17'. 8-11 ppm starting @ 17'. Additional hydrocarbon responses on FID @ 13.8-15.2 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-057	12/15/14	7	1.9	9	18.0	3*	13.0	Estimated 1 ppm chlorinated solvent responses @ 3-5 & 11-14 feet.
MIP-058	12/16/14	11	4.9	47	15.0	11	4.9	Estimated 2 ppm chlorinated solvent responses @ 4.9-5.7 feet. 1 ppm @ 15 feet. Hydrocarbon responses on FID @ 14-16 feet.
MIP-059	12/16/14	1,197	12.7	557	12.0	8	5.2	Estimated 2 ppm chlor solv response @ 5-5.9' & 1 ppm @ 7-8'. 1 ppm @ 8.9-20'. Significant petroleum observed on PID/FID starting @ 11 feet.
MIP-060	12/16/14	358	20.0	69	17.6	124	20.1	Estimated 1 ppm chlor solv responses @ 5'. 5 ppm @ 8.9, 10, 13-14 & 16.6'. 15-31 ppm @ 17.7-22'. Hydrocarbon responses on FID @ 14-16 feet.
MIP-061	12/16/14	250	16.0	50	16.0	117	16.0	Estimated 2 ppm chlorinated solvent responses @ 10.1 feet. 8 ppm @ 10.9-12.5 feet. 29 ppm starting @ 16 feet.
MIP-062	12/16/14	420	17.1	107	17.1	160	17.1	Estimated 33 ppm chlorinated solvent responses starting @ 316.1 feet.
MIP-063	12/16/14	180	16.1	100	16.1	104	16.1	Estimated 2-6 ppm chlor solv responses @ 7.9-13.7'. 9 ppm @ 15.4 feet. 26 ppm starting @ 16.1'. Hydrocarbon responses on FID @ 10.8-13.9 feet.
MIP-064	12/16/14	1,125	18.0	171	18.0	249	18.0	Estimated 1-2 ppm chlor solv responses @ 11.9-15'. 28 ppm @ 17.1, 62 ppm starting @ 18'. Hydrocarbon responses on FID @ 11.5-14.6 feet.
MIP-065	12/17/14	760	15.1	219	12.3	181	15.1	Estimated 45 ppm chlor solv response starting @ 14 feet'. Significant petroleum observed on PID/FID starting @ 8 feet.
MIP-066	12/17/14	130	20.1	39	14.3	72	20.1	Estimated 3-4 ppm chlor solv responses @ 16.9-19'. 14 ppm @ 19.1, 18 ppm starting @ 20.1'. Hydrocarbon responses on FID @ 12-17.9 feet.
MIP-067	12/17/14	102	4.9	75	14.1	59	4.9	Estimated 9-15 ppm chlorinated solvent responses @ 2-4.9'. 1-2 ppm @ 20, 23.1, 24.1 & 25'. Hydrocarbon responses on FID @ 10.6-16'.
MIP-068	12/17/14	23	12.0	91	12.7	28	6.0	Estimated 7 ppm chlorinated solvent responses starting @ 5 feet. Hydrocarbon responses on PID/.FID @ 12-16 feet.
MIP-069	12/17/14	1,165	12.1	433	12.1	273	12.1	Estimated 15-39 ppm chl solv response @ 9.9-11.1', 69 ppm starting @ 12.1', 19-27 ppm @ 17.1-20'. Additional petroleum on PID/FID starting @ 9 feet.
MIP-070	12/17/14	785	12.0	273	13.4	72	17.1	Estimated 2-5 ppm chlor solv response @ 4.9-7.1'. 4 ppm @ 11.9 & 14.9'. 15-18 ppm starting @ 16'. Significant petroleum on PID/FID starting @ 5'.
MIP-071	12/17/14	203	15.0	205	15.0	110	15.0	Estimated 3-11 ppm chlorinated solvent responses @ 5.2-13.9 feet. 27 ppm starting @ 15 feet.
MIP-072	12/18/14	436	54.0	1,169	5.0	735	4.1	Estimated 25 ppm chl solv response @ 2-3'. 75-183 ppm @ 3-5.9'. 32-58 ppm @ 7-8' & 9.9-12.9'. Significant additional petroleum on PID/FID.
MIP-073	12/18/14	393	17.0	228	4.1	81	17.9	Estimated 9 ppm chlorinated solvent response @ 15-15.7'. 17-21 ppm 16-19'. Additional petroleum on PID/FID & FID only @ 1.8-10.2'.
MIP-074	12/18/14	16	17.1	123	12.7	20	14.1	Estimated 1 ppm chlorinated solvent responses @ 5 & 14.1 feet. 3-5 ppm @ 16-19.1 feet. Hydrocarbon responses on FID @ 5.4-15.1'.
MIP-075	12/18/14	197	17.1	109	14.1	103	14.5	Estimated 1 ppm chlorinated solvent responses @ 1.9 & 2.9-3.5 feet. 26 ppm starting @ 14.5 feet.
MIP-076	12/18/14	326	14.5	131	14.5	123	14.5	Estimated 1 ppm chlorinated solvent responses @ 7, 8, 9-9.9 & 11-12'. 5 ppm @ 13.3'. 32 ppm @ 13.9-14.9'. 18 ppm @ 16-17'. 2 ppm @ 21-22'.
MIP-077	12/18/14	35	18.0	50	13.8	25	17.1	Estimated 2 ppm chlor solvent responses @ 4.2, 7.1 & 8-11'. 3-6 ppm @ 13.9-20.1'. 1 ppm @ 23-25.4'. Hydrocarbon responses on FID @ 11-14.5'.
MIP-078	12/18/14	34	16.1	24	19.1	28	17.1	Estimated 4 ppm chlorinated solvent responses @ 15-16 feet. 4-7 ppm @ 16.1-19.1'. 2 ppm @ 19.6-25.1 feet.

* Indicates @ or near detection limit.

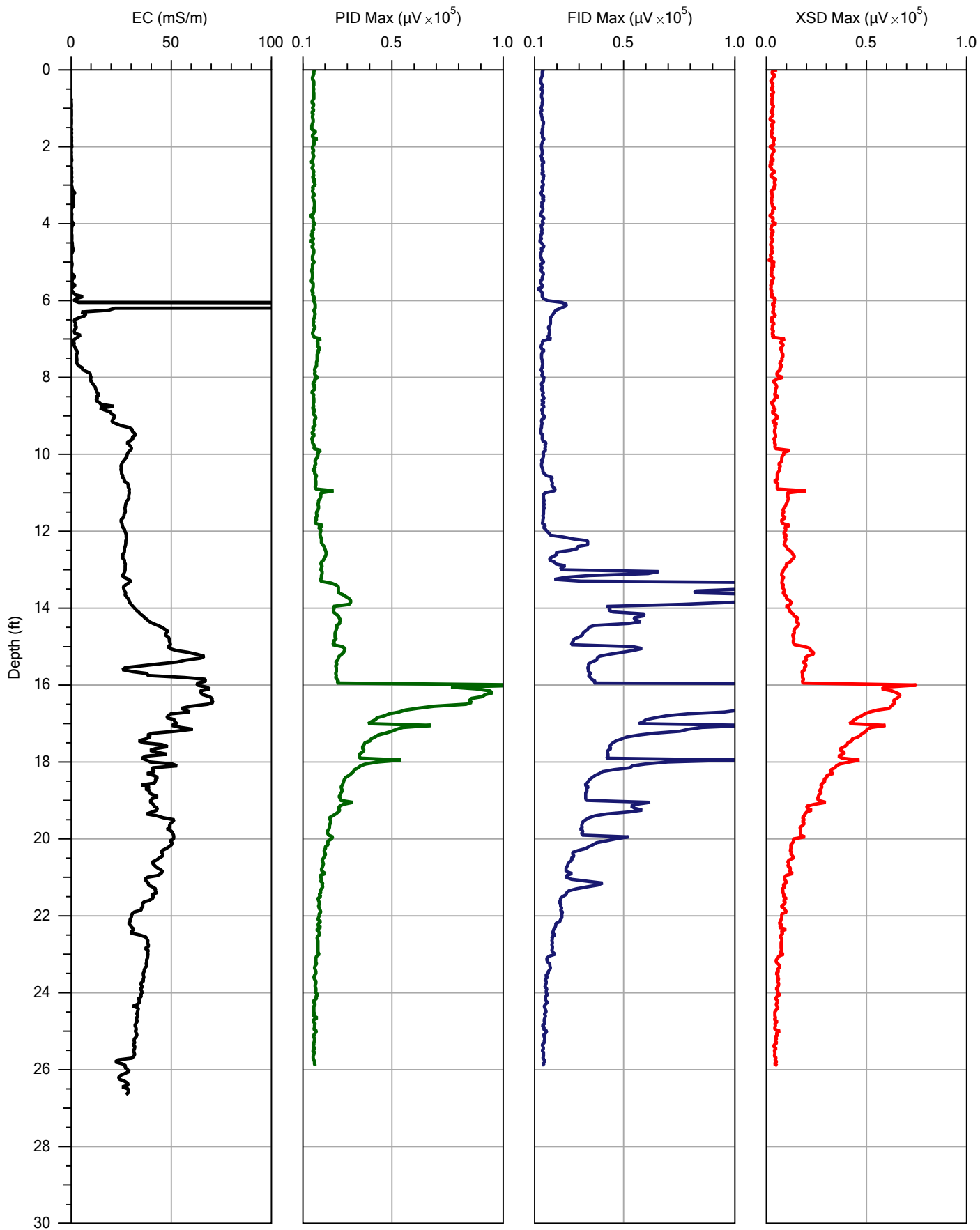
‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

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MIP LOGS

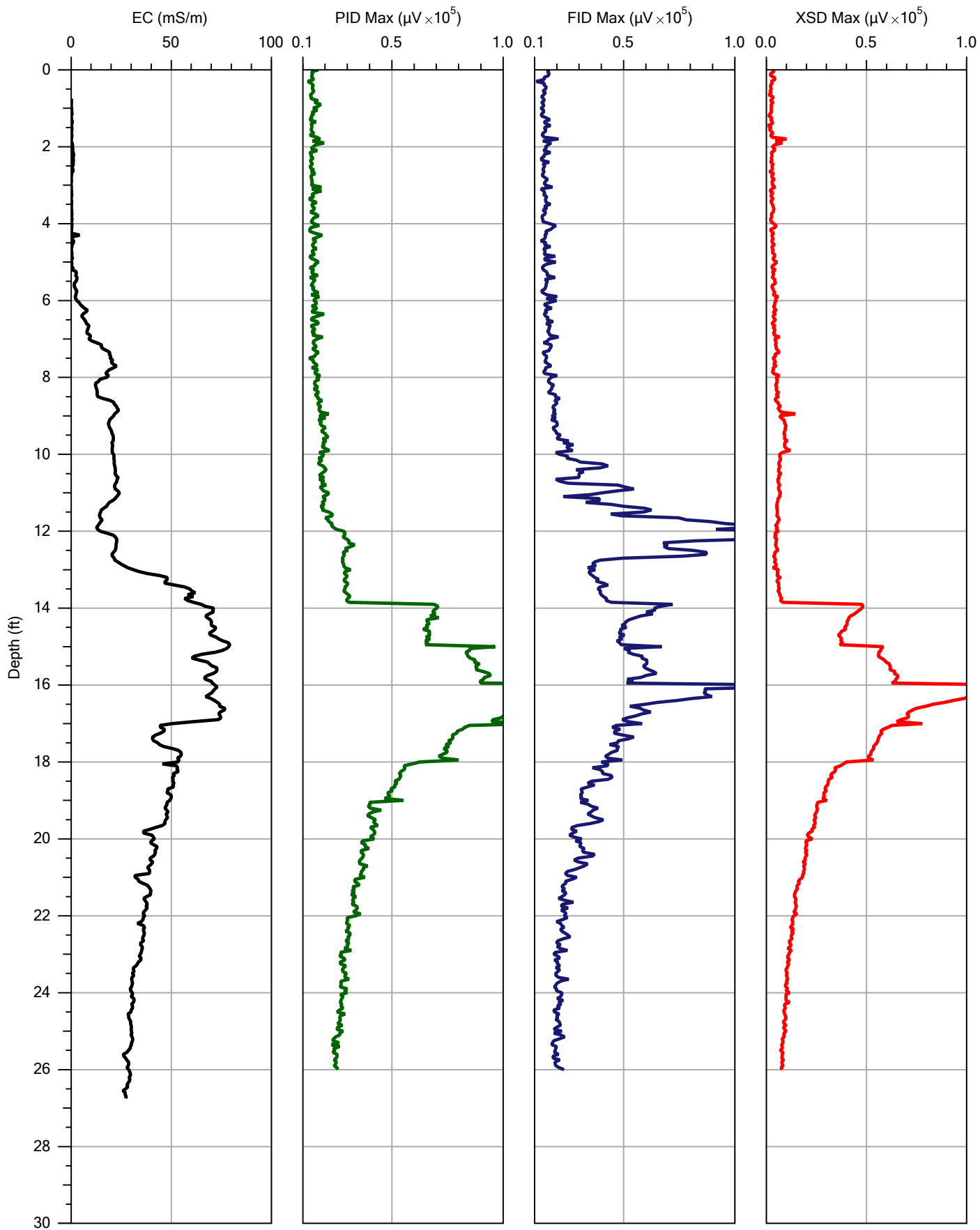
With detectors @ 100 mVolts



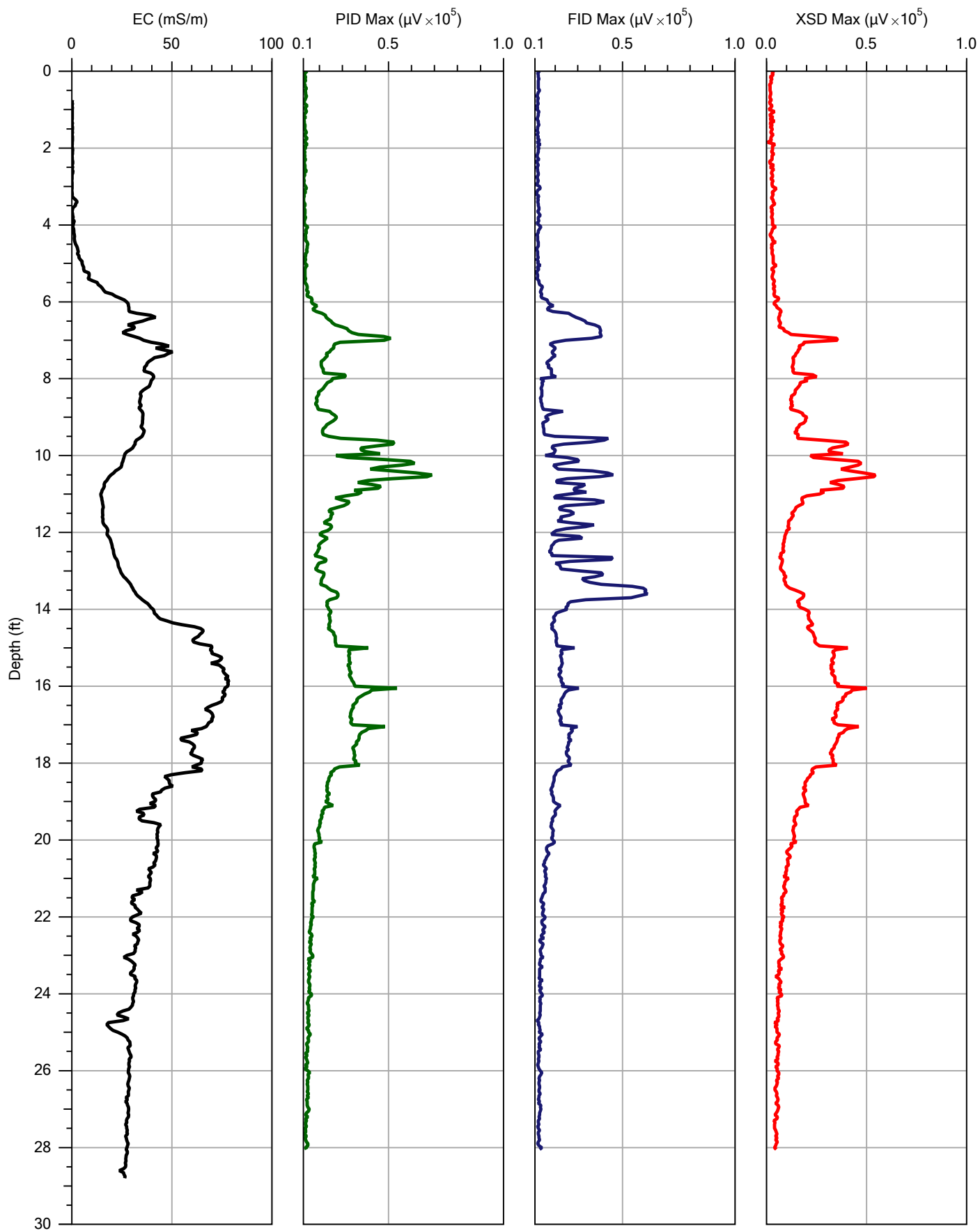
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Project ID: 319.14

Operator: M Jensen
Client: CRA

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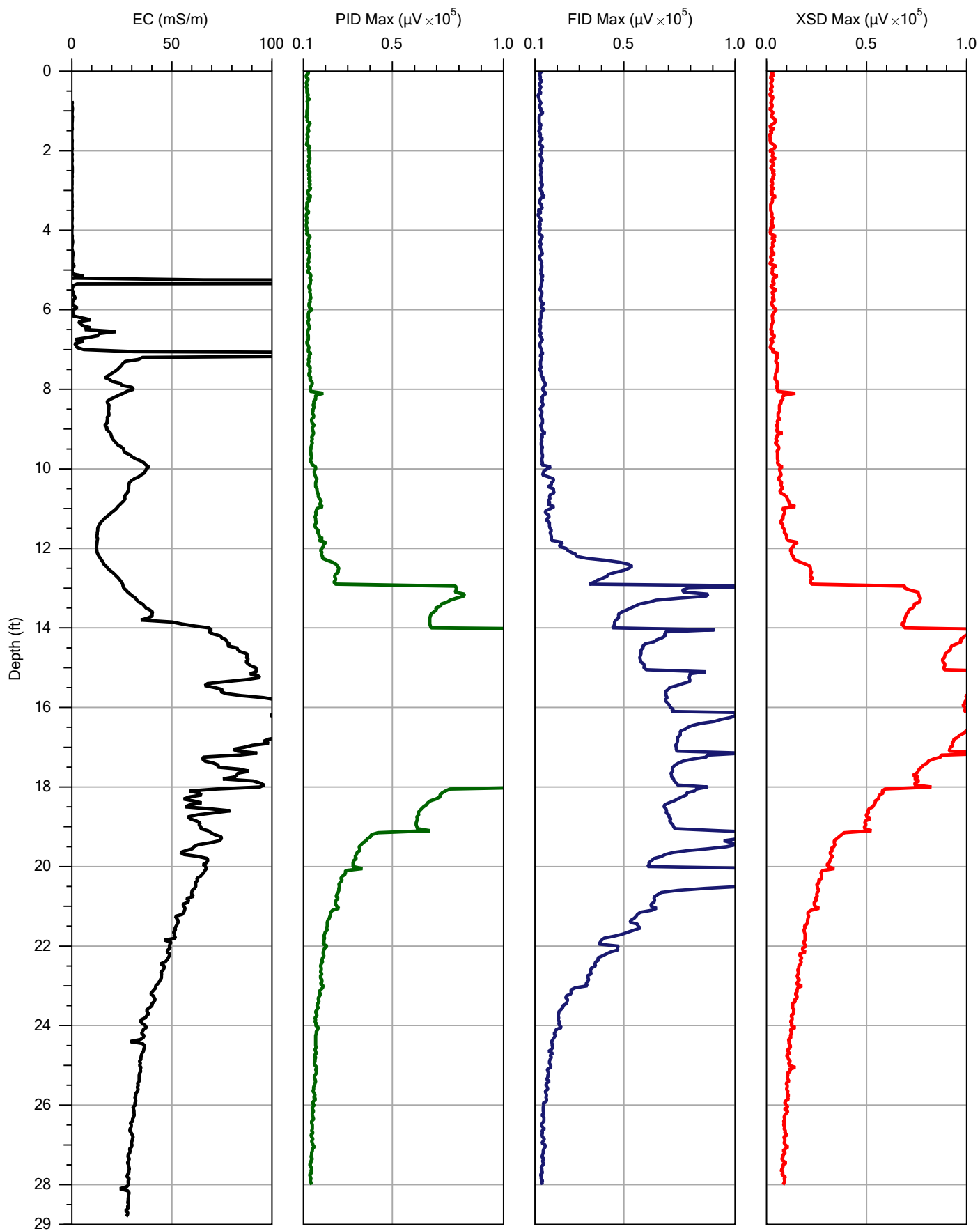
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				Location:	



Company: Matrix Environmental
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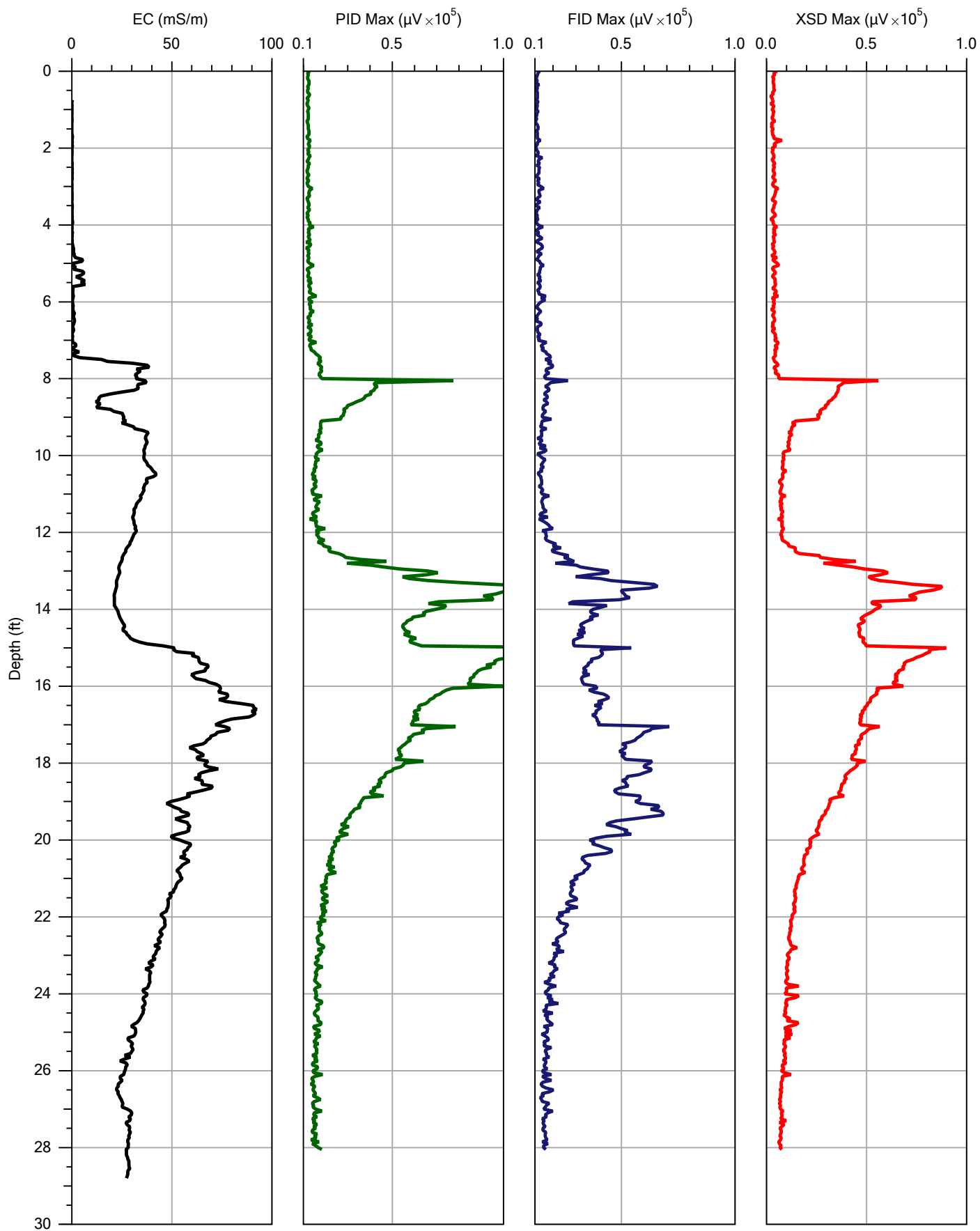
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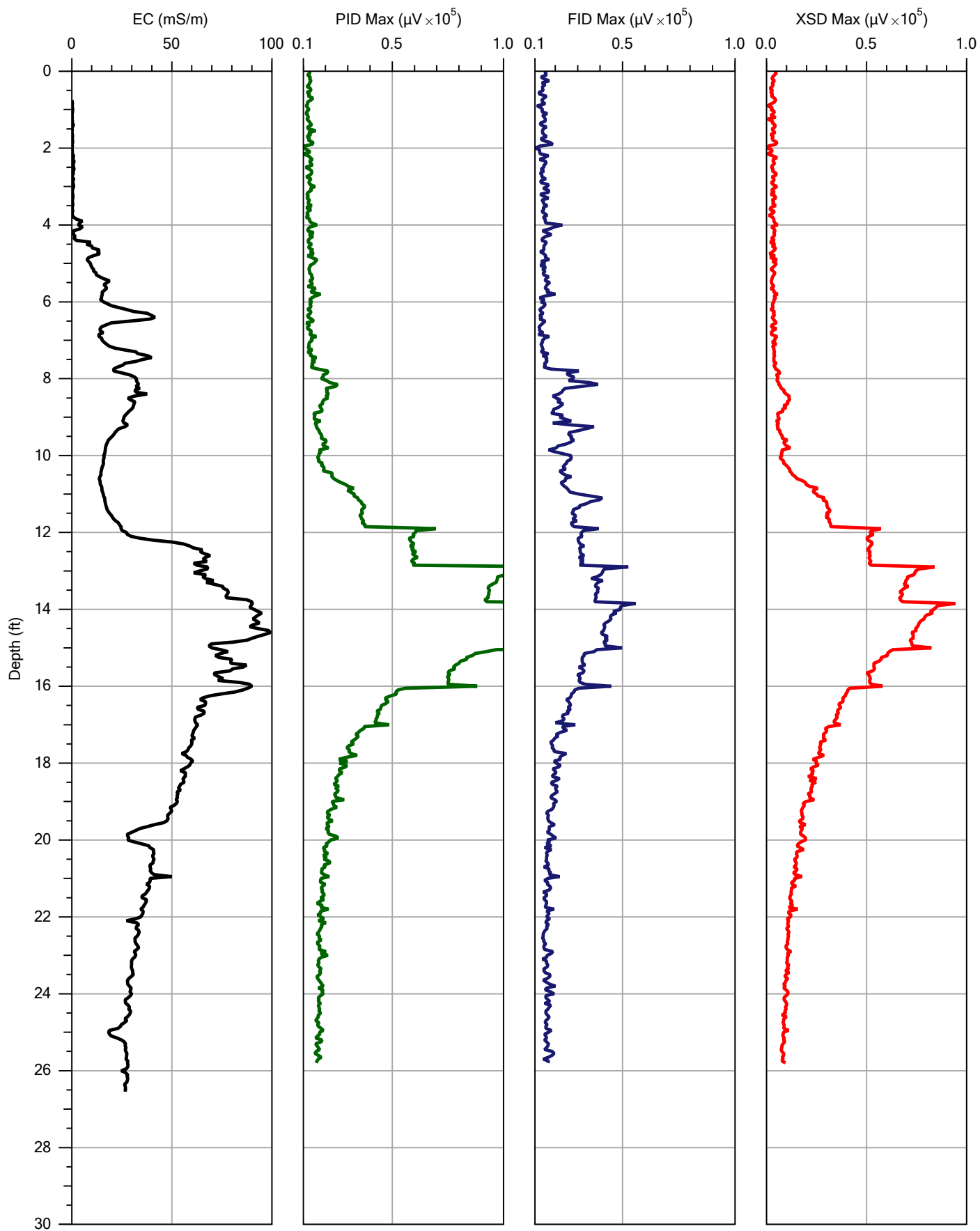
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Project ID: 319.14

Operator: M Jenson
Client: CRA

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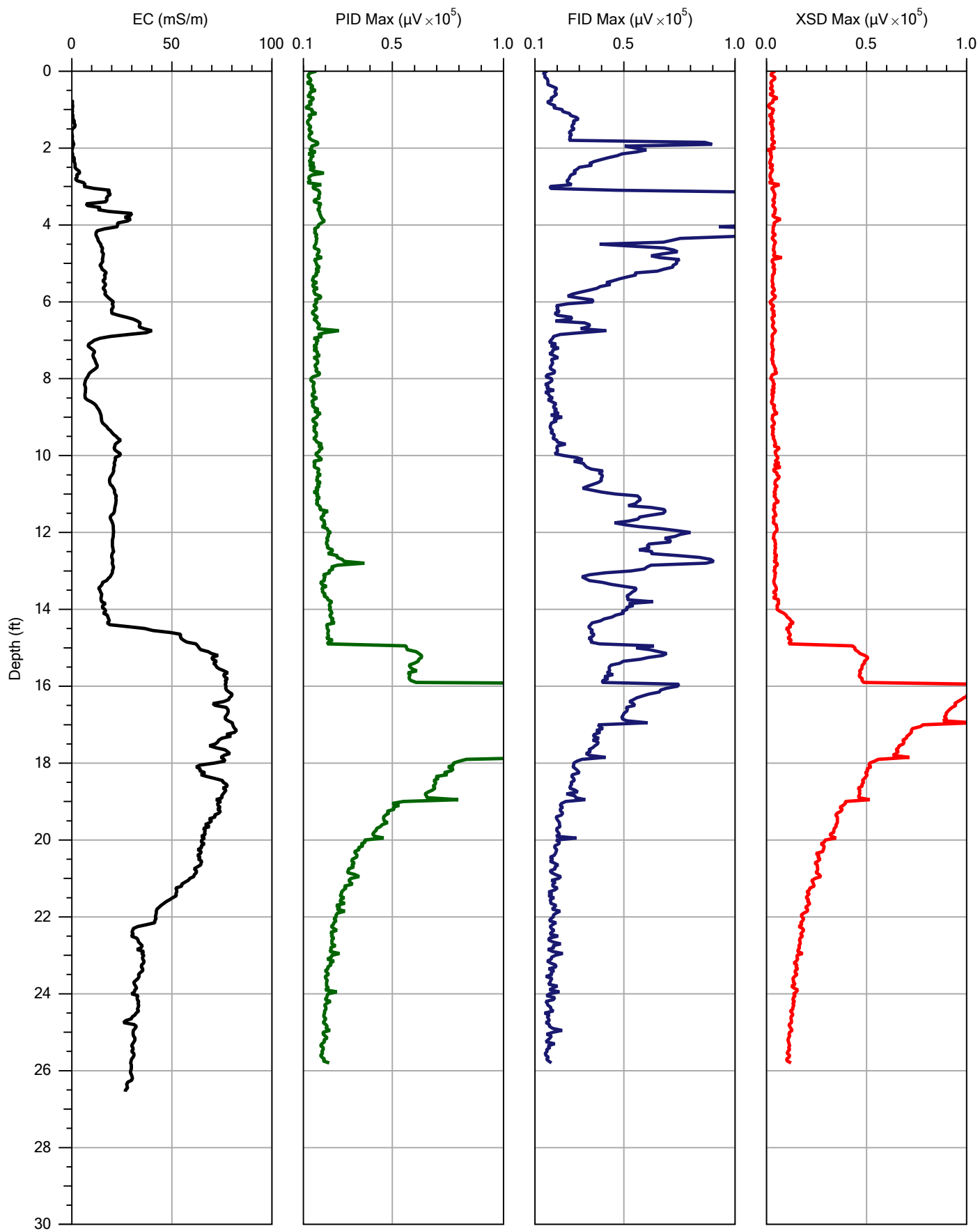
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Matrix Environmental		M Jensen	MIP-005.MIP
Project ID:		Client:	Date:
319.14		CRA	12/2/2014
			Location:



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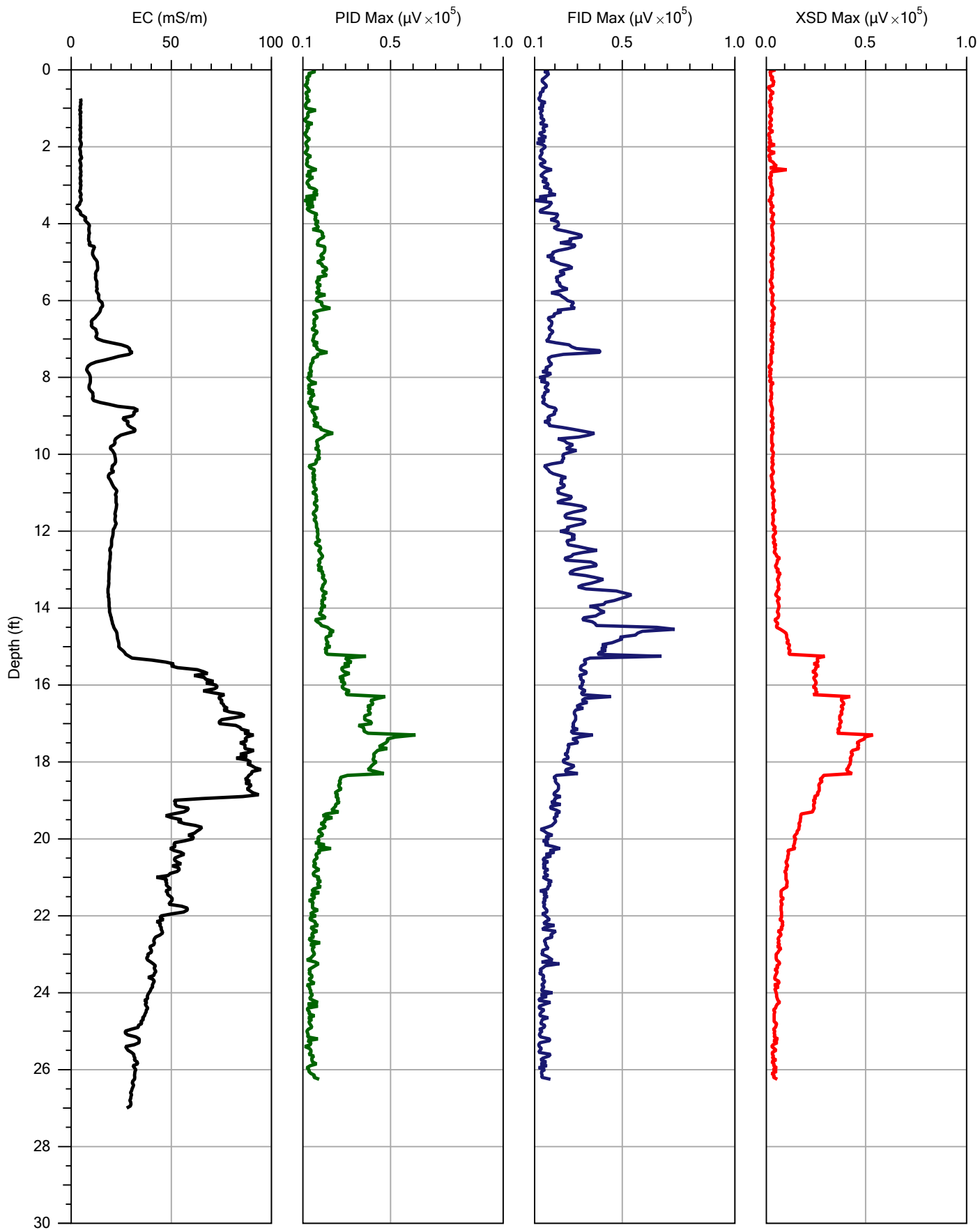
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Date:	12/3/2014
Location:	



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Operator: M Jensen
Client: CRA

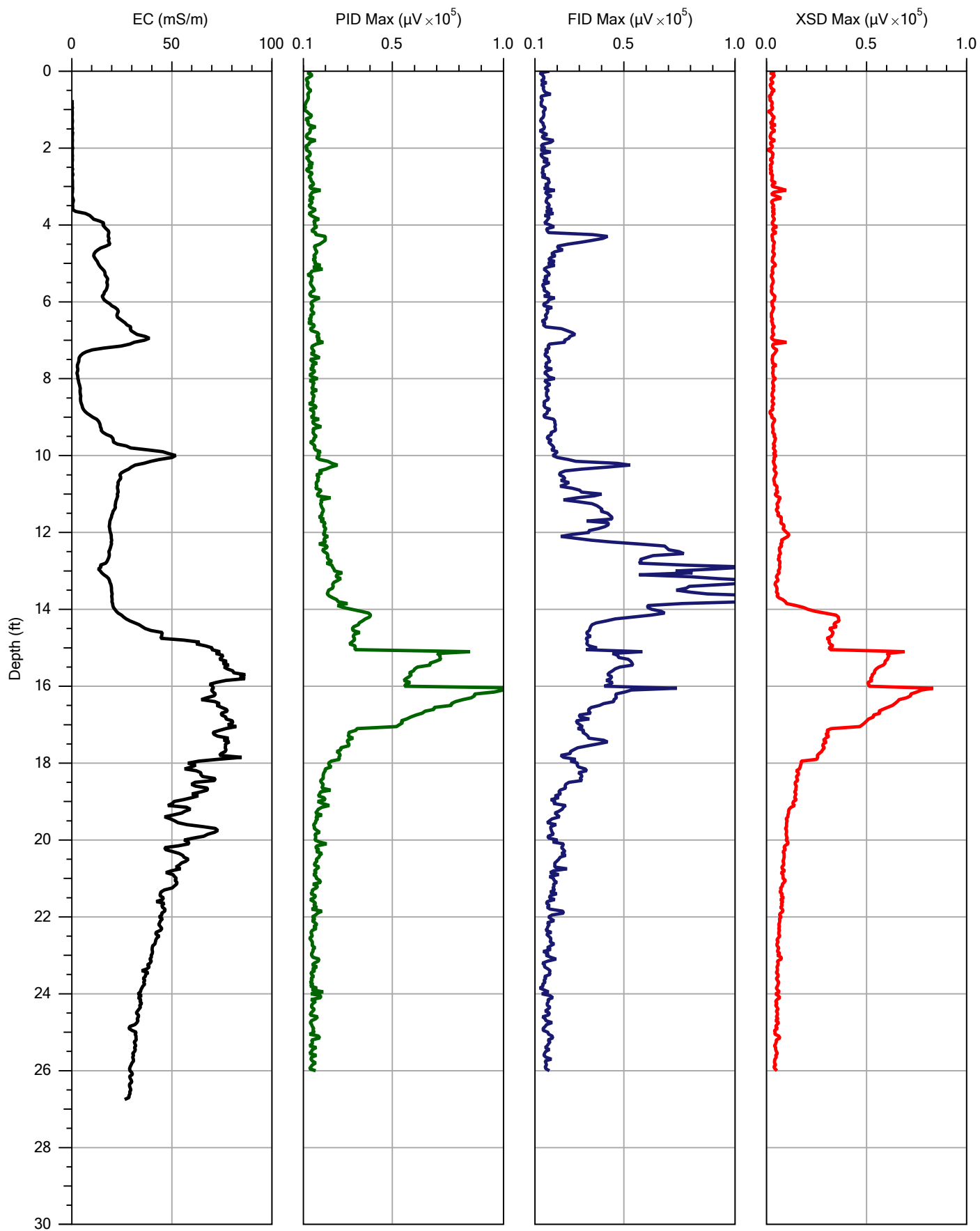
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Date:	12/3/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

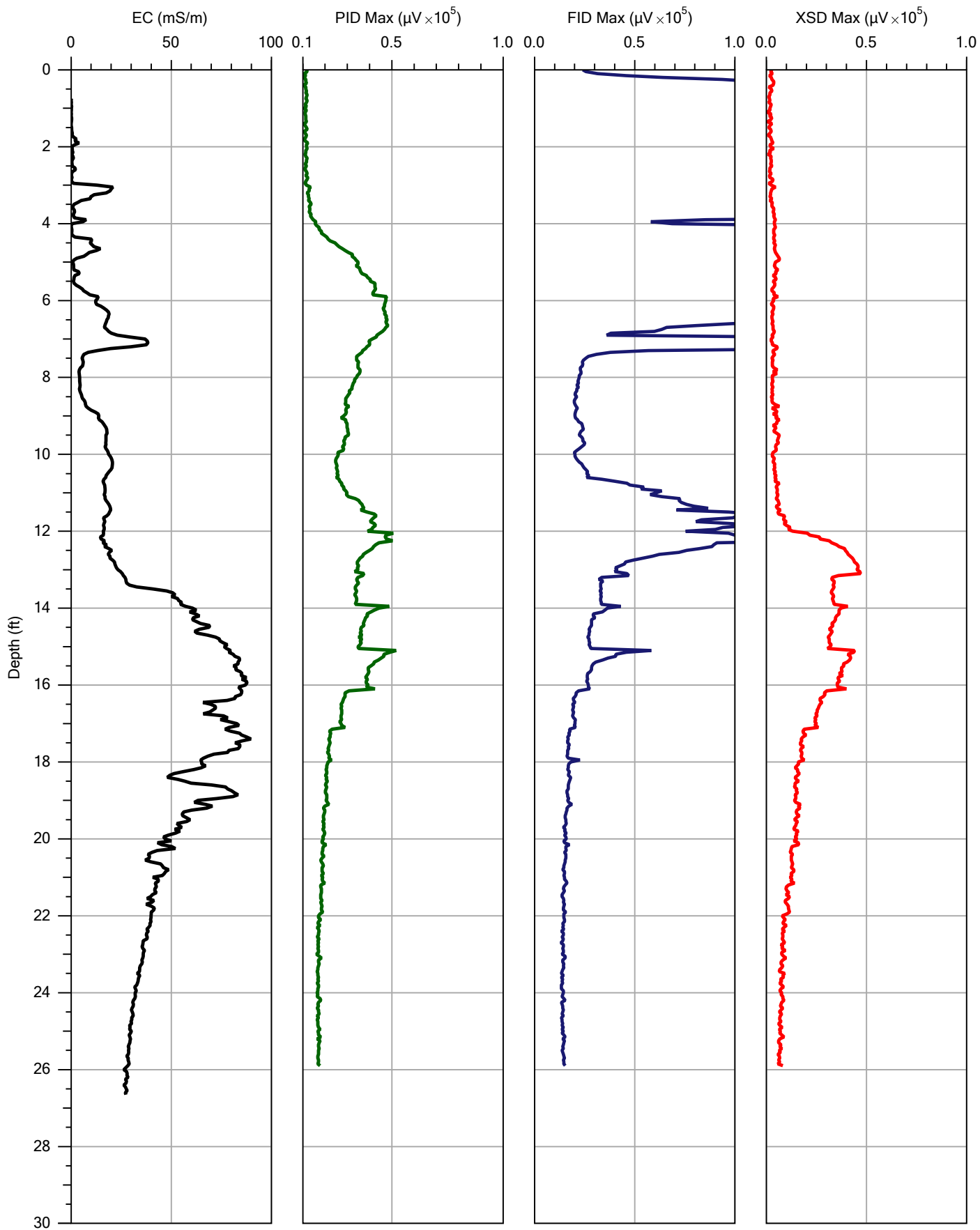
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Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

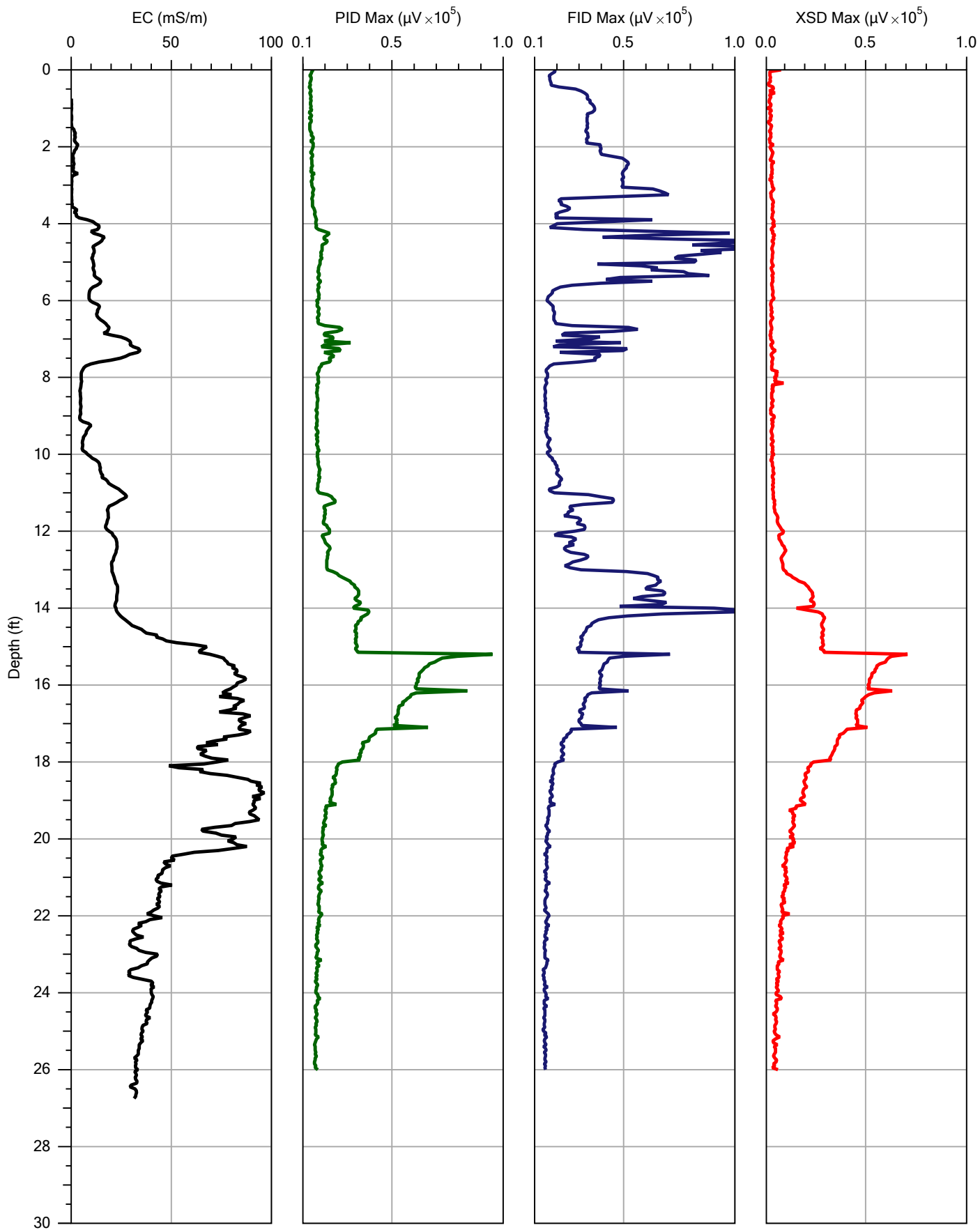
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Date: 12/3/2014
Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

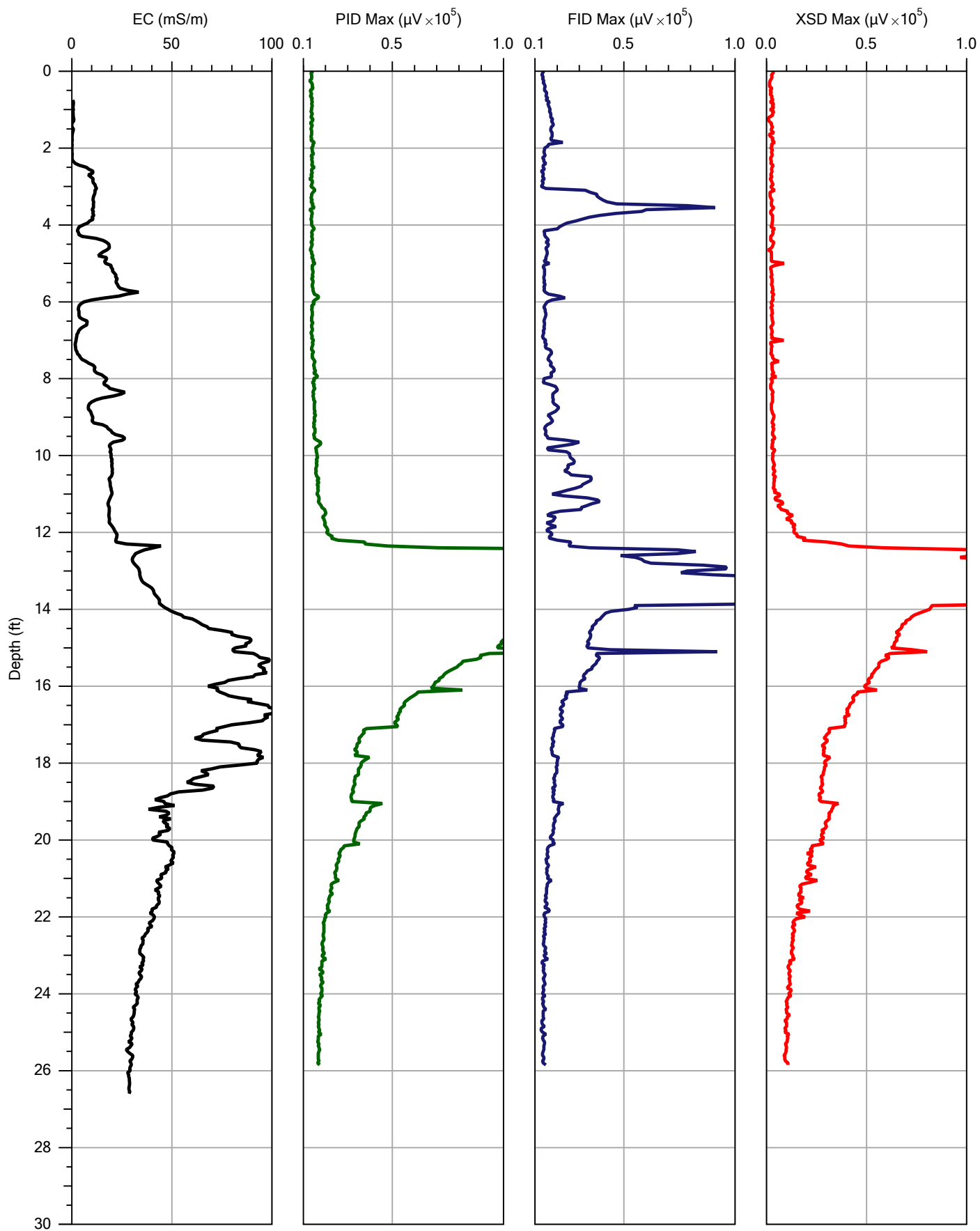
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Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

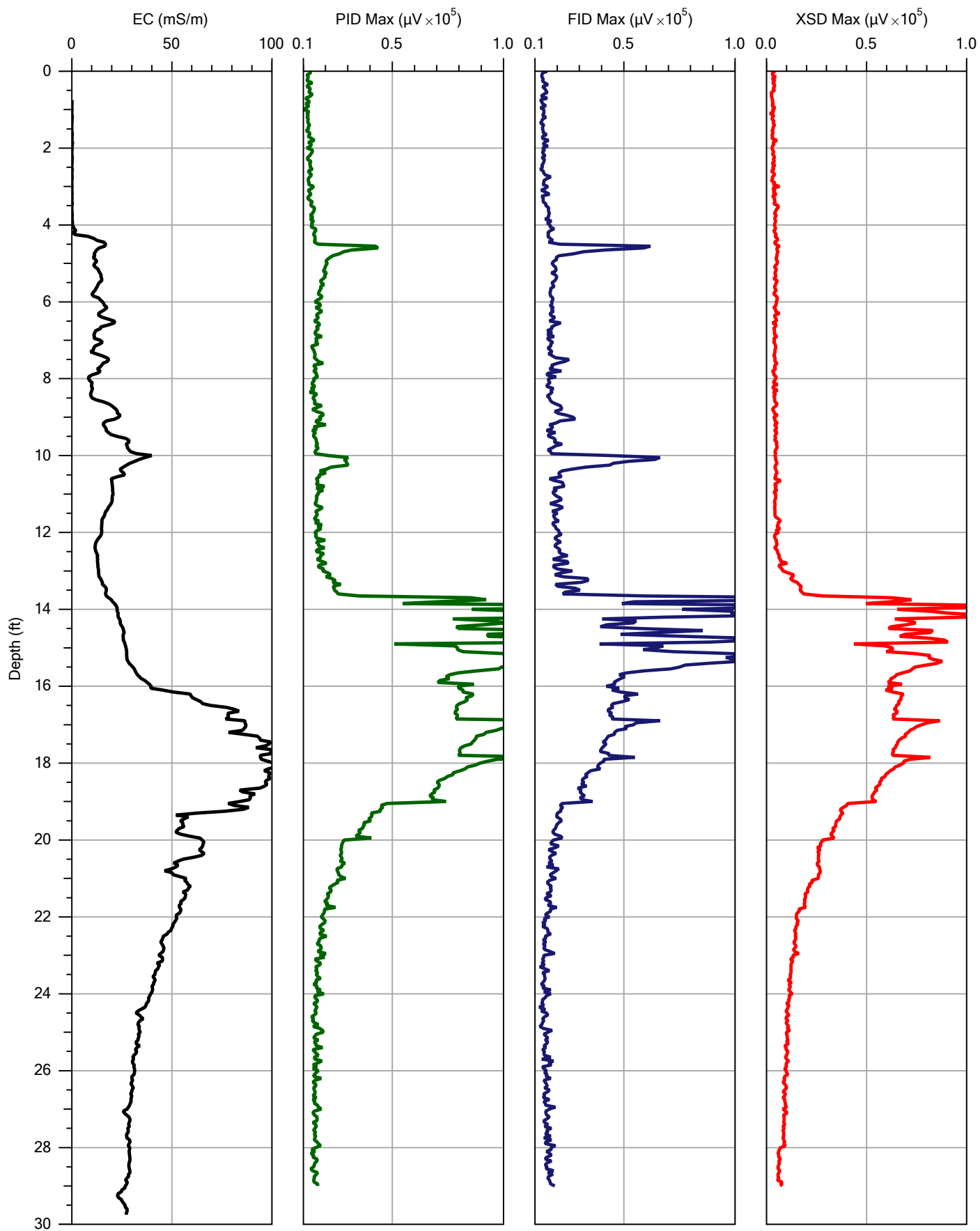
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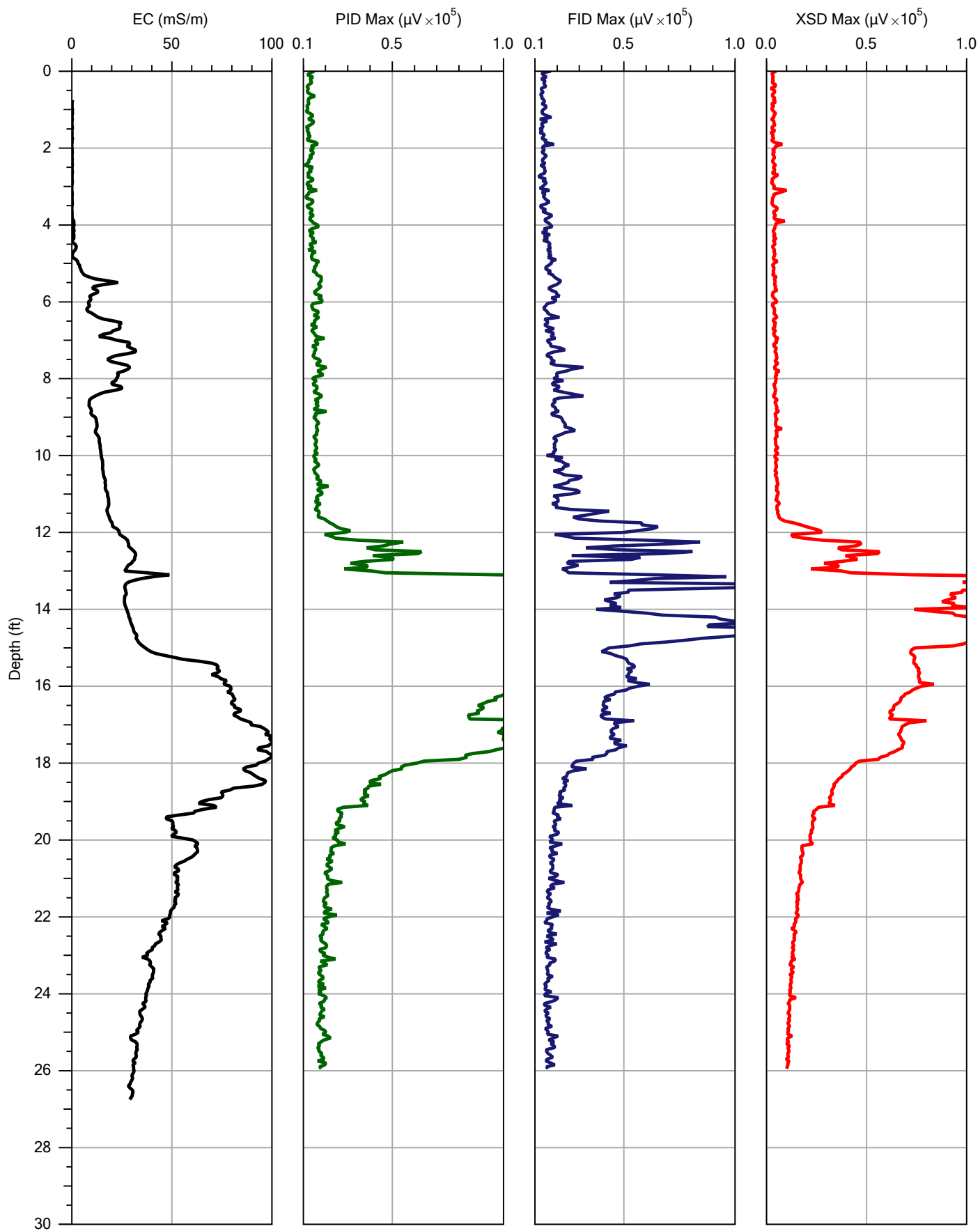
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

File:	MIP-012.MIP
Date:	12/3/2014
Location:	



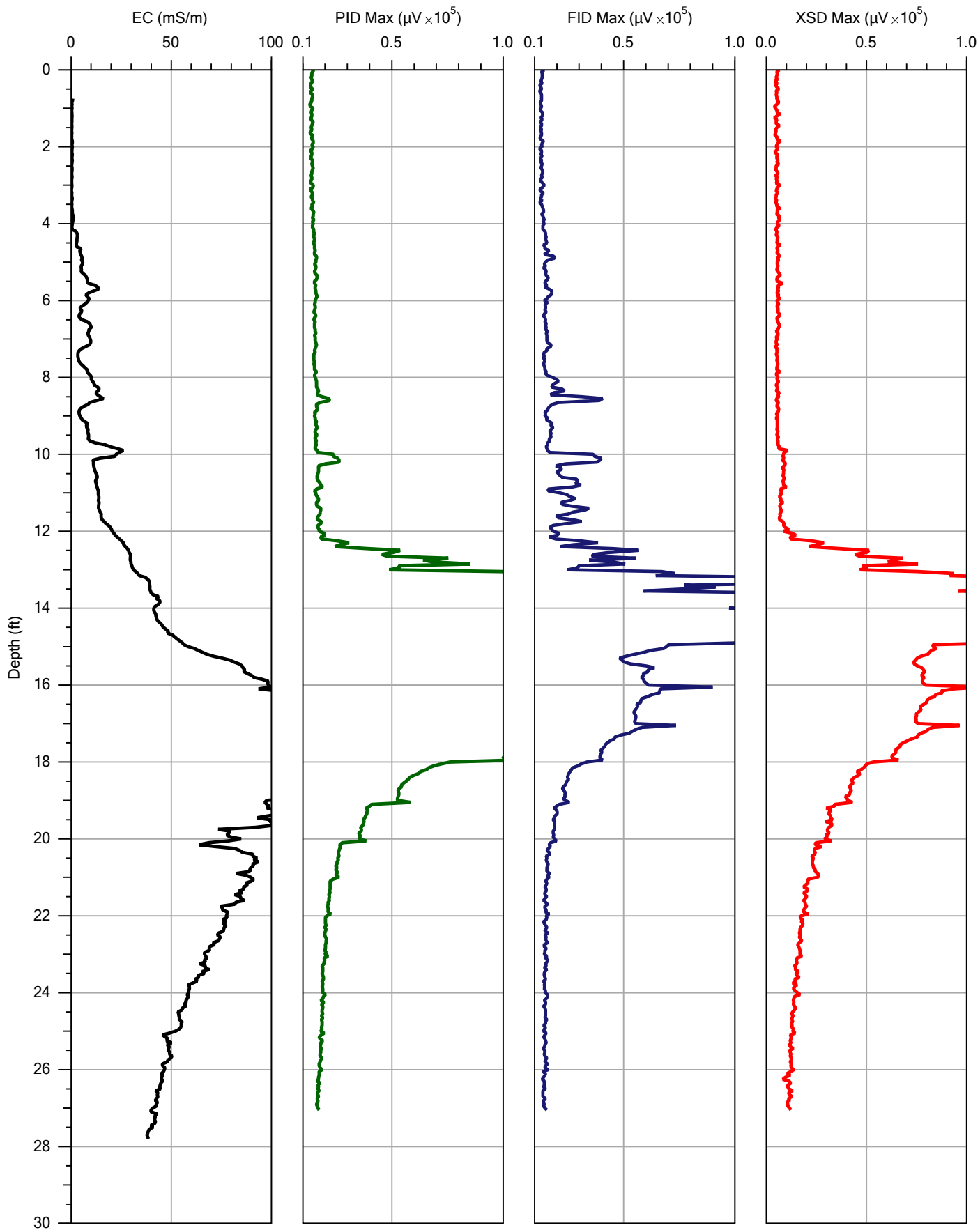
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Matrix Environmental		M Jensen	MIP-013.MIP
Project ID:		Client:	Date:
319.14		CRA	12/4/2014
			Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

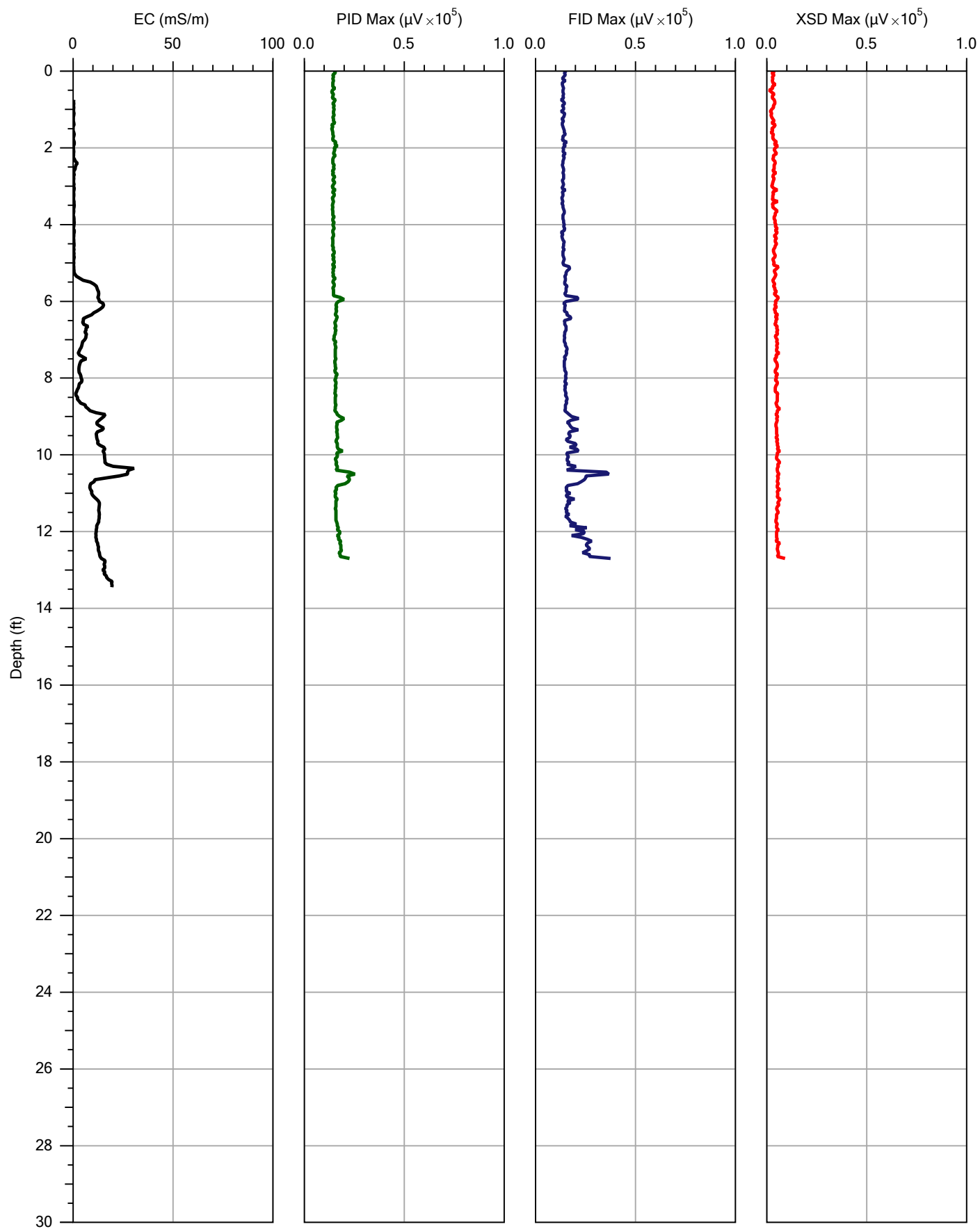
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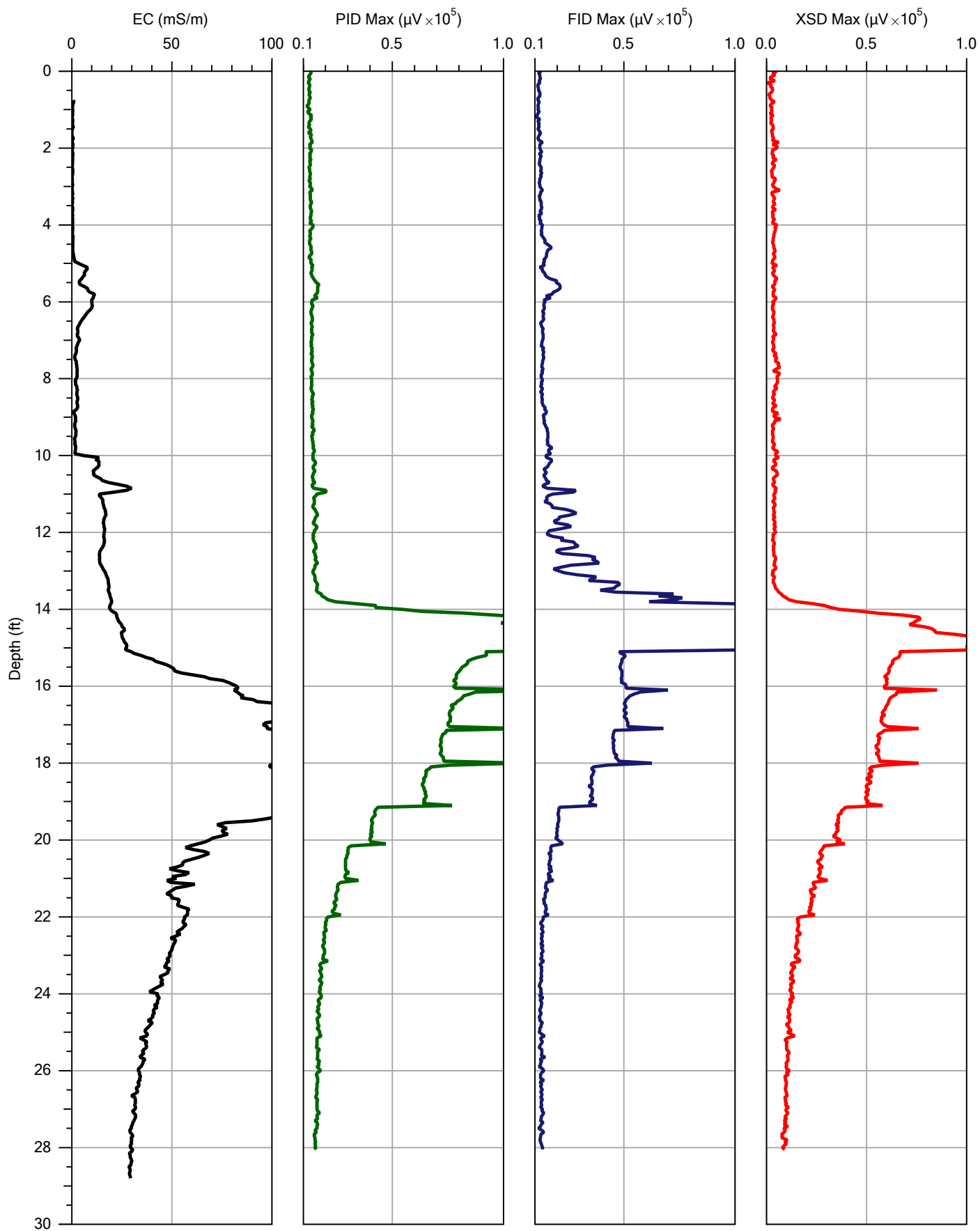
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

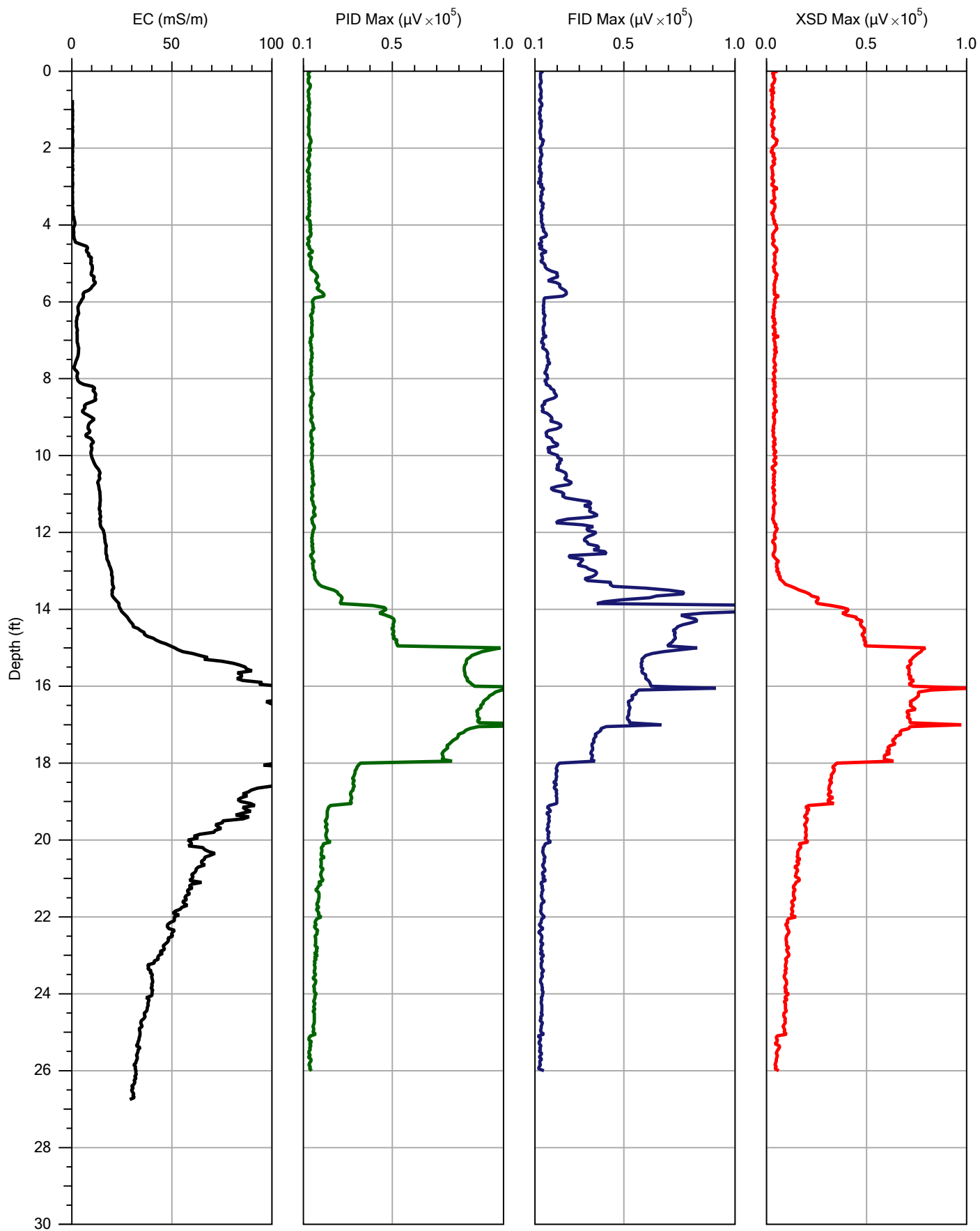
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Location:	



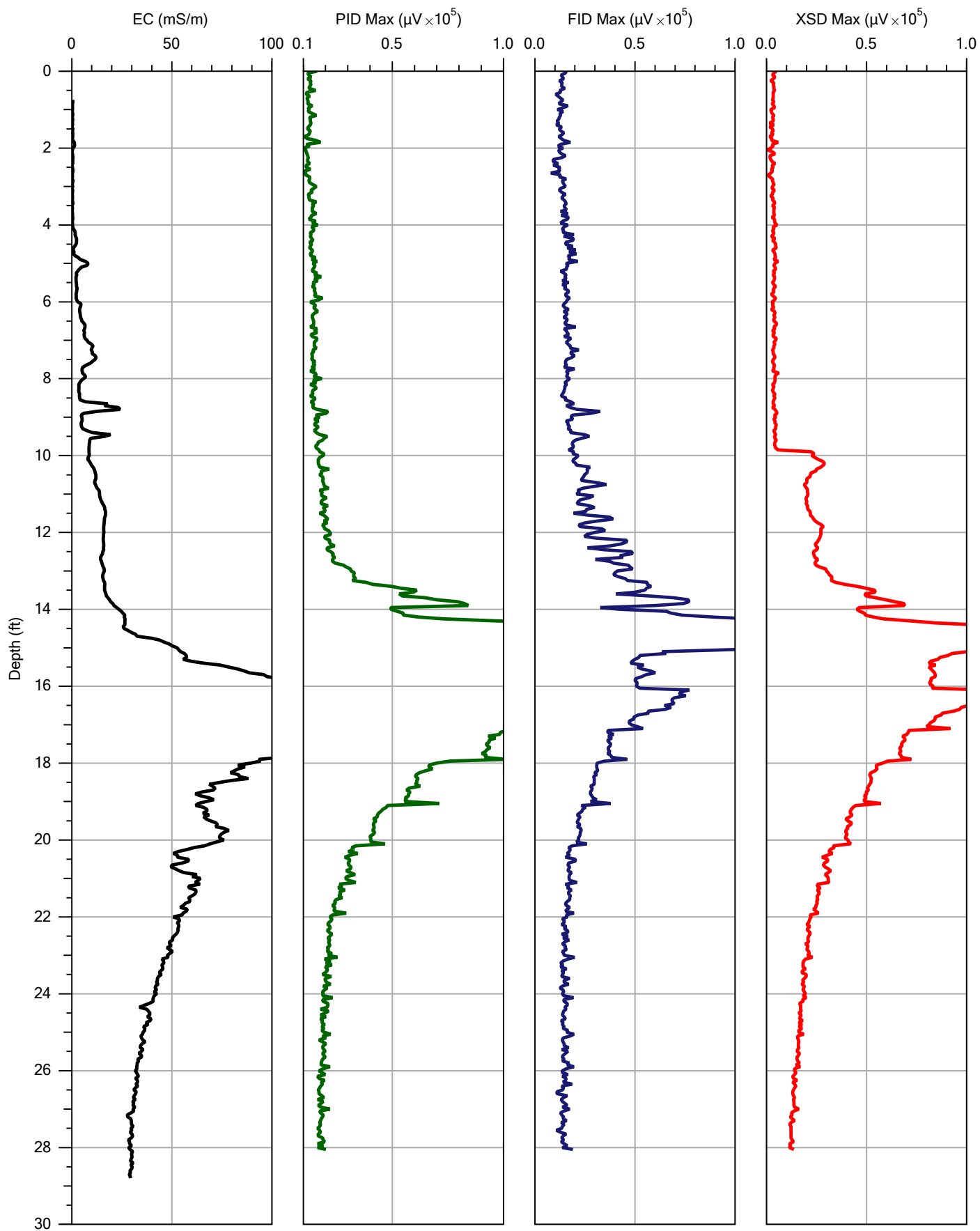
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Project ID: 319.14		Client: CRA	Date: 12/4/2014
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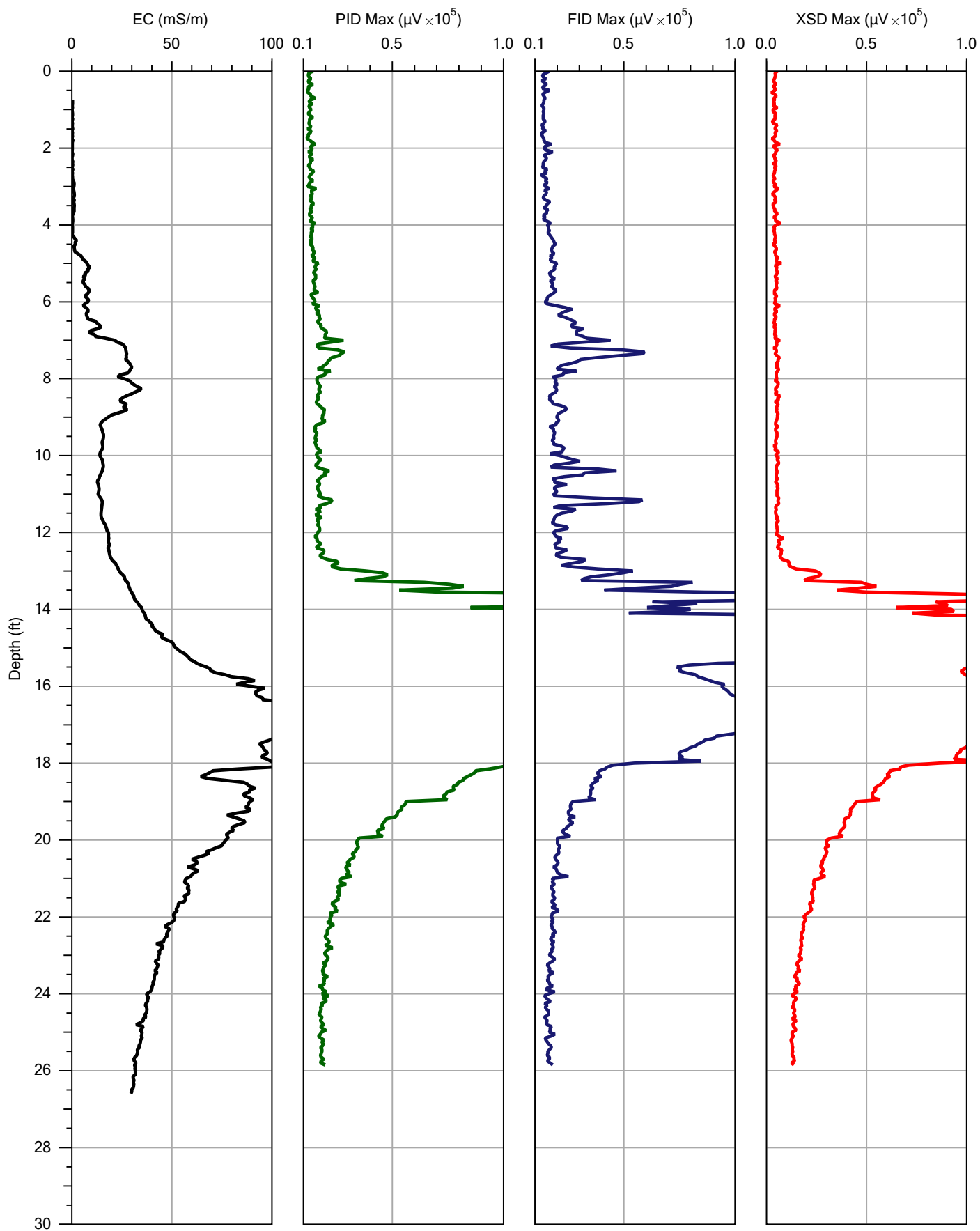
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Project ID:	319.14	Client:	CRA	Date:	12/4/2014
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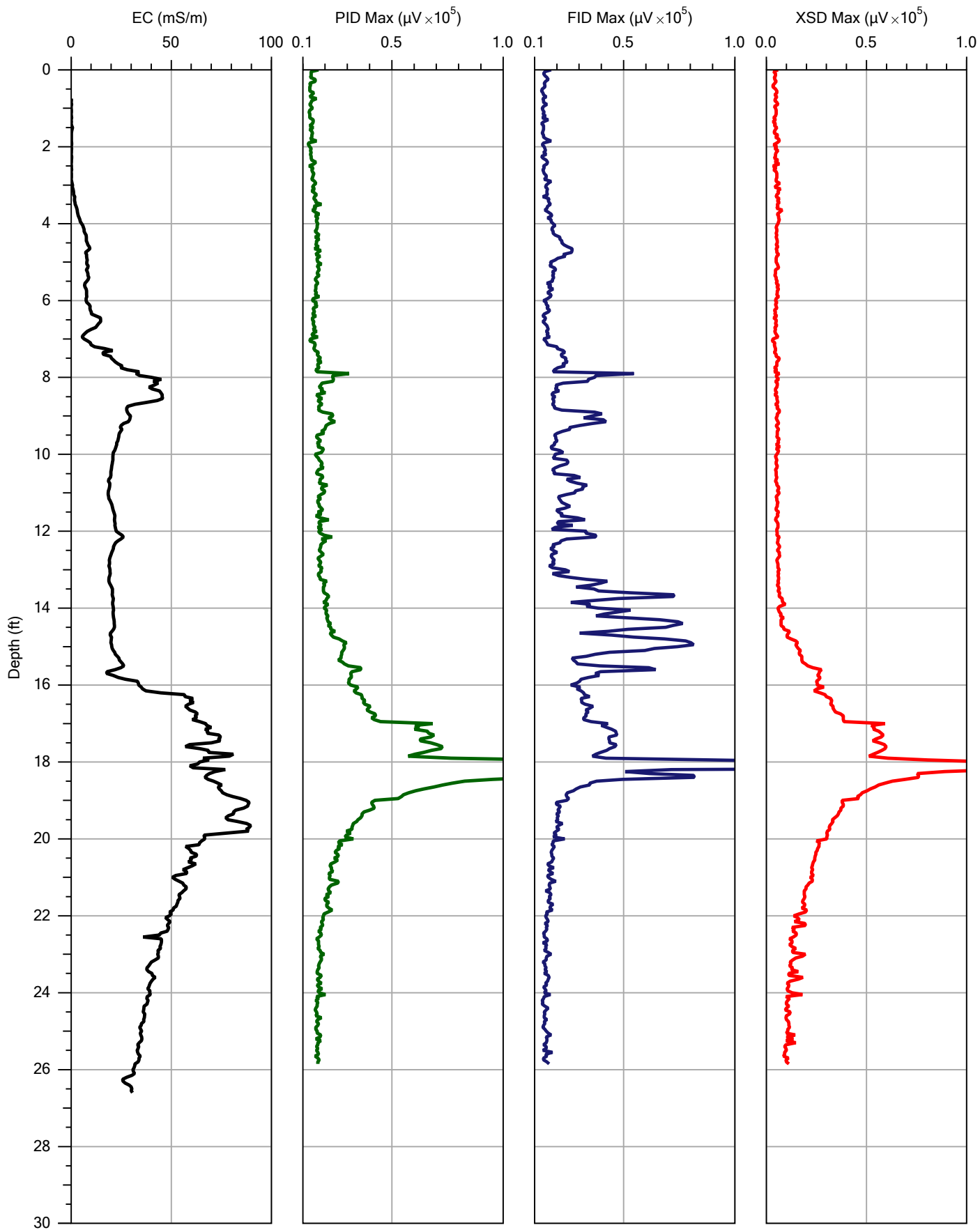
Company: Matrix Environmental		File: MIP-018.MIP
Operator: M Jenson		Date: 12/4/2014
Project ID: 319.14	Client: CRA	Location:



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Operator: M Jensen		Date: 12/4/2014
Project ID: 319.14	Client: CRA	Location:



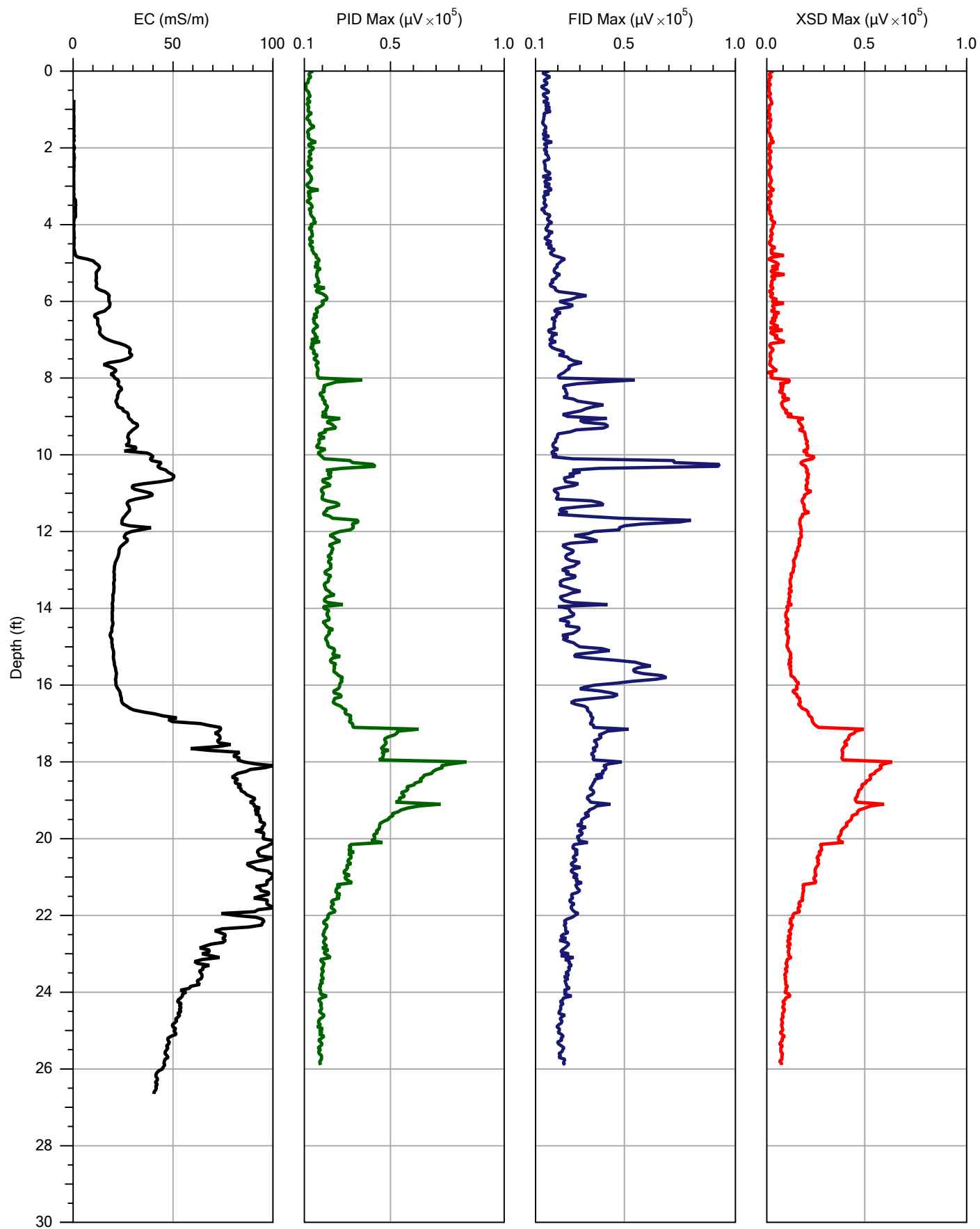
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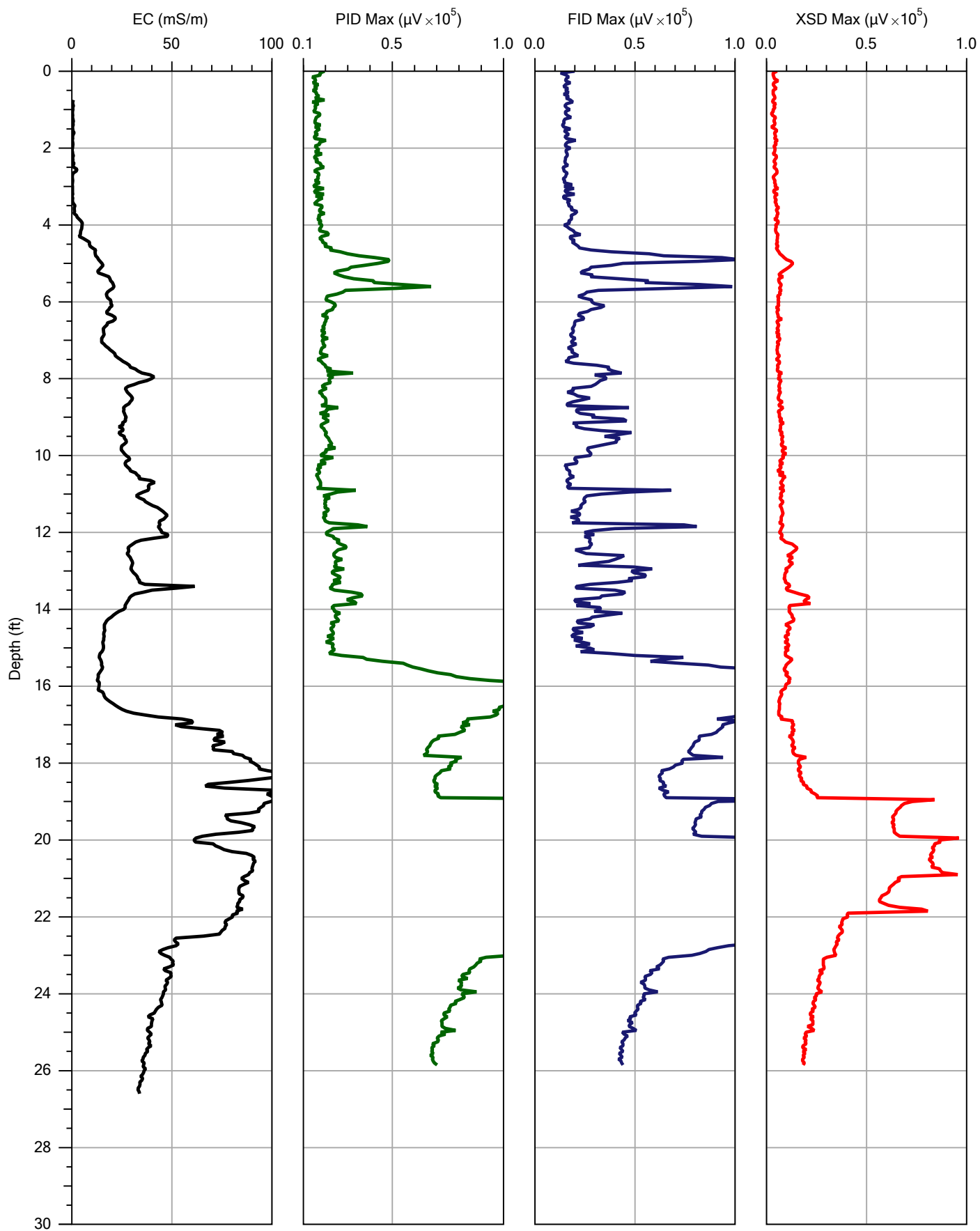
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

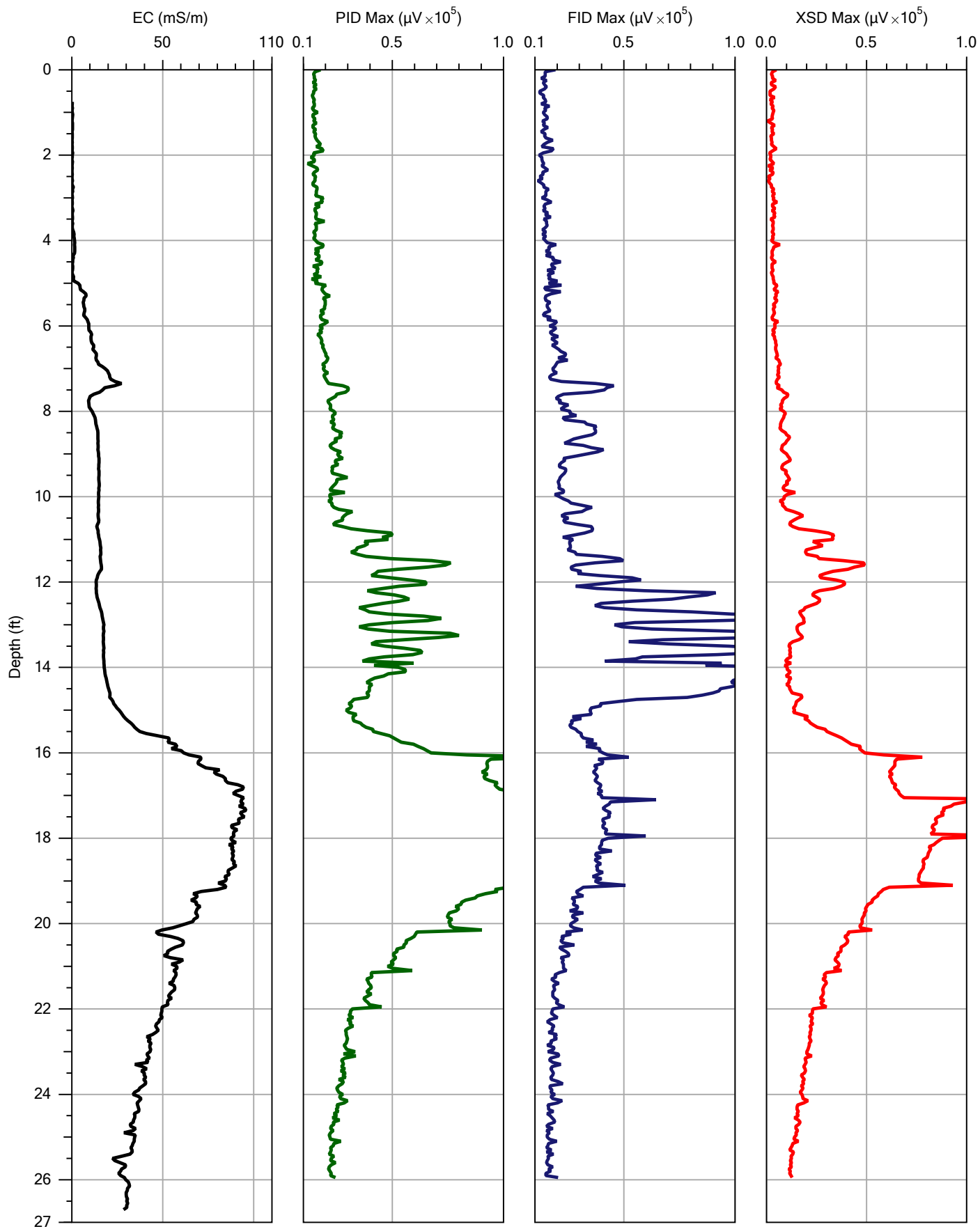
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Date: 12/5/2014
Location:



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Matrix Environmental		M Jensen	MIP-022.MIP
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319.14		CRA	12/5/2014
			Location:



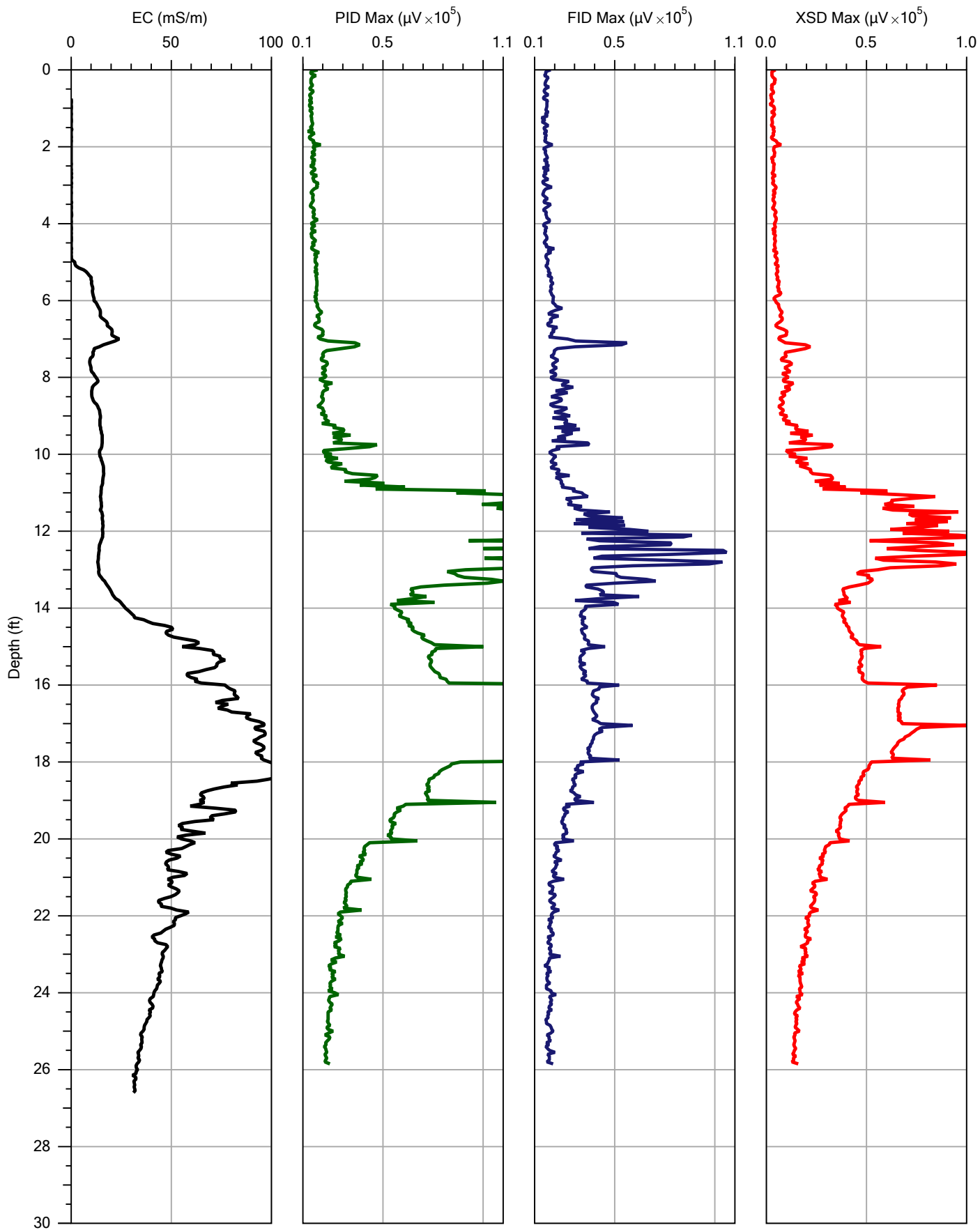
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Matrix Environmental		M Jensen	MIP-023.MIP
Project ID:		Client:	Date:
319.14		CRA	12/5/2014
			Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

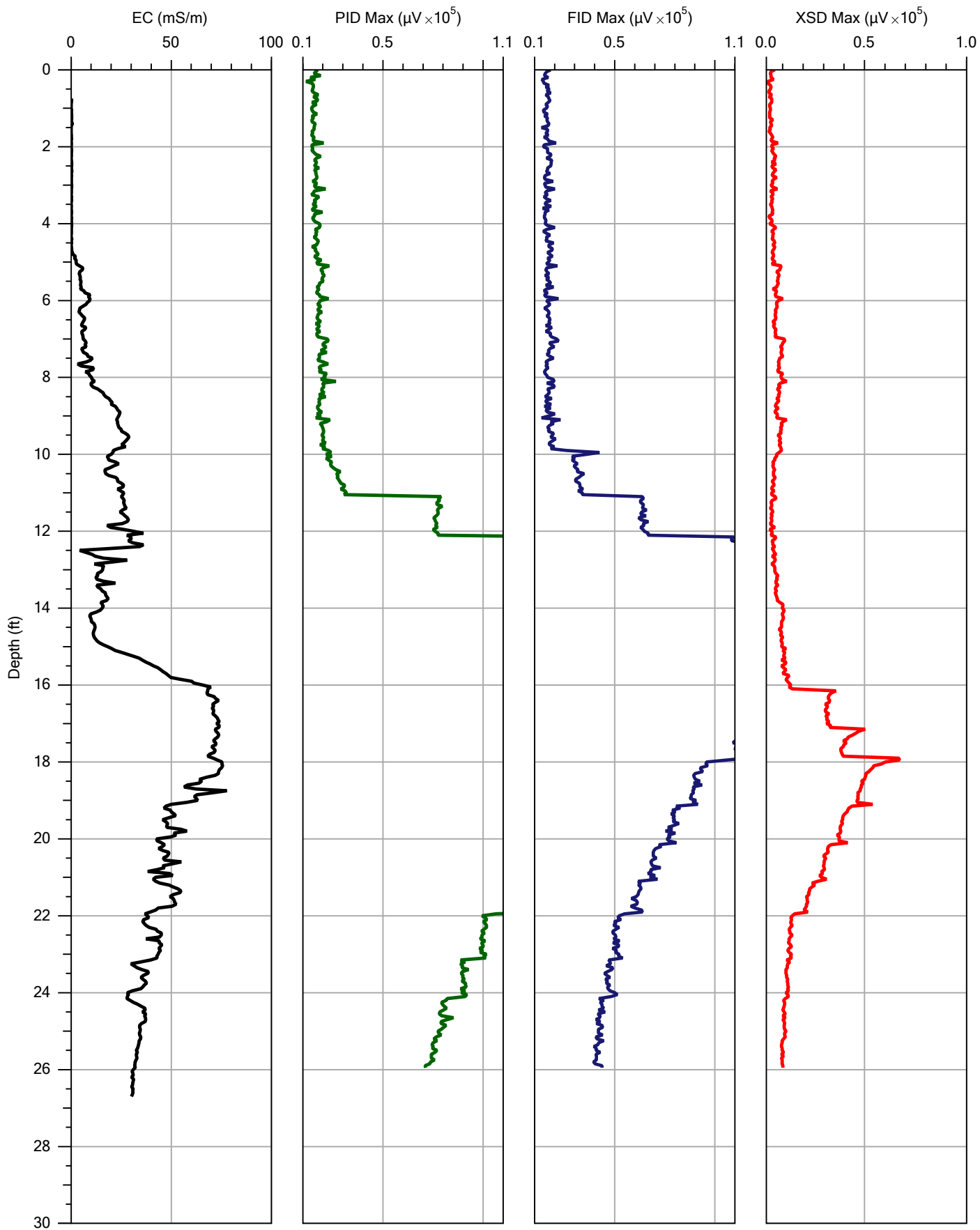
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Date:	12/5/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

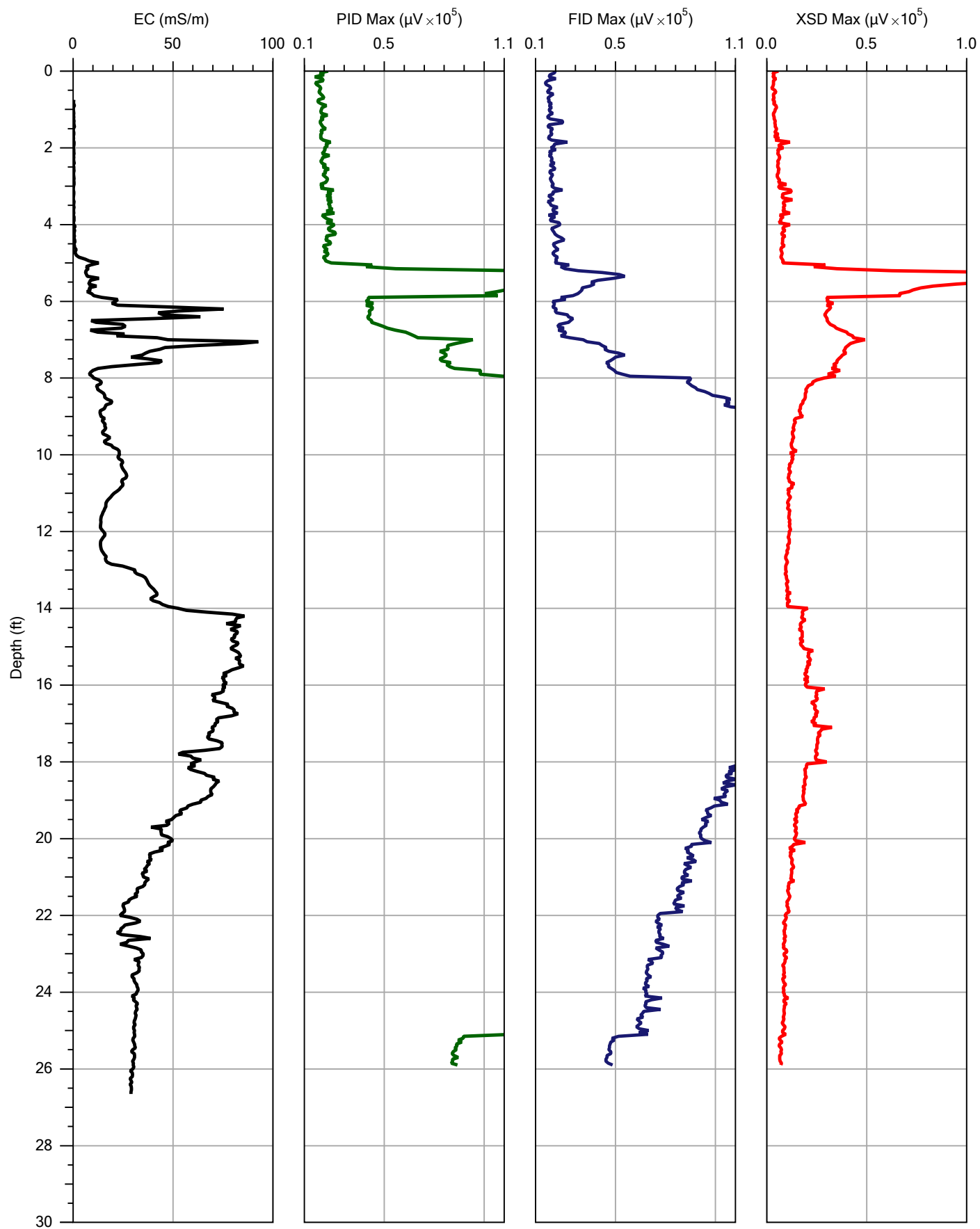
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Location:	



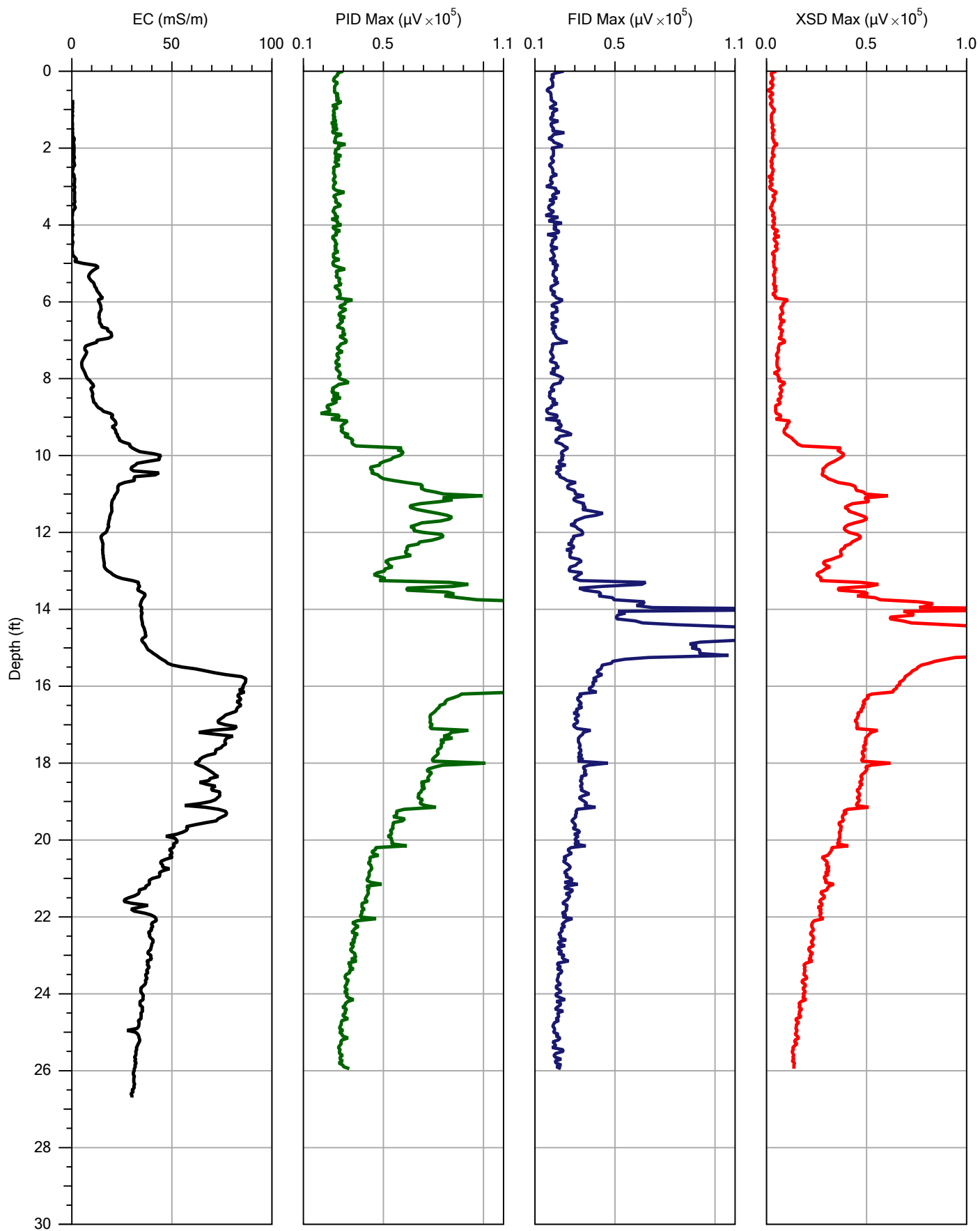
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

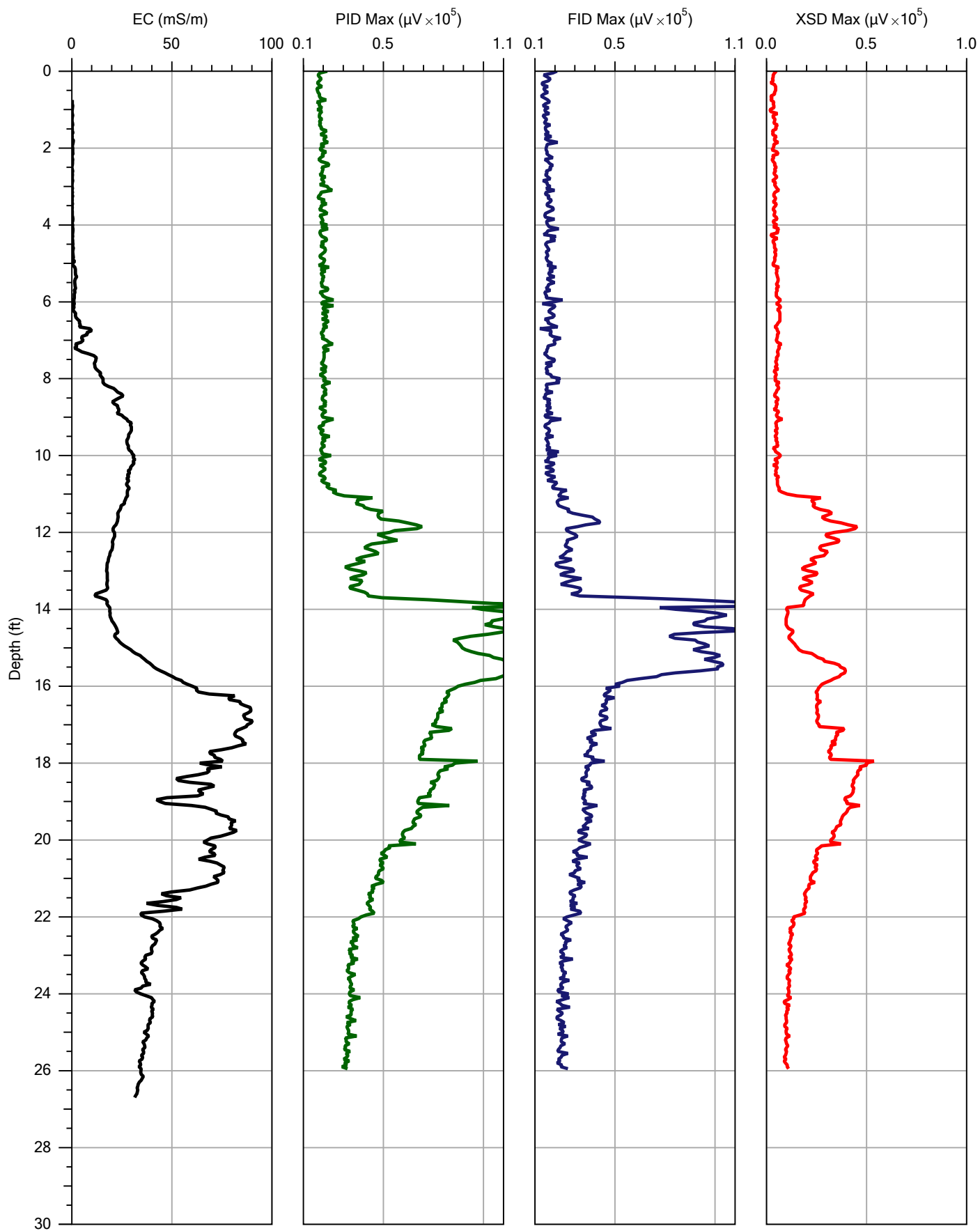
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Date:	12/8/2014
Location:	



Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-027.MIP
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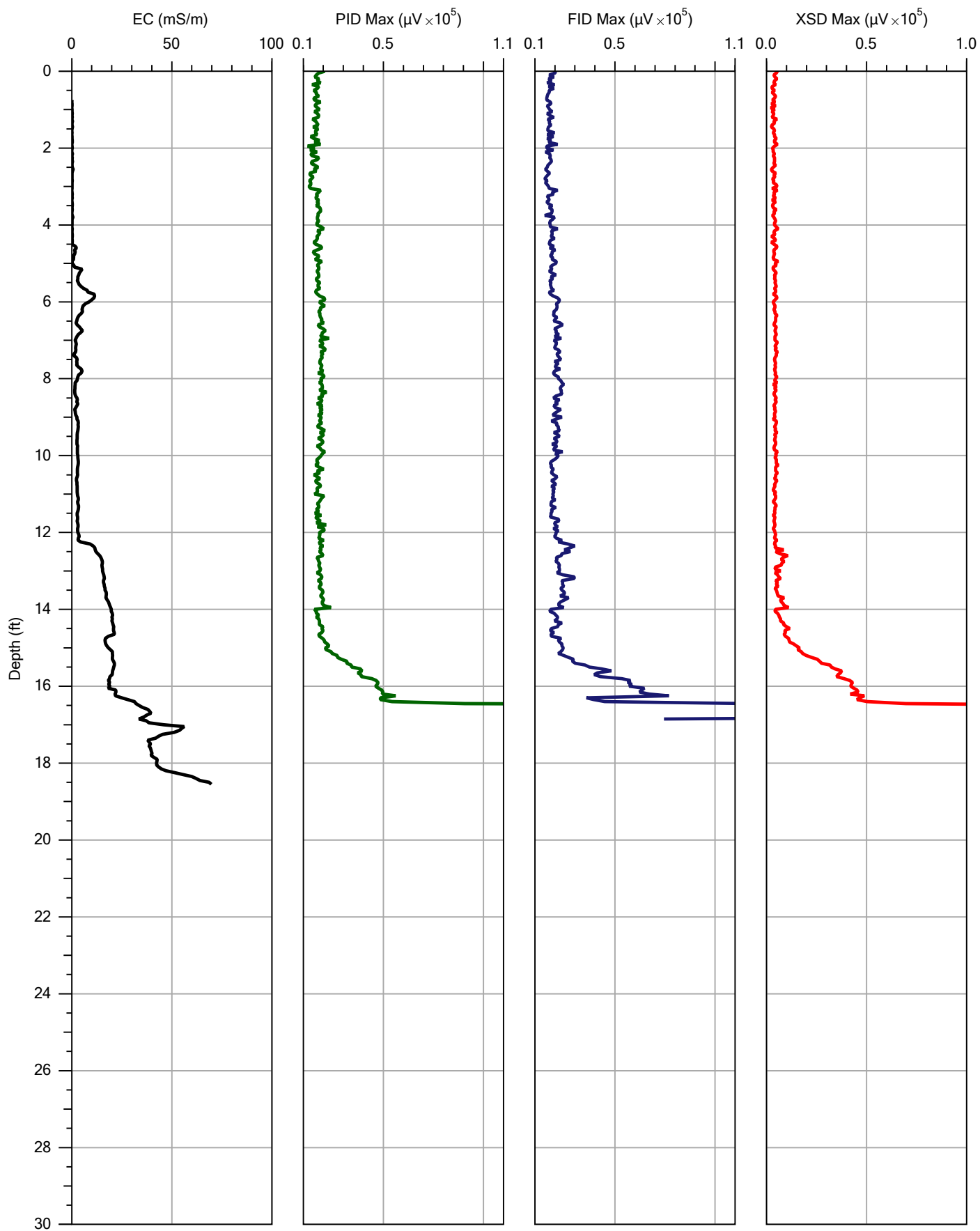
Company:	Matrix Environmental	Operator:	M Jenson	File:	MIP-028.MIP
Project ID:	319.14	Client:	CRA	Date:	12/8/2014
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

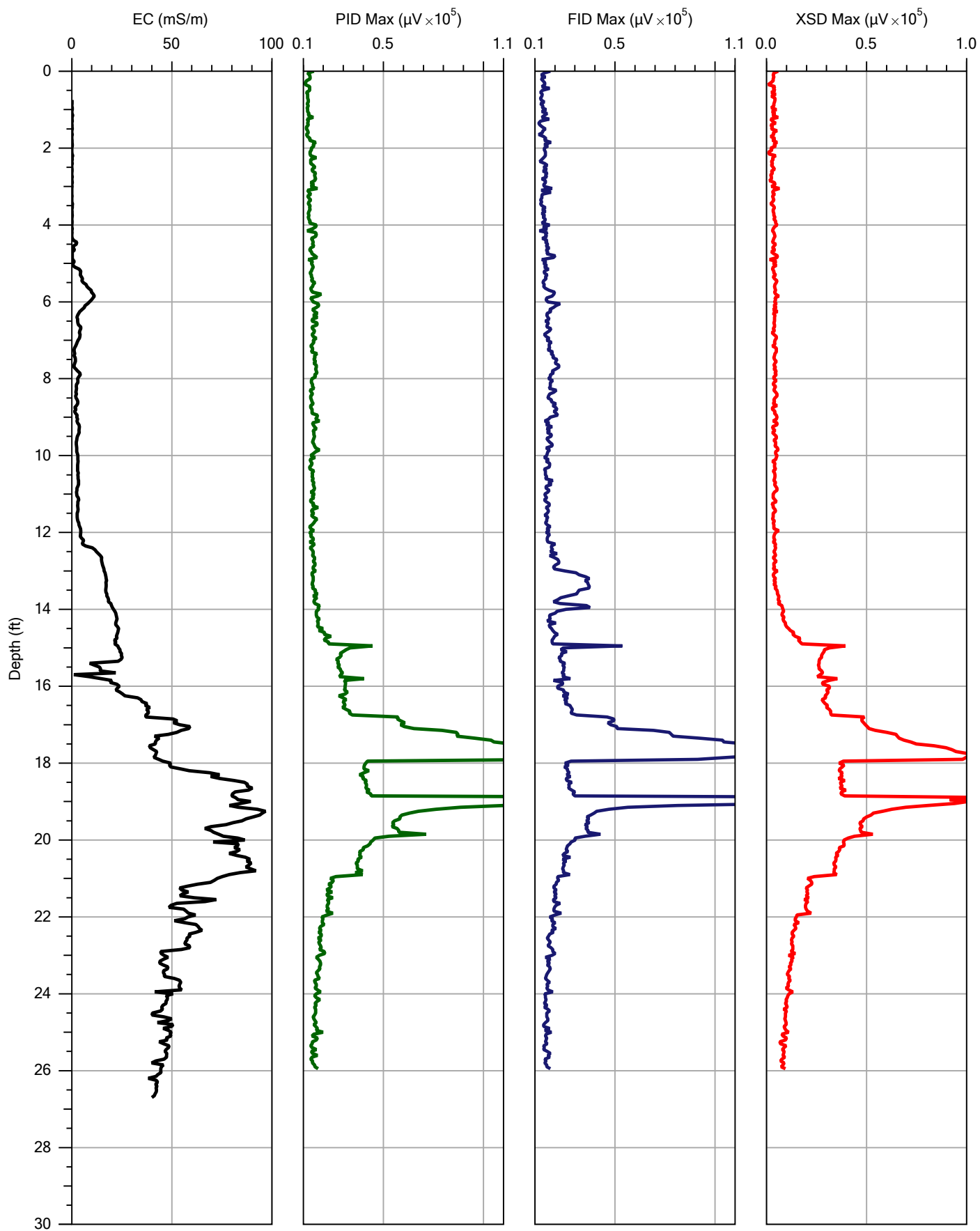
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Date:	12/8/2014
Location:	



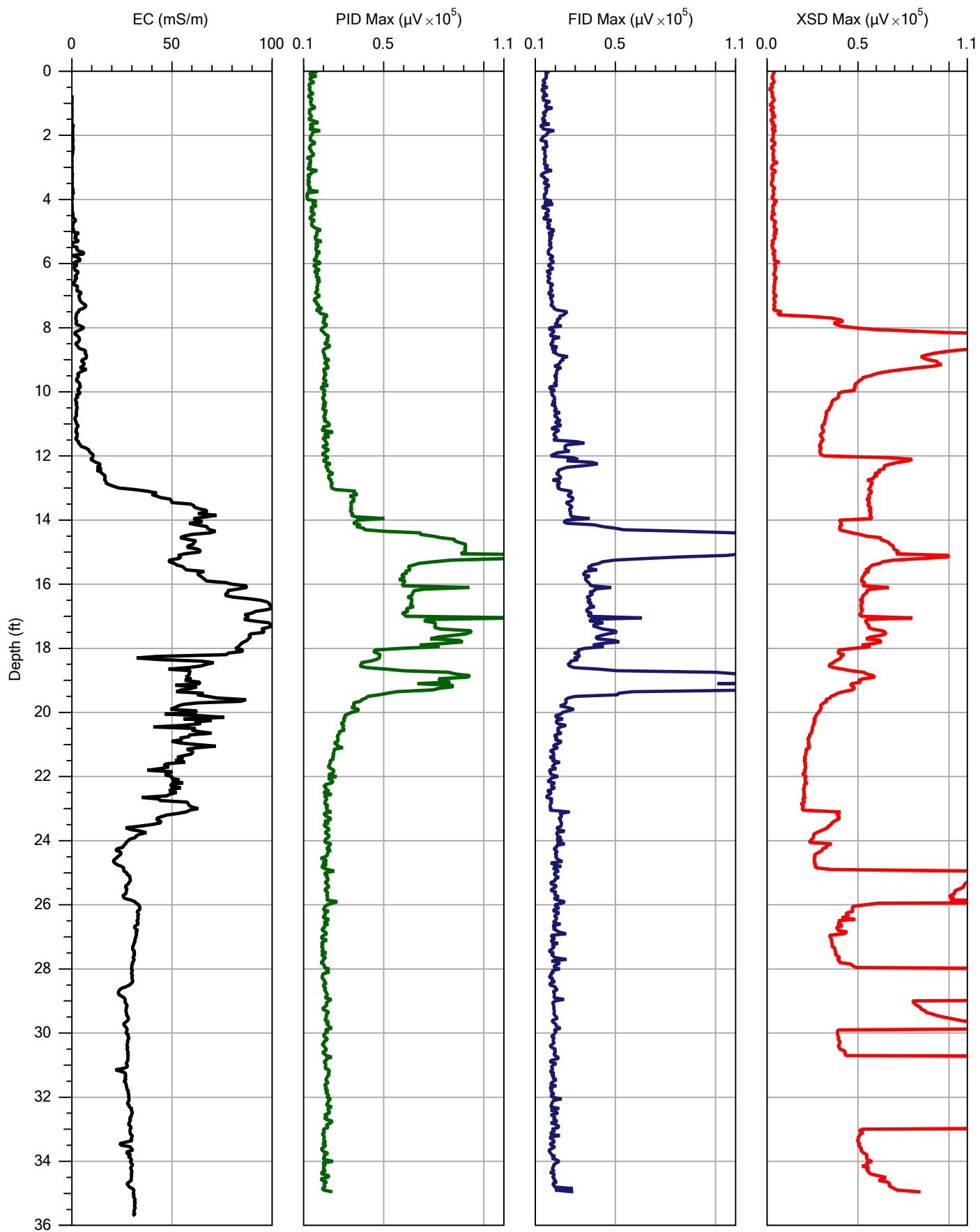
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

File:	MIP-030.MIP
Date:	12/9/2014
Location:	



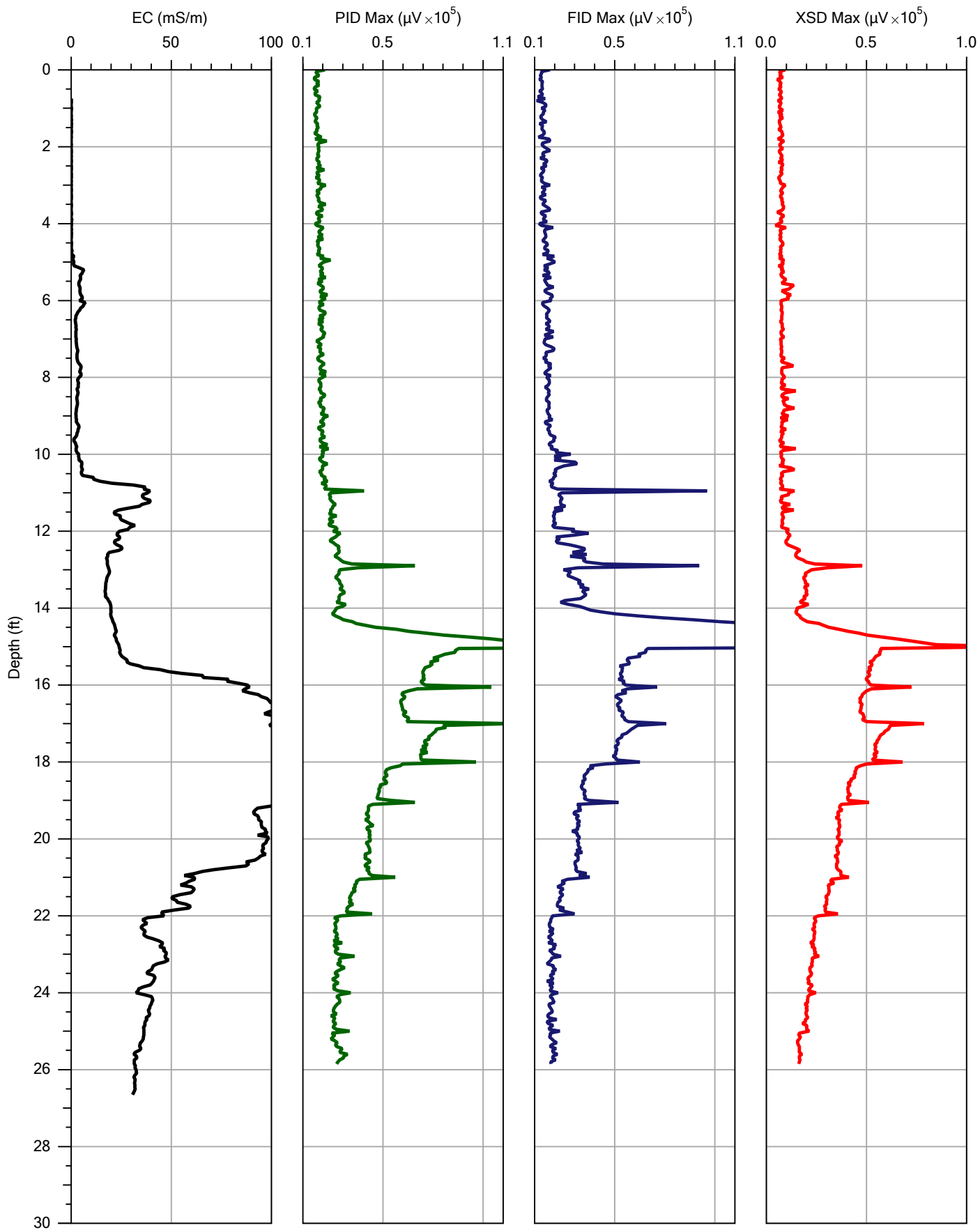
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Matrix Environmental		M Jensen	MIP-030A.MIP
Project ID:		Client:	Date:
319.14		CRA	12/9/2014
			Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

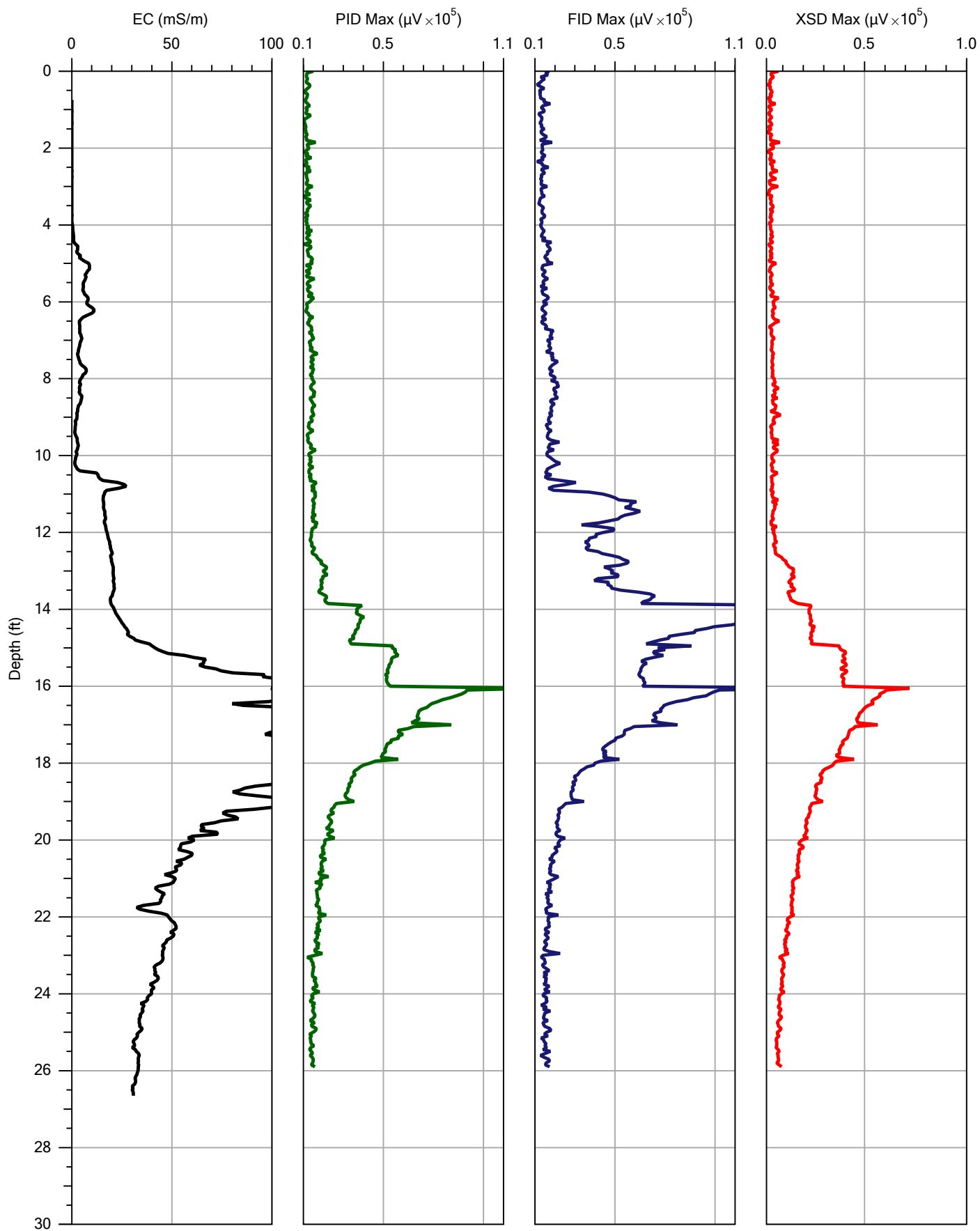
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Date: 12/9/2014
Location:



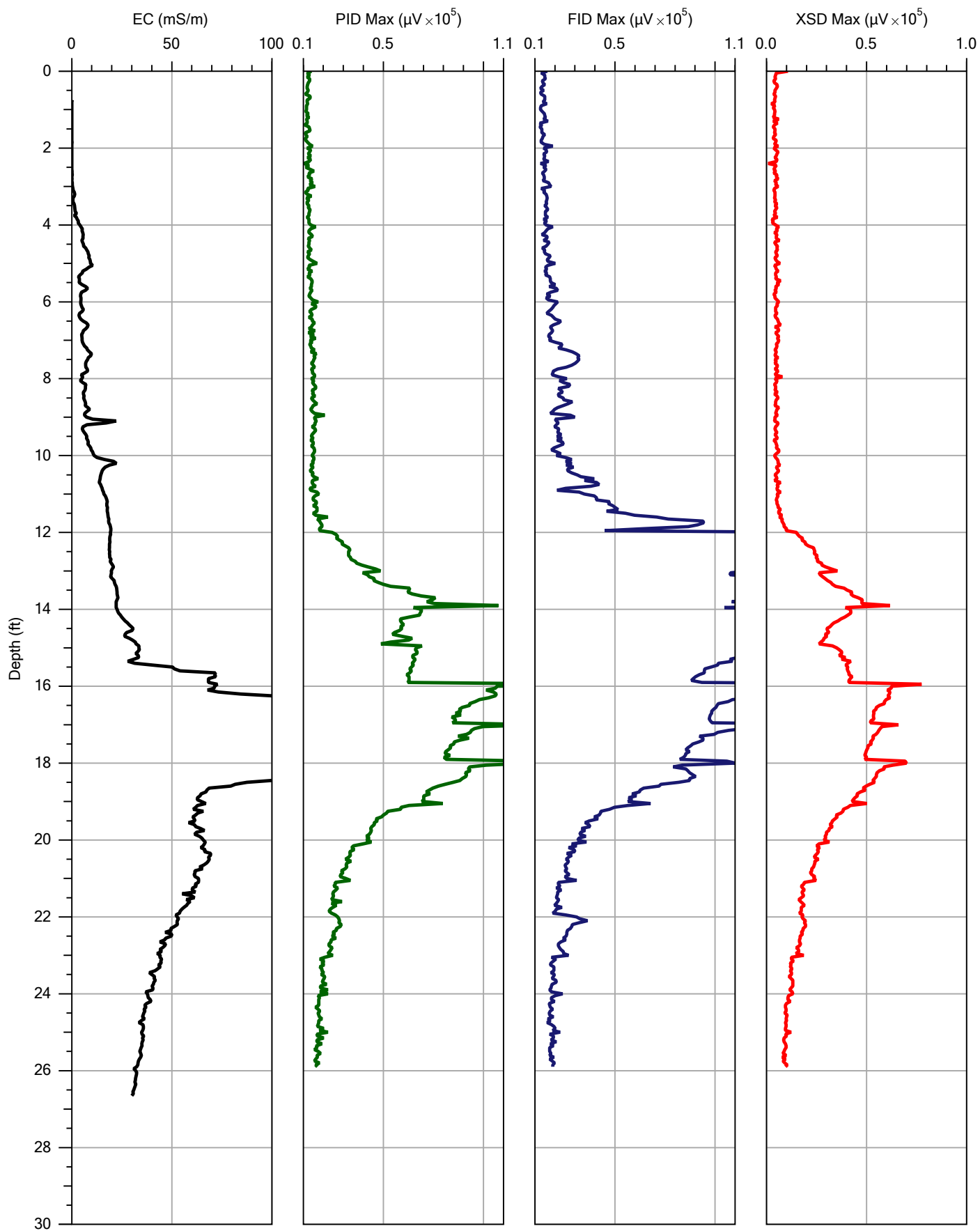
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

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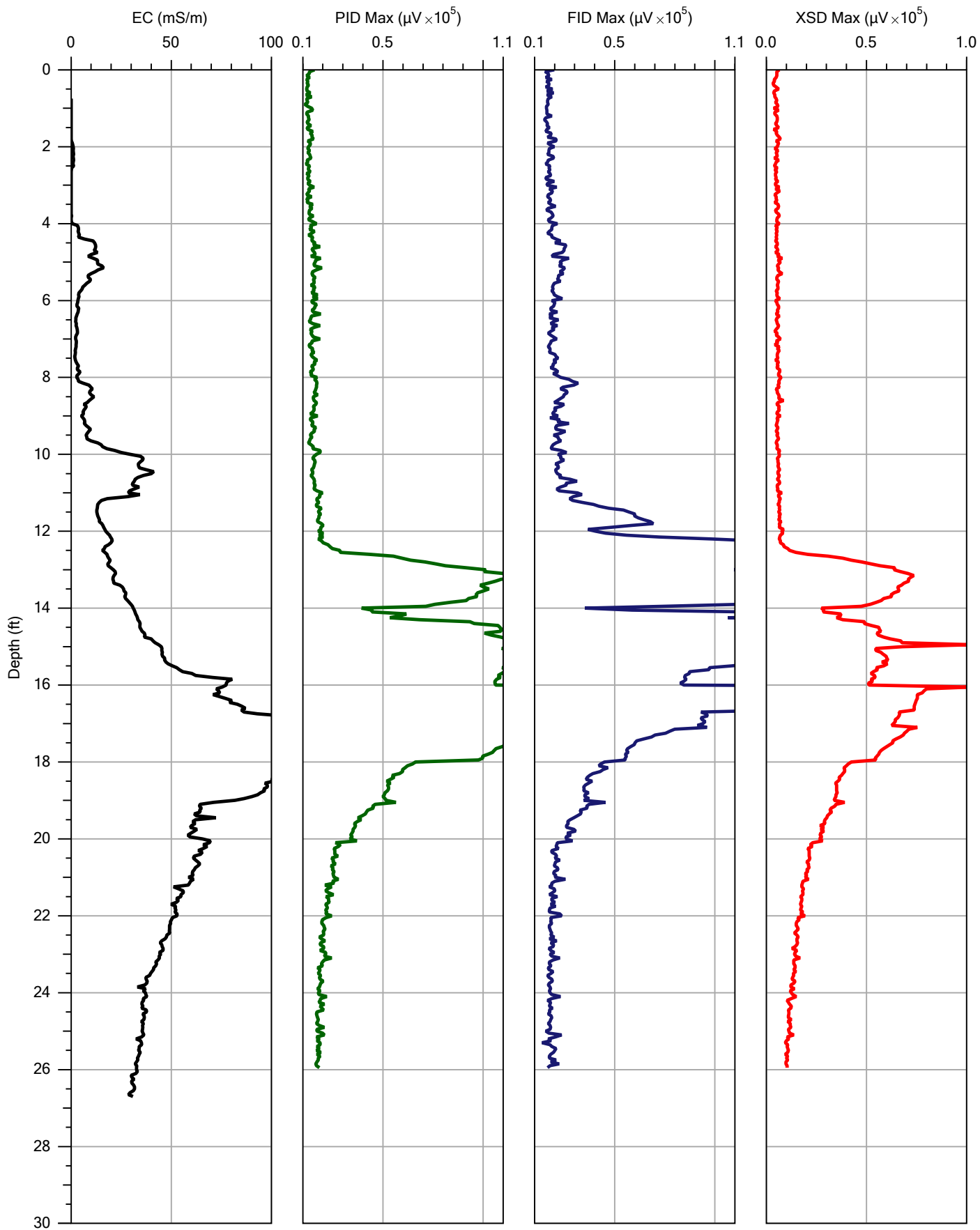
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Matrix Environmental		M Jensen	MIP-033A.MIP
Project ID:		Client:	Date:
319.14		CRA	12/9/2014
			Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

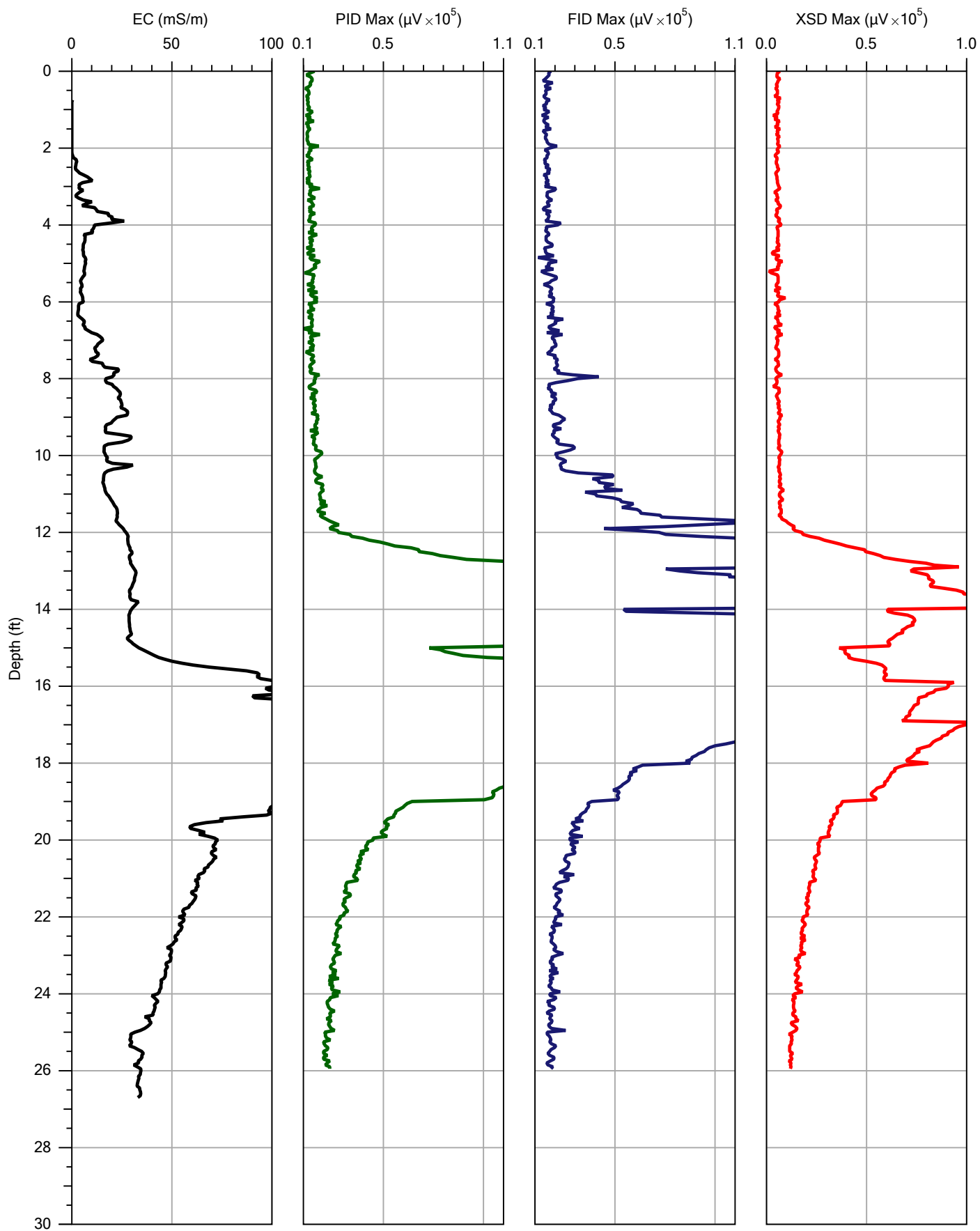
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Date:	12/10/2014
Location:	



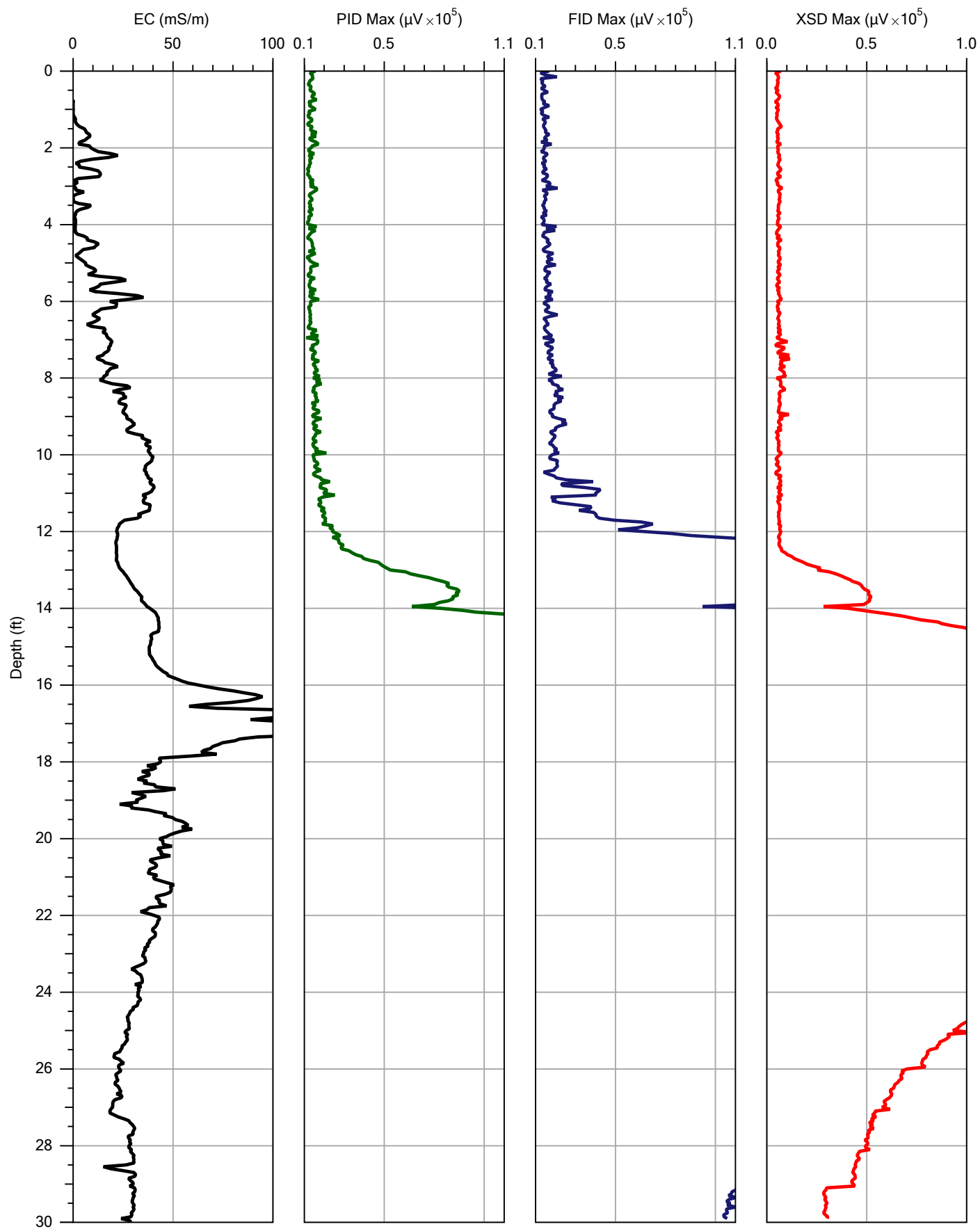
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

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Date:	12/10/2014
Location:	



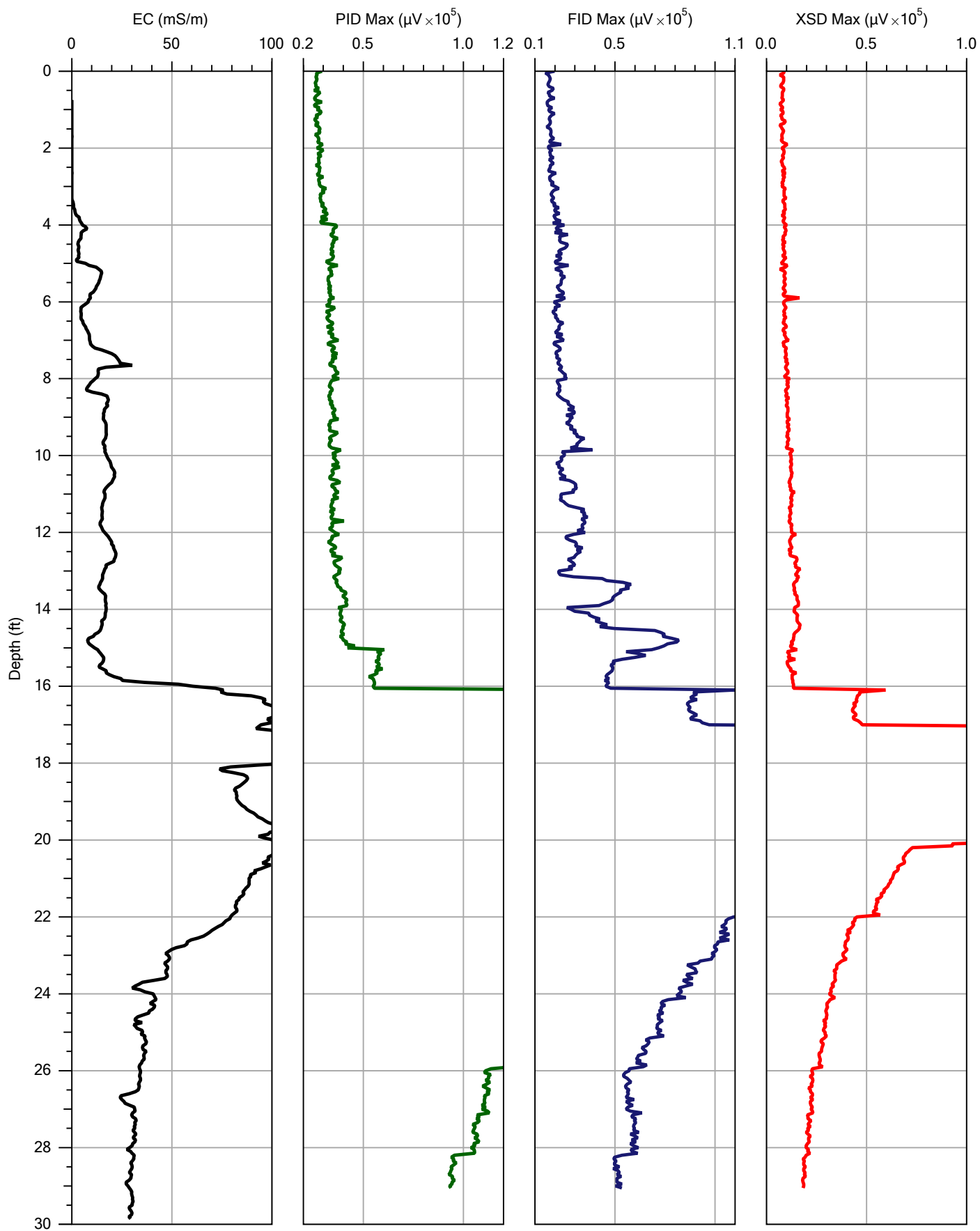
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Project ID:	319.14	Client:	CRA	Date:	12/10/2014
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

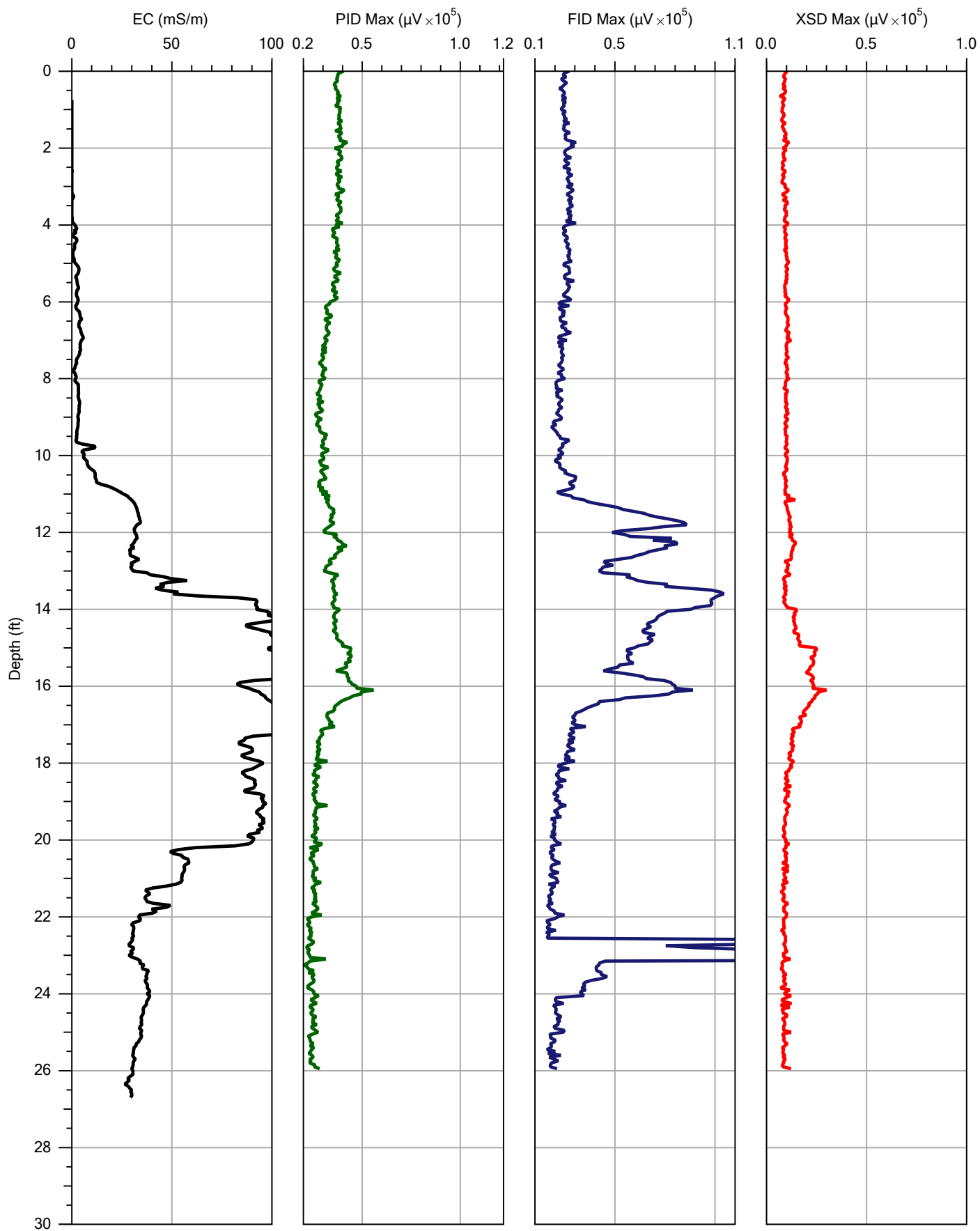
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Date:	12/10/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

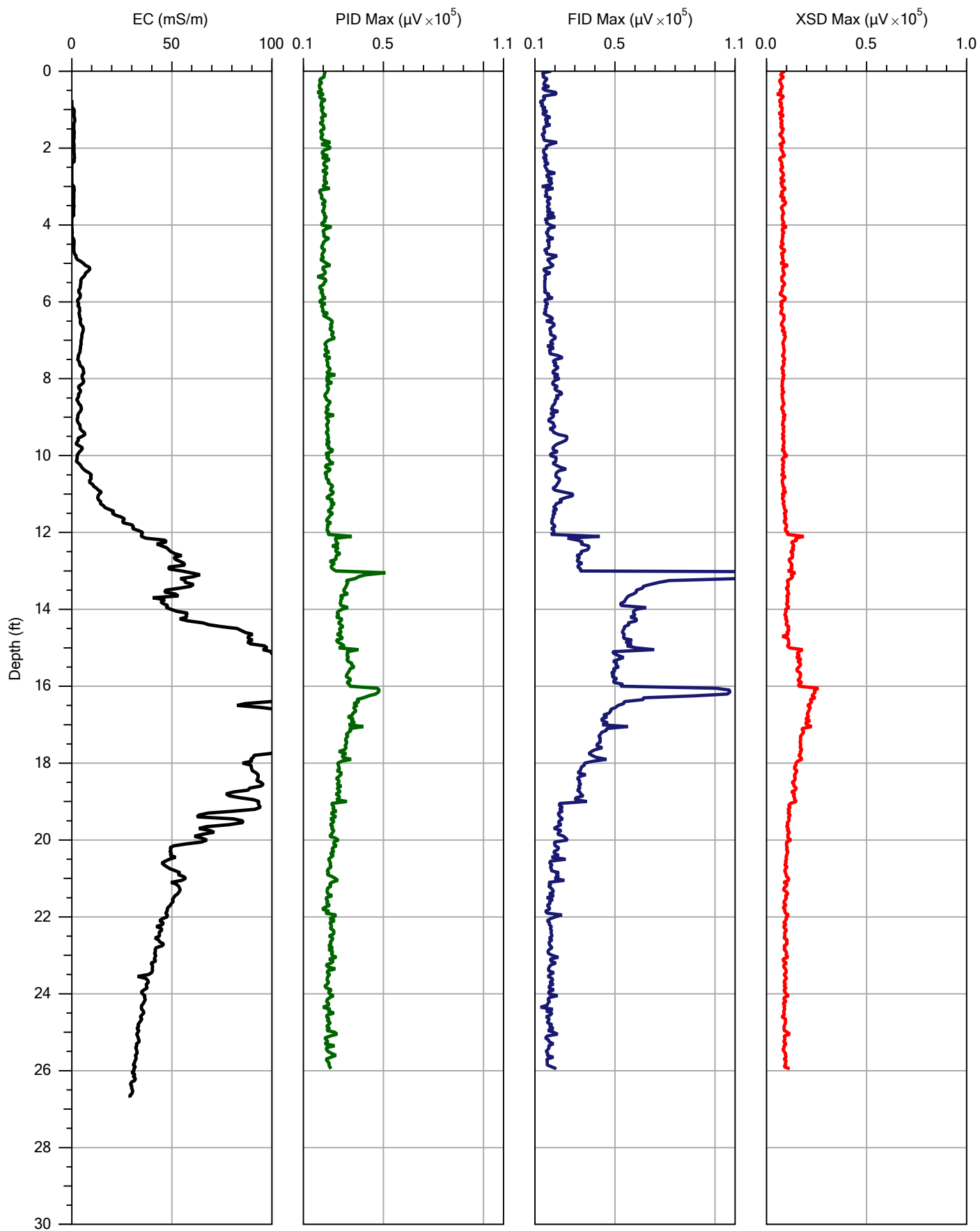
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

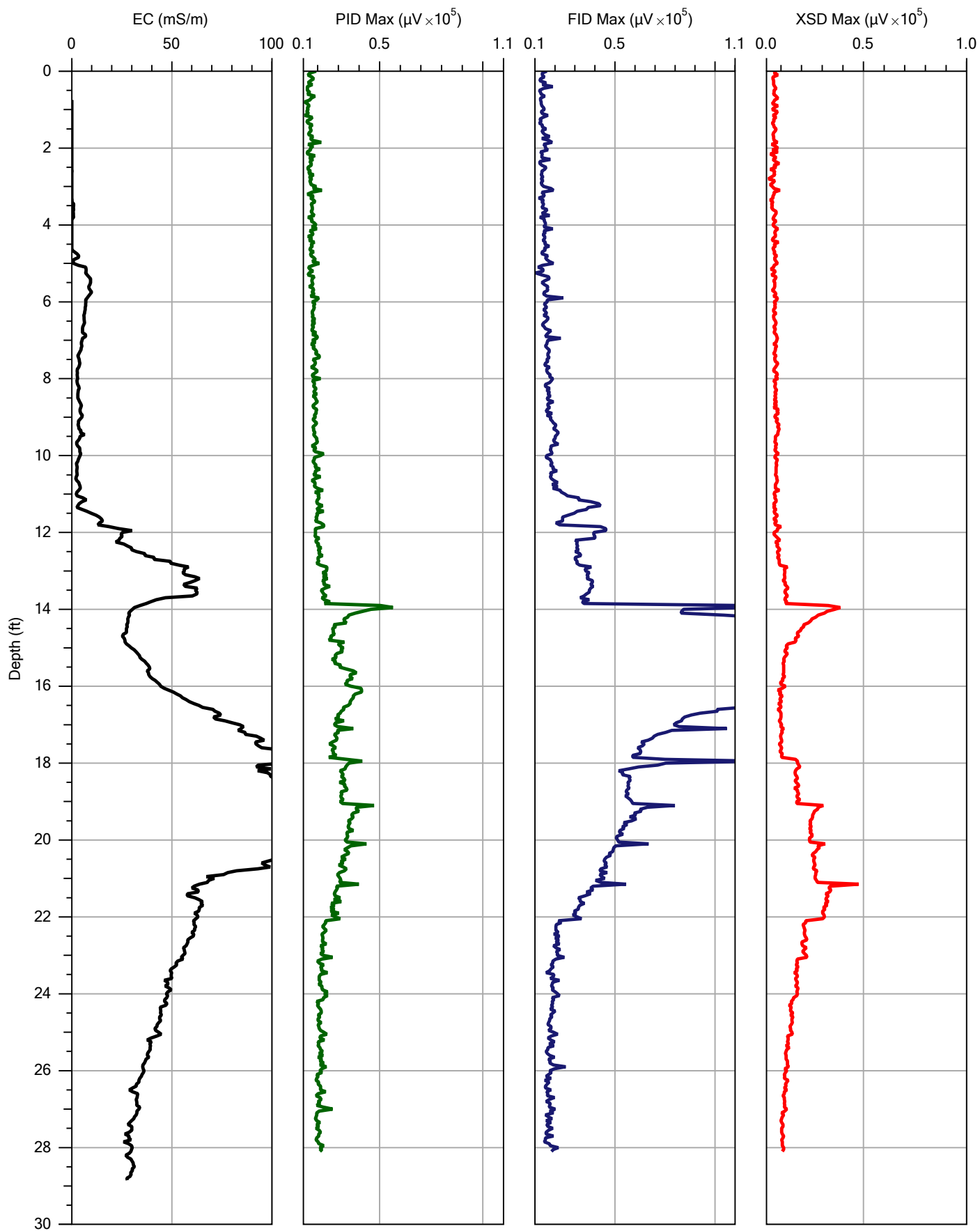
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Date: 12/10/2014
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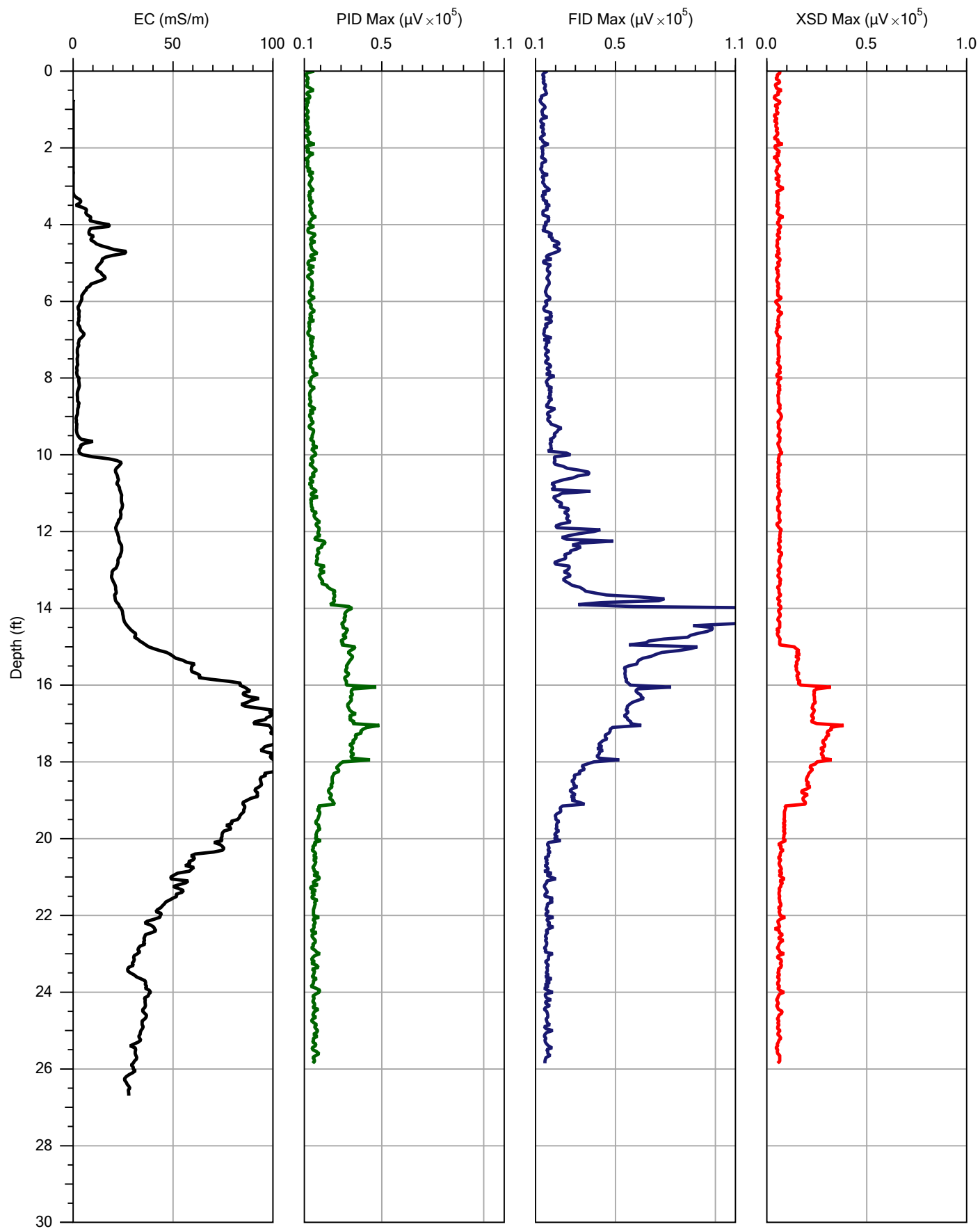
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

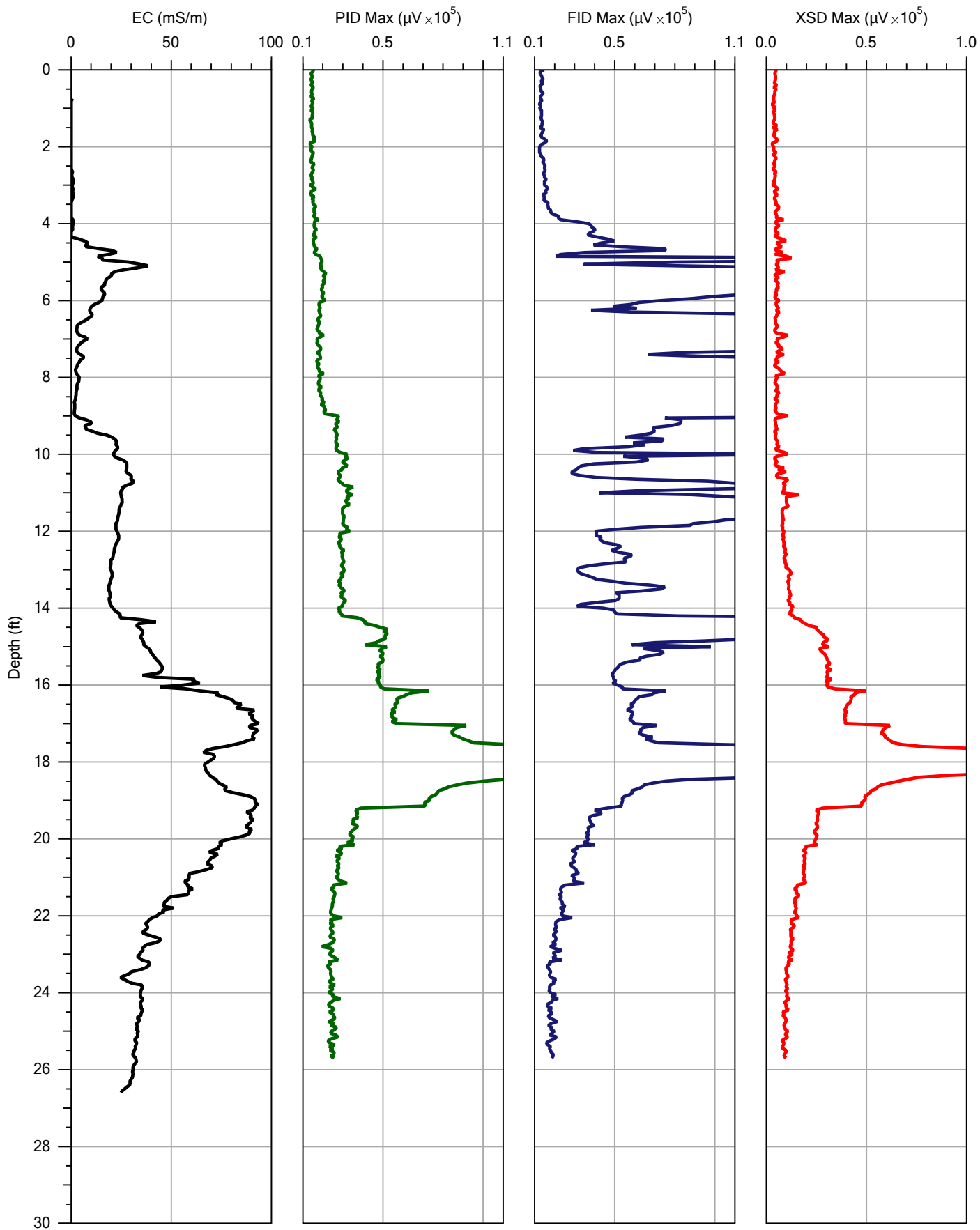
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Date: 12/10/2014
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Company: Matrix Environmental		File: MIP-041.MIP
Operator: M Jensen		Date: 12/10/2014
Project ID: 319.14	Client: CRA	Location:



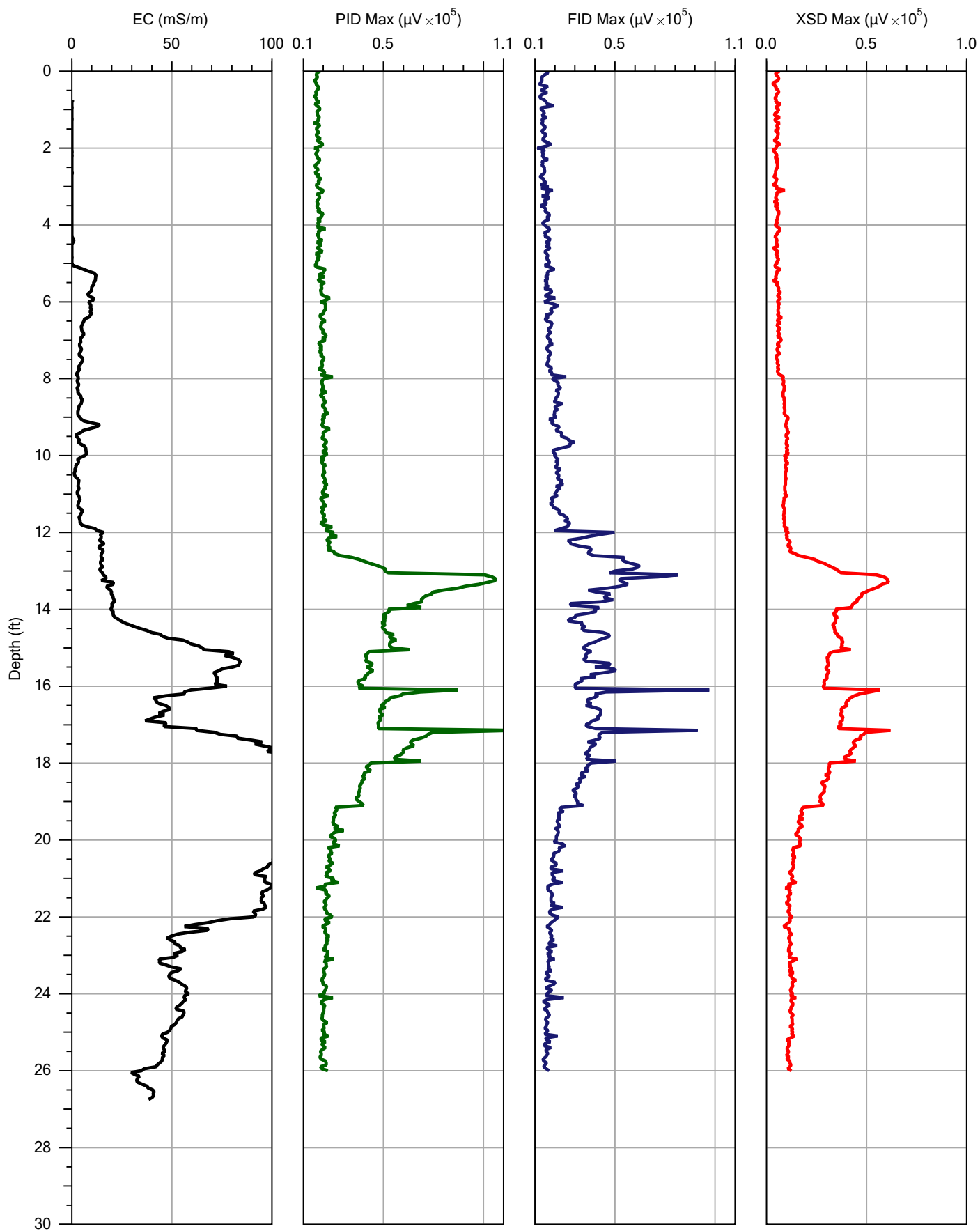
Company:		Operator:	File:
Matrix Environmental		M Jenson	MIP-042.MIP
Project ID:		Client:	Date:
319.14		CRA	12/11/2014
			Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

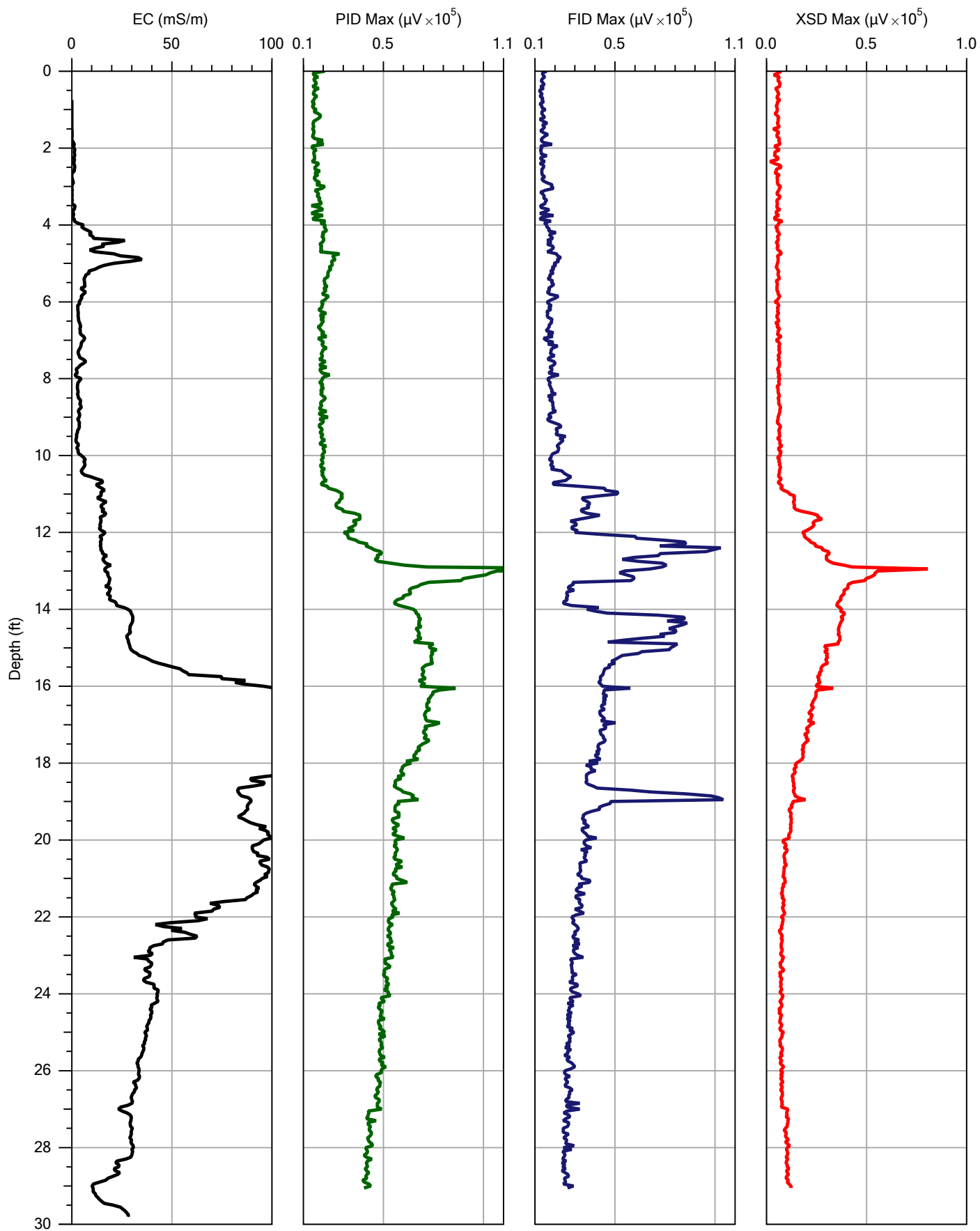
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Date: 12/11/2014
Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

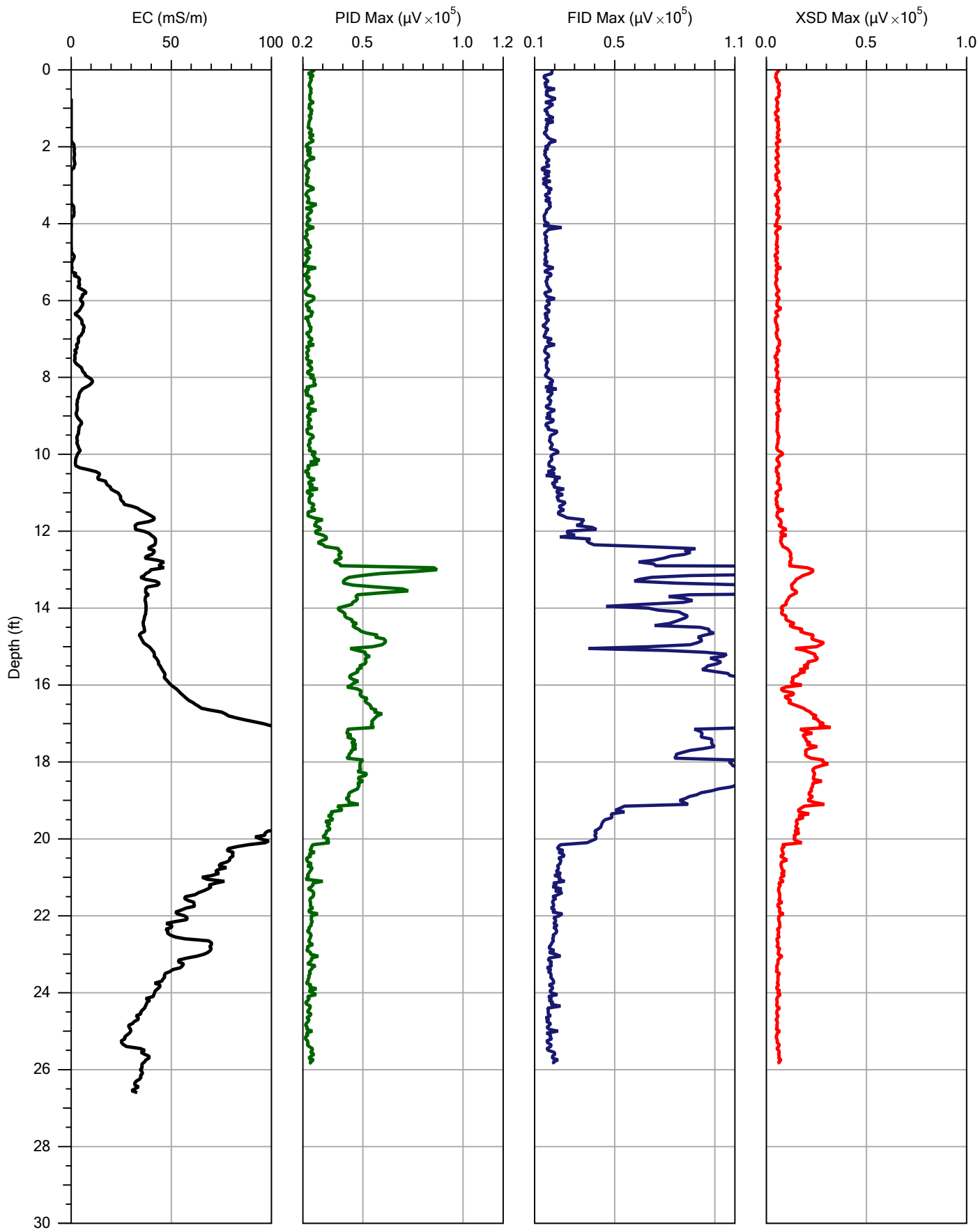
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

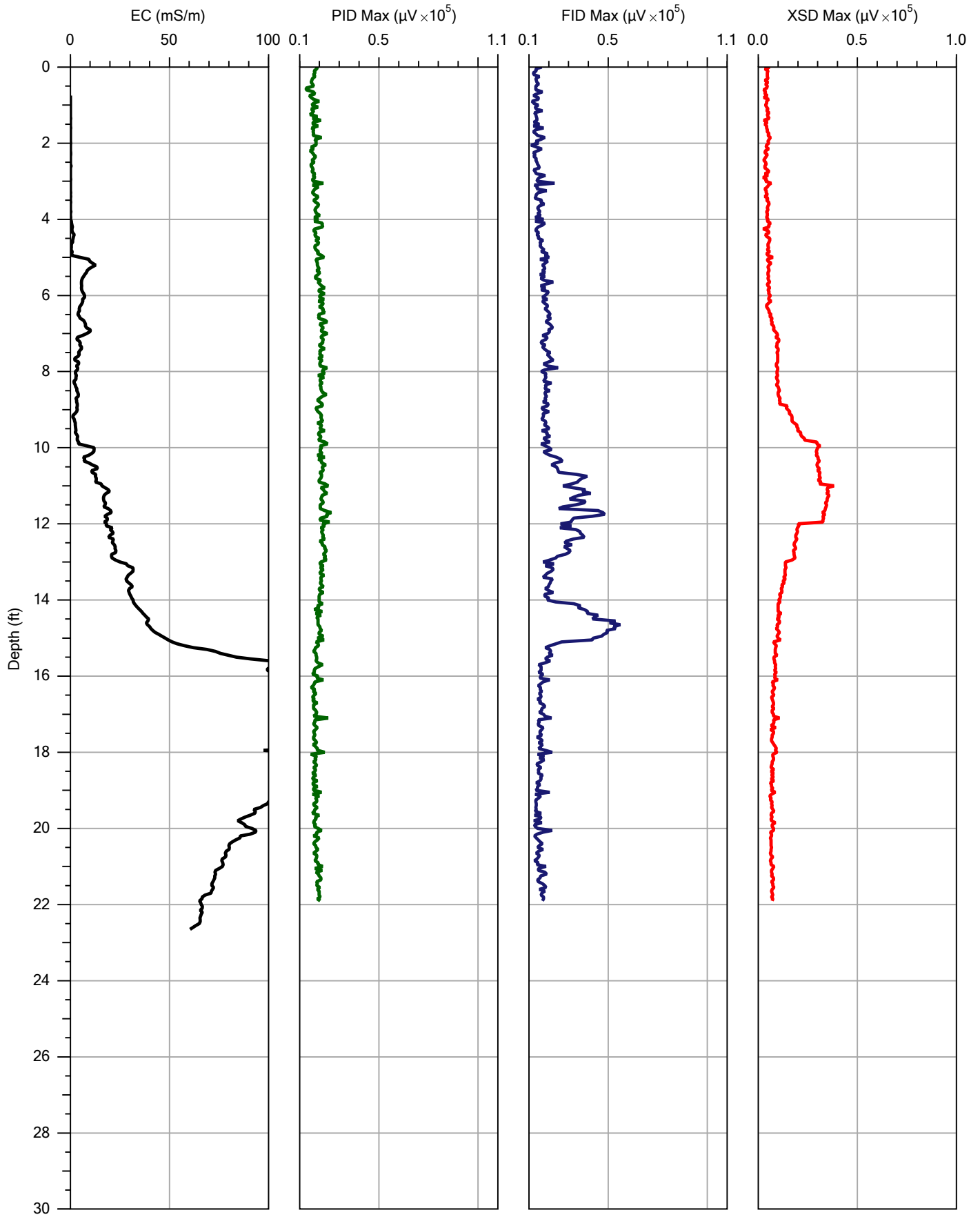
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

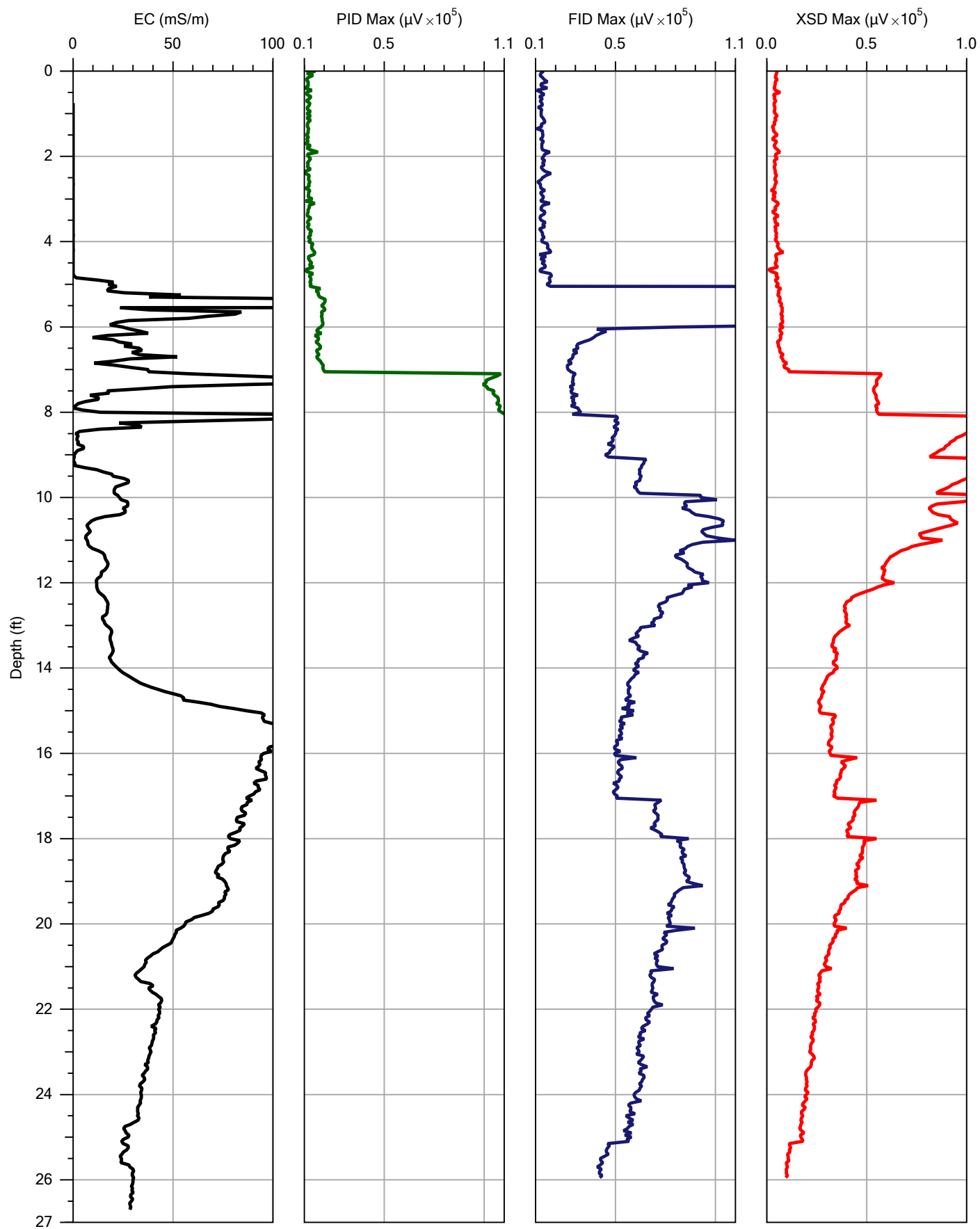
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Company: Matrix Environmental
 Project ID: 319.14

Operator: M Jensen
 Client: CRA

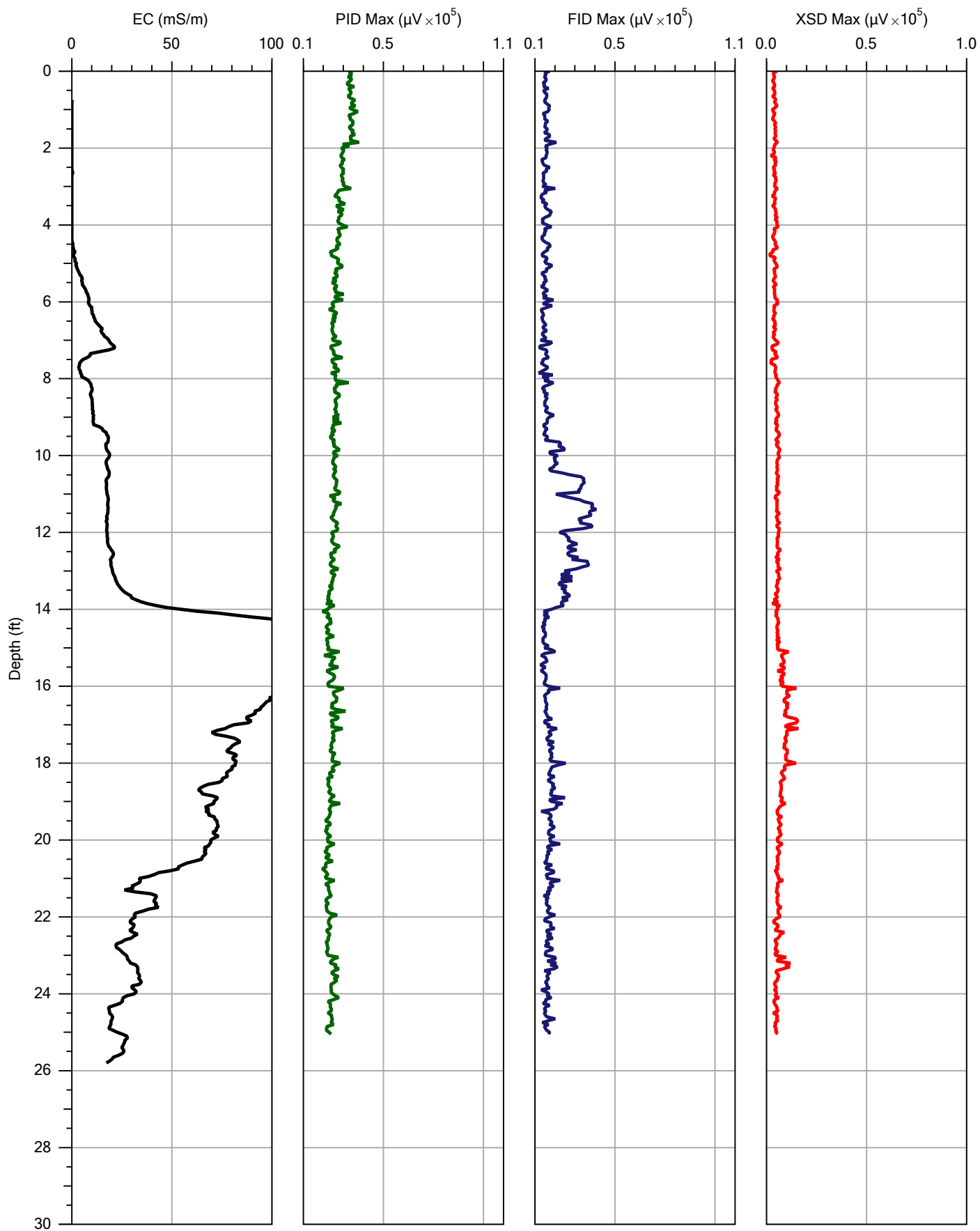
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

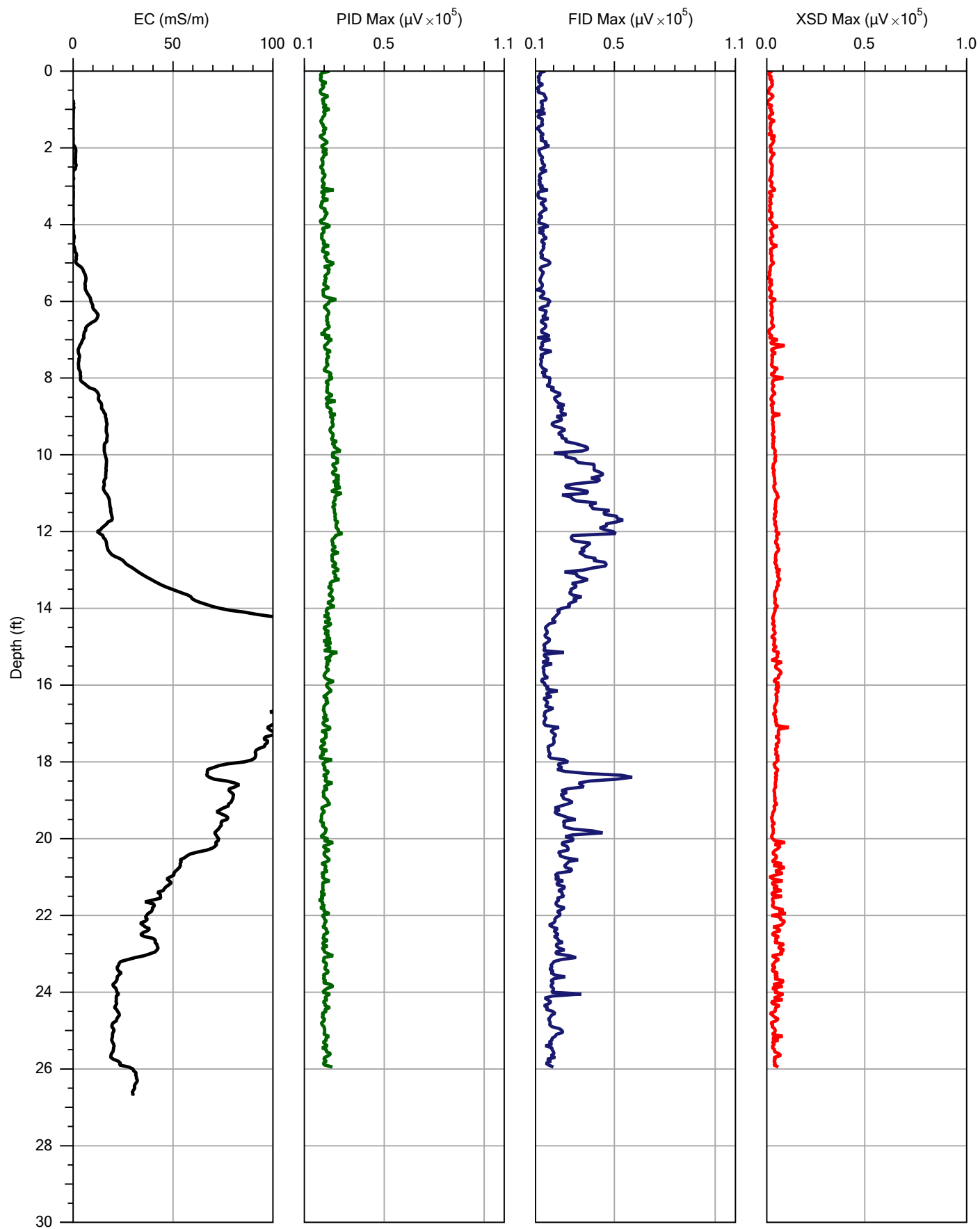
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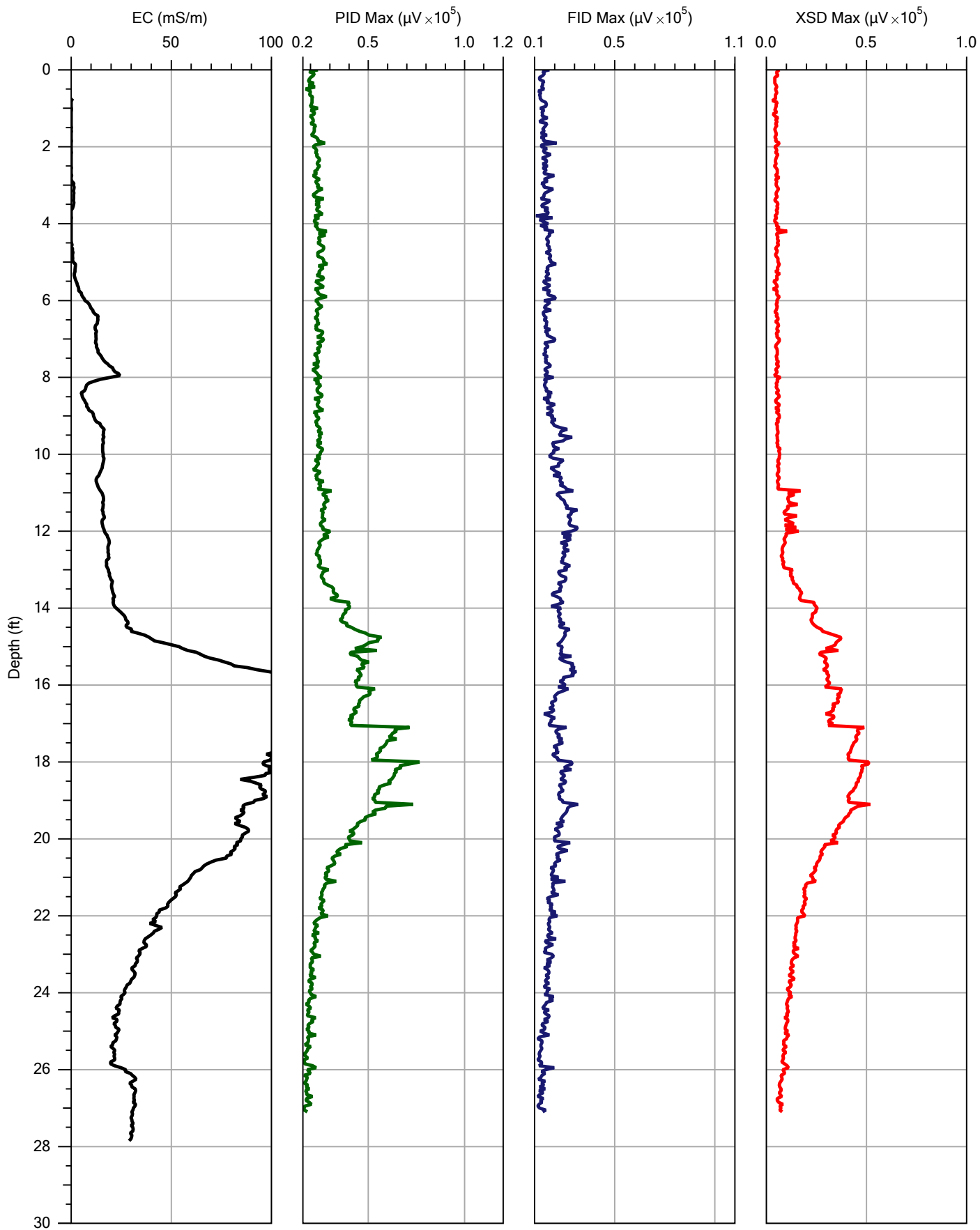
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

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Date:	12/12/2014
Location:	



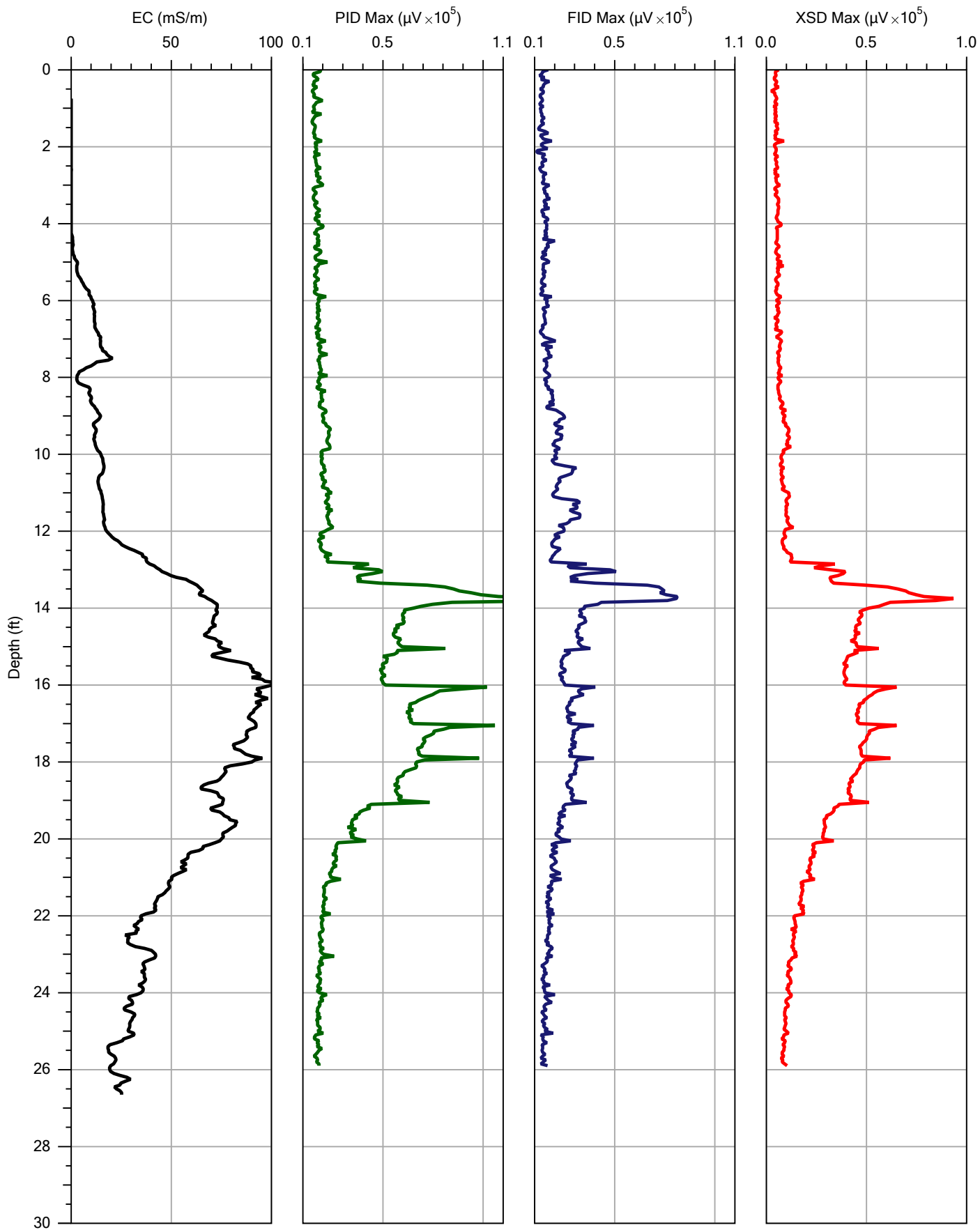
Company: Matrix Environmental		File: MIP-050.MIP
Operator: M Jensen		Date: 12/12/2014
Project ID: 319.14	Client: CRA	Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

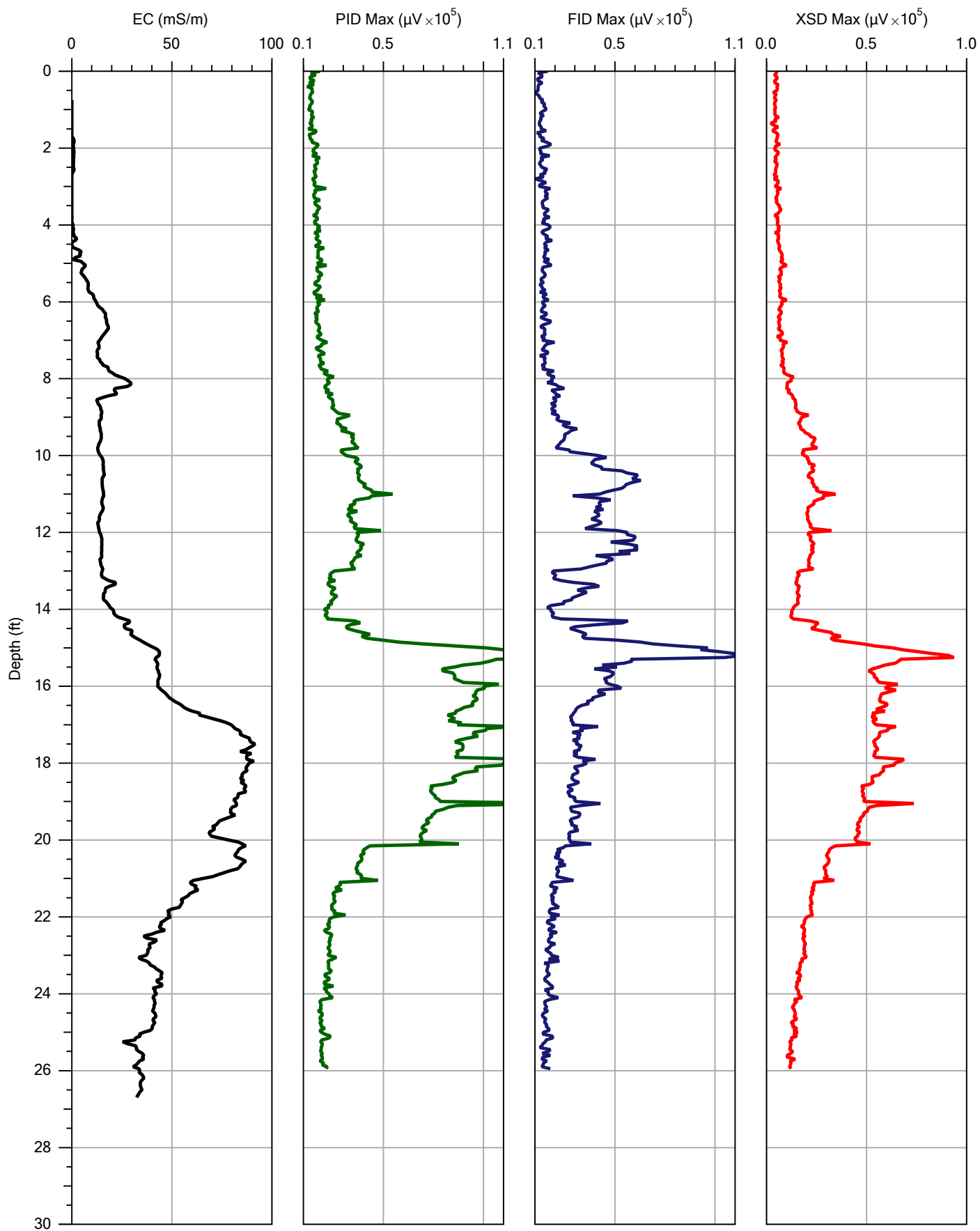
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Date: 12/12/2014
Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

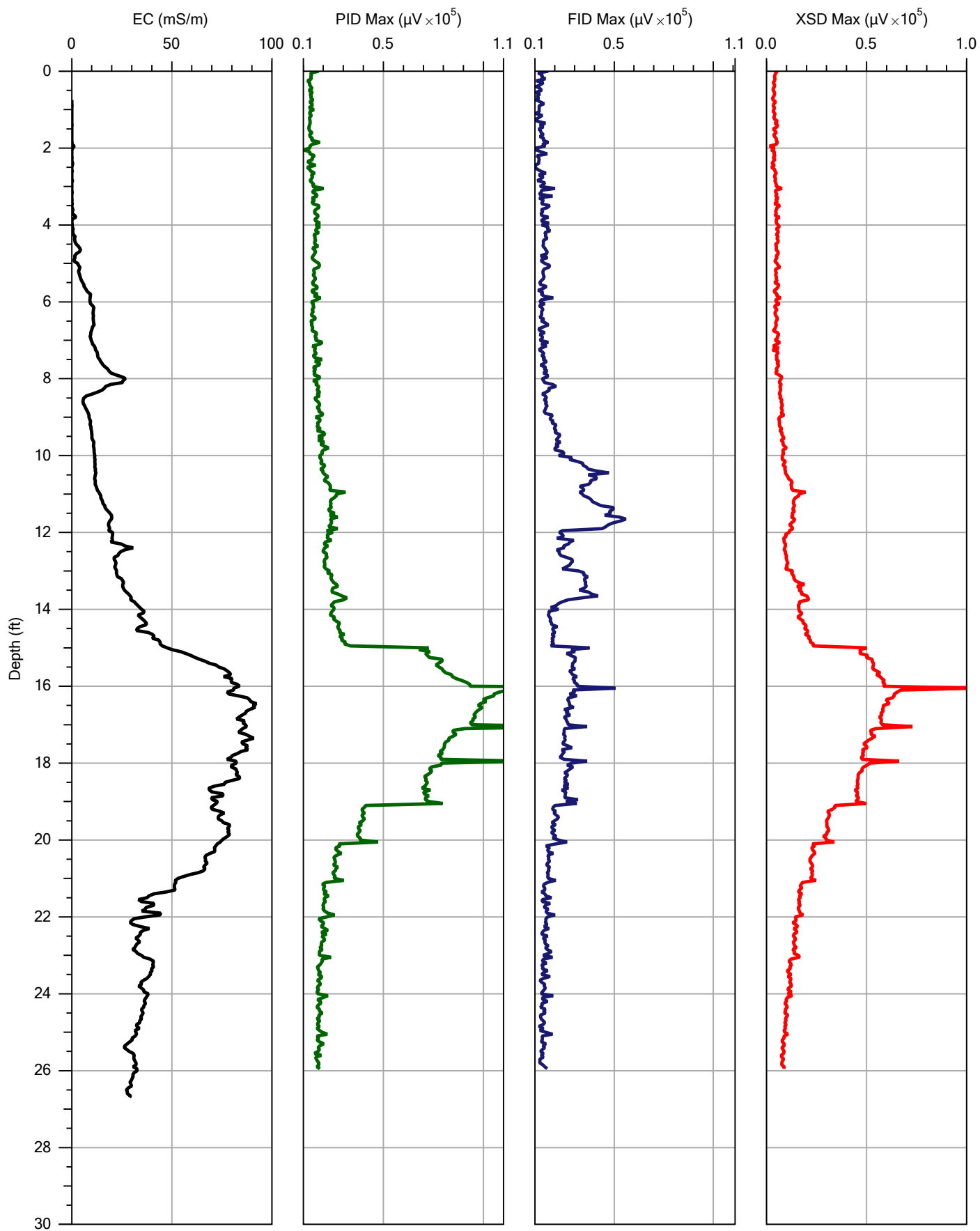
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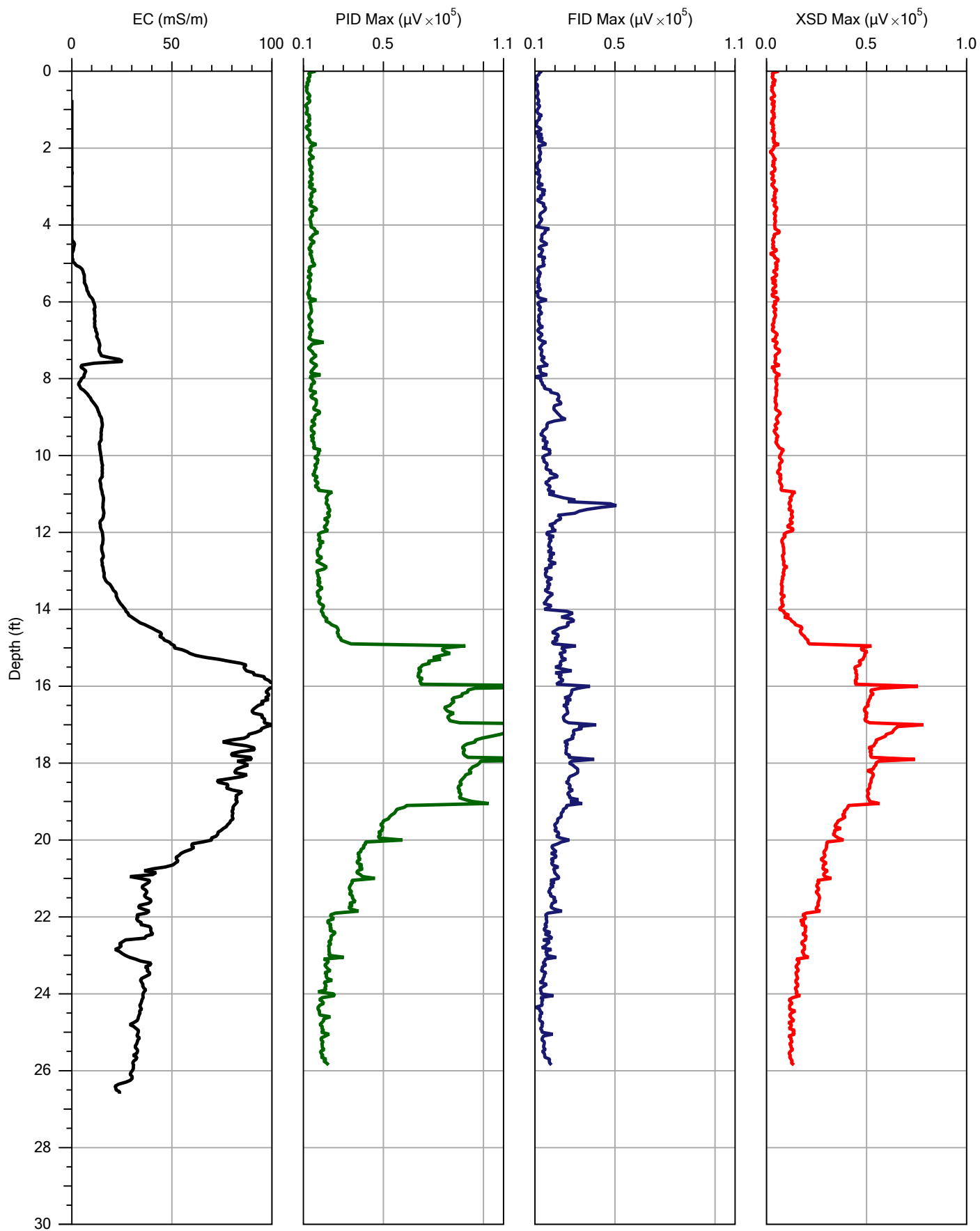
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

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Date:	12/15/2014
Location:	



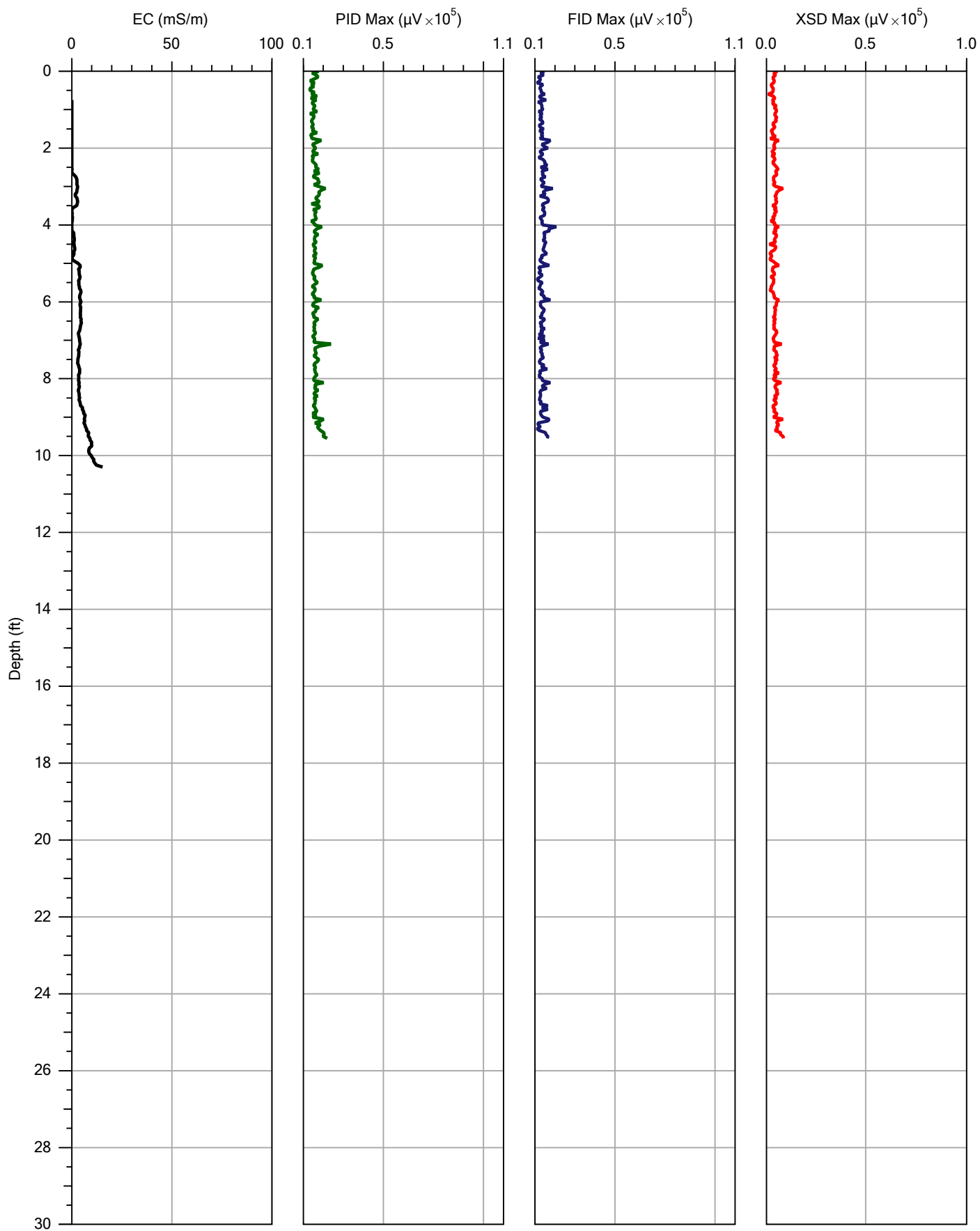
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Project ID:	319.14	Client:	CRA	Date:	12/15/2014
				Location:	



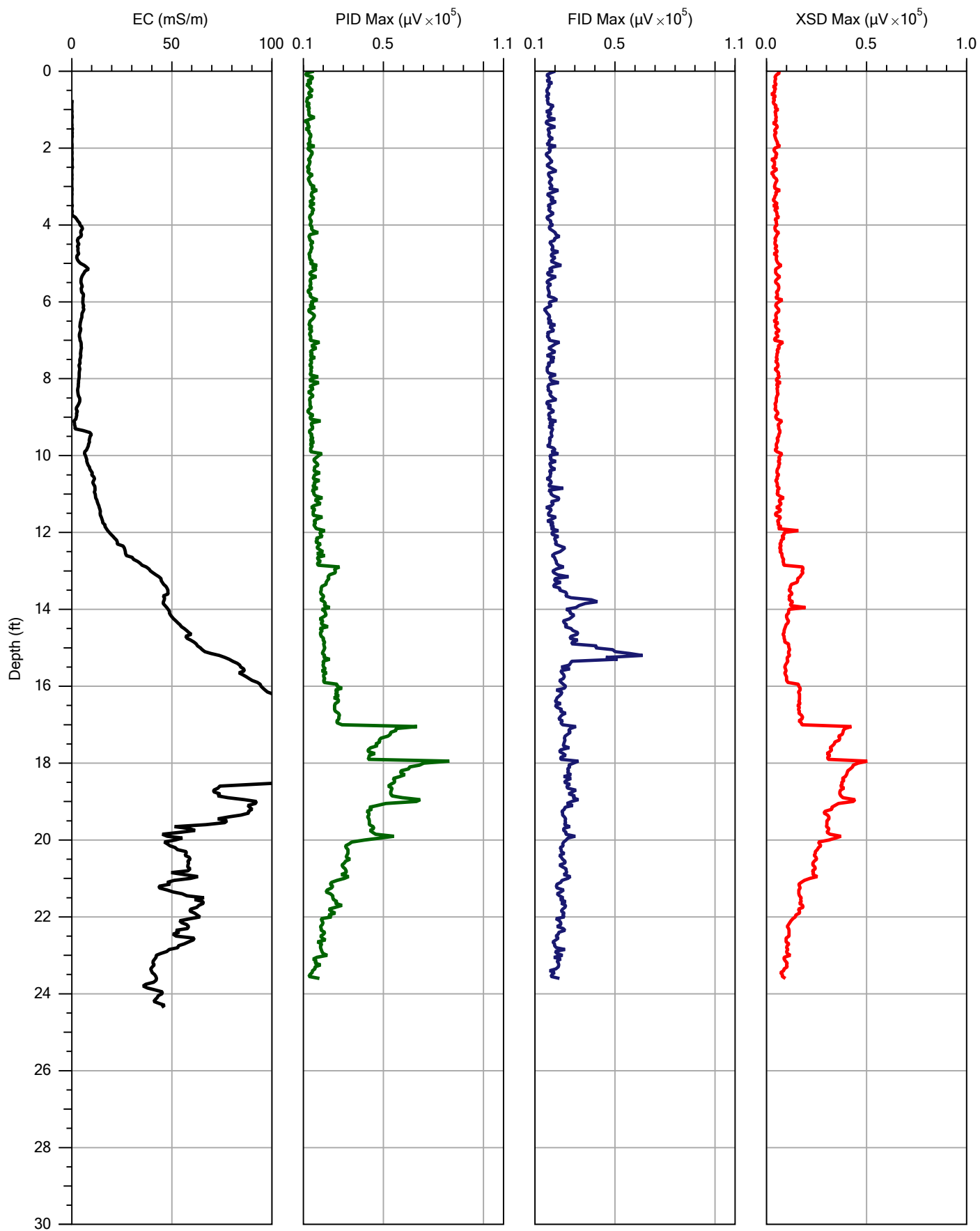
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

File:	MIP-055.MIP
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Location:	



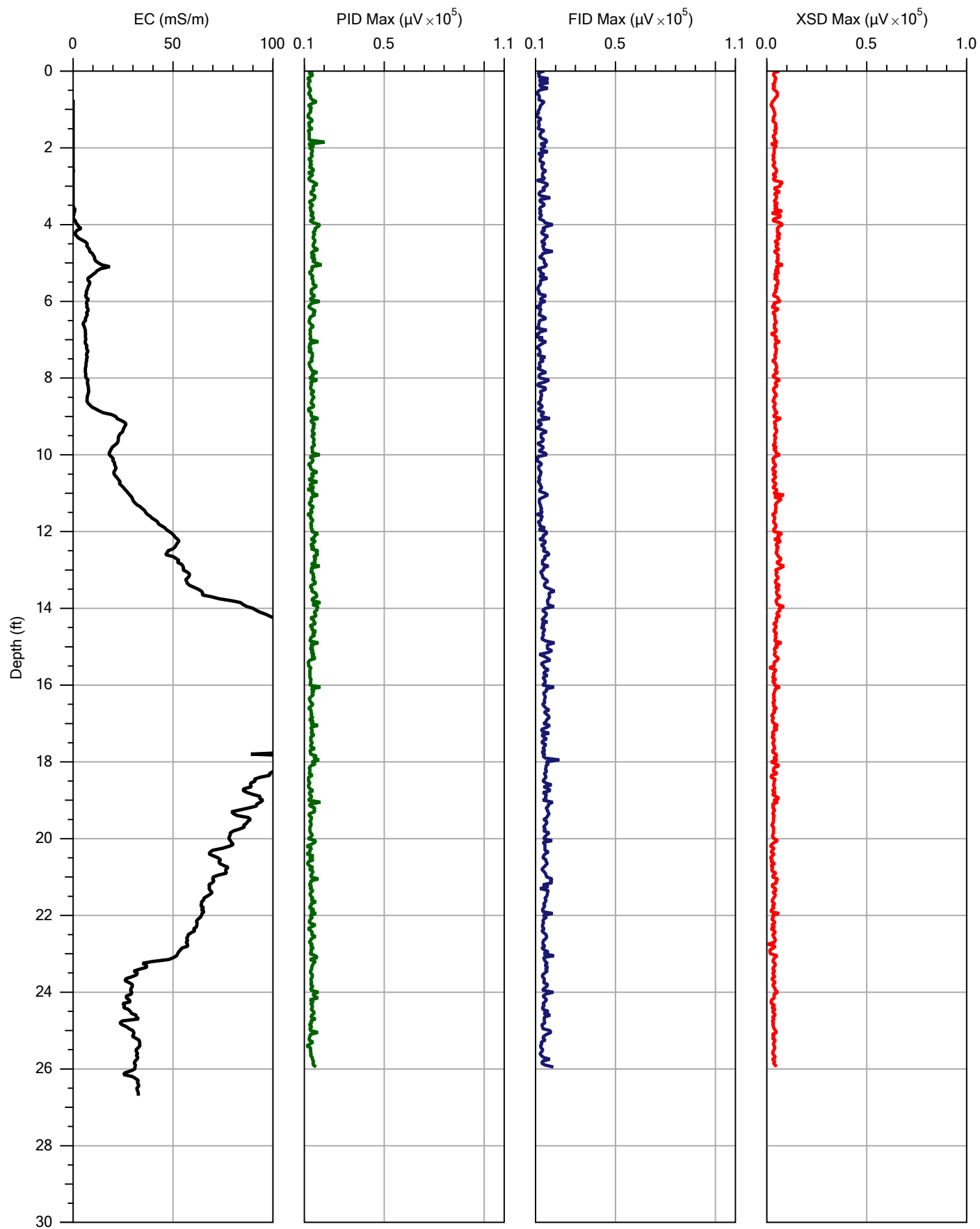
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Project ID:	319.14	Client:	CRA	Date:	12/15/2014
				Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

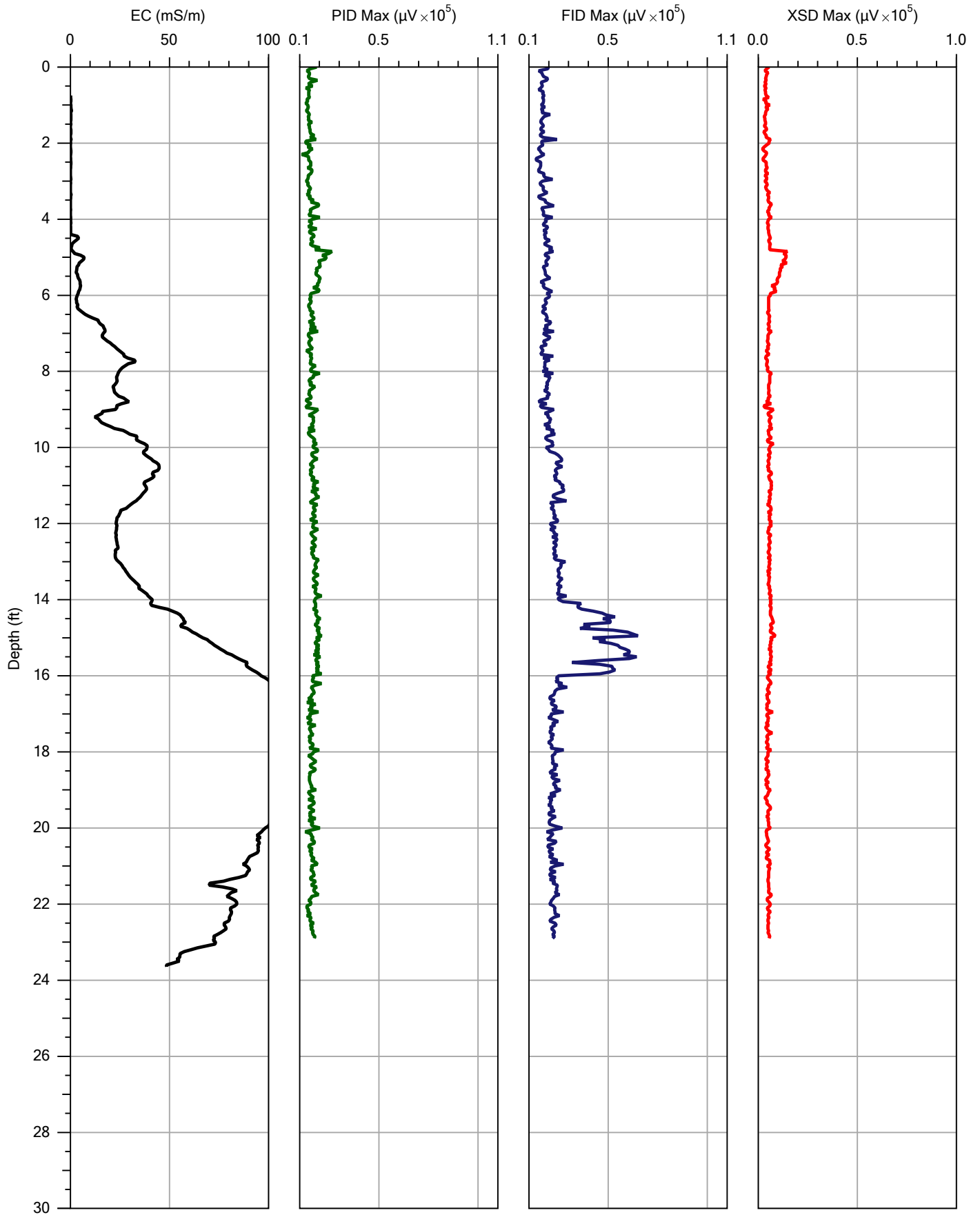
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Date: 12/16/2014
Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

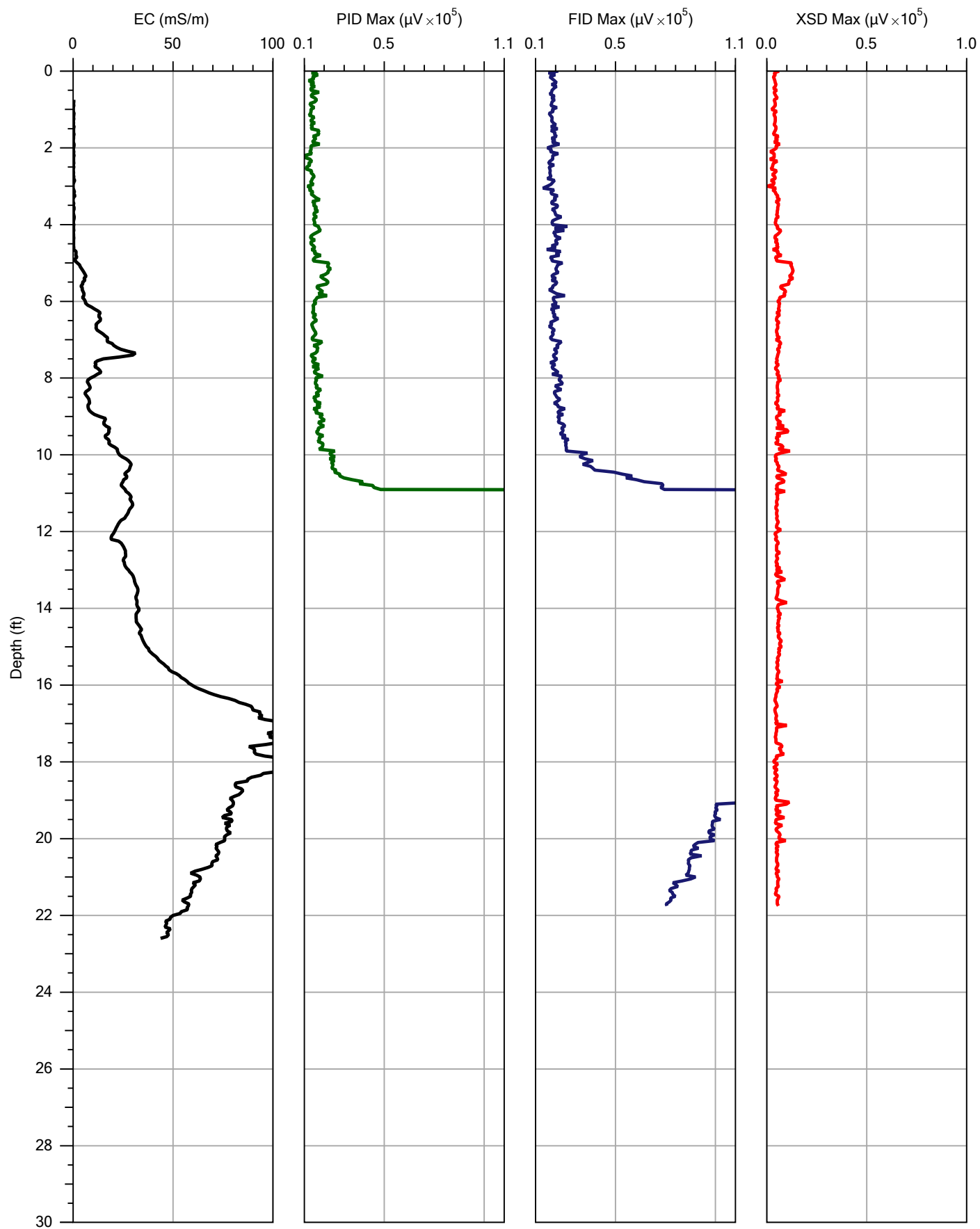
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Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

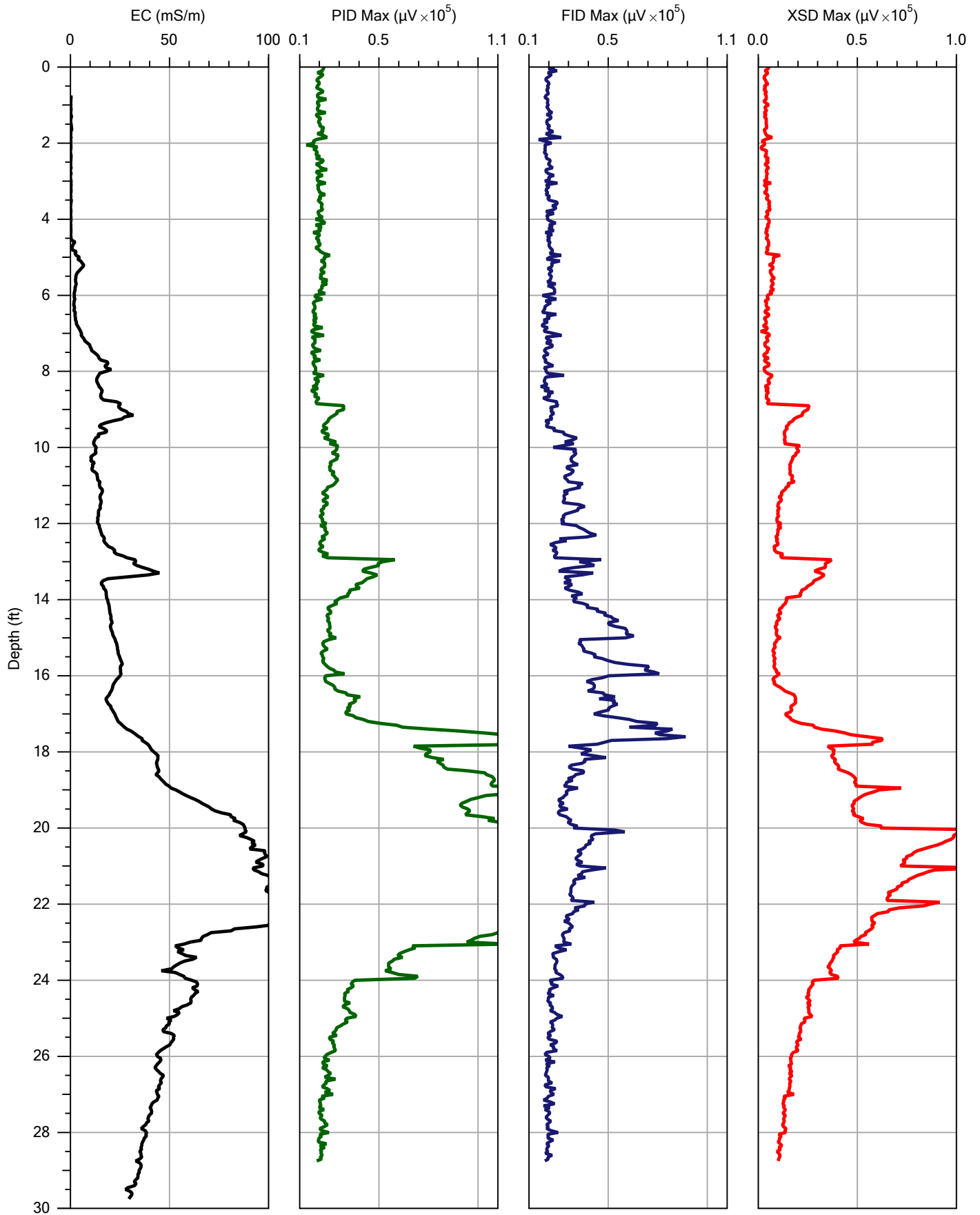
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Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

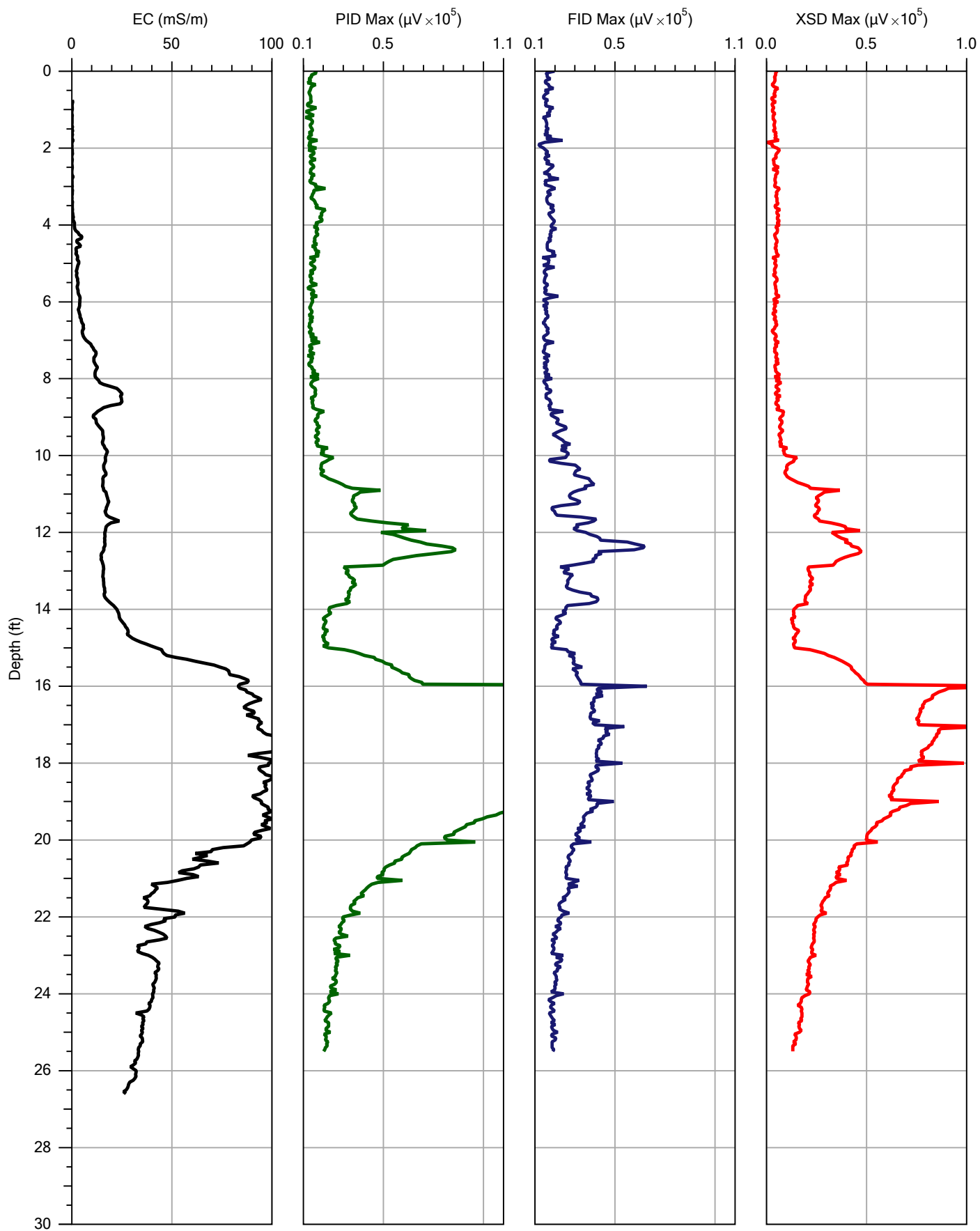
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Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

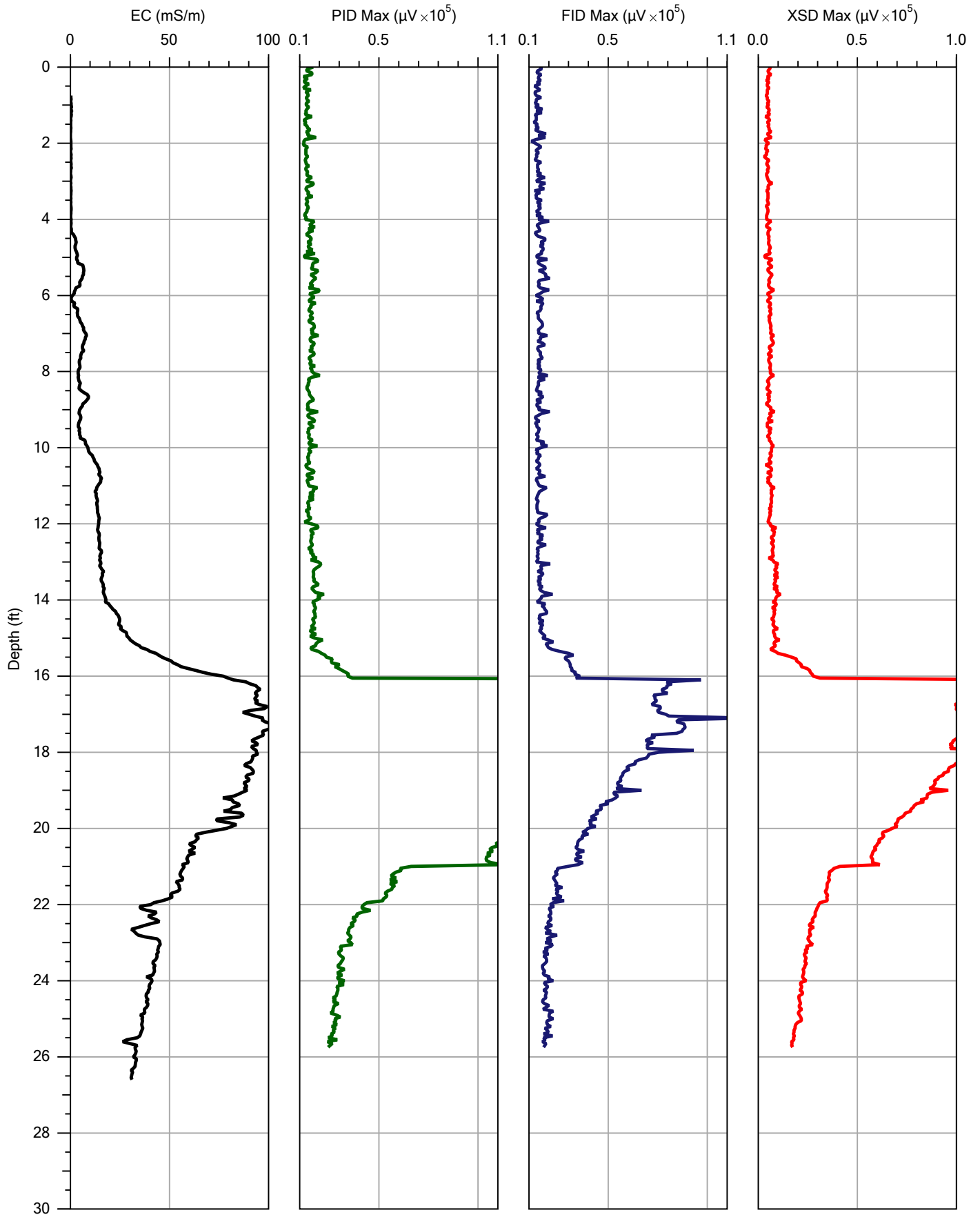
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Date:	12/16/2014
Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

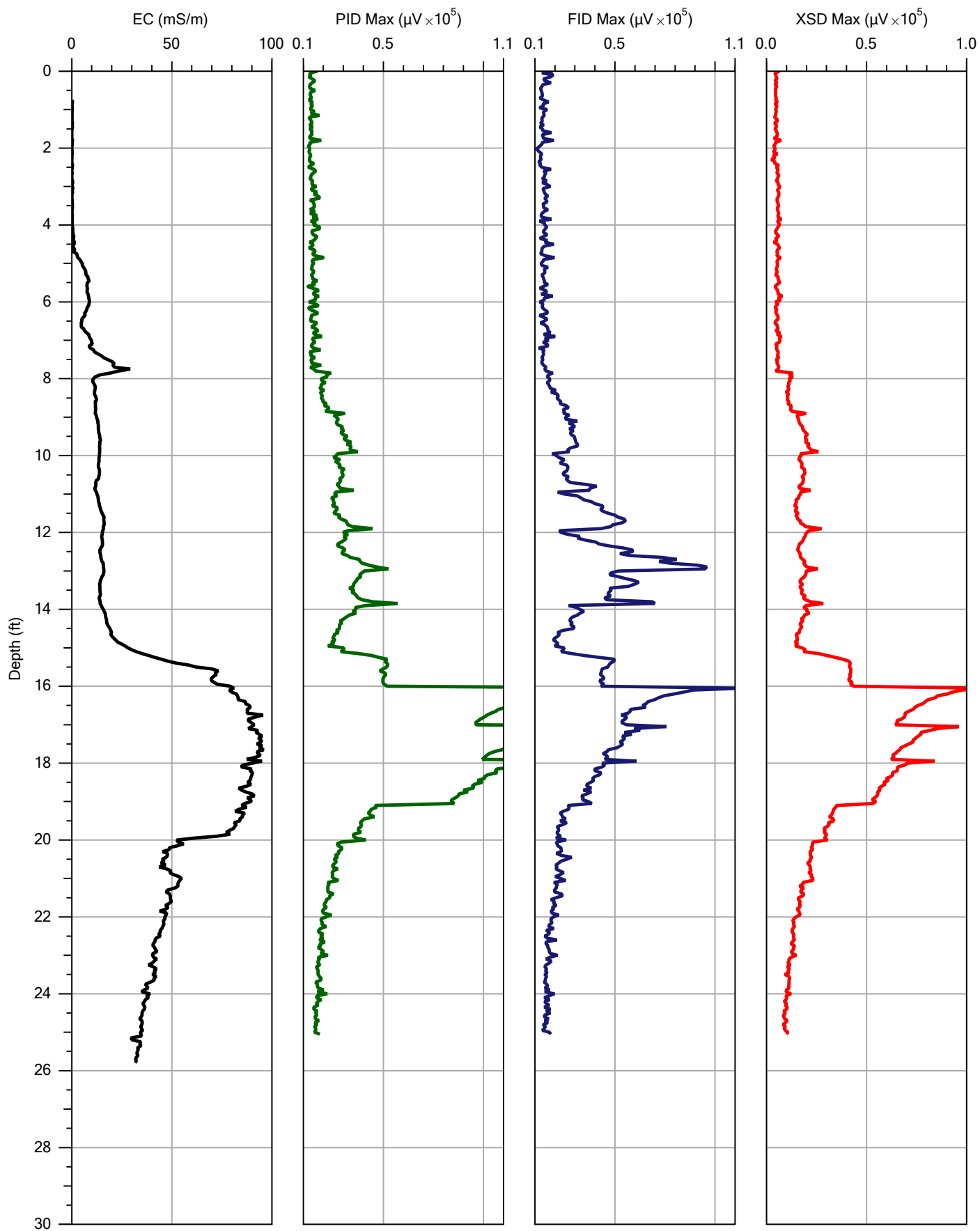
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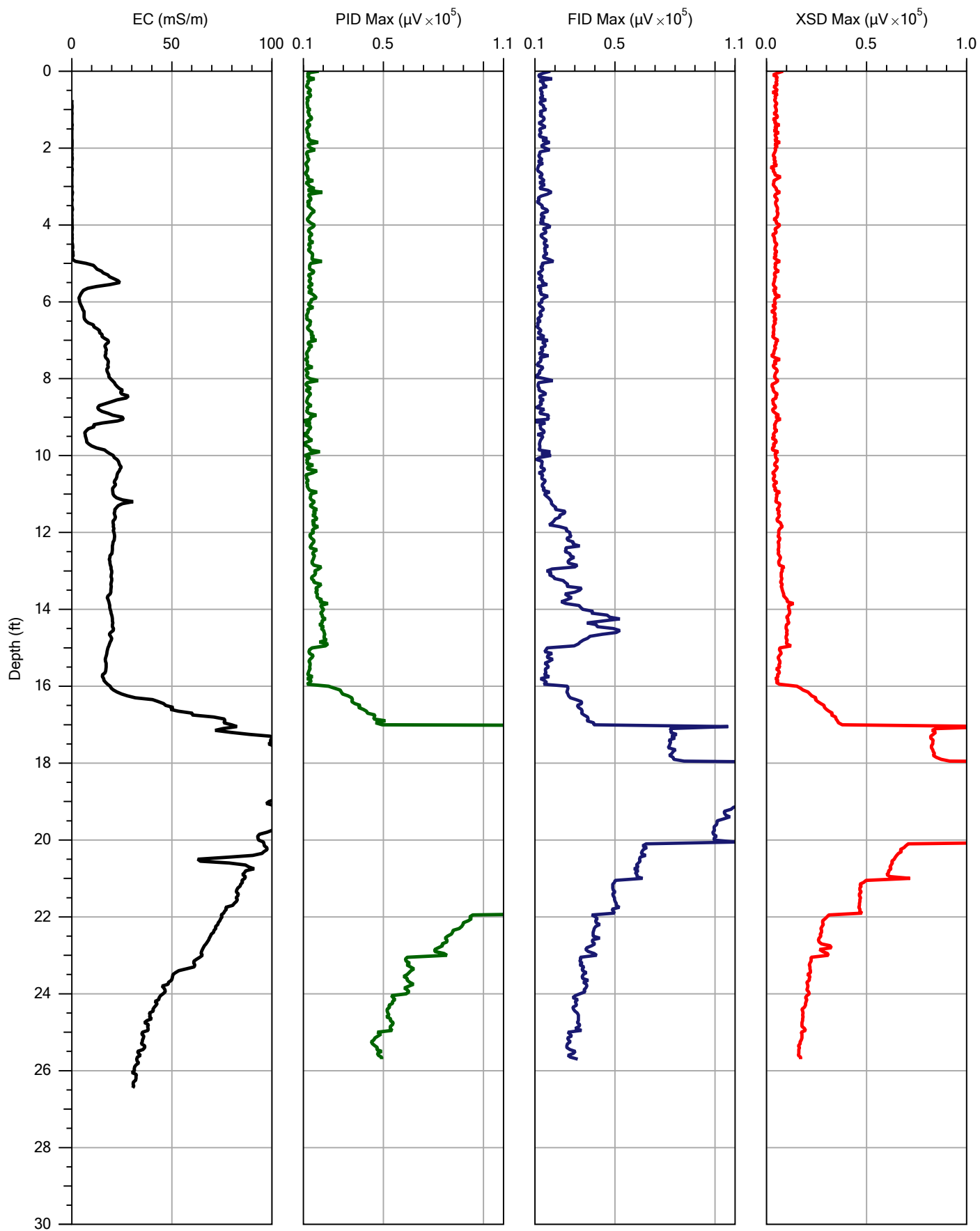
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Project ID: 139.14

Operator: M Jensen
Client: CRA

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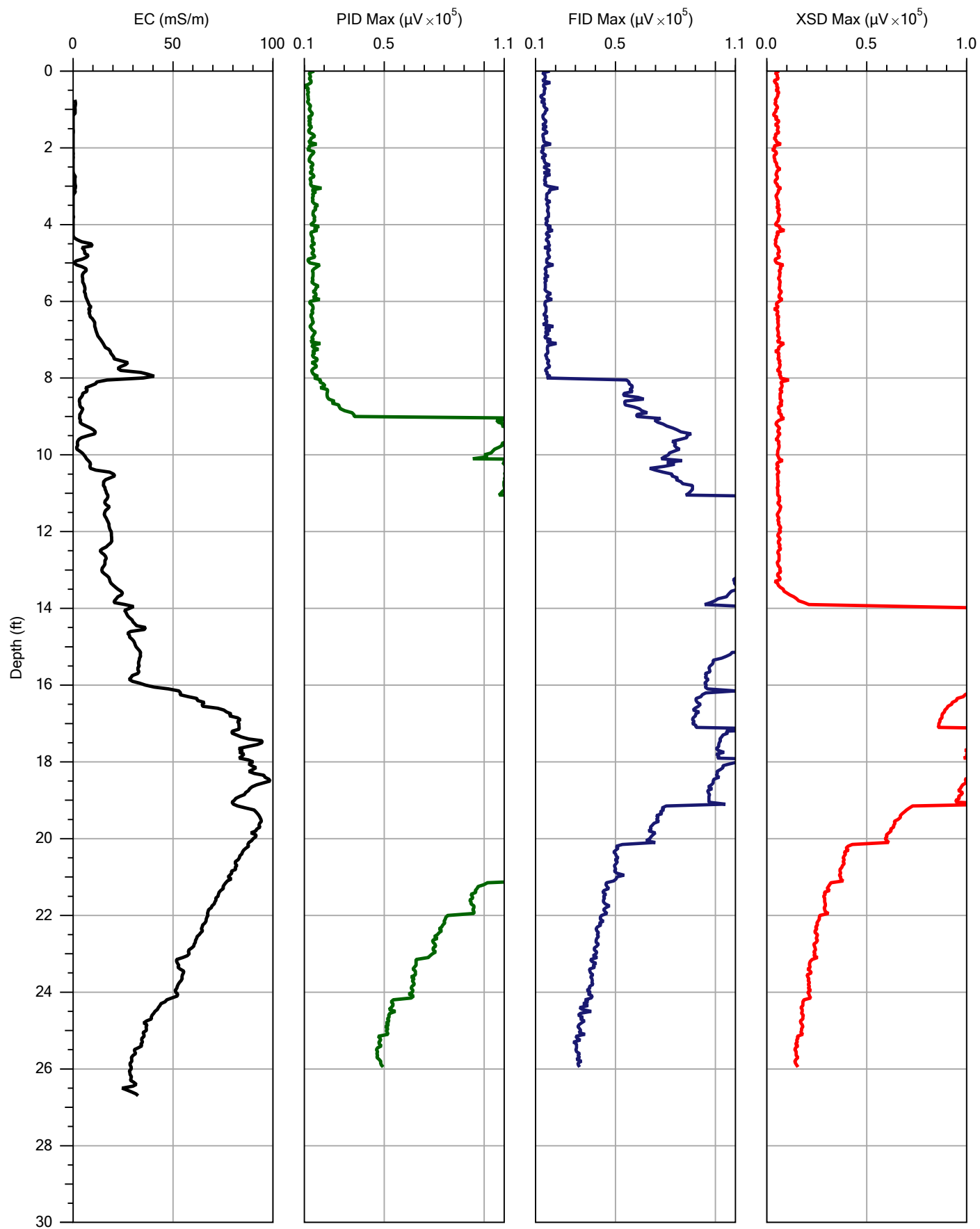
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Project ID:	139.14	Client:	CRA	Date:	12/16/2014
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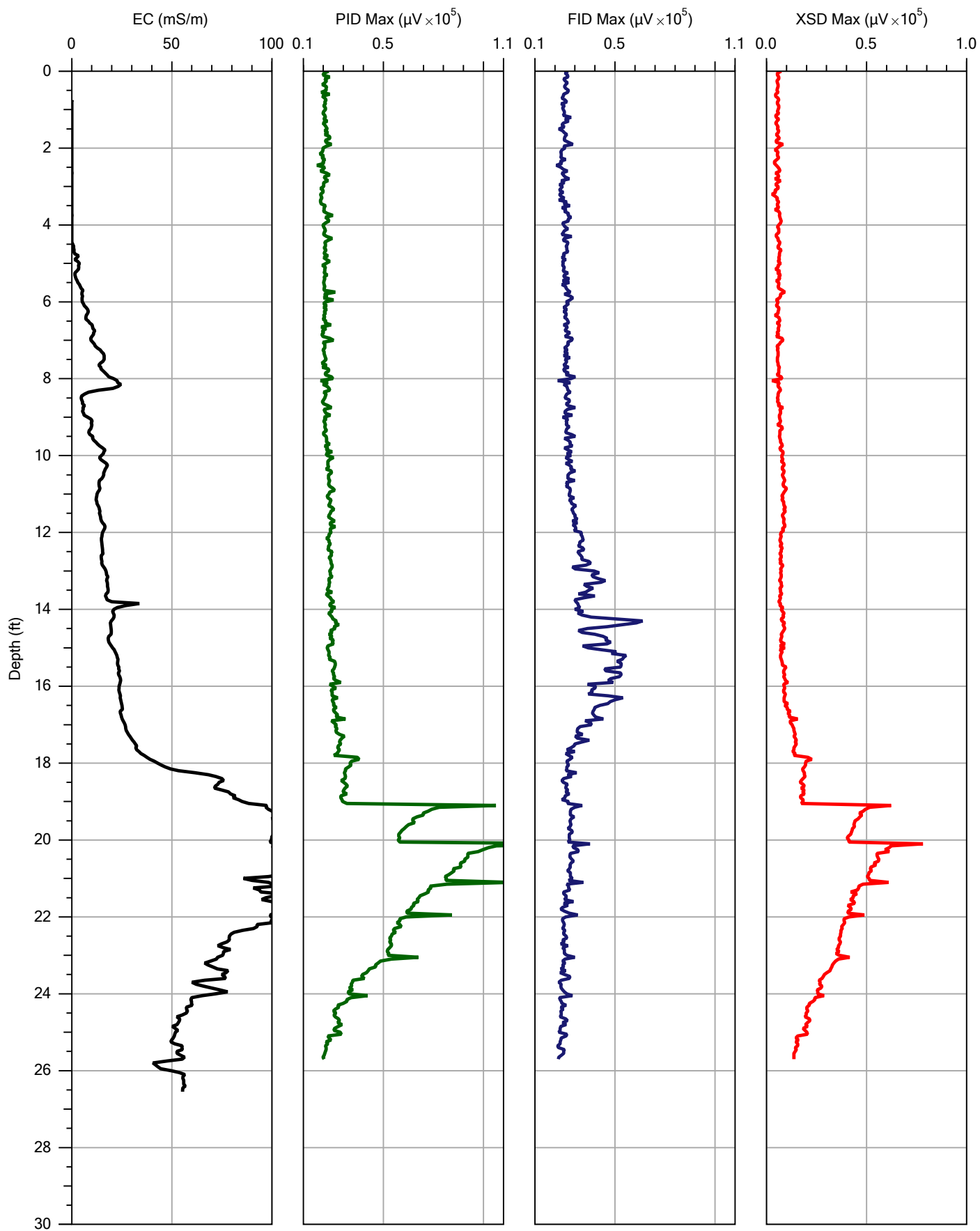
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

File:	MIP-064.MIP
Date:	12/16/2014
Location:	



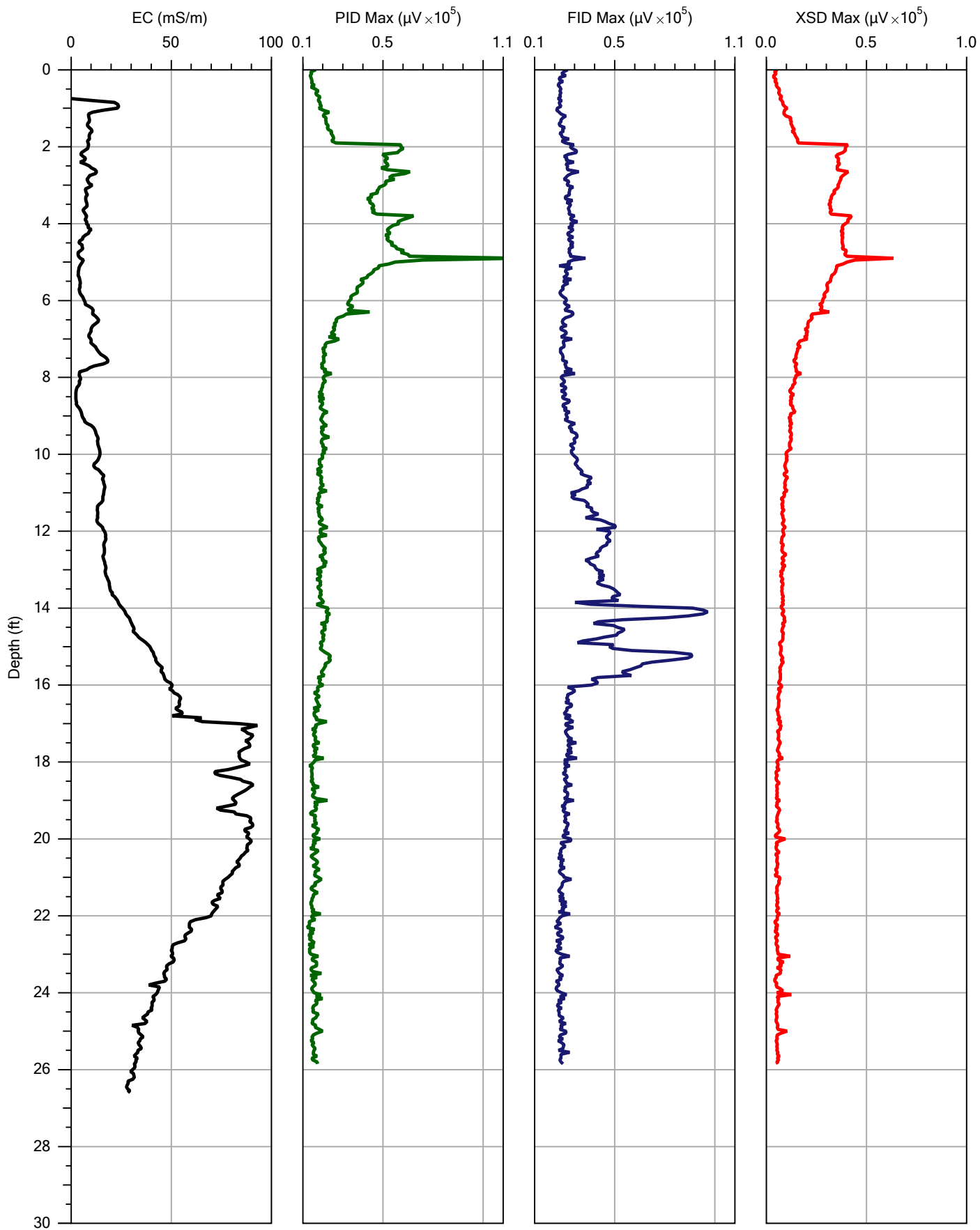
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				Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

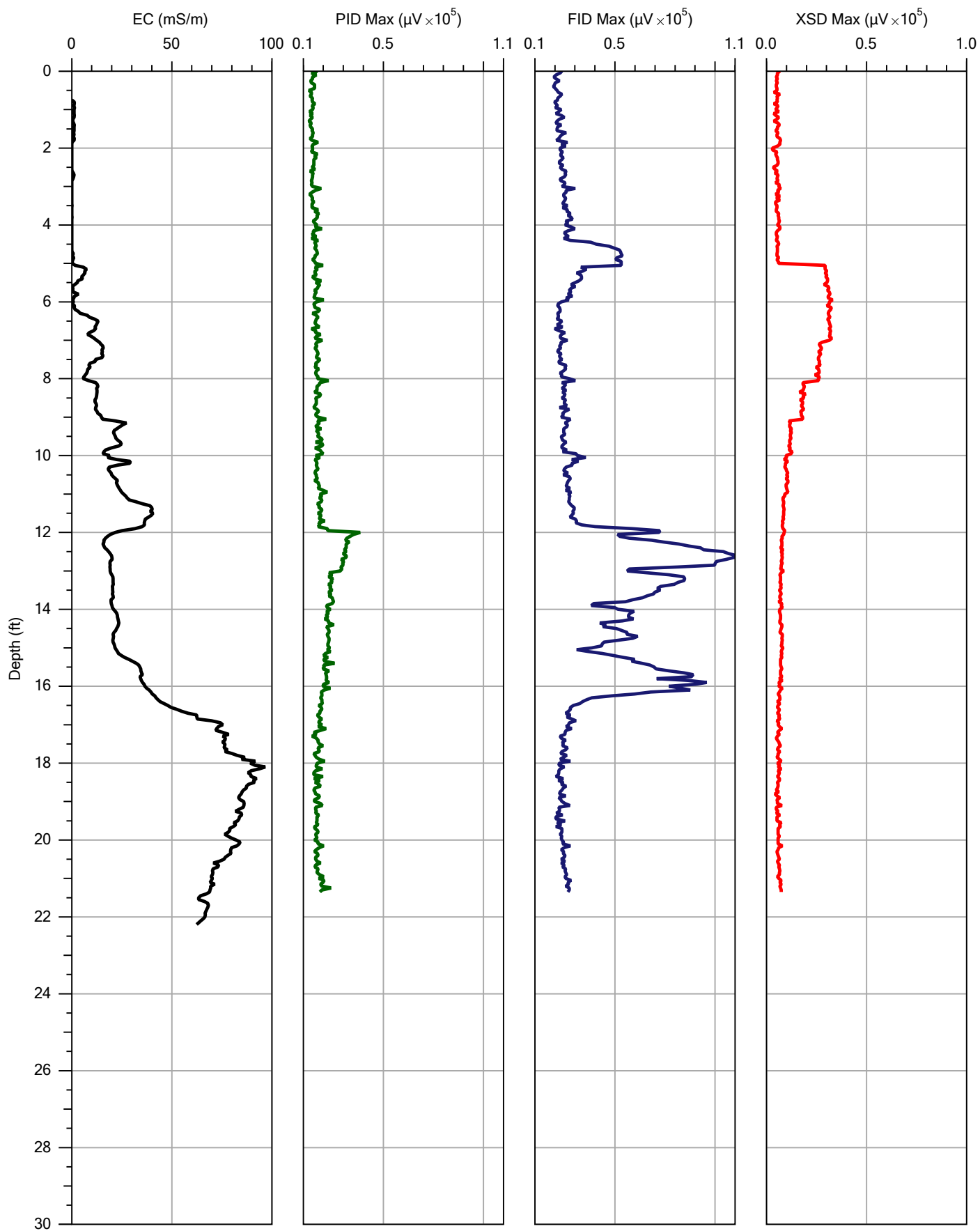
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Project ID: 139.14

Operator: M Jensen
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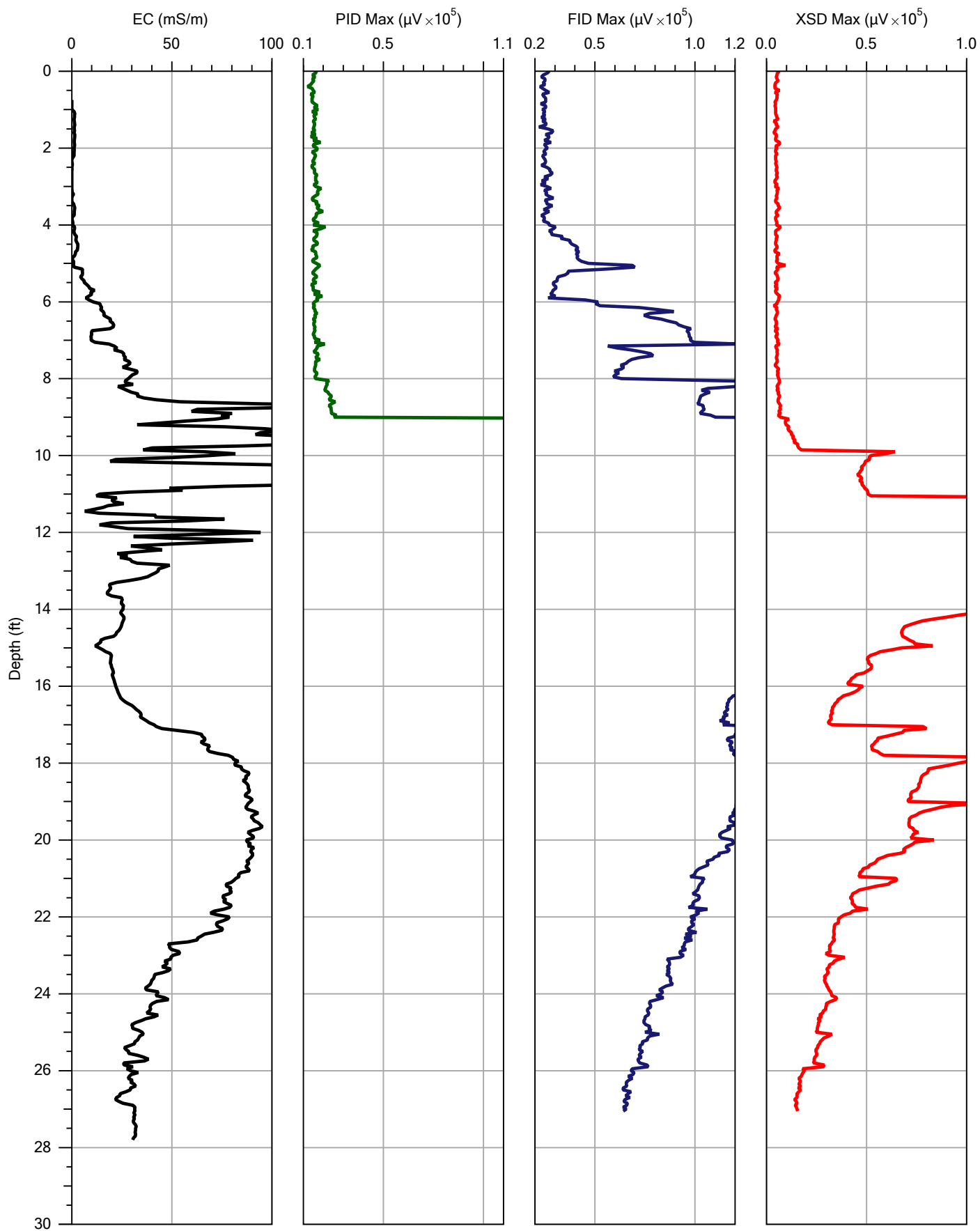
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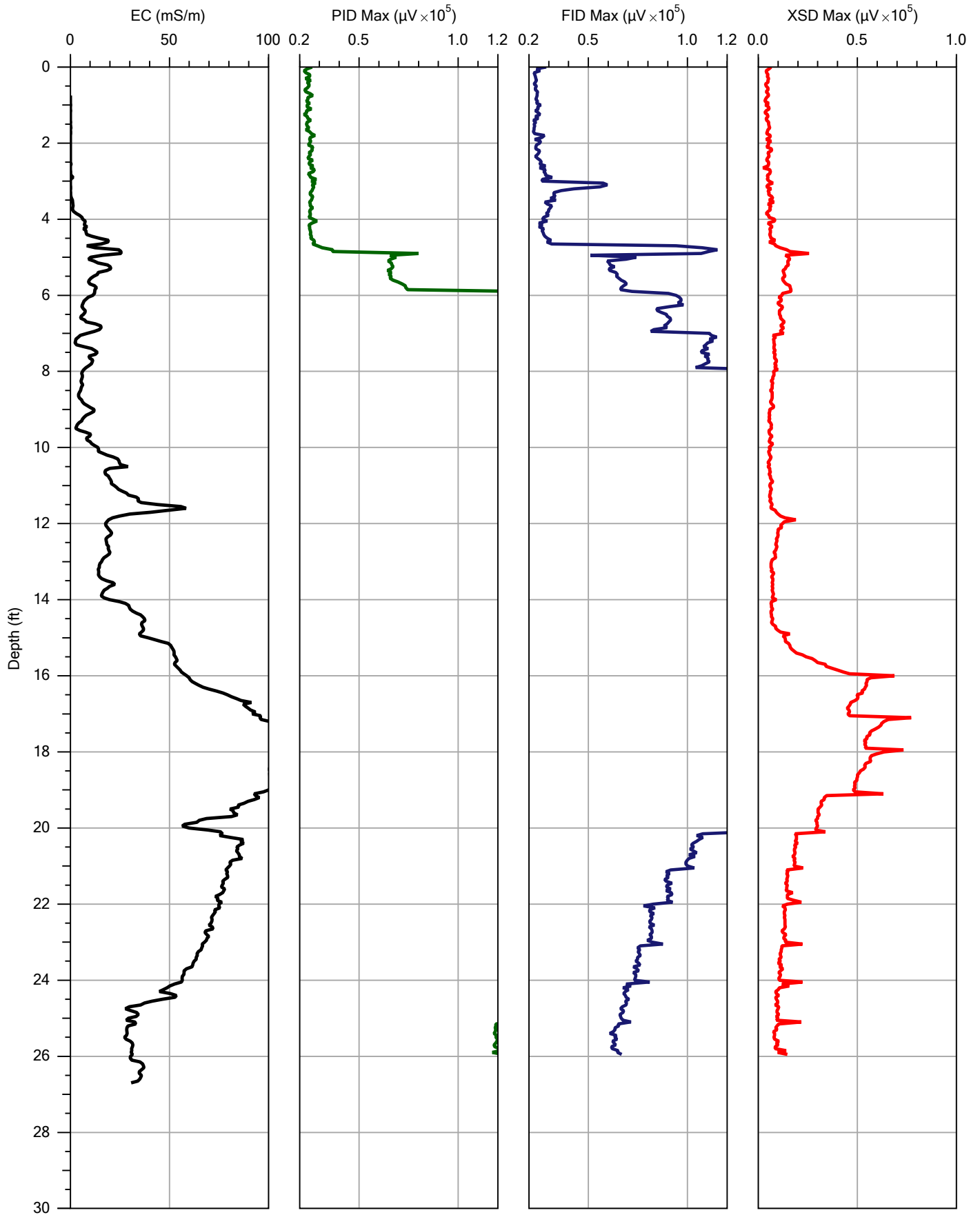
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Operator: M Jenson
Client: CRA

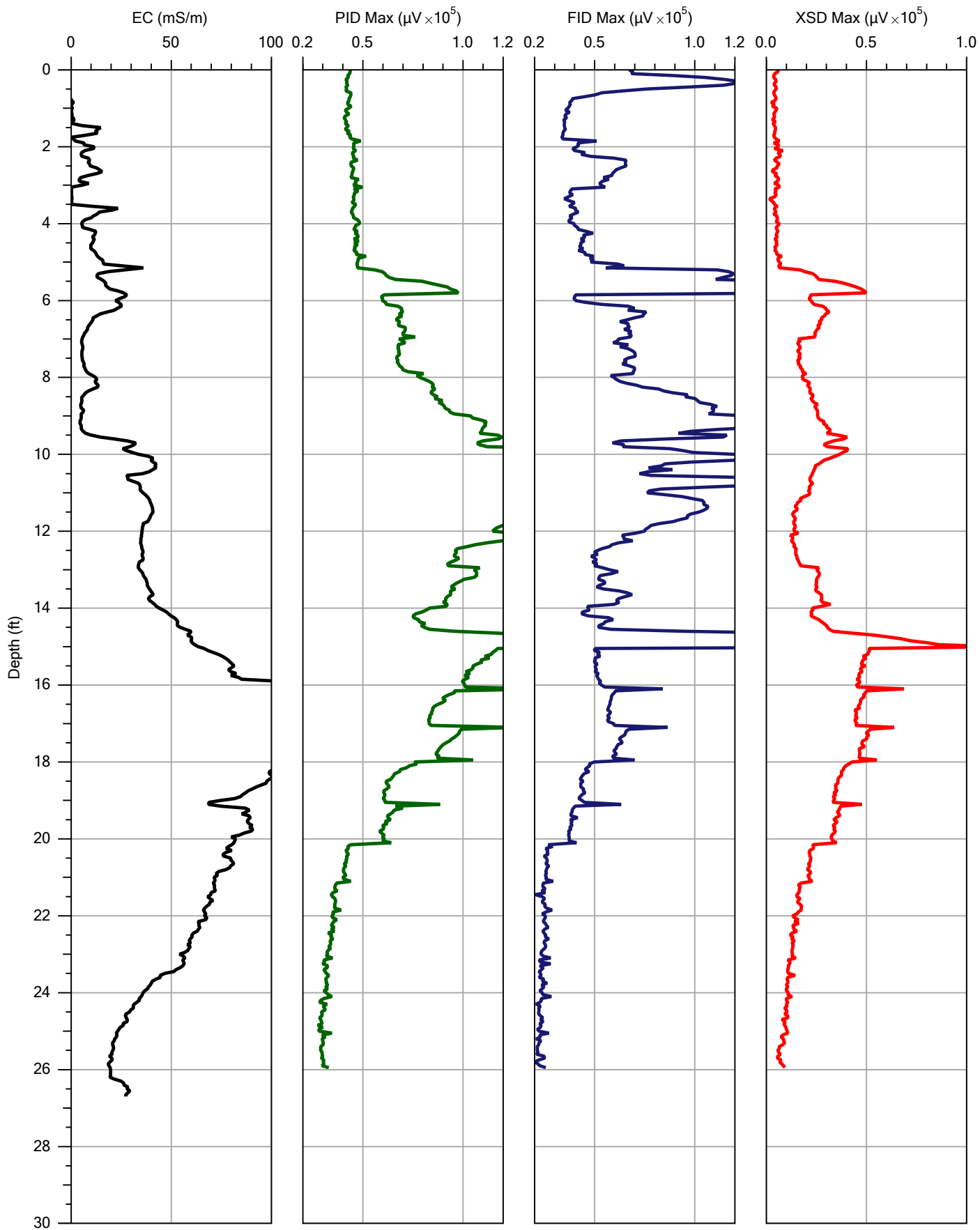
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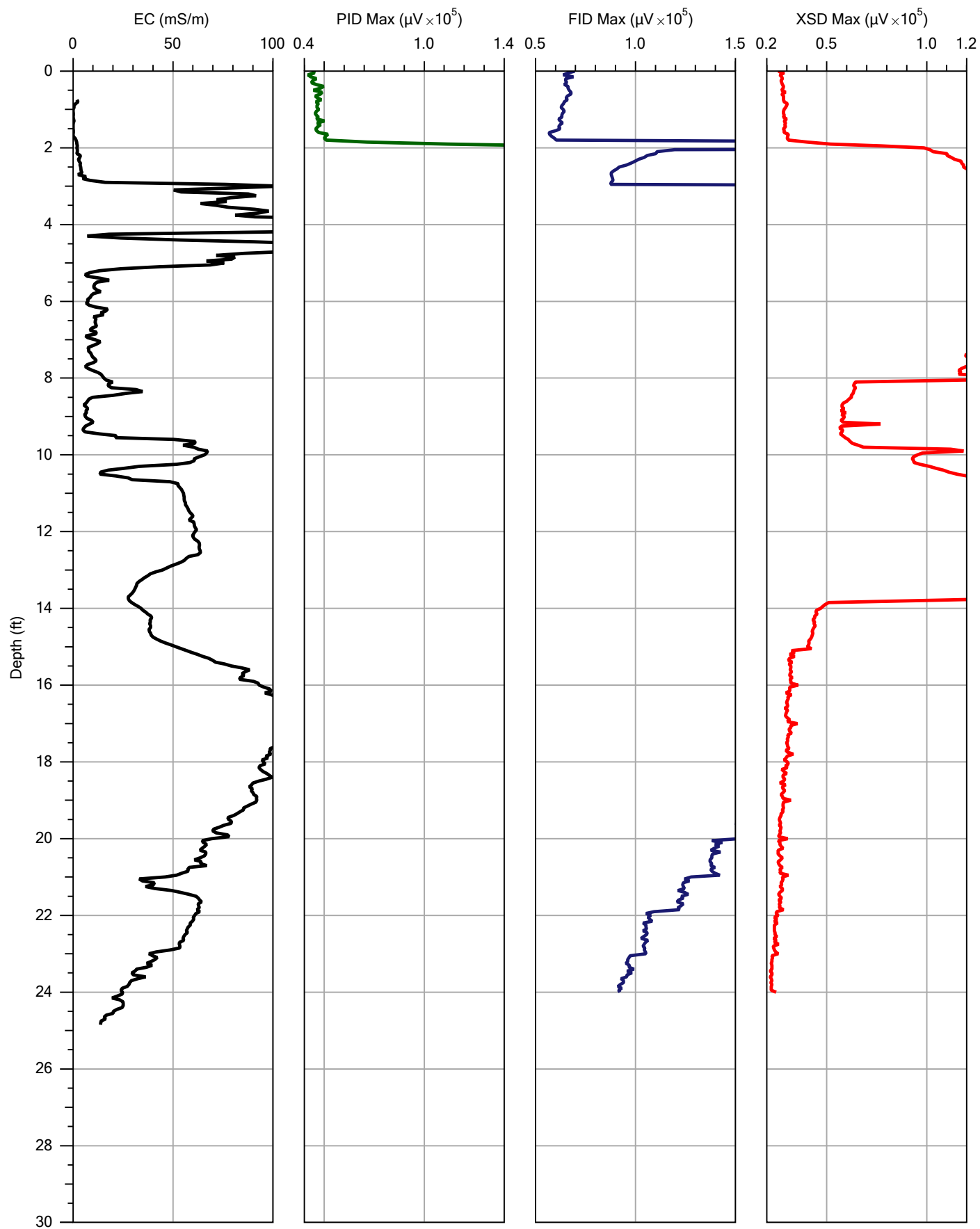
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Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

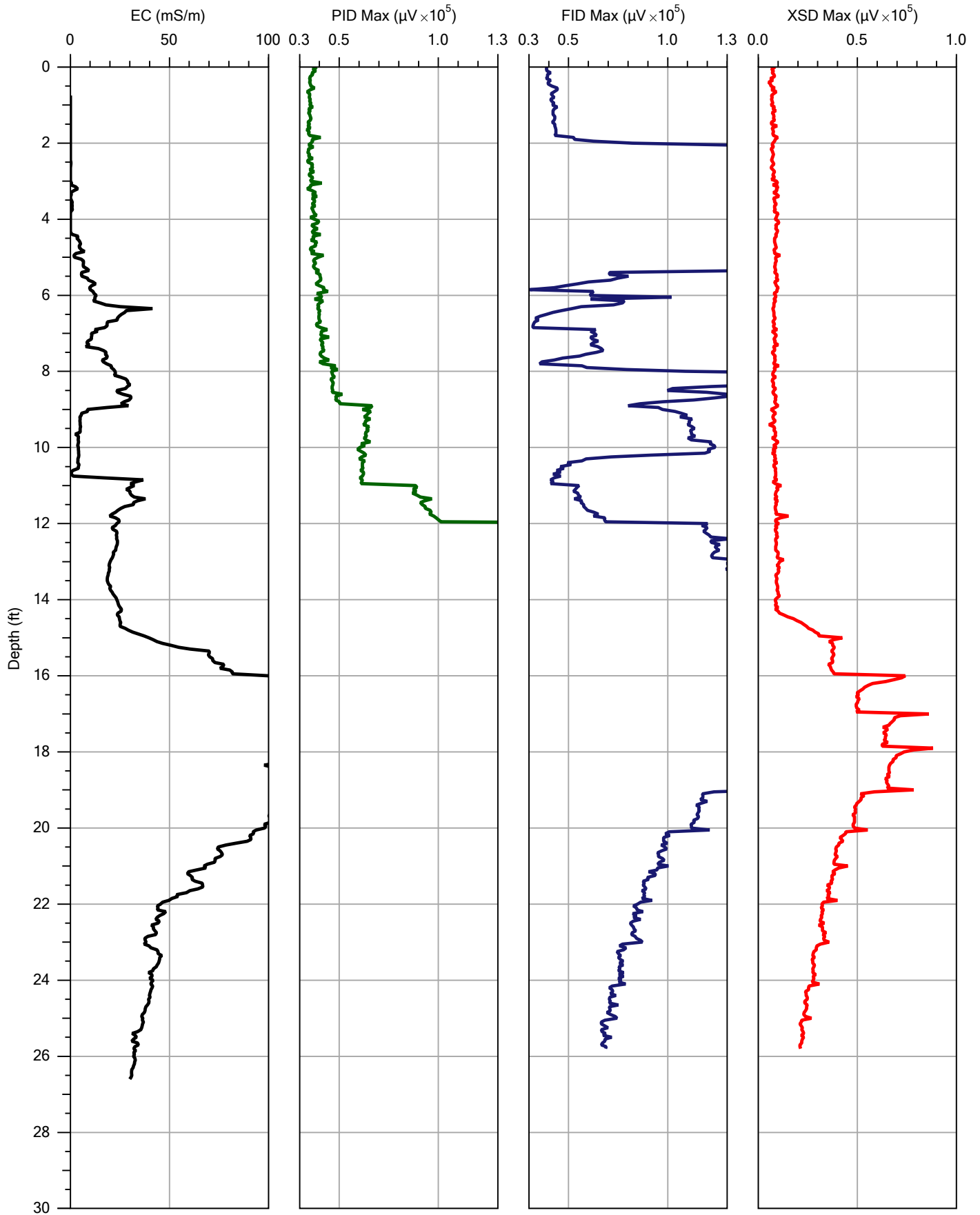
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Company: Matrix Environmental
Project ID: 139.14

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Client: CRA

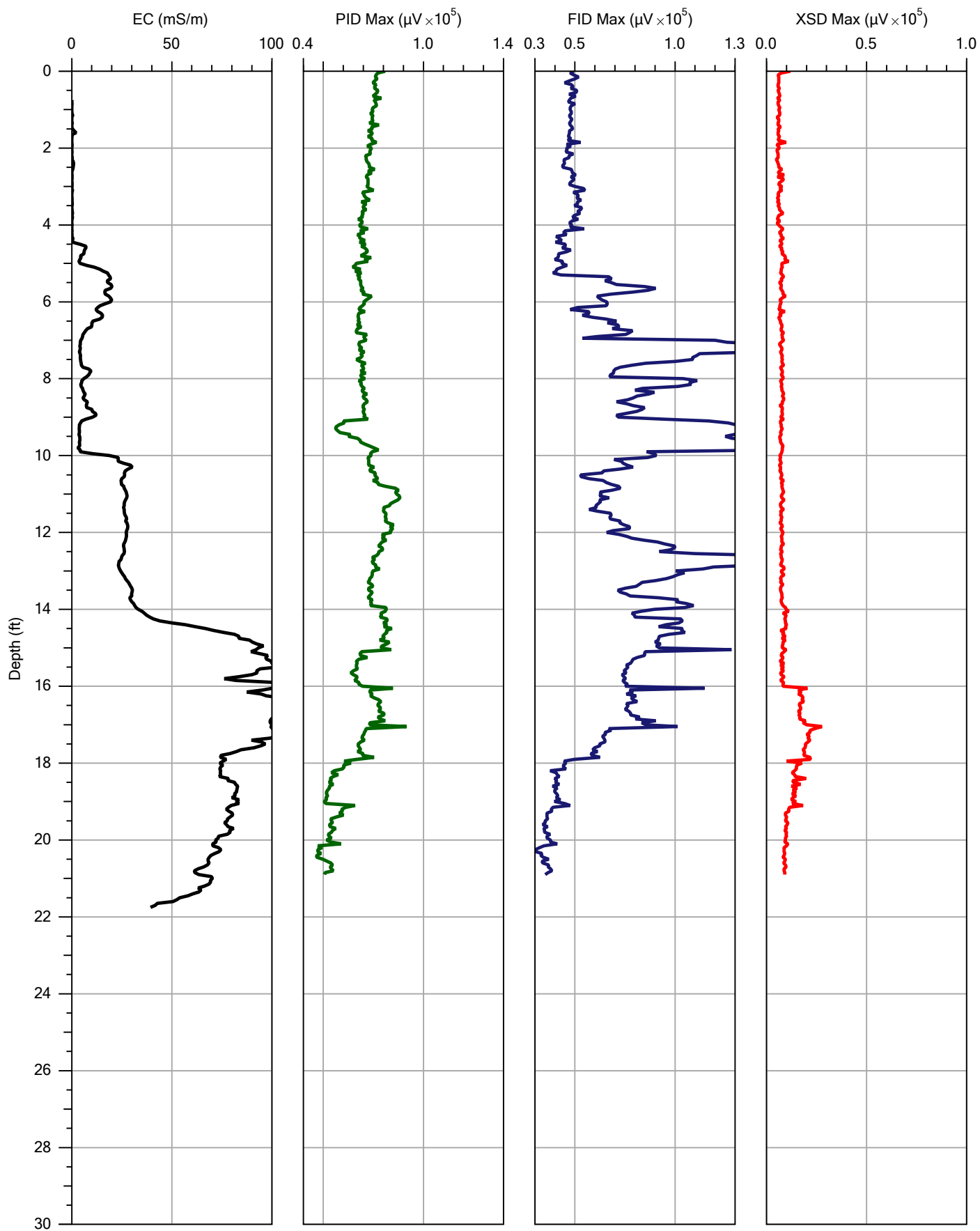
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Project ID: 139.14

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Client: CRA

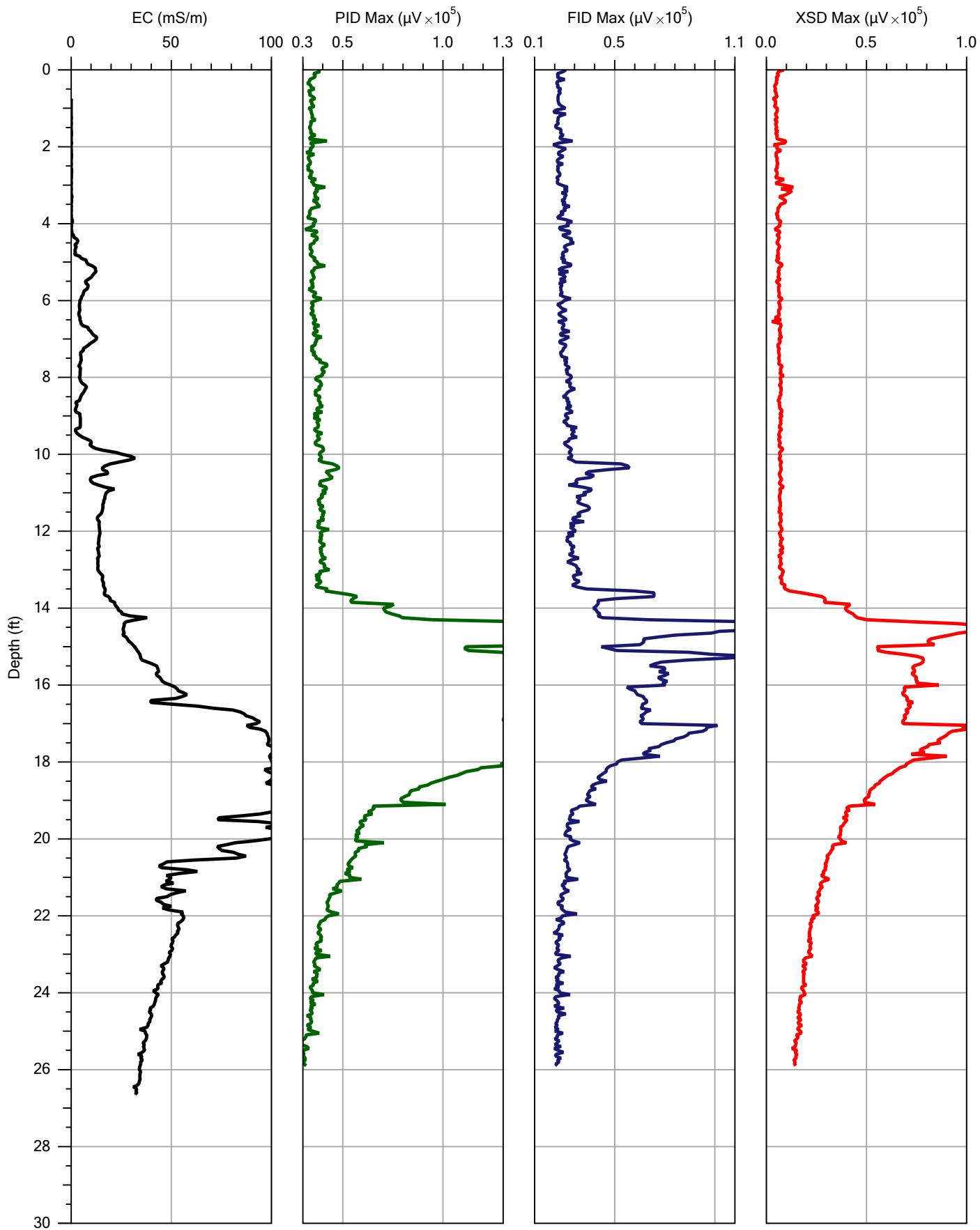
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Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

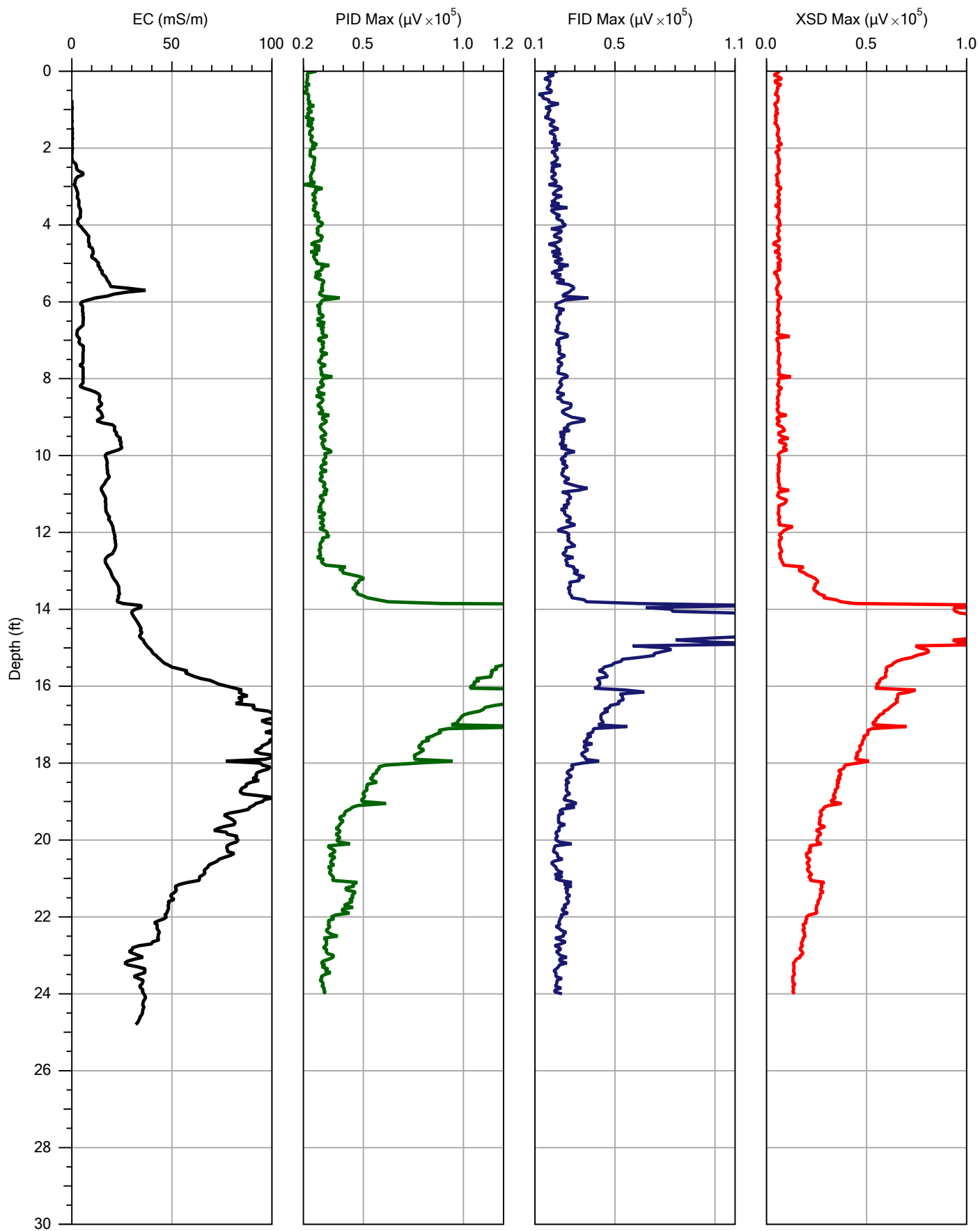
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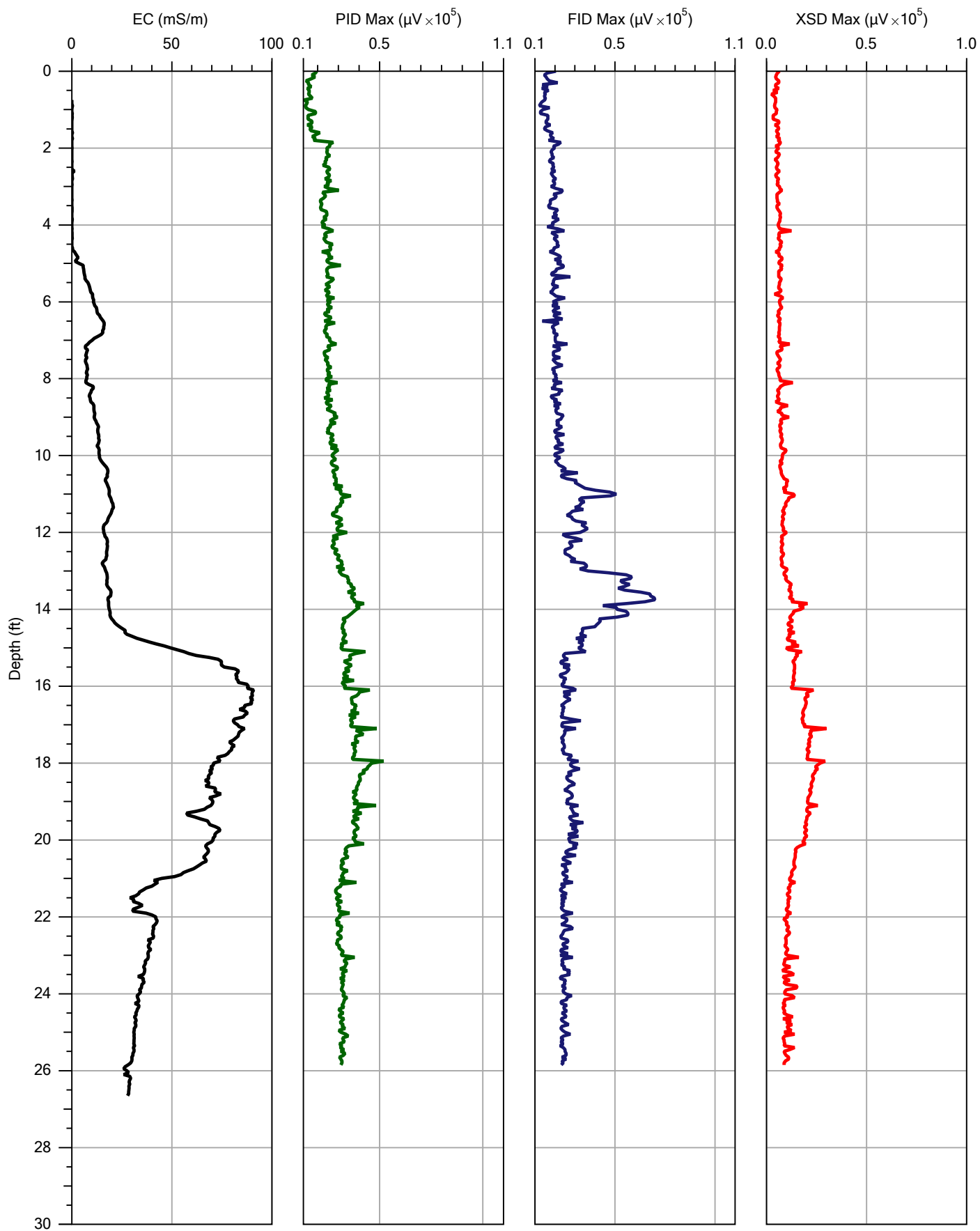
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Project ID: 139.14

Operator: M Jensen
Client: CRA

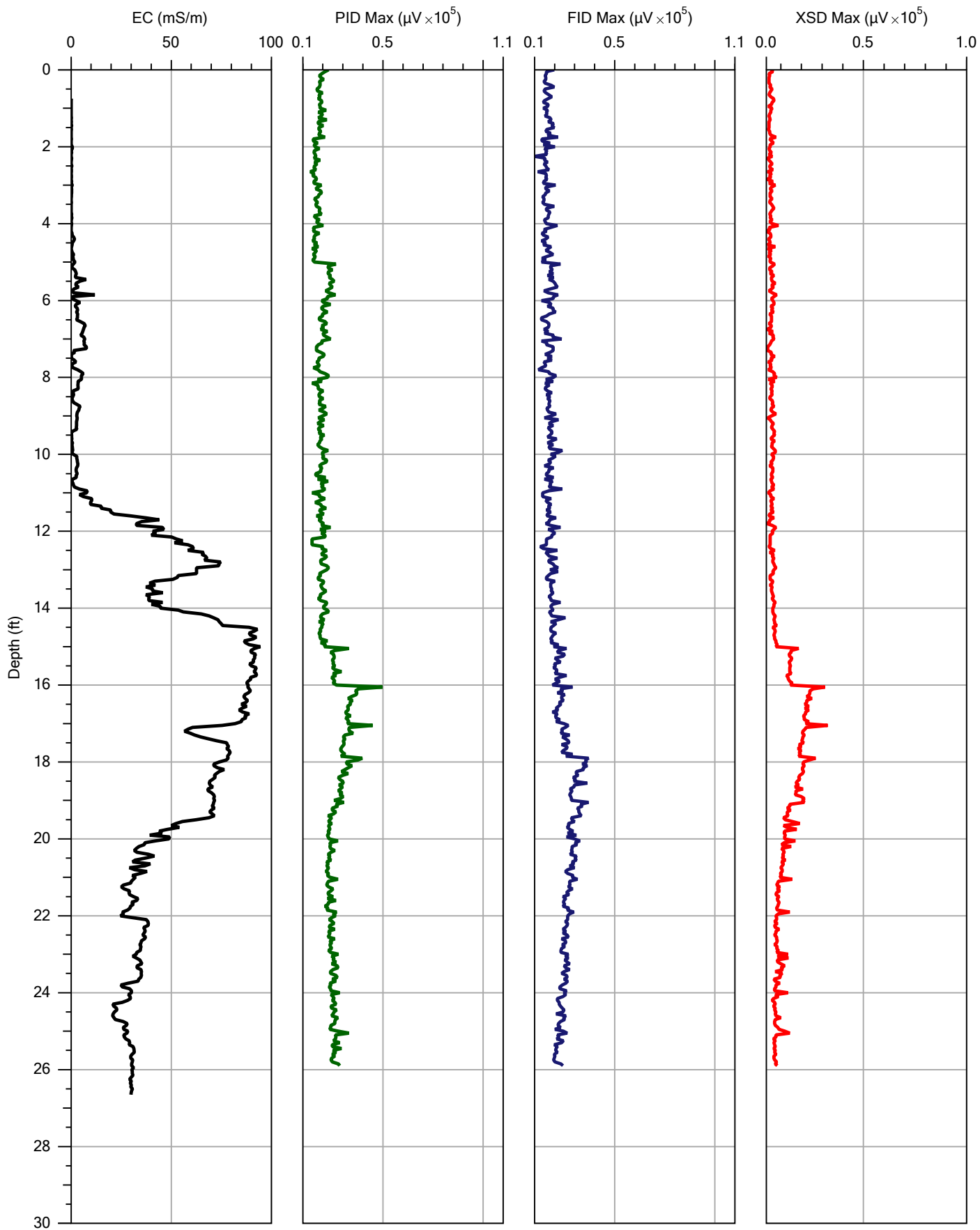
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Location:



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Operator: M Jensen		Date: 12/18/2014
Project ID: 139.14	Client: CRA	Location:



Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-077.MIP
Project ID:	139.14	Client:	CRA	Date:	12/18/2014
				Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

File: MIP-078.MIP
Date: 12/18/2014
Location:

Appendix B

Preferential Pathway Investigation Summary



**CONESTOGA-ROVERS
& ASSOCIATES**

14496 Sheldon Road, Suite #200
Plymouth, Michigan 48170
Telephone: (734) 453-5123 Fax: (734) 453-5201
www.CRAworld.com

MEMORANDUM

TO: Ken Richards, ENCORE REF. NO.: 17303

FROM: Beth Landale, CRA/sp/89D DATE: April 12, 2007

C.C.: Fred Blickle, CRA

RE: **Preferential Pathway Investigation Report and Additional Investigation Work Plan
Company Vehicle Operations Area
Ypsilanti, Michigan**

INTRODUCTION

This memorandum summarizes the results of the 2006 spring preferential pathway investigation and the scope of work for further investigation activities at the Company Vehicle Operations (CVO) Area located in Ypsilanti, Michigan (Site). Field activities were completed to delineate the suspected preferential pathway boundaries between the Haulaway Building and the southeastern property boundary. The preferential pathway boundaries along the southeastern property boundary were not completely delineated during the spring of 2006; therefore, further investigation is required. During the investigation evidence of potential non-aqueous phase liquid (NAPL) was identified in the some of the borings and was subsequently delineated.

BACKGROUND

Groundwater levels are collected on a quarterly basis to determine seasonal groundwater flow conditions each year. Quarterly groundwater monitoring results from the past several years show consistent flow direction at the Site, with a groundwater divide that extends through the center portion of the Site running west to east. Groundwater north of this divide moves north and east towards Tyler Pond, while groundwater south of the divide moves to the south and southeast towards Tyler Road. Figure 1 presents the March 6, 2006 groundwater elevation contours.

Southern boundary wells MW-4, MW-14, MW19-01, MW19-02, MW19-03, MW-14, and MW19-24 are sampled on a regular basis as part of the quarterly groundwater monitoring events. Groundwater samples collected during the quarterly monitoring events are analyzed for target compound list (TCL) volatile organic compounds (VOCs).

Generally, the concentrations of the constituents detected in the groundwater have been consistent at the Site over the past three years. The data indicates that concentrations along the southern property boundary are highest between monitoring wells MW19-02 and MW19-24, while concentrations east and west of these locations decrease substantially. Based on contaminant concentrations and groundwater flow patterns, a

preferential pathway appears to be present between the Haulaway Building and the southeastern property boundary near monitoring wells MW19-02 and MW19-24.

COMPLETED ACTIVITIES – SPRING 2006

Confining Clay Investigation - The initial preferential pathway delineation activities were conducted in three transects; Transect 1, southeast (downgradient) of test-pits TP-A30 and TP-A31; Transect 2, between MW19-07 and MW19-01; and Transect 3, between MW-5 and MW19-24, as shown on Figure 2. One soil boring within each transect was completed at least 6 inches into the sand-clay interface to verify water table and clay depths. This information along with the existing borehole logs in the area were used to determine the saturated zone. Stratigraphic logs for soil borings completed as part of this investigation are included as Attachment A. Groundwater samples were collected through a GeoProbe screen point using a peristaltic pump and were analyzed for TCL VOCs. A description of each transect is presented below:

Transect 1: Transect 1 was completed southeast (downgradient) of test-pits TP-A30 and TP-A31 and originally consisted of three soil borings SB19-26 through SB19-28. The top of the clay within Transect 1 ranges from 17 to 21 feet below ground surface (bgs). The sand-clay interface was visually examined for the presence of NAPL where an oil-like substance intermixed with water was observed in soil borings SB19-26 and SB19-28. These soil borings were converted into 2-inch monitoring wells, MW19-26 and MW19-27, respectively, to determine if sufficient NAPL was present to collect in the well screen. Groundwater samples were not collected from these wells due to the presence of the oil-like substance. Additional borings, SB19-36 through SB19-42, were completed to delineate the oil-like substance observed in the soils and collect groundwater samples. Soil boring SB19-40 was also converted into a 2-inch monitoring well MW19-28 since an oil-like substance was observed at this location. NAPL has not been identified in a measurable amount in any of these wells.

During this investigation, one foot of light non-aqueous phase liquid (LNAPL) was observed in well IW-40 located adjacent to test pits TP-A30 and TP-A31. Several drums containing oily water and sludges were removed from test pits TP-A30 and TP-A31 during an investigation completed in June 2005. The drums were properly characterized, stored, and disposed of off-Site.

Transect 2: Transect 2 included the area between the monitoring wells MW19-07 and MW19-01. Soil borings, SB19-29 through SB19-32, were completed within Transect 2. A soil boring was completed to the sand-clay interface at SB19-31 and no evidence of NAPL was observed. At locations, SB19-29, SB19-30, and SB19-32 the screen point was driven to the desired depth without examining the soils. Based on existing wells and soil boring SB19-31 the surface of the confining clay within this transect ranges from 14.5 feet to 16.5 feet bgs.

Transect 3: Transect 3 included the area between the monitoring wells MW-5 and MW19-24. Soil borings, SB19-33 through SB19-35 were completed in this transect. A soil boring was completed to the sand-clay interface at SB19-34, where no evidence of NAPL was observed. At locations, SB19-33 and SB19-35 the screen point was driven to the desired depth without examining the soils. Based on existing wells and soil boring SB19-34 the surface of the confining clay within this transect ranges from 14.4 to 17.9 feet bgs.

Groundwater Samples - Groundwater samples were collected through GeoProbe screen points to monitor the potential contaminant migration and to delineate the preferential pathway boundaries. The March 2006

quarterly groundwater sampling event was conducted within two weeks of the preferential pathway delineation activities. In addition to the regularly sampled wells, a groundwater sample was collected from MW-5 since it is located in Transect 3 and had not been sampled since December 12, 2003. The results from the March 2006 quarterly event, MW-5 and the GeoProbe screen point samples were used to delineate the preferential pathways. Well IW-40 was scheduled to be sampled to determine groundwater concentrations northwest of Transect 1 and to determine groundwater conditions adjacent to TP-A30 and TP-A31 following the test pitting activities in May 2005. However, during the investigation in Spring 2006, approximately one foot of LNAPL was observed in IW-40, therefore, a groundwater sample was collected from IW-39 located west of IW-40 and an LNAPL sample was collected from IW-40.

Discussion of Results

The total concentration of chlorinated compounds in each sample was primarily used to evaluate the potential preferential pathway. Table 1 summarizes the analytical results used in this evaluation. Figure 2 presents graphical representations of the total chlorinated compound concentration across each transect. Results from each transect are discussed below.

Transect 1: The analytical results indicate that the highest chlorinated compound concentration from the groundwater samples was detected at SB19-36 within Transect 1. The chlorinated concentration decreases north and northeast of SB19-36. Groundwater in this area flows south-southeast; therefore additional groundwater samples should be collected south of SB19-36 to verify that elevated concentrations of constituents are not migrating off-Site between MW-4 and MW19-01.

Transect 2: The highest concentration of chlorinated compounds detected within Transect 2 was at soil boring SB19-30. The chlorinated concentrations decrease southwest of this location, however concentrations decrease but remain elevated northeast of SB19-30.

Transect 3: The highest concentration of chlorinated compounds detected within Transect 3 was at SB19-33 within Transect 3, although concentrations do not differ significantly across this Transect.

Based on the results, the preferential pathway was not completely delineated during the Spring 2006 investigation. Additional step out borings are required to further investigate the southern property boundary to define the boundaries of the impacted groundwater moving off Site.

PROPOSED ACTIVITIES

The results of the preferential pathway investigation indicate that additional investigation is required along the southern boundary to verify that the location of the highest concentrations migrating off-Site has been identified. The scope of work for the additional preferential pathway investigation is summarized below:

Soil boring Completion and Groundwater Sample Collection

A GeoProbe will be used to complete six soil borings at least 6 inches into the confining clay layer. The locations of the proposed soil borings are shown on Figure 3.

Groundwater samples will be collected through a GeoProbe screen point using a peristaltic pump for TCL VOC analysis adjacent to each borehole. Groundwater samples will be collected approximately 3 feet above the clay to be consistent with the quarterly groundwater sampling protocol. The analytical results will be

evaluated to further delineate the impacted groundwater plume along the southern boundary. Detailed borehole logs will be prepared for all the soil borings.

Decon fluids and soil cuttings will be containerized in 55-gallon drums and staged on Site for proper waste characterization and disposal.

Once the investigation is completed a memorandum will be prepared to document the results.

Schedule

The additional preferential pathway investigation is scheduled to be initiated prior to a 2007 quarterly groundwater monitoring event. The results from the quarterly event along with the groundwater samples will be used to delineate the preferential pathway along the southern property boundary.

TABLE 1
PREFERENTIAL PATHWAY INVESTIGATION RESULTS
SPRING 2006
COMPANY VEHICLE OPERATIONS AREA
YPSILANTI, MICHIGAN

Sample Location: Sample ID: Sample Date: Sample Type: Parameter:				Upgradient				Transect 1				Transect 2						Transect 3						Boundary Wells																							
				IW-12		IW-33		IW-39		SB19-36		SB19-27		SB19-42		SB19-40		MW19-01		SB19-32		SB19-31		SB19-30		SB19-29		MW19-07		MW19-24		SB19-35		SB19-33		SB19-34		MW-5		MW-4		MW19-02		MW19-03		MW-14	
				030906-EV- 3/9/2006		031006-EV- 3/10/2006		030106-NR- 3/1/2006		030106-NR- 3/1/2006		030306-NR- 3/3/2006		022806-NR- 2/28/2006		030306-NR- 3/3/2006		030306-NR- 3/3/2006		030706-LA- 3/7/2006		022806-NR- 2/28/2006		022806-NR- 2/28/2006		022806-NR- 2/28/2006		030706-LA- 3/7/2006		030706-AB- 3/7/2006		030306-NR- 3/3/2006		030306-NR- 3/3/2006		022806-NR- 2/28/2006		022806-NR- 2/28/2006		030106-NR- 3/1/2006		030906-NR- 3/9/2006		030706-AB- 3/7/2006		030706-NR- 3/7/2006	
Residential Drinking Water Criteria (1)				Groundwater Surface Water Interface Criteria (1)												Duplicate																															
Units				a				b																																							
VOCs																																															
1,1,1-Trichloroethane	mg/L	0.2	0.2	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 UJ	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,1,2,2-Tetrachloroethane	mg/L	0.0085	0.0031	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 UJ	0.05 U	0.062 U	1.7 U	0.83 U	0.5 UJ	0.25 UJ	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 UJ	0.05 UJ	0.001 UJ																				
1,1,2-Trichloroethane	mg/L	0.005	0.012	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 UJ	0.05 U	0.062 U	1.7 U	0.83 U	0.5 UJ	0.25 UJ	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 UJ	0.05 UJ	0.001 UJ																				
1,1-Dichloroethane	mg/L	0.88	0.74	1 U	5 U	1.4 U	1.4 U	0.25 UJ	0.0025 U	0.05 U	0.2 UJ	0.001 UJ	0.05 U	0.062 U	1.7 U	0.83 U	0.5 UJ	0.25 UJ	0.12 U	0.12 U	0.2 U	0.1 U	0.12 UJ	0.001 U	0.71 UJ	0.05 UJ	0.001 UJ																				
1,1-Dichloroethene	mg/L	0.007	0.024	1 U	5 U	1.4 U	1.4 U	0.25 ^{ab}	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,2,4-Trichlorobenzene	mg/L	0.07	0.03	5 U	25 U	7.1 U	7.1 U	1.2 U	0.012 U	0.25 U	1 U	0.005 U	0.25 U	0.31 U	8.3 U	4.2 U	2.5 U	1.2 U	0.62 U	0.62 U	1 U	0.5 U	0.62 U	0.005 U	3.6 U	0.25 U	0.005 U																				
1,2-Dibromo-3-chloropropane (DBCP)	mg/L	0.0002		1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,2-Dibromoethane (Ethylene Dibromide)	mg/L	0.00005	0.00005	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,2-Dichlorobenzene	mg/L	0.6	0.016	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,2-Dichloroethane	mg/L	0.005	0.006	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,2-Dichloropropane	mg/L	0.005	0.0091	1 U	5 U	1.4 U	1.4 U	0.25 U	0.00063 J	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 UJ	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,3-Dichlorobenzene	mg/L	0.0066	0.038	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
1,4-Dichlorobenzene	mg/L	0.075	0.013	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
2-Butanone (Methyl Ethyl Ketone)	mg/L	13	2.2	25 U	120 U	36 U	36 U	6.2 U	0.0015 J	1.2 U	5 U	0.025 U	1.2 U	1.6 U	42 U	21 U	12 U	6.2 U	3.1 U	3.1 U	5 U	2.5 U	3.1 U	0.025 U	18 U	1.2 U	0.025 U																				
2-Hexanone	mg/L	1		50 U	250 UJ	71 U	71 U	12 U	0.12 U	2.5 U	10 U	0.05 U	2.5 UJ	3.1 U	83 U	42 U	25 U	12 UJ	6.2 U	6.2 U	10 U	5 U	6.2 U	0.05 U	36 U	2.5 U	0.05 U																				
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	mg/L	1.8	ID	50 UJ	250 U	5 J ^a	5.1 J ^a	12 U	0.12 U	2.5 U	10 U	0.05 U	2.5 U	3.1 U	83 U	42 U	25 U	12 UJ	6.2 U	6.2 U	10 U	5 U	6.2 U	0.05 UJ	36 U	2.5 U	0.05 U																				
Acetone	mg/L	0.73	1.7	25 U	120 U	36 U	36 U	6.2 U	0.062 U	1.2 U	5 U	0.025 U	1.2 U	1.6 U	42 U	21 U	12 U	6.2 U	3.1 U	3.1 U	5 U	2.5 U	3.1 U	0.025 U	18 U	1.2 U	0.025 U																				
Benzene	mg/L	0.005	0.012	1 U	5 U	1.4 U	1.4 U	0.25 U	0.068 ^{ab}	0.053 ^{ab}	0.19 J ^{ab}	0.001 U	0.025 J ^{ab}	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
Bromodichloromethane	mg/L	0.08	ID	1 UJ	5 U	1.4 U	1.4 U	0.25 UJ	0.0025 U	0.05 U	0.2 UJ	0.001 UJ	0.05 U	0.062 U	1.7 U	0.83 U	0.5 UJ	0.25 UJ	0.12 U	0.12 U	0.2 U	0.1 U	0.12 UJ	0.001 UJ	0.71 UJ	0.05 UJ	0.001 UJ																				
Bromoform	mg/L	0.08	ID	1 U	5 U	1.4 U	1.4 U	0.25 UJ	0.0025 U	0.05 U	0.2 UJ	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 UJ	0.001 U	0.71 U	0.05 U	0.001 U																				
Bromomethane (Methyl Bromide)	mg/L	0.01	0.035	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
Carbon disulfide	mg/L	0.8	ID	5 U	25 U	7.1 U	7.1 U	1.2 U	0.012 U	0.25 U	1 U	0.005 U	0.25 U	0.31 U	8.3 U	4.2 U	2.5 U	1.2 U	0.62 U	0.62 U	1 U	0.5 U	0.62 U	0.005 U	3.6 U	0.25 U	0.005 U																				
Carbon tetrachloride	mg/L	0.005	0.0056	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
Chlorobenzene	mg/L	0.1	0.047	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
Chloroethane	mg/L	0.43	ID	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
Chloroform (Trichloromethane)	mg/L	0.08	0.077	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
Chloromethane (Methyl Chloride)	mg/L	0.26	ID	1 U	5 U	1.4 U	1.4 U	0.25 U	0.0025 U	0.05 U	0.2 U	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 U	0.001 U	0.71 U	0.05 U	0.001 U																				
cis-1,2-Dichloroethene	mg/L	0.07	0.62	38 J ^{ab}	10 ^{ab}	1 J ^{ab}	1 J ^{ab}	7.9 J ^{ab}	0.0011 J	0.031 J	0.2 UJ	0.001 UJ	0.017 J	0.075 ^a	5.5 ^{ab}	6.2 ^{ab}	6 J ^{ab}	0.18 J ^a	2.3 ^{ab}	2.3 ^{ab}	4.8 ^{ab}	3.9 ^{ab}	3 J ^{ab}	0.00028 J	9.3 J ^{ab}	0.63 J ^{ab}	0.001 UJ																				
cis-1,3-Dichloropropene	mg/L			1 UJ	5 UJ	1.4 U	1.4 U	0.25 UJ	0.0025 U	0.05 U	0.2 UJ	0.001 UJ	0.05 U	0.062 U	1.7 U	0.83 U	0.5 UJ	0.25 UJ	0.12 U	0.12 U	0.2 U	0.1 U	0.12 UJ	0.001 UJ	0.71 UJ	0.05 UJ	0.001 UJ																				
Cyclohexane	mg/L			1 U	5 U	1.4 U	1.4 U	0.25 UJ	0.00059 J	0.05 U	0.2 UJ	0.001 U	0.05 U	0.062 U	1.7 U	0.83 U	0.5 U	0.25 U	0.12 U	0.12 U	0.2 U	0.1 U	0.12 UJ	0.001 U	0.71 U	0.05 U																					

ATTACHMENT A

SOIL BORINGS



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-26/MW19-26

DATE COMPLETED: February 28, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	SP-SANDS (FILL), trace silts, fine to medium subrounded gravels and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown, moist	1.50		1AL		60		3.9
4	SC-CLAYEY SANDS, trace silts and fine subrounded gravels, compact, very fine to fine grained, poorly graded, brown, moist	3.00						16.6
6	SP-SANDS (FILL), trace silts, fine to medium subrounded gravels and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown, moist	4.50						26.7
8	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, tan, moist	6.30		2AL		75		128
10	SP-SANDS, trace fine subrounded gravels, loose, fine to medium grained, poorly graded, brown, moist to wet, orange hue - with fine subrounded gravels at 9.0ft BGS	10.50						111
12	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, gray, wet			3AL		50		91.8
14								125
16								371
18				4AL		80		227
20	- petroleum-like substance intermixed with water at 20.0ft BGS							358
22	CL-CLAYS, trace silts, medium plasticity, firm, gray, moist	21.00		5AL				16.0
24								6.4
26	END OF BOREHOLE @ 25.0ft BGS	25.00						
28								
30								
32								
34								

WELL DETAILS

Screened interval:

7.00 to 22.00ft BGS

Length: 15ft

Diameter: 2in

Slot Size: 0.010

Material: PVC

Sand Pack:

5.00 to 22.00ft BGS

Material: SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-27

DATE COMPLETED: February 28, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	SP-SANDS (FILL), trace silts, gravel and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown, moist	1.50	 2" BOREHOLE BACKFILLED WITH BENTONITE CHIPS	1AL		60		43.9
4	SC-CLAYEY SANDS, trace silts and brown subrounded gravels, loose, very fine to fine grained, poorly graded, dark brown, moist	3.00						27.4
6	SP-SANDS (FILL), trace silts, gravel and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown, moist	4.30		2AL		70		46.4
8	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, brown, moist	6.60						176
10	- trace fine subrounded gravels at 6.5ft BGS							198
12	SP-SANDS, trace fine subrounded gravels, compact, very fine to fine grained, poorly graded, brown, moist to wet			3AL		85		453
14	- fine to medium grained, dark brown, slight petroleum-like odor at 8.0ft BGS							861
16	- trace silts, coarse medium grained, grayish brown at 9.0ft BGS	11.80						240
18	- coarse with fine well rounded gravels at 11.0ft BGS			4AL		90		1050
20	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, gray, wet	19.20						247
22	CI-CLAYS, trace silts, medium plasticity, firm, gray, moist, slight petroleum-like odor	20.00						
24	END OF BOREHOLE @ 20.0ft BGS							
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-28/MW19-27

DATE COMPLETED: February 28, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	SP-SANDS (FILL), trace silts, gravel and debris (crushed concrete and brick), loose, very fine to fine grained, poorly graded, dark brown to brown, moist	1.50		1AL		60		67.2
4	CL-SANDY CLAYS (FILL), trace silts and gravels, low plasticity, firm, brownish gray, moist	2.50						64.7
6	SP-SANDS (FILL), trace silts, gravel and debris (crushed concrete and brick), loose, very fine to fine grained, poorly graded, dark brown to brown, moist	4.50						11.4
8	SM-SILTY SANDS, compact, poorly graded, very fine to fine grained, tan brown, moist	6.00		2AL		65		282
10	SP-SANDS, trace silts and brown subrounded gravels, loose, fine to medium grained, poorly graded, dark brown to black, moist, slight petroleum-like odor	9.00						217
12	SP-SANDS, compact, very fine to fine grained, poorly graded, gray, wet, petroleum-like odor							136
14				3AL		80		58.3
16	- petroleum-like substance intermixed with water at 15.0ft BGS							54.9
18	CH-CLAYS, trace silts, high plasticity, firm, brownish gray, moist	18.00		4AL		85		194
20	END OF BOREHOLE @ 20.0ft BGS	20.00						157
22								
24								
26								
28								
30								
32								
34								

WELL DETAILS

Screened interval:

7.00 to 19.00ft BGS

Length: 12ft

Diameter: 2in

Slot Size: 0.010

Material: PVC

Sand Pack:

5.00 to 19.00ft BGS

Material: SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▼

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-31

DATE COMPLETED:

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	FILL-SANDS, trace silts and fine to medium subangular gravel debris (crushed concrete), loose, very fine to medium grained, poorly graded, brown, moist	1.00	 2" BOREHOLE BACKFILLED WITH BENTONITE CHIPS	1AL		60		0
4	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, orange hue, moist	4.80						0
6	SP-SANDS, trace silts and fine subangular gravels, compact, fine to medium grained, poorly graded, orangish brown, moist to wet			2AL		60		0
8								0
10	- fine to coarse grained, trace fine subangular gravels at 9.0ft BGS			3AL		70		0
12								0
14	CH-CLAYS, trace silts, high plasticity, firm, gray, moist	14.60						0
16	END OF BOREHOLE @ 15.0ft BGS	15.00						
18								
20								
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▼

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-34

DATE COMPLETED:

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	FILL-SANDS, trace silts and fine subangular gravels, debris (crushed concrete), loose, fine to medium grained, poorly graded, brown, moist	1.50	 2" BOREHOLE BACKFILLED WITH BENTONITE CHIPS	1AL				1.1
4	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, orange, moist	4.80						60 1.0
6	SP-SANDS, with fine subrounded gravels, trace silts, compact, fine to coarse grained, poorly graded, brown with orange hue, moist to wet			2AL				1.3
8								1.5 70
10	SP-SANDS, trace silts, compact, very fine to medium grained, poorly graded, brown to brownish gray, wet	10.00						2.0
12				3AL				2.1
14								70 16.8
16	CL-CLAYS, trace silts, medium plasticity, firm, gray, moist	14.40						147
18	END OF BOREHOLE @ 15.0ft BGS	15.00						
20								
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▼

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-36

DATE COMPLETED: March 2, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	SP-SANDS (FILL), trace silts, fine to medium subrounded gravels and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown, moist	1.00	 2" BOREHOLE BACKFILLED WITH BENTONITE CHIPS	1AL		60		1.4
2	SC-CLAYEY SANDS (FILL), trace silts and fine subrounded gravels, compact, very fine to fine grained, brown grained, poorly graded, brown, moist	2.00						5.3
4	SP-SANDS (FILL), trace silts, fine to medium subrounded gravels and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown, moist	4.90		2AL		80		51.9
6	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, tan brown, moist	7.00						162
8	SP-SANDS, trace fine brown subrounded gravels, loose, fine to medium grained, poorly graded, brown with orange hue and orange staining	10.50						131
10	SM-SILTY SANDS, compact, poorly graded, very fine to fine grained, gray, wet	10.50		3AL		80		181
12								103
14								149
16				4AL		85		93.7
18								90.2
20	CL-CLAYS, trace silts, medium, plasticity, firm, gray, moist	19.50						
20	END OF BOREHOLE @ 20.0ft BGS	20.00						
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-37

DATE COMPLETED: March 2, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	SP-SANDS (FILL), trace silts and fine subrounded gravels and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown to black, moist	1.20 1.50	 2" BOREHOLE BACKFILLED WITH BENTONITE CHIPS	1AL		60		4.5
4	SC-SANDY CLAYS, trace silts, loose, very fine grained, poorly graded, dark brown, moist							11.0
6	SP-SANDS (FILL), trace silts and fine subrounded gravels and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown to black, moist, black staining at 1.7', pieces of wood	4.50 6.00		2AL		60		70.1
8	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, brown, moist							90.2
10	SP-SANDS, trace silts, fine to medium subangular to subrounded gravels, compact, fine to medium grained, poorly graded, brown with orange hue, moist							119
12	- with medium to fine to coarse grained, gray at 9.0ft BGS			3AL		70		376
14	SP-SANDS, trace silts, compact, very fine to fine grained, poorly graded, gray, wet	11.50						234
16								158
18	- fine grained at 16.5ft BGS			4AL		80		71.8
20	CH-CLAYS, trace silts, high plasticity, firm, gray, moist	17.50						51.8
22	END OF BOREHOLE @ 20.0ft BGS	20.00						
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-38

DATE COMPLETED: March 2, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	SP-SANDS (FILL), trace silts and brown subrounded gravels and debris (crushed concrete), loose, fine to medium grained, poorly graded, dark brown to brown, moist	1.40	 2" BOREHOLE BACKFILLED WITH BENTONITE CHIPS	1AL		60		0.5
	ASPHALT	1.50						0.9
4	CL-SANDY CLAYS (FILL), trace silts and fine subrounded gravels, low plasticity, firm, brownish gray, moist	2.00						8.7
	SP-SANDS (FILL)	5.50		2AL		70		20.8
6	SM-SILTY SANDS, compact, poorly graded, very fine to fine grained, tan, moist	6.00						170
8	SP-SANDS, trace silts, fine brown subrounded gravels, loose, fine to medium grained, poorly graded, brownish gray, petroleum-like rainbow, petroleum-like odor							27.4
10	- with medium to coarse grained, gray at 9.0ft BGS							47.4
12				3AL		80		241
14		14.30						
16	CH-CLAYS, trace silts, high plasticity, firm, gray, moist	15.00						
16	END OF BOREHOLE @ 15.0ft BGS							
18								
20								
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▼

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-39

DATE COMPLETED:

DRILLING METHOD:

FIELD PERSONNEL:

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	CONCRETE	0.60						0.9
2	SP-SANDS (FILL), trace silts, brown fine subrounded gravels, debris (crushed concrete), loose, very fine to fine grained, poorly graded, dark brown, moist	1.60		1AL		60		63.2
4	CL-SANDY CLAYS (FILL), trace silts and gravels, low plasticity, firm, brown, moist	3.50						92.6
6	SP-SANDS (FILL), trace silts, brown fine subrounded gravels, debris (crushed concrete), loose, very fine to fine grained, poorly graded, dark brown, moist, strong petroleum-like odor, black staining (rainbow)	5.00						71.4
8	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, tan brown, moist	6.50		2AL		75		12.3
10	SP-SANDS, trace silts and fine brown subrounded gravels, loose, fine to medium grained, poorly graded, dark brown, petroleum-like odor, black staining	9.00						10.8
12	SP-SANDS, compact, very fine to fine grained, poorly graded, gray, wet			3AL		80		16.2
14	- clay lens, trace fine brown subrounded gravel (10-10.2') at 10.0ft BGS							63.3
16								19.4
18	CH-CLAYS, trace silts, high plasticity, firm, gray, moist	18.00		4AL		80		144
20	END OF BOREHOLE @ 20.0ft BGS	20.00						
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-40/MW19-28

DATE COMPLETED: March 2, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
2	SP-SANDS (FILL), trace silts, gravel and debris (crushed concrete), loose, very fine to fine grained, poorly graded, dark brown, moist	1.00		1AL		60		2.0
4	CL-SANDY CLAYS (FILL), trace silts and gravels, low plasticity, firm, brownish gray, moist	2.50						5.3
6	SP-SANDS (FILL), trace silts, gravel and debris (crushed concrete), loose, very fine to fine grained, poorly graded, dark brown, moist	5.00						13.4
8	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, tan, moist	6.00						89.8
10	SP-SANDS, trace silts and brown subrounded gravels, loose, fine to medium grained, poorly graded, dark brown, moist	8.00		2AL		65		16.0
12	SP-SANDS, compact, very fine to fine grained, poorly graded, gray, wet							278
14								127
16	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, gray, wet	13.00		3AL		80		151
18								125
20	CH-CLAYS, trace silts, high plasticity, firm, gray, moist	17.00		4AL		85		33.0
22	END OF BOREHOLE @ 20.0ft BGS	20.00						
24								
26								
28								
30								
32								
34								

WELL DETAILS

Screened interval:

6.50 to 19.50ft BGS

Length: 13ft

Diameter: 2in

Slot Size: 0.010

Material: PVC

Sand Pack:

5.00 to 19.50ft BGS

Material: SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-41

DATE COMPLETED: March 2, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	CONCRETE	0.60	 2" BOREHOLE BACKFILLED WITH BENTONITE CHIPS	1AL		60		6.2
2	CL-SANDY CLAYS (FILL), trace silts and gravel, low plasticity, firm, brownish gray, moist							8.3
4		4.60		2AL		65		3.6
6	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, tan brown, moist							2.6
8	SP-SANDS, trace silts and fine brown subrounded gravels, loose, fine to medium grained, poorly graded, dark brown, orange bands, moist to wet - fine to coarse grained at 9.0ft BGS	6.50						7.2
10								2.6
12	SP-SANDS, compact, very fine to fine grained, poorly graded, gray, wet, petroleum-like rainbow, small black dots - clay lens, trace silts and coarse grained sands at 12.0ft BGS	11.00		3AL		70		19.0
14								30.1
16				4AL		80		17.1
18	CH-CLAYS, trace silts, high plasticity, firm, gray, moist	18.50						16.0
20	END OF BOREHOLE @ 20.0ft BGS	20.00						
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▼

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-42

DATE COMPLETED: March 2, 2006

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: N. RATHBUN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	BOREHOLE INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	CONCRETE	0.60						
2	CL-SANDY CLAYS (FILL), trace silts, loose, very fine to fine grained, poorly graded, dark brown, moist, strong petroleum-like odor, black staining		2" BOREHOLE	1AL		60		0.1
4		4.80	BACKFILLED WITH BENTONITE CHIPS					57.8
6	SP-SANDS, with gravels, trace silts, loose, fine to medium grained, fine gravels, poorly graded, black, moist, strong petroleum-like odor	5.90						162
8	SM-SILTY SANDS, compact, very fine to fine grained, poorly graded, tan, moist, slight petroleum-like odor	6.00		2AL		70		35.0
10	SP-SANDS, trace silts and brown subrounded gravels, loose, fine to medium grained, poorly graded, dark brown, moist to wet							7.2
12	- coarse grained at 9.0ft BGS	11.00						4.8
14	SP-SANDS, trace silts, compact, very fine to fine, poorly graded, gray, petroleum-like rainbow (15-17')			3AL		60		23.9
16								66.9
18				4AL		80		11.3
20	CH-CLAYS, trace silts, high plasticity, firm, gray, moist	19.00						57.5
22	END OF BOREHOLE @ 20.0ft BGS	20.00						
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 4/5/07



**CONESTOGA-ROVERS
& ASSOCIATES**

14496 Sheldon Road, Suite #200
Plymouth, Michigan 48170
Telephone: (734) 453-5123 Fax: (734) 453-5201
www.CRAworld.com

MEMORANDUM

TO: Ken Richards, ENCORE REF. NO.: 17303

FROM: Beth Landale/Justin Jacques/bw/117/Det. ~~BX~~ DATE: October 10, 2007

C.C.: Fred Blickle, CRA

RE: **Preferential Pathway Investigation Report
Company Vehicle Operations Property
Ypsilanti, Michigan**

1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) has prepared this memorandum to summarize the results of the May 2007 additional preferential pathway investigation at the Company Vehicle Operations (CVO) property located in Ypsilanti, Michigan (Site). This investigation was proposed to supplement a February and March 2006 investigation that was summarized in a memorandum issued on April 12, 2007.

2.0 INVESTIGATION PURPOSE

The purpose of this investigation was to verify that the February and March 2006 investigation identified the location along the southern property boundary where the highest concentrations of chlorinated volatile organic compounds (CVOCs) were migrating.

3.0 BACKGROUND

Groundwater levels are collected on a quarterly basis at the CVO property to determine seasonal groundwater flow conditions. Quarterly groundwater monitoring results from the past several years show consistent flow direction at the Site, with a groundwater divide that extends through the center portion of the Site running west to east. Groundwater north of this divide moves north and east towards Tyler Pond, while groundwater south of the divide moves to the south and southeast towards Tyler Road. Figure 1 presents the June 4, 2007 groundwater elevation contours and the apparent groundwater divide.

Southern boundary wells MW-4, MW19-01, MW19-02, MW19-03, MW-14, and MW19-24 are sampled on a regular basis as part of the quarterly groundwater monitoring events. Groundwater samples collected during the quarterly monitoring events are analyzed for target compound list (TCL) volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs) and Site target analyte list (TAL) metals; VOCs were the only constituents used for this preferential pathway investigation. Full results from the June 2007 quarterly sampling will be reported under separate cover. Generally, the concentrations of the constituents detected in the groundwater have been consistent in this area of the Site over the past three years. The data

indicates that concentrations along the southern property boundary are highest between monitoring wells MW19-02 and MW19-24, while concentrations east and west of these locations decrease substantially. Based on contaminant concentrations and groundwater flow patterns, a preferential pathway appears to be present between the Haulaway Building and the southern property boundary near monitoring wells MW19-02 and MW19-24.

4.0 COMPLETED ACTIVITIES - APRIL 2007

A GeoProbe was used to complete six new soil borings, SB19-43 through SB19-48, at least 6 inches into the confining clay layer along the southern property boundary. The soil boring logs can be found in Appendix A and the locations of these soil borings are shown on Figure 2. Groundwater samples were collected through GeoProbe screen points adjacent to each soil boring. The June 2007 quarterly groundwater sampling event was completed within one week of the preferential pathway delineation activities. The results from the June 2007 quarterly event and the GeoProbe screen point samples were used to delineate the preferential pathways (see Table 1).

Discussion of Results

The total concentration of chlorinated compounds in each sample was used to evaluate the potential preferential pathway. Figure 2 presents graphical representations of the total chlorinated compound concentration across each transect. Results from each transect are discussed below. Data from Transects 1, 2 and 3 were collected in February and March of 2006 and summarized in the April 2007 memorandum. Results from Transect 4, which is along the southern property boundary, are from data collected during the May and June 2007 investigation.

Transect 1: The analytical results indicate that the highest chlorinated compound concentration from the groundwater samples was detected at SB19-36 within Transect 1. The chlorinated concentration decreases north and northeast of SB19-36. Groundwater in this area flows south-southeast; therefore, additional groundwater samples were collected in May and June 2007 south of SB19-36 to verify that elevated concentrations of constituents were not migrating off-Site between MW-4 and MW19-01.

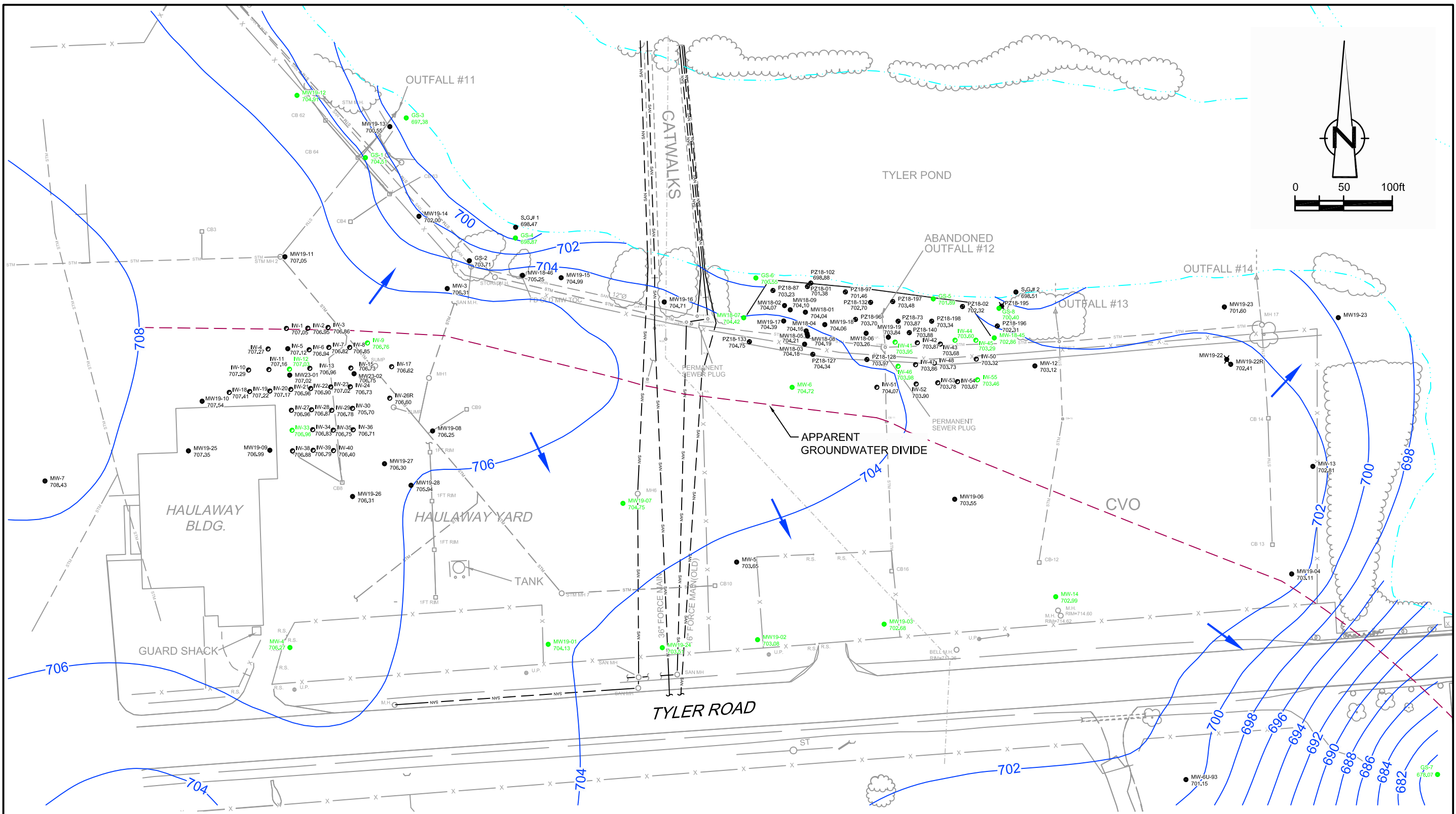
Transect 2: The highest concentration of chlorinated compounds detected within Transect 2 was at soil boring SB19-30. The chlorinated concentrations decrease southwest of this location and concentrations decrease but remain elevated northeast of SB19-30.

Transect 3: The highest concentration of chlorinated compounds detected within Transect 3 was at SB19-33, although concentrations do not differ significantly across this Transect.

Transect 4: The highest concentration of chlorinated compounds detected within Transect 4 was at MW19-02. CVOCs were detected at all but three of the Transect 4 locations (SB19-43, SB19-45 and MW-14). The sums of the concentrations of CVOCs were above 0.95 mg/L at the following sample locations: MW19-24, MW19-02, SB19-47, SB19-48 and MW19-03. These locations define the boundaries of the preferential pathway at the CVO property.

5.0 CONCLUSIONS

This investigation verifies that there is a preferential pathway for elevated CVOC concentrations along the southern property boundary between monitoring wells MW19-24 and MW19-03. The sample collected from monitoring well MW19-02 had the highest concentration of CVOCs (14.2 mg/L) along the southern property boundary. There were relatively low concentrations or no CVOCs detected in samples collected west of SB19-46 and east of MW19-03 along Transect 4. Therefore, the current quarterly groundwater sampling program is sufficiently monitoring the areas with the highest concentrations of CVOCs along the southern property boundary.



- | | | |
|---|---|---|
| <p>— DITCH, STREAM OR RIVER</p> <p>— FENCE LINE (SURVEYED)</p> <p>— TREE LINE</p> <p>— FORMER SLUDGE LINE</p> <p>— STORM SEWER</p> <p>— SANITARY SEWER</p> <p>— UTILITY POLE (SURVEYED)</p> <p>● U.P.</p> | <p>● PZ18-195</p> <p>● MW19-01</p> <p>● IW-19</p> <p>● MW-5</p> <p>● PZ18-102</p> <p>○ MH1</p> <p>□ CB9</p> | <p>ABANDONED WELL</p> <p>JUNE 2007 QUARTERLY SAMPLING LOCATIONS</p> <p>INJECTION WELL</p> <p>MONITORING WELL</p> <p>PIEZOMETER</p> <p>GROUNDWATER ELEVATION</p> <p>MANHOLE</p> <p>CATCH BASIN</p> |
|---|---|---|

figure 1

GROUNDWATER ELEVATION CONTOURS - JUNE 4, 2007

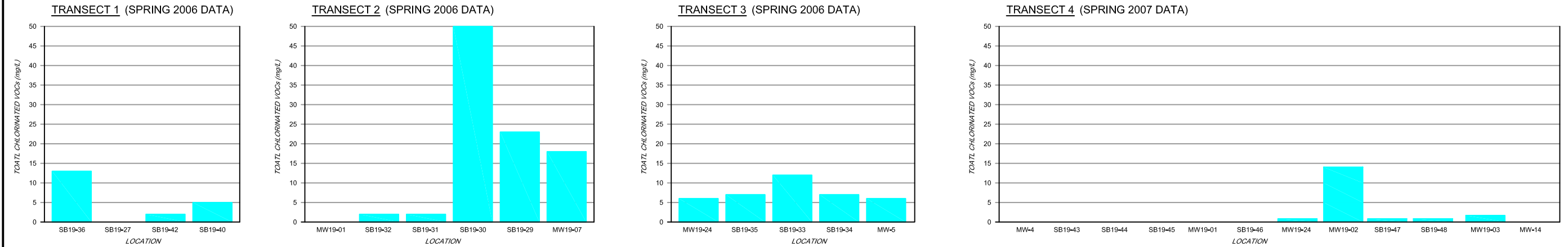
ADDITIONAL PREFERENTIAL PATHWAY INVESTIGATION WORK PLAN

COMPANY VEHICLE OPERATIONS AREA

Ypsilanti, Michigan



CONCENTRATION OF TOTAL CHLORINATED VOCs IN GROUNDWATER



NOTE: DATA FOR TRANSECT 4 WERE COLLECTED IN MAY AND JUNE 2007 WHILE DATA FROM TRANSECTS 1 THROUGH 3 WERE COLLECTED IN FEBRUARY AND MARCH 2006.

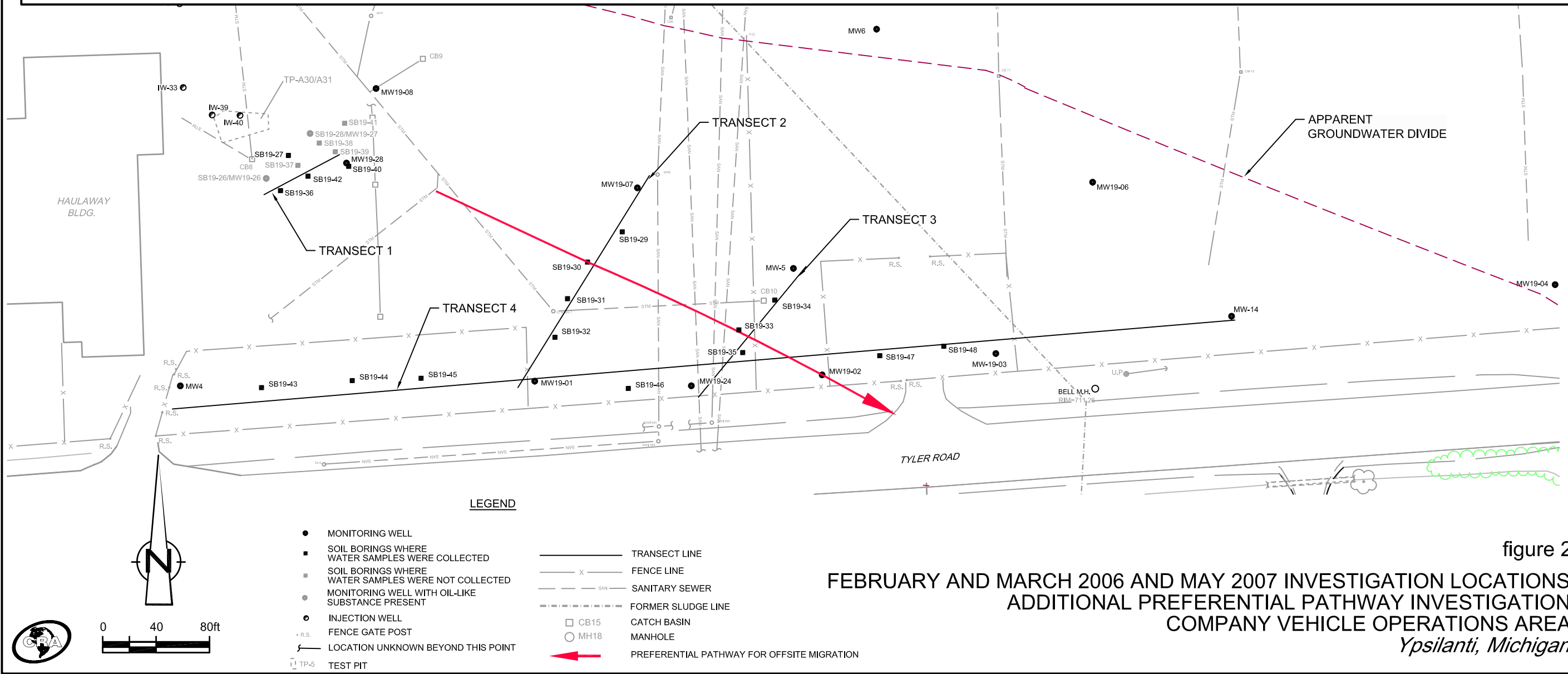


figure 2
FEBRUARY AND MARCH 2006 AND MAY 2007 INVESTIGATION LOCATIONS
ADDITIONAL PREFERENTIAL PATHWAY INVESTIGATION
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

TABLE 1

GROUNDWATER ANALYSIS RESULTS
PREFERENTIAL PATHWAY INVESTIGATION
COMPANY VEHICLE OPERATIONS
YPSILANTI, MICHIGAN

Sample Location: Sample Date: Parameter:		IDWC	RCDWC	GSI	FAV	MW-4 6/6/2007	SB19-43 5/31/2007	SB19-44 5/31/2007	SB19-44 5/31/2007	SB19-45 5/31/2007	MW19-01 6/6/2007	SB19-46 5/31/2007	MW19-24 6/6/2007	MW19-02 6/6/2007	MW19-02 6/6/2007	SB19-47 5/31/2007	SB19-48 5/31/2007	MW19-03 6/5/2007	MW-14 6/5/2007
Units																			
VOCs																			
1,1,1-Trichloroethane	mg/L	0.2	0.2	0.2	1.6	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,1,2,2-Tetrachloroethane	mg/L	0.035	0.0085	0.0032	1.8	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 U	0.0025 UJ	0.029 U	0.2 UJ	0.2 UJ	0.02 UJ	0.02 UJ	0.04 UJ	0.001 UJ
1,1,2-Trichloroethane	mg/L	0.005	0.005	0.012	5.6	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,1-Dichloroethane	mg/L	2.5	0.88	0.74	13	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,1-Dichloroethene	mg/L	0.007	0.007	0.024	2.3	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,2,4-Trichlorobenzene	mg/L	0.07	0.07	0.03	0.2	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.012 U	0.14 U	1 U	1 U	0.1 U	0.1 U	0.2 U	0.005 U
1,2,4-Trimethylbenzene	mg/L	0.063	0.063	0.017	0.31	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,2-Dibromo-3-chloropropane (DBCP)	mg/L	0.0002	0.0002			0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,2-Dibromoethane (Ethylene Dibromide)	mg/L	0.00005	0.00005	0.00005	0.28	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,2-Dichlorobenzene	mg/L	0.6	0.6	0.016	0.28	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,2-Dichloroethane	mg/L	0.005	0.005	0.006	15	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,2-Dichloropropane	mg/L	0.005	0.005	0.0091	4.0	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,3,5-Trimethylbenzene	mg/L	0.072	0.072	0.045	0.81	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,3-Dichlorobenzene	mg/L	0.019	0.0066	0.038	0.2	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
1,4-Dichlorobenzene	mg/L	0.075	0.075	0.013	0.2	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
2-Butanone (Methyl Ethyl Ketone)	mg/L	38	13	2.2	40	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.062 U	0.71 U	5 U	5 U	0.5 U	0.5 U	1 U	0.025 U
2-Hexanone	mg/L	2.9	1		ID	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.12 U	1.4 U	10 U	10 U	1 U	1 UJ	2 U	0.05 U
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	mg/L	5.2	1.8	ID	ID	0.05 UJ	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.12 U	1.4 UJ	10 UJ	10 UJ	1 U	1 UJ	2 U	0.05 UJ
Acetone	mg/L	2.1	0.73	1.7	30	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.062 U	0.71 U	5 U	5 U	0.5 U	0.5 U	1 U	0.025 U
Benzene	mg/L	0.005	0.005	0.012	1.8	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0026	0.034 ^{arc}	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Bromodichloromethane	mg/L	0.08	0.08	ID	ID	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Bromoform	mg/L	0.08	0.08	ID	ID	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Bromomethane (Methyl Bromide)	mg/L	0.029	0.01	0.035	0.64	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Carbon disulfide	mg/L	2.3	0.8	ID	ID	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.012 U	0.14 U	1 U	1 U	0.1 U	0.1 U	0.2 U	0.005 U
Carbon tetrachloride	mg/L	0.005	0.005	0.0056	1.6	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Chlorobenzene	mg/L	0.1	0.1	0.047	0.85	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Chloroethane	mg/L	1.7	0.43	ID	20	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Chloroform (Trichloromethane)	mg/L	0.08	0.08	0.077	2.6	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Chloromethane (Methyl Chloride)	mg/L	1.1	0.26	ID	ID	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 J	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
cis-1,2-Dichloroethene	mg/L	0.07	0.07	0.62	11	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0061	0.27 ^{ab}	6.4 ^{arc}	6.5 ^{arc}	0.49 ^{ab}	0.5 ^{ab}	0.67 ^{ab}	0.001 U
cis-1,3-Dichloropropene	mg/L					0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Cyclohexane	mg/L				ID	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Dibromochloromethane	mg/L	0.08	0.08	ID	ID	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Dichlorodifluoromethane (CFC-12)	mg/L	4.8	1.7	ID	ID	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 UJ	0.0025 U	0.029 UJ	0.2 U	0.2 U	0.02 U	0.02 U	0.04 UJ	0.001 UJ
Ethylbenzene	mg/L	0.074	0.074	0.018	0.32	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Isopropylbenzene	mg/L	2.3	0.8	ID	ID	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.012 U	0.14 U	1 U	1 U	0.1 U	0.1 U	0.2 U	0.005 U
Methyl acetate	mg/L					0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.29 U	2 U	2 U	0.2 U	0.2 U	0.4 UJ	0.01 UJ
Methyl cyclohexane	mg/L					0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Methyl Tert Butyl Ether	mg/L	0.04	0.04	0.1	13	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.012 U	0.14 U	1 U	1 U	0.1 U	0.1 U	0.2 U	0.005 U
Methylene chloride	mg/L	0.005	0.005	0.047	17	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.012 U	0.14 U	1 U	1 U	0.1 U	0.1 U	0.2 U	0.005 U
Styrene	mg/L	0.1	0.1	0.08	2.9	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Tetrachloroethene	mg/L	0.005	0.005	0.011	0.71	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Toluene	mg/L	0.79	0.79	0.14	1.7	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
trans-1,2-Dichloroethene	mg/L	0.1	0.1	1.5	28	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.012 J	0.21 ^{ab}	0.21 ^{ab}	0.026	0.032	0.029 J	0.001 U
trans-1,3-Dichloropropene	mg/L					0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Trichloroethene	mg/L	0.005	0.005	0.029	3.5	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Trichlorofluoromethane (CFC-11)	mg/L	7.3	2.6			0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Trifluorotrichloroethane (Freon 113)	mg/L	170	170	0.032	0.57	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025 U	0.029 U	0.2 U	0.2 U	0.02 U	0.02 U	0.04 U	0.001 U
Vinyl chloride	mg/L	0.002	0.002	0.015	17	0.00038 J	0.001 U	0.0024 ^{ab}	0.0021 ^{ab}	0.001 U	0.00041 J	0.077 ^{arc}	0.75 ^{arc}	7.6 ^{arc}	7.7 ^{arc}	0.64 ^{arc}	0.46 J ^{arc}	1.3 ^{ab}	0.001 U
Xylene (total)	mg/L	0.28	0.28	0.035	0.63	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	0.057 U	0.4 U	0.4 U	0.04 U	0.04 U	0.08 U	0.002 U
Total Chlorinated VOCs	mg/L	-	-	-	-	0.00066	0	0.0024	0.0021	0	0.00041	0.0831	1.02	14	14.2	1.13	0.96	1.97	0

Notes:

Screening Criteria is from Michigan DEQ Act 451, Part 201, as amended.

0.0024^{ab} - Constituent is above at least one of the industrial criteria values (criteria is indicated with the superscript).

ID - Insufficient data to develop criterion.

a - IDWC

b - RCDWC

c - GSI

d - FAV

FAV - Final Acute Value

GSI - Groundwater Surface Water Interface Criteria

IDWC - Industrial Drinking Water Criteria

RCDWC - Residential & Commercial I Drinking Water Criteria

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J - The associated value is qualified as an estimated quantity.

UJ - The analyte was reported or qualified as not detected however, the sample report limit is qualified as an estimated value and may be inaccurate or imprecise.



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-43

DATE COMPLETED: May 31, 2007

DRILLING METHOD: 2-1/2" DIRECT PUSH

FIELD PERSONNEL: D. RIVERS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft BGS	TEMP MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	716.90						
	ASPHALT	716.60						
	GM-SILTY GRAVELS, with fine to coarse sands, compact, fine gravels, gray, moist	715.90						
2	SM-SILTY SANDS, trace fine gravels, compact, fine grained, trace medium to coarse grained, poorly graded, brown, moist			1DP		75		0.4
4	SP-SANDS, trace silts, compact, fine grained, poorly graded, light brown, moist	713.15						
6	- orange brown at 4.3ft BGS							
8	- brown at 6.0ft BGS			2DP		75		0.1
10	- fine to coarse grained, trace fine gravels, light brown at 7.0ft BGS							
12	- banding-orange, brown, light brown at 8.3ft BGS							
14				3DP		75		0.1
16	- brown/gray, very moist to saturated at 12.5ft BGS							
18	- gray, saturated at 13.0ft BGS							
20	- fine grained, no gravels at 16.3ft BGS			4DP		80		0.1
22	CI-SILTY CLAYS, trace fine sands, firm, medium plasticity, gray, moist	698.90						
24	END OF BOREHOLE @ 20.0ft BGS	696.90						

2-1/2" BOREHOLE

BACKFILLED WITH BENTONITE CHIPS

WELL DETAILS

Screened interval:

703.90 to 699.90ft BGS

13.00 to 17.00ft BGS

Length: 4ft

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 7/27/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-44

DATE COMPLETED: May 31, 2007

DRILLING METHOD: 2-1/2" DIRECT PUSH

FIELD PERSONNEL: D. RIVERS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft BGS	TEMP MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	716.98						
	ASPHALT	716.68						
2	SM-SILTY SANDS, with fine gravels, compact, fine to coarse grained, poorly graded, brown, moist - rust brown at 2.5ft BGS			1DP		75		0.1
4	SP-SANDS, trace silts, compact, fine grained, trace medium to coarse grained, poorly graded, orange brown, moist - light brown at 4.3ft BGS	713.73						
6								
8	- fine to coarse grained, trace fine gravels, brown at 7.0ft BGS - banding, light brown, orange brown at 8.5ft BGS			2DP		75		0.2
10	- white to beige at 10.0ft BGS							
12								
14	- light brown, very moist to saturated at 13.0ft BGS - 2" CL-SILTY CLAY seam, firm, low plasticity, gray at 13.8ft BGS - fine grained, brown-gray, saturated at 14.0ft BGS			3DP		75		0.1
16	- gray at 15.0ft BGS	700.38						
18	CI-SILTY CLAYS, trace fine sands, firm, medium plasticity, gray, moist - 3" ML-SANDY SILT seam, compact, gray, saturated at 18.7ft BGS			4DP		95		0.0
20	END OF BOREHOLE @ 20.0ft BGS	696.98						
22								
24								
26								
28								
30								
32								
34								

WELL DETAILS

Screened interval:

704.48 to 700.48ft BGS

12.50 to 16.50ft BGS

Length: 4ft

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 7/27/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-45

DATE COMPLETED: May 31, 2007

DRILLING METHOD: 2-1/2" DIRECT PUSH

FIELD PERSONNEL: D. RIVERS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft BGS	TEMP MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	717.67						
	ASPHALT	717.37						
2	SM-SILTY SANDS, with fine gravels, compact, fine to coarse grained, poorly graded, brown, moist - trace fine gravels at 1.0ft BGS			1DP		75		0.4
4	SP-SANDS, trace silts, compact, fine grained, trace medium to coarse grained, poorly graded, light brown, moist	714.17						
6	- fine to coarse grained, brown, trace fine gravels at 6.5ft BGS			2DP		75		4.8
8								
10	- light brown at 10.0ft BGS							
12				3DP		85		0.0
14	- brown-gray, very moist at 13.5ft BGS - saturated at 14.3ft BGS - fine grained at 14.6ft BGS							
16	- 2" CL-SILTY CLAYS, with fine sands seam firm, gray, low plasticity at 16.5ft BGS			4DP		90		0.0
18	- fine grained, trace medium grained to fine gravels at 17.5ft BGS - fine grained at 18.0ft BGS	699.42						
20	CI-SILTY CLAYS, trace fine sands, firm, medium plasticity, gray, moist END OF BOREHOLE @ 20.0ft BGS	697.67						
22								
24								
26								
28								
30								
32								
34								

2-1/2" BOREHOLE

BACKFILLED WITH BENTONITE CHIPS

WELL DETAILS

Screened interval:

704.67 to 700.67ft BGS

13.00 to 17.00ft BGS

Length: 4ft

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 7/27/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-46

DATE COMPLETED: May 31, 2007

DRILLING METHOD: 2-1/2" DIRECT PUSH

FIELD PERSONNEL: D. RIVERS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft BGS	TEMP MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	717.30						
	ASPHALT	717.00						
2	SM-SILTY SANDS, with fine gravels, compact, fine grained, poorly graded, brown, moist			1DP		75		0.1
4	- orange-brown at 3.5ft BGS							
6	- brown at 6.0ft BGS							
8	SP-SANDS, trace silts and fine gravels, compact, fine to coarse grained, poorly graded, brown, moist	709.80		2DP		75		0.1
10	- white to beige, some orange banding at 10.0ft BGS							
12				3DP		85		0.2
14	- brown-gray, saturated at 13.7ft BGS - light brown, very moist at 13.8ft BGS							
16	- fine grained, trace medium to coarse grained, gray at 15.5ft BGS			4DP		90		0.1
18								
20	CI-SILTY CLAYS, trace fine sands, firm, medium plasticity, gray, moist	698.30						
	END OF BOREHOLE @ 20.0ft BGS	697.30						
22								
24								
26								
28								
30								
32								
34								

2-1/2" BOREHOLE

BACKFILLED WITH BENTONITE CHIPS

WELL DETAILS
Screened interval:
703.30 to 699.30ft BGS
14.00 to 18.00ft BGS
Length: 4ft

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 7/27/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-47

DATE COMPLETED: May 31, 2007

DRILLING METHOD: DIRECT PUSH

FIELD PERSONNEL: D. RIVERS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft BGS	TEMP MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	715.91						
	ASPHALT	715.61						
2	GM-SILTY GRAVELS, with fine to coarse sands, compact, fine grained, poorly graded, gray, moist	714.41		1DP		75		0.8
4	SM-SILTY SANDS, trace fine gravels, compact, fine grained, trace medium to coarse grained, poorly graded, dark brown, moist							
6	- rust brown at 2.3ft BGS - brown at 3.0ft BGS							
8	SP-SANDS, trace silts and fine gravels, compact, fine to coarse grained, poorly graded, brown, moist	709.41		2DP		80		0.2
10	- banding-brown, light brown and orange at 8.5ft BGS							
12	- white to beige at 10.5ft BGS - with orange banding at 11.5ft BGS							
14	- brown gray, very moist to saturated at 13.3ft BGS - saturated at 13.8ft BGS			3DP		80		0.1
16								
18	- fine grained, no gravels at 17.3ft BGS	697.91		4DP		85		0.1
20	CI-SILTY CLAYS, trace fine sands, firm, medium plasticity, gray, moist	695.91						
22	END OF BOREHOLE @ 20.0ft BGS							
24								
26								
28								
30								
32								
34								

WELL DETAILS

Screened interval:

702.91 to 698.91ft BGS

13.00 to 17.00ft BGS

Length: 4ft

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 7/27/07



STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 1

PROJECT NAME: GM - CVO

PROJECT NUMBER: 17303

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: YPSILANTI, MICHIGAN

HOLE DESIGNATION: SB19-48

DATE COMPLETED: May 31, 2007

DRILLING METHOD: 2-1/2" DIRECT PUSH

FIELD PERSONNEL: D. RIVERS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft BGS	TEMP MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	715.35						
	ASPHALT	715.05						
2	GM-SILTY GRAVELS, with fine to coarse sands, compact, fine grained, poorly graded, gray, moist	713.85		1DP		75		0.4
4	SM-SILTY SANDS, trace fine gravels, compact, fine grained, trace medium to coarse grained, poorly graded, dark brown, moist							
6	- orange-brown at 3.0ft BGS - brown at 3.8ft BGS - dark brown, trace clays at 6.5ft BGS							
8	SP-SANDS, trace silts and fine gravels, compact, fine to coarse grained, poorly graded, brown, moist	708.35		2DP		75		0.4
10	- banding-brown, light brown and orange at 9.0ft BGS							
12	- white to beige at 10.5ft BGS							
14	- banding-white, brown and orange at 11.5ft BGS - very moist to saturated at 12.5ft BGS - saturated, light gray at 13.0ft BGS - fine grained, brown-gray at 14.0ft BGS			3DP				0.2
16	SM-SILTY SANDS, compact, fine grained, poorly graded, gray, saturated	699.35 698.85						
18	CI-SILTY CLAYS, trace fine sands, firm, medium plasticity, gray, moist			4DP				ND
20	END OF BOREHOLE @ 20.0ft BGS	695.35						
22								
24								
26								
28								
30								
32								
34								

WELL DETAILS

Screened interval:

703.35 to 699.35ft BGS

12.00 to 16.00ft BGS

Length: 4ft

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 17303.GPJ CRA_CORP.GDT 7/27/07



Memorandum

To: Kevin Lund, Michigan Department of Environmental Quality Ref. No.: 017303

From: Beth Landale//172/Det. Date: January 6, 2015

CC: Grant Trigger, RACER

Re: **2014 Membrane Interface Probe Investigation Summary**
RACER - Willow Run Company Vehicle Operations
2901 Tyler Road
Ypsilanti, Michigan

1. Introduction

On behalf of Revitalizing Auto Communities Environmental Response Trust (RACER), GHD has prepared this memorandum to summarize the results of the Membrane Interface Probe (MIP) investigation completed in December 2014 at the Company Vehicle Operations in Ypsilanti, Michigan (Site). The MIP investigation was designed to evaluate chlorinated volatile organic compounds (CVOC) as part of the ongoing evaluation of remedial options for the Site. Despite many rounds of investigation at the Site, there were several data gaps that, if investigated, may more fully inform the identification, evaluation and selection of effective remedial alternatives by defining or eliminating the potential of additional source areas. The MIP investigation included installation of 82 MIP soil boring locations to clay and working with Matrix Environmental (Matrix) (MIP contractor) to generate isocontour maps and a 3D model of the investigated area.

The proposed locations are presented on Figure 1a and are categorized by four investigation objectives:

- Pink Locations – to provide additional information into unidentified sources for hotspots such as MW19-07 and MW19-12. Some of these locations also fill in large data gaps where high contaminate levels were detected (MW19-42), but there was limited upgradient data to define the extent of upgradient impacts, despite current understanding of source areas.
- Orange Locations – to provide information on transport of impacts to the east into a potential off-site migration pathway.
- Blue Locations – to provide additional delineation of impacts laterally and vertically related to the groundwater–surface water interface pathway and transport of impacts along the bank of the Site and Tyler Pond.

- Green Locations – to provide additional information to determine if there are impacts pooling at the clay surface. A close review of the field logs from this area indicated that there appears to be shallow bowl in the clay in the area.

The following sections summarize the investigation and the results.

2. MIP Advancement and Results

Prior to the beginning of the scope of work, locations were field marked, cleared by a private utility locate contractor, and surveyed. Between December 2 and December 18, 2014, 82 MIP soil boring locations were installed throughout the northwestern portion of the Site (west of the north-south running sanitary sewer corridor that bisects the Site) and generally north and east of the Haulaway Building (Figure 1b). Soil borings were advanced to the massive, continuous clay approximately 25 feet below ground surface (bgs), as detected by rate of push and electric resistivity.

The MIP probe is attached to a geoprobe rig and advanced through the soil to log the relative concentrations of volatile organic compounds (VOCs) in the soils. For this scope of work, the MIP probe was outfitted with:

- Photoionization detector (PID) that detects VOCs in the hydrocarbon range (e.g., benzene, toluene, ethylbenzene, xylene [BTEX]).
- Flame ionization detector (FID) that detects total VOCs and methane.
- Halogen specific detector (XSD) that detects VOCs in the chlorinated range (i.e., trichloroethylene [TCE] and tetrachloroethylene [PCE]).

With the direct push nature of the MIP probe, no soil cuttings were generated.

The Matrix Report provided in Attachment 1 provides:

- General background on the equipment used including the MIP probe, the detectors, response tests, etc.
- Site specific information for this with respect to locations where refusals and repairs took place.
- MIP Field Log Summary which includes date completed depth and comments which include refusals, additional wait times, significant fuel responses, repairs, questionable readings.
- MIP Analytical Interpretation table which provides maximum detections and depths for each detector per location and estimated concentration ranges at intervals.
- MIP logs with PID/FID/XSD and electrical conductivity results plotted side by side.
- QA/QC pre and post log checks.

3. Evaluation of Results

Utilizing the MIP results, Matrix generated several isocontour figures based on the XSD, FID, PID, and PID minus XSD which is the PID results corrected by lowering the results in direct relation to elevated XSD results (Figures 2 – 6). The PID minus XSD results, like all of the MIP results, should be viewed as strictly relative. XSD results indicated that highest chlorinated impacts are located north-northeast of the Haulaway building along the groundwater divide on-Site and extend eastward to the north-south running sewer corridor

to the east. A pocket of additional elevated chlorinated impacts is located in the northwest portion of the Site. The corrected PID isocontour figure indicates that the hydrocarbon impacts are in basically the same areas as the chlorinated impacts, though the extent is somewhat larger. One area of note is the hot spot near MIP-059 northwest of the Haulaway Building on the XSD and PID isocontours. These impacts are further upgradient than impacts were previously known to extend. The FID isocontour, as it detects the entire VOC range, shows a much larger area of impacts; however, the large range of detection also means that it is hard to discern what type of impacts elevated results indicate. Two notable areas of elevated VOCs that showed up on the FID isocontour but not on the XSD or PID isocontours are located near the northeast area of investigation adjacent to the bank of Tyler Pond and the sewer corridor and the other area is located near the southeast portion of the investigation area. These locations do not show up as particularly "hot" on the XSD or PID results, but the elevated FID results are consistent with constituent sampling in the area.

In addition to the isocontours, Matrix created a 3D model of the investigation which is on file at GHD. Several screen shots of the model are presented in Figures 7 through 12. The figures present slices of the models of the PID and XSD results; cross section locations are presented in Figure 1b. The vertical and horizontal extent of both PID and XSD (gasoline and chlorinated range VOCs, respectively) along line A-A' is illustrated on Figures 7 and 8. The highly elevated PID and somewhat elevated XSD readings in the northwestern portion of the line (near MIP-27) are likely due to debris and tar/tar-sludge encountered in this area during previous test pitting. The downgradient elevation of both PID and XSD readings near MIP-20 along A-A' may be from migration. Along line B-B' (Figures 9 and 10), the impacts near MIP-072 are obvious in both the PID and XSD responses. Drums containing DNAPL were removed from this area in 2005 and impacts from those drums likely account for the elevated responses throughout the boring. Elevated PID responses extending to/into the clay layer may be the result of system delay to flush out the elevated constituents. The separate pocket of elevated XSD readings between MIP-073 and MIP-036 to the northeast is fairly cross-gradient. PID and XSD impacts are undelineated at MIP-011, adjacent to the bluff leading down to Tyler Pond. On the C-C' section, the XSD and PID impacts follow the same basic pattern with the exception of greater vertical PID impacts at MIP-059. XSD impacts are undefined to the northeast at MIP-005, adjacent to the bluff leading down to Tyler Pond.

4. Conclusions

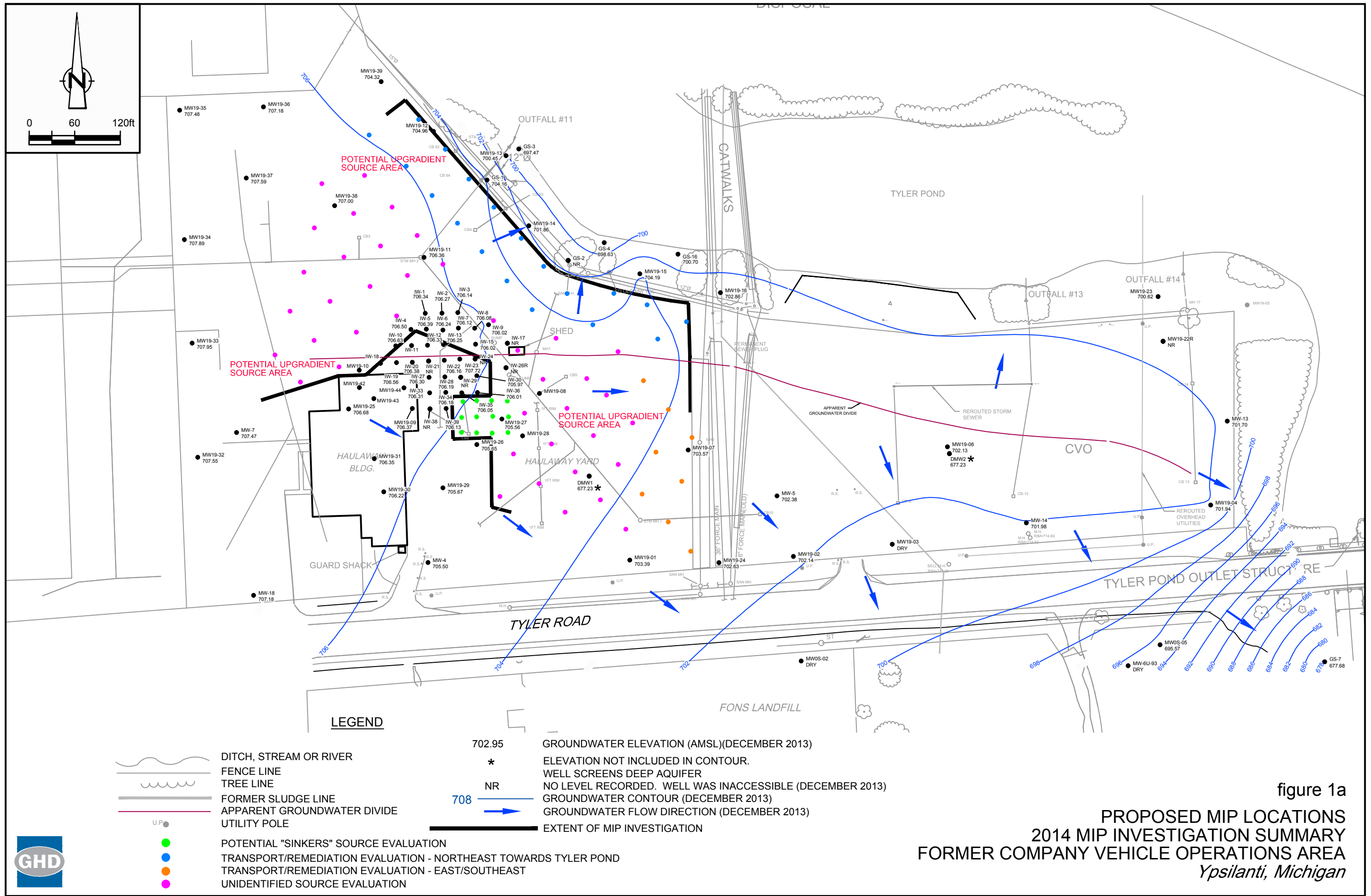
Several Site issues have been highlighted by the MIP investigation. From a source investigation viewpoint, the elevated PID and XSD results northwest of the Haulaway building indicate a previously unidentified potential upgradient source. The elevated FID results in the northeast investigation area near MIP-10 suggest a potential additional source area, though the nature of impacts is unknown. In the north-northwest portion of the investigation, near MIP-028, FID, PID and XSD results indicate that there may be a separate source area. During previous test pitting investigations in this area, automotive debris, some drum remnants, and solidified tar were found in this area. During drilling, non-aqueous phase liquid (NAPL) was observed on the rods while advancing MIP-027.

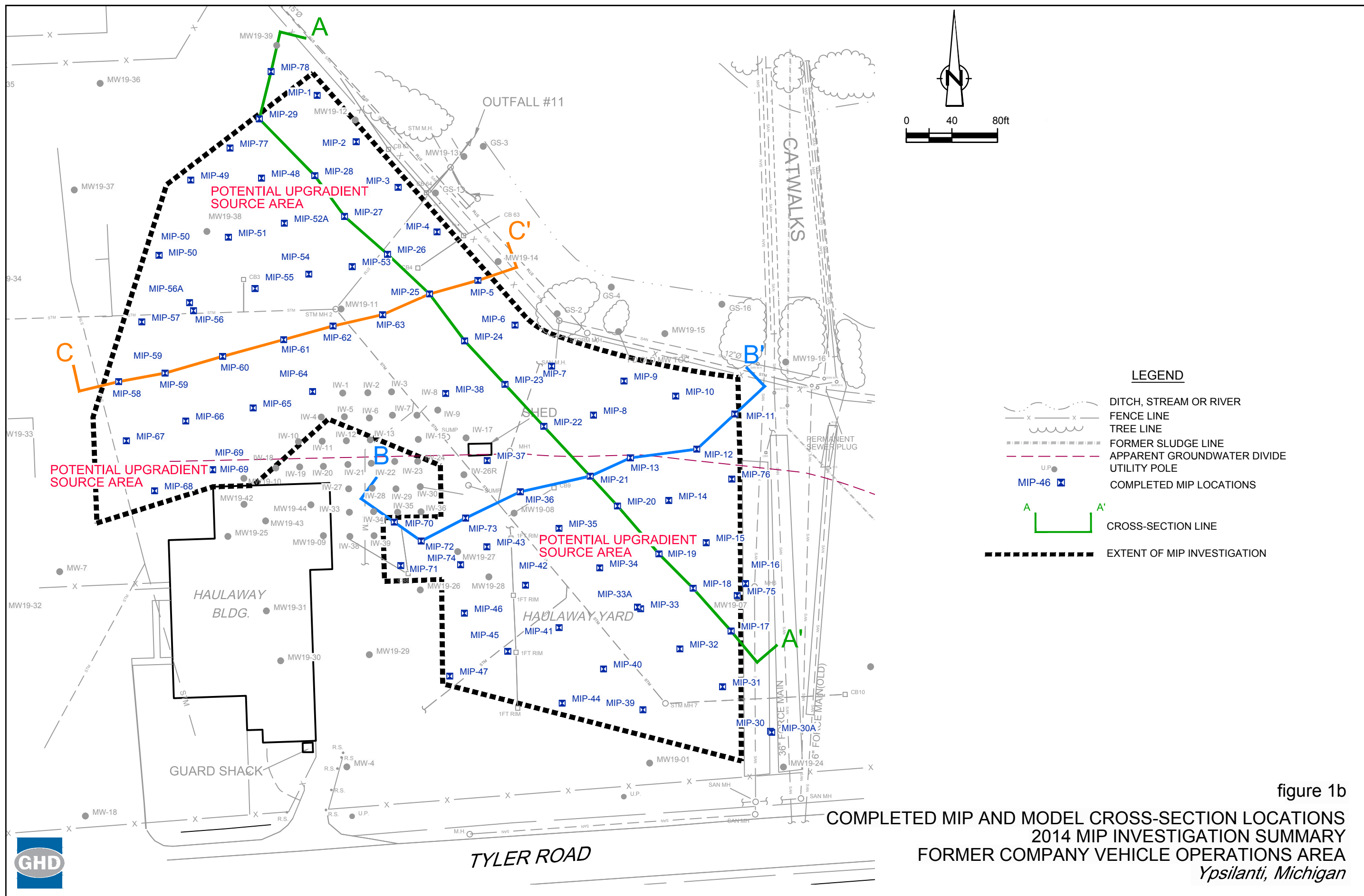
The impacts at MIP-072 stand out in the model as the impacts extend from the ground surface to the underlying clay. As mentioned, several drums were removed from this area, some of which contained DNAPL. After removal, soil from the excavation that was field screened as "clean" with a PID was returned to the excavation. It is likely that these backfilled soils are the cause of the vertical extent of impacts up to the ground surface. The extent down to the clay may be a drag-down effect where very highly elevated levels can take an extended amount of time to flush out of the MIP system and affect the results below.

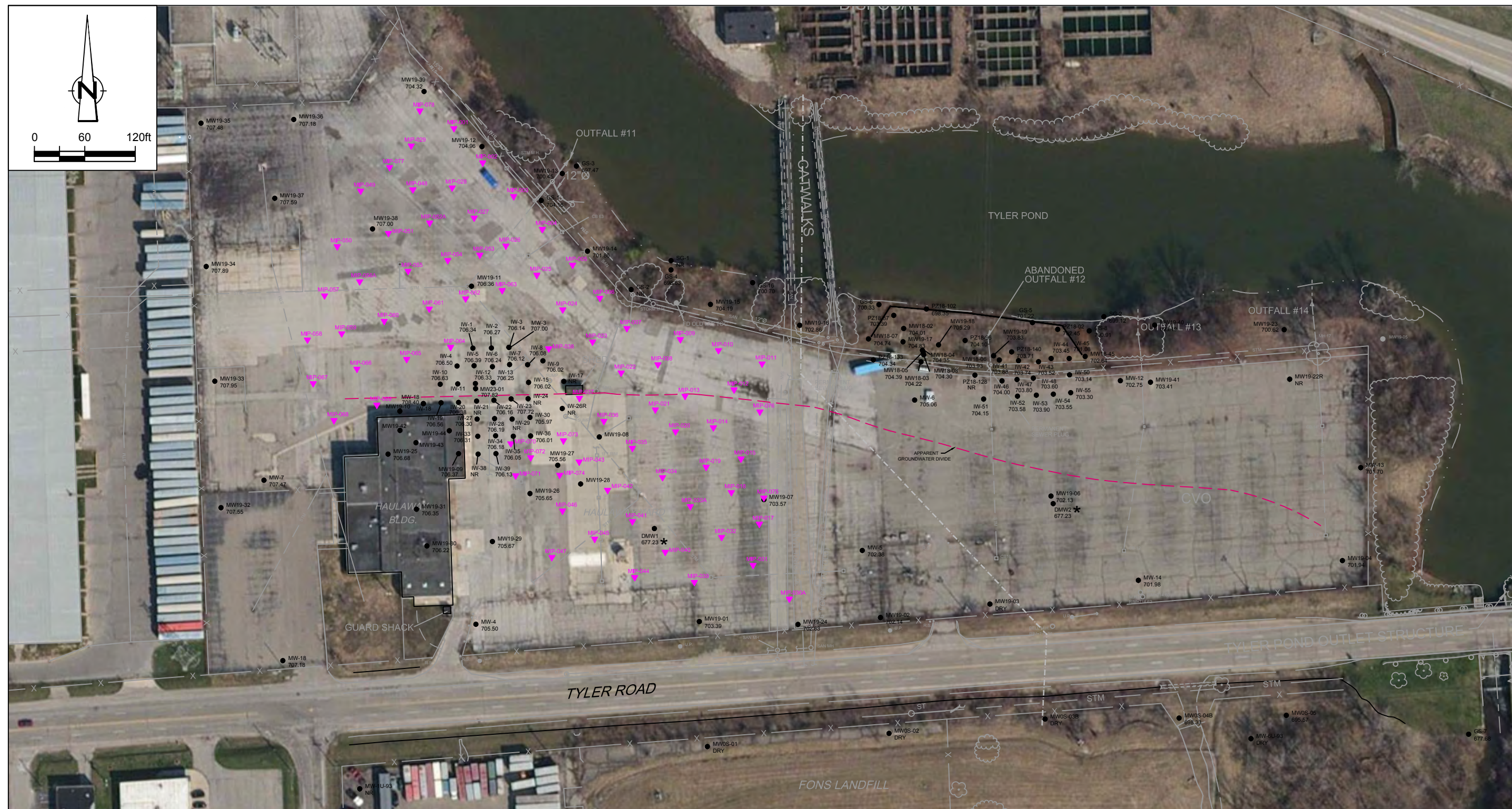
Several of the MIP borings along the northern edge of the investigation area indicated elevated FID, PID, and/or XSD readings, leaving the delineation of potential impacts to Tyler Pond incomplete.

The results discussed in this memorandum will be incorporated into an updated conceptual site model along with groundwater and other media results.

DRAFT







LEGEND

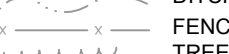
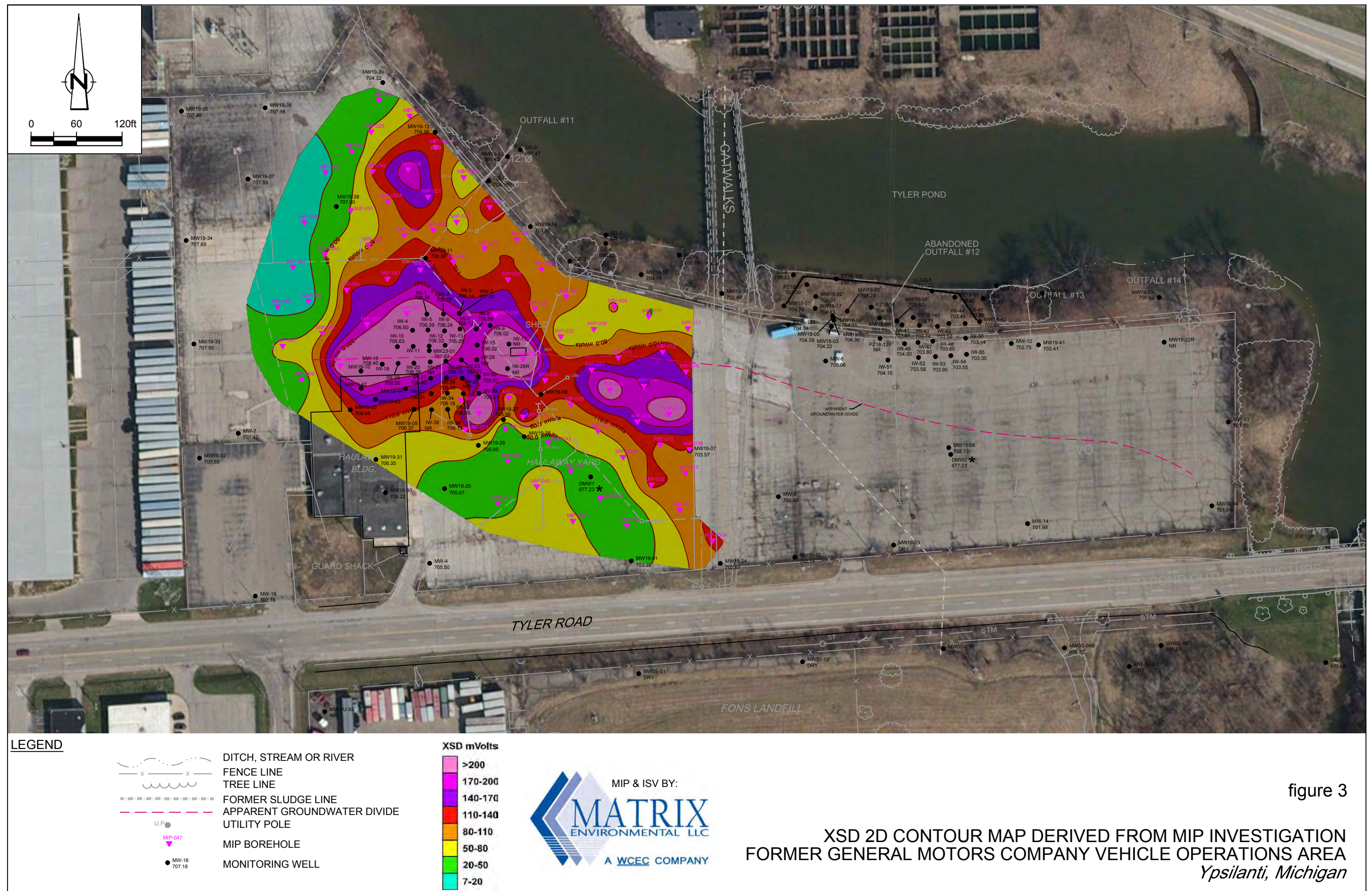
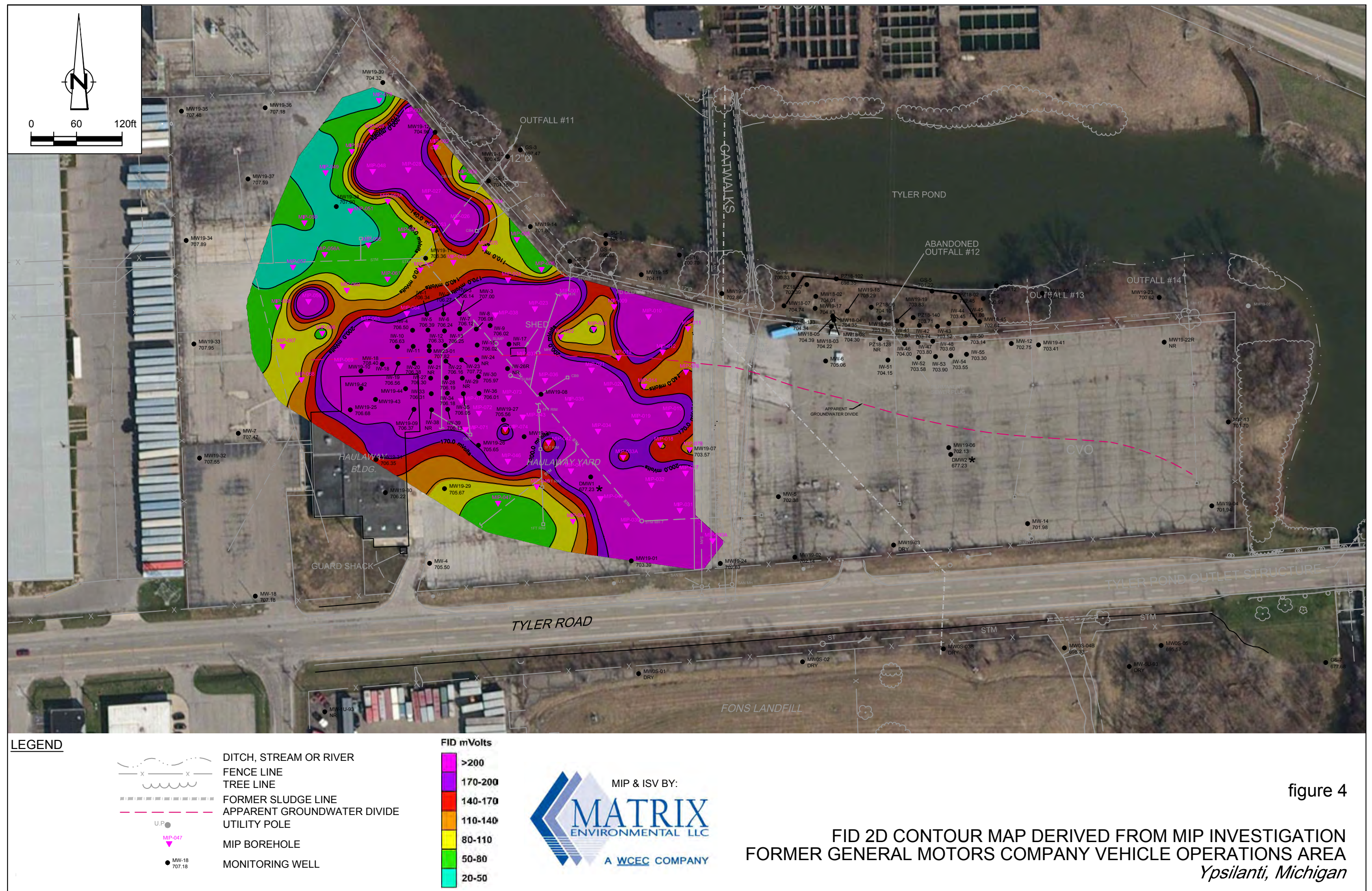
- 
-  DITCH, STREAM OR RIVER
 FENCE LINE
 TREE LINE
 FORMER SLUDGE LINE
 APPARENT GROUNDWATER DIVIDE
 UTILITY POLE
 MIP-047
 MW-18
 707.18

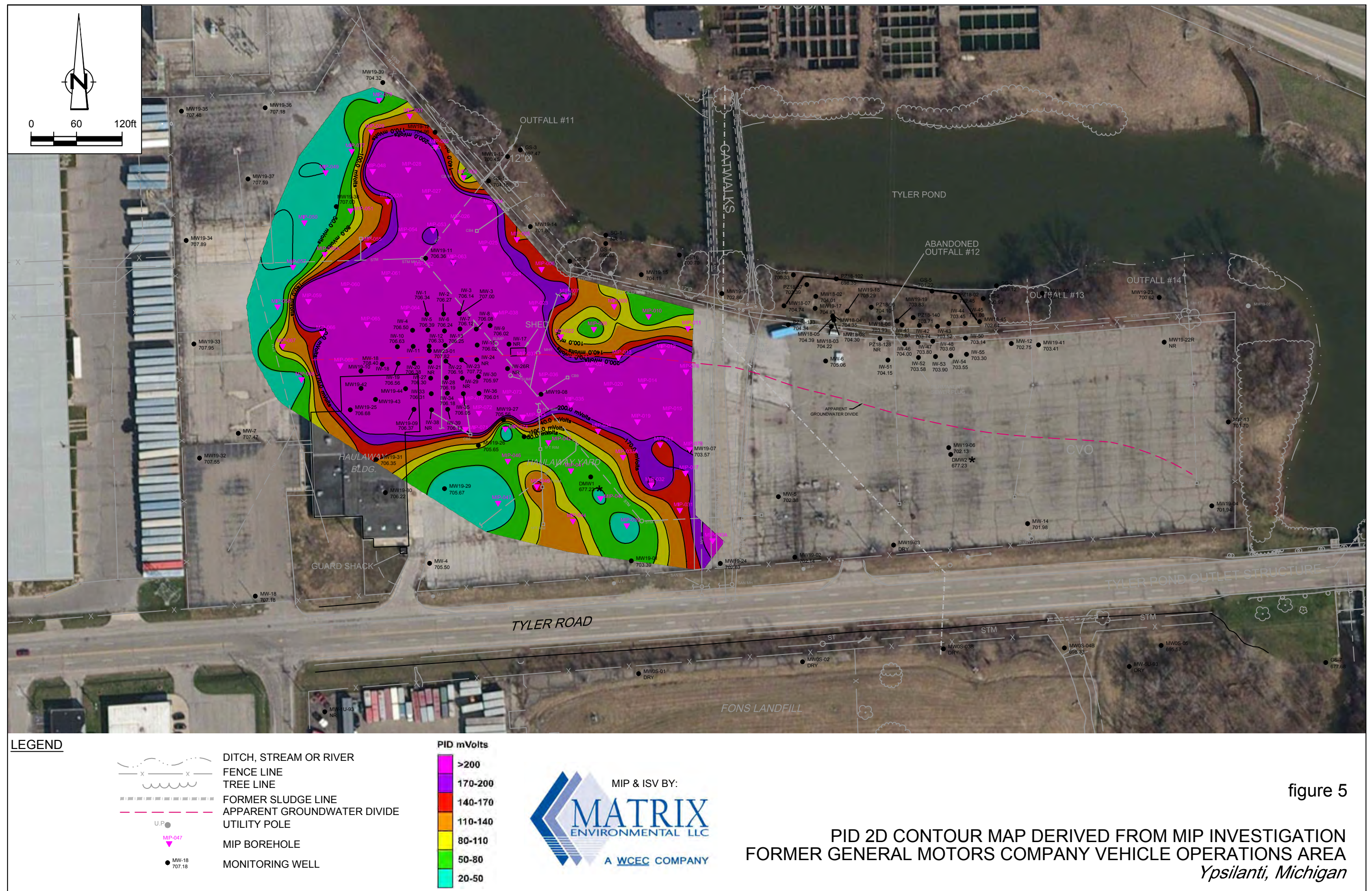


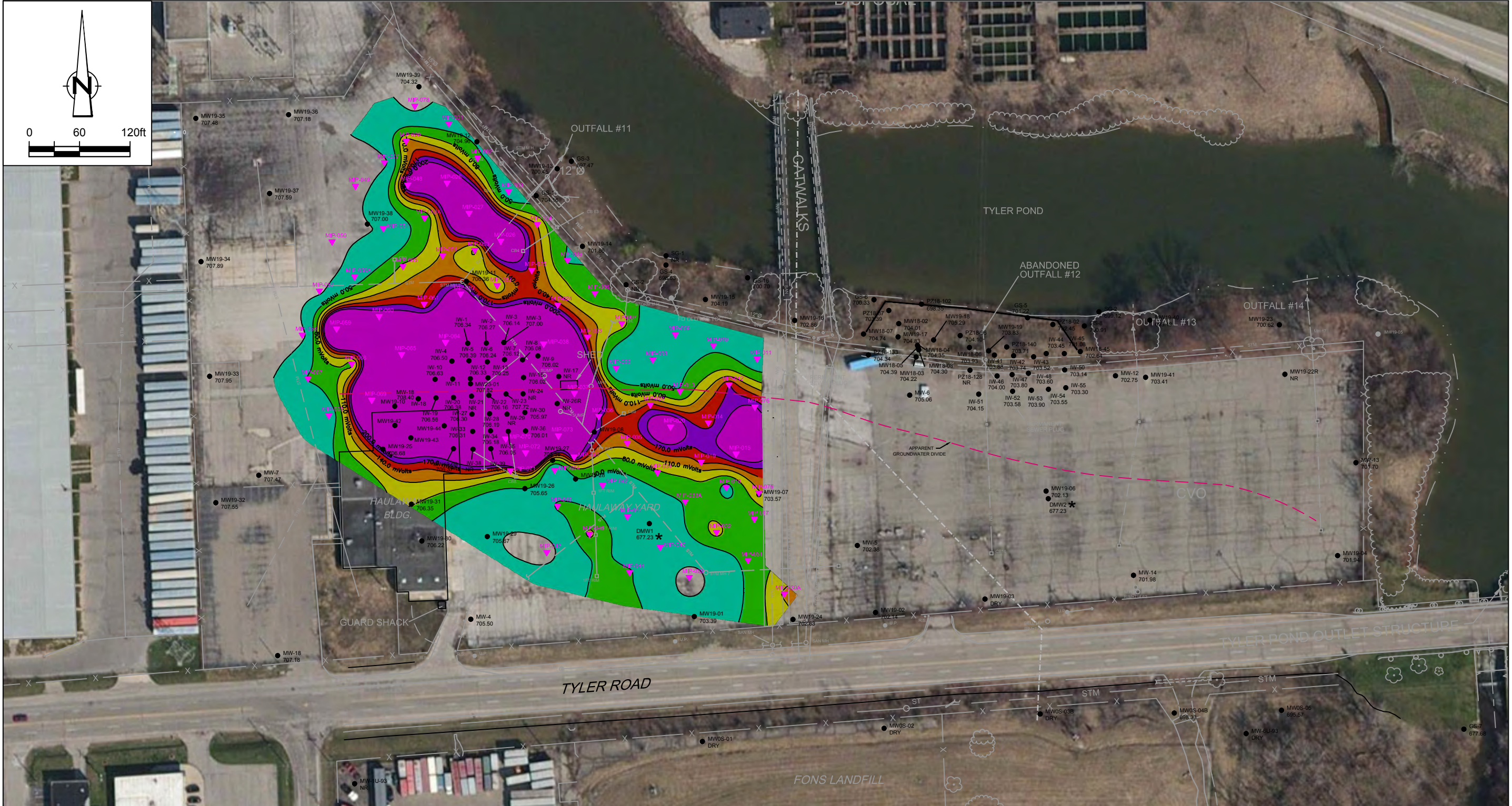
figure 2

MEMBRANE INTERFACE PROBE (MIP) BOREHOLE LOCATIONS
FORMER GENERAL MOTORS COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan









LEGEND

- DITCH, STREAM OR RIVER
- FENCE LINE
- TREE LINE
- FORMER SLUDGE LINE
- APPARENT GROUNDWATER DIVIDE
- UTILITY POLE
- MIP-047
- MIP BOREHOLE
- MW-18 707.16
- MONITORING WELL

PID-XSD mVolts

>200
170-200
140-170
110-140
80-110
50-80
20-50

MIP & ISV BY:

A WCEC COMPANY

figure 6

PID (MINUS XSD) 2D CONTOUR MAP DERIVED FROM MIP INVESTIGATION
FORMER GENERAL MOTORS COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

3D Visualization of PID Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Easting = 13,344,208.5 ft
Slice Azimuth = 140 degrees

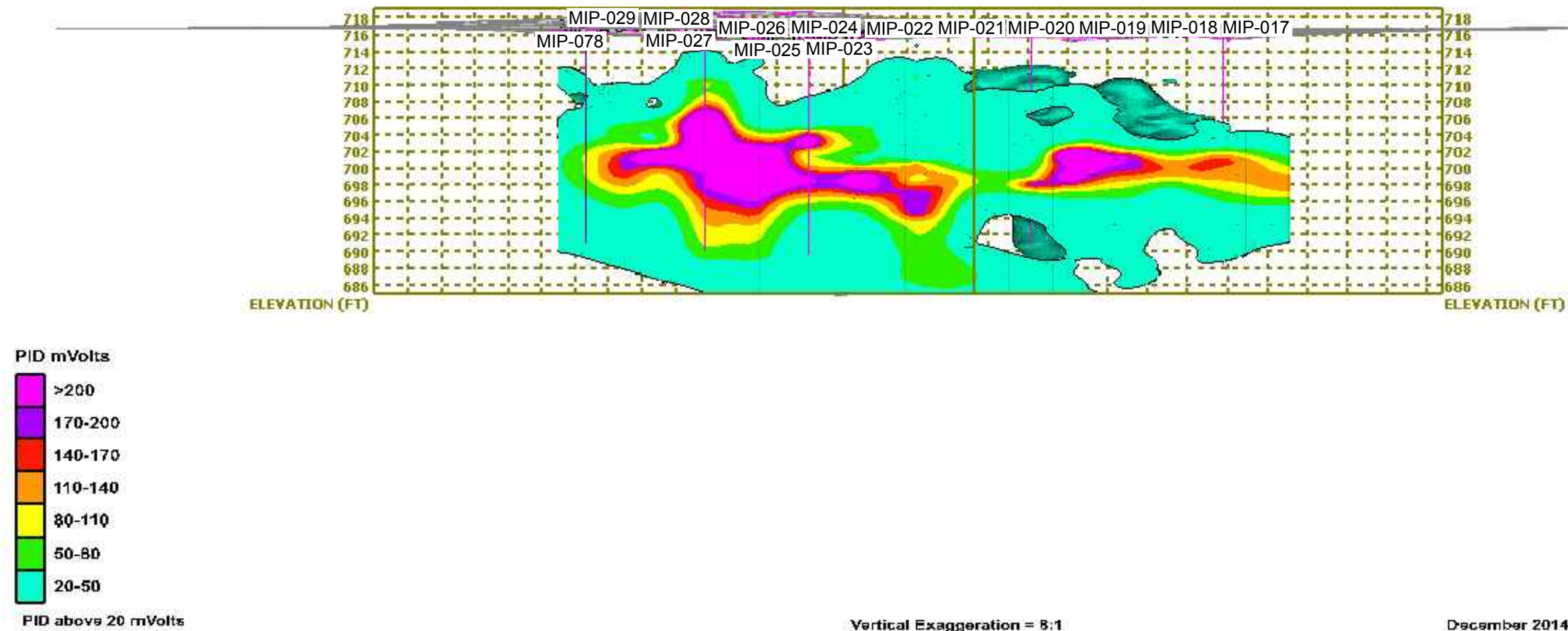


figure 7
EASTING SLICES A-A' - PID RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



3D Visualization of XSD Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Easting = 13,344,208.5 ft
Slice Azimuth = 140 degrees

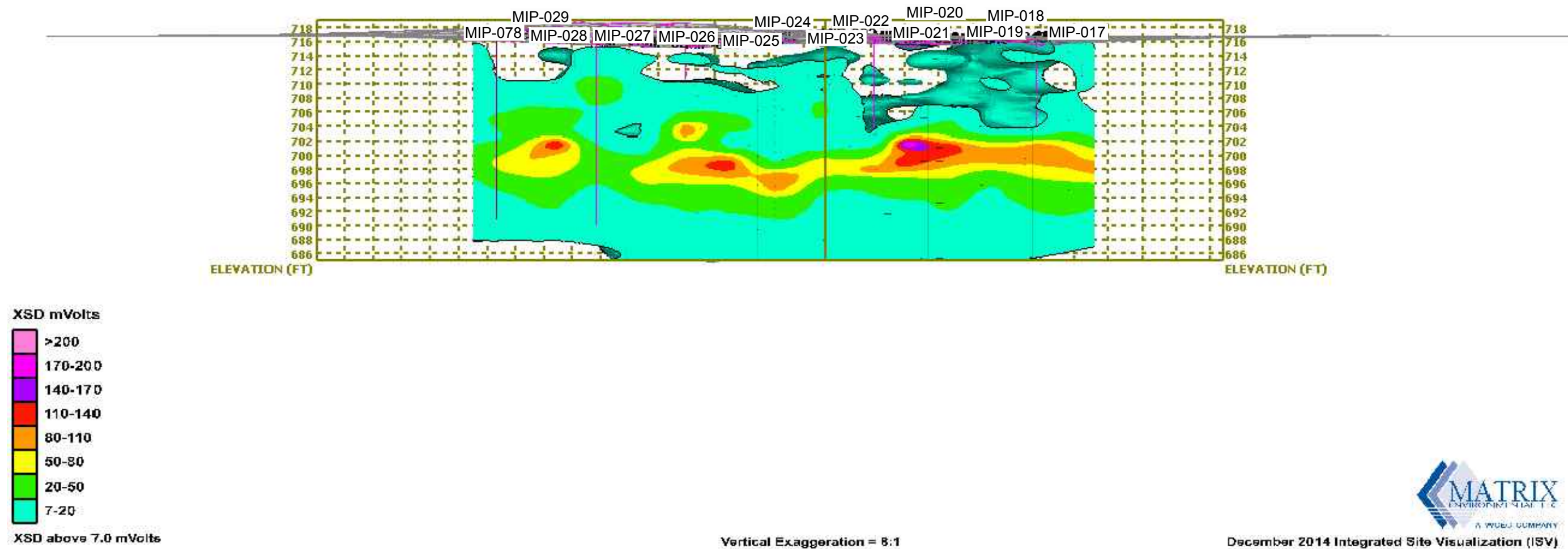


figure 8
EASTING SLICES A-A' - XSD RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



3D Visualization of PID Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Northing = 268,304.2 ft
Slice Azimuth = 72 degrees

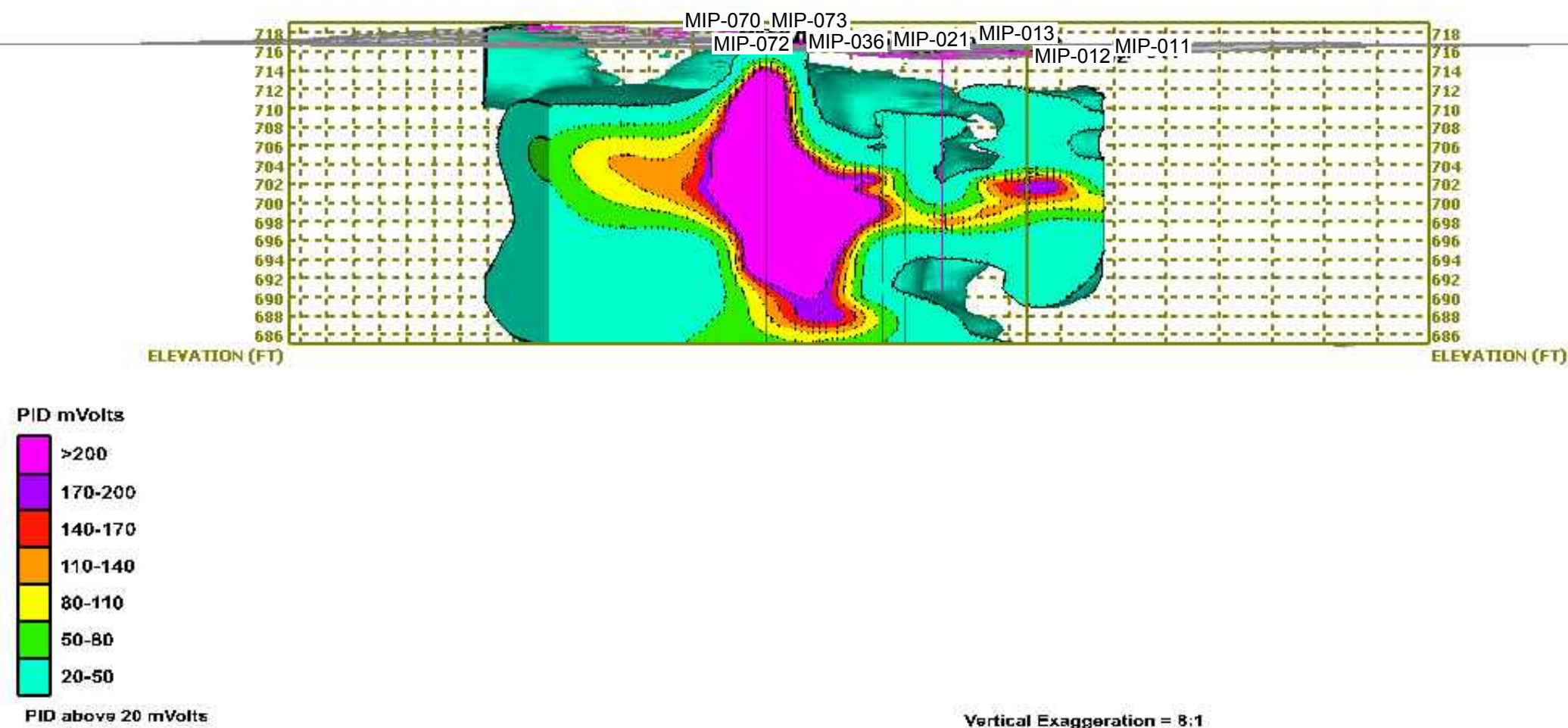
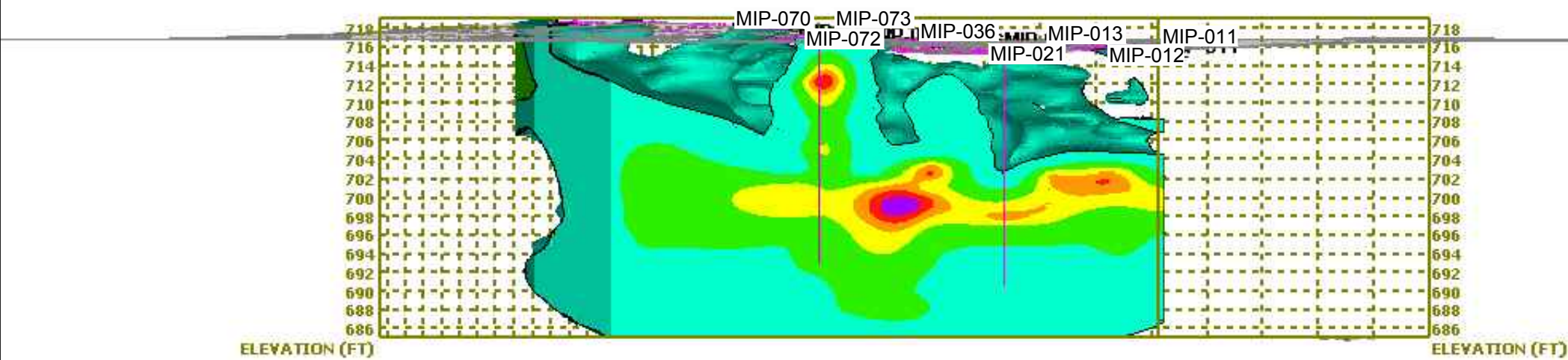


figure 9
NORTHING SLICES B-B' - PID RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

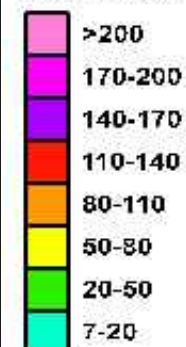


3D Visualization of XSD Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Northing = 268,304.2 ft
Slice Azimuth = 72 degrees



XSD mVolts



XSD above 7.0 mVolts

Vertical Exaggeration = 8:1



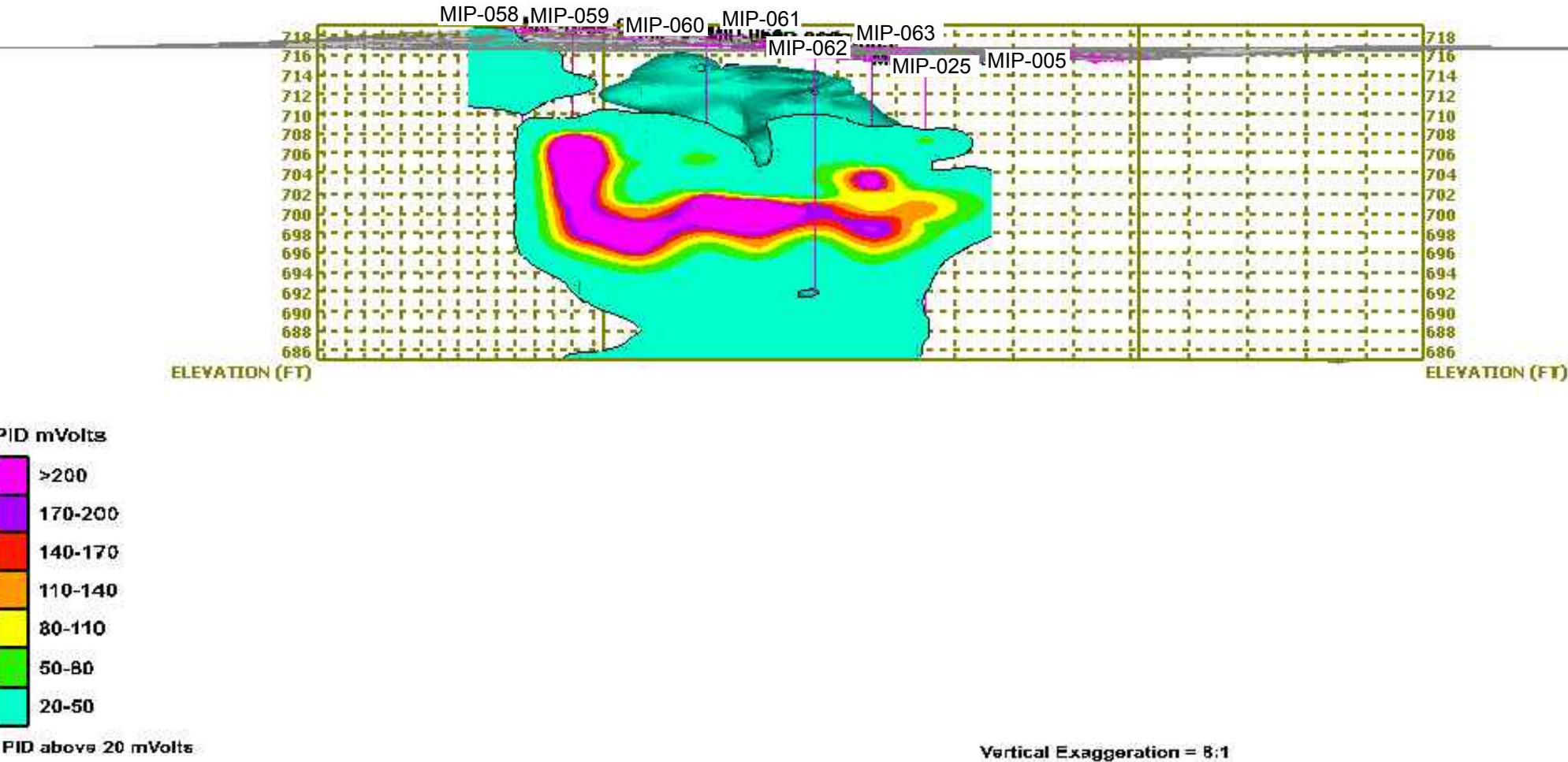
December 2014 Integrated Site Visualization (ISV)

figure 10
NORTHING SLICES B-B' - XSD RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



3D Visualization of PID Response
Former Willow Run
Ypsilanti, MI

Vertical Slice, Northing = 268,497.5 ft
Slice Azimuth = 72 degrees



A WOOD COMPANY

December 2014 Integrated Site Visualization (ISV)

figure 11
NORTHING SLICES C-C' - PID RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



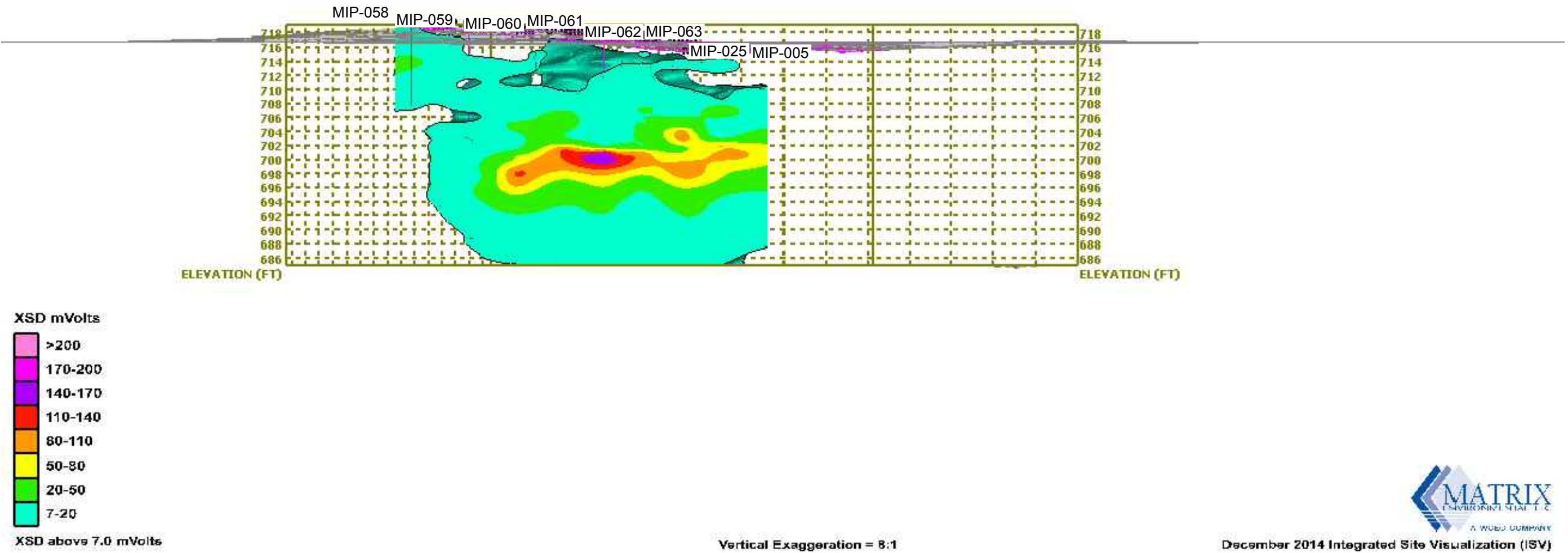


figure 12
NORTHING SLICES C-C' - XSD RESPONSE
2014 MIP INVESTIGATION SUMMARY
FORMER COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan



Attachment 1

MIP Report Matrix



Monday, January 26, 2015

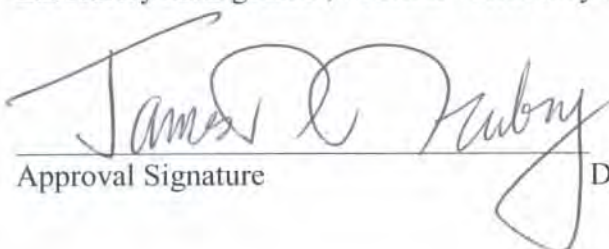
11253 91st Ave N.
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-Direct Sensing Report, MIP-

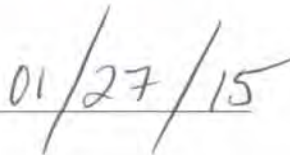
Client: **CRA**
Project Name: **Former Willow Run**
Location: **Ypsilanti, MI**
Project Number: **319.14**

The analysis and opinions expressed in this report are based upon data obtained from the samples collected at the indicated locations and from other information discussed in this report. Exceptions, if any, are discussed in the accompanying comments section of this report. This report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted laboratory practices. Reported results shall not be reproduced, except in full, without written approval of Matrix Environmental, LLC. The sample results relate only to the analytes of interest tested. No warranties, expressed or implied are intended or made.

I certify that the data contained in this final report has been generated and reviewed in accordance with approved methods and our Standard Operating Procedure. Release of this final report is authorized by Laboratory management, which is verified by the following signature.


Approval Signature

Date



MIP SYSTEM DESCRIPTION AND ON-SITE CHEMICAL ANALYSIS

VOCs are semi-quantitatively analyzed in-situ using a membrane interface probe (MIP). The probe is pushed into the ground at a rate of 1 foot per minute (including 45 second residence time). The membrane block heats to a temperature of approximately 90-120°C. Any volatile organic compounds present diffuse across the membrane into the trunkline carrier gas tubing and are brought to the surface and into the GC analytical system. The carrier gas containing samples from the subsurface then passes through a naphion dryer (if used) and a heated GC oven to remove any moisture prior to detector analysis. Compounds appropriate for the detectors and in high enough concentrations (about 1 ppm or higher for Standard MIP and about 100 ppb or higher for Low Level MIP) will produce an electrical signal which is analyzed.

The GC system is comprised of the following three-detector system: Lab grade PID/FID tandem and an XSD. The MIP's trunkline return gas is Y-split in the GC to accomplish this detector configuration. The PID utilizes a 10.0 eV lamp and will ionize aromatic, olefinic, and unsaturated halogenated hydrocarbons with an ionization potential of 10.0 eV or less. The FID will respond to all types of hydrocarbons including methane, halogenated hydrocarbons and other saturated hydrocarbons (generally the FID response gives a good indication of total hydrocarbons present.) The XSD responds selectively to only halogenated compounds (hydrocarbons containing Cl or Br atoms).

Electrical Conductivity (EC) is a measure of the soils ability to conduct an electrical current between two dipoles on the MIP/EC probe. Conductivity is the reciprocal of electrical resistivity and has the units (in our application) of millisiemens per meter (mS/m). Since soil is in the pathway of the charge flow, the grain size can be determined by comparing the EC log to a soil boring. Conductivity readings in the 100s indicate smaller grain (size such as clay). Larger grain size (sand and gravels) are typically in the 10s of mS/m range. Prior to every log the EC point of the MIP probe is checked for proper operation by performing a voltage test with a voltage meter and a conductivity test with a test block.

Since the MIP system is a screening tool, some laboratory analysis of soil or groundwater samples or some historical analytical data is needed in order to obtain optimum MIP log correlation. The following quality assurance/control measures are routinely conducted to ensure the validity of the analytical results:

Chemical Response Test: MIP data needs to be validated with passing QC at the beginning and end of every log. The probe is immersed into a 500 mL cylinder of water containing the compound(s) of interest. This test will be performed at multiple concentration levels at the beginning of each day to verify detector response and generate detection limits of the system (For example: 3 levels of TCE @ 1, 5, & 25 ppm). QC tests of at least one level are checked between each boring to determine system integrity and monitor membrane and detector fluctuations. The results of this are listed in the QA/QC report.

Butane response: May be run between each boring by dispensing butane over the membrane. Measuring the lag time of the carrier gas from the probe to the detectors is used to determine trip time and to verify FID detector response.

Continuity check: Performed before and after each boring to verify system continuity throughout the project for the electrical conductivity data.

DISCUSSION AND COMMENTS

Matrix performed chemical response tests at 0, 1, 5, and 10 ppm TCE at various times throughout the project. At a minimum, a one level response test was performed before or after each log on the MIP system (PID/FID/XSD) to assure data quality. The response tests appeared normal and were indicative of a functional MIP system

For each log, the probe was advanced one foot and then the probe was allowed residence time of 45 seconds or longer - time for the probe to reach temperature and for volatile organic compounds to diffuse through the membrane and into the trunkline. The trip time was about 60 seconds for the trunkline.

Electrical conductivity (EC) data was collected simultaneously at each MIP location. The EC was tested before and after each log for continuity and performance. All tests passed Geoprobe QC specs.

Geoprobe's recommended refusal push rate is 1 foot per minute. This project required pushing the probe at 0.5-1 foot/minute in the 10-14 foot interval for several locations in order to achieve desired depth. See ROP logs (rate of push, by date). Because of these harder drilling conditions, we did encounter refusals at 2 locations:

MIP-016 - refusal @ 12.7 feet.

MIP-056 – refusal @ 9.55 feet. Moved over 2 feet the next day – MIP-056A.

Also, the nitrogen-sending gas line on the probe broke @ MIP-030.

The stringpot (depth control) malfunctioned during MIP-052. The Pre-Log QC passed and this data was retained for this location so we moved over 2 feet and started again naming it MIP-052A.

The detector starting baselines (see *Field Summary Logs*) were elevated for some logs due to high fuel or tar contamination at the previous location. The elevated baselines were allowed due to the time constraints of waiting for the trunkline to clear out. Observing the Post-Log QC after a very contaminated log does help to gauge the amount of baseline shift for each detector independently and it should be noted that the XSD baseline was generally much less affected. The detector baselines were elevated at the start of MIP-072 because that location was very hot. As soon as the probe was lowered into the open pre-probed borehole, the membrane began collecting volatiles that were present. Note that the baselines in the Pre-Log QC are at a normal level (probe not in ground yet).

MIP-048, MIP-069 and MIP-072 contain EC readings above the clay which seem to be associated with high contamination levels (possibly tar, creosote or paint sludge). After retracting rods from location MIP-048 it was observed that the rods smelled like creosote or fuel. The probe and rod treads were covered with a "fuel" sheen (NAPL) and the probe was also covered heavily with tar. According to the site map it was noted that MIP-048 was in between 2 "tar laden" test pits.

During MIP-030 the gas line cracked on the probe/trunkline connection. The line was repaired, but the trunkline may have become compromised with fine soil particles and moisture. After observing some erratic pressure and detector readings, the trunkline and probe were changed after MIP-033. The detector data between 7-14 feet and after 20 feet was disregarded for MIP-031.



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Client: CRA
Contact: Beth Landale
Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-001	12/02/14	pass	pass	pass	25.90	3	Start project with trunkline P150 1491, Probe MP6520 4449R
MIP-002	12/02/14	pass	pass	pass	26.00	3	NC (no comment)
MIP-003	12/02/14	pass	pass	pass	28.05	3	Turn down trunkline flow @ 12 feet
MIP-004	12/02/14	pass	pass	pass	28.05	3	NC
MIP-005	12/02/14	pass	pass	pass	28.05	3	NC
MIP-006	12/03/14	pass	pass	pass	25.80	3	NC
MIP-007	12/03/14	pass	pass	pass	25.80	3	Turn up trunkline flow 1 psi @ 17 feet
MIP-008	12/03/14	pass	pass	pass	26.25	3	Drill rig down. Electrical issues
MIP-009	12/03/14	pass	pass	pass	26.00	3	NC
MIP-010	12/03/14	pass	pass	pass	25.95	3	Very hard drilling @ 4-10 feet.
MIP-011	12/03/14	pass	pass	pass	26.00	3	NC
MIP-012	12/03/14	pass	pass	pass	25.85	3	NC
MIP-013	12/04/14	pass	pass	pass	29.00	3	Wait 5 minutes (instead of typical 1 min) between 28 and 29 feet.
MIP-014	12/04/14	pass	pass	pass	26.00	3	NC
MIP-015	12/04/14	pass	pass	pass	27.05	3	NC
MIP-016	12/04/14	pass	pass	pass	12.70	3	Refusal @ 12.7 feet.
MIP-017	12/04/14	pass	pass	pass	28.05	3	NC
MIP-018	12/04/14	pass	pass	pass	26.00	3	Wait 5 minutes (instead of typical 1 min) between 25 and 26 feet.
MIP-019	12/04/14	pass	pass	pass	28.05	3	NC
MIP-020	12/05/14	pass	pass	pass	25.85	3	NC
Total Footage					520.40	(this sheet)	



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MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunk line Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	prep robed Depth (ft)	
MIP-021	12/05/14	pass	pass	pass	25.85	3	Turned up trunkline flow @ 10 feet.
MIP-022	12/05/14	pass	pass	pass	25.90	3	NC
MIP-023	12/05/14	pass	pass	pass	25.85	3	NC
MIP-024	12/05/14	pass	pass	pass	25.95	3	NC
MIP-025	12/08/14	pass	pass	pass	25.85	3	Very hard drilling @ 5-14 feet.
MIP-026	12/08/14	pass	pass	pass	25.95	3	Significant fuel response (PID/FID) starting @ 11 feet. Elevated Post-Log QC as a result
MIP-027	12/08/14	pass	pass	pass	25.90	3	Very significant fuel response (PID/FID) starting @ 8 feet. NAPL visually observed on probe/rods
MIP-028	12/08/14	pass	pass	pass	25.95	3	NC
MIP-029	12/08/14	pass	pass	pass	25.95	3	NC
MIP-030	12/09/14	pass	pass	pass	17.80	3	Charge hammer on rig. Stopped log @ 15', system pressure loss, repaired cracked teflon gas line.
MIP-030A	12/09/14	pass	pass	pass	25.95	3	NC
MIP-031	12/09/14	pass	pass	pass	34.95	3	Use data from 14-20 feet only. Erratic pressure and detector readings. Changed MIP membrane.
MIP-032	12/09/14	pass	pass	pass	25.90	3	Pressure/flow fluctuations at bottom of boring (water/soil particles entered trunkline @ MIP-030?)
MIP-033	12/09/14	pass	pass	pass	9.00	3	Pressure/flow fluctuations. After MIP-033 - restring MIP system with new trunkline & probe
MIP-033A	12/09/14	pass	pass	pass	25.90	3	Probe 4655, Trunkline 1492
MIP-034	12/10/14	pass	pass	pass	25.90	3	NC
MIP-035	12/10/14	pass	pass	pass	25.95	3	NC
MIP-036	12/10/14	pass	pass	pass	25.95	3	NC
MIP-037	12/10/14	pass	pass	pass	29.90	3	Very hot location, especially on PID/FID (fuel) Waited 5 min between 29 and 30 feet.
MIP-038	12/10/14	pass	pass	pass	29.10	3	Waited 90 minutes for detector baselines prior to this log (trunkline carry-over)
Total Footage					509.45	(this sheet)	



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MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-039	12/10/14	pass	pass	pass	25.95	3	NC (no comments)
MIP-040	12/10/14	pass	pass	pass	25.95	3	NC
MIP-041	12/10/14	pass	pass	pass	28.05	3	NC
MIP-042	12/11/14	pass	pass	pass	25.95	3	NC
MIP-043	12/11/14	pass	pass	pass	25.85	3	NC
MIP-044	12/11/14	pass	pass	pass	26.00	3	NC
MIP-045	12/11/14	pass	pass	pass	29.00	3	NC
MIP-046	12/11/14	pass	pass	pass	25.85	3	New MIP membrane
MIP-047	12/11/14	pass	pass	pass	21.90	3	Questionable response on XSD (somewhat atypical XSD plot shape, PID doesn't confirm response)
MIP-048	12/12/14	pass	pass	pass	25.95	3	New MIP membrane. Significant "tar" response, Wait 5 minutes between 25 and 26'.
MIP-049	12/12/14	pass	pass	pass	25.05	3	Detector baseline dropping throughout log due to "tar" from MIP-048. See Post-Log QC -048-049.
MIP-050	12/12/14	pass	pass	pass	25.95	3	NC
MIP-051	12/12/14	pass	pass	pass	27.10	3	NC
MIP-052	12/15/14	pass	pass	pass	2.75	3	Abort run, stringpot malfunction. Save Pre-Log QC for MIP-052A.
MIP-052A	12/15/14	pass	pass	pass	25.90	3	NC
MIP-053	12/15/14	pass	pass	pass	29.95	3	NC
MIP-054	12/15/14	pass	pass	pass	25.95	3	NC
MIP-055	12/15/14	pass	pass	pass	25.85	3	NC
MIP-056	12/15/14	pass	pass	pass	9.55	3	Refusal @ 9.55 feet, very hard obstruction.
MIP-056A	12/16/14	pass	pass	pass	25.95	3	NC
Total Footage					484.45	(this sheet)	



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Address: Ypsilanti, MI

MIP Field Log Summary

		QA/QC (pass/fail)					Comments (HP GC w/ PID/FID and XSD detectors, MIP Probe Part MP6520, MIP Trunkline Part P150)
File Log ID	Date	Pre-Log EC test	Post-Log EC test	Chemical response test	Final Depth (ft)	preprobed Depth (ft)	
MIP-057	12/15/14	pass	pass	pass	25.95	3	Possibly a very low XSD response @ 14 feet.
MIP-058	12/16/14	pass	pass	pass	22.90	3	NC
MIP-059	12/16/14	pass	pass	pass	21.85	3	High "fuel" response @ 11 feet. Turn up flow @ 17 feet to facilitate clean-up.
MIP-060	12/16/14	pass	pass	pass	29.00	3	Clay (& XSD response) are a few feet deeper at this location.
MIP-061	12/16/14	pass	pass	pass	25.85	3	NC
MIP-062	12/16/14	pass	pass	pass	39.50	3	NC
MIP-063	12/16/14	pass	pass	pass	25.05	3	NC
MIP-064	12/16/14	pass	pass	pass	25.70	3	NC
MIP-065	12/17/14	pass	pass	pass	25.95	3	Significant "Fuel" response reflected in Post-Log QC baselines.
MIP-066	12/17/14	pass	pass	pass	25.80	3	NC
MIP-067	12/17/14	pass	pass	pass	25.85	3	Chlorinated solvent response near surface. No response @ the clay.
MIP-068	12/17/14	pass	pass	pass	21.45	3	Questionable response on XSD @ 5-10 feet. (PID does not confirm response)
MIP-069	12/17/14	pass	pass	pass	27.05	3	NC
MIP-070	12/17/14	pass	pass	pass	25.95	3	High "fuel" response starting @ 5 feet.
MIP-071	12/17/14	pass	pass	pass	25.95	3	NC
MIP-072	12/18/14	pass	pass	pass	24.00	3	High "fuel" response starting @ 3 feet. Baseline increased as soon as probe was put into hole.
MIP-073	12/18/14	pass	pass	pass	25.85	3	High "fuel" response starting @ 11 feet.
MIP-074	12/18/14	pass	pass	pass	21.00	3	Detector baselines dropping throughout log due to "fuel at precious locations.
MIP-075	12/18/14	pass	pass	pass	25.90	3	NC
MIP-076	12/18/14	pass	pass	pass	24.05	3	NC
MIP-077	12/18/14	pass	pass	pass	25.95	3	NC
MIP-078	12/18/14	pass	pass	pass	25.90	3	NC
Total Footage					566.45	(this sheet)	



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Date: 12/01/14 - 12/19/14
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Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-001	12/02/14	98	16.0	314	16.0	71	16.0	Estimated 1-5 ppm chlorinated solvent responses @ 7-16 feet. 20 ppm starting @ 20 feet.
MIP-002	12/02/14	167	16.0	122	12.0	123	16.0	Estimated 2 ppm chlorinated solvent responses @ 9-10 feet. 10 ppm @ 14-16 feet. 30 ppm starting @ 16 feet.
MIP-003	12/02/14	55	10.5	48	13.6	52	10.5	Estimated 6-13 ppm chlorinated solvent responses @ 7-11 feet. 4-12 ppm 13.6-19 feet.
MIP-004	12/02/14	238	16.0	112	16.0	139	16.0	Estimated 1-3 ppm chlorinated solvent responses @ 7-11 feet. 12-35 ppm 13-19 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-005	12/02/14	123	15.0	58	17.0	87	15.0	Estimated 14 ppm chlorinated solvent response @ 8 feet. 22 ppm 12.5-16 feet. Hydrocarbon responses on FID @ 17-20'
MIP-006	12/03/14	148	13.9	40	13.9	91	13.9	Estimated 2 ppm chlorinated solvent responses @ 8.5 & 9.8 feet. 14-23 ppm 11.9-16 feet.
MIP-007	12/03/14	194	17.0	435	3.8	101	16.0	Estimated 2 ppm chlorinated solvent response @ 14.4', 12 ppm 15-16'. 25 ppm starting @ 16 feet. Petroleum responses on FID @ 3-7 & 10-14.5'
MIP-008	12/03/14	47	17.3	58	14.6	50	17.3	Estimated 1 ppm chlor solv responses @ 12.7-14.5'. 2 ppm @ 14.5-15.2'. 7-13 ppm starting at 15'. Additional petroleum observed on PID/FID
MIP-009	12/03/14	100	16.1	110	13.7	80	16.1	Estimated 2 ppm chlorinated solvent responses @ 7.1 & 12'. 8-20 ppm starting @ 14 feet. Hydrocarbon responses on FID @ 12-14 feet.
MIP-010	12/03/14	41	15.1	290	5.2	43	13.1	Estimated 7-11 ppm chlorinated solvent responses starting @ 121 feet. Petroleum observed starting at 4'on PID/FID in addition to chlorinated.
MIP-011	12/03/14	80	15.2	98	4.5	67	15.2	Estimated 1 ppm chlor solv responses @ 7.9-8.2'. 2-7 ppm @ 12-15. 17 ppm starting @ 15.2 feet. Petroleum responses on PID/FID @ 4-7.6 feet.
MIP-012	12/03/14	310	13.4	143	13.4	148	13.5	Estimated 1 ppm chlorinated solvent responses @ 5 & 7 feet. 35 ppm 12.5-13.9 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-013	12/04/14	150	14.2	120	3.7	110	13.9	Estimated 16-28 ppm chlorinated solvent responses starting @ 13.8 feet. Petroleum observed on PID/FID in addition to chlorinated.
MIP-014	12/04/14	304	13.4	114	13.4	158	13.4	Estimated 6-13 ppm chlorinated solvent responses @ 11.7-13 feet. 40 ppm starting @ 13.2 feet.
MIP-015	12/04/14	487	13.3	264	13.3	244	13.3	Estimated 1-2 ppm chlorinated solvent responses @ 9.9-10.9 feet, 6-18 ppm @ 12.3-13'. 61 ppm starting @ 13.3 feet.
MIP-016	12/04/14	11	10.5	22	10.5	4*	12.7	Refusal @ 12.7 feet. Starting to detect chlorinated solvent at the bottom of boring. Some petroleum observed on PID/FID @ 10.5 feet.
MIP-017	12/04/14	153	15.1	253	14.7	103	15.1	Estimated 25 ppm chlorinated solvent responses starting @ 14 feet. Petroleum responses on PID/FID @ 5.6 feet.
MIP-018	12/04/14	125	16.1	118	14.0	97	16.1	Estimated 6-11 ppm chlorinated solvent responses starting @ 13.5-15'. 25 ppm starting @ 15'. Petroleum responses on PID/FID @ 5.3-5.8 feet.
MIP-019	12/04/14	192	14.7	256	14.6	160	14.7	Estimated 6-16 ppm chlorinated solvent responses @ 10-13.9 feet. 40 ppm starting @ 14.7 feet.
MIP-020	12/05/14	585	14.8	331	14.8	253	14.8	Estimated 6-32 ppm chlorinated solvent responses @ 13.1-14 feet, 63 ppm starting @ 14.3 feet. Petroleum responses on PID/FID @ 6.8-7.8 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-021	12/05/14	303	18.2	250	18.1	163	18.2	Estimated 1-14 ppm chlorinated solvent responses @ 13.9-17.9'. 41 ppm starting @ 18.2'. Petroleum responses on PID/FID @ 8 & 9'.
MIP-022	12/05/14	68	18.0	77	103.0	59	18.0	Estimated 1 ppm chlorinated solvent responses @ 4.8-8.9'. 5 ppm @ 9.1-11.5'. 15 ppm starting at 17.2'. Additional hydrocarbons observed on FID
MIP-023	12/05/14	207	21.9	1,006	21.8	91	20.0	Estimated 2-4 ppm chlorinated solvent responses @ 5, 12.4-15.8, 16.9-19'. 23 ppm starting @ 19'. Petroleum responses on PID/FID @ 15.2-17'.
MIP-024	12/05/14	271	17.1	156	13.2	130	17.1	Estimated 2-12 ppm chlorinated solvent responses @ 9.9-12.5. , 19-33 ppm @ 16-19'. Additional hydrocarbons observed on FID @ 12-14 feet.
MIP-025	12/08/14	252	12.2	91	12.2	102	12.2	Estimated 5-7 ppm chlorinated solvent responses @ 7.2 & 9-11'. 25 ppm @ 11-13' and @ 16-18 feet.
MIP-026	12/08/14	595	13.9	634	12.6	63	17.9	Estimated 1 ppm chlor solv responses @ 5.1-9.8, 14'. 8-16 ppm starting at 16.2'. Significant additional petroleum observed on PID/FID starting @ 11'.
MIP-027	12/08/14	845	11.9	370	12.2	163	5.4	Estimated 40 ppm chlor solv response @ 5.4'. 8-11 ppm @ 7-8'. 4 ppm @ 14-18'. Significant additional petroleum observed on PID/FID starting @ 10'.
MIP-028	12/08/14	499	14.7	218	14.6	200	14.7	Estimated 9-14 ppm chlorinated solvent responses @ 9.8-12'. 40-50 ppm @ 14-15.2 feet.
MIP-029	12/08/14	130	13.9	126	13.9	50	18.0	Estimated 5-10 ppm chlorinated solvent responses @ 11.1-13.9, 15.6, & 17.1'. 13 ppm @ 18'. Petroleum responses on PID/FID @ 13.9-15.5'.
MIP-030	12/09/14	NA	NA	NA	NA	NA	NA	No useful data acquired. See summary comments
MIP-030A	12/09/14	220	18.9	205	18.9	112	18.9	Estimated 9-28 ppm chlorinated solvent responses @ 15-20 feet.
MIP-031	12/09/14	145	15.1	197	19.2	98	15.1	Estimated 13-24 ppm chlorinated solvent responses @ 14.5-19.3 feet.
MIP-032	12/09/14	200	15.0	233	14.8	115	15.0	Estimated 1 ppm chlorinated solvent responses @ 5.5-6 & 7.7-11.5'. 1-10 ppm @ 12.5-13.9. 13-29 ppm starting @ 15'.
MIP-033	12/09/14	NA	NA	NA	NA	NA	NA	Questionable data acquired. See summary comments
MIP-033A	12/09/14	113	16.0	140	16.0	67	16.1	Estimated 3-9 ppm chlorinated solvent responses @ 12.6-16 feet. 17 ppm starting @ 16'.
MIP-034	12/10/14	139	16.0	272	14.8	73	16.0	Estimated 8-15 ppm chlorinated solvent responses @ 12-14 feet. 11-18 ppm @ 16-19 feet.
MIP-035	12/10/14	209	16.1	380	15.0	96	15.0	Estimated 15-24 ppm chlorinated solvent responses @ 12.6-18 feet.
MIP-036	12/10/14	276	17.0	362	15.4	120	13.7	Estimated 18-30 ppm chlorinated solvent responses @ 12.5-18 feet.
MIP-037	12/10/14	3,140	20.1	6,700	19.1	390	18.0	Estimated 12-50 ppm chlorinated solvent responses @ 13-17 feet. 78-98 ppm starting @ 17 feet.
MIP-038	12/10/14	966	18.0	270	18.0	173	18.0	Estimated 1-2 ppm chlorinated solvent responses @ 12.7-15.7 feet. 13 ppm @ 16 feet. 28-44 ppm @ 17-20 feet.

* Indicates @ or near detection limit.

‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



11253 91st Ave. N.
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fax (763) 424-9452

Client: CRA
Contact: Beth Landale
Services: MIP Logging

Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-039	12/10/14	126	16.1	344	23.1	20	16.1	Estimated 1 ppm chlorinated solvent responses @ 11.2-13.1' & 14'-14.5'. 4-5 ppm @ 15-16.8'. Hydrocarbon responses on FID @ 22.6-24'.
MIP-040	12/10/14	30	13.1	231	13.1	18	16.1	Estimated 1-3 ppm chlorinated solvent responses @ 12-13.2'. 2-5 ppm @ 15.1-17.9'. Hydrocarbon responses on FID @ 13.1-16.2'.
MIP-041	12/10/14	46	14.0	274	15.1	40	21.2	Estimated 1 ppm chlorinated solvent responses @ 13. 8 ppm @ 14'. 3-10 ppm @ 18-22'. Hydrocarbon responses on FID @ 14-18'.
MIP-042	12/11/14	34	17.1	133	14.0	32	17.1	Estimated 3-8 ppm chlorinated solvent responses @ 15-19.1'. Hydrocarbon responses on FID @ 10-16'.
MIP-043	12/11/14	372	18.2	605	18.2	164	18.0	Est. 1 ppm chl sol responses @ 4.9, 6.9, 7.9, 9, & 10-11.4'. 2-14 ppm @ 11.4-17.1'. 10-41 ppm @ 17.5-19.2'. Hydrocarbon responses on FID @ 4-15'.
MIP-044	12/11/14	98	17.2	82	16.1	56	17.2	Estimated 1 ppm chlorinated solvent responses @ 8-12.5 feet. 13 ppm @ 12.5-18 feet.
MIP-045	12/11/14	156	13.0	88	19.0	75	13.0	Estimated 2-6 ppm chlorinated solvent responses @ 10.8-12.9 feet. 8-19 ppm @ 13-15 feet. Additional hydrocarbon responses on FID @ 11-19'.
MIP-046	12/11/14	62	13.0	332	13.0	27	17.1	Estimated 2-7 ppm chlorinated solvent responses @ 12.6-20 feet. Additional hydrocarbon responses on FID @ 12.5-19 feet.
MIP-047	12/11/14	6*	11.7	40	14.7	5*	17.1	Estimated 1 ppm chlorinated solvent responses @ 17.1 & 18 feet. Additional hydrocarbon responses on FID @ 10.4-15.1 feet.
MIP-048	12/12/14	387	10.0	1,450	5.1	112	9.1	Estimated 13-28 ppm chlorinated solvent responses @ 7.1-11'. 7-13 ppm @ 15.1-19.1'. Additional hydrocarbon responses on FID @ 5.1-6.1 feet.
MIP-049	12/12/14	10	16.7	26	11.3	12	17.1	Estimated 1-3 ppm chlorinated solvent responses @ 15.1-19.1' & 23.2 feet. Additional hydrocarbon responses on FID @ 9.7-13.9 feet.
MIP-050	12/12/14	9	121.0	44	18.4	9	17.1	Estimated 1 ppm chlorinated solvent responses @ 7.2, 8, 9, 17 & 20-25? feet. Additional hydrocarbon responses on FID @ 8-14 & 18.4 feet.
MIP-051	12/12/14	55	18.0	17	19.0	47	19.1	Estimated 3 ppm chlorinated solvent responses @ 11-12 feet and 5-12 ppm @ 13-19 feet.
MIP-052	12/15/14	NA	NA	NA	NA	NA	NA	Stringpot malfunction
MIP-052A	12/15/14	119	13.8	67	13.8	87	13.8	Estimated 1 ppm chlorinated solvent responses @ 9.4-9.8, 11 & 12 feet. 8-22 ppm @ 12.9-19.1 feet.
MIP-053	12/15/14	155	15.3	100	15.2	90	15.3	Estimated 1 ppm chlorinated solvent responses @ 5.6 & 7 feet. 2-8 ppm @ 8-13 feet. 12-23 ppm @ 14.4-19 feet.
MIP-054	12/15/14	202	16.1	41	11.7	99	16.1	Estimated 1-4 ppm chlorinated solvent responses @ 8-15'. 11-25 ppm starting @ 15'. Additional hydrocarbon responses on FID @ 8.9-13.7 feet.
MIP-055	12/15/14	152	17.0	39	11.3	74	17.0	Estimated 2 ppm chlorinated solvent responses @ 11-12 & 14.5'. 13-19 ppm @ 15-19'. Additional hydrocarbon responses on FID @ 9 & 11.3 feet.
MIP-056	12/15/14	NA	NA	NA	NA	NA	NA	Refusal @ 9.5 feet.
MIP-056A	12/16/14	67	18.0	42	15.2	45	18.0	Estimated 3 ppm chlorinated solvent responses @ 12-17'. 8-11 ppm starting @ 17'. Additional hydrocarbon responses on FID @ 13.8-15.2 feet.

* Indicates @ or near detection limit.

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and on the FID detector 1mVolt = very approximately 10 ppm

Cl solvent response could also refer to other halogens (e.g. fluorine, bromine...)

petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.



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Date: 12/01/14 - 12/19/14
Project: Former Willow Run
Project #: 319.14
Address: Ypsilanti, MI

MIP Analytical Interpretation

Max mV[‡] detector response @ indicated depth

File Log ID	Date	PID (mVolts)	Depth (feet)	FID (mVolts)	Depth (feet)	XSD (mVolts)	Depth (feet)	Comments: Some petroleum/hydrocarbon (PID/FID) responses in addition to chlorinated solvents are noted
MIP-057	12/15/14	7	1.9	9	18.0	3*	13.0	Estimated 1 ppm chlorinated solvent responses @ 3-5 & 11-14 feet.
MIP-058	12/16/14	11	4.9	47	15.0	11	4.9	Estimated 2 ppm chlorinated solvent responses @ 4.9-5.7 feet. 1 ppm @ 15 feet. Hydrocarbon responses on FID @ 14-16 feet.
MIP-059	12/16/14	1,197	12.7	557	12.0	8	5.2	Estimated 2 ppm chlor solv response @ 5-5.9' & 1 ppm @ 7-8'. 1 ppm @ 8.9-20'. Significant petroleum observed on PID/FID starting @ 11 feet.
MIP-060	12/16/14	358	20.0	69	17.6	124	20.1	Estimated 1 ppm chlor solv responses @ 5'. 5 ppm @ 8.9, 10, 13-14 & 16.6'. 15-31 ppm @ 17.7-22'. Hydrocarbon responses on FID @ 14-16 feet.
MIP-061	12/16/14	250	16.0	50	16.0	117	16.0	Estimated 2 ppm chlorinated solvent responses @ 10.1 feet. 8 ppm @ 10.9-12.5 feet. 29 ppm starting @ 16 feet.
MIP-062	12/16/14	420	17.1	107	17.1	160	17.1	Estimated 33 ppm chlorinated solvent responses starting @ 316.1 feet.
MIP-063	12/16/14	180	16.1	100	16.1	104	16.1	Estimated 2-6 ppm chlor solv responses @ 7.9-13.7'. 9 ppm @ 15.4 feet. 26 ppm starting @ 16.1'. Hydrocarbon responses on FID @ 10.8-13.9 feet.
MIP-064	12/16/14	1,125	18.0	171	18.0	249	18.0	Estimated 1-2 ppm chlor solv responses @ 11.9-15'. 28 ppm @ 17.1, 62 ppm starting @ 18'. Hydrocarbon responses on FID @ 11.5-14.6 feet.
MIP-065	12/17/14	760	15.1	219	12.3	181	15.1	Estimated 45 ppm chlor solv response starting @ 14 feet'. Significant petroleum observed on PID/FID starting @ 8 feet.
MIP-066	12/17/14	130	20.1	39	14.3	72	20.1	Estimated 3-4 ppm chlor solv responses @ 16.9-19'. 14 ppm @ 19.1, 18 ppm starting @ 20.1'. Hydrocarbon responses on FID @ 12-17.9 feet.
MIP-067	12/17/14	102	4.9	75	14.1	59	4.9	Estimated 9-15 ppm chlorinated solvent responses @ 2-4.9'. 1-2 ppm @ 20, 23.1, 24.1 & 25'. Hydrocarbon responses on FID @ 10.6-16'.
MIP-068	12/17/14	23	12.0	91	12.7	28	6.0	Estimated 7 ppm chlorinated solvent responses starting @ 5 feet. Hydrocarbon responses on PID/.FID @ 12-16 feet.
MIP-069	12/17/14	1,165	12.1	433	12.1	273	12.1	Estimated 15-39 ppm chl solv response @ 9.9-11.1', 69 ppm starting @ 12.1', 19-27 ppm @ 17.1-20'. Additional petroleum on PID/FID starting @ 9 feet.
MIP-070	12/17/14	785	12.0	273	13.4	72	17.1	Estimated 2-5 ppm chlor solv response @ 4.9-7.1'. 4 ppm @ 11.9 & 14.9'. 15-18 ppm starting @ 16'. Significant petroleum on PID/FID starting @ 5'.
MIP-071	12/17/14	203	15.0	205	15.0	110	15.0	Estimated 3-11 ppm chlorinated solvent responses @ 5.2-13.9 feet. 27 ppm starting @ 15 feet.
MIP-072	12/18/14	436	54.0	1,169	5.0	735	4.1	Estimated 25 ppm chl solv response @ 2-3'. 75-183 ppm @ 3-5.9'. 32-58 ppm @ 7-8' & 9.9-12.9'. Significant additional petroleum on PID/FID.
MIP-073	12/18/14	393	17.0	228	4.1	81	17.9	Estimated 9 ppm chlorinated solvent response @ 15-15.7'. 17-21 ppm 16-19'. Additional petroleum on PID/FID & FID only @ 1.8-10.2'.
MIP-074	12/18/14	16	17.1	123	12.7	20	14.1	Estimated 1 ppm chlorinated solvent responses @ 5 & 14.1 feet. 3-5 ppm @ 16-19.1 feet. Hydrocarbon responses on FID @ 5.4-15.1'.
MIP-075	12/18/14	197	17.1	109	14.1	103	14.5	Estimated 1 ppm chlorinated solvent responses @ 1.9 & 2.9-3.5 feet. 26 ppm starting @ 14.5 feet.
MIP-076	12/18/14	326	14.5	131	14.5	123	14.5	Estimated 1 ppm chlorinated solvent responses @ 7, 8, 9-9.9 & 11-12'. 5 ppm @ 13.3'. 32 ppm @ 13.9-14.9'. 18 ppm @ 16-17'. 2 ppm @ 21-22'.
MIP-077	12/18/14	35	18.0	50	13.8	25	17.1	Estimated 2 ppm chlor solvent responses @ 4.2, 7.1 & 8-11'. 3-6 ppm @ 13.9-20.1'. 1 ppm @ 23-25.4'. Hydrocarbon responses on FID @ 11-14.5'.
MIP-078	12/18/14	34	16.1	24	19.1	28	17.1	Estimated 4 ppm chlorinated solvent responses @ 15-16 feet. 4-7 ppm @ 16.1-19.1'. 2 ppm @ 19.6-25.1 feet.

* Indicates @ or near detection limit.

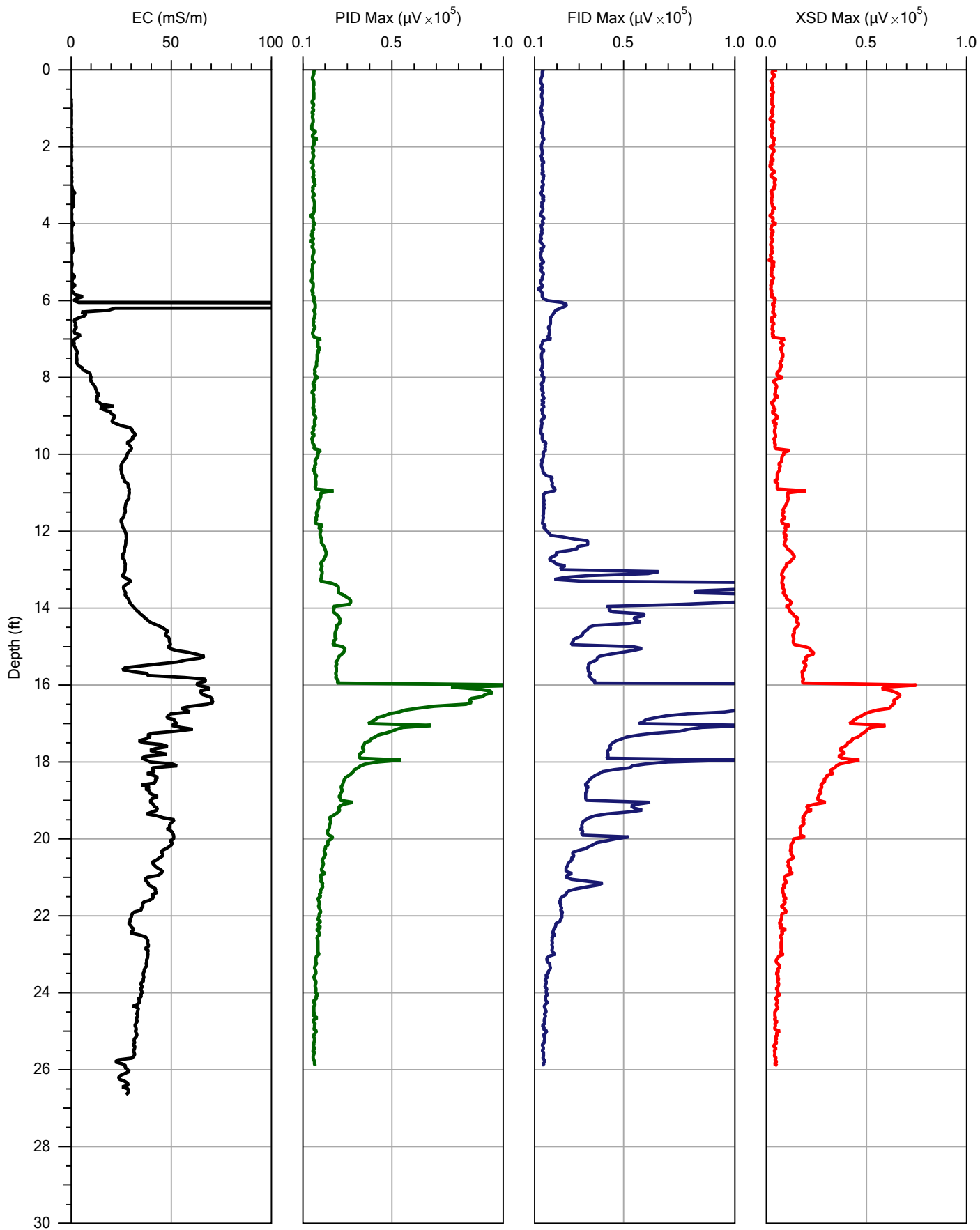
‡ (For Standard MIP) 1-5 mVolt response on PID or XSD detector = very approximately 1 ppm
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petroleum response may refer to gasoline or other lighter constituents of fuels and other hydrocarbons.

MIP LOGS

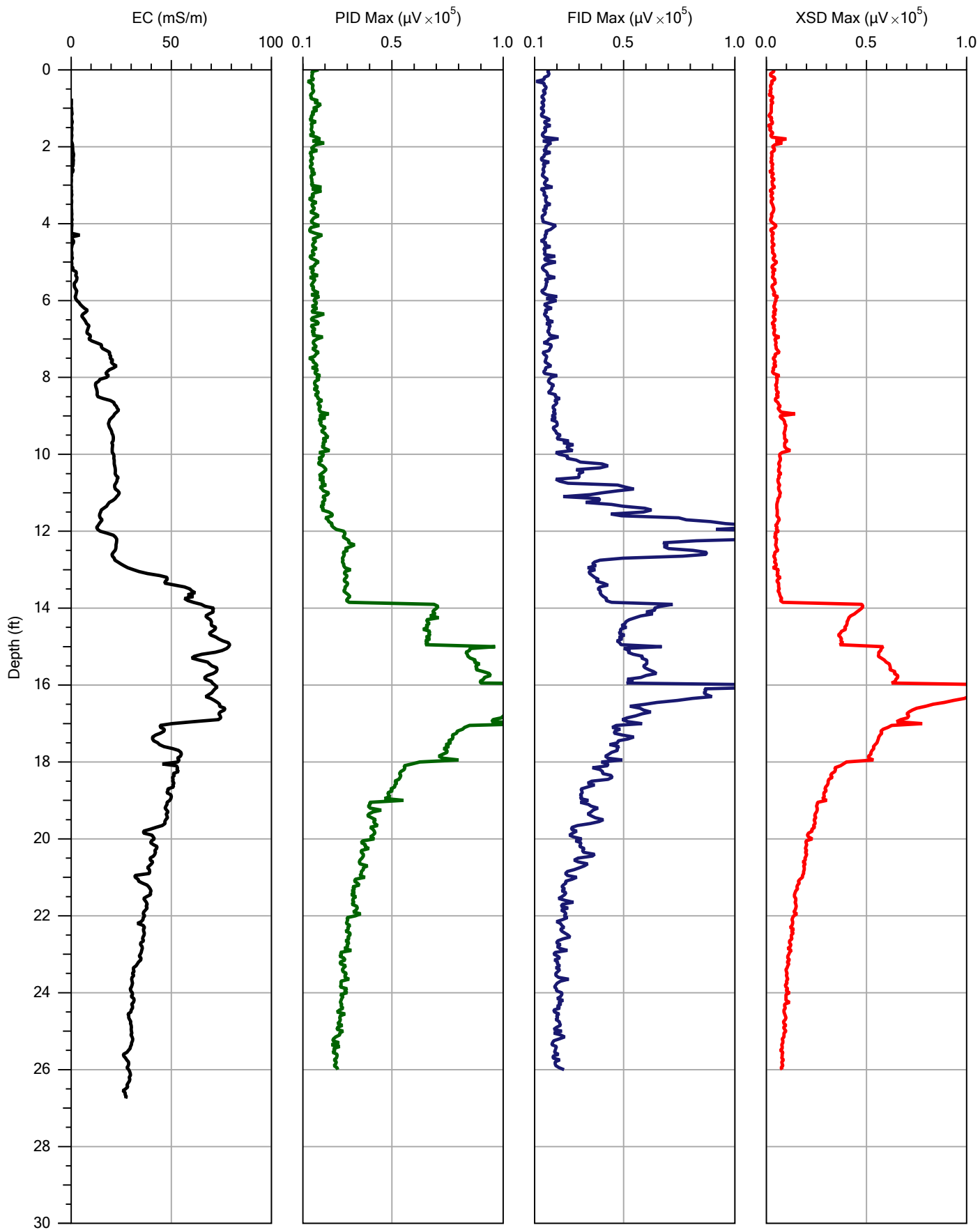
With detectors @ 100 mVolts



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

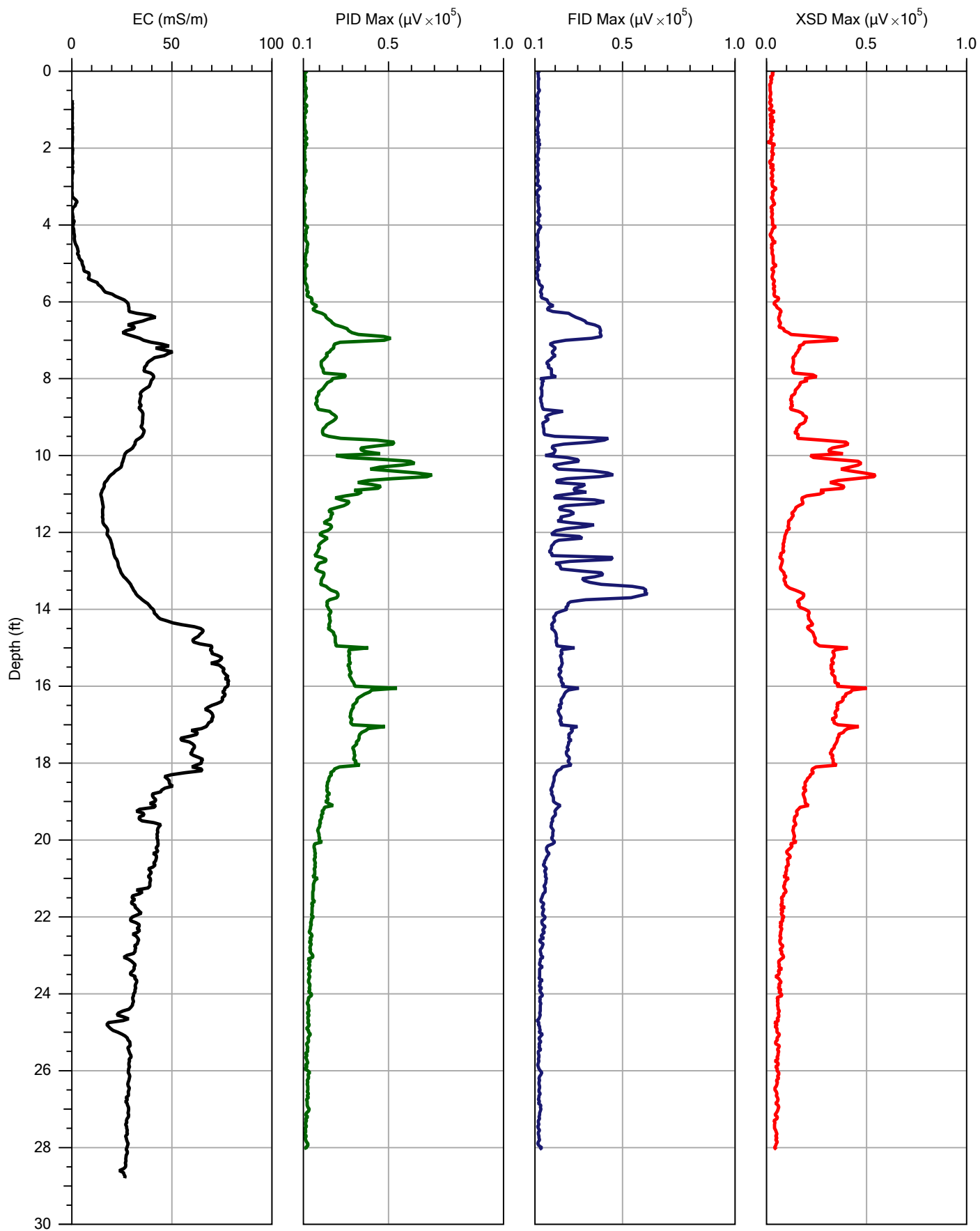
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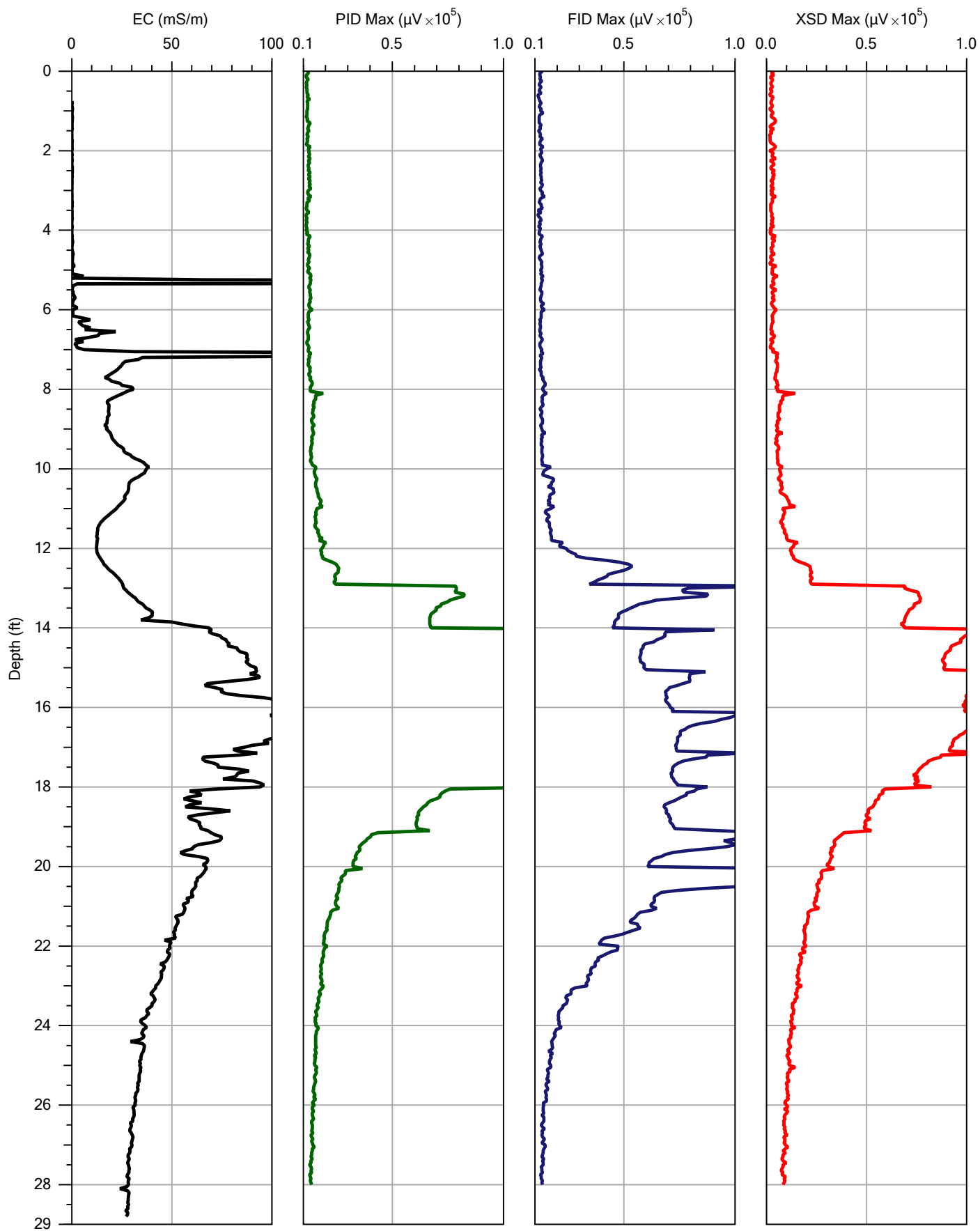
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Project ID: 319.14

Operator: M Jensen
Client: CRA

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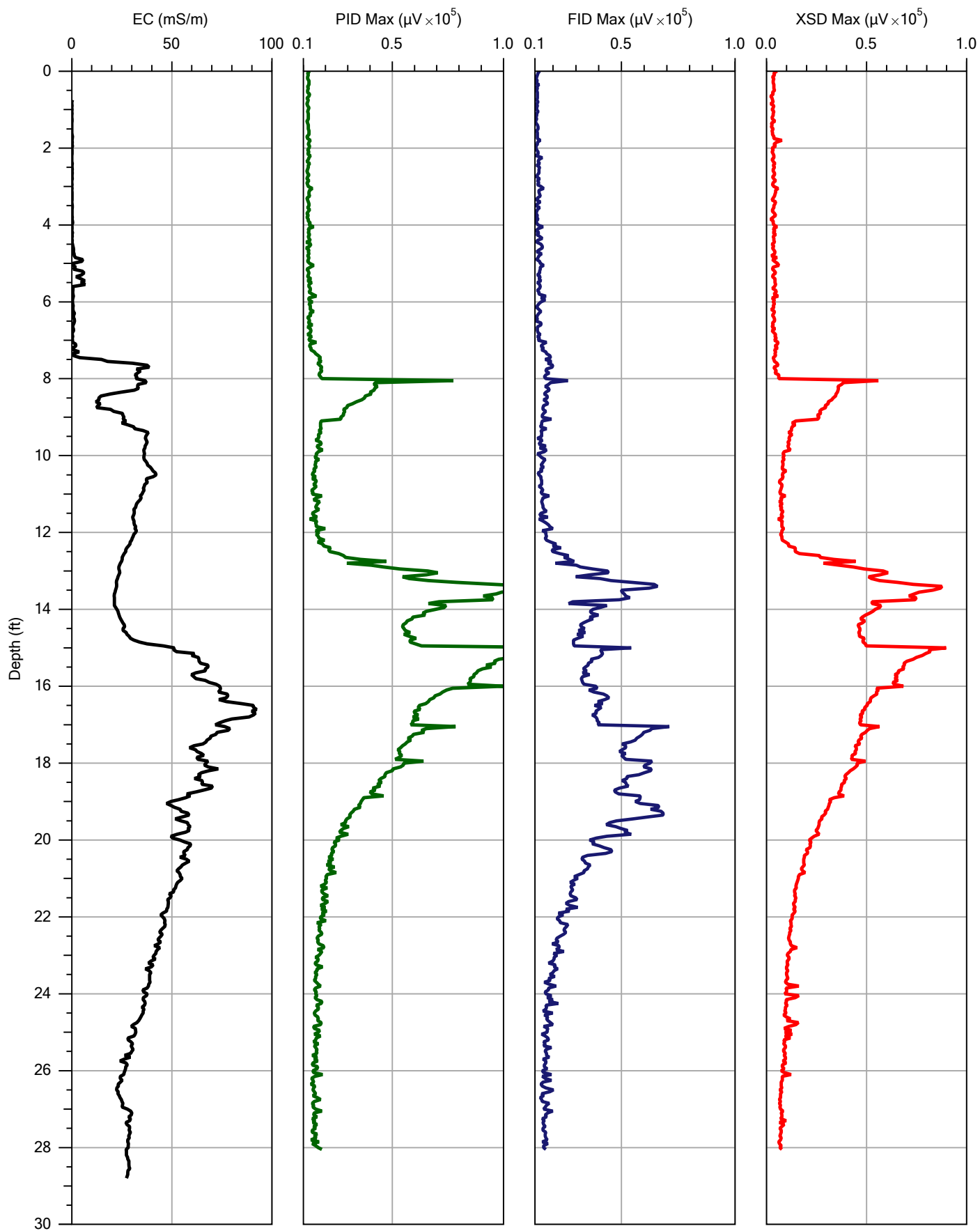
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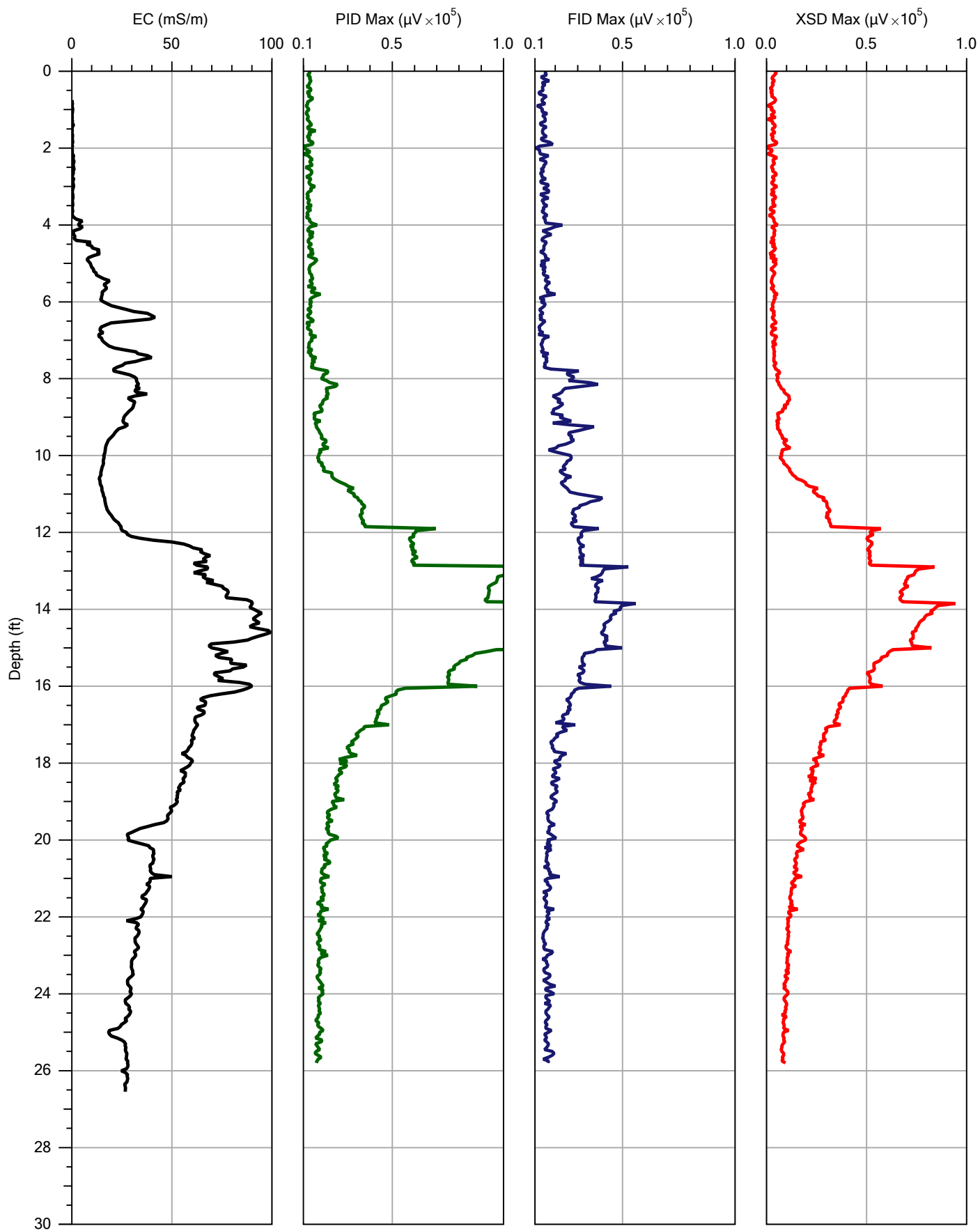
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

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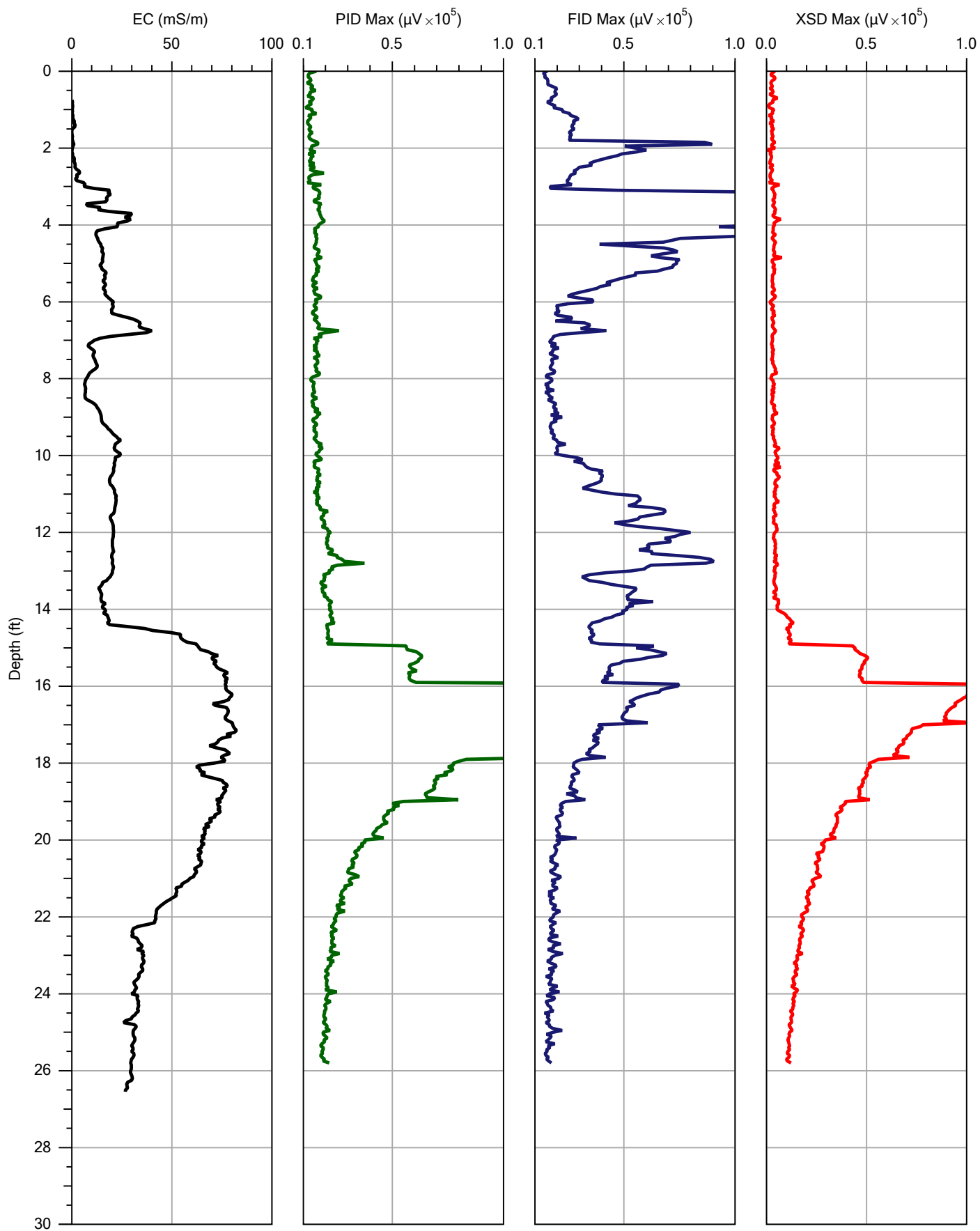
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

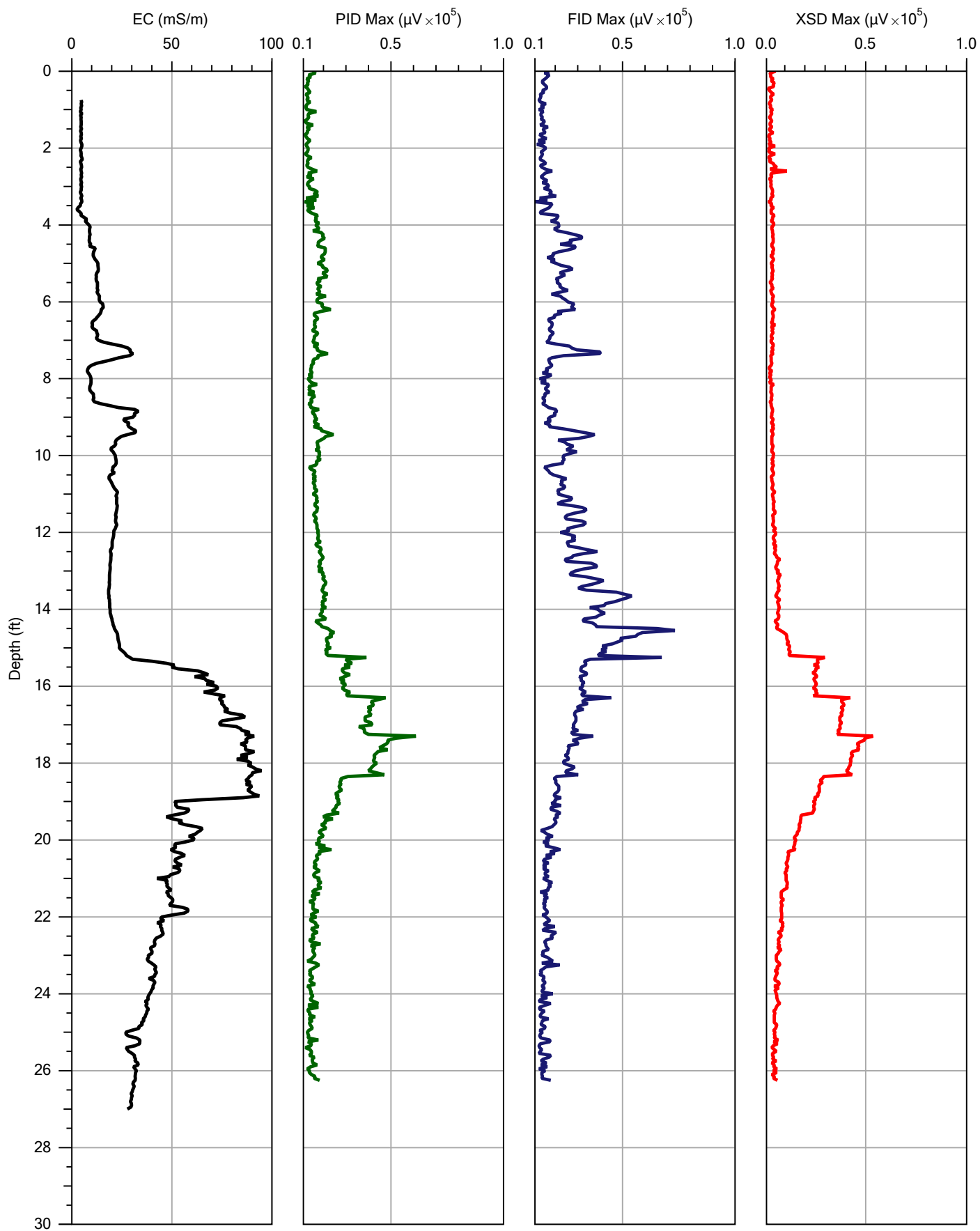
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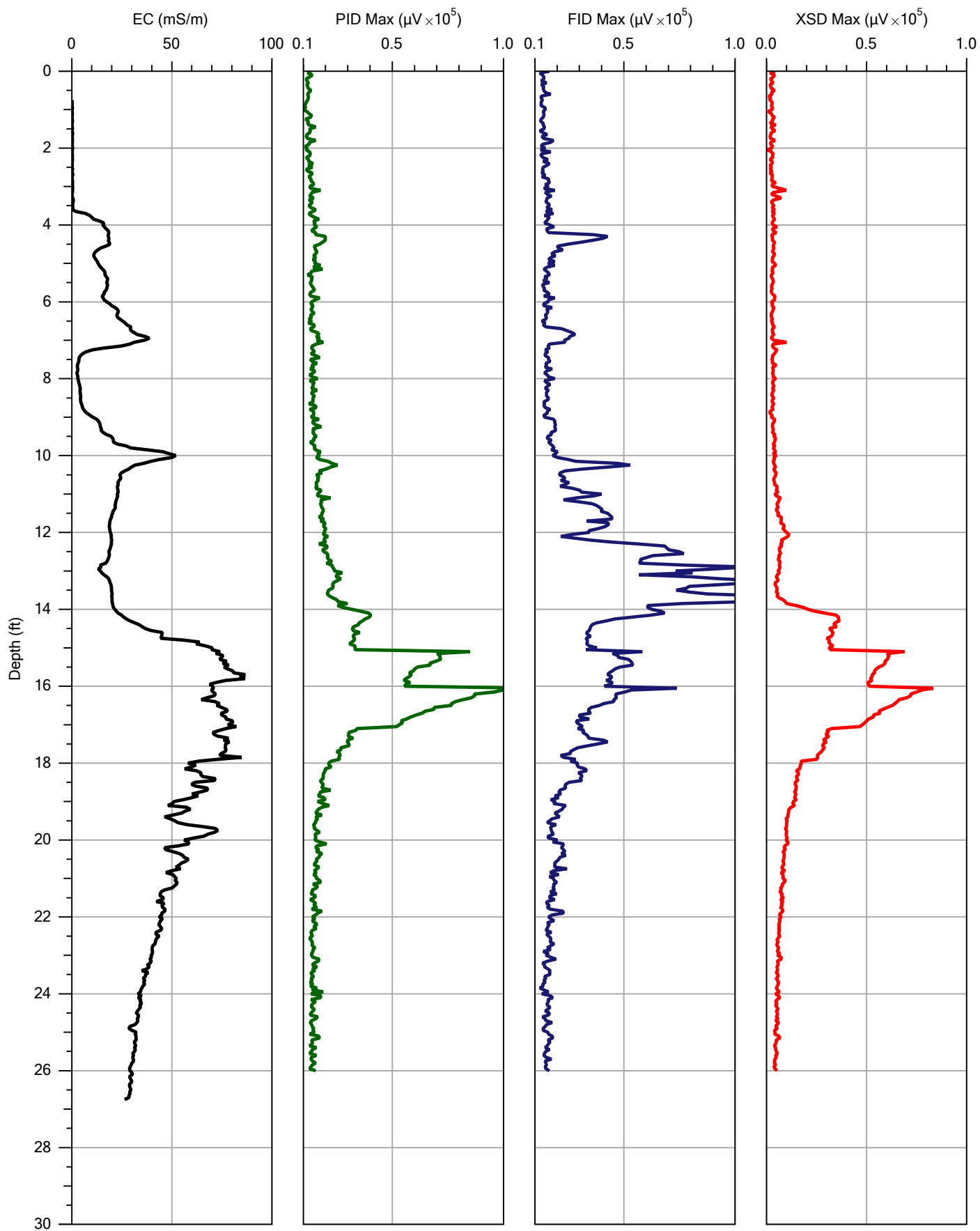
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Operator: M Jensen
Client: CRA

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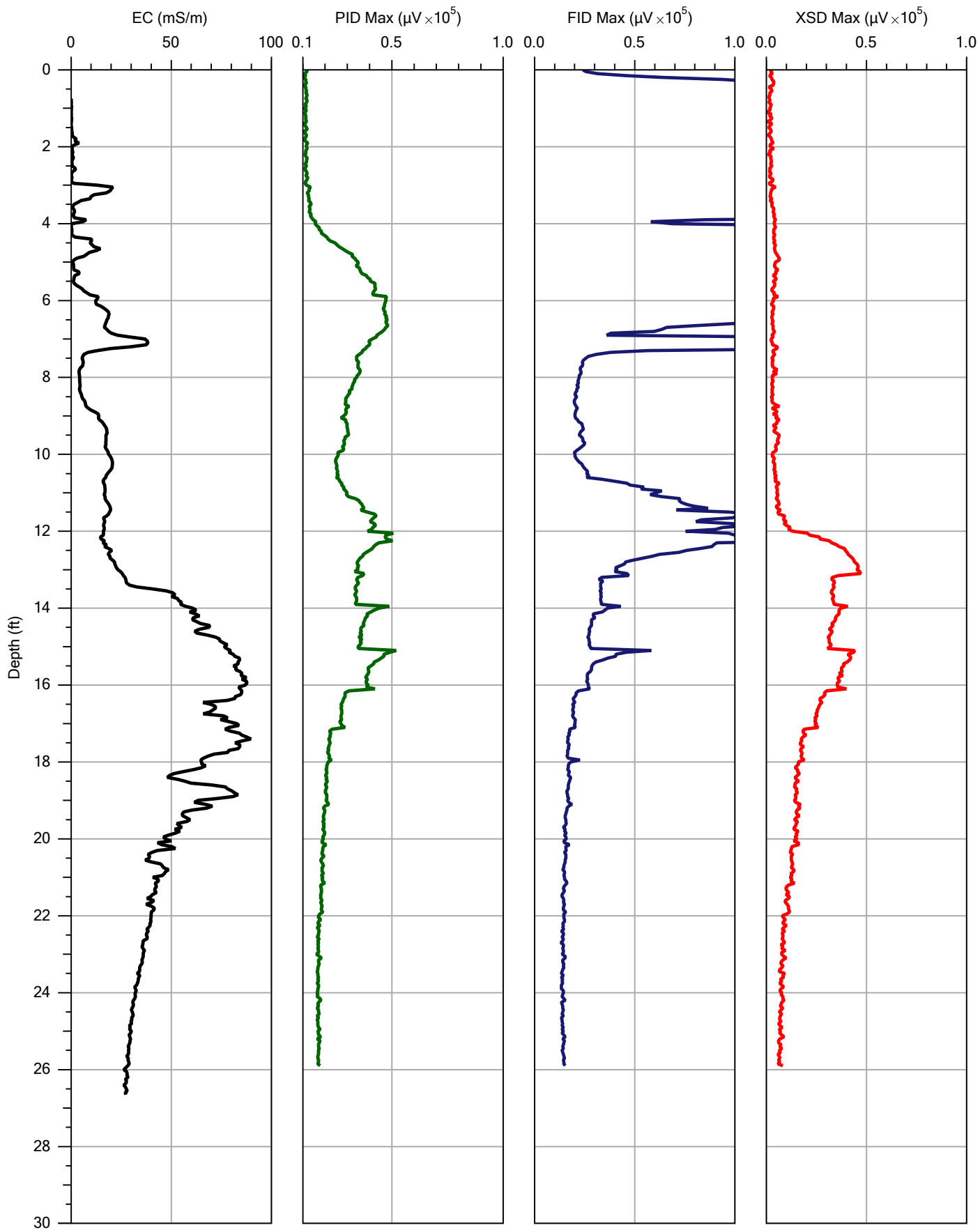
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			Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

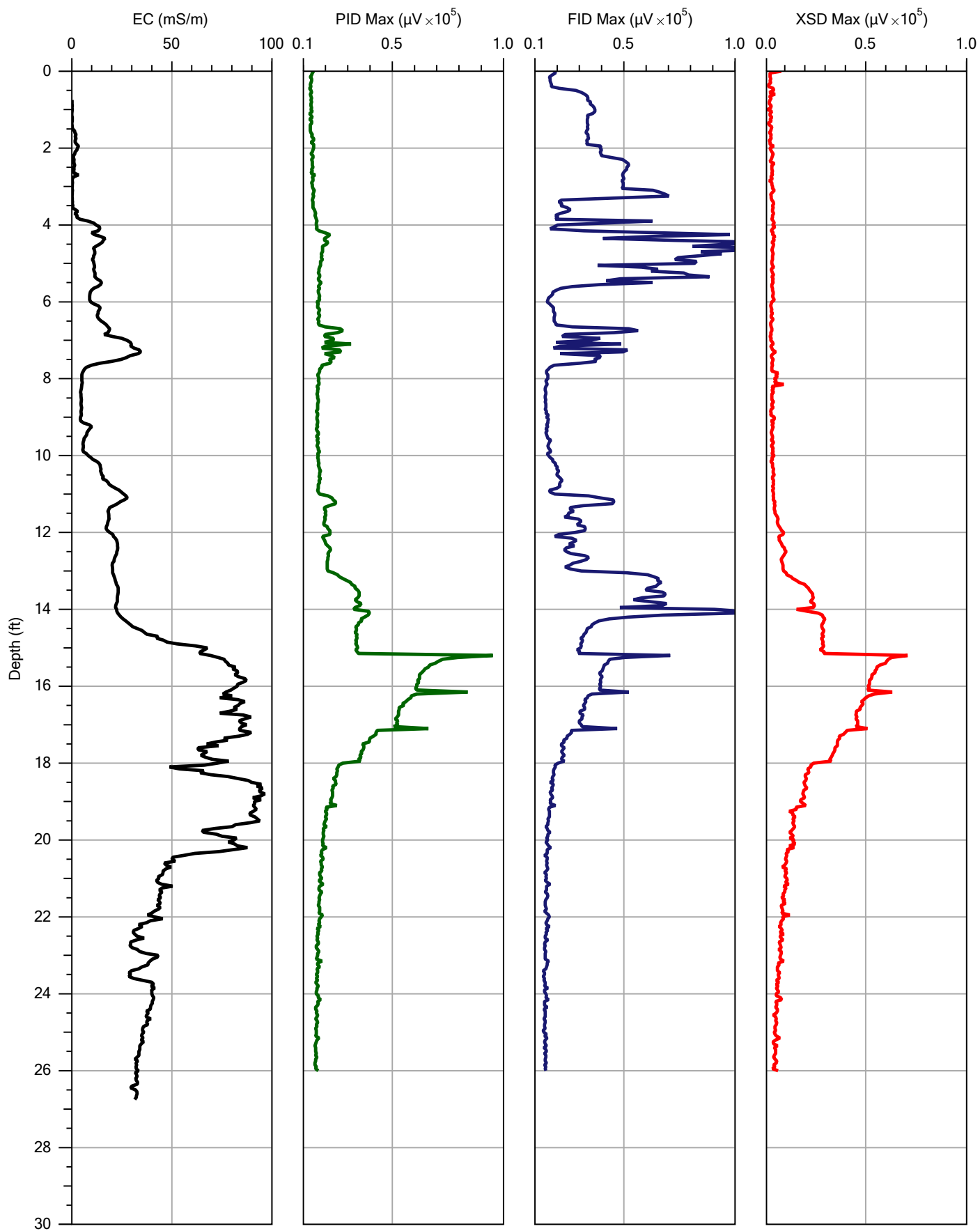
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
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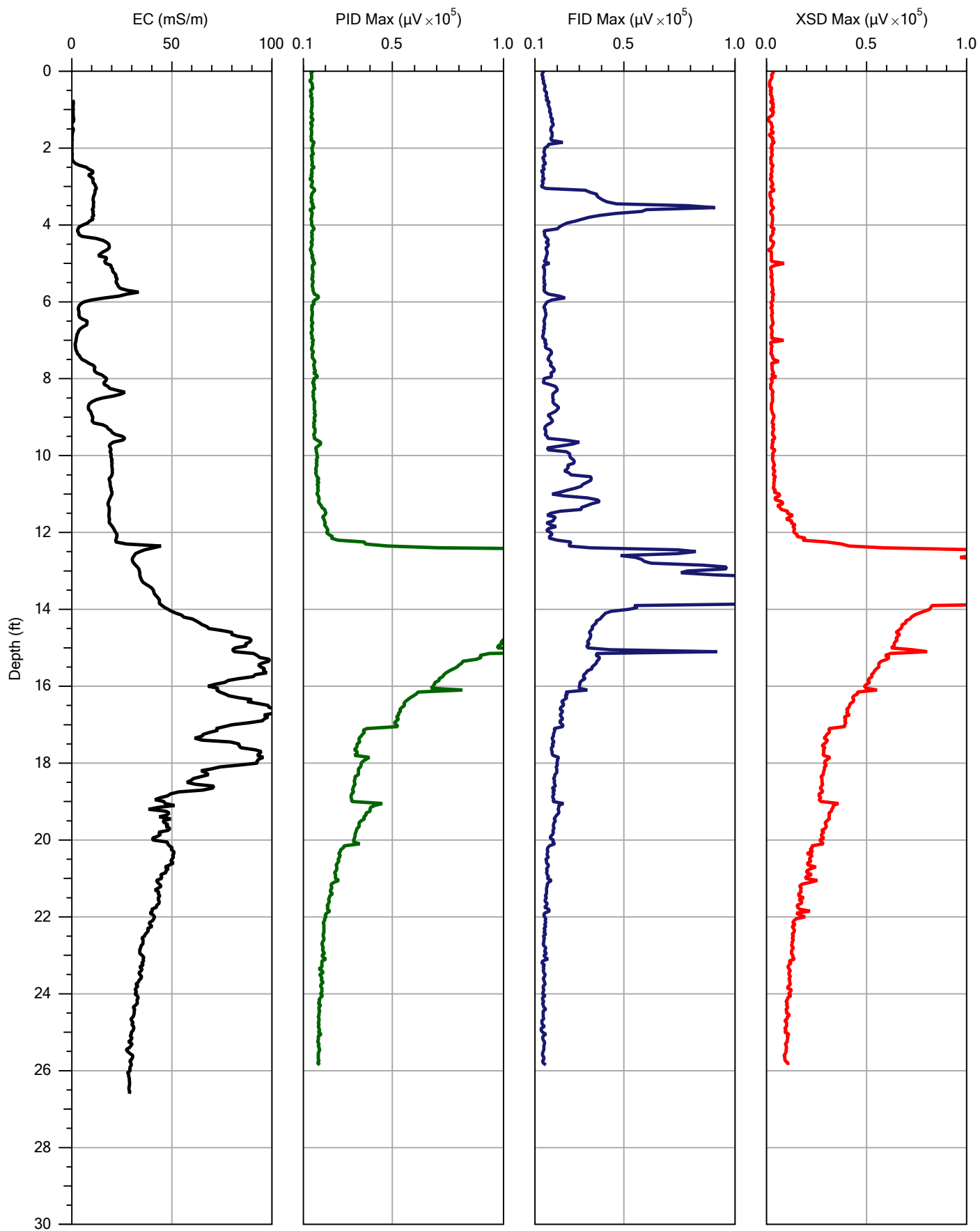
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Company: Matrix Environmental
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Operator: M Jensen
Client: CRA

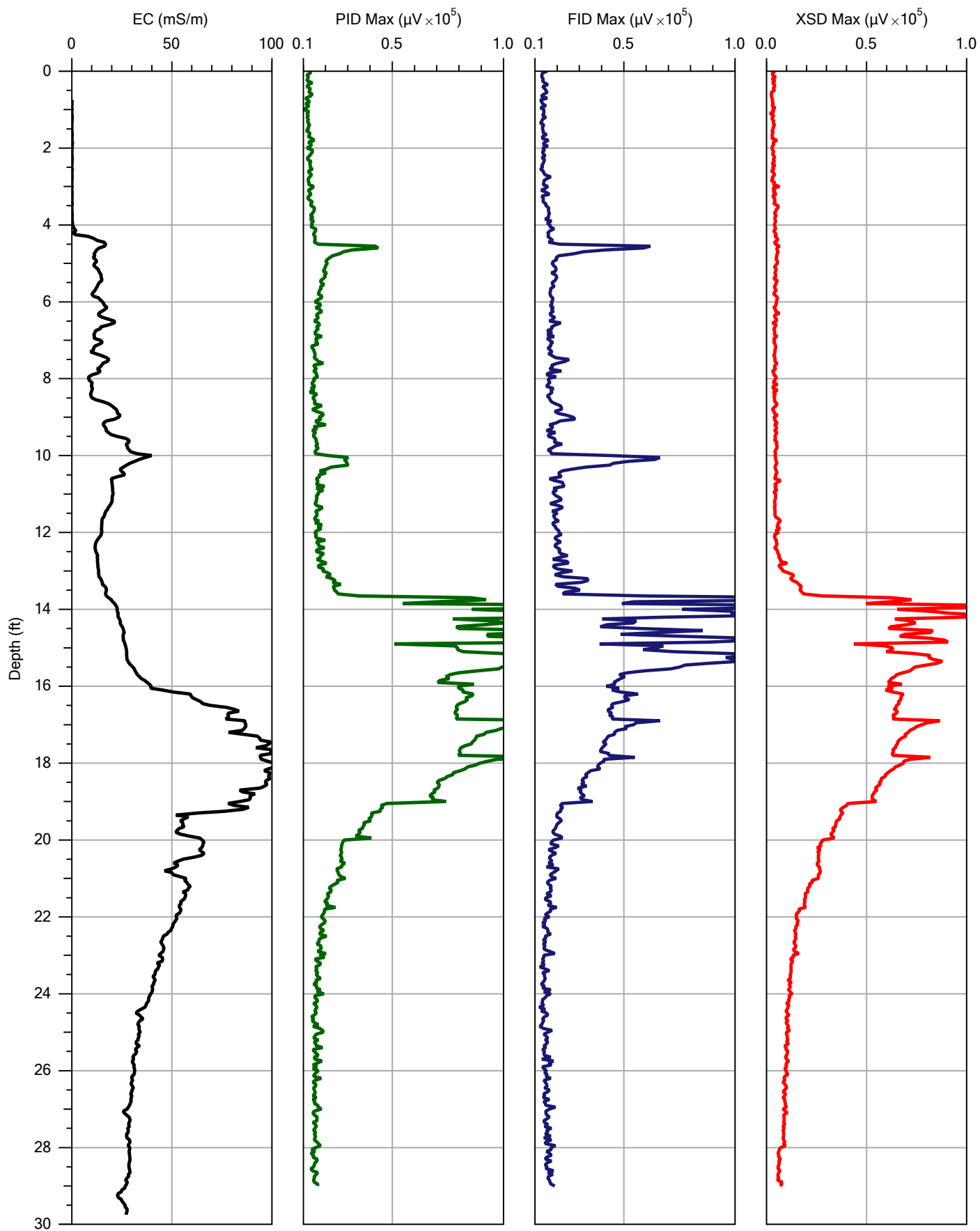
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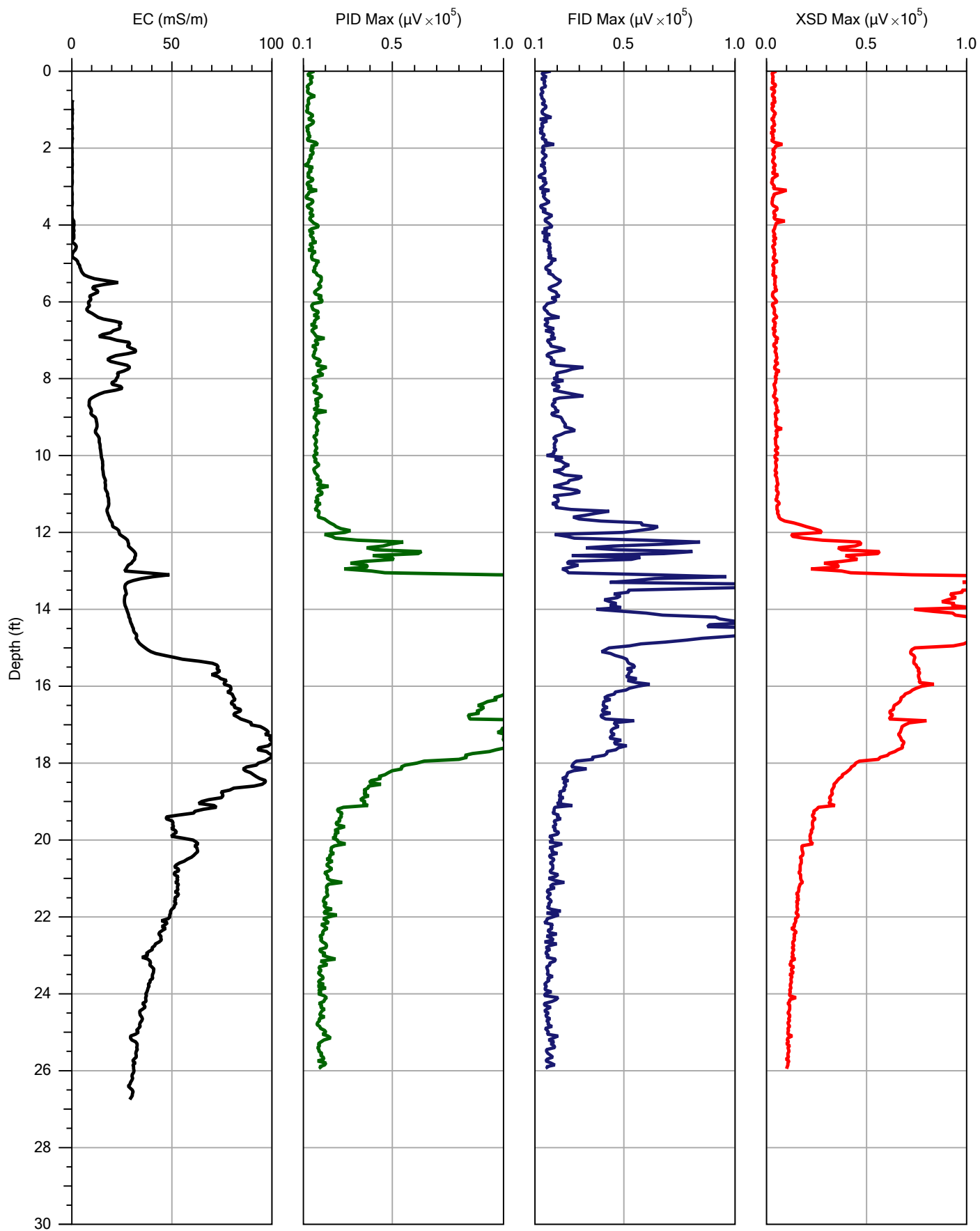
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
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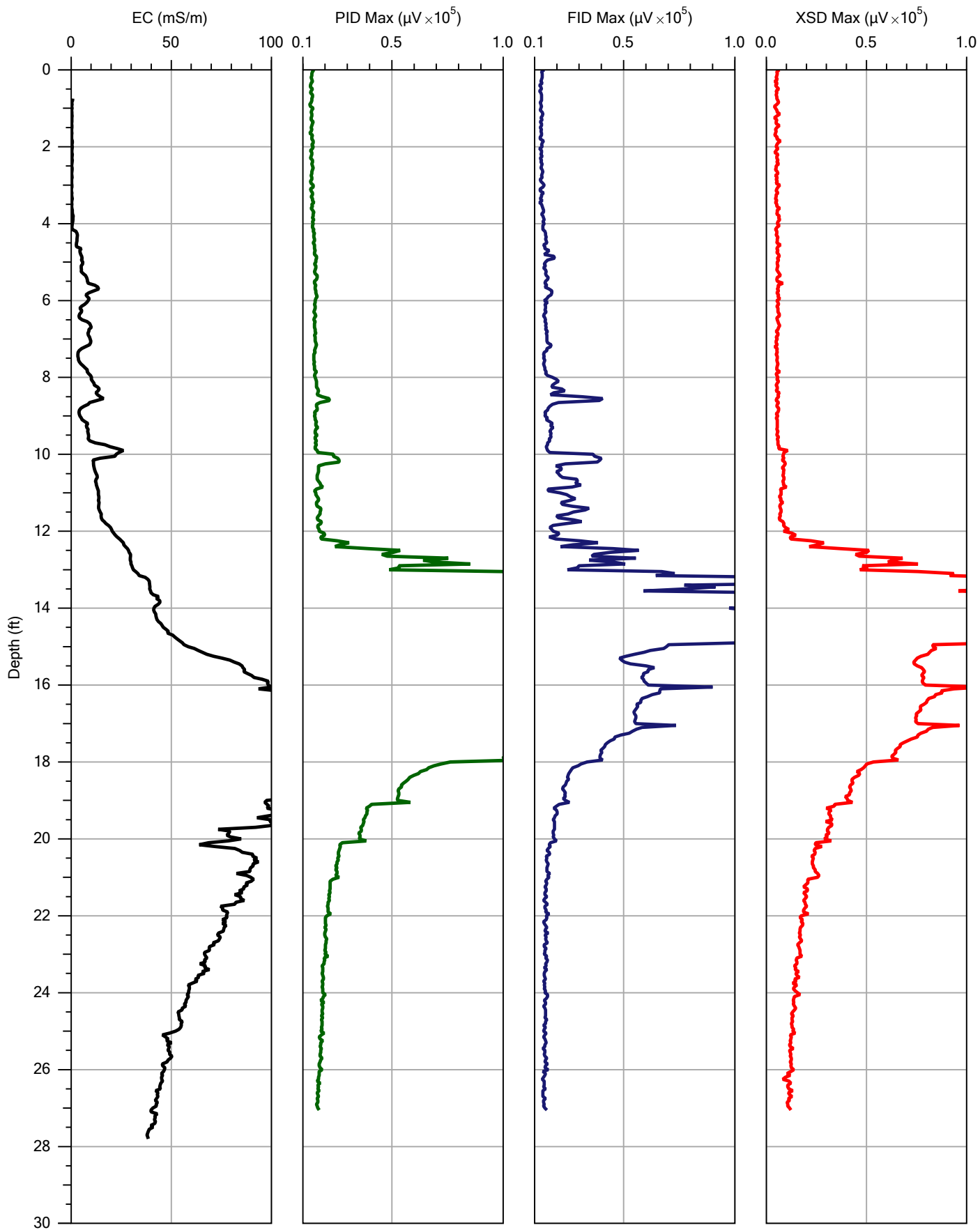
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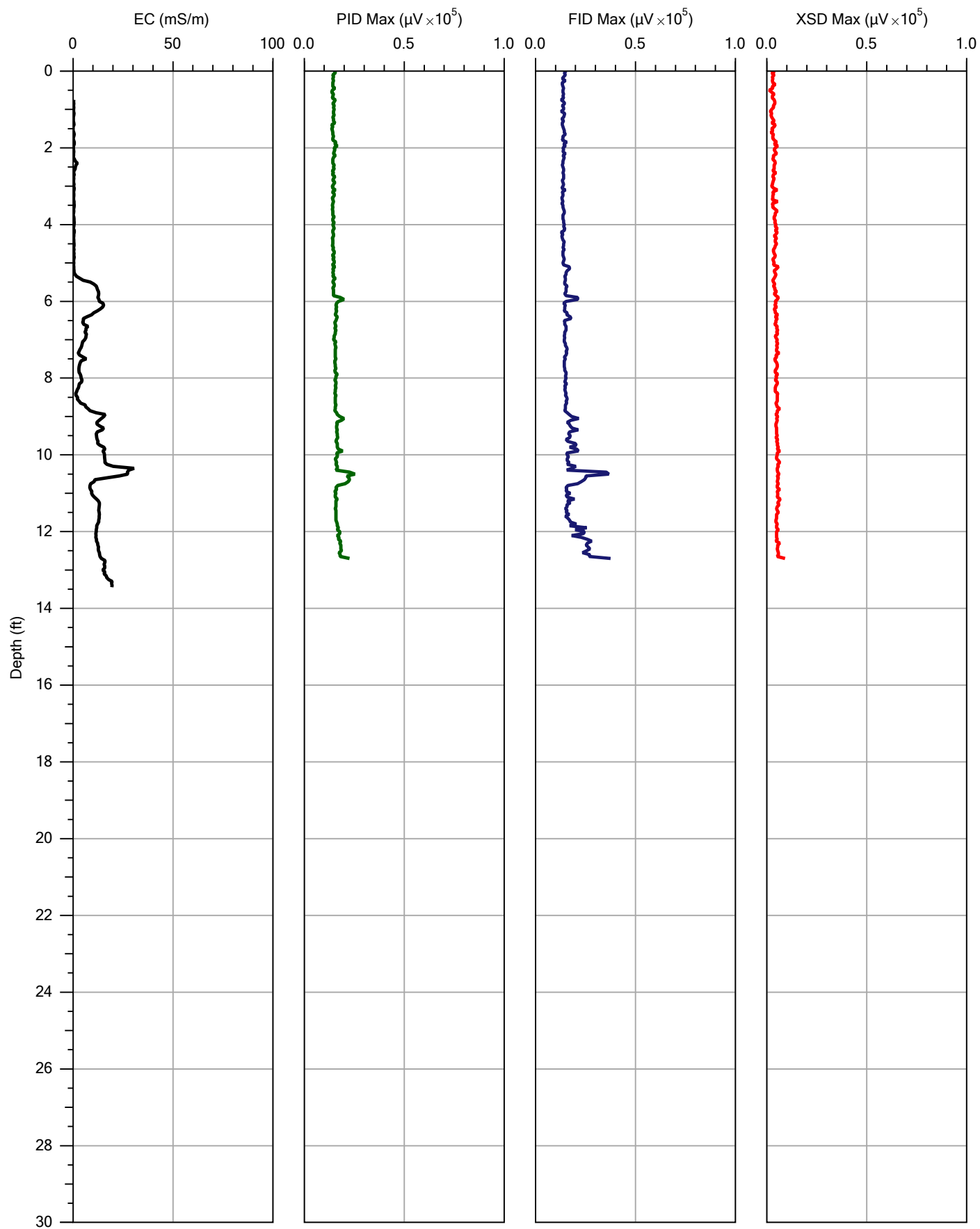
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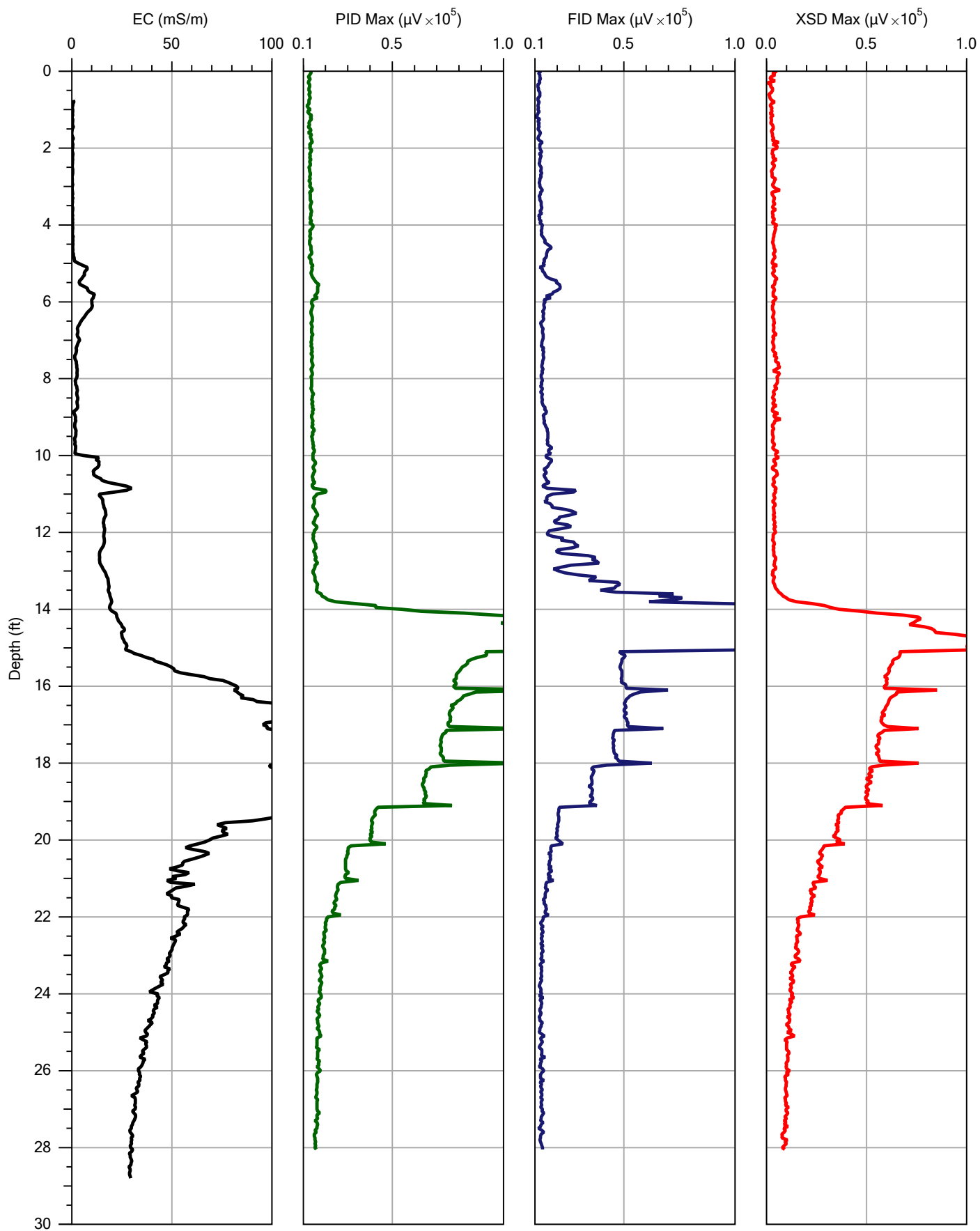
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

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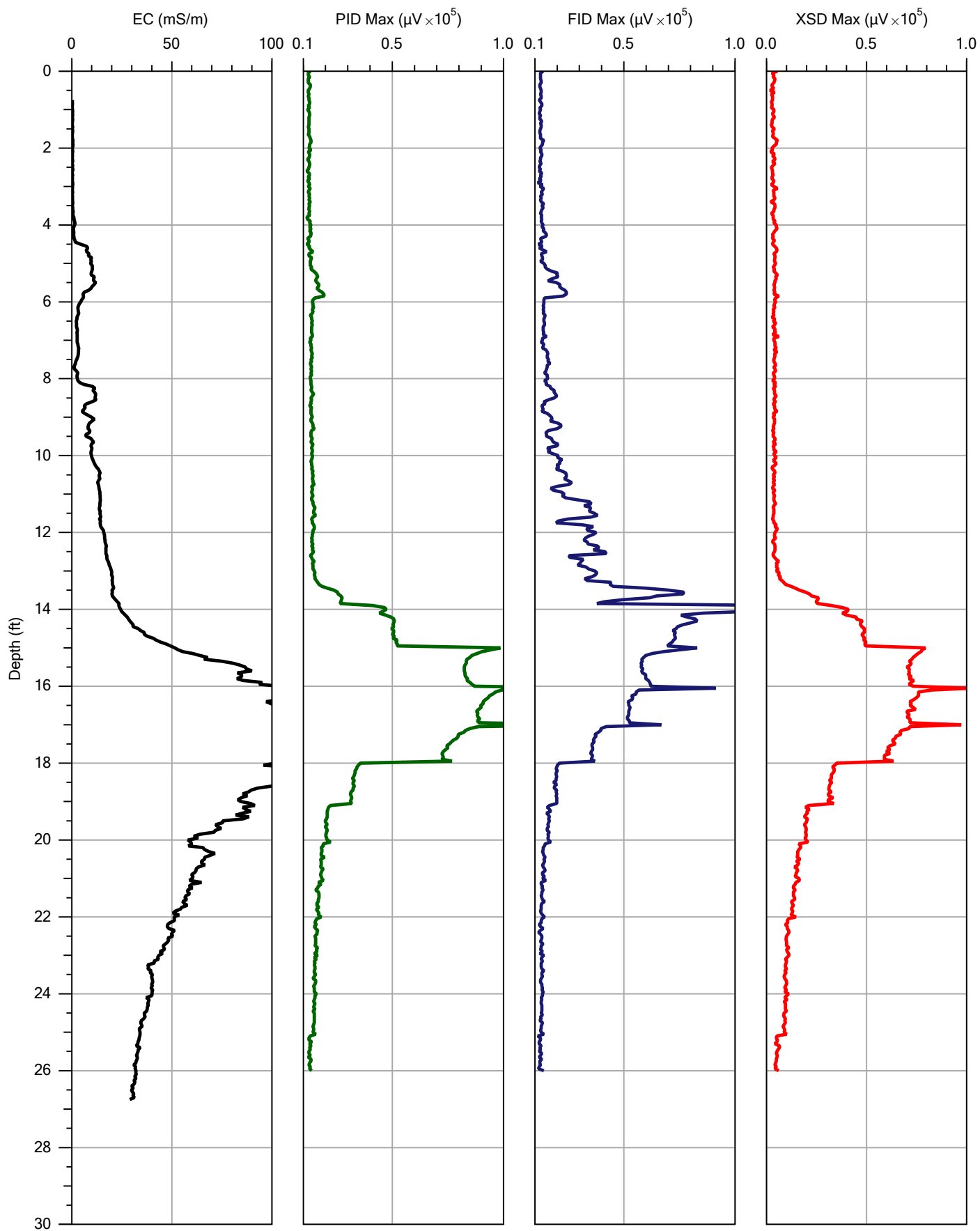
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

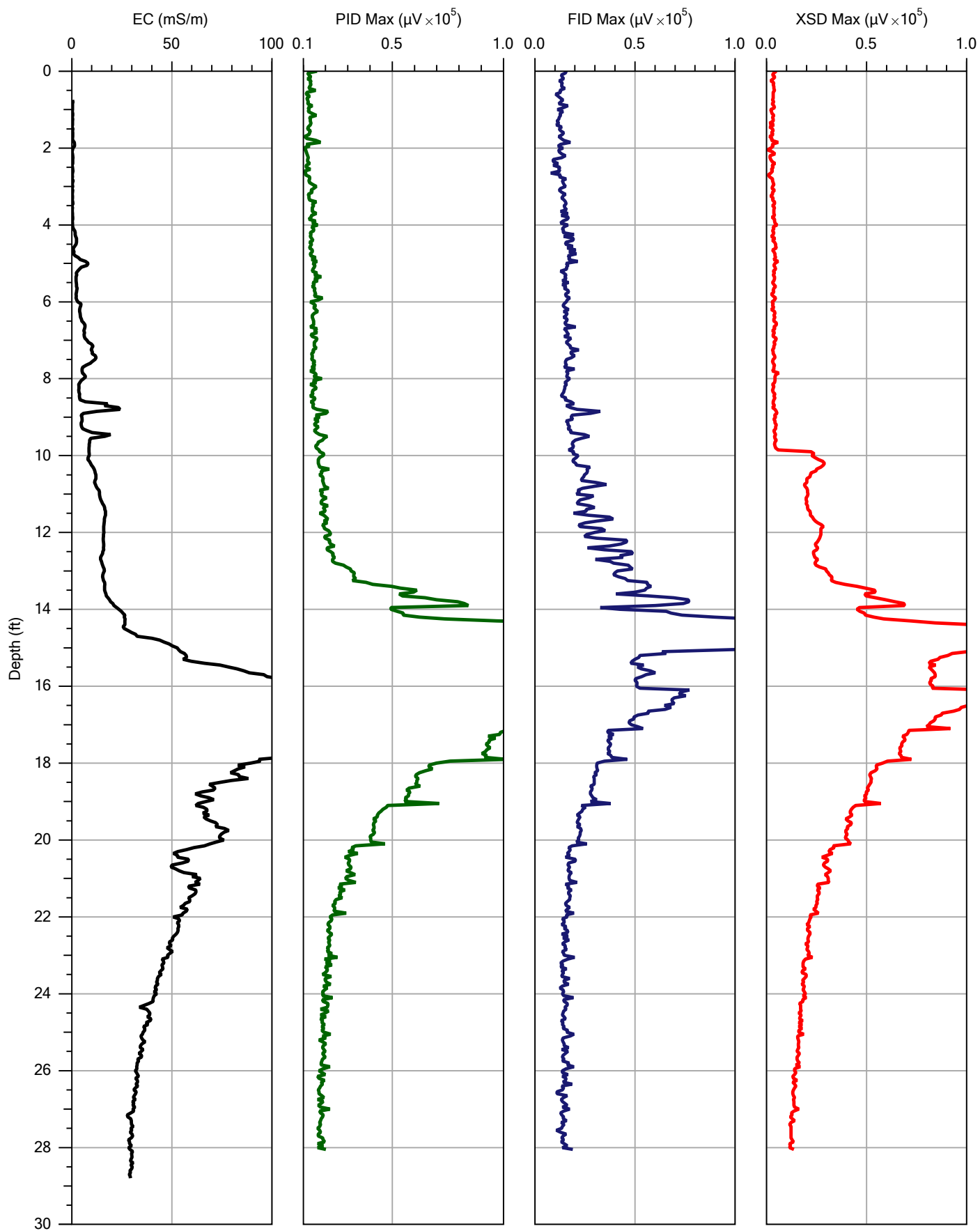
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

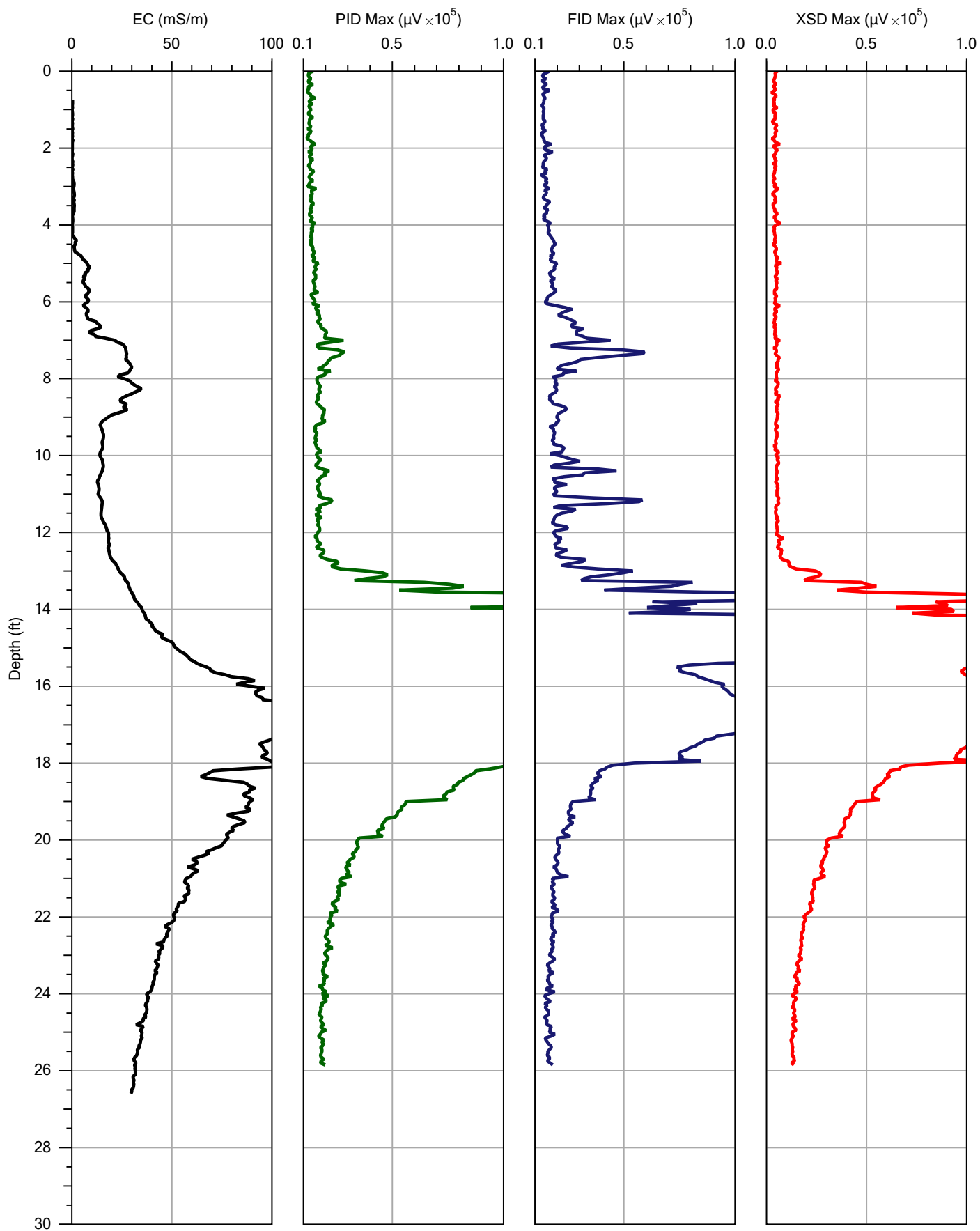
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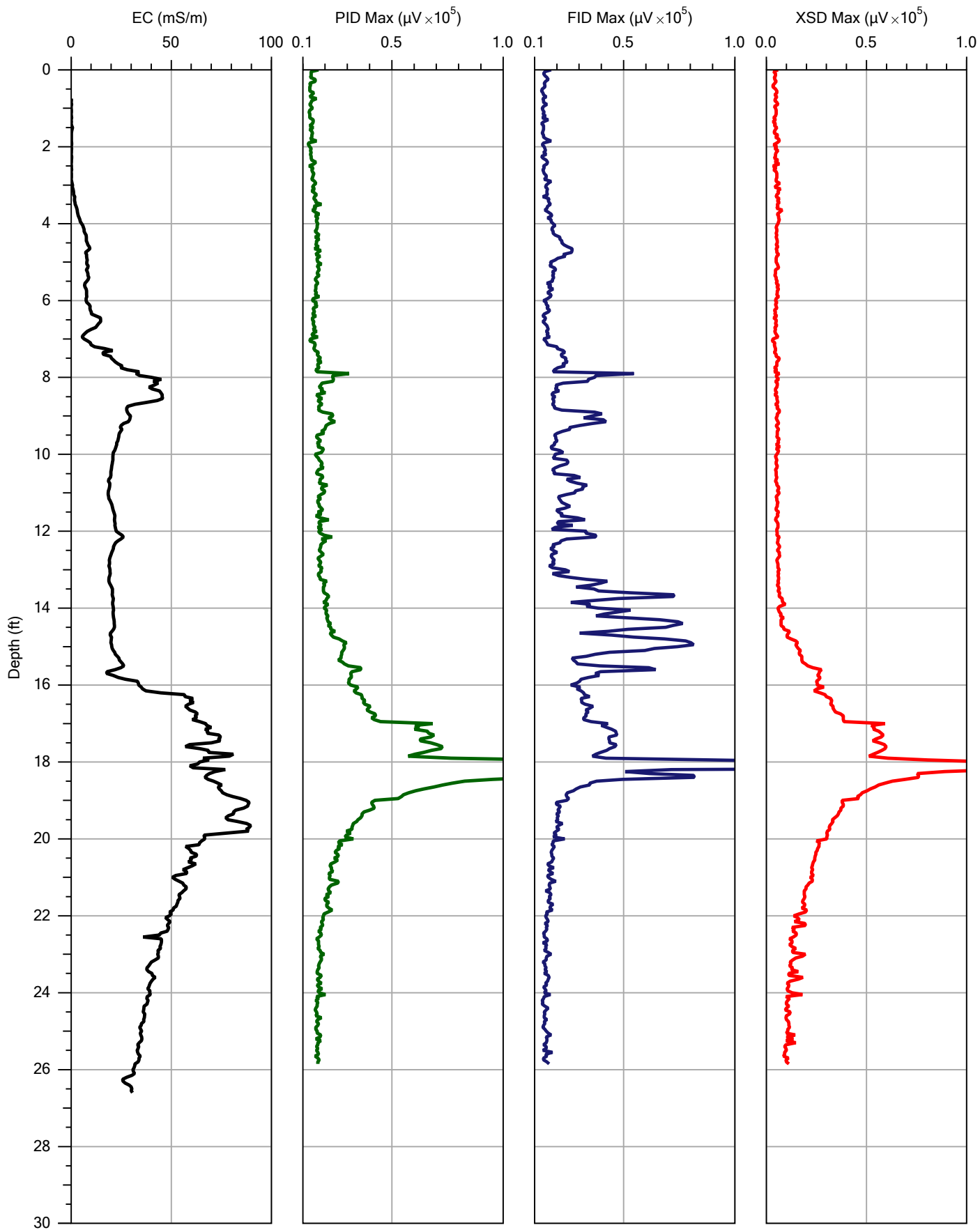
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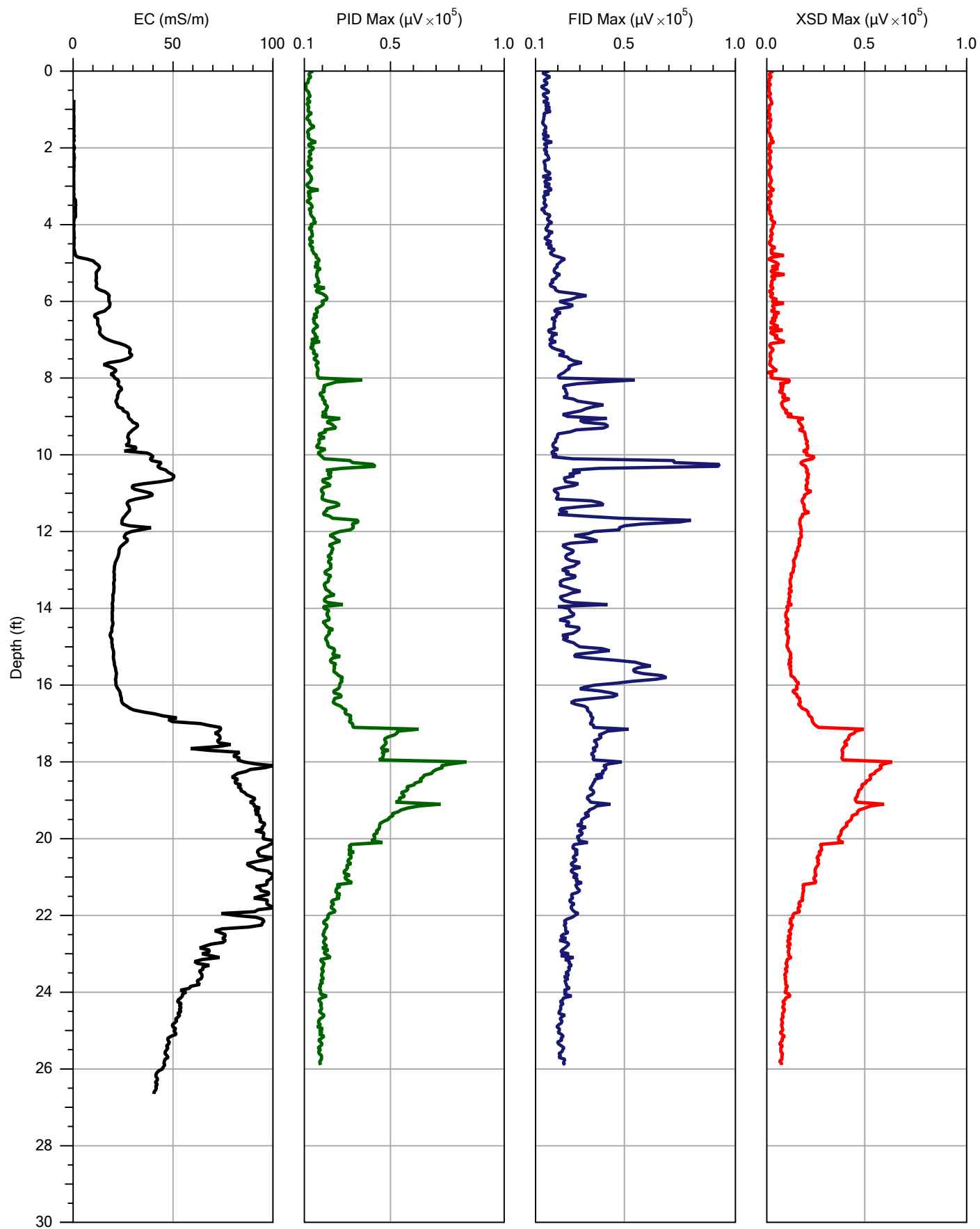
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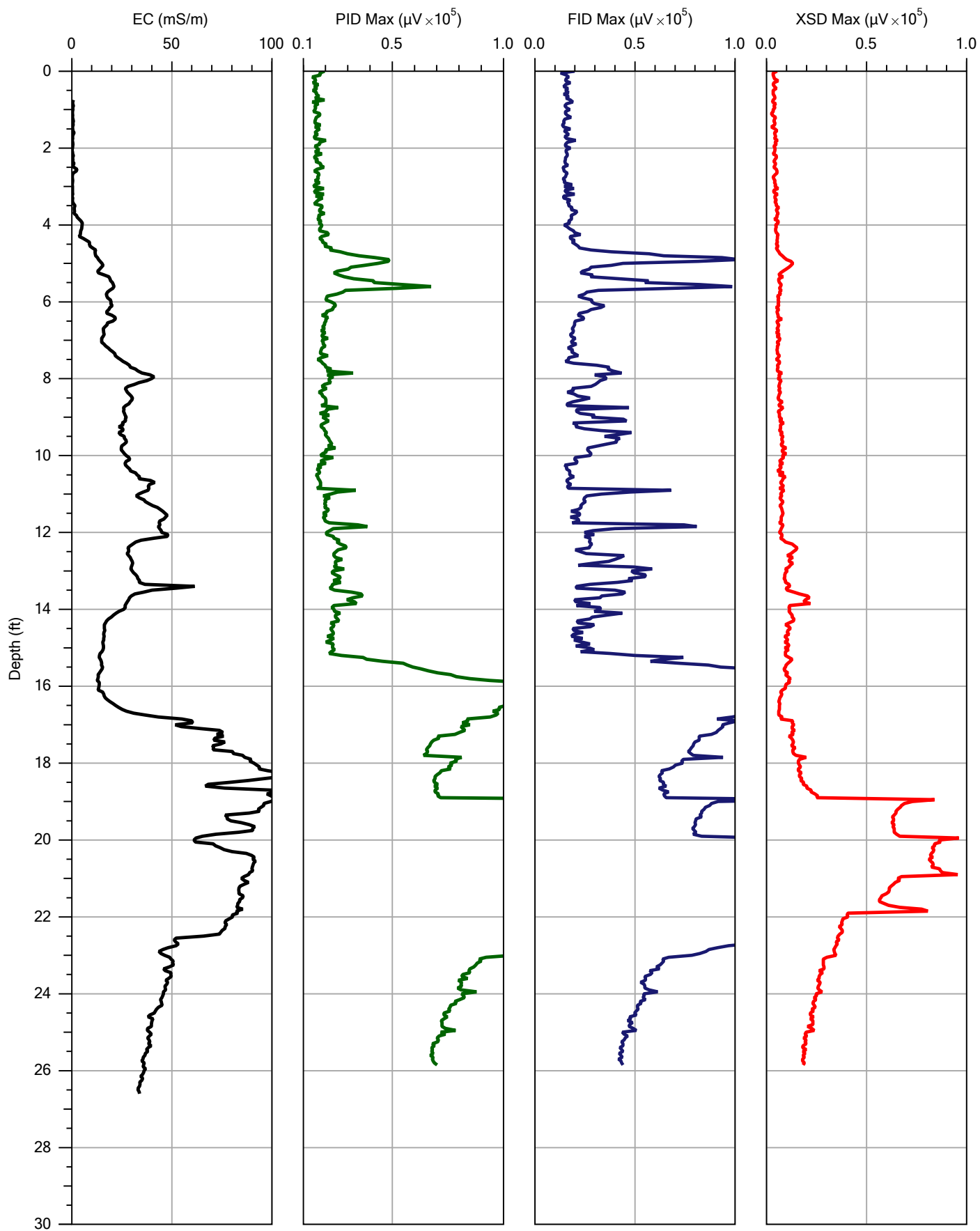
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Operator: M Jenson
Client: CRA

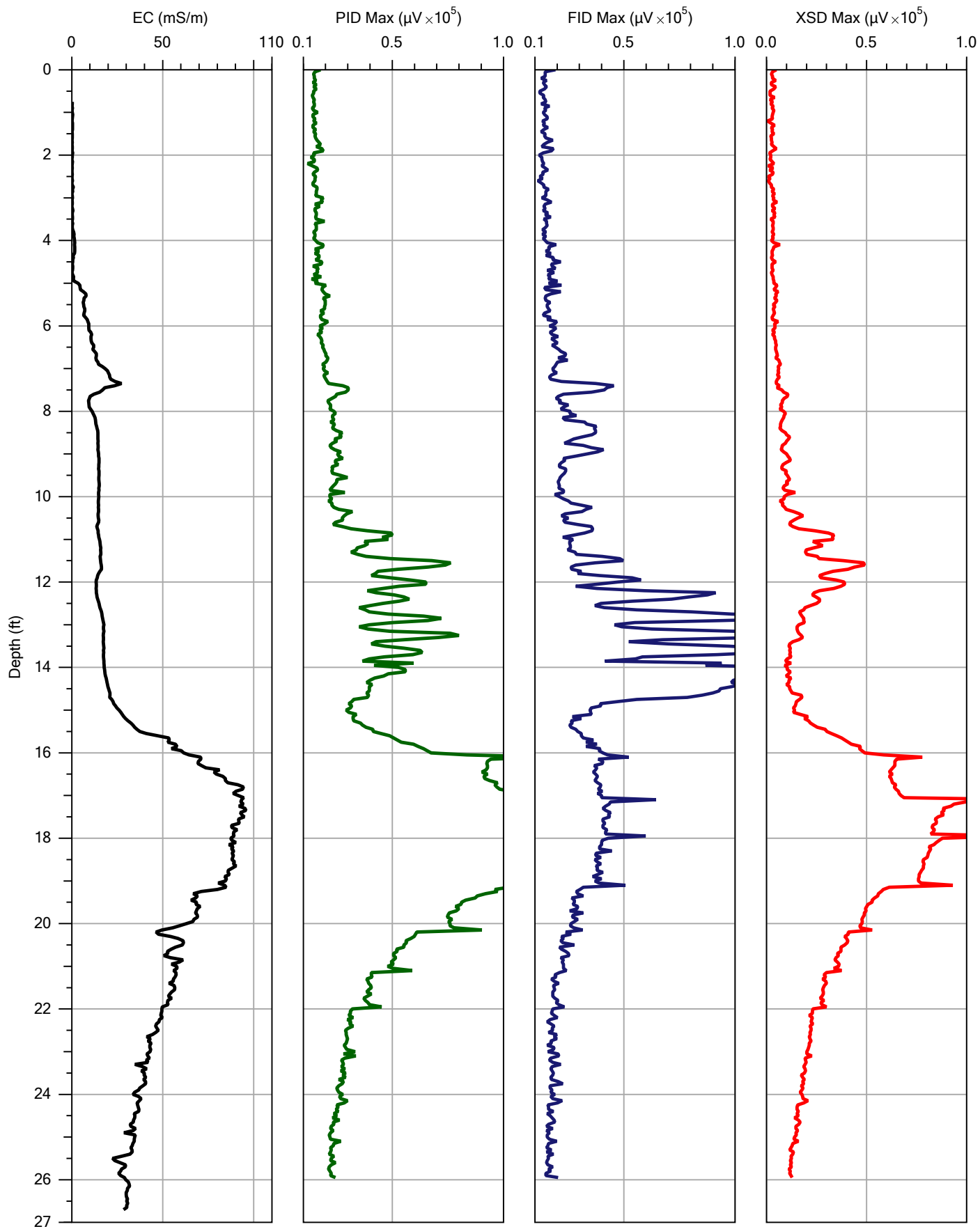
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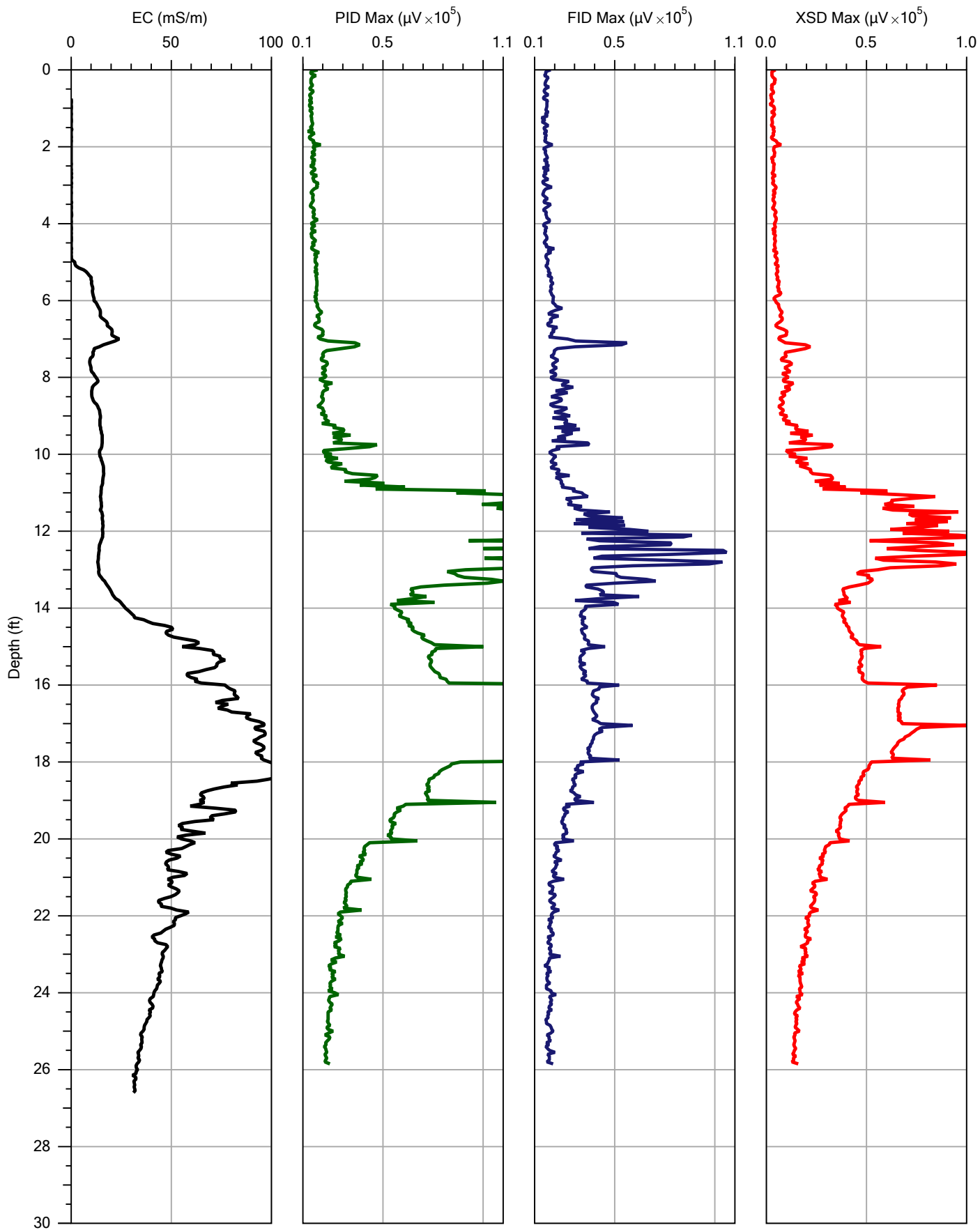
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

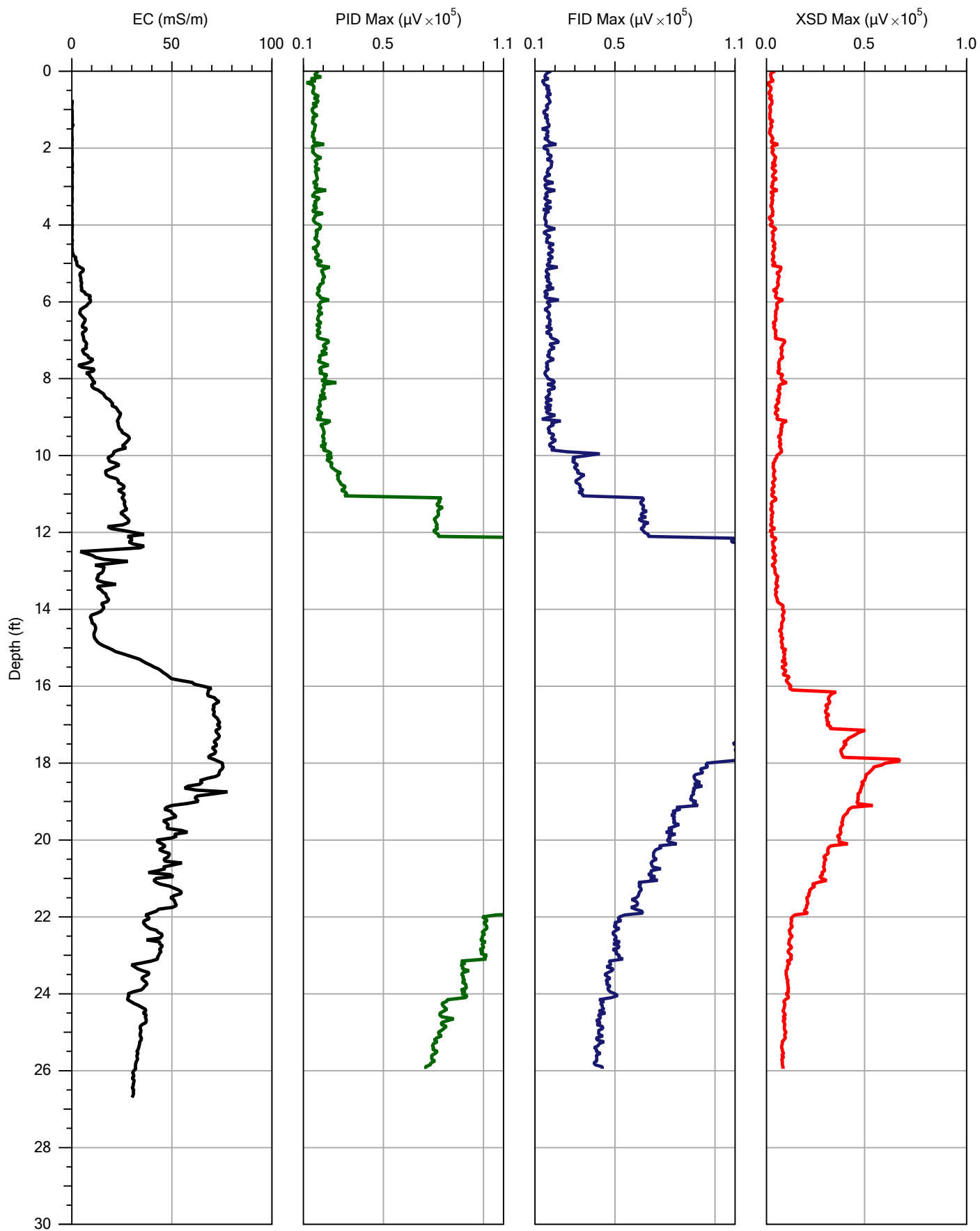
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

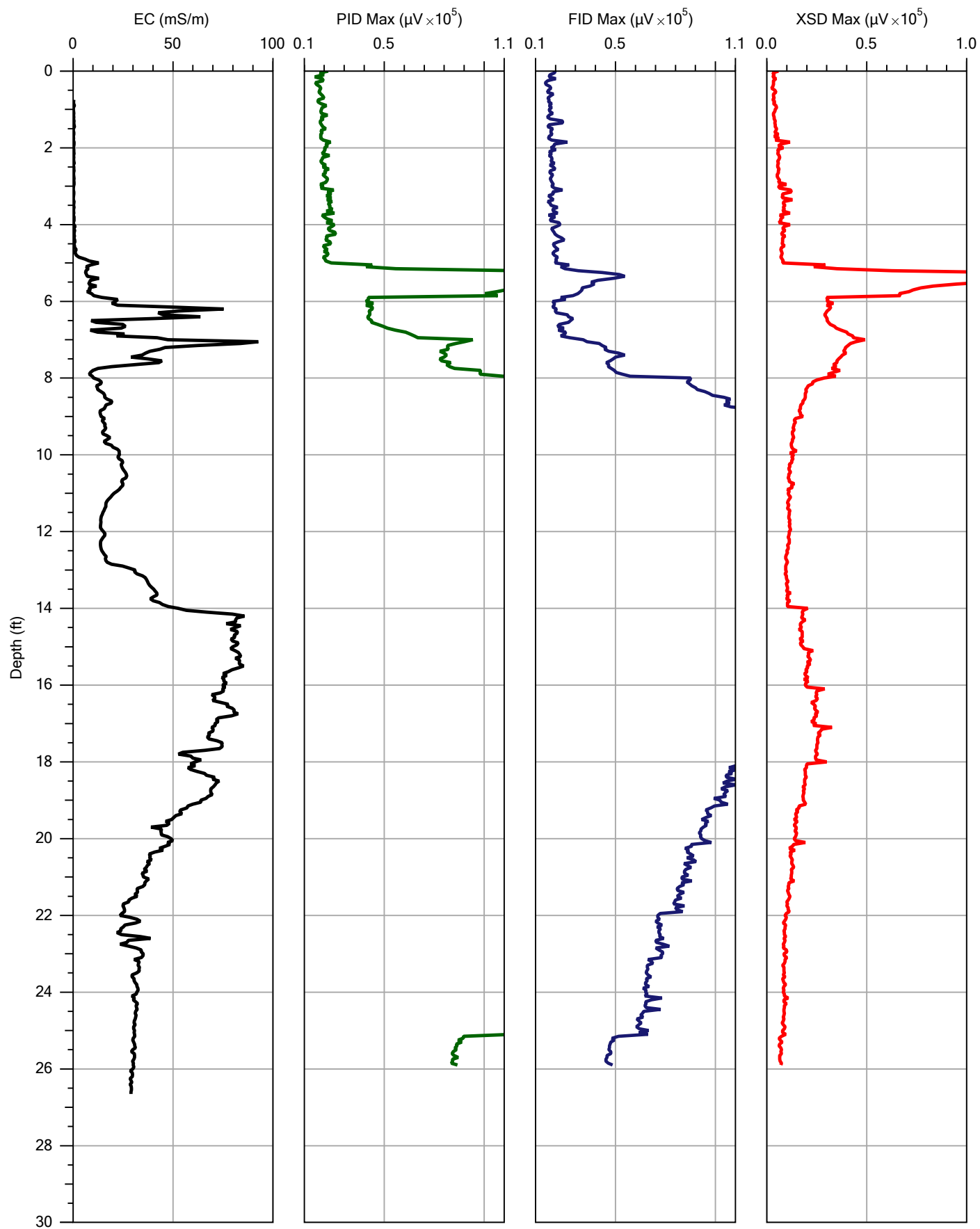
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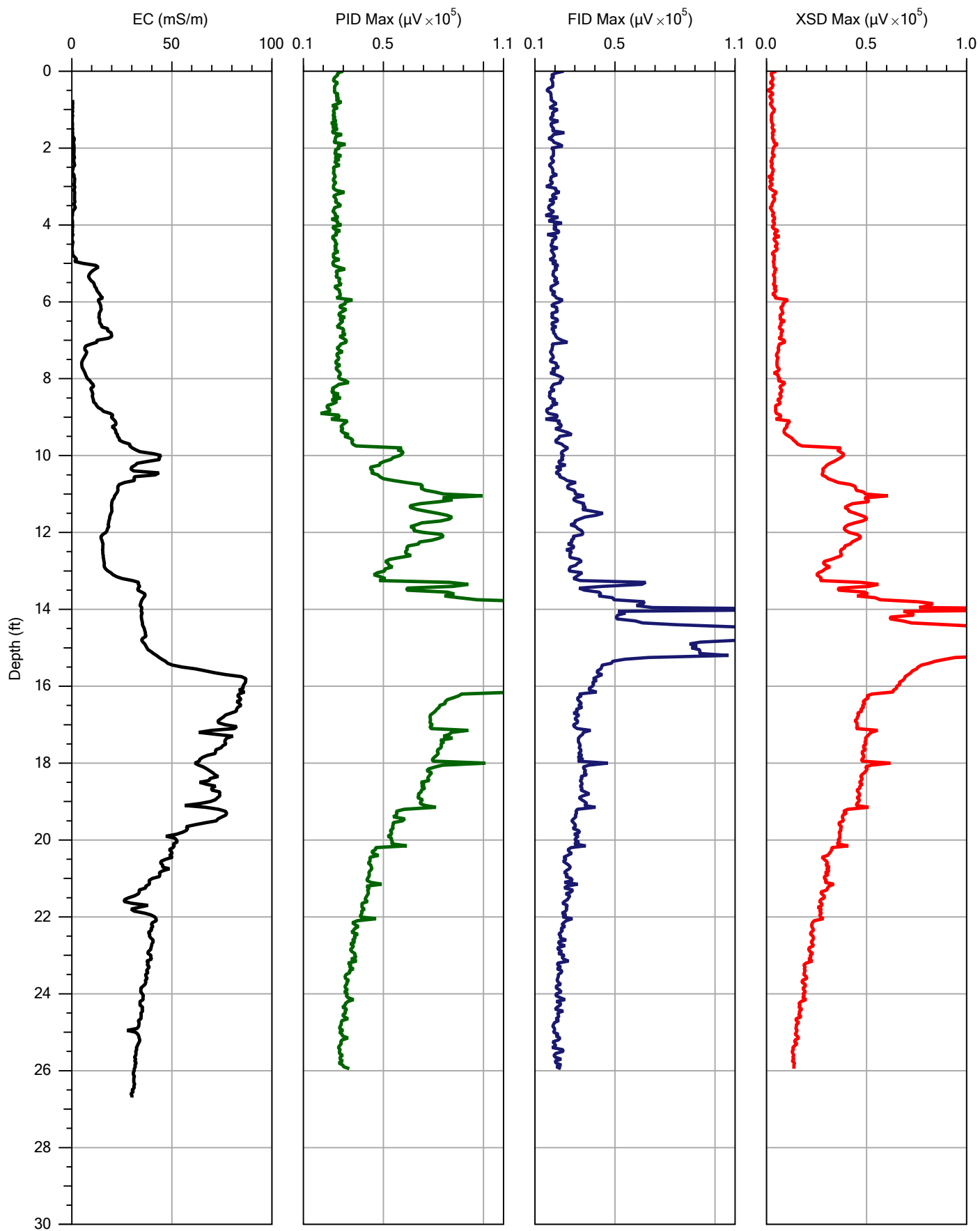
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Operator: M Jenson
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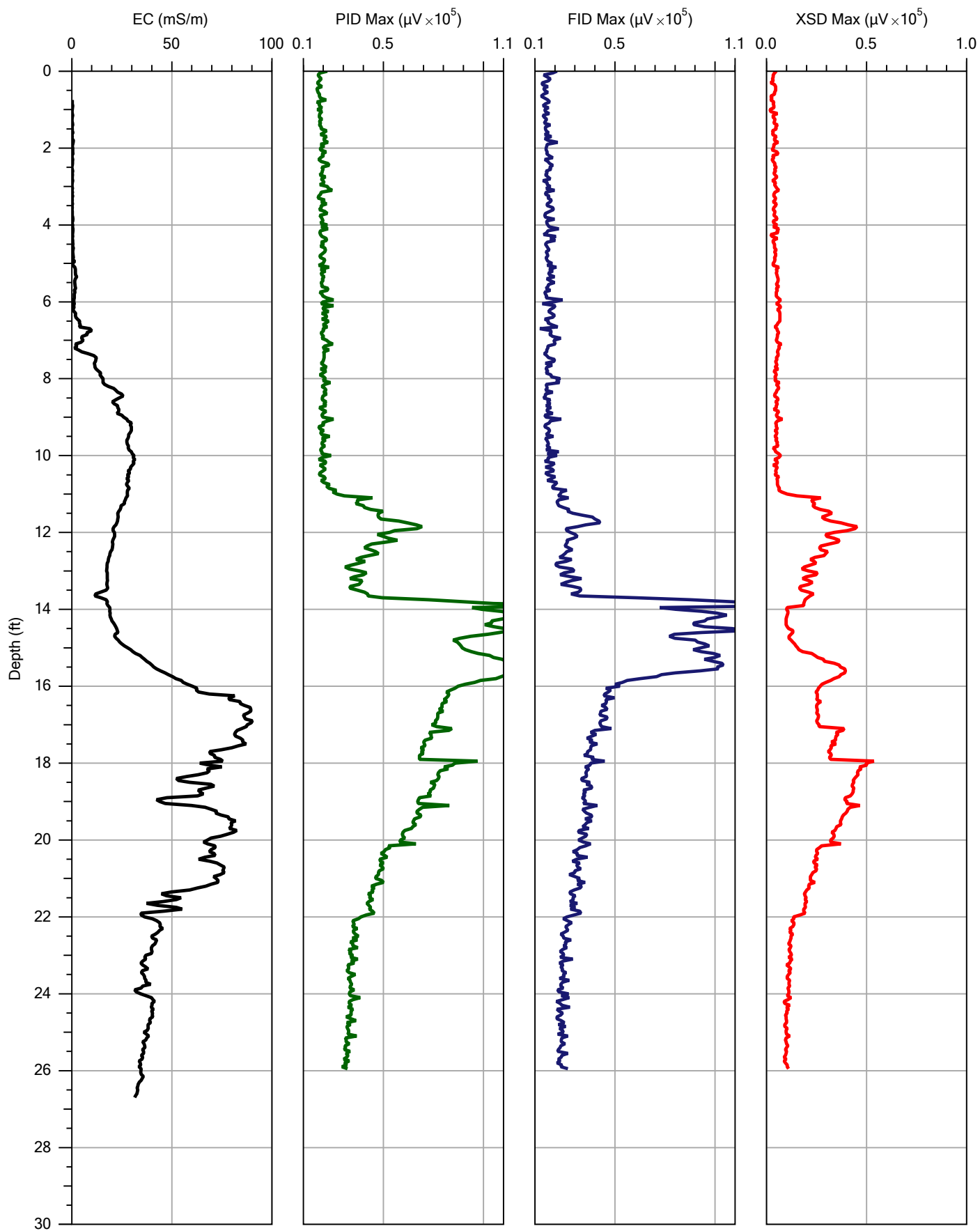
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Project ID:	319.14	Client:	CRA	Date:	12/8/2014
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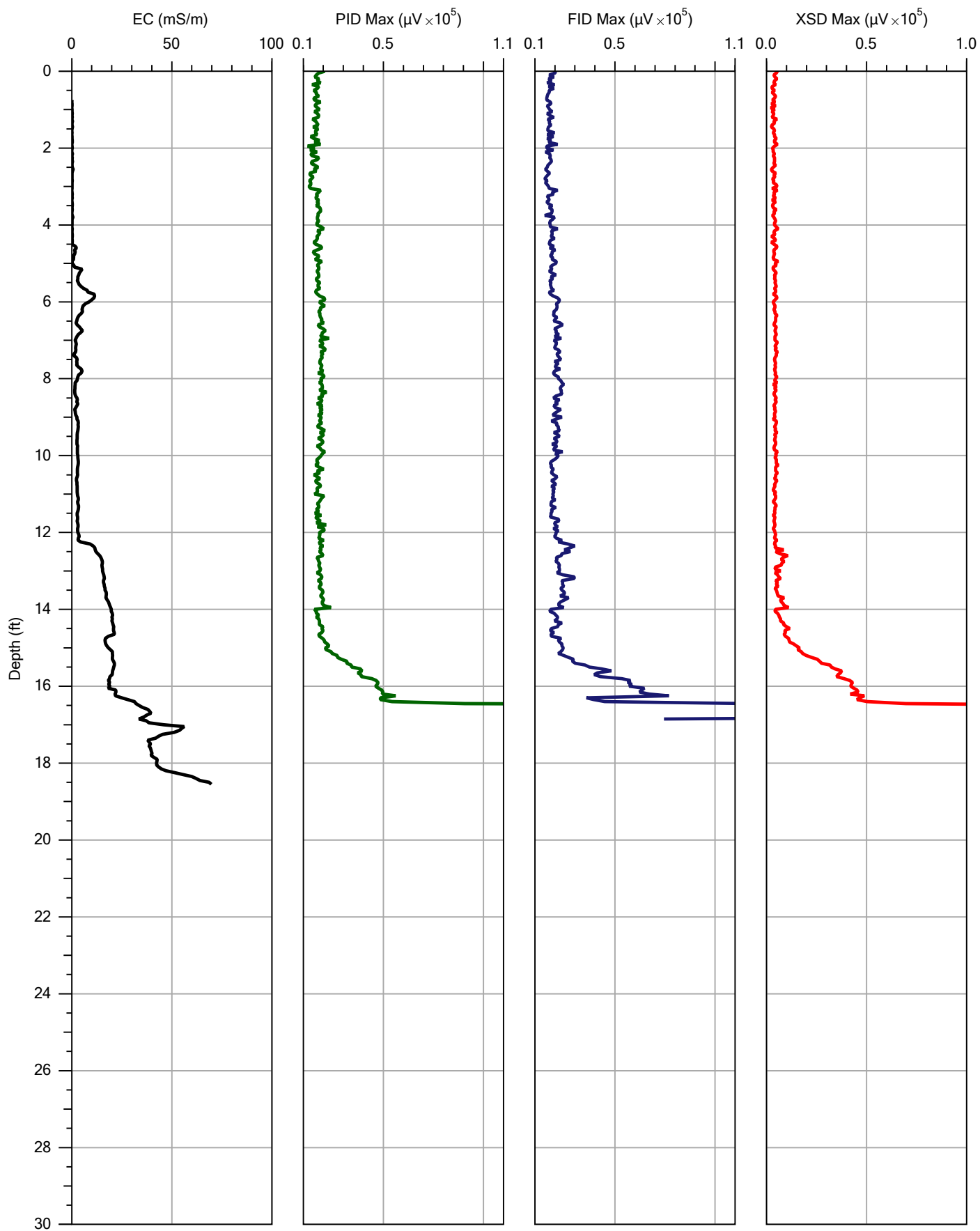
Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-028.MIP
Project ID:	319.14	Client:	CRA	Date:	12/8/2014
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

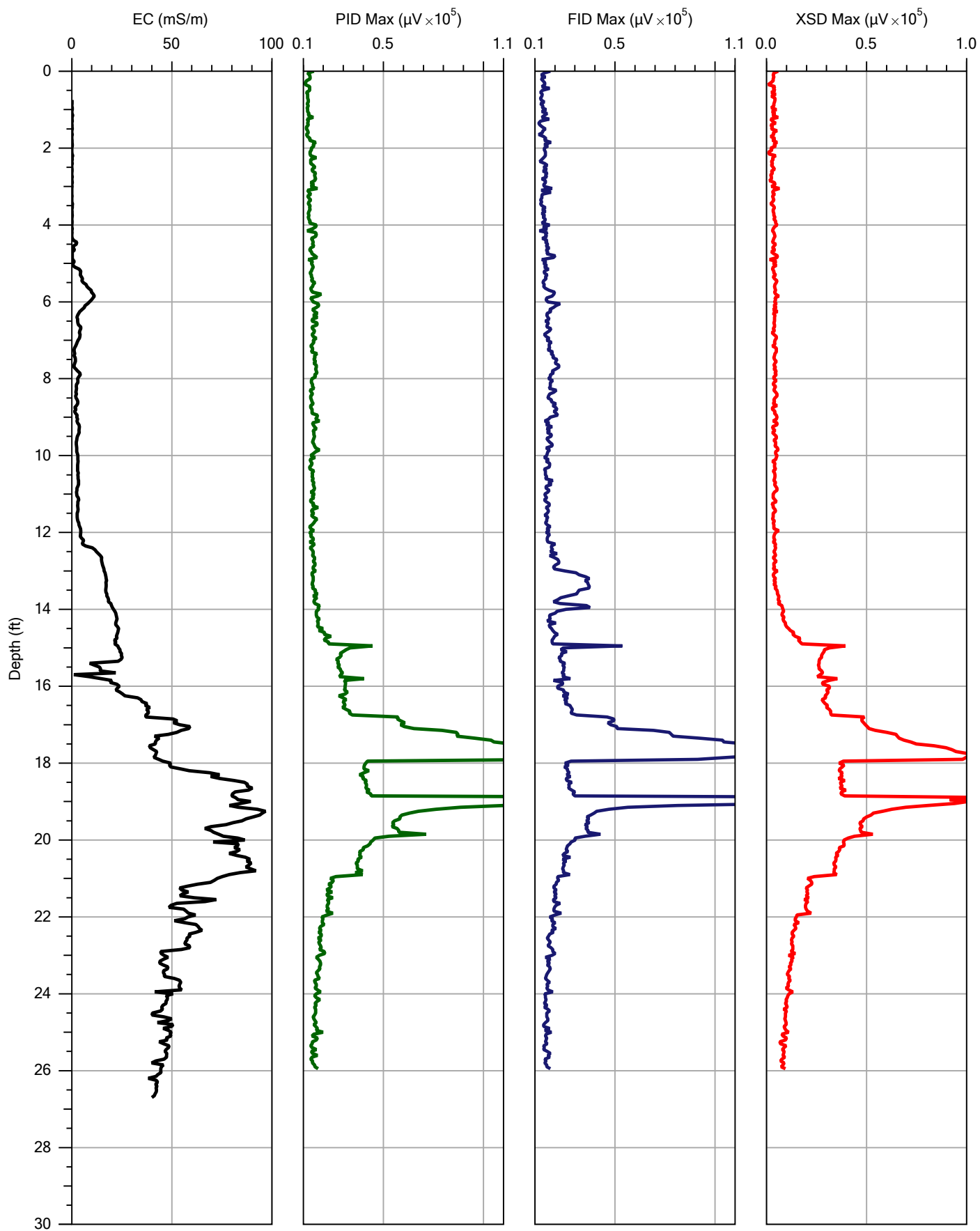
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Date:	12/8/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

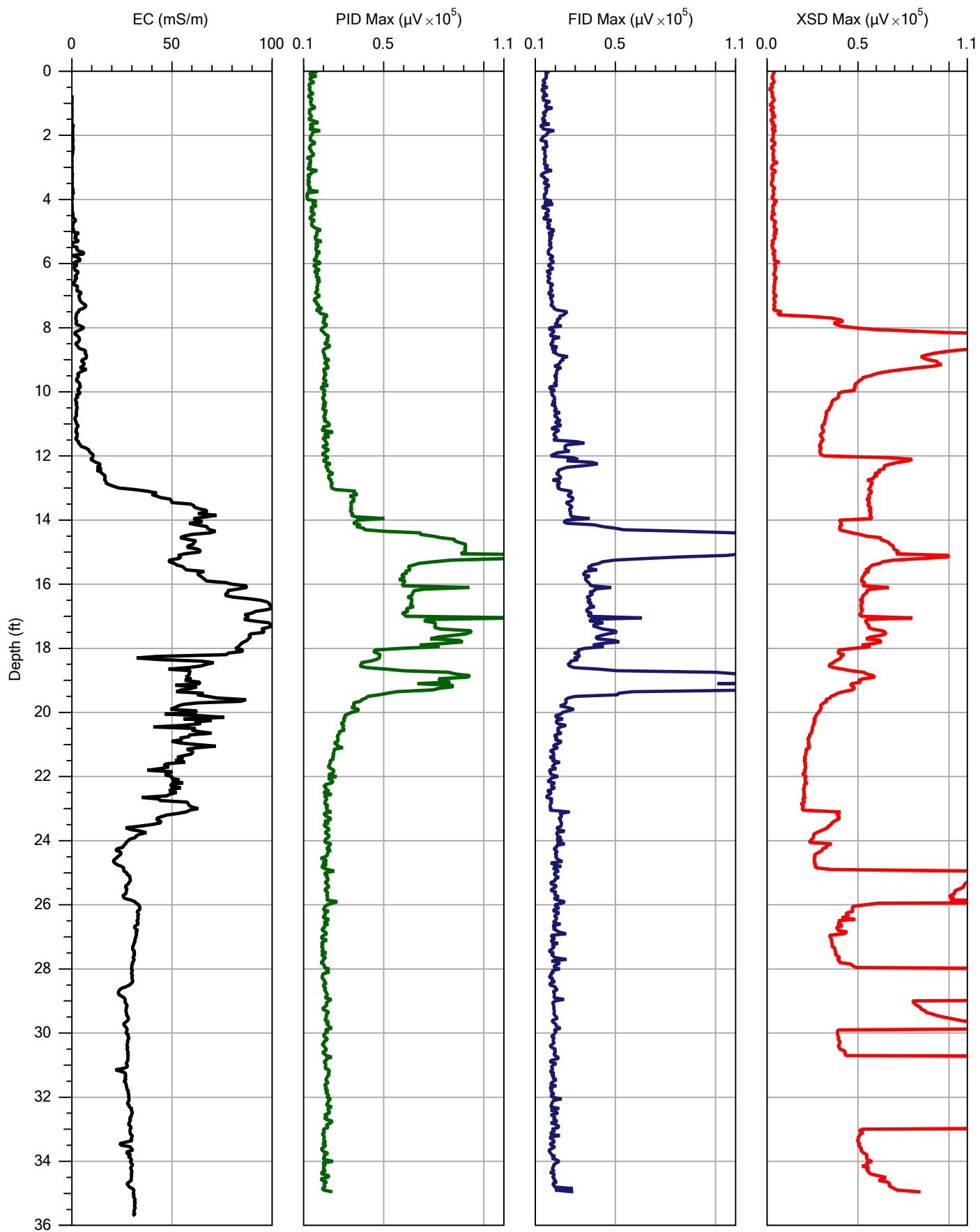
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Date:	12/9/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

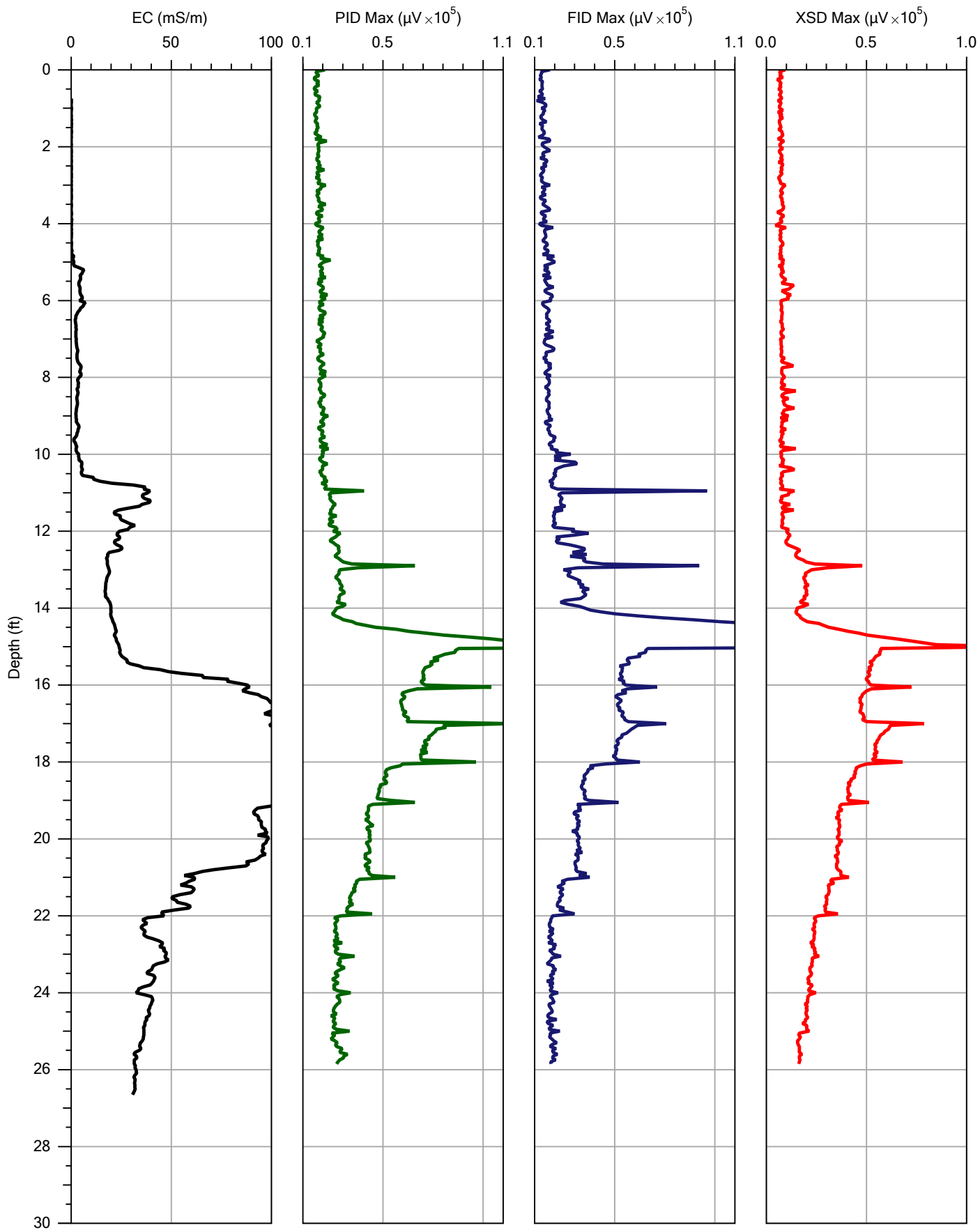
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Date:	12/9/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

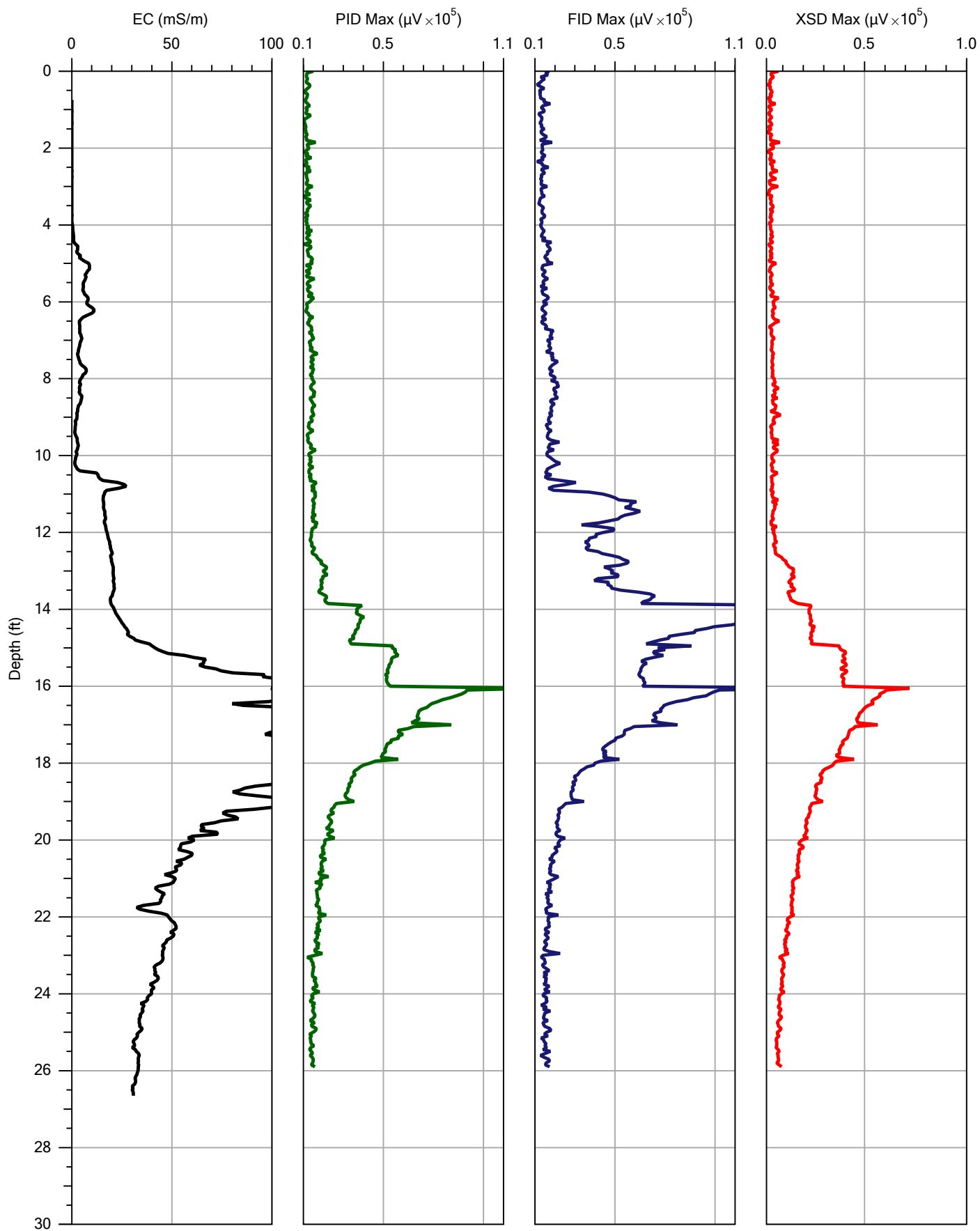
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Date: 12/9/2014
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

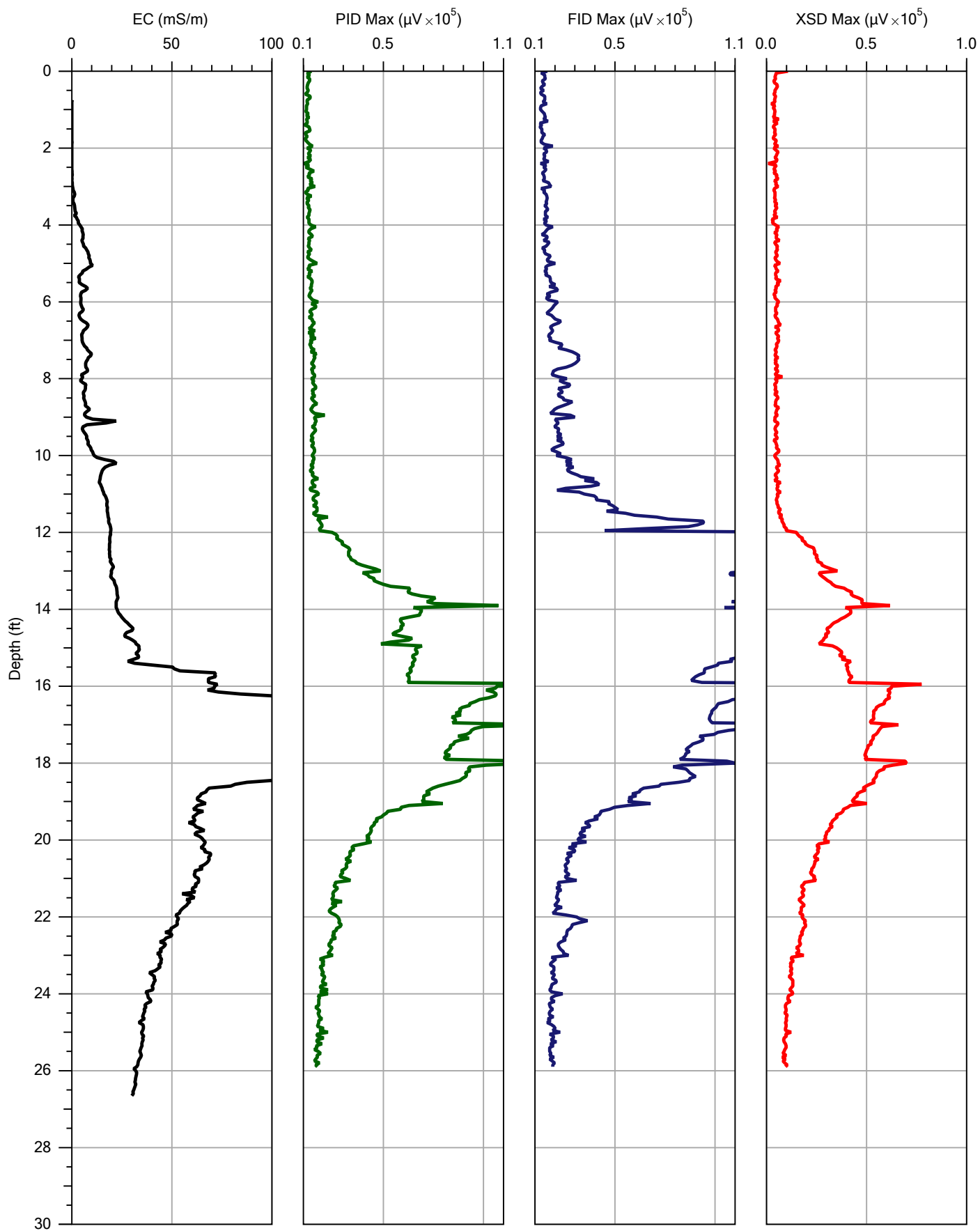
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

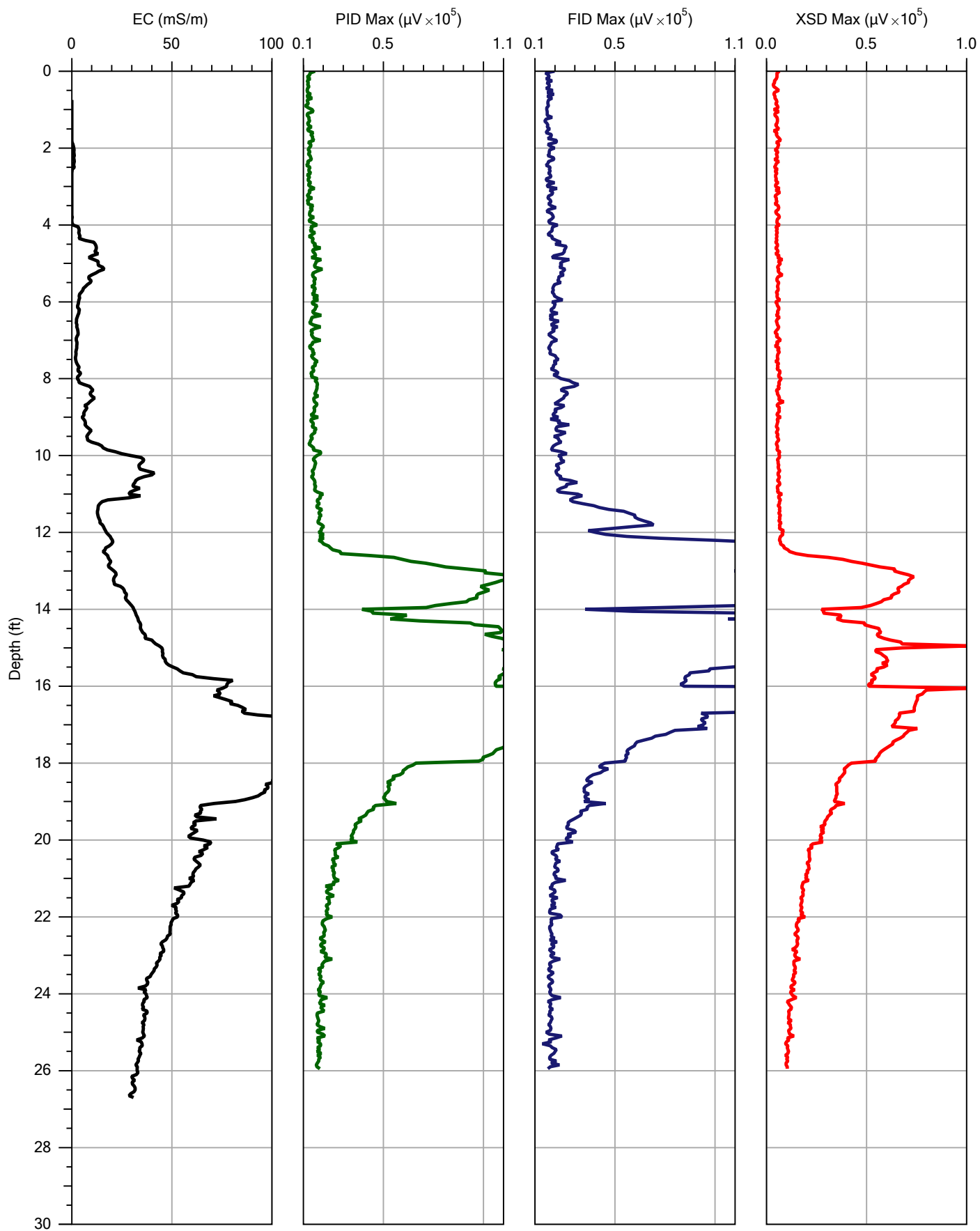
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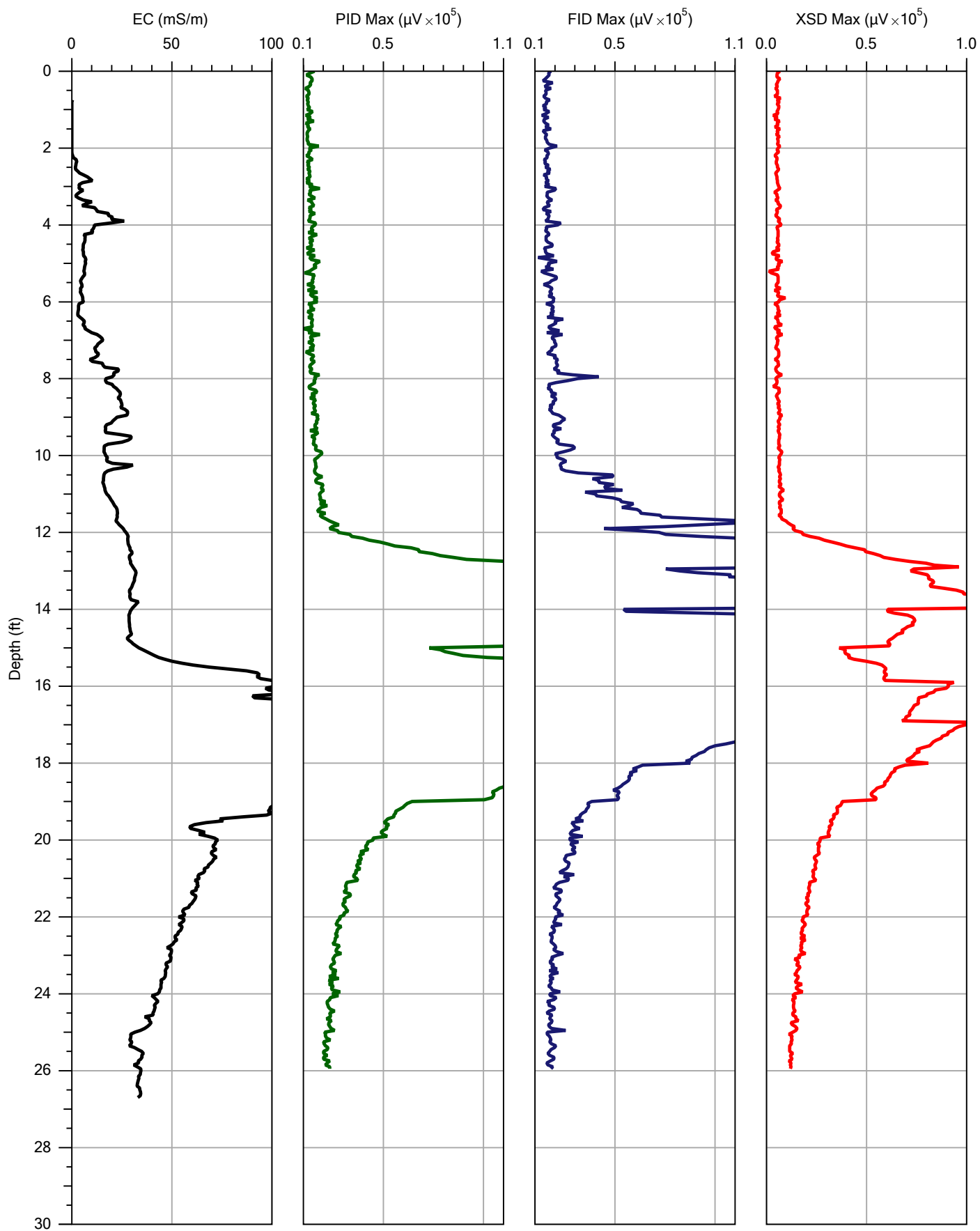
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

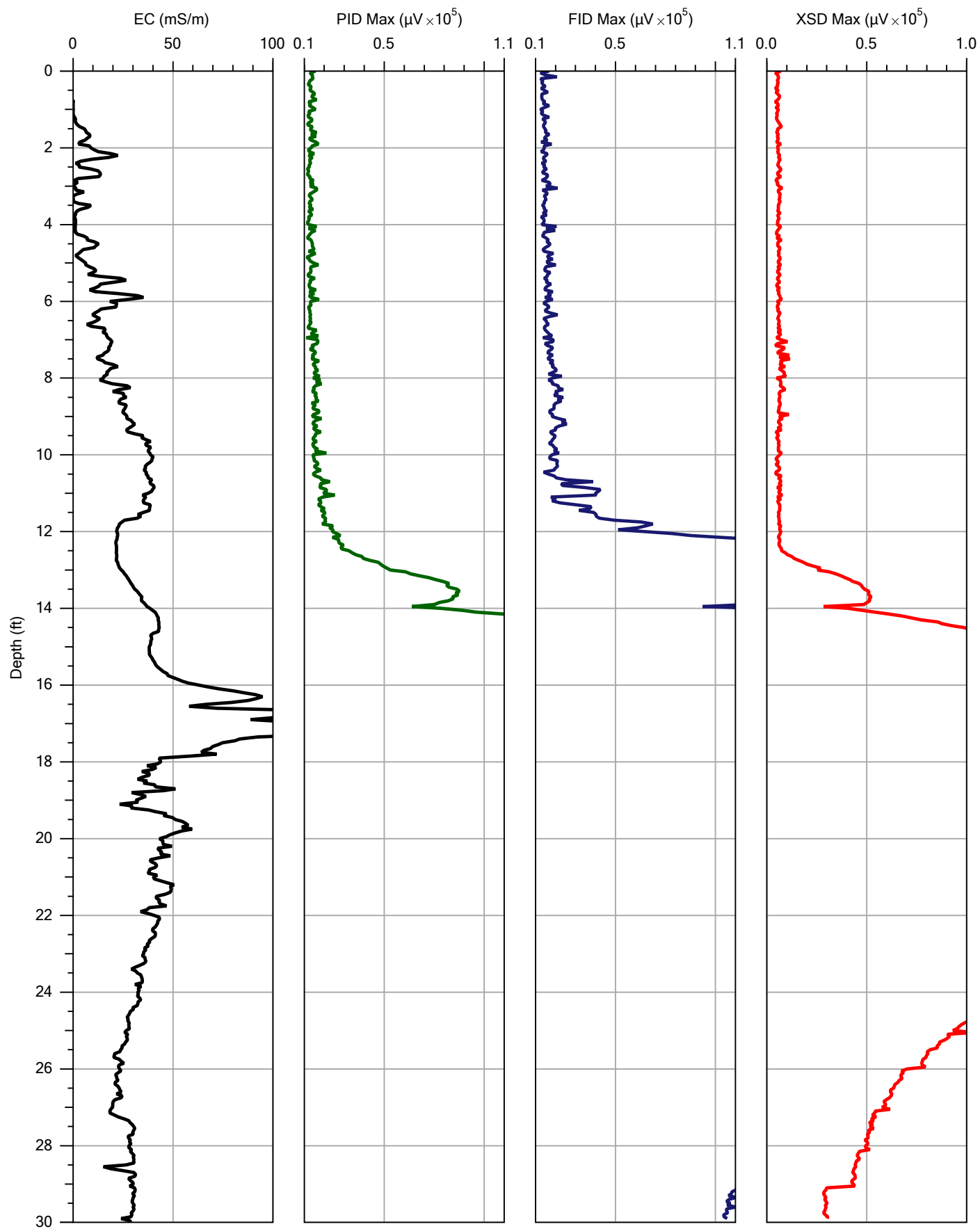
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Date:	12/10/2014
Location:	



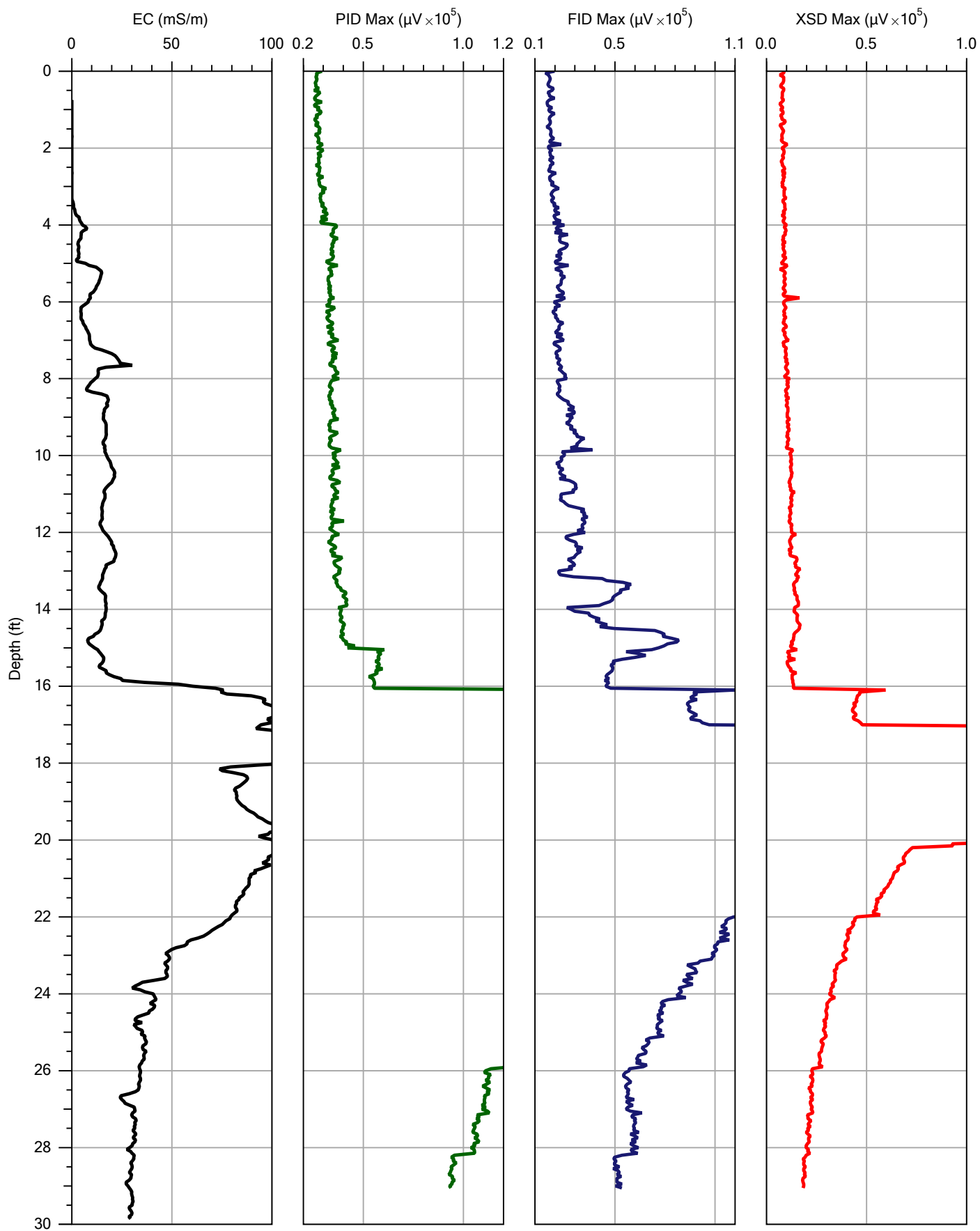
Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-035.MIP
Project ID:	319.14	Client:	CRA	Date:	12/10/2014
				Location:	



Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-036.MIP
Project ID:	319.14	Client:	CRA	Date:	12/10/2014
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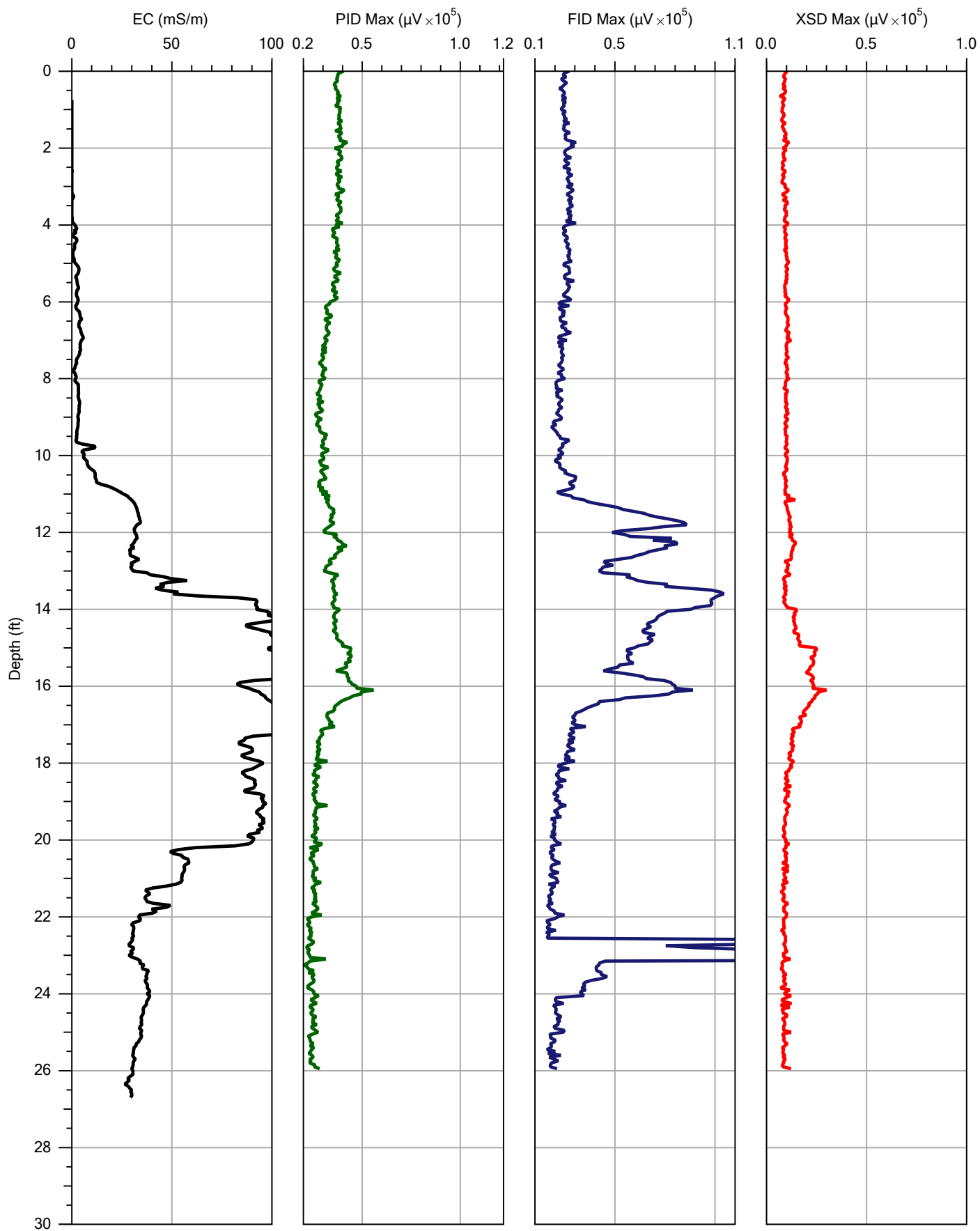
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Project ID:	319.14	Client:	CRA	Date:	12/10/2014
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

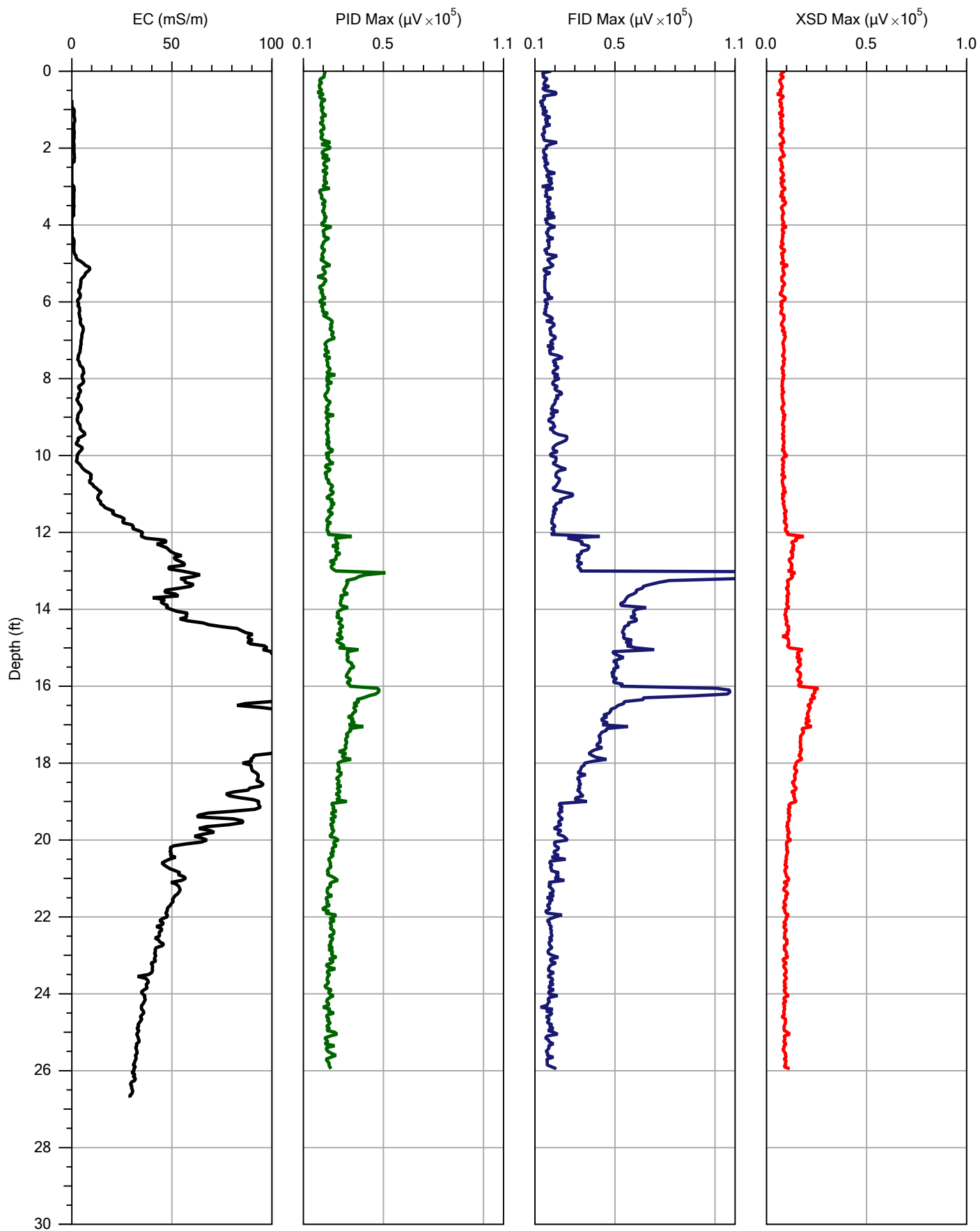
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Date: 12/10/2014
Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

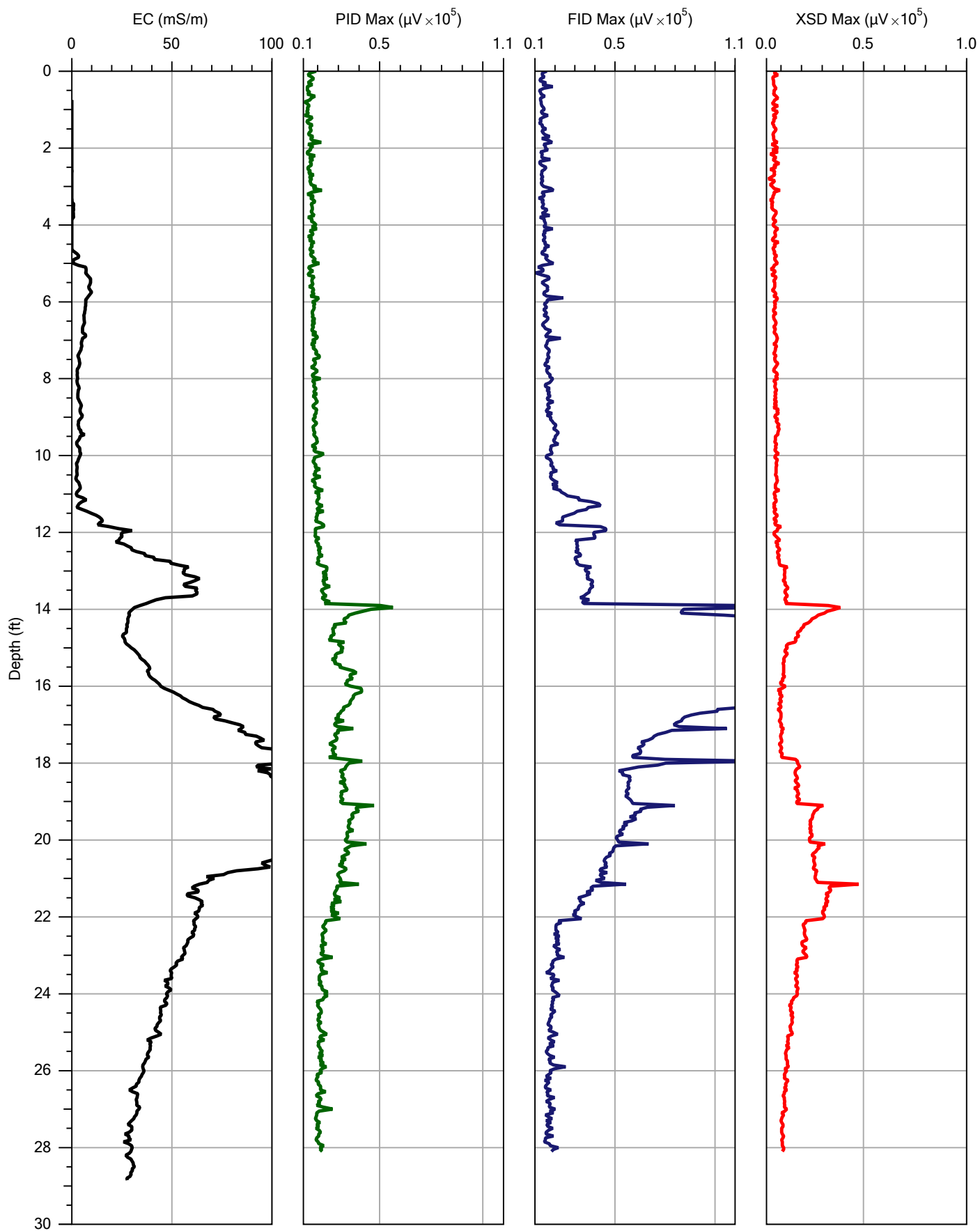
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Date: 12/10/2014
Location:



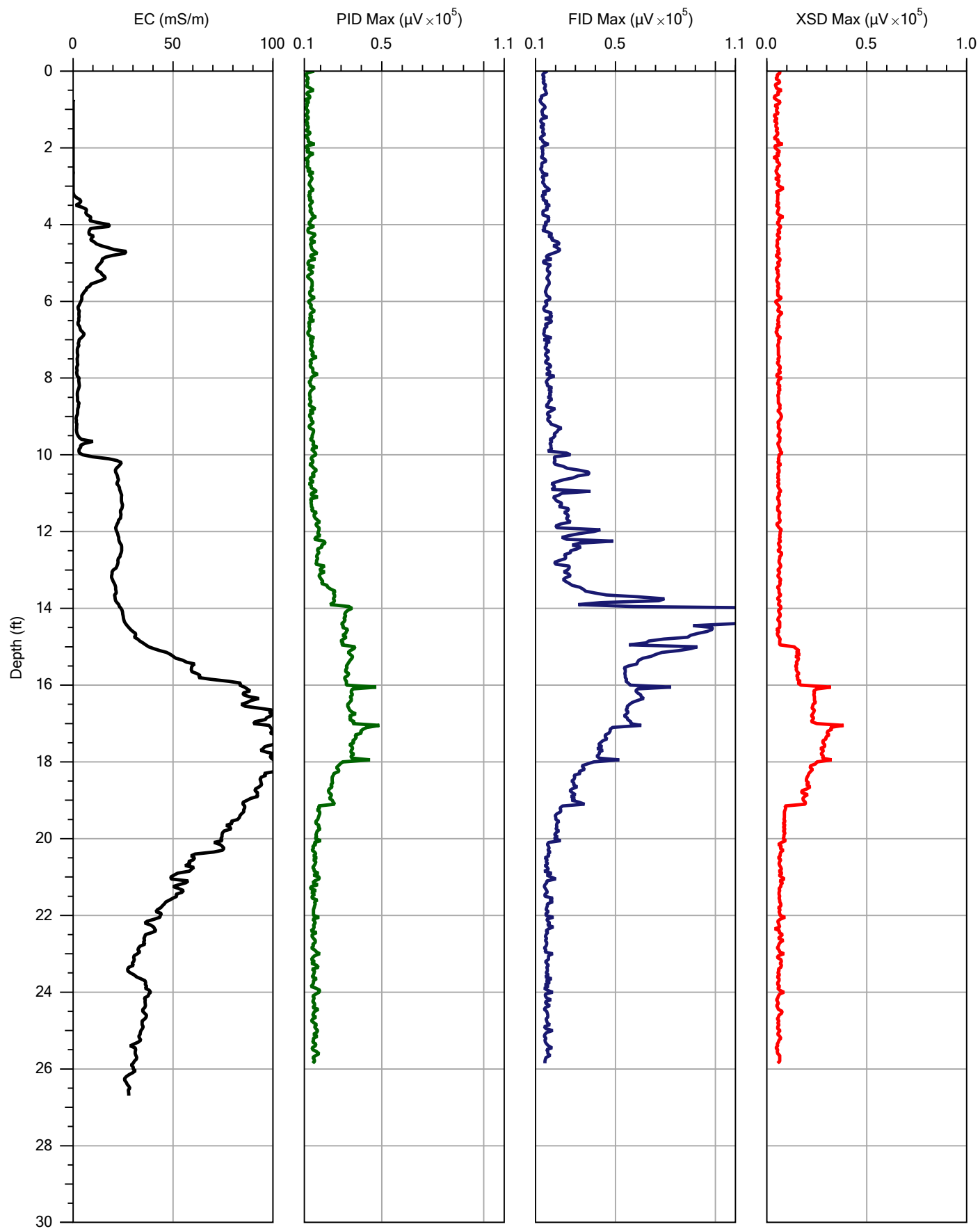
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

File: MIP-040.MIP
Date: 12/10/2014
Location:



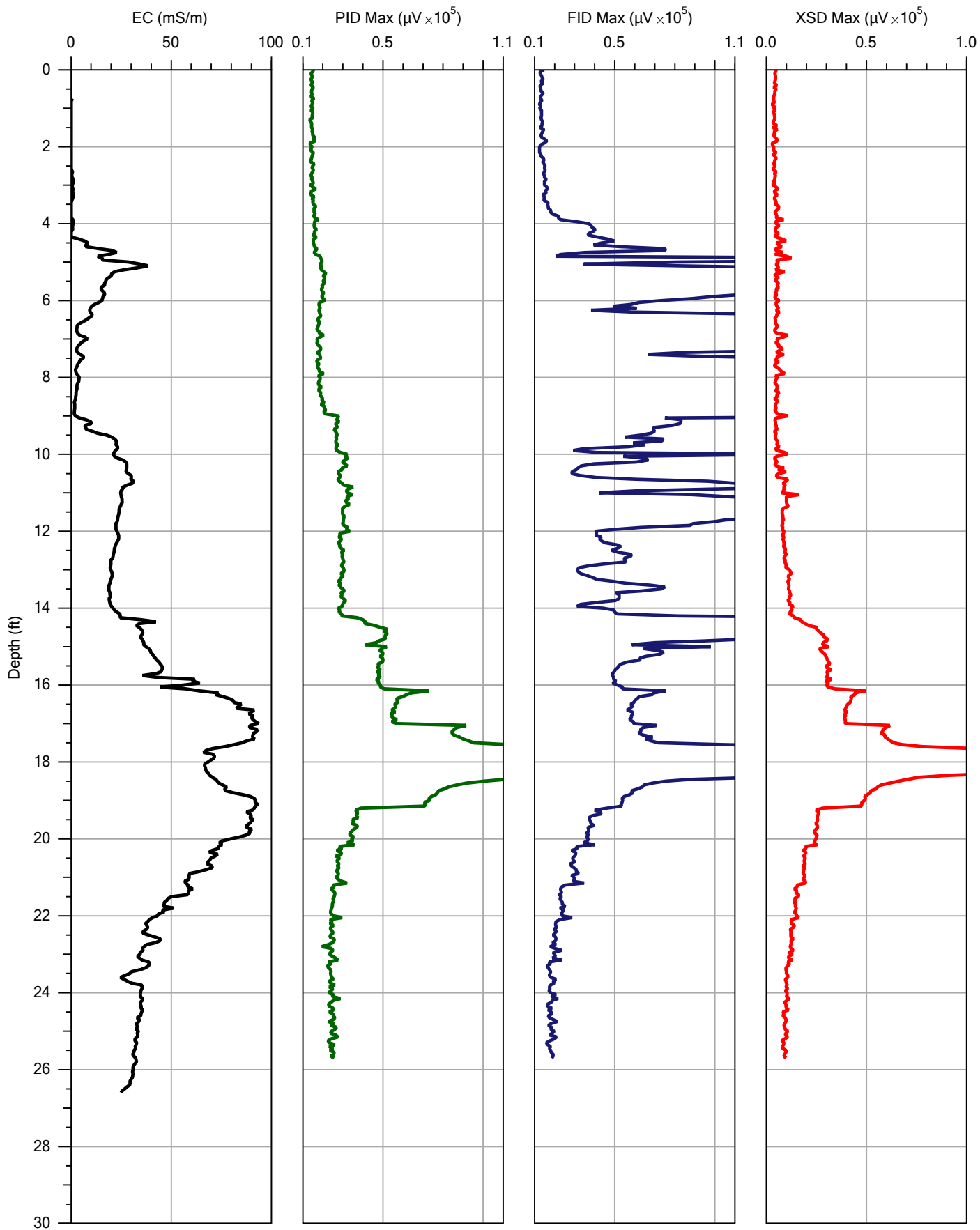
Company: Matrix Environmental		File: MIP-041.MIP
Operator: M Jensen		Date: 12/10/2014
Project ID: 319.14	Client: CRA	Location:



Company: Matrix Environmental
 Project ID: 319.14

Operator: M Jenson
 Client: CRA

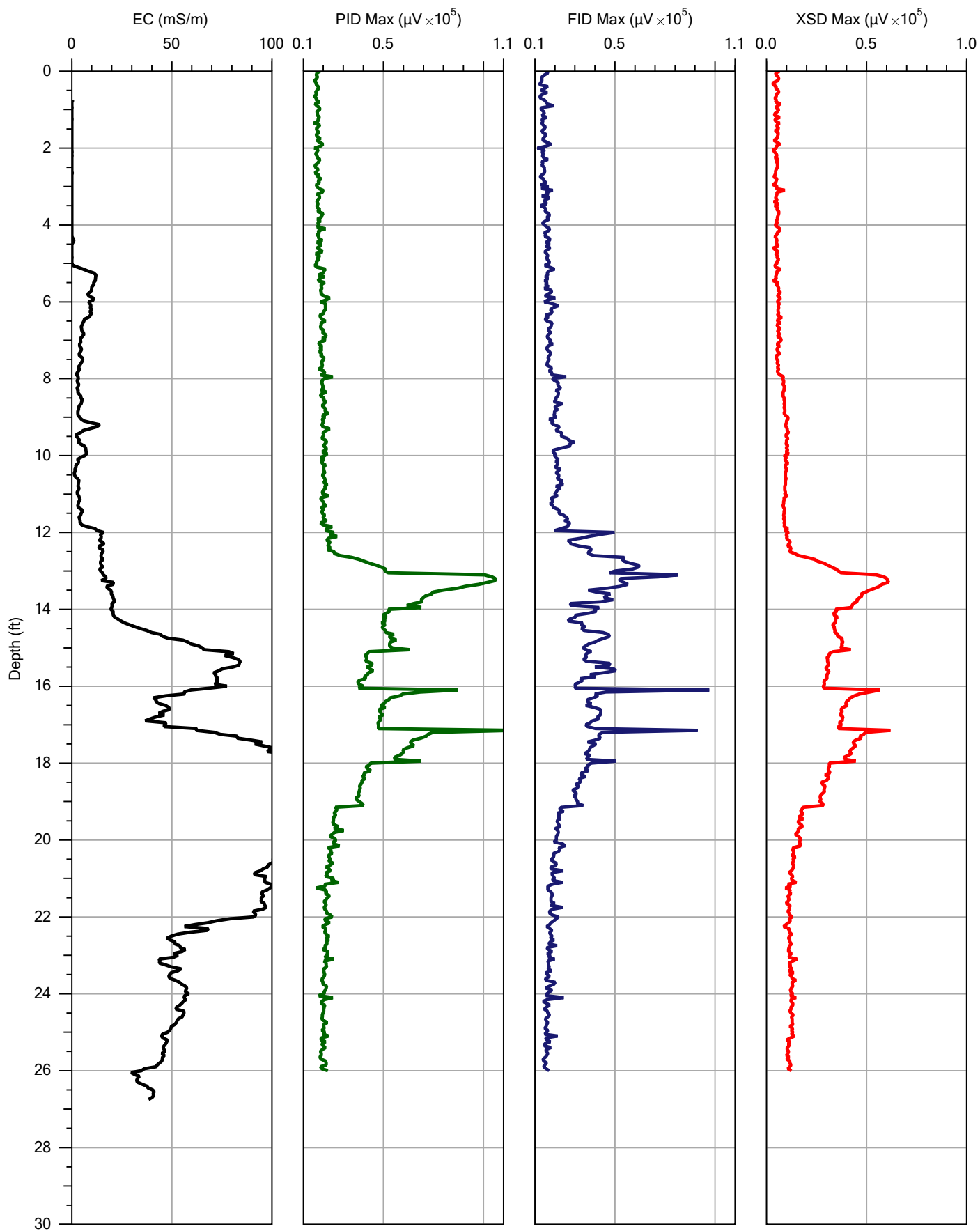
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Date:	12/11/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

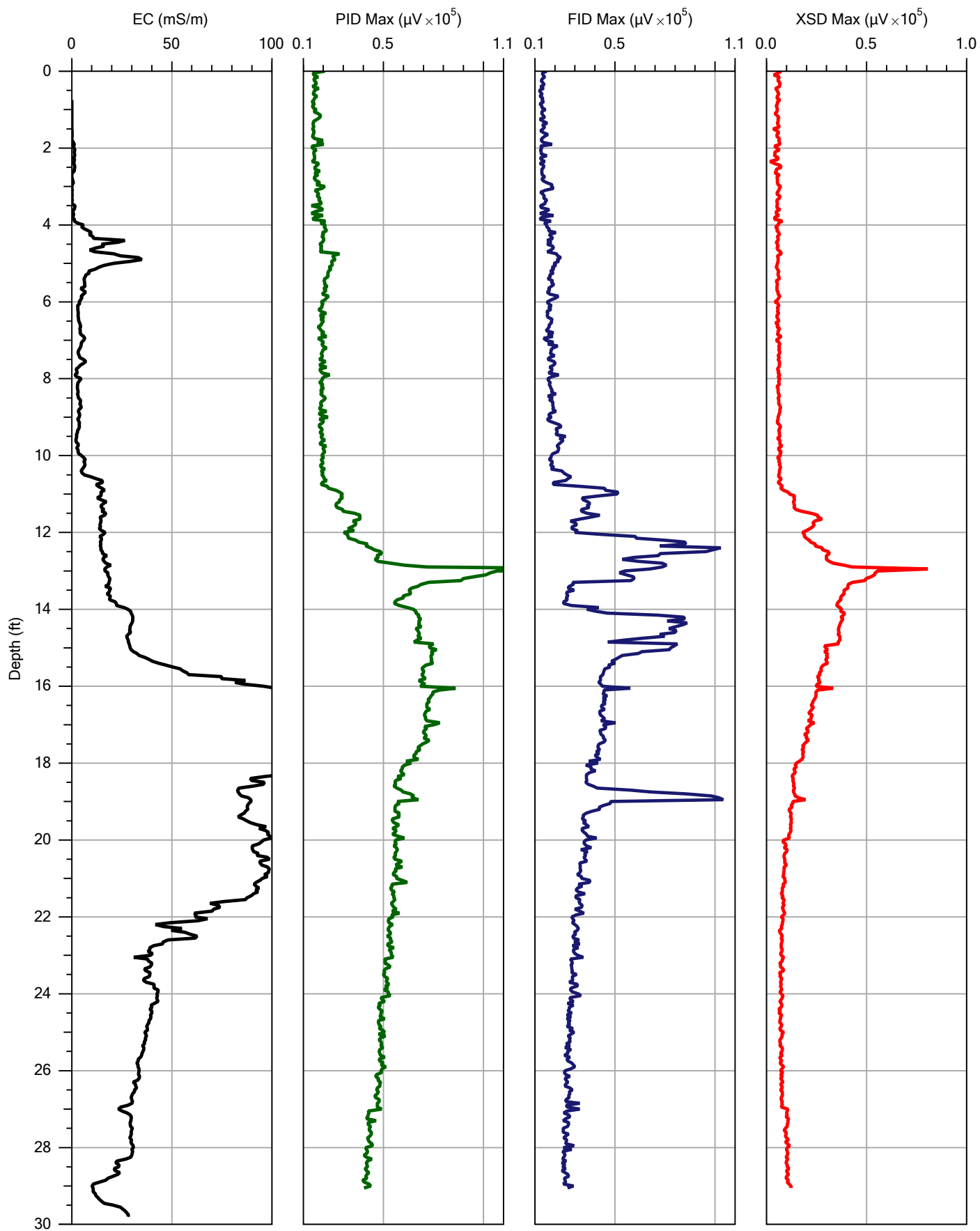
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Date: 12/11/2014
Location:



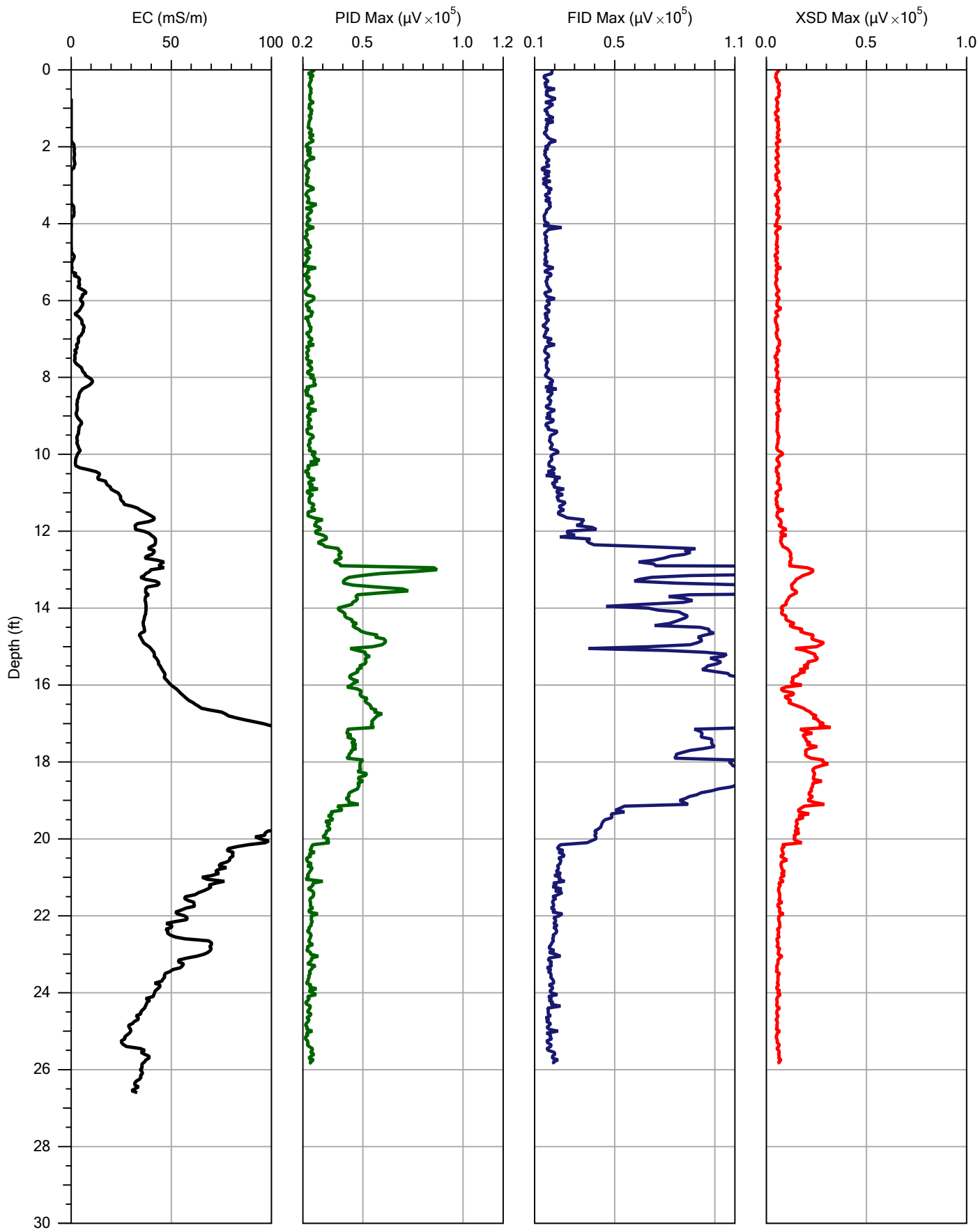
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

File: MIP-044.MIP
Date: 12/11/2014
Location:



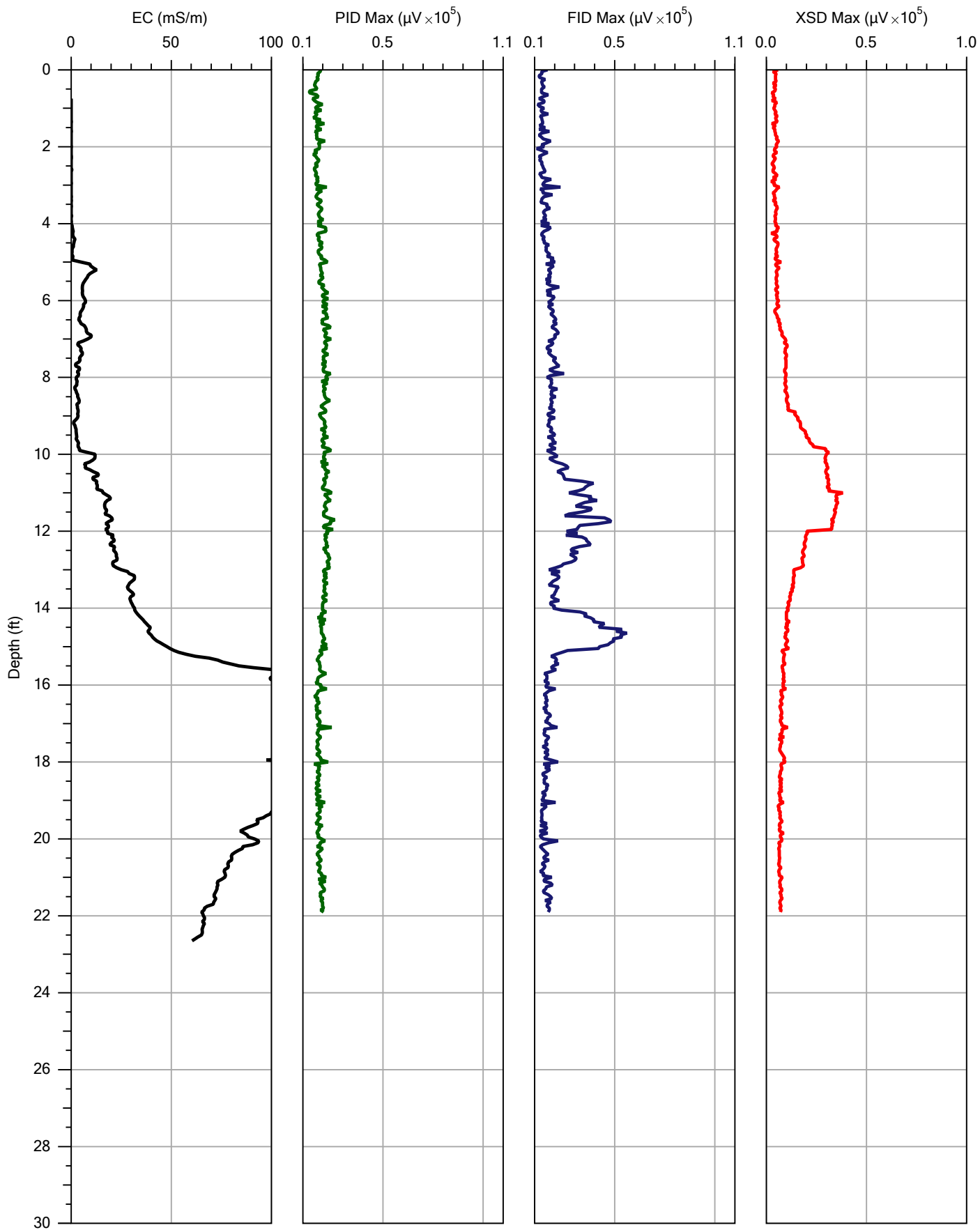
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Matrix Environmental		M Jensen	MIP-045.MIP
Project ID:	Client:	Date:	
319.14	CRA	12/11/2014	
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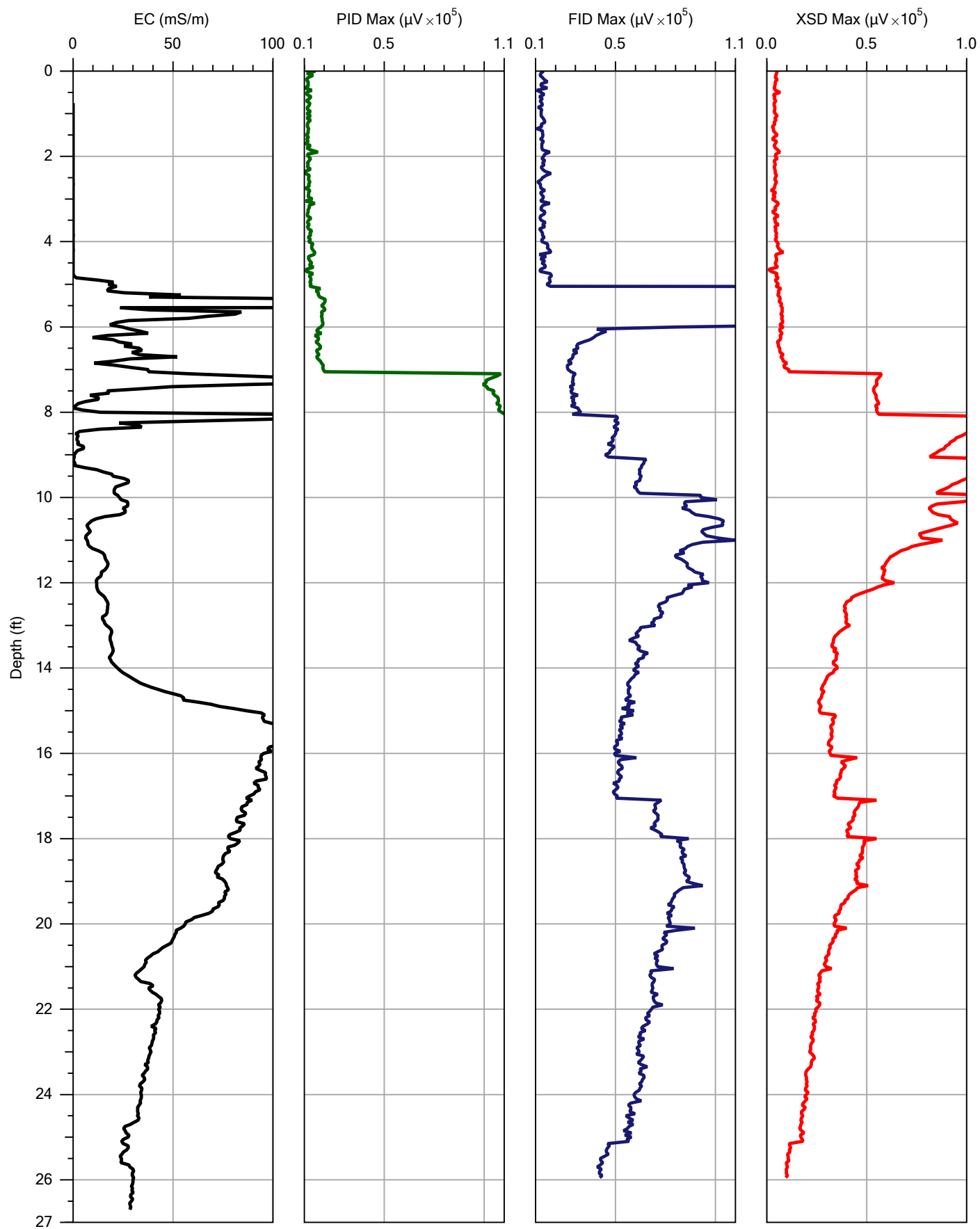
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

File: MIP-046.MIP
Date: 12/11/2014
Location:



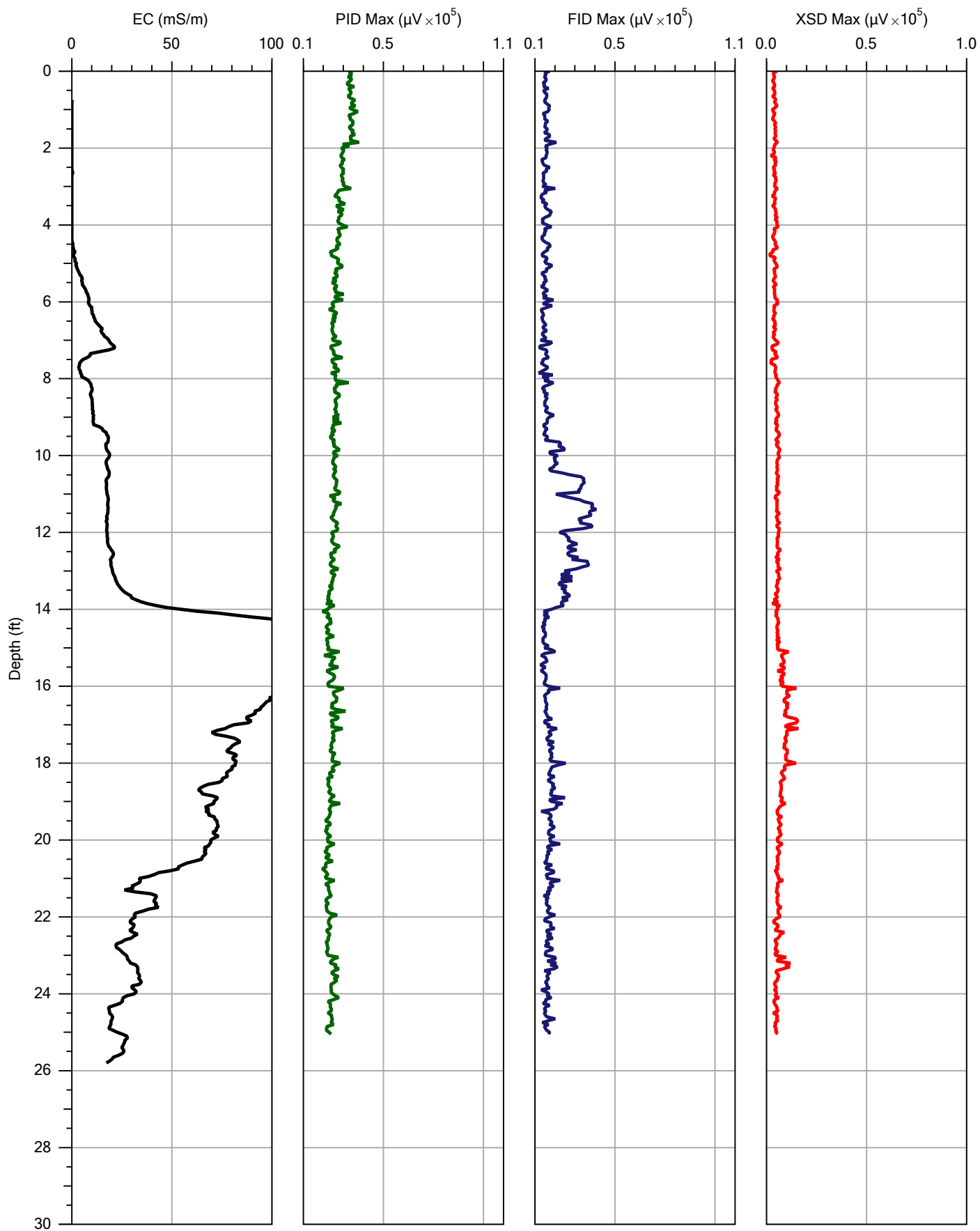
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Project ID:	319.14	Client:	CRA	Date:	12/11/2014
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

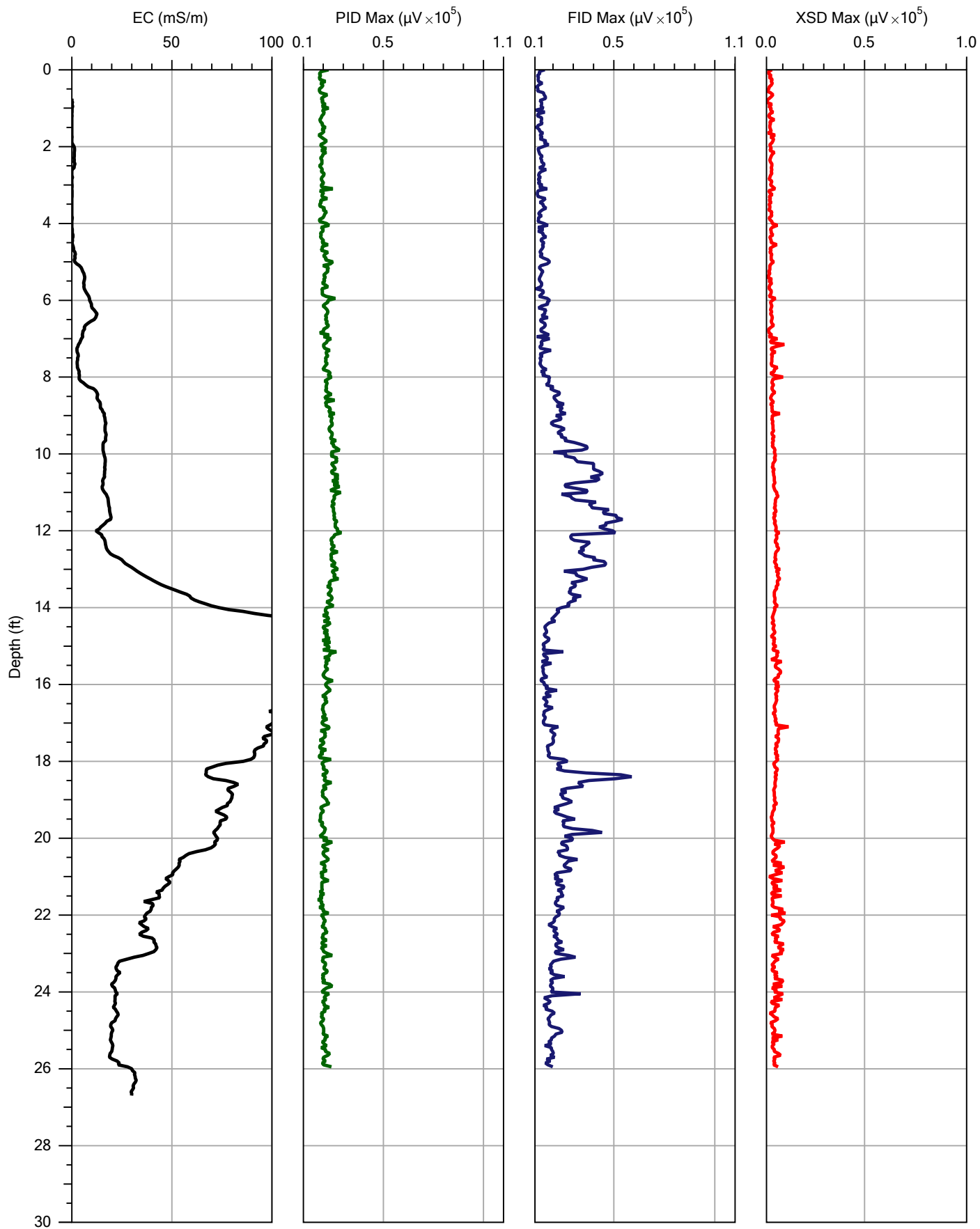
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Date:	12/12/2014
Location:	



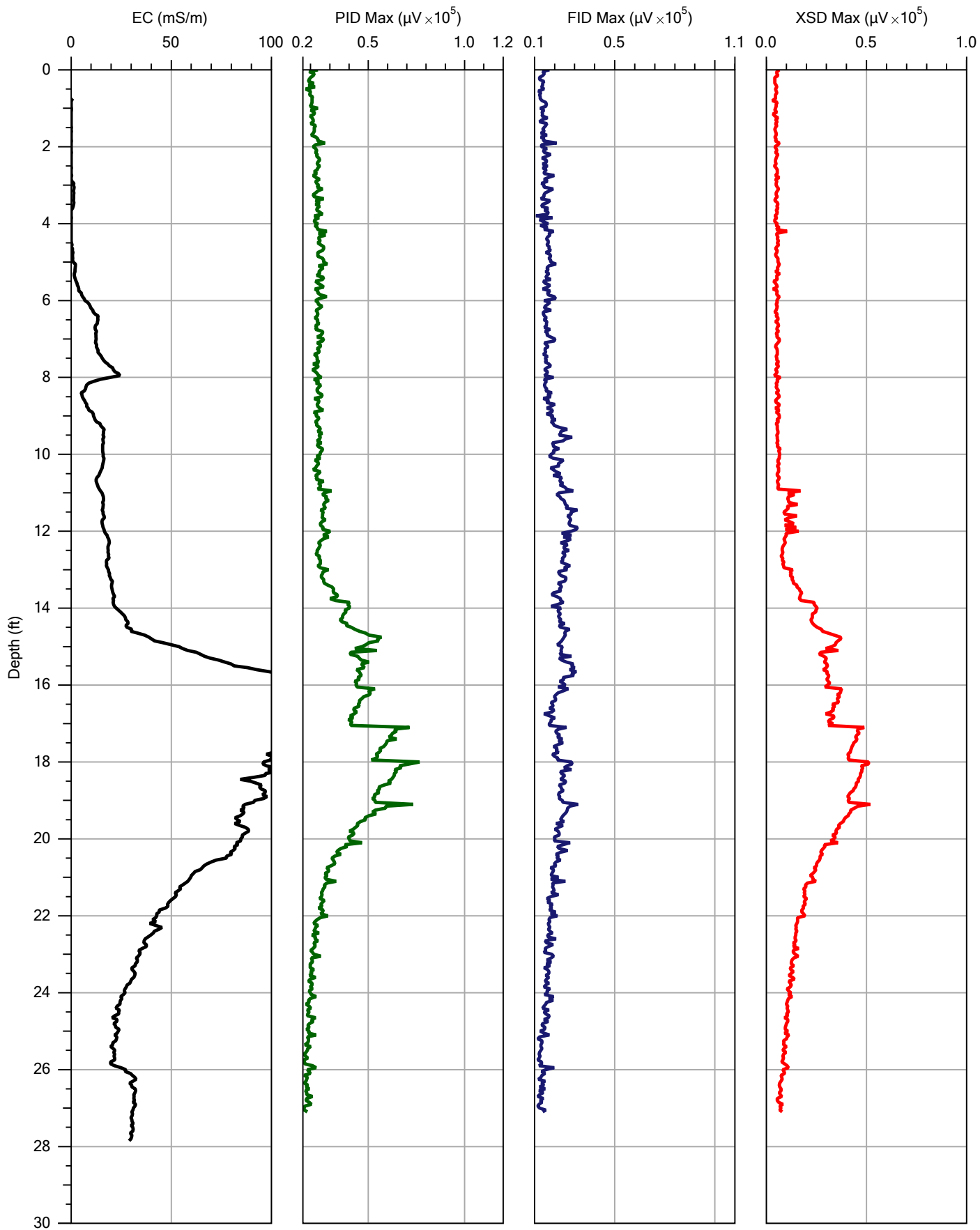
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

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Location:	



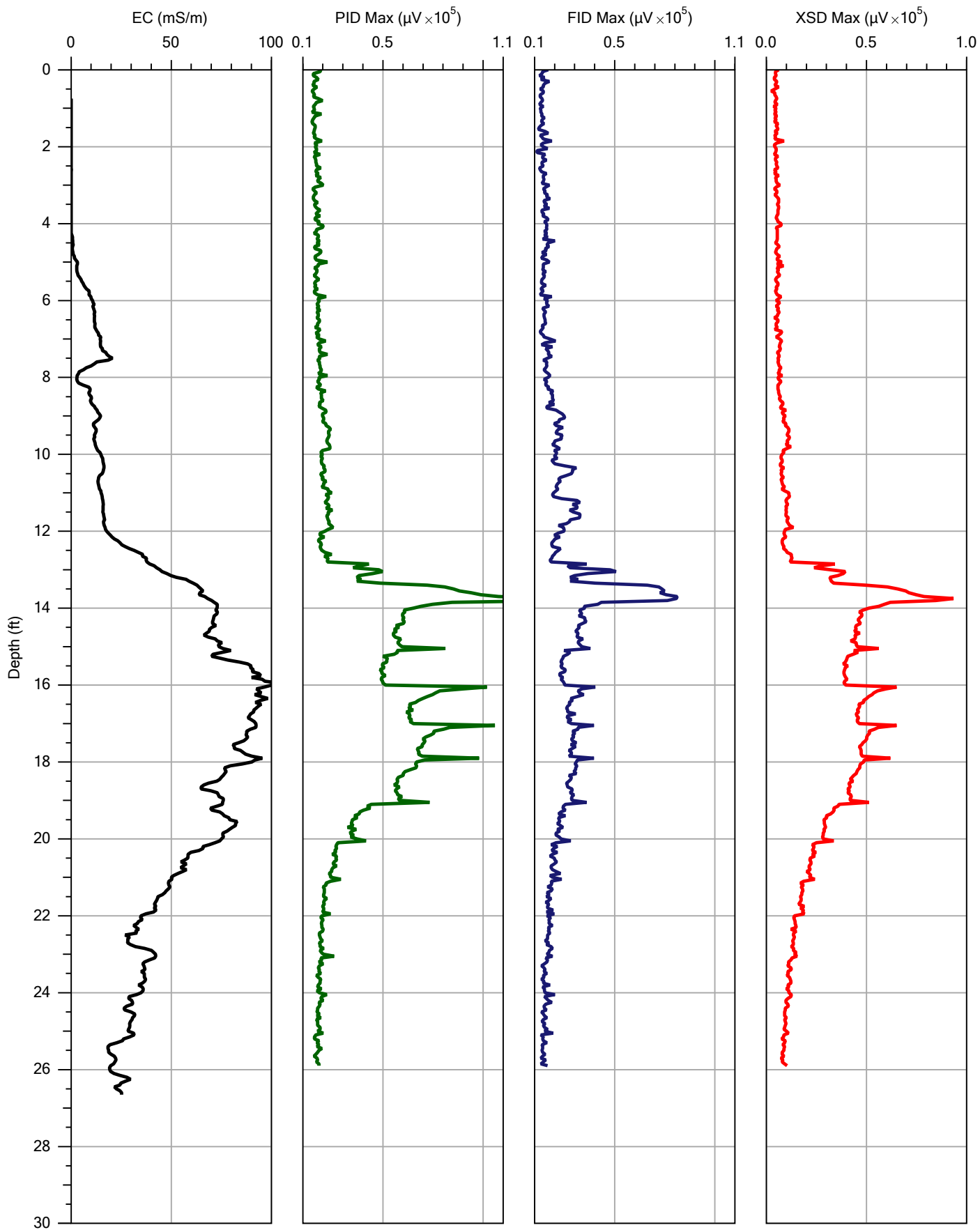
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Operator: M Jensen		Date: 12/12/2014
Project ID: 319.14	Client: CRA	Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

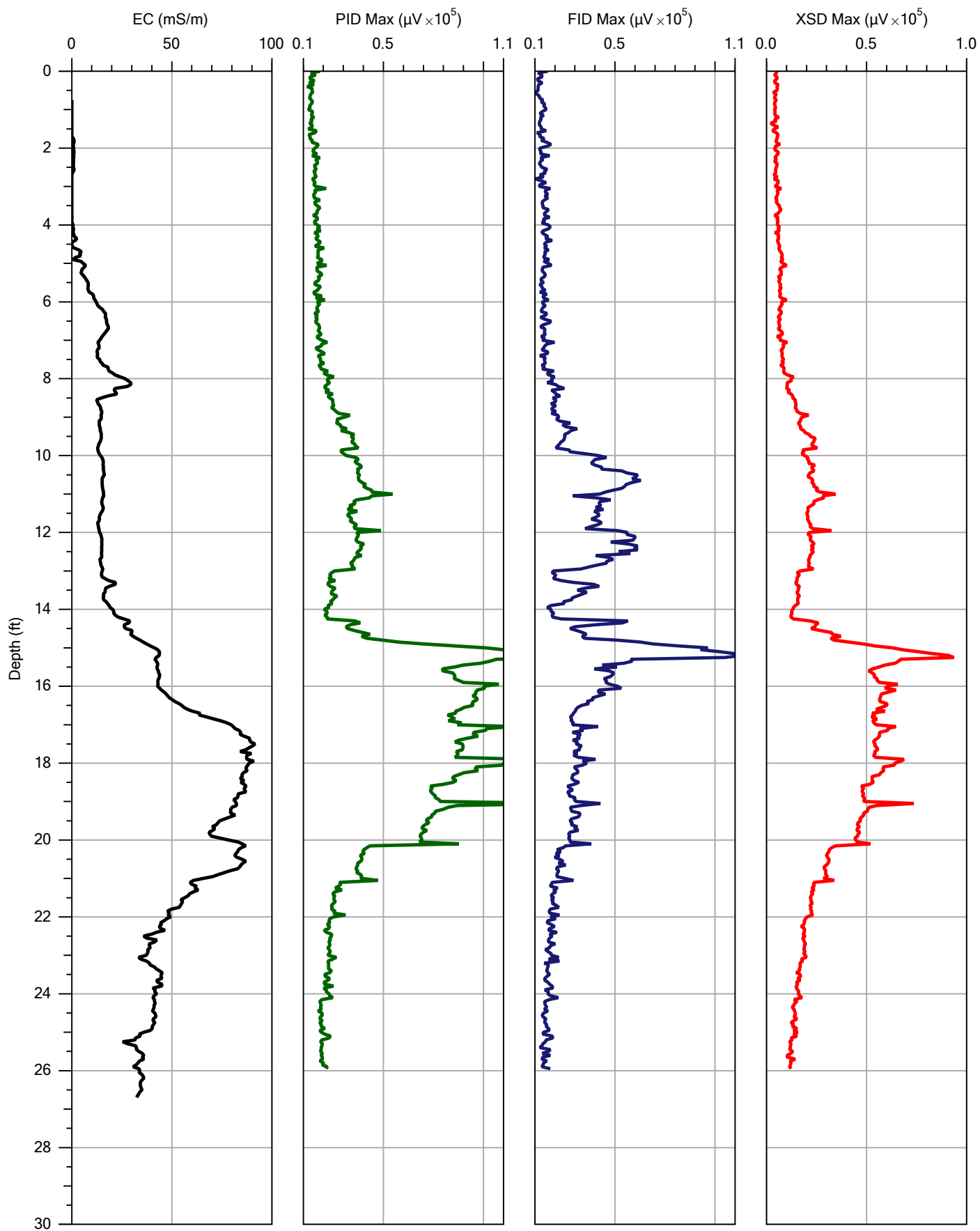
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Date: 12/12/2014
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Company: Matrix Environmental
Project ID: 319.14

Operator: M Jenson
Client: CRA

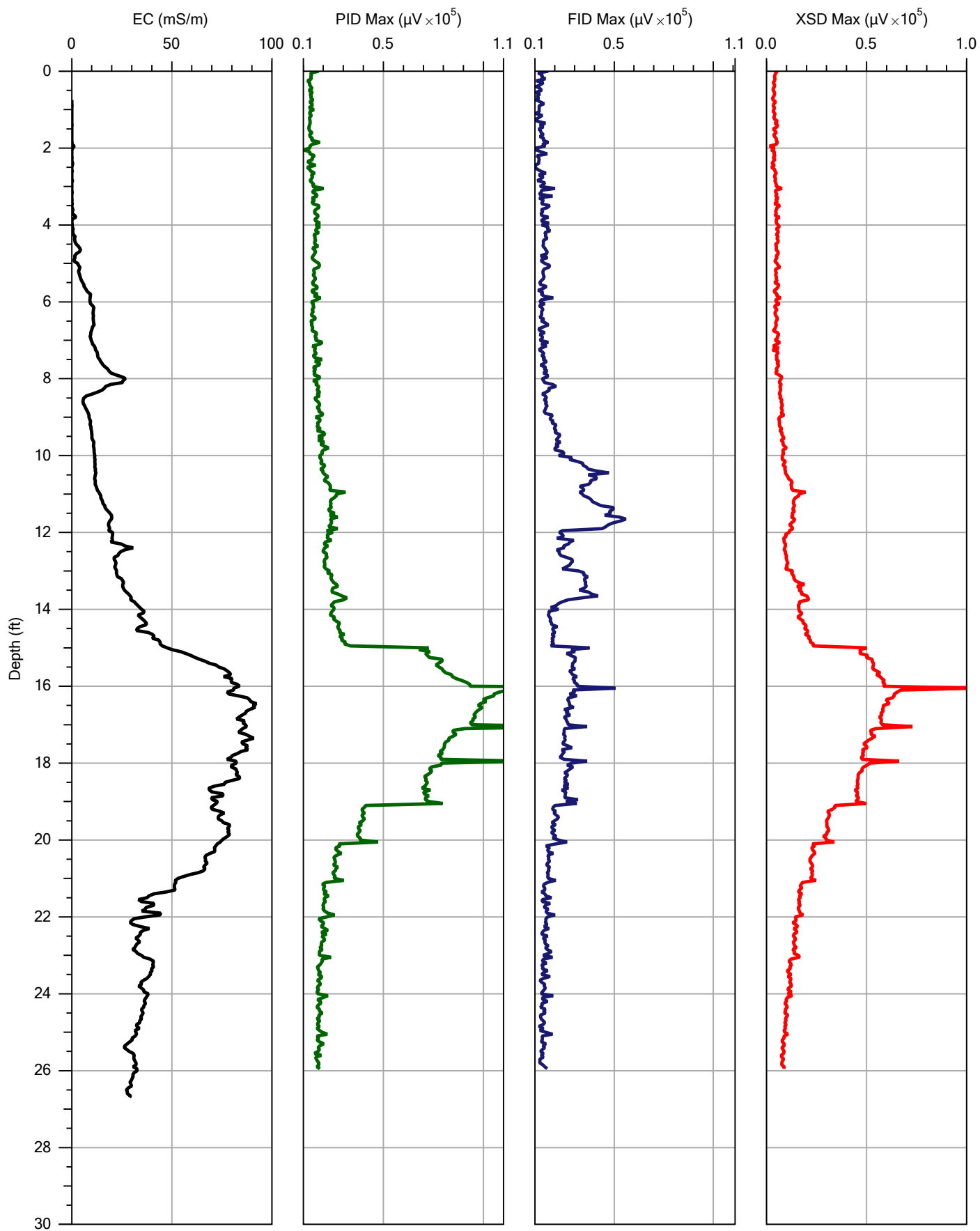
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Date: 12/15/2014
Location:



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

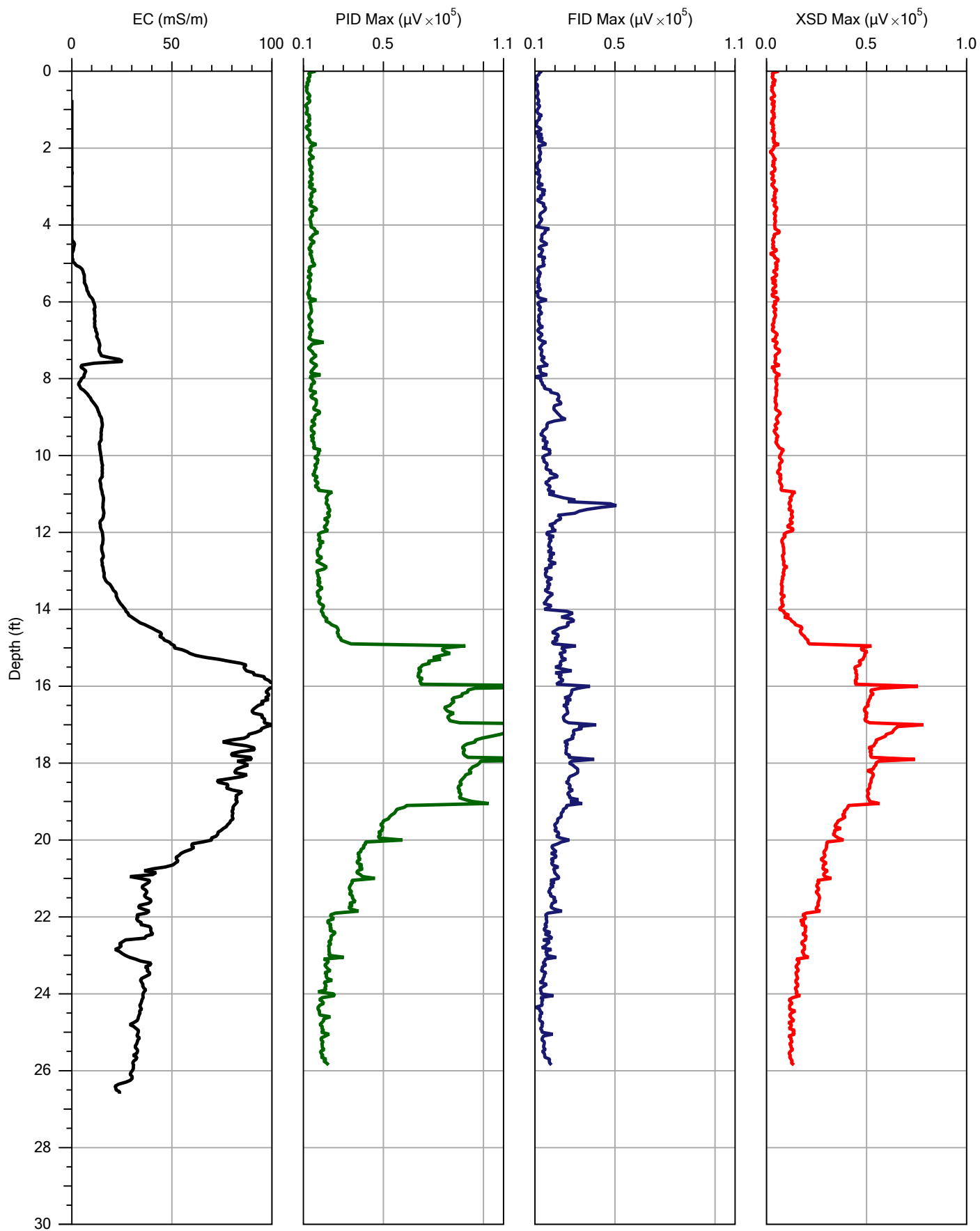
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Date:	12/15/2014
Location:	



Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

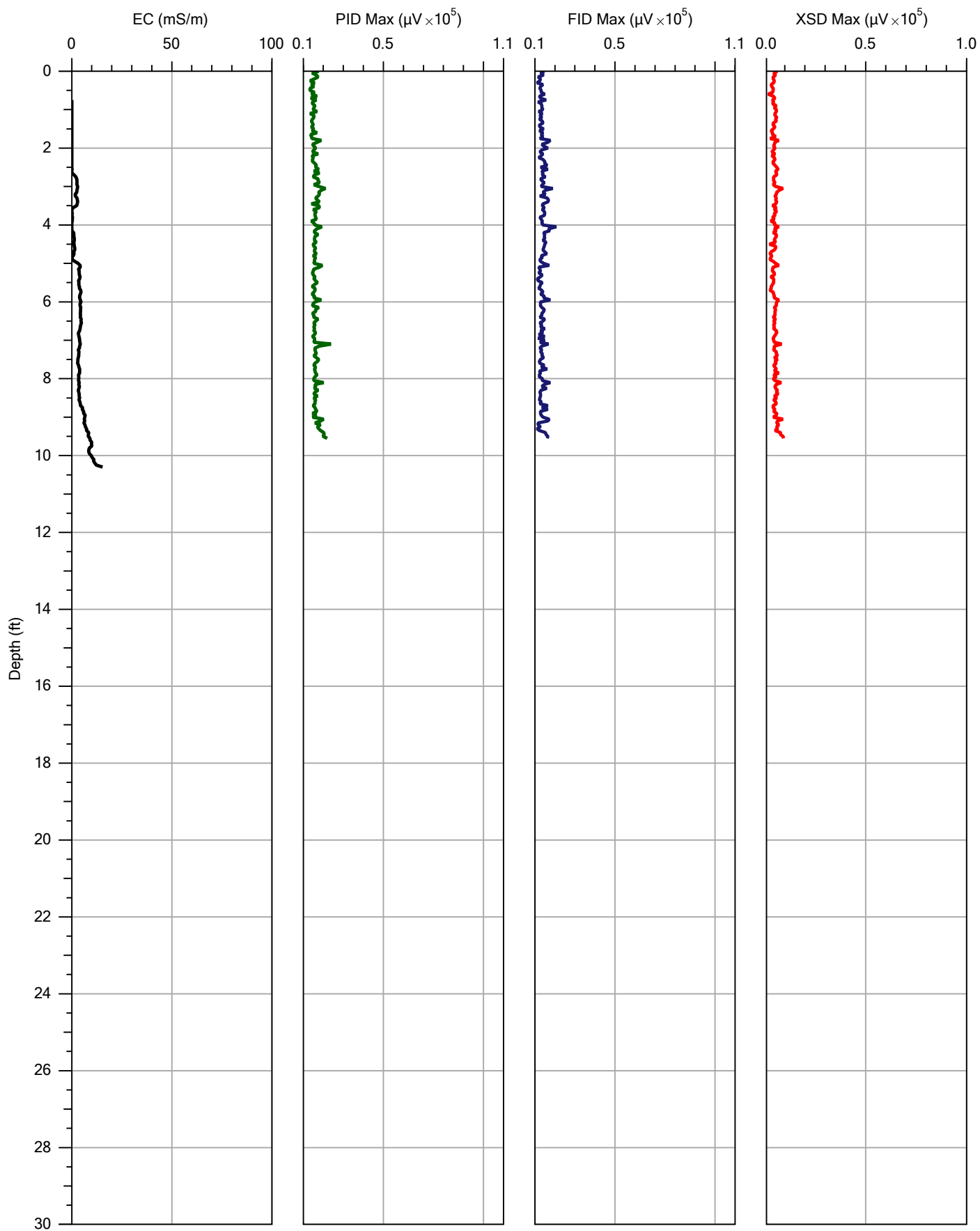
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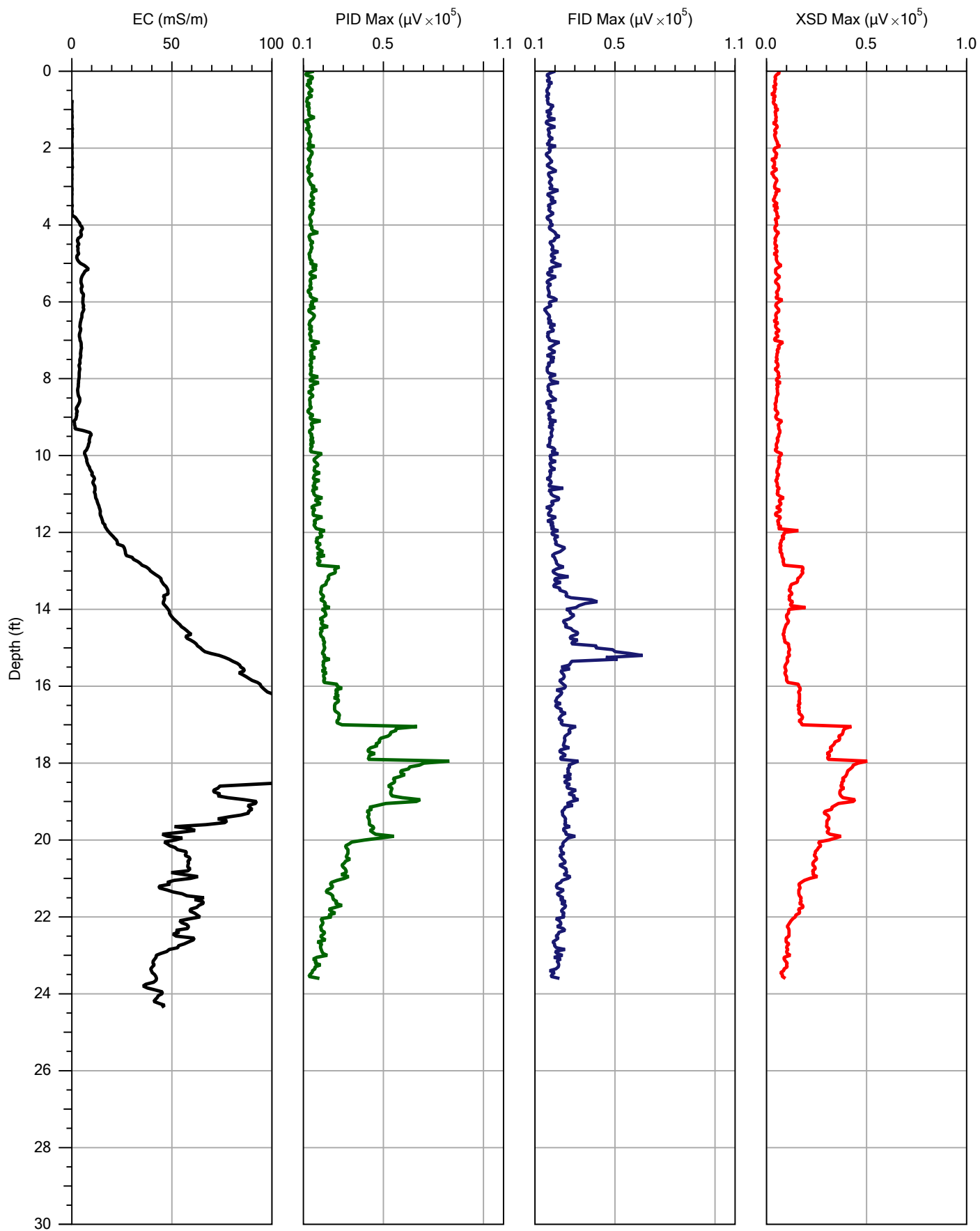
Company: Matrix Environmental
Project ID: 319.14

Operator: M Jensen
Client: CRA

File:	MIP-055.MIP
Date:	12/15/2014
Location:	



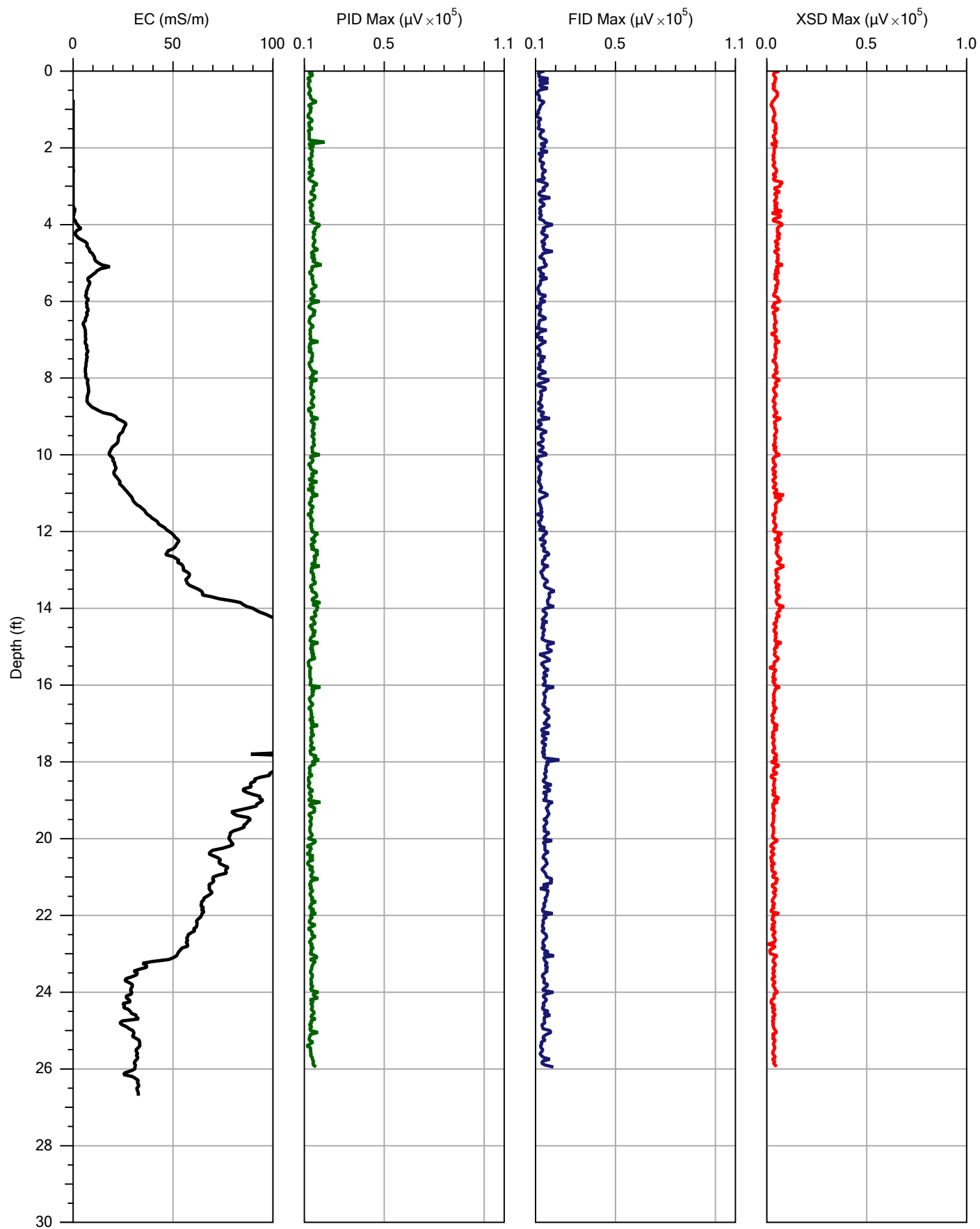
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Project ID: 319.14		Client: CRA	Date: 12/15/2014
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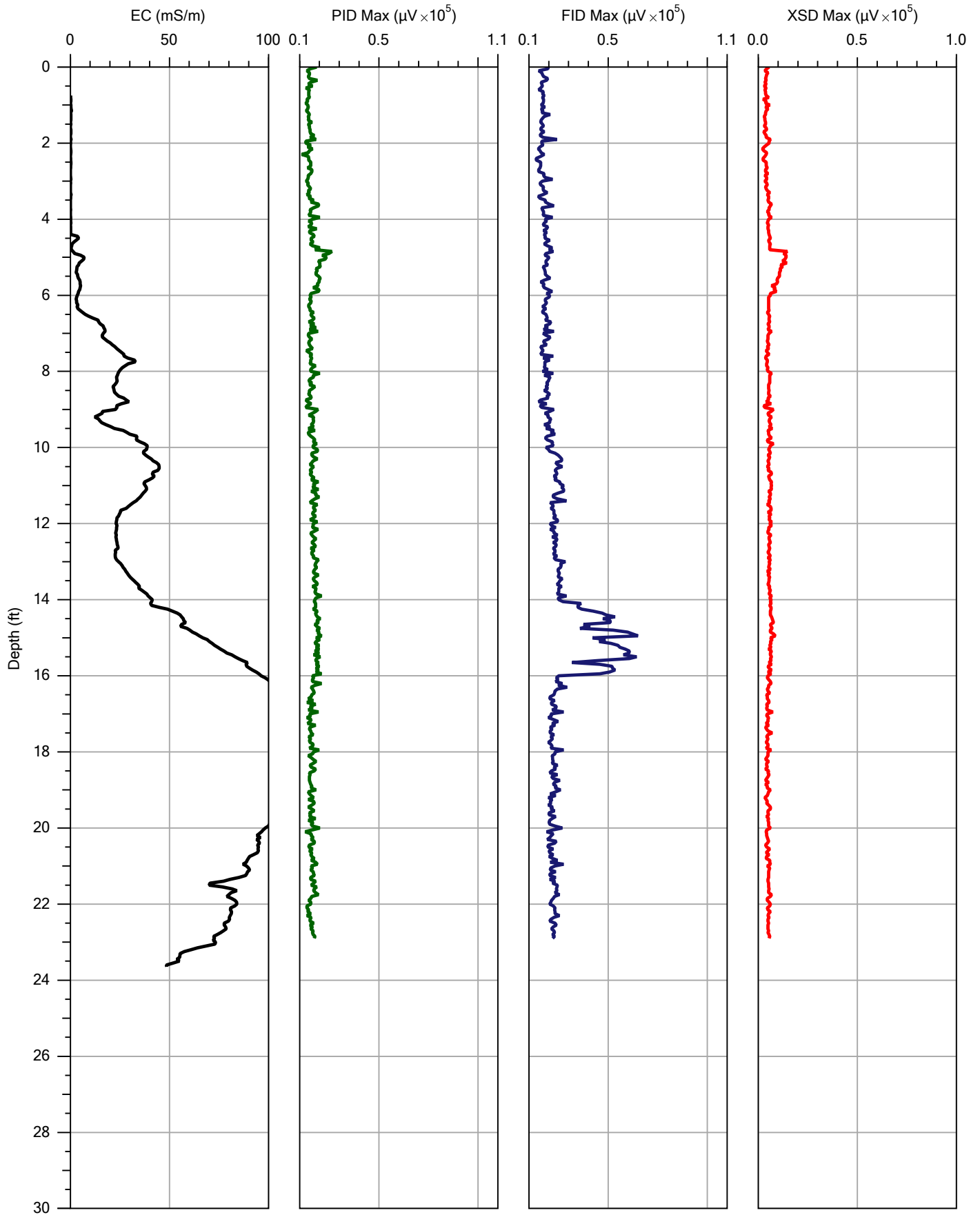
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

File: MIP-056A.MIP
Date: 12/16/2014
Location:



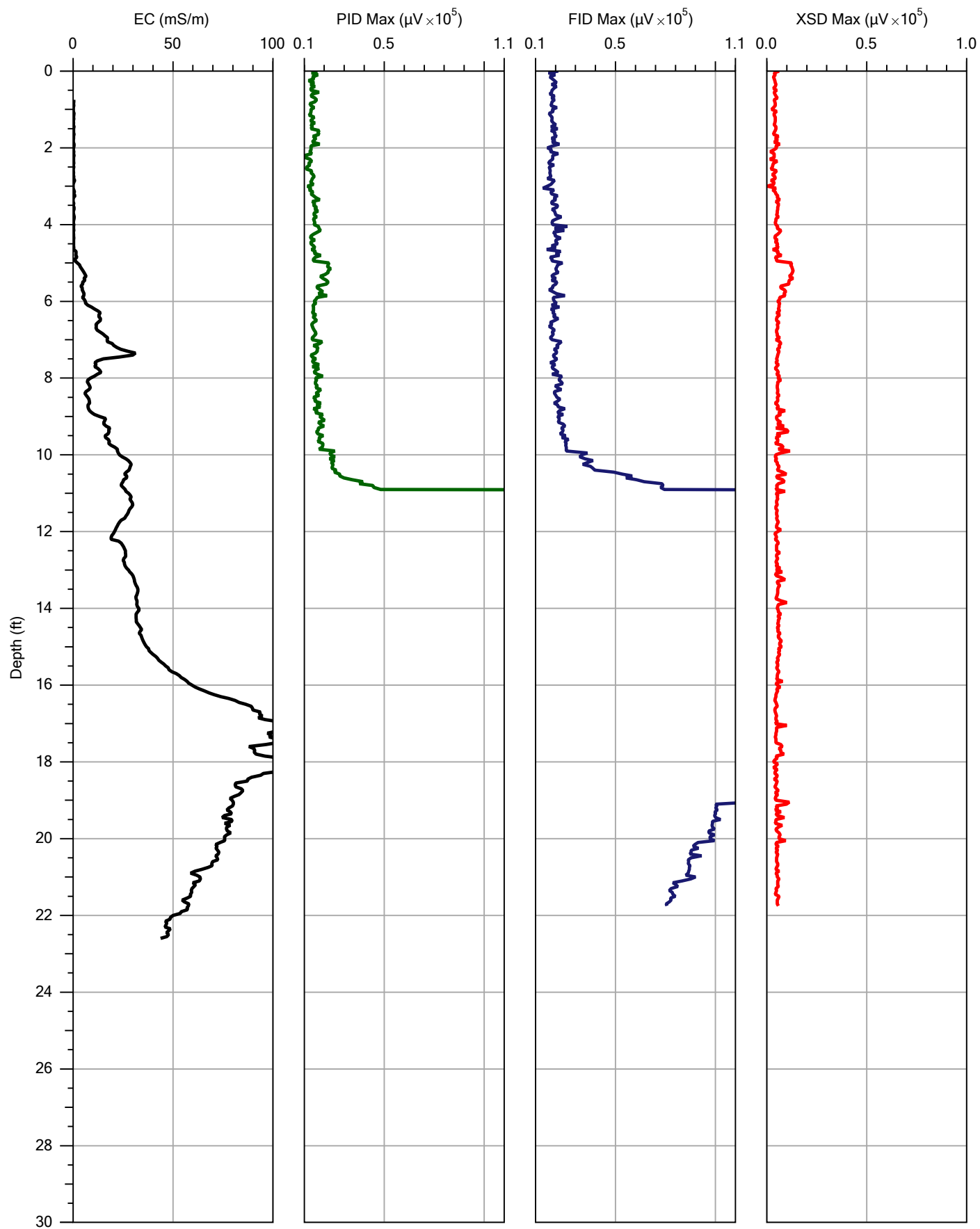
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Operator: M Jensen		Date: 12/15/2014
Project ID: 319.14	Client: CRA	Location:



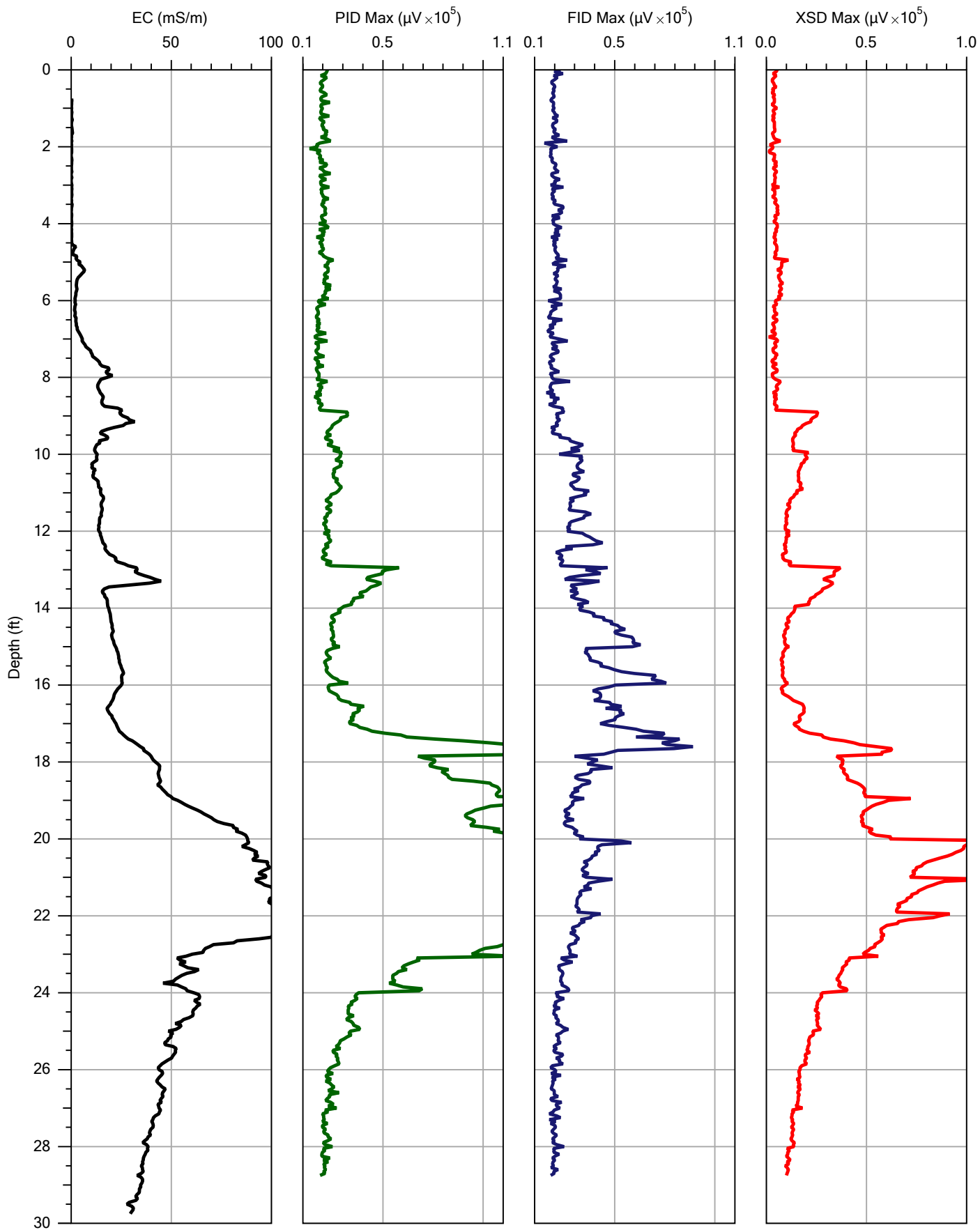
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

File:	MIP-058.MIP
Date:	12/16/2014
Location:	



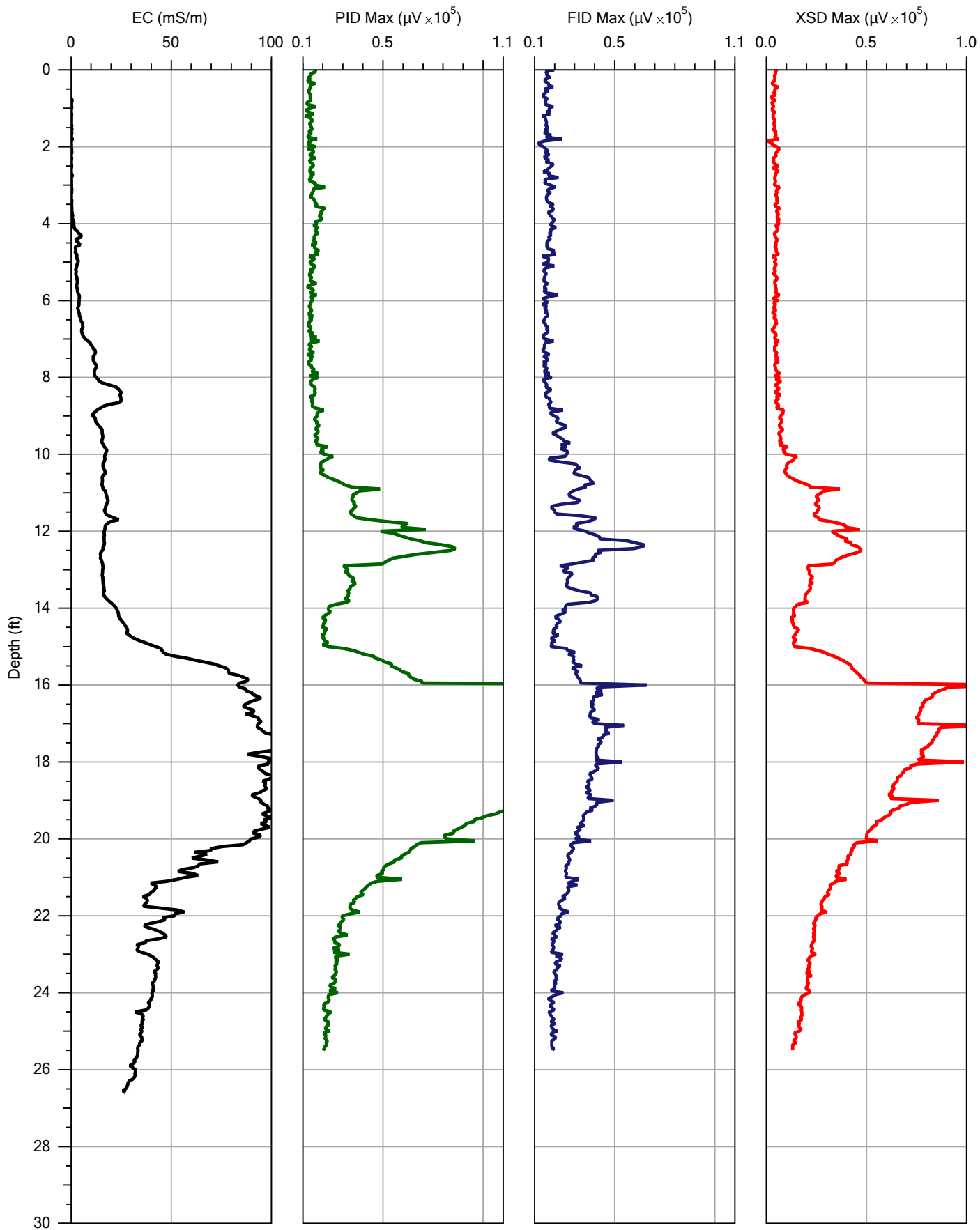
Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-059.MIP
Project ID:	139.14	Client:	CRA	Date:	12/16/2014
				Location:	



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

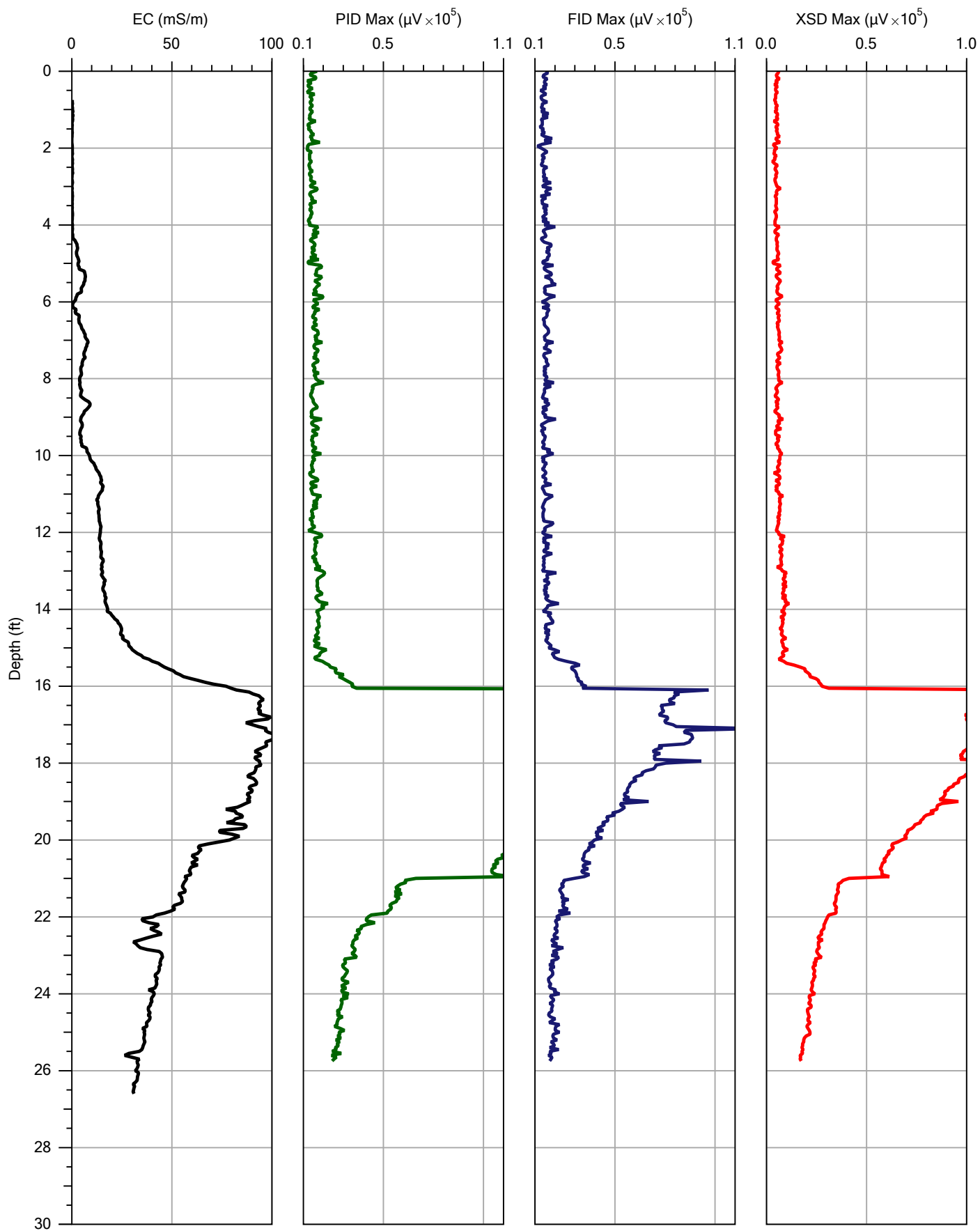
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Date: 12/16/2014
Location:



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

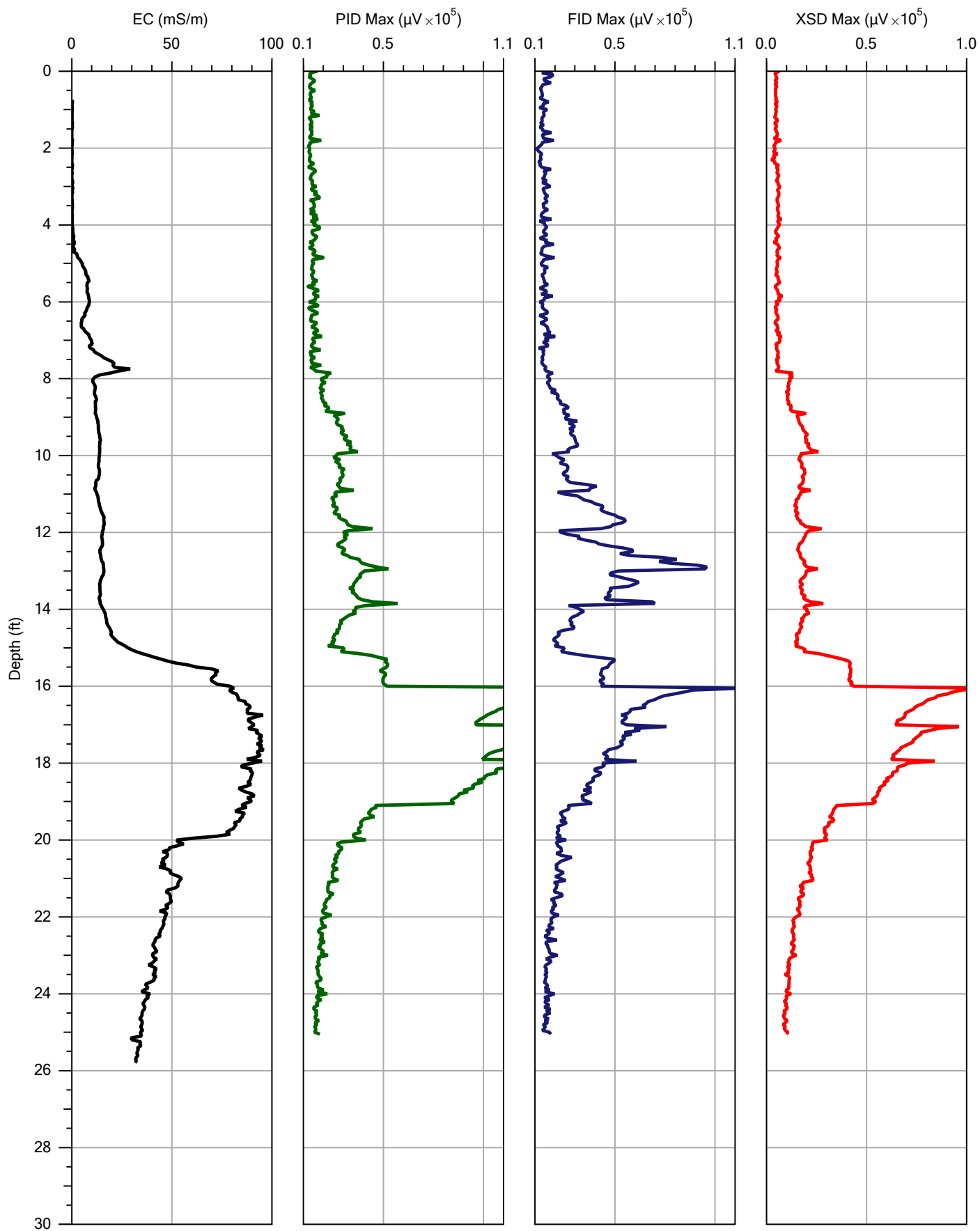
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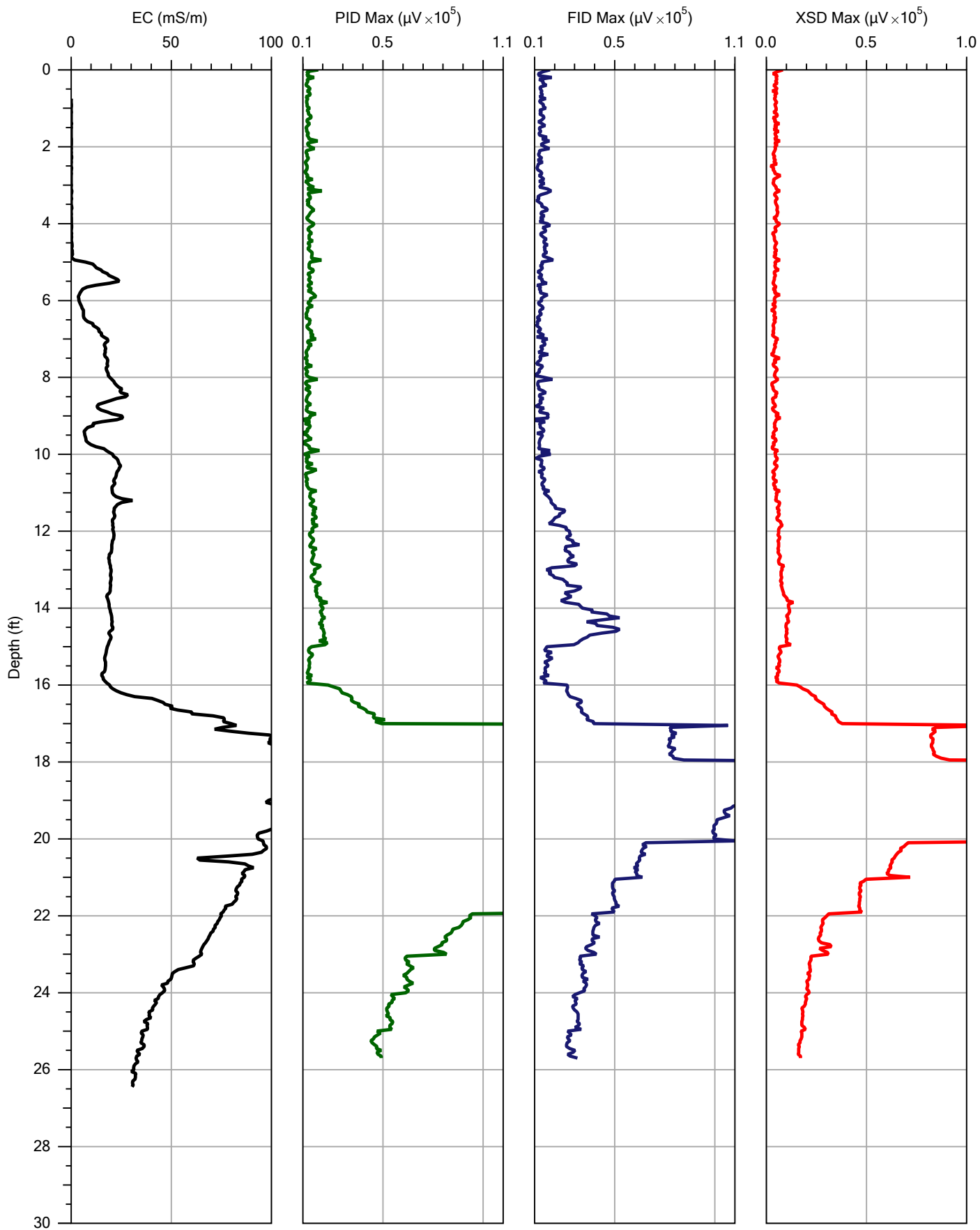
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

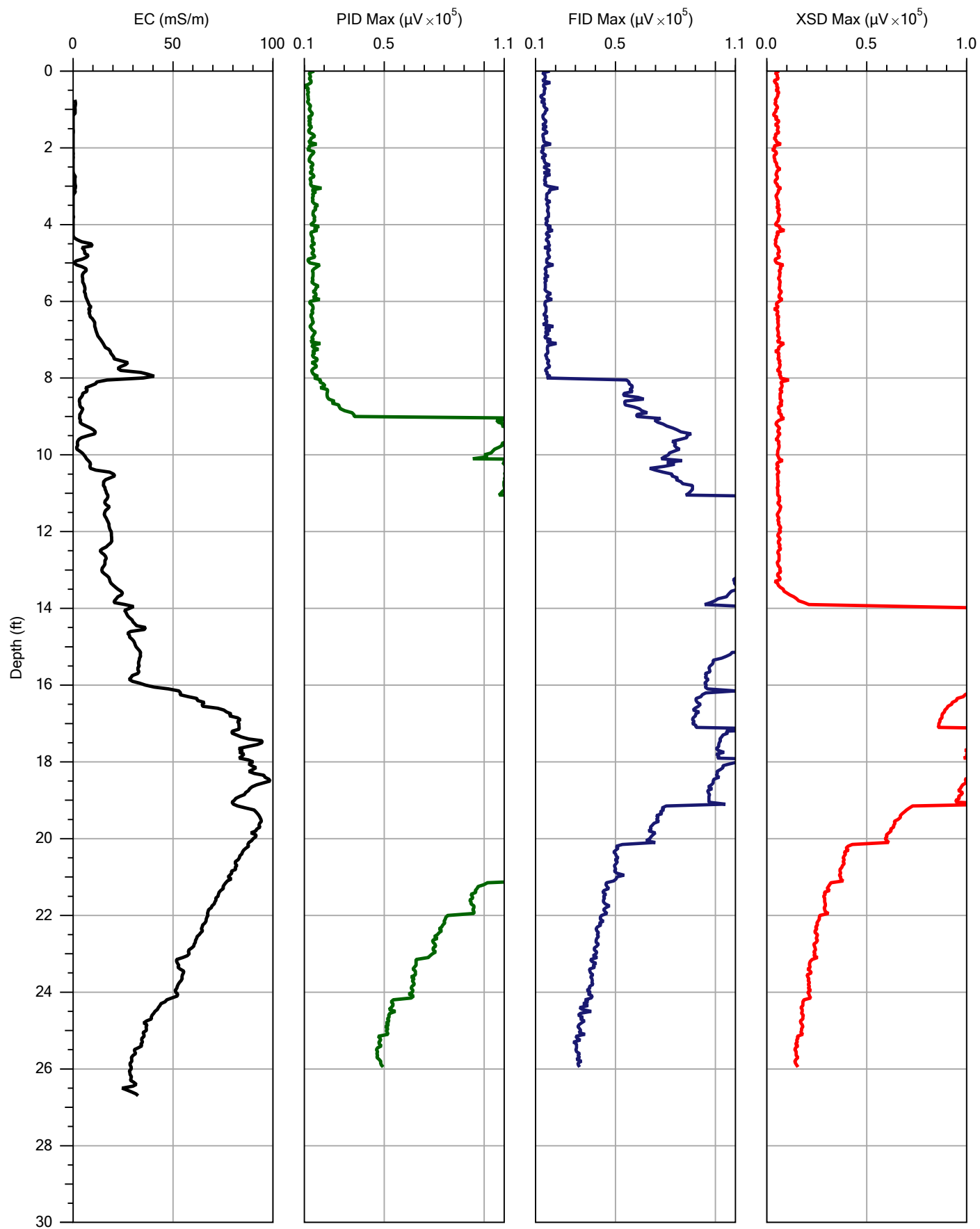
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Date:	12/16/2014
Location:	



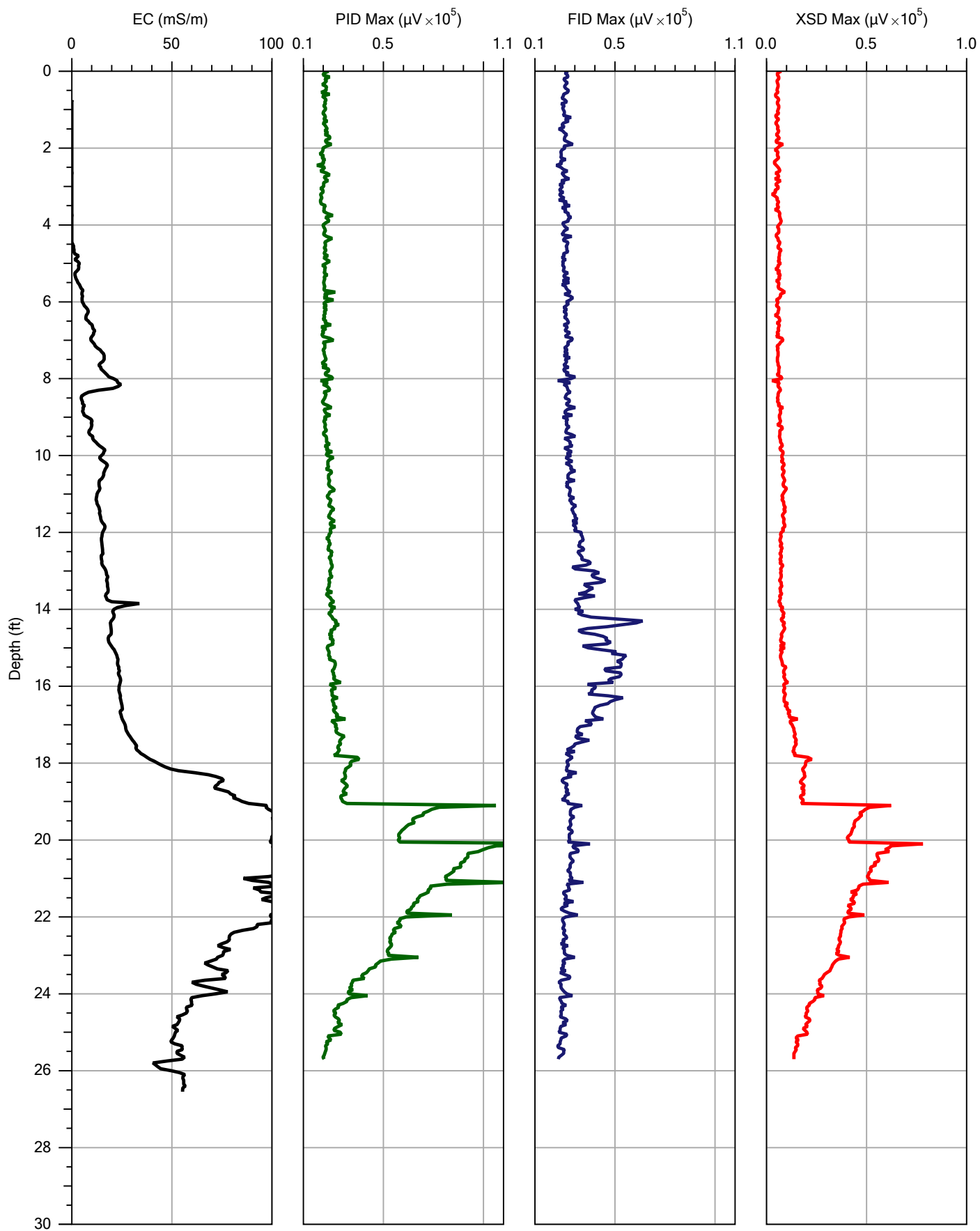
Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-063.MIP
Project ID:	139.14	Client:	CRA	Date:	12/16/2014
				Location:	



Company:		Operator:	File:
Matrix Environmental		M Jenson	MIP-064.MIP
Project ID:		Client:	Date:
139.14		CRA	12/16/2014
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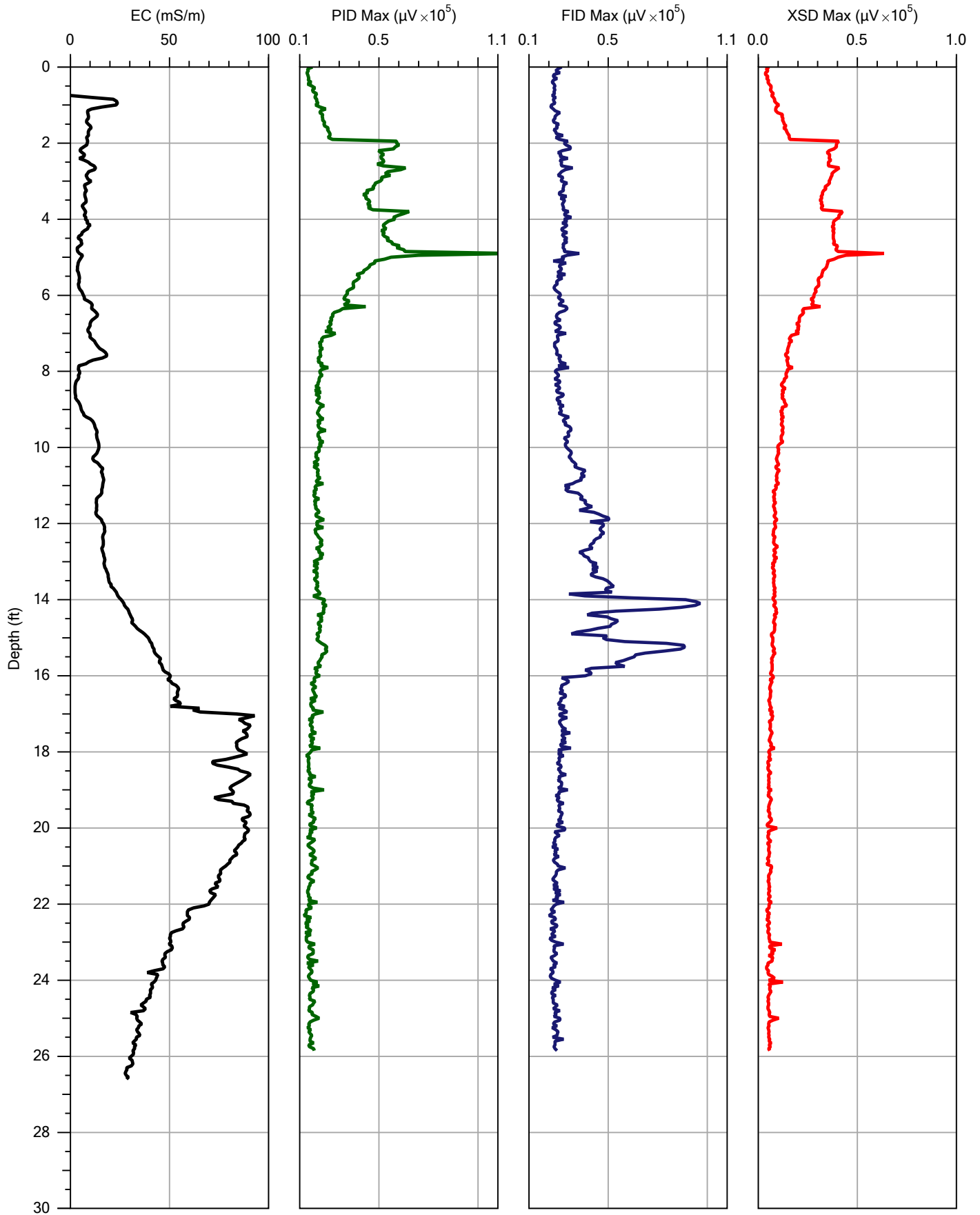
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Operator: M Jenson		Date: 12/17/2014
Project ID: 139.14	Client: CRA	Location:



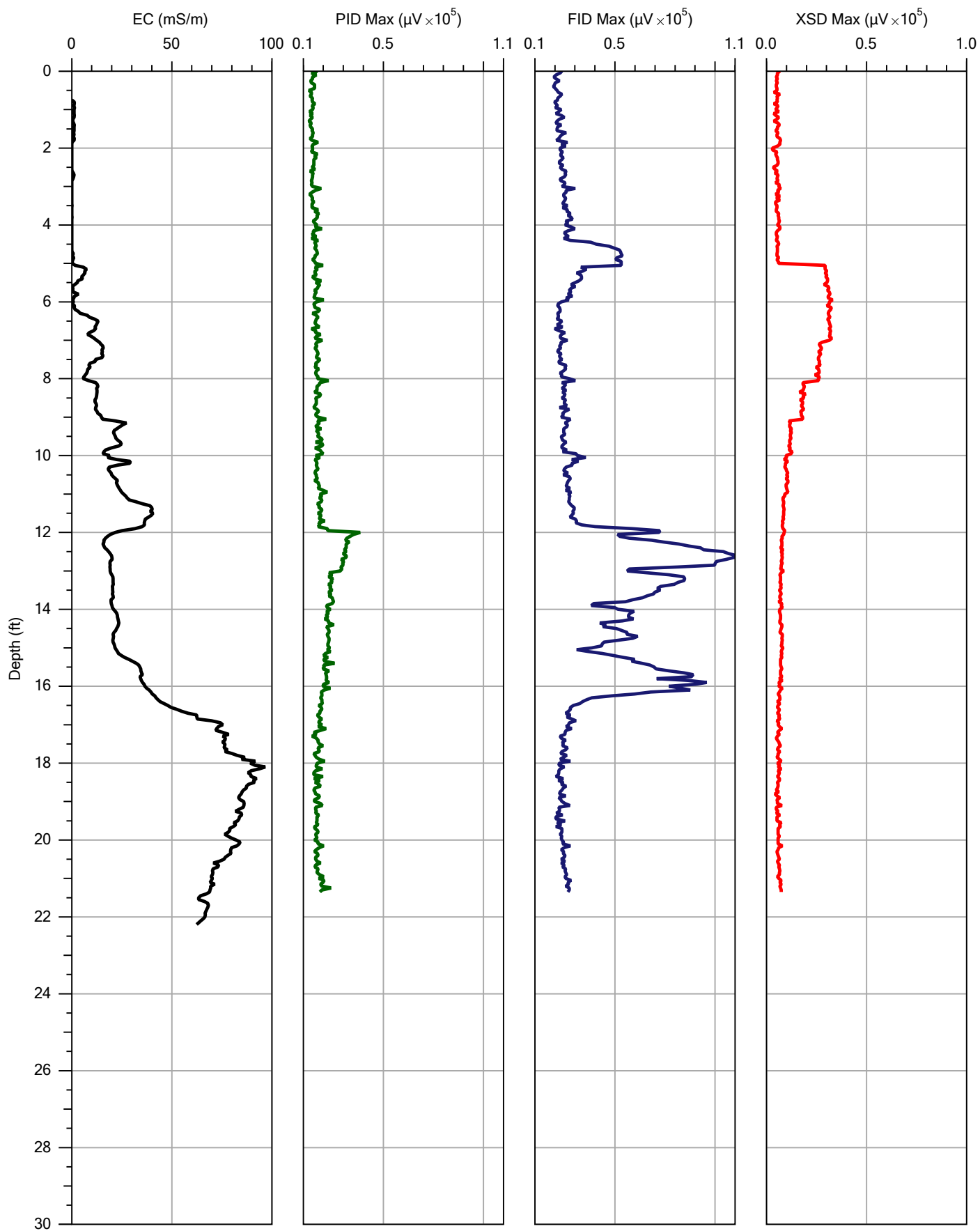
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

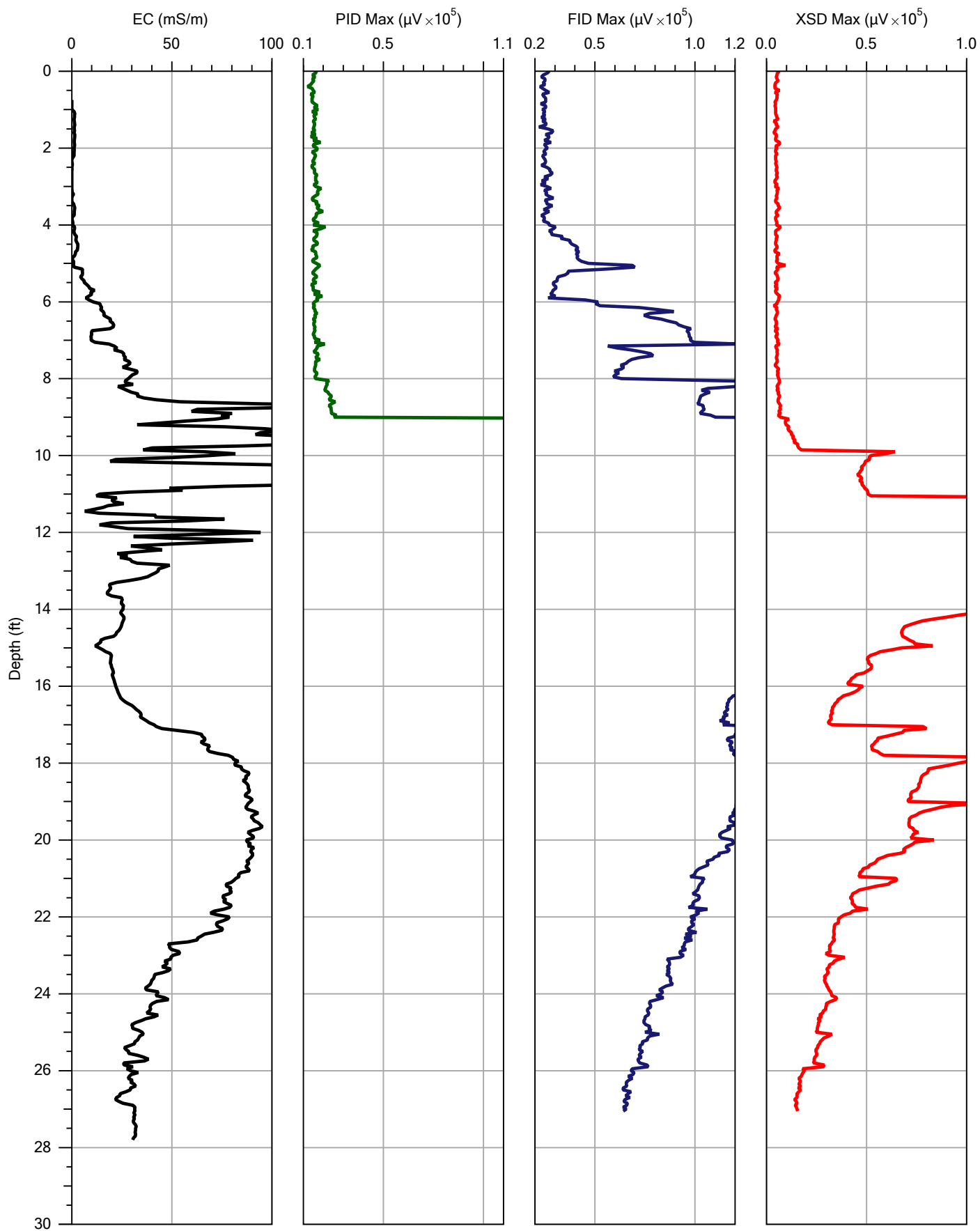
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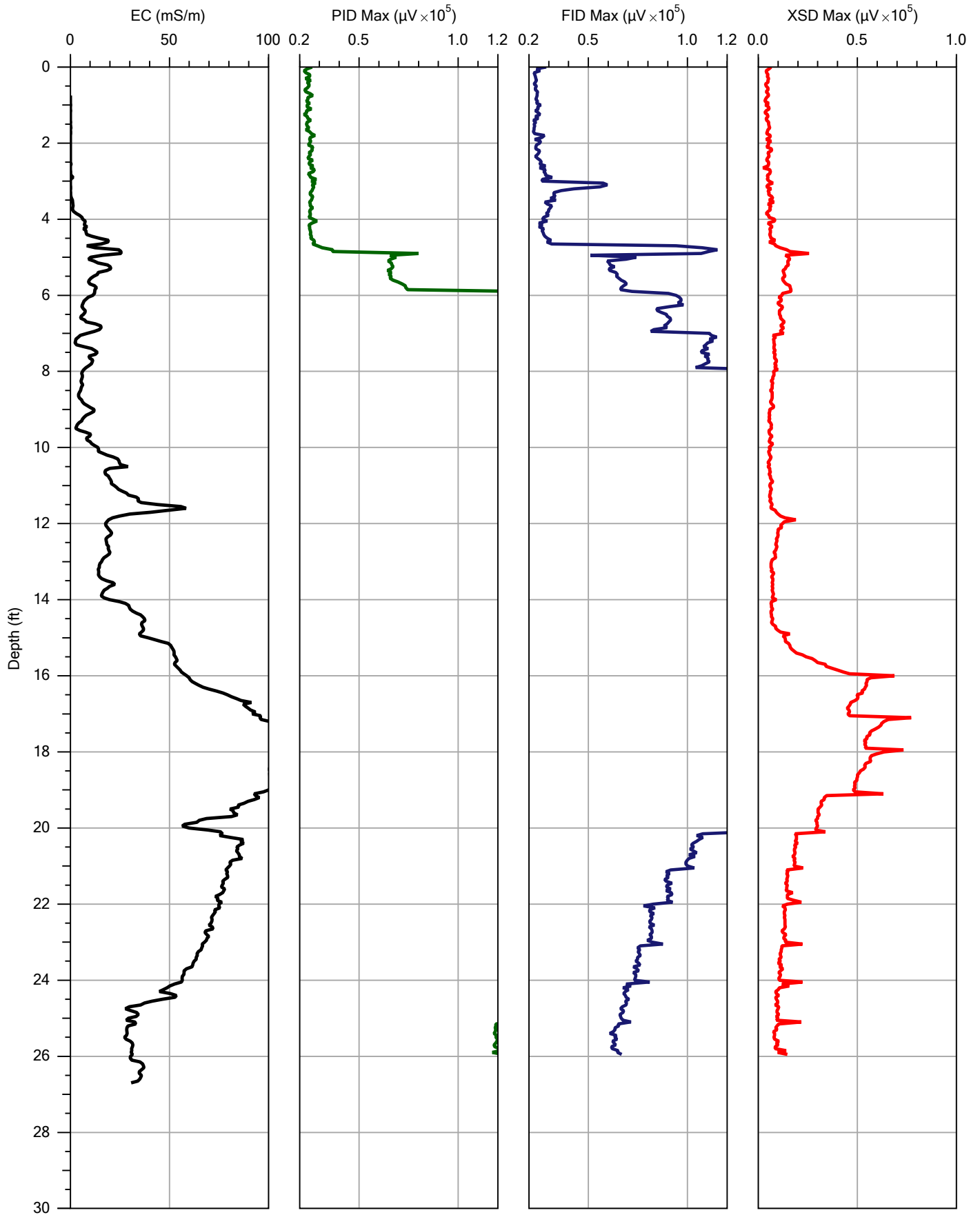
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Operator: M Jensen		Date: 12/17/2014
Project ID: 139.14	Client: CRA	Location:



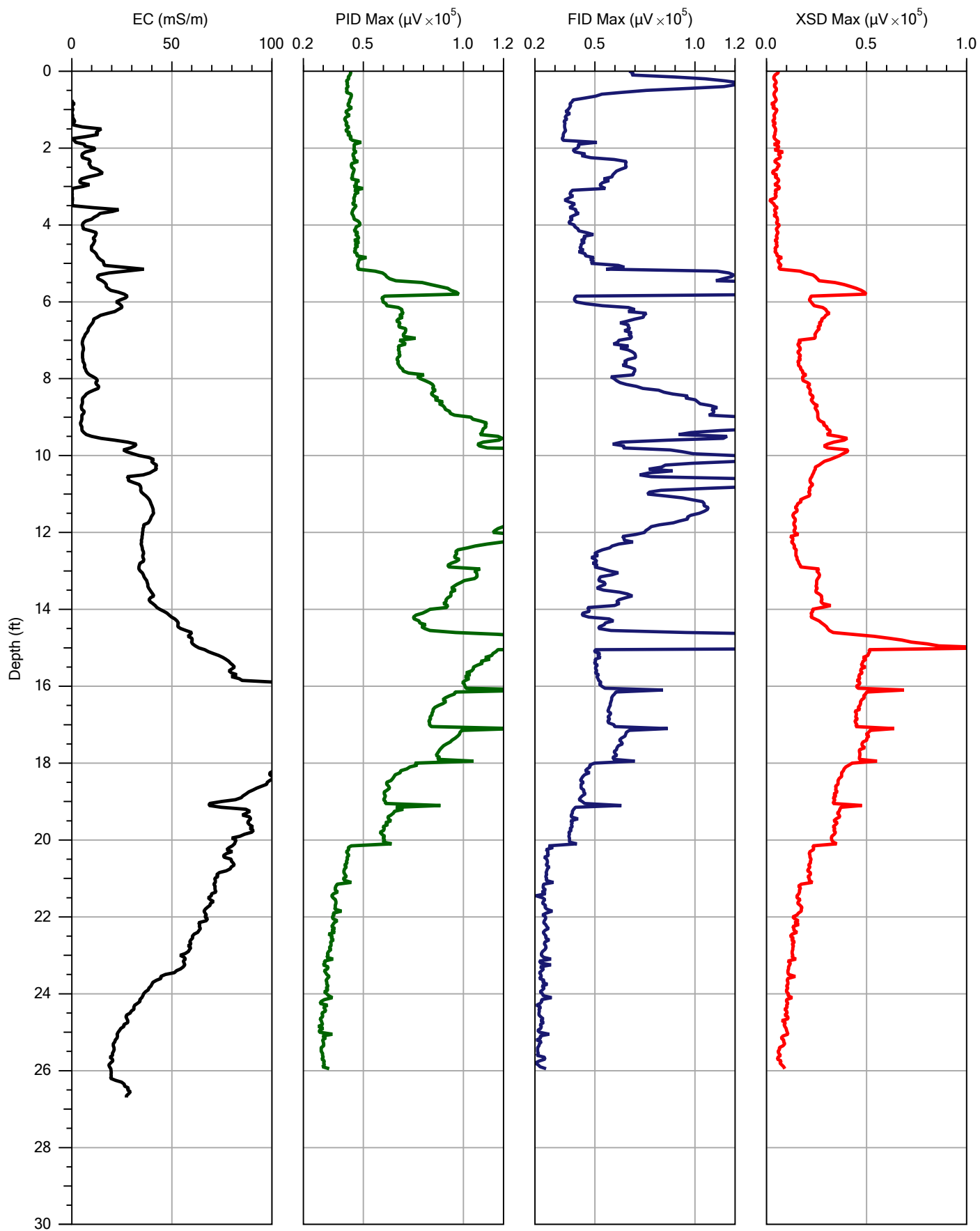
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Project ID:	139.14	Client:	CRA	Date:	12/17/2014
				Location:	



Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-069.MIP
Project ID:	139.14	Client:	CRA	Date:	12/17/2014
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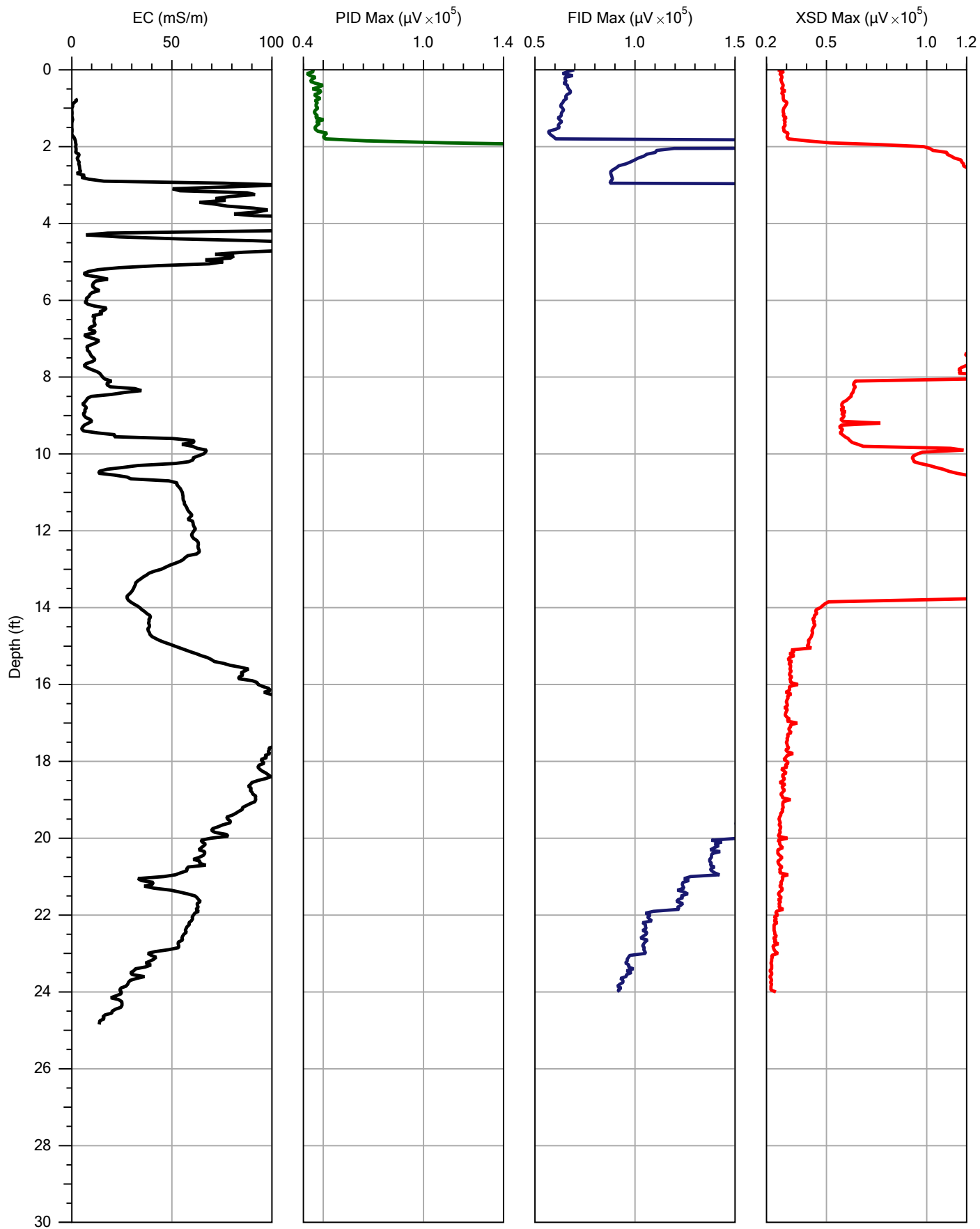
Company:	Matrix Environmental	Operator:	M Jensen	File:	MIP-070.MIP
Project ID:	139.14	Client:	CRA	Date:	12/17/2014
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Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

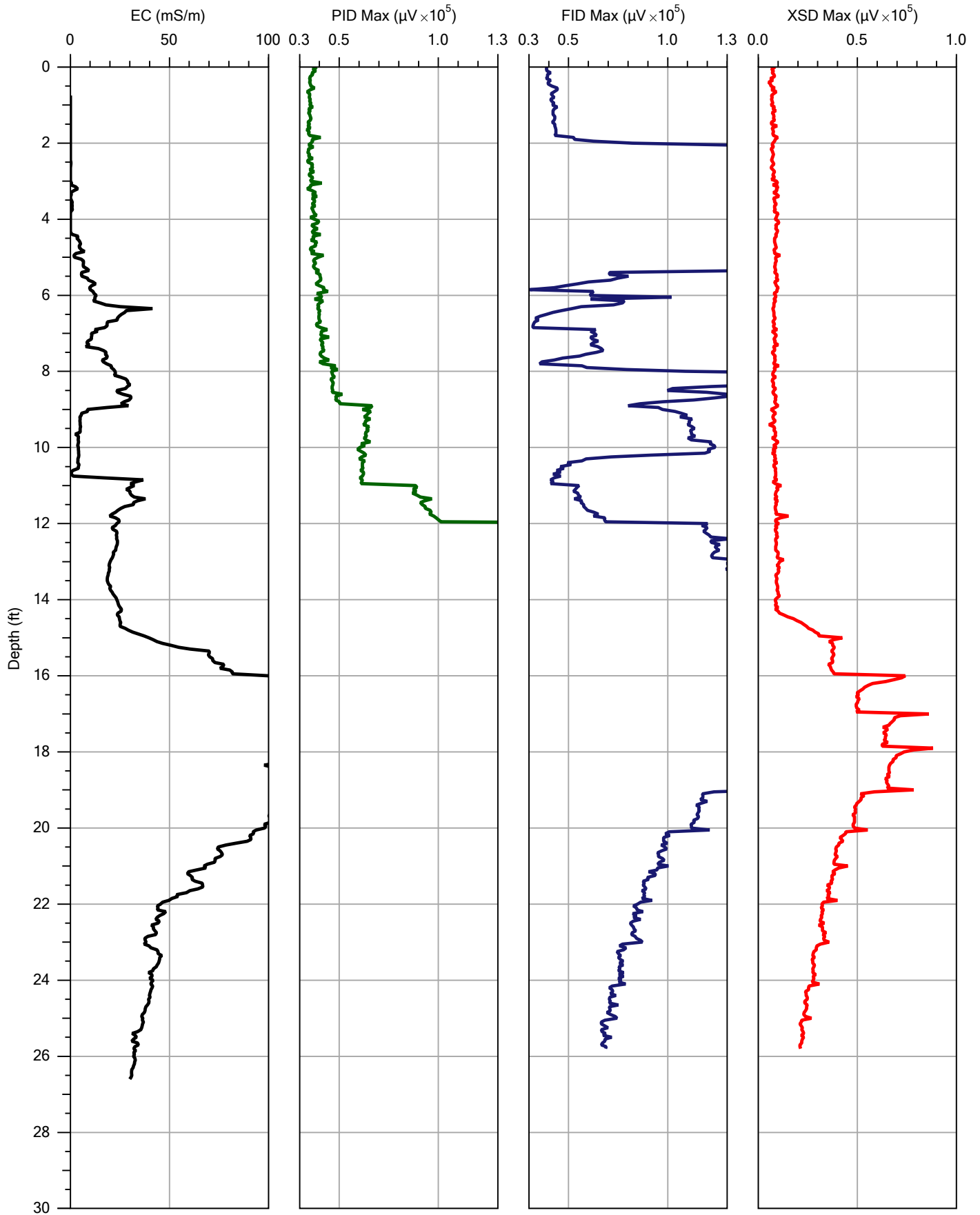
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Date:	12/17/2014
Location:	



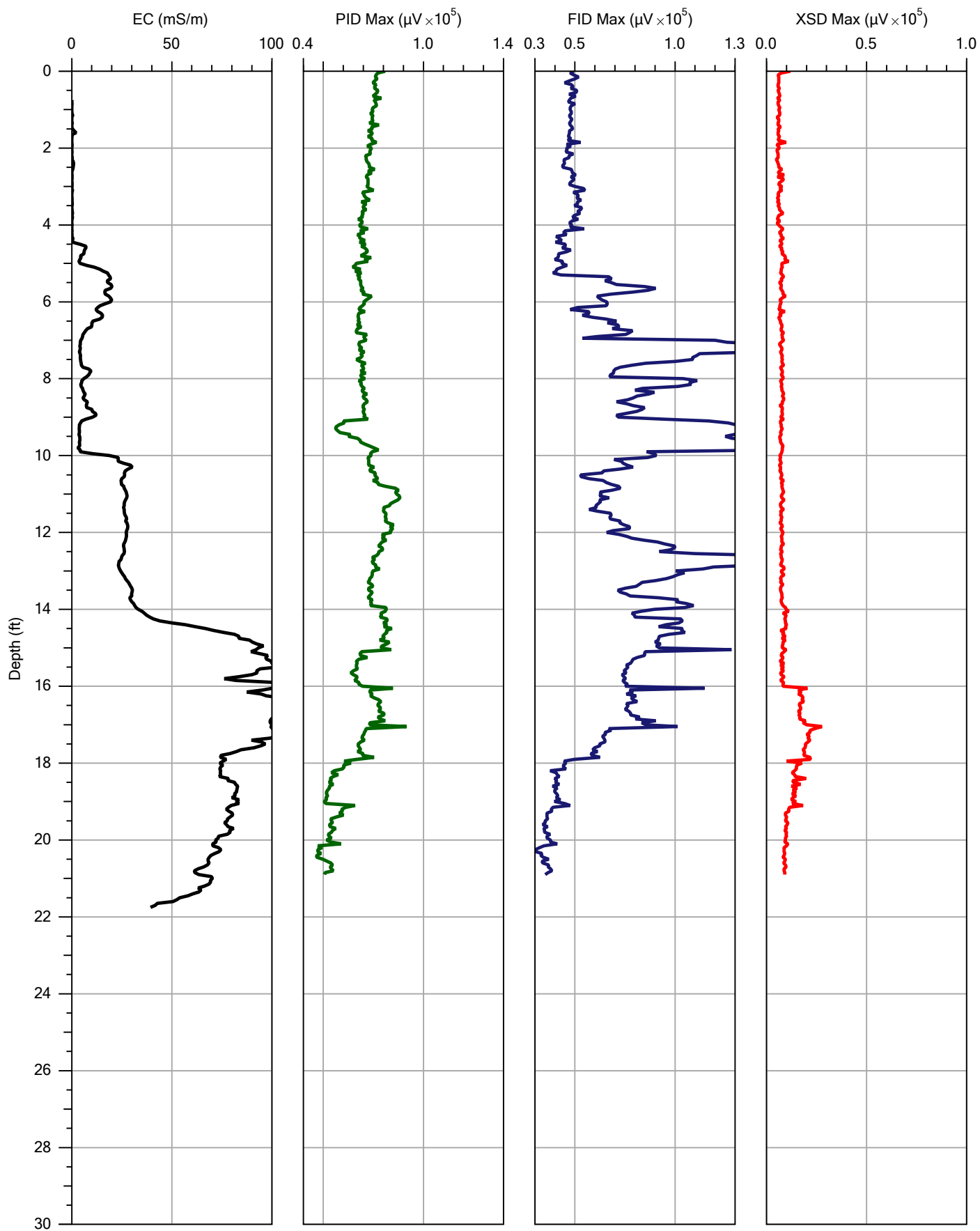
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

File: MIP-072.MIP
Date: 12/18/2014
Location:



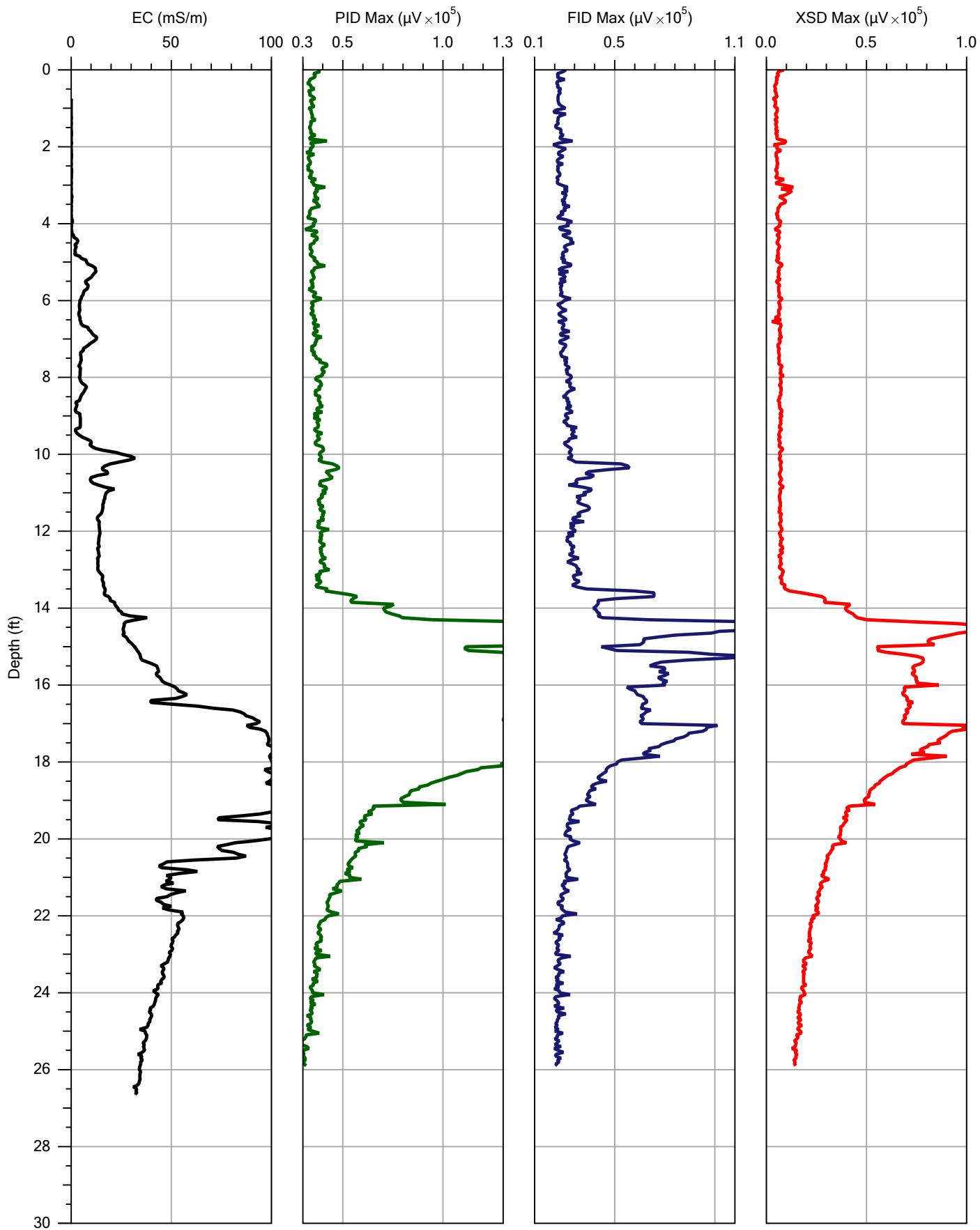
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Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

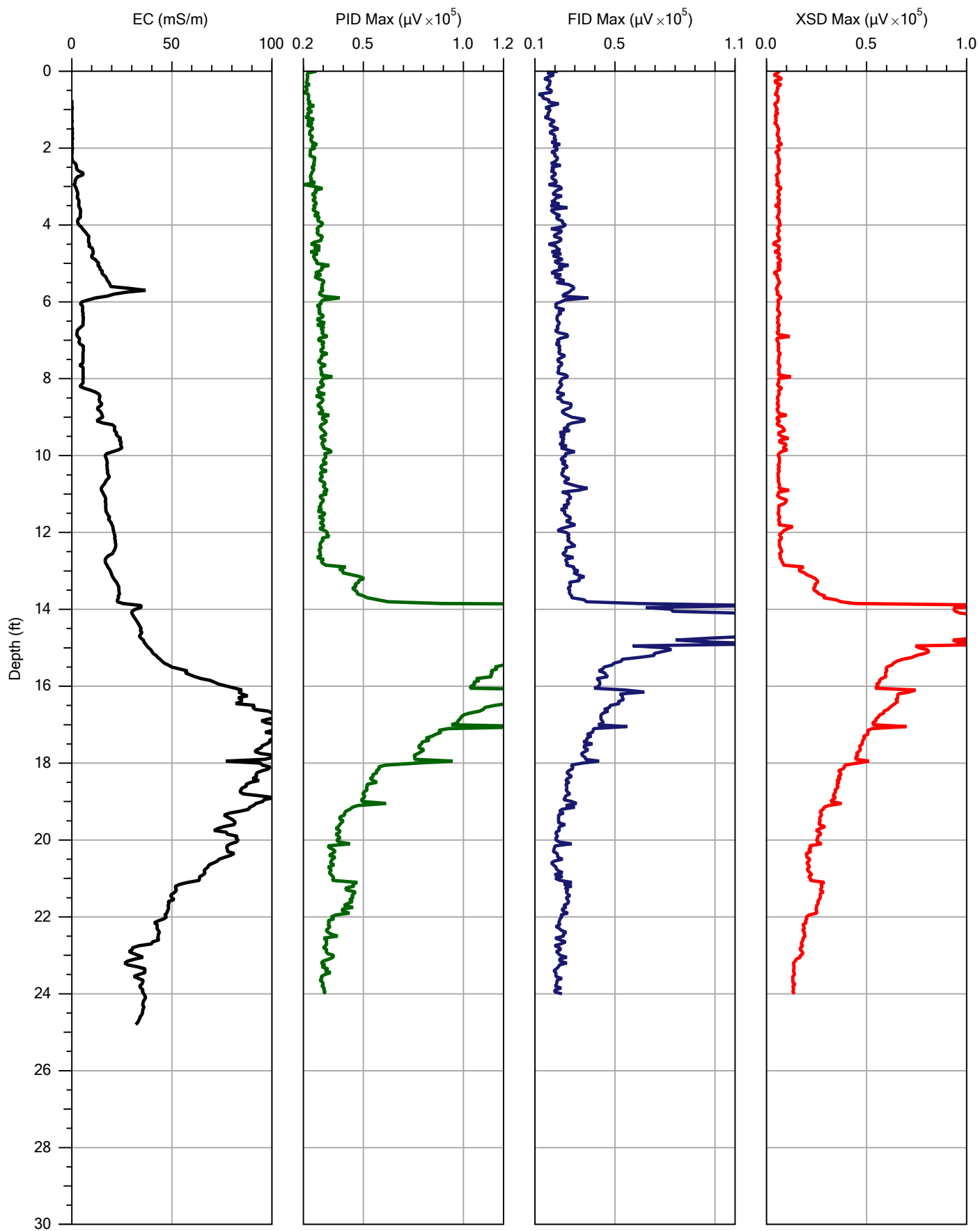
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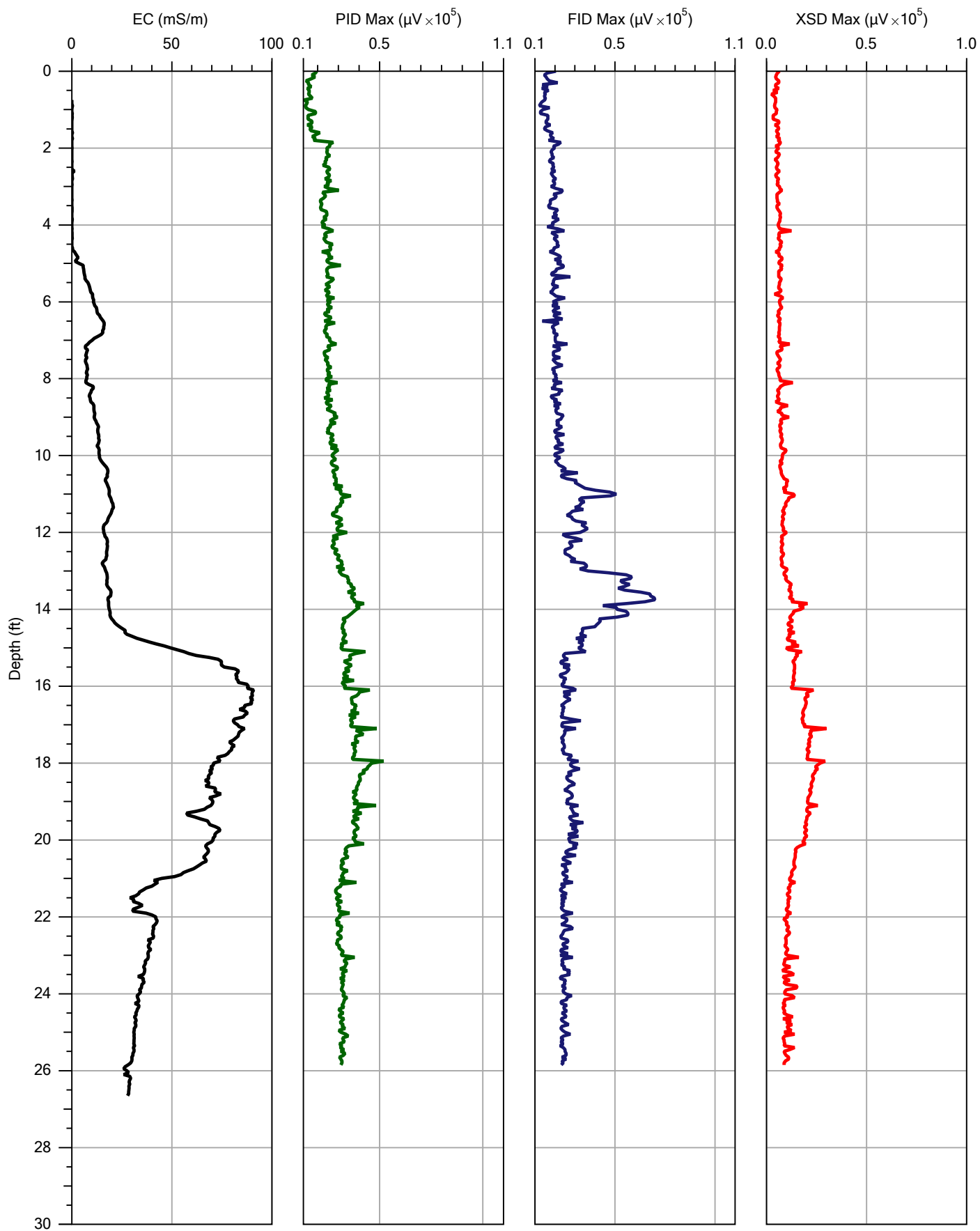
Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

File: MIP-075.MIP
Date: 12/18/2014
Location:



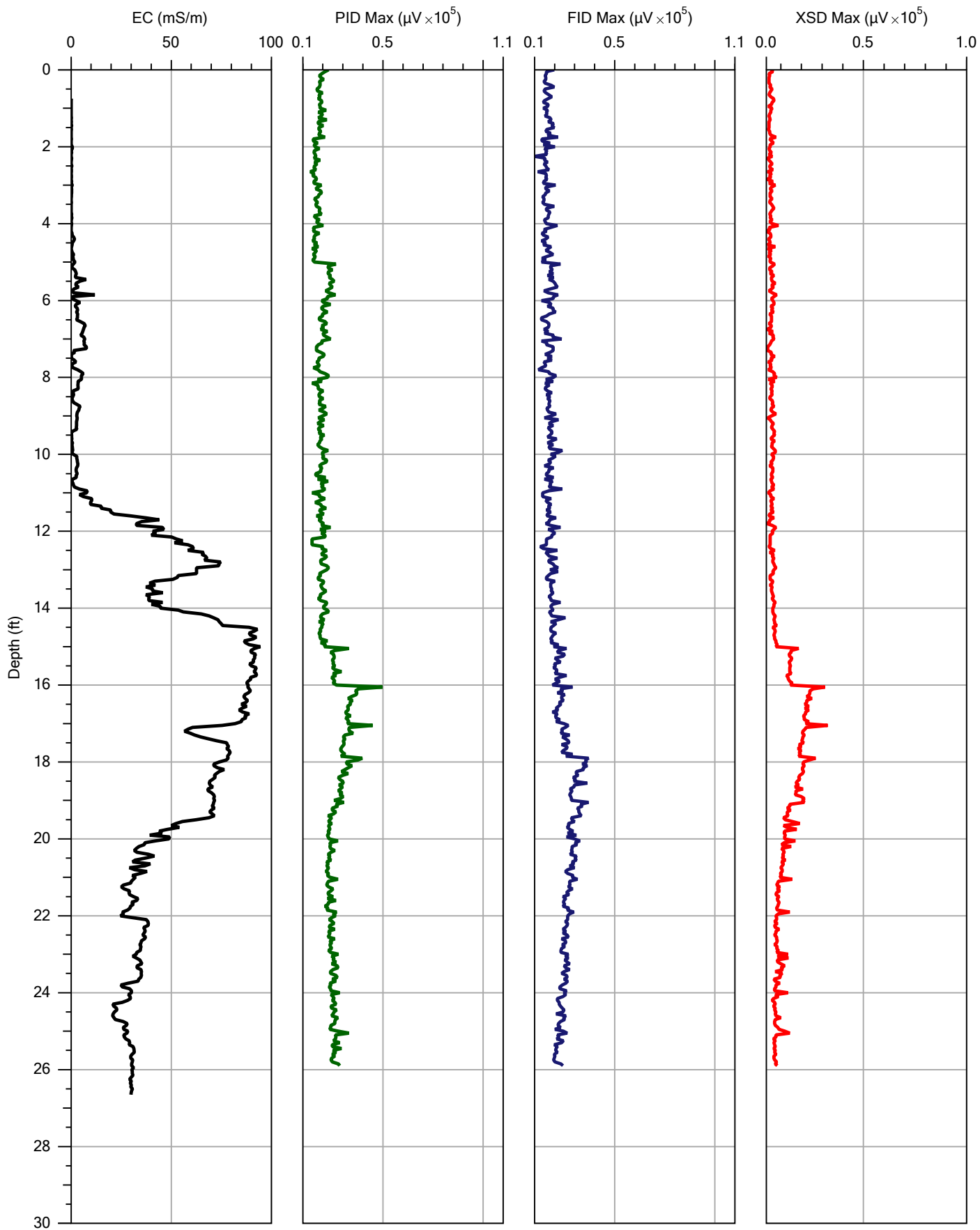
Company: Matrix Environmental		File: MIP-076.MIP
Operator: M Jensen		Date: 12/18/2014
Project ID: 139.14	Client: CRA	Location:



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jenson
Client: CRA

File: MIP-077.MIP
Date: 12/18/2014
Location:



Company: Matrix Environmental
Project ID: 139.14

Operator: M Jensen
Client: CRA

File:	MIP-078.MIP
Date:	12/18/2014
Location:	

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