FINAL REPORT

Electrokinetically-Delivered, Thermally-Activated Persulfate Oxidation (EK-TAP) for the Remediation of Chlorinated and Recalcitrant Compounds in Heterogeneous and Low Permeability Source Zones

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This project demonstrated and validated electrokinetic(EK)-enhanced amendment delivery for in-situ bioremediation (EK-BIO) via enhanced reductive dechlorination (ERD) of a tetrachloroethene source area in clay. The EK-enhanced amendment delivery technology entails the establishment of an electric field in the subsurface using a network of electrodes. The electrical current and voltage gradient established across a direct-current electric field provide the driving force to transport remediation amendments, including electron donors, chemical oxidants, and even bacteria, through the subsurface. This project showed that EK could achieve relatively uniform transport in low-permeability materials. This technology also represents a remedial alternative with excellent environmental performance.

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ACRONYMS AND ABBREVIATIONS

AC	alternating current
A	amp
CHP	catalyzed hydrogen peroxide
cm/day	centimeters per day
cm/s	centimeters per second
CVOCs	chlorinated volatile organic compounds
cDCE	cis-1,2-dichloroethene
ºC	degrees Celsius
Dem/Val	Demonstration/Validation
DoD	Department of Defense
DC	direct-current
DO	dissolved oxygen
DPT	direct push technology
EC	electrical conductivity
ERH	electrical resistance heating
EK	electrokinetic
EK-BIO	EK-enhanced amendment delivery for in-situ bioremediation
EK-TAP	electrokinetically delivered, thermally-activated persulfate
K_{eo}	electroosmotic permeability
ERDC	Engineer Research & Development Center
ft	foot (or feet)
ft bgs	feet below ground surface
FDEP	Florida Department of Environmental Protection
gpm	gallons per minute
g/L	grams per liter
K_h	hydraulic conductivity
ISB	in-situ bioremediation
ISCO	in-situ chemical oxidation
kW-hr	kilowatt-hour
LTI	Lost-Time Incident
LDPE	low-density polyethylene
low-K	low-permeability
MS/MSD	matrix spike/matrix spike duplicate
µg/L	microgram per liter

mV	millivolts
MMO	mixed metal oxide
NAS	Naval Air Station
NAVFAC SE	Naval Facilities Engineering Command Southeast
OU3	Operable Unit 3
O&M	operation and maintenance
ORP	oxidation-reduction potential
PID	photoionization detector
PVC	Polyvinyl chloride
lbs	pounds
PLC	programmable logic controller
ROI	radius of influence
E^o	redox potential
m^2/s-V	square meters per second-volt
TTA	target treatment area
TTI	target treatment interval
PCE	tetrachloroethene
TCE	trichloroethene
TOC	total organic carbon
UIC	underground injection control
USACE	United States Army Corps of Engineers
VC	vinyl chloride
V	volts
V/cm	volts per centimeter
V/m	Volts per meter
W	watt
ZVI	zero-valent iron

ABSTRACT

INTRODUCTION AND OBJECTIVES

This Demonstration/Validation (Dem/Val) project was conducted at Naval Air Station (NAS) Jacksonville, Florida (the Site) to assess and validate the performance of an electrokinetic (EK) technique to promote uniform and effective distribution of persulfate in low-permeability (low-K) and heterogeneous subsurface materials, for the purposes of improving site remediation at low-K sites.

TECHNOLOGY DESCRIPTION

The electrokinetically delivered, thermally-activated persulfate (EK-TAP) technology consists of two main components: i) delivery of persulfate through low-K and heterogeneous soils using direct current (*DC*); followed by ii) heat activation of the persulfate, by raising the temperature of the soil and pore water by electrical resistance heating (ERH) using alternating current (*AC*).

PERFORMANCE AND COST ASSESSMENT

A phased testing approach was planned for the Dem/Val but unfortunately, due to federal budget constraints, only the technical objectives associated with the first phase of testing (i.e., Phase 1 dipole test to distribute persulfate within the clay unit at the Site) were assessed. These were i) demonstrating uniform distribution of persulfate; ii) quantification of EK system operational parameters; and iii) demonstrating safety, reliability, and ease of technology implementation. Each of the technical objectives were achieved, and the Dem/Val showed that EK can achieve relatively uniform transport of persulfate in low-K materials, which is a critical and distinct advantage of the EK technology over other conventional advective flow-based approaches. EK-enhanced delivery is a safe and relatively more controllable approach compared to high-pressure/fracturing injection and thermal approaches, and the EK technology also represents a remedial alternative with excellent environmental performance. The duration of the Phase 1 dipole test ran for several months longer than anticipated due to a disruption in the supply of the potassium bicarbonate pH buffer, which impacted system uptime. However, once the supply of this pH buffer was restored system uptime recovered and was maintained through the end of the test.

Based on the information and experience obtained from this Dem/Val, there are three main cost drivers to consider when evaluating implementation costs in future projects, including: (i) footprint, depth interval, and volume of target treatment zone and contaminant mass; (ii) presence and location of above-ground and subsurface utilities; and (iii) site geochemistry, particularly pH and iron. A cost comparison was developed and showed that EK-TAP can be potentially more cost favorable to ERH, and that the EK-TAP approach is slightly more cost favorable to direct-injection in-situ chemical oxidation (ISCO) and fracturing enhanced zero-valent iron (ZVI) direct injection. Thus, at sites where low-K material and/or high-degree of heterogeneity likely preclude the consideration for direct injection, EK-TAP provides a cost-effective solution for implementing ISCO using persulfate.

IMPLEMENTATION ISSUES

When considering the use of EK-TAP at a site, additional attention may be required concerning electrical safety, elevated concentrations of iron in the treatment zone, corrosion of wetted metallic components, potential regulatory limitations for pH control amendments, cathodic protection measures when implementing the technology near "sensitive" utilities, and informing local and facility departments about the proposed remedy.

PUBLICATIONS

No publications were made during this Dem/Val.

EXECUTIVE SUMMARY

INTRODUCTION AND OBJECTIVES

This Demonstration/Validation (Dem/Val) project was conducted at Naval Air Station (NAS) Jacksonville, Florida (the Site) to assess and validate the performance of an electrokinetic (EK) technique to promote uniform and effective distribution of persulfate in low-permeability (low-K) and heterogeneous subsurface materials, for the purposes of improving site remediation at low-K sites. Recent advances in the understanding of mass distribution in subsurface environments has highlighted that in many cases a significant portion of the source mass is held in storage in low-K materials. The main limitation of current in-situ remediation applications in low-K materials using conventional hydraulic recirculation or injection techniques is the inability to effectively deliver the required amendments to the target contaminant mass.

TECHNOLOGY DESCRIPTION

The electrokinetically delivered, thermally-activated persulfate (EK-TAP) technology consists of two main components: i) delivery of persulfate through low-K and heterogeneous soils using EK processes; followed by ii) heat activation of the persulfate, by raising the temperature of the soil and pore water through low intensity thermal treatment, to promote in-situ oxidation of the target contaminants (Figure ES-1). With EK-TAP, the same infrastructure can be used for both EK distribution of persulfate using direct current (*DC*) and soil heating by electrical resistance heating (ERH) using alternating current (*AC*). The electrical current and voltage gradient established across a *DC* electric field provide the driving force to transport remediation amendments, such as persulfate, through the subsurface.

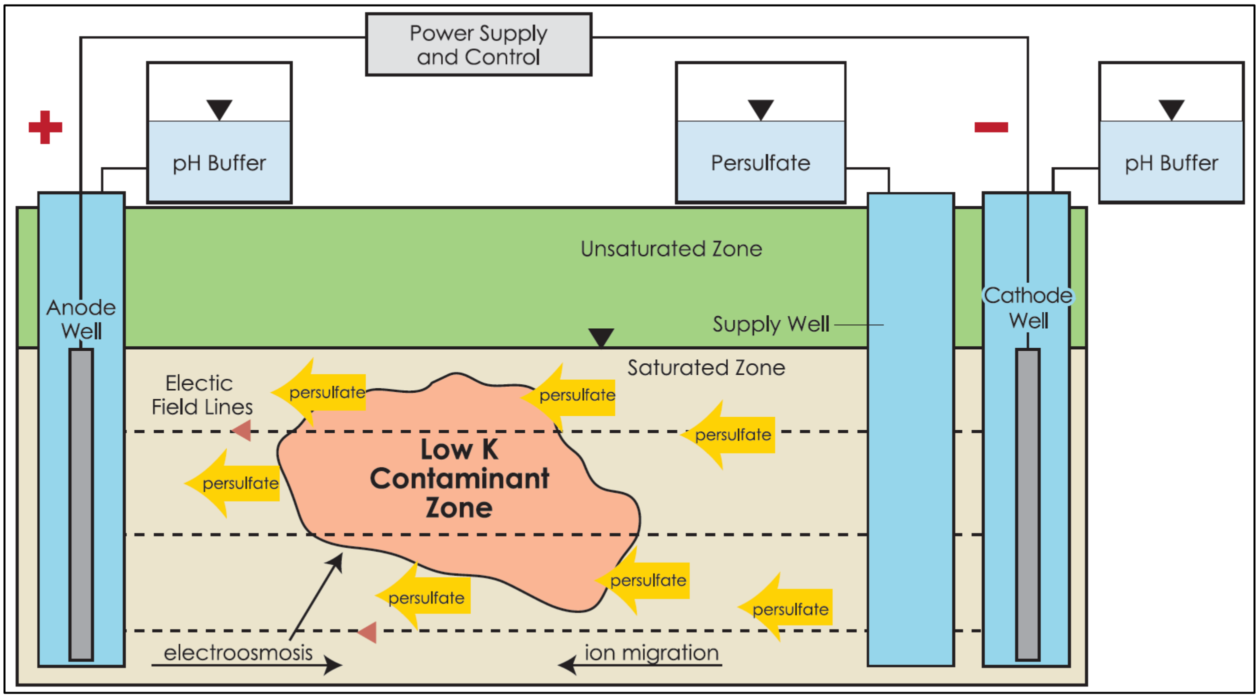


Figure ES-1. Schematic of EK-Enhanced Amendment Delivery Technology

The Dem/Val system consisted of three (3) electrode wells, four (4) supply wells, and four (4) performance monitoring wells located within the target treatment area (TTA) at the Site (Figure ES-2). Baseline soil characterization was performed during installation of select wells, and baseline groundwater characterization was performed following installation of the monitoring wells. Following system construction and startup, system operations were initiated and lasted for approximately 7 months. Performance monitoring groundwater sampling was performed throughout system operations.

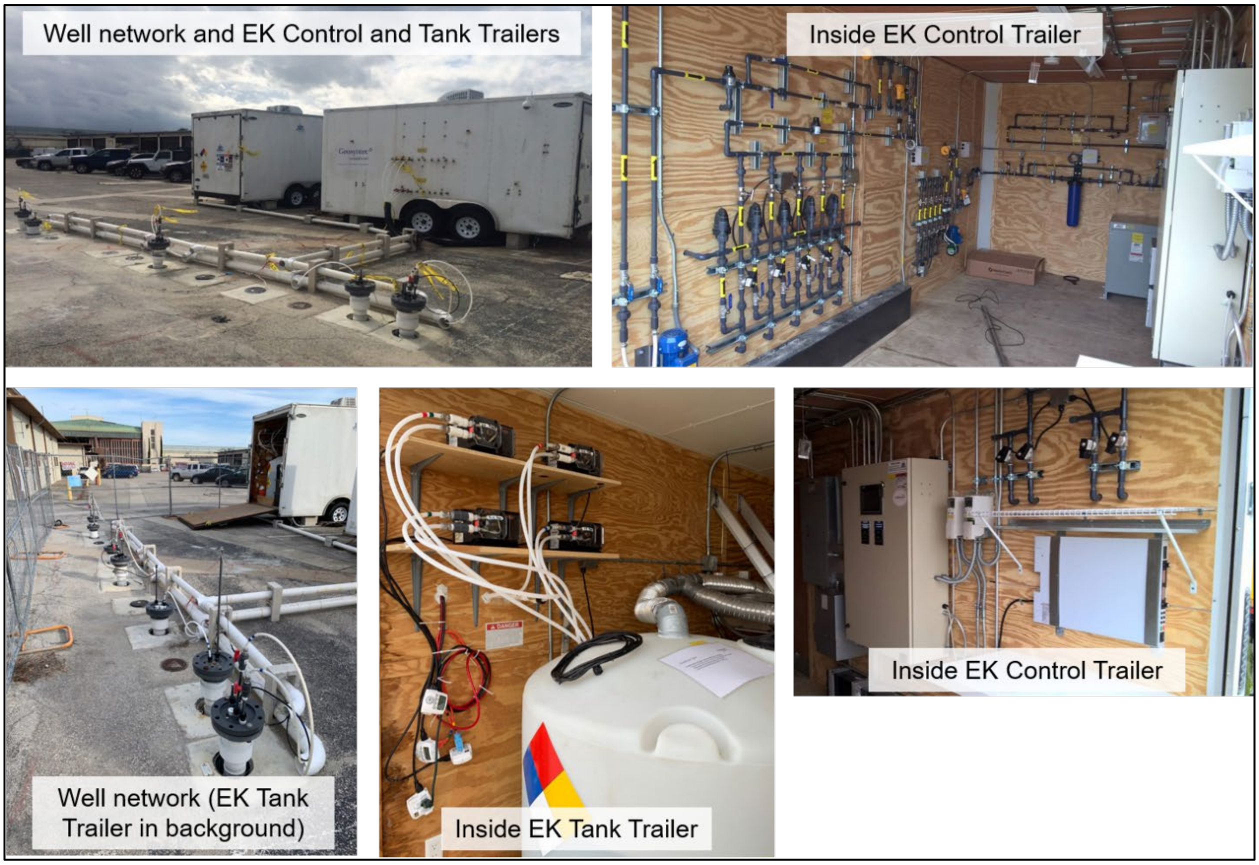


Figure ES-2. EK-TAP System Infrastructure for Dem/Val

PERFORMANCE ASSESSMENT

A phased testing approach was planned for the Dem/Val. The first phase of testing (i.e., Phase 1 dipole test) was designed to assess the applicability of EK to migrate persulfate within the clay unit using *DC* power. The second phase of testing (i.e., Phase 2 heating and persulfate activation) was designed to assess the ability of the system components to heat the subsurface (using *AC* power) to the activation temperature of persulfate, and then evaluate treatment of the target contaminants (chlorinated volatile organic compounds [CVOCs]) following heat activation of the distributed persulfate. Unfortunately, due to federal budget constraints, the second phase of the Dem/Val was not performed. As a result, only the technical objectives associated with the Phase 1 dipole test were assessed based on the performance monitoring data collected. These were:

I. Demonstrate uniform distribution of persulfate.

This Dem/Val met this objective by achieving the success criteria, including:

- Detection of persulfate at all four monitoring locations within the TTA at the end of Phase 1 operations at concentrations ranging from 1% to 100% of the amendment supply concentration; and
- No local focusing of the electric field was observed within the TTA.

II. Quantification of EK system operational parameters.

This Dem/Val met this objective by achieving the success criteria, including:

- System operational conditions (voltage and current) were maintained within ± 50% of the designed target conditions;
- Amendment supply uptime was >75% of target;
- Energy consumption was within ± 30% of design estimates; and,
- Electrode function was maintained throughout system operations.

III. Demonstrate safety, reliability, and ease of technology implementation.

This Dem/Val met this objective by achieving the success criteria, including:

- System operational conditions remained relatively steady over the course of the Dem/Val and there were no safety related lost-time incidents;
- The Dem/Val involved only conventional field construction techniques and contractors, and routine system operations were effectively monitored by a single field technician.

This Dem/Val showed that a critical and distinct advantage of EK-enhanced amendment delivery over other conventional advective flow-based approaches is that EK can achieve relatively uniform transport of persulfate in low-K materials. EK-enhanced delivery is a safe and relatively more controllable approach compared to high-pressure/fracturing injection and thermal approaches. This technology also represents a remedial alternative with excellent environmental performance. The electrical energy consumed during the active EK operation period in this Dem/Val was equivalent to operating a single 100-W lightbulb for approximately 6 months.

The duration of the Phase 1 dipole test was longer than anticipated due to a disruption in the supply of the potassium bicarbonate pH buffer, which had a significant impact on system uptime. An alternate pH buffer (potassium carbonate) was used during this period but was not as effective at controlling pH within the electrode wells as the potassium bicarbonate. Once the supply of potassium bicarbonate was restored, system uptime recovered and was maintained through the end of the Phase 1 dipole test.

COST ASSESSMENT

Based on the information and experience obtained from this Dem/Val, there are three main cost drivers to consider when evaluating implementation costs in future projects, including: (i) footprint, depth interval, and volume of target treatment zone and contaminant mass; (ii) presence and location of above-ground and subsurface utilities; and (iii) site geochemistry, particularly pH and iron.

These are also the same cost drivers for many other in-situ remediation technologies and not unique to EK technology implementation.

A cost comparison was developed and showed that EK-TAP could be potentially more cost favorable to an in-situ thermal treatment using electrical resistance heating (ERH). The energy usage required for EK-TAP is significantly less than the energy usage required for ERH, resulting in a much more favorable environmental performance of EK-TAP over ERH. The cost comparison also showed that the EK-TAP approach is slightly more cost favorable to direct-injection in-situ chemical oxidation (ISCO) and fracturing enhanced zero-valent iron (ZVI) direct injection. Thus, at sites where low-K material and/or high-degree of heterogeneity likely preclude the consideration for direct injection, EK-TAP provides a cost-effective solution for implementing ISCO using persulfate.

IMPLEMENTATION ISSUES

While EK-TAP is mainly a variation on standard ISCO using persulfate, whereby EK is used to more effectively deliver the persulfate through low-K materials, and then the same infrastructure is used to heat the treatment zone (similar to ERH) and activate the persulfate, some areas where additional attention beyond those typically considered for ISCO and ERH may be required on a site-specific basis, including:

- Safety considerations related to potential stray current/voltage to surface. To address this question, the current and voltage at surface steel structures located within the TTA were measured during system operations to confirm that there was no safety concern. Depending on the project site, and for sensitive and active facilities with dedicated safety departments, additional design and explanation effort may be required for project approvals.
- Iron fouling of filters and valves along the extraction piping. During this Dem/Val, minimal fouling of filters and valves was observed, but routine maintenance was required to minimize potential flow restrictions within the conveyance lines. Scaling of the cathodes also required maintenance actions to clean the cathode surface. The presence of iron within the target treatment zone resulted in activation of the persulfate which reduced the persulfate migration rate and extended the duration of operations. However, activation of the persulfate also resulted in some treatment of the target CVOCs, which could have reduced the effort required for a subsequent heating stage had heating been performed during the Dem/Val.
- Corrosion of wetted metallic parts in the manifold system and at wellhead fittings due to elevated chloride concentrations. Although not encountered during this Dem/Val, this can be mitigated by minimizing the amount of metallic wetted parts within the system and instead using components with plastic wetted parts.
- The technology implementation did not require specialized/proprietary equipment. We used only standard commercial off-the-shelf equipment. We designed the manifold and control system and had a remediation system vendor assemble the system per design, but the overall system was similar to other "typical" in-situ remediation systems. There were specific regulatory requirements regarding the chemical composition of the pH buffers used in this Dem/Val, but in our experience this was a unique situation and in most cases the requirements for addition of chemical amendments for an EK-TAP remedy should be similar to the requirements for other "typical" in-situ remediation technologies.

- If the technology is to be implemented near (laterally and/or vertically) utilities that are "sensitive" to electric interference or where there are concerns with corrosion, some protection measures, such as cathodic protection, may be considered.
- No special regulatory requirements or permits beyond what are typical for other ISCO projects such as UIC permit (other than perhaps limitations for the pH control amendments as noted above). Depending on the locality-/facility-specific requirements, local or facility power/electrical departments should be consulted, and local HazMat response departments should be informed about the use of a chemical oxidant at the project site.

1.0 INTRODUCTION

This Final Report summarizes the approach, methodology and results of a field Demonstration/ Validation (Dem/Val) project conducted to assess and validate the performance of an electrokinetic (EK) technique to promote uniform and effective distribution of persulfate in low-permeability (low-K) and heterogeneous subsurface materials, for the purposes of improving site remediation at low-K sites. This project was conducted in collaboration with Naval Facilities Engineering Command Southeast (NAVFAC SE) and the United States Army Corps of Engineers (USACE) Engineer Research & Development Center (ERDC).

1.1 BACKGROUND

Decades of remediation experience have shown that in-situ remediation approaches are more successful and cost effective than most ex-situ remediation methods. However, in-situ remedies, such as in-situ chemical oxidation (ISCO) and in-situ bioremediation (ISB), while capable of treating various contaminants in permeable sandy aquifers, often fail to effectively target contaminants in silt and clay materials, or combinations of sand and low-K materials. Recent advances in the understanding of mass distribution in subsurface environments has highlighted that in many cases a significant portion of the source mass is held in storage in low-K materials, and that the release rate from low-K storage is many times slower than the original contaminant loading rate. The main limitation of in-situ remedy applications in low-K materials is the inability to effectively deliver the required amendments to the target contaminant mass contained within the low-K material using conventional hydraulic recirculation or injection techniques.

While hydraulic fracturing has shown some promise in improving amendment distribution in low-K materials, the success of this approach has been limited by site access constraints, surface structure impact concerns, high cost, and consistency and predictability of induced fractures. Other technologies such as large diameter auger mixing and thermal treatment have shown promise in low-K materials. However, these approaches have been expensive and are also limited by site access and re-use limitations. Conventional thermal remediation approaches also face the challenges of removing and treating gaseous phase contaminants. Lower cost, and ideally more environmentally-sustainable remediation approaches or improvements to existing technologies are required to reduce overall remediation costs at Department of Defense (DoD) and defense contractor sites.

The electrokinetically delivered, thermally-activated persulfate (EK-TAP) technology consists of two main components: i) delivery of persulfate through low-K and heterogeneous soils using EK processes; followed by ii) heat activation of the persulfate, by raising the temperature of the soil and pore water through low intensity thermal treatment, to promote in-situ oxidation of the target contaminants. With EK-TAP, the same infrastructure can be used for both EK distribution of persulfate using direct current (*DC*) and soil heating by electrical resistance heating (ERH) using alternating current (*AC*). The electrical current and voltage gradient established across a *DC* electric field provide the driving force to transport remediation amendments, such as persulfate, through the subsurface. One reason why EK represents a fundamentally more effective delivery technique compared to an advective hydraulic approach is the relatively uniform electrical property of various soil materials. As a result, EK-enhanced amendment delivery technology can achieve effective and uniform amendment distribution at sites where heterogeneous subsurface materials often limit the applications of hydraulic methods.

1.2 OBJECTIVE OF THE DEMONSTRATION

As stated in the Technology Demonstration Plan (Geosyntec, 2019b), the overall goal of this project was to demonstrate and validate the EK-TAP technology to promote in-situ oxidation of chlorinated solvents in complex heterogeneous and low-K geological materials. Unfortunately, due to federal budget constraints, the second phase of the Dem/Val (i.e., Phase 2 heating and persulfate activation) was not performed. As a result, only the technical objectives associated with the first phase of testing (i.e., Phase 1 dipole test to distribute persulfate within a low-K unit using *DC*) were assessed. These include:

i) Demonstration and quantification of the ability to uniformly distribute persulfate throughout a low-K and/or heterogeneous target treatment area (TTA) using a *DC* electric field.

ii) Quantification of EK system operational parameters to develop tools for full-scale system design and optimization; and

iii) Demonstrate the safety, reliability, and ease of technology implementation.

1.3 REGULATORY DRIVERS

In 2011, a SERDP/ESTCP-sponsored workshop on *Investment Strategies to Optimize Research and Demonstration Impacts in Support of DoD Restoration Goals* identified treatment of contaminants in low-K subsurface materials (i.e. silts, clays, and bedrock) as a high-priority area for additional investment. The workshop participants pointed out that treatment of low-K zones would require adoption of effective and cost-effective techniques that can target delivery of remedial agents to these regions and prevent continued back-diffusion of contaminants.

Estimated costs to DoD for adopting hydraulic containment at more than 3,000 chlorinated hydrocarbon sites could surpass $100 million annually, with estimated life-cycle costs of more than $2 billion (SERDP/ESTCP, 2006). ISCO is generally considered to be an effective remedial option for chlorinated solvent sites and is widely used by DoD and remediation practitioners. Improved delivery and activation of chemical oxidants will accelerate ISCO and thereby reduce the overall cost of remediation at many of these sites, particularly at those that have low-K zones or heterogeneous materials, while avoiding the high energy and vapor treatment costs associated with traditional thermal remedies. This will broaden the application of ISCO at more DoD sites where subsurface conditions may have previously precluded the use of ISCO.

2.0 TECHNOLOGY DESCRIPTION

This section provides an overview of persulfate oxidation for remediation of chlorinated solvents, the use of EK techniques to deliver oxidants through low permeability subsurface materials, and the use of EK-TAP. Advantages and potential limitations associated with this technology are also discussed.

2.1 PERSULFATE OXIDATION

Various oxidants have been used in laboratory and field applications to aggressively destroy organic chemicals, including Fenton's reagent (or more generally known as catalyzed hydrogen peroxide [CHP]), permanganate, persulfate, ozone, and ozone combined with peroxide. These oxidants react to varying degrees with organic contaminants, converting them into innocuous end products such as carbon dioxide, water, and inorganic chloride. Because not all ISCO treatments are applicable for all organic contaminants and all geochemical conditions, site contaminants of concern and conditions must be understood to choose the appropriate oxidant and delivery method. The treatment effectiveness of chemical oxidants currently in use varies based on several factors, including the redox potential (E^o) of the oxidant, and the reactive specificity of the oxidant toward a given type of contaminant.

Activated persulfate has been demonstrated to be a very effective and powerful (E^o of -2.1 volts [V]) oxidant for many recalcitrant contaminants such as chlorinated solvents. The most common form of persulfate used in remediation is sodium persulfate. Activation of persulfate to generate sulfate radicals can dramatically increase the oxidative strength of this oxidant (E^o = -2.6 V). Activation of persulfate is typically achieved using heat, base activation (pH ~12), addition of peroxide, or addition of a suitable reductant, such as ferrous iron. Persulfate has been demonstrated to treat a broad array of organic contaminants in groundwater and is relatively persistent in comparison to some other strong oxidants such as CHP and ozone. As mentioned in Section 1.1, a common challenge at many sites with low-K soils is the ability to effectively deliver and activate persulfate to achieve successful treatment of the target contaminants. Oxidants such as CHP and ozone are typically short-lived in the subsurface, and in low permeability materials it is typically difficult to effectively distribute them before they react. In comparison, persulfate is slower to react, thereby allowing it to be distributed much farther through the subsurface and through low-K materials.

2.1.1 EK-Enhanced Amendment Delivery

The EK-enhanced amendment delivery technology entails the use of electrodes and *DC* electrical power to establish an electric field in the subsurface. The voltage gradient established across the *DC* electric field is the driving force for transporting remediation reagents, including chemical oxidants for ISCO or electron donors and/or microorganisms for ISB, through low-K soils or uniformly through heterogeneous formations. The EK transport process relies primarily on two mechanisms which occur with the application of the electric field:

- ***Electromigration*** *(or ion migration)* – the movement of charged dissolved ions through an aqueous medium in response to the applied electric field. The direction of ion migration is toward the electrode with a polarity opposite of the ion's charge; and

- ***Electroosmosis*** – the movement of pore fluid (and dissolved constituents) within a porous medium in response to the applied electric field. The direction of electroosmotic flow is usually from the anode toward the cathode.

One reason why EK represents a fundamentally more effective delivery technique in low-K materials compared to an advective hydraulic approach is the relatively uniform electrical property of various soil materials. For example, while the hydraulic conductivity (K_h) of fine sand and kaolin materials can vary by several orders of magnitude, the coefficient of electroosmotic permeability (K_{eo}) of fine sand ($4x10^{-9}$ square meters per second-volt [m^2/s-V]) is comparable to that of kaolin ($5.7x10^{-9}$ m^2/s-V) and clayey till ($5.0x10^{-9}$ m^2/s-V), as shown in **Figure 2-1**. Therefore, the EK-enhanced amendment delivery technology can achieve effective and uniform amendment distribution at sites where heterogeneous subsurface materials often limit the applications of hydraulic methods.

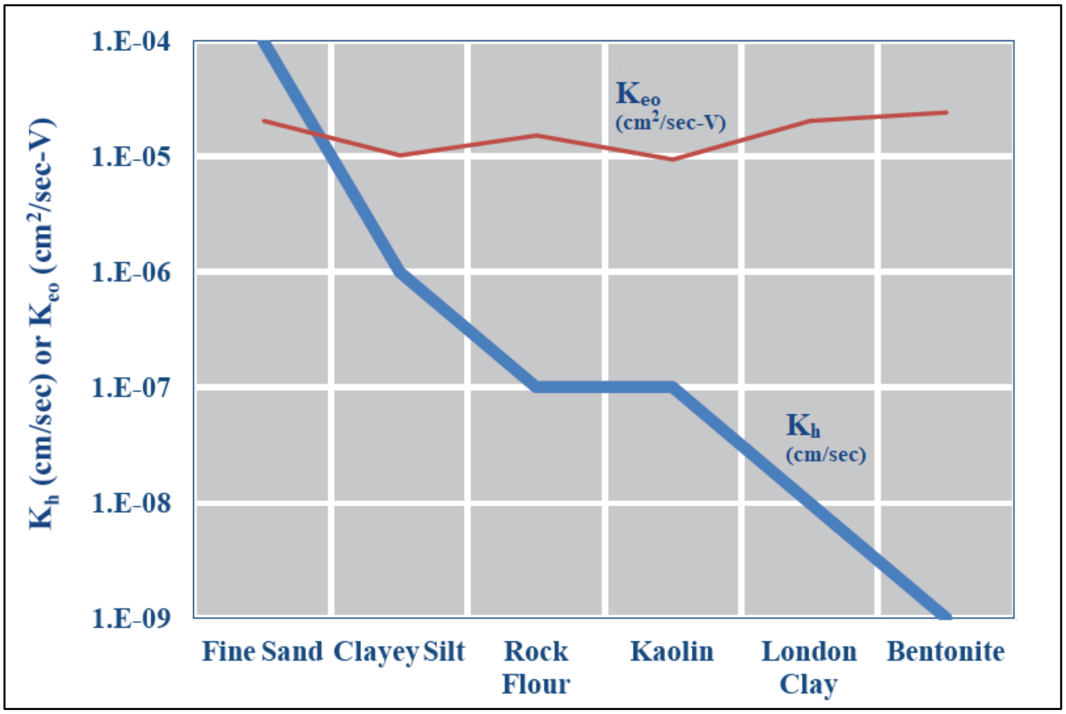


Figure 2-1. Hydraulic and Electrical Properties of Various Soils (rev. Mitchell, 1993)

The application of electric current will also result in electrolytic reactions at the electrodes. If inert electrodes (such as graphite or ceramic-coated electrodes) are used, water oxidation produces oxygen gas and acid (H_3O^+) at the anode (positively charged electrode), while water reduction produces hydrogen gas and base (OH-) at the cathode (negatively charged electrode). Electrolytic reactions of water are shown below in Equations 1 and 2,

$$2H_2O \implies 4e^- + 4H^+ + O_2 \quad \text{(at Anode)} \qquad (1)$$

$$2H_2O + 2e^- \implies 2OH^- + H_2 \quad \text{(at Cathode)} \qquad (2)$$

Faraday's law for equivalence of mass and charge can be used to calculate the rate of redox reactions that will occur at the electrodes (Koryta and Dvorak, 1987). Therefore, it is possible to engineer and control the electrolytic processes at the electrodes to produce hydrogen (H_2) and oxygen (O_2) or to control pH conditions, depending on the system design objectives.

To implement the EK-enhanced delivery technology in the field, remediation amendments are added to supply wells located intermediary to the electrode wells, mainly to shorten amendment travel distance versus consumption rate (**Figure 2-2**). Electrodes of selected inert materials are installed in electrode wells and connected to a *DC* power source. The power supply unit will supply electrical energy to the electrodes at designed settings of voltage and/or current. The electrical field will transport the amendments from the supply wells into and through the formation materials to achieve relatively uniform transport and distribution. Cross-circulation and/or pH-balancing can be employed at the electrode wells to overcome the effects of water electrolysis and retain the natural in-situ pH of the system (as required). Slight subsurface heating may occur with application of the electrical field. However, results from field trials have shown that temperature increases are minor (less than 10 degrees Celsius [^{o}C]).

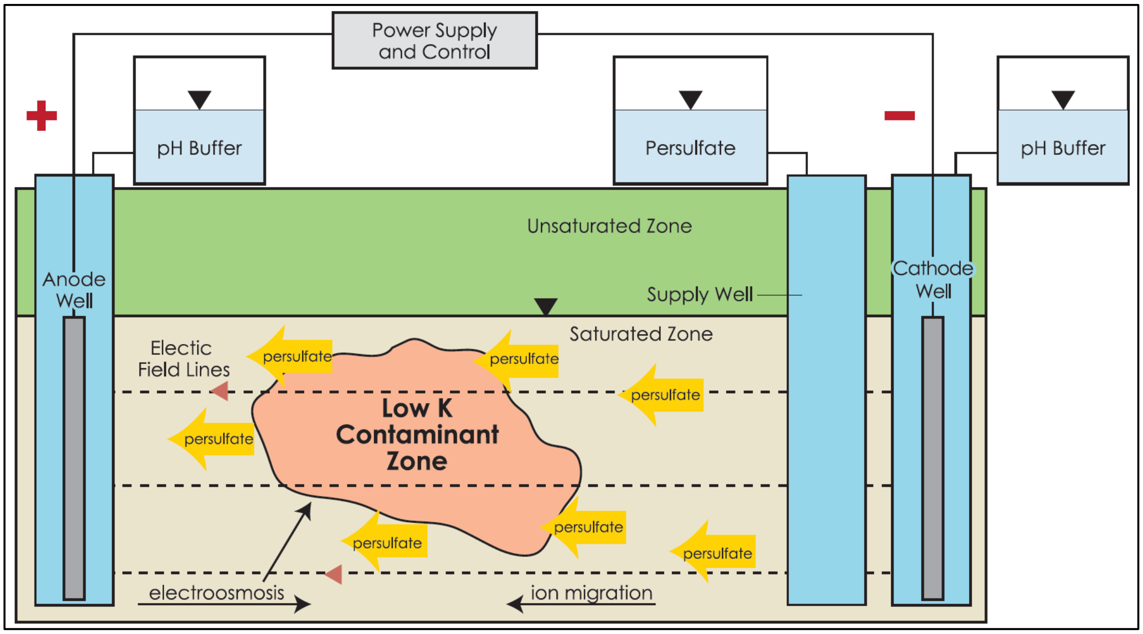


Figure 2-2. Schematic of EK-Enhanced Amendment Delivery Technology

2.2 TECHNOLOGY DEVELOPMENT

Results from many studies conducted at both bench-scale and field-pilot scale have shown the potential of EK-enhanced amendment transport (Mao et al., 2012; Gent, 2001; Wu et al., 2007; Reynolds et al., 2008; Hodges et al., 2011; SERDP ER-1204). Bench-scale studies conducted at ERDC effectively delivered acetate through loess soil ($K_h = 10^{-7}$ centimeters per second [cm/s]) and vertically deposited clay ($K_h = = 10^{-9}$ cm/s) at rates of 2.1 and 2.5 centimeters per day (cm/day), respectively, with a voltage gradient near 0.5 volts per centimeter (V/cm) (Gent, 2001). An average lactate transport rate of 3.4 cm/day under a unit voltage gradient of 1 V/cm was achieved in a bench-scale study conducted using a silty clay ($K_h = 10^{-7}$ cm/s) (SERDP ER-1204).

The observed EK-enhanced transport rate in that SERDP study was more than 120 times higher than the transport rate achievable in the same type of soil but under a unit hydraulic gradient. Geosyntec Consultants, Inc. (Geosyntec), in collaboration with ERDC, completed a field pilot test of EK-enhanced amendment delivery for in-situ bioremediation (EK-BIO) at a site in Denmark, which achieved a lactate transport rate between 2.5 and 5 cm/day through clay materials. Results from the recently completed EK-BIO Dem/Val at Naval Air Station (NAS) Jacksonville (ESTCP Project ER-201325) showed that EK was effective at uniformly distributing lactate throughout the target treatment area of a clay unit.

The use of EK-enhancement for ISCO has also been demonstrated at the bench scale in both column and sandbox experiments (Roach et al., 2006; Reynolds et al., 2008; Robertson, 2009; Hodges et al., 2011; Fan et al., 2014, 2016; Chowdhury et al., 2017). Common oxidants such as permanganate and persulfate are charged compounds and will migrate under the driving force of the imposed electric gradient. Migration rates of mono-valent and divalent oxidants have been measured in the laboratory at levels in excess of 500 times higher than that achievable through diffusion alone. In persulfate and permanganate migration column studies performed by Geosyntec using low-K soils from various sites in the United States and Denmark, estimates of persulfate and permanganate transport rates ranged from approximately 1 to 12 cm/day. Geosyntec has also completed several field pilot tests of EK-TAP (i.e., using persulfate as the oxidant) and EK-ISCO (i.e., using permanganate as the oxidant) at sites in California, Louisiana, North Carolina, Ontario Canada (Head et al., 2020), and Denmark, which achieved persulfate or permanganate transport rates between 1 and 4 cm/day through low-K soils (typically clays or silty clays). Results from most of these pilot tests indicated general uniformity of distribution of persulfate or permanganate as well as some destruction of target contaminants (primarily chlorinated volatile organic compounds [CVOCs]) within the low-K target treatment units.

The EK-TAP technology is a two-step process that uses the same infrastructure to first deliver the persulfate through the low-K target treatment area by applying *DC* power, followed by heating of the soils to 30ºC to 40ºC by *AC* electricity via the electrodes to activate the persulfate (to increase its reaction rate). The application of *AC* through the subsurface is the basis of thermal treatment by ERH. Persulfate reaction rates increase substantially with temperature, increasing by up to two orders of magnitude with an increase in temperature from 20ºC to 40ºC.

The traditional resistance heating approach for remediation consists of applying *AC* to heat the subsurface to near boiling temperatures that promote volatilization of contaminants which are subsequently captured by a subsurface vapor recovery system and conveyed to the surface for treatment. For the EK-TAP process, soil heating is used to moderately elevate the subsurface temperature only to the level where persulfate reaction kinetics are increased (i.e., 30ºC to 40ºC). This increase in temperature does not result in the creation of a vapor phase and volatilization of contaminants, which greatly decreases the required infrastructure as compared to traditional resistance heating applications (since the EK-TAP infrastructure requirements are limited to temperature monitoring and an *AC* power source) and results in destruction of contaminants in-situ, without the need for expensive vapor capture and ex-situ treatment. The combination of EK and soil heating is particularly suited to low-K sites, overcoming the high energy costs and long duration of the heating phase, and removing the need for high pressure injections or fracking to achieve contact of the oxidant with the contaminants within the low-K soils.

2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

A critical and distinct advantage of the EK technology over most other approaches is that EK can achieve relatively uniform transport in inter-bedded clays and sands, even when the hydraulic conductivities of the subsurface materials vary by orders of magnitude. EK-enhanced transport, which relies primarily on the electrical properties of aquifer materials instead of the hydraulic properties, represents a solution to the limitations of preferential pathways facing conventional advective-based hydraulic technologies.

EK-enhanced delivery is a safer, and more controllable approach compared to current high-pressure/fracturing injection and thermal approaches. The migration of remediation reagents is directed by the electrical field established between electrodes, and no high injection pressures are involved.

EK-enhanced delivery also represents a remediation technology with good environmental performance. Unlike other technologies that repeatedly deliver/flush amendments through a small number of preferential pathways in the subsurface, the EK technology can uniformly deliver the amendments, maximizing treatment effectiveness and reducing treatment cost and duration. In the case of EK-TAP, direct treatment and destruction of target contaminants in-situ can also be achieved, instead of transferring contaminants to the gas phase which requires additional containment/collection and treatment. The electrical energy usage of EK-TAP is relatively low compared to current thermal remediation technologies. The EK-TAP field pilot tests conducted by Geosyntec at other sites required less than 100V and 15 amps (A) of electrical power to sustain the EK operation. The energy usage of the EK-TAP pilot tests was equivalent to the energy needed to power approximately ten 100-watt (W) light bulbs, reflecting the small carbon footprint and excellent environmental performance of this technology.

Although conceptually there is no depth limit for this technology, applications of EK-enhanced delivery and EK-TAP in areas with subsurface metallic infrastructure will require considerations for infrastructure protection. Grounding protection of subsurface utilities as needed is a common practice for many electrical engineering projects.

There are several aspects of this technology that will require appropriate considerations and control measures, including:

- Safety considerations related to potential stray current/voltage to ground surface.
- If the technology is to be implemented near (laterally and/or vertically) utilities that are sensitive to electric interference or corrosion concerns, some protection measures, such as cathodic (grounding) protection, may be required. Depending on the locality/facility-specific requirements, local or facility power/electrical departments should be consulted, and local HazMat departments should be informed about the use of chemical oxidants at the project site.
- Although conceptually there is no depth limit for this technology, shallow treatment zones too close to the ground surface and/or utilities, or in a vadose zone, can limit the feasibility of this technology.

- Certain site hydrogeology or geochemical conditions may limit the applications or impact the costs of this technology, including:
  - High levels of iron may result in activation of the persulfate which can lead to slower persulfate migration rates and extended remediation timeframes. However, in-situ activation of the persulfate can also result in treatment of target CVOCs which may preclude the need for activation of the persulfate via a subsequent heating stage and/or the need for a second treatment cycle.
  - High levels of iron and/or chloride that require particular engineering control measures (e.g., corrosion protection) or more operational maintenance efforts for fouling controls. Iron fouling is also a common challenge to other in-situ remediation technologies.
  - High levels of total organic carbon (TOC) that can exert a higher oxidant demand and increase the amount of persulfate required for subsequent treatment of target CVOCs. This limitation is not specific to EK amendment delivery, but instead is a limitation for ISCO remediation as a whole.
  - High natural groundwater flow velocity in the permeable portion of a target treatment zone may potentially limit the EK transport in the direction against the natural groundwater flow.

3.0 PERFORMANCE OBJECTIVES

Performance objectives for the Dem/Val were identified and approved by ESTCP to provide the basis for evaluating the performance and costs of the Dem/Val technology. As noted in Section 1.2, only the first phase of the Dem/Val was performed, and therefore only the performance objectives associated with this first phase of the Dem/Val were assessed. **Table 3-1** presents a summary of the quantitative and qualitative performance objectives that were assessed, which are further discussed in the following subsections.

Table 3-1. Performance Objectives

Performance Objective	Data Requirements	Success Criteria	Assessment
Quantitative Performance Objectives			
Demonstration and quantification of the ability to uniformly distribute persulfate using a *DC* electric field	Monitoring of the concentrations of persulfate, sulfate, and total sulfur Monitoring of voltage and electrical current within the EK system during operation	• Evidence of persulfate transport to all monitoring wells located within the TTA following the EK migration phase • Persulfate transport rate greater than 2.5 cm/day • No focusing of electric field in any areas (electrical gradient between well pairs no more than 5x of average gradient between all well pairs) • Electrical potential gradient between electrode pairs maintained at level no more than 5x of target gradient at design current	Objective Met (see Section 3.1)
Quantification of EK system operational parameters	EK system operational parameters, amendment usage, and energy consumption	• System operational conditions (voltage, current) within ±50% of the final designed target voltage and current • Persulfate supply uptime greater than 75% of target • Energy consumption within +/-30% of design estimate • Electrode function is maintained for at least one full cycle of EK-TAP	Objective Met (see Section 3.2)
Qualitative Performance Objectives			
Safe and reliable operation	Monitoring of system operational parameters	• Operation conditions remain stable within the normal designed ranges over the course of the demonstration period. • No Lost-Time Incidents (LTIs)	Objective Met (see Section 3.3)
Ease of implementation	Feedback from field personnel on installation and operation of technology and system	• Ability to construct using conventional techniques and contractors. • A single field technician able to effectively monitor and maintain normal system operation	Objective Met (see Section 3.3)

3.1 PERFORMANCE OBJECTIVE: DEMONSTRATE UNIFORM DISTRIBUTION OF PERSUFLATE

The first objective of the EK-TAP technology is to achieve uniform distribution of persulfate within the TTA under the established electric field conditions. For this Dem/Val, the effective distribution of the persulfate is essential to the success of the EK-TAP technology.

3.1.1 Data Requirements

Uniform distribution of persulfate was determined by measuring concentrations of persulfate and indicator parameters (i.e., sulfate and sulfur) at the groundwater monitoring locations in the TTA throughout the Phase 1 dipole test. Groundwater samples were collected and analyzed in accordance with the sampling plan. Additionally, measurements of electric current and voltage were taken during system operation to assess the uniformity of the electrical field

3.1.2 Success Criteria

This objective is considered achieved upon observing evidence of persulfate transport at monitoring locations (represented by measurements of persulfate, sulfate and sulfur in these wells), with persulfate concentrations ranging from 1% to 100% of the amendment supply concentration. Persulfate transport rates ranged from approximately 0.6 to 1.3 cm/day. The lower than anticipated transport rate is attributed to in-situ activation of the persulfate, likely due to elevated concentrations of iron in the TTA.

For successful achievement of a uniform electric field at design levels, the electrical gradient between any individual pair of wells should not be more than 5 times the average electrical gradient between all pairs of wells. Moreover, the electrical potential gradient between electrode pairs should be maintained at a level no more than 5 times the target gradient.

3.1.3 Performance Objective Assessment

As presented in **Table 6-3** and **Figure 6-5**, increases in the concentrations of persulfate were observed at all four performance monitoring wells (i.e., EKMWs) during the Dem/Val, and by the end of Phase 1 operations persulfate was detected at all four EKMWs at concentrations ranging from 1% to 100% of the amendment supply concentration. Increases in the concentrations of sulfate and sulfur by as much as 1 to 2 orders of magnitude were also observed at wells EKMW-11 and EKMW-12. The Dem/Val has met this criterion.

Calculated persulfate migration rates ranged from approximately 0.6 cm/day to 1.3 cm/day. However, the rate of persulfate migration was inhibited due to in-situ activation of the persulfate by naturally occurring subsurface conditions (e.g., elevated concentrations of iron). The Dem/Val has partially met this criterion.

As shown in **Figure 6-3**, voltage measurements at discrete locations within the TTA were between 5.9V and 21.9V indicating that an electric field was established in the area between the electrode wells. Voltage gradients between discrete locations of closest well pairs were calculated and ranged from 0.34 volts per meter (V/m) to 0.65 V/m, and were approximately 100x below the target estimated voltage gradient of 0.5 V/cm (or 50 V/m). The variation in voltage gradients between well pairs was generally <10%, indicating that the established voltage gradients were relatively uniform and no local focusing of the electric field was encountered within the TTA. The Dem/Val has met this criterion.

The EK system was designed and operated at a constant current, determined after the start-up period, during system operations. As presented in **Figure 6-1**, the voltage required of the *DC* power supply unit was generally consistent during periods of constant current, except for a few occasions when electrodes needed cleaning. The electrical current supplied to individual wells during periods of constant current was generally steady (variation within 30% of average). Given that (i) soil electrical resistivity is a soil property not expected to vary over the course of Dem/Val, and (ii) the voltage output by the *DC* power supply unit and the current supplied to individual electrodes were generally steady, the electrical potential between electrode pairs within the TTA should maintain within 5x of target during operation. The Dem/Val has met this criterion.

3.2 PERFORMANCE OBJECTIVE: QUANTIFICATION OF EK SYSTEM OPERATIONAL PARAMETERS

For this Dem/Val, the application of the EK technology was focused on and limited to the TTA. The information obtained from this Dem/Val was used to assess the suitability of EK-TAP for full-scale operation at this and other sites.

3.2.1 Data Requirements

The suitability of the EK-TAP technology for full-scale implementation was assessed by measuring the electrical input (voltage/current) to achieve and maintain the desired electric field, by measuring operational parameters for maintaining consistent operation, and by determining the overall energy consumption within the TTA.

3.2.2 Success Criteria

This objective is considered achieved if system operational conditions are within ± 50% of the designed target voltage and current. Additionally, successful accomplishment of this objective includes amendment supply uptime to be greater than 75% of target and the energy consumption to be within ± 30% of the design estimate. Successful achievement also includes maintaining electrode function for at least one full cycle of EK-TAP.

3.2.3 Performance Objective Assessment

As discussed in Section 6.1 and Section 7.1 (criterion related to electrical gradient) and presented in **Figure 6-1**, the operating voltage and current remained relatively steady except when electrodes needed cleaning. Excluding these periods of temporary unstable readings, the overall system operation conditions were steady and within 50% of the average during each normal operation period. The Dem/Val has met this criterion.

As discussed in Section 6.1, system uptime was at least 85% during the periods when potassium bicarbonate was used to control pH in the electrode wells. During these periods, system downtime was predominantly a result of the weekly site visits for operation and maintenance (O&M) and/or groundwater sampling, in which case the *DC* power supply was manually turned off in order to protect the health and safety of field staff during these activities. The Dem/Val has met this criterion.

The EK system was designed and operated at a constant current, determined after the start-up period, during system operations. Given that the energy consumption is a function of voltage and current and, as discussed above regarding the steady system operation condition criterion, the overall system operations were steady and, thus, energy usage was also steady. The Dem/Val has met this criterion.

As noted in Section 1.2, only the first phase of testing (i.e., Phase 1 dipole test) was completed as a result of federal budget constraints. Other than a few occasions when the electrodes in the cathode wells needed to be cleaned, electrode function was maintained throughout system operations. The Dem/Val has met this criterion.

3.3 QUALITATIVE PERFORMANCE OBJECTIVES: DEMONSTRATE SAFETY, REALIABILITY, AND EASE OF IMPLEMENTATION

In addition to the quantitative objectives discussed above, qualitative objectives are also identified for this Dem/Val and include demonstrations of the safety, reliability, and ease of technology implementation.

3.3.1 Data Requirements

The suitability of the EK technology for full-scale implementation should include the considerations of safety and reliability of technology implementation. Operation records, including system operation monitoring records and field operators' notes, are the primary data for assessing the safety and reliability of the technology. For the ease of implementation criterion, field operation logs and records documented the utilization of field technician efforts for system operation and maintenance.

3.3.2 Success Criteria

This objective will be considered achieved if operational conditions remain stable over the course of the demonstration period and no lost-time incidents occur. The ease of technology implementation will be demonstrated if a single field technician is able to effectively monitor and maintain normal system operation.

3.3.3 Performance Objective Assessment

As discussed in Sections 7.1 and 7.2, the overall operational conditions remained relatively steady over the course of the Dem/Val, and there were no safety-related lost-time incidents. The Dem/Val has met these criteria.

The Dem/Val involved only conventional field construction techniques, including well drilling, well installation, and piping, as well as remediation system electrical connections performed by a qualified electrical subcontractor. The Dem/Val has met this criterion.

During system operations, one field technician performed routine system O&M tasks roughly twice per week with approximately 4 hours per visit. During the routine O&M visit, the tasks primarily included system visual inspections, recording the system operational parameters (voltage, current, amendment flow and pressure, etc.), and replenishing amendment solutions as needed. Additional system monitoring was completed remotely. Groundwater sampling events were also completed by one field technician. Over the course of system operations, there were fewer than 5 scheduled O&M events that involved two field technicians. The Dem/Val has met this criterion.

4.0 SITE DESCRIPTION

The target area for the EK-TAP Dem/Val is located within the vicinity of former Building 106 in Operable Unit 3 (OU3) at NAS Jacksonville (the Site; **Figures 4-1 and 4-2**), just south of where the ER-201325 EK-BIO Dem/Val was performed. Approval for performing the EK-TAP Dem/Val at the Site was granted by ESTCP in January 2019. This section provides a summary of site information most relevant to this technology Dem/Val.

4.1 SITE LOCATION AND HISTORY

The EK-TAP Dem/Val was conducted at NAS Jacksonville, which is located on the west bank of the St. Johns River in Duval County, Florida (**Figure 4-1**). The Dem/Val area is in OU3 in the vicinity of former Building 106, where the station's dry-cleaning facility once existed (**Figure 4-2**). The results of previous site characterizations in OU3 indicate that a tetrachloroethene (PCE) source zone exists in this area above and partially into a clay unit underneath the shallow sand unit.

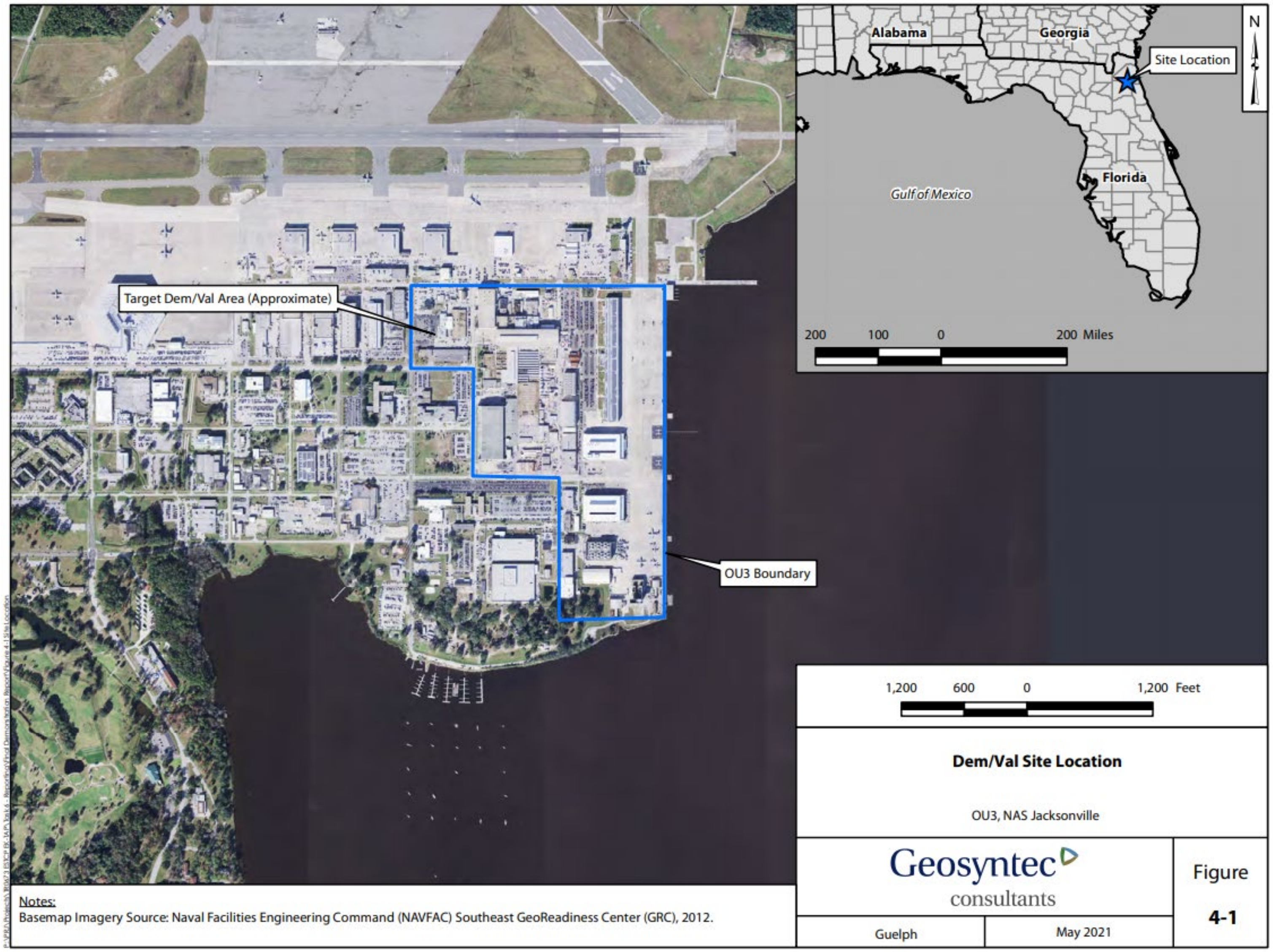
NAS Jacksonville was commissioned in October 1940 to provide facilities for pilot training and a Navy Aviation Trades School for ground crewmen. The buildings in OU3 are industrial, consisting of administrative space, workshops, storage, and aircraft hangars. The majority of the buildings were constructed in the 1940s with several additions and re-fabrications taking place since then. Over 90 percent of OU3 is covered with buildings and thick (greater than 1 foot [ft]) concrete pavement.

The contamination within OU3 that is the focus of this Dem/Val is associated with PSC 48, the former station's dry-cleaning facility located in former Building 106. PSC 48 encompasses the footprint and immediate surrounding area of former Building 106. PCE was released at former Building 106 through occasional spills and leaks, resulting in contamination of the shallow aquifer. PCE and its dechlorination daughter products, including trichloroethene (TCE), cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC), have been detected in this area in permeable sand layers within the shallow aquifer (5 to 16.5 feet below ground surface [ft bgs]). Moreover, site characterization results indicate that CVOC mass present in the low-K clay layer beneath the shallow sand aquifer can serve as a long-term source of contamination to the shallow aquifer (EISB Workplan, Geosyntec, 2013). This low-K clay layer beneath the shallow sand aquifer is the target for this EK technology Dem/Val.

4.2 SITE GEOLOGY/HYDROGEOLOGY

Site geology was characterized as part of a previous ESTCP Project (ER-0705), as described in the *Data Analysis Report for Field Event 4: NAS Jacksonville* (ESTCP, 2012b). Lithology at OU3 consists of inter-bedded layers of sand, clayey sand, sandy clay, and clay. Soil cores collected and logged at OU3 (ESTCP, 2012a) indicate that the site lithology generally consists of:

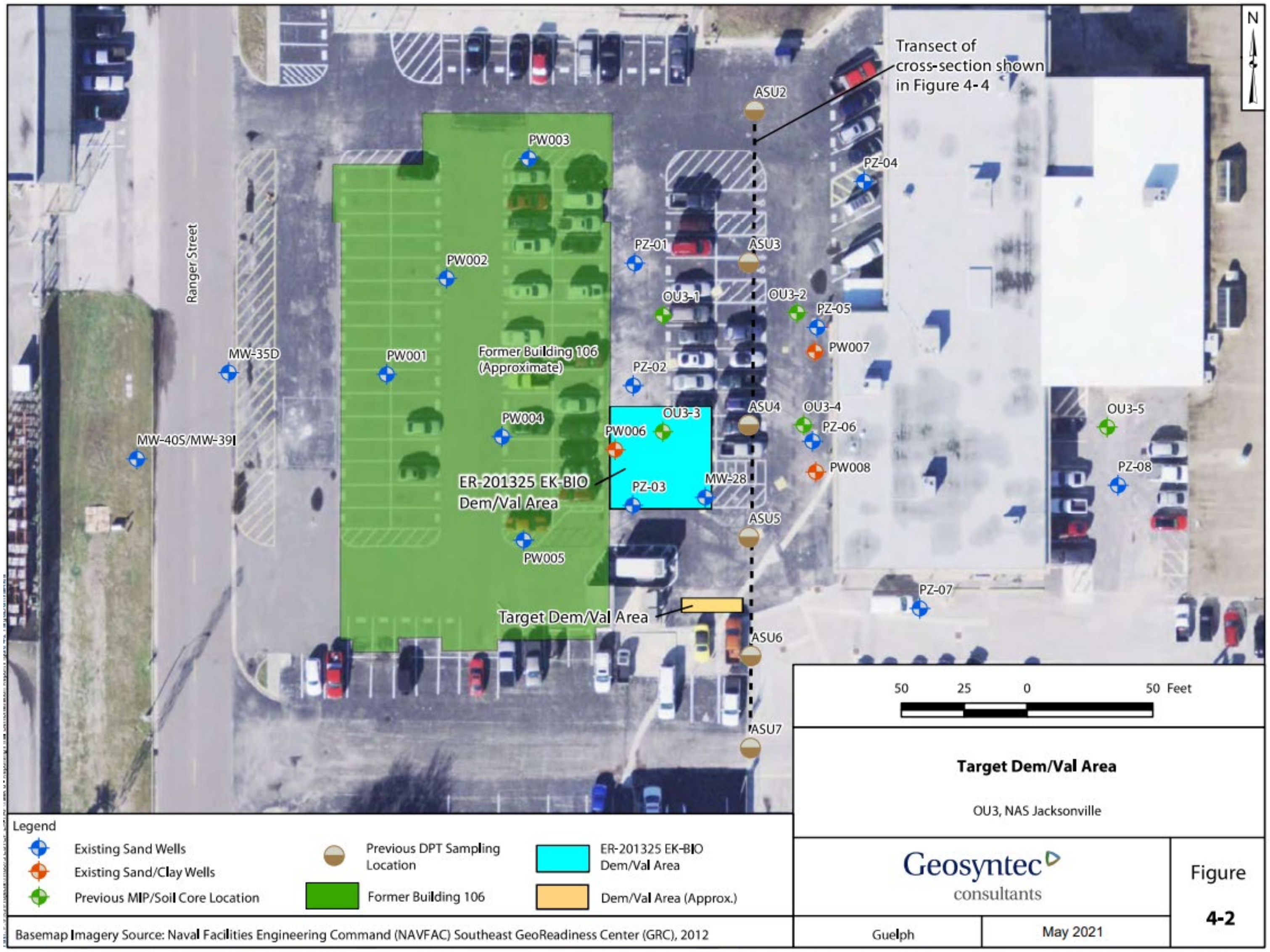
- 0.5 to 5 ft bgs: Fine sand with gravel and silt/clay;
- 5 to 7.5 ft bgs: Clay with trace sand and organic matter;
- 7.5 to 16.5 ft bgs: Fine sand/silt to fine sand with silt/clay;



Notes:
Basemap Imagery Source: Naval Facilities Engineering Command (NAVFAC) Southeast GeoReadiness Center (GRC), 2012.

Figure 4-1. Dem/Val Site Location

OU3, NAS Jacksonville



Basemap Imagery Source: Naval Facilities Engineering Command (NAVFAC) Southeast GeoReadiness Center (GRC), 2012

Figure 4-2. Target Dem/Val Area

OU3, NAS Jacksonville

- 16.5 to 18.5 ft bgs: Clay/silt with trace fine sand;
- 18.5 to 25 ft bgs: Clay with trace sand; and
- 25 to 30 ft bgs: Fine sand with silt/clay to fine sand.

A transition layer between the shallow sand and clay layers has been observed in some soil cores, generally between 13 and 16.5 ft bgs. A soil core, OU3-4 (location shown in **Figure 4-2**), exhibiting the lithology representative of the target area is presented below in **Figure 4-3**. The same lithology was again observed within the TTA for this Dem/Val during installation of the demonstration wells. The Dem/Val specifically targeted the CVOCs (predominately PCE) in the clay layer which is between approximately 16.5 to 24 ft bgs underneath the shallow sand unit in this area.

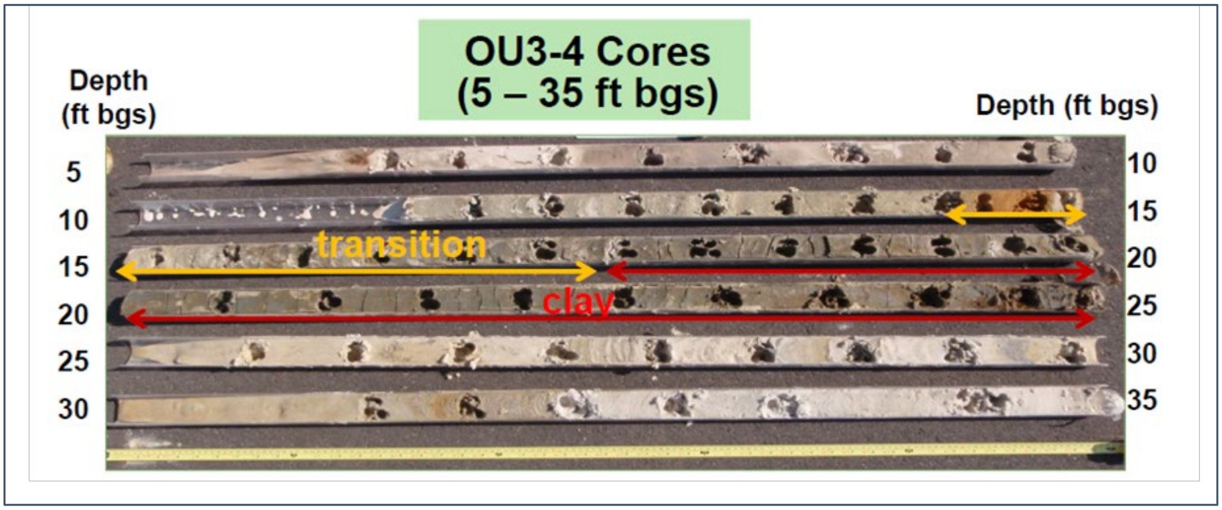


Figure 4-3. Lithology of the Target Dem/Val Area (OU3-4 from ESTCP ER-201032)

Groundwater in this area is generally first encountered at approximately 5 ft bgs and flows towards the east with gradients ranging from 0.005 to 0.02 (ESTCP, 2012b). Past hydraulic testing estimated the mid-range hydraulic conductivity of the shallow sand aquifer at $5x10^{-3}$ cm/s (ESTCP, 2012b). The linear groundwater velocity was estimated as high as 101 feet per year (using a gradient of 0.005 and the mid-range hydraulic conductivity).

ESTCP Project ER-0705 conducted depth-discrete, aquifer specific-capacity tests at various locations in this area, including along a transect from ASU-2 through ASU-7 shown in **Figure 4-2**. Depth-discrete hydraulic conductivity estimates for the clay unit beneath the shallow sand aquifer showed that at approximately 17 ft bgs the average K_h was $4x10^{-5}$ cm/s (September 2011 data); however, there was not enough water at 6 of the 7 locations tested at the depth of 22 ft bgs to provide steady-state flow rates needed for the specific-capacity testing. Based on the soil core lithology observation and the orders of magnitude decrease of K_h from the shallow sand ($5x10^{-3}$ cm/s) to the clay at a depth of 17 ft ($4x10^{-5}$ cm/s), it is believed that the clay material below 17 ft bgs has a hydraulic conductivity lower than 10^{-5} cm/s.

4.3 CONTAMINANT DISTRIBUTION

Site investigations prior to the Dem/Val showed that PCE and degradation daughter products (TCE, cDCE, and VC) were present in permeable sand layers within the shallow aquifer (5 to 16.5 ft bgs). Chlorinated ethenes have also migrated, in part through molecular diffusion, into the clay layer (generally from 16.5 to 24 ft bgs) present beneath the shallow sandy aquifer. PCE is the dominant groundwater CVOC in this area, with TCE, cDCE and VC detected at lower concentrations. The groundwater quality data collected in January 2013 before this Dem/Val (Tetra Tech, 2013) indicate that groundwater monitoring wells screened in the shallow aquifer within the target area have total chlorinated ethene concentrations ranging from 194 micrograms per liter (µg/L) in well PZ-04 to 51,000 µg/L in well PZ-02.

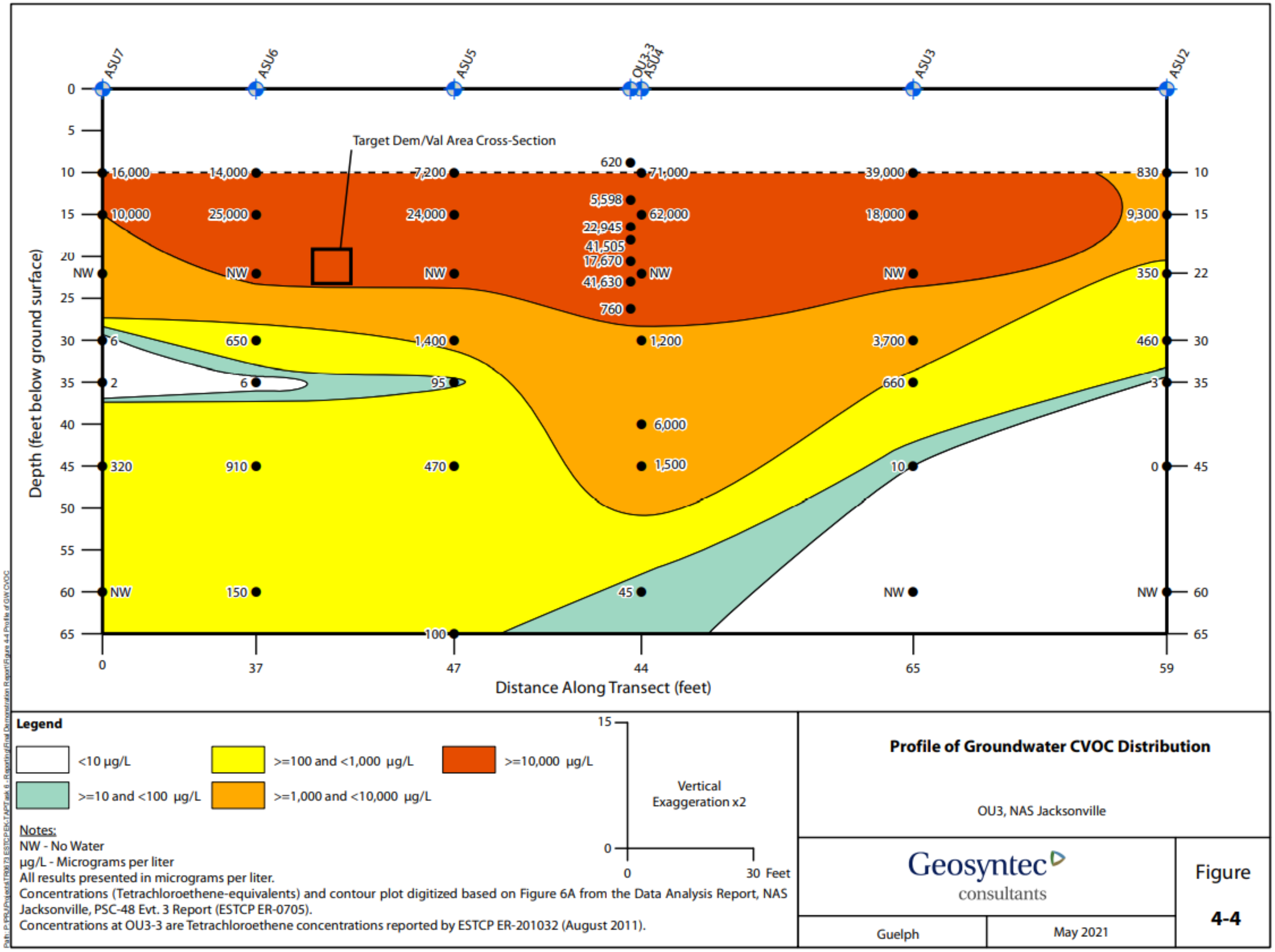
Previous SERDP/ESTCP projects have profiled the distribution of CVOCs across both the sand and clay units in the target Dem/Val area (**Figures 4-4 and 4-5**). **Figure 4-4** presents the distribution of CVOCs in groundwater along a north-south cross section just to the east (downgradient) of the target Dem/Val area (transect along ASU2 through ASU7 shown in **Figure 4-2)**.

As shown in **Figures 4-2** and **4-4**, previous sampling location OU3-3 is located just to the north of the target Dem/Val area, and within the footprint of the ER-201325 EK-BIO Dem/Val. **Figure 4-5** presents a conceptualized geologic cross section derived from high-resolution coring conducted at OU3-3 (ESTCP project ER-201032). At OU3-3, the vertical distribution of PCE, TCE, and cDCE in soil and groundwater at depths above, within, and below the clay unit depicts a classic PCE diffusion profile, with PCE penetration into approximately the upper 5 feet of the clay unit. Porewater PCE concentrations detected at OU3-3 at various depths across the clay unit ranged from 15,000 to 40,000 µg/L, indicating significant contamination within the depth interval targeted by the Dem/Val (~ 16.5 to 24 ft bgs).

Based on the site characterization results discussed above, the CVOCs residing in the clay unit in the proximity of OU3-3 represent a long-term continuing source for groundwater CVOC contamination in this and potentially the surrounding area.

During the ER-201325 EK-BIO Dem/Val, concentrations of PCE at well EKMW-11 which is located within the TTA of this EK-TAP Dem/Val, ranged from 160 µg/L to 5,850 µg/L.

Subsequent characterization data collected during the baseline sampling event for this Dem/Val are presented in Section 5.3.



Notes:
NW - No Water
µg/L - Micrograms per liter
All results presented in micrograms per liter.
Concentrations (Tetrachloroethene-equivalents) and contour plot digitized based on Figure 6A from the Data Analysis Report, NAS Jacksonville, PSC-48 Evt. 3 Report (ESTCP ER-0705).
Concentrations at OU3-3 are Tetrachloroethene concentrations reported by ESTCP ER-201032 (August 2011).

Figure 4-4. Profile of Groundwater CVOC Distribution

OU3, NAS Jacksonville

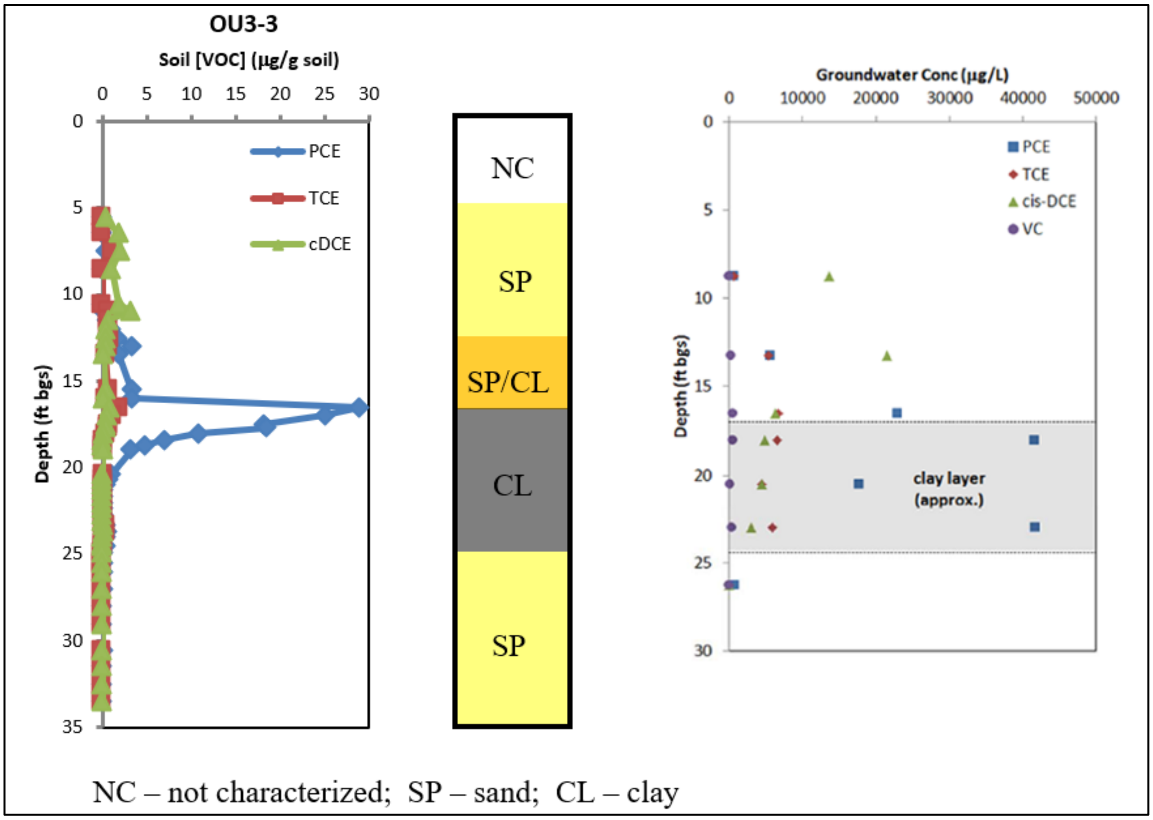


Figure 4-5. Profiles of Soil and Groundwater CVOC Concentrations at OU3-3

(Source: ESTCP Project ER-201032)

5.0 TEST DESIGN

This section provides details pertaining to the design, installation, and implementation of the Dem/Val at the Site.

5.1 EXPERIMENTAL DESIGN

As discussed in the Demonstration Plan (Geosyntec, 2019b), a phased testing approach was developed for the Dem/Val. The first phase of testing (i.e., Phase 1 dipole test) was designed to assess the applicability of EK to migrate persulfate within the clay unit using *DC* power. The second phase of testing (i.e., Phase 2 heating and persulfate activation) was designed to assess the ability of the system components to heat the subsurface (using *AC* power) to the activation temperature of persulfate, and then evaluate treatment of the target contaminants following heat activation of the distributed persulfate. However, as noted in Section 1.2, only the first phase of testing was completed as a result of federal budget constraints.

The Phase 1 dipole test involved the installation of three (3) electrode wells (E10 through E12), four (4) supply wells (S9 through S12), and three (3) monitoring wells (EKMW-12, EKMW-13B and EKMW-14) south of the EK-BIO Dem/Val test area and oriented to include existing well EKMW-11 from the EK-BIO Dem/Val as a monitoring well for the Phase 1 dipole test (**Figure 5-1**). The target treatment interval (TTI) was from approximately 19 to 23 feet below ground surface (ft bgs) and within the clay unit. Prior to installing the wells, a comprehensive utility locate was conducted in the proposed Dem/Val area to help with positioning of the wells and to identify possible routes for transient contact with energized infrastructure during system operations.

As shown in **Figure 5-2**, the power supply unit, amendment supply units and manifolds, and system operation monitoring and control unit were housed in two 20-ft trailers (Control and Tank trailers) to the south of the Dem/Val test area. Amendment conveyance and electrical lines between the wells and the trailers were installed above ground in polyvinyl chloride (PVC) conduits, and temporary, lockable fencing was positioned around the test area as a security measure.

An underground injection control (UIC) notification memorandum was prepared and submitted to the Florida Department of Environmental Protection (FDEP) in July 2019 to request approval for injection of sodium persulfate and pH buffers via the supply and electrode wells, respectively. Preparation of the UIC notification memorandum included additional analytical testing of the proposed pH buffers in order to determine their chemical composition. In our experience at other sites, additional analytical testing of the chemical amendments (i.e., beyond information provided in the manufacturer-provided chemical safety data sheets) is not typically required. Approval of the proposed injection activities was granted by FDEP in September 2019 (FDEP, 2019). A subsequent UIC modification request was submitted to FDEP in January 2020 to request approval for increasing the quantity of potassium bicarbonate that will be added via the electrode wells during pilot test operations. The UIC modification request was approved by FDEP in February 2020 (FDEP, 2020).

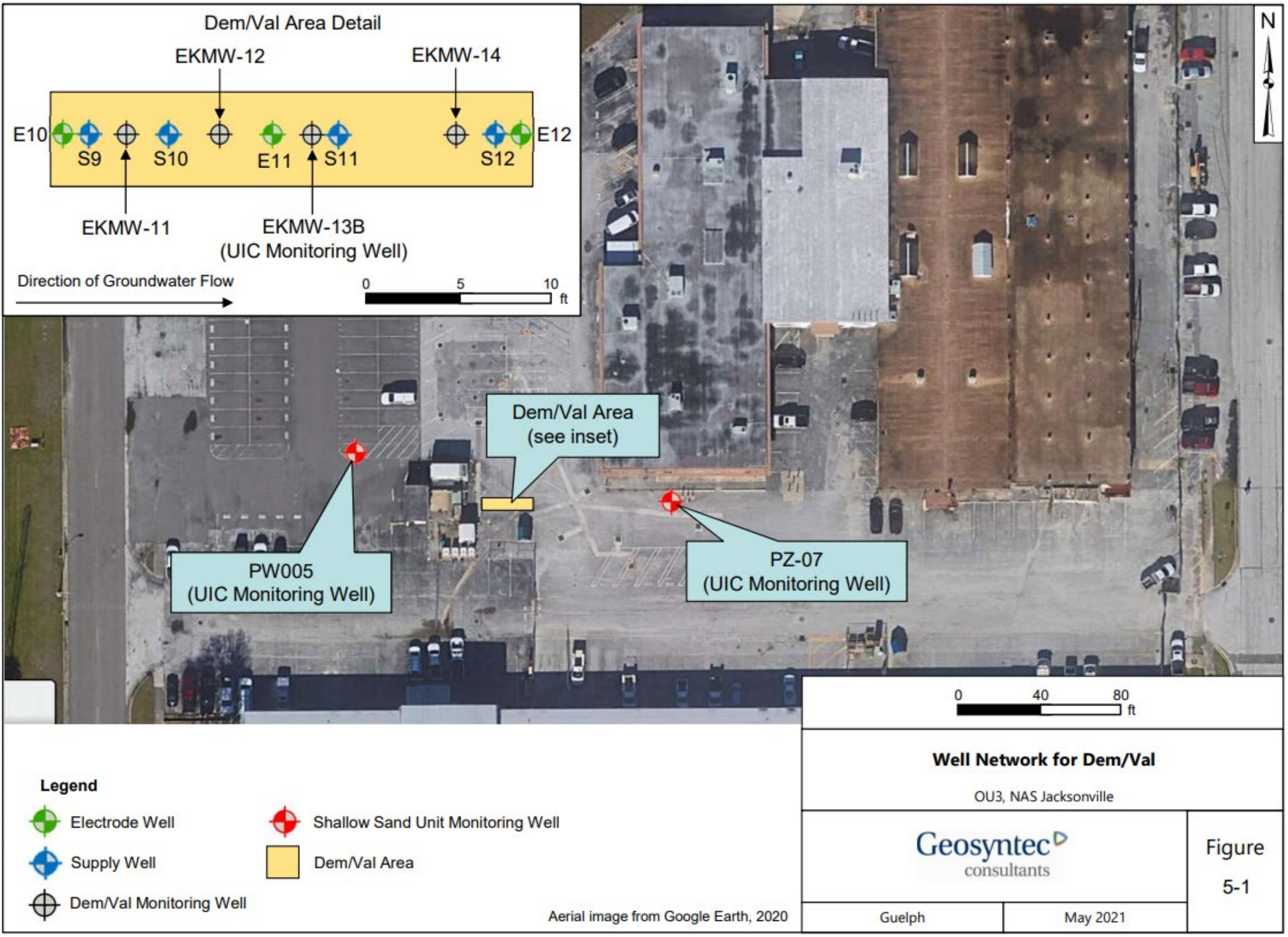


Figure 5-1. Well Network for Dem/Val

OU3, NAS Jacksonville

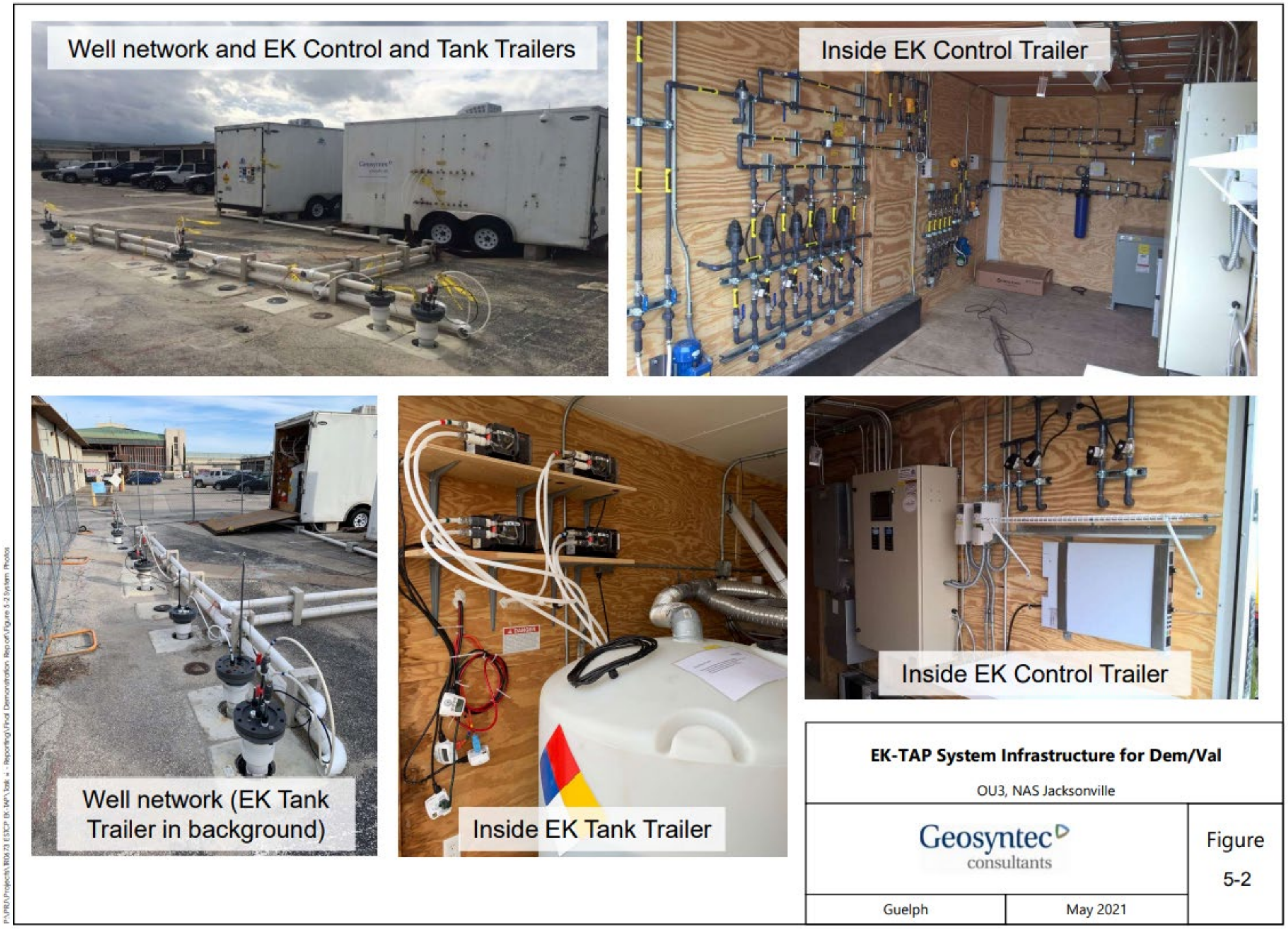


Figure 5-2. **EK-TAP System Infrastructure for Dem/Val**

OU3, NAS Jacksonville

Baseline soil samples were collected during installation of the wells, and baseline groundwater samples were collected following well installation and development. Baseline characterization results are presented in Section 5.3.

The Phase 1 dipole test began on October 9, 2019 and continued until May 8, 2020 (approximately 7 months). During Phase 1 operations, sodium persulfate was added at the supply wells. A *DC* electric field was established across the TTA between the cathodes and anode, and the induced *DC* electric field facilitated the transport of persulfate by electromigration. pH buffer (potassium bicarbonate or potassium carbonate) was added to the electrode wells to allow for pH control in these wells. The EK system also allowed for cross-circulation of electrolytes (fluids in electrode wells) between the cathodes and anode for overall pH control. Groundwater samples were collected from the monitoring wells on a bi-weekly basis for analysis of field parameters (temperature, pH, specific conductance, dissolved oxygen [DO], oxidation-reduction potential [ORP], and turbidity), persulfate, sulfate, sulfur, dissolved iron and manganese, and TOC. Results of the performance monitoring groundwater sampling program are presented in Section 6.2.

Of note, the design for the Dem/Val did not include a "blank" or control cell for comparison (i.e., where a persulfate oxidation or ERH approach is implemented without the use of EK delivery) as the state of the technology is such that the extra cost was not considered an effective return on investment.

5.2 LABORATORY TREATABILITY STUDY RESULTS

Several laboratory treatability studies were performed during the site selection/re-selection process and included laboratory natural oxidant demand tests and 1-dimensional column tests to assess the applicability of the EK-TAP technology for the OU3 area at NAS Jacksonville. Results of the studies suggested that the Building 106 area may be a suitable location for the Dem/Val, and also served as the basis for performing the Dem/Val in a phased approach. Additional details and results of the studies are presented in other reports (Geosyntec, 2016; Geosyntec, 2019a).

5.3 BASELINE CHARACTERIZATION

As discussed in Section 4, several previous SERDP/ESTCP projects (ER-0705, ER-1740, ER-201032, and ER-201325) have characterized the geology, hydrogeology, and contaminant distribution in the general area that encompasses the target Dem/Val area.

To establish the baseline geochemical conditions and contaminant distribution specifically within the TTA for this Dem/Val, soil characterization was performed during installation of select wells, and groundwater characterization was performed following installation of the monitoring wells. **Table 5-1** presents a summary of the baseline sampling program that was performed for this Dem/Val.

Table 5-1. Summary of Baseline Sampling Program

	Matrix	Frequency	Analyses	Location
Baseline Sampling	Soil	Two depths per boring	CVOCs(1), anions(2), total metals(3), pH, and total sulfur	E10, E11
	Groundwater	One Time	Field geochemistry(4), CVOCs, persulfate(5), anions(2), TOC, metals(3)	EKMW-11, EKMW-12, EKMW-13B, EKMW-14

(1) CVOCs: PCE, TCE, cDCE, and VC.
(2) Anions = chloride, nitrate, nitrite, sulfate.
(3) Metals = iron, manganese, calcium, and magnesium.
(4) Field geochemistry = temperature, pH, specific conductance, DO, ORP, and turbidity.
(5) Persulfate concentration in groundwater will be measured in the field using a field test kit.

Soil cores for the baseline sampling event were collected using a split spoon sampling approach during installation of wells E10 and E11. At each location, soil cores were obtained from depths between approximately 15 ft bgs and 23 ft bgs. The cores were also screened using a photo-ionization detector (PID) and field personnel logged the cores for soil type and stratigraphy. Sample depths were decided in the field based on PID concentrations and observations of lithology to bias the sampling towards clay materials. Two soil samples were collected from each of E10 and E11, at depths ranging between 17 and 21 ft bgs, and samples were submitted for laboratory analyses of CVOCs, anions, total metals, pH, and total sulfur (**Table 5-1**). Terra Core samplers were used for soil sample collection to minimize volatilization loss, and all down-hole drilling equipment was decontaminated between borings.

Following installation and development of the monitoring wells, groundwater samples were collected from all four Dem/Val groundwater monitoring wells (EKMW-11, EKMW-12, EKMW-13B and EKMW-14). Baseline geochemical characterization of groundwater included measurements of field parameters (temperature, pH, specific conductance, DO, ORP, electrical conductivity, and turbidity) and persulfate. Groundwater samples were collected and submitted for laboratory analyses of CVOCs, anions (chloride, nitrate, nitrite and sulfate), TOC, and dissolved metals (iron, manganese, calcium and magnesium). Additional samples were collected from well EKMW-13B and other wells outside of the TTA for analyses required under the UIC Approval Order.

Field sampling and laboratory analyses were performed in accordance with the sampling and analysis methods presented in Section 5.6. Field sampling forms are provided in **Appendix A**. The baseline soil sampling results are summarized in **Table 5-2**. The baseline groundwater sampling results are summarized along with the performance monitoring results and are presented in **Tables 6-2 to 6-4** in Section 6.2.

The baseline soil characterization data was consistent with baseline soil data from the EK-BIO Dem/Val and suggested that the majority of soil PCE within the TTA appeared to be present above a depth of 21 ft. The baseline groundwater characterization data indicated that groundwater within the TTA was generally acidic and slightly reducing, with elevated concentrations of iron at some wells.

Table 5-2. Baseline Soil Results

OU3, NAS Jacksonville

Well ID	Sample Date	Depth (ft)	Volatile Organic Compounds (µg/kg)				Metals (mg/kg)			
			PCE	TCE	cDCE	VC	Calcium	Iron	Magnesium	Manganese
E10	11-Jun-19	19	**7800 J**	**41 J+**	**42**	**1.9 J**	**2,500**	**11,000**	**1,700**	**52**
	11-Jun-19	21	**130**	**2.8 J**	**1.6 J**	2.2 U	**2,300**	**10,000**	**1,500**	**51**
E11	12-Jun-19	17	**7500 J**	**44 J+**	**33**	**1.1 J**	**2,000**	**9,100**	**1,400**	**42**
	12-Jun-19	19	**3700 J**	**13 J+**	**6.8**	2.5 U	**2,800**	**15,000**	**1,900**	**64**
DUP	12-Jun-19	19	**3700 J**	**14 J+**	**8.3**	2.4 U	**2,600**	**13,000**	**1,800**	**54**
Trip Blank (a)	12-Jun-19	--	0.5 U	0.5 U	0.5 U	0.5 U	--	--	--	--

Well ID	Sample Date	Depth (ft)	Anions (mg/kg)				Sulfur (mg/kg)	pH(b)
			Nitrate	Nitrite	Sulfate	Chloride		
E10	11-Jun-19	19	**0.26**	0.13 U	**7.3**	**600**	550 U	5.0 J
	11-Jun-19	21	**0.50**	0.13 U	**2.5 J**	**360**	560 U	5.0 J
E11	12-Jun-19	17	**0.14 J**	0.13 U	**7.2**	**650**	490 U	4.8 J
	12-Jun-19	19	**0.1 J**	0.14 U	**2.4 J**	**610**	590 U	5.1 J
DUP	12-Jun-19	19	**0.24 J**	0.14 U	**2.3 J**	**690**	530 U	5.1 J
Trip Blank (a)	12-Jun-19	--	--	--	--	--	--	--

Notes:

Bold values indicate detected results
(a) Concentrations for Trip Blank are reported in micrograms per liter (µg/L)
(b) - pH adjusted to 25 °C

µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
DUP - Duplicate sample
J - Estimated concentration
J+ - bias is high
U - Not detected above the reporting limit listed
-- - Not analyzed/not applicable

5.4 DESIGN AND LAYOUT OF TECHNOLOGY COMPONENTS

The locations of the electrode wells, supply wells, and monitoring wells are shown in **Figure 5-1.** System components and equipment for amendment supply were housed in the Control and Tank trailers that were positioned to the south of the Dem/Val test area. Prior to field construction and installation, a comprehensive utility locate and survey was conducted in the proposed Dem/Val area. The Dem/Val system design and well network was adjusted based on the results of these surveys. The following sections describe the specifics of individual system components.

5.4.1 Electrode Wells

Three electrode wells (E10 through E12) were installed by hollow stem auger (HSA) drilling in the TTA. Descriptions of the lithology and electrode well construction details are provided in the borehole logs in **Appendix B**. Electrode well construction details are provided in **Figure 5-3**. Each electrode well was constructed with 4-inch diameter PVC riser casing and a 4-ft long, 0.01-inch slotted screen. The screened interval was between approximately 19 and 23 ft bgs (i.e., same screened interval as existing monitoring well EKMW-11) within the clay unit. A medium sand (20/30) filter pack was placed around the screen from the bottom of the borehole up to the top of the screen, and topped by a fine sand (30/65) filter pack up to one foot above the screened interval. A 2-ft thick bentonite seal was installed above the sand. Grout, consisting of Type I/II Portland cement, was then added to fill the remaining annulus up to the bottom of the well vault.

The electrode wells were completed as flush mounts during installation, with surface completions consisting of an 8-inch steel traffic rated manhole cover set in a 2 ft x 2 ft x 6-inch thick concrete pad. The pad was sloped away from the well to shed surface water. The top of the riser casing was fitted with a threaded coupling to accommodate a PVC riser extension and flange assembly that extended approximately 1 ft above ground surface and facilitated installation of the down-well components. Access ports were installed in the flange for installation of the electrode, tubing for buffer addition and pH monitoring, and level switches. **Figure 5-4** presents the details of the electrode well surface completions.

5.4.2 Supply Wells

Four supply wells (S9 through S12) were installed by HSA drilling in the TTA. Descriptions of the lithology and supply well construction details are provided in the borehole logs in **Appendix B**. Supply well construction details are provided in **Figure 5-5**. Each supply well was constructed with 4-inch diameter PVC casing and 0.01-inch slotted screen. The screened interval was between approximately 19 and 23 ft bgs (i.e., same screened interval as existing monitoring well EKMW-11) within the clay unit. Two voltage probes were attached to the slotted screen portion of supply well S9 for use in monitoring the distribution of the electric field within the TTA during Phase 1 operations. A medium sand (20/30) filter pack was placed around the screen from the bottom of the borehole up to the top of the screen and topped by a fine sand (30/65) filter pack up to one foot above the screened interval. Approximately 2-ft thick bentonite seal was installed above the sand pack by placing bentonite pellets and hydrating for at least one hour. Grout, consisting of Type I/II Portland cement, was then added to fill the remaining annulus up to the bottom of the well vault.

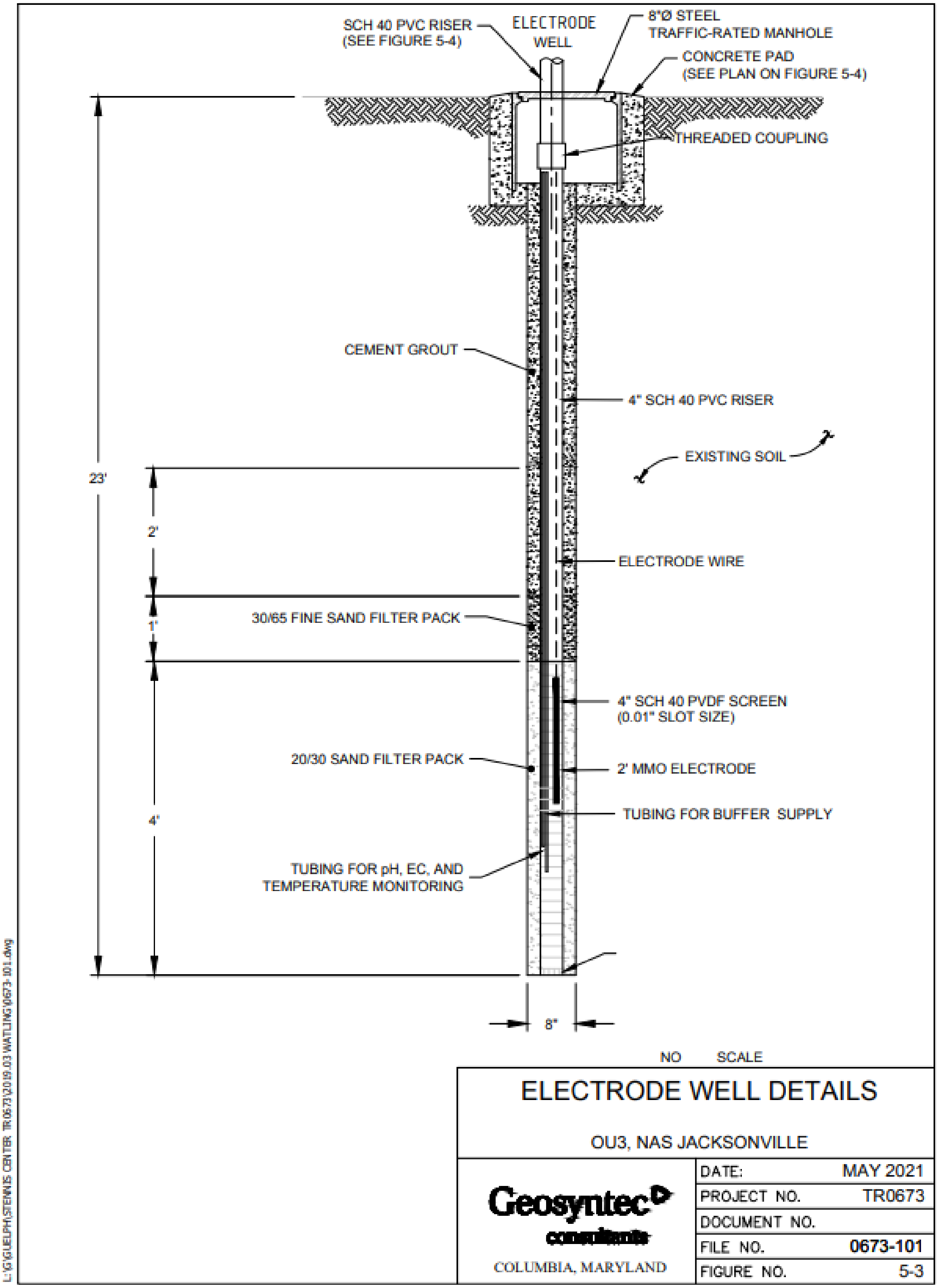


Figure 5-3. Electrode Well Details

OU3, NAS Jacksonville

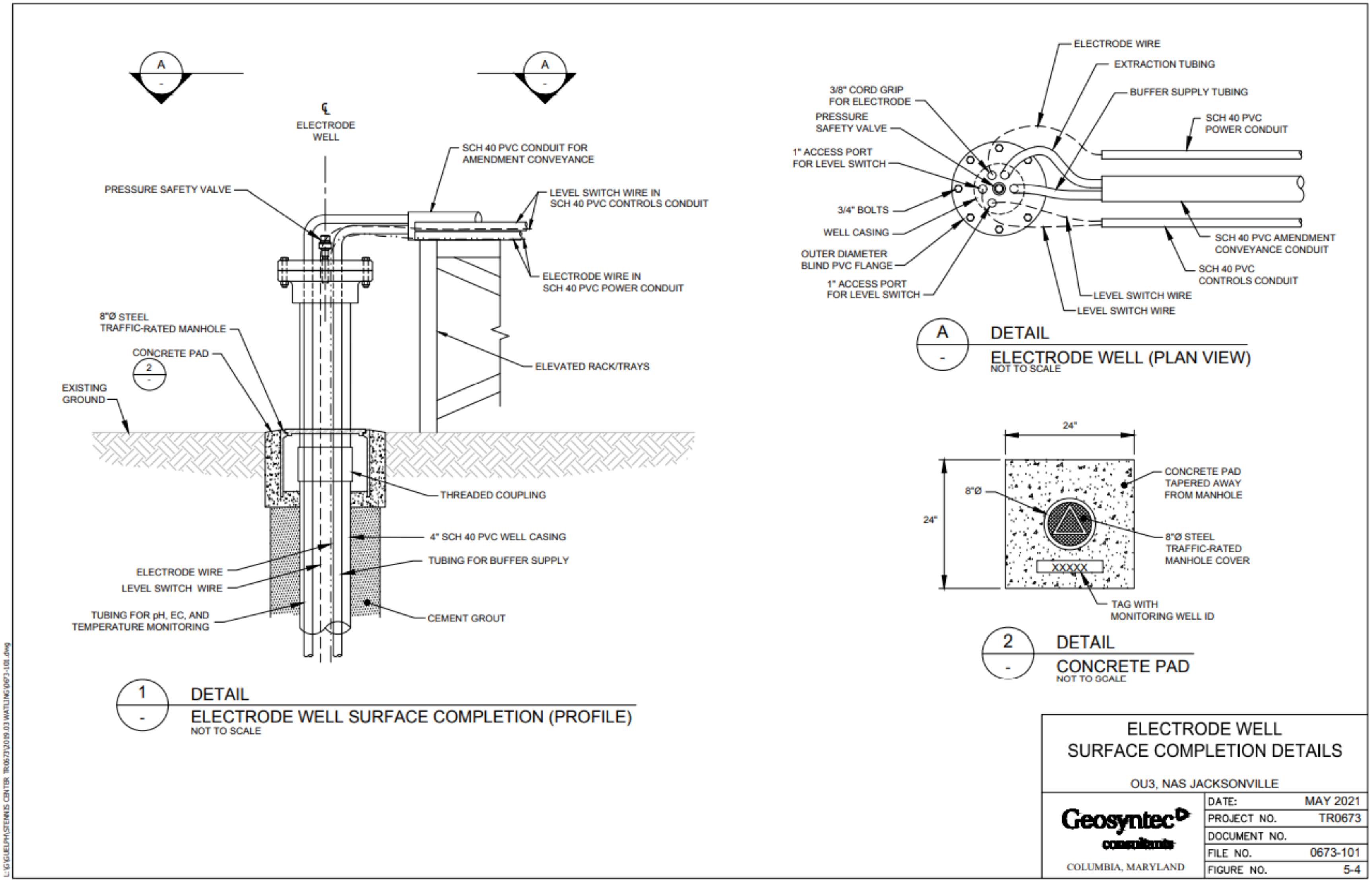


Figure 5-4. Electrode Well Surface Completion Details

OU3, NAS Jacksonville

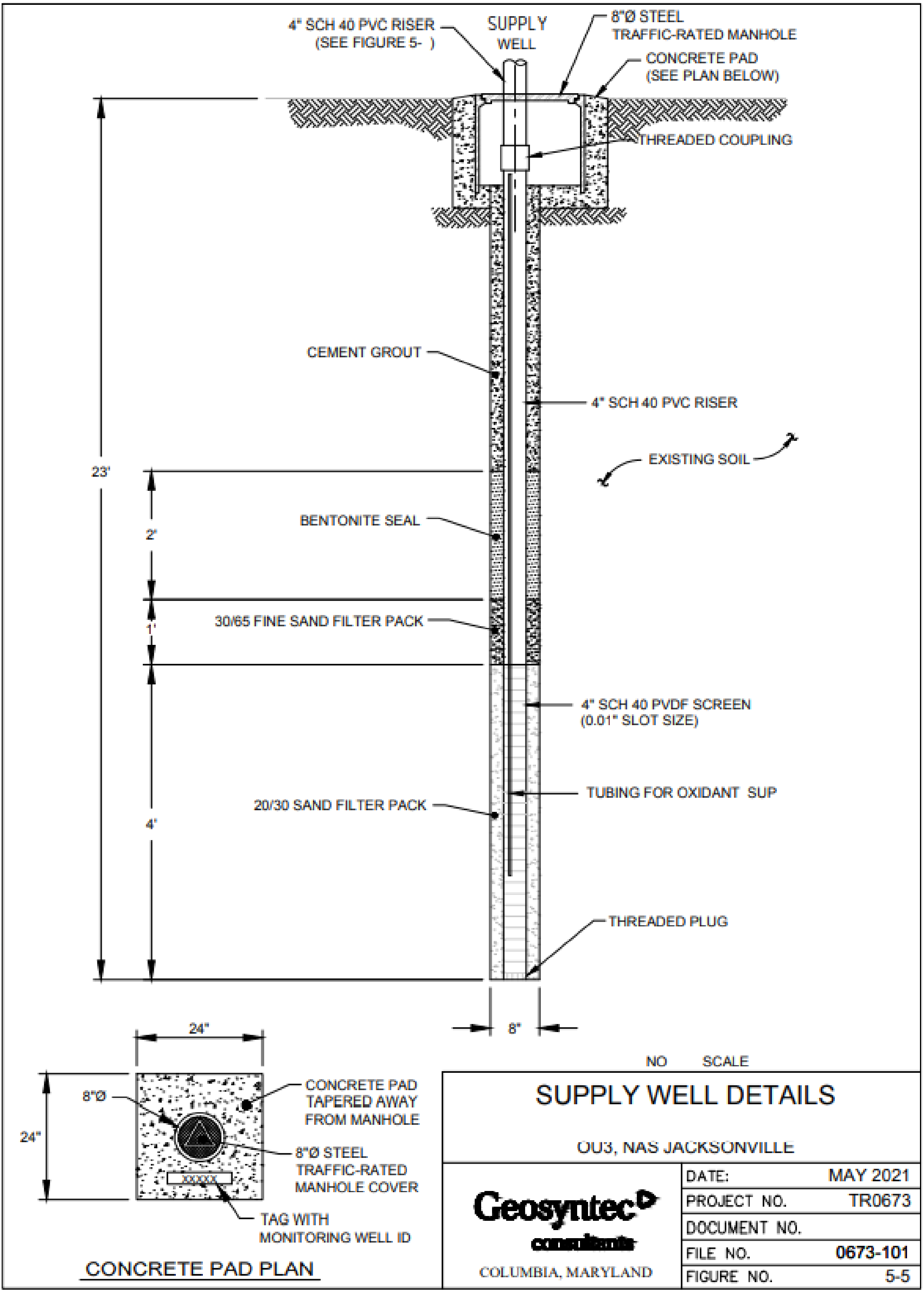


Figure 5-5. Supply Well Details

OU3, NAS Jacksonville

The supply wells were completed as flush mounts during installation, with surface completions consisting of an 8-inch steel traffic rated manhole cover set in a 2 ft x 2 ft x 6-inch thick concrete pad. The pad was sloped away from the well to shed surface water. The top of the riser casing was fitted with a threaded coupling to accommodate a PVC riser extension and flange assembly that extended approximately 1 ft above ground surface and facilitated installation of the down-well components, including level switches and tubing for persulfate addition. **Figure 5-6** presents the details of the supply well surface completions.

5.4.3 Clay Unit Monitoring Wells

Three monitoring wells (EKMW-12, EKMW-13B and EKMW-14) were installed in the clay unit of the TTA using HSA drilling. Descriptions of the lithology and monitoring well construction details are provided in the borehole logs in **Appendix B**. Monitoring well construction details are provided in **Figure 5-7**. Monitoring wells were constructed as double-cased wells, each with a 6-inch PVC surface casing installed to approximately 18 ft bgs and grouted in place. Each monitoring well was then constructed by drilling through the bottom of the grouted 6-inch casing and installing 2-inch diameter PVC casing and 0.01-inch slotted screen. The screened interval was between approximately 19 and 23 ft bgs (i.e., same screened interval as existing monitoring well EKMW-11) within the clay unit. Two voltage probes were attached to the slotted screen portions of monitoring wells EKMW-12, EKMW-13B and EKMW-14 for use in monitoring the distribution of the electric field within the TTA during Phase 1 operations. A medium sand (20/30) filter pack was placed around the screen from the bottom of the borehole up to the top of the screen, and topped by a fine sand (30/65) filter pack above the screened interval. A bentonite seal was then installed above the sand pack by placing bentonite pellets and hydrating for at least one hour. Grout, consisting of Type I/II Portland cement, was then added to fill the remaining annulus up to the bottom of the well vault.

Surface completions for the monitoring wells consisted of an 8-inch steel traffic rated manhole cover set in a 2 ft x 2 ft x 6-inch thick concrete pad. The pad was sloped away from the well to shed surface water. The top of the well casing was fitted with a compression cap to prevent entry of surface water.

5.4.4 Power Supply and Electrodes

Power for the Control and Tank trailers was obtained from the existing electrical panel that was installed for the EK-BIO Dem/Val, and all electrical connections between the panel and trailers were completed by a licensed electrician. *DC* power for Phase 1 operations was supplied by a Magna Power SL 160-9/VI (160 VDC, 9A, 120V AC in) power supply unit. The *DC* power supply was operated in constant current mode allowing the voltage to automatically adjust to the changes in soil conductivity.

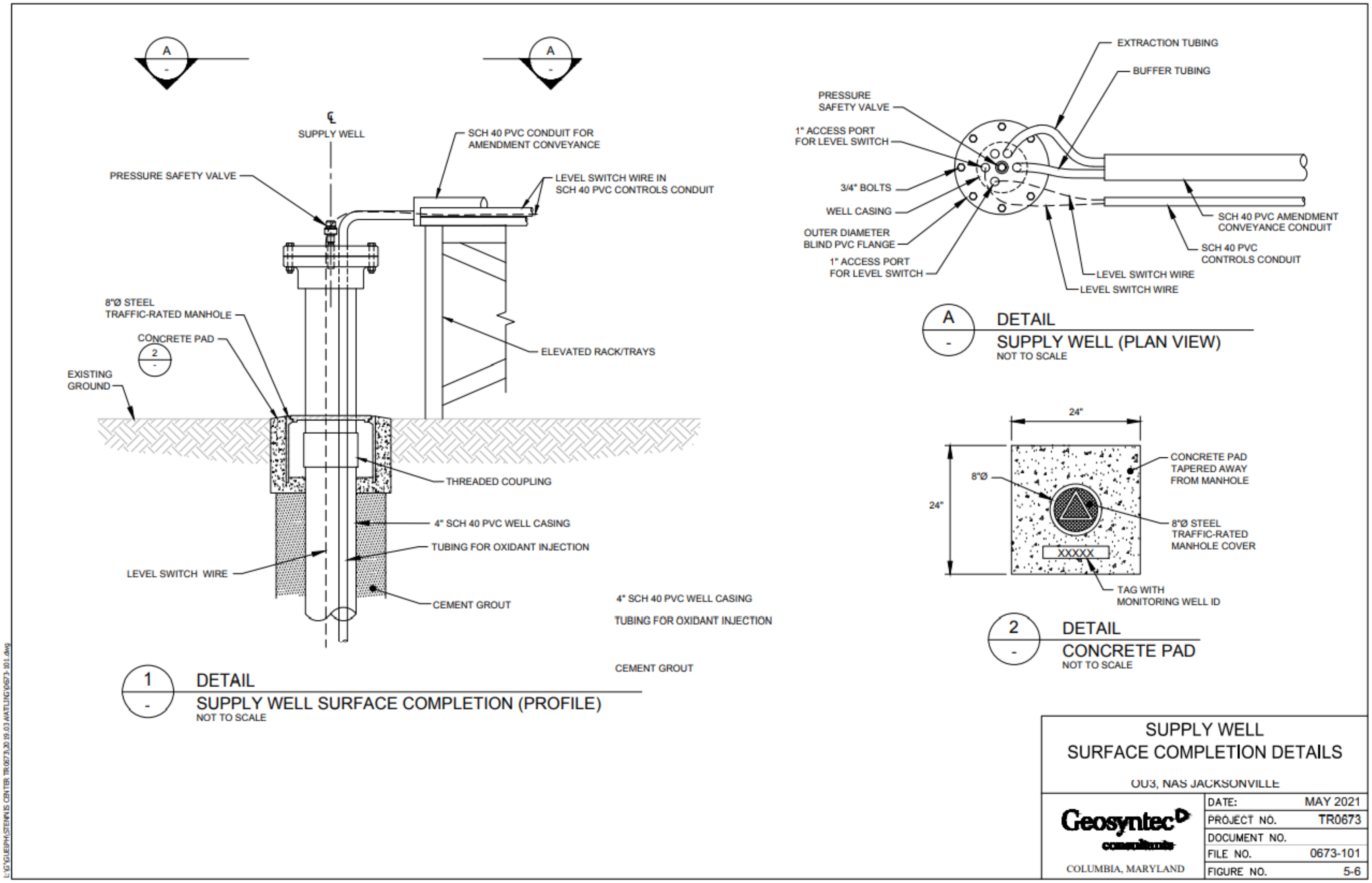


Figure 5-6. Supply Well Surface Completion Details

OU3, NAS Jacksonville

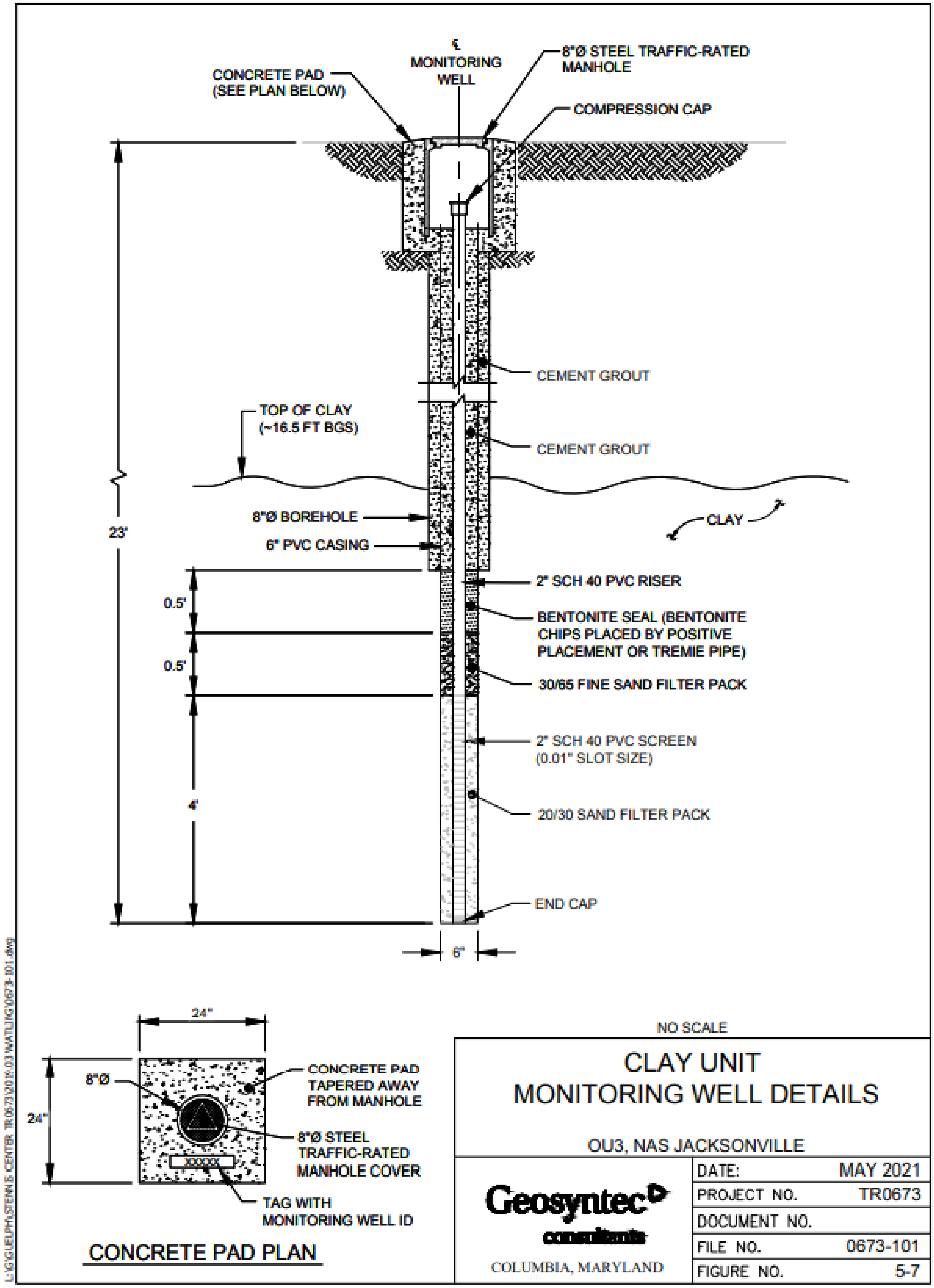


Figure 5-7. Clay Unit Monitoring Well Details

OU3, NAS Jacksonville

Each electrode was a titanium rod (¾-inch diameter) with a mixed metal oxide (MMO) coating manufactured by Water Star. The coating consists of IrO_2/Ta_2O_5 and was suitable for use in soils, carbonaceous backfill, fresh and brackish water, seawater and concrete. The titanium substrate is designed to remain stable throughout the design life of the electrode. Each electrode was 24 inches in length and one electrode was hung in each electrode well with the top of the electrode positioned at the top of the well screen. The electrode was center-connected to cathodic protection cable. The cable contained soft drawn bare copper strand surrounded with low-density polyethylene (LDPE) covering that is designed for use in cathodic systems to protect against galvanic and electrolytic corrosion.

5.4.5 Amendment Supply System

Dedicated amendment conveyance tubing ran between the EK Control and Tank trailers and the electrode well network through aboveground PVC conduits. Sodium persulfate (40 grams per liter [g/L]) was delivered from a 350-gallon chemical holding tank to the supply wells using timer-controlled chemical feed pumps. The sodium persulfate solution was prepared by mixing solid sodium persulfate (Klozur® SP; PeroxyChem) with potable water in the chemical holding tank.

Electrolysis of water in electrode wells produces acid (at the anode) and base (at the cathode) resulting in pH changes. A recirculation pump system was used to monitor the pH of the groundwater within each electrode well, and pH buffer (potassium bicarbonate or potassium carbonate) was supplied from a 500-gallon chemical holding tank to the cathode and anode wells as needed to adjust the pH in these wells. The pH buffer solutions were prepared by mixing solid potassium bicarbonate or potassium carbonate with potable water and/or extracted water from the electrode wells to a maximum concentration of 1.7 g/L (limited by the UIC Approval Order). Addition of the pH buffers was performed in timed additions using a feed pump controlled by the system programmable logic controller (PLC).

All chemical holding tanks were located in the Tank trailer. All groundwater amendments used during the Dem/Val were approved under the UIC permit (Geosyntec, 2019c; FDEP, 2019; FDEP, 2020). The volumes and concentrations of amendments delivered during Phase 1 operations are presented and discussed in Section 5.5.2.

5.4.6 Process Monitoring and Controls

The EK system was constructed with instrumentation and controls to monitor and operate the system automatically using a PLC that was housed within the Control trailer. Overall operation of the pumps for amendment supply and electrolyte cross-circulation was controlled by timers in the PLC. The PLC also controlled solenoid valves in the Control and Tank trailers to direct flows between the chemical holding tanks and individual wells.

In-line water quality stations monitored the pH, temperature, and electrical conductivity (EC) of the fluid coming from/to an individual electrode well. Voltage was also monitored at the voltage probes installed on select supply or monitoring wells. Data acquisition systems were used to record all data collected.

5.4.7 Conveyance Piping and Utilities

Dedicated amendment conveyance tubing ran between the EK Control and Tank trailers and the electrode well network through aboveground PVC conduits (**Figure 5-2**). The conduits were supported using elevated pipe supports. All electrical connections between the existing electrical panel and the trailers were completed by a licensed electrician.

5.5 FIELD TESTING

As discussed in Section 5.1, a phased testing approach was developed for the Dem/Val. However, due to federal budget constraints only the first phase of testing was completed. This section provides a description of the Phase 1 dipole test activities.

5.5.1 System Start-up

EK system start-up commenced following installation and shakedown of the system components described above in Section 5.4, and issuance of the UIC Approval Order from FDEP. System start-up activities involved intermittent *DC* application *via* the down-well electrodes in E10, E11 and E12, along with extraction of water from these wells, amendment of extracted water with potable water and potassium bicarbonate, and addition of the amended water *via* the same wells (E10, E11 and E12). A small amount of potable water was also injected *via* supply wells S9 and S12 during system shakedown testing. Surface testing of voltages all metal structures in the vicinity of the TTA was also conducted using a handheld voltage meter during start-up to confirm that structures were not energized by the EK infrastructure. The field personnel wore rubber boots and rubber gloves when performing this task.

Start-up operations included continuous monitoring of PLC data to monitor and adjust system operations as needed based on field observations. Amendment dosing rates and timing for the electrode and supply wells were adjusted, as necessary, based on operations monitoring. A recirculation pump system was used to monitor the pH of the groundwater within each electrode well. If the pH increased (at the cathodes) or decreased (at the anode) beyond the system alarm setpoints, the PLC would turn off the *DC* power supply to help prevent the development of highly acidic or basic conditions from forming within the wells which could result in damage to the wells or down-well components.

The distribution of the electric field within the TTA was monitored using voltage probes attached to the slotted screens of the monitoring wells and supply well S9. As discussed in Section 6.1, a relatively uniform electric field was confirmed for the TTA based on the voltage measurements taken at these locations.

5.5.2 Phase 1 Operations – Persulfate Migration

Phase 1 operations was initiated on October 9, 2019 and continued for approximately 7 months until May 8, 2020, when operations ended. Phase 1 operations involved the following activities:

1. Extraction of groundwater from wells E10, E11 and E12, amendment of extracted groundwater with potable water and potassium bicarbonate or potassium carbonate, and addition of the amended water *via* wells E10, E11 and E12;

2. Addition of sodium persulfate (40 g/L) *via* wells S9 and S12 from October 9, 2019 to May 8, 2020;
3. Addition of sodium persulfate (40 g/L) *via* wells S10 and S11 from December 9, 2019 to May 8, 2020; and
4. Application of *DC via* the down-well electrodes in E10, E11 and E12.

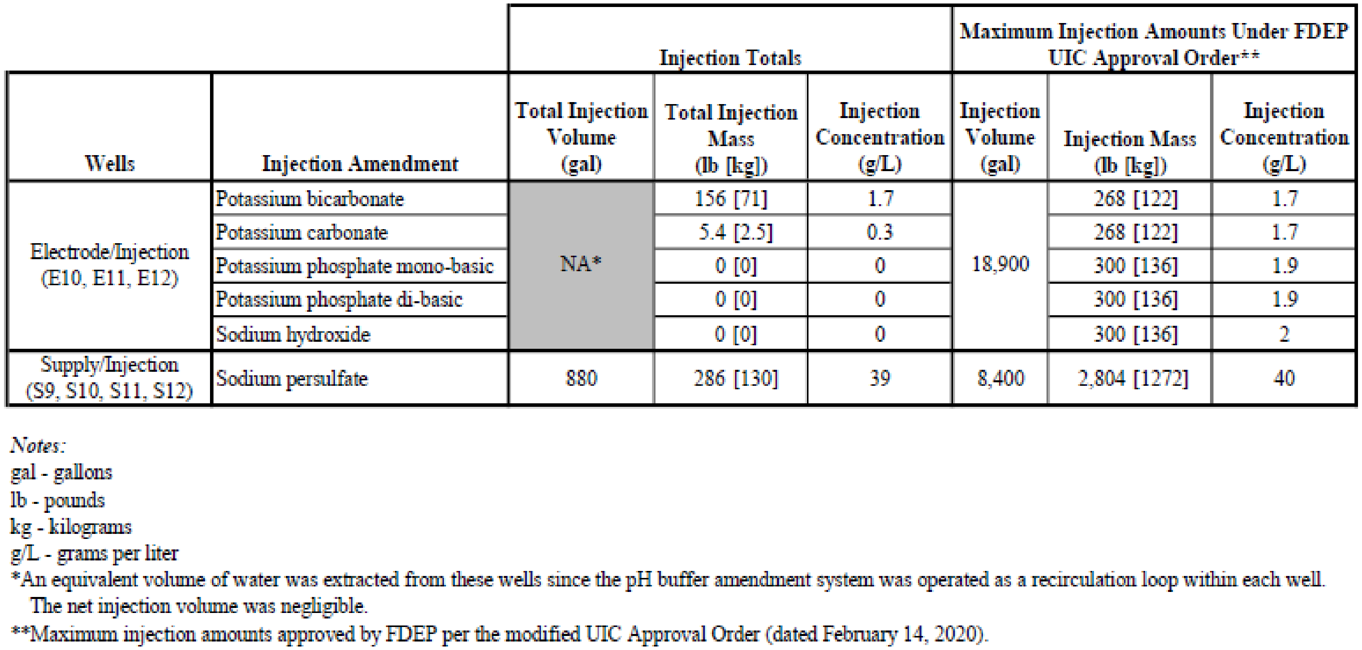
The distribution of the electric field within the TTA was monitored by determining the voltage gradient between the electrode wells and voltage probes. Process control parameters (i.e. voltage, pH, and electrical conductivity) were monitored to evaluate process control requirements. In addition, the total volume and flow rate of persulfate and pH buffers into the system were monitored and recorded. System inspections were conducted generally twice a week by a field technician to monitor and record system operational conditions and perform routine maintenance, mainly related to amendment stock solution replenishment and filter cleaning/replacement. Flow rates and the timing for persulfate and pH buffer additions to the wells were adjusted, as necessary.

Table 5-3 summarizes the total mass and volumes of amendments supplied to the TTA during the Dem/Val. Buffering of pH at the electrode wells was accomplished using potassium bicarbonate during system startup and for roughly the first two months of Phase 1 operations (i.e., October 9 to December 20, 2019), after which time the supply of potassium carbonate was disrupted due to a chemical supplier shortage, and potassium carbonate was used until the supply of potassium bicarbonate was restored on February 21, 2019. Over the course of the Dem/Val, approximately 286 pounds (lbs; 880 gallons) of sodium persulfate was delivered to the four supply wells, and approximately 156 lbs of potassium bicarbonate and 5.4 lbs of potassium carbonate were added to the electrode wells. The net volume of fluid added to the electrode wells was negligible as the volumes of extracted and injected water for these wells were roughly the same.

A summary of the performance monitoring groundwater sampling and analysis performed during Phase 1 operations is provided in **Table 5-4**. Details about the sampling methods and field quality control procedures are discussed in Section 5.6. Additional samples were collected from well EKMW-13B and other wells outside of the TTA on a quarterly basis for analyses required under the UIC Approval Order.

Table 5-3. EK-TAP Dem/Val Amendment Injection Totals

OU3, NAS Jacksonville



		Injection Totals			Maximum Injection Amounts Under FDEP UIC Approval Order**		
Wells	**Injection Amendment**	**Total Injection Volume (gal)**	**Total Injection Mass (lb [kg])**	**Injection Concentration (g/L)**	**Injection Volume (gal)**	**Injection Mass (lb [kg])**	**Injection Concentration (g/L)**
Electrode/Injection (E10, E11, E12)	Potassium bicarbonate	NA*	156 [71]	1.7	18,900	268 [122]	1.7
	Potassium carbonate		5.4 [2.5]	0.3		268 [122]	1.7
	Potassium phosphate mono-basic		0 [0]	0		300 [136]	1.9
	Potassium phosphate di-basic		0 [0]	0		300 [136]	1.9
	Sodium hydroxide		0 [0]	0		300 [136]	2
Supply/Injection (S9, S10, S11, S12)	Sodium persulfate	880	286 [130]	39	8,400	2,804 [1272]	40

Notes:
gal - gallons
lb - pounds
kg - kilograms
g/L - grams per liter
*An equivalent volume of water was extracted from these wells since the pH buffer amendment system was operated as a recirculation loop within each well. The net injection volume was negligible.
**Maximum injection amounts approved by FDEP per the modified UIC Approval Order (dated February 14, 2020).

Table 5-4. Summary of Performance Monitoring Program

	Matrix	Frequency	Analyses	Location
Phase 1 Operations	Groundwater	Bi-Weekly(1)	Field geochemistry(2), persulfate(3), sulfate, sulfur, iron and manganese, TOC, CVOCs(5)	All 4 Dem/Val monitoring wells(4)

(1) Bi-weekly = once every two weeks. Additional samples were collected for select analytes during the Dem/Val, as needed. Persulfate readings were collected more frequency to assess migration within the TTA.

(2) Field geochemistry = temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential, and turbidity.

(3) Persulfate concentration in groundwater will be measured in the field using a field test kit.

(4) Dem/Val monitoring wells are EKMW-11, EKMW-12, EKMW-13B and EKMW-14

(5) CVOCs: PCE, TCE, cDCE, and VC. While bi-weekly sampling for VOCs was not included in the monitoring plan presented in the Demonstration Plan (Geosyntec, 2019b), CVOCs were added to the analyte list during operations as another line of evidence to demonstrate persulfate migration during the Dem/Val.

5.5.3 Decommissioning

Due to federal funding constraints, system decommissioning was not completed as part of the Dem/Val.

5.6 SAMPLING METHODS

In addition to operational data (i.e., electrical current and voltage, flow rates of amendments, pH, etc.) recorded by the PLC, an overall field monitoring and sampling program was performed for the Dem/Val. This section describes the sampling and analytical methods, the equipment calibration, the quality assurance sampling, decontamination procedures, and sample documentation. Sampling was only conducted when the *DC* system was not operational to prevent electrical safety hazards.

5.6.1 Sampling and Analytical methods

The Dem/Val monitoring program included both measurements of field parameters and collection of environmental samples (soil and groundwater) for laboratory analyses. **Table 5-5** summarizes the laboratory analytical methods. The methods for field sample collection and field parameter measurements are described in this section.

For soil sampling, baseline soil cores were collected using a split-spoon sampling approach during installation of select Dem/Val wells, as described in Section 5.3. Up to two soil samples were collected from two locations (E10 and E11), and samples were submitted for laboratory analyses of CVOCs, anions, total metals, pH, and total sulfur (**Table 5-1**). Terra Core samplers were used for soil sample collection to minimize loss of CVOCs due to volatilization. All down-hole drilling equipment was decontaminated between each boring.

The groundwater monitoring well network for the Dem/Val is presented in **Figure 5-1**. A summary of the locations and frequencies of groundwater samples, and the analytical parameters that were analyzed during the baseline characterization and performance monitoring programs are presented in **Tables 5-1 and 5-4,** respectively (see Sections 5.3 and 5.5.2 for details).

Table 5-5. Analytical Methods for Sample Analysis

Matrix	Analyte	Method(1)	Container	Preservative	Holding Time
Soil	VOCs	8260B	3x 10-gram Terra Cores	2 with $NaHSO_4$; 1 with methanol; 4 ± 2°C	14 days
	Persulfate	Modified EPA 300	2-oz glass jar	4 ± 2°C	--
	Total metals (Ca^{2+}, Fe, Mn, Mg^{2+}), total sulfur	6010B	2-oz glass jar	4 ± 2°C	6 months
	Anions (Cl^-, NO_3^-, NO_2^-, SO_4^{-2})	300.0	2-oz glass jar	4 ± 2°C	Up to 28 days
Groundwater	VOCs	8260B	40 mL VOA vial	HCl(2); 4 ± 2°C	14 days
	Dissolved metals (Ca^{2+}, Fe, Mn, Mg^{2+})	200.7	250 mL polyethylene	HNO_3; 4 ± 2°C	6 months
	Anions (Cl^-, NO_3^-, NO_2^-, SO_4^{2-})	300.0	250 mL polyethylene	4 ± 2°C;(2)	28 days (except NO_3^- at 48 hours)
	Persulfate	Field	25 mL glass	--	--
	TOC	SM5310b	125 mL amber glass	H_2SO_4: 4 ± 2°C	28 days

Notes

1. Anticipated laboratory analytical method. If the contracted lab does not perform the listed method an equivalent EPA or Standard Methods analytical method will be used.
2. Samples submitted for analysis of VOCs and chloride following oxidant application will be quenched using ascorbic acid as detailed in USEPA (2012).

Groundwater elevation was measured for each monitoring well prior to sampling. After opening each well, the groundwater elevation was allowed to equilibrate with atmospheric conditions for approximately 5 minutes before taking water level measurements. The depth to groundwater and total well depth were measured using a Solinst interface meter (or equivalent) in 0.01-ft increments, relative to a permanently marked survey point located at the top of the well casing and recorded on the purge log field form. Monitoring wells were purged prior to groundwater sample collection. During purging, in-line water quality parameters were monitored for temperature, pH, specific conductance, DO, ORP, and turbidity. Stabilized readings of parameters were recorded on the field sampling log form, and groundwater samples were collected into the appropriate laboratory prepared and preserved sample containers. Sampling equipment and measurement tools lowered into wells for in-well readings were decontaminated between wells as described in Section 5.6.4.

All soil and groundwater samples collected during the Dem/Val were submitted to Eurofins TestAmerica (St. Louis, Missouri, USA). Sampling containers, holding times, and preservation methods associated with each method are presented in **Table 5-5**. The sample containers were clearly labeled and placed in an insulated cooler with ice for shipping to the laboratory following proper chain-of-custody protocols.

5.6.2 Calibration of Analytical Equipment

The field PID and water quality instruments were calibrated at the beginning of each day of sampling activities. At the end of the day, the instrument calibration was checked against the calibration standards. All calibration data were recorded on field calibration sheets.

Appropriate corrective actions were taken if a field instrument fails the instrument-specific calibration quality control criteria. Corrective action steps were as follows:

- the instrument was checked;
- the cause of failure was investigated;
- the instrument was recalibrated;
- if the instrument recalibration failed again, the instrument manufacturer or rental company technical support departments were contacted for assistance;
- if the problem persisted, the instrument was sent for service and a replacement unit was promptly obtained; and
- if the instrument was a rental, the rental office was contacted for immediate replacement of the instrument.

5.6.3 Quality Assurance/Quality Control

Quality assurance for field sampling comprised of collecting field quality control samples to indicate the accuracy and precision of the data collected. The quality assurance sampling included field duplicates, matrix spike/matrix spike duplicates (MS/MSD), field blanks, and trip blanks. No equipment rinsate blank was required because the groundwater samples were collected using dedicated sampling equipment.

Appendix C includes the laboratory chain of custody forms.

5.6.4 Decontamination Procedures

Decontamination of non-disposable sampling equipment was performed to prevent the introduction of extraneous material into samples, prevent cross-contamination between samples, and to ensure the health and safety of field personnel. The following general procedure was followed to clean equipment and sampling devices prior to and between each use.

Sampling equipment and measurement tools lowered into wells for in-well readings were disassembled to the extent possible and scrubbed with a stiff-bristle brush using a solution of laboratory grade detergent such as Liquinox and potable water. The equipment was then rinsed with potable water in a separate bucket to remove any remaining detergent, and then rinsed again in a third bucket or tub containing deionized or distilled water as a final rinse. After the final rinse, the equipment was re-assembled and placed on a clean surface covered with plastic or aluminum foil to air dry.

All decontamination fluids were contained for subsequent disposal by NAS Jacksonville personnel.

5.6.5 Sample Documentation

Field forms were used to record the sampling conditions and the collected samples. All samples were clearly labeled on-site prior to packing them in coolers for shipment. A custody seal on the sample coolers and chain-of-custody were employed to ensure the integrity of samples during shipment. The laboratory was asked to check for completeness and integrity upon receiving a shipment of samples. Upon receipt of the samples, the laboratory immediately reported any samples that were missing or appeared damaged.

6.0 SAMPLING RESULTS AND DISCUSSION

This section presents a detailed summary and discussions of all monitoring/sampling results. While baseline characterization results have already been presented in Section 5.3, select baseline characterization data are incorporated in this section, as appropriate, with other performance monitoring data to support analyses and discussions related to changes of groundwater conditions during the Dem/Val.

6.1 SYSTEM OPERATIONS MONITORING

Figure 6-1 presents the power usage over the course of Phase 1 operations. The voltage (V) and current (A) readings recorded at the power supply unit over the duration of operation are used to calculate the electrical power usage (kilowatt-hour [kW-hr]). The system was designed and operated to supply a constant current, determined after the start-up phase, and the power supply unit would then operate at a voltage level that was required in response to field electrical resistivity in order to maintain the supply of constant current.

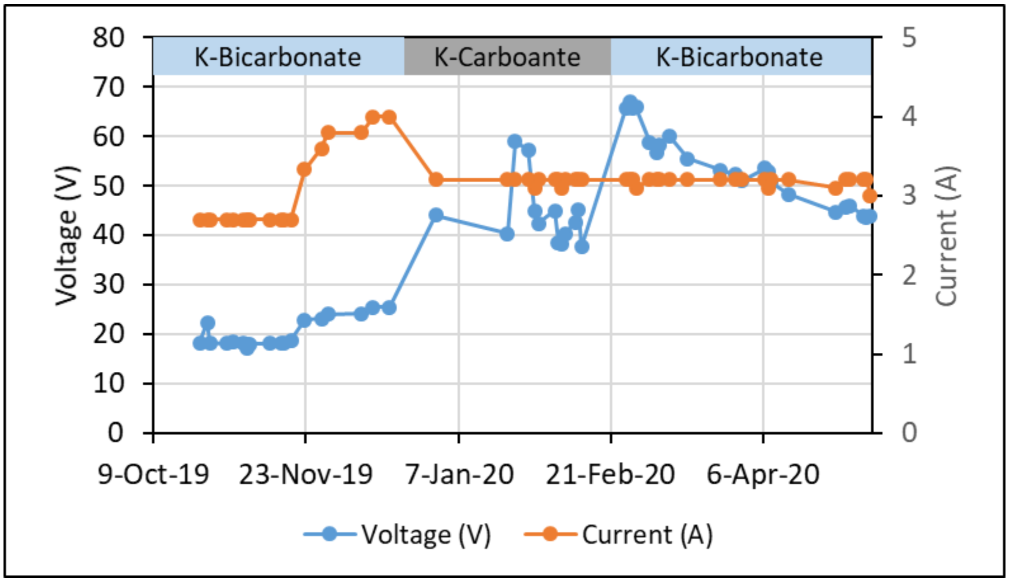


Figure 6-1. Power Usage During Phase 1 Operations

Figure 6-1 shows that the power supply unit's voltage output remained generally steady during periods of constant current.

As shown in **Figure 6-1**, the *DC* power supply unit was operated at a constant current of approximately 2.7A for roughly the first 6 weeks of operations, after which time the current was gradually increased to approximately 4A over an approximate 4-week period. The current was then lowered to approximately 3.2A and was held at this level for the remainder of system operations. The *DC* power supply unit's voltage output remained generally steady during periods of constant current. There were, however, several instances in January and February 2020 when the electrodes in wells E10 and E12 (i.e., cathodes) needed to be cleaned due to a build-up of scale on the electrode surface. As discussed below, this was also the same time during which control of pH at the electrode wells was problematic when the supply of potassium bicarbonate was disrupted.

Prior to the electrode cleaning, the system voltage readings would indicate the operating conditions were becoming unsteady. Electrode cleaning was accomplished by removing the electrode from the well and submerging it in a dilute acid bath (e.g., acetic acid) to dissolve the scale. All electrode cleaning fluids were containerized for subsequent disposal by NAS Jacksonville personnel.

System uptime, measured as *DC* uptime, or the percentage of time that the *DC* power supply unit was on and delivering current to the electrodes, was monitored throughout system operations. A summary of the system uptime during various periods of pH buffer usage is presented in **Figure 6-2**.

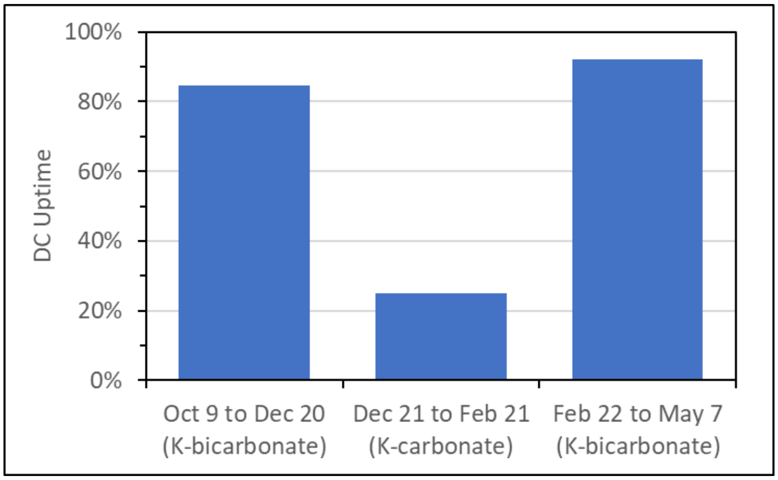


Figure 6-2. System Uptime During Phase 1 Operations

Between October 9, 2019 and December 20, 2019 when potassium bicarbonate was used as the pH buffer, system uptime was approximately 85%. During this period, system downtime (i.e., when the *DC* power supply was off) was predominantly a result of the weekly site visits for O&M and/or groundwater sampling, in which case the *DC* power supply was manually turned off in order to protect the health and safety of field staff during these activities. Between December 21, 2019 and February 20, 2020, when the supply of potassium bicarbonate was disrupted, system uptime was significantly impacted and decreased to roughly 25% over this period. It is believed that the potassium carbonate, when added to the electrode wells at the maximum concentration permitted by the UIC Approval Order, was simply not as effective at controlling pH within the electrode wells, which resulted in frequent automatic shut-downs of the *DC* power supply unit when pH at the electrodes exceeded the alarm setpoints. Once the supply of potassium bicarbonate was restored on February 21, 2020, pH at the electrodes became easier to control and system uptime recovered and was roughly 92% through the end of system operations.

The total energy usage by the EK system’s *DC* power supply unit during the 7 months of system operations was calculated to be approximately 425 kW-hr. For comparison, this energy usage is equivalent to operating a single 100W lightbulb for approximately 6 months.

In addition to monitoring the *DC* power supply unit, field measurements were taken to confirm the establishment of the electric field within the TTA. Temporal changes in the voltage measurements over the course of the Dem/Val are shown in **Figure 6-3**. Voltage measurements within the TTA showed relatively uniform voltage gradient at all locations (i.e., generally <10% variation among monitoring locations).

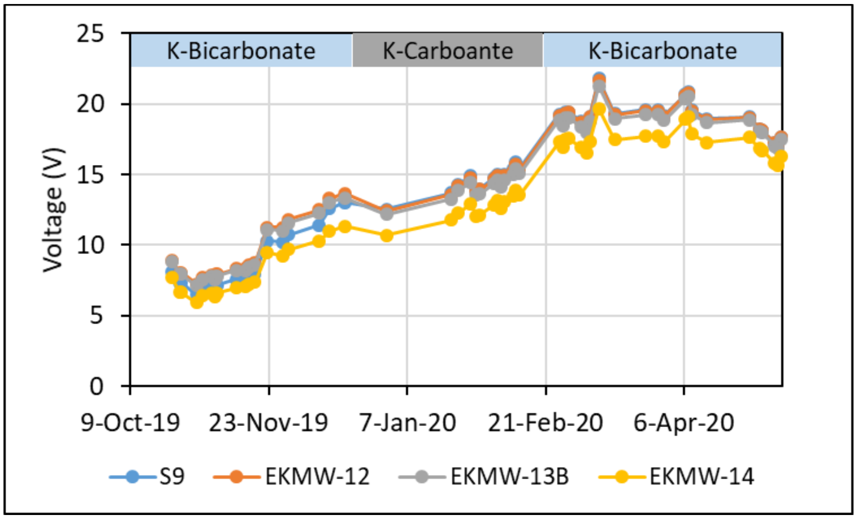


Figure 6-3. Voltage Measurements at Voltage Probes Within TTA

(Values for each well are the average of the two voltage probes affixed to the well screens)

The voltage measurements taken at individual voltage probes were used to assess if a uniform electric field was established within the TTA. Voltage measurements at individual wells relative to a common reference at the EK control system were between 5.9V and 21.9V indicating that an electric field was established in the area between electrode wells. Voltage gradients between discrete locations of closest well pairs were calculated and ranged from 0.34 V/m to 0.65 V/m. The variation in voltage gradients between well pairs was generally <10%, indicating that the established voltage gradients were relatively uniform and no local focusing of the electric field was encountered within the TTA.

Table 6-1 below presents the average and standard deviation calculated for the electrical current to individual wells during periods of constant current.

Table 6-1. Electrical Current to Electrode Wells

Oct to Nov 2019 Target Current: 2.7 A	Current (A)		
	Anode	Cathodes	
	E11	E10	E12
Avg	2.6	1.3	1.2
Std Dev	0.1	0.2	0.1

Jan to May 2020 Target Current: 3.2A	Current (A)		
	Anode	Cathodes	
	E11	E10	E12
Avg	3.0	1.3	1.6
Std Dev	0.1	0.4	0.3

A – amps
Avg – average
Std Dev – standard deviation

The data show that the current supply to individual electrode well was generally steady (variation within 30% of average). Given that (i) soil electrical resistivity is a soil property not expected to vary over the course of Dem/Val, and (ii) the voltage output by the *DC* power supply unit and the current supplied to individual electrodes were generally steady during the time periods indicated in **Table 6-1**, the electrical potential between electrode pairs within the TTA should maintain within 5x of target during operation.

6.2 GROUNDWATER SAMPLING RESULTS

Groundwater monitoring data are summarized in **Tables 6-2 through 6-4**. The locations of groundwater monitoring wells are presented in **Figure 5-1**.

6.2.1 Groundwater Geochemistry

A summary of the groundwater field parameter measurements made throughout the Dem/Val are provided in **Table 6-2**, and temporal changes in pH and ORP at the four EKMWs are shown on **Figure 6-4.** Changes in pH and ORP were most notable at EKMW-11, with both parameters transitioning to levels representative of oxidizing conditions (i.e., pH decreased to ~3, while ORP increased to ~350 millivolts [mV]) approximately 7 weeks after the start of persulfate addition at well S9. Once established, oxidizing conditions were sustained at EKMW-11 for the remainder of the Dem/Val. A shift towards oxidizing conditions (i.e., pH decreasing to below 4.5 and ORP increasing above 150 mV) was observed at wells EKMW-12 and EKMW-13B approximately 7 weeks after persulfate addition was initiated at wells S10 and S11. Despite some fluctuations in pH and ORP at EKMW-14, no significant changes from baseline conditions were observed for either parameter at this well. It should be noted that the development of or shift to oxidizing conditions appears to have been impacted by the period of Phase 1 operations when potassium carbonate was used as the pH buffer and system uptime was significantly impacted. During this period of operations there was an apparent reversal in the decreasing pH and increasing ORP trends that were observed when potassium bicarbonate was used and system uptime was 85% or higher. As a result, it is possible that oxidizing conditions may have fully developed at wells EKMW-12, EKMW-13B and EKMW-14 (like they did at EKMW-11) had the supply of potassium bicarbonate not been disrupted.

Table 6-2. Groundwater Field Parameter Results

OU3, NAS Jacksonville

Well ID	Event[1]	Sample Date	Cumulative Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Oxidation Reduction Potential (mV)
EKMW-11	Baseline	11-Jul-19	0.25	0.08	5.80	5.21	28.33	6,873	0.79	25.7	35.5
	Baseline	07-Aug-19	0.25	0.08	6.35	5.69	28.36	6,934	1.82	12.5	67.0
	PM1	22-Oct-19	0.25	0.04	6.85	5.70	28.70	6,320	0.65	19.9	53.2
	PM2/UIC1	05-Nov-19	0.25	0.05	6.93	5.42	25.83	8,740	0.60	13.4	11.9
	PM3	19-Nov-19	0.25	0.03	6.98	5.38	26.65	6,783	0.66	6.87	33.8
	VOCs	25-Nov-19	0.25	0.03	7.10	3.61	25.36	6,579	0.39	14.6	360.9
	PM4	03-Dec-19	0.75	0.75	7.41	3.35	22.10	6,367	0.88	17.9	411.2
	PM5/Metals	18-Dec-19	0.25	0.08	6.15	3.02	22.40	5,783	1.40	6.06	484.5
	PM6	07-Jan-20	0.25	0.02	NM	5.22	23.82	6,690	3.28	11.6	332.7
	Field Parameters	24-Jan-20	NM	NM	NM	2.98	NM	6,184	0.61	NM	485.9
	PM7	28-Jan-20	0.25	0.08	6.22	2.98	23.33	5,851	0.85	9.85	442.4
	PM8	11-Feb-20	0.25	0.03	6.45	2.64	24.29	6,548	1.48	20.9	528.2
	PM9/UIC2	25-Feb-20	0.25	0.06	6.94	2.65	22.45	6,342	2.71	12.9	592.3
	PM10	10-Mar-20	0.25	0.03	6.52	2.76	23.14	7,726	1.36	16.3	587.3
	PM11	24-Mar-20	0.25	0.04	8.31	2.97	25.30	10,380	0.78	19.5	536.9
	PM12	07-Apr-20	0.25	0.08	6.35	3.20	25.54	9,935	0.95	29.0	531.5
	PM13	21-Apr-20	0.50	0.08	7.50	3.65	26.01	9,858	1.03	25.8	512.1
	O&M	08-May-20	--	--	--	3.66	25.50	3,136	3.01	18.6	471.1
EKMW-12	Baseline	11-Jul-19	0.25	0.06	6.15	5.72	29.87	2,971	0.32	10.4	-40.8
	Baseline	07-Aug-19	0.25	0.08	5.70	6.40	28.89	2,865	1.72	8.25	-38.3
	PM1	22-Oct-19	0.25	0.04	6.75	5.41	29.40	2,787	0.51	17.9	-12.5
	PM2/UIC1	05-Nov-19	0.25	0.05	7.45	5.97	25.95	4,596	0.82	22.9	-69.0
	PM3	19-Nov-19	0.25	0.03	7.70	5.79	26.76	3,023	0.39	13.4	-45.1
	VOCs	25-Nov-19	0.25	0.03	7.42	5.77	24.48	3,231	0.61	9.48	-17.4
	PM4	03-Dec-19	0.50	0.05	6.45	6.11	23.88	2,457	0.19	34.9	-28.5
	PM5/Metals	18-Dec-19	0.25	0.08	6.51	5.69	22.22	2,357	0.62	17.0	36.3
	PM6	07-Jan-20	0.25	0.03	NM	5.30	24.34	3,274	0.83	32.1	67.4
	Field Parameters	24-Jan-20	NM	NM	NM	4.82	NM	2,964	0.36	NM	156.3
	PM7	28-Jan-20	0.25	0.08	7.97	4.32	24.05	2,986	1.03	85.5	182.4
	PM8	11-Feb-20	0.25	0.03	9.00	4.17	26.03	?	0.38	11.9	225.6
	PM9/UIC2	25-Feb-20	0.25	0.06	6.82	4.18	23.19	3,355	1.25	10.7	213.1
	PM10	10-Mar-20	0.25	0.03	10.40	5.10	25.22	4,382	0.79	40.2	136.8
	PM11	24-Mar-20	0.25	0.03	6.62	5.47	26.64	4,631	5.88	28.9	100.2
	PM12	07-Apr-20	0.25	0.08	4.90	5.15	26.72	4,105	1.45	27.2	97.2
	PM13	21-Apr-20	0.25	0.05	9.98	5.53	26.67	4,090	1.69	30.6	62.3
	O&M	08-May-20	--	--	--	5.66	26.22	4,325	0.43	13.6	57.0
EKMW-13B	Baseline	11-Jul-19	0.25	0.06	7.10	5.86	29.48	3,253	0.20	8.81	-62.8
	Baseline	07-Aug-19	0.25	0.08	5.77	6.34	28.68	3,352	1.74	3.82	-5.4
	PM1	22-Oct-19	0.25	0.04	6.50	5.47	29.68	2,872	1.08	7.16	-17.5
	PM2/UIC1	05-Nov-19	0.25	0.05	6.27	5.82	26.07	4,578	0.56	12.3	-64.7
	PM3	19-Nov-19	0.25	0.03	7.48	5.71	26.24	3,414	0.37	7.45	-47.4
	VOCs	25-Nov-19	0.25	0.03	7.00	5.80	24.24	3,790	0.49	4.95	-19.6
	PM4	03-Dec-19	0.50	0.06	10.01	5.82	25.67	2,845	0.69	8.42	-24.5
	PM5/Metals	18-Dec-19	0.25	0.08	5.68	5.71	23.45	3,010	0.68	26.8	38.0
	PM6	08-Jan-20	0.25	0.03	NM	4.74	21.93	3,073	5.40	51.3	138.0
	Field Parameters	24-Jan-20	NM	NM	NM	3.56	NM	2,942	0.51	NM	381.6
	PM7	28-Jan-20	0.25	0.08	8.19	4.09	23.62	2,992	1.01	24.6	235.7
	PM8	11-Feb-20	0.25	0.03	7.70	3.81	25.30	3,429	0.66	9.14	266.1
	PM9/UIC2	25-Feb-20	0.25	0.06	6.44	4.60	23.20	3,182	0.85	9.64	173.9
	PM10	10-Mar-20	0.25	0.03	5.80	4.96	24.55	4,034	1.12	40.3	176.0

Table 6-2. Groundwater Field Parameter Results (Continued)

OU3, NAS Jacksonville

Well ID	Event[1]	Sample Date	Cumulative Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Oxidation Reduction Potential (mV)
EKMW-13B (Cont'd)	PM11	24-Mar-20	0.25	0.03	7.15	5.13	25.90	4,124	0.25	NM	139.7
	PM12	07-Apr-20	0.25	0.08	4.82	5.37	26.70	3,748	0.98	9.62	93.9
	PM13	21-Apr-20	0.25	0.05	9.80	5.54	26.95	3,550	1.83	5.76	59.0
	O&M	08-May-20	--	--	--	5.60	26.35	4,079	0.33	3.06	81.4
EKMW-14	Baseline	11-Jul-19	0.25	0.06	4.58	8.38	30.76	1,415	1.16	high	-3.7
	Baseline	07-Aug-19	0.25	0.08	6.18	7.18	28.97	2,535	1.78	62.5	-129.9
	PM1	22-Oct-19	0.25	0.03	17.06	7.17	29.70	1,339	1.72	28.9	-30.1
	PM2/UIC1	05-Nov-19	1.00	0.05	11.10	5.84	26.66	3,896	0.44	24.2	-115.9
	PM3	19-Nov-19	0.25	0.03	7.72	5.93	25.12	3,319	0.57	47.6	-58.1
	VOCs	25-Nov-19	0.25	0.03	6.40	5.84	24.77	3,383	0.34	400	-19.7
	PM4	03-Dec-19	1.00	0.04	12.68	6.42	22.53	2,576	0.40	14.6	-72.1
	PM5/Metals	18-Dec-19	0.25	0.05	5.81	6.07	22.41	3,067	1.16	5.97	-40.9
	PM6	08-Jan-20	0.25	0.03	NM	6.27	23.76	2,772	0.85	85.9	-33.0
	Field Parameters	24-Jan-20	NM	NM	NM	5.74	NM	2,508	0.52	NM	30.5
	PM7	28-Jan-20	0.25	0.05	8.47	5.80	22.51	2,446	1.12	11.1	-12.2
	PM8	11-Feb-20	0.25	0.03	8.70	5.71	25.48	2,788	0.58	18.6	-26.5
	PM9/UIC2	25-Feb-20	0.25	0.06	7.03	6.97	22.06	2,646	1.73	19.3	-25.1
	PM10	10-Mar-20	0.25	0.03	6.60	6.22	24.58	3,373	0.20	18.4	-34.8
	PM11	24-Mar-20	0.25	0.04	7.76	6.15	25.63	3,428	0.78	NM	-56.0
	PM12	07-Apr-20	0.25	0.08	4.74	6.07	26.17	3,044	1.05	7.02	-44.1
	PM13	21-Apr-20	0.25	0.05	10.70	6.11	26.15	2,874	1.63	15.6	-64.7
	O&M	08-May-20	--	--	--	6.23	26.83	3,147	0.35	8.3	-44.9

Notes:

[1] PM designates the performance monitoring sampling event (e.g., PM1 = performance monitoring sampling event 1); UIC designates the quarterly sampling event required by the UIC Approval Order (e.g., UIC1 = UIC sampling event for Q1)

gal - gallons
gpm - gallons per minute
ft - feet
°C - degrees celsius
µS/cm - microsiemens per centimetre
mg/L - milligrams per litre
mV - milliVolts
NTU - Nephelometric Turbidity Units
NM - not measured
-- - no data available

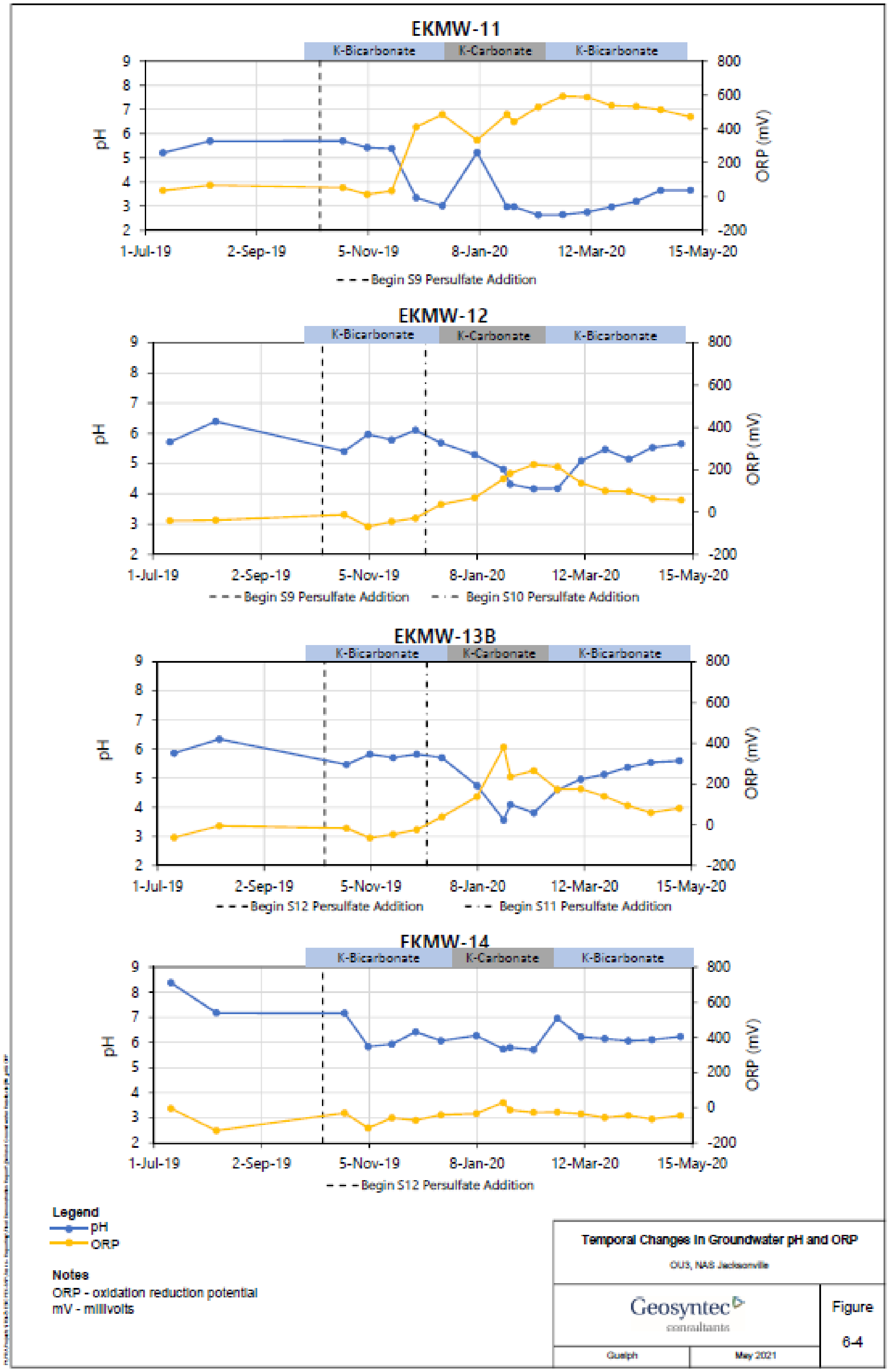


Figure 6-4. Temporal Changes in Groundwater pH and ORP

OU3, NAS Jacksonville

Groundwater analytical results for various geochemical parameters included in the Dem/Val monitoring program are presented in **Table 6-3**. Temporal changes in concentrations of sulfur species (persulfate, sulfate and sulfur) and iron at the four EKMWs are shown on **Figure 6-5.** Consistent with the oxidizing conditions that developed at EKMW-11, increases in concentrations of persulfate, sulfate and sulfur were noted at this monitoring well. By the end of Phase 1 operations, the concentration of persulfate at EKMW-11 was roughly the same as the amendment supply concentration (i.e., 40 g/L), and the concentrations of sulfate and sulfur had increased by roughly 2 orders of magnitude. A decrease in the concentration of iron by roughly 1 order of magnitude was also observed at this location. Coupled with the field parameter data discussed above, these data suggest that in-situ activation of persulfate, likely due to the iron, was occurring in this area of the TTA.

At EKMW-12, the concentration of persulfate also increased to 100% of the amendment supply concentration by the end of Phase 1 operations, and the concentrations of sulfate and sulfur increased by roughly 1 order of magnitude. However, the decrease in the concentration of iron was not as significant as that observed at EKMW-11, and analytical results indicate that the baseline concentration of iron at EKMW-12 was lower than EKMW-11. Increases in the concentrations of persulfate at EKMW-13B and EKMW-14 were less noticeable, but concentrations still reached as high as 1% and 10% of the concentrations of persulfate added to wells S11 and S12, respectively. No significant changes in the concentrations of sulfate or sulfur were observed at either EKMW-13B or EKMW-14 throughout the Dem/Val.

Based on the persulfate concentrations observed, the following persulfate migration rates were estimated: EKMW-11 (0.6 cm/day), EKMW-12 (1.3 cm/day) and EKMW-14 (0.7 cm/day). Persulfate migration rates were calculated based on the period of time between the start of persulfate addition to the supply wells and the arrival of persulfate at the monitoring wells at concentrations greater than 10% of the amended concentration. A persulfate migration rate was not calculated for EKMW-13B since the concentration of persulfate at this well did not surpass 10% of the concentration added to well S12. A correction factor was also applied to the calculated migration rates to account for system uptime (i.e., persulfate migration rates assume 100% system uptime). These results suggest that while EK was effective at enhancing the migration of persulfate within the low-K clay unit of the TTA, the rate of persulfate migration was inhibited due to in-situ activation of the persulfate by naturally occurring subsurface conditions (e.g., elevated concentrations of iron).

6.2.2 Groundwater CVOCs

Groundwater analytical results for CVOCs are presented in **Table 6-4**, and temporal changes in concentrations of PCE, TCE, cDCE and VC at the four EKMWs are shown on **Figure 6-6.**

Table 6-3. Groundwater Geochemical Results

OU3, NAS Jacksonville

Well ID	Event[1]	Sample Date	Duplicate	Persulfate(a) (mg/L)	Sulfate (mg/L)	Sulfur (mg/L)	Iron (mg/L)	Manganese (mg/L)	Calcium(b) (mg/L)	Magnesium(b) (mg/L)	Total Organic Carbon (mg/L)	Chloride(b) (mg/L)	Nitrate(b) (mg/L)	Nitrite(b) (mg/L)
EKMW-11	Baseline	11-Jul-19		--	**42**	--	**96**	**3.5**	**330**	**68**	**3.6**	**2,400**	0.02 U J	0.2 U J
	Baseline	07-Aug-19		**0.7**	--	--	--	--	--	--	--	--	--	--
	PM1	22-Oct-19		**80**	**37**	**14**	**90**	**4.5**	--	--	**2.4**	--	--	--
	PM2/UIC1	05-Nov-19		**0.7**	**78**	**34**	**90**	**4.7**	--	--	**2.5**	--	--	--
	PM3	19-Nov-19		**1.4**	**140 J**	**42**	**89**	**4.8**	--	--	**3.0**	--	--	--
	PM4	03-Dec-19		**10**	**64**	**23**	**46**	**4.5**	--	--	**3.0 J**	--	--	--
	PM5/Metals	18-Dec-19		**10**	**84**	**30**	**26**	**4.3**	--	--	**3.1 J**	--	--	--
	PM6	07-Jan-20		**2.1**	**240**	**88**	**54**	**3.8**	--	--	**3.7**	--	--	--
	Field Parameters	24-Jan-20		**45**	--	--	--	--	--	--	--	--	--	--
	PM7	28-Jan-20		**45**	**360**	**130**	**36**	**3.9**	--	--	**3.4**	--	--	--
	PM8	11-Feb-20		**28**	**430**	**160**	**29**	**4.4**	--	--	**3.3**	--	--	--
	PM9/UIC2	25-Feb-20		**450**	**720**	**220**	**11**	**4.6**	--	--	**3.7**	--	--	--
	Persulfate	06-Mar-20		**70**	--	--	--	--	--	--	--	--	--	--
	PM10	10-Mar-20		**112**	**1000.00**	**790**	**2.9**	**5.4**	--	--	**4.4**	--	--	--
	Persulfate	13-Mar-20		**250**	--	--	--	--	--	--	--	--	--	--
	Persulfate	16-Mar-20		**700**	--	--	--	--	--	--	--	--	--	--
	Persulfate	20-Mar-20		**300**	--	--	--	--	--	--	--	--	--	--
	Persulfate	23-Mar-20		**3,000**	--	--	--	--	--	--	--	--	--	--
	PM11	24-Mar-20		**1,400**	**2,300**	**1,200**	**4.5 J**	**6.2**	--	--	**5.6**	--	--	--
	Persulfate	27-Mar-20		**10,000**	--	--	--	--	--	--	--	--	--	--
	Persulfate	03-Apr-20		**3,000**	--	--	--	--	--	--	--	--	--	--
	PM12	07-Apr-20		**2,500**	**3,400**	**1,500 J**	**4.5**	**7.2**	--	--	**7.5**	--	--	--
	Persulfate	10-Apr-20		**70,000**	--	--	--	--	--	--	--	--	--	--
	PM13	21-Apr-20		--	**2,600**	**1,200 J**	**2.4 J**	**6.4**	--	--	**6.3**	--	--	--
	Persulfate	24-Apr-20		**2,500**	--	--	--	--	--	--	--	--	--	--
	Persulfate	27-Apr-20		**5,000**	--	--	--	--	--	--	--	--	--	--
	Persulfate	01-May-20		**42,000**	--	--	--	--	--	--	--	--	--	--
	Persulfate	04-May-20		**56,000**	--	--	--	--	--	--	--	--	--	--
	O&M	08-May-20		**56,000**	--	--	--	--	--	--	--	--	--	--
EKMW-12	Baseline	11-Jul-19		--	**49**	--	**35**	**2.9**	**280**	**51**	**6.3**	**820**	0.02 U J	0.2 U J
	Baseline	11-Jul-19	X	--	**54**	--	**30**	**2.7**	**270**	**49**	**6.8**	**780**	0.02 U J	0.2 U J
	Baseline	07-Aug-19		0.7 U	--	--	--	--	--	--	--	--	--	--
	PM1	22-Oct-19		0.7 U	**14**	**6.1**	**28**	**2.7**	--	--	**2.4**	--	--	--
	PM2/UIC1	05-Nov-19		0.7 U	**10**	**4.1 J**	**42**	**3.1**	--	--	**2.3**	--	--	--
	PM3	19-Nov-19		**0.7 J**	**9.5**	**5.3**	**33**	**2.7**	--	--	**2.2**	--	--	--
	PM4	03-Dec-19		**3.5**	**44**	**18**	**15**	**2.0**	--	--	**2.2 J**	--	--	--
	PM5/Metals	18-Dec-19		0.7 U	**32**	**11**	**26**	**2.7**	--	--	**2.0 J**	--	--	--
	PM6	07-Jan-20		0.7 U	**25**	**8.1**	**29**	**3.2**	--	--	**1.7**	--	--	--
	Field Parameters	24-Jan-20		0.7 U	--	--	--	--	--	--	--	--	--	--
	PM7	28-Jan-20		**2.8**	**59**	**21**	**24**	**3.4**	--	--	**1.5**	--	--	--
	PM8	11-Feb-20		**1.4**	**97**	**33**	**29**	**3.9**	--	--	**1.5**	--	--	--

Table 6-3. Groundwater Geochemical Results (Continued)

OU3, NAS Jacksonville

Well ID	Event[1]	Sample Date	Duplicate	Persulfate[(a)] (mg/L)	Sulfate (mg/L)	Sulfur (mg/L)	Iron (mg/L)	Manganese (mg/L)	Calcium[(b)] (mg/L)	Magnesium[(b)] (mg/L)	Total Organic Carbon (mg/L)	Chloride[(b)] (mg/L)	Nitrate[(b)] (mg/L)	Nitrite[(b)] (mg/L)
EKMW-12 (Cont'd)	PM9/UIC2	25-Feb-20		**1.0**	**90**	**34**	**34**	**4.0**	--	--	**1.5**	--	--	--
	PM10	10-Mar-20		**7.0**	**77**	**29**	**41**	**3.8**	--	--	**1.6**	--	--	--
	Persulfate	13-Mar-20		**500**	--	--	--	--	--	--	--	--	--	--
	Persulfate	16-Mar-20		**2.8**	--	--	--	--	--	--	--	--	--	--
	Persulfate	20-Mar-20		**5.0**	--	--	--	--	--	--	--	--	--	--
	Persulfate	23-Mar-20		**5.0**	--	--	--	--	--	--	--	--	--	--
	PM11	24-Mar-20		**2.1**	**260**	**97**	**41**	**3.7**	--	--	**1.9**	--	--	--
	Persulfate	27-Mar-20		**100**	--	--	--	--	--	--	--	--	--	--
	Persulfate	03-Apr-20		**100**	--	--	--	--	--	--	--	--	--	--
	PM12	07-Apr-20		**0.7**	**360**	**110**	**42**	**3.3**	--	--	**2.1**	--	--	--
	Persulfate	10-Apr-20		**56,000**	--	--	--	--	--	--	--	--	--	--
	Persulfate	13-Apr-20		**1.4**	--	--	--	--	--	--	--	--	--	--
	Persulfate	17-Apr-20		**700**	--	--	--	--	--	--	--	--	--	--
	PM13	21-Apr-20		**0.7**	**390**	**140 J**	**46 J**	**3.3**	--	--	**2.1**	--	--	--
	Persulfate	24-Apr-20		**25**	--	--	--	--	--	--	--	--	--	--
	Persulfate	27-Apr-20		**100**	--	--	--	--	--	--	--	--	--	--
	Persulfate	01-May-20		**7,000**	--	--	--	--	--	--	--	--	--	--
	Persulfate	04-May-20		**42,000**	--	--	--	--	--	--	--	--	--	--
	O&M	08-May-20		**10**	--	--	--	--	--	--	--	--	--	--
EKMW-13B	Baseline	11-Jul-19		--	**170**	--	**21**	**2.7**	**320**	**55**	**8.6**	**820**	0.02 U J	0.2 U J
	Baseline	07-Aug-19		0.7 U	**41**	--	**39**	**3.5**	--	--	--	**930**	--	--
	PM1	22-Oct-19		0.7 U	**35**	**13**	**32**	**2.7**	--	--	**3.3**	--	--	--
	PM1	22-Oct-19	X	--	**40**	**14**	**33**	**2.8**	--	--	**3.6**	--	--	--
	PM2/UIC1	05-Nov-19		0.7 U	**8.1 J**	**3.2 J**	**50 J**	**3.7 J**	--	--	**2.5 J**	--	--	--
	PM2/UIC1	05-Nov-19	X	--	**120 J**	**57 J**	**20 J**	**2.2 J**	--	--	**4.9 J**	--	--	--
	PM3	19-Nov-19		0.7 U	**28 J**	**78**	**28 J**	**2.3**	--	--	**2.3**	--	--	--
	PM3	19-Nov-19	X	--	**57 J**	**77**	**20 J**	**1.8**	--	--	**2.4**	--	--	--
	PM4	03-Dec-19		**1.4**	**140**	**46**	**20**	**2.3**	--	--	**2.8 J**	--	--	--
	PM4	03-Dec-19	X	--	**140**	**46**	**19**	**2.3**	--	--	**2.9 J**	--	--	--
	PM5/Metals	18-Dec-19		**4.2**	**50**	**17**	**23**	**3.1**	--	--	**2.1 J**	--	--	--
	PM5/Metals	18-Dec-19	X	--	**51**	**17**	**21**	**3.0**	--	--	**2.3 J**		--	--
	PM6	08-Jan-20		0.7 U	**25**	**9**	**12**	**3.3**	--	--	**1.7**	--	--	--
	PM6	08-Jan-20	X	--	**25**	**11**	**15**	**3.3**	--	--	**1.9**	--	--	--
	Field Parameters	24-Jan-20		**1.0**	--	--	--	--	--	--	--	--	--	--
	PM7	28-Jan-20		**2.1**	**15**	**5.5**	**8.4**	**3.5**	--	--	**1.6**	--	--	--
	PM7	28-Jan-20	X	--	**15**	**5.5**	**8.8**	**3.5**	--	--	**1.6**	--	--	--
	PM8	11-Feb-20		**0.7**	**31**	**12**	**28**	**4.1**	--	--	**1.5**	--	--	--
	PM8	11-Feb-20	X	--	**32**	**11**	**28**	**4.1**	--	--	**1.5**	--	--	--
	PM9/UIC2	25-Feb-20		**2.5**	**52**	**21 J**	**37**	**3.9**	--	--	**1.7**	--	--	--
	PM9/UIC2	25-Feb-20	X	--	**56**	**20 J**	**38**	**4.0**	--	--	**1.6**	--	--	--
	PM10	10-Mar-20		**1.4**	**67**	**25**	**34**	**3.7**	--	--	**1.7**	--	--	--

Table 6-3. Groundwater Geochemical Results (Continued)

OU3, NAS Jacksonville

Well ID	Event[1]	Sample Date	Duplicate	Persulfate(a) (mg/L)	Sulfate (mg/L)	Sulfur (mg/L)	Iron (mg/L)	Manganese (mg/L)	Calcium(b) (mg/L)	Magnesium(b) (mg/L)	Total Organic Carbon (mg/L)	Chloride(b) (mg/L)	Nitrate(b) (mg/L)	Nitrite(b) (mg/L)
EKMW-13B (Cont'd)	PM10	10-Mar-20	X	--	**70**	**25**	**33**	**3.6**	--	--	**1.7**	--	--	--
	Persulfate	13-Mar-20		**17**	--	--	--	--	--	--	--	--	--	--
	Persulfate	16-Mar-20		**2.8**	--	--	--	--	--	--	--	--	--	--
	Persulfate	20-Mar-20		**1.7**	--	--	--	--	--	--	--	--	--	--
	PM11	24-Mar-20		**1.4**	**66**	**24**	**29**	**3.3**	--	--	**1.5**	--	--	--
	PM11	24-Mar-20	X	--	**69**	**23**	**28**	**3.4**	--	--	**1.6**	--	--	--
	Persulfate	27-Mar-20		**2.8**	--	--	--	--	--	--	--	--	--	--
	Persulfate	03-Apr-20		**5.0**	--	--	--	--	--	--	--	--	--	--
	PM12	07-Apr-20		**0.7**	**110**	**26**	**37**	**3.0**	--	--	**1.7**	--	--	--
	PM12	07-Apr-20	X	--	**100**	**26**	**36**	**2.9**	--	--	**1.7**	--	--	--
	PM13	21-Apr-20		--	**89**	**30 J**	**36 J**	**2.9**	--	--	**1.8**	--	--	--
	PM13	21-Apr-20	X	--	**88**	**30 J**	**35 J**	**2.9**	--	--	**1.9**	--	--	--
	Persulfate	24-Apr-20		**10**	--	--	--	--	--	--	--	--	--	--
	Persulfate	27-Apr-20		**3.0**	--	--	--	--	--	--	--	--	--	--
	Persulfate	01-May-20		**0.7**	--	--	--	--	--	--	--	--	--	--
	Persulfate	04-May-20		**420**	--	--	--	--	--	--	--	--	--	--
	O&M	08-May-20		**2.8**	--	--	--	--	--	--	--	--	--	--
EKMW-14	Baseline	11-Jul-19		--	**450**	--	**1100****	**15**	**770**	**270**	**4.0**	**39**	**0.051 J**	0.02 U J
	Baseline	07-Aug-19		0.7 U	--	--	--	--	--	--	--	--	--	--
	PM1	22-Oct-19		**0.7**	**140**	**51**	**2.6**	**0.57**	--	--	**19**	--	--	--
	PM2/UIC1	05-Nov-19		0.7 U	**200**	**67**	**30**	**2.7**	--	--	**16**	--	--	--
	PM3	19-Nov-19		0.7 U	**360**	**120**	**44**	**3.6**	--	--	**33**	--	--	--
	PM4	03-Dec-19		**0.7**	**200**	**76**	**17**	**2.9**	--	--	**19 J**	--	--	--
	PM5/Metals	18-Dec-19		0.7 U	**710**	**260**	**46**	**4.3**	--	--	**28**	--	--	--
	PM6	08-Jan-20		--	**420**	**140**	**21**	**3.2**	--	--	**29**	--	--	--
	Field Parameters	24-Jan-20		0.7 U	--	--	--	--	--	--	--	--	--	--
	PM7	28-Jan-20		**5.0**	**390**	**130**	**16**	**3.1**	--	--	**41**	--	--	--
	PM8	11-Feb-20		0.7 U	**370**	**120**	**22**	**3.7**	--	--	**50**	--	--	--
	PM9/UIC2	25-Feb-20		**5.0**	**410**	**150**	**29**	**3.6**	--	--	**50**	--	--	--
	PM10	10-Mar-20		0.7 U	**410**	**150**	**35**	**3.6**	--	--	**49**	--	--	--
	Persulfate	13-Mar-20		**7.0**	--	--	--	--	--	--	--	--	--	--
	Persulfate	16-Mar-20		0.7 U	--	--	--	--	--	--	--	--	--	--
	Persulfate	20-Mar-20		0.7 U	--	--	--	--	--	--	--	--	--	--
	PM11	24-Mar-20		0.7 U	**400**	**160**	**44**	**3.6**	--	--	**45**	--	--	--
	Persulfate	27-Mar-20		**4.2**	--	--	--	--	--	--	--	--	--	--
	Persulfate	03-Apr-20		0.7 U	--	--	--	--	--	--	--	--	--	--
	PM12	07-Apr-20		**0.35**	**480**	**140**	**42**	**3.4**	--	--	**39**	--	--	--
	PM13	21-Apr-20		--	**410**	**150 J**	**40 J**	**3.5**	--	--	**44**	--	--	--
	Persulfate	24-Apr-20		0.7 U	--	--	--	--	--	--	--	--	--	--
	Persulfate	27-Apr-20		0.7 U	--	--	--	--	--	--	--	--	--	--
	Persulfate	01-May-20		**2,800**	--	--	--	--	--	--	--	--	--	--
	Persulfate	04-May-20		**3,500**	--	--	--	--	--	--	--	--	--	--
	O&M	08-May-20		**2.8**	--	--	--	--	--	--	--	--	--	--

Table 6-3. Groundwater Geochemical Results (Continued)

OU3, NAS Jacksonville

Well ID	Event[1]	Sample Date	Duplicate	Persulfate(a) (mg/L)	Sulfate (mg/L)	Sulfur (mg/L)	Iron (mg/L)	Manganese (mg/L)	Calcium(b) (mg/L)	Magnesium(b) (mg/L)	Total Organic Carbon (mg/L)	Chloride(b) (mg/L)	Nitrate(b) (mg/L)	Nitrite(b) (mg/L)
Field Blank	Baseline	11-Jul-19		--	**5.9**	--	0.09 U	0.012 U	**23**	**7.9**	1.0 U	**5**	**0.011 J**	0.01 U J
	Baseline	07-Aug-19		--	--	--	0.09 U	0.012 U	--	--	--	--	--	--
	PM1	22-Oct-19		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM3	19-Nov-19		--	0.15 U	4.5 U	0.09 U	0.012U	--	--	1.0 U	--	--	--
	PM4	03-Dec-19		--	**0.09 J**	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM5/Metals	18-Dec-19		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM6	07-Jan-20		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM7	28-Jan-20		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM8	11-Feb-20		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM9/UIC2	25-Feb-20		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM10	10-Mar-20		--	**0.06 J**	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM11	24-Mar-20		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM12	07-Apr-20		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--
	PM13	21-Apr-20		--	0.15 U	4.5 U	0.09 U	0.012 U	--	--	1.0 U	--	--	--

Notes:

Bold values indicate detected results

[1] PM designates the performance monitoring sampling event (e.g., PM1 = performance monitoring sampling event 1); UIC designates the quarterly sampling event required by the UIC Approval Order (e.g., UIC1 = UIC sampling event for Q1)

(a) Persulfate concentrations were determined in the field using Chemetrics test kit

(b) Analyte part of baseline characterization only

mg/L - milligrams per liter

µg/L - micrograms per liter

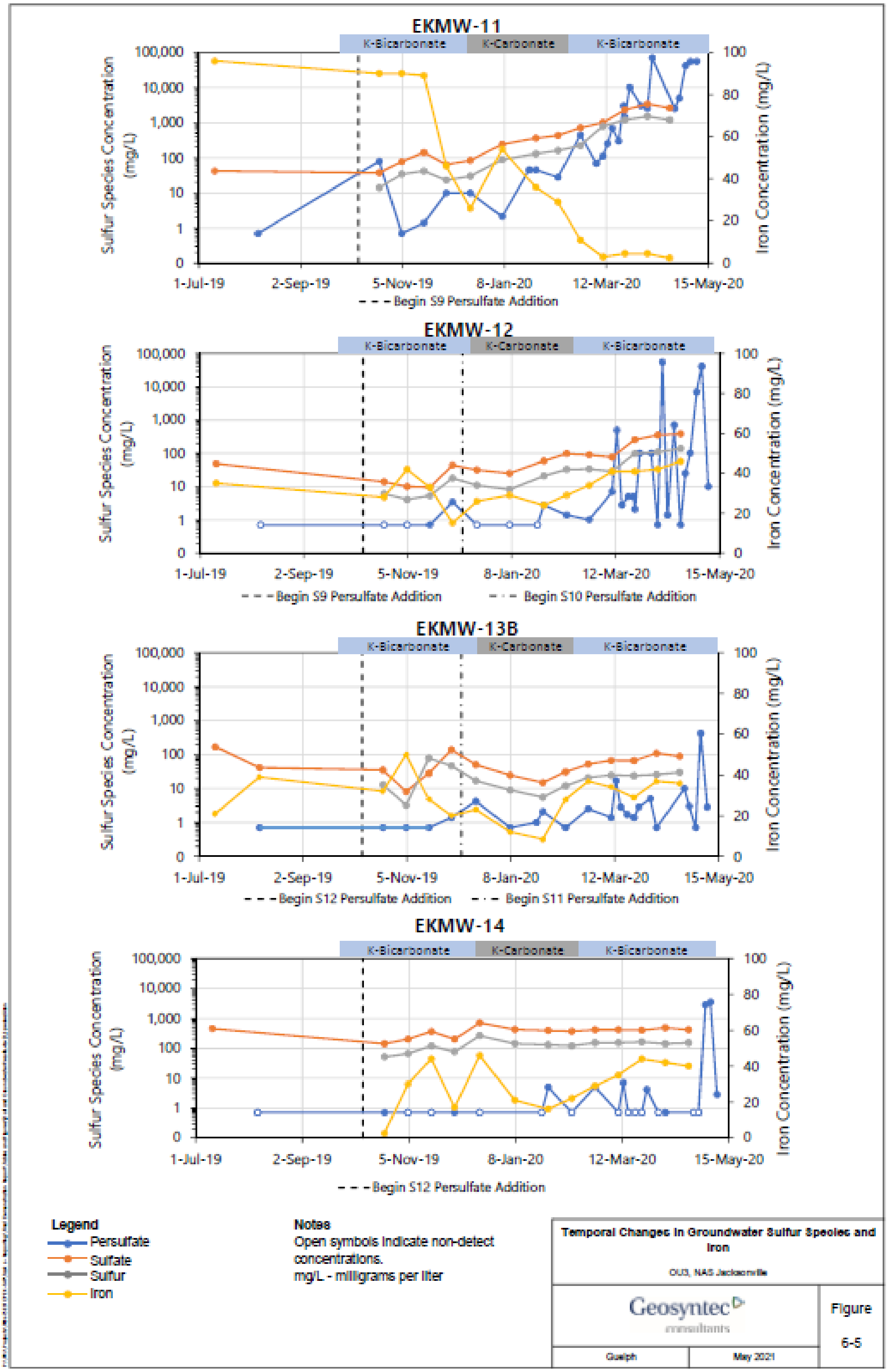
DUP - Duplicate sample

-- - Not analyzed

J - Estimated concentration

U - Not detected above the reporting limit listed

** Value suspected to be anomalous and was not included in the performance assessment



Notes
Open symbols indicate non-detect concentrations.
mg/L - milligrams per liter

Figure 6-5. Temporal Changes in Groundwater Sulfur Species and Iron

OU3, NAS Jacksonville

Table 6-4. Groundwater VOC Results

OU3, NAS Jacksonville

Well ID	Event	Sample Date	Duplicate	Volatile Organic Compounds (µg/L) [a]			
				PCE	**TCE**	**cis-1,2-DCE**	**VC**
EKMW-11	Baseline	11-Jul-19		**6,700**	**2,000**	**3,900**	**62 J**
	VOCs	25-Nov-19		**680**	**1,200**	**4,200**	**45 J**
	PM5	18-Dec-19		**430**	**650**	**3,400**	**24 J**
	PM6	07-Jan-20		**2,000**	**1,500**	**4,600**	**220**
	PM7	28-Jan-20		**2,100**	**1,300**	**2,800**	**130**
	PM8	11-Feb-20		**2,600**	**1,100**	**2,300**	**85 J**
	PM9/UIC2	25-Feb-20		**3,400**	**1,200**	**2,300**	**52 J**
	PM10	10-Mar-20		**2,600**	**950**	**1,700**	25 U
	PM11	24-Mar-20		**1,300**	**430**	**1,200**	1.7 U J
	PM12	07-Apr-20		**760 J**	**300**	**1,000**	2.0 U J
	PM13	21-Apr-20		**1,200**	**410**	**1,400**	**2.0 J**
EKMW-12	Baseline	11-Jul-19		**6.3 J**	**7.2 J**	**280**	**2.0 J**
	Baseline	11-Jul-19	X	**14 J**	**13 J**	**260**	**2.2 J**
	VOCs	25-Nov-19		**7.2**	**16**	**300**	**39**
	PM5	18-Dec-19		**4.8**	**9.4**	**200**	**19**
	PM6	07-Jan-20		**7.0**	**16**	**210**	**27**
	PM7	28-Jan-20		**12**	**20**	**160 J**	**22**
	PM8	11-Feb-20		**15**	**16**	**150**	**26**
	PM9/UIC2	25-Feb-20		**21**	**22**	**140**	**29**
	PM11	24-Mar-20		**9.5**	**16**	**130**	**28**
	PM12	07-Apr-20		**12**	**20**	**150**	**47**
	PM13	21-Apr-20		**9.2**	**17**	**140**	**61**
EKMW-13B [c]	Baseline	11-Jul-19		**94**	**15**	**14**	**0.31 J**
	PM2/UIC1	05-Nov-19		**2.4**	**4.0 J**	**250**	**0.75 J**
	PM2/UIC1	05-Nov-19	X	**3.9**	**3.7 J**	**200**	**0.63 J**
	VOCs	25-Nov-19		**22**	**19**	**240**	**0.67 J**
	PM5	18-Dec-19		**11**	**9.7**	**170**	**0.62 J**
	PM5	18-Dec-19	X	**11**	**10**	**160**	0.50 U
	PM6	08-Jan-20		**5.3**	**5.4**	**190**	**0.67 J**
	PM6	08-Jan-20	X	**6.6**	**6.8**	**150**	**0.70 J**
	PM7	28-Jan-20		**15**	**12**	**120**	**0.95 J**
	PM7	28-Jan-20	X	**14**	**11**	**130**	**0.83 J**
	PM8	11-Feb-20		**21**	**14**	**120**	**1.2 J**
	PM8	11-Feb-20	X	**21**	**13**	**120**	**1.1 J**
	PM9/UIC2	25-Feb-20		**14**	**12**	**130**	**1.4 J**
	PM9/UIC2	25-Feb-20	X	**15**	**12**	**130**	**1.3 J**
	PM13	21-Apr-20		**39 J**	**23 J**	**110 J**	**1.7 J**
	PM13	21-Apr-20	X	**37 J**	**21 J**	**110 J**	**1.5 J**
EKMW-14	Baseline	11-Jul-19		13 U	13 U	13 U	13 U
	VOCs	25-Nov-19		**6.6**	**13**	**130**	**9.6**
	VOCs	25-Nov-19	X	**5.8**	**12**	**140**	**9.5**
	PM5	18-Dec-19		**1.9**	**3.3**	**140**	**6.1**
	PM6	08-Jan-20		**1.2**	**2.1**	**98**	**3.9**
	PM7	28-Jan-20		**1.5 J**	**3.0 J**	**100**	**2.1**
	PM8	11-Feb-20		**0.35 J**	**0.92 J**	**100**	**2.2**
	PM9/UIC2	25-Feb-20		5.0 U	5.0 U	**110**	**5.3 J**
	PM13	21-Apr-20		**2.1 J**	**1.5 J**	**130**	**19**
Field Blank	Baseline	11-Jul-19		0.5 U	0.5 U	0.5 U	0.5 U
	Baseline	07-Aug-19		0.5 U	0.5 U	0.5 U	0.5 U
	PM5	18-Dec-19		0.5 U	0.5 U	0.5 U	0.5 U
	PM6	07-Jan-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM7	28-Jan-20		0.5 U	0.5 U	**0.30 J**	0.5 U
	PM8	11-Feb-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM9/UIC2	25-Feb-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM10	10-Mar-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM11	24-Mar-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM12	07-Apr-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM13	21-Apr-20		0.5 U	0.5 U	0.33 U	0.5 U
	UIC3	25-Jun-20		0.5 U	0.5 U	0.5 U	0.5 U

Table 6.4 Groundwater VOC Results (Continued)

OU3, NAS Jacksonville

Well ID	Event	Sample Date	Duplicate	Volatile Organic Compounds (µg/L) [(a)]			
				PCE	**TCE**	**cis-1,2-DCE**	**VC**
Trip Blank	Baseline	11-Jul-19		0.5 U	0.5 U	0.5 U	0.5 U
	Baseline	11-Jul-19		0.5 U	0.5 U	0.5 U	0.5 U
	Baseline	07-Aug-19		0.5 U	0.5 U	0.5 U	0.5 U
	VOCs	25-Nov-19		0.5 U	0.5 U	0.5 U	0.5 U
	PM5	18-Dec-19		0.5 U	0.5 U	0.5 U	0.5 U
	PM6	07-Jan-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM7	28-Jan-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM8	11-Feb-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM9/UIC2	25-Feb-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM10	10-Mar-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM11	24-Mar-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM12	07-Apr-20		0.5 U	0.5 U	0.5 U	0.5 U
	PM13	21-Apr-20		0.5 U	0.5 U	0.5 U	0.5 U

Notes:

Bold values indicate detected results

(a) Volatile organic compounds (VOCs) analyzed by EPA Method 8260B

PCE - Tetrachloroethene

TCE - Trichloroethene

cDCE - cis-1,2-Dichloroethene

VC - Vinyl Chloride

µg/L - micrograms per liter

J - Estimated concentration

U - Not detected above the reporting limit listed

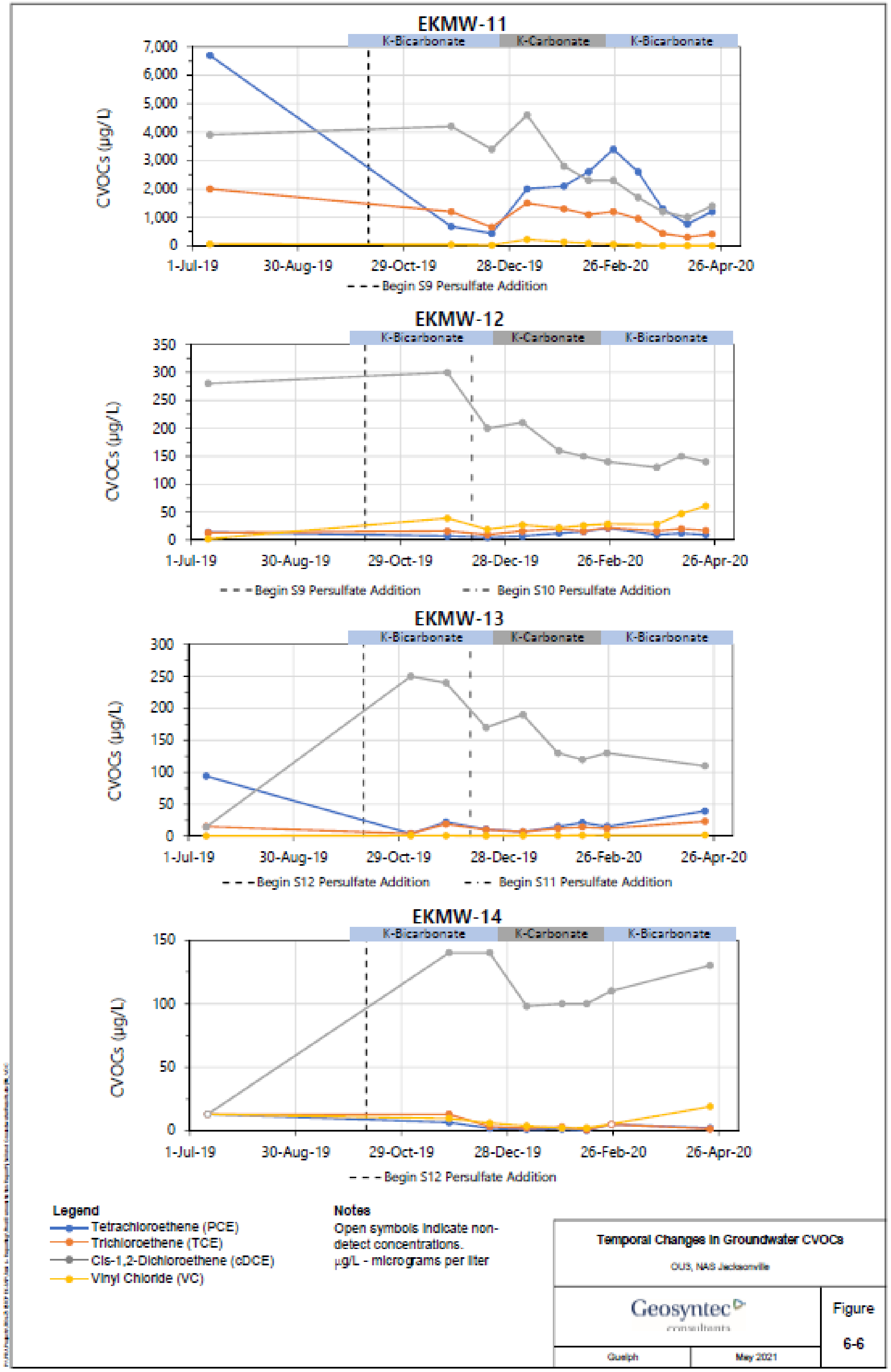


Figure 6-6. Temporal Changes in Groundwater CVOCs

OU3, NAS Jacksonville

At EKMW-11, despite some fluctuations in the data, concentrations of CVOCs decreased throughout Phase 1 operations. By the end of the Dem/Val, overall reductions in PCE, TCE, cDCE and VC ranged from approximately 64% (cDCE) to more than 95% (VC). A temporary rebound in the concentration of PCE was observed during the period of system operations when potassium carbonate was used as the pH buffer and system uptime was significantly reduced, but PCE concentrations then decreased once the supply of potassium bicarbonate was restored and system uptime increased to above 90%. These reductions in CVOC concentrations are attributed to treatment *via* chemical oxidation from the persulfate that was distributed and naturally activated in this area of the TTA.

Some treatment of CVOCs was also observed at the other EKMWs, however the extent of CVOC treatment was not as considerable as that observed at EKMW-11. Reductions in the concentrations of PCE at wells EKMW-12, EKMW-13B and EKMW-14 ranged from approximately 34% (EKMW-12) to 84% (EKMW-14). However, the baseline PCE concentrations at these locations were approximately two orders of magnitude lower than the PCE concentration at EKMW-11 (at which the concentration of PCE was reduced by approximately 82% by the end of the Dem/Val). TCE concentrations also decreased at all locations except EKMW-12, with reductions ranging from 73% (EKMW-13B) to 89% (EKMW-14). At EKMW-12, TCE concentrations remained stable throughout Phase 1 operations and were consistent with baseline. All four EKMWs displayed an initial increase in the concentration of cDCE compared to baseline concentrations, but concentrations then decreased over the course of the Dem/Val. By the end of the Dem/Val, reductions in cDCE concentrations (versus peak cDCE concentrations) ranged from approximately 7% (EKMW-14) to 70% (EKMW-11).

As noted above, the greatest extent of CVOC treatment was observed at EKMW-11. This finding is consistent with the oxidizing conditions and strong presence of sulfur species observed at this well. While the other EKMWs (EKMW-12, EKMW-13B and EKMW-14) showed more variable trends in the concentrations of specific CVOCs, PCE and TCE were generally observed to decrease at these wells following implementation of EK operations and persulfate addition at the respective supply wells.

Collectively, the performance monitoring groundwater data collected during the Dem/Val suggest that EK operations were successful in enhancing the delivery and distribution of persulfate within the TTA (at varying rates and amounts). Furthermore, in-situ activation of the distributed persulfate in some areas of the TTA, likely due to elevated concentrations of iron, led to the development of oxidizing conditions and overall reductions in the concentrations of CVOCs in these areas.

7.0 PERFORMANCE ASSESSMENT

This section provides an assessment of the performance of the Dem/Val relative to the performance objectives previously discussed in Section 3. Each subsection discusses the performance relative to an individual performance objective.

7.1 DEMONSTRATE UNIFORM DISTRIBUTION OF PERSUFLATE

The success criteria for this performance objective include:

Criterion

Evidence of persulfate transport to all monitoring wells locations located within the TTA following the EK migration phase.

As presented in **Table 6-3** and **Figure 6-5**, increases in the concentrations of persulfate were observed at all four EKMWs during the Dem/Val, and by the end of Phase 1 operations persulfate was detected at all four EKMWs at concentrations ranging from 1% to 100% of the amendment supply concentration. Increases in the concentrations of sulfate and sulfur by as much as 1 to 2 orders of magnitude were also observed at wells EKMW-11 and EKMW-12.

The Dem/Val has met this criterion.

Criterion

Persulfate transport rate greater than 2.5 cm/day.

Calculated persulfate migration rates ranged from approximately 0.6 cm/day to 1.3 cm/day. However, the rate of persulfate migration was inhibited due to in-situ activation of the persulfate by naturally occurring subsurface conditions (e.g., elevated concentrations of iron).

The Dem/Val has partially met this criterion.

Criterion

No focusing of electric field in any areas (electrical gradient between well pairs no more than 5x of average gradient between all well pairs).

As shown in **Figure 6-3**, voltage measurements at discrete locations within the TTA were between 5.9V and 21.9V indicating that an electric field was established in the area between electrode wells. Voltage gradients between discrete locations of closest well pairs were calculated and ranged from 0.34 V/m to 0.65 V/m and were approximately 100x below the target estimated voltage gradient of 0.5 V/cm (or 50 V/m). The variation in voltage gradients between well pairs was generally <10%, indicating that the established voltage gradients were relatively uniform and no local focusing of the electric field was encountered within the TTA.

The Dem/Val has met this criterion.

Criterion

Electrical potential gradient between electrode pairs maintained at level no more than 5x of target gradient at design current.

The EK system was designed and operated at a constant current, determined after the start-up period, during system operations. As presented in **Figure 6-1**, the voltage required of the *DC* power supply unit was generally consistent during periods of constant current, except for a few occasions when electrodes need cleaning. The electrical current supplied to individual wells during periods of constant current was generally steady (variation within 30% of average). Given that (i) soil electrical resistivity is a soil property not expected to vary over the course of Dem/Val, and (ii) the voltage output by the *DC* power supply unit and the current supplied to individual electrodes were generally steady, the electrical potential between electrode pairs within the TTA should maintain within 5x of target during operation.

The Dem/Val has met this criterion.

7.2 QUANTIFICATION OF EK SYSTEM OPERATIONAL PARAMETERS

The success criteria for this performance objective include:

Criterion

System operational conditions (voltage, current) within ±50% of the final designed target voltage and current.

As discussed in Section 6.1 and Section 7.1 (criterion related to electrical gradient) and presented in **Figure 6-1**, the operating voltage and current remained relatively steady except when electrodes needed cleaning. Excluding these periods of temporary unstable readings, the overall system operation conditions were steady and within 50% of the average during each normal operation period. The Dem/Val has met this criterion.

Criterion

Persulfate supply uptime greater than 75% of target.

As discussed in Section 6.1, system uptime was at least 85% during the periods when potassium bicarbonate was used to control pH in the electrode wells (i.e., a total of roughly 5 months out of the 7-month operations period). During these periods, system downtime was predominantly a result of the weekly site visits for O&M and/or groundwater sampling, in which case the *DC* power supply was manually turned off in order to protect the health and safety of field staff during these activities. The Dem/Val has met this criterion.

Criterion

Energy consumption with ±30% of the design estimate.

The EK system was designed and operated at a constant current, determined after the start-up period, during system operations. Given that the energy consumption is a function of voltage and current and, as discussed above regarding the steady system operation condition criterion, the overall system operations were steady and, thus, energy usage was also steady. The Dem/Val has met this criterion.

Criterion

Electrode function is maintained for at least one full cycle of EK-TAP.

As discussed in Section 5.1, only the first phase of testing (i.e., Phase 1 dipole test) was completed as a result of federal budget constraints. Other than a few occasions when the electrodes in the cathode wells needed to be cleaned, electrode function was maintained throughout system operations. The Dem/Val has met this criterion.

7.3 SAFE AND RELIABLE OPERATION, AND EASE OF TECHNOLOGY IMPLEMENTATION

The success criteria for this performance objective include:

Criterion

Operation conditions remain stable within the normal designed ranges over the course of the demonstration period.

As discussed in Sections 7.1 and 7.2 above, the overall operational conditions remained relatively steady over the course of the Dem/Val. The Dem/Val has met this criterion.

Criterion

No Lost-Time Incidents (LTIs)

There were no safety-related LTIs. The Dem/Val has met this criterion.

Criterion

Ability to construct using conventional techniques and contractors.

The Dem/Val involved only conventional field construction techniques, including well drilling, well installation, and piping, as well as remediation system electrical connections performed by a qualified electrical subcontractor. The Dem/Val has met this criterion.

Criterion

A single field technician able to effectively monitor and maintain normal system operation.

During system operations, one field technician performed routine system O&M tasks roughly twice per week with approximately 4 hours per visit. During the routine O&M visit, the tasks primarily included system visual inspections, recording the system operational parameters (voltage, current, amendment flow and pressure, etc.), and replenishing amendment solutions as needed. Additional system monitoring was completed remotely. Groundwater sampling events were also completed by one field technician. Over the course of system operations, there were fewer than 5 scheduled O&M events that involved two field technicians. The Dem/Val has met this criterion.

8.0 COST ASSESSMENT

This section provides cost information that a remediation professional could use to reasonably estimate the costs for implementing EK-TAP at a given site. Because the heating and persulfate activation stage of the EK-TAP technology was not performed for this Dem/Val, the cost analysis is based on *actual* costs of the tasks completed for this Dem/Val and *estimated* costs to complete the heating and persulfate activation portion of the technology based on experience at other sites where EK-TAP has been applied. Where appropriate, cost information has also been supplemented with reasonable estimates based on the team's experience from similar projects at other sites.

It should also be noted that the footprint of the TTA for this Dem/Val was purposely designed to be smaller than the footprint of most source areas at other sites in order to facilitate a phased testing approach. Based on our experience at other sites, the size of the area(s) requiring treatment will likely be larger than the TTA footprint in this Dem/Val. Nonetheless, the information presented below is considered useful for developing costs estimates of the EK-TAP technology at other sites.

8.1 COST MODEL

A cost model was developed to assist remediation professionals in understanding costs associated with the EK-TAP technology. The cost model identified the major cost elements required to implement the EK-TAP technology at a typical site with a CVOC (e.g., PCE) source area. **Table 8-1** presents a summary of cost elements and the cost tracking (where appropriate). Select cost elements are briefly discussed.

Table 8-1. Cost Model for EK-enhanced Amendment Delivery In-Situ Remediation

(For a Source Area Measuring 25 ft by 5 ft by 5 ft Thick [i.e., approximate footprint of the TTA in this Dem/Val])

Cost Element	Tracked During the Demonstration or Estimated Based on Experience at Other Sites	Costs
Bench-scale oxidant demand and EK Column Test	• Aquifer sediment materials provided by NAS Jacksonville. • Laboratory bench-scale oxidant tests – \$3K • Laboratory bench-scale EK column tests – \$20K	\$23K
Remedial Design	• Professional labor for system design and demonstration plan – \$80K	\$80K
Remediation Construction	• Utility locates and well installation subcontractors – 7 electrode/supply wells and 4 monitoring wells; \$20K • EK system construction subcontractor - \$160K • Site construction subcontractor - \$50K • Field construction oversight and system shakedown professional labor (~7 weeks) – \$40K	\$270K
Baseline characterization (soil / groundwater)	• Field staff labor - \$6K • Laboratory analytical costs - \$6K	\$12K

Table 8-1. Cost Model for EK-enhanced Amendment Delivery In-Situ Remediation

Cost Element	Tracked During the Demonstration or Estimated Based on Experience at Other Sites	Costs
Remediation System Operation & Maintenance	• Field O&M subcontractor – over 16 months of active operation (assumes 2 EK-TAP treatment cycles), $45K • Materials – persulfate, $5K • Materials - buffer and other chemicals, $3K • Materials - system parts & consumables, $4K • Professional labor for startup and scheduled O&M visits - $20K	$77K (about $5K/month)
Field Sampling (soil / groundwater)	• Performance monitoring groundwater sampling: up to 8 rounds of comprehensive sampling events and 8 rounds of limited scale sampling events; no cost tracking • Standard soil and groundwater sampling activities; no cost tracking • Field sampling staff labor; no cost tracking • Laboratory analytical costs; no cost tracking	NA (dependent on system design and regulatory requirements)-
Waste disposal	• NAS Jacksonville provided waste disposal; no cost tracking	NA
Reporting & Other Compliance Requirements	• Project reporting and meetings; no cost tracking	NA

8.1.1 Cost Element – Bench-scale Testing

For this Dem/Val, several laboratory treatability studies were performed during the site selection/re-selection process to assess the applicability of the EK-TAP technology for the OU3 area at NAS Jacksonville. It is recommended that bench-scale testing be considered as part of the remedial design for an EK-enhanced remedy. The scope of bench testing can vary depending on the test objectives. For example, the bench test can be designed to estimate oxidant demand only (for EK-ISCO or EK-TAP), or to include an assessment of amendment transport rate and treatment effectiveness (for all EK-enhanced remedies). Therefore, the costs of bench testing can vary based on the scope and objectives but will typically range between $3,000 to $40,000.

8.1.2 Cost Element – Remediation Construction

For this Dem/Val, no special drilling or field construction methods were required. System components, including amendment supply systems, a power supply system, and process controls were housed in two 20-foot trailers that were constructed by a remediation system vendor in accordance with the project-specific design. No special equipment or parts, other than off-the-shelf commercial products, were required for the EK system. The electrodes and *DC* power supply unit were also commercially available products, as where the persulfate and pH buffer amendments. During the Dem/Val there were specific requirements regarding the chemical composition of the pH buffers, but in our experience this was a unique situation and in most cases the regulatory requirements for addition of chemical amendments for an EK-TAP remedy should be similar to the regulatory requirements for addition of chemical amendments for other “typical” in-situ remediation technologies.

The EK system construction costs will vary depending on the project scale (e.g., number of electrode wells needed to cover a treatment area, number of electrodes used, etc.) and site conditions (e.g., the extent of instrument automation due to site access, iron fouling and control measures due to geochemistry, etc.). However, the cost increase for expanding an EK system at a site will typically be marginal, with the cost increase primarily related to additional wells and parts (e.g., electrodes, valves, and pipe fittings, etc.). The EK Control trailer used for this Dem/Val could have been capable of incorporating up to 10 electrode wells, thereby expanding the treatment footprint (for the electrode spacing used) by approximately 200%.

8.1.3 Cost Element – Remediation System Operation and Maintenance

The system O&M costs can vary depending on the extent of instrument automation and site conditions and restrictions. For this Dem/Val, routine O&M tasks were performed by regular remediation field technicians without needing special personnel. The material costs for chemicals and system consumables are project-specific but generally scalable. Professional labor costs for field tasks during this Dem/Val were associated with system installation, start-up, operations maintenance, and performance monitoring.

8.2 COST DRIVERS

Based on the information and experience obtained from this Dem/Val and application of the EK-TAP technology at other sites, there are three main cost drivers to consider when evaluating implementation costs in future projects, including: (i) footprint, depth interval, and volume of target treatment zone and contaminant mass; (ii) presence and location of above-ground and subsurface utilities; and (iii) site geochemistry, particularly pH and iron. These are also the same cost drivers for many other in-situ remediation technologies and not unique to EK technology implementation. Each of these cost drivers is discussed below.

8.2.1 Cost Driver – Target Treatment Zone and Contaminant Mass

As for most remediation technologies, the size and volume of the target treatment zone as well as the amount of contaminant requiring treatment significantly affects the overall remediation costs. Particularly, the drilling and well installation costs for system wells (electrode wells and supply wells) vary based on the number and depth of these wells needed to adequately address the treatment zone. The spacing between electrode wells designed for this Dem/Val was approximately 12 ft, with supply wells located within the electrode well network. This level of well spacing, coupled with the phased operation program and the duration of operations, can be considered as within ranges of normal design for this technology. However, as previously noted the footprint of the TTA for this Dem/Val was purposely designed to be smaller than the footprint of most source areas at other sites in order to facilitate a phased testing approach.

For this Dem/Val, only the first stage of the EK-TAP technology (i.e., EK-enhanced delivery of persulfate) was tested during Phase 1 operations, which lasted approximately 7 months. However, operations lasted several months longer than anticipated due to issues with the supply of pH buffer chemicals. The need for a second treatment cycle will also depend on the contaminant mass remaining at the end of the first treatment cycle and the required mass reduction goal.

While there is no technical limit for applying EK technology in terms of depth, the costs for well construction increase as the depth of target treatment zone increases. The depth interval (thickness) of the target treatment zone may affect the number of electrodes within an electrode well and, therefore, the overall number of electrodes needed. A target treatment zone of shallow depth may need additional measures and costs related to utility protection as discussed below.

8.2.2 Cost Driver – Utilities

As with other active remediation technologies, a power source is required for this technology. Although not yet tested, the energy demand and the electrical operation conditions (voltage and current) demonstrated in this Dem/Val suggest that solar energy with battery units may be a feasible option.

Special considerations are warranted at sites with metallic subsurface infrastructure or subsurface utilities that may be electrically conductive. This evaluation should take into account the vertical separation of the electric field and the utility of concern. If needed, cathodic protection measures can be considered which can increase the implementation costs. In general, the EK technology is best suited for sites where the target treatment zone is deeper than 8 ft bgs (i.e., below utilities and conduits) and the groundwater table is below 5 ft bgs, otherwise special design considerations are needed.

8.2.3 Cost Driver – Site Geochemistry

Concentrations of iron and other major cations (e.g., calcium and magnesium) in groundwater is an important factor that can affect the costs of system construction and O&M. While iron is an important factor for most in-situ remediation technologies, it requires a special consideration when implementing an EK remedy because the cathodes will attract and concentrate iron and cations in the cathode wells, at least temporarily. The EK system for sites with elevated concentrations of these cations will also need to be sized and equipped with adequate units for handling the anticipated amount of precipitates. More robust O&M programs and efforts will also need to be considered for such sites. Over the course of implementation, the O&M issues related to these major cations should diminish.

In the case of EK-TAP, high levels of iron may result in activation of the persulfate which can lead to slower persulfate migration rates and extended remediation timeframes. However, in-situ activation of the persulfate can also result in treatment of target CVOCs which may preclude the need for activation of the persulfate *via* a subsequent heating stage and/or the need for a second treatment cycle.

8.3 COST ANALYSIS

Table 8-2 provides a cost comparison between EK-TAP, conventional direct-injection ISCO, hydraulic fracturing direct push technology (DPT) injection of zero-valent-iron (ZVI), and ERH thermal treatment for a typical CVOC source site in low-K materials. The key characteristics of the framework site are as follows:

- The site characterization and conceptual site model have been completed. The characterization of the target treatment area is sufficient and no additional pre-design investigation data are needed to support the remedial design;
- The footprint of TTA is approximately 80 ft x 80 ft;
- The depth interval of the TTA is between 10 and 30 ft bgs;
- Geology consisting of mainly fine-grained clayey material (K_h <10^{-6} cm/s);
- CVOC mass (chlorinated ethenes) is approximately 500 lbs;
- Treatability testing has been completed to support remediation design. Results of the treatability testing demonstrate the ability of EK to successfully migrate persulfate in site soils with persulfate migration rates >2.5 cm/day, and of EK-TAP to degrade the target CVOCs to below the target treatment criteria. The results also demonstrate that the levels of iron in site soils should not unduly activate the persulfate and prevent its delivery to the TTA using EK;
- The site has available potable water supply and adequate power utility; and
- No concerns for site access, subsurface obstruction, electrical interference or corrosion.

Estimates of the full-scale implementation costs and key assumptions associated with each technology for which the estimated costs are developed are presented in **Table 8-2**. Given that performance monitoring requirement is highly project-specific, the estimated costs are presented with and without the costs for performance monitoring. These estimates are prepared at the level of a feasibility study (e.g., +50%/-30%) for a cleanup site.

For baseline comparison, the cost of excavation with offsite disposal was also estimated. The feasibility-level cost estimate for an excavation-disposal option is in the range of $1,300,000 to $1,500,000. This estimate assumes that 50% of the excavated volume would need to be managed as hazardous waste. If more than 50% of the excavated volume is deemed hazardous, the costs for implementing this remedial option would increase significantly.

Table 8-2. Cost Model for Full-Scale Implementation of Select Source Area Remediation Technologies

Cost Element	Tasks	Excavation - Disposal	EK-TAP	Injection ISCO	Hydraulic Fracturing DPT Injection ZVI	ERH	Descriptions / Assumptions
Remedial Design and Permitting	Design, project workplans, UIC permit ERH – also needs air permit, water discharge permit	$50K	$70K	$50K	$65K	$80K	NA
Remedial Construction (*Excavation-disposal and hydraulic fracturing DPT ZVI injection costs presented in Remediation System Operation & Maintenance below)	EK-TAP – 1. Well installations 2. Site construction; utilities 3. EK system & control center fabrication / mobilization / field connections 4. Professional field oversight and system shakedown/startup		1. $53K 2. $140K 3. $175K 4. $60K				• 25 electrode wells and 15 supply wells; 4-inch PVC wells • Electrode well spacing at ~ 18 ft • Two electrodes vertically spaced in each electrode well • One EK control / amendment supply system
	Injection ISCO – 1. Well installations 2. Site construction; utilities 3. Injection system mobilization / field connections 4. Professional field oversight and system shakedown/startup			1. $70K 2. $35K 3. $20K 4. $40K			• 49 injection wells; 2-inch PVC wells • Injection well spacing at ~ 13 ft • Injection ROI at ~ 7 ft • Up to three injection manifolds are constructed • Area is accessible during injection, and no trenching is required
	ERH – 1. Well installations 2. Site construction; utilities 3. ERH system mobilization / field connection / system shakedown/startup 4. Professional field oversight					1. $92K 2. $180K 3. $190K 4. $60K	• 25 electrode wells and 25 co-located vapor recovery wells • Electrode well spacing at ~ 18 ft • A surface cap will not be required • Include a 20-hp vapor extraction blower • Adequate power supply is available for a 500-kW power unit
Remediation System Operation & Maintenance	Excavation with Off-site Disposal – 1. Excavation 2. Dewatering 3. Off-site disposal of soil and water 4. Backfill 5. Professional field oversight	$1,250K to $1,450K					• 7,000 CY excavated volume • 150,000 gallons dewater volume • 50% excavated volume as hazardous • 25 miles to disposal facility

Table 8-2. Cost Model for Full-Scale Implementation of Select Source Area Remediation Technologies (Continued)

Remedial System Operation & Maintenance	EK-TAP – 1. Materials – chemicals 2. Materials – parts and supplies 3. Labor – O&M operator 4. Labor – professional 5. Utilities – water and electrical power		1. $60K to $75K 2. $25K to $40K 3. $65K to $95K 4. $50K to $75K 5. $7K to $10K				• Sodium persulfate and pH buffer chemical amendments • Approximately up to 3A current between each pair of cathode and anode • Four treatment cycles over two years; each cycle is four months of active EK operation followed by one month of heating and one month cool-down; a 3rd year is assumed for contingency • Less than 5,000 kW-hr electrical energy required for EK operation; less than 10,000 kW-hr electrical energy required for heat activation of distributed persulfate • Weekly visit by a system operator; up to three major O&M events
	Injection ISCO – (injection rate from 0.75 gpm to 1 gpm) 1. Injection system rental 2. Materials – chemicals 3. Labor – field injection 4. Utilities – water and electrical power 5. Reinjection – 2 reinjection events			1. $25K to $30K 2. $65K 3. $60K to $90K 4. $5K 5. $155K to $190K x 2 events			• Sodium persulfate as oxidant, sodium hydroxide for base activation of persulfate • Achievable injection rate from 0.75 gpm to 1 gpm • Up to two re-injection events over a period of five years
	Hydraulic Fracturing DPT Injection ZVI – 1. Injection vendor all labor/material inclusive costs 2. Professional oversight				1. $695K to $845K 2. $30K		• 25 DPT injection points; ROI ~12 ft; spacing ~ 20 ft • 7 fractures per DPT location (~ 3 ft depth interval per fracturing) • 1.5% wt ZVI to soil mass (total ZVI mass = 210,000 lbs) • 20 to 25 days of field injection
	ERH – 1. System rental and system operator 2. Labor – professional oversight 3. Utilities – electrical power 4. Permit monitoring (air and condensate) 5. Waste (activated carbon) disposal					1. $360K 2. $24K 3. $114K 4. $30K 5. $53K	• Total heating time of 180 days • Approximately 142,000 kW-hr electrical energy needed • Approximately 8,000 lb of activated carbon for regeneration/disposal • Vapor and condensate sampling and analysis in compliance with permits
Estimated Total (no performance monitoring costs)		**$1,300K - $1,500K**	**$705K - $793K**	**$680K to $785K)**	**$790K - $940K**	**$1,183K**	

Table 8-2. Cost Model for Full-Scale Implementation of Select Source Area Remediation Technologies (Continued)

Remediation Performance Monitoring	EK-TAP – Semi-annual groundwater monitoring for 3 to 4 years; Final soil sampling Injection ISCO – Semi-annual groundwater monitoring for 5 years; Final soil sampling Hydraulic fracturing DPT ZVI Injection – Semi-annual groundwater monitoring for 3 years; Final soil sampling ERH – Two semi-annual groundwater following the active operation; Final soil sampling		$190K - $240K	$290K	$190K	$90K	For costing purpose, assumes: $25K per semi-annual groundwater monitoring event; $40K for final soil sampling event.
Estimated Total (with performance monitoring costs)		**$1,300K - $1,500K**	**$895K - $1,033K**	**$970K - $1,075K***	**$980K - $1,130K**	**$1,273K**	

Based on the cost estimates presented in **Table 8-2**, EK-TAP can be potentially more cost favorable to an ERH remedy or excavation and disposal. The cost saving of EK-TAP compared to ERH is smaller when factoring in the monitoring costs because ERH can complete the remediation within a shorter timeframe (approximately 6 months with ERH compared to approximately 2 to 3 years with EK-TAP for the framework site). However, the energy usage required for EK-TAP is significantly less than the energy usage for ERH, resulting in a much more favorable environmental performance of EK-TAP over ERH.

The feasibility and effectiveness of the direct-injection ISCO approach is highly dependent on whether direct injection can achieve a reasonable injection rate and a reasonable radius of influence (ROI) in the low-K target treatment area of the framework site. For cost estimating purpose, an injection rate of 0.75 gallons per minute (gpm) to 1 gpm and a ROI of 7 ft are assumed; it is possible that at certain low-K sites these assumed injection rates and ROI may not be achievable. The estimated costs for direct-injection ISCO are presented in **Table 8-2** as a range based on injection rates. The estimated cost for the EK-TAP approach is comparable to that of direct-injection ISCO when factoring in the costs for ISCO reinjections (assuming two reinjections over five years). When accounting for the performance monitoring costs, which depend on the overall timeframe of the remedy, EK-TAP is potentially a more cost favorable alternative to direct-injection ISCO. Therefore, at sites where low-K material and/or high-degree of heterogeneity limits the feasibility of applying direct injection, EK-TAP can provide a cost-effective solution for implementing ISCO using persulfate.

Fracturing DPT injection has an overall estimated cost slightly higher than EK-TAP. Certain site conditions may present more constraints for fracturing DPT injection than EK-TAP, such as sensitive subsurface utilities or a shallow treatment zone close to ground surface. While fracturing DPT technology can enhance aquifer permeability, if a target treatment zone is in a heterogeneous formation, the fracturing technique may still result in non-uniform distribution of injected amendment. Alternately, the depth interval for fracturing will need to be reduced, with associated increased costs to achieve uniform distribution.

9.0 IMPLEMENTATION ISSUES

EK-TAP is a variation on standard ISCO using persulfate, whereby EK is used to more effectively deliver the persulfate through low-K materials. In addition, EK-TAP utilizes the same infrastructure to heat the treatment zone to the activation temperature of persulfate. Implementation of the heating stage for EK-TAP is similar to ERH, albeit with much lower subsurface temperatures. As such, there are only a few additional requirements or implementation issues that need to be addressed beyond those typically encountered with standard ISCO and ERH implementations. Some areas where additional attention may be required, on a site-specific basis, include:

- Safety considerations related to potential stray current/voltage to surface. To address this question during the Dem/Val, the current and voltage at the surface steel structures located within the treatment area (e.g., trailers, perimeter fencing, well manhole steel covers, etc.) where measured while the EK system was in operation to confirm that there was no safety concern. Depending on the project site, and for sensitive and active facilities with dedicated safety departments, additional design and explanation effort may be required for project approvals.
- Iron fouling of filters and valves along the extraction piping. During this Dem/Val, minimal fouling of filters and valves was observed, but routine maintenance was required to minimize potential flow restrictions within the conveyance lines. Scaling of the cathodes also required maintenance actions to clean the cathode surface. The presence of iron within target treatment zone resulted in activation of the persulfate which reduced the persulfate migration rate and extended the duration of operations. However, in-situ activation of the persulfate also resulted in some treatment of the target CVOCs, which could have reduced the effort required for a subsequent heating stage had heating been performed during the Dem/Val.
- Although not encountered during this Dem/Val, corrosion of metallic parts with the system piping and at wellheads fittings may occur with elevated chloride concentrations. This can be mitigated by minimizing the amount of metallic wetted parts within the system and instead using components with plastic wetted parts.
- The technology implementation did not require specialized/proprietary equipment. We used only standard commercial off-the-shelf equipment. We designed the manifold and control system and had a remediation system vendor assemble the system per design, but the overall system was similar to other “typical” in-situ remediation technologies. There were specific regulatory requirements regarding the chemical composition of the pH buffers used in this Dem/Val, but in our experience at other sites this was a unique situation and in most cases the requirements for addition of chemical amendments for an EK-TAP remedy should be similar to the requirements for addition of chemical amendments for other “typical” in-situ remediation technologies.
- If the technology is to be implemented near (laterally and/or vertically) utilities that are “sensitive” to electric interference where there are concerns with corrosion, some protection measures, such as cathodic protection, may be considered.

- No special regulatory requirements or permits beyond what are typical for other ISCO projects such as UIC permit. Depending on the locality-/facility-specific requirements, local or facility power/electrical departments should be consulted, and local HazMat response departments should be informed about the use of a chemical oxidant at the project site.

10.0 REFERENCES

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APPENDIX A GROUNDWATER SAMPLING FORMS

Appendix A

Groundwater Sampling Forms

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-11

SAMPLE ID: EKMW-11

DATE: 7/11/2019

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 4.10

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 11:05

PURGING ENDED AT: 11:08

TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
11:08	0.25	0.25	0.08	5.80	5.21	28.33	6873	0.79	25.7	clear	35.5

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 11:15

SAMPLING ENDED AT: 11:25

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: Y [✓ N]

FILTER SIZE: _____ µm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	PE	250 mL	HNO_3	—	—	Ca, Fe, Mg, Mn	APP	<100
"	1	PE	250 mL	NONE	—	—	Cl, SO_4, NO_3, NO_2	APP	<100
"	3	AG	40 mL	H_2SO_4	—	—	TOC	APP	<100
"	3	CG	40 mL	HCl	—	—	VOHs	APP	<100

REMARKS: Wells historically purge dry. One equipment volume purged before sampling.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-12

SAMPLE ID: EKMW-12

DATE: 7/11/2019

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 3.99

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 11:52

PURGING ENDED AT: 11:56

TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/l] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
11:56	0.25	0.25	0.06	6.15	5.72	29.87	2971	0.32	10.4	clear	-40.8

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 12:00

SAMPLING ENDED AT: 12:20

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:

FILTER SIZE: _____ µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)

DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	PE	250 mL	HNO_3	—	—	Ca, Fe, Mg, Mn	APP	<100
"	1	PE	250 mL	NONE	—	—	Cl, SO_4, NO_3, NO_2	APP	<100
"	3	AG	40 mL	H_2SO_4	—	—	TOC	APP	<100
"	3	CG	40 mL	HCl	—	—	VOHs	APP	<100

REMARKS: Wells historically purge dry. Collect one equipment volume before sampling.
DUP-01 sample collected.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: **1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 7/11/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.12
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 12:40
PURGING ENDED AT: 12:44
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
12:44	0.25	0.25	0.06	7.10	5.86	29.48	3253	0.20	8.81	clear	-62.8

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 12:50
SAMPLING ENDED AT: 13:00
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: _____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	PE	250 mL	HNO_3	—	—	Ca, Fe, Mg, Mn	APP	<100
"	1	PE	250 mL	NONE	—	—	Cl, SO_4, NO_3, NO_2	APP	<100
"	3	AG	40 mL	H_2SO_4	—	—	TOC	APP	<100
"	3	CG	40 mL	HCl	—	—	VOHs	APP	<100

REMARKS: Wells historically purge dry. One equipment volume purged before sampling.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: BZ ~~X~~ NAS JAX EK TAP	SITE LOCATION: Jacksonville, FL

WELL NO: EKMW - 14	SAMPLE ID: EKMW - 14	DATE: 7/11/19

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 2.35	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 13:30	PURGING ENDED AT: 13:34	TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
13:34	0.25	0.25	0.06	4.58	8.38	30.76	1415	1.16	HIGH	brown	-3.7

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Byce Zinckgraf / Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 13:40	SAMPLING ENDED AT: 13:50
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	FILTER SIZE: ____ µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	PE	250 mL	HNO_3	—	—	Ca, Fe, Mg, Mn	APP	<100
"	1	PE	250 mL	NONE	—	—	Cl, SO_4, NO_3, NO_2	APP	<100
"	3	AG	BZ ~~25~~ 40 mL	H_2SO_4	—	—	TOC	APP	<100
"	3	CG	40 mL	HCl	—	—	VOHs	APP	<100
" MS	3	CG	40 mL	HCl	—	—	VOHs	APP	<100
" MSD	3	CG	40 mL	HCl	—	—	VOHs	APP	<100

REMARKS: Wells historically purge dry. One equipment volume purged before sampling. Collected matrix spike (MS) and matrix spike duplicate (MSD) samples.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP		SITE LOCATION: Jacksonville, FL	
WELL NO: EKMW-11	SAMPLE ID: EKMW-11		DATE: 10/22/19

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 4.29	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 10:00	PURGING ENDED AT: 10:07	TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
10:07	0.25	0.25	0.04	6.85	5.70	28.70	6320	0.65	19.9	clear	53.2

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec	SAMPLER(S) SIGNATURE(S): Bryce Zinckgraf	SAMPLING INITIATED AT: 10:10	SAMPLING ENDED AT: 10:20
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	FILTER SIZE: _____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N (replaced)]	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	300
EKMW-11	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-11	1	PE	250 mL	NONE	—	—	SO_4^{2-}	APP	300
EKMW-11	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	300
EKMW-11	1	PE	250 mL	HNO3	—	—	Fe, Mn	APP	300

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. ~~S_2O_8~~ S_2O_8: 80 mg/L (2:1 dilution)
Sodium persulfate tested in field with CHEMETS colorimetric tubes.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12
SAMPLE ID: EKMW-12
DATE: 10/22/19

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.83
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 10:40
PURGING ENDED AT: 10:47
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
10:47	0.25	0.25	0.04	6.75	5.41	29.40	2787	0.51	17.9	clear	-12.5

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 10:50
SAMPLING ENDED AT: 11:00
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: _____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	300
EKMW-12	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-12	1	PE	250 mL	NONE	—	—	$SO4^{2-}$	APP	300
EKMW-12	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	300
EKMW-12	1	PE	250 mL	HNO3	—	—	Fe, Mn	APP	300

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8 :~0.25 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: **1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 10/22/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.71
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 11:15
PURGING ENDED AT: 11:22
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/l] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
11:22	0.25	0.25	0.04	6.50	5.47	29.68	2872	1.08	7.16	clear	-17.5

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S): Br Zf
SAMPLING INITIATED AT: 11:25
SAMPLING ENDED AT: 11:45
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE
FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:
FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	300
EKMW-13B	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-13B	1	PE	250 mL	NONE	—	—	SO4^{2-}	APP	300
EKMW-13B	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	300
EKMW-13B	1	PE	250 mL	HNO3	—	—	Fe, Mn	APP	300

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8 : 0.0 mg/L
DUP-01 collected.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: **1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW - 14
SAMPLE ID: EKMW - 14
DATE: 10/22/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 15. 53
*PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 19
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 19
PURGING INITIATED AT: 15:17
PURGING ENDED AT: 15:25
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
15:25	0.25	0.25	0.03	17.06	7.17	29.70	1339	1.72	28.9	clear	-30.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S): B Z
SAMPLING INITIATED AT: 15:30
SAMPLING ENDED AT: 15:40 / 16:15
PUMP OR TUBING DEPTH IN WELL (feet): 19
TUBING MATERIAL CODE: PE
FIELD-FILTERED: Y [✓ N] 16:00
Filtration Equipment Type:
FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHMETS	25 mL	NA	—	—	S_2O_8 (persulfate)	APP	~ 300
↓	3	AG	40 mL	H_2SO_4	—	—	TOC	↓	< 100
	1	PE	250 mL	NONE	—	—	SO_4^{2-}		~ 300
	1	PE	250 mL	HNO_3	—	—	Sulfur, Total		~ 300
	1	PE	250 mL	HNO_3	—	—	Fe, Mn		~ 300

REMARKS: * Purged dry and allowed to recharge for 2 hours S_2O_8 : 0.7 mg/L
Stop sampling due to lightning and heavy rain at 15:40; resume at 16:00

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP | SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-11 | SAMPLE ID: EKMW-11 | DATE: 11/5/19

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 4.35 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 950 | PURGING ENDED AT: 958 | TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
957	0.25	0.25.	0.05	6.93	5.42	25.83	8740	0.60	13.4	Clear	11.9

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1000 | SAMPLING ENDED AT: 1010

PUMP OR TUBING DEPTH IN WELL (feet): 21 | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: Y [✓ N] Filtration Equipment Type: | FILTER SIZE: _____ µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced) | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	NA	NA	S2O8 (Persulfate)	APP	~100
EKMW-11	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-11	1	PE	250 mL	NONE	↓	NA	$SO4^{2-}$	APP	↓
EKMW-11	1	PE	250 mL	HNO3	↓	<2	Sulfur, Total	APP	↓
EKMW-11	1	PE	250 mL	HNO3	↓	<2	Fe, Mn	APP	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → S_2O_8 = 0.7 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12
SAMPLE ID: EKMW-12
DATE: 11/5/19

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 5.34
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1015
PURGING ENDED AT: 1021
TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1020	0.25	0.25	0.05	7.45	5.97	25.95	4596	0.82	22.9	Clear.	-68.0

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1025
SAMPLING ENDED AT: 1035.
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	NA	NA	S2O8 (Persulfate)	APP	~100
EKMW-12	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-12	1	PE	250 mL	NONE		NA	SO4^{2-}	APP	
EKMW-12	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-12	1	PE	250 mL	HNO3		<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → S_2O_8 = 0 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 11/5/19

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 3.62
PURGE PUMP TYPE OR BAILER:

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1219
PURGING ENDED AT: 1225
TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1224	0.25	0.25	0.05	6.27	5.82	26.07	4578	0.56	12.3	Clear	-64.7

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: K Johnson / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1230
SAMPLING ENDED AT: 1300 ~~1250~~ (KJ)
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE,S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: [✓ Y] N

And DUP-01 for same parameters

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	N/A	N/A	S2O8 (Persulfate)	APP	~100
EKMW-13B	3	CG	40 mL	HCl	↓	<2	VOCs	APP	↓
EKMW-13B	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-13B	1	PE	250 mL	NONE	↓	N/A	SO_4^{2-}	APP	↓
EKMW-13B	3	PE	250 mL	HNO3	↓	<2.	Na^+; Fe, Mn; Sulfur	APP	↓
EKMW-13B	1	PE	500 mL	NONE	↓	N/A	TDS	APP	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8 : 0 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-14
SAMPLE ID: EKMW-14
DATE: 11/5/19

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.11
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): ~~21~~ 19 IAJ
FINAL PUMP OR TUBING DEPTH IN WELL (feet): ~~21~~ 19 IAJ
PURGING INITIATED AT: 1302
PURGING ENDED AT: 1327
TOTAL VOLUME PURGED (gallons): 1.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1325	~~0.25~~ 1.0 IAJ	~~0.25~~ 1.0 IAJ	0.05	11.10	5.84	26.66	3896	0.44	24.2	Clear	-115.9

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: IA Johnson | Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1330
SAMPLING ENDED AT: 1340
PUMP OR TUBING DEPTH IN WELL (feet): ~~21~~ IAJ 19
TUBING MATERIAL CODE: PE S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	NA	NA	S2O8 (Persulfate)	APP	~100
EKMW-14	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-14	1	PE	250 mL	NONE	↓	NA	SO4²⁻	APP	↓
EKMW-14	1	PE	250 mL	HNO3	↓	<2	Sulfur, Total	APP	↓
EKMW-14	1	PE	250 mL	HNO3	↓	<2	Fe, Mn	APP	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. → extra purge due to initially high turbidity
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → S_2O_8 = 0 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP	SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-11	SAMPLE ID: EKMW-11	DATE: 11/19/2019

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 4.46	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (~~23~~ feet – – feet) X – gallons/foot = – gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= – gallons + (0.0026 gallons/foot X 24 feet) + 0.132 gallons = 0.19 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 1435	PURGING ENDED AT: 1444	TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1444	0.25	0.25	0.025	6.98	5.38	26.65	6783	0.66	6.87	CLEAR	33.8

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1450	SAMPLING ENDED AT: 1458
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	FILTER SIZE: – µm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] (replaced) ALREADY IN WELL	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	–	5.38	S2O8 (Persulfate)	APP	<100
EKMW-11	3	AG	40 mL	H2S04	–	<2	TOC	APP	↓
EKMW-11	1	PE	250 mL	NONE	–	5.37	$SO4^{2-}$	APP	
EKMW-11	1	PE	250 mL	HNO3	–	<2	Sulfur, Total	APP	
EKMW-11	1	PE	250 mL	HNO3	–	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12
SAMPLE ID: EKMW-12
DATE: 11/19/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.83
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (– feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= – gallons + (0.0026 gallons/foot X 24 feet) + 0.122 gallons = 0.19 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1510
PURGING ENDED AT: 1519
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (~~circle units~~) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1519 ~~[illegible]~~ JB	0.25	0.25	0.025	7.70	5.79	26.76	3023	0.39	13.4	CLEAR	-45.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1523
SAMPLING ENDED AT: 1530
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: – µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] ~~(replaced)~~
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	-	5.79	S2O8 (Persulfate)	APP	<100
EKMW-12	3	AG	40 mL	H2S04	—	<2	TOC	APP	
EKMW-12	1	PE	250 mL	NONE	–	5.79	$SO4^{2-}$	APP	
EKMW-12	1	PE	250 mL	HNO3	–	<2	Sulfur, Total	APP	
EKMW-12	1	PE	250 mL	HNO3	—	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-13B

SAMPLE ID: EKMW-13B

DATE: 11/19/2019

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 4.36

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (23 feet – — feet) X — gallons/foot = - gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 24 feet) + 0.132 gallons = 0.19 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 1543

PURGING ENDED AT:

TOTAL VOLUME PURGED (gallons):

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1553	0.25	0.25	0.025	7.48	5.71	26.24	3414	0.37	7.45	CLEAR	-47.4

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1558

SAMPLING ENDED AT: 1615

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: Y [✓ N] FILTER SIZE: — μm
Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] ~~(replaced)~~

DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	-	-	S2O8 (Persulfate)	APP	<100
EKMW-13B	3	CG	40 mL	HCl	-	<2	VOCs	APP	↓
EKMW-13B	3	AG	40 mL	H2S04	-	5.71	TOC	APP	
EKMW-13B	1	PE	250 mL	NONE	-	5.71	$SO4^{2-}$	APP	
EKMW-13B	3	PE	250 mL	HNO3	-	<2	Na^+; Fe, Mn; Sulfur	APP	
~~EKMW-13B~~	~~1~~	~~PE~~	~~500 mL~~	~~NONE~~	~~-~~		~~TDS~~	~~APP~~	JB

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
DUP-01 TAKEN HERE

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP | SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14 | SAMPLE ID: EKMW-14 | DATE: 11/19/2019

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 4.25' | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 24 feet) + 0.32 gallons = 0.19 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 1620 | PURGING ENDED AT: 1630 | TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1630	0.25	0.25	0.025	7.72	5.93	25.12	3319	0.57	47.6	FOGGY *SEE REMARKS	-58.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1635 | SAMPLING ENDED AT: 1642

PUMP OR TUBING DEPTH IN WELL (feet): 21 | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: Y [✓ N] Filtration Equipment Type: | FILTER SIZE: — µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	–		S2O8 (Persulfate)	APP	<100
EKMW-14	3	AG	40 mL	H2S04	–	<2	TOC	APP	↓
EKMW-14	1	PE	250 mL	NONE	–		SO4²⁻	APP	
EKMW-14	1	PE	250 mL	HNO3	–	<2	Sulfur, Total	APP	
EKMW-14	1	PE	250 mL	HNO3	–	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. *CONTAINS ORANGE & WHITE SUSPENDED SOLIDS

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-11
SAMPLE ID: EKMW-11
DATE: 12/03/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.30
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1100
PURGING ENDED AT: 1115
TOTAL VOLUME PURGED (gallons): 0.75

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (^oC)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1115	0.75	0.75	0.75	7.41	3.35	22.10	6367	0.88	17.9	CLEAR w/ ORANGE S.S	411.2

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1125
SAMPLING ENDED AT: 1130
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: — µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	–	3.35	S2O8 (Persulfate)	APP	<100
EKMW-11	3	AG	40 mL	H2S04	–	<2	TOC	APP	
EKMW-11	1	PE	250 mL	NONE	–	3.35	SO4^{2-}	APP	
EKMW-11	1	PE	250 mL	HNO3	–	<2	Sulfur, Total	APP	
EKMW-11	1	PE	250 mL	HNO3	–	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. [>10ppm]

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12
SAMPLE ID: EKMW-12
DATE: 12/03/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.32
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME =** (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 30 feet) + ~~0~~ .132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1150
PURGING ENDED AT: 12:00
TOTAL VOLUME PURGED (gallons): 0.5

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1200	0.50	0.50	0.05	8.45	6.11	23.88	2457	0.19	34.9	CLEAR	-28.5
										w/SS	

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Joshua Barnhart / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 12:05
SAMPLING ENDED AT: 12:15
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: — µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	–	6.11	S_2O_8 (Persulfate)	APP	<100
EKMW-12	3	AG	40 mL	H_2SO_4	–	<2	TOC	APP	↓
EKMW-12	1	PE	250 mL	NONE	–	6.11	SO_4^{2-}	APP	
EKMW-12	1	PE	250 mL	HNO_3	–	<2	Sulfur, Total	APP	
EKMW-12	1	PE	250 mL	HNO_3	–	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → = [3.5 ppm]

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: **1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 12/03/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): NM
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= – gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1334
PURGING ENDED AT: 1342
TOTAL VOLUME PURGED (gallons): 0.50

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or ~~% saturation~~	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1342	0.56	0.50	0.06	10.01	5.82	25.67	2845	0.69	8.42	CLEAR	-24.5

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. Barnhart / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1347
SAMPLING ENDED AT: ~~1354~~ 1400 (JB)

PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:
FILTER SIZE: – µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	–	5.82	S2O8 (Persulfate)	APP	<100
EKMW-13B	3	AG	40 mL	H2S04	–	<2	TOC	APP	↓
EKMW-13B	1	PE	250 mL	NONE	–	5.82	SO4²⁻	APP	
EKMW-13B	1	PE	250 mL	HNO3	–	<2	Sulfur, Total	APP	
EKMW-13B	1	PE	250 mL	HNO3	–	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → 1.4 PPM
DUP-01 collected

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-14
SAMPLE ID: EKMW-14
DATE: 12/03/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): NM
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= – gallons + (0.0026 gallons/foot X 26 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): BZ ~~21~~ 19.5
PURGING INITIATED AT: 1412
PURGING ENDED AT: 14:39
TOTAL VOLUME PURGED (gallons): 1.0

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1427	0.50	0.50	0.04	NM	6.07	24.22	3213	0.24	OOR	FOGGY	-92.5
1439	0.50	1.00	0.04	12.68	6.42	22.53	2526	0.60	14.6	clear	-72.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Joshua Barnhart
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 14:45
SAMPLING ENDED AT: 14:55
PUMP OR TUBING DEPTH IN WELL (feet): BZ ~~21~~ 19.5
TUBING MATERIAL CODE: PE,S
FIELD-FILTERED: Y [✓ N]
Filtration Equipment Type:
FILTER SIZE: —— µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	–	6.42	S2O8 (Persulfate)	APP	<100
EKMW-14	3	AG	40 mL	H2S04	–	<2	TOC	APP	↓
EKMW-14	1	PE	250 mL	NONE	–	6.42	SO_4^{2-}	APP	
EKMW-14	1	PE	250 mL	HNO3	–	<2	Sulfur, Total	APP	
EKMW-14	1	PE	250 mL	HNO3	–	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → 0.7 ppm
OOR = out of range
High turbidity; raise tubing to 19.5' bls.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP | SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-11 | SAMPLE ID: EKMW-11 | DATE: 12/18/2019

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 4.56 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 11:01 | PURGING ENDED AT: 11:04 | TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
11:04	0.25	0.25	0.08	6.15	3.02	22.40	5783	1.40	6.06	clear	484.5

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 11:10 | SAMPLING ENDED AT: 11:25

PUMP OR TUBING DEPTH IN WELL (feet): 21 | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: [✓ Y] N | FILTER SIZE: 0.45 µm
Filtration Equipment Type: in-line

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced) | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-11	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-11	1	PE	250 mL	NONE	—	—	$SO4^{2-}$	APP	~300
EKMW-11	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~300
EKMW-11	~~1~~ 2	PE	250 mL	HNO3	—	—	Metals ~~Fe, Mn~~ (8) Total & Dissolved	APP	~300
EKMW-11	3	CG	40 mL	HCl	—	—	VOCs	APP	<100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8: 10 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump;
RFPP = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-12

SAMPLE ID: EKMW-12

DATE: 12/10/2019

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 5.10

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)

= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)

= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 11:39

PURGING ENDED AT: 11:42

TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
11:42	0.25	0.25	0.08	6.51	5.69	22.22	2357	0.62	17.0	clear	36.3

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec

SAMPLER(S) SIGNATURE(S): Bz

SAMPLING INITIATED AT: 11:50

SAMPLING ENDED AT: 12:05

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: [✓ Y] N

Filtration Equipment Type: in-line

FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N]   TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~ 300
EKMW-12	3	AG	40 mL	H2S04	—	—	TOC	APP	< 100
EKMW-12	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~ 300
EKMW-12	1	PE	250 mL	HNO3	—	—	Sulfur, Total BZ	APP	~ 300
EKMW-12	1	PE	250 mL	HNO3	—	—	Metals ~~Fe, Mn~~ Total & Dissolved	APP	~ 300
EKMW-12	3	CG	40 mL	BZ ~~40~~ HCl	—	—	VOCs	APP	< 100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes.

S_2O_8: 0 mg/L

EKMW-12 (MS/MSD) collected.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 12/18/2019

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.16
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 13:36
PURGING ENDED AT: 13:39
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
13:39	0.25	0.25	0.08	5.68	5.71	23.45	3010	0.68	26.8	clear	38.0

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S): Bryce Zinckgraf
SAMPLING INITIATED AT: 13:45
SAMPLING ENDED AT: 14:15
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] ~~N~~ BZ
Filtration Equipment Type: in-line
FILTER SIZE: 0.45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-13B	3	CG	40 mL	HCl	—	—	VOCs	APP	<100
EKMW-13B	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-13B	1	PE	250 mL	NONE	—	—	SO_4^{2-}	APP	~300
EKMW-13B	BZ ~~1~~ 2	PE	250 mL	HNO3	—	—	Metals (Total & Dissolved) ~~Na⁺, Fe, Mn, Sulfur~~	APP	~300
EKMW-13B	1	PE	25~~500~~ mL	BZ ~~NONE~~ HNO3	—	—	BZ ~~TDS~~ Sulfur	APP	~300

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8: 4.2 mg/L (orange color – less pink)
DUP-01 field duplicate collected.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP | SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14 | SAMPLE ID: EKMW-14 | DATE: 12/18/2019

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 3.75 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 19 ~~21~~ BZ | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 19 | PURGING INITIATED AT: 14:29 | PURGING ENDED AT: 14:34 | TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
14:34	0.25	0.25	0.05	5.81	6.07	22.41	3067	1.16	5.97	clear	-40.9

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 14:40 | SAMPLING ENDED AT: 14:55

PUMP OR TUBING DEPTH IN WELL (feet): 19 | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: [✓ Y] N Filtration Equipment Type: in-line | FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-14	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-14	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~300
EKMW-14	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~300
EKMW-14	1	PE	250 mL	HNO3	—	—	Metals ~~Fe, Mn~~ BZ Total & Dissolved	APP	~300
EKMW-14	3	CG	40 mL	HCl	—	—	VOCs	APP	<100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8: 0 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP	SITE LOCATION: Jacksonville, FL	
WELL NO: EKMW-11	SAMPLE ID: EKMW-11	DATE: 1/7/20

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): NM	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (- feet – - feet) X - gallons/foot = - gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 1355	PURGING ENDED AT: 1410	TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1410	0.25	0.25	0.02	NM	5.22	23.82	10690	3.29	11.6	Clear	332.7

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP =** Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson/Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1412	SAMPLING ENDED AT: 1430
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PES	FIELD-FILTERED: [✓ Y] N Filtration Equipment Type:	FILTER SIZE: 0.45 μm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING [✓ Y] N (replaced)	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA		5.22	S2O8 (Persulfate)	APP	~100
EKMW-11	3	AG	40 mL	H2S04		<2	TOC	APP	
EKMW-11	1	PE	250 mL	NONE		5.22	SO4²⁻	APP	
EKMW-11	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-11	2	PE	250 mL	HNO3		<2	Fe, Mn	APP	
EKMW-11	3	CG	40mL	HCl		<2	VOCs total + dissolved	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → ~2.1 mg/L S_2O_8

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP		SITE LOCATION: Jacksonville, FL	
WELL NO: EKMW-12	SAMPLE ID: EKMW-12		DATE: 1/7/20

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): NM | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (– feet – – feet) X – gallons/foot = – gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 1440 | PURGING ENDED AT: 1450 | TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1450	0.25	0.25	0.03	NM	5.30	24.34	3274	0.83	32.1	Clear	60.4

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson/Geosyntec | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1455 | SAMPLING ENDED AT: 1510

PUMP OR TUBING DEPTH IN WELL (feet): 21 | TUBING MATERIAL CODE: PE,S | FIELD-FILTERED: [✓ Y] N Filtration Equipment Type: | FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING [✓ Y] N (replaced) | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA		5.30	S2O8 (Persulfate)	APP	~100
EKMW-12	3	AG	40 mL	H2S04		<2	TOC	APP	↓
EKMW-12	1	PE	250 mL	NONE		5.30	SO4²⁻	APP	
EKMW-12	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-12	2	PE	250 mL	HNO3		↓	Fe, Mn (total, dissolved)	APP	
EKMW12	9	CG	40 mL	HCl			VOCs +	↓	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → ~0.7 mg/L S_2O_8 NS/NSD

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump;
RFPP = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: **1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 1/8/20

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): NM
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1256
PURGING ENDED AT: 1306
TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1306	0.25	0.25	0.03	NM	4.74	21.93	3073	5.40	51.3	Clear	138.0

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson | Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1310
SAMPLING ENDED AT: 1330
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: 0.45 μm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
EKMW-13B	1	CHEMETS	25 mL	NA		4.74	S2O8 (Persulfate)	APP	~100
EKMW-13B	3	CG	40 mL	HCl		<2	VOCs	APP	
EKMW-13B	3	AG	40 mL	H2S04		u	TOC	APP	
EKMW-13B	1	PE	250 mL	NONE		4.74	SO_4^{2-}	APP	
EKMW-13B	3	PE	250 mL	HNO3		<2	Total/Dissolved Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. → ~0.7 mg/L S_2O_8

DUP-01 collected for all above except S_2O_8

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)
SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14
SAMPLE ID: EKMW-14
DATE: 1/8/20

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): NM
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1340
PURGING ENDED AT: 1350
TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1340	0.25	0.25	0.03	NM	6.27	23.76	2772	0.85	85.9	cloudy white	-33.0

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1355
SAMPLING ENDED AT: 1410

PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE,S
FIELD-FILTERED: [✓ Y] N Filtration Equipment Type:
FILTER SIZE: 0.45 μm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA		6.27	S2O8 (Persulfate)	APP	~100
EKMW-14	3	AG	40 mL	H2S04		<2	TOC	APP	↓
EKMW-14	1	PE	250 mL	NONE		6.27	SO4^{2-}	APP	↓
EKMW-14	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	↓
EKMW-14	2	PE	250 mL	HNO3		<2	Fe, Mn (total dissolved)	APP	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. ~>0.7 mg/L S_2O_8

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: **1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP	SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-11	SAMPLE ID: EKMW-11	DATE: 1/28/2020

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 4.82	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME 0.63
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 13:13	PURGING ENDED AT: 13:16	TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
13:16	0.25	0.25	0.08	6.22	2.98	23.33	5851	0.85	9.85	clear	442.4

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 13:25	SAMPLING ENDED AT: 13:40
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: [✓ Y] N Filtration Equipment Type: in-line	FILTER SIZE: 0.45 μm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] (replaced)	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~ 300
EKMW-11	3	AG	40 mL	H2S04	—	—	TOC	APP	< 100
EKMW-11	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~ 300
EKMW-11	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~ 300
EKMW-11	2x [illegible]	PE	250 mL	HNO3	—	—	Fe, Mn (Total + Dissolved)	APP	~ 300
EKMW-11	3	CG	40 mL	HCl	—	—	VOCs	APP	< 100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8: 45 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP		SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12	SAMPLE ID: EKMW-12	DATE: 1/28/2020

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 6.53 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME 0.63
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 13:55 | PURGING ENDED AT: 13:58 | TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
13:58	0.25	0.25	0.08	7.97	4.32	24.05	2986	1.03	85.5	light yellow	182.4

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 14:05 | SAMPLING ENDED AT: 14:20

PUMP OR TUBING DEPTH IN WELL (feet): 21 | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: [✓ Y] N FILTER SIZE: 0.45 µm
Filtration Equipment Type: in-line

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-12	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-12	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~300
EKMW-12	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~300
EKMW-12	2 1 (B2)	PE	250 mL	HNO3	—	—	Fe, Mn (Total + Dissolved)	APP	~300
EKMW-12	3	CG	40 mL	HCl	—	—	VOCs	APP	<100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
EKMW-12 (MS/MSD) collected for VOCs.
S_2O_8: 2.8 mg/L (orange-pink in color)

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 1/28/2020

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 6.57
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME 0.63
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): BZ ~~19~~ 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 14:34
PURGING ENDED AT: 14:37
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
14:37	0.25	0.25	0.08	8.19	4.09	23.62	2992	1.01	24.6	light yellow	235.7

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 14:45
SAMPLING ENDED AT: 15:15
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
FILTER SIZE: 0.45 μm
Filtration Equipment Type: in-line
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-13B	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-13B	1	PE	250 mL	NONE	—	—	SO4^{2-}	APP	~300
EKMW-13B	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~300
EKMW-13B	2 ~~1~~ BZ	PE	250 mL	HNO3	—	—	Fe, Mn (Total + Dissolved)	APP	~300
EKMW-13B	3	CG	40 mL	HCl	—	—	VOCs	APP	<100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
DUP-01 collected.
S_2O_8: 2.1 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14
SAMPLE ID: EKMW-14
DATE: 1/28/2020

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 6.50
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME 0.63
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 19
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 19
PURGING INITIATED AT: 15:40
PURGING ENDED AT: 15:45
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
15:45	0.25	0.25	0.05	8.47	5.80	22.51	2446	1.12	11.1	clear	-12.2

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S): Br Zinf
SAMPLING INITIATED AT: 15:50
SAMPLING ENDED AT: 16:05

PUMP OR TUBING DEPTH IN WELL (feet): 19
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
FILTER SIZE: 0.45 µm
Filtration Equipment Type: in-line

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-14	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-14	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~300
EKMW-14	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~300
EKMW-14	BZ ~~1~~ 2	PE	250 mL	HNO3	—	—	Fe, Mn (Total + Dissolved)	APP	~300
EKMW-14	3	CG	40 mL	HCl	—	—	VOCs	APP	<100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8: 5.0 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP		SITE LOCATION: Jacksonville, FL	
WELL NO: EKMW-11	SAMPLE ID: EKMW-11		DATE: 2/11/20

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 4.89	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 1122	PURGING ENDED AT: 1133	TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1132	0.25	0.25	0.03	6.45	2.64	24.29	10548	1.48	20.9	Clear	528.2

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1135	SAMPLING ENDED AT: 1158
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: [✓ Y] N Filtration Equipment Type:	FILTER SIZE: .45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] ~~(replaced)~~	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~150
EKMW-11	3	AG	40 mL	H2S04	—	<2	TOC	APP	↓
EKMW-11	1	PE	250 mL	NONE	—	2.04	SO4²⁻	APP	↓
EKMW-11	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	↓
EKMW-11	2	PE	250 mL	HNO3	—	↓	Total/dissolved Fe, Mn	APP	↓
EKMW-11	3	CG	40mL	HCl	—	↓	VOCs	APP	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8 = ~28 mg/L.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP | SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-12 | SAMPLE ID: EKMW-12 | DATE: 2/11/20

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 6.95 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (– feet – – feet) X – gallons/foot = – gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 1200 | PURGING ENDED AT: 1212 | TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1210	0.25	0.25	0.03	9.10	4.17	26.03	~~225.[illegible]~~ [illegible]	0.38	11.9	clear	225.6

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson/CCU | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1215 | SAMPLING ENDED AT: 1240

PUMP OR TUBING DEPTH IN WELL (feet): 21' | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: [✓ Y] N | FILTER SIZE: .45 µm
Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] | TUBING Y [✓ N] ~~(replaced)~~ | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	–	–	S2O8 (Persulfate)	APP	~100
EKMW-12	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-12	1	PE	250 mL	NONE		4.17	SO4²⁻	APP	
EKMW-12	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-12	2	PE	250 mL	HNO3		↓	Total dissolved Fe, Mn	APP	
EKMW12	9	CG	40mL	HCl	↓	↓	VOCs	APP	↓

+ MS/MSD

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8 = ~1.4mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP	SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-13B	SAMPLE ID: EKMW-13B	DATE: 2/11/20

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 5.40	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (– feet – – feet) X – gallons/foot = – gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (.0026 gallons/foot X 30 feet) + .133 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 1430	PURGING ENDED AT: 1442	TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1441	0.25	0.25.	0.03	7.70	3.81	25.30	3429	0.66	9.14	Clear	266.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / [illegible]	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1445	SAMPLING ENDED AT: 1515.

PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: [✓ Y] N FILTER SIZE: .45 µm Filtration Equipment Type:
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] (replaced)	DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	–	–	S2O8 (Persulfate)	APP	~100
EKMW-13B	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-13B	1	PE	250 mL	NONE		3.81	SO4²⁻	APP	
EKMW-13B	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-13B	2	PE	250 mL	HNO3		↓	Total/field dissolved Fe, Mn	APP	
EKMW-13B	3	CG	40ml	HCl	↓	↓	VOCs	APP	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8 = ~0.7 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

→ field dup for all except S_2O_8

*Switched dedicated tubing due to air leak

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14

SAMPLE ID: EKMW-14

DATE: 2/11/20

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 5.70

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 1537

PURGING ENDED AT: 1550

TOTAL VOLUME PURGED (gallons): 0.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1550	0.25	0.25	0.02	8.70	5.71	25.48	2788	0.58	18.40	Clear	-26.5

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geo

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1555

SAMPLING ENDED AT: 1610

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: [✓ Y] N

Filtration Equipment Type:

FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	—	–	S2O8 (Persulfate)	APP	~100
EKMW-14	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-14	1	PE	250 mL	NONE		5.71	SO4²⁻	APP	
EKMW-14	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-14	2	PE	250 mL	HNO3		↓	Total & dissolved Fe, Mn	APP	
EKMW14	3	CG	40mL	HCl			VOCs	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8 = ~0 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-11
SAMPLE ID: EKMW-11
DATE: 2/25/2020

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 5.74
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + ~~0.00~~ 0.132 gallons = 0.20 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 10:58
PURGING ENDED AT: 11:02
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
11:02	0.25	0.25	0.06	6.94	2.65	22.45	6342	2.71	12.9	clear	592.3

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 11:10
SAMPLING ENDED AT: 11:25
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: 0.45 μm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~ 300
EKMW-11	3	AG	40 mL	H2S04	—	—	TOC	APP	< 100
EKMW-11	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~ 300
EKMW-11	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~ 300
EKMW-11	~~1~~ 2	PE	250 mL	HNO3	—	—	Fe, Mn (Total & Dissolved)	APP	~ 300
EKMW-11	3	CG	40 mL	HCl	—	—	VOCs	APP	< 100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8: 450 mg/L (10:1 dilution) Moderate rain during sample collection.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-12

SAMPLE ID: EKMW-12

DATE: 2/25/2020

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 5.10

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = ~~0.26~~ 0.20 (BZ) gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 11:50

PURGING ENDED AT: 11:54

TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
11:54	0.25	0.25	0.06	6.82	4.18	23.19	3355	1.25	10.7	clear	213.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec

SAMPLER(S) SIGNATURE(S): Br Zinf

SAMPLING INITIATED AT: 12:00

SAMPLING ENDED AT: 12:15

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:

FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-12	3	AG	40 mL	H2SO4	—	—	TOC	APP	<100
EKMW-12	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~300
EKMW-12	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~300
EKMW-12	~~1~~ 2	PE	250 mL	HNO3	—	—	Fe, Mn	APP	~300
EKMW-12	3	CG	40 mL	HCl	—	—	VOCs	APP	<100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
S_2O_8: 1.0 mg/L
Light rain during sampling

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 2/25/2020

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.59
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = 0.20 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 12:26
PURGING ENDED AT: 12:30
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
12:30	0.25	0.25	0.06	6.44	4.60	23.20	3182	0.85	9.64	clear	173.9

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S): Br Zinf
SAMPLING INITIATED AT: 12:40
SAMPLING ENDED AT: ~~13:10~~ 13:25 (BZ)
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: 0.45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: [✓ Y] N DUP-01, MS/MSD

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-13B	3	CG	40 mL	HCl	—	—	VOCs	APP	<100
EKMW-13B	3	AG	40 mL	H2SO4	—	—	TOC	APP	<100
EKMW-13B	1	PE	250 mL	NONE	—	—	$SO4^{2-}$	APP	~300
EKMW-13B	~~3~~ 4	PE	250 mL	HNO3	—	—	Na^+; Fe, Mn; Sulfur	APP	~300
EKMW-13B	1	PE	500 mL	NONE	—	—	TDS	APP	~300

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8: 2.5 mg/L
DUP-01, EKMW-13B (MS/MSD) collected.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-14
SAMPLE ID: EKMW-14
DATE: 2/25/2020

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 5.50
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 25 feet) + 0.132 gallons = 0.20 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): (BD) 21~~19~~
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 14:50
PURGING ENDED AT: 14:54
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) [✓ μmhos/cm] or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
14:54	0.25	0.25	0.06	7.03	6.97	22.06	2646	1.73	19.3	clear	-25.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 15:05
SAMPLING ENDED AT: 15:20
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: 0.45 μm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~300
EKMW-14	3	AG	40 mL	H2S04	—	—	TOC	APP	<100
EKMW-14	1	PE	250 mL	NONE	—	—	SO4^{2-}	APP	~300
EKMW-14	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~300
EKMW-14	~~1~~ 2	PE	250 mL	HNO3	—	—	Fe, Mn (Total & Dissolved)	APP	~300
EKMW-14	3	CG	40 mL	HCl	—	—	VOCs	APP	<100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S2O8: 5.0 mg/L Light rain during sampling. Orange-red and black suspended particles in sample.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP		SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-11	SAMPLE ID: EKMW-11	DATE: 3/10/20

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 4.50	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 1026	PURGING ENDED AT: 1036	TOTAL VOLUME PURGED (gallons): 0.4

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1036	0.25	0.25	0.03	6.52	2.76	23.14	7726	1.36	16.3	Clear	587.3

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1040	SAMPLING ENDED AT: 1050
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: [✓ Y] N Filtration Equipment Type:	FILTER SIZE: 0.45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] (replaced)	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	2.76	S2O8 (Persulfate)	APP	~100
EKMW-11	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-11	1	PE	250 mL	NONE	↓	2.76	$SO4^{2-}$	APP	↓
EKMW-11	1	PE	250 mL	HNO3	↓	<2	Sulfur, Total	APP	↓
EKMW-11	2	PE	250 mL	HNO3	↓	<2	total/diss. Fe, Mn	APP	↓
EKMW-11	3	CG	40 mL	HCl	↓	<2	VOCs	↓	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8 ≈ 112 mg/L (2x dilution).

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12
SAMPLE ID: EKMW-12
DATE: 3/10/20

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 8.80
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1112
PURGING ENDED AT: 1123
TOTAL VOLUME PURGED (gallons): 0.4

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1122	0.25	0.25	0.03	10.40	5.10	25.22	4382	0.79	40.2	cloudy/ Clear	136.8

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1125
SAMPLING ENDED AT: 1145
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] ~~N~~ Filtration Equipment Type:
FILTER SIZE: 0.45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	5.10	S2O8 (Persulfate)	APP	~100
EKMW-12	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-12	1	PE	250 mL	NONE		5.10	SO4²⁻	APP	
EKMW-12	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-12	2	PE	250 mL	HNO3		<2	total diss. Fe, Mn	APP	
EKMW-12	[illegible] 9	CG	40 mL	HCl		<2	VOCs	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8 ≈ 7 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Collect VOC MS/MSD

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP	SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-13B	SAMPLE ID: EKMW-13B	DATE: 3/10/20

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 4.62	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 ~~0.132~~ (ft) feet) + 0.132 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 1318	PURGING ENDED AT: 1328	TOTAL VOLUME PURGED (gallons): 0.4

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1328	0.25	0.25	0.03	5.90	4.96	24.55	4034	1.12	40.3	Clear	176.6

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1335	SAMPLING ENDED AT: 1355

PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: [✓ Y] N Filtration Equipment Type:	FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] (replaced)	DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	4.96	S2O8 (Persulfate)	APP	~100
EKMW-13B	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-13B	1	PE	250 mL	NONE		4.96	SO4²⁻	APP	
EKMW-13B	1	PE	250 mL	HNO3		<2	Sulfur, Total	APP	
EKMW-13B	2	PE	250 mL	HNO3		<2	total diss Fe, Mn	APP	
EKMW-13B	3	CG	40 mL	HCl		<2	VOCs	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. $S_2O_8 \approx 1.4$ mg/L.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

→ Collect Field Dup for all except S_2O_8.

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14

SAMPLE ID: EKMW-14

DATE: 3/10/20

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 4.25

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = ~0.25 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 1405

PURGING ENDED AT: 1416

TOTAL VOLUME PURGED (gallons): 0.4

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1415	0.25	0.25	0.03	6.60	6.22	24.58	3373	0.20	18.4	Clear	-34.8

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A Johnson / Geosyntec

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1420

SAMPLING ENDED AT: 1435.

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: [✓ Y] N FILTER SIZE: 0.45 µm
Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA		6.22	S2O8 (Persulfate)	APP	~100
EKMW-14	3	AG	40 mL	H2S04	↓	<2	TOC	APP	↓
EKMW-14	1	PE	250 mL	NONE	↓	6.22	$SO4^{2-}$	APP	↓
EKMW-14	1	PE	250 mL	HNO3	↓	<2	Sulfur, Total	APP	↓
EKMW-14	2	PE	250 mL	HNO3	↓	<2	tot/diss. Fe, Mn	APP	↓
EKMW-14	3	CG	40mL	HCl	↓	<2	VOCs	APP	↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. $S_2O_8 \simeq 0.7$ mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump;
RFPP = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-11
SAMPLE ID: EKMW-11
DATE: 03/24/20

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.70
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 23 feet) + 0.32 gallons = 0.2 gallons
x3=0.6

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1321
PURGING ENDED AT: 1328
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1328	0.25	0.25	0.04	8.31	2.97	25.30	10,380	0.78	19.5	CLEAR	536.9

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1335
SAMPLING ENDED AT: 1349
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE,S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: .45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	—
EKMW-11	3	AG	40 mL	H2S04	—	<2	TOC	APP	~100
EKMW-11	1	PE	250 mL	NONE	—	2.97	SO4²⁻	APP	<200
+VOG EKMW-11	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	
EKMW-11	1	PE	250 mL	HNO3	—		Fe, Mn, TOTAL	APP	
"	"	"	"	"	—		FE, MN, FILTERED	"	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
PERSULFATE : 1.4g/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12
SAMPLE ID: EKMW-12
DATE: 03/24/2020

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 3.40
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 23 feet) + 0.132 gallons = 0.2 gallons

X3=0.6

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1400
PURGING ENDED AT: 1409
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1409	0.25	0.25	0.03	6.62	5.47	26.64	4631	5.88	28.9	YELLOW TINT	100.2

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1414
SAMPLING ENDED AT: 1428
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: .45 μm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: Y [✓ N]

+VOC'

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	
EKMW-12	3	AG	40 mL	H2S04	—	<2	TOC	APP	~100
EKMW-12	1	PE	250 mL	NONE	—	5.47	SO_4^{2-}	APP	<200
EKMW-12	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	↓
EKMW-12	1	PE	250 mL	HNO3	—	↓	Fe, Mn TOTAL	APP	↓
"	"	"	"	"	—	↓	FE, MN FILTERED		↓

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes.

PERSULFATE: 2.1 mg/L = 0.021g/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 03/29/20

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 3.10
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (0.0026 gallons/foot X 23 feet) + 0.132 gallons = 0.2 gallons x3= 0.6

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1439
PURGING ENDED AT: 1447
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) μmhos/cm or [✓ μS/cm]	DISSOLVED OXYGEN ~~(circle units)~~ [✓ mg/L] ~~or~~ % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1447	0.25	0.25	0.03	7.15	25.90	5.13	4124	0.25	[illegible]	CLEAR	139.7

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: ~~1439~~ 1452
SAMPLING ENDED AT: 1517
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
FILTER SIZE: .45 μm
Filtration Equipment Type:
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)
DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	
EKMW-13B	3	AG	40 mL	H2S04	—	<2	TOC	APP	~100
EKMW-13B	1	PE	250 mL	NONE	—	5.13	$SO4^{2-}$	APP	<200
EKMW-13B	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	
EKMW-13B	1	PE	250 mL	HNO3	—		Fe, Mn, TOTAL	APP	
"	"	"	"	"	—		Fe, Mn, FILTERED AND		

+VOCs

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes.

PERSULFATE: 1.4 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-14
SAMPLE ID: EKMW-14
DATE: 03/24/20

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 4.20
PURGE PUMP TYPE OR BAILER: APP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 23 feet) + .132 gallons = 0.2 gallons x3=0.6

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1528
PURGING ENDED AT:
TOTAL VOLUME PURGED (gallons):

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1535	0.25	0.25	0.04	7.76	6.15	25.63	3428	0.78	[illegible]	CLEAR	-56.0

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016
PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1540 ~~1528~~
SAMPLING ENDED AT: 1555
PUMP OR ~~TUBING~~ DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: .45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	–	–	S2O8 (Persulfate)	APP	–
EKMW-14	3	AG	40 mL	H2S04	–	<2	TOC	APP	<100
EKMW-14	1	PE	250 mL	NONE	–	6.15	SO_4^{2-}	APP	<200
EKMW-14	1	PE	250 mL	HNO3	–	<2	Sulfur, Total	APP	↓
EKMW-14	1	PE	250 mL	HNO3	–	↓	Fe, Mn, TOTAL	APP	
"	"	"	"	"	–		DISSOLVED Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
PERSULFATE : 0.0 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)
SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP		SITE LOCATION: Jacksonville, FL	
WELL NO: EKMW-11	SAMPLE ID: EKMW-11		DATE: 4/07/2020

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 4.76	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 12:43	PURGING ENDED AT: 12:46	TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
12:46	0.25	0.25	0.08	6.35	3.20	25.54	9935	0.95	29.0	clear	531.5

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 12:50	SAMPLING ENDED AT: 13:10
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: [✓ Y] N Filtration Equipment Type:	FILTER SIZE: 0.45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] (replaced)	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~ 300
EKMW-11	3	AG	40 mL	H2S04	—	—	TOC	APP	< 100
EKMW-11	1	PE	250 mL	NONE	—	—	SO4²⁻	APP	~ 300
EKMW-11	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~ 300
EKMW-11	~~1~~ 2	PE	250 mL	HNO3	—	—	Total & Dissolved Fe, Mn	APP	~ 300
EKMW-11	3	CG	40 mL	HCl	—	—	VOCs	APP	< 100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8 : 2.5 g/L (~~1000~~ 100 : 1 dilution) (82)

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-12
SAMPLE ID: EKMW-12
DATE: 4/07/2020

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 3.38
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 13:34
PURGING ENDED AT: 13:37
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
13:37	0.25	0.25	0.08	4.90	5.15	26.72	4105	1.45	27.2	clear	97.2

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 13:45
SAMPLING ENDED AT: 14:00
PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:
FILTER SIZE: 0.45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~ 300
EKMW-12	3	AG	40 mL	H2S04	—	—	TOC	APP	< 100
EKMW-12	1	PE	250 mL	NONE	—	—	$SO4^{2-}$	APP	~ 300
EKMW-12	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~ 300
EKMW-12	~~1~~ 2	PE	250 mL	HNO3	—	—	Fe, Mn (Total & Dissolved)	APP	~ 300
EKMW-12	3	CG	40 mL	HCl	—	—	VOCs	APP	< 100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling. Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8: 0.7 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP		SITE LOCATION: Jacksonville, FL
WELL NO: EKMW-13B	SAMPLE ID: EKMW-13B	DATE: 4/07/2020

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4	WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet	STATIC DEPTH TO WATER (feet): 3.32	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21	PURGING INITIATED AT: 14:19	PURGING ENDED AT: 14:22	TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
14:22	0.25	0.25	0.08	4.82	5.37	26.70	3748	0.98	9.62	clear	93.9

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 14:30	SAMPLING ENDED AT: 15:00
PUMP OR TUBING DEPTH IN WELL (feet): 21	TUBING MATERIAL CODE: PE, S	FIELD-FILTERED: [✓ Y] N Filtration Equipment Type:	FILTER SIZE: 0.45 µm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N] (replaced)	DUPLICATE: [✓ Y] N	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~ 300
EKMW-13B	3	AG	40 mL	H2S04	—	—	TOC	APP	< 100
EKMW-13B	1	PE	250 mL	NONE	—	—	SO4^{2-}	APP	~ 300
EKMW-13B	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~ 300
EKMW-13B	~~1~~ 2	PE	250 mL	HNO3	—	—	Fe, Mn (Total & Dissolved)	APP	~ 300
EKMW-13B	3	CG	40 mL	HCl	—	—	VOCs	APP	< 100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
Field DUP-01 collected. EKMW-13B (MS/MSD) collected.
S2O8: 0.7 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP	SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14 | SAMPLE ID: EKMW-14 | DATE: 04/07/2020

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 3.24 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: **1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: **1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= 0 gallons + (0.0026 gallons/foot X 30 feet) + 0.132 gallons = 0.21 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 15:21 | PURGING ENDED AT: 15:24 | TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
15:24	0.25	0.25	0.08	4.74	6.07	26.17	3044	1.05	7.02	clear	-44.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Bryce Zinckgraf / Geosyntec | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 15:30 | SAMPLING ENDED AT: 15:45

PUMP OR TUBING DEPTH IN WELL (feet): 21 | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: [✓ Y] N Filtration Equipment Type: | FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	~ 300
EKMW-14	3	AG	40 mL	H2S04	—	—	TOC	APP	< 100
EKMW-14	1	PE	250 mL	NONE	—	—	SO4^{2-}	APP	~ 300
EKMW-14	1	PE	250 mL	HNO3	—	—	Sulfur, Total	APP	~ 300
EKMW-14	~~1~~ 2	PE	250 mL	HNO3	—	—	Fe, Mn (Total & Dissolved)	APP	~ 300
EKMW-14	3	CG	40 mL	HCl	—	—	VOCs	APP	< 100

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes. S_2O_8: 0.35 mg/L (no dilution)

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-11

SAMPLE ID: EKMW-11

DATE: 04/21/20

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 4.50

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 23 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 1347

PURGING ENDED AT: 1354

TOTAL VOLUME PURGED (gallons): 0.50

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1354	0.50	0.50	0.08	7.50	3.05	26.01	9858	1.03	25.8	CLEAR	512.1

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1400

SAMPLING ENDED AT: 1410

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: [✓ Y] ~~N~~ Filtration Equipment Type:

FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-11	1	CHEMETS	25 mL	NA	—		S2O8 (Persulfate)	APP	<200
EKMW-11	3	AG	40 mL	H2S04	—	<2	TOC	APP	
EKMW-11	1	PE	250 mL	NONE	—	—	SO4^{2-}	APP	
EKMW-11	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	
EKMW-11	1	PE	250 mL	HNO3	—	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP

SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-12

SAMPLE ID: EKMW-12

DATE: 04/21/20

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4

WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet

STATIC DEPTH TO WATER (feet): 4.05

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 23 feet) + 0.132 gallons 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 1425

PURGING ENDED AT: 1430

TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (^oC)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1430	0.25	0.25	0.05	9.98	5.53	24.67	4070	1.69	30.6	CLEAR	62.3

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1436

SAMPLING ENDED AT: 1448

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE, S

FIELD-FILTERED: [✓ Y] N
Filtration Equipment Type:

FILTER SIZE: 0.45 µm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N] (replaced)

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-12	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	<200
EKMW-12	3	AG	40 mL	H2S04	—	<2	TOC	APP	↓
EKMW-12	1	PE	250 mL	NONE	—	—	$SO4^{2-}$	APP	
EKMW-12	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	
EKMW-12	1	PE	250 mL	HNO3	—	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
PERSULFATE: 0.7 mg/L

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.

2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24
GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP
SITE LOCATION: Jacksonville, FL.

WELL NO: EKMW-13B
SAMPLE ID: EKMW-13B
DATE: 04/21/20

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/4
WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet
STATIC DEPTH TO WATER (feet): 3.51
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= . — gallons + (0.0026 gallons/foot X 23 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21
PURGING INITIATED AT: 1500
PURGING ENDED AT: 1505
TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (^{o}C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1505	0.25	0.25	0.05	9.80	5.54	26.95	3550	1.83	5.76	CLEAR	59.0

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART/GEOSINTEC
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1510
SAMPLING ENDED AT: 1535

PUMP OR TUBING DEPTH IN WELL (feet): 21
TUBING MATERIAL CODE: PE, S
FIELD-FILTERED: [✓ Y] N
FILTER SIZE: 0.45 µm
Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-13B	1	CHEMETS	25 mL	NA	—	—	S2O8 (Persulfate)	APP	< 200
EKMW-13B	3	AG	40 mL	H2S04	—	<2	TOC	APP	↓
EKMW-13B	1	PE	250 mL	NONE	—	—	SO4^{2-}	APP	
EKMW-13B	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	
EKMW-13B	1	PE	250 mL	HNO3	—	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.
DUP-01 & MS/MSD

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: NAS JAX EK TAP | SITE LOCATION: Jacksonville, FL

WELL NO: EKMW-14 | SAMPLE ID: EKMW-14 | DATE: 04/21/20

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 19 feet to 23 feet | STATIC DEPTH TO WATER (feet): 4.46 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (— feet – — feet) X — gallons/foot = — gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= — gallons + (0.0026 gallons/foot X 23 feet) + 0.132 gallons = 0.2 gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21 | PURGING INITIATED AT: 1545 | PURGING ENDED AT: 1551 | TOTAL VOLUME PURGED (gallons): 0.25

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or [✓ µS/cm]	DISSOLVED OXYGEN (circle units) [✓ mg/L] or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ORP (mV)
1551	0.25	0.25	0.05	10.70	6.11	26.15	2874	1.63	15.6	CLEAR	64.7

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: J. BARNHART / GEOSYNTEC | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1555 | SAMPLING ENDED AT: 1606

PUMP OR TUBING DEPTH IN WELL (feet): 21 | TUBING MATERIAL CODE: PE, S | FIELD-FILTERED: [✓ Y] N | FILTER SIZE: 0.45 µm
Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N](replaced) | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
EKMW-14	1	CHEMETS	25 mL	NA	—	[illegible]	S2O8 (Persulfate)	APP	<200
EKMW-14	3	AG	40 mL	H2S04	—	<2	TOC	APP	
EKMW-14	1	PE	250 mL	NONE	—	—	SO_4^{2-}	APP	
EKMW-14	1	PE	250 mL	HNO3	—	<2	Sulfur, Total	APP	
EKMW-14	1	PE	250 mL	HNO3	—	<2	Fe, Mn	APP	

REMARKS: Well historically purges dry. Purge one equipment volume prior to sampling.
Sodium persulfate tested in field with CHEMETS colorimetric tubes.

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

APPENDIX B BORING LOGS AND WELL CONSTRUCTION LOGS

Appendix B
Boring Logs and Well Construction Logs

Geosyntec consultants

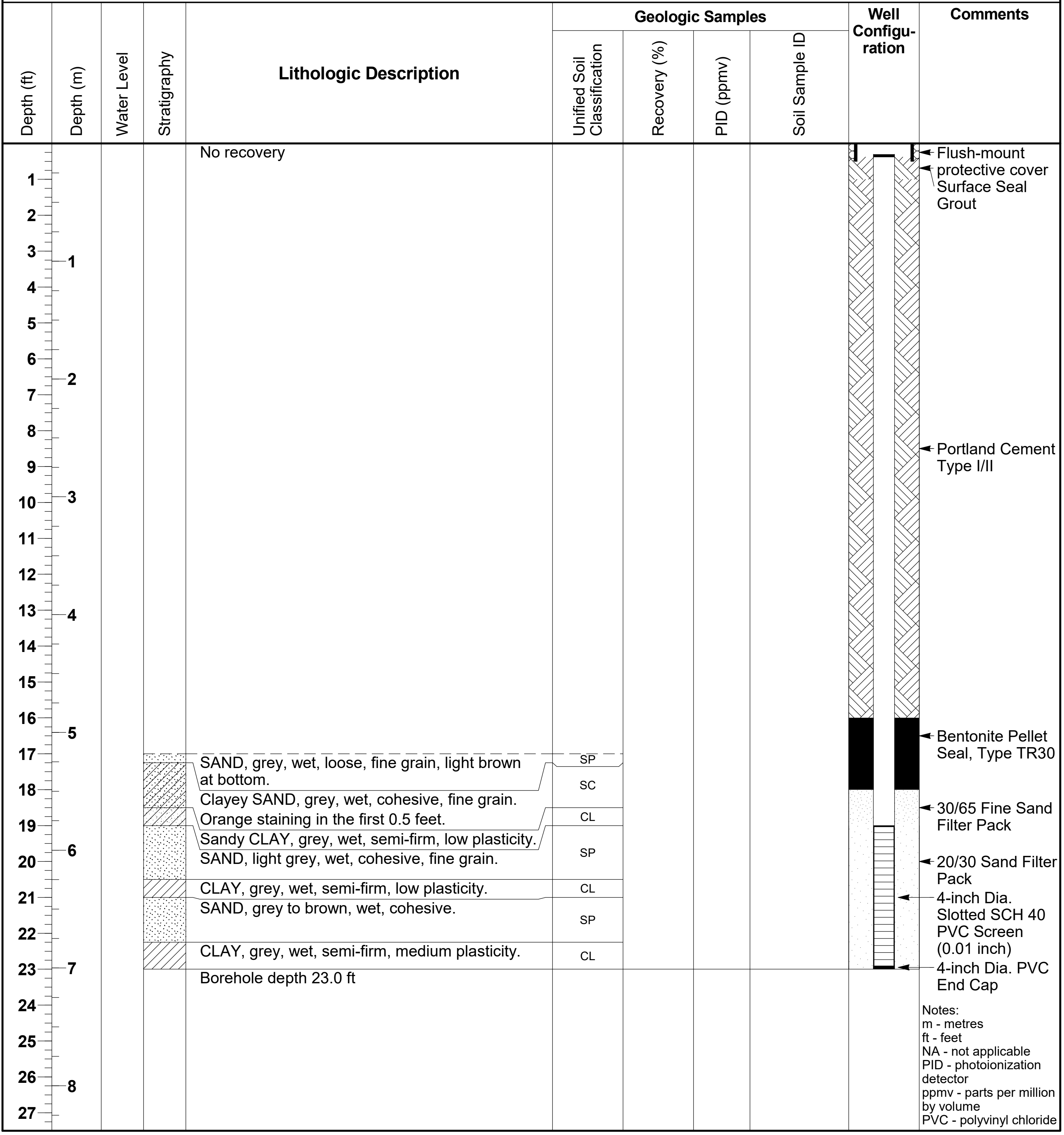
Borehole No. E10

Page 1 of 1

Borehole Log

Project No.: TR0673
Client: ESTCP
Logged By: Joshua Barnhart
Reviewed By: M. Watling
Drilling Company: EDS - JR Pennington
Drilling Method: Hollow Stem Auger
Well Material: Schedule 40 PVC

Location: NAS-JAX OU3, FL
Coordinates:
Borehole Diameter: 4 inches
Site Datum:
Ground Surface Elevation:
Top PVC Casing Elevation: N/A
Completion Date: 11 June 2019



Lithologic Description	Geologic Samples			
	Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID
No recovery				
SAND, grey, wet, loose, fine grain, light brown at bottom.	SP			
Clayey SAND, grey, wet, cohesive, fine grain. Orange staining in the first 0.5 feet.	SC			
Sandy CLAY, grey, wet, semi-firm, low plasticity.	CL			
SAND, light grey, wet, cohesive, fine grain.	SP			
CLAY, grey, wet, semi-firm, low plasticity.	CL			
SAND, grey to brown, wet, cohesive.	SP			
CLAY, grey, wet, semi-firm, medium plasticity.	CL			
Borehole depth 23.0 ft				

Comments

Flush-mount protective cover
Surface Seal Grout
Portland Cement Type I/II
Bentonite Pellet Seal, Type TR30
30/65 Fine Sand Filter Pack
20/30 Sand Filter Pack
4-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)
4-inch Dia. PVC End Cap

Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Geosyntec consultants

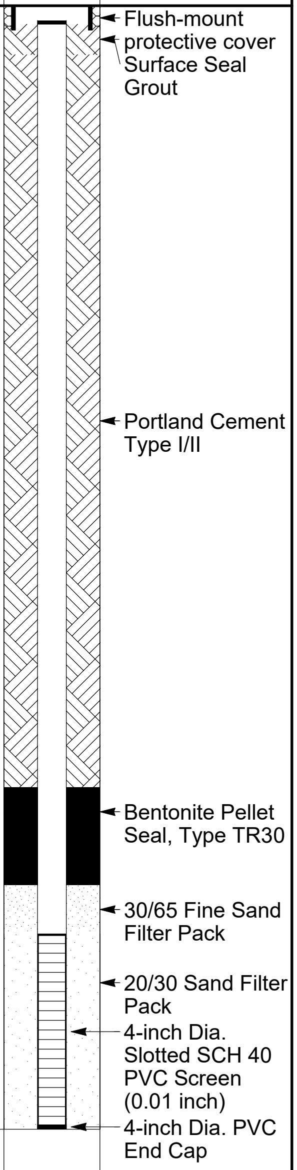
Borehole No. E11

Page 1 of 1

Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Joshua Barnhart	**Borehole Diameter:**	4 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	12 June 2019

Depth (ft)	Depth (m)	Water Level	Stratigraphy	Lithologic Description	Geologic Samples				Well Configuration	Comments
					Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID		
				No recovery						
				SAND, grey, saturated, loose, fine grain, orange staining throughout.	SP					
				Clayey SAND, grey, cohesive, fine grain, orange staining.	SC					
				Sandy CLAY, grey, semi-firm, low plasticity.	CL					
				Clayey SAND, grey, compact, fine grain, orange staining in the first 0.25 feet Orange staining in the first 0.25 feet. Increase in grain size in the last 0.25 feet.	SC					
				Sandy CLAY, grey, semi-firm, low plasticity, wet.	CL					
				CLAY, grey, semi-firm, semi-plastic, wet.	CL					
				Sandy CLAY, grey, semi-firm, low plasticity, wet. Orange staining in the first 0.25 feet.	CL					
				CLAY, grey, wet, semi-firm, medium plasticity.	CL					
				Sandy CLAY, wet, grey, semi-firm, low plasticity. Orange staining in the first 0.25 feet.	CL					
				CLAY, grey, semi-firm, medium plasticity.	CL					
				Borehole depth 23.0 ft						



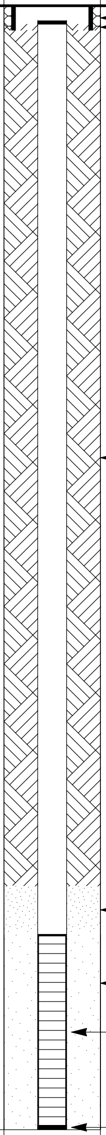
Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Geosyntec consultants

Borehole No. E12 — Page 1 of 1 — Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Bryce Zinckgraf	**Borehole Diameter:**	4 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR and Mitch Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	25 June 2019

Depth (ft)	Depth (m)	Water Level	Stratigraphy	Lithologic Description	Geologic Samples: Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID	Well Configuration	Comments
0				Not logged						Flush-mount protective cover Surface Seal Grout
9										Portland Cement Type I/II
18.5										30/65 Fine Sand Filter Pack
20										20/30 Sand Filter Pack
21										4-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)
23	7			Borehole depth 23.0 ft						4-inch Dia. PVC End Cap



Depth (ft): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Depth (m): 1 2 3 4 5 6 7 8

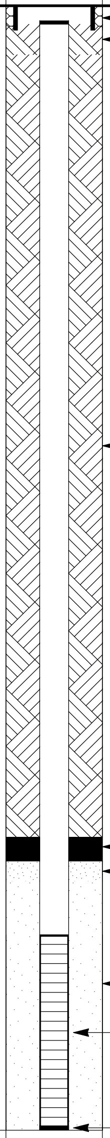
Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Borehole No. EKMW-12 Page 1 of 1 Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Joshua Barnhart	**Borehole Diameter:**	2 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	10 June 2019

Depth (ft)	Depth (m)	Water Level	Stratigraphy	Lithologic Description	Geologic Samples: Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID
0				Not logged				
23	7			Borehole depth 23.0 ft				

Well Configuration



Comments

Flush-mount protective cover

Surface Seal Grout

Portland Cement Type I/II

Bentonite Pellet Seal, Type TR30

30/65 Fine Sand Filter Pack

20/30 Sand Filter Pack

2-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)

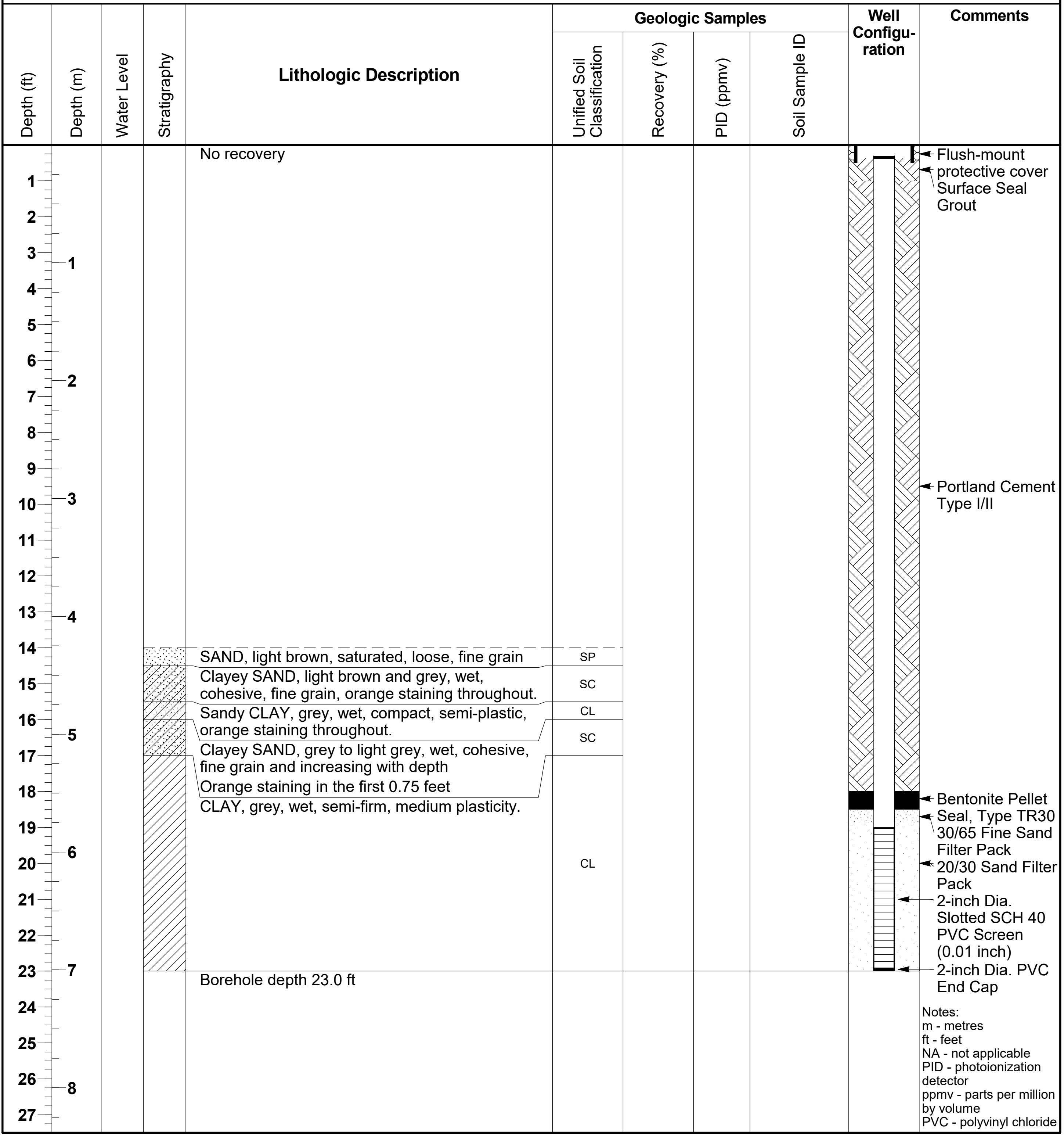
2-inch Dia. PVC End Cap

Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Report: MASTER (MASCO); File: P:\PRJ\ADMIN\GINT\PROJECTS\TR0673 EK-TAP.GPJ; 9/27/2019

Borehole No. EKMW-13B Page 1 of 1 Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Joshua Barnhart	**Borehole Diameter:**	2 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	11 June 2019



Lithologic Description	Unified Soil Classification
No recovery	
SAND, light brown, saturated, loose, fine grain	SP
Clayey SAND, light brown and grey, wet, cohesive, fine grain, orange staining throughout.	SC
Sandy CLAY, grey, wet, compact, semi-plastic, orange staining throughout.	CL
Clayey SAND, grey to light grey, wet, cohesive, fine grain and increasing with depth Orange staining in the first 0.75 feet	SC
CLAY, grey, wet, semi-firm, medium plasticity.	CL
Borehole depth 23.0 ft	

Comments:

Flush-mount protective cover

Surface Seal Grout

Portland Cement Type I/II

Bentonite Pellet Seal, Type TR30

30/65 Fine Sand Filter Pack

20/30 Sand Filter Pack

2-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)

2-inch Dia. PVC End Cap

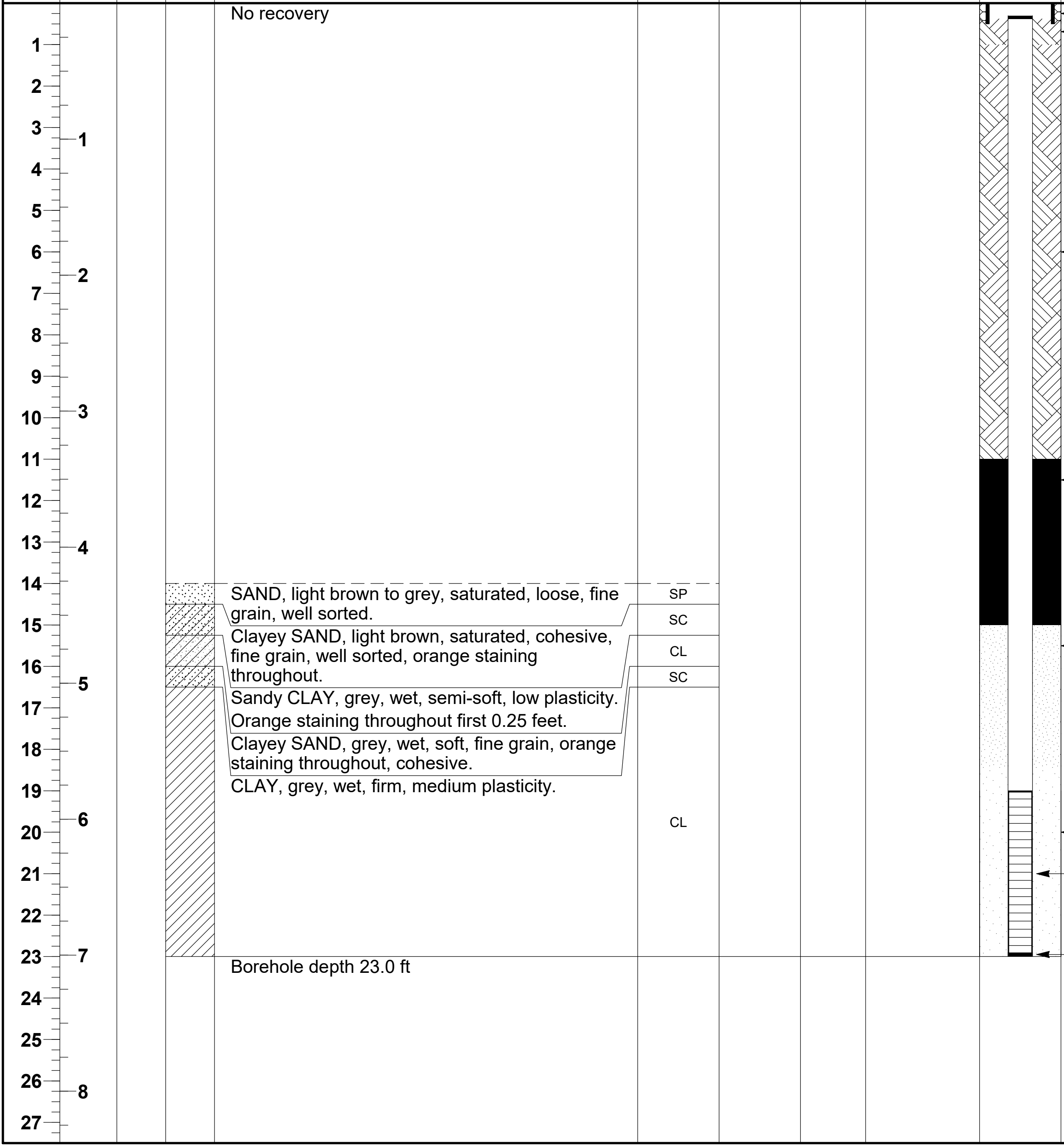
Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Geosyntec consultants

Borehole No. EKMW-14 Page 1 of 1 Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Blaine Dawson	**Borehole Diameter:**	2 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	7 June 2019

Lithologic Description	Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID
No recovery				
SAND, light brown to grey, saturated, loose, fine grain, well sorted.	SP			
Clayey SAND, light brown, saturated, cohesive, fine grain, well sorted, orange staining throughout.	SC			
Sandy CLAY, grey, wet, semi-soft, low plasticity. Orange staining throughout first 0.25 feet.	CL			
Clayey SAND, grey, wet, soft, fine grain, orange staining throughout, cohesive.	SC			
CLAY, grey, wet, firm, medium plasticity.	CL			
Borehole depth 23.0 ft				



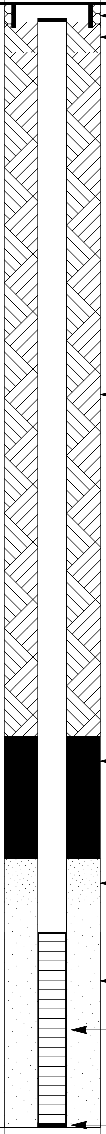
Comments

Flush-mount protective cover
Surface Seal Grout
Portland Cement Type I/II
Bentonite Pellet Seal, Type TR30
30/65 Fine Sand Filter Pack
20/30 Sand Filter Pack
2-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)
2-inch Dia. PVC End Cap

Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Borehole No. S9 Page 1 of 1 Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Blaine Dawson	**Borehole Diameter:**	4 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	7 June 2019

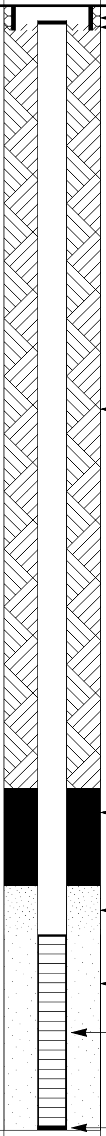
Depth (ft)	Depth (m)	Water Level	Stratigraphy	Lithologic Description	Geologic Samples Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID	Well Configu-ration	Comments
				Not logged						Flush-mount protective cover Surface Seal Grout
8										Portland Cement Type I/II
16										Bentonite Pellet Seal, Type TR30
18										30/65 Fine Sand Filter Pack
20										20/30 Sand Filter Pack
21										4-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)
23	7			Borehole depth 23.0 ft						4-inch Dia. PVC End Cap

Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Geosyntec consultants

Borehole No. S10 Page 1 of 1 Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Bryce Zinckgraf	**Borehole Diameter:**	4 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR and Mitch Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	24 June 2019

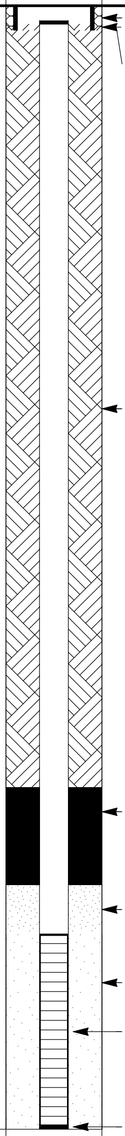


Depth (ft)	Depth (m)	Water Level	Stratigraphy	Lithologic Description	Geologic Samples				Well Configu-ration	Comments
					Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID		
				Not logged						Flush-mount protective cover Surface Seal Grout
1										
2										
3	1									
4										
5										
6	2									
7										
8										Portland Cement Type I/II
9										
10	3									
11										
12										
13	4									
14										
15										
16	5									Bentonite Pellet Seal, Type TR30
17										
18										30/65 Fine Sand Filter Pack
19										
20	6									20/30 Sand Filter Pack
21										4-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)
22										
23	7			Borehole depth 23.0 ft						4-inch Dia. PVC End Cap
24										
25										
26	8									
27										

Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Borehole No. S11 Page 1 of 1 Borehole Log

Project No.:	TR0673	**Location:**	NAS-JAX OU3, FL
Client:	ESTCP	**Coordinates:**	
Logged By:	Bryce Zinckgraf	**Borehole Diameter:**	4 inches
Reviewed By:	M. Watling	**Site Datum:**	
Drilling Company:	EDS - JR and Mitch Pennington	**Ground Surface Elevation:**	
Drilling Method:	Hollow Stem Auger	**Top PVC Casing Elevation:**	N/A
Well Material:	Schedule 40 PVC	**Completion Date:**	24 June 2019

Depth (ft)	Depth (m)	Water Level	Stratigraphy	Lithologic Description	Geologic Samples				Well Configuration	Comments
					Unified Soil Classification	Recovery (%)	PID (ppmv)	Soil Sample ID		
0				Not logged						Flush-mount protective cover Surface Seal Grout Portland Cement Type I/II Bentonite Pellet Seal, Type TR30 30/65 Fine Sand Filter Pack 20/30 Sand Filter Pack 4-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch) 4-inch Dia. PVC End Cap
23	7			Borehole depth 23.0 ft						

Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Geosyntec consultants

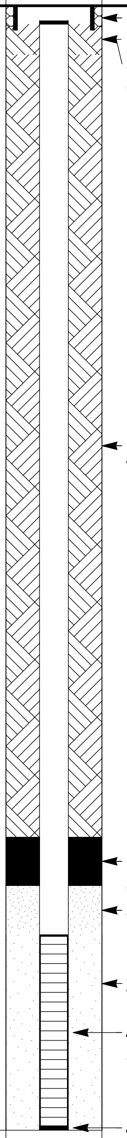
Borehole No. S12

Page 1 of 1

Borehole Log

Project No.: TR0673
Client: ESTCP
Logged By: Blaine Dawson
Reviewed By: M. Watling
Drilling Company: EDS - JR Pennington
Drilling Method: Hollow Stem Auger
Well Material: Schedule 40 PVC

Location: NAS-JAX OU3, FL
Coordinates:
Borehole Diameter: 4 inches
Site Datum:
Ground Surface Elevation:
Top PVC Casing Elevation: N/A
Completion Date: 11 June 2019

Depth (ft)	Depth (m)	Water Level	Stratigraphy	Lithologic Description	Geologic Samples: Unified Soil Classification	Geologic Samples: Recovery (%)	Geologic Samples: PID (ppmv)	Geologic Samples: Soil Sample ID	Well Configuration	Comments
				Not logged						Flush-mount protective cover Surface Seal Grout
1										
2										
3	1									
4										
5										
6										
7	2									
8										
9										Portland Cement Type I/II
10	3									
11										
12										
13	4									
14										
15										
16	5									
17										Bentonite Pellet Seal, Type TR30
18										30/65 Fine Sand Filter Pack
19										
20	6									20/30 Sand Filter Pack
21										4-inch Dia. Slotted SCH 40 PVC Screen (0.01 inch)
22										
23	7			Borehole depth 23.0 ft						4-inch Dia. PVC End Cap
24										
25										
26	8									
27										

Notes:
m - metres
ft - feet
NA - not applicable
PID - photoionization detector
ppmv - parts per million by volume
PVC - polyvinyl chloride

Report: MASTER (MASCO); File: P:\PRJ\ADMIN\GINT\PROJECTS\TR0673 EK-TAP.GPJ; 9/27/2019

APPENDIX C LABORATORY CHAIN OF CUSTODY FORMS

Appendix C

Laboratory Chain of Custody Forms

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

681-Atlanta

Chain of Custody Record

eurofins Environment Testing TestAmerica

Client Information	Sampler: B. Zinckgraf	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):	COC No: 160-8189-4152.1
Client Contact: Mr. Mark Watling	Phone: (904) -302-1500	E-Mail: jayna.awalt@testamericainc.com		Page: Page 1 of 1
Company: Geosyntec Consultants, Inc.				Job #:

Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mwatling@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site: NAS JAX EK TAP

Due Date Requested:
TAT Requested (days): STD
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D, 300_ORGFMS	200.7_DOD5 - Dissolved Metals - Ca, Fe, Mg, Mn (ICP)	8260C_DOD5_LL - VOCs (GC/MS)	9060A - Organic Carbon, Total (TOC) - single rep	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D	A	S		
EKMW-11	7/11/19	11:15	G	Water	N		X	X	X	X		
EKMW-12	7/11/19	12:00	G	Water			X	X	X	X		
EKMW-13B	7/11/19	12:50	G	Water			X	X	X	X		
EKMW-14	7/11/19	13:40	G	Water			X	X	X	X		
DUP-01	—	—	G	Water			X	X	X	X		
EKMW-14 (MS)	7/11/19	13:40	G	Water					X			
EKMW-14 (MSD)	7/11/19	13:40	G	Water					X			
FIELD BLANK	7/11/19	14:45	G	Water			X	X	X	X		
TRIP BLANK 1	—	—	—	Water					X			
TRIP BLANK 2	—	—	—	Water					X			

160-34870 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by:	Date/Time: 7/11/2019 18:00	Company: Geosyntec	Received by:	Date/Time: 071219 0905	Company: TA STL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: △ Yes △ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins | Environment Testing TestAmerica

Client Information
Client Contact: Michelle Cho
Company: Geosyntec Consultants, Inc.
Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mcho@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site:

Sampler: B. Zinckgraf /J. Barnhart
Phone: 904-302-1500
Due Date Requested:
TAT Requested (days): STD
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Lab PM: Awalt, Jayna K
E-Mail: jayna.awalt@testamericainc.com
Carrier Tracking No(s):
COC No: 160-8517-4315.1
Page: Page 1 of 1
Job #:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒	N	D	S	D	☒	
EKMW-11	10/22/19	10:10	G	Water			X	X	X	X		
EKMW-12	↓	10:50	↓	Water			X	X	X	X		
EKMW-13B	↓	11:25	↓	Water			X	X	X	X		
EKMW-14	↓	15:30	↓	Water			X	X	X	X		
DUP-01	↓	—	↓	Water			X	X	X	X		
FIELD BLANK	↓	16:20	↓	Water			X	X	X	X		

160-36113 Chain of Custody

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)

Other:

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
	10/23/19 16:00	Geosyntec		102419 0930	ETA STL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins Environment Testing TestAmerica

Client Information	Sampler: B. Zinckgraf	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):	COC No: 160-8549-4327.1
Client Contact: Michelle Cho	Phone: 904-302-1500	E-Mail: jayna.awalt@testamericainc.com		Page: Page 1 of 2
Company: Geosyntec Consultants, Inc.				Job #:
Address: 130 Stone Road West	Due Date Requested:			
City: Guelph	TAT Requested (days): STD			
State, Zip: ON, N1G3Z2				
Phone:	PO #: 100004032			
Email: mcho@geosyntec.com	WO #:			
Project Name: NAS Jacksonville Project TR0673	Project #: 16008378			
Site: NAS JAX EK TAP	SSOW#:			

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	8260C_DOD5_LL - VOCs (GC/MS)	2540C - TDS	6020B - Metals (ICP/MS) - Sodium only								Total Number of containers
				Preservation Code:	X	X	N	D	S	D	A	N	D								X
EKMW-11	11/05/19	10:00	G	Water	N	N	1	1	3	1											
EKMW-12		10:25		Water			1	1	3	1											
EKMW-13B		12:30		Water			1	1	3	1	3	1	1								
EKMW-14		13:30		Water			1	1	3	1											
PZ-07		14:05		Water		↓					3	1	1								
PZ-07 (MS/MSD)		14:05		Water		Y					2										
PW005		15:00		Water		N					3	1	1								
DUP-01	↓	—	↓	Water	↓	↓	1	1	3	1	3	1	1								
				Water																	
				Water																	
				Water																	

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Special Instructions/Note:

160-36286 Chain of Custody

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by: B Zinck	Date/Time: 11/06/19 17:00	Company: Geosyntec	Received by:	Date/Time: 11-7-19/0920	Company: TASTL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins Environment Testing TestAmerica

Client Information	Sampler: J. Barnhart	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):	COC No: 160-8613-4372.1
Client Contact: Michelle Cho	Phone: 904.858.1818	E-Mail: jayna.awalt@testamericainc.com		Page: Page 1 of 1
Company: Geosyntec Consultants, Inc.				Job #:
Address: 130 Stone Road West	Due Date Requested:			
City: Guelph	TAT Requested (days):			
State, Zip: ON, N1G3Z2				
Phone:	PO #: 100004032			
Email: mcho@geosyntec.com	WO #:			
Project Name: NAS Jacksonville Project TR0673	Project #: 16008378			
Site: NAS-JAX	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D	S	D		
EKMW-11	11/19/2019	1450	G	Water	N		X	X	X	X	6	
EKMW-12	↓	1523	G	Water	N		X	X	X	X	6	
EKMW-13B		1558	G	Water	N		X	X	X	X	6	
EKMW-14		1635	G	Water	N		X	X	X	X	6	
DUP-01		–	G	Water	N		X	X	X	X	6	
FIELD BLANK		1650	G	Water	N		X	X	X	X	6	
				Water								
				Water								

160-36445 Chain of Custody

Possible Hazard Identification
☒ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For ________ Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
J. Barnhart	11/20/2019 10:30			11/21/19 0900	
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No

Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins | Environment Testing TestAmerica

Client Information	Sampler: Josh Bernhart	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):	COC No: 160-8668-4400.1
Client Contact: Michelle Cho	Phone: 904-858-1818	E-Mail: jayna.awalt@testamericainc.com		Page: Page 1 of 1
Company: Geosyntec Consultants, Inc.		**Analysis Requested**		Job #:

Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mcho@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site: NAS JAX EK TAP

Due Date Requested:
TAT Requested (days): STD
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒	N	D	D	S	☒	
EKMW-11	12/03/19	11:25	G	Water	N	N	1	1	1	3		
EKMW-12	↓	12:05	G	Water	↓	↓	1	1	1	3		
EKMW-13B	↓	13:47	G	Water	↓	↓	1	1	1	3		
EKMW-14	↓	14:45	G	Water	↓	↓	1	1	1	3		
DUP-01	↓	—	G	Water	↓	↓	1	1	1	3		
FIELD BLANK	↓	12:00	G	Water	↓	↓	1	1	1	3		NO PRESERVATIVES NOT ENOUGH BOTTLES WERE SHIPPED

160-36576 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by:	Date/Time: 12/03/19 17:30	Company: Geosyntec	Received by: Michelle Chen	Date/Time: 12-4-19/0930	Company: TASTL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins | Environment Testing
TestAmerica

Client Information	Sampler: Bryce Zinckgraf	Lab PM: Await, Jayna K	Carrier Tracking No(s):	COC No: 160-8697-4420.2
Client Contact: Michelle Cho	Phone: 904-302-1500	E-Mail: jayna.awalt@testamericainc.com		Page: B2 Page ~~2 of 2~~ 1 of 1
Company: Geosyntec Consultants, Inc.		**Analysis Requested**		Job #:
Address: 130 Stone Road West	Due Date Requested: 12/27/2019			
City: Guelph	TAT Requested (days): RUSH			
State, Zip: ON, N1G3Z2				
Phone:	PO #: 100004032			
Email: mcho@geosyntec.com	WO #:			
Project Name: NAS Jacksonville Project TR0673	Project #: 16008378			
Site: NAS JAX EK TAP	SSOW#:			

Preservation Codes:

- A - HCL
- B - NaOH
- C - Zn Acetate
- D - Nitric Acid
- E - NaHSO4
- F - MeOH
- G - Amchlor
- H - Ascorbic Acid
- I - Ice
- J - DI Water
- K - EDTA
- L - EDA
- M - Hexane
- N - None
- O - AsNaO2
- P - Na2O4S
- Q - Na2SO3
- R - Na2S2O3
- S - H2SO4
- T - TSP Dodecahydrate
- U - Acetone
- V - MCAA
- W - pH 4-5
- Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Metals - long list (ICP)	8260C_DOD5_LL - VOCs (GC/MS)	9060A - Organic Carbon, Total (TOC) - single rep	200.7_DOD5 - Dissolved ICP Metals - Long list - FF	200.7_DOD5 - Dissolved Metals - long list (ICP)	200.7_DOD5 - Total Sulfur (ICP)	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒	N	D	A	S	D	D	D	☒	
EKMW-11	12/18/19	11:10	G	Water			X		X	X			X		
EKMW-12		11:50		Water			X		X	X			X		
EKMW-12 (MS/MSD)		11:50		Water					X						
EKMW-13B		13:45		Water			X		X	X			X		
EKMW-14		14:40		Water			X		X	X			X		
DUP-01		—		Water			X		X	X			X		
FIELD BLANK	↓	15:05	↓	Water			X		X	X			X		
TRIP BLANK	—	—	—	Water					X						
				Water											
				Water											
				Water											

160-36787 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by: Geosyntec B2	Date/Time: 12/19/19 14:30	Company Geosyntec	Received by:	Date/Time: 12-20-19/1100	Company TASTL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

TestAmerica, St. Louis
r Trail North
y, MO 63045
314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins | Environment Testing TestAmerica

ient Information	Sampler: Bryce Zinckgraf	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):
Client Contact: Michelle Cho	Phone: 904 - 302 - 1500	E-Mail: jayna.awalt@testamericainc.com	

COC No: 160-8697-4420.1
Page: Page 1 of 2
Job #:

Company: Geosyntec Consultants, Inc.
Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mcho@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site: NAS JAX EK TAP

Due Date Requested: 12/27/2019
TAT Requested (days): RUSH
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Preservation Codes:

A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA

M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)

Other:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Metals - long list (ICP)	8260C_DOD5_LL - VOCs (GC/MS)	9060A - Organic Carbon, Total (TOC) - single rep	200.7_DOD5 - Dissolved ICP Metals - Long list - FF	200.7_DOD5 - Dissolved Metals - long list (ICP)	200.7_DOD5 - Total Sulfur (ICP)	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒	N	D	A	S	D	D	D	☒	
EKMW-11	12/18/19	11:10	G	Water	Y						X				
EKMW-12		11:50		Water							X				
EKMW-13B		13:45		Water							X				
EKMW-14		14:40		Water							X				
PZ-07		15:50		Water							X				
PW005		16:40		Water							X				
DUP-01		—		Water							X				
FIELD BLANK	↓	15:05	↓	Water	↓						X				
				Water											
				Water											
				Water											

160-36787 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
	12/19/19 14:30	Geosyntec		12-20-19/1100	TASTL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins | Environment Testing TestAmerica

Client Information	Sampler: AJohnson	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):	COC No: 160-8737-4435.1
Client Contact: Michelle Cho	Phone: 9044504262	E-Mail: jayna.awalt@testamericainc.com		Page: Page 1 of 2
Company: Geosyntec Consultants, Inc.				Job #:
Address: 130 Stone Road West	Due Date Requested:			
City: Guelph	TAT Requested (days):			
State, Zip: ON, N1G3Z2				
Phone:	PO #: 100004032			
Email: mcho@geosyntec.com	WO #:			
Project Name: NAS Jacksonville Project TR0673	Project #: 16008378			
Site:	SSOW#:			

x = yes

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	8260C_DOD5_LL - VOCs (GC/MS)	9060A - Organic Carbon, Total (TOC) - single rep	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D	A	S	D	D	D		
EKMW-11	1/7/20	1412	G	Water	X		1	1	3	3	1				
EKMW-12 +(MS/MSD)	1/7/20	1455	G	Water	X	X	1	1	3	3	1				
EKMW-13B	1/8/20	1310	G	Water	X		1	1	3	3	1				
EKMW-14	1/8/20	1355	G	Water	X		1	1	3	3	1				
DUP-01	–	–	G	Water	X		1	1	3	3	1				
Field Blank	1/7/20	1340	G	Water			1	1	3	2	X				* 1 metals container collected only
				Water											
				Water											
				Water											
				Water											
				Water											
				Water											

160-36922 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time: 1/8/20 1730	Company: Geo	Received by:	Date/Time: 1.9.20 9100	Company: ETASTL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins | Environment Testing TestAmerica

Client Information	Sampler: Bryce Zuckgraf	Lab PM: Await, Jayna K	Carrier Tracking No(s):	COC No: 160-8807-4469.2
Client Contact: Michelle Cho	Phone: 904-302-1500	E-Mail: jayna.awalt@testamericainc.com		Page: ~~Page 2 of 2~~ 1 of 1
Company: Geosyntec Consultants, Inc.		**Analysis Requested**		Job #: TR0673
Address: 130 Stone Road West	**Due Date Requested:**			
City: Guelph	**TAT Requested (days):** STD			
State, Zip: ON, N1G3Z2				
Phone:	PO #: 100004032			
Email: mcho@geosyntec.com	WO #:			
Project Name: NAS Jacksonville Project TR0673	Project #: 16008378			
Site: NAS JAX EK TAP	SSOW#:			

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	8260C_DOD5_LL - VOCs (GC/MS)	9060A - Organic Carbon, Total (TOC) - single rep	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	Total Number of containers	Special Instructions/Note:
			Preservation Code:		☒	☒	N	D	A	S	D	D	D	☒	
EKMW-11	1/28/2020	13:25	G	Water			1	1	3	3	1	1			
EKMW-12		14:05		Water			1	1	3	3	1	1			
EKMW-12 (MS/MSD)		14:05		Water		X			3						
EKMW-13B		14:45		Water			1	1	3	3	1	1			
EKMW-14		15:50		Water			1	1	3	3	1	1			
FIELD BLANK		16:15					1	1	2	2	1	1			INSUFFICIENT DI WATER PROVIDED
DUP-01	↓	—	↓	↓			1	1	3	3	1	1			
TRIP BLANK	—	—	—	—					3						

160-37092 Chain of Custody

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
	1/28/2020 18:30	Geosyntec		1-29-20/0850	TASTL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins | Environment Testing TestAmerica

Client Information

Sampler: A Johnson
Lab PM: Awalt, Jayna K
Carrier Tracking No(s):
COC No: 160-8838-4488.3
Client Contact: Michelle Cho
Phone: 904 450 4262
E-Mail: jayna.awalt@testamericainc.com
Page: Page 3 of 4
Company: Geosyntec Consultants, Inc.
Job #:
Address: 130 Stone Road West
Due Date Requested:
City: Guelph
TAT Requested (days):
State, Zip: ON, N1G3Z2
Phone:
PO #: 100004032
Email: mcho@geosyntec.com
WO #:
Project Name: NAS Jacksonville Project TR0673
Project #: 16008378
Site:
SSOW#:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	8260C_DOD5_LL - VOCs (GC/MS)	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - Field Filtered Metals - Fe and Mn (ICP)	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	2540C - Solids, Total Dissolved (TDS)	6020B - Metals (ICP/MS) - Sodium only				Total Number of containers	Special Instructions/Note:
				Preservation Code:	X	X	N	D	S	A	D	D	D	D	N	D				X	
EKMW-11	2/11/20	1135	G	Water	✓		X	X	X	X			X								
EKMW-12	↓	1215	↓	Water	✓	✓	X	X	X	X			X								* MS/MSD (VOCs)
EKMW-13B	↓	1445	↓	Water	✓		X	X	X	X			X								
EKMW-14	↓	1555	↓	Water	✓		X	X	X	X			X								
Field Blank	↓	1050	↓	Water	✓		X	X	X	X			X								
Field Dup.	↓	—	↓	Water	✓		X	X	X	X			X								
				Water																	
				Water																	
				Water																	
				Water																	
				Water																	

160-37224 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed . . . are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment:

Relinquished by:	Date/Time: 2/12/20 1730	Company: Geo	Received by: Nicholas Frost	Date/Time: 2-13-20/0835	Company: TA STL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact:
Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins Environment Testing TestAmerica

160-37388 Chain of Custody

Client Information
Client Contact: Michelle Cho
Company: Geosyntec Consultants, Inc.
Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mcho@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site: NAS JAX EK TAP

Sampler: Bryce Zinckgraf
Phone: 904-302-1500
Due Date Requested:
TAT Requested (days): STD
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Lab PM: Await, Jayna K
E-Mail: jayna.awalt@testamericainc.com

COC No: 160-8838-4488.1
Page: Page 1 of ~~4~~ 1
Job #: TR0673

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	8260C_DOD5_LL - VOCs (GC/MS)	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - Field Filtered Metals - Fe and Mn (ICP)	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	2540C - Solids, Total Dissolved (TDS)	6020B - Metals (ICP/MS) - Sodium only				Total Number of containers	Special Instructions/Note:
				Preservation Code			N	D	S	A	D	D	D	D	N	D					
EKMW-11	2/25/20	11:10	G	Water	Y	N	X	X	X	X	X										
EKMW-12	↓	12:00	↓	Water	Y	N	X	X	X	X	X										
EKMW-13B	↓	12:40	↓	Water	Y	N	X	X	X	X	X				X	X					
EKMW-13B (MS)	↓	12:40	↓	Water	N	Y				X											
EKMW-13B (MSD)	↓	12:40	↓	Water	N	Y				X											
EKMW-14	↓	15:05	↓	Water	Y	N	X	X	X	X	X										
PZ-07	↓	16:00	↓	Water	N	N				X					X	X					
PW005	↓	17:05	↓	Water	N	N				X					X	X					
FIELD BLANK	↓	14:00	↓	Water	N	N	X	X	X	X	X				X	X					
DUP-01	↓	—	↓	Water	N	N	X	X	X	X	X				X	X					
TRIP BLANK	—	—	—	Water						X											

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ____ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
	2/26/2020 12:30	Geosyntec		2.27.20 855	ETASR

Custody Seals Intact:
Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins Environment Testing TestAmerica

Client Information

Client Contact: Michelle Cho
Sampler: Asmunson
Phone: 9044504262
Lab PM: Awalt, Jayna K
E-Mail: jayna.awalt@testamericainc.com
Carrier Tracking No(s):
COC No: 160-8943-4537.3
Page: Page 3 of 3
Job #:

Company: Geosyntec Consultants, Inc.
Address: 130 Stone Road West
Due Date Requested:
City: Guelph
TAT Requested (days):
State, Zip: ON, N1G3Z2
Phone:
PO #: 100004032
Email: mcho@geosyntec.com
WO #:
Project Name: NAS Jacksonville Project TR0673
Project #: 16008378
Site:
SSOW#:

Analysis Requested

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	8260C_DOD5_LL - VOCs (GC/MS)	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP) (Filtered)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	200.7_DOD5 - Field Filtered Metals - Fe and Mn (ICP)	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D	S	A	D	D	D	D		
EKMW-11	3/10/20	1040	G	Water	X		X	X	X	X	X					
EKMW-12		1125			X	X	X	X	X	X	X					*hold VOCs
EKMW-13B		1335			X		X	X	X	X	X					*hold VOCs
EKMW-14		1420			X		X	X	X	X	X					*hold VOCs
Field Blank		1010			X		X	X	X	X	X					
Field Dup	—	—			X		X	X	X	X	X					*hold VOCs

160-37531 Chain of Custody

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment:

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
Relinquished by:	Date/Time: 3/10/20 1730	Company: Geo	Received by: FE	Date/Time:	Company:
Relinquished by: FE	Date/Time:	Company:	Received by:	Date/Time: 3/11/2020 1635	Company: ETA STL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins Environment Testing TestAmerica

Client Information	Sampler: J. BARNHART	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):	COC No: 160-8982-4550.2
Client Contact: Michelle Cho	Phone: (904) 226-6454	E-Mail: jayna.awalt@testamericainc.com		Page: Page 2 of 3
Company: Geosyntec Consultants, Inc.				Job #:

Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mcho@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site:

Due Date Requested:
TAT Requested (days):
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type** (C=comp, G=grab)	**Matrix** (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	8260C_DOD5_LL - VOCs (GC/MS)	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	200.7_DOD5 - Field Filtered Metals - Fe and Mn (ICP)	Total Number of containers	**Special Instructions/Note:**
				Preservation Code:			N	D	S	A	D	D	D	D		
EKMW-11	03/24/20	1335	G	Water			X	X	X	X				X	9	
EKMW-12		1414		Water			X	X	X	X				X	9	
EKMW-13B		1452		Water			X	X	X	X				X	9	HOLD VOC ANALYSES
EKMW-14		1540		Water			X	X	X	X				X	9	HOLD VOC ANALYSIS
DUP-01		—		Water			X	X	X	X				X	9	HOLD VOC ANALYSES
FIELD BLANK		1615		Water			X	X	X	X				X	9	
				Water												
				Water												
				Water												
				Water												
				Water												
				Water												

Possible Hazard Identification
☒ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Deliverable Requested: I, II, III, IV. Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: Time: Method of Shipment:

Relinquished by:	Date/Time: 03/25/20 / 12:00	Company: GEOSYNTEC	Received by: FE	Date/Time:	Company:
Relinquished by: FE	Date/Time:	Company:	Received by:	Date/Time: 3/26/2020 10:08	Company: ETA STL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

r: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins Environment Testing TestAmerica

Client Information	Sampler: B. Zinckgraf	Lab PM: Awalt, Jayna K	Carrier Tracking No(s):	COC No: 160-9009-4556.1
Client Contact: Michelle Cho	Phone: 904-302-1500	E-Mail: jayna.awalt@testamericainc.com		Page: Page 1 of ~~5~~ 1
Company: Geosyntec Consultants, Inc.		**Analysis Requested**		Job #: TR0673

Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mcho@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site: NAS JAX EK TAP

Due Date Requested:
TAT Requested (days): STD
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	8260C_DOD5_LL - VOCs (GC/MS)	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - Field Filtered Metals - Fe and Mn (ICP)	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	2540C - Solids, Total Dissolved (TDS)	6020B - Metals (ICP/MS) - Sodium only	300_ORGFM_28D - Diss Sulfate,Fluoride,Chloride,Nitrate	9060_DC_DIC, 9060_Diss	200.7_DOD5 - Dissolved Metals - Mg, Ca, Si, Na, B, Fe	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D	S	A	D	D	D	D	N	D	N	S	D		
EKMW-11	4/07/20	12:50	G	Water	Y	N	1	1	3	3	1										
EKMW-12		13:45		Water	Y	N	1	1	3	3	1										
EKMW-13B		14:30		Water	Y	N	1	1	3	3*	1										*HOLD VOCs
EKMW-13B (MS/MSD)		14:30		Water	N	Y				6											MS/MSD
EKMW-14		15:30		Water	Y	N	1	1	3		1										
FIELD BLANK		16:00		Water	N	N	1	1	3	3*	1										* HOLD VOCs
FIELD DUP-01		—		Water	Y	N	1	1	3	3*	1										* HOLD VOCs
				Water																	
				Water																	
				Water																	
				Water																	

160-37773 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment:

Relinquished by:	Date/Time: 4/08/2020 18:30	Company: Geosyntec	Received by: FED EX	Date/Time:	Company
Relinquished by: FED EX	Date/Time:	Company	Received by:	Date/Time: 4/9/2020 09:20	Company: ETA STL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact:
Δ Yes Δ No

Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Chain of Custody Record

eurofins Environment Testing TestAmerica

Client Information
Client Contact: Michelle Cho
Company: Geosyntec Consultants, Inc.
Address: 130 Stone Road West
City: Guelph
State, Zip: ON, N1G3Z2
Phone:
Email: mcho@geosyntec.com
Project Name: NAS Jacksonville Project TR0673
Site:

Sampler: J. BARNHART
Phone: (904) 226-6154
Due Date Requested:
TAT Requested (days):
PO #: 100004032
WO #:
Project #: 16008378
SSOW#:

Lab PM: Awalt, Jayna K
E-Mail: jayna.awalt@testamericainc.com
Carrier Tracking No(s):

COC No: 160-9064-4589.1
Page: Page 1 of 3
Job #:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	300_ORGFM_28D - Anions - Sulfate only	200.7_DOD5 - Total Sulfur (ICP)	9060A - Organic Carbon, Total (TOC) - single rep	8260C_DOD5_LL - VOCs (GC/MS)	200.7_DOD5 - Dissolved Metals - Fe and Mn (ICP)	200.7_DOD5 - Total Sulfur, Total Fe and Mn	200.7_DOD5 - TotalMetals - Fe, Mn (ICP)	200.7_DOD5 - Field Filtered Metals - Fe and Mn (ICP)	2540C - Solids, Total Dissolved (TDS)	6020B - Metals (ICP/MS) - Sodium only	300_ORGFM_28D - Diss Sulfate,Fluoride,Chloride,Nitrate	9060_DC_DIC, 9060_Diss	200.7_DOD5 - Dissolved Metals - Mg, Ca, Si, Na, B, Fe	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒	N	D	S	A	D	D	D	D	N	D	N	N	D	☒	
EKMW-11	04/21/20	1400	G	Water			X	X	X	X				X							
EKMW-12	04/21/20	1436	G	Water			X	X	X	X				X							
EKMW-13B	04/21/20	1510	G	Water			X	X	X	X				X							HOLD VOC ANALYSIS
EKMW-14	04/21/20	1555	G	Water			X	X	X	X				X							HOLD VOC ANALYSIS
FIELD DUP_01	04/21/20	–	G	Water			X	X	X	X				X							HOLD VOC ANALYSIS
FIELD BLANK	04/21/20	1645	G	Water			X	X	X	X				X							
				Water																	
				Water																	
				Water																	
				Water																	
				Water																	
				Water																	

160-37878 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: Time: Method of Shipment:

Relinquished by:	Date/Time: 04/22/20 1800	Company: GEOSYNTEC	Received by: FED EX	Date/Time:	Company:
Relinquished by: FED EX	Date/Time:	Company:	Received by:	Date/Time: 4/23/2020 0840	Company: ETA STL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

12 11 10 9 8 7 6 5 4 3 2 1

APPENDIX D POINTS OF CONTACT

POINT OF CONTACT	ORGANIZATION	Phone E-mail	Role in Project
Evan Cox	Geosyntec Consultants Waterloo, ON, Canada	519-514-2235 ECox@Geosyntec.com	PI Supervising the project
Dr. David Gent	US Army ERDC Environmental Lab Vicksburg, MS	601-634-4822 David.B.Gent@usace.army.mil	Co-PI Senior technical support
Mark Watling	Geosyntec Consultants Guelph, ON, Canada	519-515-0879 MWatling@Geosyntec.com	Performer Technical design and execution
Dr. David Reynolds	Geosyntec Consultants Pty. Ltd. Surry Hills, NSW, Australia	+61 (0)478 187 62 DReynolds@Geosyntec.com	Senior technical support
Dr. James Wang	Geosyntec Consultants Columbia, MD	410-381-4333 JWang@Geosyntec.com	Senior technical support
Michael Singletary Adrienne Wilson	NAVFAC Southeast Jacksonville, FL	904-542-4204 Michael.a.singletary@navy.mil Adrienne.Wilson@navy.mil	Site Liaison, technical review