Lockheed Martin Corporation
1600 Tallevast Road, Sarasota, Fl 34243
Telephone 240-687-1813

LOCKHEED MARTIN

Electronically Transmitted

October 29, 2019

Ms. Simone Core, P.E.
Remediation Engineer
Florida Department of Environmental Protection
Permitting and Waste Cleanup
13051 N. Telecom Parkway
Temple Terrace, FL 33637-0926

Re: 2019 Remedial Action Status Report
Lockheed Martin Tallevast Site
FDEP Site No. COM_169624/Project No. 238148
Tallevast, Manatee County, Florida

Dear Ms. Core:

Please find attached one copy of the 2019 Remedial Action Status Report (RASR) for the referenced site. Per your request, this RASR is being distributed to you in electronic form only. This RASR covers the period of performance from September 1, 2018 through August 31, 2019 and provides a comprehensive summary of system operation and maintenance for the groundwater treatment system. This report also summarizes other Site-related programs that include groundwater level monitoring, effectiveness monitoring, private well monitoring, groundwater modeling, and wetlands monitoring. If you have any questions, please contact me at 240-687-1813, or paul.e.calligan@lmco.com.

Sincerely,

Paul E. Calligan, P.G.
Project Manager, Environmental Remediation
Lockheed Martin Corporation

cc: Ms. Mary Ellen Fugate, SWFWMD (email)
Mr. Derek Matory, EPA (hard copy and CD)
Ms. Gladys Liehr, FDOH (CD)
Mr. Robert Brown, Manatee County (hard copy and CD)
Mr. Andre Rachmaninoff, Manatee County (hard copy and CD)
Mr. Tom Larkin, Manatee County, (CD)
Mr. Michael DiPinto, Manatee County (CD)
Mrs. Laura Ward (hard copy and CD)
Mrs. Wanda Washington (hard copy and CD)
Mr. Rob Powell, Ramboll (CD)
Mr. Kent Bontrager, SMAA (CD)

REMEDIAL ACTION STATUS REPORT FOR THE GROUNDWATER RECOVERY AND TREATMENT SYSTEM

TALLEVAST SITE, FLORIDA FDEP SITE NO. COM 169624/PROJECT NO. 238148

SEPTEMBER 2018 THROUGH AUGUST 2019

Prepared for:
Lockheed Martin Corporation

Prepared by:
AECOM Technical Services, Inc

October 2019

Approved by:
Lockheed Martin, Inc.

Revision: 0

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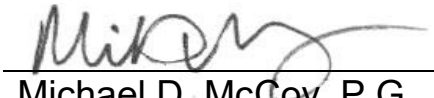
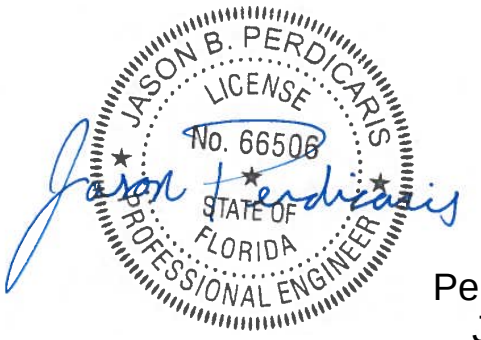


Michael D. McCoy, P.G.
Project Manager

CERTIFICATION

This Remedial Action Status Report for the Remedial Action Plan Addendum Groundwater Recovery and Treatment System at the Lockheed Martin Tallevast Site located at 1600 Tallevast Road, Sarasota, Florida documents the remediation and monitoring activities for the period of September 1, 2018 through August 31, 2019. This report has been prepared for Lockheed Martin Corporation under the direction of a State of Florida Registered Professional Engineer. The work and professional opinions rendered in this report were developed in accordance with Section 471 Florida Statutes, the governing state and federal regulations, and commonly accepted protocols and procedures. If conditions are discovered that differ from those described, the undersigned should be notified.

This item has been digitally signed and sealed by:



Perdicaris, Jason

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Date: 2019.10.29 13:29:41 -04'00'

Jason Perdicaris, P.E.
Florida Professional Engineer
License No. 66506
Engineering Business No. 8115
Date: 10/29/2019

Printed copies of this document are not considered signed and sealed. The signature must be verified on the electronic document.

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ACRONYMS AND ABBREVIATIONS

ABC	American Beryllium Company
AF	Arcadia Formation (Upper)
AOP	advanced oxidation process
COC	chemical of concern
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
cis-1,2-DCE	cis-1,2-dichloroethene
1,4-D	1,4-dioxane
DID	District Identification
EW	extraction well
Facility	The "Facility" is defined as the approximately 5-acre property located at 1600 Tallevast Road
FDEP	Florida Department of Environmental Protection
FIT	flow indicator transmitter
GAC	granular activated carbon
GCTL	groundwater cleanup target level
GRTS	Groundwater Recovery and Treatment System
ID	isotope dilution
Lockheed Martin	Lockheed Martin Corporation
LPGAC	liquid phase granular activated carbon
LSAS	Lower Shallow Aquifer System
LTWLM	long-term water level monitoring
msl	mean sea level
µg/L	microgram per liter
MW	monitoring well
OMM	operation, maintenance, and monitoring
PCE	tetrachloroethene
PLC	programmable logic controller

POTW	publicly owned treatment works
PZ	piezometer
RAOs	Remedial Action Objectives
RAP	Remedial Action Plan
RAPA	Remedial Action Plan Addendum
RASR	Remedial Action Status Report
RC	Recharge (infiltration gallery or injection well)
RO	reverse osmosis
RW	reference wetland
S&P	Salt & Pepper
SIM	selective ion monitoring
Site	The "Site" consists of the Tallevast Facility and the surrounding area underlain by groundwater impacted by chemicals of concern
SOP	standard operating procedure
SU	standard unit
SWFWMD	Southwest Florida Water Management District
TCE	trichloroethene
TDS	total dissolved solids
TestAmerica	TestAmerica Laboratories, Inc.
TPOC	Temporary Point of Compliance
TW	target wetland
USAS	Upper Surficial Aquifer System
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound
WUP	Water Use Permit

SECTION 1
INTRODUCTION

Lockheed Martin Corporation presents this annual Remedial Action Status Report to the Florida Department of Environmental Protection for Site No. 169624/Project No. 238148. This document provides a comprehensive summary of remediation and monitoring activities.

1.1 GENERAL

This Remedial Action Status Report describes operation, maintenance, and monitoring activities for the Remedial Action Plan Addendum (ARCADIS, 2009a) Groundwater Recovery and Treatment System, at the Lockheed Martin Tallevast Site (also known as the Former American Beryllium Company Site) (the Site) located in Tallevast, Manatee County, Florida. The Site consists of both the Facility (also referred to as the "on-Facility" portion of the Site) and the surrounding area (referred to as the "off-Facility" portion of the Site) where groundwater is impacted by the chemicals of concern. Refer to Figure 1-1 for a Site Location Map. This Remedial Action Status Report documents the reporting period from September 1, 2018 through August 31, 2019.

This report was prepared in accordance with and contains the applicable items required in Rule 62.780.700(12), Florida Administrative Code for a Remedial Action Status Report. The activities, analyses, and results described in this report demonstrate the fulfillment of Lockheed Martin Corporation commitments and compliance with Florida Department of Environmental Protection requirements. The Remedial Action Status Report also provides permit compliance status for Southwest Florida Water Management District Water Use Permit number 20 020198.000 and Manatee County Discharge Permit #IW-0025S. Manatee County Utility Operations will continue receiving annual reports concurrent with Florida Department of Environmental Protection reporting requirements. Also included in this Remedial Action Status Report are results of the biennial Persulfate Pilot Study Monitoring, the Wetlands Monitoring, and the Long-Term Water Level Monitoring programs.

1.2 OBJECTIVES

The Groundwater Recovery and Treatment System Remedial Action Objectives provided in the Remedial Action Plan Addendum are as follows:

- Reduce the potential for human exposure to the chemicals of concern in groundwater.
- Hydraulically control groundwater containing chemicals of concern in concentrations greater than the groundwater cleanup target levels as listed in Chapter 62-777, Florida Administrative Code.
- Actively extract and treat the groundwater plume until concentrations are below groundwater cleanup target levels.
- Reduce the potential for exposure to the chemicals of concern present in soil at the Facility.
- Minimize community and natural resource disturbance.

This Remedial Action Status Report provides descriptions and results demonstrating adherence to achieving the Remedial Action Objectives.

1.3 REPORT ORGANIZATION

This report is organized into seven sections as described below.

Section	Description
1 – Introduction	Presents the purpose and objectives of remedial actions and the organization of this report.
2 – Background	Summarizes the regulatory and physical settings, Site hydrology, geology, and hydrogeology, and history of Facility operations.
3 – Groundwater Recovery and Treatment System Description	Provides a general description of the Groundwater Recovery and Treatment System.
4 – System Operation, Maintenance, and Monitoring Activities	Describes operation, maintenance, and monitoring, Long-Term Water Level Monitoring, persulfate pilot study monitoring, wetlands monitoring, and groundwater modeling activities.
5 – System Operation, Maintenance, and Monitoring Results	Describes the operation, maintenance, and monitoring, Long-Term Water Level Monitoring, wetlands monitoring, and persulfate pilot study monitoring results.
6 – Summary and Recommendations	Summarizes data and analyses presented in this report and provides recommendations for changes to system operations and monitoring.
7 – References	Lists of references used to support and prepare this report.

SECTION 2
BACKGROUND

This section of the Remedial Action Status Report (RASR) provides an overview of the Facility location and description, regulatory setting, and historical operations. A more detailed description of the Groundwater Recovery and Treatment System (GRTS) located on the Facility can be found in the first Lockheed Martin Corporation (Lockheed Martin) Tallevast Site RASR (AECOM Technical Services, Inc., 2014) submitted to the Florida Department of Environmental Protection (FDEP) on October 28, 2014.

2.1 FACILITY LOCATION

The Facility is an approximate 5-acre property located at 1600 Tallevast Road, between the cities of Sarasota and Bradenton, in southwestern Manatee County, Florida. Land use in the area consists of single-family residential homes, churches, light commercial and industrial development, and heavy manufacturing. The location of the Facility is shown on Figure 1-1.

2.2 REGULATORY SETTING

The Remedial Action Plan Addendum (RAPA) was developed in accordance with the Consent Order for the Site entered into by Lockheed Martin and the FDEP. The File Number for the Consent Order is 04-1328 with an effective date of July 28, 2004, as amended by Consent Order No. 08-2254 with an effective date of October 13, 2008. The Consent Order requires Lockheed Martin to perform assessment and remediation activities at the Site.

Lockheed Martin submitted the RAPA to the FDEP on July 14, 2009. The FDEP issued a Remedial Action Plan (RAP) Approval Order on November 5, 2010. Construction of the full-scale groundwater remedy provided in the RAPA began in March 2011. A challenge to the RAP Approval Order was heard by an Administrative Law Judge, who recommended in an October 6, 2011 filing, that FDEP issue a final order approving the RAPA. The final order from FDEP was received on January 4, 2012.

2.3 SITE DESCRIPTION

This section provides the physical setting of the Site and describes Site hydrologic, geologic, and hydrogeological conditions.

2.3.1 Physical Setting

The Facility is bounded by Tallevast Road to the north; 17th Street Court East to the east; a nine-hole golf course and driving range to the south; and an abandoned industrial property to the west, as shown on Figure 2-1. The treatment building is located in the north-central portion of the Facility property as shown on Figure 2-2. The treatment building is located within a concrete parking area to the east, a concrete driveway to the south, and impermeable asphalt with a permeable artificial turf overlay to the north and to the west. A stormwater retention pond is located west of the treatment building. A map showing Site monitoring well, extraction well, stilling well, private well, and staff gauge locations is presented as Figure 2-3.

Recent development work at the eastern areas of the Site include the construction of the Manatee County Transit facility and land development at a commercial lot. These site development projects are located at the northwest and southwest corners of Tallevast Road and US 301, respectively. At both locations, additional impervious surfaces such as parking lots, buildings, and associated stormwater drainage features (stormwater ponds, outfall structures, etc.) have been constructed.

2.3.2 Site Hydrology

Several small surface water bodies are located within and near the Site. Shallow swales convey surface runoff to streets and stormwater channels. In addition, local wetlands are present within and near the Site according to the Florida Department of Transportation Survey and Mapping *Florida Land Use, Cover and Forms Classification System Handbook Third Edition*, (Florida Department of Transportation, 1999). Surface water on the western portion of the Facility flows west toward improved drainage features around the Sarasota-Bradenton Airport, which drain into Sarasota Bay. Surface water on the easternmost portion of the Site flows southeast toward the Pearce Canal.

2.3.3 Site Geology and Hydrogeology

In January 1995, the Southwest Florida Water Management District (SWFWMD) published a report titled ROMP TR-7 Oneco Monitor Well Site, Manatee County, Florida (SWFWMD, 1995), which describes the drilling and testing of a well completed to a reported depth of 1,715 feet below ground surface at a location approximately 2.5 miles north of the Facility in southwestern Manatee County. The nomenclature used in the SWFWMD report to describe subsurface sediments is typically used to describe consolidated carbonate formations in the region and therefore is used for this Site. Local hydrogeologic units and water-bearing zones beneath the Site are detailed on Figure 2-4.

2.4 FACILITY OPERATION

The following sections summarize the history of Facility operations and RAPA implementation.

2.4.1 History of Facility Operations

From 1962 until 1996, the Facility was owned by Loral Corporation and operated by American Beryllium Company (ABC) as an ultra-precision machine parts manufacturing plant in which metals were milled, lathed, and drilled into various components. Some of the components were finished by electroplating, anodizing, and ultrasonic cleaning. Lockheed Martin acquired ownership of the former ABC facility through its 1996 acquisition of Loral Corporation, the parent company of ABC. Historical plant operations were discontinued in late 1996. Lockheed Martin sold the property in 2000 and re-purchased it in June 2009 to prepare it for remedial actions.

2.4.2 History of RAPA System Implementation

Construction of the GRTS building began in January of 2012, and Manatee County issued a Temporary Certificate of Occupancy on February 1, 2013. Construction reached substantial completion on April 19, 2013, and Manatee County issued the final Certificate of Occupancy on August 21, 2013 when the Facility civil improvements were completed.

Startup and testing activities began in February 2013 and concluded on November 18, 2013, the date of official GRTS startup. As-built Drawings, which included the soil control plan at the completion of Site civil activities, were submitted to the FDEP on November 14, 2013. The Site is currently in the operation, maintenance, and monitoring phase of remedial activities.

SECTION 3
GROUNDWATER RECOVERY AND TREATMENT SYSTEM DESCRIPTION

This section presents a summarized process description of the Tallevast Groundwater Recovery and Treatment System (GRTS).

3.1 TREATMENT BUILDING SUMMARY

The GRTS equipment is housed inside a 14,200 square-foot reinforced concrete building. The Treatment System General Arrangement Plan, shown as Figure 3-1, provides the location of GRTS equipment in the process area. The treatment building is constructed with secondary containment sufficient to contain more than the entire volume of water present in the piping, tanks, and process equipment at any one time. The treatment building includes treatment equipment, chemical containment rooms, operator offices, restroom facilities, a break room, a sample preparation room, and a parts storage room.

3.2 EXTRACTION WELL AND PUMP SUMMARY

The GRTS includes 77 vertical groundwater extraction wells, four horizontal extraction wells, three infiltration galleries, and five injection wells. A submersible pump and pressure transducer are located in each extraction well. The GRTS extracts groundwater from 33 on-Facility vertical wells, 44 off-Facility vertical wells, and four off-Facility horizontal wells. Most of the treated water is discharged to the publicly owned treatment works (POTW), but it is also used for Facility irrigation and discharged to the infiltration galleries and injection wells. Contaminated groundwater at the Site is extracted from the Upper Surficial and Lower Shallow Aquifer Systems, the Upper Arcadia Formation (Arcadia Formation) Gravels, and Salt & Pepper Sands (Figure 2-4). The primary operational objectives of the GRTS are (a) to provide hydraulic containment, capture and mass removal of the chemicals of concern (COC) plumes within each impacted water-bearing zone and (b) to ultimately achieve COC concentrations that are less than groundwater

cleanup target levels (GCTLs) in groundwater beneath the Site - two of the Site Remedial Action Objectives.

3.3 CONVEYANCE PIPING AND FIELD UTILITIES

Groundwater from horizontal and vertical extraction wells is transported in the underground conveyance piping network to the treatment plant. Each well vault contains a flow meter, pressure transducer, sample port, check valve, Y strainer, and isolation ball valve. On-Facility extraction wells are individually piped to the treatment building. Piping for the individual off-Facility extraction wells connects to main pipelines for conveyance to the treatment building. Conveyance piping for the on-Facility and off-Facility extraction wells is combined once inside the treatment building. Conveyance carrier piping is enclosed in secondary containment (i.e., containment piping, manhole structures, etc.) until it reaches the interior of the treatment building. Manifold piping inside of specific cleanout manholes and extraction well vaults are constructed to provide leak detection in the capture and conveyance system using permanent dual-containment termination fittings and capacitance sensors capable of detecting water. Once the capacitance sensors detect water, the operator is alerted and the extraction well network is automatically disabled.

Five on-Facility injection wells are contained inside pre-cast concrete vaults. Each vault contains a level sensor, drop pipe, and air release valve. The flow rate to each well is controlled via flow control valves, and flow is totalized using a single flow meter inside the process area. Injection wells are supplied treated water from a single pump which feeds from the recharge tank inside the process area.

3.4 TREATMENT PLANT PROCESS OPERATION SUMMARY

Refer to Figure 3-2 for a treatment process diagram. Extracted groundwater is pumped to the treatment system where pre-treatment equipment is used to adjust the pH of the groundwater, oxidize metals, and remove solids using settling tanks, media filters, and ultrafilters. Removed solids and metals are pumped to a solids thickening tank for further settling. The concentrated solids are dewatered using a filter press before being loaded into 55-gallon drums and transported as non-hazardous waste to a licensed and permitted landfill. Advanced oxidation process (AOP) units and liquid phase granular activated carbon (LPGAC) vessels are used to provide treatment

of contaminants to meet POTW discharge permit limits. Groundwater COC at the Site include 1,4-dioxane, tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethene, 1,1-dichloroethane, and vinyl chloride.

Water that has been treated through the settling tanks, filters, AOP units, and activated carbon processes meets the POTW discharge standards. In addition to discharge to the POTW, treated water is used for the following: 1) backwash supply water for the media filters and LPGAC vessels; 2) further process treatment through softeners and reverse osmosis systems to meet GCTLs and Florida Surface Water Quality Criteria for application to the infiltration galleries or injection wells; and 3) non-potable process water used for equipment wash-down, Facility irrigation, and miscellaneous non-potable uses. The on-Facility injection wells recharge the Upper Surficial Aquifer System via five passive injection wells that focus flushing of areas with the highest historical COC concentrations. The three off-Facility infiltration galleries are used as needed to maintain established wetland hydroperiod water levels to minimize wetland health impacts due to drawdown effects of the groundwater extraction system.

A compressed air system operates the pneumatic equipment, including double-diaphragm pneumatic pumps and the pneumatic valves. Compressed air is also used to assist in metals oxidation in the primary pretreatment tanks. Displaced air from the pre-AOP holding tank, backwash surge tank, and solids thickening tank vent systems are routed to the vapor phase granular activated carbon vessels located in the process area loading dock for passive treatment of volatile organic compounds.

Various instruments are used to monitor key process variables (primarily flow rate, water level, line pressures, pH, and temperature). Redundant alarms, switches, and control logic are used to automate the GRTS and prevent system failures such as accidental overfilling of tanks. A programmable logic controller provides control and communications between systems, equipment, and instrumentation. The treatment building includes an operations room where operators monitor and control the GRTS.

SECTION 4
SYSTEM OPERATION, MAINTENANCE, AND MONITORING ACTIVITIES

This section describes activities conducted as part of system operation, maintenance, and monitoring (OMM). The data for these activities are detailed in Sections 5 and 6 of this document.

4.1 SYSTEM OPERATION

The Groundwater Recovery and Treatment System (GRTS) operated continuously from September 1, 2018 through August 31, 2019, with the exception of planned downtime for required maintenance activities, and a few unplanned shutdowns. In addition to GRTS operations due to system and component status, on August 16, 2019, during the annual sampling event, the Manatee County Utilities maintenance supervisor requested flow from the GRTS to the publicly owned treatment works (POTW) be reduced due to the inability of downstream lift stations to handle the full plant discharge flow after a period of heavy rainfall. Manatee County allowed operations to resume unrestricted discharge flow on August 19, 2019.

The extraction wells were in operation during the reporting period, with the exception of extraction well EW-5002 (refer to Section 5.4.1).

An OMM log describing key GRTS operations, maintenance activities, and downtime events during this period of performance is presented in Table 1. Treatment plant shift daily logs document the key GRTS readings and are presented in Appendix A. System runtime is discussed in Section 5.1 and presented in Table 2. Monthly extraction well volumes since startup are presented in Table 3.

Startup of the on-Facility injection wells occurred October 4, 2016 and injection continued throughout the 2018/2019 reporting period. Discharge to infiltration gallery RC-7002 began on July 9, 2014 and was temporarily discontinued on June 26, 2019 to facilitate drawdown of the Upper Surficial Aquifer System (USAS) in the southeastern portion of the Site. Suspension of

recharge to this location continued through the reporting period. Discharge to RC-7001 and RC-7003 began on July 5, 2017 and continued throughout the reporting period. Refer to Figure 2-1 and Figure 2-2 for the locations of infiltration galleries and injection wells, respectively. The use of treated effluent for the Facility irrigation system used for maintenance of landscaping was initiated April 17, 2017. Refer to Section 5.2 for additional details.

4.2 WATER TREATMENT PROCESS AND COMPLIANCE MONITORING

The following sections describe water treatment process sampling and laboratory analyses. Data that demonstrate Remedial Action Plan Addendum (RAPA) and regulatory permit compliance are also provided. Water treatment and compliance sampling was conducted in accordance with Florida Department of Environmental Protection (FDEP) Standard Operating Procedures (SOPs) FS 2000 *General Aqueous Sampling*, revision date January 2017 (FDEP, 2017a) and FC 1000 *Cleaning/Decontamination Procedures*, revision date January 2017 (FDEP, 2017b). Table 4 summarizes the monitoring schedule as originally specified in RAPA Table 12-1.

4.2.1 Compliance Sampling

Treatment System POTW effluent compliance samples were collected in accordance with the RAPA and the requirements of Manatee County Discharge Permit #IW-0025S. The Manatee County Discharge Permit, located in Appendix B, was renewed in late 2018 with an effective date of November 9, 2018. The current permit expires November 9, 2021. Effluent compliance sampling dates and analytical results are presented in Table 5. The analytical results of this sampling are described in Section 5.2. The calibration sheet from April 19, 2019, for discharge flow indicator transmitter (FIT) 500 is presented in Appendix C.

TestAmerica Laboratories, Inc. (TestAmerica) located in Tampa, Florida analyzed compliance samples using United States Environmental Protection Agency (USEPA) Method 8260B for volatile organic compounds (VOCs) and USEPA Method 8260C with heated purge and selective ion monitoring isotope dilution (SIM/ID) for 1,4-dioxane (1,4-D). Effluent samples were also analyzed for the 12 metals (aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, nickel, zinc, sodium, and molybdenum) specified in the Manatee County Utility Operations

Discharge Permit by USEPA Method 6010B. Temperature and pH are continuously monitored using treatment system instrumentation.

4.2.2 GRTS Performance Monitoring Sampling

Performance samples were collected from the reverse osmosis (RO) system effluent on September 10, 2018 and September 24, 2018 to document the water quality during discharge to infiltration galleries and injection wells. Samples collected on September 10, 2018 were analyzed for the RO system effluent 10 metals (aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, zinc, and sodium) by USEPA Method 6020A, total dissolved solids (TDS) by Standard Method 2540C, and chloride and sulfate by USEPA Method 300.0. The results were compared to the values in Table 6, to confirm that RO permeate met the lower of either groundwater cleanup target level (GCTL) or surface water quality criteria for discharge to infiltration galleries, and adherence to GCTL for discharge to injection wells. TestAmerica in Tampa, Florida analyzed the samples collected on September 24, 2018 using USEPA Method 8260B for VOCs and USEPA Method 8260C with heated purge, and SIM/ID for 1,4-D. These results were also compared to the effluent limitations in Table 6.

To evaluate critical process performance parameters, samples are collected at the combined plant influent, advanced oxidation process (AOP) feed, AOP effluent, and the primary and secondary carbon vessel discharge points. These samples were analyzed using USEPA Method 8260B for VOCs and USEPA Method 8260C with heated purge, and SIM/ID for 1,4-D. Refer to Table 7 for the process monitoring analytical results. Refer to Table 8 for the combined influent analytical results. Section 5.2 includes a discussion of the analytical results.

4.2.3 SWFWMD Water Use Permit Compliance

The Southwest Florida Water Management District (SWFWMD) issued a General Water Use Permit (WUP) No. 20 020198.000 on November 18, 2011that limits the volume of groundwater extracted at the Site. The current permit, provided in Appendix D, expires on November 18, 2021, and is to be renewed during the year prior to the date of expiration. As prescribed in the permit, Lockheed Martin Corporation (Lockheed Martin) is permitted to extract a total of 410,600 gallons daily from the network of extraction wells. Table 3 presents monthly extraction well volumes pumped. Table 9 summarizes cumulative groundwater volumes extracted, treated, and discharged.

Section 5.1 summarizes the monthly influent flow totals plus the daily maximum and average flows; the plant was compliant with the water use permit during the reporting period. Permit special conditions require monthly reporting of meter readings at three compliance points (District Identification numbers DID-95, DID-96, and DID-97). DID-95 and DID-97 correspond to the GRTS influent (FIT-100) and discharge to the POTW (FIT-500), respectively. The discharge total for the infiltration galleries (RC-7001, RC-7002, and RC-7003), the injection wells (RC-6001, RC-6002, RC-6003, RC-6004, and RC-6005), and treated effluent used for Facility irrigation is calculated (DID-95 minus DID-97) and submitted as DID-96. Summarized in Table 9a, below, are the dates that monthly WUP compliance point flow totals were submitted to the SWFWMD online e-Permitting website service portal. Appendix C contains flow meter calibration sheets for the extraction wells, combined influent, POTW effluent, combined injection well flow meters, and infiltration gallery flow meters.

Table 9a – Southwest Florida Water Management District (SWFWMD) E-Permitting Submittal Dates

Month	SWFWMD E-Permitting Submittal Date
September 2018	October 1, 2018
October 2018	November 1, 2018
November 2018	December 3, 2018
December 2018	January 3, 2019
January 2019	February 1, 2019
February 2019	March 1, 2019
March 2019	April 1, 2019
April 2019	May 1, 2019
May 2019	June 3, 2019
June 2019	July 1, 2019
July 2019	August 1, 2019
August 2019	September 3, 2019

4.3 WATER LEVEL AND WETLANDS MONITORING

Groundwater level monitoring provides a means for confirming hydraulic capture of the chemicals of concern (COC) plume, optimizing the extraction system, and providing adequate protection of groundwater supply resources. The following sections describe the water level gauging events performed in February 2019 and August 2019.

4.3.1 Semi-Annual Gauging Event

During the semi-annual groundwater gauging event, field personnel collected water levels from a total of 186 monitoring locations. These locations included monitoring wells, staff gauges, stilling wells, and piezometers, as identified in Table 10 and shown on Figure 2-3. The monitoring wells gauged during this event were opened and vented on February 19, 2019 and water levels were allowed to equilibrate for approximately 24 hours. Field personnel gauged monitoring wells on February 20, 2019 while under GRTS pumping conditions.

4.3.2 Annual Effectiveness Monitoring Gauging Event

Sampling personnel collected water level data during the annual event from 298 monitoring points, including monitoring wells, piezometers, staff gauges, and stilling wells, as identified in Tables 10 and 11, and shown on Figure 2-3. Field personnel opened monitoring wells on August 5, 2019, and water levels were allowed to vent and equilibrate for approximately 24 hours. Monitoring wells were gauged on August 6, 2019 while under GRTS pumping conditions. Groundwater elevation and potentiometric contour maps were developed using data collected from the USAS, Lower Shallow Aquifer System, Arcadia Formation (AF) Gravels, Salt & Pepper Sands, and Lower AF Sands Aquifer. These data are presented on Figures 4-1 through 4-5, respectively. Capture boundaries shown on these figures are estimated using data from monitoring wells, stilling wells, and piezometers, and by applying professional judgment including consideration of information from extraction well instrumentation. The water level information and capture boundaries are discussed in Section 5.3.2.

4.3.3 Long-Term Water Level Monitoring Program

The long-term water level monitoring (LTWLM) program at the Site began in 2008 and has provided important information and data to monitor and improve project performance. The

LTWLM program has identified specific off-Site groundwater pumping stresses that were further investigated and evaluated using desktop and numerical modeling techniques and integrated into the conceptual site model. The LTWLM program data have also been used to characterize hydraulic interrelationships and gradients between geologic units at the Site, allow evaluation of potential regional groundwater trends, and monitor the effects of groundwater extraction. The LTWLM program includes ongoing data collection and analysis, maintenance, and reporting of the data from the LTWLM network of transducers installed in wells at the Site. The LTWLM transducer download events for this reporting period were conducted September 10 through 11, 2018, December 10 through 11, 2018, March 4 through 5, 2019, and June 3 through 4, 2019. The annual *Long-Term Water Level Monitoring Report* (Tetra Tech, Inc., 2019a) is provided in Appendix E.

4.3.4 Wetlands Monitoring Program

In accordance with the July 2009 *Wetlands Monitoring Plan* (ARCADIS, 2009b) the semi-annual wetland manual water-level monitoring event was conducted on December 11, 2018 and the annual wetlands assessment was conducted on May 30 through 31, 2019. Wetland telemetry monitoring systems continued to provide real-time collection and reporting of water levels at each of the reference wetlands and target wetlands. Results of monitoring activities are provided in the approved *Wetlands Monitoring Report - June 2018 through June 2019, Tallevast Site* (AECOM Technical Services, Inc., 2019: referenced herein as the Wetlands Monitoring Report) in Appendix F.

4.4 GROUNDWATER QUALITY MONITORING

Groundwater quality monitoring was conducted in accordance with FDEP SOP *FS 2200 Groundwater Sampling*, revision date January 2017 (FDEP, 2017c), and *FC 1000 Cleaning/Decontamination Procedures* (FDEP, 2017b). Completed groundwater sampling logs for the groundwater sampling events are included in Appendix G. Equipment used for field measurements was calibrated each morning before the start of purging and sampling and a calibration check was conducted each afternoon following completion of the day's activities. Field personnel sampled monitoring and private wells as part of the effectiveness monitoring events and extraction wells as part of the GRTS performance monitoring program.

Groundwater samples were placed into insulated coolers and maintained at temperatures between 2 and 6 degrees Celsius. The coolers were sealed, and the contained samples were delivered to TestAmerica in Tampa, Florida for laboratory analysis. The coolers and samples were delivered to the laboratory under chain-of-custody procedures found in the USEPA's *Quality Assurance Handbook Volume II*, Section 8 (USEPA, 2008). Laboratory analytical reports and associated chain-of-custody forms are included in Appendix H. Data Validation Reports are presented in Appendix I. There were no laboratory analytical quality control issues that adversely affected data usability, as documented in the Data Validation Reports.

The groundwater purged during monitoring well sampling was stored in containers within secondary containment trays. Purged water was manually transferred to the GRTS for treatment. The following sections provide more detail on the performance and effectiveness sampling events.

4.4.1 Semi-Annual Extraction Well Monitoring

Field personnel conducted groundwater sampling at 77 vertical extraction wells and four horizontal extraction wells on February 21, 2019 and August 7, 2019. Groundwater pumped from 30 on-Facility extraction wells was collected from the sample ports located on each dedicated line inside the treatment building. Groundwater samples from three of the on-Facility extraction wells, 44 of the off-Facility vertical extraction wells and the four off-Facility horizontal extraction wells were collected utilizing dedicated sample ports located inside their respective well vaults. TestAmerica analyzed the samples using USEPA Method 8260B for VOCs and USEPA Method 8260C SIM/ID with heated purge for 1,4-D. Section 5.4.1 includes a discussion of the analytical results provided in Table 12.

4.4.2 Semi-Annual Effectiveness Monitoring

Groundwater sample collection was performed at 53 monitoring wells identified on Table 13 from February 25 through 28, 2019. Monitoring well MW-101 was added to the semi-annual effectiveness monitoring schedule, as discussed in the *Response to Comments 2016 Remedial Action Status Report, Tallevast Site* (AECOM Technical Services, Inc., 2016). The FDEP requested MW-101 be sampled semi-annually until a downward trend of 1,4-D concentrations is observed with at least a 95% confidence factor using the *Mann-Kendall* statistical method (Mann-Kendall, 2003). TestAmerica analyzed the samples using USEPA Method 8260B for VOCs and

USEPA Method 8260C SIM/ID with heated purge for 1,4-D. Section 5.4.4 provides a discussion of the extent and trends of the COC in the impacted water bearing units using the analytical results from Table 14.

4.4.3 Biennial Persulfate Compliance Monitoring

No groundwater monitoring for persulfate was performed in 2019. The results from historical persulfate monitoring are presented in Table 15. The next biennial persulfate compliance monitoring event will take place in August 2020.

4.4.4 Annual Effectiveness and Private Well Monitoring

As part of the annual effectiveness monitoring, on August 6, 2019 total depths were measured in accessible monitoring wells. These measurements were used to determine if monitoring wells required redevelopment to provide continued sampling functionality. None of the wells required redevelopment during this reporting period. The total well depths measured in August 2019 are summarized along with the initial total depths in Table 10.

Annual effectiveness sampling was conducted at 141 monitoring wells, three private wells, and seven piezometers between August 7 and August 30, 2019, in accordance with the RAPA and as detailed in Table 13. TestAmerica analyzed the samples using USEPA Method 8260B for VOCs and USEPA Method 8260C SIM/ID with heated purge for 1,4-D. The analytical data from the August 2019 annual sampling event are summarized in Table 14. The analytical data from sampling the private wells are summarized in Table 16. Section 5.4.4 includes a discussion of the analytical results from this sampling event.

4.5 FIVE YEAR MODELING UPDATE

A groundwater flow and transport model for the GRTS was initially developed and submitted to the FDEP in 2009 (Arcadis, 2009a, Appendix D). The model has been regularly updated since that time to provide Lockheed Martin with an effective tool for assisting in the operation of the GRTS. A five-year report has been prepared to summarize the status of the model for the FDEP, describe the evolution of the model between 2009 and 2019, and present material to support the viability of the model as a GRTS operation and management tool. The *Five Year Modeling Update and Report* (Tetra Tech, Inc., 2019b) is provided in Appendix J.

SECTION 5
SYSTEM OPERATION, MAINTENANCE, AND MONITORING RESULTS

This section provides results from system operation, treatment and compliance, water level, effectiveness, persulfate, and wetlands monitoring and data analysis. The section also includes a summary of waste management activities.

Lockheed Martin Corporation has operated the Groundwater Recovery and Treatment System (GRTS) at the Site per the following orders and guidance:

- Consent Order No. 04-1328
- Consent Order No. 08-22542009 (as amended)
- 2009 Remedial Action Plan Addendum (RAPA)
- 2012 Florida Department of Environmental Protection (FDEP) Remedial Action Plan Addendum Approval Order
- Approved Operation, Maintenance, and Monitoring Manual
- Approved recommendations in each annual Remedial Action Status Report (RASR)

5.1 SYSTEM OPERATION

The total volume of groundwater pumped from the extraction system for the reporting period from September 1, 2018 to August 31, 2019 was approximately 79,072,900 gallons, resulting in a total of 458,575,000 gallons of groundwater extracted and treated since initial system startup in November 2013. A cumulative monthly summary of groundwater volumes that were extracted, treated and discharged is presented in Table 9. The GRTS operated for 96.8% of the reporting period excluding planned downtime. The GRTS was able to process groundwater for 8,478.1 hours, with 262.8 hours of planned downtime and 19.1 hours of unplanned downtime. GRTS runtime is presented in Table 2.

Table 16a below presents monthly influent flow totals, plus the daily maximum and average flows, as recorded automatically by the programmable logic controller (PLC) and archived in the reporting software database. The flow rates during the reporting period were compliant with the Water Use Permit pumping volume allowance of 410,600 gallons daily (annual average) from the extraction network.

Table 16a – Southwest Florida Water Management District (SWFWMD) Influent Flow Totals

SWFWMD - District Identifications (DID)	DID 95	DID 95	DID 95
Month	Maximum Daily Influent Flow in Gallons	Average Daily Influent Flow in Gallons	Monthly Total Influent Flow in Gallons
September 2018	242,000	197,900	5,936,300
October 2018	240,300	227,600	7,054,900
November 2018	238,800	215,900	6,475,900
December 2018	235,800	229,400	7,110,000
January 2019	229,900	216,400	6,709,100
February 2019	235,300	223,400	6,255,400
March 2019	233,900	206,600	6,403,400
April 2019	218,100	210,900	6,327,800
May 2019	219,100	198,000	6,138,500
June 2019	238,200	208,400	6,252,300
July 2019	250,000	233,700	7,244,200
August 2019	255,300	231,100	7,165,100

Table 3 presents monthly flow volumes for individual extraction wells, as recorded automatically by the PLC. Facility personnel operate and maintain the GRTS safely and effectively 24 hours per day, 7 days per week.

5.2 TREATMENT PROCESS AND COMPLIANCE MONITORING RESULTS

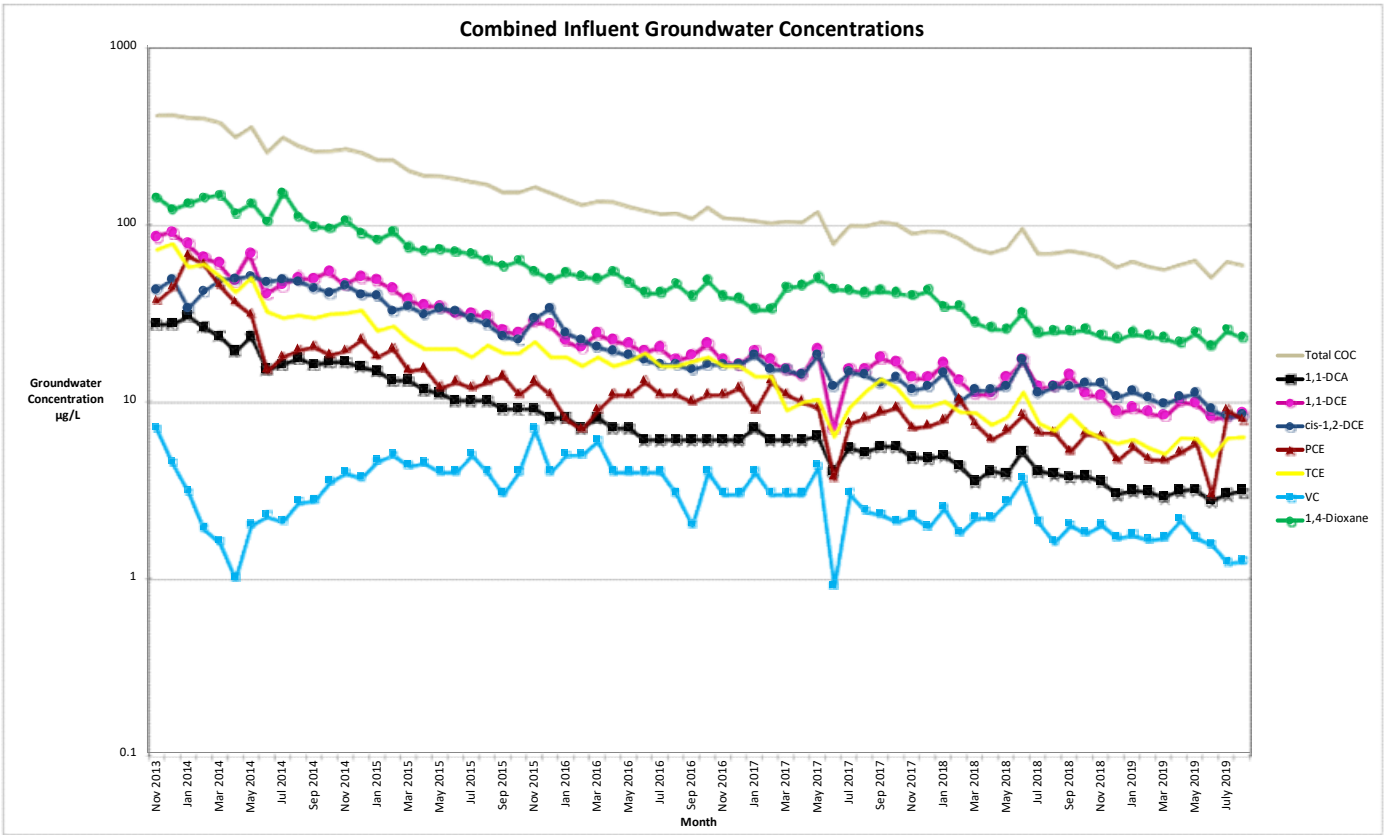
System process monitoring samples collected upstream and downstream of the advanced oxidation process (AOP) units and downstream of the primary and secondary granular activated carbon (GAC) vessels demonstrate that the process units are effectively treating groundwater to meet limits in the Manatee County Discharge Permit. The permit limits are summarized in Table 6. The monthly average GRTS combined influent chemicals of concern (COC) concentrations (1,4-dioxane [1,4-D], tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [cis-1,2-DCE], 1,1-dichloroethene [1,1-DCE], 1,1-dichloroethane [1,1-DCA], and vinyl chloride [VC]) are presented in Table 16b below.

Table 16b – Average Monthly Plant Influent Total Chemicals of Concern (COC) Concentration

Month	Influent Total COC Average Concentrations (micrograms per liter [µg/L])
September 2018	70
October 2018	68
November 2018	65
December 2018	57
January 2019	61
February 2019	58
March 2019	55
April 2019	59
May 2019	62
June 2019	50
July 2019	61
August 2019	58

The historical combined influent groundwater concentrations for individual and total COC from November 2013 to August 2019 are presented on Figure 5 below. The concentrations on this figure are presented in logarithmic scale.

Figure 5 - Combined Influent Groundwater Concentrations



The individual and total COC concentrations have maintained a steady downward trend since the start of GRTS operation; the exception is the concentration of VC, which had an initial drop in March 2014, a subsequent rebound, and has trended downwards since March of 2016. The slower decline in concentration with time of VC is expected, as it is generated through the conversion of the higher order chlorinated compounds associated with TCE to ethene during anaerobic reduction, which results in overall plume mass reduction. VC may also be reduced aerobically. The concentration of VC declining at a slower rate than other COC is likely due to the rate of VC generation being just slightly slower than the rate of degradation and removal by the GRTS system.

Combined influent samples from the extraction system were collected approximately twice per month as part of process monitoring. Samples were collected quarterly from the system effluent that is conveyed to the publicly owned treatment works (POTW), in accordance with the RAPA and the POTW discharge permit. To verify compliance with discharge permit requirements,

process samples were collected upstream and downstream of the AOP units and at the primary and secondary carbon vessel discharge sample ports. These process sampling results also allow operators to track the effectiveness of the AOP units in removing COC. Table 7 provides the GRTS process monitoring analytical results.

The permit limits for chemicals in the system discharge prescribed in the Manatee County Discharge Permit #IW-0025S were not exceeded. Refer to Appendix B for a copy of Manatee County Discharge Permit #IW-0025S. Appendix B also includes the required Manatee County Industrial Pretreatment Program Certification Statement. There were no laboratory analytical quality control issues that adversely affected data usability, as documented in the Data Validation Reports. Analytical results for the POTW effluent samples indicate that COC and metals concentrations in the treated effluent were below limits set forth in the discharge permit.

Table 16c below presents the Discharge Permit limits and minimum and maximum recorded values for pH, temperature, and daily discharge flow for the year, as recorded by the GRTS PLC using discharge instrumentation.

Table 16c - Manatee County Discharge Permit Compliance Limits

Monitored Parameter	Discharge Permit Limits	Publicly Owned Treatment Works (POTW) Discharge Recorded Values
pH Range	5 to 11.5 standard units (SU)	5.59 to 9.43 SU
Maximum Temperature	104 Degrees Fahrenheit	102.6 Degrees Fahrenheit
Maximum Daily POTW Effluent Flow	432,000 Gallons	249,400 Gallons
Average Daily POTW Effluent Flow	Report Only	200,500 Gallons

Presented below in Table 16d are the detailed monthly pH range and maximum recorded temperatures recorded by the GRTS PLC using discharge instrumentation. This table demonstrates compliance with the Discharge Permit.

Table 16d - Manatee County Discharge Permit Compliance			
Reporting Period	**Minimum POTW Discharge pH**	**Maximum POTW Discharge pH**	**Maximum POTW Discharge Temp (degrees Fahrenheit)**
September 2018	5.73	9.43	98.3
October 2018	6.08	7.66	99.2
November 2018	6.01	7.46	92.5
December 2018	6.27	7.67	92.9
January 2019	6.11	7.39	96.0
February 2019	5.59	7.42	100.3
March 2019	5.98	7.43	95.2
April 2019	6.26	7.30	96.1
May 2019	6.24	7.39	102.6
June 2019	6.34	7.87	96.7
July 2019	6.38	8.51	95.4
August 2019	6.08	7.24	97.9

POTW = publicly owned treatment works

The total volume of treated groundwater discharged to the POTW is recorded automatically by the PLC. These data, including maximum and average daily flows, and water reuse conveyed to the infiltration galleries, injection wells, and the facility irrigation system, are archived in the reporting software database and are presented below in Table 16e.

Table 16e – SWFWMD Effluent Flow Totals				
SWFWMD DID	**DID 97**	**DID 97**	**DID 97**	**DID 96***
Month	**Maximum Daily POTW Effluent Flow in Gallons**	**Average Daily POTW Effluent Flow in Gallons**	**Monthly Total POTW Effluent Flow in Gallons**	**Monthly Total Water Reuse in Gallons**
September 2018	244,200	179,400	5,381,800	554,500
October 2018	188,300	159,700	4,951,600	2,103,300
November 2018	188,100	136,000	4,079,500	2,396,400
December 2018	222,800	171,800	5,326,000	1,784,000

Table 16e – SWFWMD Effluent Flow Totals				
SWFWMD DID	**DID 97**	**DID 97**	**DID 97**	**DID 96***
Month	**Maximum Daily POTW Effluent Flow in Gallons**	**Average Daily POTW Effluent Flow in Gallons**	**Monthly Total POTW Effluent Flow in Gallons**	**Monthly Total Water Reuse in Gallons**
January 2019	220,100	167,400	5,190,300	1,518,800
February 2019	207,100	166,700	4,667,700	1,587,700
March 2019	199,600	148,100	4,591,900	1,811,500
April 2019	175,700	136,100	4,082,300	2,245,500
May 2019	219,600	140,800	4,365,400	1,773,100
June 2019	208,100	142,100	4,262,300	1,990,000
July 2019	244,000	217,800	6,750,900	493,300
August 2019	249,400	220,500	6,835,500	329,600

*Water reuse calculated using Plant influent total flow minus POTW effluent total flow
DID = District Identification
POTW = publicly owned treatment works
SWFWMD = Southwest Florida Water Management District

Table 9 provides additional information on volumes of groundwater extracted, treated and discharged via the POTW or through reuse or injection. The difference between the recorded values of the combined influent and the POTW effluent flow totals is due primarily to discharge to the three infiltration galleries, on-Facility injection wells, and on-Facility irrigation usage of treated effluent. The potable water used for general treatment plant cleaning, filter press cleaning, and carbon change-out also contributes to the difference in recorded flow totals. Potable water used for these activities flows to the plant sump, treated by the GRTS, and subsequently discharged. This additional water volume is reflected in the POTW effluent flow total, but not in the combined influent flow total, because the potable water collected in the plant sump is not routed through the combined influent flow meter (flow indicator transmitter-100).

Analytical results from samples collected from the reverse osmosis (RO) system effluent confirmed that discharge to infiltration galleries and injection wells met both the groundwater cleanup target level (GCTL) and surface water quality criteria, as specified in RAPA Table 10-3 (ARCADIS, 2009a) and shown on Table 6 of this document. Discharge of RO system effluent to infiltration gallery RC-7002 (Figure 2-1), located adjacent to target wetland TW-6 on the

agricultural area to the east-southeast of the Facility, began on July 9, 2014 and was temporarily discontinued on June 26, 2019 as discussed in Section 4. Discharge to RC-7001 and RC-7003 was initiated on July 5, 2017 and continued through this reporting period. As shown on Table 9, a total of 16,019,600 gallons of RO system effluent were discharged to the three infiltration galleries during the reporting period. Approximately 1,707,400 gallons of RO treated water was discharged to on-Facility injection wells RC-6001 through RC-6005 during the reporting period. Approximately 24% of the influent groundwater was treated and discharged to the infiltration galleries and on-Facility injection wells. In addition, approximately 860,700 gallons of RO-treated water were utilized for irrigation of on-Facility green areas during the reporting period.

5.3 GROUNDWATER LEVEL MONITORING RESULTS

The results of groundwater level monitoring are presented in Table 10. Groundwater water level elevation contour maps for the Upper Surficial Aquifer System (USAS), and potentiometric surface contour maps for the Lower Shallow Aquifer System (LSAS), Arcadia Formation (AF) Gravels, Salt & Pepper (S&P) Sands, and Lower AF Sands, based on the annual water level event, are provided as Figures 4-1 through 4-5, respectively.

Groundwater elevation data from some monitoring wells were not contoured. Typically, this is due to data from monitoring wells screened in combined hydrogeologic units not being representative of a specific unit. Data plotted on a figure, but not used in contouring, are noted on the maps by an asterisk (*). Groundwater elevations measured at extraction wells were also not used in contouring. Based on professional judgment the localized effects of extraction wells and infiltration galleries, as well as modeling information, were considered when contouring. Vertical hydraulic gradients for the August 2019 monitoring event were calculated between each water-bearing adjacent unit and were generally consistent with the August 2018 data. Gradients between vertically adjacent units were estimated by dividing the difference in the groundwater elevations between the two units by the distance between the bottoms of the screens for the wells in each of the units.

5.3.1 Semi-Annual Gauging Event

All the vertical and horizontal extraction wells, except for extraction well EW-5002, were operational during the semi-annual gauging event, as discussed in Section 4.1. The results of the semi-annual gauging event are presented in Table 10.

5.3.2 Annual Gauging Event

All the vertical and horizontal extraction wells, except for EW-5002, were operational at the Site during the annual gauging event. The results of the August 2019 gauging event are presented in Table 10 and on Figures 4-1 through 4-5. Capture zones were delineated based on the well data, interpreted potentiometric contours, and professional judgment. The August 2019 capture zones and water levels were very similar to those of prior years and illustrate the consistent containment of the COC plumes that are discussed in Section 5.4.4, except along the southeastern capture zone boundary in the USAS. Piezometer PZ-USAS-19 is currently located outside of the capture zone and has a concentration of 1,4-D that is slightly greater than the GCTL. Following discussions with the FDEP, several actions have been implemented to evaluate and extend the USAS capture zone in the southeast quadrant of the Site. Those actions began in June 2019 and included:

- the installation of nine transducers in USAS piezometers and monitoring wells located in the southeast quadrant of the Site to evaluate capture;
- an increase of the extraction flow rate in EW-2103;
- a temporary discontinuation of discharge to RC-7002; and
- an engineering evaluation for upsizing the extraction well pump in EW-2104 to maximize the groundwater extraction from this well. The evaluation criteria included: potential well yield, head loss calculations, anticipated well draw down levels, and electrical requirements. Lockheed Martin will install a Grundfos model 77S75-12 submersible pump has been selected for installation, which is a 4-inch diameter, twelve stage pump head powered by a 7.5 horse power, 230-volt, 60-hertz electrical motor. The upsizing of this pump is expected to provide an increase of approximately 59,000 gallons per day of captured groundwater assuming an expected flow rate of 75 gallons per minute is achieved.

Monitoring has consistently shown the Lower AF, below the S&P Sands, is not well-connected to the overlying units and is unaffected by GRTS operation. Vertical gradients were predominantly downward from the USAS and LSAS toward the AF Gravels and upward from the Lower AF and S&P Sands toward the AF Gravels, which is consistent with the design of the GRTS. The elevation

data from August 2018 and August 2019 and vertical gradient information are provided in Table 16f, below.

Table 16f – 2019 Average Water Elevations and Aquifer Vertical Gradients

Aquifer Zone	Average Water Elevation 2019 (ft above msl)	Average Water Elevation 2018 (ft above msl)	Change in Water Elevation from 2018	Average Vertical Gradient 2019 (ft/foot)*
USAS	22.08	21.98	0.10	-0.93
LSAS	10.90	10.94	-0.04	-0.14
AF Gravels	4.00	3.22	0.78	-
S&P Sands	7.61	7.16	0.45	+0.04
Lower AF	13.53	12.83	0.70	+0.07

ft/foot = feet per foot
msl = mean sea level
*Negative number indicates downward vertical gradient and positive number indicates upward vertical gradient

5.3.3 Long-Term Water Level Monitoring

The long-term water level monitoring program facilitates detailed tracking of the hydraulic and hydrologic relationships within and between water-bearing zones over time. The results from the annual *Long-Term Water Level Monitoring Report* (Tetra Tech, Inc., 2019a) provided in Appendix E are consistent with the horizontal and vertical gradient data presented above. In addition, the long-term water level monitoring of wells located near the edges of the Site provide information on the lateral extent of GRTS effects in each water-bearing zone. This information helps demonstrate that the Remedial Action Objectives (RAOs) are being met, or significant progress toward ultimate achievement of the RAOs is being made, by monitoring the hydraulic control, and extraction of the groundwater plume.

5.4 GROUNDWATER QUALITY MONITORING RESULTS

The applicable FDEP cleanup criteria for Site COC are listed below.

Chemical of Concern	Groundwater Cleanup Target Level (micrograms per liter) (62-777 Florida Administrative Code)
1,4-Dioxane	3.2
Trichloroethene	3
Tetrachloroethene	3
cis-1,2-Dichloroethene	70
1,1-Dichloroethene	7
1,1-Dichloroethane	70
Vinyl Chloride	1

5.4.1 Extraction Well Monitoring

Groundwater quality data for vertical and horizontal extraction wells are provided in Table 12. As further discussed in this section, the data from the August 2019 sampling event indicate that COC concentrations in the USAS and LSAS extraction wells have declined since November 2013. In the AF Gravels extraction wells, laboratory analytical data indicate stable to decreasing COC concentrations since November 2013. Two extraction wells are screened in the S&P Sands (EW-5001 and EW-5002). The data from the August 2019 sampling event indicate that COC concentrations in the S&P Sands extraction wells have been stable to decreasing since February 2016. In the Response to Comments 2016 RASR (AECOM Technical Services, Inc., 2016), Lockheed Martin decided to leave S&P Sands extraction well EW-5002 in the off position given the stable to decreasing COC trends observed at that well since the August 2016 extraction well sampling event, and the extensive capture zone present in the S&P Sands. EW-5002 is periodically operated to maintain well function, and for groundwater sampling events.

5.4.2 Semi-Annual Effectiveness Monitoring

The results from semi-annual groundwater sampling conducted in February 2019 are presented in Table 14. This table also includes historical data dating to 2009. Further discussion of COC

concentrations that includes consideration of the semi-annual groundwater sampling data is presented in Section 5.4.4.

5.4.3 Biennial Persulfate Compliance Monitoring

The results from historical persulfate sampling are presented in Table 15. There was no sampling scheduled for this reporting period and the next biennial event is scheduled for August 2020.

5.4.4 Monitoring Well and Private Well Annual Effectiveness Monitoring

Groundwater monitoring events are conducted on an annual basis to monitor current COC concentrations, the extent of the COC plumes, and provide a basis for comparison of the progress of ongoing active remediation and natural degradation occurring at the Site. The analytical results of the annual effectiveness monitoring event at Site monitoring wells and private wells are provided in Tables 14 and 16. Figures 5-1 through 5-39 present 1,4-D, TCE, PCE, cis-1,2-DCE, 1,1-DCE, 1,1-DCA, and VC groundwater concentrations, including interpreted isoconcentration lines in the USAS, LSAS, AF Gravels, and S&P Sands. Observed variations in concentration and plume morphology in these aquifers from August 2018 through August 2019 are discussed in Sections 5.4.4.1 through 5.4.4.5 below.

The following information is provided to aid the discussion of the annual sampling results:

- Analytical results indicate an overall decline of average COC concentrations for the monitoring wells in the USAS, LSAS, AF Gravels, and S&P Sands since August 2018, indicating continued reduction of in-situ COC mass. Consistent with previous sampling events, no COC were detected in the Lower AF Sands. Appendix K includes charts of COC concentration versus time for a group of selected monitoring wells and relevant COC. The distributions of COC within aquifer zones in August 2019 are generally consistent with those in August 2018.

- Average concentrations of each COC in the USAS, LSAS, AF Gravels, and S&P Sands, calculated using the laboratory analytical data from the August 2015 through August 2019 sampling events, are summarized in Tables 16g, 16h, 16i, and 16j, below. To avoid skewing results due to varying detection limits, and in order to ease calculations in the tables, non-detect concentrations were set to zero.

5.4.4.1 COC Distribution in the USAS

Concentrations of 1,4-D, TCE, PCE, cis-1,2-DCE, 1,1-DCE, 1,1-DCA, and VC in the monitoring wells and private wells within the USAS are shown on Figures 5-1 through 5-7, respectively. Average concentrations for each COC, calculated using the laboratory analytical data from the August 2015 through August 2019 annual sampling events, are summarized in Table 16g, below. Results indicate that average COC concentrations have decreased overall since the 2015 sampling event; however, the concentrations of 1,4-D and TCE have increased. The increase in average 1,4-D and TCE concentrations since 2018 is primarily attributable to an increase in the concentrations of these COC in monitoring wells MW-27 and MW-28, respectively. Historically, concentrations at these two wells have fluctuated significantly.

Table 16g - Average COC Concentrations in the Upper Surficial Aquifer System in 2015 through 2019

COC	August 2015 (µg/L)	August 2016 (µg/L)	August 2017 (µg/L)	August 2018 (µg/L)	August 2019 (µg/L)
1,4-D	10.7	5.4	5.8	4.0	5.0
TCE	4.9	3.1	2.6	2.2	2.6
PCE	19.1	11.0	4.6	1.3	0.9
cis-1,2-DCE	0.7	0.5	0.5	0.6	0.5
1,1-DCE	3.3	1.6	1.6	1.1	0.9
1,1-DCA	2.3	1.2	1.2	0.8	0.5
VC	0.0	0.0	0.0	0.0	0.0

The composite COC distribution in the USAS is presented on Figure 5-8, along with the estimated USAS capture zone. The capture zone shown on Figure 5-8 does not completely capture the depicted extent of 1,4-D in the southeast USAS, as discussed above in Section 5.3.2. The area of COC concentrations exceeding GCTLs in the USAS in August 2019 was 57 acres, compared to 44 acres in August 2018. The August 2019 area is similar to the August 2017 area of 58 acres. The increase in area of COC concentrations is primarily due to the detection of 1,4-D above the GCTL

in PZ-USAS-19, which was sampled for the first time on April 8, 2019. Appendix K includes charts of COC concentration versus time for a group of selected USAS monitoring wells (MW-27, MW-35, MW-63, MW-67, MW-114, and MW-254).

5.4.4.2 COC Distribution in the LSAS

The concentrations of 1,4-D, TCE, PCE, cis-1,2-DCE, 1,1-DCE, 1,1-DCA, and VC concentrations in the monitoring wells and private wells within the LSAS are shown on Figures 5-9 through 5-15, respectively. Average concentrations for each COC using the laboratory analytical data from the August 2015 through August 2019 annual sampling events are summarized below in Table 16h. Average COC concentrations have steadily decreased since 2015. The concentration of cis-1,2-DCE initially increased and then began decreasing as indicated on the table below, suggesting that dechlorination of TCE and PCE may be occurring to reduce mass in addition to extraction.

Table 16h - Average COC Concentrations in the Lower Shallow Aquifer System in 2015 through 2019

COC	August 2015 (µg/L)	August 2016 (µg/L)	August 2017 (µg/L)	August 2018 (µg/L)	August 2019 (µg/L)
1,4-D	32.4	29.6	19.0	12.5	10.7
TCE	161.6	95.9	86.6	50.0	23.9
PCE	7.4	5.1	3.5	3.4	2.0
cis-1,2-DCE	15.0	15.2	20.0	18.2	10.9
1,1-DCE	10.5	10.1	5.5	4.4	3.4
1,1-DCA	7.4	5.8	3.8	2.5	1.9
VC	0.0	0.1	0.0	0.1	0.0

The composite COC distribution in the LSAS is presented on Figure 5-16, along with the estimated LSAS capture zone. The area in which COC concentrations exceeded GCTLs in the LSAS in August 2019 was 80 acres in size, compared to 76 acres in August 2018. The August 2019 area is smaller than the August 2017 area of 88 acres. Application of the *Mann-Kendall* statistical method (Mann-Kendall, 2003) to the 1,4-D data at MW-101 from April 2009 to August 2019 (see Section

4.4.2) indicated an increasing trend at that well with a 95.2% confidence factor. However, analytical results since August 2016 indicate COC concentrations in MW-101 are stable and the monitoring well is within GRTS capture. Appendix K includes charts of COC concentration versus time for a group of selected LSAS monitoring wells (MW-41, MW-77, MW-81, MW-86R, MW-87, MW-98, MW-101, MW-105, and PZ-LSAS-4).

5.4.4.3 COC Distribution in the AF Gravels

The concentrations of 1,4-D, TCE, PCE, cis-1,2-DCE, 1,1-DCE, 1,1-DCA, and VC in the monitoring wells and private wells within the in the Upper AF Gravels are shown on Figures 5-17 through 5-23, respectively. Average concentrations for each COC using the laboratory analytical data from the August 2015 through August 2019 annual sampling events are summarized in Table 16i, below. These data indicate that average total COC concentrations in the AF Gravels have decreased or remained relatively stable since the 2015 sampling event. The average concentrations of 1,4-D, cis-1,2-DCE, 1,1-DCE, 1,1-DCA, and VC have increased relative to those from the 2018 sampling event. However, the concentrations are lower than those from the August 2017 sampling event. The increase in average COC concentrations since 2018 is primarily attributable to the increase in the concentrations in EW-UAFG-1. Historically, COC concentrations have fluctuated significantly at this well.

Table 16i - Average COC Concentrations in the Arcadia Formation Gravels in 2015 through 2019

COC	August 2015 (µg/L)	August 2016 (µg/L)	August 2017 (µg/L)	August 2018 (µg/L)	August 2019 (µg/L)
1,4-D	28.4	22.7	25.4	12.8	17.3
TCE	15.7	6.8	6.0	1.3	1.3
PCE	0.0	0.0	0.0	0.0	0.0
cis-1,2-DCE	146.5	88.1	70.1	40.4	47.9
1,1-DCE	14.6	12.6	10.1	5.8	8.6
1,1-DCA	3.9	3.1	3.1	1.6	2.0
VC	16.0	18.0	14.9	6.3	11.8

The composite COC distribution is presented on Figure 5-24 along with the estimated AF Gravels capture zone. The area of COC concentrations exceeding GCTLs in the AF Gravels identified in August 2019 is 59 acres in size, compared to 58 acres in August 2018. The August 2019 area is smaller than the August 2017 area of 67 acres. Appendix K includes charts of COC concentration over time for a group of selected AF Gravels monitoring wells (IWI-1, MW-127, MW-129, MW-130, MW-134, and MW-253).

5.4.4.4 COC Distribution in the S&P Sands

The concentrations of 1,4-D, TCE, PCE, cis-1,2-DCE, 1,1-DCE, 1,1-DCA, and VC in monitoring wells in the S&P Sands in August 2019 are shown on Figures 5-25 through 5-31, respectively. Average concentrations for each COC using the laboratory analytical data from the August 2015 through August 2019 annual sampling events are summarized in Table 16j, below. These results indicate average concentrations of 1,4-D, TCE, cis-1,2-DCE, 1,1-DCE, and 1,1-DCA remained relatively constant from 2015 through 2019, with minor fluctuations. The increase in average TCE and VC concentrations, both of which have been below GCTLs, since 2018 is primarily attributable to the increase in the concentrations in IWI-2. Historically, concentrations of these two compounds have fluctuated significantly at this well.

Table 16j - Average COC Concentrations in the Salt & Pepper Sands in 2015 through 2019

COC	August 2015 (µg/L)	August 2016 (µg/L)	August 2017 (µg/L)	August 2018 (µg/L)	August 2019 (µg/L)
1,4-D	3.4	5.4	3.7	4.5	3.4
TCE	1.5	2.3	1.2	1.0	1.6
PCE	0.0	0.0	0.0	0.0	0.0
cis-1,2-DCE	1.9	3.5	1.6	4.0	2.0
1,1-DCE	0.4	1.3	0.3	1.0	0.6
1,1-DCA	0.8	0.4	0.5	0.4	0.3
VC	0.1	0.1	0.1	0.2	0.6

The composite COC distribution is presented on Figure 5-32, along with the estimated S&P Sands capture zone. The area of COC concentrations exceeding GCTLs in the S&P Sands identified in August 2019 is 2 acres in size, compared to 2 acres in August 2018. Concentrations of COC in MW-21, IWI-2, and MW-128 have historically fluctuated. Appendix K includes charts of COC concentration over time for a group of selected S&P Sands monitoring wells (MW-21, IWI-2, and MW-128).

5.4.4.5 COC Distribution in the Lower AF Sands

No COC were detected at concentrations greater than their respective GCTLs in monitoring wells screened within the Lower AF Sands, as shown on Figures 5-33 through 5-39. These results are consistent with historical data.

5.4.4.6 Temporary Point of Compliance

The comprehensive August 2019 GCTL boundary is presented on Figure 5-40. This boundary was derived from integrating the composite COC concentration maps from each unit impacted by COC above GCTLs and is used to define the proposed 2019 Temporary Point of Compliance (TPOC). The changes in groundwater COC concentrations and distributions discussed in Section 5.4.4 necessitated one additional TPOC notification on July 8, 2019 for Manatee County parcel #2006500009 related to the analytical results for PZ-USAS-19. The estimated area of the August 2019 GCTL boundary was 132 acres in size, as compared to 120 acres for the August 2018 boundary. The August 2019 area is the same as the August 2017 area of 132 acres. This difference in area between August 2018 and August 2019 reflected an increase of approximately 10%. The increase in area of COC concentrations is primarily attributable to the detection of 1,4-D above the GCTL in PZ-USAS-19.

5.4.4.7 Additional Volatile Organic Compounds

Data from the United States Environmental Protection Agency (USEPA) Method 8260B laboratory analyses were reviewed to determine if concentrations of additional compounds, other than the COC discussed in the preceding sections of this report, were detected or exceeded GCTL limits in groundwater samples. Concentrations of additional volatile compounds were either not detected or detected below their respective GCTLs.

5.5 CHEMICAL OF CONCERN MASS REMOVAL

The mass of COC (PCE, TCE, cis-1,2-DCE, VC, 1,4-D, 1,1-DCA, and 1,1-DCE) removed during this 1-year reporting period is estimated to be approximately 40 pounds, based on the average combined influent COC concentrations and the volumes of extraction for each month. The mass is calculated using the average of two (if available) groundwater combined influent sample results per month, as presented in Table 8, and the monthly combined influent flow totals, which were presented in Section 5.1. The results of these calculations are shown in Table 17. Mass removal rates in 2019 averaged approximately 3.3 pounds per month compared to 4.6 pounds per month during the 2018 reporting period. The reduction in the mass removal rate is attributed to the overall decrease in COC concentrations due to contaminant removal by the GRTS and natural processes.

5.6 WETLANDS MONITORING PROGRAM

The May 2019 annual wetlands monitoring event was the fifth conducted during RAPA operations. The reference wetlands and target wetlands exhibited normal water level fluctuations in response to the seasonal rainfall distribution for the region. The Wetlands Monitoring Report was submitted to the FDEP and the Southwest Florida Water Management District on August 28, 2019. The wetland telemetry system continued to operate well, eliminating the previous need for frequent wetlands visits, and allowed quick access to water level instrumentation status to determine changes in functionality requiring attention. Data provided by the telemetry system is used for monitoring and adjusting groundwater extraction and recharge in the vicinity of TW-6. The locations of the wetlands covered in this report, can be observed on Figure 3-1 of the Wetlands Monitoring Report which is provided as Appendix F.

The results of quarterly water level monitoring and annual wetland assessments, and a comparison to the reference wetlands during this period, provide direct evidence that TW-1, TW-2, and TW-18 are not negatively affected by groundwater withdrawal from the GRTS. Groundwater elevations at target wetland TW-6 during the 2019 monitoring event were consistent with those observed during the 2018 monitoring event. In 2019, RC-7002 successfully augmented groundwater recharge and effectively buffered TW-6 from declines that might otherwise have occurred due to operation of the GRTS.

Wetland vegetation observed in the reference wetlands and target wetlands during the 2019 monitoring event remained similar to those recorded during the 2018 reporting period. As discussed in the Wetlands Monitoring Report review letter from FDEP dated September 27, 2019, a shift in plant species composition was observed in several of the wetlands. The migration of plant species commensurate with the water levels present are indicative of regional drought conditions. Total precipitation observed during the reporting period of June 2018 through May 2019 was 48.50 inches of rainfall. This is substantially lower when compared to 64.05 inches of rainfall observed during the previous reporting period (June 2017 through May 2018). Water levels observed in the 2017 through 2018 reporting period were also higher on average due to precipitation, facilitating the migration of hydrophytic vegetation across zones. Current reporting period observations indicate that the hydrophytic plant species that had migrated into upper zones during the period of higher water levels receded back into the lower zones as a result of the lack of rainfall and the overall wetland extent and acreage remains intact.

The FDEP issued an approval letter for the August 28, 2019 report on September 27, 2019. The letter included concurrence that there appeared to be no significant changes to the hydrology in the wetlands. The FDEP agreed on the reduction of the monitoring frequency for the Site wetlands, except TW-6 and reference wetland RW-3.

5.7 WASTE MANAGEMENT

Approximately 45,000 pounds of non-hazardous dewatered filter cake solids were removed and transported to the Clark Environmental disposal facility in Mulberry, Florida during the reporting period. Solids are removed through primary settling tanks, ultra-filters, and media filter backwashing, and subsequently pumped to the solids thickening tank, settled, and then dewatered through the operation of the filter press. Transportation and disposal of the dewatered solids is contracted through NRC Environmental Services, Inc. (formerly Southern Waste Services, Inc.). Appendix L includes the waste characterization laboratory analytical results of the dewatered solids and disposal facility waste acceptance letters. Appendix M includes the dewatered solids non-hazardous waste manifests.

The GAC system provides a polishing step for the removal of organics and redundancy in the event of a process upset upstream. The GAC either becomes saturated with organic compounds or the

media experiences physical breakdown requiring replacement. During each GAC replacement event, approximately 10,000 pounds of non-hazardous spent carbon is removed, stored in lined and covered dumpsters, and transported to a landfill for disposal. Carbon change-out events were conducted in October 2018, November 2018, January 2019, and June 2019. During these events, Adler Tank removed and transported approximately 50,000 pounds (dry weight) of spent carbon to the Waste Management landfill in Okeechobee, Florida for disposal. Appendix L includes the spent carbon waste characterization laboratory analytical results and landfill waste acceptance letters. Appendix M includes the spent carbon non-hazardous waste manifests.

The filter cake material and GAC are disposed at Lockheed Martin-approved, permitted and licensed facilities in accordance with applicable environmental laws and regulations.

5.8 EXTRACTION WELL SHUTDOWN

Section 13.5.1 of the approved 2009 RAPA allows for the shutdown of extraction wells and implementation of a post-active remedial monitoring process at areas of the site where COC concentrations no longer exceed GCTLs for at least two consecutive events. Following evaluation of the August 2019 monitoring data, eight extraction wells meet the shutdown criteria: EW-2001, EW-2002, EW-2003, EW-2004, EW-2005, EW-2007, EW-2017, and EW-2031. These extraction wells, along with the associated monitoring wells in the area of influence, have had COC concentrations below applicable GCTLs for four or more consecutive groundwater monitoring events.

Following shutdown, the wells will remain in an operational but inactive status. Monitoring wells MW-11R, MW-70, MW-73, MW-74, MW-100, MW-103, MW-118, MW-219, and MW-254 will be sampled in conjunction with the EWs and as summarized in tabular format within Section 6.4. These EWs and MWs will be sampled on a quarterly basis for a minimum of one year. TestAmerica will analyze the samples using USEPA Method 8260B for volatile organic compounds and USEPA Method 8260C selective ion monitoring/isotope dilution with heated purge for 1,4-dioxane. Results will be reported in the annual RASR or a separate report.

SECTION 6
SUMMARY AND RECOMMENDATIONS

Lockheed Martin Corporation constructed and has operated the Groundwater Recovery and Treatment System at the Site per the orders, regulations and guidance presented in this report. The reporting period for this document documents operation from September 1, 2018 through August 31, 2019. The Groundwater Recovery and Treatment System is meeting or advancing the Remedial Action Objectives described in Section 1.2, with the exception of hydraulic control along the southeastern capture zone boundary in the Upper Surficial Aquifer System.

The groundwater model has been updated and recalibrated on approximately a biannual basis, resulting in a 6-year flow model simulation of the period of October 2012 to August 2018. Statistical analysis of the simulation results indicates that the groundwater flow model is well calibrated. The model indicates that all zones with chemicals of concern concentrations in excess of their respective groundwater cleanup target level criteria will be captured through carefully planned and FDEP-approved adjustments to the Groundwater Recovery and Treatment System, as needed, as summarized below.

The following sections provide summaries of the reported data during this operational reporting period by operation, maintenance, and monitoring activity in the appropriate context for further interpretation and provide recommendations for each activity.

6.1 PROCESS PERFORMANCE AND COMPLIANCE MONITORING

Based on the data presented in this report, Lockheed Martin Corporation provides the following summary and recommendations for the Groundwater Recovery and Treatment System:

- A total of approximately 79,072,900 gallons of groundwater was successfully extracted, treated, and discharged, bringing the total cumulative volume of groundwater extracted and treated since initial startup in November 2013 to approximately 458,575,000 gallons.

- The Groundwater Recovery and Treatment System was successful in meeting the Manatee County Utility Operations Discharge Permit criteria.

- The conditions of the Southwest Florida Water Management District Water Use Permit for extraction volumes and monthly reporting were achieved.

- The reverse osmosis effluent concentrations discharged to the infiltration galleries and on-Facility injection wells met discharge criteria which is, defined as the lower of either the groundwater cleanup target level or Surface Water Quality Standards for constituents summarized in Table 6.

- The Groundwater Recovery and Treatment System run time was 96.8% and removed approximately 40 pounds of chemicals of concern mass during the current reporting period.

- Approximately 45,000 pounds of non-hazardous dewatered filter cake solids and 50,000 pounds (dry weight) of non-hazardous spent granular activated carbon were removed and transported for disposal to approved facilities.

Lockheed Martin Corporation will continue to operate the Groundwater Recovery and Treatment System through the next operational reporting period. The operation will include the following actions:

- Adherence to the established Remedial Action Objectives.

- Extract groundwater for treatment and discharge per the Consent Orders, the 2009 Remedial Action Plan Addendum, the 2012 FDEP Remedial Action Plan Addendum Approval Order, and the approved Operation, Maintenance, and Monitoring Manual.

- Continue scheduled compliance sampling.

- Discharge to infiltration galleries as needed to maintain water levels in wetland areas, and to on-Facility injection wells to perform flushing in the Upper Surficial Aquifer System.

- Use treated effluent water for on-site irrigation and other approved purposes.

- Meet Manatee County Utility Operations discharge permit and Water Use Permit requirements.

6.2 GROUNDWATER LEVEL MONITORING

Based on the data presented in this report, Lockheed Martin Corporation provides the following summary for the groundwater level monitoring program:

- Groundwater level monitoring indicated the Groundwater Recovery and Treatment System continued to maintain adequate hydraulic control of the Site chemicals of concern in the Upper Surficial Aquifer System, Lower Shallow Aquifer System, Arcadia Formation Gravels, and Salt & Pepper Sands as discussed in Section 5.3, except along the southeastern capture zone boundary in the vicinity of Upper Surficial Aquifer System piezometer PZ-USAS-19.

Based on the data presented above, Lockheed Martin Corporation recommends the following for maintaining and improving hydraulic capture:

- Continue the current water level monitoring program, as described in Table 18, and the long-term water level monitoring program

- Install a larger pump in EW-2104, as detailed in Section 5.3.2, to improve the southeastern capture zone boundary in Upper Surficial Aquifer System

6.3 EXTRACTION WELL SAMPLING

Based on the data presented in this report, Lockheed Martin Corporation provides the following summary of the extraction well sampling program:

- The Groundwater Recovery and Treatment System continued to extract and treat the groundwater chemicals of concern plume. In general, the chemicals of concern concentrations in the groundwater extracted from the Upper Surficial Aquifer System, Lower Shallow Aquifer System and Arcadia Formation Gravels have been stable or decreasing, as indicated by the results presented in Section 5.4.1. The chemicals of concern

concentrations in Salt & Pepper Sands extraction wells have been generally stable or decreasing since February 2016.

- Groundwater in the Salt & Pepper Sands with chemicals of concern concentrations in excess of groundwater cleanup target levels was well within the Salt & Pepper Sands capture zone.

- Eight extraction wells, EW-2001, EW-2002, EW-2003, EW-2004, EW-2005, EW-2007, EW-2017, and EW-2031, along with the associated monitoring wells in the area of influence, meet the post-active remediation monitoring criteria for shutdown of extraction wells as described in Section 5.8.

Lockheed Martin Corporation recommends the following for the extraction well sampling program:

- Continue semi-annual extraction well sampling aligned with the effectiveness monitoring to occur in February and August 2020

- Continue to evaluate the future operation of EW-5002

- Turn off EW-2001, EW-2002, EW-2003, EW-2004, EW-2005, EW-2007, EW-2017, and EW-2031, and enter post-active remediation monitoring for those areas of the Site, as described in Section 13.5.1 of the approved 2009 Remedial Action Plan Addendum and Section 5.8 of this report. Refer to the following section for the proposed sampling schedule.

6.4 EFFECTIVENESS MONITORING

Based on the data presented in Section 5.4.4, Lockheed Martin Corporation provides the following summary for the effectiveness monitoring program:

- Analytical results indicated average chemicals of concern concentrations have been decreasing in the Upper Surficial Aquifer System and Lower Shallow Aquifer System groundwater since August 2015 and these concentrations indicate a reduction of in-situ chemicals of concern mass.

- The 2019 data indicated an overall Temporary Point of Compliance groundwater cleanup target level boundary increase. Details are discussed in Section 5.4.4.1 and 5.4.4.6.

Lockheed Martin Corporation recommends the following for the effectiveness monitoring program:

- Continue with semi-annual and annual sampling scheduled to occur in February 2020 and August 2020, respectively, as shown on Figure 6-1 and Table 19
- Add PZ-USAS-19 to the semi-annual effectiveness monitoring program
- Following shutdown of the extraction wells listed in Sections 5.8 and 6.3, sample the associated monitoring wells in Table 19 and Table 19a, below. These monitoring wells will be sampled on a quarterly basis for a minimum of 1 year. Results will be reported in the annual Remedial Action Status Report or a separate report.

Table 19a – Monitoring Wells Recommended for Post-Active Remediation Monitoring due to Extraction Well Shut Down

Extraction Wells	Aquifer Zone	Associated Monitoring Wells
EW-2001	Upper Surficial Aquifer System	MW-74, MW-100, and MW-219
EW-2002	Upper Surficial Aquifer System	MW-74, MW-100, and MW-219
EW-2003	Upper Surficial Aquifer System	MW-73, MW-100, and MW-219
EW-2004	Upper Surficial Aquifer System	MW-73 and MW-118
EW-2005	Upper Surficial Aquifer System	MW-73, MW-103, and MW-118
EW-2007	Upper Surficial Aquifer System	MW-73, MW-103, and MW-118
EW-2017	Upper Surficial Aquifer System	MW-11R and MW-70
EW-2031	Upper Surficial Aquifer System	MW-11R and MW-254

6.5 BIENNIAL PERSULFATE MONITORING

No persulfate monitoring was performed in 2019. The next biennial persulfate monitoring event will occur in August 2020.

6.6 WETLANDS MONITORING

The following conclusions are from the 2019 Wetlands Monitoring Report, which were approved by the FDEP in a deliverable review letter dated September 27, 2019:

- Groundwater elevations at target wetland TW-6 during the 2019 monitoring event were consistent with those observed during the 2018 monitoring event.

- Wetland vegetation observed in the reference wetlands and target wetlands during the 2019 monitoring event remained similar to those recorded during the 2018 reporting period.

- November 2019 will mark completion of six years of active Groundwater Recovery and Treatment System operation and the June 2019 wetland assessment concluded the five-year monitoring period described in Section 13.6.3 of the Remedial Action Plan Addendum.

- TW-1, TW-2, and TW-18 are not negatively affected by groundwater withdrawal from the Groundwater Recovery and Treatment System.

Lockheed Martin Corporation recommended the following changes to the wetlands monitoring plan in the 2019 Wetlands Monitoring Report:

- Removal of TW-1, TW-2, TW-18, RW-1, and RW-2 from the Wetlands Monitoring Plan. The modified Wetlands Monitoring Plan is provided in Table 20. The solar powered telemetric groundwater level monitoring systems currently installed at these locations will be shut down and removed from the field. Water level gauging will be discontinued at these locations.

- Continue to address potential Groundwater Recovery and Treatment System impacts to TW-6 and RW-3 by appropriately adjusting flow rates at extraction wells and through the operation of RC-7002. The telemetry systems at these locations will maintain current operations.

- Continue Wetlands Monitoring Plan annual assessment, and quarterly water level collection and reporting for TW-6 and RW-3 during Groundwater Recovery and Treatment System operation.

- Submit a Wetlands Monitoring Report and comparative analysis with local climate and previously collected data to the Southwest Florida Water Management District by September 1, annually.

SECTION 7
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APPENDICES

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