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Lockheed Martin Corporation

Operations, Maintenance, and Monitoring Manual

Interim Remedial Action
Lockheed Martin Tallevast Site
Tallevast, Florida

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Engineers Certification

This Operations, Maintenance, and Monitoring Manual for the groundwater extraction and treatment system at the Lockheed Martin Tallevast Site (also known as the Former American Beryllium Company Site) located at 1600 Tallevast Road in Manatee County, Florida has been prepared in accordance with the Florida State Department of Environmental Protection Consent Order 04-1328 with an effective date of July 28, 2004 and, as amended, 08-2254 with an effective date of October 13, 2008.

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Tables

Figures

Appendices

Acronyms and Abbreviations

ABC	American Beryllium Company
AF	Arcadia Formation
AOP	Advanced Oxidation Process
AST	Aboveground Storage Tank
BECSD	BECSD, LLC
BBL	Blasland, Bouck & Lee, Inc., an ARCADIS company
bgs	below ground surface
CAP	Corrective Action Plan
COCs	Constituents of Concern
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
cis-1,2-DCE	cis-1,2-Dichloroethene
DOPs	Detailed Operating Procedures
EW	Extraction Well
F.A.C	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
GAC	Granular Activated Carbon
GCTLs	Groundwater Cleanup Target Levels
gpm	gallons per minute
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HMI	Human-Machine Interface

HP	Horsepower
IAS	Intermediate Aquifer System
IRAP	Interim Remedial Action Plan
Lockheed Martin	Lockheed Martin Corporation
LSAS	Lower Shallow Aquifer System
MCC	Motor Control Center
MCP	Main Control Panel
MOC	Management of Change
MCUO	Manatee County Utility Operations
mg/L	Milligrams per Liter
msl	mean sea level
O&M	Operation & Maintenance
OMM	Operation, Maintenance, and Monitoring
PCE	Tetrachloroethene
PLC	Programmable Logic Controller
PRF	Peace River Formation
Purifics	Purifics ES, Inc.
PVC	Polyvinyl chloride
RAP	Remedial Action Plan
S&P	Salt and Pepper
SAS	Surficial Aquifer System

SIM	Selective Ion Monitoring
SOPs	Standard Operating Procedures
SWFWMD	Southwest Florida Water Management District
TCE	Trichloroethene
TiO_2	Titanium Dioxide
USAS	Upper Surficial Aquifer System
USD	Undifferentiated Surficial Deposits
UST	Underground Storage Tank
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet
VFD	Variable Frequency Drive
VOCs	Volatile Organic Compounds
WPI	WPI Sarasota Division, Inc.

1. Introduction

1.1 General

ARCADIS prepared this Operation, Maintenance and Monitoring (OMM) Manual for the groundwater extraction and treatment system at the Lockheed Martin Corporation (Lockheed Martin) Tallevast Site (also known as the Former American Beryllium Company [ABC] Site) located in Tallevast, Manatee County, Florida (see Figure 1). The groundwater extraction and treatment system was described in the Interim Remedial Action Plan (IRAP, Blasland, Bouck & Lee, Inc., an ARCADIS company [BBL], February 2006) that was approved by the Florida Department of Environmental Protection (FDEP) on April 25, 2006. Start-up of the groundwater extraction and treatment system described in the IRAP commenced on August 23, 2006.

The IRAP was developed in accordance with the Consent Order for the Site entered into by Lockheed Martin and FDEP. The File Number for the Consent Order is 04-1328 with an effective date of July 28, 2004 and, as amended, Consent Order No. 08-2254 with an effective date of October 13, 2008. The Consent Order requires the performance of site assessment and remediation activities by Lockheed Martin at the Site.

This OMM Manual is intended to be the primary reference for the operation, maintenance, and associated monitoring of the IRAP groundwater treatment system. The OMM specifications for the key components of the IRAP groundwater treatment system are described in this manual.

The objectives of the groundwater extraction and treatment system described in the IRAP are as follows:

- Provide on-Facility hydraulic containment of groundwater containing the highest concentrations of constituents of concern (COCs) in the upper surficial aquifer system (USAS) and lower shallow aquifer system (LSAS) at the Site.

- Remove a significant amount of COC mass from the groundwater plume.

- Provide additional hydrogeologic information near the Site that will assist in the design of the full-scale groundwater remedy provided in the Remedial Action Plan (RAP) Addendum (ARCADIS, 2009).

- Destroy COCs in extracted groundwater prior to discharge to the sanitary sewer system using technologies that will neither result in air emissions nor disrupt the aesthetic qualities of the neighborhood.

The IRAP groundwater treatment system was shut down on August 3, 2008 due to an accidental discharge that occurred as a result of an overflow of the influent storage tank containment area. An FDEP-approved Corrective Action Plan (CAP) has been implemented at the Facility. On January 29, 2009, a revised OMM Manual was submitted to the FDEP. FDEP approved the CAP and OMM Manual on March 27, 2009, and the IRAP groundwater treatment system was restarted on May 4, 2009. The OMM Manual was updated and resubmitted to FDEP on August 26, 2010.

1.2 Operation, Maintenance, and Monitoring Manual Organization

Following this Introduction (Section 1), this OMM Manual is organized as outlined below.

- Section 2 (Background) provides a description of the Site, including physical setting, hydrology, hydrogeology, and historical operations.
- Section 3 (Environmental Monitoring) describes the environmental component of the OMM Manual, including operational hydraulic measurements, groundwater quality monitoring and analytical program.
- Section 4 (Description of IRAP Groundwater Treatment System Components and Operation) describes each remedial system component.
- Section 5 (System Start-Up) describes the procedures for system start-up including standard operating procedures (SOPs) and detailed operating procedures (DOPs).
- Section 6 (Monitoring and Testing) describes the procedures for short-term and long-term system performance monitoring and testing.
- Section 7 (IRAP Groundwater Treatment System Maintenance and Monitoring) describes the routine maintenance activities and preventive maintenance schedule.
- Section 8 (Record Keeping and Reporting) describes remedial system record keeping and reporting requirements.
- Section 9 (Health and Safety Plan) introduces the site-specific project Health and Safety Plan (HASP).
- Section 10 (Contingency Plan) introduces the emergency contingency plan.

- Section 11 (Record Drawings and Manufacturer Supplied Equipment Information) provides a list of record drawings and pertinent equipment operation and maintenance (O&M) manuals.
- Section 12 (Clean-Up Target Levels) describes the clean-up target levels specified in Chapter 62-780.700 (Florida Administrative Code (F.A.C.) and the cessation criteria.
- Section 13 (Security) outlines Facility security measures in place.
- Section 14 (Management of Change) describes how changes to the IRAP groundwater treatment system will be managed.
- In addition, the following information is provided as Appendices to this OMM Manual.
  - Appendix A (Record Drawings)
  - Appendix B (Extraction Well Construction Details)
  - Appendix C (Manufacturer-Supplied Equipment Information)
  - Appendix D (OMM Log Sheet)
  - Appendix E (Health and Safety Plan)
  - Appendix F (Contingency Plan)
  - Appendix G (Purifics O&M Manual)
  - Appendix H (SOPs)

2. Background

2.1 Facility Location

The Facility is located at 1600 Tallevast Road, between the cities of Sarasota and Bradenton, in southwestern Manatee County, Florida. Land use in the area is predominantly single-family residential homes, churches, light commercial and industrial development, and heavy manufacturing. A large percentage of the ground cover in the area includes grass fields, a golf course, and residential landscaping. The Facility is located in the northwest quarter of Section 31, Township 35 South, Range 18

East, as shown on the Bradenton, Florida United States Geological Survey (USGS) 7½-minute quadrangle, as shown on Figure 1.

2.2 Facility Description

2.2.1 Physical Setting

The Facility encompasses an area slightly larger than 5 acres and is zoned for heavy manufacturing by Manatee County. It is bounded by Tallevast Road to the north; 17th Street Court East to the east; a golf course, undeveloped land, and residential areas to the south; and an abandoned industrial facility to the west (Figure 2).

Five primary buildings (Buildings 1 through 5), covering a surface area of approximately 66,000 square feet , were once located in the central portion of the Facility. Buildings 4 and 5 were removed in December 2008. Buildings 1 through 3 were removed in February 2011. The areas now occupied by the former buildings are paved with asphalt. Surface cover consists of a landscaped stormwater retention pond surrounded by grass on the west portion of the property, asphalt paved parking areas south of the retention pond and south and east of the former buildings, and grass in the southwestern and southern portions of the property adjoining the asphalt surface. The stormwater retention pond was reportedly constructed in approximately 1960.

Properties adjoining and near the Facility include the Sarasota-Bradenton Airport to the southwest, a golf course/driving range adjoining the Facility to the south, an abandoned industrial facility (formerly operated at various times by ABC, Spindrift, and Wellcraft) adjoining the Facility to the west, a CITGO gas station approximately 500 feet northwest of the Facility, and a north-south trending spur of the Seminole Gulf Railroad that intersects Tallevast Road approximately 200 feet east of the Facility. Aside from these features, surrounding properties are primarily single-family residences. Two churches and the Tallevast Community Center are also nearby.

2.2.2 Topographic Setting

The Facility sits on a gently sloping plain known as the Gulf Coastal Lowlands at an elevation of approximately 30 feet above mean sea level (msl). The Facility is approximately 1.5 miles east (inland) of Sarasota Bay and approximately 6 miles from the Gulf of Mexico. The land surface close to the Facility has very little relief and slopes gently in a radial pattern away from the Facility. The land surface declines from approximately 30 feet above msl at the Facility to 25 feet above msl to the west near the intersection of Tallevast Road and 15th Street East. Farther west, land surface elevations decrease to approximately 15 feet above msl just north of the Sarasota-Bradenton Airport. Elevation contours show a very gentle slope from approximately 30 feet above msl at the Facility to 25 feet above msl approximately 2,000 feet north, northeast, southeast, and southwest of the Facility.

2.2.3 Regional and Site Hydrology

The Site is located in the Sarasota Bay watershed within Florida's Southern Coastal Watershed. The Southern Coastal Watershed includes numerous estuaries, wetlands, and small coastal streams that are tidally influenced over much of their length, and a few longer stream/canal systems with predominantly freshwater habitats. The Sarasota Bay watershed drains more than 200 square miles within Manatee, Sarasota, and Charlotte Counties. In the area of the Site, the Braden River watershed, a sub-basin of the Manatee River watershed, borders the Sarasota Bay watershed to the east.

The Site is located along the drainage divide between two stream/canal systems, Bowlees Creek and Pearce Canal, within the Sarasota Bay and Braden River watersheds. Bowlees Creek, a major tributary of Sarasota Bay, extends from east to west and is located approximately 1.25 miles northwest of the Facility at its closest point to Tallevast. The Pearce Canal extends generally from northeast to southwest and is located approximately 0.75 mile southeast of the Facility at its closest point to Tallevast. A topographical high runs north-south through the Facility, between the Pearce Canal to the east and Sarasota Bay to the west. Surface water on the western portion of the Facility flows west toward the improved drainage features around the Sarasota-Bradenton Airport, which drain into Sarasota Bay. Surface water on the easternmost portion of the Facility flows toward the Pearce Canal. The Pearce Canal drains both south into the Sarasota Bay watershed and north into the Braden River watershed. The drainage divide along the Pearce Canal is located about 1 mile north of the Manatee/Sarasota County line, which is approximately where the canal crosses US 301, approximately 1 mile southeast of the Facility; therefore, surface water from the easternmost portion of the facility drains into the Braden River watershed.

A number of small surface water bodies lie within a 0.5-mile radius of the Facility. Several shallow swales also convey surface runoff to the street and stormwater channels. In addition, a number of wetlands have been identified near the Site by the Florida Department of Transportation's Florida Land Use, Cover, and Forms Classification System.

2.2.4 Regional 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*, which describes the drilling and testing of a well completed to a reported depth of 1,715 feet below ground surface (bgs) at a location approximately 2.5 miles north of the Facility in southwestern Manatee County. The nomenclature used in the 1995 SWFWMD report to describe subsurface sediments is typically used to describe consolidated carbonate formations in the Site area and is, therefore, used for this Site.

The regional geology consists of three main lithostratigraphic units, which are further subdivided into hydrogeologic units and water-bearing zones for monitoring purposes. From the surface downward, the geologic units underlying southern Manatee County consist of the following:

- Undifferentiated Surficial Deposits (USD) (Pleistocene to Recent)

- The Hawthorn Group, consisting of the Peace River Formation (PRF) and the Arcadia Formation (AF) (Miocene to Oligocene) — the AF consists of an upper undifferentiated section and the lower Tampa Member.

- A thick sequence of marine carbonates (limestone and dolomite) exists below the Tampa Member of the AF and includes the Suwannee Limestone (Oligocene), Ocala Limestone (Eocene), and the Avon Park Formation (Eocene).

The main geologic units listed above are further subdivided into the local hydrogeologic units and water-bearing zones listed below.

- Surficial Aquifer System (SAS) — the unconfined surficial aquifer overlying the Hawthorn Group.

- USAS — the unconfined surficial aquifer, consisting of unconsolidated Pleistocene to recent siliciclastic sand units with up to 20 percent fines.

- Intermediate Aquifer System (IAS) and Confining Units — the confined aquifers and confining units overlying the Upper Floridan Aquifer (Floridan). This aquifer system is made up of strata from the Hawthorn Group, which comprise the PRF and the AF.

- LSAS — the uppermost portion of the PRF, the top of which is indurated limestone/calcareous rock, known locally as the Hard Streak. The LSAS consists of a series of interbedded limestone, clay, and carbonate mudstone units. The LSAS is generally encountered at around 30 feet bgs. Previously, the LSAS was defined as the Lower Surficial Aquifer System, and was considered part of the SAS. However, recent carbonate content and rock coring data indicate characteristics more consistent with the IAS. The unit itself has not changed since previous reports; rather, additional data support an updated understanding of its relationship to overlying and underlying aquifer systems.

- Venice Clay — the lower portion of the PRF, consisting of siliciclastic to calcareous clays with a distinctive greenish-grey to olive color.

- Clay/Sand Zone 1 — the uppermost sub-unit of the AF, consisting of a series of low permeability carbonate mudstones.

- Upper AF Gravels (AF Gravels) — a fractured to vuggy carbonate unit approximately 100 feet bgs in the AF. This unit is significantly more permeable than the overlying and underlying AF units, and is usually identified in drilling logs as “wet.” Hereafter, the term AF Gravels is only used to refer to the Upper AF Gravels.

- Clay/Sand Zone 2 — a subunit of the AF, consisting primarily of low permeability carbonate mudstones.

- Salt & Pepper (S&P) Sands — a subunit of the AF characterized by increased sand content and dark phosphatic sand grains, which give it a black and white speckled (salt and pepper) appearance. The S&P Sands are more permeable than the overlying and underlying units but less permeable than the AF Gravels.

- Clay/Sand Zone 3 & 4 and Lower AF Gravel — a subunit of the AF consisting of a series of low permeability calcareous mudstones and underlying a somewhat higher permeability carbonate (Lower AF Gravel).

- Lower AF Sands — a sub-unit of the AF containing an increased percentage of sand sized particles and located approximately 280 feet bgs.

- Clay/Sand Zone 5 — a subunit of the AF consisting of a series of calcareous mudstones.

Beneath the SAS and IAS is the underlying Floridan (Oligocene). The Floridan consists of the Tampa Member of the AF, the Suwannee and Ocala Limestones, and the upper part of the Avon Park Formation. The Floridan is comprised of a series of limestone to dolomite units that are used for local water supply and irrigation.

2.3 Facility Operations

Lockheed Martin acquired ownership of the former ABC Facility through its 1996 acquisition of Loral Corporation, the parent company of ABC. Plant operations were discontinued in late 1996. Between 1997 and 2000, Lockheed Martin prepared the property for sale and initiated Site investigations. In early 2000, Lockheed Martin sold the property and its improvements to BECSD, LLC (BECSD), who in turn leased the Facility to WPI Sarasota Division, Inc. (WPI), a privately owned manufacturing company. In March 2007, WPI was subsequently sold to Cooper Industries, Inc., which assumed the lease of the Facility and continued the same manufacturing processes until operations ceased in June 2007. Lockheed Martin leased the Facility from BECSD in July 2007 and in June 2009, purchased it from BECSD.

From 1962 until 1996, the Facility was owned by Loral Corporation and operated by ABC as an ultra-precision machine parts manufacturing plant where metals were milled, lathed, and drilled into various components. Some of the components were finished by electroplating, anodizing, and ultrasonic cleaning. Chemicals used and wastes generated at the Facility included oils, fuels, solvents, acids, and metals.

Areas of potential environmental concern at the Facility included an underground storage tank/aboveground storage tank (UST/AST) area near the southeast corner of former Building 1; an area on the east and northeast side of former Building 5 where five sumps were located; a hazardous materials storage area in the southeast corner of former Building 5; and the wastewater treatment pond located to the south of the former buildings. In the UST/AST area, two 1,500-gallon ASTs historically were used to store fuel oil, a 1,000-gallon AST was used to store solvents, and a 550-gallon UST was used to store gasoline.

Anecdotal information purported that a production well was once present in an area formerly occupied by former Building 5, which is also near the former sump area. Construction and operational details for this purported well (e.g., exact location, depth, open or screened intervals, diameter, pumping rate) cannot be located, nor can any records of how this purported well may have been decommissioned, although verbal reports indicate that the well casing was cut off below the surface and buried beneath the floor slab of an addition to former Building 5. All information regarding this purported well is based on conversations with former ABC employees. In 2011, Lockheed Martin located and abandoned a production well that was located in this general area.

3. Environmental Monitoring

This section of the OMM Manual describes the environmental monitoring program that has been developed to monitor the effectiveness of the IRAP groundwater treatment system.

3.1 Monitoring Program

The environmental monitoring component of the OMM Manual includes two elements as follows: 1) operational hydraulic monitoring (also referred to as water-level measurements), and 2) operational groundwater quality monitoring. In summary, a total of 105 wells are included in the hydraulic monitoring network (51 USAS, 25 LSAS, and 29 IAS [13 AF Gravel, 11 S&P Sand, 4 Lower AF Sand and 1 Clay/Sand Zone 3 &4] monitoring wells.) A total of 35 wells are included in the groundwater quality monitoring network (13 USAS, 10 LSAS, and 12 IAS monitoring wells). Section 6 summarizes the wells included in the monitoring plan for hydraulic monitoring and groundwater quality. The wells included in the monitoring network may be modified based on a review of the monitoring reports and with prior approval from FDEP.

3.2 Sampling and Analysis

Sampling and analysis of treated groundwater discharged to the Manatee County Utility Operations (MCUO) is conducted in accordance with the requirements established in the MCUO Industrial User Permit. Sewer discharge monitoring samples are collected from the sampling port on the discharge side of the secondary liquid-phase granular activated carbon (GAC) unit and submitted for laboratory analysis for parameters specified by MCUO. Influent, mid-process and primary carbon discharge monitoring is also conducted. Influent samples are collected from the combined extraction wells discharge, mid-process samples are collected between the Photo-Cat and the primary liquid-phase GAC unit, and primary carbon discharge samples are collected from between the primary and secondary GAC units. Influent samples are collected and submitted for laboratory analysis for the same parameters at the same frequency as the effluent samples. In addition, VOC and 1,4-dioxane samples are also periodically collected (currently weekly) at the mid-process and primary carbon discharge points to better anticipate carbon breakthrough.

3.3 Schedule

Monitoring of the treatment system components will be conducted as summarized below. Effluent, influent, mid-process and primary carbon discharge sampling will be conducted, at a minimum, three times per week for the first week of operation, weekly for the next three weeks, monthly for the next two months, and quarterly thereafter. The treatment system sampling schedule is outlined in Table 2. However, sampling frequency may be adjusted based on requirements established by the MCUO and system performance. A request to alter the frequency or parameters will be made to FDEP and MCUO prior to modifying the sampling and analysis program.

4. Description of IRAP Groundwater Treatment System Components and Operation

The location of the groundwater extraction and treatment system is shown on the Facility Plan in Figure 2. With the exception of the influent tank, treatment equipment is housed inside the treatment system building located along the southern portion of the Facility. Piping and Instrumentation Diagrams, including Interlocks, Legend, and Abbreviations, are provided on Figures 3A through 3D. Record Drawings are included in Appendix A. The Record Drawings and Figures 3A through 3D have been revised to reflect changes to the treatment system since August 2008. Additionally, ARCADIS has verified them to accurately reflect the current configuration as of August 26, 2011.

Groundwater is extracted using 0.5-horsepower (HP) submersible stacked impeller centrifugal pumps in each of the ten on-Facility extraction wells (EWs). Five of these wells are screened in the USAS (EW-101, EW-103, EW-105, EW-107, and EW-109) and five are screened in the LSAS (EW-102, EW-104, EW-106, EW-108, and EW-110). In 2008, USAS extraction well EW-109 was shut down due to low concentrations of volatile organic compounds (VOCs) and 1,4-dioxane. However, extraction well EW-109 was restarted along with the other extraction wells on May 4, 2009.

Each pump operates automatically at a constant speed; however, flow from each well is manually adjusted to maintain a relatively constant groundwater level in the well and limit pump cycling. Well pumps are designed for an instantaneous flow rate of up to 10 gallons per minute (gpm); however, each extraction well generally averages less than 5 gpm daily due to limited aquifer yields. Together, the extraction wells typically produce instantaneous flows of approximately 20 to 25 gpm. The discharge from each extraction well pump is individually piped from the well to the treatment system building with dual-containment high-density polyethylene (HDPE) pipe. Within the treatment system building, piping from each extraction well is equipped with a totalizing flow meter along with associated ball valves and manual flow control diaphragm valves to individually monitor and adjust flow rates as well as individual sample taps.

The water from the extraction wells is then combined in a manifold which includes a separate totalizing flow meter. The discharge from the manifold exits the treatment system building through dual-containment stainless steel inside polyvinyl chloride (PVC) piping into a 17,640-gallon double-walled influent tank. Water is pumped from the influent tank through an aeration system to oxidize iron and back to the tank in a closed circulation loop. The influent tank discharge feeds the treatment system by a 7.5 HP centrifugal pump controlled by a Variable Frequency Drive (VFD). A pressure transducer located in the influent tank provides input to the VFD. Programming through the treatment system programmable logic controller (PLC) allows the operator to set high and low water levels within the influent tank which correspond to output from the pressure transducer. A high water level within the influent tank will automatically shut down the extraction well pumps to avoid overfilling the tank. A low water level within the influent tank will restart the extraction well pumps if they have been shut down by a high water level reading. A low/low water level within the influent tank will automatically shut down the entire treatment system to avoid running the feed pump dry. The influent tank is also equipped with a water level sensor and two backup sensors utilized as a high/high level alarm which will automatically shut down the entire treatment system including the groundwater extraction wells if any one of the three sensors is activated. The interstitial space for the influent tank is also equipped with a water level sensor and two backup sensors, which will also automatically shut down the entire treatment system if activated. The influent tank operates at atmospheric conditions, and vapors vented from the tank are piped to a vapor-phase activated carbon adsorption filter to passively treat tank emissions as the water level rises in the tank.

Water discharged from the feed pump flows through primary filtration units to remove iron and particulates. The first set of four filters operates in parallel and contains 8-micron (absolute) bag filters. The second set of filters includes two parallel bag filter canisters containing 1-micron (90 percent nominal) bag filters followed in series by two parallel filter cartridge canisters containing 10-micron (absolute) cartridge filters. The filters are equipped with pressure gauges located at the influent and effluent of each series of filters to measure filter fouling.

After filtration, the COCs in the groundwater are treated via an advanced oxidation process (AOP). The AOP in use is a Photo-Cat water treatment system manufactured by Purifics ES, Inc. (Purifics). The COCs in the groundwater are destroyed when the groundwater is mixed with a catalyst, titanium dioxide (TiO_2), to create a slurry which is then exposed to ultraviolet (UV) light in the reactor. This photocatalytic process purifies and detoxifies the groundwater, resulting in benign end-products of carbon dioxide, water, and salts. No daughter products (e.g., vinyl chloride) are generated during this process. The catalyst utilized by this AOP is not soluble and is completely removed from the treated groundwater prior to discharge. The catalyst is recovered for reuse with proprietary ceramic filters located within the Photo-Cat system.

Following the Photo-Cat, the treated groundwater flows through two liquid-phase GAC units installed in series. Each of the two vessels contain 1,500 pounds of GAC and are plumbed as lead and lag vessels for final treatment or polishing of any remaining VOCs in the water. A third 1,500-pound GAC unit is present in standby mode. When VOC breakthrough in the lead carbon vessel occurs, the lag vessel becomes the lead vessel and the standby vessel becomes the lag vessel. In addition, carbon media is replaced in the former lead vessel that demonstrated VOC breakthrough and it becomes the new standby vessel. Using this method, the freshest activated carbon medium is in the lag position as a precautionary measure. The treated groundwater is then discharged through an on-Facility connection to the Manatee County sanitary sewer as authorized under MCUO Office of Industrial Compliance Permit IW0025S.

Because iron is not completely removed by the aeration and filtration processes, part of the overall treatment process includes pH adjustment. The two pH adjustment systems (acidification and neutralization) are essentially identical. Sulfuric acid (93 percent concentration) is utilized for acidification and is added via a metering pump to the process upstream of the Photo-Cat units between the first and second sets of filtration units. The purpose of acidification is to maintain iron in a reduced form through the Photo-Cat. Oxidized iron will attach to the catalyst and reduce the ability of the Photo-Cat to remove COCs from the water. Sodium hydroxide (50 percent concentration) is utilized for neutralization and is added via a metering pump downstream of the GAC units and prior to discharge. The purpose of neutralization is to maintain the treatment system effluent within the MCUO Discharge Permit pH requirements. For each pH adjustment system, a sensor located downstream of a static mixer is used to measure the resulting pH and automatically control the chemical addition. Sulfuric acid and sodium hydroxide are delivered in 55-gallon HDPE drums to the Facility and transferred to polyethylene storage tanks in accordance with established procedures. Dedicated portable drum pumps and flexible reinforced transfer hoses are used to transfer the sulfuric acid and sodium hydroxide from 55-gallon drums to the chemical storage tanks that are located inside secondary containment structures inside the treatment building. During chemical transfer the chemical drums are located within a secondary containment tray. During chemical delivery, the sulfuric acid and sodium hydroxide transfer hoses are within these secondary containment areas.

The groundwater extraction and treatment system is designed to run continuously. The PLC-based control system monitors and tracks key treatment system parameters. These parameters include influent tank level, process flow rate, pH, differential pressure across the bag and cartridge filters just upstream of the Photo-Cat unit, Photo-Cat system alarms, and pump operation. An operator is also on duty at the Facility 24 hours per day, 7 days per week to monitor critical operating parameters and perform routine maintenance.

When critical operating parameters are out of the operating range, the treatment system automatically shuts down. These critical parameters include, but are not limited to, high/high water level in the influent tank, water detection in the influent tank interstitial space, Photo-Cat influent pH out of range, and treatment system effluent pH out of range.

5. System Start Up

This section discusses system pre-start-up and start-up activities to be followed during start-up of the IRAP groundwater treatment system. More detailed protocols are presented in the SOPs and DOPs in Appendix H.

5.1 Pre-Start-Up Activities

The following activities will be conducted prior to system start-up following a shutdown period of one month or longer. System start-up activities will not commence until malfunctions that could affect system start-up and operation are corrected.

1. Check utilities – electrical, potable water and telephone.

2. Check/test electrical equipment – transformers, switch gear, control panels, electrical panels, motors, and motor control center (MCC).

3. Test building controls – Ventilation and lighting.

4. Check/test piping.

5. Test mechanical equipment (i.e., operate each piece of mechanical equipment briefly to ensure proper operation prior to start-up activities).

6. Test instrumentation, alarms, and interlocks.

5.2 System Start-Up Control Sequence

The system requires a manual start-up. This manual start-up triggers a series of steps that the PLC will sequence. The steps required to start the system are outlined below.

1. Engage Extraction Well Pumps (MH-101, MH-102, MH-103, MH-104, MH-105, MH-106, MH-107, MH-108, MH-109, and MH-110); by switching HS-101, HS-102, HS-103, HS-104, HS-105, HS-106, HS-107, HS-108, HS-109, and HS-110 to auto position with pre-set design flow rates and with 1 minute between engagement of each extraction well pump. Allow 2 minutes to elapse before Step 2.

2. Engage Photo-Cat system by switching to auto position.

3. Engage Caustic Feed Pump P-301 by switching to the auto position.

4. Engage Acid Feed Pump P-202 by switching to auto position.

5. Engage System Pump P-201 by switching to auto position with pre-set design flow rate.

6. Engage Aerator Pump P-400 by switching to auto position.

6. Monitoring and Testing

Monitoring and testing includes activities that will be performed to evaluate the operation of the IRAP groundwater treatment system. The monitoring and testing activities to be conducted after system start-up are described in this section.

6.1 Overview

In accordance with Chapter 62-780.700(3)(g)2, 3 and 4, F.A.C., effectiveness monitoring of the IRAP groundwater treatment system will consist of collecting monthly water levels for the first six months, quarterly groundwater samples and water levels for the first two years following start-up of the IRAP groundwater treatment system, and semi-annual groundwater samples and water levels beginning in year 3 until cessation of pumping. Groundwater samples will be collected using previously approved sampling methods and shipped to a certified laboratory for analysis of VOCs via United States Environmental Protection Agency (USEPA) Method 8260B and 1,4-dioxane by USEPA Method 8260C with heated purge, selective ion monitoring (SIM) and isotope dilution. Influent and effluent samples will also be collected and analyzed for metals (aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, nickel and zinc) specified in the MCUO Permit and for iron by USEPA Method 6010B.

Operational monitoring of the treatment system will consist of collecting influent, effluent, mid-process (between Photo-Cat and GAC units) and primary carbon discharge samples on three days during the first week, followed by weekly sampling for the next three weeks, monthly sampling for the next two months, and quarterly sampling thereafter. The treatment process monitoring samples will be initially analyzed for parameters specified by the MCUO, but may change based on operational experience. In addition, VOC and 1,4-dioxane samples will also be periodically collected (currently weekly) at the mid-process and primary carbon discharge points to better anticipate carbon breakthrough.

Table 2 summarizes the schedule for monitoring the groundwater IRAP groundwater treatment system per Chapter 62-780.700(3)(g), F.A.C.

6.2 Monthly Groundwater Monitoring

Monthly monitoring will occur during the first six months following restart of the IRAP groundwater treatment system in May 2009 and will involve measurement of water levels at a specified subset of USAS, LSAS and IAS monitoring wells. The purpose of this portion of the monitoring program is to monitor the development of the groundwater capture zones in the USAS and LSAS and verify that the IRAP system is providing hydraulic control of the source area. The data will be used to prepare potentiometric surface contour maps and delineate capture zones in the USAS and LSAS. As described in Section 6.6, monitoring reports will be submitted to FDEP showing the results. After the six month monthly monitoring is finished, water levels will be collected on a quarterly basis as discussed in Section 6.3. Groundwater levels will be measured at the on- and off-Facility monitoring wells listed on Table 3 at the locations shown on Figures 4 through 6.

6.3 Quarterly Groundwater Monitoring

In accordance with Chapter 62-780.700(3)(g)4, F.A.C., quarterly groundwater monitoring will occur during the first two years following restart of the IRAP groundwater treatment system in May 2009 and will involve collecting groundwater samples from the monitoring wells listed below and measuring water levels at the USAS, LSAS, AF Gravel, S&P Sand, Lower AF Sand and Clay/Sand Zone 3 & 4 monitoring wells listed on Tables 3 and 4 at the locations shown on Figures 4 through 6. Additionally, during one sampling event each calendar year, groundwater samples will be collected from the monitoring wells specified in the 2009 RAP Addendum. The purpose of this monitoring program will be to observe the COC mass removal rates of the IRAP groundwater treatment system, changes in COC concentrations over time during operation of the IRAP groundwater treatment system and monitor the extent of the capture zones. The data will be used to estimate COC mass removal rates, evaluate changes in COC concentrations over time, prepare potentiometric surface contour maps, and delineate capture zones in the USAS and LSAS. As described in Section 6.6, monitoring reports will be submitted to FDEP summarizing the monitoring results. After one year of quarterly groundwater monitoring, quarterly monitoring locations and sample analyses will be re-evaluated, and modifications to the quarterly monitoring program may be suggested to the FDEP. After two years of quarterly monitoring, groundwater samples and water level measurements will be collected on a semi-annual basis as discussed in Section 6.4.

In accordance with Chapter 62-780.700(3)(g)2, F.A.C., groundwater samples will be collected quarterly from the wells specified in Table 4 and analyzed for the COCs (VOCs via USEPA Method 8260B and 1,4-dioxane by USEPA Method 8260C with heated purge, SIM and isotope dilution) to monitor the cleanup progress. A proposal to change sample locations, frequency, or analytical methods may be proposed in the quarterly monitoring reports for approval by FDEP, if warranted based on system performance.

Due to the dimension of the area of highest groundwater concentrations (source) and the radial nature of groundwater flow from the source area, several source area, upgradient and downgradient monitoring wells were selected from both the USAS and LSAS to evaluate the change in COC concentrations in groundwater over time. Mainly monitoring wells screened on top of the hard streak or at the base of the USAS were selected for quarterly monitoring because these wells exhibit greater impacts than the shallower USAS monitoring wells. Also, 12 IAS monitor wells located upgradient, downgradient and below the source area will be monitored to evaluate any vertical influence the IRAP groundwater treatment system may have on the IAS. Groundwater samples will be collected from the wells listed on Table 4 at the locations shown on Figures 4 through 6.

6.4 Semi-Annual Groundwater Monitoring

After the two-year quarterly monitoring program is complete, groundwater monitoring will occur on a semi-annual basis until cessation of pumping. The semi-annual sampling events will be similar to quarterly monitoring and involve collecting groundwater samples and measuring water levels at the USAS, LSAS and IAS monitoring wells listed on Tables 3 and 4 at the locations shown on Figures 4 through 6. The purpose of the semi-annual groundwater monitoring program will be to monitor COC mass removal rates, changes in COC concentrations over time during operation of the IRAP, and the extent of the capture zones. The data will be used to evaluate changes in COC concentrations over time, prepare potentiometric surface contour maps, and delineate capture zones in the USAS and LSAS. As described in Section 6.6, monitoring reports will be submitted to FDEP summarizing the monitoring results. After one year of semi-annual groundwater monitoring, monitoring locations and sample analyses will be re-evaluated, and modifications to the semi-annual monitoring program may be proposed to the FDEP for approval.

6.5 Water Treatment Process and Compliance Monitoring

As discussed in Section 3.2, influent samples are collected from the combined extraction wells discharge, mid-process samples are collected between the Photo-Cat and the primary liquid-phase GAC unit, and primary carbon discharge samples are collected from between the primary and secondary GAC units. Influent samples are collected and submitted for laboratory analysis for the same parameters at the same frequency as the effluent samples. In addition, VOC and 1,4-dioxane samples are also periodically collected (currently weekly) at the mid-process and primary carbon discharge points to better anticipate carbon breakthrough. This may change based on operational experience. A request to alter the frequency or parameters will be made to FDEP and MCUO prior to modifying the sampling and analysis program.

6.6 Monitoring Reports

As discussed in Sections 6.2 through 6.5 and shown on Table 2, groundwater and groundwater treatment process data will be summarized in monitoring reports to be submitted to FDEP. These monitoring reports will be prepared monthly for one month following restart in May 2009, quarterly for two years, and semi-annually thereafter. Data collected during the monitoring period will be reported as follows:

- Measurements and analytical data will be provided in summary tables.
- Groundwater elevation contour maps will be provided for the USAS, LSAS, AF Gravel Wells, S&P Sand and Lower AF Sand.
- Capture zones in the USAS and LSAS will be estimated by contouring groundwater elevation data and determining the location of hydraulic stagnation points, and shown on Site maps.
- Hydrographs will be provided showing groundwater elevations versus time at select monitoring locations.
- Graphs of groundwater COC concentrations versus time will be provided for select monitoring locations.
- COC mass removal rates will be estimated and tabulated.
- Operator log sheets.

Analysis of the above-listed data and figures includes, but is not limited to, plotting water level data for wells located within the same well cluster together on the same hydrograph to evaluate changes in vertical gradients, and reviewing water level and analytical data to determine if it is appropriate to suggest modifications to the effectiveness monitoring program or analytical methods to FDEP. Additionally, influent, mid-process, primary carbon discharge, and effluent treatment system water quality data will be evaluated to determine mass removal rates during operation of the IRAP groundwater treatment system.

7. IRAP Groundwater Treatment System Operation, Maintenance and Monitoring

The anticipated operation, maintenance and monitoring activities and their associated schedules for the IRAP groundwater treatment system are described in this section. An operator will be on-Facility 24-hours per day, 7 days per week. In addition to the activities described below, the operator will refer to the individual system O&M Manuals located in Appendices C and G for the manufacturer-recommended maintenance activities of individual components. SOPs and DOPs provided in Appendix H will be used for daily operation, maintenance and monitoring procedures.

7.1 Regularly Scheduled Maintenance Activities

Regularly scheduled daily maintenance activities for the IRAP groundwater treatment system are as follows:

- Check for proper system operation and water flow rates at main control panel (MCP) Human-Machine Interface (HMI) terminal on-Facility. Check for alarm conditions at MCP HMI terminal.

- Verify the status of the bag filter and replace bag filters, if necessary.

- Perform routine system checks and maintenance each operator shift in accordance with the SOPs and DOPs.

The schedule for the above-described regularly scheduled maintenance activities may be modified with prior FDEP approval.

7.2 Critical Alarm Testing

In accordance with the SOPs and DOPs, critical alarms will be tested every quarter.

7.3 Preventive Maintenance Schedule

Preventive maintenance consists of lubricating pump motors, calibrating pH meters, etc. Preventive maintenance activities for specific components of the IRAP groundwater treatment system are identified in manufacturer supplied equipment information presented in Appendices C and G.

8. Record Keeping and Reporting

Records documenting the operation and maintenance of the IRAP groundwater treatment system will be maintained manually and/or electronically using Operations Log Books and on an OMM Log Sheet (see Appendix D). The OMM Log Sheets will be completed during daily Facility inspections to document system operation and maintenance activities. Operations Log books and OMM Log Sheets will be retained a minimum of 10 years after data is collected.

9. Health and Safety Plan

The site-specific HASP for the facility is provided under separate cover in Appendix E.

10. Contingency Plan

The Contingency Plan for the facility is provided in Appendix F.

11. Record Drawings and Manufacturer Supplied Equipment Information

Record Drawings and manufacturer supplied equipment information are provided in Appendix A, and Appendices C and G, respectively, of this OMM Manual.

12. Cleanup Target Levels

Groundwater Cleanup Target Levels (GCTLs) for COCs in Site groundwater are specified in Chapter 62-780.700, F.A.C. as follows:

Chemical of Concern	GCTL (mg/L)
Tetrachloroethene (PCE)	0.003
Trichloroethene (TCE)	0.003
cis-1,2-Dichloroethene (cis-1,2-DCE)	0.070
1,1-Dichloroethene (1,1-DCE)	0.007
1,1-Dichloroethane (1,1-DCA)	0.070
1,4-dioxane	0.0032
Vinyl Chloride	0.001

Note:

mg/L = milligrams per liter

The IRAP groundwater treatment system will be operated until the system described in the Remedial Action Plan Addendum (ARCADIS, 2009) is constructed or COC concentrations in groundwater are below cessation criteria. Cessation criteria for this IRAP will be the GCTLs for Site-related COCs specified in Chapter 62-777, F.A.C.

13. Security

To reduce the risk of vandalism, the following security measures have been implemented:

- Round the clock security services.
- Round the clock on-Facility operators.
- A 6-foot fence around the Facility.
- Exterior lighting around the treatment building.

14. Management of Change

The purpose of a management of change (MOC) process is to ensure that potential impacts to system operation and regulatory compliance are reviewed prior to initiating changes to the system. The MOC process is intended to apply to changes in equipment, raw materials, and processing conditions. However, changes that are termed replacement in kind are excluded from the MOC process. Replacement in kind means a replacement that satisfies the design specifications. For example, replacing a well pump with one from a different manufacturer where both pumps have the same technical specifications (e.g., flow rate, pressure, etc), piping, instrumentation, and controls would be a replacement in kind.

If the change is not replacement in kind, then a MOC process will include appropriate review and approval prior to initiating the change. This review will consider the technical basis for the change to confirm it's in accordance with sound engineering and safety practices. The review will also consider operational impacts including identification of procedures that may need to change or additional training that will be required. Prior to start-up of any change following the MOC process, an independent verification of the change will be conducted.

Tables

TABLE 1

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

TREATMENT SYSTEM EFFLUENT LIMITATIONS

Parameter	Units	Daily Minimum [1]	Daily Maximum [1]	Frequency	Sample Type
pH [2]	SU [6]	5.0	11.5	Continuous	Metered
flow [3, 4]	GPD [7]	N/A [9]	108,000	Continuous	Metered
1,4-Dioxane [5]	mg/L [8]	N/A [9]	Report	Quarterly	Grab
Trichloroethene	mg/L [8]	N/A [9]	0.003	Quarterly	Grab
Tetrachloroethene	mg/L [8]	N/A [9]	0.003	Quarterly	Grab
1,1-Dichloroethene	mg/L [8]	N/A [9]	0.007	Quarterly	Grab
1,1-Dichloroethane	mg/L [8]	N/A [9]	0.07	Quarterly	Grab
cis 1,2-Dichloroethene	mg/L [8]	N/A [9]	0.07	Quarterly	Grab
Vinyl Chloride	mg/L [8]	N/A [9]	0.001	Quarterly	Grab
Aluminum	mg/L [8]	N/A [9]	Report	Quarterly	Composite
Arsenic	mg/L [8]	N/A [9]	2.51	Quarterly	Composite
Beryllium	mg/L [8]	N/A [9]	0.004	Quarterly	Composite
Cadmium	mg/L [8]	N/A [9]	0.73	Quarterly	Composite
Chromium	mg/L [8]	N/A [9]	9.9	Quarterly	Composite
Copper	mg/L [8]	N/A [9]	28.48	Quarterly	Composite
Nickel	mg/L [8]	N/A [9]	11.08	Quarterly	Composite
Lead	mg/L [8]	N/A [9]	1.87	Quarterly	Composite
Zinc	mg/L [8]	N/A [9]	4.78	Quarterly	Composite

Notes:

[1] Effluent Limitations are specified in accordance with Manatee County Utility Operations Department Office of Industrial Compliance (MCUO) Permit IW0025S dated February 23, 2010.

[2] pH meters must be calibrated according to manufacturer's instructions but in no case less than once per month.

[3] Flow may not exceed 75 gallons per minute (gpm).

[4] Flow meters must be calibrated according to manufacturer's instructions but in no case less than once per year.

[5] Must be analyzed using either EPA Method 1624 or EPA Method 8260C with heated purge, isotope dilution and selective ion monitoring (SIM).

[6] SU - Standard Units

[7] GPD - Gallons per Day

[8] mg/L - Milligrams per Liter

[9] N/A - Not applicable

TABLE 2

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

SUMMARY OF MONITORING SCHEDULE

Monitoring Task & Location(s) [2]	2009 [1]											2010												2011												2012 through cessation of pumping											
Month >	M				J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Week >	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Treatment System - Analytical Results [7]																																															
System Effluent - Treated Groundwater to POTW [3]	X[4]	X	X	X	X	X		X			X			X			X			X			X			X			X			X			X			X			X			X			X
System Influent - Extraction Wells	X	X	X	X	X	X		X			X			X			X			X			X			X			X			X			X			X			X			X			X
System Primary Carbon Discharge								X			X			X			X			X			X			X			X			X			X			X			X			X			X
System Mid-Process - Between Photo-Cat System Discharge and Primary Carbon Inlet	X[4]	X	X	X	X	X		X			X			X			X			X			X			X			X			X			X			X			X			X			X
Treatment System - Volume Measurements																																															
Influent - Groundwater from Recovery Wells [8]	X	X	X	X	X	X		X			X			X			X			X			X			X			X			X			X			X			X			X			X
Groundwater Analytical [5, 9]																																															
Extraction Wells	X	X	X	X	X	X		X			X			X			X			X			X			X			X						X						X						X
USAS Monitoring Wells	X							X			X			X			X			X[6]			X			X			X[6]						X						X[6]						X
LSAS Monitoring Wells	X							X			X			X			X			X[6]			X			X			X[6]						X						X[6]						X
IAS Monitoring Wells	X							X			X			X			X			X[6]			X			X			X[6]						X						X[6]						X
Water Levels																																															
Extraction Wells [10]	X	X	X	X	X	X		X			X			X			X			X			X			X			X						X						X						X
USAS Monitoring Wells	X	X	X	X	X	X		X			X			X			X			X[6]			X			X			X[6]						X						X[6]						X
LSAS Monitoring Wells	X	X	X	X	X	X		X			X			X			X			X[6]			X			X			X[6]						X						X[6]						X
IAS Monitoring Wells	X	X	X	X	X	X		X			X			X			X			X[6]			X			X			X[6]						X						X[6]						X
Reports/Submittals [11]																																															
As Built Drawings (Submitted with OMM Manual)																																															
1=Monthly, 2=Quarterly, 3=Semi-Annually					1		2			2			2			2			2			2			2			2			2						3						3				

Notes:

1 The schedule is based on restart of the system on May 4, 2009.
2 A request to modify sample locations, analytical parameters and frequency may be submitted to FDEP based on the results.
3 Samples collected following the activated carbon vessels.
4 Samples will be collected on three days during the first week of system operations. The first 2 samples will be analyzed using a 24-hour turn-around-time.
5 Groundwater samples will be analyzed for VOCs by USEPA Method 8260B and 1,4-Dioxane by USEPA Method 8260C with heated purge, selective ion monitoring (SIM) and isotope dilution. Extraction wells also sampled for nine metals (aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, nickel and zinc) specified in MCUO Permit and iron.
6 Annual groundwater sampling event.
7 Following restart of treatment system in 2009, treatment system effluent samples will be collected at the same frequency as during initial treatment system start-up.
8 Following restart of treatment system in 2009, volume of groundwater recovered at all extraction wells will be measured monthly for the first quarter and quarterly thereafter except that the four additional extraction wells (EW-101, EW-102, EW-107 and EW-108) will be measured monthly for 9 months (combined with the previous 3 months of measurements equals 12 months total) and quarterly thereafter.
9 Following restart of treatment system in 2009, extraction wells will be sampled weekly for first month, monthly for next two months, quarterly for next seven quarters and semi-annually thereafter.
10 Water levels at the extraction wells will be recorded from the pressure transducer measurements taken automatically by the system.
11 Following restart of treatment system in 2009, reports will be submitted monthly for the first month, quarterly for the next seven quarters and semi-annually thereafter. Reports will be submitted within 30 days following the end of the reporting period.

TABLE 3

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

WELLS FOR
GROUNDWATER WATER LEVEL MONITORING

Monitoring Well Locations
USAS Extraction Wells
EXU-1 (EW-101)
EW-103
EW-105
EW-107
EW-109
USAS Monitoring Wells
MW-3
MW-4
MW-5
MW-6
MW-7S
MW-7D
MW-8S
MW-8D
MW-9S
MW-9D
MW-10
MW-11
MW-12
MW-13D
MW-13S
MW-14S
MW-14D
MW-15S
MW-15D
MW-16S
MW-16D
MW-17S
MW-17D
MW-18S
MW-18D
MW-20
MW-25
MW-29
MW-30
MW-32
MW-35
MW-36
MW-38
MW-40
MW-42
MW-47
MW-63
MW-67
MW-69
MW-70
MW-71
MW-72
MW-76
MW-89
MW-90
MW-100
MW-108
MW-109
MW-110
MW-151
MW-254

TABLE 3

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

WELLS FOR
GROUNDWATER WATER LEVEL MONITORING

Monitoring Well Locations
LSAS Monitoring Wells
EW-102
EW-104
EW-106
EXL-1 (EW-108)
EW-110
LSAS Monitoring Wells
MW-33
MW-37
MW-39
MW-41
MW-43
MW-48
MW-68
MW-77
MW-78
MW-79
MW-80
MW-81
MW-82
MW-84
MW-85
MW-86
MW-87
MW-91
MW-92
MW-93
MW-98
MW-105
MW-113
MW-152
MW-171
AF Gravel Monitoring Wells
MW-127
MW-129
MW-130
MW-132
MW-133
MW-134
MW-153
MW-158
MW-232
MW-233
MW-239
MW-253
DW-1
S&P Sand Monitoring Wells
MW-23
MW-34
MW-44 (formerly RS-8)
MW-45
MW-49
MW-52
MW-57 (formerly RS-4)
MW-58
MW-59
MW-128
MW-252
Lower AF Sand
MW-19 (formerly RS-1)
MW-22
MW-46
MW-155
Clay/Sand Zone 3 & 4
IWI-2

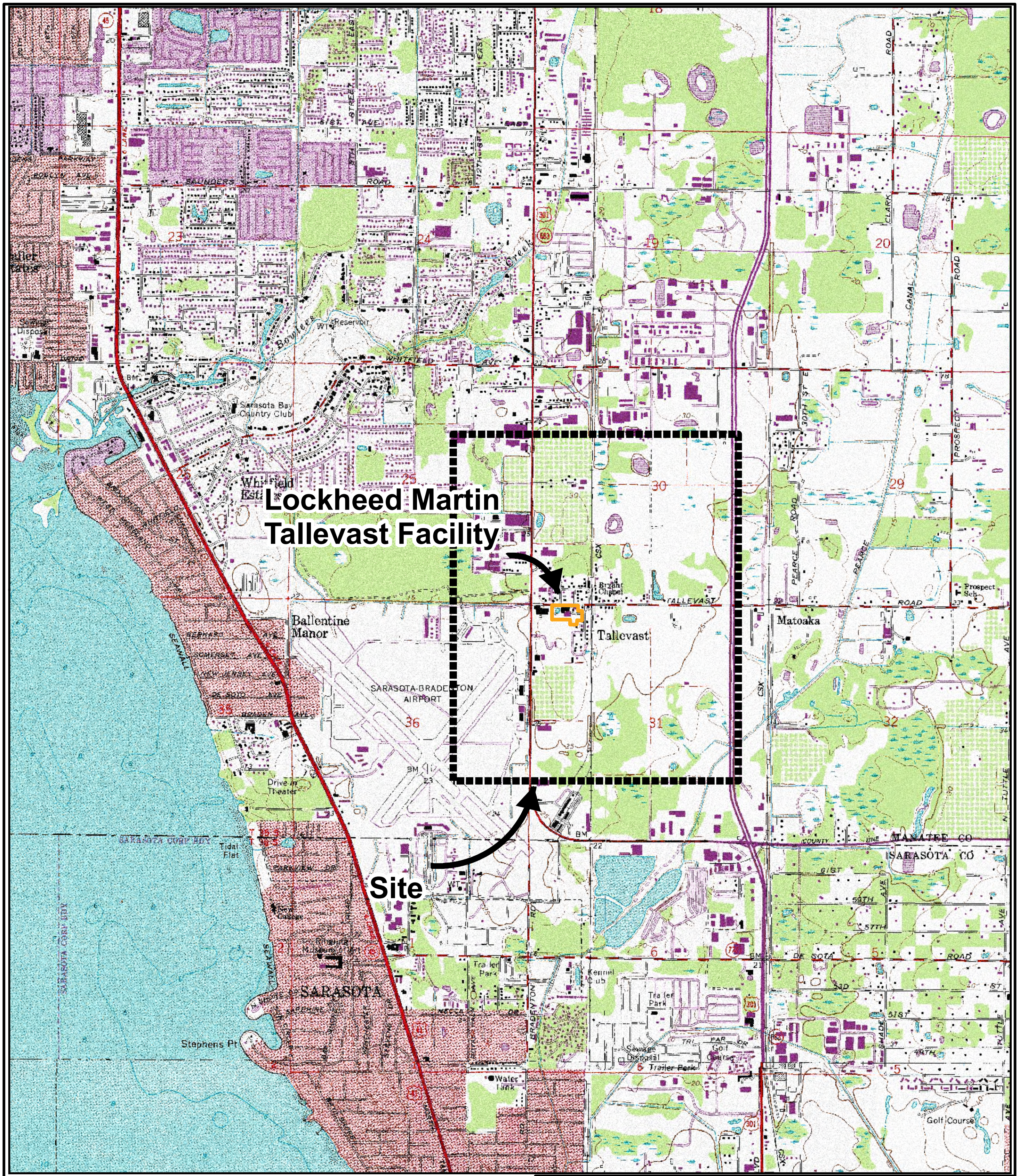
TABLE 4

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

WELLS FOR
GROUNDWATER QUALITY MONITORING

Monitoring Well Locations
USAS Extraction Wells
EXU-1 (EW-101)
EW-103
EW-105
EW-107
EW-109
USAS Monitoring Wells
MW-32
MW-35
MW-36
MW-40
MW-42
MW-47
MW-63
MW-69
MW-71
MW-72
MW-100
MW-108
MW-254
LSAS Extraction Wells
EW-102
EW-104
EW-106
EXL-1 (EW-108)
EW-110
LSAS Monitoring Wells
MW-33
MW-37
MW-41
MW-43
MW-68
MW-80
MW-81
MW-85
MW-91
MW-98
IAS Monitoring Wells
MW-19 (formerly RS-1)
MW-23
MW-44 (formerly RS-8)
MW-57 (formerly RS-4)
MW-127
MW-128
MW-130
MW-134
MW-158
MW-239
MW-253
IWI-2

Figures



REFERENCE: BASE MAP USGS 7.5 MINUTE QUAD BRADENTON, FL, 1964, PHOTOREVISED 1987.

N

0 3,000 6,000

Scale in Feet

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

SITE LOCATION MAP

ARCADIS

FIGURE
1

CITY: Highlands Ranch DIV/GROUP: GIS
Project #: B0038055.0020
I:\LockheedMartin\LockheedMartin\RAP\2009\MXD\Fig1-1_SiteLocation_0609_rev1.mxd - 8/25/2009 @ 11:22:31 AM

R625-OMM-000439-2

CITY: DIV/GROUP: DB: LD: AM: PD: TM: TR: LYR:ON=*;OFF=*REF*
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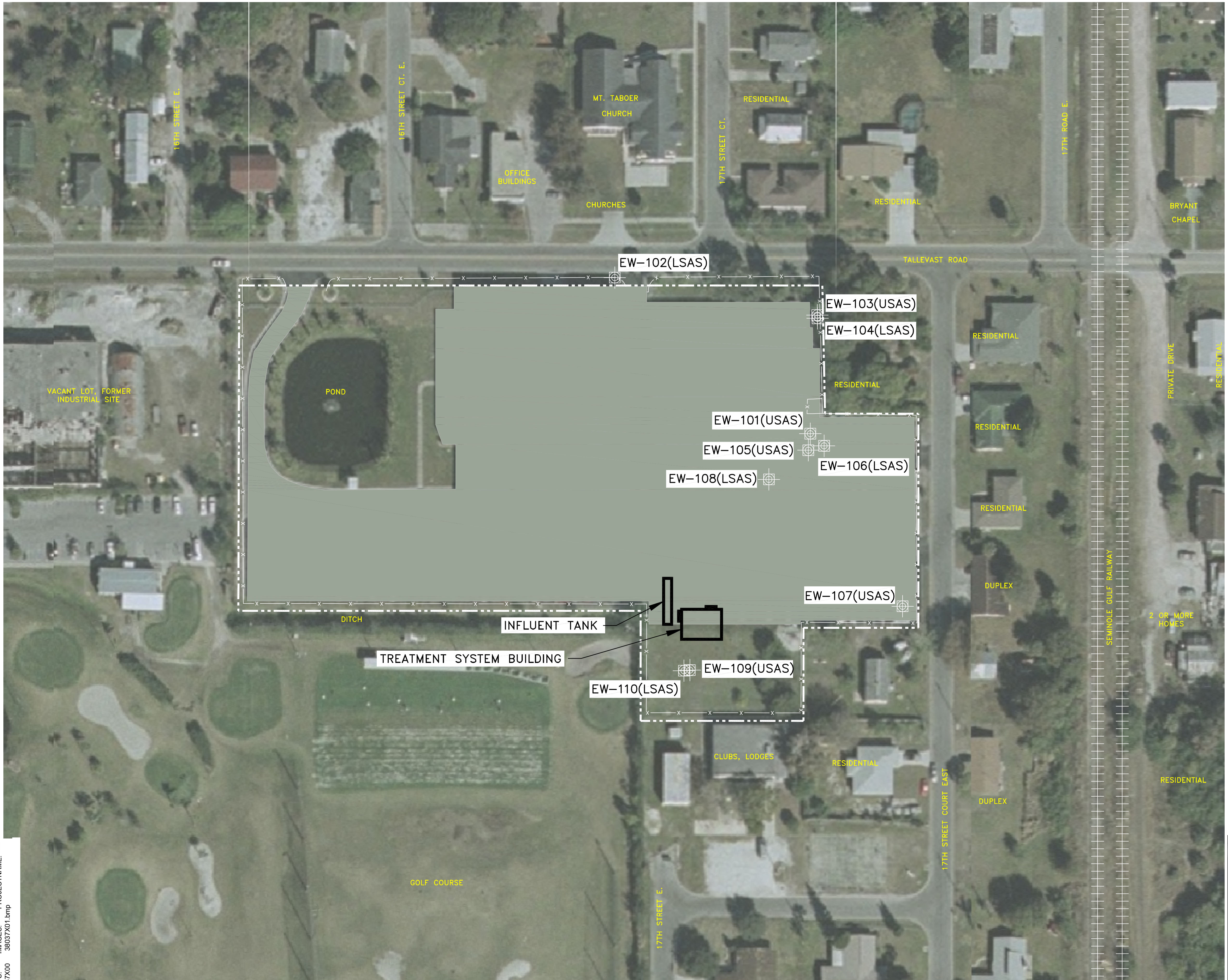


LEGEND:

- FACILITY BOUNDARY
- RAILROAD TRACKS
- FENCE
- EXTRACTION WELL

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM A TETRA TECH, INC. FIGURE 2–8 ENTITLED "TCE IN SURFICIAL AQUIFER SYSTEM BASED ON SCREEN POINT SAMPLING AT THE BASE OF THE SURFICIAL AQUIFER" DATED 10/5/04, AT A SCALE OF 1"=280'.
2. USAS = UPPER SURFICIAL AQUIFER SYSTEM
3. LSAS = LOWER SURFICIAL AQUIFER SYSTEM

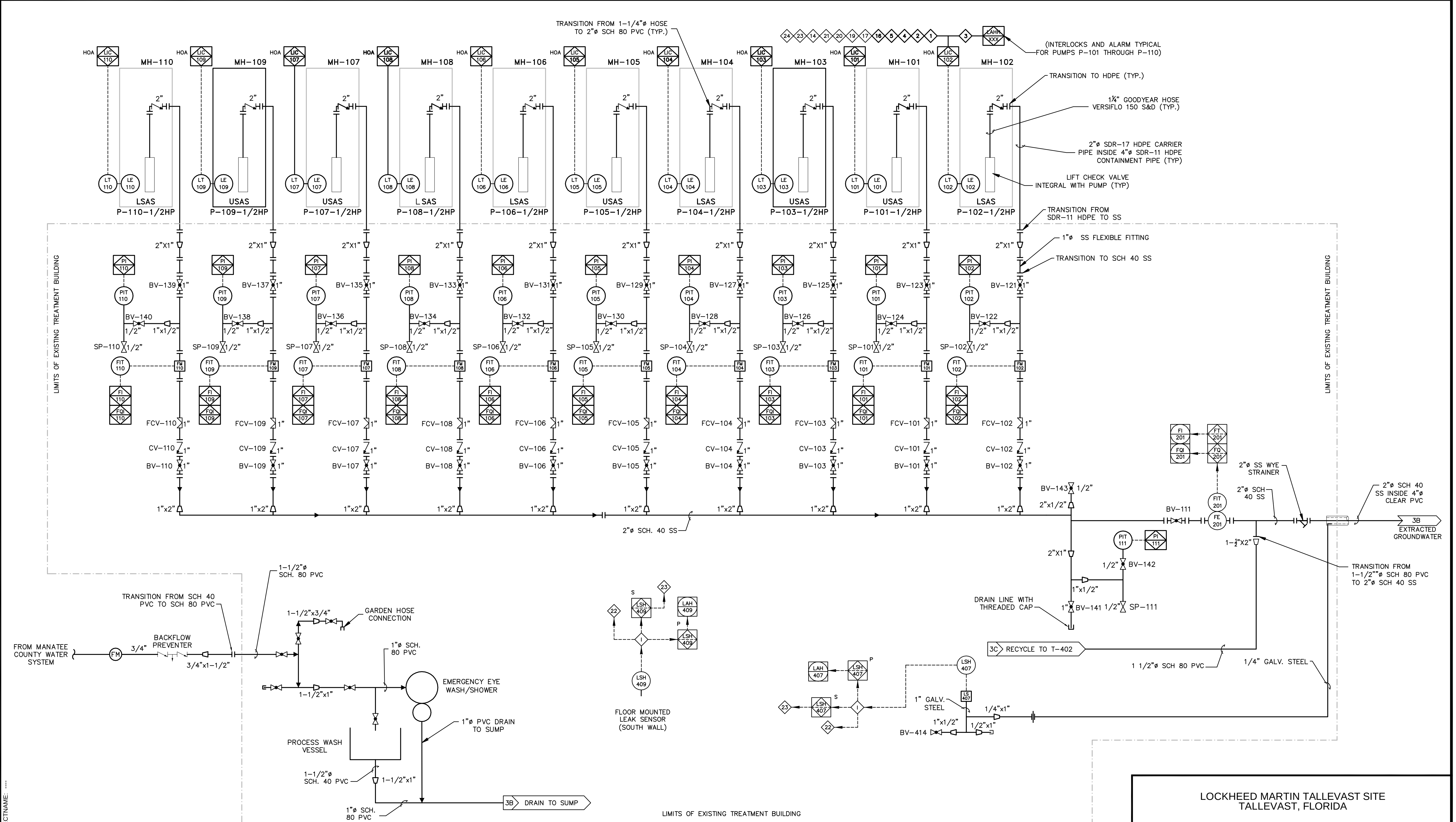
0 50' 100'
GRAPHIC SCALE

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

FACILITY PLAN

ARCADIS

FIGURE
2

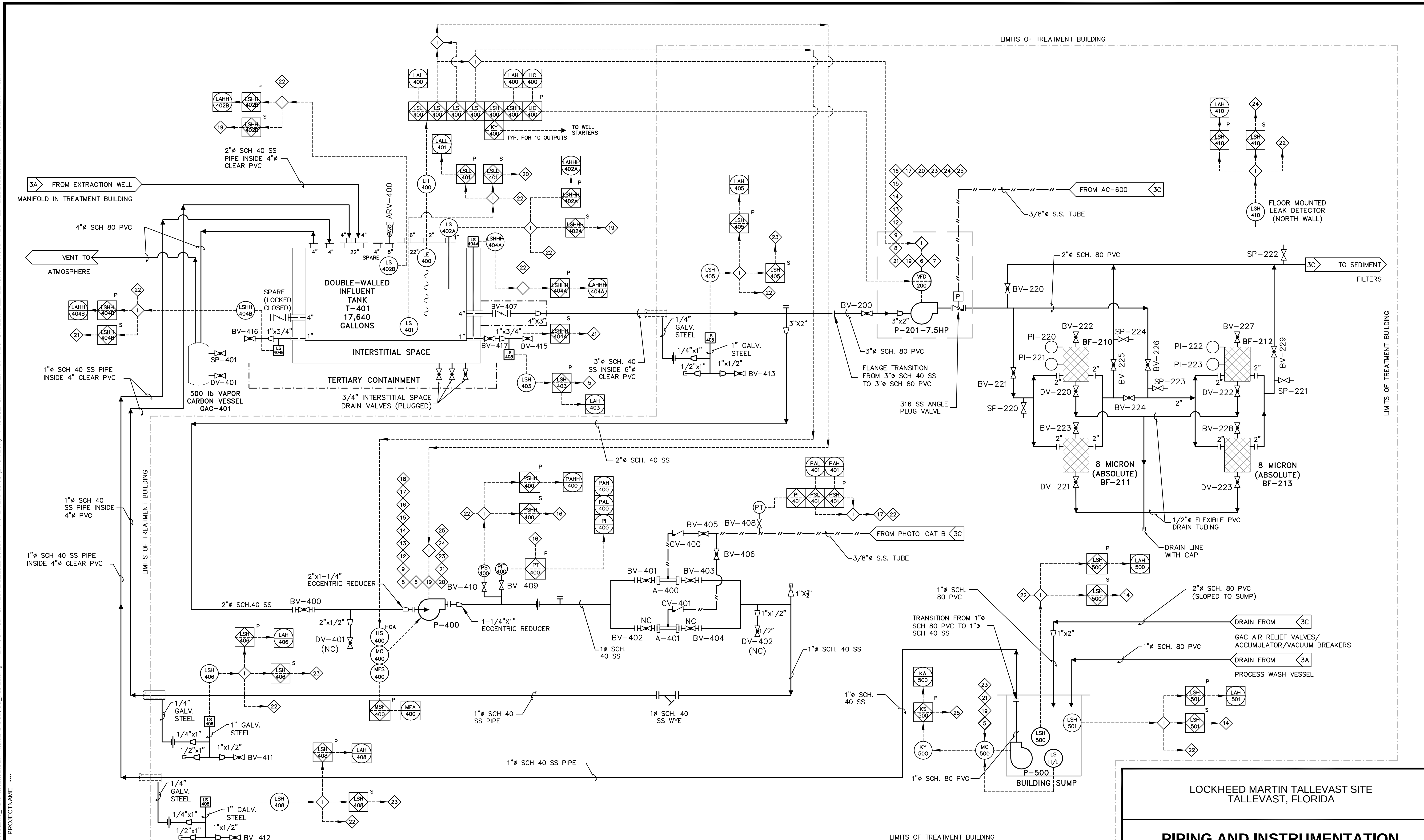


LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

PIPING AND INSTRUMENTATION DIAGRAM

ARCADIS

FIGURE
3A

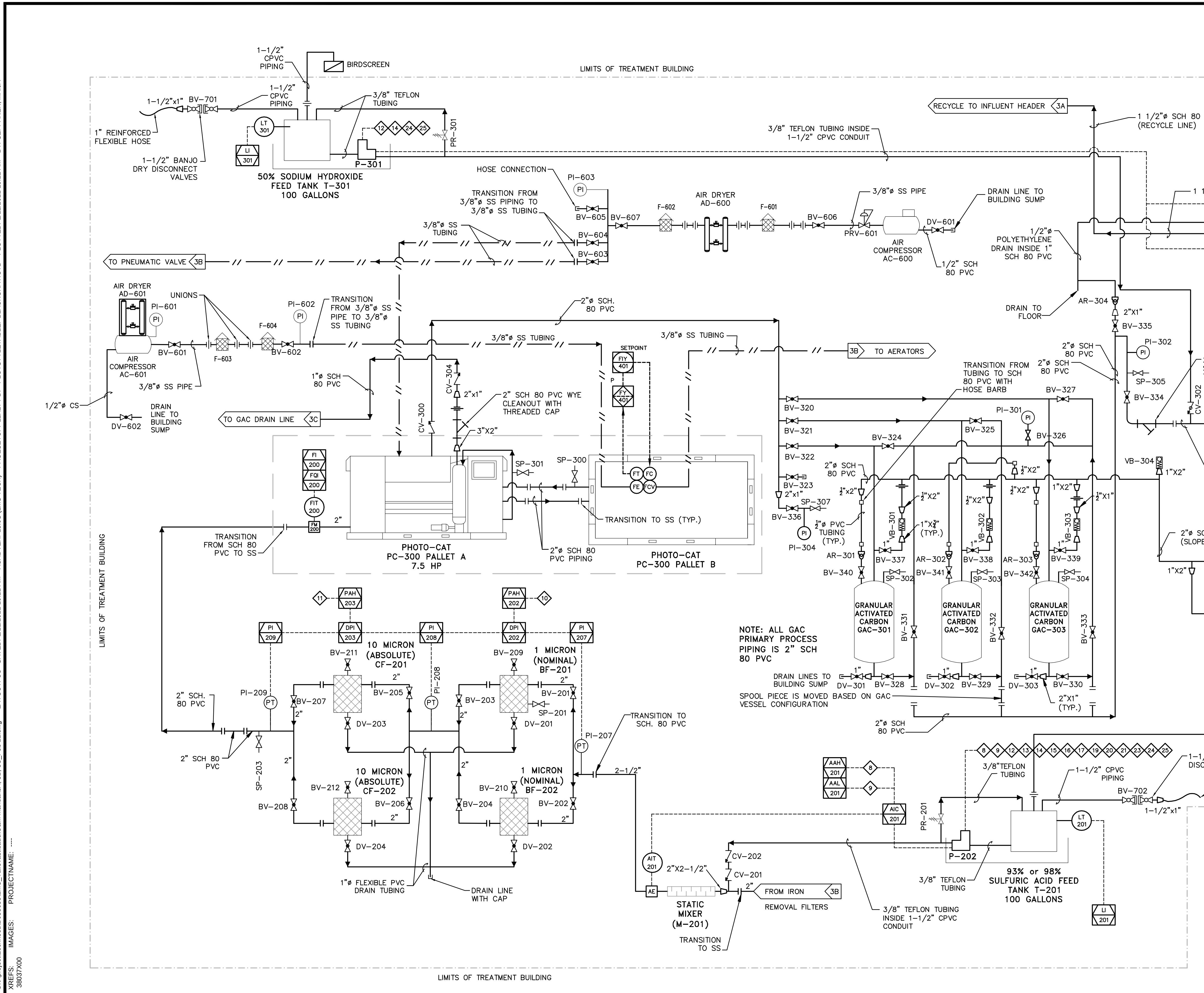


LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

PIPING AND INSTRUMENTATION DIAGRAM

ARCADIS

FIGURE
3B



LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

PIPING AND INSTRUMENTATION DIAGRAM

ARCADIS

FIGURE 3C

INTERLOCKS:

1. HIGH LEVEL AT EXTRACTION WELL (MH-101 THROUGH MH-110), TURN ON RESPECTIVE PUMP (P-101 THROUGH P-110). IF PLC DOES NOT REGISTER FLOW AT RESPECTIVE FLOW METER (FIT-101 THROUGH FIT-110), TURN OFF PUMP.
2. LOW LEVEL AT EXTRACTION WELL (MH-101 THROUGH MH-110), TURN OFF RESPECTIVE PUMP (P-101 THROUGH P-110).
3. HIGH HIGH LEVEL AT EXTRACTION WELL (MH-101 THROUGH MH-110), SIGNAL ALARM AT PLC (LAHH-101 THROUGH LAHH-110). PLC TO SIGNAL AUTO DIALER.
4. HIGH LEVEL ALARM (LAH-400) AT INFLUENT TANK T-401. TURN OFF EXTRACTION WELL PUMPS P-101 THROUGH P-110, PUMPS P-201, P-202, P-301, P-400, P-500 AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC (LAH-400). PLC TO SIGNAL AUTO DIALER.
5. HIGH LEVEL ALARM (LAH-403) AT INFLUENT TANK T-401 INTERSTITIAL SPACE. TURN OFF EXTRACTION WELL PUMPS P-101 THROUGH P-110, PUMPS P-201, P-202, P-301, P-400, P-500, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC (LAH-403). PLC TO SIGNAL AUTO DIALER.
6. PUMP OFF SET POINT AT INFLUENT TANK (T-401). TURN OFF P-201 AND P-400.
7. PUMP ON SET POINT AT INFLUENT TANK (T-401). TURN ON P-201.
8. PH ALARM HIGH (AAH-201) AT ACID INJECTION POINT. TURN OFF PUMPS P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
9. PH ALARM LOW (AAL-201) AT ACID INJECTION POINT. TURN OFF PUMPS P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
10. HIGH DIFFERENTIAL PRESSURE ALARM (PAH-202) ACROSS BAG FILTERS (BF-201 AND BF-202). SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
11. HIGH DIFFERENTIAL PRESSURE ALARM (PAH-203) ACROSS CARTRIDGE FILTERS (CF-201 AND CF-202). SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
12. PH ALARM HIGH (AAH-301) AT CAUSTIC INJECTION POINT. TURN OFF PUMPS P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
13. PH ALARM LOW (AAL-301) AT CAUSTIC INJECTION POINT. TURN OFF PUMPS P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
14. HIGH LEVEL ALARM (LAH-500) AND HIGH LEVEL ALARM (LAH-501) AT BUILDING SUMP. TURN OFF PUMPS P-101 THROUGH P-110, P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
15. HIGH DIFFERENTIAL pH ALARM (AAH-302) ACROSS EFFLUENT pH PROBES. TURN OFF PUMPS P-201, P-202, P-301. P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
16. HIGH/LOW PRESSURE IN AERATOR PIPING (PAH-400, PAL-400, PAHH-400). TURN OFF PUMPS P-101 THROUGH P-110, P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
17. HIGH/LOW PRESSURE IN AIR LINE TO AERATOR PIPING (PAH-401, PAL-401). TURN OFF PUMPS P-101 THROUGH P-110, P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC. PLC TO SIGNAL AUTO DIALER.
18. PUMP ON SET POINT AT INFLUENT TANK (T-401). TURN ON P-400.
19. HIGH/HIGH LEVEL ALARM (LAHHH-402A AND LAHH-402B) AT INFLUENT TANK T-401. TURN OFF PUMPS P-201, P-202, P-301, P-400, P-500, EXTRACTION WELL PUMPS P-101 THROUGH P-110 AND PHOTOCAT SYSTEM.
20. LOW/LOW LEVEL ALARM (LALL-401) AT INFLUENT TANK T-401. TURN OFF EXTRACTION WELL PUMPS P-101 THROUGH P-110, PUMPS P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM.
21. HIGH/HIGH ALARM (LAHHH-404A, LAHH-404B) AT INFLUENT TANK INTERSTITIAL SPACE. TURN OFF EXTRACTION WELL PUMPS P-101 THROUGH P-110, PUMPS P-201, P-202, P-301, P-400, P-500, AND PHOTOCAT SYSTEM. SIGNAL ALARM AT PLC.
22. SIGNALS ALARM AT AUTO DIALER.
23. HIGH ALARM (LAH-405, LAH-406, LAH-407, AND LAH-408) AT DOUBLE CONTAINED PROCESS PIPING. TURN OFF PUMPS P-201, P-202, P-301, P-400, EXTRACTION WELL PUMPS P-101 THROUGH P-110, AND PHOTOCAT SYSTEM. TURN OFF PUMP P-500 FOR HIGH ALARM (LAH-408) ONLY.
24. HIGH ALARM (LAH-409 AND LAH-410) AT FLOOR MOUNTED CONDUCTANCE PROBES. TURN OFF PUMPS P-201, P-202, P-301, P-400, EXTRACTION WELL PUMPS P-101 THROUGH P-110, AND PHOTOCAT SYSTEM.
25. KY-500 TIME DELAY RELAY IS INITIATED WHEN P-500 STARTS AND IS RESET WHEN P-500 STOPS. KY-500 IS SET FOR 30 MINUTES. WHEN KY-500 TIMES OUT IT SHUTS OFF PUMPS P-101 THROUGH P-110, P-201, P-202, P-301, P-400, AND PHOTOCAT SYSTEM.

LEGEND:

- PROCESS PIPING
- EXISTING PIPING/EQUIPMENT
- PNEUMATIC PIPING
- SKID MOUNTED EQUIPMENT
- BUILDING PERIMETER
- FENCE
- BALL VALVE
- BUTTERFLY VALVE
- GLOBE VALVE
- BALL CHECK VALVE
- SWING CHECK VALVE
- SAMPLE TAP
- PRESSURE GAUGE
- ANALYZER ELEMENT
- FLOW METER (MECH.)
- FLANGED CONNECTION
- ECCENTRIC REDUCER
- REDUCER
- FEMALE HOSE FITTING
- CENTRIFUGAL PUMP
- DIAPHRAGM PUMP
- METERING PUMP
- INSTRUMENT SIGNAL
- PRESSURE RELIEF VALVE
- PRESSURE REGULATING VALVE
- PNEUMATIC ACTUATOR
- MALE HOSE FITTING
- FLEXIBLE HOSE
- PURIFICS IN-LINE AERATOR
- AIR RELEASE
- AIR/VACUUM RELEASE
- VACUUM BREAKER
- ISO DAMPENER FITTING
- UNION
- CAP
- AIR FILTER

ABBREVIATIONS:

A	AERATOR
AAH	pH ANALYZER ALARM HIGH
AAL	pH ANALYZER ALARM LOW
AC	AIR COMPRESSOR
AD	AIR DRYER
AE	pH ANALYZER ELEMENT
AI	pH ANALYZER INDICATOR
AIT	pH ANALYZER INDICATING TRANSMITTER
AR	AIR RELEASE
AVR	AIR/VACUUM RELEASE
BF	BAG FILTER
BP	BY-PASS
BV	BALL VALVE
CF	CARTRIDGE FILTER
CV	CHECK VALVE
DAI	DIFFERENTIAL pH INDICATOR
DPI	DIFFERENTIAL PRESSURE INDICATOR
DS	DISCONNECT SWITCH
DWG	DRAWING
DV	DRAIN VALVE
FCV	FLOW CONTROL VALVE
GAC	GRANULAR ACTIVATED CARBON
GV	GLOBE VALVE
HDPE	HIGH DENSITY POLYETHYLENE
MC	MOTOR CONTROLLER
MH	MANHOLE
NC	NORMALLY CLOSED
P	PRIMARY PLC
PC	PHOTO-CAT
PCV	PRESSURE CONTROL VALVE
PI	PRESSURE INDICATOR
POTW	PUBLICLY OWNED TREATMENT WORKS
PRV	PRESSURE REGULATING VALVE
PVC	POLYVINYL CHLORIDE PIPE
S	SECONDARY PLC
SCH	SCHEDULE
SDR	STANDARD DIMENSIONAL RATIO
SP	SAMPLE PORT
T	TANK
TYP	TYPICAL
VB	VACUUM BREAKER
VFD	VARIABLE FREQUENCY DRIVE
ø	DIAMETER

GENERAL NOTES:

1. ALL ANALOG SETPOINTS SHALL BE FIELD ADJUSTED BY OPERATOR AT HMI INTERFACE SCREEN.
2. ALARMS THAT SHUT DOWN EXTRACTION WELLS AND TREATMENT EQUIPMENT MUST BE CLEARED BY OPERATOR BEFORE BEING RESTARTED.
3. THIS DRAWING IS PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

INSTRUMENT IDENTIFICATION LETTERS

FIRST LETTER		SUCCEEDING LETTERS		
MEASURE OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A = ANALYSIS		ALARM		
B = BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C = USER'S CHOICE			CONTROL, CLOSED	
D = USER'S CHOICE	DIFFERENTIAL			
E = VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F = FLOW RATE	RATIO (FRACTION)			
G = USER'S CHOICE		GLASS, VIEWING DEVICE		
H = HAND				HIGH
I = CURRENT (ELECTRICAL)		INDICATE		
J = POWER	SCAN			
K = TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L = LEVEL		LIGHT		LOW
M = USER'S CHOICE	MOMENTARY			MIDDLE, INTERMEDIATE
N = USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O = USER'S CHOICE		ORIFICE, RESTRICTION	OPEN	
P = PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q = QUANTITY	INTEGRATE, TOTALIZE			
R = RADIATION		RECORD	RUN	
S = SPEED, FREQUENCY	SAFETY	SWITCH	STOP	
T = TEMPERATURE			TRANSMIT	
U = MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V = VIBRATION, MECH. ANALYSIS			VALVE, DAMPER, LOUVER	
W = WEIGHT, FORCE		WELL		
X = UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y = EVENT, STATUS OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z = POSITION, DIMENSION	Z AXIS		DRIVE, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

NOTES:

1. ANY FIRST LETTER COMBINED WITH MODIFIER REPRESENTS A NEW AND SEPARATE MEASURED VARIABLE. EXAMPLES: PD = DIFFERENTIAL PRESSURE FQ = TOTALIZED OR INTEGRATED FLOW. EXCEPTION IS THE MODIFIER "J" FOR MULTIPOINT SCANNING.
2. FOR ANALYSIS NOT IDENTIFIED BY A SPECIFIC LETTER IN THE TABLE, USE FIRST LETTER "A" NEAR THE INSTRUMENT SYMBOL, SPECIFY THE NATURE OF THE ANALYSIS. EXAMPLE: PH
3. MEANING OF A "USER CHOICE" LETTER SHALL BE CONSISTENT THROUGHOUT A PROJECT, AND SHALL BE SPECIFIED IN THE DRAWING LEGEND.
4. UNCLASSIFED LETTER MAY HAVE A FEW DIFFERENT MEANINGS ON A PROJECT, THE MEANING SHALL BE SPCIFIED NEAR EACH INSTRUMENT SYMBOL USING THE UNCLASSIFIED LETTER.
5. THE MODIFIER "SCAN" APPLIES TO MULTIPOINT PRINTING INSTRUMENTS, SUCH AS CJRS (MULTIPOINT CONDUCTIVITY RECORDER WITH ALARM SWITCHES).

INSTRUMENT SYMBOLS

	PRIMARY CONTROL PANEL NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY PANEL OR RACK NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS			
SHARED DISPLAY, SHARED CONTROL			
COMPUTER FUNCTION INCLUDING DISTRIB. CNTL. SYS.			
PROGRAMMABLE LOGIC CONTROLLER FUNCTION			

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

INTERLOCKS, LEGEND, AND ABBREVIATIONS

ARCADIS

FIGURE **3D**

CITY:TAMPA DIV/GROUP:ENV-141 DB:JAR LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\Aproject\Lockheed\B0038055\LMC_Tallevast\cadd\O&M Manual\Fig 3D_Feb 11.dwg LAYOUT: 3D SAVED: 2/11/2011 10:09 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: 11X17 PDF PLOTSTYLETABLE: BLACKGRAY.CTB PLOTTED: 2/11/2011 10:10 AM BY: SEPPANEN, MAIJA
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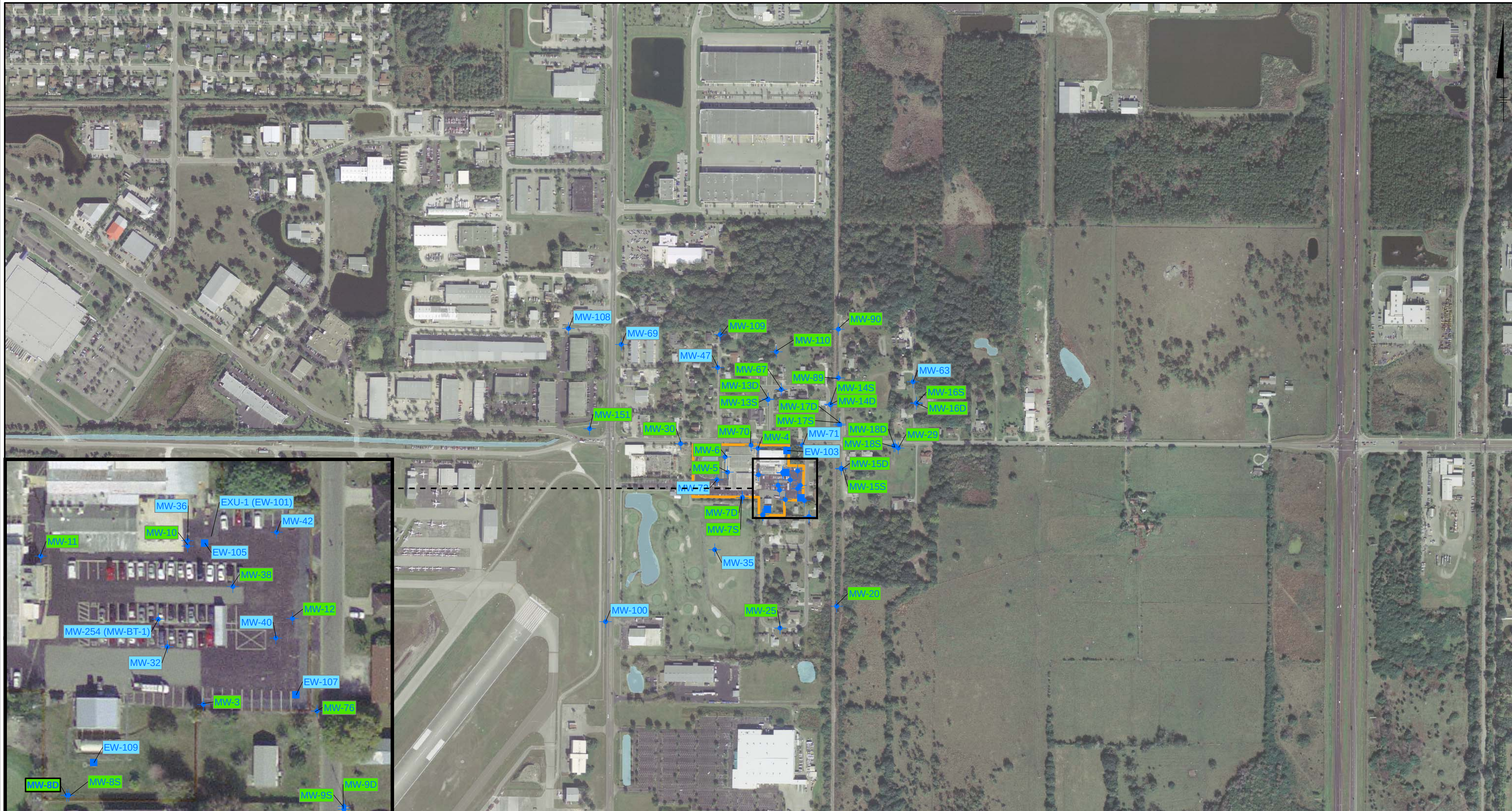

Extraction Well Location - USAS

Monitoring Well Location - USAS

Former ABC Facility Boundary

Ponds

MW-100 Quarterly Groundwater Quality Monitoring Locations

MW-3 Quarterly Groundwater Water Level Monitoring Locations

0 300 600 Feet

GRAPHIC SCALE

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

USAS GROUNDWATER MONITORING WELLS

ARCADIS

FIGURE
4

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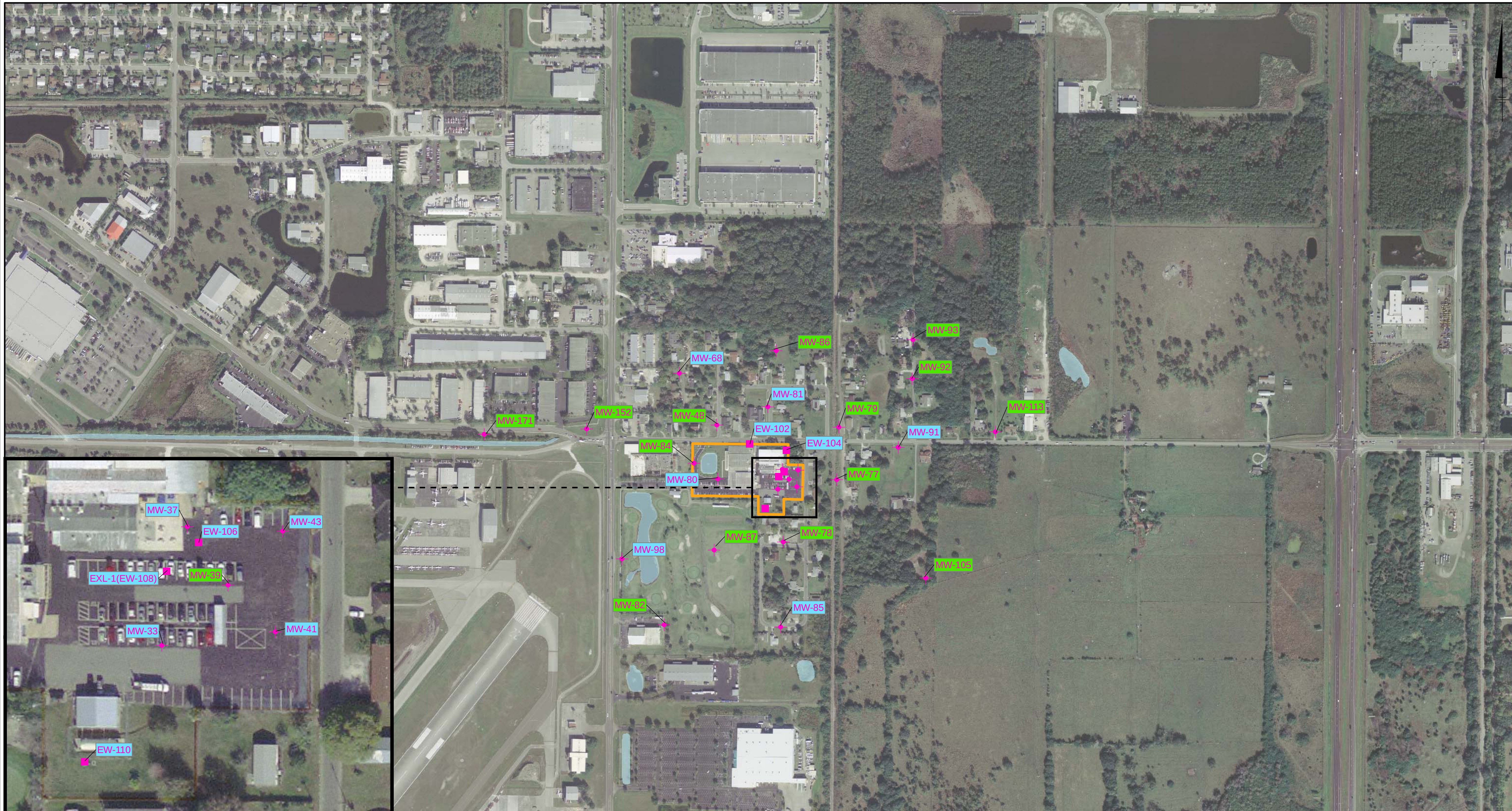
DEN-080 MSS
Project #: B0038055.0000



■ Extraction Well Location - LSAS
Former ABC Facility Boundary
✦ Monitoring Well Location - LSAS
Ponds

MW-33 Quarterly Groundwater Quality Monitoring Locations
MW-39 Quarterly Groundwater Water Level Monitoring Locations

0 300 600 Feet

GRAPHIC SCALE

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

LSAS GROUNDWATER MONITORING WELLS

ARCADIS

FIGURE 5

I:\LockheedMartin\LockheedMartin\FormerABC\FDEP\mxd\LSAS_Samples_rev2.mxd - 8/10/2010 @ 11:15:53 AM

DEN-080 MSS
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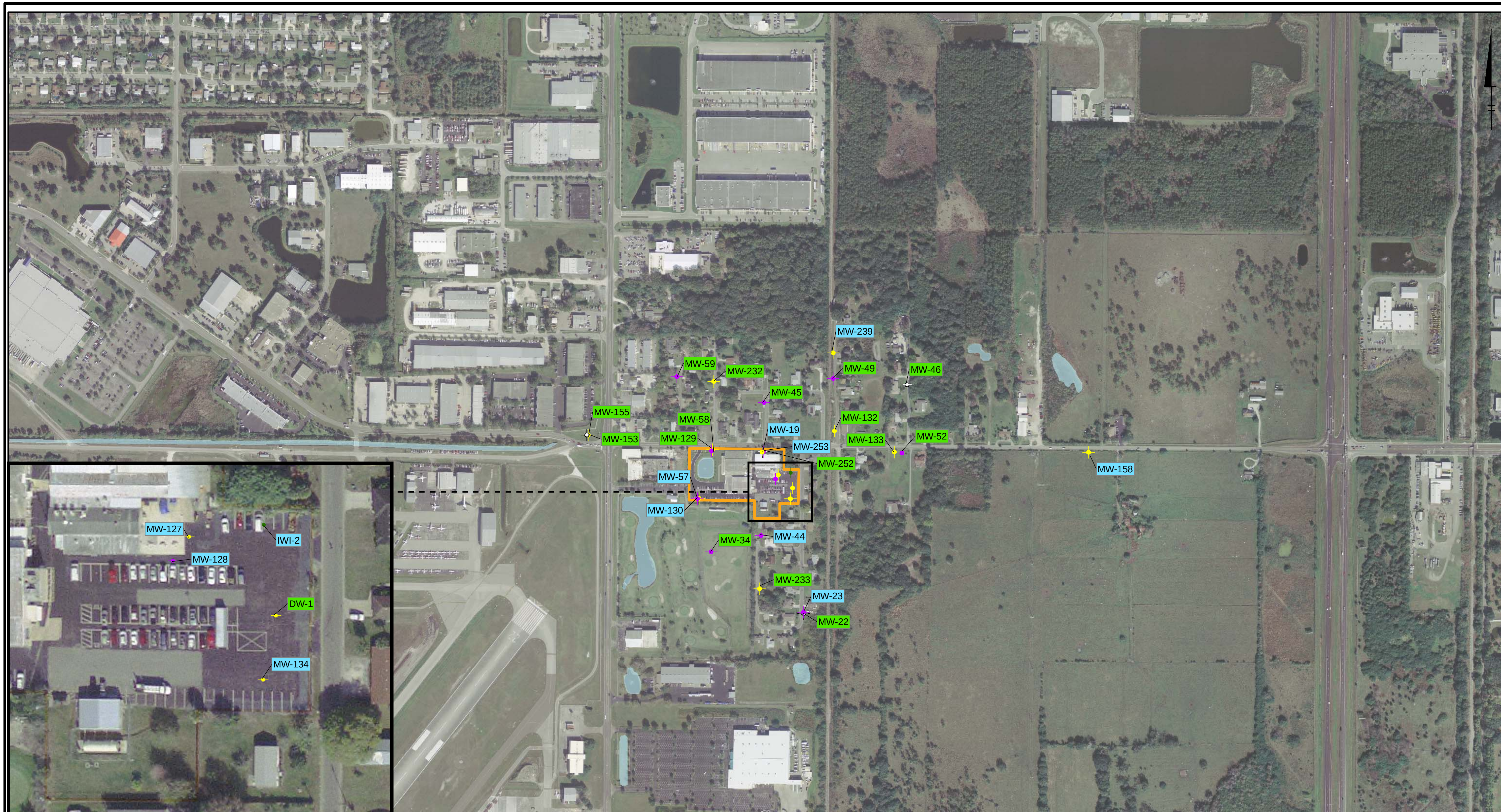

Monitoring Well - (AF Gravel)
Monitoring Well - (SP Sand)
Monitoring Well - (Lower AF)
Injection Well - (Clay/Sand Zone 3-4)

Former ABC Facility Boundary
Ponds

MW-23 Quarterly Groundwater Quality Monitoring Locations
MW-252 Quarterly Groundwater Water Level Monitoring Locations

0 300 600 Feet
GRAPHIC SCALE

LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA

IAS GROUNDWATER MONITORING WELLS

ARCADIS

FIGURE
6

I:\LockheedMartin\LockheedMartin\FormerABC\FDEP\mxd\OtherZones_Samples_rev2.mxd - 8/10/2010 @ 11:15:28 AM
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